Caroline County, Maryland

Comprehensive Water and Sewerage Plan

1992

w/Amendments through September 2019

Caroline County Department of Planning and Codes

RESOLUTION #92-028

ADOPTION OF 1992 CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN

WHEREAS, the County Commissioners of Caroline County are required by Health-Environmental Article 9, Subtitle 5, Annotated Code of Maryland to adopt a Comprehensive Water and Sewerage Plan;

WHEREAS, the County Commissioners held a duly advertised public hearing on the proposed plan on November 24, 1992.

NOW, THEREFORE, IT IS RESOLVED that the 1992 Caroline County Comprehensive Water and Sewerage Plan is hereby adopted.

IT IS FURTHER RESOLVED that the 1984 Caroline County Comprehensive Water and Sewerage Plan and all amendments thereto are hereby repealed.

FURTHER RESOLVED that this resolution shall take effect immediately upon adoption.

ADOPTED this first day of December 1992.

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

ATTEST:

LEIGH SANDS, CLERK

SEAL

MARGARET R. MYERS, PRESIDENT

E DEE MERRIKEN

CHARLES O. DAVIS, JR.

STATE OF MARYLAND
DEPARTMENT OF THE ENVIRONMENT
2500 Broening Highway Baltimore, Maryland 21224
(410) 631- 3567

William Donald Schaefer
Governor

Robert Perciasepe
Secretary

March 1, 1993

The Honorable Margaret R. Myers, President
Caroline County Commissioners
Post Office Box 207
Denton MD 21629

Dear Commissioner Myers:

We have completed our review of the 1992 "Report of the Review" (Update) of the 1990 Caroline County Water and Sewerage Plan (County Plan). This Update, adopted by the County Commissioners on December 1, 1992, represents a complete rewrite of the 1990 County Plan and presents the County's growth management decisions for the 1990s.

The Update is consistent with the County's land use plan and our growth management concerns. The Maryland Department of the Environment (MDE) approves the Update. This action completes our review, as required by Section 9-507 of the Environment Article of State law.

Thank you for giving us this opportunity to review this Update. MDE appreciates the County's continued efforts in water and sewerage planning. Mr. Lester Coble and Ms. Belinda Melvin of your staff are commended for assisting in preparing the Update.

Should you have any questions regarding this matter, please feel free to call me at (410) 631-3567 or Mr. Ray Anderson, Head, Water and Sewerage Planning Section at (410) 631-3721.

Sincerely,

J.L. Hearn/JSB

J.L. Hearn, Director
Water Management Administration

JLH:lp

A-2

Recycled Paper

RESOLUTION #96-002

AMENDMENT AND READOPTION OF COMPREHENSIVE WATER AND SEWERAGE PLAN

WHEREAS, the County Commissioners of Caroline County are empowered by Health-Environmental Article 9, Subtitle 5, Annotated Code of Maryland to adopt and amend the 1992 Caroline County Comprehensive Water and Sewerage Plan;

WHEREAS, the County Commissioners have held a duly advertised public hearing on January 23, 1996.

NOW, THEREFORE, IT IS HEREBY RESOLVED that the existing Caroline County Comprehensive Water and Sewerage Plan is amended to include the attachment which replaces the current page 4-19.

THEREFORE, IT IS ALSO RESOLVED that the amended 1992 Caroline County Comprehensive Water and Sewerage Plan has been reviewed and found adequate for planning purposes and is hereby re-adopted.

IT IS FURTHERMORE RESOLVED that the Caroline County Comprehensive Water and Sewerage Plan will be reviewed and updated to include the visions and other requirements of the Maryland Economic Growth, Resource Protection and Planning Act of 1992 by July 1, 1997.

PASSED AND DULY ADOPTED this 30th day of January 1996.

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

ATTEST:

LEIGH SANDS, CLERK

SEAL

MARGARET R. MYERS, PRESIDENT

EARL R. COHEE

JOHN S. LEGATES

STATE OF MARYLAND
CAROLINE COUNTY
FILED FOR RECORD
AT 9:10 AM
ON Feb. 5 96
DULY RECORDED IN LIBER
No. 2 990
Resolution
BOOKS FOR THE CLERK
E. Dale Minner
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A-3

4.7.3. Election District No 2 (Greensboro)

The Greensboro Election District (1990 population - 4097) currently has 65% of its total population served by individual sewage disposal systems. The remainder of the population is served by the Town of Greensboro's sewerage system. In the future, the town of Greensboro is not expected to need to expand its sewage treatment plant beyond its 0.28 mgd capacity. Minor rehabilitation of the Town's sewerage system is ongoing. Existing small mains will be replaced with 8-inch lines. The vacuum pumps will be removed from the lift stations. Extension of service to currently unserved areas of town will occur as development proceeds.

Beginning in 1996, the town will upgrade its wastewater facilities to bring the discharge into compliance with regulations protecting public health and the environment. The existing facilities were constructed over 25 years ago and prior to the current environmental regulations governing the discharge of treated effluent. The modifications include a new headworks, replacement of the existing trickling filter with twin rotating biological contactors, addition of a new secondary clarifier, additional covered sludge drying beds, and improvements to the sludge pumping system. Also, improvements to the wastewater collection and pumping system will replace aging below-ground ejector stations with new submersible pumping systems.

A-4

RESOLUTION #2002-008

CAROLINE COUNTY COMPREHENSIVE LAND USE PLAN AMENDMENTS

RIDGELY AIRPARK AND PROPOSED BUSINESS/TECHNOLOGY PARK

WHEREAS, the County Commissioners are empowered by Article 66B of the Annotated Code of Maryland to adopt and amend a Comprehensive Plan; and

WHEREAS, the Caroline County Planning Commission has prepared and approved amendments to the Caroline County Comprehensive Land Use Plan and Land Use Map regarding Ridgely Airpark and proposed Business/Technology Park and recommended them to the County Commissioners for adoption; and

WHEREAS, the Planning Commission and County Commissioners have each held duly advertised public hearings on the proposed amendments.

NOW, THEREFORE, IT IS HEREBY RESOLVED by the County Commissioners of Caroline County, Maryland, that the 1991 Update of the Comprehensive Plan and *"Caroline 2000, A Comprehensive Plan"*, adopted in 1986, be amended as follows:

A. Add to Page I-30 of the 1991 Supplement a description of a proposed Business/Technology Park for industrial development as follows:

The proposed site for the Ridgely Business/Technology Park consists of 92 acres on MD Route 312, located at the intersection of Hog Lot Road and Racetrack Road. The site is located immediately south of the existing Ridgely Airpark and northeast of the Town of Ridgely.

The Planning Commission recommends the following additional policies for industrial development in Caroline County:

1. The County should purchase and develop the Ridgely Business/Technology Park, as stated in the "One Maryland Strategic Plan for Economic Development for Caroline County."

2. The State of Maryland should guarantee that access to modern high speed communication services will be available to the Ridgely Business/Technology Park.

3. The County should encourage and support the annexation of the Business/Technology Park by the Town of Ridgely to permit water, sewerage, and other municipal services.

MARYLAND DEPARTMENT OF THE ENVIRONMENT
2500 Broening Highway • Baltimore, Maryland 21224
(410) 631-3000

Parris N. Glendening
Governor

Jane T. Nishida
Secretary

August 6, 1996

The Honorable Margaret R. Myers
President
Caroline County Commissioners
Courthouse
Post Office Box 207
Denton MD 21629

Dear Mrs. Myers:

We have completed our review of the 1996 "Report of the Review" (update) of the 1992 Caroline County Water and Sewerage Plan. The update was adopted by the County Commissioners on January 30, 1996 as Resolution #96-002.

The update is consistent with the County's land use plan and our growth management concerns.

The Maryland Department of the Environment (MDE) approves the 1996 update. This action completes our review, as required by Section 9-507 of the Environment Article of State law.

MDE appreciates the County's continued efforts in water and sewerage planning.

Ms. Elizabeth Krempasky of your Planning Department is commended for having prepared the update. Thank you for giving us this opportunity to review the update.

If you have questions regarding this matter, please call me at (410) 631-3567 or Mr. Ray Anderson at (410) 631-3721.

Sincerely,

J L Hearn

J.L. Hearn, Director
Water Management Administration

JLH:lp

cc: Ms. Elizabeth Krempasky
Mr. Ronald Kreitner

A-5

B. Add to Page I-34 of the 1991 Supplement a description of Ridgely Airpark for air transportation as follows:

The Ridgely Airpark consists of 152.46 acres, located at the intersection of MD Route 312 and Racetrack Road, less than 1 mile northeast of the Town of Ridgely. Ridgely Airpark has been used continually as an airport since 1966 and currently provides small aircraft with a paved runway, airplane hangers, self service fueling facilities, and radio facilities for aviation assistance. As stated in the One Maryland Strategic Plan for Economic Development for Caroline County, approved by the Caroline County Commissioners on July 27, 1999, "protection of the airpark as a valuable resource is a priority for the County and is strongly supported by the Maryland Aviation Administration." The proposed site for the Ridgely Business/Technology Park adjoins MD Route 312, Racetrack Road, and Hog Lot Road, immediately south of Ridgely Airpark.

The Planning Commission recommends the following policies for air transportation in Caroline County:

1. Maintain and expand the use and services of Ridgely Airpark as a general aviation airport.

2. Consider purchase of the Ridgely Airpark to access available FAA and other State funding for improvements.

3. A twenty (20) year master plan should be developed for Ridgely Airpark operations and its expansion.

4. Discourage inappropriate future land uses around Ridgely Airpark by adopting an Airport Protection Overlay Zoning District and acquiring land or use easements on neighboring lands as necessary.

5. The County should purchase and develop the Hayman Farm immediately south of the Ridgely Airpark as a Business/Technology Park, as stated in the "One Maryland Strategic Plan for Economic Development for Caroline County," to attract businesses that will need or will benefit from close proximity to airport services.

6. Upgrade Racetrack Road to improve access for the Ridgely Airpark and the Business/Technology Park.

7. Encourage and support the annexation of Ridgely Airpark and Business/Technology Park by the Town of Ridgely to facilitate the extension of water and sewerage and other municipal services.

C. Amend the Caroline County Comprehensive Land Use Plan Map, 1986, to show Ridgely Airpark and the proposed Ridgely Business/Technology Park.

DULY ADOPTED AND EFFECTIVE THIS ELEVENTH DAY OF JUNE 2002.

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

John W. Cole, President

Franklin W. Prettyman, Vice President

ATTEST:

Leigh Sands, Executive Assistant

(Vacant)

STATE OF MARYLAND
CAROLINE COUNTY
FILED FOR RECORD
at 2:20 o'clock pm
on 6-11 2002 and
duly recorded in Liber FCM
No. 3 Folio 530 one of the
Land Records
kept for the County aforesaid
Hale Minner Clerk
Recording Fees

SGT ____ SP ____
CT ____ LMF ____
Postage ____ AT ____

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A-8

RESOLUTION #2002-009

CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN AMENDMENTS

RIDGELY WATER AND SEWER SERVICE TO RIDGELY AIRPARK AND BUSINESS/TECHNOLOGY PARK

WHEREAS, the County Commissioners are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, the Caroline County Planning Commission has approved amendments to the Caroline County Comprehensive Water and Sewerage Plan to include amendments and updated maps showing existing and planned water and sewer service areas by the Town of Ridgely and recommended them to the County Commissioners for adoption; and

WHEREAS, the Planning Commission and County Commissioners have each held duly advertised public hearings on the proposed amendments.

NOW, THEREFORE, IT IS HEREBY RESOLVED by the County Commissioners of Caroline County, Maryland, that the Comprehensive Water and Sewerage Plan be amended to include the two attached maps showing existing and planned water and sewer service areas by the Town of Ridgely and the text amendments as follows:

1. Add to Page 3-17:

   Election District No. 7

   WATER – Water service from the Town of Ridgely is proposed to be provided to Ridgely Airpark and a proposed County Business/Technology Park. The water lines will extend along Seward Road and Hog Lot Road and across Racetrack Road. A new well and water storage tank is anticipated. Other properties along Seward Road and Hog Lot Road will be denied access to water service unless annexed and rezoned to meet requirements for a "Priority Funding Area."

2. Add to Page 4-26:

   Election District No. 7

   SEWERAGE – Sewer service from the Town of Ridgely is proposed to be provided to the Ridgely Airpark and proposed County Business/Technology Park. Sewer lines will extend along Seward Road and Hog Lot Road and across Racetrack Road. A new pumping station is anticipated. Other property along Seward Road and Hog Lot Road will be denied access to sewer services unless annexed and rezoned to meet requirements for a "Priority Funding Area."

DULY ADOPTED AND EFFECTIVE THIS ELEVENTH DAY OF JUNE 2002.

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

John W. Cole, President

Franklin W. Prettyman, Vice President

ATTEST:

Leigh Sands, Executive Assistant

(Vacant)

STATE OF MARYLAND
CAROLINE COUNTY
FILED FOR RECORD
At 2:20 o'clock PM
On 6-11 2002, And
DULY RECORDED IN LIBER FOM
No. 3 FOLIO 533 ONE OF THE
Resolution RECORDS
KEPT FOR THE COUNTY AND STATE
G. Dale Vinnes CLERK

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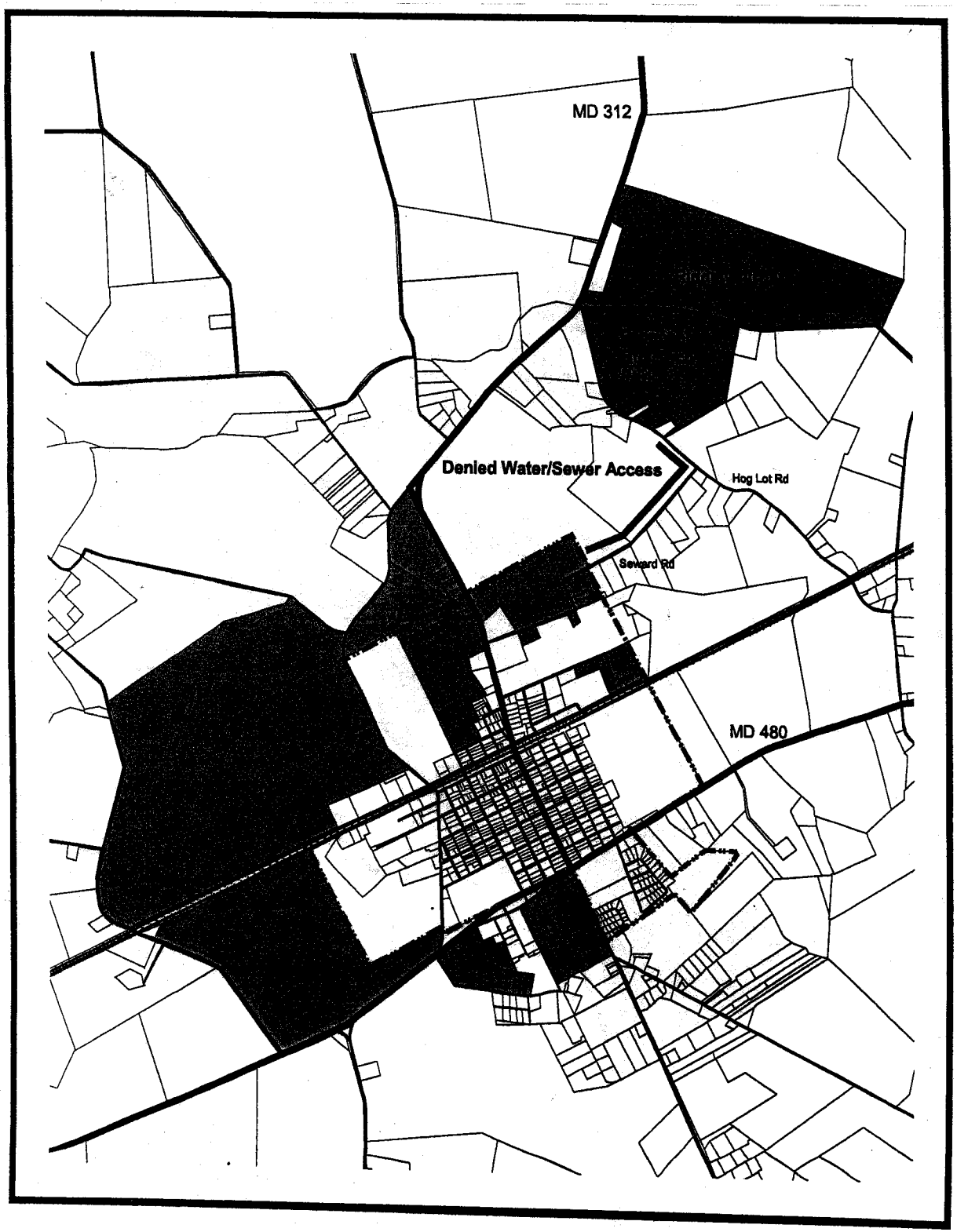
A-10



Use Legend: Ridgely Water Services

- Existing/Available Water Service Areas
- Planned Water Service Areas
- Existing and Planned Municipal Wastewater Treatment Facilities
- Ridgely Corporate Boundaries
- Denied Access Line (Water/Sewer)
- MD State Roads
- Caroline County Roads
- Railroad

Prepared by the Caroline County
Department of Planning and Codes Administration

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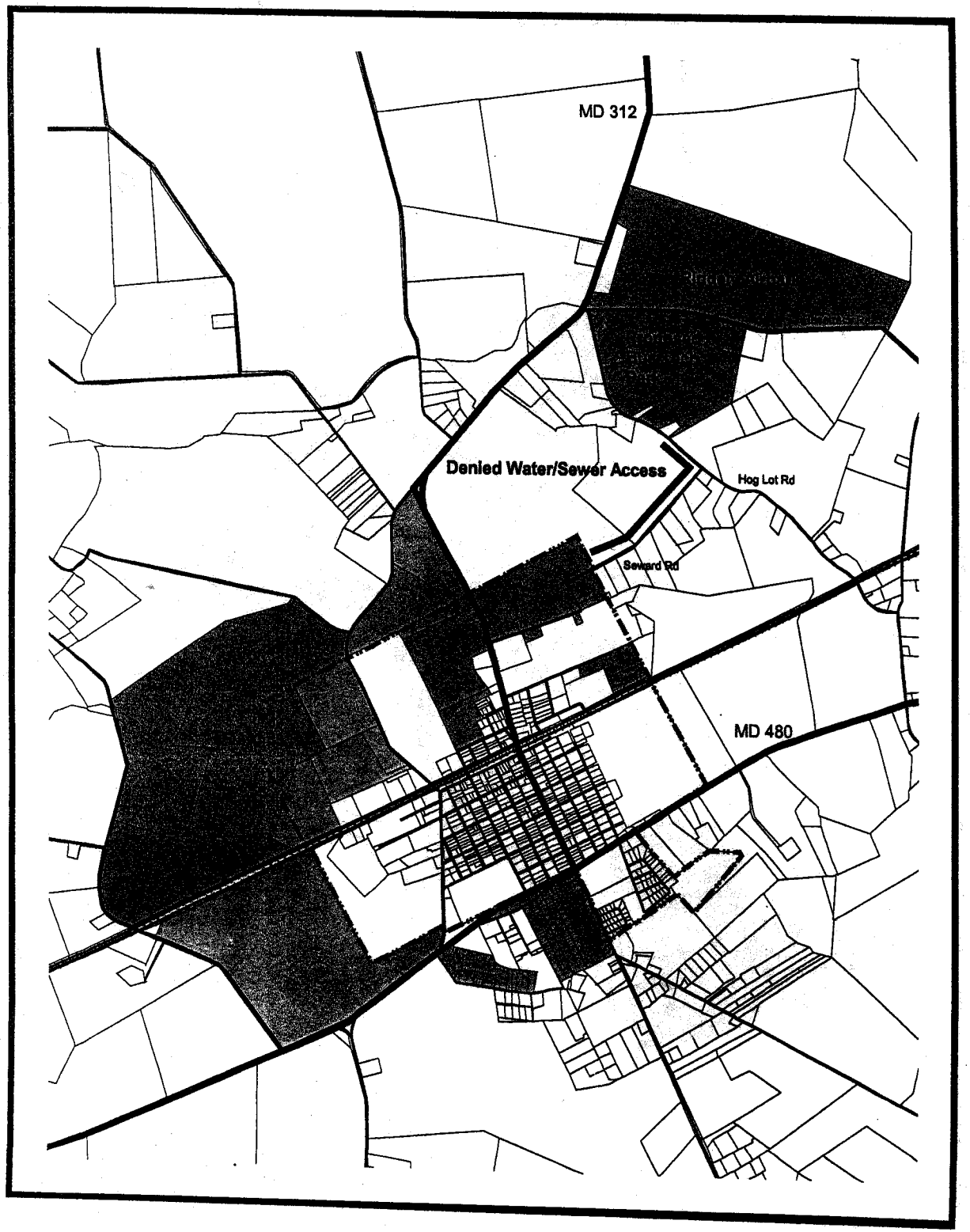
A-11



Use Legend: Ridgely Sewerage Services

- Existing/Available Sewer Service Areas
- Planned Sewer Service Areas
- Existing and Planned Municipal Wastewater Treatment Facilities
- Ridgely Corporate Boundaries
- Denied Access Line (Water/Sewer)
- MD State Roads
- Caroline County Roads
- Railroad

Prepared by the Caroline County
Department of Planning and Codes Administration

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A-12

MDE
MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Parris N. Glendening
Governor

Kathleen Kennedy Townsend
Lt. Governor

Richard F. Pecora
Secretary

Merrylin Zaw-Mon
Deputy Secretary

OCT 11 2002

The Honorable John W. Cole, President
County Commissioners of Caroline
County, Maryland
Courthouse, Room 103
Market Street
Denton MD 21629

Dear Mr. Cole:

We have completed our review of two amendments which were adopted by the Caroline County Commissioners on June 11, 2002 by Resolutions 2002-008 (Ridgely Airpark) and 2002-009 (Ridgely Business/Technology Park) to the 1996 Caroline County Water and Sewerage Plan. During the 90-day review period, the Maryland Department of the Environment (MDE) did not receive any comments on these amendments which would require disapproval. MDE approves these amendments. This action completes our review, as required by Section 9-507 of the Environment Article of State law.

Thank you for giving us this review opportunity. Ms. Elizabeth A. Krempasky, Director, Caroline County Planning & Codes Administration is commended for preparing these amendments. If you have any questions, please call Mr. Ray Anderson at (410) 537-3726.

Sincerely,

Virginia P. Kearney /for

Robert M. Summers, Director
Water Management Administration

cc: Ms. Elizabeth A. Krempasky
Mr. James T. Noonan

RESOLUTION #2002-018

ADOPTION OF CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN AMENDMENTS

WHEREAS:

The County Commissioners of Caroline County are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan;

The Town of Denton has proposed to annex 82.758 acres on Garland and Hobbs Roads owned by Garland and Hobbs, LLC, and 18.232 acres on Legion Road owned by Christian and Gail Jensen;

The Caroline County Planning Commission has reviewed amendments to the Caroline County Comprehensive Water and Sewerage Plan to include updated maps showing existing and planned 10 year water and sewer service areas by the Town of Denton, which include the properties described above;

The County Commissioners held a duly advertised public hearing on the proposed amendments on July 23, 2002.

NOW, THEREFORE, IT IS HEREBY RESOLVED by the County Commissioners of Caroline County, Maryland, that the Comprehensive Water and Sewerage Plan be amended to include the two attached maps showing existing and planned 10 year water and sewer service areas by the Town of Denton.

ADOPTED/EFFECTIVE THIS 30TH Day of July 2002.

Attest:

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

Leigh Sands, Executive Assistant

John W. Cole, President

Franklin W. Prettyman, Vice President

Marty J. Gangemi, Member

CAROLINE COUNTY
FILED FOR RECORD
At 12:30 o'clock PM
On 7-31 2002 At
DAILY RECORDED IN LIBER FOR
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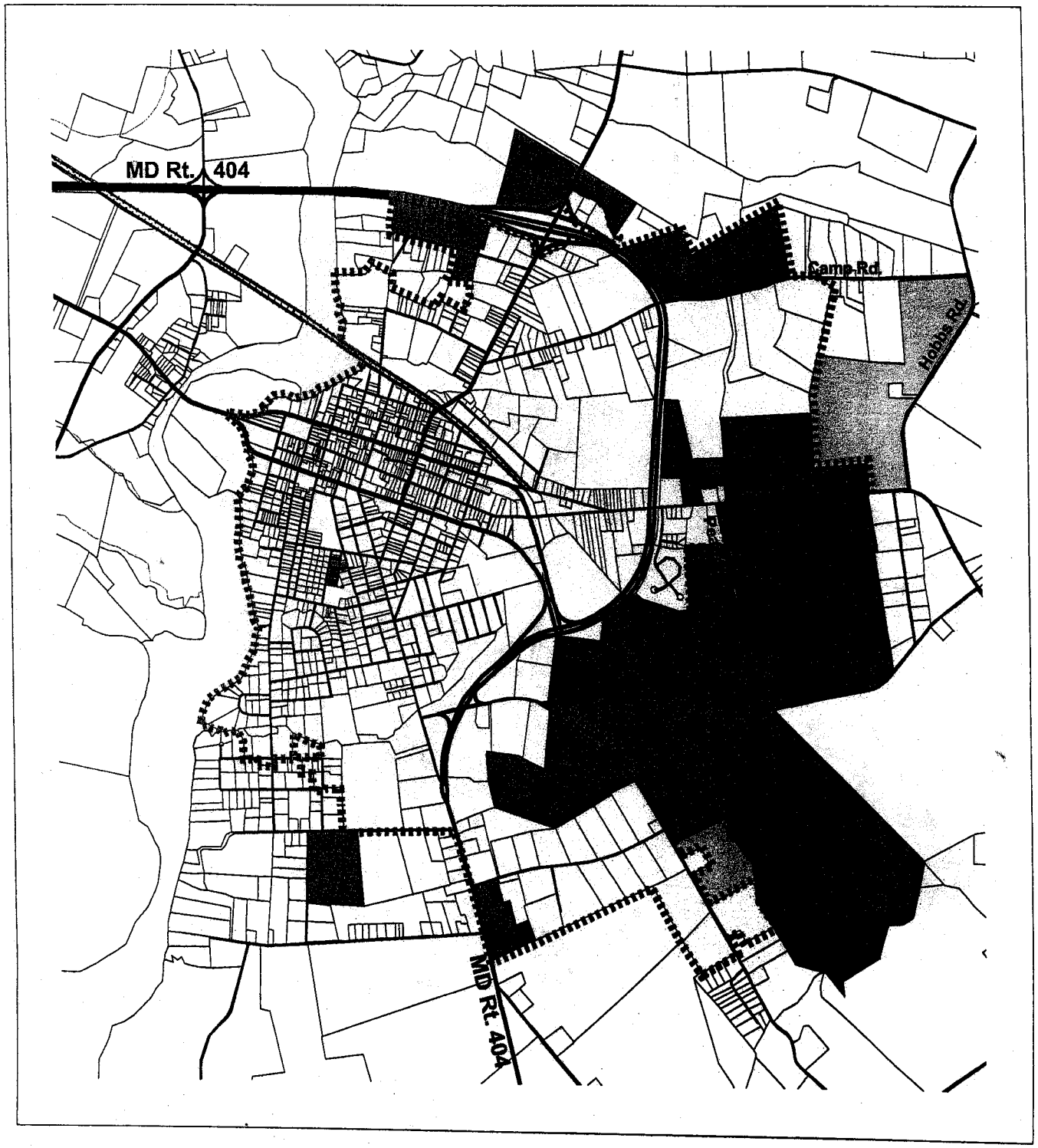
A-14



Use Legend: Denton Water Services

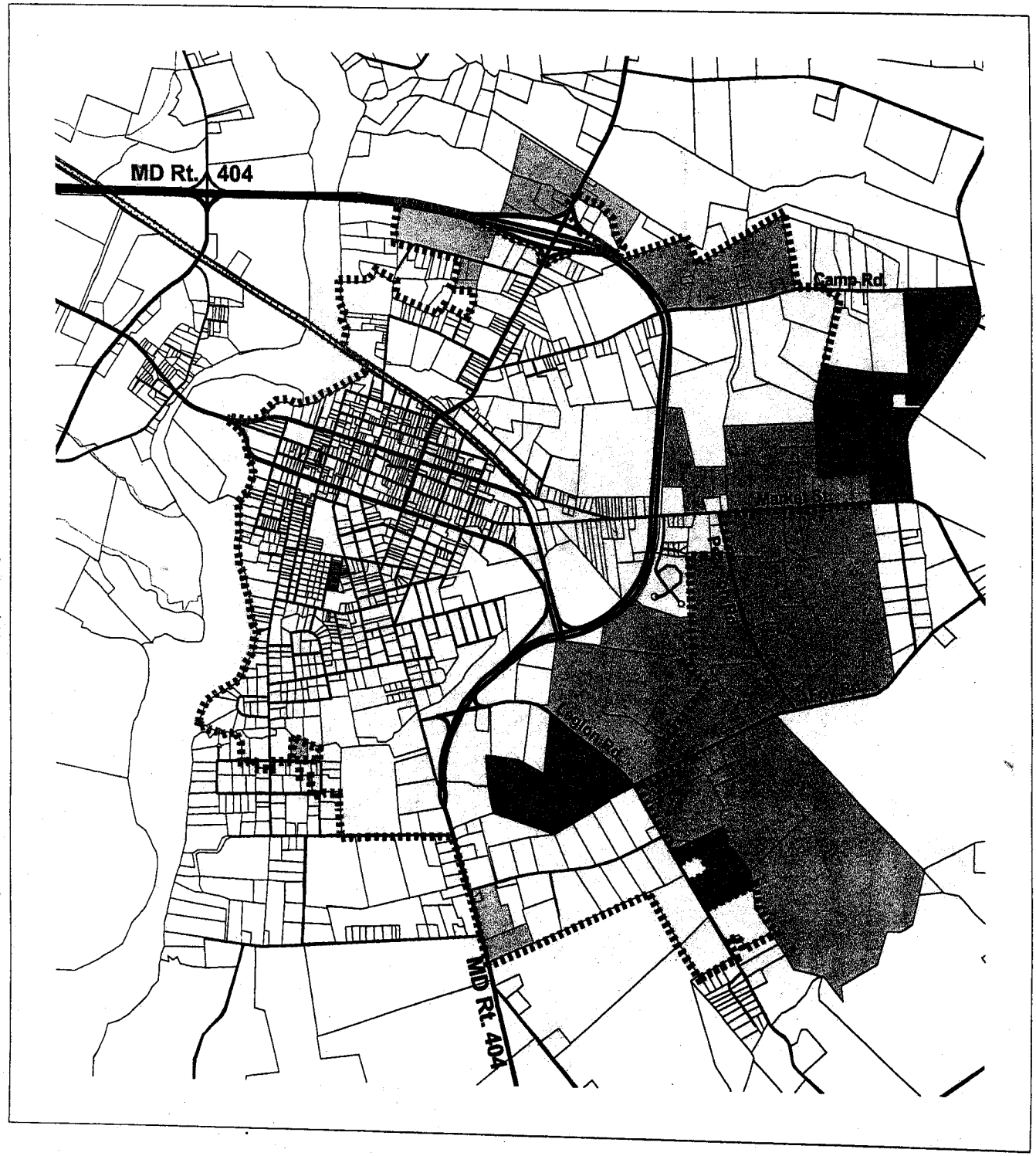
- Existing/Available Water Service Areas
- Planned Water Service Areas (10 Year)
- Annexation Areas Planned Water Service
- Water/Wastewater Treatment Plant
- Denton Corporate Boundaries
- Maryland State Roads
- County/Town Roads
- Railroad

THE GREAT SEAL OF CAROLINE COUNTY IN MARYLAND 1773

August 2002 (V-2)

1000 0 1000 2000 Feet

D-15



Use Legend: Denton Sewer Services

- Existing/Available Sewer Service Areas
- Planned Sewer Service Areas (10 Year)
- Annexation Areas Planned Sewer Service
- Water/Wastewater Treatment Plant
- Denton Corporate Boundaries
- Maryland State Roads
- County/Town Roads
- Railroad

July 2002 (V-2)

1000 0 1000 2000 Feet

Maryland Department of Planning

Parris N. Glendening
Governor
Kathleen Kennedy Townsend
Lt. Governor

Roy W. Kienitz
Secretary
Mary J. Abrams
Deputy Secretary

December 4, 2002

Ray E. Anderson Jr., P. E.
Maryland Department of the Environment
1800 Washington Blvd
Water Quality Infrastructure Program
Baltimore MD 21230

Subject: Amendment to the Caroline County Comprehensie Water and Sewer Plan – Resolution 2002-018 for Jensen property and Garland & Hobbs

Dear Mr. Anderson:

Thank you for providing the Maryland Department of Planning with a copy of the aforementioned amendment. We have reviewed this amendment as required by the Environmental Article Section 9-507 (b)(2) and find it to be consistent with local plan and state growth management policies.

If you have any questions concerning these comments, please contact me at 410-767-4564.

Sincerely,

La Verne Gray
Planner
Local Planning Assistance

cc: Elizabeth Krempasky
Mark Gradecak

301 West Preston Street • Suite 1101 • Baltimore, Maryland 21201-2365
Telephone: 410.767.4500 • Fax: 410.767.4480 • Toll Free: 1.877.767.6272 • TTY Users: Maryland Relay
Internet: www.MDP.state.md.us

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Parris N. Glendening
Governor

Kathleen Kennedy Townsend
Lt. Governor

Richard F. Pecor
Secretar

Merrylin Zaw-Mor
Deputy Secretar

DEC 20 2002

The Honorable John W. Cole, President
County Commissioners of Caroline County, Maryland
Courthouse
Market Street, Room 103
Denton MD 21629

Dear Mr. Cole:

We have completed our review of two amendments which were adopted by the Caroline County Commissioners on July 30, 2002 by Resolution #2002-018 (Jensen property and Garland and Hobbs property) to the 1996 Caroline County Water and Sewerage Plan. The Maryland Department of Planning (MDP) advises that the amendment is consistent with the Caroline County Comprehensive Plan.

The Maryland Department of the Environment approves these amendments. This action completes our review, as required by Section 9-507 of the Environment Article of State law. Enclosed for your review is a copy of the supportive comments from the MDP.

Thank you for giving us this review opportunity. Ms. Elizabeth A. Krempasky, Director, Caroline County Planning & Codes Administration is commended for preparing these two amendments. If you have questions regarding the amendments, please call Mr. Ray Anderson at (410) 537-3726.

Sincerely,

Virginia T. Kearney /fr

Robert M. Summers, Director
Water Management Administration

enclosure

cc: Ms. Elizabeth A. Krempasky
Mr. James T. Noonan

"Together We Can Clean Up"

A-18

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

LEGISLATIVE BILL #2008-7

INTRODUCED BY:	COMMISSIONERS COLE, LAYTON AND GHRIST
INTRODUCED ON:	AUGUST 12, 2008
ATTEST:	JOHN W. COLE, PRESIDENT
PUBLIC HEARING:	AUGUST 26, 2008; COURTHOUSE, 109 MARKET STREET, RM. 106, DENTON, MARYLAND; BEGINNING AT 7:30 PM
THIRD READING:	**SEPTEMBER 9, 2008**
ENACTED:	**SEPTEMBER 9, 2008**
EFFECTIVE:	**OCTOBER 25, 2008**

A BILL ENTITLED

CREATION OF NEW CHAPTER 173 – WATER AND SEWER DISTRICTS AND AUTHORITIES – IN THE CODE OF PUBLIC LOCAL LAWS OF CAROLINE COUNTY MARYLAND AND TO PROVIDE FOR A NORTH COUNTY WATER & SEWER AUTHORITY IN CAROLINE COUNTY AND TO AUTHORIZE THE PARTICIAPTION OF CAROLINE COUNTY IN SUCH AUTHORITY AND TO ADOPT THE ARTICLES OF INCORPORATION FOR SUCH AUTHORITY

CODE OF PUBLIC LOCAL LAWS OF CAROLINE COUNTY
Chapter 173 – WATER AND SEWER DISTRICTS AND AUTHORITIES

FOR THE PURPOSE of adding new Chapter 173 to the Code of Public Local Laws of Caroline County, Maryland; providing that the County Commissioners of Caroline County may enact legislation with respect to the creation and operation of water and/or sewer districts and/or authorities as may be permitted by applicable law, including districts and/or authorities consisting of multiple jurisdictions including towns, cities, and other water and/or sewer districts, authorities, systems, or otherwise; providing for the participation of, and entry by, Caroline County in the proposed North County Water & Sewer Authority; providing for the adoption of the Articles of Incorporation for the North County Water & Sewer Authority; providing for the designation of the initial director from the County within the Articles of Incorporation for the North County Water & Sewer Authority; providing that this title be deemed a fair summary of this public local law for all purposes; and relating generally to matters concerning water and sewer districts and authorities in Caroline County, Maryland.

NOW, THEREFORE, BE IT ENACTED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND THAT:

SECTION 1. Chapter 173 is hereby added to the Code of Public Local Laws of Caroline County, Maryland to read as follows:

Chapter 173
WATER AND SEWER DISTRICTS AND AUTHORITIES

§ 173-1. General Authority.

The County Commissioners of Caroline County, subject to applicable law, including, but not limited to Subtitle 9 of Title 9 of the Environment Article of the Annotated Code of Maryland, are authorized and empowered to create, join, enter into, operate, provide financing for (including loan and grant guarantees to third parties), manage, have an ownership or

operational interest in, and otherwise participate in water and/or sewer districts, authorities, systems, consortiums, and ventures, in any form or structure, including districts, authorities, systems, consortiums, and ventures consisting of multiple jurisdictions including towns, cities, and other water and/or sewer districts, authorities, systems, or otherwise for the provision of water and/or sewer services.

§ 173-2. North County Water & Sewer Authority – Approval.

The County Commissioners of Caroline County approve the entry of Caroline County into the North County Water & Sewer Authority (the "Authority") on the terms and conditions set forth in the proposed Articles of Incorporation ("Articles") for the Authority, which Articles are set forth below, provided that all of the jurisdictions referenced in the Articles similarly agree to enter into and form the Authority:

ARTICLES OF INCORPORATION

NORTH COUNTY WATER & SEWER AUTHORITY

ARTICLE I

The undersigned, being the duly elected officials of the political subdivisions named herein, the requisite laws having been enacted in each of such political subdivisions, hereby form an authority pursuant to Subtitle 9 of Title 9 of the Environmental Article of the Annotated Code of Maryland, said authority being a non-stock corporation under and by the virtue of the laws of the State of Maryland.

ARTICLE II

The name of the corporation (which is hereinafter called the "Authority") is:

North County Water & Sewer Authority

ARTICLE III

The Authority is formed for the following purposes:

The Authority is organized exclusively to exercise, perform, and carry out essential governmental functions and services, and to provide for the public health and welfare, pursuant to Subtitle 9 of Title 9 of the Environmental Article of the Annotated Code of Maryland (the "State Authority Code"), including, more specifically, but not by way of limitation, to operate as an authority pursuant to the State Authority Code, to operate a sanitary sewer district and sewerage system as provided for in the State Authority Code to provide for the collection, carrying, treatment, neutralization, and disposal of sewage, to operate a water district and water system as provided for in the State Authority Code to provide for the collection, supply, treatment, and distribution of water, and to have and exercise all powers granted to such authorities pursuant to the State Authority Code and to do all things permitted such authorities and all things necessary, incidental, or related thereto not prohibited to such authorities under the State Authority Code or other provisions of applicable law, including, but not limited to, the acquisition, ownership, leasing, construction, operation, disposal, and other activities with respect to real and personal property, the sale of bonds, and the entering into of contracts with its members and others.

ARTICLE IV

The post office address of the principal office of the Authority in this State is County Administrator, Courthouse, 109 Market Street, Room 123, Denton, Maryland, 21629. The name and post office address of the Resident Agent of the Authority in this State is Ernest A. Crofoot, 315 High Street, Suite 202, Chestertown, Maryland 21620. By his signature at the end of this document, this person acknowledges acceptance of the responsibilities as Resident Agent of the Authority. Said Resident Agent is an individual actually residing in this State of Maryland.

ARTICLE V

(a) The Authority is not organized for profit; it shall have no capital stock and shall not be authorized to issue capital stock. The number of directors of the Authority shall be the greater of five (5) or the number of member political subdivisions. The five (5) incorporating political subdivisions of the Authority are:

1. Mayor and Council of Goldsboro ("Goldsboro")
2. The Commissioners of Henderson ("Henderson")
3. Commissioners of Marydel ("Marydel")
4. The Commissioners of Templeville ("Templeville")

each of the foregoing towns being a body corporate and politic and a municipal corporation duly existing under the laws of the State of Maryland and situated wholly or partly in Caroline County, Maryland, and

5. County Commissioners of Caroline County ("Caroline"), a body corporate and politic and a subdivision of, and duly existing under the laws of, the State of Maryland.

(b) The initial five Directors of the Authority, as required by the State Authority Code, each of which shall serve for an initial term commencing upon the issuance of a certificate of approval by the State Department of Assessments and Taxation of Maryland as provided for in § 9-907 of the State Authority Code and ending on the date specified below after the name of each such Director, are:

1. On behalf of Goldsboro:
   ROBIN CAHALL (January 31, 2011)
   P.O. BOX 132
   GOLDSBORO, MARYLAND 21636

2. On behalf of Henderson:
   SANDY COOK (January 31, 2011)
   BOX 10
   HENDERSON, MARYLAND 21640

3. On behalf of Marydel:
   DEBBIE ROWE (January 31, 2011)
   P.O. BOX 81
   MARYDEL, MARYLAND 21649

4. On behalf of Templeville:
   HELEN KNOTTS (January 31, 2010)
   P.O. BOX 25
   TEMPLEVILLE, MARYLAND 21670

5. On behalf of Caroline:
   DAVID PORTER (January 31, 2010)
   COUNTY ENGINEER
   403 SOUTH SEVENTH STREET
   DENTON, MARYLAND 21629

(c) After the initial term has been completed, Directors for each of the incorporating jurisdictions shall serve for terms of three (3) years.

(d) If a vacancy shall occur during the term of a Director, the governing body of the jurisdiction represented by the Director whose position has become vacant shall select a new Director to complete the term of the vacant Director's position.

(e) If an additional political subdivision joins the Authority, the governing body of the joining political subdivision immediately shall appoint one Director for a term that is the same as the full term Directors.

(f) If a political subdivision withdraws from the Authority, and Director who was appointed to represent the withdrawing political subdivision immediately shall cease to be a Director, no Director shall be appointed in the place thereof, and the number of Directors, if necessary, shall be the number required under § 9-915 of the State Authority Code and these Articles of Incorporation shall be amended forthwith to provide for the any required apportioning thereof.

(g) Other matters relating to the Authority's members and Directors shall be as set forth in the Bylaws of the Authority.

ARTICLE VI

Upon the dissolution of the Authority or the termination of its activities or affairs, or upon the abandonment of the Authority's activities, upon compliance with § 9-911 of the State Authority Code, the assets of the Authority then remaining in the hands of the Authority shall be distributed, transferred, conveyed, delivered and handed or paid over to its members and/or some other entity for the further conduct of activities having a similar or analogous character or purpose to those of the Authority or for distribution to such members as any plan of dissolution or applicable law may dictate.

ARTICLE VII

Anything in these Articles to the contrary notwithstanding, no action of the Authority shall be binding upon any member political subdivision, the financial obligations or financial credit of which may be increased, compromised, or extended, without the express written consent of that political subdivision granted in accordance with the laws and procedures of that political subdivision in accordance with its legal and customary practices. No Director of a member political subdivision shall have the right to extend, compromise, or increase the financial obligations or financial credit of the member political subdivision appointing such Director by virtue of the Director's status as such.

Subject to the foregoing, the Authority may enter into contracts, agreements, indentures, loans, credit facilities, and other devices with a member political subdivision wherein or whereby that member political subdivision takes on an obligation, duty, or risk and for which such member political subdivision may, but shall not be obligated to, receive a separate and distinct fee, benefit, consideration, or payment therefore or with respect thereto.

ARTICLE VIII

The Authority may by its Bylaws make any other provisions or requirements for the arrangement or conduct of the business of the Authority, provided the same are not inconsistent with these Articles of Incorporation or contrary to the laws of the State of Maryland or of the United States.

[Signature & formality lines and information not included for purposes of legislation; Directors for local jurisdiction to be determined by the local jurisdictions.]

§ 173-3. North County Water & Sewer Authority - Execution of Articles of Incorporation.

Upon approval of the Articles by the participating local jurisdictions, the County Commissioners of Caroline County are authorized to, and shall, execute the Articles and to take all necessary and appropriate actions to cause the Articles to be filed with the Maryland State Department of Assessment and Taxation, and to take all reasonable and appropriate acts in furtherance of the creation of the Authority and for Caroline County's participation therein.

SECTION 2. The title of this legislative bill, or a condensed version thereof, shall be deemed to be, and is, a fair summary of this bill for publication and all other purposes.

SECTION 3. This public local law shall take effect forty-five days after enactment by the County Commissioners.

ENACTED THIS 9th DAY OF September, 2008.

ATTEST:

Sara B. Visintainer
SARA B. VISINTAINER
EXECUTIVE ASSISTANT

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

J. W. Cole
JOHN W. COLE, PRESIDENT

Roger L. Layton
ROGER L. LAYTON, VICE PRESIDENT

JEFFERSON L. CHRIST, COMMISSIONER

COUNTY COMMISSIONERS CAROLINE COUNTY MARYLAND

NOTE: ***CAPITALS indicate bill amendment additions.***

RESOLUTION #2002-024

ADOPTION OF FIVE-YEAR PLAN FOR THE ESTABLISHMENT OF NORTH CAROLINE COUNTY WATER AND SEWER SERVICE DISTRICT TO INCLUDE THE TOWNS OF GOLDSBORO, HENDERSON, MARYDEL, AND TEMPLEVILLE

WHEREAS:

In response to longstanding problems posed by failing septic systems, the County Commissioners of Caroline County, in cooperation with municipal and State officials, entities and agencies, have undertaken an extensive study and review of water and wastewater needs in the North Caroline County region and its four incorporated communities;

Pursuant to Caroline County Resolution #2001-007, titled North County Water and Sewer Service Districts, the Maryland Environmental Service developed a "*Five-Year Plan for the Establishment of North Caroline County Water and Sewer Service District to Include the Towns of Goldsboro, Henderson, Marydel, and Templeville,"* (the "Plan");

In the Plan, certain areas of North Caroline County, including the towns of Goldsboro, Henderson, Marydel, Templeville, and surrounding localities, as well as the incorporated area of the Town of Templeville in Queen Anne's County, have been designated to be served by a regional water and wastewater system upon availability of funding;

A duly advertised public hearing was held in the Town of Goldsboro on October 29, 2002, at which time the Maryland Environmental Service solicited public comments on the proposed concept of a water and sewer service district for the North Caroline County region. Public support for the project was demonstrated at the hearing; and

Pursuant to the Maryland Environmental Service Act, Natural Resources Article, Title 3-101, et seq. of the Annotated Code of Maryland, and subject to the approval of the County Commissioners of Caroline County, and the participating municipalities, the Maryland Environmental Service has the authority to create a water and wastewater service district for North Caroline County communities and surrounding areas.

NOW, THEREFORE, IT IS HEREBY RESOLVED By the County Commissioners of Caroline County, Maryland, that:

1. North Caroline County, including the Towns of Goldsboro, Henderson, Marydel, Templeville, and surrounding localities, as well as the incorporated area of the Town of Templeville located in Queen Anne's County, is an area in need of a regional system for public water supply and wastewater treatment and disposal;

2. In order to meet that need, the "*Five-Year Plan for the Establishment of North Caroline County Water and Sewer Service District to Include the Towns of Goldsboro, Henderson, Marydel, and Templeville,*" as prepared by the Maryland Environmental Service, is herewith adopted by reference; and

3. Following adoption of the Plan by Caroline County, and by the participating municipalities, the Maryland Environmental Service is hereby authorized and requested, when funding is available, to establish a water and sewer service district for the aforesaid North Caroline County communities and surrounding areas, and to assume ownership and operation of the water and wastewater system serving the district, with operating costs to be paid by system users.

ADOPTED: DECEMBER 17, 2002

ATTEST:

Leigh Sands, Executive Assistant

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

John W. Cole, President

Roger L. Layton

Mario J. Gangemi

Liber 3 page 543

MARYLAND ENVIRONMENTAL SERVICE

FIVE YEAR PLAN

FOR

THE ESTABLISHMENT AND MANAGEMENT OF A NORTH COUNTY WATER AND SEWER SERVICE DISTRICT

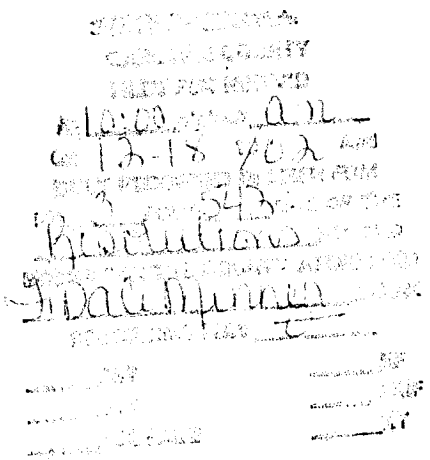
TO INCLUDE THE TOWNS OF

GOLDSBORO, HENDERSON, MARYDEL, TEMPLEVILLE

Prepared by:

MARYLAND ENVIRONMENTAL SERVICE
2011 COMMERCE PARK DRIVE
ANNAPOLIS, MARYLAND 21401

May 23, 2002



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A: MD. Code Ann., Natural Resources; Section 3-101, 3-104, 3-106, 3-107, 3-108, and Section 3-128
B: Partial List of Names and Addresses of Property Owners in Goldsboro, Henderson, Marydel, Templeville
C: Cost Summary for Construction of Facilities

Folder 3 page 5/15

SUMMARY

In response to problems posed by failing septic systems in the communities of Northern Caroline County, Caroline County Government through MES initiated a region wide study in 1998. The study, which was conducted by the firm of George, Miles & Buhr (GMB), LLP, targeted the towns of Goldsboro, Henderson, Marydel, Templeville and the surrounding areas. The study recommended a regional water and wastewater system to be appropriate and cost effective in resolving problems associated with failing septic systems in the area.

In response to the recommendation, the Caroline County Commissioners passed a resolution asking MES to prepare a Five Year Plan for the establishment of a water and sewer service district. This Five Year plan has been prepared in response to the County's request. MES is designating the areas of Northern Caroline and Queen Anne's Counties as the Service Region for this purpose. The portion of the community of Marydel which is inside Delaware is not included in this Five Year Plan. However, service to that portion of the Town can be rendered under a contractual arrangement as necessary. The Maryland Environmental Service Act, giving MES its power to designate a service region is set forth in the Annotated Code of Maryland Natural Resources Article, Section 3-101, and subsequent sections. MES is an instrumentality of the State of Maryland created by the Maryland General Assembly to provide, among other things, dependable, effective, and efficient water supply and wastewater collection and treatment services to public and private sectors in compliance with State laws, regulations, and policies that govern air, land and water pollution.

The Five Year Plan outlines an effective and economical means of providing water supply and wastewater collection and treatment service. It also outlines:

- Development and construction of facilities;
- Acquisition or improvement of facilities;
- Potential expansion; and
- Ownership and operation of the water supply and wastewater collection and treatment facilities.

Adoption of this Five Year Plan by the MES Board of Directors is not anticipated until funding for the project is available. Adoption would occur after a public hearing is held in Caroline and Queen Anne's Counties and approval by Commissioners of respective Counties and affected Towns.

Upon adoption of the Five Year plan and establishment of the Service District, MES will initiate construction of water distribution and wastewater collection and treatment facilities. Although the basis for selection of facilities is the 1998 engineering feasibility study and cost estimate of water supply/distribution and wastewater collection/treatment systems, MES may modify the recommended facilities as necessary. Facilities to be constructed by MES include water supply, storage and distribution systems for the Towns Goldsboro, Marydel-Maryland and Templeville. The current public water system in the Town of Henderson will be integrated into the service district and maintained. MES will also construct a gravity sewer system to collect domestic wastewater from these Towns and convey it to a central treatment plant to be constructed in Goldsboro.

The total estimated capital cost for the construction of the proposed facilities is $15,115,837. This funding will come from a combination of Federal, State grants and loans from private and public lenders. The annual operation and maintenance cost is estimated to be about $186,515 and will be covered by charges levied against water and sewer service customers.

Capital and O&M Cost Summary

Facility	Capital Cost	Annual O&M Cost
Water Supply	$5,686,387	$38,525
Wastewater Collection	$7,975,700	$50,836
Wastewater Treatment	$1,453,750	$97,154
Total	**$15,115,837**	**$186,515**

The projected monthly user charge is based on the total number dwelling units to be connected to water and sewer system. Based on the 1998 count of 368 units, the monthly cost per connection is estimated to be about $42.24. However, based on current count of 553 units (estimated by Caroline County), the monthly cost per connection is estimated to be about $28.11.

Dwelling Units/Population Summary/Monthly Cost Estimate

Town/Community	1998 Estimate		2002 Caroline County Estimate	
	Dwelling Units	*Population*	*Dwelling Units*	*Population*
Goldsboro	105	305	105	305
Henderson	53	154	53	154
Marydel-Maryland	93	270	62	270
Marydel-Delaware	55	160	55	160
Templeville	62	180	37	80
Caroline Acres			137	300
Cedars			91	455
Hill Top Mobile Home			13	30
Total	**368**	**1069**	**553**	**1754**
Monthly Cost	$42.24/Month		$28.11/Month	

* Estimated dwelling units (105 in Goldsboro, 53 in Henderson, 62 in Marydel-MD, 55 in Marydel-DE, 37 in Templeville, and approximately 241 mobile homes). The figures will have to be certified through actual house counts.

It should be noted that this monthly cost estimate is tentative and will require a new income survey and actual house counts for accuracy and certification of number of dwelling units to be connected to the proposed water and sewer system. The capital cost estimates also does not include connection costs for the residents of the community of Marydel-Delaware.

Volume 3 page 547

RESOLUTION #2001-007

NORTH COUNTY WATER AND SEWER SERVICE DISTRICT(S)

Expressing general support, contingent upon the review and approval of a five-year plan, for establishment of a service district to be submitted by the Maryland Environmental Service ("MES"), for creation by MES of one or more MES water and wastewater service districts in the general vicinity of northern Caroline County.

WHEREAS:

Certain areas of northern Caroline County, which generally include the Towns of Goldsboro, Henderson, Marydel and Templeville, and surrounding localities (including, without limitation, certain areas of Queen Anne's County, Maryland, and Kent County, Delaware) are in need of improved water supply and wastewater treatment systems;

The County Commissioners, in cooperation with municipal and State officials, have undertaken extensive study and review of the water and wastewater needs of the northern Caroline County area;

The County Commissioners believe that the water supply and wastewater treatment needs of northern Caroline County can best be met by development of a regional system(s);

Pursuant to the Maryland Environmental Service Act (the "Act"), Natural Resources Article, Title 3, subtitle 1, Annotated Code of Maryland, MES has been established to provide for dependable, effective, and efficient water supply and purification and disposal of liquid wastes;

The Act authorizes MES to create water and wastewater service districts, but only after MES has prepared a five-year plan and obtained certain approvals, including the approval of the governing body of the county in which the service district is to be established;

liber 3 page 466

Officials of MES have represented to the County Commissioners of Caroline County that MES is capable of preparing a five-year plan for the establishment of a water and wastewater service district for northern Caroline County;

Prior to expending substantial resources on the preparation of a five-year plan, MES desires to obtain an assurance from the County Commissioners of Caroline County that the County generally supports the efforts of MES to prepare a five-year plan and establish a water and wastewater service district(s), and further that the County Commissioners will consider funding the preparation of a five-year plan for the portion of a proposed service district(s) located in Caroline County;

The County Commissioners believe that in preparing a five-year plan, MES can benefit from the expertise of the citizens of Caroline County; and

MES understands that adoption of this resolution does not in any way bind the County Commissioners to approve the five-year plan which MES may propose for the creation of one or more water or wastewater service district(s).

NOW, THEREFORE, IT IS HEREBY RESOLVED By the County Commissioners of Caroline County:

1. The County Commissioners acknowledge that the area of northern Caroline County, which includes the Towns of Goldsboro, Henderson, Marydel and Templeville, and surrounding localities (including, without limitation, certain areas of Queen Anne's County, Maryland and Kent County, Delaware) are in need of regional systems for water supply and wastewater treatment and disposal.
2. The County Commissioners hereby request MES to consider establishing one or more water supply and wastewater treatment service districts in northern Caroline County.
3. The County Commissioners hereby request MES to prepare and submit a cost proposal for the preparation of the five-year plans necessary to develop the water supply and wastewater treatment service district(s) described herein. The cost proposal should separately itemize the costs for any portion of a proposed service district not located in Caroline County.

liber 3 page 467

4. The County Commissioners may establish an advisory committee of not more than 15 individuals who will provide advice to MES and the County Commissioners on matters related to the proposed service district(s).

ADOPTED/EFFECTIVE: MAY 1, 2001

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

ATTEST:

Leigh Sands, Executive Assistant

(SEAL)

John W. Cole, President

Franklin W. Prettyman, Vice President

John S. LeGates, Member

STATE OF MARYLAND
CAROLINE COUNTY
FILED FOR RECORD
AT 11:00 am
ON 5-8 2001
RESOLUTION
T. Nate Minner

liber 3 page 468

RESOLUTION #99-003

**ENDORSEMENT OF NORTH CAROLINE WATER AND WASTEWATER PROJECT;
AGREEMENT TO SEEK GRANT FUNDS**

A RESOLUTION concerning a water distribution and wastewater collection and treatment system for northern Caroline County in an area including the Towns of Goldsboro, Henderson, Marydel and Templeville.

WHEREAS:

The County Commissioners of Caroline County, Maryland ("the Commissioners"), acknowledge that officials from the Maryland Department of the Environment have issued a consent order to the Town of Goldsboro directing the Mayor and Council to eliminate pollution resulting from failing on-site waste disposal systems within the town;

The Commissioners recognize that the Mayor and Council of the Town of Goldsboro are committed to finding a solution to the town's failing on-site septic systems for the improvement of health and environmental conditions for its residents;

A series of community meetings were held in the towns of Goldsboro, Henderson, Marydel and Templeville in August 1997, with approximately 180 residents from the towns and surrounding area in attendance, where widespread support was expressed at those meetings for working together to find a regional solution for the water and wastewater problems of the towns and surrounding areas;

The Commissioners support the concept of a regional water distribution and wastewater collection and treatment system and contributed $10,000 to the George, Miles and Buhr *North Caroline Water and Wastewater Preliminary Engineering Feasibility Study,* which demonstrates under certain conditions that the regional project is economically and financially feasible;

liber 3 page 217

The Commissioners recognize that the governing bodies of the Towns of Goldsboro, Henderson, Marydel and Templeville have each approved resolutions supporting a regional water distribution and wastewater collection and treatment system for their towns and the area surrounding their jurisdictions as a joint project; and

The Commissioners recognize the importance of safe water distribution and wastewater collection and treatment for the health and welfare of north county citizens, and understand the need for the timely submission of grant and loan requests in support of a regional water distribution and wastewater collection and treatment system; and

The Commissioners desire to provide leadership and assistance to the Towns of Goldsboro, Henderson, Marydel and Templeville and the areas surrounding those jurisdictions in creating a management structure to provide ownership, and operation and maintenance responsibilities for a regional water distribution and wastewater collection and treatment system.

NOW, THEREFORE, IT IS HEREBY RESOLVED That the County Commissioners of Caroline County, Maryland, do hereby endorse the North Caroline Regional Water and Wastewater Project and participation by the Towns of Goldsboro, Henderson, Marydel and Templeville in the project.

FURTHER RESOLVED, That the Commissioners agree to submit to various Federal and State agencies on behalf of said Towns requests for funding for preliminary engineering and planning for this project, and to assist the Towns in seeking further funding for the design and construction of a regional water distribution and wastewater collection system for the Towns of Goldsboro, Henderson, Marydel and Templeville.

FURTHER RESOLVED, That Helen Spinelli, Caroline County director of economic development, is designated as the County project coordinator with planning authority.

ADOPTED/EFFECTIVE:
MARCH 2, 1999

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

ATTEST:

LEIGH SANDS
EXECUTIVE ASSISTANT

SEAL

JOHN W. COLE, PRESIDENT

FRANKLIN W. PRETTYMAN,
VICE PRESIDENT

JOHN S. LEGATES, MEMBER

STATE OF MARYLAND
CAROLINE COUNTY
FILED FOR RECORD
At 2:00 o'clock PM
On 3-4 1999 And
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liber 3 page 219

RESOLUTION #2008-028

ADOPTION OF NORTH CAROLINE COUNTY COMPRHENSIVE PLAN AMENDMENTS

RECITALS:

WHEREAS, The County Commissioners of Caroline County are empowered by Article 66B of the Annotated Code of Maryland to adopt and amend the 2003 North Caroline County Comprehensive Plan; and

WHEREAS, Caroline County and the Towns of Goldsboro, Henderson, Marydel and Templeville collaborated to complete a build-out analysis to determine wastewater treatment needs for the region, and to define a water and sewer district; and

WHEREAS, The Caroline County Planning Commission has reviewed amendments to the North Caroline County Comprehensive Plan to include updated maps showing planned water and sewer service areas in the North Caroline County by the Towns of Goldsboro, Henderson, Marydel and Templeville, and specific areas of Caroline County surrounding those towns; and

WHEREAS, The County Commissioners held a duly advertised public hearing on the proposed amendments on September 16, 2008.

NOW, THEREFORE, IT IS HEREBY RESOLVED by the County Commissioners of Caroline County, Maryland, that the North Caroline County Comprehensive Plan be amended to include the five attached maps showing planned water and sewer service areas in the North Caroline County region, and as follows:

> Add to page 91: Water and sewer service is proposed to be provided to the Towns of Goldsboro, Henderson, Marydel and Templeville, along with specific properties in Caroline County. Other property in this region will be denied access to sewer services unless annexed and rezoned to meet requirements for a "Priority Funding Area."

ADOPTED/EFFECTIVE: September 23, 2008

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

Attest:

Sara B. Visintainer, Executive Assistant

John W. Cole, President

Roger L. Layton, Vice President

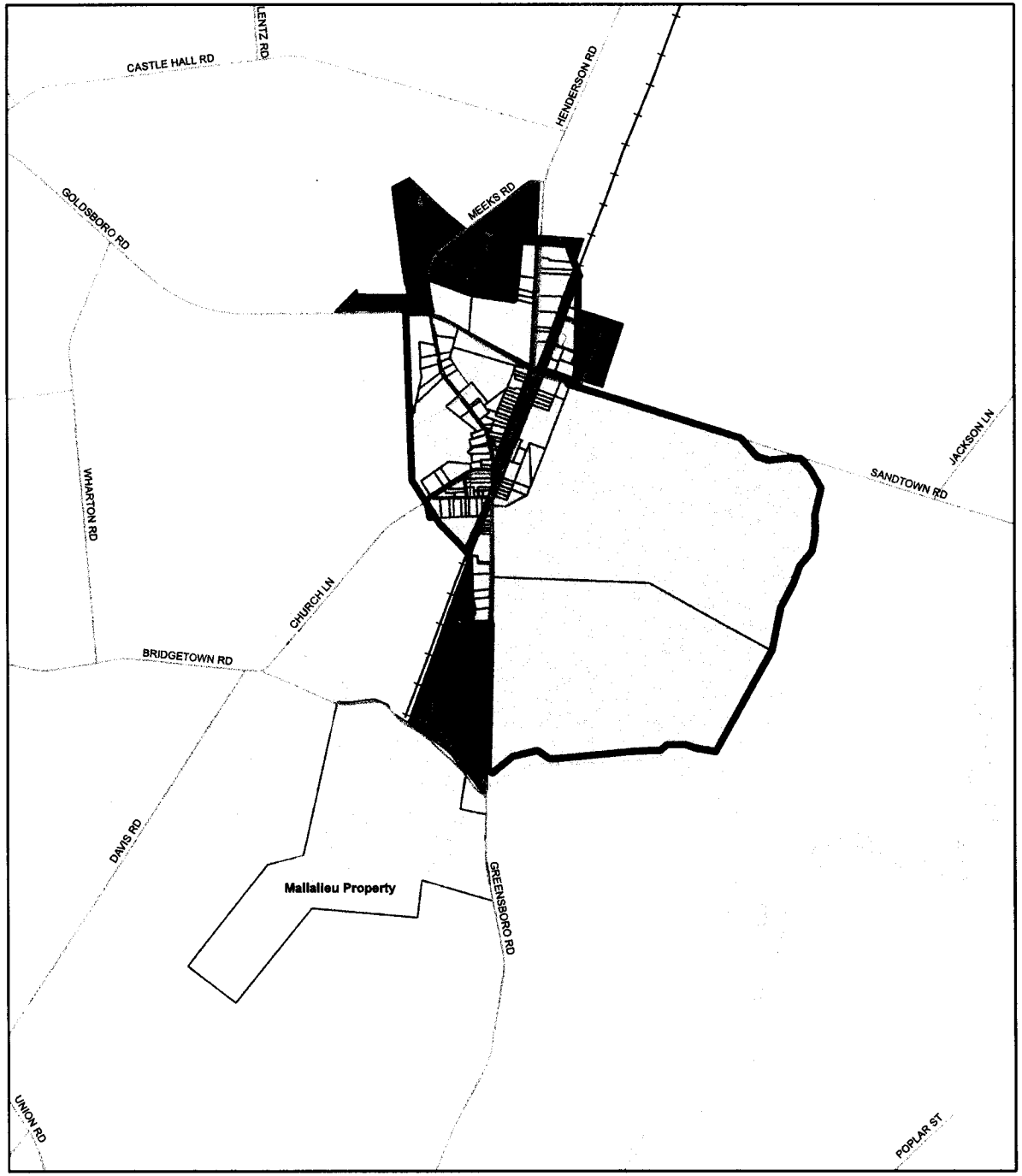
Jefferson L. Ghrist, Member

(SEAL)

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 10:00 o'clock am on 9/24 20 08
and duly recorded in Liber FDM 4
Folio 306 one of the Real
Record books for the aforesaid and
Dale Minner, Clerk
Recording Fee 0

LIBER 004 PAGE 306

LIBER004 PAGE307



Goldsboro Water and Sewer Service District

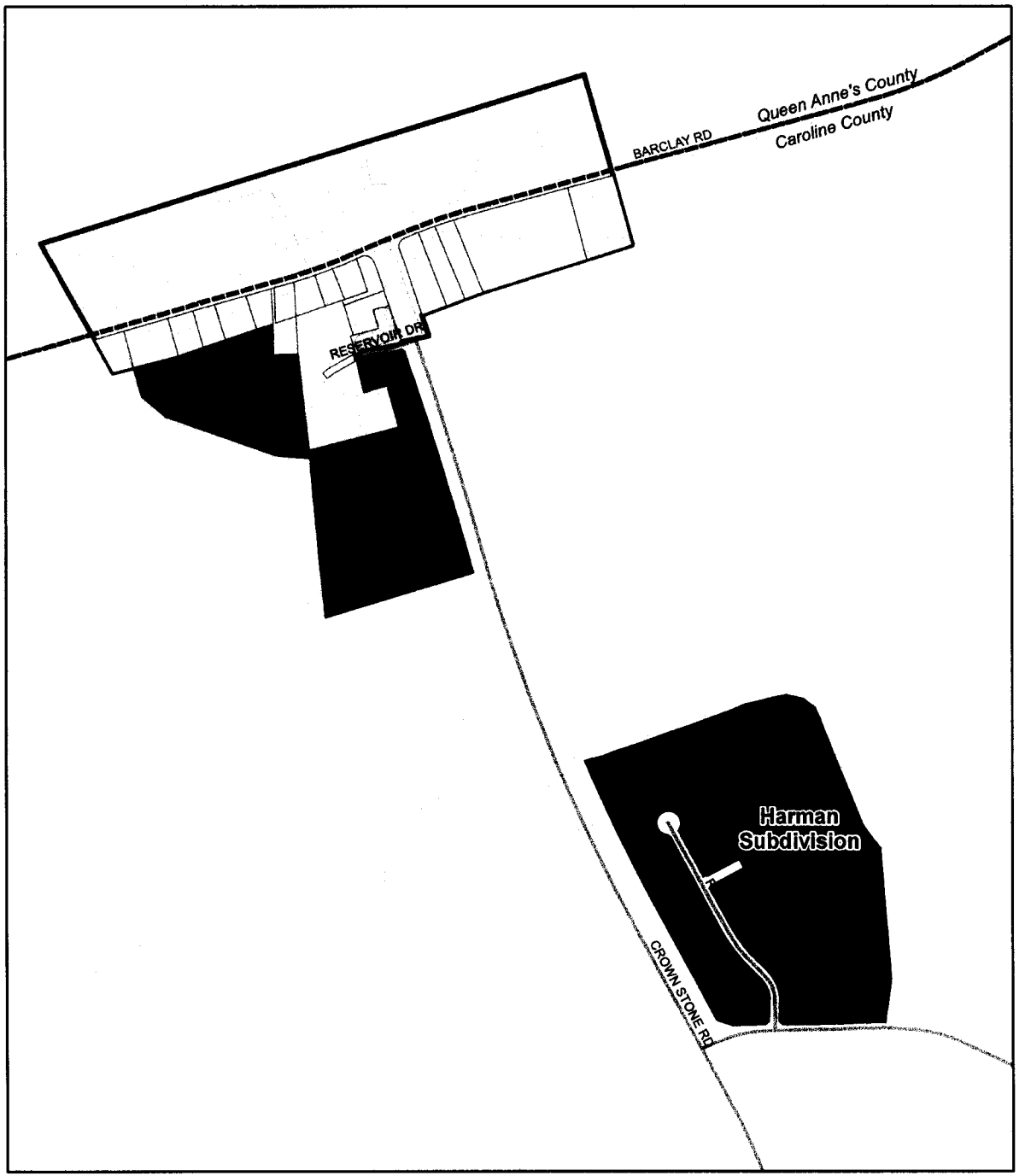
- Road
- Railroad
- Corporate Boundary
- Potential Spray Irrigation Site
- Municipal Water/Sewer District
- Unincorporated Areas Water/Sewer District
- Water

¶

2,000 Feet

Caroline County Planning and Codes Administration
July 2008

LIBER004 PAGE308



Templeville Water and Sewer Service District

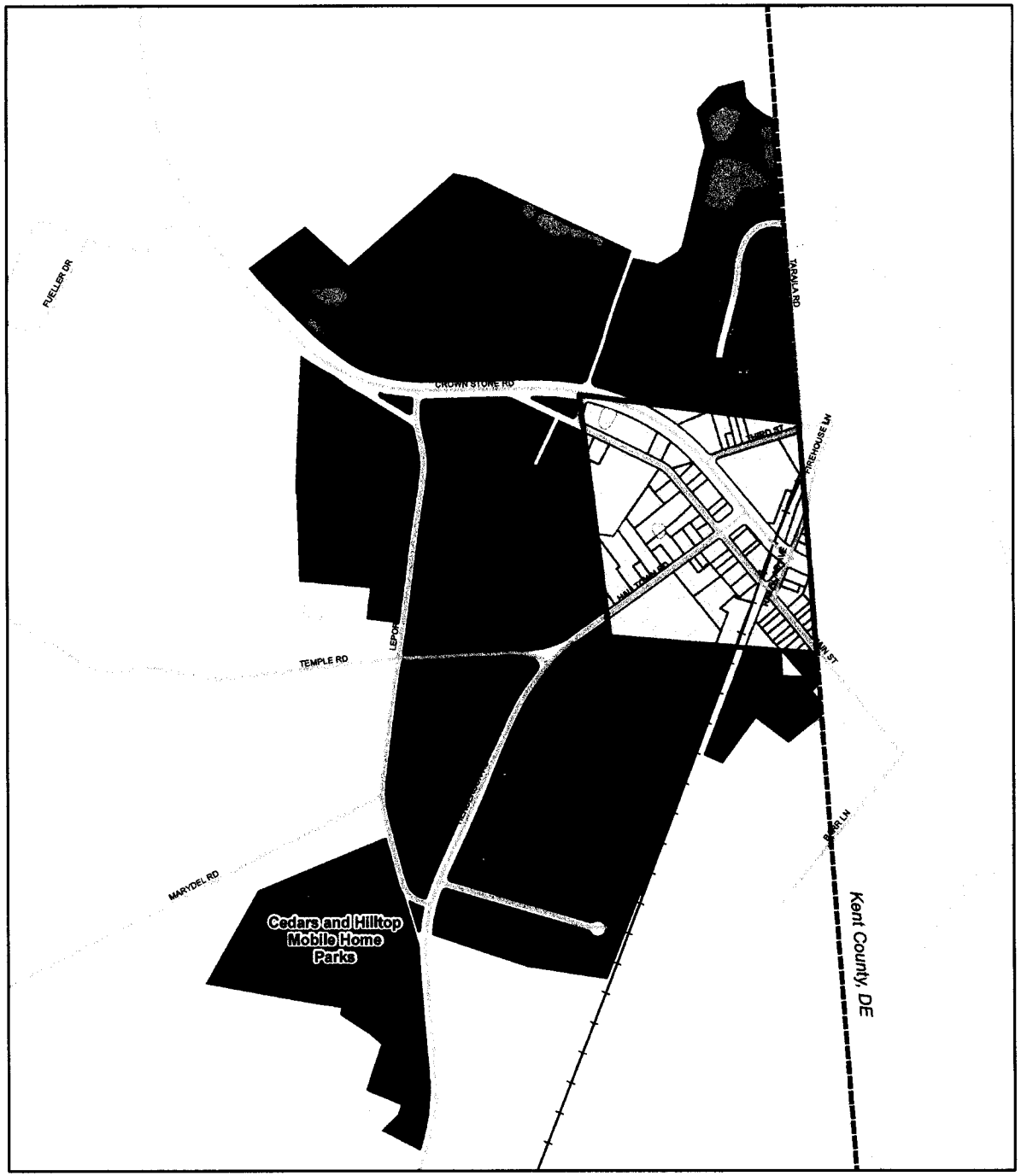
- County Boundary
- Water
- Municipal Water/Sewer District
- Corporate Boundary
- Unincorporated Water/Sewer District
- Road
- Railroad

¶

660 Feet

Carolline County Planning and Codes Administration
July 2008

LIBER004 PAGE309



Marydel Water and Sewer Service District

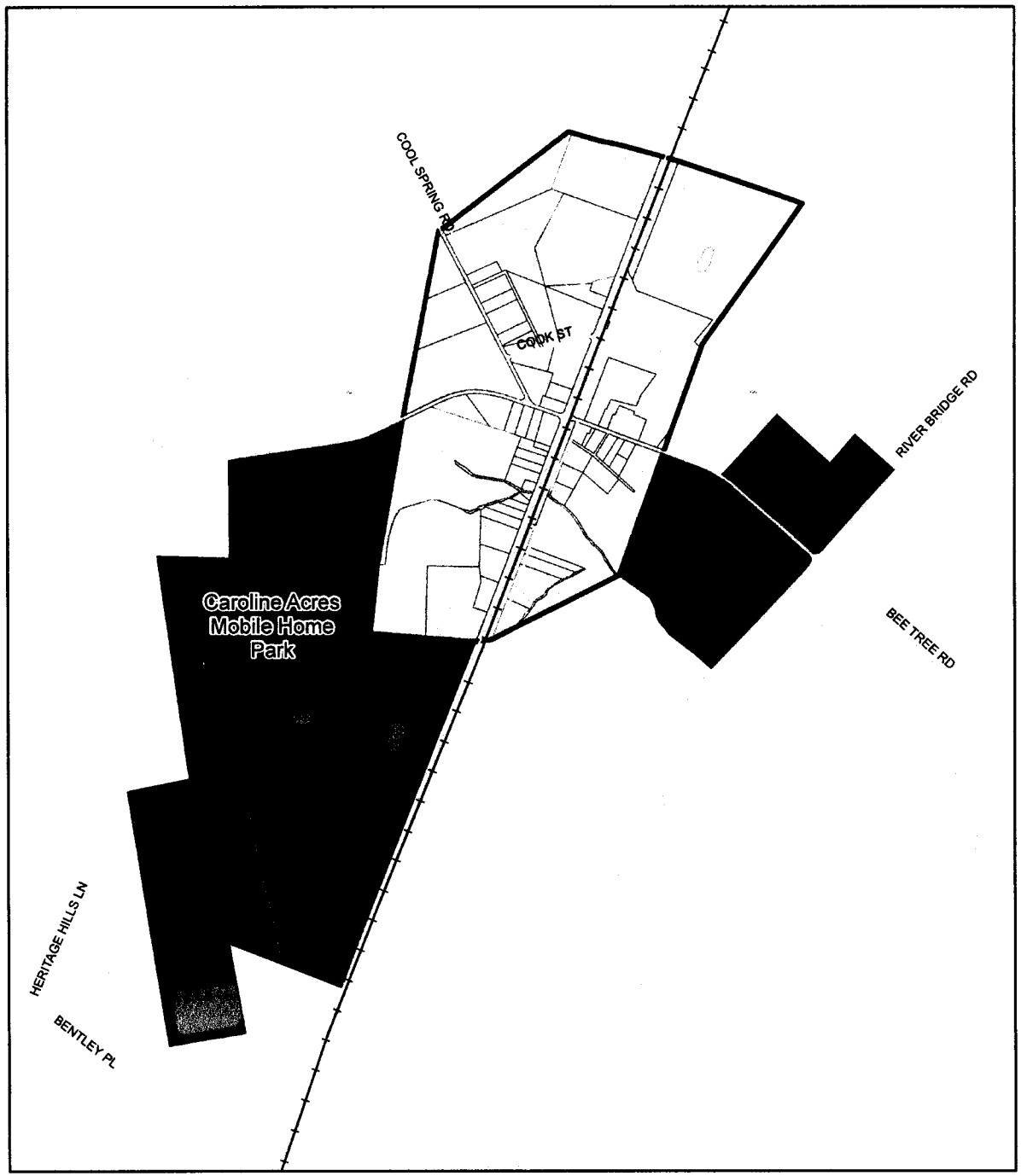
- Municipal Water/Sewer District
- Unincorporated Water/Sewer District
- Corporate Boundary
- DE/MD State Boundary
- Water
- Road
- Railroad

¶

1,000 Feet

Carolline County Planning and Codes Administration
July 2008

LIBER 004 PAGE 310



Henderson Water and Sewer Service District

Water
Corporate Boundary
Municipal Water/Sewer District
Unincorporated Areas Water/Sewer District
Road
Railroad

¶

800
Feet

Carolline County Planning and Codes Administration
February 2008

MDE

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Robert L. Ehrlich, Jr.
Governor

Michael S. Steele
Lieutenant Governor

Kendl P. Philbrick
Secretary

Jonas A. Jacobson
Deputy Secretary

APR 11 2006

The Honorable John W. Cole, President
The County Commissioners of Caroline County
Caroline County, Maryland
Courthouse
Room 123
109 Market Street
Denton MD 21629

Dear Mr. Cole:

The Maryland Department of the Environment (MDE) has completed its review of the **January 2006 Amendment** (amendment). The amendment was adopted by the County Commissioners on August 23, 2005 by Resolution #2005-020. The amendment indicates that the Town of Denton (Town) will provide water and sewer service to properties located within the Town's municipal limits. These properties are Shirley Trice property, Gannon's Purchase, Sidewinder Partners, and the State Highway Administration.

During the review, the Maryland Department of Planning (MDP) and MDE's Water Supply Program (WSP) provided the enclosed comments. The MDP advises that the amendment is consistent with the County's comprehensive plan. The WSP comments are for the County's consideration as the County prepares an update of the 1996 Caroline County Water and Sewerage Plan (Plan). That Plan was adopted by the County Commissioner's on January 30, 1996. The deadline for the update of the Plan was January 30, 1999. It is my understanding that significant planning activities have been accomplished, and that the County is making a good faith effort to prepare an update this year. Please be advised that COMAR requires that the County provide a copy of your draft 2006 Plan to MDE, prior to adoption. This action will insure that MDE's comments can be incorporated, as appropriate, into the County's final Plan.

The amendment is approved. This action completes our review, as required by Section 9-507 of the Environment Article, Annotated Code of Maryland. Thank you for giving MDE this review opportunity. If you have any questions on these matters, please call Ray Anderson at (410) 537-3726.

Sincerely,

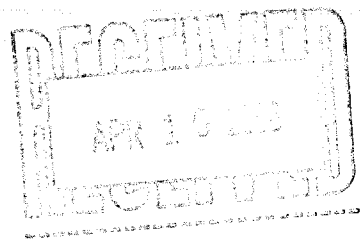
Virginia F. Kearney Hfa

Robert M. Summers, Director
Water Management Administration

enclosures

cc: The Honorable H. Victoria Goldsborough, Mayor, Town of Denton
Ms. Terry Fearins, Town Manager, Denton
Mr. Shane Johnston, Deputy Director, Caroline County Planning and Codes Administration
Mr. Don Wilson, Director, Environment Health, Caroline County Health Department
Mr. James T. Noonan, MDP
Ms. Janice Outen, MDE, WSP

STATE OF MARYLAND
DEPARTMENT OF THE ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION
WATER SUPPLY PROGRAM



MEMORANDUM

TO: Ray E. Anderson, Jr.
FROM: Matthew G. Pajerowski *J Outten for MGP*
DATE: April 4, 2006
SUBJECT: **January 2006 Amendment - Denton Caroline County Water and Sewerage Plan**
WSP File: **06-030**

The Water Supply Program has reviewed the referenced project and offers the following comments:

The Town of Denton has annexed a number of parcels for which public water service is planned. The Town has a water appropriation permit (CO1971G002) allowing an annual average of 420,000 gpd. The Town has 700,000 gallons of storage. Water use during the past two years has averaged 350,000 gpd. There is sufficient capacity under the existing permit to serve the annexed areas.

Please direct the representatives of Caroline County to contact the Water Supply Program at 410-537-3702 for further assistance.

cc: Saeid Kasraei
WSP Files

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Robert L. Ehrlich, Jr.
Governor

Michael S. Steele
Lieutenant Governor

Kendl P. Philbrick
Secretary

Jonas A. Jacobson
Deputy Secretary

MAY 0 1 2006

The Honorable John W. Cole, President
The County Commissioners of Caroline County
Caroline County, Maryland
Courthouse, Room 123
109 Market Street
Denton MD 21629

Dear Mr. Cole:

The Maryland Department of the Environment (MDE) has completed its review of the **Greensboro Amendment** (Amendment). The Amendment was adopted by the Caroline County Commissioners on February 28, 2006 by Resolution #2006-006. The Amendment indicates that the Town of Greensboro (Town) will provide water and sewer service to properties located within the Town's municipal limits. These properties are: Greensboro Farms Joint Venture; Medford and Ruth Marie Hutson; Ella Hutson; and Greensboro Enterprises LLC.

During the review, the Maryland Department of Planning (MDP) and MDE's Water Supply Program (WSP) provided the enclosed comments. The MDP advises that the Amendment is consistent with the County's comprehensive plan. The WSP comments are for the County's consideration as the County prepares the 2006 Plan, which was due in this office by August 6, 1996.

Please be advised that COMAR requires that the County provide a copy of your draft 2006 Plan to MDE, prior to adoption. This action will insure that MDE's comments can be incorporated, as appropriate, into the County's final Plan.

The Amendment is approved. This action completes our review, as required by Section 9-507 of the Environment Article, Annotated Code of Maryland. Thank you for giving MDE this review opportunity. If you have any questions, please call Ray Anderson at (410) 537-3726.

Sincerely,

Virginia M Kearney /jfr

Robert M. Summers, Director
Water Management Administration

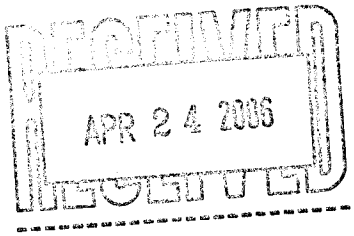
enclosures

cc: The Honorable Thomas Riddleberger, Mayor, Town of Greensboro
Ms. Dianne Ewing, Town Manager, Greensboro
Mr. Shane Johnston, Deputy Director, Caroline County Planning and Codes Administration
Mr. Don Wilson, Director, Environment Health, Caroline County Health Department
Mr. James T. Noonan, MDP
Ms. Janice Outen, MDE, WSP

STATE OF MARYLAND
DEPARTMENT OF THE ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION
WATER SUPPLY PROGRAM

MEMORANDUM

TO: Ray E. Anderson, Jr.
FROM: Matthew G. Pajerowski J Outten for MGP
DATE: April 21, 2006
SUBJECT: **Greensboro Amendment (Res. 2006-006)**
Caroline County Water and Sewerage Plan
WSP File: **06-036**



The Water Supply Program has reviewed the referenced project and offers the following comments:

This Amendment indicates that the Town of Greensboro plans to provide water and sewer service to the following properties located within the Town's municipal limits:

1. Greensboro Farms Joint Venture
   (231 residential lots and 188,000 square feet of commercial use; developer furnishing 100,000 gallon water storage tank)
2. Medford and Ruth Marie Hutson
3. Ella Hutson
4. Greensboro Enterprises LLC

The Town of Greensboro has an adequate water supply to support the proposed projects. The developer of Greensboro Farms Joint Venture has agreed to furnish a water storage tank.

Please direct the representatives of Caroline County to contact the Water Supply Program at 410-537-3702 for further assistance.

cc: Saeid Kasraei
WSP Files

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Shari T. Wilson
Secretary

Robert M. Summers, Ph.D.
Deputy Secretary

DEC - 3 2010

The Honorable John W. Cole, President
The County Commissioners of Caroline County
Caroline County Courthouse, Room # 123
109 Market Street
Denton MD 21629

Dear President Cole:

The Maryland Department of the Environment (MDE) has completed its review of an amendment to the 1996 Caroline County Water and Sewerage Plan (Plan). The amendment consists of text and map changes to the Plan for the Rural Village – Priority Funding Area for the unincorporated village of Jonestown.

The amendment creates water and sewer service areas whose boundaries match the boundaries of the Jonestown Rural Village – Priority Funding Area. The amendment would also allow the installation of community water and sewerage systems in the Rural Village. The Department acknowledges the County's efforts to address long-standing water and sewer issues in Jonestown.

The County intends to own and operate a community water system in the Rural Village to eliminate a potential health problem from the use of individual wells on 48 lots located outside of the Nelpine Heights subdivision as well as for the 28 lots located within the subdivision (20 lots are served by the Nelpine Heights water system). A community sewerage system is proposed so as to better manage the current nutrient load that results from the daily operation of over 88 existing septic systems in the Rural Village.

During MDE's review of the amendment, the Maryland Department of Planning advised MDE that the amendment is consistent with the Caroline County Comprehensive Plan (enclosed comments). The Department notes that the Jonestown Rural Village lies within a Tier II – High Quality Waters Catchment (Hunting Creek 1).

The amendment is approved for the creation of water and sewer service areas in the Rural Village of Jonestown and for the installation of a community water system in the Village, but not for the installation of a community sewerage system at this time.

Please be advised that an amendment to the County Plan will be needed to indicate the means of wastewater treatment and the method of disposal that has been mutually agreed upon by the County and MDE. This amendment must also indicate the location of the treatment system and the discharge point of the wastewater.

Since the Rural Village of Jonestown lies within a Tier II-High Quality Waters Catchment (Hunting Creek 1), an Antidegradation Review of the proposed wastewater system will be required by COMAR 26.08.02.04 and .04-1. This Review is intended to ensure that appropriate measures will be taken by the County so that the discharge of treated wastewater will not degrade the water quality of Hunting Creek. The Antidegradation Review is in addition to and precedes the review MDE usually undertakes before permitting a new wastewater treatment plant (WWTP) and point of discharge for the treatment wastewater. MDE's permitting review includes a determination of the technology-based or water quality based discharge permit limits, and whether or not the nutrient discharge is consistent with the Chesapeake Bay Watershed Implementation Plan.

The above-mentioned determination is considered by MDE in its review of a construction permit for the WWTP and outfall. When water quality degradation cannot be avoided, MDE is only able to approve an amendment to a County Water and Sewerage Plan after the County demonstrates to MDE that the project is necessary to accommodate important social and economic development. This demonstration is termed a Social and Economic Justification.

Please be advised that the Update of the Plan is overdue. Also be advised that COMAR requires that the County provide a copy of your draft Update to MDE, prior to adoption. This action will ensure that MDE's comments can be incorporated, as appropriate, into the County's final Plan.

Thank you for giving MDE the opportunity to review this amendment. If you need assistance, please contact Virginia F. Kearney, Deputy Director, at 410-537-3512, toll-free at 800-633-6101 or by e-mail at vkearney@mde.state.md.us.

Sincerely,

Virginia F Kearney for

Jay G. Sakai, Director
Water Management Administration

Enclosures

RESOLUTION #2009-027

ADOPTION OF CAROLINE COUNTY, MARYLAND WATER AND SEWERAGE PLAN AMENDMENT

RECITALS:

WHEREAS, the County Commissioners of Caroline County Maryland are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, the County Commissioners recognize water and sewer problems are creating health and environmental hazards for the citizens and neighbors of the Rural Village of Jonestown and the Subdivision of Nelpine Heights; and

WHEREAS, the County Commissioners recognize the need to establish a community water distribution system for above-referenced communities in order to provide for the community public health, safety and welfare and ensure its operation and maintenance; and

WHEREAS, the Caroline County Health Departments of Health, Planning, Codes & Engineering, and Public Works, and the Maryland Department of the Environment, have coordinated efforts to protect public health, safety and welfare through the provision of a water distribution system to serve the communities of Jonestown and Nelpine Heights: and

WHEREAS, the *Jonestown/Nelpine Heights Water Study*, as prepared by the engineering firm of George Miles & Buhr, with assistance from Caroline County and the Maryland Department of the Environment, cited the upgrade and addition to the current water system for residents of Jonestown and Nelpine Heights as a viable and affordable solution to supply adequate potable water; and

WHEREAS, the County Commissioners endorse the recommendation made in the above-referenced study that Caroline County undertake ownership of the community water distribution system that currently serves the communities of Jonestown and Nelpine Heights, for the purposes of upgrading and improving the system and ensuring the proficient quality of its operation and maintenance; and

WHEREAS, the Caroline County Planning Commission has reviewed and recommended an amendment to the Caroline County Comprehensive Water and Sewerage Plan to include appropriate text and map changes reflecting the inclusion of the above-referenced area in the County's Water and Sewer Service areas in the W-1 and S-3 timing categories; and

WHEREAS, the County Commissioners held a duly advertised public hearing on the proposed amendment on September 15, 2009.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND the Caroline County Comprehensive Water and Sewerage Plan be amended to include the Rural Village of Jonestown and Subdivision of Nelpine Heights in the County's W-1 and S-3 Service Areas and to update Plan maps and text accordingly.

ADOPTED/
EFFECTIVE: September 22, 2009

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Sara B Visintainer
SARA B. VISINTAINER
EXECUTIVE ASSISTANT

SEAL

JOHN W. COLE, PRESIDENT

ROGER L. LAYTON, VICE PRESIDENT

JEFFERSON L. GHRIST, MEMBER

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 2:35 **o'clock** pm **on** 9/22 **20**09
and duly recorded in Liber FDM 4
Folio 406 **one of the** Record
record books for the aforesaid and
Linda Mimmen **. Clerk**
Recording Fee

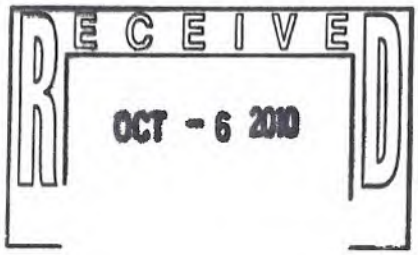
liber 4 page 407

cc: Katheleen Freeman, Caroline County Department of Planning, Codes & Engineering
Leslie Grunden, Caroline County Department of Planning, Codes & Engineering
Don Wilson, Caroline County Health Department
La Verne Gray, MDP
Virginia F. Kearney, Deputy Director, WMA, MDE
Saeid Kasraei, Water Supply Program, WMA, MDE
Rich Eskin, Director, Science Services Administration, MDE
Brigid Kenney, Director of Planning, MDE
Walid Saffouri, Engineering and Capital Projects Program, MDE

MDP
Maryland Department of Planning

Martin O'Malley
Governor
Anthony G. Brown
Lt. Governor

Richard Eberhart Hall
Secretary
Matthew J. Power
Deputy Secretary



September 29, 2010

Ray E. Anderson Jr., P. E.
Maryland Department of the Environment
Water Quality Infrastructure Program
1800 Washington Boulevard
Baltimore, Maryland 21230

Subject: Caroline County – Resolution 2009-027: Jonestown RV WSP amendment

Dear Mr. Anderson:

MDP has reviewed this amendment pursuant to our mandate to advise the Maryland Department of the Environment (MDE) on local comprehensive plan consistency and other appropriate matter as required by Environmental Article Section 9-507 (b)(2).

Summary of Amendment

This amendment serves to update the 1992 Caroline County Water and Sewerage Plan to include the Jonestown Rural Village area in the text section for Election District No. 4 (Preston), and add service area maps for both water and sewer that reflects the status of these public services.

Finding of Consistency:

MDP finds this adopted amendment to be consistent with the County Comprehensive Plan goals and policies towards growth, the environment, and public health.

Priority Funding Area

This amendment covers the rural village of Jonestown and as such is subject to infill and peripheral development limits, not to exceed 10% of the exiting number of improved properties. The total number of lots in the service area is 124, the number of improved lots is 88, 10% growth would be new service to 9 lots, total build out would be 97 lots. Growth beyond the 10% limit will require Comprehensive Plan changes.

If you have any questions please contact me at 410-767-5497.

Sincerely,

John G. Leocha, Regional Planner, MDP
Water and Sewer Planning

cc: Mr. John W.Cole, President, Caroline County Commissioners
Katheleen Freeman, Director of Planning, Codes, and Engineering, Caroline County
Scott Hymes, DNR
Dwight Dotterer, MDA

MDE
MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Shari T. Wilson
Secretary

Robert M. Summers, Ph.D.
Deputy Secretary

NOV - 5 2010

The Honorable John W. Cole, President
The County Commissioners of Caroline County
Caroline County Courthouse, Room # 123
109 Market Street
Denton MD 21629

Dear Commissioner Cole:

The Maryland Department of the Environment (MDE) has completed its review of two amendments to the 1996 Caroline County Water and Sewerage Plan (Plan). The first amendment adds the **Prettyman Manor Mobile Home Park Community Sewerage System** to the Plan while the second amendment adds text information as well as water and sewer service area maps relating to the **North County Water and Sewer Project.**

During MDE's review of the amendments, the Maryland Department of Planning (MDP) advised MDE that both amendments are consistent with the Caroline County 2010 Comprehensive Plan. The MDP also advised MDE that the North County amendment is consistent with the growth plans of the Towns of Goldsboro, Henderson, Marydel, and Templeville (comments enclosed).

The Prettyman Manor Mobile Home Park lies within a Tier II-High Quality Waters Catchment (Hog Creek 1). In the Greensboro vicinity, the proposed route of the North County Water and Sewer Project would likely follow Maryland Route 313 towards Greensboro. This portion of the probable route would bound a Tier II-High Quality Waters Catchment (Forge Branch 1).

MDE staff have analyzed the potential impact of the Prettyman Manor Mobile Home Community Sewerage System on water quality and determined that water quality degradation is unlikely. Considerations used in the analysis included the fact that the existing trench disposal system is to be replaced by a spray or drip irrigation disposal system to serve not only the existing 63 connections but also the 32 sites with failing septic systems; stormwater impacts will be mitigated to the maximum extent possible; and, structural BMPs will not be used.

MDE staff have analyzed the potential impact of the North County Water and Sewer Project on water quality and determined that water quality degradation is unlikely.

Considerations used in the analysis included the fact that almost all of the likely route (Maryland Routes 313, 311, and 454 from Greensboro to Templeville) would lie outside of the Tier II-High Quality Waters Catchment (Forge Branch 1); an added benefit to water quality impacts to the Catchment would result from construction of the service lines in the east shoulder of Route 313 in the Greensboro vicinity, which does not drain to a Tier II Catchment; stormwater impacts will be mitigated to the maximum extent possible; and, structural BMPs will not be used.

The amendments are approved. By copy of this letter, the Towns are advised of MDE's approval of the North County Water and Sewer Project.

Please be advised that the Update of the 1996 Caroline County Water and Sewerage Plan is overdue. Also, be advised that COMAR requires that the County provide a copy of your draft Update to MDE, prior to adoption. This action will ensure that MDE's comments can be incorporated, as appropriate, into the County's final Plan.

Thank you for giving MDE the opportunity to review these amendments. If you need further assistance, please contact Virginia F. Kearney, Deputy Director, at 410-537-3512, toll-free at 800-633-6101 or by e-mail at vkearney@mde.state.md.us.

Sincerely,

Virginia F Kearney for

Jay G. Sakai, Director
Water Management Administration

Enclosures

cc: The Honorable Gerald P. Garey, Mayor, Town of Greensboro
The Honorable Robin L. Cahall, Mayor, Town of Goldsboro
The Honorable Sandra M. Cook, Mayor, Town of Henderson
The Honorable Debra Rowe, Mayor, Town of Marydel
The Honorable Helen M. Knotts, Mayor, Town of Templeville
Katheleen Freeman, Caroline County Department of Planning, Codes & Engineering
Leslie Grunden, Caroline County Department of Planning, Codes & Engineering
Don Wilson, Caroline County Health Department
La Verne Gray, MDP
Virginia F. Kearney, Deputy Director
Saeid Kasraei, WMA, WSP
Jay Prager, WMA, WWPP
Ken Pensyl, WMA, SS&DS
Gary Setzer, WMA, W&WWP
Rich Eskin, MDE, SSA
Walid Saffouri, MDE, OB
Brigid Kenney, MDE, Director of Planning

Martin O'Malley
Governor
Anthony G. Brown
Lt. Governor

MDP
Maryland Department of Planning

Richard Eberhart Hall
Secretary
Matthew J. Power
Deputy Secretary

RECEIVED
SEP 22 2010

September 16, 2010

Ray E. Anderson Jr., P.E.
Maryland Department of the Environment
1800 Washington Blvd.
Water Quality Infrastructure Program
Baltimore, MD 21230

Subject: Caroline County – Water and Sewer Plan Amendments, North County Service Area (Resolution 2010-018) and Prettyman Manor MHP

Dear Mr. Anderson:

Thank you for providing the Maryland Department of Planning with a copy of the Caroline County Amendments, **North County Service Area and Prettyman Manor MHP.**

The Maryland Department of Planning has reviewed these Plan amendments pursuant to our mandate to advise the Maryland Department of the Environment on local comprehensive plan consistency and other appropriate matters as required by the Environmental Article Section 9-507 (b)(2).

Summary of Amendments:

North County Water and Sewer Service Area:

This request is to update the County Water and Sewerage Plan to include the North County Utility Service Area for public water and sewer services in the effort to remove failing septic systems and allow for moderate growth in the towns of Goldsboro, Henderson, Marydel, and Templeville. After many studies, comprehensive plan document updates, water and sewer planning studies, and much deliberation locally and with the State Agencies, the scope of this amendment request completes the necessary items pertinent to the management of this service area. This amendment is supportive to all previous Water and Sewer Plan amendments regarding the North County Service Area.

The amendment contains information on the service area authority, COMAR service timing categories, restrictions to service (denied access policy), allocation directives, and a cohesive projection plan for water and sewer demands.

Prettyman Manor Mobil Home Park (MHP):

This amendment adds this existing MHP that utilizes a community sewer collection and treatment system to the text of Chapter 4 and appropriate tables of Chapter 4. This corrects an omission of information to the 1992 County Water and Sewerage Plan.

Comprehensive Plan Consistency Review:

These amendment requests were found consistent with the growth goals and policies of the Caroline County 2010 Comprehensive Plan and the growth plans of the North County Towns (Goldsboro, Henderson, Marydel, and Templeville).

Priority Funding Area Comments:

Pursuant to Finance and Procurement Article 5-7B-02, local jurisdictions are eligible to receive State financial assistance under certain programs if the project is located in a Priority Funding Area (PFA).

If you have any questions or concerns on these comments please contact me at 410 767-5497.

Sincerely,

John G. Leocha, Regional Planner
Water and Sewerage Planning

Cc: John W. Cole, President, Caroline County Commissioners
Don Wilson, Division of Environmental Health, Caroline County Health Department
Kathleen Freeman, Planning Director, Caroline County Dept. of Planning and Codes
Scott Hymes, DNR
Dwight Dotterer, MDA

RESOLUTION #2010-018

ADOPTION OF CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN AMENDMENT FOR NORTH COUNTY WATER AND SEWER PROJECT

WHEREAS, the County Commissioners of Caroline County, Maryland are empowered by Environment Article, Title 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, Caroline County and the Towns of Goldsboro, Henderson, Marydel and Templeville collaborated to determine wastewater treatment needs for the northern region of the County; and

WHEREAS, the County Commissioners of Caroline County have authorized by Resolution #2001-007 and Resolution #2002-024 the establishment of water and sewer service districts for certain unincorporated areas of northern Caroline County and the Towns of Goldsboro, Henderson, Marydel and Templeville; and

WHEREAS, the Caroline County Commissioners have authorized by Legislative Bill #2008-7 the establishment of the North County Water and Sewer Authority and Water and Sewer Service Areas; and

WHEREAS, the Caroline County Commissioners have authorized by Resolution #2008-028 the amendment of the North Caroline County Comprehensive Plan to establish water and sewer service areas in the Towns of Goldsboro, Henderson, Marydel and Templeville; and

NOW THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND that the Caroline County Comprehensive Water and Sewerage Plan be amended as follows:

1. Amend the Introduction chapter of the Comprehensive Water and Sewerage Plan (CWSP) to include information as it relates to the North County Water and Sewer Authority, its membership, and its jurisdictional duties and responsibilities;

2. Amend the Introduction and Sewerage chapters of the CWSP to include a summary of the findings of the October 2009 Engineering Report "North County Regional Wastewater Collection and Treatment System" and the December 4, 2009 Supplemental Engineering Report "Feasibility of the Proposed North County Wastewater Extension Project," prepared by Rummel, Klepper and Kahl, LLP and Greenstone Engineering, LLC;

3. Amend the Goals, Policies and Organization chapter of the CWSP to include a Denied Access policy regarding access to public utility lines that traverse areas of the County not programmed for public water and sewer service;

4. Amend the Introduction and the Goals, Policies and Organization chapters of the CWSP to include COMAR water and sewer service timing classifications;

5. Amend the Water and Sewerage chapters of the CWSP to establish areas within the First Election District (Election District No. 1 – Henderson), including the Towns of Goldsboro, Henderson, Marydel and Templeville; Caroline Acres, Cedars and Hilltop mobile home parks;

Harman subdivision, and a Caroline County-owned property located immediately west of Marydel that is designated for a future government/institutional use, as water and/or sewer service areas as follows:

- Town of Goldsboro: W-6/S-3
- Town of Henderson: W-1/S-3
- Town of Marydel: W-6/S-3
- Town of Templeville: W-6/S-3
- Caroline Acres MHP: W-1/S-1
- Cedars MHP: W-1/S-1
- Hilltop MHP: W-1/S-3
- Harman Subdivision: W-1/S-3
- County-owned Parcel 0018, Map 0002, Grid 022: W-6/S-3

6. Amend Water and Sewerage Service Area maps to add designated North County water and sewer service areas and service timing categories in the First Election District (Election District No. 1 – Henderson) as described above; and

7. Amend the following tables in the Sewerage chapter of the CWSP to include the North County service area:
   a. Water Quality Problems Due to Storm Drainage Outfalls and Non-Point Sources;
   b. Projected Sewerage Demands and Planned Capacity for Existing and/or Planned Sewerage Systems;
   c. Immediate, Five, and 10 Year Priorities for Sewerage Development; and
   d. Flow Data – Wastewater Treatment Facilities.

ADOPTED/
EFFECTIVE: August 3, 2010

Sara B. Visintainer
SARA B. VISINTAINER
EXECUTIVE ASSISTANT

SEAL

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

John W. Cole
JOHN W. COLE, PRESIDENT

Roger L. Layton
ROGER L. LAYTON, VICE PRESIDENT

JEFFERSON L. GHRIST, MEMBER

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD

At 11:00 **o'clock** PM **on** 8/3 **20**10
and duly recorded in Liber FDM 4
Folio 529 **one of the** Resolution Books
record books for the aforesaid and
F. Dale Hinds **Clerk**
Recording Fee _____

RESOLUTION #2010-017

ADOPTION OF CAROLINE COUNTY WATER AND SEWERAGE PLAN AMENDMENT FOR PRETTYMAN MANOR

WHEREAS, the County Commissioners of Caroline County, Maryland are empowered by the Environment Article, Title 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, Tax Map 52, Parcel 264 and Parcel 233 (including former Parcel 211) are owned by Franklin W. Prettyman, Sr. and Brenda L. Prettyman; and

WHEREAS, Parcel 233 contains 20 mobile home units (including 2 units located on former Parcel 211) plus 5 model units and Parcel 264 contains 59 mobile home units which collectively comprise a part of the Prettyman Manor mobile home park; and

WHEREAS, Parcel 264 is the site of a community sewage disposal system that serves 62 mobile home units located on parts of Parcels 264 and 233 and which was originally permitted in 1981 by Caroline County Environmental Health as delegated by the Secretary of the Environment; and

WHEREAS, the community sewerage disposal system was erroneously omitted in the County's 1992 Comprehensive Water and Sewerage Plan (CWSP) sewerage chapter (Chapter 4) or the Inventory of Community Sewerage Systems (Table 4-3); and

WHEREAS, the Caroline County Planning Commission has reviewed and recommended an amendment to the Caroline County Comprehensive Water and Sewerage Plan to include appropriate text and map changes reflecting the inclusion of the above referenced community sewerage disposal system in Chapter 4, Sewerage, Section 4.7.4. Election District No. 4 (Preston), the Inventory of Community Sewerage Systems (Table 4-3); and the Table of Projected Sewerage Demands and Planned Capacity for Existing and/or Planned Sewerage Systems (Table 4-6); and

WHEREAS, the County Commissioners held a duly advertised public hearing on the proposed amendment on July 20, 2010.

NOW THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND that the Caroline County Comprehensive Water and Sewerage Plan be amended to include the "Prettyman Manor community sewerage disposal system" and to update Plan text, inventories, and maps accordingly.

ADOPTED/EFFECTIVE: August 3, 2010

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Sara B. Visintainer
SARA B. VISINTAINER
EXECUTIVE ASSISTANT

SEAL

JOHN W. COLE, PRESIDENT

ROBIN L. LAYTON, VICE PRESIDENT

JEFFERSON L. GHRIST, MEMBER

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 1:00 **o'clock** PM **on** 8/3/10
and duly recorded in Liber FDM 4
Folio 528 **one of the** Resolution Docket
record books for the aforesaid and
F. Dale Mims **. Clerk**
Recording Fee -0-

LIBER 04 FOLIO 528

RESOLUTION #2010-018

ADOPTION OF CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN AMENDMENT FOR NORTH COUNTY WATER AND SEWER PROJECT

WHEREAS, the County Commissioners of Caroline County, Maryland are empowered by Environment Article, Title 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, Caroline County and the Towns of Goldsboro, Henderson, Marydel and Templeville collaborated to determine wastewater treatment needs for the northern region of the County; and

WHEREAS, the County Commissioners of Caroline County have authorized by Resolution #2001-007 and Resolution #2002-024 the establishment of water and sewer service districts for certain unincorporated areas of northern Caroline County and the Towns of Goldsboro, Henderson, Marydel and Templeville; and

WHEREAS, the Caroline County Commissioners have authorized by Legislative Bill #2008-7 the establishment of the North County Water and Sewer Authority and Water and Sewer Service Areas; and

WHEREAS, the Caroline County Commissioners have authorized by Resolution #2008-028 the amendment of the North Caroline County Comprehensive Plan to establish water and sewer service areas in the Towns of Goldsboro, Henderson, Marydel and Templeville; and

NOW THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND that the Caroline County Comprehensive Water and Sewerage Plan be amended as follows:

1. Amend the Introduction chapter of the Comprehensive Water and Sewerage Plan (CWSP) to include information as it relates to the North County Water and Sewer Authority, its membership, and its jurisdictional duties and responsibilities;

2. Amend the Introduction and Sewerage chapters of the CWSP to include a summary of the findings of the October 2009 Engineering Report "North County Regional Wastewater Collection and Treatment System" and the December 4, 2009 Supplemental Engineering Report "Feasibility of the Proposed North County Wastewater Extension Project," prepared by Rummel, Klepper and Kahl, LLP and Greenstone Engineering, LLC;

3. Amend the Goals, Policies and Organization chapter of the CWSP to include a Denied Access policy regarding access to public utility lines that traverse areas of the County not programmed for public water and sewer service;

4. Amend the Introduction and the Goals, Policies and Organization chapters of the CWSP to include COMAR water and sewer service timing classifications;

5. Amend the Water and Sewerage chapters of the CWSP to establish areas within the First Election District (Election District No. 1 – Henderson), including the Towns of Goldsboro, Henderson, Marydel and Templeville; Caroline Acres, Cedars and Hilltop mobile home parks;

Harman subdivision, and a Caroline County-owned property located immediately west of Marydel that is designated for a future government/institutional use, as water and/or sewer service areas as follows:

- Town of Goldsboro: W-6/S-3
- Town of Henderson: W-1/S-3
- Town of Marydel: W-6/S-3
- Town of Templeville: W-6/S-3
- Caroline Acres MHP: W-1/S-1
- Cedars MHP: W-1/S-1
- Hilltop MHP: W-1/S-3
- Harman Subdivision: W-1/S-3
- County-owned Parcel 0018, Map 0002, Grid 022: W-6/S-3

6. Amend Water and Sewerage Service Area maps to add designated North County water and sewer service areas and service timing categories in the First Election District (Election District No. 1 – Henderson) as described above; and

7. Amend the following tables in the Sewerage chapter of the CWSP to include the North County service area:
   a. Water Quality Problems Due to Storm Drainage Outfalls and Non-Point Sources;
   b. Projected Sewerage Demands and Planned Capacity for Existing and/or Planned Sewerage Systems;
   c. Immediate, Five, and 10 Year Priorities for Sewerage Development; and
   d. Flow Data – Wastewater Treatment Facilities.

ADOPTED/
EFFECTIVE: August 3, 2010

Sara B. Visintainer
SARA B. VISINTAINER
EXECUTIVE ASSISTANT

SEAL

COUNTY COMMISSIONERS OF
CAROLINE COUNTY, MARYLAND

John W. Cole
JOHN W. COLE, PRESIDENT

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JEFFERSON L. GHRIST, MEMBER

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD

At 11:00 **o'clock** PM **on** 8/3 **20**10
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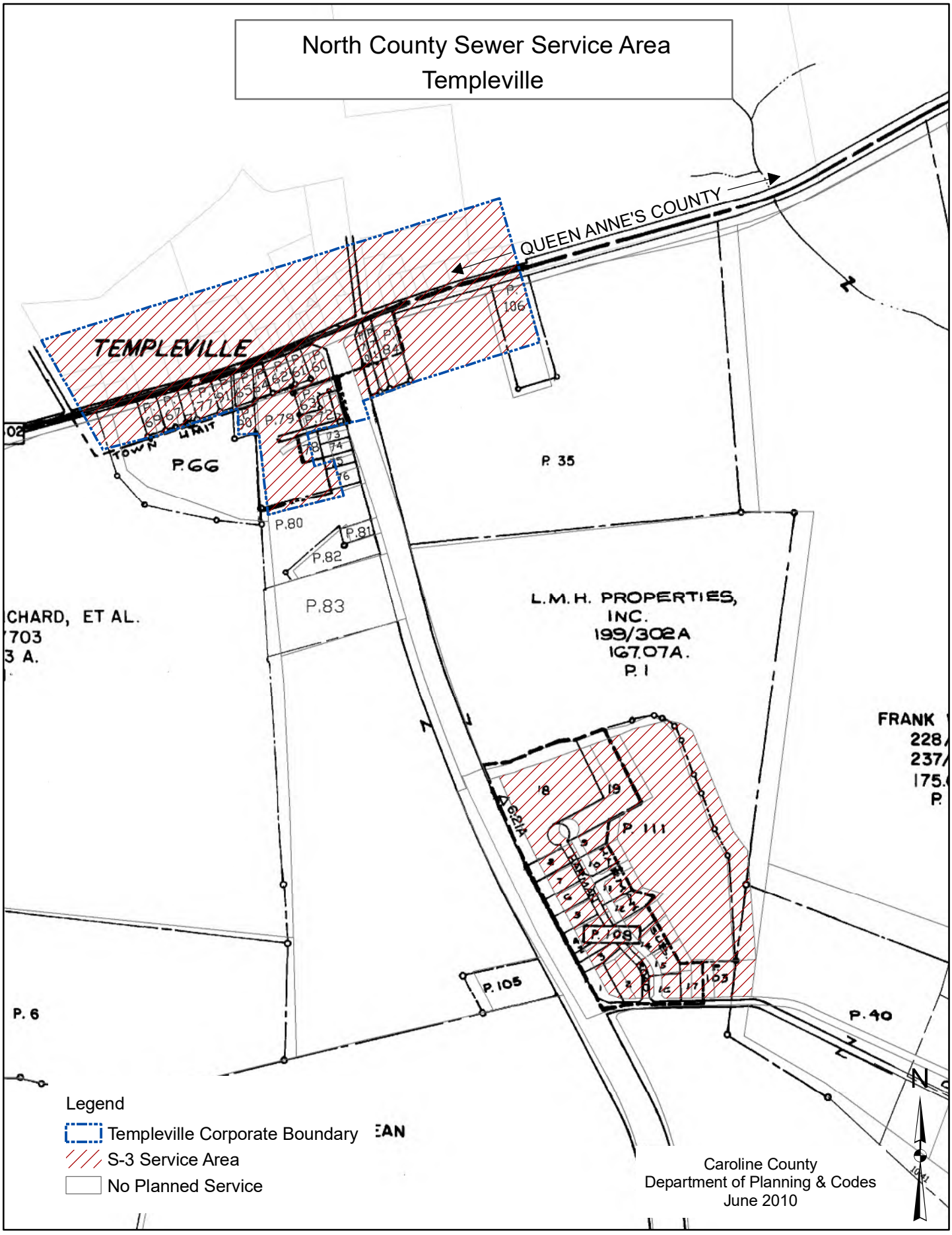
record books for the aforesaid and
F. Dale Hinds **Clerk**
Recording Fee _____


North County Sewer Service Area
Templeville
QUEEN ANNE'S COUNTY
TEMPLEVILLE
TOWN LIMIT
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P.81
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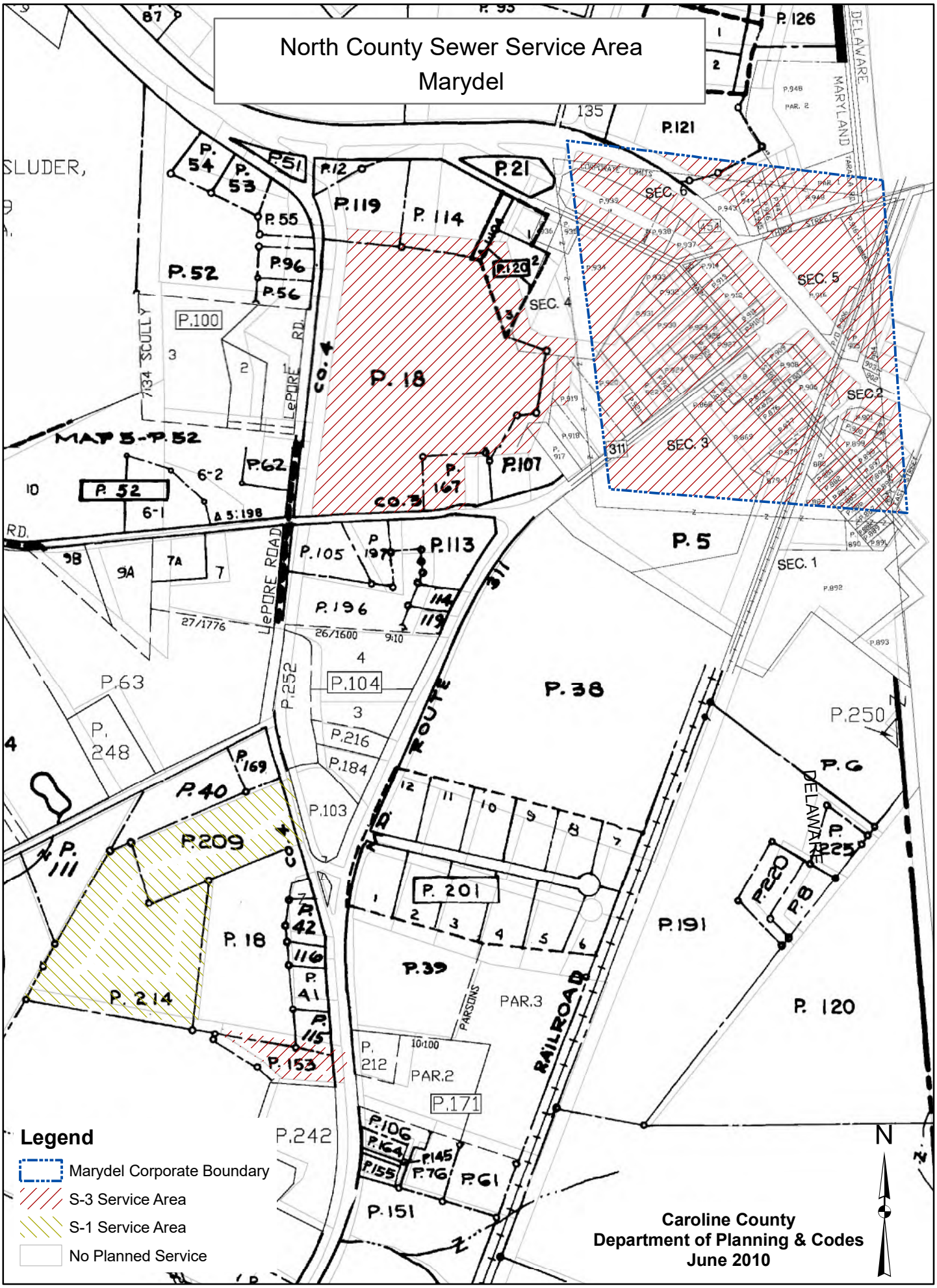
P.83
L.M.H. PROPERTIES, INC.
199/302A
167.07A.
P. 1
CHARD, ET AL.
703
3 A.
FRANK
228
237
175.
P.
P. 111
P. 108
P. 105
P. 6
P. 40
Legend
Templeville Corporate Boundary
S-3 Service Area
No Planned Service
Caroline County
Department of Planning & Codes
June 2010
N


North County Sewer Service Area
Marydel
SEC. 6
SEC. 5
SEC. 4
SEC. 3
SEC. 2
SEC. 1
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P. 8
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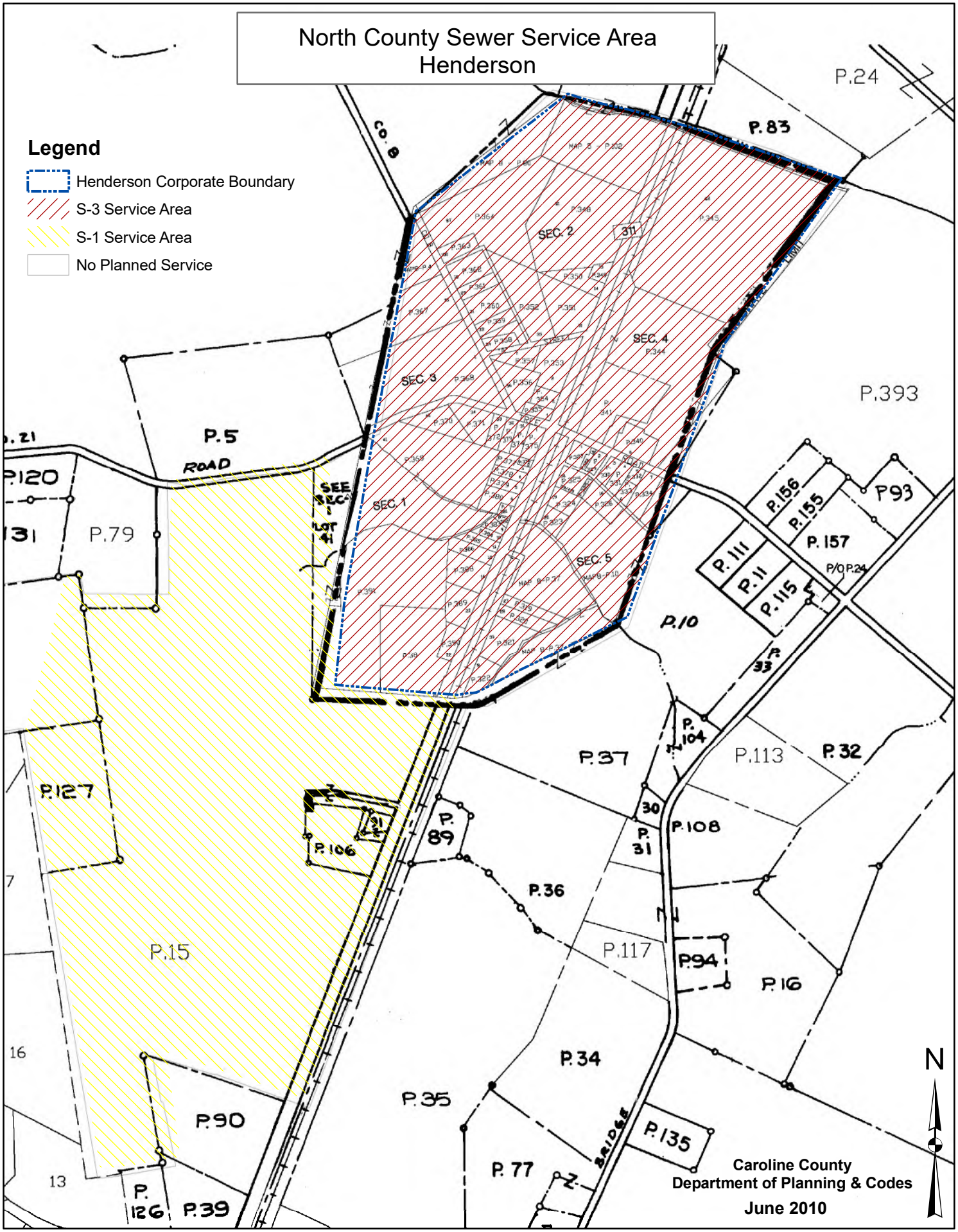
SCULLY RD.
LePORE RD.
LePORE ROAD
ROUTE 311
DELAWARE RAILROAD
DELAWARE MARYLAND
PARSONS
MAP 5-P. 52
6-1
6-2
9A
9B
7A
7
27/1776
26/1600
9:10
A 5:198
CO. 4
CO. 3
Legend
Marydel Corporate Boundary
S-3 Service Area
S-1 Service Area
No Planned Service
N
Caroline County
Department of Planning & Codes
June 2010


North County Sewer Service Area
Henderson
Legend
Henderson Corporate Boundary
S-3 Service Area
S-1 Service Area
No Planned Service
P.24
P. 83
CO. 8
SEC. 2
SEC. 3
SEC. 4
SEC. 1
SEC. 5
311
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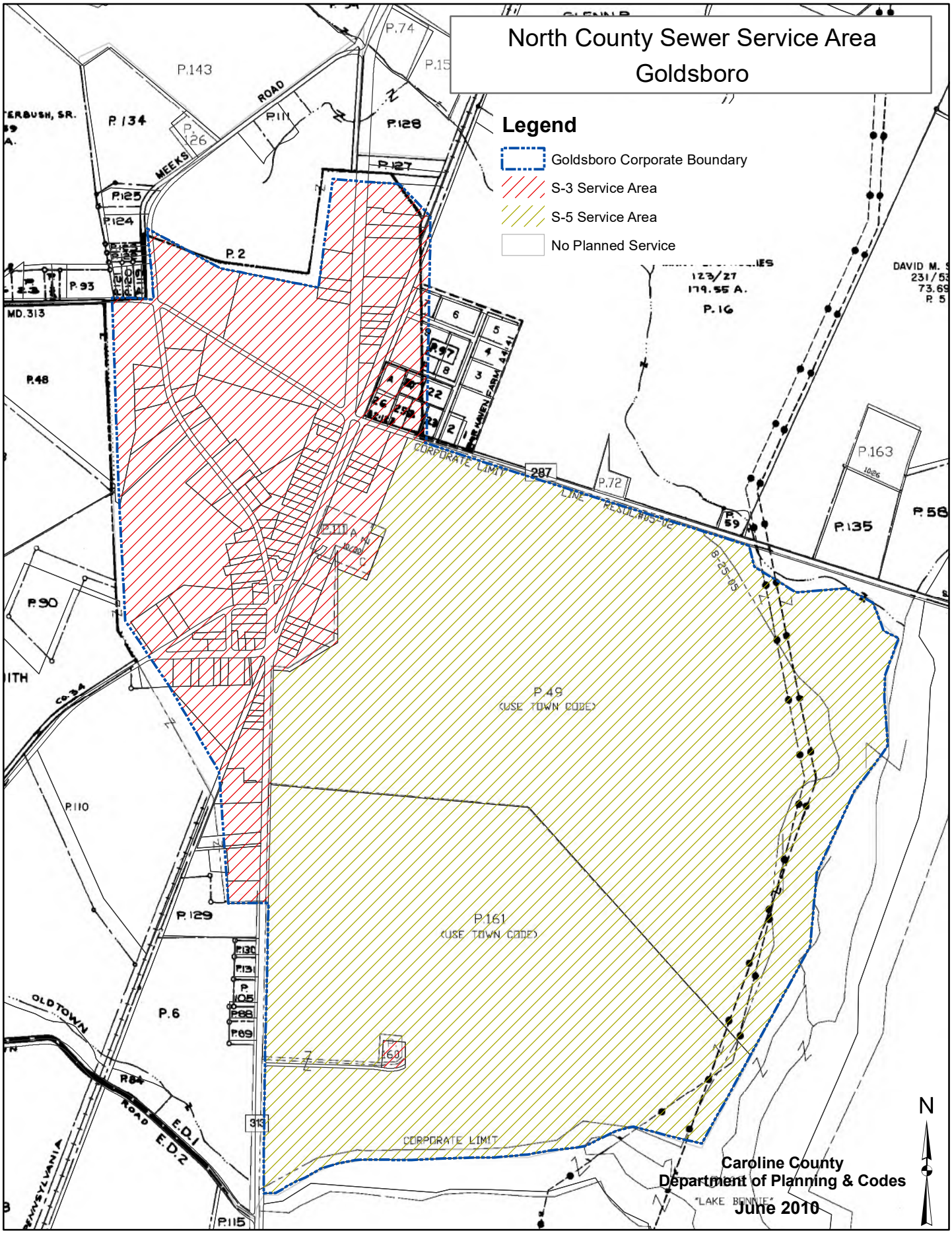
P. 11
P. 115
P.156
P.155
P. 157
P93
P/O P.24
Caroline County
Department of Planning & Codes
June 2010
N


North County Sewer Service Area
Goldsboro
Legend
Goldsboro Corporate Boundary
S-3 Service Area
S-5 Service Area
No Planned Service
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P.15
P.134
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P.49
(USE TOWN CODE)
P.110
P.129
P.161
(USE TOWN CODE)
P.6
P.115
CORPORATE LIMIT
287
313
MEEKS ROAD
OLD TOWN ROAD
E.D.1
E.D.2
N
Caroline County
Department of Planning & Codes
June 2010

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101 • www.mde.maryland.gov

Larry Hogan
Governor

Boyd Rutherford
Lieutenant Governor

Ben Grumbles
Secretary

APR 15 2015

The Honorable Larry C. Porter
President, County Commissioners of Caroline County
109 Market Street, Room 123
Denton MD 21629

Dear President Porter:

The Maryland Department of the Environment (MDE) has completed its review of **Resolution No. 2012-031: Federalsburg Sanitary Sewer and Stormwater Separation Project (Amendment),** which amends the Caroline County 1996 Comprehensive Water and Sewerage Plan. The County Commissioners of Caroline County adopted the Amendment on October 16, 2012. The Amendment updates Section 4.7.6 – Election District 5 and Table 13 of the Plan (see enclosed plan excerpts). The Amendment facilitates the Town's project to construct separate sewer lines and stormwater drains to replace existing combined sewer lines.

During MDE's review of the Amendment, the Maryland Department of Planning (MDP) advised the Department that the Amendment is consistent with the Caroline County Comprehensive Plan (see enclosed comments). The Department hereby approves the **Federalsburg Sanitary Sewer and Stormwater Separation Project Amendment** to the Caroline County Comprehensive Water and Sewerage Plan.

Please also be advised that a portion of the Amendment area is located within the Chesapeake Bay Critical Area Resource Conservation Area (RCA). Any development occurring as a result of the approval of this Amendment must adhere to all Critical Area restrictions associated with the RCA. Please contact the Critical Area Commission at 410-260-3476 concerning Critical Area requirements.

This action completes MDE's review, as required by §9-507 of the Environment Article, Annotated Code of Maryland. If you need further assistance, please contact me at 410-537-3567, toll-free at 800-633-6101; or by email at virginia.kearney@maryland.gov.

Sincerely,

Virginia F. Kearney

Virginia F. Kearney, Acting Director
Water Management Administration

Enclosures

cc: Leslie Grunden, Planner III, Caroline County Department of Planning and Codes
Nick Kelly, Chesapeake Bay Critical Area Commission
Charles Boyd, Deputy Director, Planning Services, MDP
La Verne Gray, MDP

RESOLUTION #2012-031

ADOPTION OF CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN AMENDMENT FOR FEDERALSBURG SANITARY SEWER AND STORMWATER PROJECT

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article, Title 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, the Town of Federalsburg has identified a significant incidence of infiltration of stormwater in the Town's wastewater treatment system during significant rain and snow events as a result of aging, combined sewer and stormwater conveyance lines; and

WHEREAS, infiltration of stormwater in wastewater treatment systems has the potential to negatively impact water quality, decrease wastewater system capacity, and increase operational expenses associated with unnecessarily high plant flows; and

WHEREAS, the Town of Federalsburg has undertaken to separate combined sanitary sewer and stormwater conveyance lines within the Town limits to prevent the occurrence of infiltration; and

WHEREAS, it is a goal of the Caroline County Comprehensive Water and Sewerage Plan that water and sewer services be maintained in a manner that strives to maximize the public health, safety, and welfare for all citizens of Caroline County while minimizing every environmental impact; and

WHEREAS, it is a goal of the Caroline County Comprehensive Plan that investment in public infrastructure be protected through the regular maintenance and upgrades of infrastructure systems to ensure that those systems are maintained to function to engineering design standards; and

WHEREAS, the Caroline County Planning Commission has reviewed the proposed amendment to the Comprehensive Water and Sewerage Plan and, following an advertised public hearing, recommended it to the County Commissioners for adoption; and

WHEREAS, the County Commissioners held a duly advertised public hearing on the proposed amendment to the Comprehensive Water and Sewerage Plan on October 9, 2012.

NOW THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND that the Caroline County Comprehensive Water and Sewerage Plan be amended as follows:

liber 4 page 690

Section 4.7.6. (Election District 5 – Federalsburg) and Table 13 (Sewer Priorities) of the Sewerage Chapter to include the design and construction of new, separate sewer lines and storm drains to replace the existing, combined sanitary sewer/stormwater lines in the Town of Federalsburg.

ADOPTED/EFFECTIVE:
October 16, 2012

ATTEST:

Sara B. Visintainer, Chief of Staff

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Larry C. Porter, President

Wilbur Levengood Jr., Vice President

Jefferson L. Ghrist, Commissioner

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 9:00 o'clock am on 10/23/2012
and duly recorded in Liber FDM 4
Folio 690 one of the Resolution
record books for the aforesaid and
Dale Minner. Clerk
Recording Fee

liber 4 page 691

4.7.6 Election District No. 5 (Federalsburg)

The Federalsburg Election District (2010 population - 4,841) is the most densely populated district in the County. Of the total population, 74% is served by individual sewage disposal systems. The Federalsburg wastewater treatment plant serves the remainder of the population.

The Town of Federalsburg (2010 population 2,739) owns and operates a trickling filter-design wastewater treatment plant that has a design capacity of 750,000 gallons per day (gpd). In 2010, average flow at the plant was approximately 250,000 gallons per day, however during periods of significant precipitation, inflow and infiltration pushed flows to as much as 375,000 gpd. In 2011 construction was completed on a project to upgrade the plant to ENR treatment level. In 2012 the facility is capable of achieving effluent quality with annual average nutrient goals of 3 mg/l for Total Nitrogen and 0.3 mg/l for Total Phosphorous. The upgrade to the plant resulted in reducing the plant's total nitrogen load by 34,250 lbs/year and its phosphorus load by 3,885 lbs/year.

Federalsburg Wastewater Treatment Plant Upgrade Funding Sources	
Total Project Cost	**$9,819,000**
Bay Restoration Fund	$3,360,000
State BNR Grant	$2,360,000
Local Share/State Revolving Loan Fund	$3,170,300
State Supplemental Grant	$495,000
EPA Grant	$433,700
Source: Maryland Department of Environment, 2011.	

The Town's 2007 Comprehensive Plan and 2009 update of the Plan note that the Town foresees the need, over the longer term, to identify and protect suitable sites for the spray irrigation of wastewater. There is an abundance of undeveloped acres in the vicinity of Town with soil conditions that are suitable for spray irrigation. A land bank of 200 to 300 acres would provide adequate land to permit Federalsburg to use spray irrigation as a meaningful complement to its wastewater treatment plant. Sites south of Town are under consideration.

The Comprehensive Plan also includes a discussion of extending sewer service to an area with failing septic systems located southeast of Town. Sixty-nine units exist and these units would require 17,250 gpd of treatment capacity should the sewer be extended. Before proceeding with this potential strategy the Town would request PFA exception for those areas being considered and a Water and Sewer Plan amendment to delineate the service area.

The Town is in the process of designing and constructing new separate sewer lines and storm drains to functionally replace existing deteriorated combined sewer lines. The new storm drain system will eliminate the potential for combined sewer overflows (as noted above) and significantly reduce stormwater from entering the sewer system and adversely impacting Federalsburg's pumping station and its newly upgraded wastewater treatment plant. The first component of this project was completed in 2010 with a new storm drain system along Maple Avenue, including a new treatment device for the storm drain outfall to Marshyhope Creek, funded by $2.5M in MDE and ARRA Clean Water grants.

The Town identified Railroad Avenue and Park Lane as additional stormwater/sanitation separation priority areas and in August 2012 was awarded a $1,137,500 Chesapeake Bay Water Quality Projects grant to help fund the engineering, design and construction of sanitary and stormwater sewer lines along those streets. As with the Maple Avenue project, this project will reduce existing infiltration problems and eliminate outfalls of diluted sewage into Marshyhope Creek. An additional $225,536 capital construction grant to the Town will help fund its Railroad Avenue Water Main Replacement project, which will improve the water supply system.

Additional projects underway include the upgrade of the outdated and obsolete Nuttle's pump station. The Town anticipates an award of $621,000 by the State Water Quality Revolving Loan Fund to convert the existing pump station to a submersible type station with a valve vault.

Table 13: Immediate, Five- and Ten-Year Priorities for Sewer Development		
Sewer Service Area	**Description**	**Projected Schedule**
Election District 5 - Federalsburg		
a. Federalsburg	Design and construction of new, separate sewer lines and storm drains to replace the existing, combined sewer lines in Town.	2011 - 2014
	Nuttles Wastewater Pump Station Project	2013
Sources: Maryland Department of Environment, Town of Federalsburg, 2012; Federalsburg Comprehensive Plan, 2007 and 2009.		

March 2, 2015

Mrs. Janice Outen
Maryland Department of the Environment
1800 Washington Blvd.
Water Quality Infrastructure Program
Baltimore, MD 21230

Subject: Caroline County – Resolution 2012-031

Dear Mrs. Outen:

Thank you for providing the Maryland Department of Planning (MDP) with a copy of the Caroline County Water and Sewer Plan Amendment (Resolution 2012-031) that updates Section 4.7.6, Election District 5 (Federalsburg) and Table 13, specifically addressing the stormwater and sewerage separation efforts for the Railroad Avenue project.

Pursuant to our mandate to advise the Maryland Department of the Environment on local comprehensive plan consistency and other appropriate matters as required by the Environmental Article Section 9-507 (b)(2), please accept our review and comments to help support your approval process.

Comprehensive Plan Consistency Review:

MDP finds this language to be consistent with the development and environmental goals and policies of the County Comprehensive Plan.

Priority Funding Area Comments:

Pursuant to Finance and Procurement Article 5-7B-02, local jurisdictions are eligible to receive State financial assistance under certain programs if the project is located in a Priority Funding Area (PFA).

The Railroad Avenue storm drain separation project is within the PFA.

If you have any questions or concerns on these comments please contact John Leocha at 410 767-5497.

Sincerely,

Richard Josephson, AICP
Director of Planning Services

Cc: Jeff Horan, DNR
Royden N. Powell, MDA
John Leocha, MDP
David Dahlstrom, MDP

MDE

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101• www.mde.state.md.us

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Robert M. Summers, Ph.D.
Secretary

DEC 2 8 2012

The Honorable Larry C. Porter
President, County Commissioners of Caroline County
Caroline County Courthouse, Room 123
109 Market Street
Denton MD 21629

Dear President Porter:

The Maryland Department of the Environment (MDE) has completed its review of the **Greensboro-Goldsboro Sewer System Amendment,** which amends the 1996 Caroline County Water and Sewer Plan in order to construct a new wastewater treatment plant in the Town of Greensboro, which will provide sewer service to the existing Greensboro Municipal Service Area and to a new service area for the Town of Goldsboro via a denied access sewer main. The Caroline County Board of Commissioners adopted the Amendment on September 18, 2012 by Resolution No. 2012-26.

Subsequent to the adoption of Resolution No. 2012-26, Caroline County provided supplemental materials to the Department for review and approval. These materials consisted of:

- A revision of the proposed capacity of the new WWTP from 326,000 gpd to 332,000 gpd based on the monitoring of flows from the existing Greensboro WWTP;
- An allocation of wastewater capacity based on Equivalent Dwelling Units (EDUs) for Greensboro, Goldsboro and an area of Caroline County with failing septic systems adjacent to Goldsboro, as follows:

Greensboro existing EDUs	796
Greensboro infill EDUs	396
Goldsboro existing EDUs	186
Goldsboro infill EDUs	19
County existing EDUs	25
TOTAL Existing and Infill EDUs	1,422

- Map 1 – Greensboro, Goldsboro and Vicinity - Service Area Designations and Facilities; and
- Map 2 – Greensboro, Goldsboro and Vicinity - Existing and Planned Sewer Service.

During MDE's review of the Amendment, the Maryland Department of Planning (MDP) advised the Department that the Amendment is consistent with the Caroline County Comprehensive Plan (see enclosed comments). In addition, the MD Smart Growth Coordinating Committee granted a special exception in support of funding to provide the sewer service to the 25 properties with failing septic systems adjacent to Goldsboro (see enclosed October 15, 2012 letter).

The Department hereby approves the Greensboro-Goldsboro Sewer System Amendment to the 1996 Caroline County Water and Sewer Plan in accordance with the following requirements:

- The capacity of the new Greensboro WWTP is limited to 332,000 gpd at this time;
- The allocation of wastewater capacity is limited at this time to 1,192 EDUs for Greensboro, 205 EDUs for Goldsboro and 25 EDUs for the area of Caroline County with failing septic systems adjacent to Goldsboro;
- The planned service areas and service area designations are limited at this time to the areas and designations depicted on Maps 1 and 2; and
- The 8-inch force main along MD Rt. 313 between Goldsboro and Greensboro must be designated a "denied-access sewer line."

Please be advised that a portion of the proposed denied-access sewer line will be located within the Chesapeake Bay Critical Area. Please contact the Critical Area Commission at 410-260-3476 concerning Critical Area requirements pertaining to the sewer line.

This action completes MDE's review, as required by §9-507 of the Environment Article, Annotated Code of Maryland. If you need further assistance on these matters, please contact Virginia F. Kearney, Deputy Director, at 410-537-3512, toll free at 800-633-6101 or by email at vkearney@mde.state.md.us.

Sincerely,

Jay G. Sakai, Director
Water Management Administration

Enclosures

cc: Katheleen Freeman, Director, Caroline County Dept. of Planning and Codes
Don Wilson, Director, Division of Environmental Health, Caroline County Health Dept.
Rich Josephson, Planning Services, MDP
Laverne Gray, MDP
Saeid Kasraei, Water Supply Program, WMA, MDE
Virginia F. Kearney, Deputy Director, WMA, MDE
Brigid Kenney, Senior Policy Advisor, MDE
Jag Khuman, Water Quality Financing Administration, MDE
Walid Saffouri, Engineering and Capital Projects Program, MDE
Edwal Stone, Wastewater Permits Program, WMA, MDE

RESOLUTION #2012-026

ADOPTION OF CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN AMENDMENT FOR NORTH COUNTY WATER AND SEWER PROJECT

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article, Title 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, the County Commissioners and the Towns of Greensboro, Goldsboro, Henderson, Marydel and Templeville collaborated to determine wastewater treatment needs for the northern region of the County; and

WHEREAS, the County Commissioners have authorized by Resolution #2001-007, Resolution #2002-024, and Resolution #2010-018 the establishment of water and sewer service districts for certain unincorporated areas of northern Caroline County and the Towns of Goldsboro, Henderson, Marydel and Templeville; and

WHEREAS, the County Commissioners have authorized by Legislative Bill #2008-7 the establishment of the North County Water and Sewer Authority and Water and Sewer Service Areas; and

WHEREAS, the County Commissioners have authorized by Resolution #2008-028 the amendment of the North Caroline County Comprehensive Plan to establish water and sewer service areas in the Towns of Goldsboro, Henderson, Marydel and Templeville; and

WHEREAS, the Caroline County Planning Commission has reviewed the proposed amendment to the Comprehensive Water and Sewerage Plan and, following an advertised public hearing, recommended it to the County Commissioners for adoption; and

WHEREAS, the County Commissioners held a duly advertised public hearing on the proposed amendment to the Comprehensive Water and Sewerage Plan on September 11, 2012.

NOW THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND that the Caroline County Comprehensive Water and Sewerage Plan be amended as follows:

1. Amend the Introduction and Sewerage chapters of the Comprehensive Water and Sewerage Plan (CWSP) to include information as it relates to the Greensboro-North County Water and Sewer project and changes in the scope of that project that have occurred in 2012 as a result of reductions in grant funding ;

2. Amend the maps in the Sewerage chapter of the CWSP to add the locations of the proposed Greensboro ENR wastewater treatment plant, the proposed Goldsboro collection/conveyance system, and the proposed sewer line between Goldsboro and Greensboro, including the locations of the sewer line that will be designated Denied Access;

BRD04 [illegible]5

3. Amend the existing Goldsboro Sewer Service Area to include specific properties (table attached) in the vicinity of the Town of Goldsboro, including existing lots with failing septic systems/and or nonconforming septic systems as identified and documented by the Caroline County Health Department's Division of Environmental Health; and

4. Amend the following tables to reflect changes in the scope, capacity and project schedule of the proposed Greensboro ENR wastewater treatment plant and proposed Goldsboro Collection/Conveyance System:

    a. Immediate, Five- and Ten-Year Priorities for Sewer Development
    b. Project Municipal Sewerage Demands and Capacity

ADOPTED/EFFECTIVE:
September 18, 2012

ATTEST:

Sara B. Visintainer, Chief of Staff

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Larry C. Porter, President

Wilbur Levengood Jr., Vice President

Jefferson L. Ghrist, Commissioner

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
at 1:30 o'clock PM on 9/20 2012
and duly recorded in Liber FDM 4
folio 685 one of the Resolution
record books for the aforesaid and
Dale Munger. Clerk
Recording Fee

CAROLINE COUNTY COMPREHENSIVE WATER AND SEWER PLAN 2012 AMENDMENT TO NORTH COUNTY S-3 SERVICE AREA TO INCLUDE PROPERTIES IN THE VICINITY OF GOLDSBORO					
ACCTID	**PLAT**	**LOT**	**MAP**	**GRID**	**PARCEL**
0601010107			0011		0023
0601007726			0011		0086
0601006401			0011	0013	0088
0601004905			0011	0013	0089
0601002546	4 41	1	0011	0002	0097
0601014021	4 41	3	0011	0002	0097
0601014099	4 41	8	0011	0002	0097
0601014056	4 41	4	0011	0002	0097
0601014072	4 41	5	0011	0002	0097
0601014080	4 41	6	0011	0002	0097
0601012657	2 123	2	0011	0002	0097
0601000616			0011	0013	0105
0601012509			0011		0111
0601000454			0011	0001	0119
0601000624			0011	0001	0120
0601002902			0011	0001	0121
0601008676			0011	0001	0122
0601006495			0011	0001	0123
0601006509			0011	0001	0124
0601006967			0011	0001	0125
0601010263			0011	0001	0126
0601009478			0011		0129
0601001442			0011	0013	0130
0601001507			0011	0013	0131
0601013114	9 619		0011	0001	0134

D10b 0287

Properties Proposed for North County Service Area in the Vicinity of the Town of Goldsboro						
	ACCTID	LOT	MAP	GRID	PARCEL	PROPOSED TIMING CATEGORY
1	0601010107		0011		0023	S-3
2	0601007726		0011		0086	S-3
3	0601006401		0011	0013	0088	S-3
4	0601004905		0011	0013	0089	S-3
5	0601002546	1	0011	0002	0097	S-3
6	0601014021	3	0011	0002	0097	S-3
7	0601014099	8	0011	0002	0097	S-3
8	0601014056	4	0011	0002	0097	S-3
9	0601014072	5	0011	0002	0097	S-3
10	0601014080	6	0011	0002	0097	S-3
11	0601012657	2	0011	0002	0097	S-3
12	0601000616		0011	0013	0105	S-3
13	0601012509		0011		0111	S-3
14	0601000454		0011	0001	0119	S-3
15	0601000624		0011	0001	0120	S-3
16	0601002902		0011	0001	0121	S-3
17	0601008676		0011	0001	0122	S-3
18	0601006495		0011	0001	0123	S-3
19	0601006509		0011	0001	0124	S-3
20	0601006967		0011	0001	0125	S-3
21	0601010263		0011	0001	0126	S-3
22	0601009478		0011		0129	S-3
23	0601001442		0011	0013	0130	S-3
24	0601001507		0011	0013	0131	S-3
25	0601013114		0011	0001	0134	S-3

MAP 1
Greensboro, Goldsboro and Vicinity
Service Area Designations and Facilities

Legend

- Municipal Boundary
- Denied Access Line
- S-3 Service Area (Unincorporated)
- S-3 Service Area
- S-5 Service Area
- S-1 Service Area
- WTP — Proposed Treatment Plant
- PS — Proposed Pump Station
- Approximate Subdivision of Parcel

WTP

PS

Greensboro

0 0.125 0.25 0.5 0.75 Miles

N

Caroline County
Department of Planning and Codes
October 11, 2012

MAP 2
Greensboro, Goldsboro and Vicinity
Existing and Planned Sewer Service
Pending MDE Approval
of Resolution #2012-026

Legend

- Municipal Boundary
- Denied Access Line
- WTP — Proposed Treatment Plant
- PS — Proposed Pump Station
- Approximate Subdivision of Parcel
- Existing and Planned Sewer Service Pending MDE Approval

Goldsboro

PS

WTP

Planned Infill
101 EDUs

Planned Infill
238 EDUs

Greensboro

0 0.125 0.25 0.5 0.75
Miles

N

Caroline County
Department of Planning and Codes
October 11, 2012

Caroline County Comprehensive Water And Sewerage Plan
North County Water And Sewer Amendments

CHAPTER 1 INTRODUCTION

1.5 CAROLINE COUNTY SEWER SERVICE NEEDS

1.5.1 North County Region

Background

In 1996, the Town of Goldsboro, located in the northern region of the County, entered into a Consent Order with Maryland Department of the Environment (MDE) to construct a public sewer system to resolve the problem of failing septic systems in the Town. Due to a lack of funding and other constraints, the Town was unable to comply with the terms of the Order, which required the Town to connect the individual septic systems operating within Town limits to a public sewerage system (see Chapter 5, Sewerage, Section 5.7.2. Election District 1 (Henderson), 'Maryland Department of Environment vs. Town of Goldsboro Consent Order'). In 2006, the four towns in the north County region (Goldsboro, Henderson, Marydel and Templeville) and Caroline County became the subjects of a draft Consent Order (Proposed Order) prepared by MDE that sought to resolve the problem of failing septic systems on a regional scale by mandating the construction of a regional wastewater treatment facility to serve the four towns and rural properties adjacent to the towns.

The Division of Environmental Health of the Caroline County Health Department confirms that many of the septic systems in northern Caroline County lack the necessary soil conditions to properly treat septic tank effluent. Compounding the problem are the surrounding drainage ditches that penetrate the shallow groundwater and channel effluent from failing systems to streams and creeks that feed into the Choptank River. An additional threat is posed by the predominance of shallow wells in the region which may act as conduits for surface and groundwater contaminants to move into shallow and possibly deeper aquifers. None of these concerns have diminished over time. A more alarming trend now is the installation of sewage holding tanks to abate failing systems. The cost of providing ongoing maintenance to these tanks is often overwhelming for residents, resulting in tanks overflowing or backing up inside homes – an even greater public health threat.

In 2008, the Commissioners of Caroline County and the towns of Goldsboro, Henderson, Marydel and Templeville formed the North County Water and Sewer Authority pursuant to Subtitle 9 of Title 9 of the Environmental Article of the Annotated Code of Maryland, to:

> *"....exercise, perform, and carry out essential governmental functions and services, and to provide for the public health and welfare, pursuant to Subtitle 9 of Title 9 of the Environmental Article of the Annotated Code of Maryland (the "State Authority Code"), including, more specifically, but not by way of limitation, to operate as an authority pursuant to the State Authority Code, to operate a sanitary sewer district and sewerage system as provided for in the State Authority Code to provide for the collection, carrying, treatment, neutralization, and disposal of sewage, to operate a water district and water system as provided for in the State Authority Code to provide for the collection, supply, treatment, and distribution of water, and to have and exercise all powers granted to such authorities pursuant to the State Authority Code and to do all things permitted such authorities and all things necessary, incidental, or related thereto not prohibited to such authorities under the State Authority Code or other provisions of applicable law, including, but not limited to, the acquisition, ownership, leasing, construction, operation, disposal, and other activities with respect to real and personal property, the sale of bonds, and the entering into of contracts with its members and others."*[1]

The Authority consists of five (or the number of member political subdivisions, whichever is greater) directors. In 2010, the five incorporating political subdivisions of the Authority are:

1. Mayor and Council of Goldsboro ("Goldsboro")
2. The Commissioners of Henderson ("Henderson")
3. Commissioners of Marydel ("Marydel")
4. The Commissioners of Templeville ("Templeville")
5. County Commissioners of Caroline County ("Caroline")

One representative is appointed by each political subdivision to serve a three-year membership term on the Authority. The Authority conducts meetings at least four times per year. One of these serves as an Annual Meeting in which officers

[1] County Commissioners Of Caroline County, Maryland Legislative Bill #2008-7

are elected to one-year terms. The Authority delineated the North County Service Area to include properties within the corporate boundaries of Goldsboro, Henderson, Marydel and Henderson, certain parcels in proximity to each town, as well as the Harman subdivision (south of Templeville), Caroline Acres mobile home park (south of Henderson), and Hilltop and Cedars mobile home parks (south of Marydel). An allocation agreement executed by the Authority limits the maximum number of connections to the north County wastewater treatment system to 1,532, or a maximum flow of 383,000 gpd.

The distribution of allocations is outlined below:

North County Water and Sewer Authority Allocation Agreement			
	Minimum	**Additional**	**TOTAL**
Goldsboro	140	466	606
Henderson	68	166	234
Marydel	86	69	155
Templeville	47	7	54
County	414	69	**483**
TOTAL	**755**	**777**	**1532**

On behalf of the Authority, Caroline County and the Maryland Environmental Service commissioned an Engineering Study, completed in October 2009, to determine the most appropriate type of regional wastewater system to serve the Authority's service area. Several engineering studies performed in the past provided recommendations for implementing wastewater systems, however, none of the recommendations were implemented, primarily due to the unavailability of funds.

In the October 2009 Engineering Study, alternatives were evaluated for a regional wastewater collection, conveyance, treatment, and disposal system that would serve a minimum of 746 equivalent dwelling units (EDU) and a maximum of 1,532 EDUs. In the study, the use of a centralized system and de-centralized, or multiple, systems for collection and treatment were evaluated. A total of six alternative systems, or options, as well as a "no action" alternative were evaluated and compared. A preliminary Environmental Assessment was performed for the recommended alternative.

Based on a comparative analysis that addressed economic and non-economic factors, the study recommended the most cost-feasible alternative: a low pressure (grinder pump) sewer collection system in each of the four towns and

surrounding areas and a conveyance system to convey the collected wastewater to a single treatment plant near Goldsboro, which would have an initial capacity of 260,000 gpd, expandable to 383,000 gpd. Based on funding considerations the construction of the system would be phased over a period ranging in length from between five and nine years, beginning with the Town of Goldsboro in the first phase.

In December 2009, a supplemental engineering study (PER #2) was commissioned by Caroline County on behalf of the NCWSA to assess the feasibility of a seventh option (the "Greensboro option"), wherein wastewater from the NCWSA and the Town of Greensboro would be treated at a new Enhanced Nutrient Removal (ENR) treatment plant located in Greensboro (Greensboro owns and operates a 280,000 gpd stream discharge treatment plant built in 1964 that discharges effluent to the Choptank River and has an average TN concentration of 20 mg/l). The study evaluated the economic and non-economic impacts of extending the project to include Greensboro, and addressed impacts on conveyance, treatment and final effluent disposal were evaluated. The evaluation was performed on the basis that the Town of Greensboro would not be a member of the Authority and the Authority would contract with Greensboro to treat its wastewater flow.

The Greensboro option included a new collection system and pumping station in Goldsboro, new force main from Goldsboro to Greensboro, a new pumping station and force main in Greensboro, and a new ENR treatment facility located at a site on the north side of Greensboro, with discharge to the Choptank River. The project would be implemented in phases, with the initial phase providing a treatment capacity of 540,000 gpd to accommodate Greensboro's existing capacity and 260,000 gpd to serve septic users located in the Authority's service areas. Beyond this initial capacity, the new WWTP could be expanded to accommodate future development, with costs borne by developers.

PER #2 recommended that the Greensboro option be implemented based on environmental benefits and long-term economic factors, with construction occurring in phases over a five to nine year period. Early phases would include construction of a new ENR WWTP in Greensboro with an initial capacity of 540,000 gpd, a pumping station and force main to serve Greensboro, decommissioning of the existing Greensboro WWTP, and construction of a collection/conveyance system to serve Goldsboro and connect the town to the new Greensboro ENR plant. In later phases, sewers would be extended to service areas in and around Henderson, Marydel and Templeville, including three

mobile home parks and a small subdivision located in unincorporated areas near the towns. PER #2 was submitted to the Maryland State Clearinghouse Review, CDBG and USDA for review and comment. Maryland State agencies (including MDE) and CDBG approved the PER and its recommendation.

In early 2010, at USDA's request, a third Engineering Report was commissioned to explore lower cost alternatives for the Greensboro option. PER #3 was completed in July 2010 and identified a lower cost alternative for Phase I of the Greensboro option. The option included the construction of a new facility in Greensboro with an initial capacity of 326,000 gpd (smaller than the 540,000 gpd recommended in the original Greensboro option) to accommodate Greensboro's current capacity and to serve existing users in Goldsboro only. The option also included construction of a new pumping station at the existing Greensboro WWTP with a force main from the existing plant to the new plant, and a new low pressure collection and conveyance system in Goldsboro. Future phases of the project would consist of expanding the new WWTP in modular increments to accommodate phased additions of users in the remaining North County service areas and new development in Greensboro.

A fourth, and final, PER for the project summarized all alternatives evaluated in the previous three PERs. Based on cost and environmental analyses of the alternatives, the final PER recommended implementation of the Greensboro option recommended in the 2nd PER. Both Greensboro and the NCWSA supported this recommendation.

In mid-2010 MDE approved a finance package of $3.5M for Phases 1 and 2 of the Greensboro option, with a required construction start date of December 31, 2011. This deadline was later extended to December 31, 2012 by Jag Khuman of MDE.

In January 2011, the County, on behalf of the Authority, submitted an application for MDE WQRLF funding for Phase 3 of the project, collection/conveyance in Henderson. It ranked 35th out of 166 projects on the State Board of Public Works' FY2011-2013 Intended Use Plan (IUP). In the Spring of 2011, Greensboro and the Authority began developing a bulk service agreement wherein the Authority would contract with the Town to treat wastewater conveyed from North County service areas to the new plant in Greensboro. At the same time, with the assistance of USDA and Maryland Rural Development Corporation (MRDC), the Authority began developing a fee/rate structure for North County users.

In May 2011 Greensboro submitted an application to the Community Development Block Grant (CDBG) program of the Maryland Department of Housing and Community Development for funding of Phase 1 of the project. In July 2011 CDBG approved a grant of $600,000 for design and land acquisition for the new treatment plant. The CDBG funding commitment required final approval of USDA grant and loan funding by October 31, 2011.

In September 2011, USDA met with Authority members to review the draft bulk service agreement and user fee/rates structure. At that meeting, USDA indicated that an invitation to apply for Rural Development funding could be delayed until Spring of 2012, which would jeopardize the ability to meet MDE/CDBG deadlines. At the request of Greensboro, CDBG extended its deadline to accommodate USDA's revised timetable. In December 2011, with USDA still uncertain about the timing of its invitation to apply for funding, MDE encouraged Greensboro and the NCWSA to reapply for funding of Phases 1 and 2. If these phases were re-selected, MDE could fund them in the FY 2014 budget, which would extend MDE's construction deadline to December 2014 and provide additional time to accommodate the changes in USDA's timetable. Greensboro and the County, on behalf of the NCWSA, re-submitted applications for Phase 1 and 2 in January 2012.

The bulk service agreement between Greensboro and the Authority and the user fee/rates structure for Authority users were finalized in late February 2012 and submitted to USDA, MDE and CDBG for review and comment. In early March 2012 Greensboro purchased land adjacent to the town's northern boundary for the site of the new treatment plant and began annexation proceedings.

Current Status

In mid-March 2012 MDE met with representatives from Greensboro, the Authority, USDA and CDBG and reported that the recently announced federal budget for WQSRF funding for FY 2014 significantly reduced the amount of loan forgiveness (grants) provided through the WQSRF program. As a result, MDE funding for any phases following Phases 1 and 2 would be in the form of loans only, i.e., no loan forgiveness/grant funding. Greensboro, the Authority, and the funders all agreed that this would make the per user project cost prohibitively expensive for Authority users. USDA, CDBG and MDE evaluated the feasibility of securing State and/or federal funding for the phased construction of the facility to accommodate Greensboro and the entire North County service area, and recommended that the project be revised to reflect the lower cost option

recommended in the third engineering report, i.e., a new ENR treatment plant constructed in Greensboro with sufficient initial capacity to serve Greensboro and the Goldsboro service area only, and a collection/conveyance system for Goldsboro service area. The plant and collection/conveyance systems will be designed to allow incremental capacity expansion to accommodate users in the remaining North County service areas, should funding become available to continue extending collection/conveyance northward to Templeville. The funders recommended that Greensboro and Goldsboro proceed to the design phase as soon as possible to meet MDE's December 31, 2012 deadline of 90% of design being completed.

In late March 2012, the towns of Greensboro and Goldsboro elected to move ahead with the project. In July 2012 Goldsboro resigned its membership in the NCWSA. As of July 2012, a service agreement between Greensboro and Goldsboro is in final draft form. The agreement stipulates that Greensboro will treat wastewater conveyed from the Goldsboro service area, and that the town of Greensboro will own and operate the treatment plant and the collection/conveyance system in Goldsboro. The new WWTP will have a rated capacity of 321,000 gpd (Greensboro's existing permitted capacity plus capacity to serve the Goldsboro vicinity service area). It will be designed to be capable of treating effluent to ENR standards although it is expected the discharge permit requirements will be less stringent. The WWTP will be located near the intersection of MD Rt. 313 and MD Rt. 480, at the north end of town (see map); effluent will be discharged to the Choptank River.. The WWTP will feature sequencing batch reactor (SBR) and denitrification filter (DNF) technology, with screening provided at the collection systems pump stations. The new plant's effluent requirements are based on the combined effluent allocations for the Greensboro WWTP and for the allocation provided by taking existing septics offline in Goldsboro.

The proposed effluent requirements for the new WWTP are shown below:

Nutrient Allocation	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)
Greensboro allocation	6,100	457
Goldsboro allocation	596	0
TOTAL	6,696	457

In July 2012 the town of Greensboro signed a contract for engineering, design, bidding and construction services with the engineering firm of RK&K, North County project engineers since 2008.As outlined in the contract, the project will consist of three parts:

Part 1 – Greensboro WWTP – New WWTP in Greensboro with a rated capacity of 326,000 gpd designed to treat to enhanced nutrient removal (ENR) standards and discharge to the Choptank River, located on a parcel located near the intersection of MD Rt. 313 and MD Rt. 480 (north end of town). The WWTP will be designed so as not to preclude future capacity expansion to other areas in North Caroline County.

Part 2 – Greensboro Conveyance System – Conveyance system consisting of a new pumping station (PS) located at the existing WWTP in Greensboro and a force main from the new PS to the new WWTP.

Part 3 – Goldsboro Collection/Conveyance System – Low pressure (grinder pump) collection system and PS in Goldsboro with a force main along Rt. 313 from Goldsboro to the new WWTP.

The commitments for funding from MDE and CDBG remain in place, along with the MDE requirement that 90 percent of design be completed by December 31, 2012 as a condition of funding. As of July 2012 USDA has not specified the grant and loan amounts it will commit to the project or when it will invite the Town of Greensboro to apply for funding. The remaining members of the North County Water and Sewer Authority will continue to meet on a regular basis and pursue alternatives for wastewater treatment, including systems to serve one, two or all three of the remaining towns.

The funders have indicated that the remaining four members of the Authority (the towns of Henderson, Marydel and Templeville and the County) may pursue the original regional concept should funding become available for the later

phases of the project. The members would be favorable to continuing the regional project should funding support it, and in the meantime will continue to evaluate potential wastewater treatment options. In support of this, new systems designed for any of the remaining North County towns will be reviewed for potential opportunities to connect to the Greensboro-Goldsboro system at a future date, if feasible.

Should Henderson, Marydel and/or Templeville pursue an opportunity to connect to the Greensboro-Goldsboro system or to construct a new wastewater system, amendments will be made to this Plan accordingly.

2.5.8. Policies Regarding Denied Access Lines

2.5.8.1. In order to properly regulate development and direct growth to appropriate locations in accordance with the Comprehensive Plan, access will not be permitted to water and sewer lines identified on Water and Sewer Maps as "Denied Access Lines" except under the conditions listed below.

2.5.8.1.1. The Caroline County Departments of Health and/or Environmental Health determines access is necessary to abate an existing threat to public health; and

2.5.8.1.2. The property is constrained by factors that prohibit the use of reasonable alternative systems to solve the existing health-related problem; and

2.5.8.1.3. Only the immediate health emergency area is to be served; and

2.5.8.1.4. Any change to the status of a denied access line will require an amendment to the Comprehensive Water and Sewerage Plan approved by a vote of the County Commissioners. Prior to such a vote, a vote in the affirmative to consider the change must be received from the Planning Commission. Should a vote by the County Commissioners to change the status of a denied access line be successful, a subsequent hearing must then be held to amend the service area maps on a parcel-by-parcel basis following the typical procedures outlined in Section 2.6.2.

2.5.8.1.5. Such extension is not to be construed as a modification of the Land Use Plan, zoning, or character of the area being served, or of the areas adjacent to any conveyance line required to serve the affected health emergency area.

2.6 ORGANIZATION AND ADMINISTRATION PROCEDURES

2.6.1. Water and Sewer Plan Classifications

In conjunction with COMAR regulations (26.03.01.04), the County has established a classification system for properties which will be served by water and sewer service. The system reflects a progression towards the extension or establishment of community water and sewer service to achieve County growth management goals as set forth in the County Water and Sewerage Plan and County Comprehensive Plan.

The classification system is designed to show need and intent of the County, its municipalities and private developers for establishing or extending community water and sewer systems. The classification system is not intended to prevent development of community water and/or sewerage facilities prior to or later than the time periods indicated; rather it is the best estimate at the time of adoption as to when such development may be expected to occur. Every effort should be made by the County, municipalities, and developers to progress with water and sewer projects to the point that construction may occur in accordance with the Plan. However, there is no guarantee that having achieved one level water of sewer service timing, the next level will be granted.

Tracts of land where the County or municipalities anticipate that development may occur within 20 years may be assigned one of the following service timing classifications:

W-1/S-1: areas served by community and multi-use water and sewerage systems which are either existing or are under construction. The actual bounds of areas served by these systems shall be clearly indicated. The areas so delineated in this category shall be referred to as W-1 for water systems and S-1 for sewerage systems.

W-2/S-2: areas to be served by extensions of existing community and multi-use water supply and sewerage systems which are in the final planning stages. The areas so shown in this category shall be referred to as W-2 for water systems and S-2 for sewerage systems.

W-3/S-3: areas where improvements to, or construction of, new community and multi-use water supply and sewerage systems will be given immediate priority. The areas so shown in this category shall be referred to as W-3 for water systems and S-3 for sewerage systems.

W-4/S-4: areas where improvements to, or construction of, new community and multi-use water supply and sewerage systems will be programmed for the 3 to 5/6 year period. The areas so shown in this category shall be referred to as W-4 for water systems and S-4 for sewerage systems.

W-5/S-5: areas where improvements to, or construction of, new community and multi-use water supply and sewerage systems are programmed for inclusion within the 6/7 through 10-year period. The areas so shown in this category shall be referred to as W-5 for water systems and S-5 for sewerage systems.

W-6/S-6(NPS – No Planned Service): areas that are not planned or projected to be provided with community water or sewer service within the timeframe of the current County Comprehensive Plan.

5.7.2. Election District No.1 (Henderson)

Election District No. 1 (2010 population – 3,348), the northernmost election district, is comprised of the towns of Goldsboro, Henderson, Marydel and Templeville, and approximately 35 square miles of the unincorporated area of the County. With the exception of the mobile homes located in Caroline Acres and Cedars mobile home parks (located outside of the towns of Henderson and Marydel, respectively), the area is served by on-site sewage disposal (septic) systems.

Water quality problems stemming from failing septic systems have been a regional public health issue since the 1970s. Major concerns include:

- Goldsboro: The Town's 216 residents are served by private, individual water supply wells and septic systems. Incidences of failing septic systems in the Town were recorded as early as 1975. In 1996 the Maryland Department of the Environment (MDE) issued a Consent Order to the Town to resolve the problem of failing septic systems.

- Henderson: The Town's 118 residents are served by a municipal water system and private, individual septic systems, a large number of which are failing. The Town's public water system and elevated water storage tank water provide protection from septic contamination and the Town has thus far avoided serious public health issues as a result of contaminated drinking water.

- Marydel: the Town lies on both sides of the state line between Maryland and Delaware. The Town's 147 Maryland residents are served by private individual wells and septic systems, most of which are suspected to be failing. Municipal and County officials are aware of public health issues stemming from contaminated groundwater in wells located within 100 feet of failing septic systems.

- Templeville: the Town lies on both sides of the boundary between Caroline and Queen Anne's County. Approximately 25 percent of the Town's residents (total Town population is approximately 180) live in the Caroline County portion of the Town. All of the residents of the Town are served by private wells and septic systems. Caroline County Department of Health

reports that many of these systems are failing, and that contaminated groundwater is a serious public health issue in the Town.

Two community sewer systems are in operation within Election District 1:

- Cedars Mobile Home Park (formerly Walker's Mobile Home Park): located south of the town of Marydel, the Park's 91 mobile homes are served by public water supply and wastewater collection and treatment systems. The wastewater treatment facility has a permitted flow capacity of 15,000 gpd, and is permitted to discharge treated effluent to the Tidy Island Branch of the Choptank River.

- Caroline Acres Mobile Home Park: located just outside the municipal boundary of Henderson, the community's 134 mobile homes are served by a public water supply and wastewater collection and treatment system. The wastewater treatment facility employs a lagoon treatment system with spray irrigation and has a permitted flow capacity of 24,000 gpd.

North County Water and Sewer Authority

In 1996, Maryland Department of the Environment (MDE) filed a Consent Order against the Town of Goldsboro to resolve the public health threat posed by the numerous failing septic systems in the Town. Similarly, Henderson, Marydel, Templeville and the County are the subjects of a proposed complaint and draft Consent Order (Proposed Order) prepared in 2006 by MDE. Both the Consent Order and the Proposed Order recommended that North County local governments work together to develop a regional solution to address failing septics.

In 2008, the Commissioners of Caroline County and government representatives of the North County towns – Goldsboro, Henderson, Marydel and Templeville – formed the North County Water and Sewer Authority (NCWSA) to facilitate a regional solution for the area's failing septic systems. In addition to municipal service areas, the Authority identified areas in the vicinity of the four towns where aging and failing septic and small sewer systems are located, to be designated as County (unincorporated) sewer service areas.

The Authority developed an allocation agreement with minimum and maximum numbers of connections allocated for each member (for a detailed history of the

North County Regional Wastewater Treatment Project, please refer to Section 1.5 of this Plan, Caroline County Sewer Service Needs, North County Region).

NCWSA Allocation Agreement			
Jurisdiction	**Minimum**	**Additional**	**Maximum**
Goldsboro	140	466	**606**
Henderson	68	166	**234**
Marydel	86	69	**155**
Templeville	47	7	**54**
Town Total	**341**	**708**	**1049**
County*	414	69	**483**
TOTAL	**755**	**777**	**1532**
*includes mobile home parks and Harman Subdivision			

On behalf of the Authority, Caroline County and the Maryland Environmental Service commissioned an Engineering Study, completed in October 2009, to determine the most appropriate type of regional wastewater system to serve the Authority's service area. Several engineering studies performed in the past provided recommendations for implementing wastewater systems, however, none of the recommendations were implemented, primarily due to the unavailability of funds.

In the October 2009 Engineering Study, alternatives were evaluated for a regional wastewater collection, conveyance, treatment, and disposal system that would serve a minimum of 746 equivalent dwelling units (EDU) and a maximum of 1,532 EDUs. In the study, the use of a centralized system and de-centralized, or multiple, systems for collection and treatment were evaluated. A total of six alternative systems, or options, as well as a "no action" alternative were evaluated and compared. A preliminary Environmental Assessment was performed for the recommended alternative.

Based on a comparative analysis that addressed economic and non-economic factors, the study recommended the most cost-feasible alternative: a low pressure (grinder pump) sewer collection system in each of the four towns and surrounding areas and a conveyance system to convey the collected wastewater to a single treatment plant near Goldsboro, which would have an initial capacity of 260,000 gpd, expandable to 383,000 gpd. Based on funding considerations the construction of the system would be phased over a period ranging in length from between five and nine years, beginning with the Town of Goldsboro in the first phase.

In December 2009, a supplemental engineering study (PER #2) was commissioned by Caroline County on behalf of the NCWSA to assess the feasibility of a seventh option (the "Greensboro option"), wherein wastewater from the NCWSA and the Town of Greensboro would be treated at a new Enhanced Nutrient Removal (ENR) treatment plant located in Greensboro (Greensboro owns and operates a 280,000 gpd stream discharge treatment plant built in 1964 that discharges effluent to the Choptank River and has an average TN concentration of 20 mg/l). The study evaluated the economic and non-economic impacts of extending the project to include Greensboro, and addressed impacts on conveyance, treatment and final effluent disposal were evaluated. The evaluation was performed on the basis that the Town of Greensboro would not be a member of the Authority and the Authority would contract with Greensboro to treat its wastewater flow.

The Greensboro option included a new collection system and pumping station in Goldsboro, new force main from Goldsboro to Greensboro, a new pumping station and force main in Greensboro, and a new ENR treatment facility located at a site on the north side of Greensboro, with discharge to the Choptank River. The project would be implemented in phases, with the initial phase providing a treatment capacity of 540,000 gpd to accommodate Greensboro's existing capacity and 260,000 gpd to serve septic users located in the Authority's service areas. Beyond this initial capacity, the new WWTP could be expanded to accommodate future development, with costs borne by developers.

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In early 2010, at USDA's request, a third Engineering Report was commissioned to explore lower cost alternatives for the Greensboro option. PER #3 was

completed in July 2010 and identified a lower cost alternative for Phase I of the Greensboro option. The option included the construction of a new facility in Greensboro with an initial capacity of 326,000 gpd (smaller than the 540,000 gpd recommended in the original Greensboro option) to accommodate Greensboro's current capacity and to serve existing users in Goldsboro only. The option also included construction of a new pumping station at the existing Greensboro WWTP with a force main from the existing plant to the new plant, and a new low pressure collection and conveyance system in Goldsboro. Future phases of the project would consist of expanding the new WWTP in modular increments to accommodate phased additions of users in the remaining North County service areas and new development in Greensboro.

A fourth, and final, PER for the project summarized all alternatives evaluated in the previous three PERs. Based on cost and environmental analyses of the alternatives, the final PER recommended implementation of the Greensboro option recommended in the 2nd PER. Both Greensboro and the NCWSA supported this recommendation.

In mid-2010 MDE approved a finance package of $3.5M for Phases 1 and 2 of the Greensboro option, with a required construction start date of December 31, 2011. This deadline was later extended to December 31, 2012 by Jag Khuman of MDE.

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In mid-March 2012 MDE met with representatives from Greensboro, the Authority, USDA and CDBG and reported that the recently announced federal budget for WQSRF funding for FY 2014 significantly reduced the amount of loan forgiveness (grants) provided through the WQSRF program. As a result, MDE funding for any phases following Phases 1 and 2 would be in the form of loans only, i.e., no loan forgiveness/grant funding. Greensboro, the Authority, and the funders all agreed that this would make the per user project cost prohibitively expensive for Authority users. USDA, CDBG and MDE evaluated the feasibility of securing State and/or federal funding for the phased construction of the facility to accommodate Greensboro and the entire North County service area, and recommended that the project be revised to reflect the lower cost option recommended in the third engineering report, i.e., a new ENR treatment plant constructed in Greensboro with sufficient initial capacity to serve Greensboro and the Goldsboro service area only, and a collection/conveyance system for Goldsboro service area. The plant and collection/conveyance systems will be designed to allow incremental capacity expansion to accommodate users in the remaining North County service areas, should funding become available to continue extending collection/conveyance northward to Templeville. The funders recommended that Greensboro and Goldsboro proceed to the design

phase as soon as possible to meet MDE's December 31, 2012 deadline of 90% of design being completed.

In April 2012, the towns of Greensboro and Goldsboro elected to move ahead with the project. In July 2012, the Town of Goldsboro, with the support of the North County Water and Sewer Authority, resigned its membership in the NCWSA. The existing service area established in Goldsboro in 2010 as part of the NCWSA service area is now the Goldsboro municipal service area. The remaining members of the North County Water and Sewer Authority will continue to meet on a regular basis and pursue alternatives for wastewater treatment, including systems to serve one, two or all three of the remaining towns.

As of August 2012, the towns of Greensboro and Goldsboro are finalizing an agreement wherein the town of Greensboro will treat wastewater conveyed from the Goldsboro service area to the new treatment plant at Greensboro. A new collection/conveyance system will be constructed in the Town of Goldsboro and will include a low pressure (grinder pump) collection system and pump station. A new force main (Denied Access Line) will be constructed along Route 313 to convey wastewater from Goldsboro to the new WWTP at Greensboro. Greensboro will own and operate the treatment plant, conveyance lines between Greensboro and Goldsboro, and the collection/conveyance system in Goldsboro. Improved properties within the service area will have one year from the date of the commencement of sewer service in the area in which the property is located to abandon existing individual septic or community systems and connect to the sewerage line. Properties located adjacent to Denied Access sewerage lines which pass through areas outside of the service area may connect to sewerage lines only in accordance with the Denied Access Policy of this Plan (Section 2.5.8.), or through annexation into the towns of Greensboro or Goldsboro. Funding for the project is being provided by MDE, the Maryland Department of Housing and Community Development Block Grant program, and the USDA Rural Development program. Per MDE funding requirements, project design must be 90% complete by the end of 2012; construction is planned to begin in the summer of 2013.

The funders have indicated that the remaining four members of the Authority (the towns of Henderson, Marydel and Templeville and the County) may pursue the original regional concept should funding become available for the later phases of the project. The members would be favorable to continuing the regional project should funding support it and in support of this, new systems designed for any of the remaining North County towns will be reviewed for

potential opportunities to connect to the Greensboro-Goldsboro system at a future date, if feasible. In the meantime the members will continue to evaluate potential wastewater treatment options for themselves and the Authority. Should any of the members pursue an opportunity to connect to the Greensboro-Goldsboro system or to construct a new wastewater system, amendments will be made to this Plan accordingly.

The Goldsboro sewer service area is located in the Town of Goldsboro and includes 25 properties located outside of town boundaries, approved for sewer service due to failing or non-conforming systems. The North County sewer service areas are located in the towns of Henderson, Marydel and Templeville. Additional North County sewer service areas include Cedars and Hilltop mobile home parks (south of Marydel), a County-owned property located adjacent to the boundary of Marydel, Caroline Acres mobile home park (south of Henderson), and the Harman subdivision (south of Templeville). Future connections to properties located in the vicinities of the towns are anticipated where failing or non-conforming septics exist.

Timing categories for North County sewer service areas are outlined below.

S-1: (Areas served by community and multi-use water and sewerage systems which are either existing or are under construction.) Properties currently served by community water systems (Caroline Acres and Cedars mobile home parks).

S-3: (Areas where improvements to, or construction of, new community and multi-use water supply and sewerage systems will be given immediate priority.) Properties within the towns of Goldsboro, Henderson, Marydel and Templeville, Hilltop Mobile Home Park, Harman Subdivision, and specific properties with failing or nonconforming systems located in the unincorporated area in the vicinity of the four towns, as specified in future amendments to this Plan.

At such time that Henderson, Marydel and/or Templeville undertake planning project(s) to construct individual or regional wastewater treatment and/or collection/conveyance systems to serve these service areas, additional CWSP amendments will be submitted to address these plans.

S-5: (Areas where improvements to, or construction of, new community and multi-use water supply and sewerage systems are programmed for inclusion within the 6/7 through 10-year period.) The East Star property, annexed into the Town of Goldsboro. At the time of this update the property is the site of a mineral extraction operation. Future development of the site is anticipated; at such time the timing category will be evaluated to determine if re-assignment is appropriate. Amendments for these timing changes will need to be coordinated with estimated timelines for development of the property.

5.7.3. Election District No 2 (Greensboro)

The Greensboro Election District (2010 population – 5,614) is comprised of the town of Greensboro (about one square mile) and just under 50 square miles of unincorporated land. Currently about 65% of the district's total population is served by individual sewage disposal systems. The remainder of the population is served by the Town of Greensboro community sewerage system.

The Town of Greensboro operates a fixed film, activated sludge type wastewater treatment plant located on the northwest bank of the Choptank River, within the Critical Area. The facility was originally constructed in 1968 and last modified in 1996. The plant consists of an influent screen, primary clarifier, dual rotating biological contactors, two secondary clarifiers, disinfection, post aeration, and sludge drying beds. Wastewater effluent flows by gravity through the plant to an outfall that discharges into an unnamed tributary of the Choptank River. The plant has a design capacity of 280,000 gpd. In 2012, the plant's five-year average daily flow is 155,000 gpd. The Town has allocated approximately 82,750 gpd (331 EDUs) through annexation and DRR agreements. As stated in the Greensboro 2010 Comprehensive Plan, remaining plant capacity is limited to public uses and commercial or industrial uses that would create jobs within the community.

The Town calculates that infill development will create demand for an additional 100,750 gpd, which would leave 37,250 gpd in remaining capacity and place the system at 85 percent of capacity. As a result, in 2006 the Town limited the sewer allocation to public uses, rehabilitative uses, and non-residential job-creating uses. According to the Town's draft 2008 Comprehensive Plan, any future growth beyond that from infill development, including development of subdivisions that have been planned and/or approved and are located within the Town limits, would require expanding the plant and upgrading it to an ENR

treatment level capability. The plant's aging facilities and habitual flooding make the construction of a new plant at a higher elevation a priority for the Town.

In August 2011, Hurricane Irene caused severe flooding in Greensboro after eleven inches of rain fell within a few days. The Town's treatment plant was submerged when the Choptank River rose to a record height (see Figure 1) during the storm. The incident underscored the critical need for a new WWTP to be located on higher ground, out of the floodplain.

Figure 1 Greensboro WWTP facility submerged as a result of hurricane-related flooding and tidal surge.

In 2009, at the request of Caroline County, Greensboro officials participated in an evaluation of the feasibility of including Greensboro in the North County Wastewater Treatment Project (for a detailed history of the North County Regional Wastewater Treatment Project, please refer to Section 1.5, Caroline County Sewer Service Needs, North County Region).

In July 2012, the towns of Greensboro and Goldsboro were finalizing bulk service agreement wherein the town of Greensboro will treat wastewater conveyed from Goldsboro to a new treatment plant at Greensboro. The new ENR WWTP in Greensboro will have a rated capacity of 326,000 gpd (Greensboro's existing permitted capacity plus capacity to serve the Goldsboro service area). It will be designed to treat to ENR standards though it is expected the discharge permit requirements will be less stringent. The effluent will be discharged to the Choptank River. The WWTP and collection and conveyance system in Goldsboro will be owned and operated by Greensboro and will be located near the intersection of MD Rt. 313 and MD Rt. 480, at the north end of town (see facilities map). The WWTP will feature sequencing batch reactor (SBR) and denitrification filter (DNF) technology, with screening provided at the collection systems pump stations. The new plant's proposed effluent requirements are based on the combined effluent allocations for the Greensboro WWTP and for the allocation provided by taking existing septics offline in Goldsboro. The proposed effluent requirements are shown below:

Nutrient Allocation	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)
Greensboro allocation	6,100	457
Goldsboro allocation	596	0

TOTAL	6,696	457

Also in July 2012 the town of Greensboro signed a contract for engineering, design, bidding and construction services with the engineering firm of RK&K, North County project engineers since 2008.As outlined in the contract, the project will consist of three parts:

Part 1 – Greensboro WWTP – New WWTP in Greensboro with a rated capacity of 326,000 gpd designed to treat to enhanced nutrient removal (ENR) standards and discharge to the Choptank River, located on a parcel located near the intersection of MD Rt. 313 and MD Rt. 480 (north end of town). The WWTP will be designed so as not to preclude future capacity expansion to other areas in North Caroline County.

Part 2 – Greensboro Conveyance System – Conveyance system consisting of a new pumping station (PS) located at the existing WWTP in Greensboro and a force main from the new PS to the new WWTP.

Part 3 – Goldsboro Collection/Conveyance System – Low pressure (grinder pump) collection system and PS in Goldsboro with a force main along Rt. 313 from Goldsboro to the new WWTP.

Table 5-9: Projected Municipal Sewerage Demands and Capacity									
	POPULATION PROJECTIONS					WWTP FLOWS (GPD)			
Municipality	**2010**	**2015**	**2020**	**2025**	**2030**	**Permit**	**Design**	**Existing**	**Planned/ Projected**
Election District 2 Greensboro									
Greensboro	2,485	2,028	2,129	2,257	2,392	220,000	280,000	140,000	327,500
Election District 3 Denton									
Denton	4,547	4,947	5,734	6,648	7,707	800,000	800,000	349,000	800,000
Election District 4 Preston									
Preston	271	277	298	320	343	115,000	116,000	95,000	
Election District 5 Federalsburg									
Federalsburg	2,739	3,042	3,197	3,360	3,394	740,000	750,000	250,000	539,000
Election District 7 Ridgely									
Ridgely	1,424	1,498	1,572	1,646	1,720	200,000	200,000	129,000	288,023
Sources: 2010 U.S. Census; 2009 and 2010 Municipal Comprehensive Plan Municipal Growth and Water Resources Elements									

Table 6-13: Immediate, Five- and Ten-Year Priorities for Sewer Development		
Sewer Service Area	**Description**	**Projected Schedule**
Election District 1 - Henderson		
a. Goldsboro	Design/construction of collection and conveyance system to convey 46,000 gpd of wastewater to new ENR WWTP in Greensboro	90% of design completed by 12/31/12; Construction start by summer 2013
b. Unincorporated Area	Design/Construction of treatment and/or collection and conveyance system to serve NCWSA non-municipal service area in the vicinity of Goldsboro	90% of design completed by 12/31/12; Construction start by summer 2013
Election District 2 - Greensboro		
a. Greensboro	Design/construction of 321,000 gpd ENR WWTP to serve Greensboro and the Goldsboro North County Service Area	90% of design completed by 12/31/12; Construction start by summer 2013

Proposed Sewer Facilities
Greensboro and Goldsboro

Legend

- Municipal Corporate Boundary
- S-5 Service Area
- S-5 Service Area
- S-1 Service Area
- Proposed S-3 Service Area
- Denied Access Line
- WTP — Proposed Treatment Plant
- PS — Proposed Pump Station

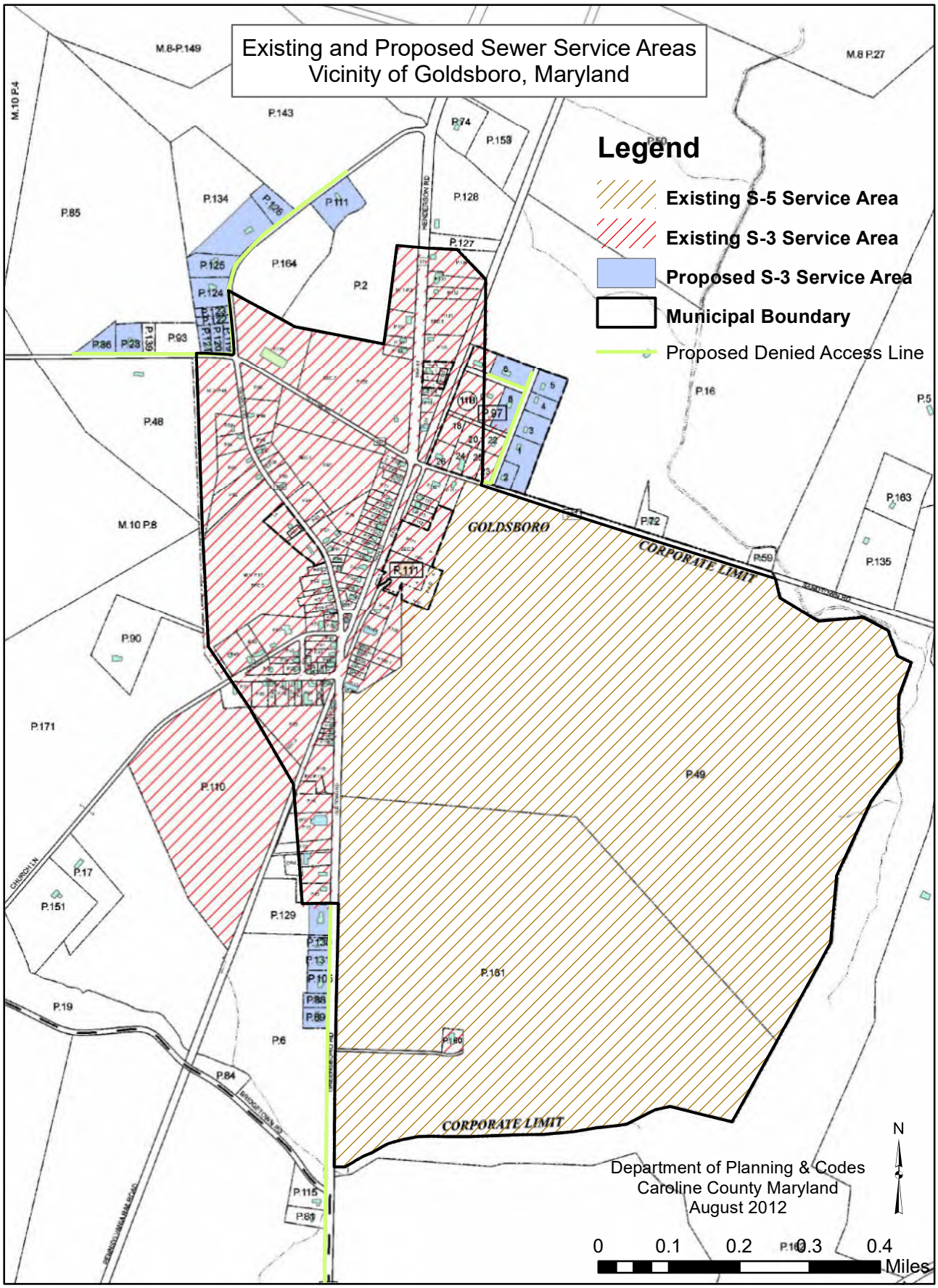
Goldsboro

Greensboro

0 0.1250.25 0.5 0.75 Miles

N

Caroline County
Department of Planning and Codes
August 2012


Existing and Proposed Sewer Service Areas
Vicinity of Goldsboro, Maryland
Legend
Existing S-5 Service Area
Existing S-3 Service Area
Proposed S-3 Service Area
Municipal Boundary
Proposed Denied Access Line
GOLDSBORO
CORPORATE LIMIT
CORPORATE LIMIT
Department of Planning & Codes
Caroline County Maryland
August 2012
N
0 0.1 0.2 0.3 0.4
Miles

Existing Sewer Service Areas
Vicinity of Greensboro

Legend

- Greensboro Corporate Boundary
- S-1 Sewer Service Area
- Greensboro S-5 Service Area
- Streams
- Ditches

WTP

PS

Greensboro

N

Caroline County
Department of Planning and Codes
August 2012

0 0.125 0.25 0.5 Miles

December 13, 2012

Mrs. Janice Outen
Maryland Department of the Environment
1800 Washington Blvd.
Water Quality Infrastructure Program
Baltimore, MD 21230

Subject: Caroline County – Resolution 2012-26 Greensboro-Goldsboro WSP Amendment

Dear Mrs. Outen:

Thank you for providing the Maryland Department of Planning with the Caroline County Water and Sewer Plan Amendment, Resolution 2012-26, to provide sewer service from the Town of Greensboro to the Town of Goldsboro, via a denied access sewer main. The Maryland Department of Planning has reviewed this amendment to the County Water and Sewer Plan pursuant to our mandate to advise the Maryland Department of the Environment on local comprehensive plan consistency and other appropriate matters as required by the Environmental Article Section 9-507 (b)(2).

Summary of Amendments:

Resolution 2012-26 amends the text for the North County Water and Sewer Service as it relates to the phased approach of bringing public sewer to Goldsboro and surrounding failed, failing, and insufficient septic systems. The text also explains the revised North County Sewer Authority members and failing septics solutions with the removal of Goldsboro from the Authority.

The Amendment provides a map (Map 1) showing the expanded service areas for Greensboro and Goldsboro with the appropriate service timing designations. The map also details the 25 lots outside of the Town of Goldsboro that have failing/failed septic systems. These improved parcels were granted a special exception by the MD Smart Growth Coordinating Committee on October 10, 2012 to connect via a denied access line. The Committee granted the exception based on the following information (see attached October 15, 2012 letter):

- The new WWTP, which will be owned and operated by the Town of Greensboro, will serve existing users in the Greensboro area, an additional approximately 396 EDUs in the Greensboro PFA, the WWTP itself and the relocated firehouse (both of which are outside the PFA on property that Greensboro recently has annexed).

- The new WWTP will also serve developed and infill lots in the Goldsboro PFA and 25 developed properties with failing septic systems just outside the Goldsboro PFA.
- An amendment to the Caroline County Water and Sewer Plan will soon be submitted to the State for review and approval that specifically identifies the number of EDUs allocated to different portions of the proposed Greensboro WWTP service area, and the locations of the denied access lines (this amendment satisfies that condition).

Map 1 and Map 2 (both shared with the Smart Growth Coordinating Committee on October 10, 2012, as part of the PFA Exception consideration) were submitted with this amendment. Map 1 identifies the locations of the denied access lines. Map 2 is an "allocation map" that identifies the areas within and surrounding Greensboro and Goldsboro to which the Greensboro WWTP capacity will be restricted, including the number of EDUs allocated for particular portions of the Greensboro WWTP service area.

Comprehensive Plan Consistency Review:

This amendment is consistent with the growth and environmental goals and policies of the Caroline County Comprehensive Plan, the Town of Greensboro and the Town of Goldsboro Comprehensive Plans.

Caroline County Water and Sewer Plan Comments:

MDP understands that the current service allocation is for those areas of existing (S-1) and planned (S-3) service as well as the SGCC-approved septic connections (Map 2).

Priority Funding Area Comments:

Pursuant to Finance and Procurement Article 5-7B-02, local jurisdictions are eligible to receive State financial assistance under certain programs if the project is located in a Priority Funding Area (PFA).

The sewer service to be provided outside of the PFA has been granted a special exception by the MD Smart Growth Coordinating Committee to connect via a denied access line. Any additional connections to the denied access service lines in the Greensboro Sewer Service Area will require another SE from the SGCC and an amendment to the County WSP. All other areas of sewer service are within the certified PFA.

December 13, 2012
Mrs. Janice Outen
Caroline County – Resolution 2012-26 Greensboro-Goldsboro WSP Amendment

If you have any questions or concerns on these comments please contact me at 410 767-0901.

Sincerely,

Richard Josephson
Director, Planning Services

cc: David Dahlstrom, UES, MDP
Greg Golden, DNR
Royden N. Powell, MDA
Matt Power, Deputy Director, MDP
Jenny King, Chief of Staff, MDP
Jason Dubow, MDP
John Leocha, MDP

October 15, 2012

Brigid Kenney, Senior Policy Advisor
Maryland Department of the Environment
Office of the Secretary
1800 Washington Boulevard
Baltimore, MD 21230

Dear Ms. Kenney:

The Smart Growth and Neighborhood Conservation Coordinating Committee met on October 10, 2012, to review a request by the Maryland Department of the Environment for a Priority Funding Area (PFA) exception for a sewer project involving the Caroline County towns of Goldsboro and Greensboro.

The Committee understands that the project is necessary to address failing septic systems in and around Goldsboro and the resulting contamination of groundwater and surface water. The multi-part project consists of construction of a new wastewater treatment plant (WWTP) at Greensboro; conversion of the existing Greensboro WWTP to a pumping station to convey wastewater to the new WWTP; installation of a sewage collection system and pumping station in Goldsboro where residents are currently served by septic systems; and construction of a denied access force main from Goldsboro to Greensboro. The new WWTP, which will be owned and operated by the Town of Greensboro, will serve existing users in the Greensboro area, an additional approximately 396 EDUs in the Greensboro PFA, and the WWTP itself and the relocated firehouse, both of which are outside the PFA on property that Greensboro recently has annexed. The new WWTP also will serve developed and infill lots in the Goldsboro PFA plus 25 developed properties with failing septic systems just outside the Goldsboro PFA. An amendment to the Caroline County Water and Sewer Plan will soon be submitted to the State for review and approval that specifically identifies the number of EDUs allocated to different portions of the proposed Greensboro WWTP service area, and the locations of the denied access lines.

301 West Preston Street - Suite 1101 - Baltimore - Maryland - 21201
Tel: 410.767.4500 - Toll Free: 1.877.767.6272 - TTY users: Maryland Relay - Planning.Maryland.gov

Based on this information, the Committee voted to approve this as an exception based on the applicable criteria of the PFA law.

Sincerely,

Richard Josephson
Director of Planning Services
Chairman, Interagency Smart Growth Coordinating Committee

cc: Pat Goucher, Director of Infrastructure Planning, Maryland Department of Planning

MDE
MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101 • www.mde.maryland.gov

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Robert M. Summers, Ph.D.
Secretary

MAY 12 2014

The Honorable Jefferson L. Ghist
President, County Commissioners of Caroline County
Caroline County Courthouse, Room 123
109 Market Street
Denton MD 21629

Dear Mr. Ghist:

The Maryland Department of the Environment (MDE) has completed its review of **Resolution No. 2014-003: Criteria for Eligibility to Apply for Bay Restoration Fund Grants (Amendment)**, which amends the Caroline County 1996 Comprehensive Water and Sewerage Plan. The County Commissioners of Caroline County adopted the Amendment on February 11, 2014 by Resolution No. 2014-003. The Amendment creates a new policy in the Comprehensive Water and Sewerage Plan guaranteeing that no septic system constructed after October 1, 2008 will be permitted to connect to a portion of a sewerage system funded using the Bay Restoration Fund (BRF). The new policy ensures State requirements for the BRF are met and only eligible Caroline County septic owners will be able to apply for BRF grants.

During MDE's review of the Amendment, the Maryland Department of Planning (MDP) advised the Department that the Amendment is consistent with the Caroline County Comprehensive Plan (see enclosed comments). The Department hereby approves the proposed **Amendment (Resolution No. 2014-003: Criteria for Eligibility to Apply for Bay Restoration Fund Grants)** to the Caroline County Comprehensive Water and Sewerage Plan.

This action completes MDE's final review, as required by §9-507 of the Environment Article, Annotated Code of Maryland. If you need further assistance, please contact Virginia F. Kearney, Deputy Director, at 410-537-3512, toll free at 800-633-6101 or by email at virginia.kearney@maryland.gov.

Sincerely,

Jay Sakai /VFK

Jay G. Sakai, Director
Water Management Administration

Enclosure

cc: Leslie Grunden, Planner III, Caroline County Department of Planning and Codes
Rich Josephson, Director, Planning Services, MDP
La Verne Gray, MDP
Virginia F. Kearney, Deputy Director, WMA, MDE

May 6, 2014

Mrs. Janice Outen
Maryland Department of the Environment
1800 Washington Blvd.
Water Quality Infrastructure Program
Baltimore, MD 21230

Subject: Caroline County – Resolution 2014-03

Dear Mrs. Outen:

Thank you for providing the Maryland Department of Planning (MDP) with a copy of the Caroline County Water and Sewer Plan Amendment (Resolution 2014-03) for the language pertaining to the use of Bay Restoration funds to connect qualified septic systems to BNR/ENR wastewater treatment plants to the Greensboro WWTP.

Please accept our comments on this adopted amendment pursuant to our mandate to advise the Maryland Department of the Environment on local comprehensive plan consistency and other appropriate matters as required by the Environmental Article Section 9-507 (b)(2).

Comprehensive Plan Consistency Review:

MDP finds this language to be consistent with the development and environmental goals and policies of the County Comprehensive Plan. This same language would apply to any other WWTP service area in the County.

Other Planning Matters:

The County should be made aware that said connections are not to supersede other septic remediation method requests as prioritized in the Bay Restoration Fund legislation.

Priority Funding Area Comments:

Pursuant to Finance and Procurement Article 5-7B-02, local jurisdictions are eligible to receive State financial assistance under certain programs if the project is located in a Priority Funding Area (PFA).

Where said connections are outside of the Priority Funding Area (PFA), the County must follow all State protocols under House Bill 11 to expend BRFs on failing septic systems prior to connection to a qualified wastewater treatment facility.

As this entire system upgrade to the Greensboro WWTP and service to Goldsboro will be funded with State monies, additional connections, not already approved by the Maryland Smart Growth Coordinating Committee (SGCC), that are outside of the PFA will require prior approval from the SGCC.

If you have any questions or concerns on these comments please contact John Leocha at 410 767-5497.

Sincerely,

Richard Josephson, AICP
Director of Planning Services

Cc: Jeff Horan, DNR
Royden N. Powell, MDA
Jason Dubow, MDP
Peter Conrad, MDP
John Leocha, MDP
David Dahlstrom, MDP

RESOLUTION #2014-003

ADOPTION OF CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN AMENDMENT FOR BAY RESTORATION FUND GRANT ELIBIBILITY REQUIREMENTS

A Resolution to amend the Caroline County Comprehensive Water and Sewerage Plan to accept grant funding from the Maryland Board of Public Works, Chesapeake Bay Restoration Fund (BRF) for construction of an Enhanced Nutrient Removal (ENR) wastewater treatment plant (WWTP) in the Town of Greensboro, and to authorize use of such additional BRF grant funding as may be awarded up to $20,000 per lot to defray the costs to connect individual properties in the Goldsboro Sewer Service Area to the Greensboro ENR WWTP, subject to grant conditions and restrictions that include prohibiting connection of any property not having an existing on-site sewage disposal system installed on or before October 1, 2008.

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article, Title 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, Caroline County collaborates with municipalities from time to time to assess and respond to wastewater treatment needs in the County; and

WHEREAS, the County Commissioners have authorized, by Resolution #2001-007, Resolution #2002-024, and Resolution #2010-018, the establishment of water and sewer service districts for certain unincorporated areas of northern Caroline County and the Towns of Goldsboro, Henderson, Marydel and Templeville; and

WHEREAS, the County Commissioners have authorized, by Resolution #2012-026, the incorporation of the Greensboro ENR wastewater treatment plant and Goldsboro conveyance and collection system design and construction projects into the Comprehensive Water and Sewerage Plan; and

WHEREAS, the County Commissioners desire to amend the Comprehensive Water and Sewerage Plan to authorize the acceptance of Bay Restoration Fund (BRF) grant funding for connection to sewer collection, conveyance and/or treatment facilities, and to make sewer service available to eligible properties upon the terms and conditions required by the grant funding, this Resolution, and all other applicable laws, ordinances, regulations, plans, and resolutions for the benefit of the North County Water and Sewer Service Areas and all other eligible properties in the County; and

WHEREAS, the Caroline County Planning Commission has reviewed the proposed amendment to the Comprehensive Water and Sewerage Plan and, following an advertised public hearing, recommended it to the County Commissioners for adoption; and

liber 5 page 269

WHEREAS, the County Commissioners held a duly advertised public hearing on the proposed amendment to the Comprehensive Water and Sewerage Plan on February 4, 2014.

NOW THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND tha:

Section 1. Chapter 2 – Goals, Policies, and Objectives of the Caroline County Comprehensive Water and Sewerage Plan is hereby amended as follows:

2.2.3. Bay Restoration Fund Enhanced Nutrient Reduction (ENR)

The Bay Restoration Fund (BRF) was created by Senate Bill 246 in May, 2004. The BRF uses funding from public sewer taxes to provide up to 100 percent state grant funds to local governments to retrofit or upgrade sewage treatment plants to reduce the nutrient levels in plant discharge to Enhanced Nutrient Removal (ENR) levels: 3 mg/l total nitrogen (TN) and .3 mg/l total phosphorus (TP). Upon completion of an ENR upgrade, MDE requires the permittee to make a best effort to meet the load goals, providing reasonable assurance of implementation.

The BRF also funds the cost of installing denitrification upgrades for septic systems in the Bay watershed through funding supplied by septic user fees paid by property owners with septic systems. Denitrification systems remove 50 percent or more of the nitrogen discharged by septic systems. The Chesapeake Bay Nitrogen Reduction Act, passed at the end of the State's last legislative session, requires that septic systems being built or replaced for homes located within the Critical Area must utilize the "best available technology" to reduce the level of nitrogen output of the septic system. The Caroline County office of Maryland Department of Environmental Health oversees implementation of the BRF program and consistency with program regulations.

PURSUANT TO RESTRICTIONS ENACTED AS PART OF THE BAY RESTORATION (SEPTIC) FUND STATUTE (ANNOTATED CODE OF MARYLAND UNDER 9-1605.2), NO PARCEL WITH AN ON-SITE SEWAGE DISPOSAL SYSTEM ("SEPTIC SYSTEM") ORIGINALLY CONSTRUCTED AFTER OCTOBER 1, 2008, WILL BE PERMITTED TO CONNECT TO COLLECTION, CONVEYANCE OR TREATMENT FACILITIES USING BRF SEPTIC FUNDS. ALL BRF-ELIGIBLE PROPERTIES PROPOSED FOR CONNECTION MUST HAVE HAD A SEPTIC SYSTEM IN EXISTENCE AS OF OCTOBER 1, 2008. ANY SEPTIC SYSTEM INITIALLY INSTALLED AFTER OCTOBER 1, 2008 IS EXCLUDED FROM CONNECTING TO SUCH FACILITIES USING BRF SEPTIC FUNDS. THIS EXCLUSION DOES NOT APPLY TO REPLACEMENT SYSTEMS, PROVIDED THE SYSTEM BEING REPLACED WAS INSTALLED PRIOR TO OCTOBER 1, 2008.

THE CAPITAL COST UP TO THE MAXIMUM AMOUNT OF $20,000 MAY BE AVAILABLE FOR BRF GRANT FUNDING THROUGH THE MARYLAND WATER QUALITY FINANCING ADMINISTRATION TO CONNECT AN ELIGIBLE PROPERTY TO THE SEWERAGE SYSTEM. THE AMOUNT, IF ANY, OF GRANT FUNDING AVAILABLE FOR EACH PROPERTY TO CONNECT REMAINS TO BE

DETERMINED UNDER APPLICABLE GRANT AND OTHER CRITERIA, INCLUDING WITHOUT LIMITATION, THE COST TO CONNECT AS TO EACH ELIGIBLE PROPERTY AND THE PROPERTY OWNERS' INDIVIDUAL HOUSEHOLD INCOME.

Section 2. Matter added is shown in **BOLD CAPITALIZATION**.

ADOPTED/EFFECTIVE: February 11, 2014

ATTEST:

Sara B. Visintainer, Chief of Staff

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Jefferson L. Ghrist, President

Larry C. Porter, Vice President

Wilbur Levengood Jr, Commissioner

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
at 11:10 o'clock am on 2/13 2014
and duly recorded in Liber FDM 5
folio 269 one of the Resolution
record books for the aforesaid and
J. Dale Minner. Clerk
Recording Fee

Liber 5 Page 271

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101 • www.mde.maryland.gov

Larry Hogan
Governor

Boyd Rutherford
Lieutenant Governor

Ben Grumbles
Secretary

May 26, 2015

The Honorable Larry C. Porter
President, County Commissioners of Caroline County
109 Market Street, Room 123
Denton MD 21629

Dear President Porter:

The Maryland Department of the Environment (MDE) has completed its review of **Resolution No. 2014-026: Prettyman Manor Mobile Home Park Sewer System (Amendment),** which amends the Caroline County 1996 Comprehensive Water and Sewerage Plan. The County Commissioners of Caroline County adopted the Amendment on November 18, 2014. The Amendment updates *Section 4.7.5 – Election District No. 4 (Preston), Table 4-3 – Inventory of Existing Community and Multi-Use Sewerage Systems*, and *Table 4-6 – Projected Sewerage Demands and Planned Capacity for Existing and Planned Community and Multi-Use Sewerage Systems* of the Plan. The Amendment facilitates the construction of the new 20,000 gpd ENR sewage system for the property to serve 79 existing units and 1 vacant lot.

During MDE's review of the Amendment, the Maryland Department of Planning (MDP) advised the Department that the Amendment is consistent with the Caroline County Comprehensive Plan (see enclosed comments). The Department's Wetlands and Waterways Program determined that the proposed outfall is within 1000 feet of tidal wetlands and within the regulated 25-foot nontidal wetland buffer (see enclosed memo). Please contact the Wetlands and Waterways Program at 410-713-3685 for more information on regulatory requirements. The Department's Wastewater Permits Program advised that the proposed discharge location of the Prettyman WWTP was incorrectly referenced as Marsh Creek; the correct proposed discharge location of the Prettyman WWTP is Little Creek.

In accordance with §9-507(a) of the Environment Article, Annotated Code of Maryland, the Department hereby approves the Amendment in part and modifies the Amendment in part. Specifically, the Department approves the changes to Table 4-5 and Table 4-6. The Department modifies the text of Section 4.7.5 to reflect the correct outfall location (see attached Amendment text, including modification, and Tables 4-5 and 4-6); and the

Department modifies the Prettyman Manor Mobile Home Park Sewer Service Area Map to reflect the consolidation of parcels into a single parcel (Parcel 264). The map also depicts the 79 existing units and 1 vacant lot to be served (see attached modified map).

The Department of Natural Resources (DNR) advised MDE that the Prettyman Manor service area is within a Rare, Threatened, and Endangered (RTE) species area. RTE areas are places where rare, threatened, or endangered native Maryland flora and fauna occur. Please be advised that special protection of these areas is necessary to ensure the persistence of these imperiled flora and fauna throughout the State. For guidance concerning the protection of RTE areas, please contact Greg Golden of DNR's Project Review Division at 410-260-8331, who will further coordinate with Lori Byrne of the Wildlife and Heritage Service at 410-260-8573.

Please also be advised that a portion of the Amendment area is located within the Chesapeake Bay Critical Area Resource Conservation Area (RCA). Any development occurring as a result of the approval of this Amendment must adhere to all Critical Area restrictions associated with the RCA. Please contact the Critical Area Commission at 410-260-3476 concerning Critical Area requirements.

This action completes MDE's review, as required by §9-507 of the Environment Article, Annotated Code of Maryland. If you need further assistance, please contact me at 410-537-3567, toll-free at 800-633-6101; or by email at virginia.kearney@maryland.gov.

Sincerely,

Virginia F. Kearney, Acting Director
Water Management Administration

Enclosures

cc: Leslie Grunden, Planner III, Caroline County Department of Planning and Codes
Greg Golden, DNR
Nick Kelly, Chesapeake Bay Critical Area Commission
Charles Boyd, Deputy Director, Planning Services, MDP
La Verne Gray, MDP

RESOLUTION #2014-026

ADOPTION OF CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN AMENDMENT

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, Tax Map 52, Parcel 264, Parcel 94 and Parcel 233 (including former Parcel 211) are owned by Franklin W. Prettyman, Sr. and Brenda L. Prettyman and collectively comprise the Prettyman Manor Mobile Home Park; and

WHEREAS, Parcel 233 contains 20 mobile home units (including 2 units located on former Parcel 211) and Parcel 264 contains 59 mobile home units and 1 mobile home site currently vacant; and

WHEREAS, Parcel 264 is the site of the Prettyman Manor Mobile Home Park shared sewage disposal system, which has a capacity of 9,300 gallons per day and serves 62 of the Park's mobile home units; and

WHEREAS, the Prettyman Manor Mobile Home Park shared sewerage disposal system is deemed by Maryland Department of the Environment to be failing; and

WHEREAS, in September 2014, the Prettymans consolidated Parcel 264, Parcel 233 (including former Parcel 211) and part of Parcel 94 to create Parcel 264, which contains 79 mobile home units and 1 mobile home unit site that constitute Prettyman Manor Mobile Home Park in order to enable Mr. Prettyman to apply for an NPDES surface water or hybrid discharge permit for a new 20,000 gallons per day, multi-use Enhanced Nutrient Removal sewerage disposal system to serve multiple users on one lot; and

WHEREAS, Mr. Prettyman intends to connect 62 existing mobile home units currently served by the existing failing sewerage system, 17 mobile home units currently served by individual septic systems, and 1 vacant mobile home site to the new system; and

WHEREAS, the Caroline County Planning Commission (the "Planning Commission") has reviewed and recommended an amendment to the Caroline County Comprehensive Water and Sewerage Plan to include appropriate text and/or map changes reflecting the inclusion of the above-referenced new multi-use sewerage disposal system in Chapter 4, Sewerage, Section 4.7.4. Election District No. 4 (Preston), the Inventory of Community Sewerage Systems (Table 4-3); and the Table of Projected Sewerage Demands and Planned Capacity for Existing and/or Planned Sewerage Systems (Table 4-6); and

WHEREAS, the Planning Commission held a duly advertised public hearing on the proposed amendment on September 29, 2014 and voted unanimously to forward the proposed amendment to the County Commissioners with a recommendation for adoption; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on October 28, 2014.

NOW THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND, that the Caroline County Comprehensive Water and Sewerage Plan is amended to include the proposed "Prettyman Manor multi-use Enhanced Nutrient Removal sewerage disposal system" in relevant Plan sections, inventories, and maps.

ADOPTED/EFFECTIVE: November 18, 2014

ATTEST:

Sara B. Visintainer, Chief of Staff

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Jefferson L. Christ, President

Larry C. Porter, Vice President

Wilbur Levengood Jr, Commissioner

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 11:10 o'clock am on 11/20 2014
and duly recorded in Liber FDM 5
Folio 371 one of the Resolution
record books for the aforesaid and
E Dale Misner. Clerk
Recording Fee 0

liber 5 page 372

4.7.5 Election District No; 4 (Preston)

In addition to the Preston community sewerage system, one additional community sewerage system serves a portion of this District's population. The Prettyman Manor Mobile Home Park (MHP) community system serves 63 mobile home sites located in the mobile home park and treats wastewater via subsurface treatment cells; an additional 17 sites are occupied by mobile home units served by on-site sewage disposal systems (septics).

Surface failures of the park's sewer system were first recorded in 2008; these were eventually controlled through site repairs and pump and haul measures. In early 2010 those repairs began to fail; the continued likelihood of the system's failure has rendered construction of a replacement system as the only viable option available to the Park's owner to prevent additional environmental degradation. In 2010, the owner proposed to replace the failing system with a new surface discharge (irrigation spray or drip) system to serve all existing mobile home units in Prettyman Manor MHP as well as an additional 15 existing units located in neighboring Marsh Creek MHP. Ultimately, the owner was unable to install the proposed new system due to financial constraints.

In late 2012, the owner requested a CWSP amendment to construct a new surface water discharge sewer system to replace the (still) failing community system serving 62 sites in the MHP, and to connect the17 units served by septics to the new system.

In December 2012, the County Administrator advised the owner of Prettyman Manor MHP that the County will not serve as a controlling authority for any shared water or sewer system. The owner was further advised that if the Maryland Department of the Environment (MDE) has no objection to the proposed system being designated as a "multi-use" system, which would operate under the controlling authority of MDE and require consolidation of all lots to be served by the system, the County would consider his request for a Water and Sewer Plan Amendment to construct a new sewer system to serve the existing 79 mobile home units plus one currently permitted but vacant mobile home site.

In 2014, the owner consolidated the lots occupied by Prettyman Manor MHP and resubmitted the request for CWSP amendment for a new multi-use sewer system to serve all existing mobile home units in the Park (79) plus one mobile home site currently vacant.

The proposed new system will have a capacity of 20,000 gpd to serve the 79 existing mobile home units in the Park and 1 additional mobile home site, currently vacant. The system will feature a membrane bioreactor (MBR) that will treat effluent to Enhanced Nutrient Removal (ENR) standards of 5 mg/l TN and .3 mg/l TP. Surface discharge will be to Marsh Creek, a tributary of the Choptank River. Pending water quality testing results, the proposed new system may utilize a hybrid surface discharge/spray or drip irrigation system to meet MDE permit limits for total nitrogen and phosphorus loads.

The decommissioning of the existing treatment system and 17 aging septic systems will result in an annual nitrogen load reduction (credit) of at least 306 lbs. Per permit requirements, any new phosphorus load will be offset via advanced treatment or the purchase of phosphorus credits.

Table 4-3 Inventory of Existing Community and Multi-Use Sewerage Systems

Sewer Service Area	Type of Treatment	NPDES Number/ Permit Flow	PLANT			Capacity (gpd)	Avg. Flow (gpd)
			DIGXCORD*	DIGYCORD*	Point of Discharge		
Election District 4 - Preston							
Prettyman Manor MHP	Subsurface treatment cells (1981), interim repairs inc. pumping chamber & shallow trenches (2009), subsurface treatment failing; pump and haul required by MDE (2014)	MD0068063 .0093	489344.9	120272.8	Marsh Creek to Choptank River	9,300	9,300

Table 4-6 Projected Sewerage Demands and Planned Capacity for Existing and Planned Community and Multi-Use Sewerage Systems

Sewer Service Area	Description	Estimated Cost	County Priority	Population Served	Capacity Demand/Planned
Election District 4 - Preston					
Prettyman Manor MHP	Expansion of existing 9,300 gpd subsurface discharge community shared system to 20,000 gpd surface water or hybrid discharge multi-use system	$400,000 - $500,000	S-3	170	20,000gpd/ 20,000 gpd

Prettyman Manor Mobile Home Park
S-3 Service Area

LEGEND

Parcel 264 S-3 Service Area

Occupied Site

Streams

Vacant Site

N

Caroline County
Department of Planning & Codes

4.7.5 Election District No; 4 (Preston)

In addition to the Preston community sewerage system, one additional community sewerage system serves a portion of this District's population. The Prettyman Manor Mobile Home Park (MHP) community system serves 63 mobile home sites located in the mobile home park and treats wastewater via subsurface treatment cells; an additional 17 sites are occupied by mobile home units served by on-site sewage disposal systems (septics).

Surface failures of the park's sewer system were first recorded in 2008; these were eventually controlled through site repairs and pump and haul measures. In early 2010 those repairs began to fail; the continued likelihood of the system's failure has rendered construction of a replacement system as the only viable option available to the Park's owner to prevent additional environmental degradation. In 2010, the owner proposed to replace the failing system with a new surface discharge (irrigation spray or drip) system to serve all existing mobile home units in Prettyman Manor MHP as well as an additional 15 existing units located in neighboring Marsh Creek MHP. Ultimately, the owner was unable to install the proposed new system due to financial constraints.

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In December 2012, the County Administrator advised the owner of Prettyman Manor MHP that the County will not serve as a controlling authority for any shared water or sewer system. The owner was further advised that if the Maryland Department of the Environment (MDE) has no objection to the proposed system being designated as a "multi-use" system, which would operate under the controlling authority of MDE and require consolidation of all lots to be served by the system, the County would consider his request for a Water and Sewer Plan Amendment to construct a new sewer system to serve the existing 79 mobile home units plus one currently permitted but vacant mobile home site.

In 2014, the owner consolidated the lots occupied by Prettyman Manor MHP and resubmitted the request for CWSP amendment for a new multi-use sewer system to serve all existing mobile home units in the Park (79) plus one mobile home site currently vacant.

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Election District 4 - Preston							
Prettyman Manor MHP	Subsurface treatment cells (1981), interim repairs inc. pumping chamber & shallow trenches (2009), subsurface treatment failing; pump and haul required by MDE (2014)	MD0068063 .0093	489344.9	120272.8	Marsh Creek to Choptank River	9,300	9,300

Table 4-6 Projected Sewerage Demands and Planned Capacity for Existing and Planned Community and Multi-Use Sewerage Systems

Sewer Service Area	Description	Estimated Cost	County Priority	Population Served	Capacity Demand/Planned
Election District 4 - Preston					
Prettyman Manor MHP	Expansion of existing 9,300 gpd subsurface discharge community shared system to 20,000 gpd surface water or hybrid discharge multi-use system	$400,000 - $500,000	S-3	170	20,000gpd/ 20,000 gpd

MDE Modification to the Prettyman Manor Mobile Home Park Sewer Service Area
Amendment Modification Effective May 26, 2015

March 17, 2015

TO: Daniel Laird

FR: Denise Clearwater

RE: Prettyman Manor Mobile Home Park

Water and Sewer Plan Amendment-Caroline County

I have coordinated review of this proposed amendment with the Tidal Wetlands Division and Nontidal Wetlands Division of the Wetlands and Waterways Program. The following are our comments:

1) The proposed outfall will require authorization from the Tidal Wetlands Division, as it is located within 1000 feet of tidal wetlands.

2) Nontidal Wetlands Division staff have determined from a field visit that the proposed outfall is within the regulated 25-foot nontidal wetland buffer. The Division has requested that the pipe to the outfall be shortened so that the outfall is located outside of the nontidal wetland buffer.

3) The Program recommends that special care be taken to ensure that the outfall is sized and designed to reduce discharges below erosive velocities.

The landowner or his agent is encouraged to contact Mr. Alan Kampmeyer at alan.kampmeyer@maryland.gov or (410) 713-3685 for nontidal wetland requirements or Ms. Mary Phipps-Dickerson at Mary.Phipps-Dickerson@maryland.gov or (410) 901-4033 for tidal wetland requirements and any questions or suggestions regarding the revised plans or permit application.

cc: Rebecca Krieg

Jonathan Stewart

Alan Kampmeyer

Mary Phipps-Dickerson

April 27, 2015

Mrs. Janice Outen
Maryland Department of the Environment
Water Management Administration
1800 Washington Boulevard
Baltimore, Maryland 21230

Subject: Caroline County – Prettyman Mobile Home Park – Resolution 2014-026

Dear Mrs. Outen:

MDP has reviewed the Caroline County WSP amendment as adopted by Resolution 2014-026, to advise the Maryland Department of the Environment (MDE) on local comprehensive plan consistency and other appropriate matters for compliance with State Law and policies and land use goal efforts.

Comprehensive Plan Consistency Comments:

MDP finds the request to serve the exiting MHP with an on-site trickling sewerage sub-surface discharge system and individual septic sytems, where numerous lots were consolidated to form one parcel that contains all the homes with an upgraded multi-use ENR on-site sewerage treatment facility, that will allow for an NPDES surface water or hybrid discharge permit, consistent with the Caroline County Comprehensive Plan environmental stewardship goals and objectives.

The amendment updates the text, map, and tables in Chapter 4, specifically Section 4.7.4, Elections District No.4 (Preston), Table 4-3, and Table 4-6.

The system will be designed to treat 20,000 gpd, serving a total of 79 existing housing units.

Previous draft amendment review documents include site plan sewer improvements and show proposed surface water discharge. There will be a total nitrogen (TN) credit achieved with this improvement; however, the MHP will have to acquire a total phosphorus (TP) credit of 30.6

pounds from an existing WWTP with TP credits, pending the amount of surface water discharge is permitted.

Planning Concerns:

Please submit to our Department all final text, maps, and tables changes that are approved by MDE for this amendment to supplement our copy of the 1992 Caroline County Water and Sewerage Plan. There were items submitted for the draft review in 2014 that were not re-submitted with this amendment review that are part of this amendment. Please submit the full file that MDE approves, as part of this amendment.

Priority Funding Area Comments:

Pursuant to Finance and Procurement Article 5-7B-02, local jurisdictions are eligible to receive State financial assistance under certain programs if the project is located within the certified Priority Funding Area (PFA).

This site is not in the County PFA. The use of State funding and BNR/ENR grants would prohibit the addition of any new units to this new system.

If you have any questions or concerns on these comments please contact John Leocha at 410 767-5497.

Regards,

Charles W. Boyd, AICP
Deputy Director
MDP, Planning Services

cc: Greg Golden, DNR
Dwight Dotterer, MDA
Jason Dubow, Director of Environmental Planning, MDP
John Leocha, Water and Sewer Regional Planner, MDP
David Dahlstrom, Upper Eastern Shore Regional Planner, MDP

Maryland
Department of
the Environment

Larry Hogan
Governor

Boyd Rutherford
Lieutenant Governor

Ben Grumbles
Secretary

JUL 28 2016

The Honorable Wilbur Levengood Jr.
President
Caroline County Commissioners
109 Market Street, Room 123
Denton, MD 21629

Dear President Porter:

The Maryland Department of the Environment (MDE) has completed its review of **Resolution No. 2016-004: Denton Annexation Deep Shore Road (Amendment)**, which amends the 1996 Caroline County Comprehensive Water and Sewerage Plan. The County Commissioners of Caroline County adopted the Amendment on May 17, 2016. The Amendment revises the water and sewer service area maps to reflect the annexation of 374 Deep Shore Road, Denton, Maryland (Tax Map 107, Parcel 130) into the Town of Denton. This annexation was adopted by the Town of Denton via Resolution No. 827 and became effective on May 23, 2016. The annexed property has been reclassified from "W-2" and "S-2" (Final Planning 0-2 years) to "W-1" and "S-1" (Existing Service).

During MDE's review of the Amendment, the Maryland Department of Planning (MDP) advised the Department that the Amendment is consistent with the Caroline County Comprehensive Plan (see enclosed comments). The Department hereby approves the **Resolution No. 2016-004: Denton Annexation Deep Shore Road** amendment to the Caroline County Comprehensive Water and Sewerage Plan.

Please be advised that an update to the 1996 Caroline County Comprehensive Water and Sewerage Plan is overdue. Also, please be advised that COMAR requires that a copy of the draft Plan be submitted to MDE prior to County adoption. This action ensures that MDE's comments can be incorporated, as appropriate, into the County's final plan.

This action completes MDE's review, as required by §9-507 of the Environment Article, Annotated Code of Maryland. If you need further assistance, please contact Virginia F. Kearney, Deputy Director, at (410) 537-3512, toll free at (800) 633-6101, or by e-mail at virginia.kearney@maryland.gov.

Sincerely,

Lynn Buhl, Director
Water Management Administration

Enclosure

cc: Leslie Grunden, Env. and Facilities Planner, Caroline Co. Dept. of Planning & Codes
Charles Boyd, Director, Planning Coordination, MDP

MARYLAND DEPARTMENT OF
PLANNING

Larry Hogan, Governor
Boyd Rutherford, Lt. Governor

David R. Craig, Secretary
Wendi W. Peters, Deputy Secretary

June 22, 2016

Ms. Janice Outen
Maryland Department of the Environment
Water Management Association
1800 Washington Boulevard
Baltimore, Maryland 21230

Re: Caroline County Water and Sewerage Plan
Town of Denton Annexation 374 Deep Shore Road (Tax Map 107, Parcel 130)

Dear Ms. Outen:

Thank you for providing the Maryland Department of Planning with a copy of the Caroline County Water and Sewerage map amendment for Tax Map 107, Parcel 130, from W-2 to W-1 and S-2 to S-1. We reviewed the document as required by the Environmental Article Section 9-506 and offer the following comments for your consideration.

Summary of Revisions

Below is a summary of the amendment to the Water and Sewerage Master Plan:

1. Changes the Caroline County Comprehensive Water and Sewerage Plan to reclassify the "Water and Sewer Area", "Sewer Service Area", and "Water Service Area Maps" for Tax Map 107, Parcel 130, for a property approximately 2.21 acres in size located at the intersection of Route 404 and Deep Shore Road. The property is placed in the W-1 and S-1 (Existing Service) categories from the W-2 and S-2 (Final Planning 0-2 years) categories. The property was annexed into the Town of Denton with a "Regional Highway Commercial" zoning, effective May 23, 2016. The property is currently served with a private well and septic system. This property has submitted a Concept Plan to the Town of Denton and is anticipated to be developed within two years.

Consistency with the Caroline County 2010 Comprehensive Plan

The revisions are consistent with the Caroline County 2010 Comprehensive Plan. The change is consistent with the County's goals to direct growth to designated municipal growth areas and provision of public services in a manner that will protect the environmental quality of the County's valuable resources.

The change also supports the County's Phase 2 Watershed Implementation Plan goals to connect properties served by conventional septic systems to ENR WWT's where possible.

Consistency with the Town of Denton 2010 Comprehensive Plan

The revisions are consistent with the Town of Denton 2010 Comprehensive Plan. The parcel is located within the Town's "Growth Area". The change is consistent with the Growth Area depicted on Map 4-3 of the Town's Municipal Growth Element.

Priority Funding Areas Review

Pursuant to the State Finance and Procurement Article, §5-7B-02, local jurisdictions are eligible to receive State financial assistance if the project is located in a Priority Funding Area (PFA). The subject parcel is not currently located within the Town or County Priority Funding Area. However, it appears that the parcel would qualify as PFA, based upon its current zoning of Regional Highway Commercial (HRC), its location within the Town's Growth Area, and Sewer Service Area. Staff has provided technical assistance to the Town on the requirements for submitting a PFA designation request. A PFA designation request from the Town is anticipated.

Growth Tier Map Review

The Town has designated the parcel as Tier II (Municipal Growth Area).

If you have any questions concerning these comments, please call David Dahlstrom at 410-819-4084 or John Leocha at 410-767-5497.

Sincerely,

Charles W. Boyd, AICP
Director of Planning Coordination

cc: Greg Golden, DNR
Dwight Dotterer, MDA
Dan Laird, MDE
Jason Dubow, MDP
John Leocha, MDP
Peter Conrad, MDP
David Dahlstrom, MDP

RESOLUTION #2016-004

AMENDMENT OF THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN & MAPS, DENTON ANNEXATION DEEP SHORE ROAD

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan; and

WHEREAS, the Town of Denton is in the process of annexing Parcel 130, Tax Map 107, located at 374 Deep Shore Road, Denton, Maryland, 21629 (the "Property"), through the adoption of a Town Resolution to be effective on May 23, 2016; and

WHEREAS, the owner of the Property has requested Caroline County, Maryland (the "County") amend the Caroline County Comprehensive Water and Sewerage Plan ("CWSP") to re-classify and remap the Property from the current classifications of "W-2" and "S-2" (Final Planning 0-2 years) to "W-l" and "S-1" (Existing Service); and

WHEREAS, the Town of Denton has processed the owner's request to authorize the extension of water and sewer service to the Properties in accordance with the Implementing Policies of the CWSP; and

WHEREAS, in accordance with State and local law requirements, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Comprehensive Plan, and the Planning Commission has provided a positive recommendation; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on May 3, 2016.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, that the Caroline County Comprehensive Water and Sewerage Plan is hereby amended as follows:

DENTON WATER AND SEWER SERVICE AREA MAPS: The Caroline County Comprehensive Water and Sewerage Plan (the "Plan") is amended to reclassify and remap Parcel 130, Tax Map 107, located at 374 Deep Shore Road, Denton, Maryland from the current classifications of "W-2" and "S-2" to "W-l" and "S-l" in the Water and Sewer Service Area Maps of the Water and Sewer Chapters of the Third Election District, Caroline County, Maryland.

BE IT FURTHER RESOLVED THAT, this Resolution shall become effective, if at all, upon the effective date of Denton Town Council Resolution No. 827, which shall be the later of: (i) May

liber 5 page 486

23, 2016, or (ii) if Resolution No. 827 is petitioned to referendum, the date that all applicable referenda are resolved in support of the annexation.

ADOPTED: May 17, 2016

ATTEST:

Jennifer M. Farina
Administrative Coordinator

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Wilbur Levengood Jr., President

Daniel J. Franklin, Vice President

Larry C. Porter, Commissioner

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 9:45 o'clock am on 5/18 2016
and duly recorded in Liber FDM 5
Folio 486 one of the Rcod.
record books for the aforesaid and
J Dale Minner. Clerk
Recording Fee

liber 5 page 487

Denton, Maryland
Water and Sewer Service Areas

Legend

- Municipal Boundary
- S1/W1 Service Area
- S2/W2 Service Area
- CAROLINE_S3_Service_Area
- CAROLINE_S4_Service_Area
- CAROLINE_S5_Service_Area

0 0.25 0.5 Miles

N

Data Sources:
Caroline County Planning and Codes Department
Eastern Shore Regional GIS Cooperative
Maryland Department of Planning
Maryland Department of Natural Resources

Caroline County Planning and Codes
403 South 7th Street, Suite 210
Denton, Maryland 21629
410-479-8100
410-479-4187 (fax)
www.carolineplancode.org

2016

Maryland
Department of
the Environment

Larry Hogan
Governor

Boyd Rutherford
Lieutenant Governor

Ben Grumbles
Secretary

JUN 2 2 2017

The Honorable Daniel J. Franklin
President
Caroline County Commissioners
109 Market Street, Room 123
Denton, MD 21629

Dear President Franklin:

The Maryland Department of the Environment (MDP) has completed its review of **Resolution 2017-004: Preston Wastewater Treatment Plant ENR Upgrade (Amendment)**, which amends the 1996 Caroline County Comprehensive Water and Sewerage Plan. The Caroline County Commissioners adopted the Amendment on March 14, 2017. The Amendment revises *§4.7.5 Election District No. 4 (Preston)*, *Table 4-3: Inventory of Existing Community and Multi-use Sewerage Systems*, and *Table 4-7: Immediate, Five- and Ten-Year Priorities for Sewer Development* to include the Preston Wastewater Treatment Plant ENR upgrade. Subsequent to the initial submission, Caroline County submitted a revised map showing the Town of Preston Sewer Service Areas.

During MDE's review of the Amendment, the Maryland Department of Planning (MDP) advised the Department that the Amendment is consistent with the 2005 Preston Comprehensive Plan and 2012 Municipal Growth Element (see enclosed comments). The Department hereby approves in part and modifies in part the **Resolution 2017-004: Preston Wastewater Treatment Plant ENR Upgrade Amendment** to the 1996 Caroline County Comprehensive Water and Sewerage Plan. Specifically, the Department modifies the Amendment to include the updated Town of Preston Sewer Service Areas map (see enclosed modification).

The Department notes that some of the Preston Sewer Service Areas are located within the Marsh Creek 1 watershed, identified as a Tier II stream pursuant to COMAR 26.08.02.04-1. Tier II streams are high quality waters that must be given extra consideration to protect their quality. Any new or expanded discharge to these Tier II watersheds would require an Anti-degradation Review. All possible considerations should be implemented to protect high quality waters from any necessary development. This primarily consists of rigorous watershed planning, with consideration of the extra provisions necessary to protect high quality waters.

The Department recommends that the County consider the following measures in an effort to maintain these high quality waters when approving new growth in the watersheds of these stream segments: 1) implement restrictive zoning or ordinances to protect

environmental features; 2) re-direct planned growth out of the watersheds of these stream segments; 3) retrofit existing infrastructure; 4) incorporate environmental site design (ESD) and other low-impact development (LID) practices into new development; 5) maintain and expand existing forest cover; and 6) provide riparian buffers of 100-230 feet (depending upon soil types and slopes). The County should be aware that future plans facilitated by this Amendment may incur an additional Anti-degradation Review at later stages, on a project-by-project basis. The County is advised to contact Matt Rowe, Acting Director of MDE's Science Services Administration, at (410) 537-3578 for additional information about regulatory requirements for Tier II waters.

Please be advised that an update to the 1996 Caroline County Comprehensive Water and Sewerage Plan is overdue. Also, please be advised that COMAR requires that a copy of the draft Plan be submitted to MDE prior to County adoption. This action ensures that MDE's comments can be incorporated, as appropriate, into the County's final plan.

This action completes MDE's review, as required by §9-507 of the Environment Article, Annotated Code of Maryland. If you need further assistance, please contact Virginia F. Kearney, Deputy Director, at (410) 537-3512, toll free at (800) 633-6101, or by e-mail at virginia.kearney@maryland.gov.

Sincerely,

Virginia F Kearney/jm

D. Lee Currey, Acting Director
Water Management Administration

Enclosures

cc: Leslie Grunden, Env. and Facilities Planner, Caroline Co. Dept. of Planning & Codes
Charles Boyd, Director, Planning Coordination, MDP
Matthew Rowe, Acting Director, SSA, MDE
Virginia F. Kearney, Deputy Director, WMA, MDE

RESOLUTION #2017-004
AMENDMENT OF THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN
TOWN OF PRESTON WASTEWATER TREATMENT PLANT UPGRADE TO ENHANCED NUTRIENT REMOVAL TECHNOLOGY

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan;

WHEREAS, The Caroline County Water and Sewerage Plan established goals to insure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards and that water and sewerage planning be coordinated with efforts to minimize water pollution;

WHEREAS, Caroline County has established water quality improvement goals in the County's 2010 Comprehensive Plan, 2012 Upper Choptank River (319)(h) Watershed Plan, and other major policy documents;

WHEREAS, the Town of Preston proposes to upgrade the Town's wastewater treatment plant (WWTP) with Enhanced Nutrient Removal (ENR) technology;

WHEREAS, the proposed ENR treatment upgrade is consistent with the Caroline County Comprehensive Water and Sewerage Plan and will significantly improve water quality in the Choptank River;

WHEREAS, in accordance with the requirements of Environment Article § 9-506(a)(l), Md. Ann. Code, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Comprehensive Plan; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on February 21, 2017.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND that the Caroline County Comprehensive Water and Sewerage Plan shall be and is hereby amended as follows:

Section 1. Chapter 4.7.5. Election District No. 4 (Preston) is amended as follows:

~~In the Preston Election District approximately 76% of the population (1990 population – 3,476) is serviced by individual sewage disposal systems. The remainder of the population is served by the Town of Preston. The Preston Sewage Treatment Plan was upgraded and expanded in 1988.~~

~~The areas of Jonestown, Bethlehem and Tanyard have been identified as having failing septic systems. As part of the Preston 201 Facilities Plan, a separate innovative central sewerage system was proposed for Jonestown. However because the system was not supported by the majority of~~

liber 5 page 517

~~residents and there was no compelling public health justification for a central system, the County has decided not to proceed with the project. (see Exhibits 4-H & 4-I)~~

~~It has also been determined that there is no economically feasible central sewerage system which could be provided to the Bethlehem-Tanyard area. Problems with failing septic systems will be corrected on an individual basis (see Exhibits 4-H & 4-I)~~

~~No new central sewerage systems are planned, unless one or more of the mobile home parks in this district decide to expand.~~

ABOUT 82 PERCENT OF THIS ELECTION DISTRICT (2010 POPULATION 4,044) IS SERVED BY INDIVIDUAL ON-SITE SEWAGE DISPOSAL SYSTEMS. THE REMAINDER OF THE DISTRICT IS SERVED BY THE TOWN OF PRESTON'S (2010 POPULATION 719) WASTEWATER TREATMENT SYSTEM AND ONE PRIVATE, MULTI-USE COMMUNITY WASTEWATER TREATMENT SYSTEM.

THE PRESTON WASTEWATER TREATMENT PLANT (WWTP) IS A LAGOON TREATMENT FACILITY ORIGINALLY CONSTRUCTED IN THE 1960'S. THE PLANT DISCHARGES INTO THE CHOPTANK RIVER VIA HUNTING CREEK. THE PLANT HAS A PERMITTED FLOW (NPDES PERMIT MD0020621) OF 115,000 GALLONS PER DAY (GPD). AVERAGE DAILY FLOWS BETWEEN JANUARY 2013 AND AUGUST 2015 WERE 86,000 GPD. THE LAST IMPROVEMENTS TO THE FACILITY WERE MADE IN 2003 WHEN THE STABILIZATION LAGOON WAS UPGRADED AND EXPANDED. ASSUMING THE GROWTH RATES AS STATED IN THE 2012 MUNICIPAL GROWTH ELEMENT OF THE TOWN'S COMPREHENSIVE PLAN, THE EXISTING PERMITTED FLOW OF 115,000 GPD IS ADEQUATE TO SERVE THE NEEDS OF PRESTON FOR APPROXIMATELY 20 YEARS.

ALTHOUGH CAPACITY IS ADEQUATE, THE PLANT'S AGING TREATMENT SYSTEM HAS EXPERIENCED MULTIPLE PROBLEMS THAT INDICATE A TREATMENT UPGRADE IS NECESSARY FOR THE PLANT TO CONTINUE OPERATING WITHIN ITS PERMITTED DISCHARGE LIMITS. BETWEEN NOVEMBER 2007 AND SEPTEMBER 2014, THE TOWN HAD SEVERAL VIOLATIONS OF ITS DISCHARGE PERMIT, INCLUDING VIOLATIONS OF ITS E. COLI LIMIT, RESIDUAL CHLORINE LIMITS AND VIOLATIONS RELATED TO STANDARDS FOR BIOCHEMICAL OXYGEN DEMAND. THE TOWN AND MDE ENTERED INTO A CONSENT ORDER WHICH REQUIRED THE TOWN TO BEGIN PLANS FOR STRUCTURAL IMPROVEMENTS TO THE PLANT. THE TOWN COMMISSIONED A PRELIMINARY ENGINEERING REPORT (PER) TO IDENTIFY RECOMMENDED ALTERNATIVES TO ADDRESS THE CONSENT ORDER AND FEASIBLE TREATMENT UPGRADES. THE PER EVALUATED SIX TECHNICALLY FEASIBLE ALTERNATIVES FOR UPGRADES AND INCLUDED ESTIMATED CAPITAL COSTS, ANNUAL OPERATION AND MAINTENANCE (O&M) COSTS, AND LIFE CYCLE PRESENT WORTH COSTS FOR EACH ALTERNATIVE.

BASED ON THE RESULTS OF THE PER, A PROGRAMMED LAGOON AERATION SYSTEM WITH CLARIFIERS FOR BNR TREATMENT WITH DENITRIFICATION FILTERS FOR ENR EFFLUENT WAS THE SELECTED ALTERNATIVE. THE NEW

PLANT, WHICH WILL BE PERMITTED FOR 115,000 GPD, WILL BE CONSTRUCTED ON THE SAME SITE AS THE EXISTING PLANT AND WILL UTILIZE THE SAME STREAM DISCHARGE LOCATION AS THE EXISTING PLANT

THE TOWN COMMISSIONERS APPROVED THE RECOMMENDATION FROM THE PER IN MID-2016 AND ARE CURRENTLY FINALIZING TERMS OF A GRANT-LOAN FUNDING PACKAGE FROM MDE, WHICH INCLUDES A BAY RESTORATION FUND GRANT AND LOAN/LOAN FORGIVENESS FINANCING. THE DESIGN PHASE OF THE UPGRADE IS ANTICIPATED TO BE COMPLETE IN 2017, FOLLOWED BY A CONSTRUCTION PHASE OF 1-2 YEARS.

Section 2. Table 4-3. Inventory of Existing Community and Multi-Use Sewerage Systems is amended as follows:

Table 3 Inventory of Existing Community and Multi-Use Sewerage Systems

Sewer Service Area	Type of Treatment	NPDES Number/ Permit Flow	PLANT			Capacity (gpd)	Avg. Flow (gpd)
			DIGX CORD*	DIGY CORD*	Point of Discharge		
Election District 4 - Preston							
a. Preston	**Stabilization lagoons (1965), chlorination (1974), stabilization lagoon (1985), lagoon upgrade & expansion (1988 & 2003)**	**MD0020621 .115 mgd**	**495412.3**	**115747.7**	**Hunting Creek to Choptank River**	**115,000**	**86,000**
b. Prettyman Manor MHP	Subsurface treatment cells (1981), interim repairs inc. pumping chamber & shallow trenches (2009), subsurface treatment failing; pump and haul required by MDE (2014) New surface discharge with ENR treatment system (2016)	MD0068063 .0093	489344.9	120272.8	Marsh Creek to Choptank River	9,300	9,300

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Section 3. Table 4-7, Immediate, 5, and 10 Year Priorities for Sewerage Development is amended as follows:

Table 7 Immediate, Five- and Ten-Year Priorities for Sewer Development			
Sewer Service Area	**Description**	**Estimated Cost**	**County Priority**
Election District 4			
a. Preston	**Design/construction of ENR treatment upgrade to existing plant**	**Approx. $5.6M**	**S-2**
b. Prettyman Manor MHP	Capacity expansion from 9,300 gpd to 23,750 gpd and ENR treatment upgrade	Approx. $600,000	S-1

Section 4. Matter deleted is shown by ~~strikethrough~~. Matter added is shown in **BOLD CAPITALIZATION.**

BE IT FURTHER RESOLVED, that this Resolution shall take effect immediately upon the date of its passage.

ADOPTED/EFFECTIVE:

ATTEST:

Jennifer M. Farina
Administrative Coordinator

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Daniel J. Franklin, President

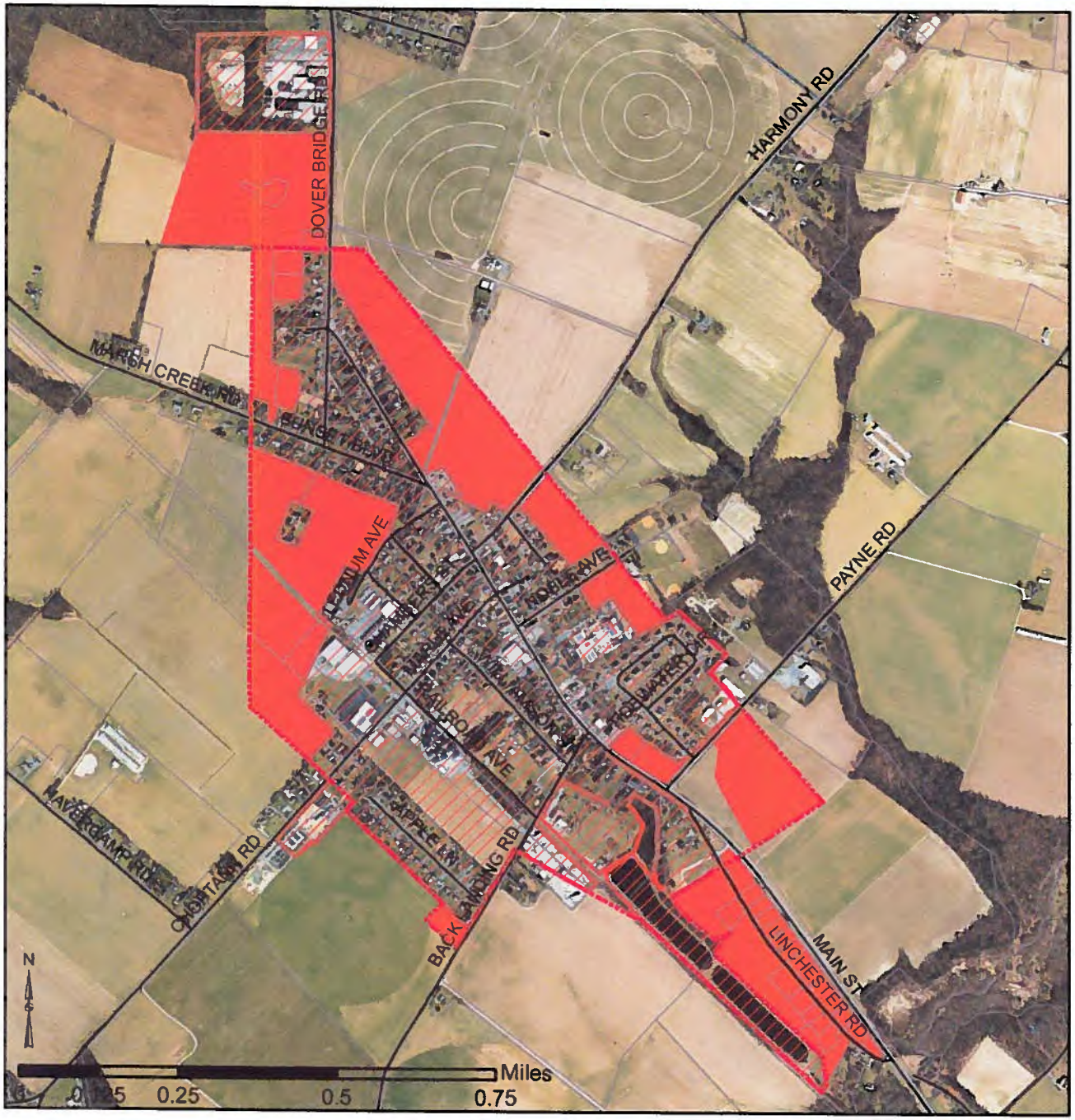
Larry C. Porter, Vice President

Wilbur Levengood, Jr., Commissioner

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
at 2:30 o'clock pm on 3/14 2017
and duly recorded in Liber FDM 5
Folio 517 one of the Resolution
record books for the aforesaid and
Gale Mitchell, Clerk
Recording Fee

liber 5 page 520

MDE Modification - Town of Preston Sewer Service Areas
Modification effective June 22, 2017



Town of Preston Sewer Service Areas

Legend

- Caroline_Municipal_Boundary
- S1 Service Area
- S5 Service Area

Caroline County
Comprehensive Water & Sewerage Plan

Caroline County Department of Planning & Codes
403 S. Seventh Street, Suite 210
Denton MD 21629

MAY 2017

May 1, 2017

Ms. Janice Outen
Maryland Department of the Environment
Water Management Association
1800 Washington Boulevard
Baltimore, Maryland 21230

Re: Caroline County – Preston WWTP ENR Upgrade & WSP Amendment

Dear Ms. Outen:

Thank you for providing the Maryland Department of Planning with a copy of the adopted Caroline County Water and Sewerage Master Plan amendment for the Preston WWTP ENR upgrade. We reviewed these changes in draft form, and again now, as required by the Environmental Article Section 9-507(b)(2) and find the changes to be consistent with the 2005 Preston Comprehensive Plan and the 2012 Municipal Growth Element. Below is a summary of the Water and Sewer Plan changes and our comments to consistency, Priority Funding Area findings, and Growth Tier observations for your use in the approval process.

Summary of Revisions

1. Updates Section 4.7.5 Election District No. 4 (Preston), Table 3 – Inventory of Existing Community and Multi-Use Systems.
2. Updates Section 4.7.5 Election District No. 4 (Preston), Table 7 – Immediate, Five- and Ten-Year Priorities for Sewer Development.

Consistency with the Comprehensive Plan

The revisions are consistent with the 2005 Preston Comprehensive Plan and the 2012 Municipal Growth Element. The amendments ensure that new development is served by a new treatment plant, will reduce residential sprawl on septic tanks, and minimize water pollution.

Priority Funding Areas Review

Pursuant to State Finance and Procurement Article §5-7B-02, local jurisdictions are eligible to receive State financial assistance if the project is located in a Priority Funding Area.

The entire Town is within the PFA, except for five residential lots (R-1) and the Town's existing sewage lagoons (R-2). The existing zoning for these areas meet the minimum density requirements

for PFA, are designated as S-1, and are otherwise eligible for PFA designation. Planning will work with the Town to address PFA designation.

Growth Tier Map Review

The entire Sewer Service Area is located with the Tier I and Tier II categories on the adopted Caroline County Tier Map. Therefore, no growth tier map amendments are needed.

Other Comments

Planning has noted that the Sewer Service Area map included in the amendment package should be adjusted either by the County or modified by MDE to ensure that the S-1 and S-5 map layers match up to the parcel boundaries. In some instances, it appears that portions of parcels may not be included within the established service area.

If you have any questions concerning these comments, please call David Dahlstrom at 410-819-4084 or John Leocha at 410-767-5497.

Sincerely,

Charles W. Boyd, AICP
Director, Planning Coordination

cc: Tony Redman, DNR
Dwight Dotterer, MDA
Jason Dubow, MDP
John Leocha, MDP
David Dahlstrom, MDP

RESOLUTION #2018-014

AMENDMENT OF THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN & MAPS, FEDERALSBURG WATER LINE REPLACEMENT

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan (the "Water and Sewerage Plan"); and

WHEREAS, the Town of Federalsburg (the "Town") proposes to replace aging municipal water infrastructure in an area served by the Federalsburg municipal water system, consisting of the replacement of 2,700 feet of six-inch pipe along Old Denton Road, from Laurel Grove Road north to an existing fire hydrant, 48 new one-inch connections to existing homes, one two-inch connection, four hydrants and valves, and two six-inch valves (the "Project");

WHEREAS, the Town is seeking funding from State and federal sources to support the Project cost and those funders require the Project be included in the Water and Sewerage Plan; and

WHEREAS, the Project supports the goals of the Water and Sewerage Plan to "protect the general health, safety and welfare of the people of Caroline County through the provision of adequate water and sewerage facilities," and to "ensure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards."

WHEREAS, in accordance with State and local law requirements, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Comprehensive Plan, and the Planning Commission has provided a positive recommendation; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on May 22, 2018.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, that the Caroline County Comprehensive Water and Sewerage Plan is hereby amended as follows:

Section 1. The Plan's Water Chapter inventory is updated to include the Project as indicated in the following table:

notes) constitute "obligations" and "reimbursement bonds", as applicable, within the meaning of the Reimbursement Regulations.

6. The Board of County Commissioners of Caroline County (the "County Commissioners") desires to adopt this Resolution for the purpose of evidencing the clear and official intent of the County to reimburse from reimbursement bond proceeds original expenditures made in connection with Costs of the Project.

BE IT RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND THAT:

Section 1. (a) The Recitals to this Resolution are deemed a substantive part of this Resolution and are incorporated by reference herein, and capitalized terms used in the Sections of this Resolution and not otherwise defined herein shall have the meanings given to such terms in the Recitals.

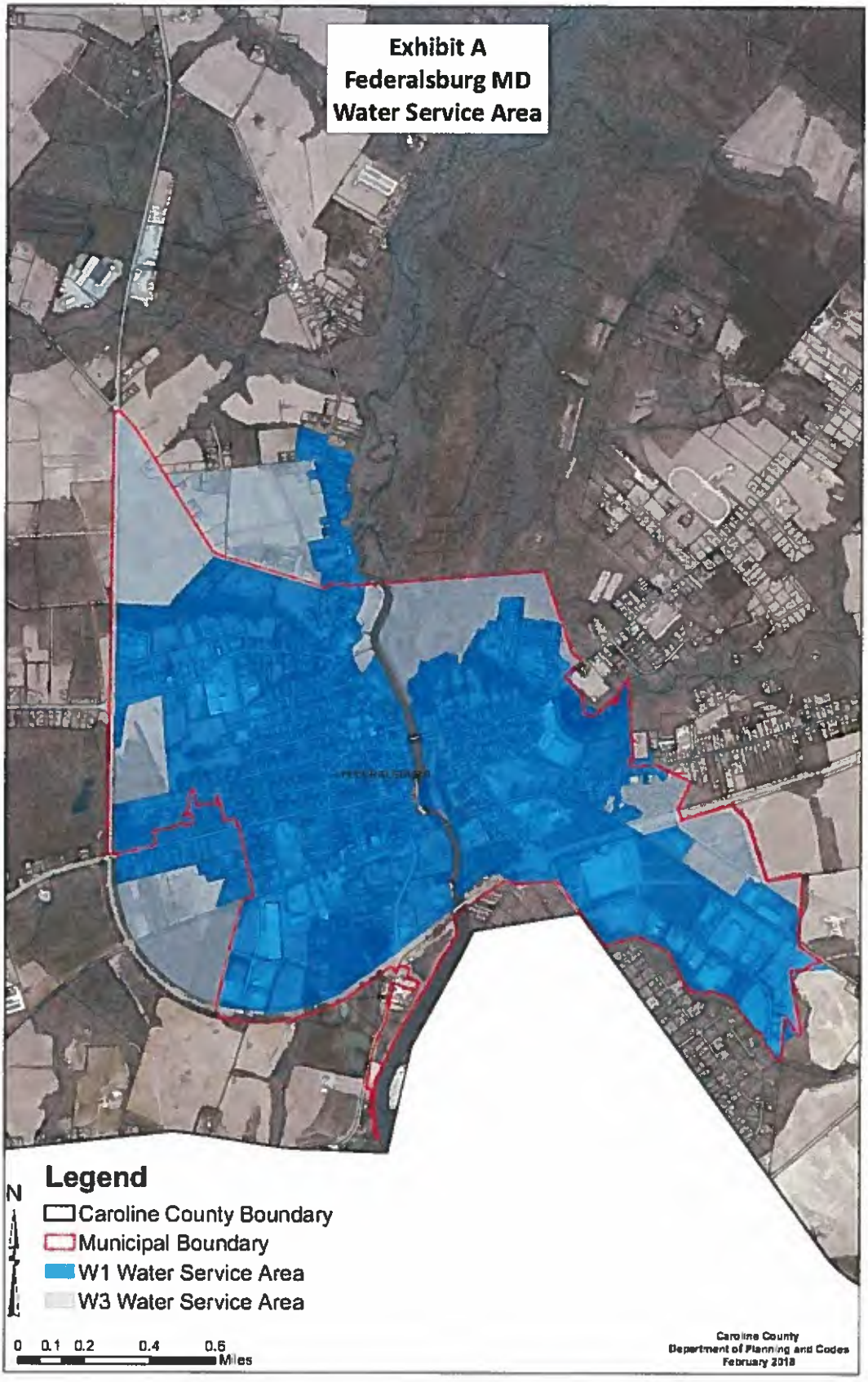
(b) References in this Resolution to the Project shall be deemed to include any changes in the scope of Project activities made by the County in accordance with applicable budgetary procedures or other applicable law. References in this Resolution to Costs of the Project shall be deemed to be to expenditures that constitute capital expenditures and costs of issuance of any borrowing relating to the Project as well as capitalized interest, to the extent applicable, as contemplated by the Reimbursement Regulations.

Section 2. In accordance with the Reimbursement Regulations, the County hereby makes this declaration of official intent in order to evidence its reasonable expectation to make original expenditures with respect to Costs of the Project prior to the issuance of the Obligations (or of any interim financing incurred in anticipation of the Obligations) and to utilize the proceeds of the Obligations (or of such interim financing) to reimburse all or a portion of such original expenditures. This Resolution is intended to be a declaration of official intent within the meaning of the Reimbursement Regulations. Proceeds of the Obligations (or of any interim financing incurred in anticipation of the Obligations) may be spent to reimburse any of the activities that comprise the definition of Costs of the Project set forth in the Recitals to this Resolution.

Section 3. The maximum original aggregate principal amount of the Obligations expected to be issued to finance, reimburse or refinance Costs of the Project (and the maximum original aggregate principal amount of any interim financing to be incurred by the County in anticipation of the Obligations) is reasonably expected not to exceed Four Million Five Hundred Dollars ($4,500,000.00) each.

[CONTINUED ON FOLLOWING PAGE]

Resolution #2018-014 – Exhibit A



liber 6 page 91

Immediate, Five- and Ten-Year Priorities for Water Development				
Sewer Service Area	**Description**	**Funder/Cost**	**Priority**	**Projected Schedule**
Election District 5 - Federalsburg				
a. Federalsburg	**Replacement of 2,700' of 6" pipe along Old Denton Rd from Laurel Grove Rd north to an existing fire hydrant inc. 48 new 1" connections to existing houses, one 2" connection, four hydrants and valves, and two 6" valves**	**The Town is seeking funding from State and federal sources to support the project cost of $400,000.00**	**Immediate**	**2018-2019**
	Design and construction of new, separate sewer lines and storm drains to replace the existing, combined sewer lines in Town.	USDA, MDE, CDBG	Immediate	2011 - 2014
	Nuttles Wastewater Pump Station Project	USDA, MDE, CDBG	Immediate	2013
Source: Town of Federalsburg, 2017, Maryland Department of Environment, Town of Federalsburg, 2012; Federalsburg Comprehensive Plan, 2007 and 2009.				

Section 2. The Federalsburg Water and Sewer Service Area Map is updated and corrected to include unincorporated area parcels located to the north of the Town that are currently served by the Town's Water System and have been for more than 20 years, as shown in Exhibit A.

ADOPTED/EFFECTIVE: June 12, 2018

ATTEST:

Jennifer Farina, Administrative Coordinator

(SEAL)

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 1:10 o'clock pm on 6/13 2018
and duly recorded in Liber FDM 6
Folio 89 one of the Resolution
record books for the aforesaid and
/s/ Dale Minner, Cl
Recording Fee 0

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Larry C. Porter, President

Wilbur Levengood Jr., Vice President

Daniel J. Franklin, Commissioner

liber 6 page 90

RESOLUTION #2018-021

AMENDMENT OF THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN, CAROLINE COUNTY DETENTION CENTER PUMP STATION UPGRADE

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan (the "Water and Sewerage Plan"); and

WHEREAS, the Caroline County Detention Center's (the "Detention Center") wastewater system design is located within the flood plain and is also antiquated. This results in the impellers becoming jammed on a repeated basis, causing the system to stop functioning, and the existing, aging alarm system is inadequate to signal failures in a timely manner, which adds a potential risk of health and environmental hazards; and

WHEREAS, the County has made improvements to the system of the years, including pump replacements, however a major upgrade (the "Project") is now necessary; and

WHEREAS, the Project will retrofit and upgrade the Detention Center's wastewater treatment system to modern standards and provide redundant protections to avoid the discharge of contaminants and/or nutrients that pose health or environmental threats, through a scope of work that includes engineering, design, and construction, including the addition of an in-line sewage communicator to macerate all atypical items deposited in the system to allow the pumps with in the Pump Station to function normally. The existing wet well will also be raised so that it is outside the flood plain and the current system of float controls will be replaced with a submersible transducer system, and the control system fully automated; and

WHEREAS, the Maryland Department of the Environment and the United States Department of Agriculture-Rural Development, which are providing funding for the Project, require that the Project be included in the Water and Sewerage Plan and be consistent with the Plan's goals and objectives; and

WHEREAS, the Project supports the goals of the Water and Sewerage Plan to "protect the general health, safety and welfare of the people of Caroline County through the provision of adequate water and sewerage facilities," and to "ensure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards;" and

WHEREAS, in accordance with State and local law requirements, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Comprehensive Plan, and the Planning Commission has provided a positive recommendation; and

liber 6 page 104

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on August 14, 2018.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, that the Caroline County Comprehensive Water and Sewerage Plan's Sewer Chapter is hereby amended to include the Project as indicated in the following table:

Immediate, Five- and Ten-Year Sewer System Priorities				
Sewer Service Area	**Description**	**Funder/Cost**	**Priority**	**Projected Schedule**
Election District 3 - Denton				
a. Caroline County Detention Center Pump Station	Upgrade the Detention Center pump station with new pumps, rails, piping, valves, and the addition of an in-line sewage comminutor to macerate all atypical items deposited in the system. Raise existing wetwell out of the floodplain. Replace float with submersible transducer system and fully automated control system.	The County is seeking funding from State sources to support the project cost of $245,000.00	Immediate	2018-2019
Source: Caroline County, Maryland, 2017.				

ADOPTED/EFFECTIVE: August 28, 2018

ATTEST:

Jennifer M. Farina

Jennifer Farina, Administrative Coordinator

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Larry C. Porter, President

Wilbur Levengood Jr., Vice President

Daniel J. Franklin, Commissioner

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 4:00 o'clock pm on 8/29 2018
and duly recorded in Liber FDM 6
Folio 104 one of the Resolution
record books for the aforesaid and
Dale Meiner, Clerk
Recording Fee 0

Liber 6 page 105

RESOLUTION #2019-020

AMENDMENT TO THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN & TABLES, PRESTON INFLOW AND INFILTRATION STUDY

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan (the "Water and Sewerage Plan"); and

WHEREAS, the Town of Preston ("Town") wastewater system has experienced a long-standing problem with inflow and infiltration ("I&I") of stormwater in the pipes that collect and convey wastewater to the treatment plant and the Maryland Department of Environment has recommended the Town initiate an I&I study (the "Project") as a first step towards resolving the problem;

WHEREAS, the Town is seeking funding from State and federal sources to support the Project cost and those funders require the Project be included in the Water and Sewerage Plan; and

WHEREAS, the Project supports the goals of the Water and Sewerage Plan to "protect the general health, safety and welfare of the people of Caroline County through the provision of adequate water and sewerage facilities," and to "ensure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards;" and

WHEREAS, in accordance with State and local law requirements, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Comprehensive Plan, and the Planning Commission has provided a positive recommendation; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on July 23, 2019.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, that the Caroline County Comprehensive Water and Sewerage Plan is hereby amended as follows:

Section 1. Sewer Chapter, Election District #4:

4.7.5 Election District No. 4 (Preston)

About 82 percent of this Election District (2010 population 4,044) is served by individual on-site sewage disposal systems. The remainder of the District is served by the Town of Preston's (2017 population 719) wastewater treatment system and one private multi-use community wastewater treatment system.

Liber 6 page 267

The Preston Wastewater Treatment Plant (WWTP) is a lagoon treatment facility originally constructed in the 1960's. The plant discharges into the Choptank River via Hunting Creek. The plant has a permitted flow (NPDES Permit MD0020621) of 115,000 gallons per day (gpd). ~~Average daily flows between January 2013 and August 2015 were~~ **IN EARLY 2019 THE PLANT'S 3-YEAR AVERAGE DAILY FLOW WAS** 86,000 gpd. The last improvements to the facility were made in 2003 when the stabilization lagoon was upgraded and expanded. Assuming the growth rates as stated in the 2012 Municipal Growth Element of the Town's Comprehensive Plan, the existing permitted flow of 115,000 gpd is adequate to serve the needs of Preston for approximately 20 years.

Although capacity is adequate, the plant's aging treatment system has experienced multiple problems that indicate a treatment upgrade is necessary for the plant to continue operating within its permitted discharge limits. Between November 2007 and September 2014, the town had several violations of its discharge permit, including violations of its e. Coli limit, residual chlorine limits and violations related to standards for biochemical oxygen demand. The Town and MDE entered into a Consent Order which required the Town to begin plans for structural improvements to the plant. The Town commissioned a Preliminary Engineering Report (PER) to identify recommended alternatives to address the consent order and feasible treatment upgrades. The PER evaluated six technically feasible alternatives for upgrades and included estimated capital costs, annual operation and maintenance (O&M) costs, and life cycle present worth costs for each alternative.

between November 2007 and September 2014, the Town had several violations of its discharge permit, including violations of its E. coli limit, residual chlorine limits and violations related to standards for biochemical oxygen demand. The Town and MDE entered into a Consent Order which required the Town to begin plans for structural improvements to the plant. In 2016 the Town commissioned a Preliminary Engineering Report (PER) to identify recommended alternatives to address the Consent Order and feasible treatment upgrades. The PER evaluated six technically feasible alternatives for upgrades and included estimated capital costs, annual operation and maintenance (O&M) costs, and life cycle present worth costs for each alternative.

Based on the recommendations of the PER, a programmed lagoon aeration system with clarifiers for BNR treatment with denitrification filters for ENR effluent was the selected alternative. The new ~~plant~~ **SYSTEM**, which will be permitted for 115,000 gpd, will be constructed on the same site as the existing plant and will utilize the same stream discharge location as the existing plant. **CONSTRUCTION OF THE NEW TREATMENT SYSTEM BEGAN IN 2019 AND IS SCHEDULED TO BE COMPLETED IN 2020.**

The Town Commissioners approved the PER recommendation in mid-2016 ~~and are currently finalizing terms of a grant loan funding package from MDE, which includes a Bay Restoration Fund grant and loan/loan forgiveness financing. The design phase of the upgrade is anticipated to be complete in 2017, followed by a construction phase of~~

~~1-2 years~~. **CONSTRUCTION OF THE UPGRADES ARE UNDERWAY (2019) AND ARE SCHEDULED TO BE COMPLETE BY MID-2020. THE PROJECT IS BEING FUNDED THROUGH THE MARYLAND DEPARTMENT OF ENVIRONMENT BAY RESTORATION FUND AND THE STATE WATER QUALITY REVOLVING LOAN FUND.**

THE PROPOSED UPGRADE IS TO THE PLANT'S TREATMENT TECHNOLOGY ONLY; THE PLANT CAPACITY WILL REMAIN 115,000 GPD. THE UPGRADE TO ENR TREATMENT ALLOWS PRESTON TO TAKE ADVANTAGE OF GRANT FUNDING FROM MDE'S BAY RESTORATION FUND AS WELL AS THE STATE WATER QUALITY REVOLVING LOAN FUND.

IN 2019, THE TOWN IDENTIFIED THE STUDY AND CORRECTION OF STORM WATER INFLOW AND INFILTRATION (I&I) IN THE SEWER COLLECTION/CONVEYANCE SYSTEM AS ITS NEXT SEWER PRIORITY. THE TOWN WILL SEEK STATE FUNDING ASSISTANCE TO UNDERTAKE A STUDY TO IDENTIFY I&I LOCATIONS AND MAKE RECOMMENDATIONS FOR CORRECTION OF THE PROBLEM. FOLLOWING COMPLETION OF THE STUDY THE TOWN WILL SEEK FUNDING ASSISTANCE TO IMPLEMENT STUDY RECOMMENDATIONS. IT IS ANTICIPATED THAT CORRECTION OF THE I&I PROBLEM WILL IMPROVE WWTP EFFICIENCY, REDUCE MAINTENANCE NEEDS AND ENSURE SUFFICIENT FLOW CAPACITY TO SERVE THE TOWN'S FUTURE INFILL AND GROWTH AREA DEVELOPMENT NEEDS.

Section 2. The Sewer Chapter's sewer development priorities inventory is updated to include the Project as indicated in the following table:

Immediate, Five- and Ten-Year Priorities for Sewer Development			
Sewer Service Area	**Description**	**Funder/Cost**	**Priority**
Election District 4 - Preston			
a. Preston	Design/construction of ENR treatment upgrade to existing plant	~~APPROX. $5.6M~~ **TOTAL $11,076,345.50** **MDE GRANT (BRF) $8,816,606.00** **MDE SRF $2,259,739.30** **(50/50 LOAN FORGIVENESS)** **TOWN SHARE $1,129,869.65**	~~S-2~~ **S-1**
	PRELIMINARY ENGINEERING REPORT OF INFLOW AND INFILTRATION IN WASTEWATER SYSTEM	**THE TOWN IS SEEKING FUNDING FROM STATE AND FEDERAL SOURCES TO SUPPORT THE PROJECT COST, ESTIMATED TO BE UNDER $100,000.**	**S-3**
Source: Town of Preston, 2019.			

Section 3. Matter deleted is shown by ~~strikethrough~~. Matter added is shown by **BOLD CAPITALIZATION**.

ADOPTED/EFFECTIVE: August 27, 2019
EFFECTIVE: July 1, 2019

ATTEST:

Jennifer M. Faina
Jennifer Faina, Administrative Coordinator

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Larry C. Porter, President

Daniel J. Franklin, Vice President

Wilbur Levengood, Jr., Commissioner

STATE OF MARYLAND CAROLINE COUNTY
FILED FOR RECORD
At 1145 o'clock am on 8/28 2019
and duly recorded in Liber TBL 6
Folio 267 one of the Resolution
record books for the aforesaid and
Terry B. Ford, Clerk
Recording Fee ____

liber 6 page 270

January 22, 2021

The Honorable Larry C. Porter
President , Caroline's County Commissioners
109 Market St
Room 103
Denton, Maryland 21629

Dear President Porter:

The Maryland Department of the Environment (MDE) has completed its review of the **Resolution 2020-023** to the 1992 Caroline County Comprehensive Water and Sewer Plan (CWSP). The Caroline County Commissioners adopted the Amendment on November 24, 2020, by Resolution 2020-023. The Amendment contains one water and sewer service category change. The Amendment requests that Tax Map 61, Parcels 252 and 454, and a portion of Parcel 102 (totaling 211.649 acres) be changed from W-6/S-6 to W-3/S-3.

Maryland Department of Planning Findings

The Maryland Department of Planning (MDP) advised the Department that the map changes in the amendment are consistent with the 2009 Federalsburg Comprehensive Plan.

MDP also noted that the 211.649-acre area is not currently located within the Priority Funding Area (PFA); however, the area was annexed by the town on November 2, 2020 (effective December 17, 2020), and is eligible to become a PFA once this CWSP amendment is approved (See attached MDP consistency report for more detail).

MDE Findings and Action

While reviewing the Amendment and the supplemental materials that accompanied this Amendment, MDE noted that the Wastewater Calculated Capacity Analysis Report prepared by Rauch, Inc uses an average daily flow of 125 GPD/EDU for determining the future residential use. MDE's Wastewater Capacity Management Plans Guidance[1] indicates using 250 GPD/EDU. This can assist in reducing wastewater system overloads. While this does not affect the outcome for this Amendment as this Amendment concerns a commercial/industrial use, future analysis should be updated to be consistent with the MDE Guidance.

[1]https://mde.maryland.gov/programs/researchcenter/reportsandpublications/documents/www.mde.state.md.us/assets/document/water/wastewatercapacitymgmtguidance.pdf

In accordance with §9-507(a) of the Environment Article, Annotated Code of Maryland, the Department hereby **approves the Resolution 2020-023**.

This completes MDE's review, as required by §9-507 of the Environment Article, Annotated Code of Maryland. If you need further assistance on these matters, please contact Heater Barthel, Deputy Director, at (410) 537-3512, toll-free at (800) 633-6101, or by e-mail at heather.barthel@maryland.gov.

Sincerely,

D. Lee Currey, Director
Water and Science Administration

Enclosure

cc: Leslie Grunden, Assistant Director of Planning, Caroline County Department of Planning and Codes
Don Wilson, Environmental Health Director, Caroline County
Charles Boyd, Director, Planning Coordination, MDP
Heather Barthel, Deputy Director, Water and Science Administration, MDE

RESOLUTION #2020-023

AMENDMENT OF THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN & MAPS, FEDERALSBURG ANNEXATION OF LAND FOR INDUSTRIAL DEVELOPMENT

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan (the "Water and Sewerage Plan"); and

WHEREAS, pursuant to "Resolution No. 2020-02," referred to herein as the "Resolution," and in accordance with Title 4, Subtitle 4 of the Local Government Article of the Maryland Annotated Code (the "Code), the Town of Federalsburg (the "Town") annexed 211.649 acres of land generally located west of Wright Road and adjacent to the Town's existing municipal boundary, comprised of Parcel 253, Parcel 454, and a portion of Parcel 102 of Caroline County Tax Map 61 and a portion of the public road right-of-way known as "Wright Road" (hereinafter collectively referred to as the "Annexed Property");

WHEREAS, the Town plans to rezone the Annexed Property for industrial use in response to a project proposal from AquaCon Maryland, LLC (hereinafter the "Project");

WHEREAS, the Project supports the goals of the Water and Sewerage Plan to "protect the general health, safety and welfare of the people of Caroline County through the provision of adequate water and sewerage facilities," and to "ensure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards."

WHEREAS, in accordance with State and local law requirements, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Comprehensive Plan, and the Planning Commission has provided a positive recommendation; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on November 10, 2020, with the record held open for additional public comment until November 24, 2020.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, that the Caroline County Comprehensive Water and Sewerage Plan is hereby amended as follows: the Federalsburg Water and Sewer Service Area Maps are amended to include the following properties: Tax Map 61, Parcels 253, 454 and the portion of Parcel 102 located south of MD Route 318, as shown in Exhibit A.

[Balance left intentionally blank. Signatures follow.]

ADOPTED/EFFECTIVE: November 24, 2020

ATTEST:

Jennifer Farina, Administrative Coordinator

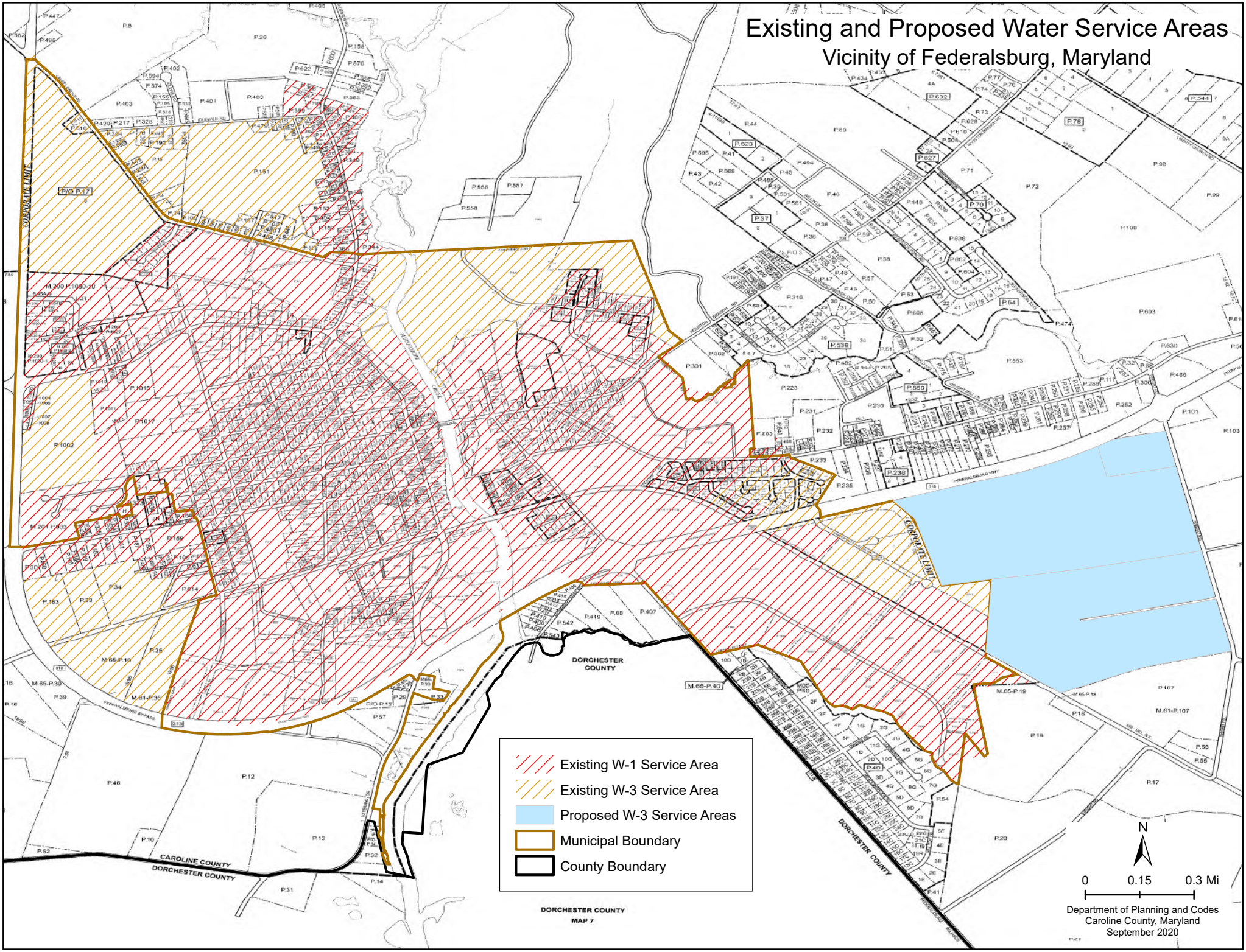
(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Larry C. Porter, President

Daniel J. Franklin, Vice President

Wilbur Levengood, Jr., Commissioner


Existing and Proposed Water Service Areas
Vicinity of Federalsburg, Maryland
Existing W-1 Service Area
Existing W-3 Service Area
Proposed W-3 Service Areas
Municipal Boundary
County Boundary
DORCHESTER COUNTY
MAP 7
CAROLINE COUNTY
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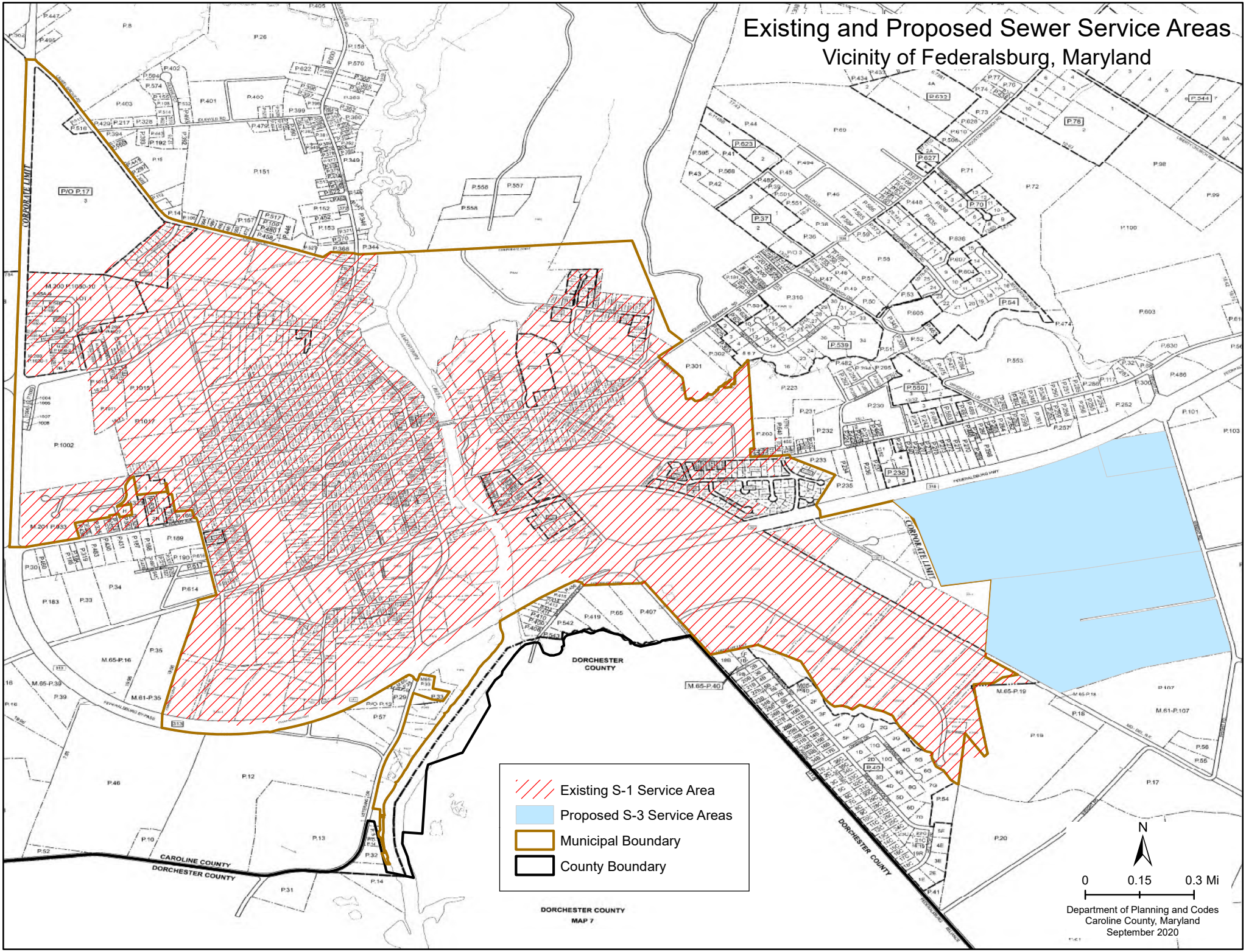
Department of Planning and Codes
Caroline County, Maryland
September 2020


Existing and Proposed Sewer Service Areas
Vicinity of Federalsburg, Maryland
Existing S-1 Service Area
Proposed S-3 Service Areas
Municipal Boundary
County Boundary
DORCHESTER COUNTY
MAP 7
CAROLINE COUNTY
DORCHESTER COUNTY
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Department of Planning and Codes
Caroline County, Maryland
September 2020

RESOLUTION #2022-001

AMENDMENT OF THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN & MAPS, EXPANSION OF THE GREENSBORO REGIONAL WASTEWATER SYSTEM (RWS)

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan (the "Water and Sewerage Plan"); and

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article, Title 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the 1992 Comprehensive Water and Sewerage Plan; and

WHEREAS, the County Commissioners and the Towns of Greensboro, Goldsboro, Henderson, Marydel and Templeville collaborated to determine wastewater treatment needs for the northern region of the County; and

WHEREAS, the County Commissioners have authorized by Resolution #2001-007, Resolution #2002-024, Resolution #2008-028, and Resolution #2010-018 the establishment of water and sewer service areas for certain unincorporated areas of northern Caroline County and the Towns of Goldsboro, Henderson, Marydel and Templeville; and

WHEREAS, the County Commissioners have authorized by Resolution #2012-026 the amendment of the Introduction and Sewerage chapters of the Comprehensive Water and Sewerage Plan (CWSP) to include updated information about the Greensboro regional wastewater system project to serve unincorporated and municipal service areas in northern Caroline County; and

WHEREAS, the Project supports the goals of the Water and Sewerage Plan to "protect the general health, safety and welfare of the people of Caroline County through the provision of adequate water and sewerage facilities," and to "ensure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards."

WHEREAS, in accordance with State and local law requirements, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Comprehensive Plan, and the Planning Commission has provided a positive recommendation; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on February 22, 2022, with the record held open for public comment until March 1, 2022.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, that the Caroline County Comprehensive Water and Sewerage Plan is hereby amended as follows:

1. Amend the Introduction and Sewerage chapters of the Comprehensive Water and Sewerage

Plan (CWSP) to incorporate updated information about the next phases of the Greensboro Regional Wastewater System expansion project (as shown in Attachment A), including:

- the expansion of the Greensboro RWS to accommodate 100,000 gpd additional flow from the remaining North County service areas;
- installation of sewage collection systems in the towns of Henderson, Marydel and Templeville and the Harman subdivision (residents there are currently served by septic systems);
- installation of pumping stations at Caroline Acres and Cedar mobile home parks and connection of the MHPs to the regional system;
- construction of denied access force main from Goldsboro to Templeville; and
- mapped locations of service areas, pump stations and denied access force main from Goldsboro to Templeville.

ADOPTED/EFFECTIVE:

ATTEST:

Kaleigh Leager, Executive Assistant

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Larry C. Porter, President

Daniel J. Franklin, Vice President

Wilbur Levengood, Jr., Commissioner

Caroline County Comprehensive Water and Sewerage Plan
North County Water and Sewer Amendments

CHAPTER 1 INTRODUCTION

1.5 CAROLINE COUNTY SEWER SERVICE NEEDS

1.5.1 North County Region

Background

In 1996, the Town of Goldsboro, located in the northern region of the County, entered into a Consent Order with Maryland Department of the Environment (MDE) to construct a public sewer system to resolve the problem of failing septic systems in the Town. Due to a lack of funding and other constraints, the Town was unable to comply with the terms of the Order, which required the Town to connect the individual septic systems operating within Town limits to a public sewerage system (see Chapter 5, Sewerage, Section 5.7.2. Election District 1 (Henderson), 'Maryland Department of Environment vs. Town of Goldsboro Consent Order'). In 2006, the four towns in the north County region (Goldsboro, Henderson, Marydel and Templeville) and Caroline County became the subjects of a draft Consent Order (Proposed Order) prepared by MDE that sought to resolve the problem of failing septic systems on a regional scale by mandating the construction of a regional wastewater treatment facility to serve the four towns and rural properties adjacent to the towns being served by failing or non-conforming septic systems.

The Division of Environmental Health of the Caroline County Health Department confirms that many of the septic systems in northern Caroline County lack the necessary soil conditions to properly treat septic tank effluent. Compounding the problem are the surrounding drainage ditches that penetrate the shallow groundwater and channel effluent from failing systems to streams and creeks that feed into the Choptank River. An additional threat is posed by the predominance of shallow wells in the region which may act as conduits for surface and groundwater contaminants to move into shallow and possibly deeper aquifers. None of these concerns have diminished over time. A more alarming trend is the installation of sewage holding tanks to abate failing systems. The cost of providing ongoing maintenance to these tanks is often overwhelming for residents, resulting in tanks overflowing or backing up inside homes – an even greater public health threat.

In 2008, the Commissioners of Caroline County and the towns of Goldsboro, Henderson, Marydel and Templeville formed the North County Water and Sewer Authority pursuant

to Subtitle 9 of Title 9 of the Environmental Article of the Annotated Code of Maryland, to:

> *"….exercise, perform, and carry out essential governmental functions and services, and to provide for the public health and welfare, pursuant to Subtitle 9 of Title 9 of the Environmental Article of the Annotated Code of Maryland (the "State Authority Code"), including, more specifically, but not by way of limitation, to operate as an authority pursuant to the State Authority Code, to operate a sanitary sewer district and sewerage system as provided for in the State Authority Code to provide for the collection, carrying, treatment, neutralization, and disposal of sewage, to operate a water district and water system as provided for in the State Authority Code to provide for the collection, supply, treatment, and distribution of water, and to have and exercise all powers granted to such authorities pursuant to the State Authority Code and to do all things permitted such authorities and all things necessary, incidental, or related thereto not prohibited to such authorities under the State Authority Code or other provisions of applicable law, including, but not limited to, the acquisition, ownership, leasing, construction, operation, disposal, and other activities with respect to real and personal property, the sale of bonds, and the entering into of contracts with its members and others."*[1]

At its formation, the Authority consisted of five directors, who represented the political subdivisions located in northern Caroline County:

1. Mayor and Council of Goldsboro ("Goldsboro")
2. The Commissioners of Henderson ("Henderson")
3. Commissioners of Marydel ("Marydel")
4. The Commissioners of Templeville ("Templeville")
5. County Commissioners of Caroline County ("Caroline")

The Authority delineated the North County Service Area to include properties within the corporate boundaries of Goldsboro, Henderson, Marydel and Henderson, certain parcels in proximity to each town, as well as the Harman subdivision (south of Templeville), Caroline Acres mobile home park (south of Henderson), and Cedars mobile home parks (south of Marydel).

On behalf of the Authority, Caroline County and the Maryland Environmental Service commissioned a Preliminary Engineering Report (PER) for the 'North County Regional Wastewater Collection and Treatment System', completed in October 2009, to determine the most feasible type of regional wastewater system to serve the North County service areas. Several earlier engineering studies had provided recommendations for

[1] County Commissioners of Caroline County, Maryland Legislative Bill #2008-7

implementing wastewater systems, however, none of the recommendations were implemented, primarily due to the unavailability of sufficient funding.

In the October 2009 PER, alternatives including centralized and de-centralized systems for collection and treatment were evaluated. Six alternative systems and a "no action" alternative were evaluated and compared based on economic and non-economic advantages.

Based on the comparative analysis, the report recommended a low pressure (grinder pump) sewer collection system in each of the four towns and surrounding areas and a conveyance system to convey the collected wastewater to a single treatment plant near Goldsboro, which would have an initial capacity of 260,000 gpd, expandable to 383,000 gpd. Based on funding considerations the construction of the system would be phased over a period ranging in length from between five and nine years, beginning with the Town of Goldsboro in the first phase. The estimated capital cost was $21.5 million.

In early 2010, while the PER was under review by the NCWSA and funding agencies, Caroline County was developing its Phase 1 Watershed Implementation Plan ("WIP") to address the newly established Chesapeake Bay TMDL. The County coordinated its assessment of point source impacts to local water quality with towns, including Greensboro, to determine annual nutrient loads from municipal WWTP surface discharges and potential best management practices to reduce those loads if possible, particularly in the Choptank River. Of the five municipal WWTPs in operation, Greensboro WWTP, built in the floodplain in 1964 with a surface discharge to the Choptank River, had the highest annual TN load at 10,000+ lbs. The County discussed the feasibility of Greensboro upgrading it's WWTP to Enhanced Nutrient Removal (ENR) technology with the Town, however the high cost of the upgrade, estimated at $8 million, and its likely low ranking on the State Board of Public Works' Priority Projects List (PPL) made an ENR upgrade highly unlikely.

The County proposed to Greensboro that it join the North County project as a partner, wherein it would build a new regional ENR WWTP and collection/conveyance system to serve Greensboro and the North County service areas, and the North County service areas would become bulk customers of the system. The Town's elected officials agreed to participate in a study to determine if this option was feasible for all the jurisdictions involved.

A supplemental engineering study (PER #2) to assess the feasibility of a seventh option (the "Greensboro option"), wherein wastewater from the North County municipal and County service areas and the Town of Greensboro would be treated at a new Enhanced Nutrient Removal (ENR) treatment plant located in Greensboro, was completed in late 2010. The study evaluated the economic and non-economic impacts of extending the

project to include Greensboro, and addressed impacts on conveyance, treatment, and final effluent disposal. The evaluation was performed on the basis that the North County towns and the County would contract with the Town of Greensboro to treat wastewater flow from the North County municipal and County service areas.

The Greensboro option recommended decommissioning the existing Greensboro Wastewater Treatment Plant (WWTP) and constructing a new regional treatment plant in Greensboro with Enhanced Nutrient Removal (ENR) technology capable of achieving 3 mg/l total nitrogen and 0.3 mg/l total phosphorus. The new facility would be located at a new site located outside of the floodplain; the old plant would be converted to a pump station and connected to the new plant via force main. Collection/conveyance systems were recommended for the towns Goldsboro, Henderson, Marydel and Templeville with wastewater conveyed to the new ENR facility in Greensboro via Denied Access force main. The project was recommended to be constructed in phases with the first phase to include the new ENR treatment facility in Greensboro and pump station at the old Greensboro facility and a new collection/conveyance system in Goldsboro with force main connection to the new treatment plant.

The estimated capital cost of the Greensboro option was $21.6 million, a significant savings compared to implementing the North County and Greensboro WWTP projects separately.

The main advantages of this option (the Regional Wastewater System/Greensboro Option) were:

(1) The regional system can be funded in phases, which is more feasible for the funding agencies.
(2) O&M cost may be further reduced by utilizing the existing and already staffed Greensboro system.
(3) The project will result in large nutrient reductions assisting MDE in achieving its Watershed Implementation Plan goals in Caroline County. The ENR technology at the plant will be capable of achieving effluent concentration goal of 3.0 mg/l Total Nitrogen and 0.3 mg/l Total Phosphorus resulting in a 83% reduction in nitrogen and 90% reduction in phosphorus to the Choptank River and, ultimately, to the Chesapeake Bay.

The new plant's effluent requirements were based on the combined effluent allocations for the old Greensboro WWTP and for the allocation provided by taking existing septics offline in Goldsboro.

The effluent requirements for the new facility are shown below:

Nutrient Allocation	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)
Greensboro allocation	6,100	457
Goldsboro allocation	596	0
TOTAL	6,696	457

The first five phases included: Phase 1, construction of the new ENR treatment plant (WWTP) in Greensboro; Phase 2, construction of a conveyance system from the old Greensboro plant to the new Regional Wastewater System (RWS) including pump station and force main; Phase 3, construction of a conveyance system from Goldsboro to the new RWS including pump station and force main, Phase 4, construction of a collection system in Goldsboro; and Phase 5, connection of individual properties in the Goldsboro vicinity service area to the collection system. Future phases of the project will consist of expanding the new WWTP in modular increments to accommodate additions of users in the remaining North County municipal and County service areas.

The Greensboro option was approved by USDA Rural Development, MDE and MD DHCD in 2013; grant/loan funding from the three funding agencies for the Town of Greensboro (owner of the RWS) for the first five phases was approved in 2015, and construction began shortly thereafter.

2021 Project Update

Phases 1-5 were completed 2016-2019; in 2019 the new Greensboro RWS was treating flows from both the Greensboro and Goldsboro vicinity service areas. The force main connecting the Goldsboro vicinity service area to the Town of Greensboro service area is designated as a Denied Access line in locations outside of sewer service areas; properties located adjacent to the force main but outside of a service area may connect to sewerage lines only in accordance with the Denied Access Policy of this Plan (Section 2.5.8.). With the initial phases successfully completed, the project will continue to be implemented in the remaining North County municipal and County service areas to the RWS. The towns of Greensboro, Goldsboro, Henderson, Marydel and Templeville, Caroline County, USDA, MDE and MD DHCD all continue to support the expansion of the regional system to serve the northern Caroline County service areas.

In 2020, Greensboro received USDA funding to complete a cost update of PER #2 for improvements to and expansion of the Greensboro RWS from .332 mgd to .432 mgd to accommodate extension of wastewater treatment service to the Henderson, Marydel, Templeville municipal service areas and the County services areas of Caroline Acres and Cedars mobile home parks and Harman Subdivision, and extension of the collection/conveyance system to the North County service areas. As with the Goldsboro and vicinity service areas, existing septic systems in the service areas will be

decommissioned. In addition, the existing wastewater facilities at Caroline Acres and Cedars mobile home parks also will be decommissioned.

Expansion of the Greensboro RWS to serve the Towns of Henderson, Marydel, and Templeville, the Harman subdivision and the Caroline Acres and Cedars MHPs requires:

- Expansion of the WWTP to accommodate an additional average daily design flow of 100,250 gallons per day (gpd) to serve the three Towns, subdivision and MHPs;
- New collection systems in each town;
- New pumping stations and force mains to convey flow from each service area to the Goldsboro PS, which will be used to convey flow to the Greensboro WWTP. The force main connecting North County municipal and County service areas to the RWS will be designated as a Denied Access line where it runs between sewer service areas.

The type of collection system for each town and subdivision was based on a low pressure sewer system to be consistent with prior reports and recommendations of the low pressure sewer system being the least costly alternative and implementation of this type of system in the Town of Goldsboro. New pumping stations are required in the Towns of Marydel and Henderson. An evaluation was performed to compare using the grinder pumps in the Town of Templeville to convey flow to the Town of Marydel PS versus a new centralized PS in Templeville. New force mains are required between each Town. The only upgrade required to the Goldsboro PS is the addition of a vertical mechanical bar screen. The pump capacity and force main between Goldsboro and Greensboro is sufficient.

The WWTP expansion evaluation included a comparison of three liquid treatment expansion technologies including:

- An additional third sequencing batch reactor (SBR) basin (expansion of the current technology);
- Utilizing the BioMag ballasted activated sludge system to operate within the existing reactor tankage;
- Utilizing the newly introduced membrane aerated biofilm reactor (MABR) within the existing reactor tankage

The recommended liquid treatment expansion technology is providing a third SBR basin.

Additional unit process expansion/upgrades include:

- Replacement screen for the existing Greensboro PS

- New grit decanter
- Expansion of the aeration system
- New, additional sludge holding tank
- New pavilion over the existing UV disinfection channel

The recommended Maintenance Facility layout includes areas for maintenance of grinder pumps, storage, offices, training rooms, and restroom facilities.

The capital cost estimate for the recommendations is $20 million, including construction, engineering, and construction management and inspection; twenty-year operation and maintenance costs are estimated at $4.4 million.

The updated PER was completed in late 2020 and in 2021 is undergoing review by USDA Rural Development and MDE. After agency review is complete, the towns and County will meet with USDA, MDE and MD DHCD representatives to discuss funding timelines for design and construction of the expansion of the regional system to serve the North County service areas, including the towns of Henderson, Marydel and Templeville, the Caroline Acres and Cedars mobile home parks, and Harman Subdivision.

CHAPTER 5 SEWERAGE

5.7.2. Election District No.1 (Henderson)

Election District No. 1 (2010 population – 3,348), the northernmost election district, is comprised of the towns of Goldsboro, Henderson, Marydel and Templeville, and approximately 35 square miles of the unincorporated area of the County. The Town of Goldsboro is served by the Greensboro Regional Wastewater System (RWS). Caroline Acres mobile home park, located adjacent to the southern border of the Town of Henderson corporate boundary, is served by a 24,000 gpd community sewerage system that utilizes spray irrigation for treatment. Cedars mobile home park, located south of Marydel, is served by a 15,000 gpd community sewerage system that discharges treated wastewater through surface discharge to an unnamed tributary of Tidy Island Creek in the Upper Choptank River Watershed. The remainder of Election District No. 1 is served by on-site sewage disposal (septic) systems.

Additional information about the two community sewer systems in operation within Election District 1 include:

- Cedars Mobile Home Park (formerly Walker's Mobile Home Park): located south of the town of Marydel, the Park's 60 mobile homes are served by public water supply and wastewater collection and treatment systems. The wastewater treatment facility has a permitted flow capacity of 15,000 gpd and is permitted to discharge treated effluent to the Tidy Island Branch of the Choptank River.

- Caroline Acres Mobile Home Park: located just outside the municipal boundary of Henderson, the community's 134 mobile homes are served by a public water supply and wastewater collection and treatment system. The wastewater treatment facility employs a lagoon treatment system with spray irrigation and has a flow allocation of 24,000 gpd, however in 2020 existing flows were averaging around 30,000 gpd.

Water quality problems stemming from failing septic systems have been a regional public health issue since the 1970s. Major concerns include:

- Henderson: the Town's 118 residents are served by a municipal water system and private, individual septic systems, a large number of which are failing. The Town's public water system and elevated water storage tank water provide protection from septic contamination and the Town has thus far avoided serious public health issues as a result of contaminated drinking water.

- Marydel: the Town lies on both sides of the state line between Maryland and Delaware. The Town's 147 Maryland residents are served by private individual wells

and septic systems, most of which are suspected to be failing. Municipal and County officials are aware of public health issues stemming from contaminated groundwater in wells located within 100 feet of failing septic systems.

- Templeville: the Town lies on both sides of the boundary between Caroline and Queen Anne's County. Approximately 25 percent of the Town's residents (total Town population is approximately 180) live in the Caroline County portion of the Town. All the residents of the Town are served by private wells and septic systems. Caroline County Department of Health reports that many of these systems are failing, and that contaminated groundwater is a serious public health issue in the Town. In 1996, Maryland Department of the Environment (MDE) filed a Consent Order against the Town of Goldsboro to resolve the public health threat posed by the numerous failing septic systems in the Town. Similarly, Henderson, Marydel, Templeville and the County are the subjects of a proposed complaint and draft Consent Order (Proposed Order) prepared in 2006 by MDE. Both the Consent Order and the Proposed Order recommended that North County local governments work together to develop a regional solution to address failing septics.

In 2008, the Commissioners of Caroline County and government representatives of the North County towns – Goldsboro, Henderson, Marydel and Templeville – formed the North County Water and Sewer Authority (NCWSA) to facilitate a regional solution for the area's failing septic systems. In addition to municipal service areas, the Authority identified areas in the vicinity of the four towns where aging and failing septic and small sewer systems are located, to be designated as County (unincorporated) sewer service areas.

The towns of Greensboro and Goldsboro finalized a bulk service agreement in 2012 wherein the town of Greensboro treats wastewater conveyed from the Goldsboro vicinity service area (105 municipal users and 25 users in the unincorporated area) to the Greensboro RWS. The Greensboro RWS was commissioned at the end of 2016, and in 2019 construction was completed on the RWS collection/conveyance system in the Town of Goldsboro. The system includes a low pressure (grinder pump) collection system and pump station, with a force main along Route 313 connecting Goldsboro to the WWTP at Greensboro. A total of 130 properties, including 105 improved properties located within the Goldsboro municipal sewer service area and 25 improved properties located in the unincorporated County sewer service area outside the Town of Goldsboro abandoned their existing individual septic systems and connected to the sewerage line in 2019.

The force main connecting the Goldsboro vicinity service area to the Town of Greensboro service area is designated as a Denied Access line; properties located

adjacent to the force main but outside of a service area may connect to sewerage lines only in accordance with the Denied Access Policy of this Plan (Section 2.5.8.).

The North County sewer service areas are located in the First Election District and include the municipal boundaries of the towns of Goldsboro, Henderson, Marydel and Templeville, as well as a County sewer service area that includes 25 properties located north and south of the Goldsboro municipal boundary; Cedars mobile home park (south of Marydel); Caroline Acres mobile home park (south of Henderson), and the Harman subdivision (south of Templeville).

Timing categories for North County sewer service areas are outlined below.

S-1: (Areas served by community and multi-use water and sewerage systems which are either existing or are under construction.) Properties currently served by public or community sewer systems (Caroline Acres and Cedars mobile home parks).

S-3: (Areas where improvements to, or construction of, new community and multi-use water supply and sewerage systems will be given immediate priority.) Properties within the municipal boundaries of Henderson, Marydel and Templeville, and properties located in the unincorporated areas of the service area (Caroline Acres and Cedars mobile home parks and Harman Subdivision).

S-5: (Areas where improvements to, or construction of, new community and multi-use water supply and sewerage systems are programmed for inclusion within the 6/7 through 10-year period.) The East Star property annexed into the Town of Goldsboro. At the time of this update the property is the site of a mineral extraction operation. Future development of the site is anticipated; at such time the timing category will be evaluated to determine if re-assignment is appropriate. Amendments for these timing changes will be coordinated with estimated timelines for development of the property.

5.7.3. Election District No 2 (Greensboro)

The Greensboro Election District (2010 population – 5,614) is comprised of the Town of Greensboro (2010 population 1,931) and just under 50 square miles of unincorporated land. Currently about 65% of the district's total population is served by individual sewage disposal systems. The remainder of the population is served by the Town of Greensboro wastewater treatment plant.

The Town replaced its secondary wastewater treatment plant in 2016. The former facility was a fixed film, activated sludge type wastewater treatment plant located on the in the Critical Area on the northwest bank of the Choptank River. The facility was originally constructed in 1964 and was permitted for 280,000 gpd. The plant's aging facilities, high nutrient content in its effluent discharge and habitual flooding made the construction of a new plant with nutrient removal technology and out of the floodplain a priority for the Town.

Figure 1 Greensboro WWTP facility submerged as a result of hurricane-related flooding and tidal surge in 2011.

In 2009, at the request of Caroline County, the Greensboro Town Council participated in an evaluation of the feasibility of including Greensboro in the North County Wastewater Treatment Project (for a detailed history of the North County Regional Wastewater Treatment Project, please refer to Section 1.5, Caroline County Sewer Service Needs, North County Region). In 2011 the Town Council voted in favor of the regional treatment plant project and worked with State and federal funding agencies to obtain funding for design and construction of the regional facility to serve the towns of Greensboro, Goldsboro, Henderson, Marydel and Templeville, and the County service areas of Caroline Acres and Cedars mobile home parks and Harman Subdivision.

In 2012, Greensboro received MDE, USDA Rural Development and MD DHCD Block Grant approval for funding of construction a new ENR treatment plant and collection/conveyance system to serve the Town of Greensboro and the Goldsboro service area. Lack of funding due to the nationwide financial crisis at the time prevented extension of regional service to the remaining North County municipal and County service areas, however future extension is planned when funding levels improve. The towns of Greensboro and Goldsboro finalized a bulk service agreement in late 2012.

The Greensboro Regional Wastewater System (RWS) was commissioned in late 2016. The new wastewater treatment plant is designed for an average daily flow of 332,000 gallons. It was designed to treat to Enhanced Nutrient Removal (ENR) standards and has effluent discharge limits of 4 mg/L total nitrogen (TN)_, with 3 mg/l as a goal, and 0.3 mg/L total phosphorus (TP). Treated effluent is discharged to the Choptank River.

The new treatment facility is located near the intersection of MD Rt. 313 and MD Rt. 480, in north Greensboro. The Town's former facility is reconfigured to serve as a pump station to the new RWS. The treatment system includes vortex grit removal, a sequencing batch reactor, denitrification filters, cascade post aeration, UV disinfection and chemical storage and feed systems—including methanol, alum, phosphoric acid, and sodium hypochlorite. Reed beds are used for sludge treatment/storage. Screening is

provided at the collection system pump stations at the old Greensboro WWTP and in Goldsboro.

The plant's effluent requirements are based on the combined effluent allocations for the Greensboro WWTP and for the allocation provided by taking existing septic systems offline in the Goldsboro and vicinity service areas. The effluent requirements are shown below:

Greensboro WWTP Effluent Requirements		
Nutrient Allocation	**Nitrogen (lbs/yr)**	**Phosphorus (lbs/yr)**
Greensboro allocation	6,100	457
Goldsboro allocation	596	0
TOTAL	6,696	457

In 2019 construction was completed on a new collection/conveyance system in Goldsboro, owned and operated by the town of Greensboro. The system includes a low pressure (grinder pump) collection system and pump station, with a force main along Route 313 connecting Goldsboro to the WWTP at Greensboro. The collection/conveyance system serves 130 properties in Goldsboro, including 105 improved properties located within the Goldsboro municipal sewer service area and 25 improved properties located in the vicinity of Goldsboro in the unincorporated County sewer service area.

In 2020, Greensboro received USDA funding to complete a cost update of PER #2 for improvements to and expansion of the Greensboro RWS from .332 mgd to .432 mgd to accommodate extension of wastewater treatment service to the Henderson, Marydel, Templeville municipal service areas and the County services areas of Caroline Acres and Cedars mobile home parks and Harman Subdivision, and extension of the collection/conveyance system to the North County service areas. As with the Goldsboro and vicinity service areas, existing septic systems in the service areas will be decommissioned. In addition, the existing wastewater facilities at Caroline Acres and Cedars mobile home parks also will be decommissioned.

Expansion of the Greensboro RWS to serve the Towns of Henderson, Marydel, and Templeville, the Harman subdivision and the Caroline Acres and Cedars MHPs requires:

- Expansion of the WWTP to accommodate an additional average daily design flow of 100,250 gallons per day (gpd) to serve the three Towns, subdivision and MHPs;
- New collection systems in each town;

- New pumping stations and force mains to convey flow from each service area to the Goldsboro PS, which will be used to convey flow to the Greensboro WWTP.

The PER also addresses an ancillary requirement of the Town of Greensboro to provide a new Maintenance Facility to be used for maintenance and storage, as well as office and training space.

Also included in the PER are:

- Evaluation and construction cost estimates for a new low-pressure sewer system in the Towns of Henderson, Marydel and Templeville and Harman subdivision;
- Sizing and construction cost estimates for new pumping stations and force mains to convey flow from the three Towns, the subdivision and MHPs to the Town of Goldsboro PS;
- Identification of planning limits from the Maryland Department of the Environment (MDE) for the WWTP expansion;
- Evaluation and construction cost estimates of three liquid process treatment systems and three biosolids dewatering systems for the WWTP expansion;
- Preliminary layout of a new Maintenance Facility.

Expansion of the WWTP will include:

- construction of a third SBR basin
- expansion of the reed bed dewatering system
- replacement screen for the existing Greensboro pump station
- new grit decanter
- expansion of the aeration system
- new, additional sludge holding tank
- new pavilion over the existing UV disinfection channel

The capital cost estimate for the recommendations is $20 million, including construction, engineering, and construction management and inspection; twenty-year operation and maintenance costs are estimated at $4.4 million.

The updated PER was completed in late 2020 and in 2021 is undergoing review by USDA Rural Development and MDE. After agency review is complete, the towns and County will meet with USDA, MDE and MD DHCD representatives to discuss funding timelines for design and construction of the expansion of the regional system to serve the North County service areas, including the towns of Henderson, Marydel and Templeville, the Caroline Acres and Cedars mobile home parks, and Harman Subdivision.

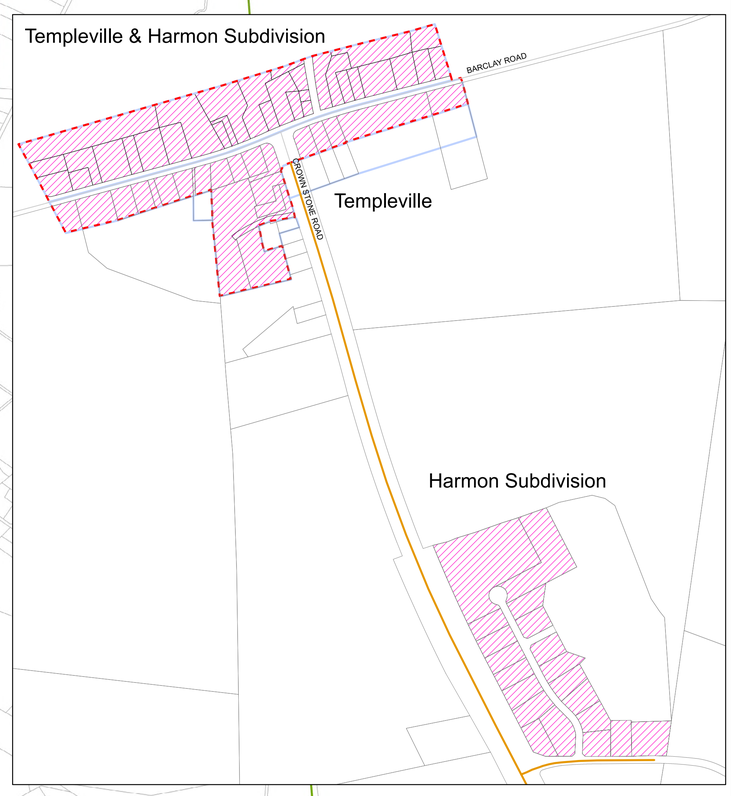
G2 Expansion Service Areas
Maryland

- Existing Pump Station
- New Pump Station
- Denied Access Line Goldsboro to Templeville Proposed
- Denied Access Line Greensboro to Goldsboro
- Incorporated Boundaries
- Priority Funding Areas
- S1 Service Area
- S3 Service Area
- S5 Service Area
- Caroline County Boundary

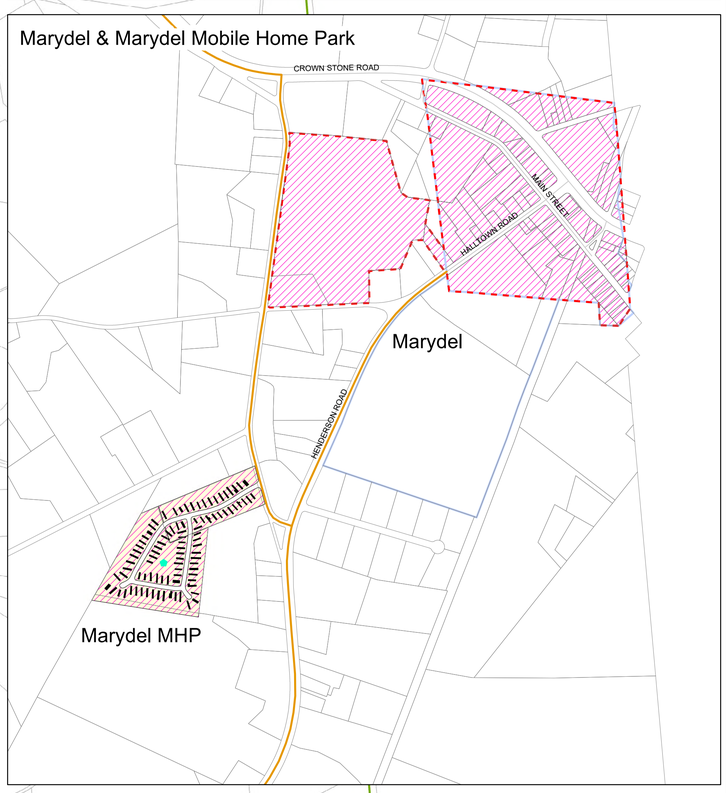
N

1 inch = 1,410.61 feet

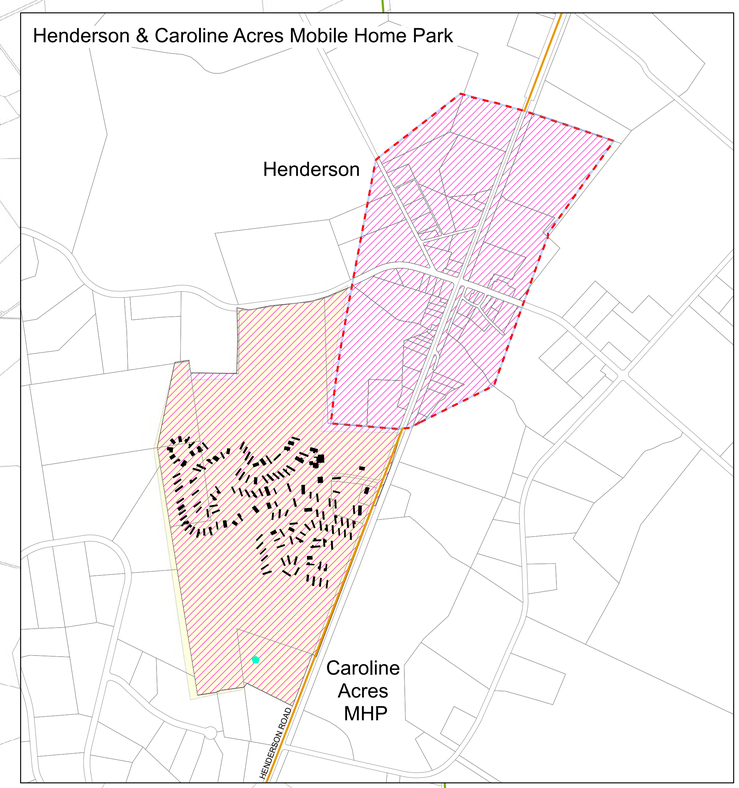
Templeville & Harmon Subdivision



Marydel & Marydel Mobile Home Park



Henderson & Caroline Acres Mobile Home Park



November 12, 2021

Ms. Dinorah Dalmasy, Manager, Integrated Water Planning Program
Maryland Department of the Environment
Water Management Association
1800 Washington Boulevard
Baltimore, Maryland 21230

Re: PFA Exception for Greensboro WWTP Expansion and Extension of the Sewer System to three non-Priority Funding Areas in northern Caroline County

Dear Ms. Dalmasy:

The Smart Growth and Neighborhood Conservation Coordinating Committee (SGCC) met on October 13, 2021 to review a request by the Maryland Department of the Environment (MDE) to grant a Priority Funding Area (PFA) exception to allow state funding--Water Quality Revolving Loan Fund and Bay Restoration Funds - Wastewater Grant--for the partial expansion of the Greensboro wastewater treatment plant and to connect three non-PFA areas as part of a larger regional public sewer service project for the towns in the north Caroline County.

Due to the regional problem of failing septic systems, the project involves (1) the expansion of the existing enhanced nitrogen removal (ENR) regional wastewater treatment plant (WWTP) constructed in the Town of Greensboro, which currently only serves the towns of Greensboro and Goldsboro, and (2) the extension of the regional sewer system to serve the towns of Henderson, Marydel, and Templeville, which are all within a PFA area. As part of that WWTP expansion and sewer extension project, three non-PFAs have been identified needing public sewer to address documented public health and safety concerns. These non-PFAs are two Mobile Home Parks (MHPs), the Marydel MHP and the Caroline Acres MHP, and a residential subdivision, known as Harman Subdivision.

The Caroline County Department of Health letter dated September 1, 2021 reports:

> "Based upon time-series data collected from various State and local governing agencies including this office the continued use of existing sewage treatment and disposal facilities at these sites present undue risk to public health and the environment. It is the opinion of this office that public sewerage service provision is the most adequate alternative to alleviate realized and potential risk factors."

The Health Department letter further notes the MHPs are operating in a non-compliant status as reported by the MDE's Compliance Division, and they have numerous violations including exceedances of biological oxygen demand (BOD), ammonia and E. Coli bacteria. Additionally, the letter states the existing or original on-site disposal systems serving the Harmon Subdivision were installed in the early to mid-1970s and most are not conforming, and numerous failures, including surface discharges, have been recorded and investigated by the Health Department.

Maryland Department of Planning staff confirmed that are the two MHPs and the Harman Subdivision in Caroline County do not meet the PFA Law criteria under §5-7B-03 of the State Finance and Procurement Article for local PFA designation.

Expansion of the WWTP will accommodate an additional average daily design flow of 100,250 gallons per day (gpd) and the extension of the sewer system to all areas will be on a denied access line north of Goldsboro. This extension project also includes needed pump stations and force mains. A portion of the additional WWTP capacity associated with this project will be allocated to the non-PFAs, by equivalent dwelling units (EDUs), as follows:

- Marydel (formally Cedar) MHP (Tax Map 5, Parcel 209 & 214) will be allocated 60 EDUs,
- Caroline Acres MHP (Tax Map 8, Parcels 15, 91,106 & 127) will be allocated 120 EDUs, and
- the Harman Subdivision (Tax Map 2, Parcel 108) will be allocated 19 EDUs, one EDU per lot, as listed below for the 17 developed residences and 2 undeveloped lots.

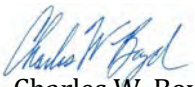
Developed	Account ID	Address	Map	Parcel	Lot
1	601003852	27030 STAFFORD ROAD	0002	0108	1
2	601003925	19025 HARMAN ROAD	0002	0108	10
3	601003933	19011 HARMAN ROAD	0002	0108	11
4	601002023	19001 HARMAN ROAD	0002	0108	12
5	601006363	18995 HARMAN ROAD	0002	0108	13
6	601003941	18985 HARMAN ROAD	0002	0108	14
7	601003968	18979 HARMAN ROAD	0002	0108	15
8	601003976	27050 STAFFORD ROAD	0002	0108	16
9	601003984	27066 STAFFORD ROAD	0002	0108	17
10	601015338	19050 HARMAN ROAD	0002	0108	18
11	601015311	19049 HARMAN ROAD	0002	0108	19
12	601004492	18974 HARMAN ROAD	0002	0108	2
13	601003739	27084 STAFFORD ROAD	0002	0108	20
14	601000314	18998 HARMAN ROAD	0002	0108	4
15	601009516	19010 HARMAN ROAD	0002	0108	5
16	601003909	19030 HARMAN ROAD	0002	0108	8
17	601003917	19035 HARMAN ROAD	0002	0108	9
Vacant - Not eligible for State funding but could connect if connection is approved by local authorities					
Undeveloped	Account ID	Address	Map	Parcel	Lot
18	601003887		0002	0108	6
19	601003895		0002	0108	7

Based on this information, the SGCC voted to approve use of state funding as a PFA exception for the partial expansion of the Greensboro wastewater treatment plant and to connect three non-PFA areas as part of a larger regional public sewer service project for the towns in the north Caroline County, due to the necessity to protect public health or safety, with the following conditions:

1) The Caroline County Comprehensive Water and Sewer Master Plan must be updated to include the proposed WWTP expansion, the denied-access sewer line extension to the north Caroline County towns, and the sewer service area expansion to the towns of Henderson, Marydel, and Templeville, and the three non-PFAs, and
2) The WWTP allocation of EDUs to the non-PFAs shall be as stipulated above.

Please let me know if there are any questions regarding the SGCC's action on this PFA exception request.

Sincerely,



Charles W. Boyd, AICP
Director of Planning Coordination

RESOLUTION #2021-018

AMENDMENT OF THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN & MAPS, DENTON, MARYLAND WATER AND SEWER SERVICE AREA TIMING CATEGORIES

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Title 9, Subtitle 5, of the Environment Article of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan (the "Water and Sewerage Plan"); and

WHEREAS, the Town of Denton has requested that the Water and Sewerage Plan Denton Water and Sewer Service Area maps be amended to update water and sewer service timing categories for a portion of Sharp Road from W4/S4 (service in 3-6 years) to W3/S3 (priority for connection); and

WHEREAS, the present resolution supports the goals of the Water and Sewerage Plan to "protect the general health, safety and welfare of the people of Caroline County through the provision of adequate water and sewerage facilities," and to "ensure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards."

WHEREAS, in accordance with State and local law requirements, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Comprehensive Plan, and the Planning Commission has provided a positive recommendation; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on August 17, 2021.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, that the Caroline County Comprehensive Water and Sewer Plan (CWSP) Denton Water and Sewer Service Area maps are hereby amended to reflect that the water and sewer service timing categories for extension of municipal water and sewer service for the following properties has been changed from W4/S4 to W3/S3: the following properties on Sharp Road and Lupine Lane: Tax Map 107, Parcels 283, 2225, 2226, 2229, 2319, 2320, 2321, 2322, 2324, and 2325.

[Balance left intentionally blank. Signatures follow.]

ADOPTED/EFFECTIVE: August 17, 2021

ATTEST:

Kaleigh Leager, Executive Assistant

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

Larry C. Porter, President

Daniel J. Franklin, Vice President

Wilbur Levengood, Jr., Commissioner

Denton Water Service Areas
Sharp Road Service Timing Category
W4 to W3 Map Amendment - July 2021

Legend

- Municipal Boundary
- PFA Boundary
- W1 Service Area
- W2 Service Area
- Proposed W4 to W3 Service Area
- W4 Service Area
- W5 Service Area
- Parcel Boundary

N

0 1,450 2,900 5,800 Feet

Caroline County
Department of Planning and Codes
2021

Denton Sewer Service Areas
Sharp Road Service Timing Category
S4 to S3 Map Amendment - July 2021

Legend

- Municipal Boundary
- PFA Boundary
- S1 Service Area
- S2 Service Area
- Proposed S4 to S3 Service Area
- S4 Service Area
- S5 Service Area
- Parcel Boundary

N

0 1,450 2,900 5,800 Feet

Caroline County
Department of Planning and Codes
2021

November 15, 2021

The Honorable Larry C. Porter
President, Caroline County Commissioners
109 Market St, Room 103
Denton, Maryland 21629

Dear President Porter:

The Maryland Department of the Environment (MDE) has completed its review of **Resolution #2021-018 (Amendment)** to the 1992 Caroline County Comprehensive Water and Sewerage Plan. The Caroline County Commissioners adopted the Amendment on August 17, 2021, by Resolution 2021-018. The Amendment contains water and sewer service category changes from W-4/S-4 (service in 3-6 years) to W-3/S-3 (priority for connection) for the following ten residential properties (two properties are unimproved) on Sharp Road and Lupine Lane: Tax Map 107, Parcels 283, 2225, 2226, 2229, 2319, 2320, 2321, 2322, 2324, and 2325 (see enclosed maps).

Maryland Department of Planning Findings

The Maryland Department of Planning (MDP) advised the Department that the amendment adopting the change in water and sewer service categories is consistent with the Caroline County Comprehensive Plan, and Town of Denton Comprehensive Plan.

In addition, MDP noted that all of the Town of Denton properties are designated as Priority Funding Areas (PFA). Parcel 282 is located within the unincorporated county and is zoned R-1, Single-Family Residential. Parcel 282 is not currently designated as PFA and does not appear to be eligible for PFA designation because the R-1 zoning does not permit a residential density of at least 3.5 du/acre. Parcel 282 is located within the Town of Denton Growth Area and may be annexed into the town at either the Suburban Residential (SR), or Town Residential (TR) category, and would then qualify for PFA.

MDE Findings and Action

Please be advised that based on MDE's Digital Flood Insurance Rate Maps, the property on Tax Map 107, Parcel 2225 is in Flood Zones AE (100-year Floodplain) and X (500-year Floodplain), and in Special Flood Hazard Areas T and F. The property owner should follow local floodplain ordinances and Federal Emergency Management Agency's guidelines and standards.

It is advised that the county consider climate resiliency for this property, which could include but not limited to the following steps (https://toolkit.climate.gov/):

- Explore Hazards: Identify climate and non-climate stressors, threats, and hazards and how they could affect assets (people and infrastructure).
- Assess vulnerability and risks: Evaluate assets vulnerability and estimate the risk to each asset.
- Investigate options: Consider possible solutions for your highest risks, check how others have responded to similar issues, and reduce your list to feasible actions.
- Prioritize and plan: Evaluate costs, benefits, and capacity to accomplish each action integrating the highest value actions into a stepwise plan.
- Take action: Move forward with your plan and check to see if your actions are increasing your resilience with monitoring.

The County is advised to contact Dave Guignet, State NFIP Coordinator, of MDE's Stormwater, Dam Safety, and Flood Management Program, at (410) 537-3775 for additional information regarding the regulatory requirements for Floodplains and Storm Surges.

The County is advised to contact Matthew C. Rowe, CC-P, Assistant Director of MDE's Water and Science Administration, at (410) 537-3578 for additional information regarding Climate Change and Resiliency.

Please be reminded that the Caroline County Comprehensive Water and Sewerage Plan update is overdue. COMAR requires that the County provide a copy of the draft Plan to MDE prior to County adoption. This action ensures that MDE's comments can be incorporated, as appropriate, in the County's final plan.

In accordance with §9-507(a) of the Environment Article, Annotated Code of Maryland, the Department hereby **approves the Resolution #2020-018 Amendment**.

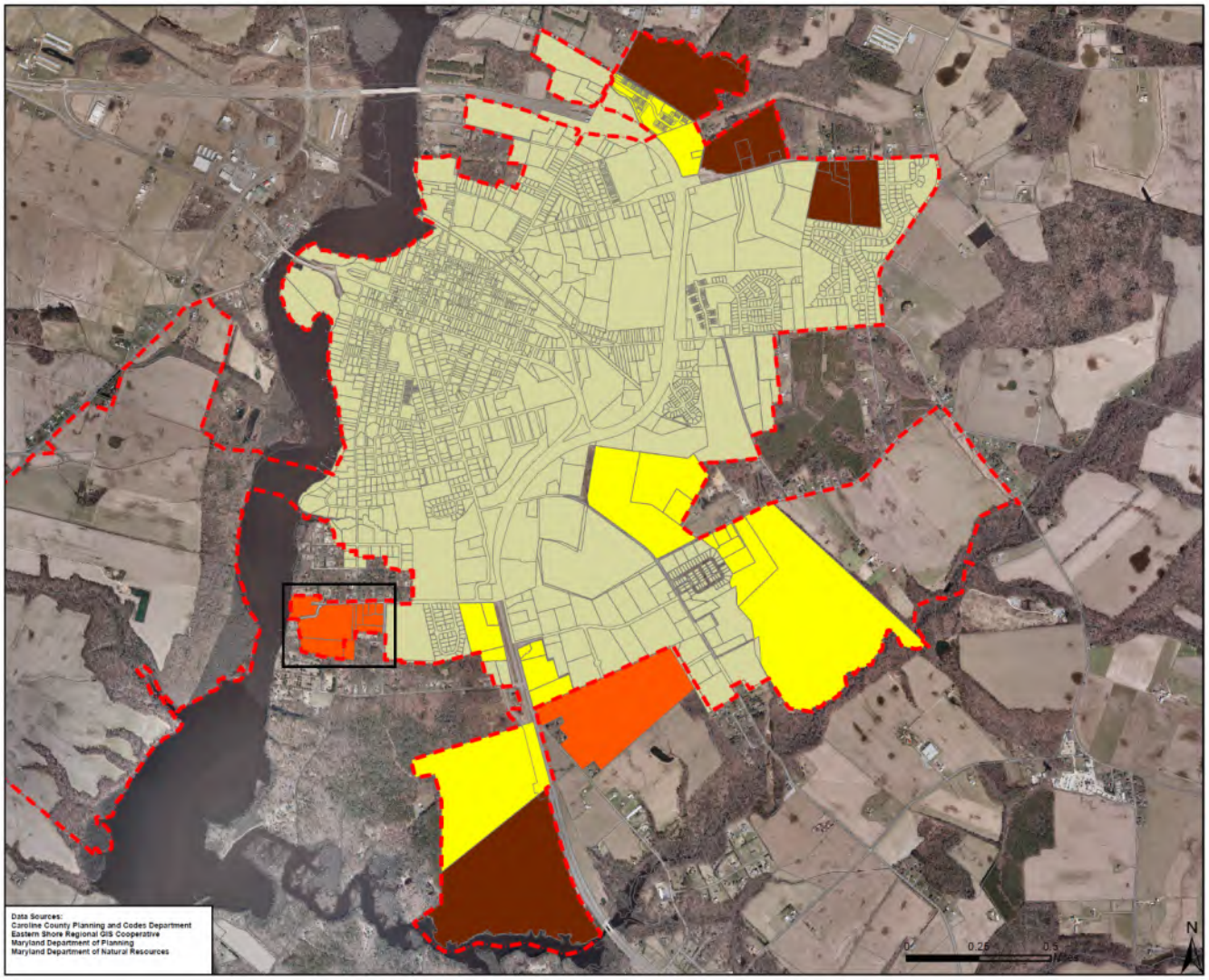
This completes MDE's review, as required by §9-507 of the Environment Article, Annotated Code of Maryland. If you need further assistance on these matters, please contact Heater Barthel, Deputy Director, at (410) 537-3512, toll-free at (800) 633-6101, or by e-mail at heather.barthel@maryland.gov.

Sincerely,

D. Lee Currey, Director
Water and Science Administration

Enclosure

cc: Leslie Grunden, Assistant Director of Planning, Caroline County Department of Planning and Codes
Charles Boyd, Director, Planning Coordination, MDP
Heather Barthel, Deputy Director, Water and Science Administration (WSA), MDE
Dave Guignet, State NFIP Coordinator, Stormwater, Dam Safety, and Flood Management Program, MDE
Matthew C. Rowe, Assistant Director, WSA, MDE



Denton, Maryland
Sewer Service Areas

Legend

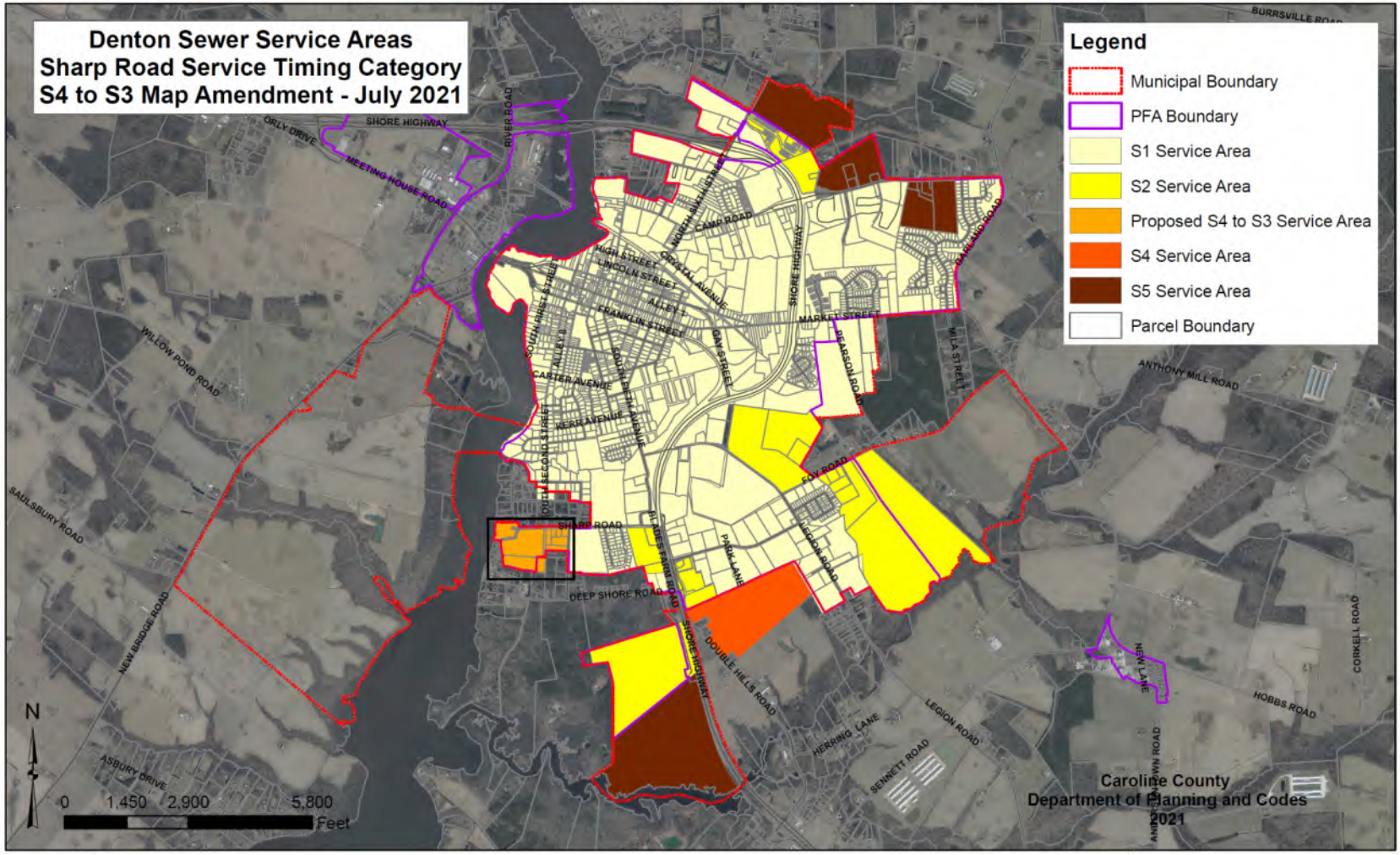
- Municipal Boundary
- S1 Service Area
- S2 Service Area
- S3 Service Area
- S4 Service Area
- S5 Service Area

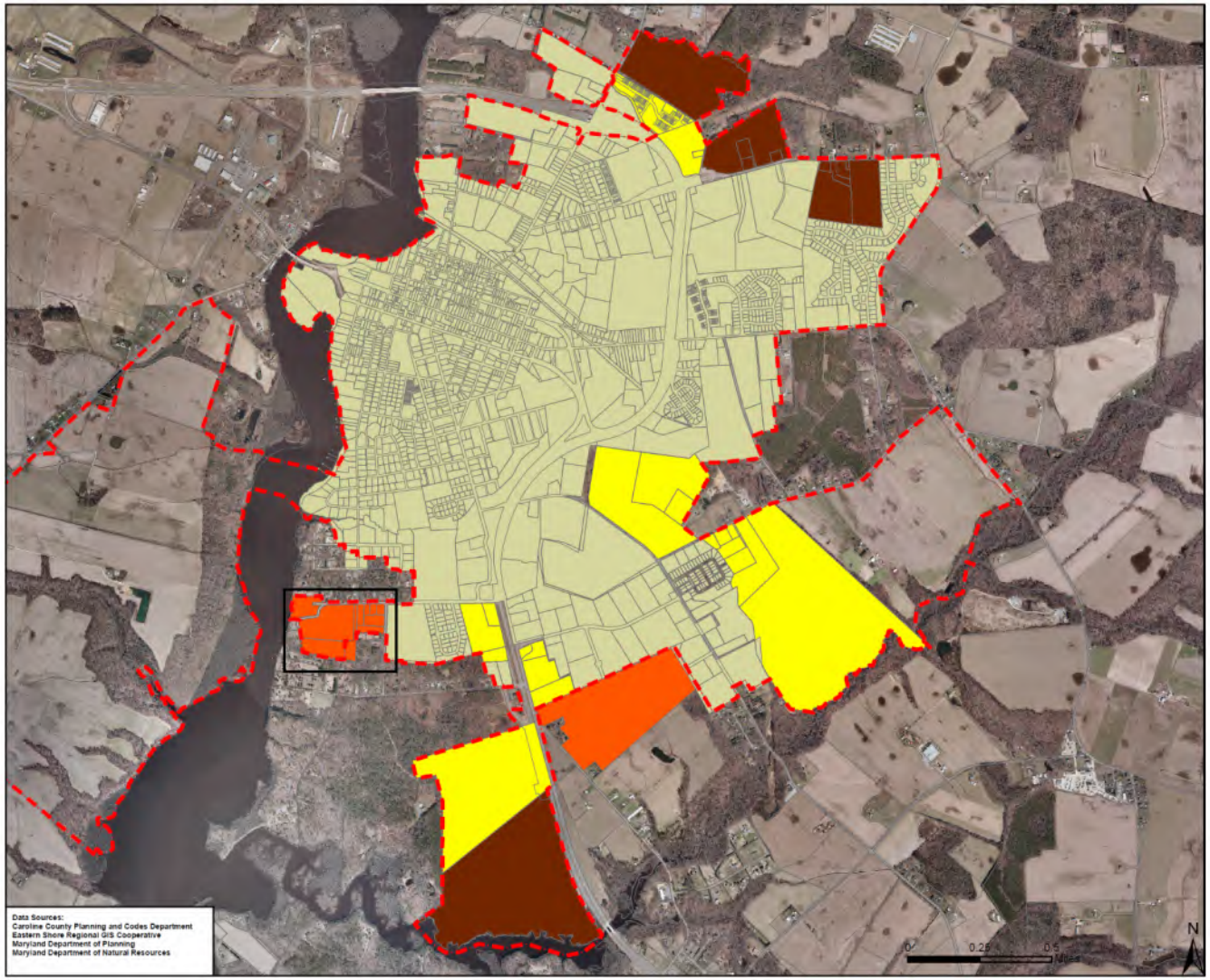
Before Resolution
#2021-018

Caroline County Planning and Codes
403 South 7th Street, Suite 210
Denton, Maryland 21629
410-479-8100
410-479-4187 (fax)
www.carolineplancode.org

2016

After Resolution #2021-018





Denton, Maryland
Water Service Areas

Legend

- Municipal Boundary
- W1 Service Area
- W2 Service Area
- W3 Service Area
- W4 Service Area
- W5 Service Area

Before Resolution
#2021-018

Caroline County Planning and Codes
403 South 7th Street, Suite 210
Denton, Maryland 21629
410-479-8100
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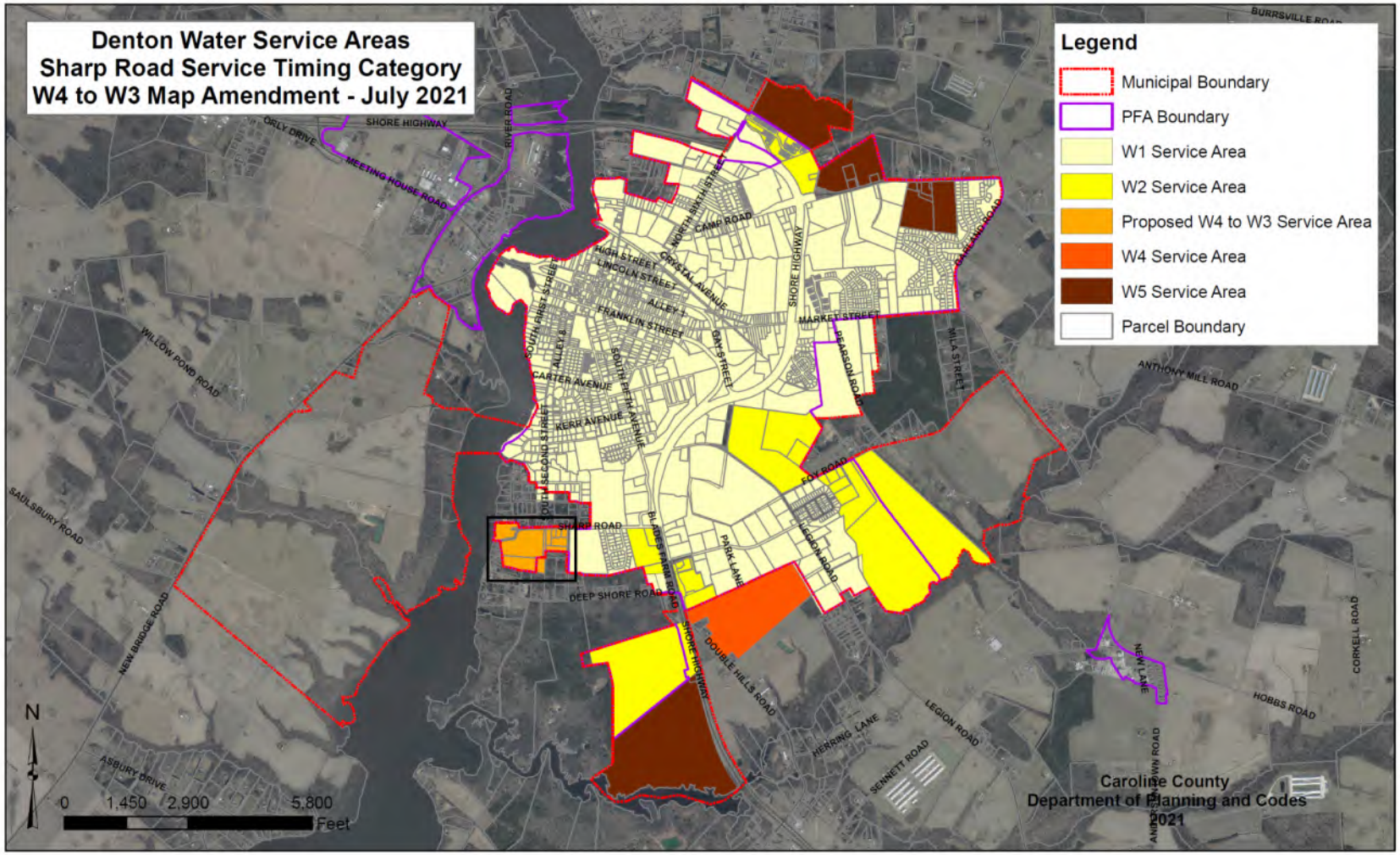
2016

After Resolution #2021-018



October 13, 2021

Ms. Dinorah Dalmasy, Integrated Water Planning Program
Maryland Department of the Environment
Water and Science Administration1800 Washington Boulevard
Baltimore, Maryland 21230

Re: Adopted Caroline County Master Water and Sewerage Plan Amendment, Resolution 2021-018
Denton, Sharp Road, Sharp Road and Lupine Lane: Tax Map 107, Parcels 283, 2225, 2226, 2229, 2319, 2320, 2321, 2322, 2324, and 2325.

Dear Ms. Dalmasy:

Thank you for providing the Maryland Department of Planning (Planning) with a copy of the adopted Denton amendment to the Caroline County Water and Sewerage Master Plan (1992 with amendments through 2019). Planning has reviewed the above-referenced water and sewerage plan amendment pursuant to our mandate to advise the Maryland Department of the Environment (MDE) on local comprehensive plan consistency and other appropriate matters as required by Environment Article Section 9-507 (b)(2) and find the adopted revisions to be consistent with the 2010 Denton Comprehensive Plan. Below is a summary of the adopted Water and Sewerage Plan (WSP) changes and our review comments regarding consistency, Priority Funding Areas (PFA), and Growth Tiers for your use in the approval process.

Summary of Revisions

This amendment adopts a change to the Denton Water and Sewerage Service Area map from W4/S4 (3 to 5/6 years) to W3/S3 (immediate priority) for ten (10) parcels (Resolution 2021-018). Nine of the parcels are located within the corporate limits of the Town of Denton. Parcel 283 is adjacent to Town of Denton Parcel 2229.

Comment

The Denton Water and Sewer Service Area Map (2016), appearing on page 144/335 (Resolution 2016-004) of the Caroline County Water and Sewerage Plan, does not contain a W3 or W4 service category on the legend. The area in question is only designated as S4. Therefore, the adopted change is from S4 to W3/S3.

Consistency with the Comprehensive Plan

To meet the requirements of Environment Article Section 9-507 (b)(2), Planning reviews and comments regarding consistency with the local comprehensive plan on any future activities that provide or accelerate water and sewer service and related infrastructure to properties to facilitate future water or sewer service (such as a capital improvement project).

Planning finds the amendment adopting the change in Water and Sewer service categories to be **consistent** with the Caroline County Comprehensive Plan, and Town of Denton Comprehensive Plan, specifically:

The proposed service area is part of the Caroline County Growth Area, which includes existing developed residential uses adjacent to the town that will require public facilities. The proposed update of the service timing categories is consistent with programs and objectives to protect the general health, safety, and welfare of the population through the provision of public facilities and services, and to provide for the stable and orderly extension of public facilities and services to serve the population efficiently and effectively. The connection of properties currently served by septic systems to Denton's ENR [Enhanced Nutrient Removal] wastewater treatment system also will result in a lower annual nitrogen load to Choptank River, which supports the county's watershed and water quality goals.

The proposed service area is within the Denton Growth Area as depicted in Map 4-3, Comprehensive Plan 2010 Denton, Maryland Priority Funding Area. The Denton Comprehensive Plan includes objectives to prioritize densely populated areas served by private wells and septic systems (page 4-10) and serve areas in need of municipal services for health or safety reasons (page 12-5).

Priority Funding Areas Review

Pursuant to the State Finance and Procurement Article §5-7B-02, local jurisdictions are eligible to receive State financial assistance under certain programs, if the project is located within the PFA. All the Town of Denton properties are designated as PFA. Parcel 282 is located within the unincorporated county and is zoned R-1, Single-Family Residential. Parcel 282 is not currently designated as PFA and does not appear to be eligible for PFA designation because the R-1 zoning does not permit a residential density of at least 3.5 du/acre. Parcel 282 is located with the Town of Denton Growth Area and may be annexed into the town at either the Suburban Residential (SR), or Town Residential (TR) category, and would then qualify for PFA.

Growth Tier Map Review

Parcel 283 is depicted on the Town of Denton Tier Map as Tier II – Municipal Growth Area (county). The balance of the amendment area is depicted as Tier II – Municipal Growth Areas Planned for Sewer. Parcel 283 appears to be designated as Tier 2 on the Caroline County Tier Map. The approval of this amendment would not necessitate an update to the Town of Denton or Caroline County Tier Maps.

If you have any questions or concerns regarding these comments, please contact David Dahlstrom, AICP, Regional Planner at david.dahlstrom@maryland.gov.

Sincerely,

Charles W. Boyd, AICP
Director, Planning Coordination

cc: Robin Pellicano; Nicholai Francis-Lau; Steve Alfaro; and Hannah C. Benzion, MDE
Tony Redman, DNR
Dwight Dotterer, MDA
Jason Dubow; Joseph Griffiths; Sylvia Mosser; David Dahlstrom; and Cassandra Malloy, Planning

RESOLUTION #2023-08

AMENDMENT OF THE CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN TOWN OF RIDGELY WATER SYSTEM UPGRADES

WHEREAS, the County Commissioners of Caroline County, Maryland (the "County Commissioners") are empowered by Environment Article 9, Subtitle 5, of the Annotated Code of Maryland to adopt and amend the Caroline County Comprehensive Water and Sewerage Plan (the "Water and Sewerage Plan"); and

WHEREAS, the Town of Ridgely (the "Town") proposes to upgrade municipal water infrastructure in an area served by the Ridgely municipal water system, including the construction of a new 300,000-gallon water tower, new water treatment facility, new well and new water main (the "Project");

WHEREAS, the Town is seeking funding to support the Project cost and those funders require the Project be included in the Water and Sewerage Plan; and

WHEREAS, the Project supports the goals of the Water and Sewerage Plan to "protect the general health, safety and welfare of the people of Caroline County through the provision of adequate water and sewerage facilities," and to "ensure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards."

WHEREAS, in accordance with State and local law requirements, the proposed amendment has been submitted to the Caroline County Planning Commission for review for consistency with planning goals and policies for the area, in particular the Caroline County Water and Sewerage Plan and Comprehensive Plan, and the Planning Commission has provided a positive recommendation; and

WHEREAS, the County Commissioners held a duly advertised public hearing for the proposed amendment on May 23, 2023.

NOW, THEREFORE, IT IS HEREBY RESOLVED BY THE COUNTY COMMISSIONERS OF CAROLINE COUNTY, that the Caroline County Comprehensive Water and Sewerage Plan is hereby amended as follows:

1) The Plan's Water Chapter inventory of "Immediate, Five- and Ten-Year Priorities for Water Development" is updated to include the Project as indicated in the following table:

Immediate, Five- and Ten-Year Priorities for Water Development				
Sewer Service Area	**Description**	**Funder/Cost**	**Priority**	**Projected Schedule**
Election District 7 - Ridgely				
a. Ridgely	**Construction of new 300,000-gallon water tower, new water treatment facility, new well and new water main (to connect new components with existing system) in order to support fire suppression and municipal capacity needs and create system redundancy for safety and maintenance.**	**The Town is seeking funding from State and federal sources to support the project costs: - construction of new water tower: $4,665,415.00 - construction of treatment plant: $245,121.00 - construction of new well: $133,248.00 - construction of new water main: $378,924.00**	**Immediate**	**2023 - 2025**
Source: Town of Ridgely, Maryland Department of Environment, March 2023.				

2) The Ridgely Election District section of the Comprehensive Water and Sewerage Plan's Water chapter is updated with the following text:

3.4.8. Election District No.7 (Ridgely)

The Town Ridgely water system currently serves a population of 1,868 via 747connections with an average daily demand of 167,000 gallons. The Town currently operates two active production wells, #2 and #3, drawing from the Piney Point Aquifer at a capacity of 108,000 and 144,000 gallons per day respectively. The water quality in the aquifer is generally good. Each well has a depth of 310-350 feet, with 6" diameter. The wells operate 6-12 hours per day, depending on the time of year. The water is treated with chlorine prior to entering the tower.

A Water Infrastructure Study was completed for the Town in 2007 and resulted in the recommendation of an additional elevated water storage tank with at least 500,000 gallons holding capacity. The system is permitted to withdraw an annual daily average of 200,000 gpd and a maximum of 300,000 gpd. In 2006 and 2007, usage averaged about 140,000 gpd, 70 percent of the system's permitted capacity. The system's current daily flow average of 106,000 gpd coupled with the committed water allocation of 54,000 gpd represent an 80% withdrawal

of the water tower's capacity of 200,000 gallons per day. An additional 120,000 gpd is needed for the Town's fire reserve flow needs, which indicates a potential water tower storage deficit. Sufficient water storage volume must be provided to allow for fire protection, emergency shut down reserve and equalization by well pumps (required storage tank volumes are calculated by combining these three elements of water demand). A 2021 assessment of the existing water tower, built in 1984, indicated it is in urgent need of maintenance and rehabilitation. The Town has been unable to complete this maintenance because taking the tower offline would impair potable water supply to the citizens; the Town does not have an adequate back-up or reserved capacity storage option to be activated when necessary maintenance is required on the existing tower.

In 2023, to resolve this and the above-mentioned capacity issues, the Town plans to add an additional 300,000-gallon water tower to create the needed redundancy for maintenance and safety improvements, and allow for fire protection, emergency shut down reserve and equalization by well pumps.

An additional well and new treatment facility are also planned as part of the Town's water system improvements. The addition of one new well will serve the planned new water tower, serve as a back-up for the current wells, and meet the overtaxed current system demand. The system's GAP permit will be amended to accommodate the additional new well and higher withdrawal capacity. A new water main will be constructed to connect the new water system components into the Town's existing water system. Further studies and water modeling will determine the best construction path and connection to the existing town system.

ADOPTED/EFFECTIVE: May 23, 2023

ATTEST:

Kaleigh E. Leager

Kaleigh Leager, Executive Assistant

(SEAL)

COUNTY COMMISSIONERS OF CAROLINE COUNTY, MARYLAND

J. Travis Breeding, President

Larry C. Porter, Vice President

N. Franklin Bartz, Commissioner

INTRODUCTION

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INTRODUCTION

BACKGROUND

During the decade of the 1980's Maryland experienced several "boom" years in industrial, commercial, and residential growth. The opening of a second Chesapeake Bay Bridge at Kent Island improved commuter travel and further encouraged growth on the Eastern Shore of Maryland. Caroline County has been successfully improving the local industrial base. Also, the growth of the City of Dover, Delaware has increased the number of people seeking to live in Caroline County near this metropolitan center. This growing development in Caroline County requires careful planning of water and sewerage facilities to protect the public health, to protect the quality of the environment, and to most efficiently use the limited financial resources available. These concerns will be addressed in this revision of the Caroline County Comprehensive Water and Sewerage Plan.

The Plan was last revised in 1986. Several amendments have been approved to update and reflect changes and new proposals that were not incorporated in the last major version.

PURPOSE OF THE PLAN

The Comprehensive Water and Sewerage Plan has two major purposes. First, it serves as a guide for the future expansion of water and sewerage systems in Caroline County, whether publicly or privately owned, over the next ten years. Second, it can be used as a tool to implement County development policy, the Caroline County Comprehensive Plan, and the requirements of State law and regulations. The goals and policies contained in this plan will greatly affect both the magnitude and locations of future growth.

STATE REQUIREMENTS

All counties in Maryland are required to adopt a Comprehensive Water and Sewerage Plan under Environment Article 9, Subtitle 5, of the Annotated Code of Maryland, and to submit the plan to the Maryland Department of the Environment. An approved plan is required before construction permits for water and sewerage projects will be approved. Provision shall be made for amendments and revisions to the plan at least once every 2 years.

The Maryland Department of the Environment has adopted rules setting out specific requirements for comprehensive water and sewerage plans. COMAR 26.03.01 contains the guidelines used to write this plan.

ADOPTION OF THE PLAN

State law requires that the Comprehensive Water and Sewerage Plan be reviewed and approved by the County Commissioners. The County Commissioners will hold a public hearing and invite review and comment prior to adopting the plan update. Once adopted, the plan will be the official policy of Caroline County with regard to water and sewerage development.

The Caroline County Comprehensive Water and Sewerage Plan will not remain static. It will be reviewed by the County Commissioners and amended as necessary. These amendments will reflect future changes in governing laws, population, housing, land use patterns and industry in Caroline County.

CHAPTER 1

GOALS, POLICIES, AND ORGANIZATION

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CHAPTER 1

GOALS, POLICIES AND ORGANIZATION

1.1 GOALS

Goals are broad policy statements intended to guide future actions over a long time period. Policies, on the other hand, are more specific actions that can be undertaken immediately. They can be used to implement the general goals of the plan and to measure the progress in achieving these goals. The following goals are recommended for adoption:

1. To protect the general health, safety and welfare of the people of Caroline County through the provision of adequate water and sewerage facilities.

2. To protect the natural resources and maintain the environmental quality of Caroline County.

3. To provide for stable orderly pattern of population growth where it can be efficiently and effectively served by public facilities and services.

4. To encourage the use of flow-reducing plumbing fixtures and other water conservation techniques.

5. To insure that all municipal, industrial and individual water supply and wastewater systems are designed and constructed to acceptable standards.

6. To coordinate water and sewerage planning with efforts to minimize water pollution caused by storm water runoff and non-point pollution sources.

1.2 IMPLEMENTING POLICIES

The following policies are recommended for adoption:

1. Guidelines shall be developed to identify which water and sewerage systems may be privately operated and which shall be dedicated for public ownership and operation.

2. Where economically practical, the County will encourage the integration of two or more adjacent community water and sewerage systems into a single system by with-holding County approval until it is proven if adjacent systems must be constructed, operated, and maintained separately.

3. The County shall maintain the capability to review and approve proposed community water and sewerage systems where these systems are extended and the Maryland Department of the Environment does not require State Construction Permits. This is managed by the Caroline County Health Department, Division of Environmental Health.

4. Caroline County shall be divided into water and sewerage service areas, as shown on the detailed maps in Chapters 3 and 4.. Area Designations shall mean:

W-1 and S-1: Community Water and Sewerage systems are either existing or under construction.

W-2 and S-2: Water and sewerage systems or improvements are in the final planning stages, or are programmed in the next 2-5 years.

W-3 and S-3: Construction of water and sewerage systems or improvements is programmed in the next 6 to 10 years.

W-4 and S-4: Areas with development potential where there are not current plans to construct water and sewerage systems.

W-5 and S-5: Agricultural and open space areas where community water and sewerage systems will not be constructed.

5. All individual water supply or sewerage systems shall be considered to be interim in nature. Interim individual water supply or sewerage systems will be permitted provided that:

a. Adequate community facilities are not available within a reasonable distance;

b. Such interim systems are judged by the County Health Department to be adequate, safe and in compliance with Chapter 5, and pertinent State and local regulations;

c. Permits for such systems shall state that they are interim in nature and that connection to a future community system shall be made within one year after it becomes available;

d. Such interim systems are designed and located so as to permit connection to the public or community facilities in an economical and convenient manner.

6. Emergency individual water and sewerage systems may be provided where community facilities are available, provided;

   a. the need is justified (e.g. Civil Defense) to local, state and/or federal authorities;

   b. such emergency systems are judged by the County Health Department to be adequate, safe and in compliance with pertinent State and local regulations; and

   c. the systems are used for emergency purposes only.

7. In areas where a community water supply is available, individual water supply wells for non-potable uses (e.g. irrigation, swimming polls) may be approved provided certain safeguards are met and approval is received from the community water service authority. These safeguards will include a registry of the well by the owner of the supply which also provides for inspection of the well.

8. The authorities which operate community sewage treatment plants shall be responsible for not over-allocating their available flow. The County Health Department shall provide oversight through subdivision plat approval and moratorium enforcement.

9. Within those areas designated as W-1, W-2, S-1 or S-2 in Chapters 3 and 4, all new subdivisions shall provide central water and sewerage facilities, which shall be connected to the existing public or community system.

10. Within those areas designated W-2 or S-2, the Planning Commission may require new subdivisions to provide central water and sewerage lines. These lines shall be connected to the community system when it becomes available and any interim individual systems shall be abandoned.

11. Within areas designated as W-3, W-4, S-3, or S-4, new subdivisions will not normally be required to provide community water and sewerage facilities, unless the nature of the subdivision is such that the absence of a community system would endanger water quality or the public health. Subdivision approvals within these areas shall be conditioned on the abandonment of individual systems and connection to a community system within one year of when it becomes available.

12. Areas not designated as S-1 through S-4 or W-1 through W-4 are agricultural and open space areas. Community water and sewerage facilities will not be provided in these areas, and non-agricultural development within them is discouraged.

13. The use of innovative wastewater collection, treatment and disposal systems is encouraged for existing problem areas only for replacement systems and shall be reviewed on a case-by-case basis. Shared Facilities do not conform to the goals of the Comprehensive Development Plan and will not be approved. A management entity for shared facilities will not be established.

14. Use of flow reducing fixtures to achieve water conservation and reduced sewage generaton shall be required in accordance with State law. This shall be enforced by the Caroline County Plumbing Department through permitting and inspection procedures.

15. Marina sites shall be evaluated to determine necessary sanitary facilities on on a case-by-case basis.

16. Amendments to the Comprehensive Water and Sewerage Plan shall be considered from time-to-time as requested. Any person desiring an amendment shall submit a written request to the County Commissioners in a form prescribed by the County Planner.

17. In the subdivision of land where on-site sewerage disposal systems are to be utilized, maximum allowable lot sizes may be required by State or Federal law; e.g., Agricultural Preservation Act. Mimimum lot sizes may be established in other laws; e.g., groundwater protection criteria. The requirements shall be met.

1.3 CONSISTENCY WITH THE COMPREHENSIVE PLAN

The goals and policies stated above are consistent with the Caroline County Comprehensive Plan. Listed below are summarized objectives from the Comprehensive Plan which are related to water and sewerage development.

1. New manufacturing should be encouraged in accessible locations near towns where utilities are available or can be made available. Housing development should be guided within or adjacent to existing communities.
2. Retail and commercial development should be enhanced through new housing development near the County's major towns.
3. Encourage new housing in and adjacent to the towns to reduce pollution dangers and lessen the costs of community facilities.
4. Protect the County's agricultural lands by avoiding a random development pattern.

1.4 CONSISTENCY WITH STATE GOALS

The goals and policies stated in this plan are consistent with those of the Department of the Environment, as found in Environmental Article 9, Subtitle 5 Annotated Code of Maryland. Briefly, that Subtitle states that ample water supply and wastewater collection be available; that wastewater be adequately treated before discharge to State waters; that adequate sanitary facilities be provided at marinas; and that consideration be given to related aspects of land use, zoning, population estimates, engineering and economic factors, and all plans for privately-owned water and sewerage facilities.

1.5 ORGANIZATION

At the present time, five of the County's incorporated towns own and operate water and sewerage systems: Denton, Federalsburg, Preston, Greensboro and Ridgely. The County Commissioners do not currently own or operate any community water and sewerage systems. Numerous privately owned community water systems are located at mobile home facilities. Two of the facilities also operate sewerage systems.

The existing organizational structure for Caroline County is shown in Figure 1-A. The County Commissioners are responsible for adoption of the Comprehensive Water and Sewerage Plan. They are advised in planning matters by the Planning Commission and the County Planner.

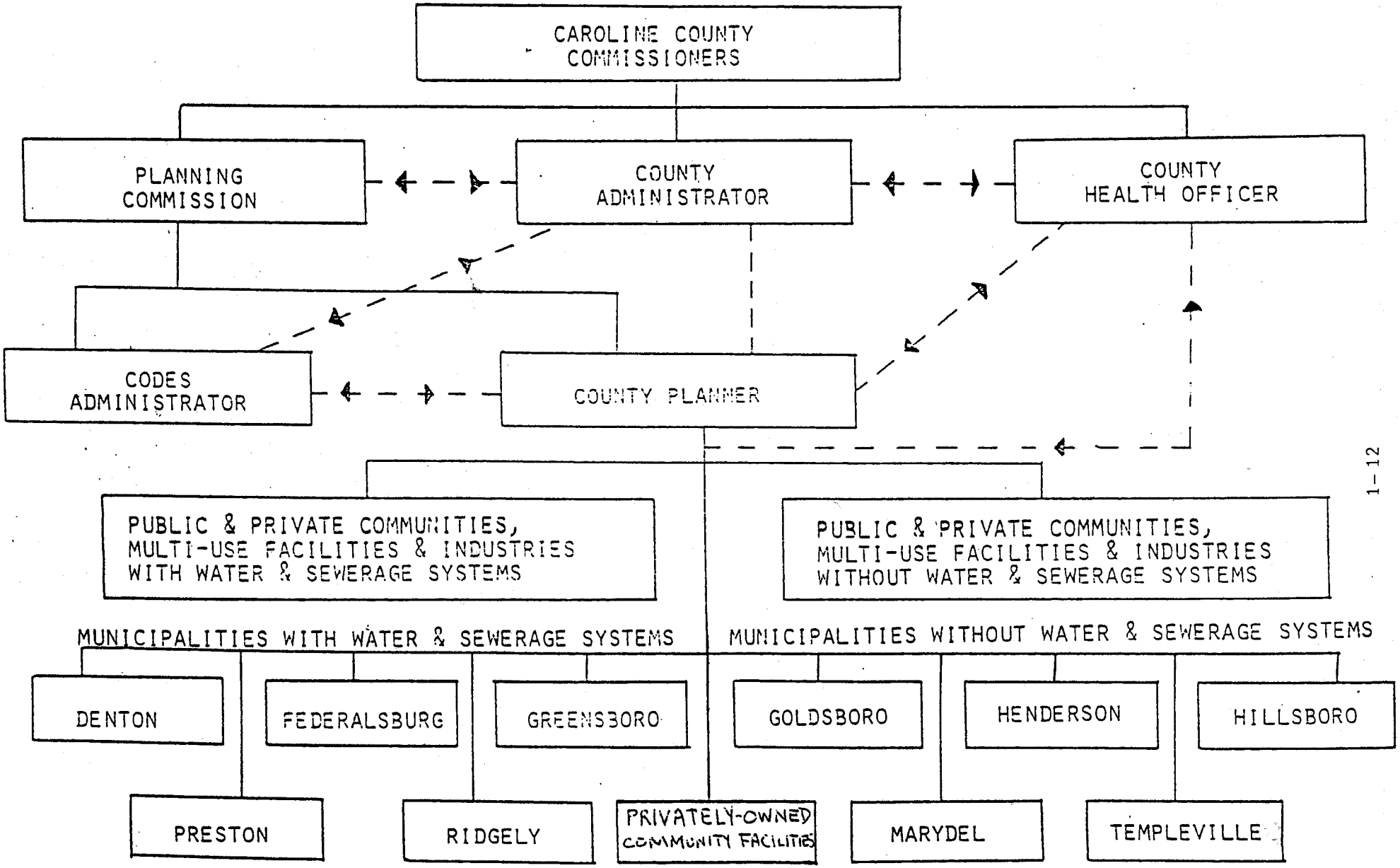
Section 201 Sewerage Facility studies often include recommendations that some form of public sewerage service be provided outside the current limits of incorporated towns. This service could take various forms, including, but not limited to:

1. Annexation into and service by the towns.
2. Creation of separate sanitary district commissions to provide the service for each area.
3. Creation of a County Department of Public Works to provide for the service, possibly combined with sanitary districts.
4. Service by private sewerage companies.

At the present time, the Caroline County Commissioners do not plan to establish any sanitary districts, and consider annexation into and service by the towns as the preferred method of providing sewerage service.

EXHIBIT 1-A

ORGANIZATIONAL CHART FOR WATER AND SEWERAGE PLANNING IN CAROLINE COUNTY



CHAPTER 2

BACKGROUND INFORMATION

CHAPTER 2

BACKGROUND INFORMATION

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CHAPTER 2

BACKGROUND INFORMATION

2.1 INTRODUCTION

Comprehensive water and sewer facilities planning must be based upon a thorough understanding of five broad interrelated factors. These are:

Physical characteristics, including topography, soil characteristics, surface drainage, and groundwater resources.

Population trends, including past and anticipated future population distribution, population density, age distribution, migration patterns and other social phenomena.

Economic conditions, including past and anticipated future employment opportunities, present commuting patterns to work centers in other areas, industrial development patterns, local finances and other elements.

Housing conditions, including type of housing, location, age, structural condition and manner of occupancy.

Land use, including past land use trends, present land use patterns, zoning practices and future land use plans.

The purpose of this chapter is to examine the role and importance of each of these factors to Caroline County and its water and sewerage needs.

2.2 GENERAL

Caroline County, Maryland, is located in the central portion of Maryland's Eastern Shore. The county is bordered by Queen Anne's County to the north, Talbot County to the west, Dorchester County to the south and Sussex and Kent Counties, Delaware, to the east. Caroline is the only county on the Eastern Shore which does not border either the Chesapeake Bay or the Atlantic Ocean as shown on Exhibit 2-A.

2.3 CAROLINE COUNTY PHYSICAL CHARACTERISTICS

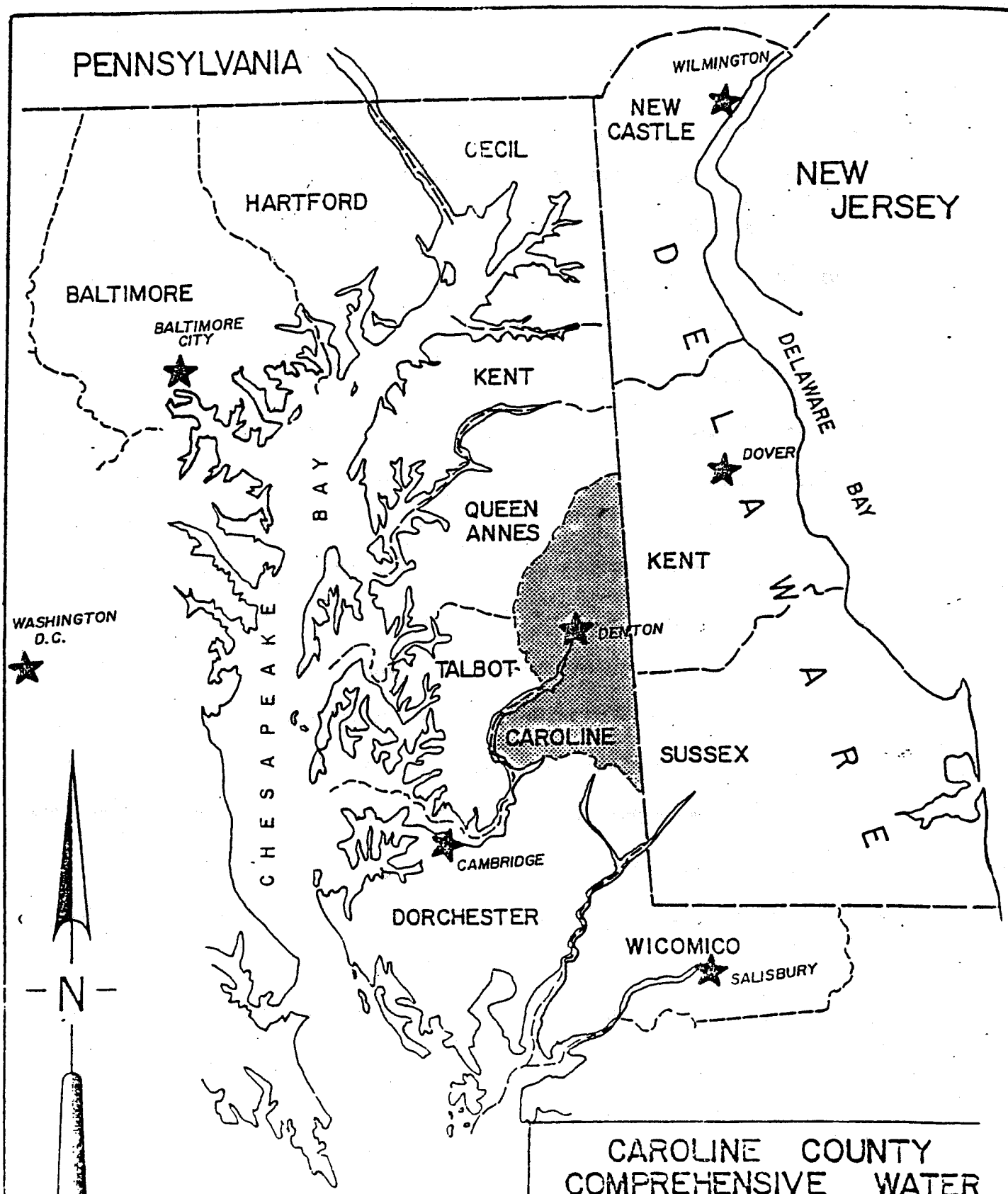
2.3.1 Topography

Caroline County lies entirely within the Atlantic Coastal Plain, a broad expanse of flat unconsolidated sediments ranging from New England to Florida.

Within Caroline County, changes in elevation are slight. The lowest point in the county, approximately 5 feet above sea level, is in the village of Choptank; the highest, 77 feet above sea level, is approximately 1/2 mile north of Mount Zion. Most of the county is at least 40 feet above sea level.

2.3.2 Surface Water

Caroline County has an abundance of streams, creeks and rivers. All ultimately drain into the Chesapeake Bay through two major watersheds -- the Choptank River Area (sub-basin code 02-13-04) and the Nanticoke River Area (sub-basin code 02-13-03).



CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN

LOCATION MAP

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS - SURVEYORS
CAMBRIDGE, MARYLAND 21613

EXHIBIT 2-A

The Choptank River Area drains approximately 90% of the land area in Caroline County through either the main stem of the river or Tuckahoe and Hunting Creeks -- two primary tributaries of the Choptank forming the western and southern boundary of the county. Marshyhope Creek, a major branch of the Nanticoke River, drains the southeastern corner of the county. The drainage areas of each of the two watersheds and major subbasins are delineated in Exhibit 2-B.

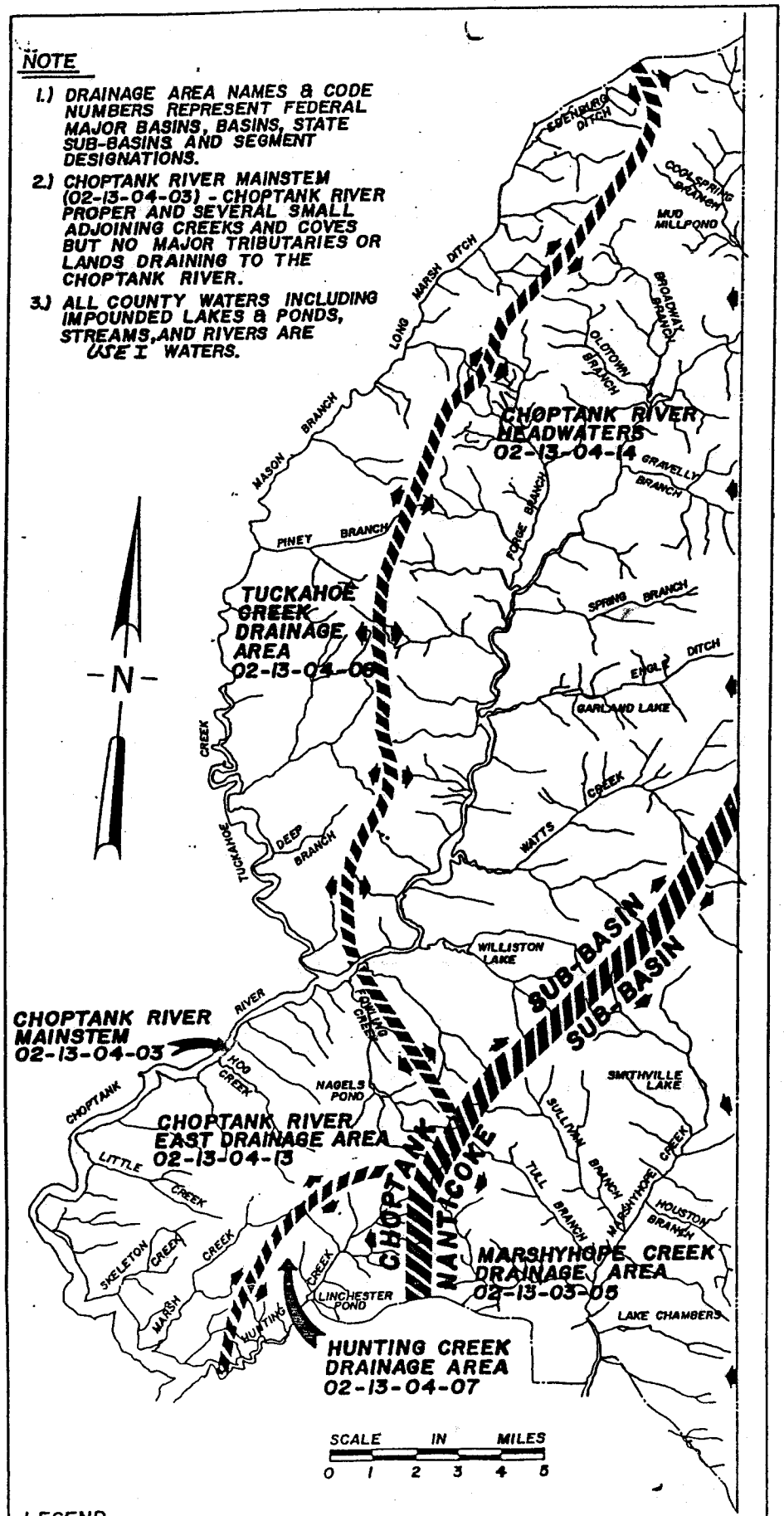
Since the main rivers are tidal and slow-flowing and the terrain is gentle, tidal and fresh water marshes occur throughout the county. Tidal marshes are especially evident along Tuckahoe Creek south of Hillsboro, the Choptank River south of Denton, and along Marshyhope Creek.

These marsh or wetland areas are a unique habitat for many forms of plant and animal life. They are feeding and nesting grounds for many species of waterfowl and spawning grounds or nurseries for fish and other aquatic life. Because of their poor drainage, marsh and wetland areas are not suited for intensive development especially with conventional on-site sewage disposal systems such as septic tanks.

2.3.3 Soils

Caroline County may be divided into four major soil associations:

1. Sassafras-Galestown-Fallsington
2. Sassafras-Fallsington-Woodstown
3. Fallsington-Woodstown-Sassafras
4. Pocomoke-Fallsington



CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN
SURFACE DRAINAGE PATTERNS WATER QUALITY CRITERIA
ANDREWS, MILLER & ASSOC., INC. ENGINEERS-SURVEYORS CAMBRIDGE, MARYLAND 21613

Each of the four soil associations is shown on Exhibit 2-C, along with its general suitability as seepage fields for individual septic tanks.

The Sassafras-Galestown-Fallsington soil association consists of moderately coarse textured soils that are predominantly well drained to excessively drained. This association generally runs in a band through the center of Caroline County from its southwest corner to the Delaware line, south of Route 313. It is bounded on the west by the Choptank River and on the east by the Marshyhope Creek divide. Another small segment of the Sassafras-Galestown-Fallsington soil association extends along the county's southern boundary and up the east side of Marshyhope Creek. Altogether, the association covers 144 square miles or approximately 45 percent of the county. The soils are easily tilled and well suited for truck farming and residential development with conventional on-site sewage disposal systems.

The Sassafras-Fallsington-Woodstown soil association includes moderately coarse textured soils that vary from well drained to poorly drained. Within Caroline County, this association is bounded by Tuckahoe Creek on the west, the Choptank River on the east, and Cherry Lane & River Road on the north. The association covers approximately 67 square miles, or 21 percent of Caroline County. Crop yields are higher than in the Sassafras-Galestown-Fallsington soil association because of the Sassafras-Fallsington-Woodstown soil association's greater ability to retain moisture and nutrients. In general, the soils in this assocciation are also well suited for septic tank absorption fields.

The Fallsington-Woodstown-Sassafras soil association is comprised of moderately coarse, poorly drained soils. In general, this association includes the area west of Route 313 and south of Burrsville, an area of approximately 54 square miles or 17 percent of Caroline County. In this association, forests and scrubland are common. Extensive drainage systems are necessary before the soils can be desirable cropland. Percolation characteristics for underground sewage disposal systems range from poor to bad.

The Pocomoke-Fallsington soil association is predominantly poorly drained or very poorly drained clayey soil ranging from Greensboro northward into Delaware. It covers approximately 54 square miles, or 17 percent of Caroline County's land area. Many portions of the association have never been cleared or have reverted to woodland. Here too, extensive drainage systems are needed before the area can be used for general farming. Percolation for underground sewage disposal is also poor.

In general, of the 211 square miles in Caroline County, approximately 66 percent is well suited for septic tanks and underground sewage disposal. The following table, developed by the USDA Soil Conservation Service, delineates soil characteristics and features affecting the operation of septic systems. These characteristics and features are:

1. depth to seasonal high water tables
2. incidence of flooding
3. permeability within the first four feet of soil
4. slope

SOIL ASSOCIATIONS AND SEPTIC TANK SUITABILITY

SUITABLE:

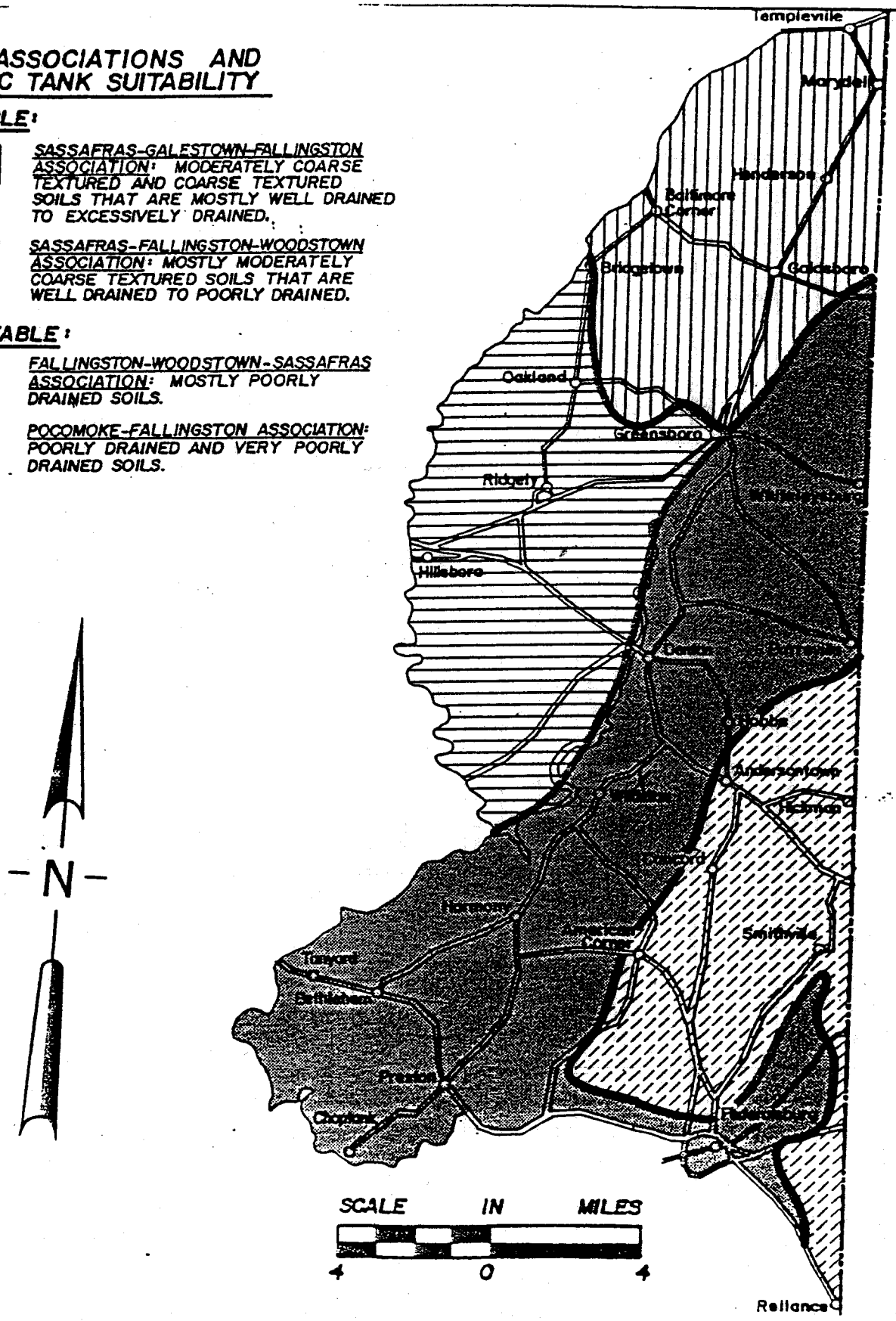
SASSAFRAS-GALESTOWN-FALLINGSTON ASSOCIATION: MODERATELY COARSE TEXTURED AND COARSE TEXTURED SOILS THAT ARE MOSTLY WELL DRAINED TO EXCESSIVELY DRAINED.

SASSAFRAS-FALLINGSTON-WOODSTOWN ASSOCIATION: MOSTLY MODERATELY COARSE TEXTURED SOILS THAT ARE WELL DRAINED TO POORLY DRAINED.

UNSUITABLE:

FALLINGSTON-WOODSTOWN-SASSAFRAS ASSOCIATION: MOSTLY POORLY DRAINED SOILS.

POCOMOKE-FALLINGSTON ASSOCIATION: POORLY DRAINED AND VERY POORLY DRAINED SOILS.



NOTE:
SOIL IDENTIFICATIONS TAKEN FROM "SOIL SURVEY OF CAROLINE COUNTY, MARYLAND", JANUARY, 1964.

CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

GENERAL SOIL MAP

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

EXHIBIT 2-C

TABLE 2-1
CAROLINE COUNTY SOIL LIMITATIONS FOR SEPTIC TANK ABSORPTION FIELDS

		Soil Features and Estimated Degree of Limitations				
Soil Name	Period to Test	Soil Drainage Class	Flooding	Permeability within first four feet	Slope	Overall Soil Rating
Bayboro silt loam	Jan. 1–Apr. 30	Severe	Moderate*	Severe	Slight	Severe
Bibb silt loam	Do not test/serious flooding	Severe	Severe	Severe	Slight	Severe
Elkton	Jan. 1–Apr. 30	Severe	Slight	Severe	Slight	Severe
Fallsington soils	Jan. 1–Apr. 30	Severe	Slight	Slight	Slight	Severe
Galestown loamy sands	Anytime	Slight	Slight	Slight**	Slight	Slight
Johnston loam	Do not test/serious flooding	Severe	Severe	Slight**	Slight	Severe
Klej loamy sands	Jan. 1–Apr. 30	Moderate	Slight	Slight**	Slight	Moderate
Lakeland	Anytime	Slight	Slight	Slight**	Slight	Slight
Made land	Varies	Varies	Varies	Varies	Varies	Varies
Matapeake silt loams, 0% to 5% slopes	Anytime	Slight	Slight	Slight to Moderate	Slight	Slight to Moderate
Matapeake silt loams, 15% to 30% slopes	Anytime	Slight	Slight	Slight to Moderate	Severe	Severe
Mattapex silt loams, 0% to 5% slopes	Jan. 1–Apr. 30	Moderate	Slight	Severe	Slight	Severe
Mattapex silt loams, 15% to 30% slopes	Jan. 1–Apr. 30	Moderate	Slight	Severe	Severe	Severe
Mixed alluvial lands	Do not test	Severe	Severe	Variable	Slight	Severe
Much	Do not test	Severe	Severe	Slight	Slight	Severe
Othello silt loams	Jan. 1–Apr. 30	Severe	Slight	Severe	Slight	Severe

TABLE 2-1 (CONTINUED)
CAROLINE COUNTY SOIL LIMITATIONS FOR SEPTIC TANK ABSORPTION FIELDS

		Soil Features and Estimated Degree of Limitations				
Soil Name	Period to Test	Soil Drainage Class	Flooding	Permeability within first four feet	Slope	Overall Soil Rating
Plummer loamy sands	Feb. 1–Apr. 30	Severe	Slight	Slight**	Slight	Severe
Pocomoke loams	Feb. 1–Apr. 30	Severe	Moderate*	Slight	Slight	Severe
Pocomoke sandy loams	Feb. 1–Apr. 30	Severe	Moderate*	Slight	Slight	Severe
Portsmouth silt loams	Feb. 1–Apr. 30	Severe	Moderate*	Severe	Slight	Severe
Sassafras loams, 0% to 5% slopes	Anytime	Slight	Slight	Slight	Slight	Slight
Sassafras loams, heavy substratum	Anytime	Slight	Slight	Slight	Slight	Slight
Sassafras loamy sands	Anytime	Slight	Slight	Slight**	Slight	Slight
Sassafras loamy sands, 15% to 30% slopes	Anytime	Slight	Slight	Slight**	Severe	Severe
Sassafras sandy loams	Anytime	Slight	Slight	Slight	Slight	Slight
Sassafras sandy loams, heavy substratum, 0% to 5% slopes	Anytime	Slight	Slight	Slight	Slight	Slight
Swamp	Do not test	Severe	Severe	Variable	Slight	Severe
Tidal Marsh	Do not test	Severe	Severe	Variable	Slight	Severe
Woodstown loams, 0% to 2% slopes	Feb. 1–Apr. 30	Moderate	Slight	Slight	Slight	Moderate
Woodstown loams, moderately eroded	Feb. 1–Apr. 30	Moderate	Slight	Slight	Slight	Moderate

*Subject to ponding of short duration in depressions lacking outlets.
**These soils are so sandy and rapidly permeable throughout that the possibility of polluting nearby streams, lakes, springs, and shallow wells is a special consideration.

The degree of limitation of each characteristic or feature is set forth as either slight, moderate or severe.

Soil characteristics and features rated slight will generally not affect septic tank-soil absorption systems when properly installed.

Soil characteristics and features rated moderate will generally adversely affect the functioning of septic tank-soil absorption systems. Correction of these characteristics and features will increase installation and maintenance costs.

Soil characteristics and features rated severe will adversely affect, and often prevent, the functioning of septic tank-soil absorption systems.

In some instances, a limiting characteristic can be overcome, though only with special design and engineering, and at considerable cost.

An overall soil rating based on the most limiting soil characteristic or feature is shown on the table along with the recommended period to perform percolation tests. The percolation test dates correspond to that portion of the year when water tables are expected to be highest in each soil.

Together, analysis of the general soil associations and the specific limitations for septic tank sewage disposal systems of each soil form a major element in Caroline County's water and sewer planning.

2.3.4 Surface Water Quality

The State of Maryland has established water quality standards and water pollution regulations (COMAR 26.08.02) for all the State's waters. The purpose of the standards and regulations is to enhance water quality wherever it has deteriorated or is deteriorating, to maintain water quality where it is satisfactory and to protect legal and reasonable water uses.

All waters throughout Maryland must be protected for use as water contact recreation, for fish and other aquatic life, and for wildlife. These waters are officially designated as Use I waters. No waters within Caroline County are designated as the more stringent Use II, or Shellfish Harvesting Waters. No waters in Caroline County are designated as Use III, Natural Trout Waters, or Use IV, Recreational Trout waters.

The following table (Table 2-2) summarizes water quality criteria for Caroline County waters.

Most of Caroline County's streams and creeks presently meet the prescribed standards for Use I or Use II waters, however, some areas are restricted and are described in more detail in Chapter 4. Present land uses and future development both must be strictly controlled and monitored to prevent pollution and insure that these water quality standards are maintained in the future.

TABLE 2 - 2

WATER QUALITY CRITERIA

SUB BASIN (CODE)	WATER QUALITY CLASSIFICATIONS	EXTENT
NANTICOKE RIVER (02-13-03)	Use I Waters: Water contact recreation, fish, other aquatic life and wildlife.	All waters
CHOPTANK RIVER (02-13-04)	Use I Waters: Water contact recreation, fish, other aquatic life and wildlife	All waters
	Use II Waters: Shellfish harvesting (None within Caroline County)	All estuarine portions of the Choptank River below a line from Bow Knee Point to Wright Wharf

2.3.5 Groundwater

Like other portions of the Atlantic Coastal Plain, Caroline County contains a series of unconsolidated sedimentary deposits overlying older crystalline rocks.

These sediments are nearly flat layers of sand, gravel, silt and clay. The sand and gravel deposits are the most significant aquifers or water bearing sediments in Caroline County.

Since Caroline County's soils and topography are ill-suited for large water storage reservoirs, it is easier and more efficient to develop the county's confined aquifers which contain an abundance of good quality water. The water quality and supply characteristics of each aquifer are discussed in Chapter 5.

2.3.6 Physical Characteristics Summary

Caroline County, Maryland possesses a unique array of physical assets which must be an integral component in the county's water and sewer program. Major features to be considered are:

Topography - to insure the development of economical gravity flow, sewage collection and disposal systems wherever possible.

Marshes - to insure preservation and protection of Caroline County's valuble marsh and wetlands.

Soil Capability - to guide new residential development and other land uses to the best sites for future development.

Surface Water - to prevent land use which would detract from the present high quality of Caroline County waters.

Groundwater - to protect Caroline County's many and varied water reserves and insure their optimal development.

2.4 CAROLINE COUNTY POPULATION TRENDS

An understanding of the current make-up of Caroline County's population and future conditions is essential for planning water and sewerage needs.

2.4.1 Population Growth

During the 1980's Caroline County experienced a 17 percent increase in population and an average annual growth rate consistent with that of the 1970's. (Table 2-3). Caroline's rate of population increase was greater than for the State of Maryland and three other Eastern Shore counties (Table 2-4).

Most of this growth occurred in the unincorporated areas of the county resulting in the suburbanization of some previously rural areas of the county. The composition of this increase consists of retired persons and families with members employed outside of Caroline County, particularly in Talbot County and Delaware.

However, during the 1980's the population of the county's towns stabilized after a period of decline. Annexations of adjoining areas and active housing programs should result in population growth in several of the towns in the next decade. This is encouraging, since one of the goals of the Caroline County Comprehensive Plan is to have new development in and around the incorporated towns and existing population centers.

TABLE 2-3

CAROLINE COUNTY POPULATION GROWTH: 1930-1990

YEAR	Population	Average Annual Growth Rate During the Previous Decade
1930	17,387	
1940	17,549	0.1%
1950	18,234	0.4
1960	19,462	0.7
1970	19,781	0.2
1980	23,143	1.7
1990	27,035	1.7
1930-1990 Annual Growth Rate =		0.9%

Source: U.S. Census

Table 2-4
Population Growth: 1980-1990

	1990 Population	Percent Change 1980 - 1990
State of Maryland	4,781,468	13.4
Caroline	27,035	16.8
Cecil	71,347	18.1
Dorchester	30,236	(- 1.3)
Kent	17,842	6.9
Queen Anne's	33,953	33.1
Talbot	30,549	19.3
Wicomico	74,339	15.2

Source: 1980 and 1990 U.S. Census

2.4.2 Population Distribution

The 1990 population for Caroline County is 27,035. The county's ten incorporated towns contain 32.8 percent of the total population. The five incorporated towns which have central water and sewerage facilities contain 30.5 percent of the county's total population. The other 2.3 percent reside in the five incorporated towns without central water and sewerage facilities. The remaining 67.2 percent of the county's total population live outside of the towns and few of these residents have access to central water and sewerage systems.

According to the 1990 U.S. Census, 17.3 percent of Caroline County's population is non-white. However, the minority population is not distributed uniformly throughout the county, with a higher percentage in the towns of Denton and Federalsburg and in the Preston Election District (Table 2-5).

TABLE 2-5
POPULATION - 1980 AND 1990
CAROLINE COUNTY

	Total 1980	Total 1990	1980 -1990 Change Number	Percent	Race - 1990 White	Black	Other	Hispanic Origin
County Total	23,143	27,035	3,892	17	22,355	4,459	221	231
City or Town								
Denton	1,927	2,977	1,050	54.5	2,014	934	29	31
Federalsburg (pt)	1,952	2,365	413	21.2	1,595	745	25	24
Goldsboro	188	185	-3	-1.6	183	2	0	0
Greensboro	1,253	1,441	188	15.0	1,239	181	21	19
Henderson	156	66	-90	-57.7	66	0	0	0
Hillsboro	180	164	-16	-8.9	160	1	3	0
Marydel	152	143	-9	-5.9	133	3	7	3
Preston	498	437	-61	-12.2	413	15	9	15
Ridgely	933	1,034	101	10.8	954	51	29	14
Templeville (pt)	36	66	30	83.3	64	2	0	0

Source: U.S. Census Bureau, 1990 Census

TABLE 2 - 5A

CAROLINE COUNTY POPULATION

E.D.	1980 Census	1990 Census	Increase (Number)	Increase (Percentage)	Percentage of County Increase
1	2,338	2,888	550	23.5%	14.1%
2	3,371	4,097	726	21.5%	18.7%
3	4,595	5,600	1,005	21.9%	25.8%
4	3,293	3,476	183	5.6%	4.7%
5	4,136	4,443	307	7.4%	7.9%
6	1,565	1,904	339	21.7%	8.7%
7	2,178	2,700	522	24.0%	13.4%
8	1,667	1,927	260	15.6%	6.7%
TOTAL	23,143	27,035	3,892	16.8%	100.0%

Caroline County

Election

Districts

ELECTION
DISTRICT

1. HENDERSON
2. GREENSBORO
3. DENTON
4. PRESTON
5. FEDERALSBURG
6. HILLSBORO
7. RIDGELY
8. AMERICAN CORNER

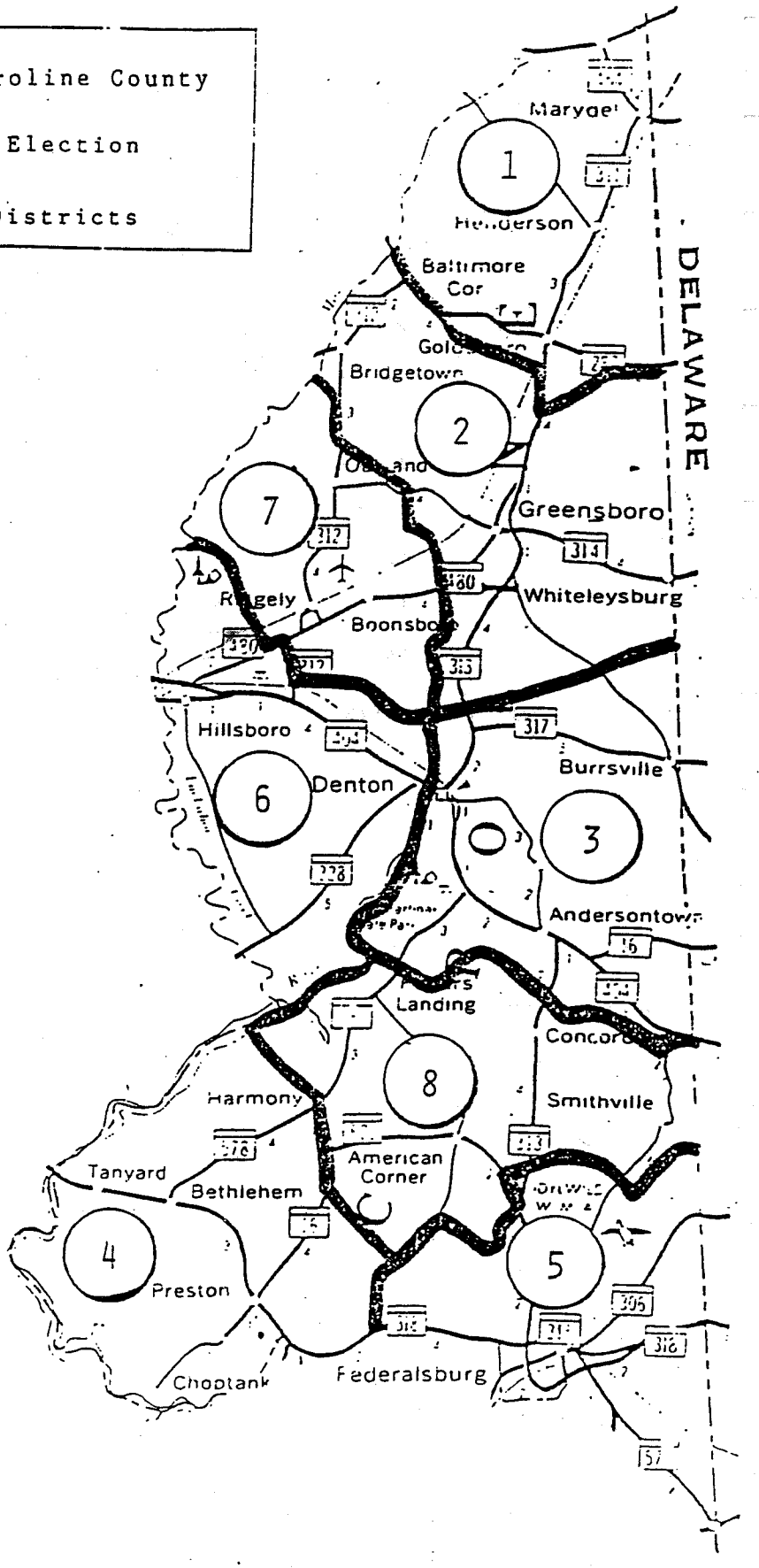


EXHIBIT 2-D

2.4.3 Income

Income is one measure of economic well-being. Levels of family income tend to be lower in rural areas than in urban ones. The Maryland Eastern Shore counties follow this pattern. In 1989, all Shore counties had lower median incomes than the State of Maryland. Median income indicates a theoretical point where half the population earns more and half earns less.

Median family income in Caroline County in 1989 was $27,758, seventy percent of the State of Maryland median. In 1979 the Caroline County Median family income was 74 percent of the State median and in 1969 only 67 percent. A significant drop has occurred in the past ten years.

1989 Income

	Median Household Income	Rank	Average Household Income	Rank	Per Capita	Rank
Allegany	$21,546	24	$28,339	22	$11,393	22
Anne Arundel	45,147	5	52,176	4	18,509	5
Baltimore	38,837	11	47,725	7	18,658	4
Baltimore City	24,045	21	31,415	20	11,994	20
Calvert	47,608	3	52,872	3	17,521	6
Caroline	27,758	18	32,058	19	11,926	21
Carroll	42,378	7	47,338	8	16,320	12
Cecil	36,019	13	40,904	14	14,314	16
Charles	46,415	4	50,334	5	16,555	11
Dorchester	24,922	20	30,273	21	12,437	19
Frederick	41,382	9	46,690	11	16,571	10
Garrett	22,733	23	28,019	23	10,124	24
Harford	41,680	8	47,277	9	16,612	9
Howard	54,348	1	61,833	2	22,704	2
Kent	30,104	15	40,491	15	15,488	13
Montgomery	54,089	2	68,007	1	25,591	1
Prince Georges	43,127	6	48,606	6	17,391	8
Queen Anne's	39,190	10	47,162	10	17,489	7
St. Mary's	37,158	12	41,887	13	14,454	14
Somerset	23,379	22	27,482	24	10,232	23
Talbot	31,885	14	45,096	12	18,755	3
Washington	29,632	16	34,003	18	12,970	18
Wicomico	28,512	17	35,097	16	13,425	17
Worcester	27,586	19	34,965	17	14,341	15
Maryland	39,386		47,905		17,730	

1990 U.S. Census

2.4.4 Population Projections

Caroline County's population was very stable for the several decades, prior to 1970 rising by only 2,394 inhabitants, 13.7 percent, in the forty year period of 1930 to 1970. However, during the period between 1970 and 1980, Caroline County experienced an accelerated growth rate, which continued to 1990. The reasons for this expansion are varied but include better access across the Bay Bridge, national trends toward early retirement, an increasing desire on the part of many young adults to live in rural settings and significant employment opportunities in nearby counties, especially Talbot, as well as increasing employment in Caroline County.

Population projections for the county as determined by the Department of State Planning are presented on Table 2-6. Also shown are population projections for each of the county's election districts. The greatest growth areas are expected to be the Denton and Greensboro Election Districts as the trends established in the 1970's are continued. The remaining areas of the county are expected to grow more moderately.

2.4.5 Population Trends Summary

Caroline County's population is expected to continue to increase substantially in coming years. This population growth will have the following primary characteristics:

Older workers and retirees

Caroline County's proportion of children will continue to decline or stabilize; however, the number of adults and retirees will increase. These changes will affect the types and number of public institutions in the county. New schools may not be constructed; but more geriatric care facilities may be needed.

Increased suburbanization

Even though the county encourages new residential development in the towns, much of the new growth will be outside their corporate boundaries. These suburban homes will probably be single-family residences on large lots, one acre or greater in size. Such large lot residential areas are difficult to serve economically with central water and sewerage if on-site systems are inadequate or fail.

TABLE 2-6

CAROLINE COUNTY POPULATION PROJECTIONS

YEAR	1970	1980	1990	1995	2000	2005	2010
CAROLINE COUNTY	19,781 (a)	23,143 (a)	27,035 (a)	28,500 (b)	29,700 (b)	30,600 (b)	31,500 (b)
ELECTION DISTRICT: (c)							
1. HENDERSON	1,887	2,338	2,689	2,843	2,960		
2. GREENSBORO	2,817	3,371	3,974	4,177	4,348		
3. DENTON	3,771	4,595	5,304	5,551	5,772		
4. PRESTON	2,675	3,293	3,846	4,049	4,220		
5. FEDERALSBURG	4,037	4,136	4,397	4,519	4,600		
6. HILLSBORO	1,313	1,565	1,826	1,948	2,028		
7. RIDGELY	1,882	2,178	2,439	2,561	2,641		
8. AMERICAN CORNER	1,399	1,667	1,928	2,050	2,131		

(a) U.S. Census
(b) Maryland Office of Planning (June, 1990)
(c) Caroline County Planning Department (July, 1983)

TABLE 2-7

CAROLINE COUNTY LAND USE

	Existing Land Use 1983		Zoned Land 1983		Comprehensive Plan 1985	
	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total
Residential	5,000	2.4	19,000	9.1	7,000	3.4
Commercial, Industrial	1,200	0.6	5,000	2.4	4,000	1.9
Agricultural & Open Space	199,200	95.5	184,600	88.5	196,723	94.6
Surface Water	3,200	1.5	-------	----	277	0.1
TOTAL	208,600	100.0	208,600	100.0	208,000	100.0

2.5 CAROLINE COUNTY LAND USE

2.5.1 Existing Land Use

The historic development pattern of Caroline County was influenced primarily by the availability of waterways. Settlement proceeded up the navigable rivers, as they provided the only reliable means of transportation. Towns were established along these rivers and at their heads of navigation as sailing ships moved inland as far as Denton, Greensboro, Hillsboro, and Federalsburg.

As settlement increased, farmland was cleared farther from the rivers and a pattern of local roads developed. However, water transportation remained dominant until the end of the 19th Century with the arrival of the railroads. This era saw the development of towns such as Henderson, Marydel, Goldsboro, and Ridgely, which were located on rail lines or at major road intersections rather than on a navigable stream.

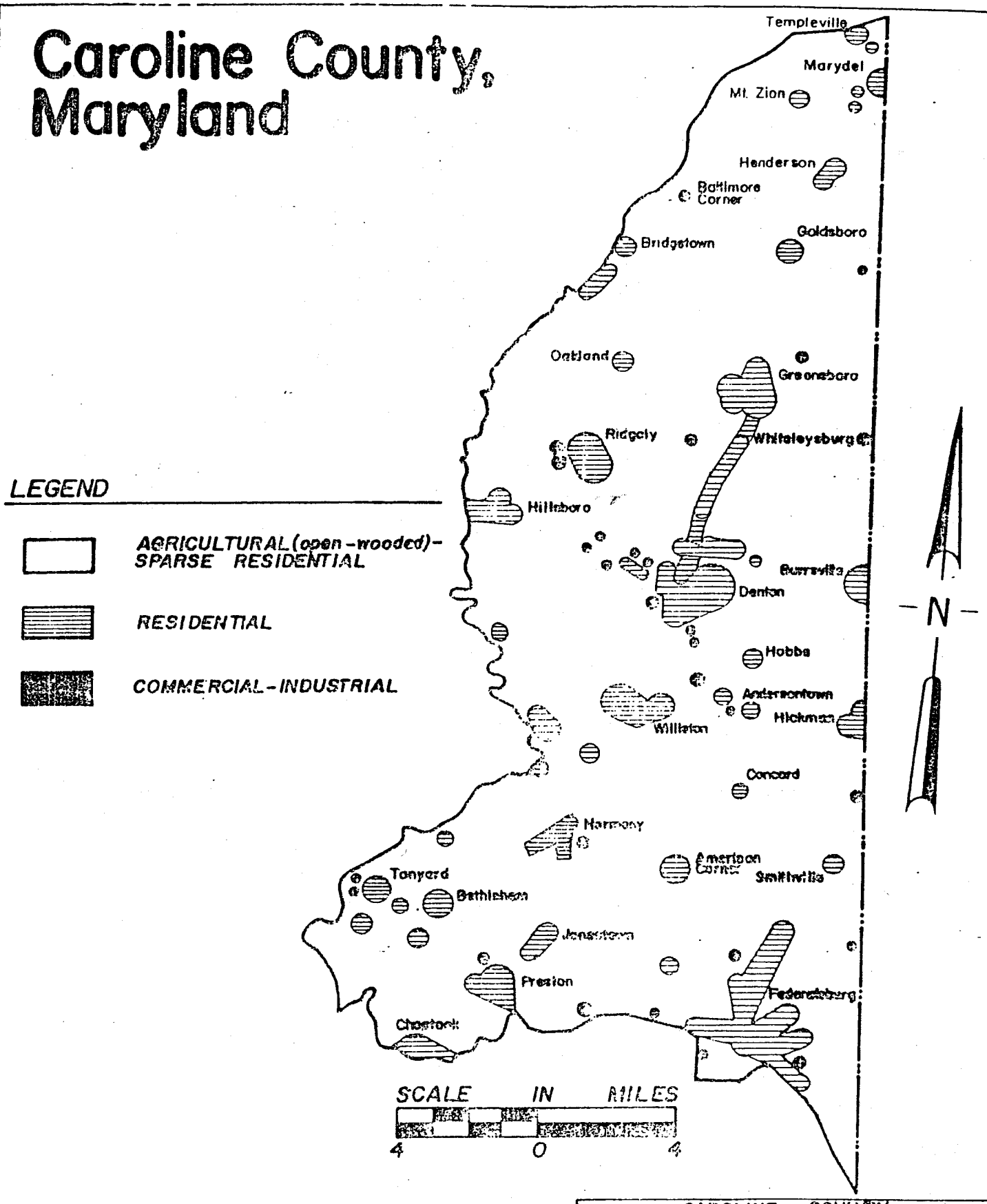
Through most of its history the land use pattern in Caroline County has consisted of small closely developed towns surrounded by sparsely populated farmland. Except for farmsteads, housing was concentrated in the towns. By necessity, people lived close to their places of employment. In addition to the towns, many small unincorporated villages or "corners" developed, which also provided some access to stores and services.

The advent of automobile transportation began a process of decentralization and scattering of development. As transportation improved, residential development began to spread out from the towns, especially in strips along major highways.

The residential development along Maryland Route 313 between Denton and Greensboro is an example of this development pattern. Such attenuated strip development is costly to serve with central water and sewage systems.

In recent years a new development trend towards larger scale subdivisions has occurred. Through the planned action of the subdivider or developer, an entire community could emerge in a relatively few years. This trend has been especially apparent since the preparation of the first Comprehensive Plan in 1968. Also, the 1986 Comprehensive Development Plan is further assisting in encouraging growth at or within existing centers of population density.

Caroline County, Maryland



CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

EXISTING LAND USE

1983

EXHIBIT 2-F

MOBILE HOME PARKS

CAROLINE COUNTY, MD

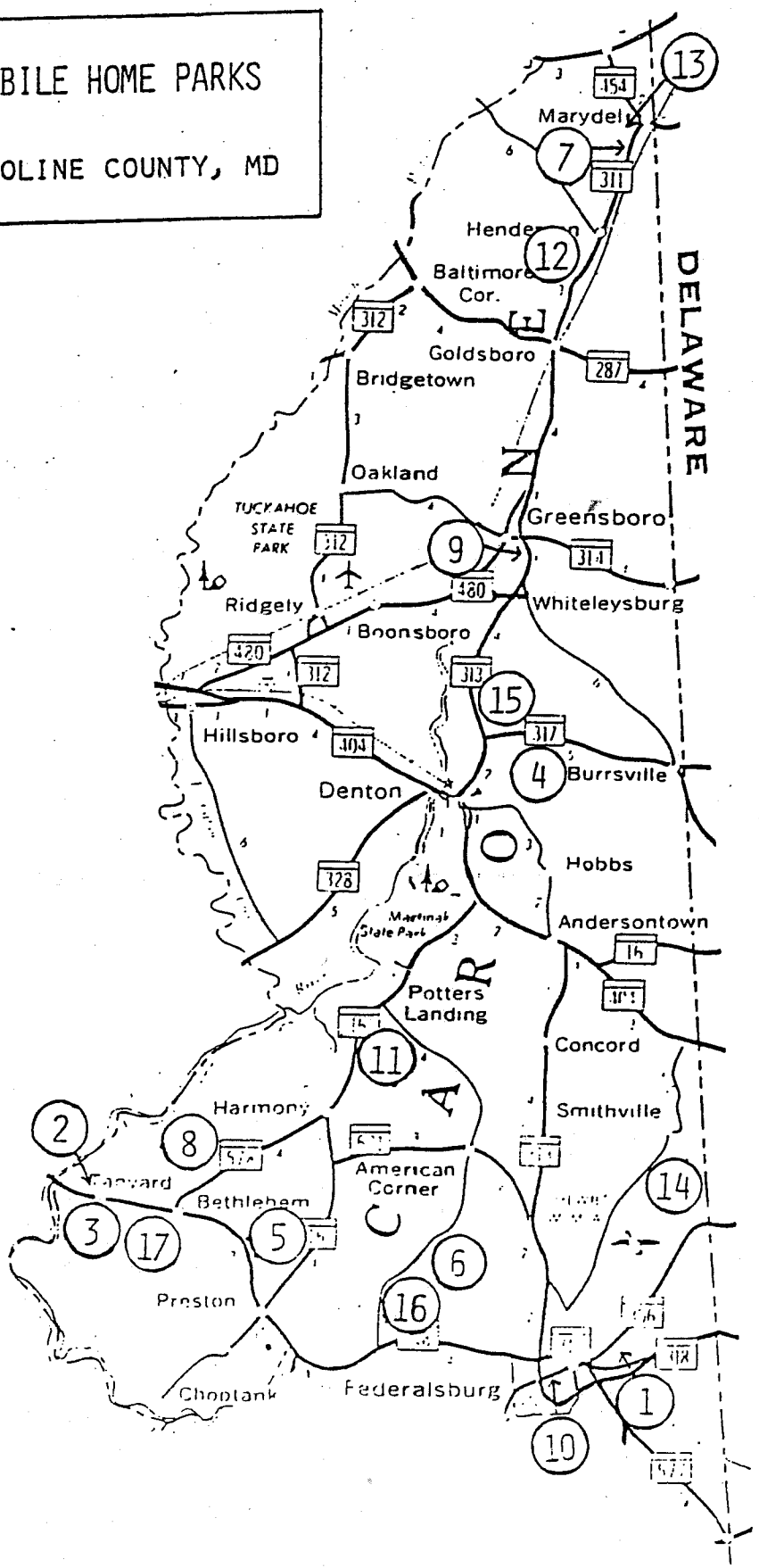


EXHIBIT 2-J

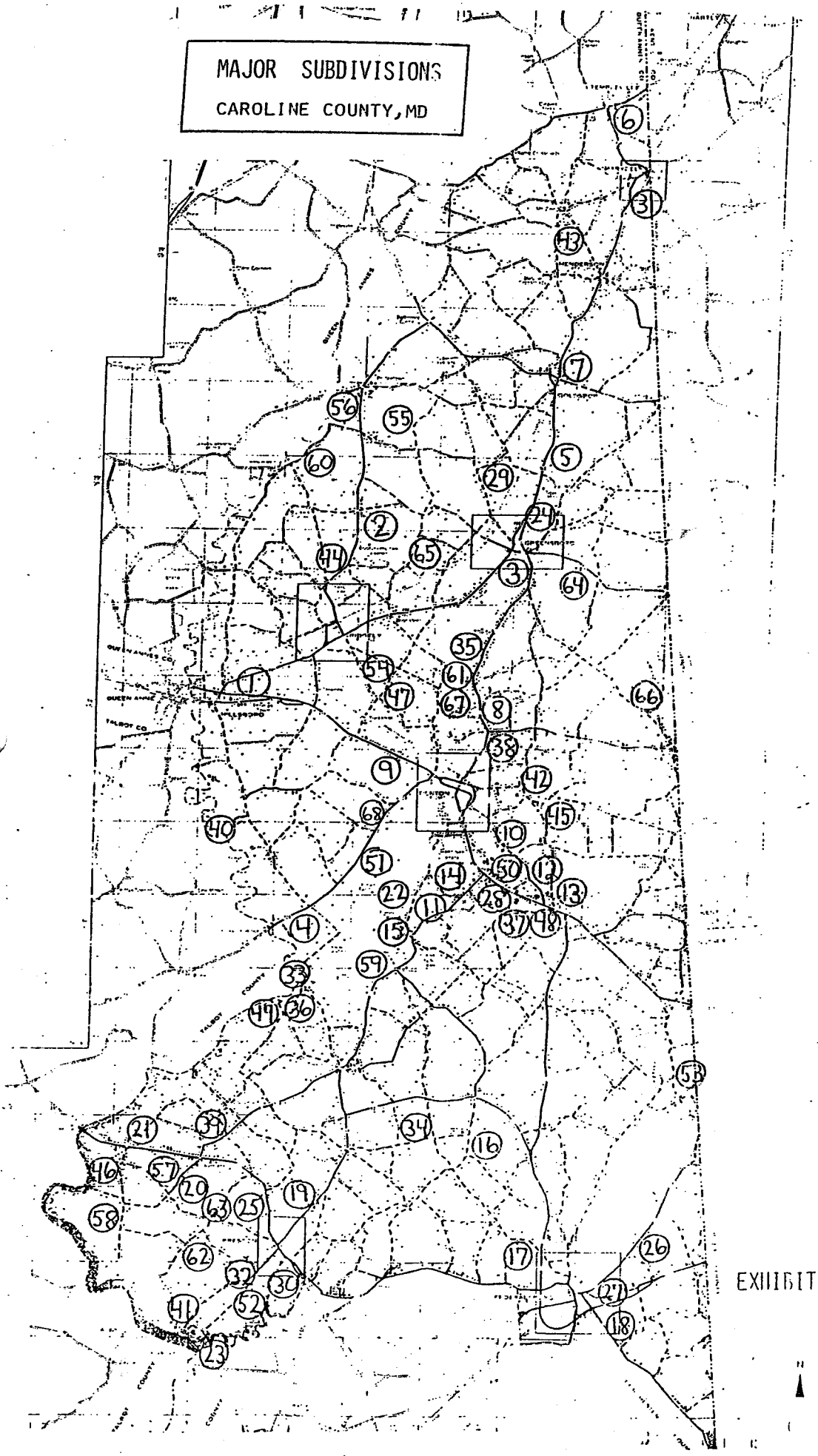


EXHIBIT 2-

TABLE - 2-8 CAROLINE COUNTY MAJOR SUBDIVISION INVENTORY

ID No.	Subdivision Name	Developer	E.D.	No. Of Lots	Zoning	Acre-rage	Date Recorded
1	Hillsboro Estates I	Hillsboro Joint Venture	6	10	R-1	19	9/19/73, 12/13/74, 6/23/75, 5/4/76
	Hillsboro Estates II	Hillsboro Joint Venture	6	16	R-1	32	5/27/76, 12/15/82
2	Oakland Acres	James H. Lynch	7	36	R	196	7/3/73, 11/19/75, 4/1/80
3	Fox Grape Farms	John Wood Logan, Sr.	2	179	R-1	198	9/17/68, 3/17/70, 5/14/70, 10/29/71, 10/6/72, 3/29/73, 7/24/73
4	Tuckahoe Springs I	Third Haven Heights, Inc.	6	45	R-1	56	9/30/70, 4/2/71, 11/30/76
	Tuckahoe Springs II	Third Haven heights, Inc.	6	42	R-1	55	
5	Choptank Pines	Joseph Horwath	2	51	R	391	6/29/73, 3/22/74
6	Harmon Subdivision	H & H Builders	1	17	R-1	12	8/15/73
7	Fair Haven Farms	Major John A. Dorman	1	26	R-1	17	6/7/71
8	Riding Acres	Gustav Pfutzner	2	9	R	30	5/14/73, 5/31/73
9	Lor-J Estates	E. Ray Kitchen	6	16	R	22	9/19/73
10	Stafford Heights	Mike Stafford	3	23	R-1	16	7/13/73
11	Fairways	Vernon J. Nily, etal.	3	58	R-1	43	5/17/73
12	Herring Run	Barney Nuttle	3	47	R	60	10/31/72
13	Briar Patch	Barney Nuttle	3	22	R	36	11/10/72
14	Country Club Estates	Barney Nuttle	3	28	R	30	1/28/66, 9/22/69
15	Williston Heights	Ira Daffin	3	27	R-1	26	2/16/66
16	Federalsburg Estates	FMR Dev. & Housing Corp.	8	87	R	117	6/15/73
17	Bradley Heights	The Anthony Co.	5	12	R	53	1/30/73, 9/24/73 2/27/80

Plan2.1/jh

TABLE - 2-8 CAROLINE COUNTY MAJOR SUBDIVISION INVENTORY (CONT'D)

ID No.	Subdivision Name	Developer	E.D.	No. Of Lots	Zoning	Acre-rage	Date Recorded
18	Meadowbrook Park	Avery W. Ownes	5	87	R R-1	56	6/12/70,6/14/73, 7/15/74
19	Nelpine Heights	C & P Development, Inc.	4	26	R-1	13	6/30/69
20	Cedar Lane	KAL, Inc. - Alden Lobert	4	37	R-1	23	8/19/71, 10/13/72 6/5/74
21	Woodside	The Anthony Co.	4	38	R-1	22	1/11/65
22	Long Branch Acres	W&P Enterprises	3	19	R-1	18	11/10/72
23	Belmont Acres	M.P. Voshell & M.R. Mezick	4	31	R-1	21	1/18/65, 10/25/67, 11/9/72, 6/19/73
24	Hollywood Acres	Lawrence A. Taylor	2	5	R	24	11/5/73
25	Westview	Mary T. A. Johnson	4	25	R-1	10	10/16/63
26	Liberty Heights	The Anthony Co.	5	12	R	60	10/13/72, 2/28/80
27	Nor-J (Len-Lar)	Norman & James Glime	5	23	R-1	11	10/26/72
28	Jans Woods	Donald N. Trice	3	7	R	8	4/3/74
29	Hill View	James H. Lynch	2	5	R	9	11/16/73
30	Reeds Villa	W. Francis Ewing	4	7	R-1	4	1/18/74, 4/16/75
31	Hyeland Estates	Arthur Reedy	1	12	R	18	2/27/74
32	Sandy Grove	Joseph H. Secrist, Jr.	4	5	R	20	3/26/74
33	Gilpins Point Farm	Paul A. Croll	8	10	R	16	4/29/66, 7/27/70
34	Richardson Heights	The Anthony Co.	8	5	R	32	4/11/74, 3/16/78
35	Choptank Overlook	Fred Wampler and Charles Smith	2	36	R	126	10/24/75, 5/21/76, 9/30/76, 6/18/79

TABLE - 2-8 CAROLINE COUNTY MAJOR SUBDIVISION INVENTORY (CONT'D)

ID No.	Subdivision Name	Developer	E.D.	No. Of Lots	Zoning	Acre-rage	Date Recorded
36	New Hope - I	Hope M. Newton	8	10	R	12	10/16/74
	New Hope - West	Hope M. Newton	8	8	R	16	4/5/76
37	Kaufman Property	Edgar Kaufman	3	18	R	7	1/9/67
38	Williamson Co.	Nuttle Lumber & Coal Co.	3	16	R-1	10	4/29/71
39	Van Schaik Property	Leonard Van Schaik	4	23	R,R-1	25	5/21/63, 8/18/69
40	Country Life Estates	John W. Logan, Et.Al.	6	35	R	68	8/15/74, 11/24/75
41	Lust Property	Thomas W. Lusk	4	12	R-1	7	7/1/70
42	Calvert Acres	Calvert Merriken, Jr.	3	15	R	36	11/24/75, 2/16/79
43	Brownmiller Property	Paul M. Brownmiller	1	7	R	33	2/13/74
44	Ja-Mar Acres	James H. Lynch	7	9	R	17	10/14/74, 9/14/76
45	Donsland	Donald Trice	3	13	R	17	9/3/75, 8/10/79
46	Tammuxzena Shores	B. Hope Harrison, Inc.	4	9	R	10	1/16/73, 10/30/75 9/21/79
47	Ridgely Acres	James H. Lynch	7	8	R	18	10/9/75, 7/14/80
48	Legion Heights	The Anthony Co.	3	14	R	50	2/19/76, 10/2/81
49	Lyn-Oaks	James H. Lynch	4	11	R	16	4/15/76
50	Double Hills Estates	Edgar Kaufman	3	16	R	61	7/9/76
51	Choptank Plantation	Edgar Kaufman	6	55	R	192	3/23/76
52	Hunting Creek	Harry H. Rieck, Jr.	4	9	R	16	6/21/76, 1/25/77

TABLE - 2-8° CAROLINE COUNTY MAJOR SUBDIVISION INVENTORY (CONT'D)

ID No.	Subdivision Name	Developer	E.D.	No. Of Lots	Zoning	Acre-rage	Date Recorded
53	Woodenhawk Pines	Calvert Merriken, Jr.	8	8	R	14	4/21/77, 6/15/77
54	Holly Acres	Stanley Hutchinson	7	5	R	20	9/6/77
55	High Land Farm	Harry Hoch, Jr.	2	10	R	17	11/9/77
56	M & MEverlea-Sec. I	Mike Tuneff	2	5	R-1	13	6/9/78
57	Tanyard Estates - I	Everett Ramsburg	4	22	R	44	12/19/77
58	Two Johns Estates - I	Kal, Inc. - Alden Lobert	4	11	R	16	2/17/78
59	Two Johns Estates - II	Two Johns Corp. - James H. Lynch	8	42	R	68	6/2/78
59A	Lyn-Woods I	Two Johns Corp - " " "	8	5	R	23	8/28/78, 6/5/79
60	Lyn-Woods II	James H. Lynch	7	40	R	119	6/16/78
60A	Griffith Subdivision	James H. Lynch	7	26	R	60	4/22/80
61	Jones Subdivision - I	Olin & Ruth Griffith	2	6	R-1	2	10/5/65
62	Jones Subdivision - II	Samuel E. Jones Estate	4	7	R	15	9/19/64
63	White Oaks	Samuel E. Jones Estate	4	9	R	13	9/19/64
64	Boonland	Richard Rostien	2	8	R	32	9/11/79, 3/6/81
65	Lohmeyer Subdivision	Wayne R. Butler	7	5	R	17	4/10/80
66	Passapae Landing	Charles W. Lohmeyer	3	3	R	3	10/16/80
67	Kath Chase Subdivision	Calvert C. Merriken, Jr.	2	61	R-1	33	11/14/80, 7/13/81
68		Fritz W. Mezger	6	6	R	14	2/11/82

TABLE 2-9 CAROLINE COUNTY BUILDING PERMITS ISSUED 1970-1991

NEW HOMES

E.D.	1970-74	1975-79	Subtotal 1970-79	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Subtotal 1980-89	1990	1991	TOTAL
1	64	60	124	4	8	3	3	9	6	8	19	16	17	93	10	8	235
2	88	145	233	21	8	12	17	8	21	35	50	49	38	259	31	40	563
3	102	143	245	16	22	10	11	22	15	15	37	40	32	220	29	13	507
4	160	137	297	12	12	11	10	18	13	10	26	29	32	173	20	17	507
5	77	61	138	7	14	3	4	5	16	8	17	11	10	95	9	11	253
6	64	94	158	20	7	1	10	14	16	24	25	32	37	186	21	19	384
7	52	126	178	14	7	5	10	12	11	17	23	22	31	152	28	22	380
8	49	83	132	7	10	13	12	9	18	18	13	18	21	139	16	15	302
TOTAL	656	849	1,505	101	88	58	77	97	116	135	210	217	218	1,317	164	145	3,131

MOBILE HOMES

E.D.	1970-74	1975-79	Subtotal 1970-79	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Subtotal 1980-89	1990	1991	TOTAL
1	23	33	56	7	6	7	4	6	4	4	5	4	2	49	3	2	110
2	19	26	45	8	7	8	-	8	5	4	-	3	3	46	4	1	96
3	16	11	27	-	4	-	3	1	2	4	1	3	1	19	3	-	49
4	6	12	18	-	3	4	4	1	3	1	1	1	1	19	-	3	40
5	20	11	31	3	7	5	1	3	4	2	2	1	1	29	3	5	68
6	5	12	17	3	1	1	2	2	1	2	2	1	-	15	-	3	35
7	8	10	18	4	4	4	4	3	-	2	1	-	2	24	2	1	45
8	23	21	44	3	3	5	2	4	7	3	3	2	-	32	3	1	80
TOTAL	120	136	256	28	35	34	20	28	26	22	15	15	10	233	18	16	523

- Does not include incorporated towns
- Mobile home figures are for individual lots only and do not include Mobile Home Parks
- "New Homes" include stick-built, modular and double-wide homes

PREPARED BY: Caroline County Planning Department

Table 10

CAROLINE COUNTY SUBDIVISION STATISTICS

Cummulative Total	1977-79	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTAL
Number of Major Subdivisions	64	67	67	68	68	68	69	69	73	78	84	90	94	
Number of Lots	1603	1700	1701	1708	1708	1712	1731	1729	1821	1850	1885	1968	2005	
Acreage	2908	3017	3020	3034	3034	3042	3083	3086	3352	3628	3695	3920	4032	
Number of Lots with Home Built	499	527	553	567	594	620	659	716	814	889	969	1020	1068	
Percentage	31%	31%	33%	33%	35%	36%	38%	41%	45%	48%	51%	52%	53%	
Vacant Lots	1104	1173	1148	1141	1114	1092	1072	1013	1007	961	916	948	937	
Number of Homes Built in Caroline County	515	101	88	58	77	97	116	135	210	217	218	164	145	2141
Number of Homes Built in Major Subdivisions	119*	28	26	14	27	26	39	57	98	75	80	51	48	688
Percentage of New Homes	37%*	28%	30%	24%	35%	27%	34%	42%	47%	35%	37%	31%	33%	32%
Number of Subdivision Major Building Lots Approved Per Year	165	97	1	7	--	4	19	-2	92	29	35	83	37	567
Acreage	374	109	3	14	--	8	41	3	266	276	67	225	112	1498
Number of Subdivision Minor Building Lots Approved	309	67	66	51	54	77	89	52	92	141	146	125	71	1340
Acreage	892	212	173	146	125	200	242	210	370	503	610	594	245	4522
Average Acres Per Lot	2.88	3.17	2.62	2.87	2.31	2.60	2.72	4.04	4.02	3.57	4.18	4.75	3.45	3.37

May 1986: Updated June 1992

Note: Home construction in unincorporated areas of Caroline County only

* Does not include 1977

Source: Caroline County Planning Department

Percentage of new subdivision lots 1977-1985 containing less than 2 acres equals 402/713 or 56.4%

Percentage of new subdivision lots in 1986-1991 containing less than 2 acres equals 163/627 or 26.0%

TABLE II - 11

MAJOR SUBDIVISION STATISTICS

CAROLINE COUNTY, MARYLAND

Year	Lots Recorded	Acreage Subdiv.	Av. Lot Size	Cum. Lot Total	Cum. Acres
1963	34	21	0.62	34	21
1964	16	28	1.75	50	49
1965	69	39	0.57	119	88
1966	61	66	1.08	180	154
1967	18	7	0.39	198	161
1968	88	66	0.75	286	227
1969	40	27	0.68	326	254
1970	146	122	0.84	472	376
1971	55	37	0.67	527	413
1972	167	218	1.31	694	631
1973	377	753	2.00	1,071	1,384
1974	135	522	3.87	1,206	1,906
1975	68	197	2.90	1,274	2,103
1976	168	431	2.57	1,442	2,534
1977	46	99	2.15	1,488	2,633
1978	102	239	2.34	1,594	2,872
1979	13	36	2.77	1,603	2,909
1980	97	109	1.12	1,704	3,017
1981	1	3	3.00	1,701	3,021
1982	7	14	2.00	1,708	3,034
1983	0	0	--	1,708	3,034
1984	4	8	2.00	1,712	3,042
1985	19	41	2.16	1,731	3,083
1986	-2	3	--	1,729	3,086
1987	92	266	2.89	1,821	3,352
*1988	29	276	9.52	1,850	3,628
1989	35	67	1.91	1,885	3,695
1990	83	225	2.71	1,968	3,920
1991	37	112	3.02	2,005	4,032
TOTAL	2,005	4,032	2.01		

*w/o large lot sub'd
22 lots, 123 acres, 5.59 Avg.

TABLE 2-12
CAROLINE COUNTY MOBILE HOME PARKS

County ID No.	Name and Vicinity	Owner and Address	Units Occupied	Health Department Approved Sites	E.D.
3	Liberty Trailer Park Liberty Road (Rt. 315) at Town Line Federalsburg, MD 21632	Lawrence E. Passwaters 410 Liberty Road Federalsburg, MD 21632	21	21	5
12	Swann's Trailer Park Route 331 at Dover Bridge Preston, MD 21655	Paul T. Ewing, Sr. 9353 Ocean Gateway Easton, MD 21601	6	6	4
5	Mobile Manor Park Rt. 331, 1 mile east of Tanyard Preston, MD 21655	Franklin W. Prettyman Rt. 1, Box MM-1 Preston, MD 21655	59	59	4
2	Tower Mobile Court 1 mile east of Rt. 313 on Rt. 317 Denton, MD 21629	Fred E. Jackson 7848 Oakdale Avenue Baltimore, MD 21237	22	22	3
4	Nelpine Mobile Home Park Rt. 16, 1 mile north of Preston	David Allen Ewing 9206 Chapel Road Rt. 2, Box 738 Easton, MD 21601	20	20	4
6	Meadow Brook Court Laurel Grove Road at Nichols near Federalsburg, MD	Linda B. McKean Rt. 1, Box 161 Federalsburg, MD 21632	19	20	8
15	Hilltop Trailer Park Rt. 311, 1/2 mile south of Marydel, MD	Arthur Reedy P.O. Box 153 Marydel, MD 21649	16	16	1
8	Holly Cove Harbor Mobile Home Park Newton Rd. near Smithson, Preston, MD 21655	Holly Cove, Inc. c/o L. Paige Marvel 1800 Mercantile Bank & Trust Baltimore, MD 21201	19	20	4
9	Taylors Trailer Park Rt. 313 south of Greensboro Boundary Greensboro, MD	Denny Taylor Rt. 1, Box 261 Greensboro, MD 21639	21	23	2

TABLE 2- 12
CAROLINE COUNTY MOBILE HOME PARKS (CONT'D.)

County ID No.	Name and Vicinity	Owner and Address	Units Occupied	Health Department Approved Sites	E.D.
1	Caroline Acres Mobile Home Park Rt. 311 near Henderson, MD	Edmund Racz P.O. Box 40 Henderson, MD 21640	136	171	1
16	The Cedars Mobile Home Park Lepore Rd. near Rt. 311 Marydel, MD 21649	James F. Walker Rt. 1, Box 93B Marydel, MD 21649	91	85	1
14	Russels Trailer Park Hrynko Rd. near Houston Branch Rd. Federalsburg, MD 21632	Tull Enterprises Bridgeville, DE 19933	9	12	5
10	Shady Acres Ischer Road Federalsburg, MD 21632	Sarah A. Trice Rt. 2, Box 382-1 Federalsburg, MD 21632	9	9	5
18	Marsh Creek Trailer Park Rt. 331, 1 mi. east of Tanyard Preston, MD 21655	Charles F. Harrison 27893 Waverly Rd. Easton, MD 21601	15	15	4
7	Tilghman Bros. Mobile Home Park W. Central Ave. Federalsburg, MD 21632	John F. Tilghman, Jr. 500 Academy Avenue Federalsburg, MD	20	20	5

CHAPTER 3

WATER

CHAPTER 3

WATER

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CHAPTER 3

WATER

3.1 GENERAL

A description of existing, planned, and future requirements for water service areas in Caroline County is included in this Chapter. Also, supplemental maps, tables and references are provided to give a comprehensive picture of existing and future water usage in the County. Water use predictions are based on past and present use, population projections, industrial and agricultrual trends, public reaction to expansion, soil conditions, and political and financial contingencies. A complete discussion regarding groundwater and surface water resources may be found in the U.S. and Maryland Geological Survey's Bulletin 18 - The Water Resources of Caroline, Dorchester and Talbot Counties, referenced in the Appendix of this Plan.

Approximately two (2) percent of the County is covered with water (surface water and marsh and/or swamp) and because of the comparatively low lying and flat topography, it is currently economically unfeasible for this surface water to be used as a source for impounded water supplies. Therefore, the prime source of potable water for Caroline County is groundwater and the needs of the County are such that this source will be adequate throughout this century.

Caroline County is a part of the Atlantic Coastal Plain which is a wedge-shaped mass of unconsolidated sedimentary deposits overlying older hard crystalline rocks of Pre-Cambrian or early Paleozoic age. Overlying these rocks are the nearly flat layers of sand, gravel, silt, and clay which constitute the unconsolidated sedimentary deposits. The sand and gravel deposits comprise the important water bearing sediments for the County. These deposits lie in stratified layers and are classified in series or groups according to geological age. Starting with the youngest formation, then progressively to the oldest formation, the groups are: Holocene, Pleistocene, Upper and Middle Miocene, Chesapeake, Eocene, Paleocene, Upper Cretaceous, and Lower Cretaceous. Each of these groups is subdivided into formations generally referred to as aquifers or aquicludes. Aquifers are water yielding beds or strata while aquicludes are confining beds of strata lying between aquifers which yield water very slowly due to the low porosity of their soils. The major aquifers in Caroline County listed according to geological age and starting with the oldest are:

1. Patapsco-Raritan
2. Magothy
3. Aquia Greensand
4. Piney Point
5. Calvert
6. Choptank
7. Pleiocene-Pleistocene (Columbia)

A detailed description of the water quality and quantity in each of these groundwater resources is provided in Chapter 5.

3.2 GROUNDWATER RESOURCES (See Chapter 5)

3.3 SURFACE WATER RESOURCES

Surface water covers nearly two percent of Caroline County's total area of 325 square miles. This valuable resource has experienced limited development in the past as a major water source because of an abundance of good quality groundwater and extremely high costs involved in the storage, treatment and transportation of surface water. Presently, there are no impounded surface water reservoirs used for potable water supplies in the County. However, there are several recreational and irrigation impoundments.

The Choptank and Nanticoke Rivers are two of the largest surface drainage channels on Maryland's Eastern Shore and both are fed by drainage from Caroline County. Of all the streams in the County, only the Marshyhope Creek (main tributary of the Nanticoke River) above Federalsburg and the Choptank River above Greensboro have suitable hydrologic characteristics that might permit development for an adequate water supply.

Due to the nature of the terrain (elevations as high as 80' above mean sea level and pronounced relief) in the northern part of the County, the tributaries and streams are flashy at times of intense rainfall near the headwaters while the main courses of the two rivers are quite sluggish downstream. Complete record gaging stations operated by State and Federal agencies are located in the County; one on the Choptank River at Greensboro and one on the Marshyhope Creek at Federalsburg. In addition, three partial record stations are located in the County for monitoring the Choptank.

From long-term records of these stations it has been determined that an average stream discharge of 1.0 to 1.2 cubic foot per second per square mile is representative of the area.

Both the Choptank and Nanticoke Rivers were studied to determine the tidal effect on the salinity (dissolved solids) of the streams. For the Choptank, the farthest point upstream at which a significant increase in specific conductance (185 micro-ohms) and chloride concentrations (31 ppm) at high tide occurred was at Denton, approximately 26 miles upstream from the mouth of the River, with normal salinity variations as related to tide cycles occurring no further upstream than Tuckahoe Creek near Matthews. No tidal influence on chloride concentrations were found in the Marshyhope Creek upstream of Eldorado.

The water quality of the Choptank River is found to be generally good but mildly enriched with occasionally elevated algae levels, particularly in the segment from Goldsboro to Tuckahoe Creek. Water quality problems occur in some of the creeks, including Marshyhope and Tuckahoe, where a high concentration of nutrients is discharged from a local sewage treatment plant or from non-point sources. Violations of bacteriological standards are also found in some segments, usually in the upper reaches.

The quality of the water in the non-tidal reaches of the streams is generally favorable for most agricultural and recreational uses without costly treatment. At present, it is usually less costly to develop groundwater supplies for potable water use rather than store, treat and transmit surface water. However, this concept should be reviewed constantly because of the vast potential for an alternative water supply as the County grows and possibly depletes or otherwise adversely affects the now abundant groundwater supplies.

3.4 EXISTING AND FUTURE COUNTY WATER USE

3.4.1 Caroline County

All water used in the County for domestic consumption and industrial-commercial usage is currently obtained from wells. Individual residential wells presently serve 68 percent of the County's total population (1989 population estimate - 23,653). These individual wells are generally adequate throughout the County except for those withdrawing water from the shallower aquifers, which are susceptible to

groundwater pollution due to high nitrate levels. Community water systems serve the remainder of Caroline County's population.

The following sections discuss existing water use and existing community and multi-use systems in each Election District. Detailed information on these systems is contained in Table 3-2 (Inventory of Existing Public and/or Private Community and Other Multi-Use Water Supply Systems), Table 3-3 (Inventory of Existing Public and/or Private Community and Other Multi-use Water Treatment Facilities), Table 3-4 (Inventory of Water Problem Areas) and Table 3-5 (Projected Water Demands and Planned Capacity for Existing and/or Planned Public or Private Community Water Systems).

Future water systems in Caroline County are described in detail in Table 3-5 (Projected Water Demands and Planned Capacity for Existing and/or Planned Public or Private Community Water Systems) and Table 3-6 (Immediate, 5 and 10 Year Priorities for Water Development). A general discussion is included below:

BY 1995 - About 33 percent of Caroline County's total population, or approximately 9,263 residents wil be served by community water systems. This service is expected to be created by the routine extension of existing community systems. The Town of Henderson is in the final stages of preparation for construction of a new community system.

BY 2000 - The area of West Denton is expected to have a community water system. Even with this new system and the routine extensions of the other communities, the County is expected to still have approximately 35 percent of its total population or 9,671 residents serviced by central community systems.

BY 2005 - Thirty-five percent of the County's total population or 9,941 residents are expected to be serviced by central community water systems.

3.4.2 Election District No. 1 (Henderson)

The Henderson Election District (1990 population - 2888) is located in the extreme northern portion of the County. Eighty-four percent of the current population, including all residents of the incorporated towns of Templeville, Marydel, and Goldsboro obtain water from individual residential wells.

Templeville (Exhibit 3-H) - The majority of residents of this town (1990 population - 66) obtain water from shallow wells of depths of 15-30 feet that penetrate the Pleistocene aquifer. A few deeper wells, also in use, penetrate the Choptank or Calvert aquifers at depths of 50-150 feet. A community system, privately owned, serves Harman Subdivision (19 lots), with water from the Piney Point Aquifer.

Marydel (Exhibit 3-I) - Individual shallow wells that penetrate the Pleistocene aquifer serve the majority of residents (1990 population - 143), however, a few obtain water from deeper wells that penetrate the Aquia Greensand aquifer. One hundred percent of the septic systems are discharging inadequately treated wastewater onto the ground or into the groundwater where the shallow wells are located. The wells and septic systems are subject to flooding and cross-contamination due to very high groundwater levels. A preliminary study for a water system has been done.

Henderson (Exhibit 3-J) - The residents of Henderson (1990 population - 166) obtain water from wells of varying depths. A few residents along Route 311 near the southern boundary of town are served by a line from the Caroline Acres Mobile Home Park. These sources will be improved by a new community system in 1993.

Goldsboro (Exhibit 3-K) - The residents of Goldsboro (1990 population - 185) obtain water from shallow wells that penetrate the Choptank aquifer at depths of 20-40 feet. In this area, a high percentage of shallow wells go dry during times of extremely dry weather and are slowly being replaced with deep wells. Many of the shallow wells are less than 100 feet from septic systems penetrating groundwater. Nitrate levels continue to rise due to the septic system contamination. The septic systems are discharging inadequately treated wastewater onto the ground, into the groundwater, or into the storm drainage system where the shallow wells are located. The wells and septic systems are subject to cross-contamination. The residents refuse to consider public systems) to address the health risk.

There are presently four community water systems in Election District No.1;

1. Harmon Subdivision
2. Caroline Acres Mobile Home Park
3. Hilltop (Shults) Trailer Park
4. The Walkers Mobile Home Park

A new community water system is planned only for Henderson. Goldsboro must investigate improving water supply to properties still using unconfined aquifer wells and deep wells that may be in close proximity to septic systems.

There are two non-community water systems in the Election District;

1. Lake Bonnie Campground
2. Holiday Park Campground

3.4.3 Election District No. 2 (Greensboro)

The Greensboro Election District (1990 population - 4097) currently has 65 percent of its population serviced by individual residential water systems. There are two community water systems in this Election District:

1. Town of Greensboro (1990 population - 1441)
2. Taylor's Trailer Park

The Town of Greensboro is currently working to rehabilitate its water supply system. Water mains will be upgraded to proper size, replacement and new fire hydrants will be installed, and mains will be looped. A new .150 MG water storage tank will replace the existing .050 MG tank. Water service is planned for a commercial annexation north of Town, as well as for two new subdivisions.

No new community water systems are planned for this Election District. There are five non-community water systems in this Election District.

1. Caroline Health Center
2. Godfreys Migrant Labor Camp
3. Walkers Market
4. VFW Post 7937
5. Greensboro Elementary School

3.4.4 Election District No. 3 (Denton)

Individual residential water systems currently serve 47 percent of the Denton Election District's total population (1990 population - 5,600). The remaining percentage of this District's population is serviced by the following public or private community water systems:

1. Town of Denton (1990 population - 2977)
2. Tower Mobile Court

No new community water systems are planned.

There are ten non-community water systems in the Election District.

1. McConnells Fun Food
2. Martinak State Park
3. Cindy's Country Store
4. Caroline County Club
5. American Legion
6. Denton Elementary School
7. N. Caroline High School
8. Cohees Grill
9. 4-H Park
10. Caroline Medical Center

3.4.5 Election District No. 4 (Preston)

Individual residential water systems currently serve 80 percent of this Election District's total population (1990 population - 3,476). The remaining residents are served by the following community water systems:

1. Town of Preston (1990 population 437)
2. Nelpine Heights Subdivision
3. Marsh Creek Mobile Park
4. Holly Cove Mobile Home Park
5. Nelpine Mobile Home Park

Preston water facilities and service should retain the Town's character. In 1991, for the safety of the community the Town increased its water storage tank to 150,000 gals. capacity and had an additional well installed, giving the Town two production wells. Both Production wells are at Piney Point depths. These wells will pump alternately to provide adequate water for the existing population and any anticipated growth. The installation of additional water facilities has already encouraged residential growth and will encourage commercial development.

There are ten non-community water systems in this Election District:

1. Preston Trucking
2. John N. Wright, Jr. (Seasonal Tomato Cannery)
3. Dew Lines, Inc.
4. A. W. Sisk Co.
5. Worm Bros. Migrant Camp #1
6. Worm Bros. Migrant Camp #2
7. Ed Quidas Migrant Camp
8. Wayne Quidas Migrant Camp
9. Chances County Store
10. Alan Quidas Migrant Camp

No new community water systems are planned in this Election District.

3.4.6 Election District No. 5 (Federalsburg)

Currently 45 percent of this Election District's total population (1990 population - 4,443) is served by individual residential water systems. The remainder of the population of this District is served by the following community water systems:

1. Town of Federalsburg (1990 population 2365)
2. Passwaters Trailer Park
3. Meadowbrook Court

The Town of Federalsburg has three storage tanks for water. The newest holds 200,000 gallons of water. The other two, built around 1926 hold 150,000 and 100,000 gallons of water. The water mains are sized from 4" to 12". The Town has five wells which can pump a total of approximately 1025 gpm. The existing water supply is adequate and of good quality. However, at least 400,000 gallons of additional storage is needed for the summer months.

No new community water systems are planned for this Election District.

There are five non-community water systems in the Election District:

1. VFW Post 5246
2. Glacier Refrigerated Express
3. Tri Gas & Oil Co.
4. Maryland Plastics
5. Shady Pine Grove Trailer Park

3.4.7 Election District No. 6 (Hillsboro)

All residents of the Hillsboro Election District (1990 population - 1904), including residents within the Town of Hillsboro and community of West Denton, are serviced by individual residential water systems.

Hillsboro (Exhibit 3-P) - The majority of residents in this Town utilize wells penetrating the Choptank Aquifer at depths of 20-30 feet. Deeper wells, also in use, penetrate the Calvert Aquifer at 100-300 feet. The town of Hillsboro (1990 population -164) is in a unique position since it is located where three counties (Caroline, Talbot and Queen Anne's) converge and have a common boundary at the Tuckahoe River. Hillsboro is adjacent to the incorporated Town of Queen Anne in both Talbot and Queen Anne's Counties. Accordingly, any water and sewerage planning for Hillsboro should be coordinated with the other counties and the Town of Queen Anne.

West Denton (Exhibit 3-M) - Currently approximately 150 residents reside in this community of which approximately 50 percent obtain water from the Columbia Aquifer at depths of 20-40 feet. The remaining portion of the population utilizes deeper wells tapping the Choptank Aquifer at depths of 60-100 feet. Community water service could be provided to West Denton by 1995 by the Town of Denton.

There are five non-community water systems in the District:

1. Tuckahoe Shopping Center
2. Hitchler Industries
3. Mulholland-Harper Co., Inc.
4. Choptank Electric Corp.

3.4.8 Election District No. 7 (Ridgely)

Currently 42 percent of the Ridgely Election District's total population (1990 population -2700) is serviced by individual residential water systems. The remainder of the population is serviced by the Town of Ridgely (1990 population -1034) water system, and the Benedictine School water system.

The construction of two wells and a .200MG water storage tower for the Town of Ridgely was completed in 1985. The existing wells were sealed and the existing storage tank was removed. The reconstruction of the distribution system including pumps, chlorination, water meters, piping, fire hydrants and a new maintenance building was completed in 1986.

There are four non-community water systems:

1. Tuckahoe State Park
2. Saulsbury Bros., Inc.
3. Plyto Ecology
4. North Caroline High School

No new community water systems are planned for this Election District.

3.4.9 Election District No. 8 (American Corner)

Currently 100 percent of the American Corner Election District's total population (1990 population - 1927) is serviced by individual residential water systems. There are four non-community water supply systems within the District:

1. Earle LeGates Co., Inc. (Seasonal Tomato Cannery)
2. J.F.D. Canners, Inc. (Seasonal Tomato Cannery)
3. Colonel Richardson Middle and High Schools

No new community water systems are planned for this Election District.

TABLE 3-2

INVENTORY OF EXISTING COMMUNITY AND MULTI-USE WATER SUPPLY SYSTEMS

OWNER	WELL NUMBER	AQUIFER	COORDINATE LOCATION NORTH	EAST	DEPTH (FEET)	DIAMETER (INCHES)	WATER QUALITY	STORAGE CAPACITY (GALLONS)	COMMENTS
I. PUBLIC COMMUNITY									
A. DENTON	1	PINEY POINT	386	1,134	400	8	GOOD	480,000 ELEVATED	
	2	"			402	8	GOOD		
	3	"			440	12	GOOD		
	4	CHESWOLD							SEWAGE TREATMENT ONLY
B. FEDERALSBURG	1	COLUMBIA	316	1,152	45	N/A	GOOD	450,000 ELEVATED	WELL #1 DISCONTINUED
	2	COLUMBIA	316	1,152	46	N/A	GOOD		WELL #2 DISCONTINUED
	3	CALVERT	316	1,149	300	6	GOOD		
	4	COLUMBIA	316	1,149	82	N/A	GOOD		WELL #4 EPO (emergency purposes only)
	5	CALVERT	315	1,152	300	10	GOOD		
	6	COLUMBIA	312	1,156	61	12	GOOD		WELL #6 EPO
	7	CALVERT(CHESWLD)	313	1,148	350		GOOD		
C. GREENSBORO	1	PINEY POINT	418	1,141	275	8	GOOD	200,000 ELEVATED	WELL #1 ABANDONED
	2	CALVERT	418	1,141	144	8	GOOD		WELL #2 STANDBY
	3	PINEY POINT	419	1,136	350	8	GOOD		WELL #3 EPO
	4	PINEY POINT	419	1,137	350	6	GOOD		WELL #4 1970 PRODUCTION
D. PRESTON	1	COLUMBIA	322	1,111		8	FAIR	150,000 ELEVATED	WELL #1 DISCONTINUED
	2	COLUMBIA	322	1,111		8	FAIR		WELL #2 DISCONTINUED
	3	N/A	320	1,114		12	FAIR		WELL #3 DISCONTINUED
	4	PINEY POINT	322	1,111	600	8	GOOD		WELL #4 PRODUCTION
	5	PINEY POINT	322	1,111	533	12 X 6	GOOD		WELL #5 PRODUCTION
E. RIDGELY	1	COLUMBIA	405	1,120	345	6	GOOD	200,000 ELEVATED	WELL #1 ABANDONED
	2	COLUMBIA	406	1,110	343	6	GOOD		WELL #2 ABANDONED
	3	COLUMBIA							WELL #3 ABANDONED
	4	PINEY POINT							
	5	PINEY POINT							

TABLE 3-2

INVENTORY OF EXISTING COMMUNITY AND MULTI-USE WATER SUPPLY SYSTEMS, CONTINUED

OWNER	WELL NUMBER	AQUIFER	COORDINATE LOCATION NORTH	EAST	DEPTH (FEET)	DIAMETER (INCHES)	WATER QUALITY	STORAGE CAPACITY (GALLONS)	COMMENTS
L. SHADY PINES TRAILER PARK	1	CALVERT	334	1,165	190	4	GOOD		4" Diameter lines
M. PASSWATERS MOBILE HOME PARK	1	COLUMBIA	320	1,155	55	4	POOR		2" Diameter lines
N. NELPINE MOBILE HOME PARK	1	PINEY POINT	328	1,116	440	4	GOOD	240	2" Diameter lines
O. TAYLOR'S MOBILE HOME PARK	1	CALVERT	416	1,141	203	4	GOOD		
P. MARSH CREEK	1	PINEY POINT	334	1,093	369	4	GOOD		
Q. SHADY ACRES MHP	1 2	N/A N/A	325 325	1,137 1,137	40 302	4 4 X 2	GOOD		
III. COMMERCIAL A. TUCKAHOE SHOPPING CENTER	1	N/A	398	1,100	289	4	GOOD		
B. PRESTON TRUCKING CO., INC.	1 2	PINEY POINT PINEY POINT	326 326	1,110 1,110	477 486	4 4	GOOD GOOD		
IV. INSTITUTIONAL A. NORTH CAROLINE HIGH SCHOOL	1	PINEY POINT	393	1,130	356	8	GOOD		
B. COLONEL RICHARDSON HIGH SCHOOL	1	AQUIA GREENSAND	338	1,135	328	8	GOOD		
C. DENTON ELEMENTARY SCHOOL	1	PINEY POINT	380	1,133	262	8	GOOD		
D. GREENSBORO ELEMENTARY SCHOOL	1 2	PINEY POINT PINEY POINT	421 421	1,140 1,140	360 355	8 8	GOOD GOOD		
E. BENEDICTINE SCHOOL	1 & 2	N/A	427	1,116	65 - 70	4	GOOD		

TABLE 3-2

INVENTORY OF EXISTING COMMUNITY AND MULTI-USE WATER SUPPLY SYSTEMS, CONTINUED

OWNER	WELL NUMBER	AQUIFER	COORDINATE LOCATION NORTH EAST	DEPTH (FEET)	DIAMETER (INCHES)	WATER QUALITY	STORAGE CAPACITY (GALLONS)	COMMENTS
V. INDUSTRIAL								
A. CONCORD FARMS	1 - 8	N/A	385 1,130	N/A	2 - 8	GOOD		
B. EARLE LEGATES CO.	1 - 3	N/A	346 1,120	100	3	GOOD		
C. HITCHLER INDUSTRIES	1	N/A	389 1,126	384	6	GOOD		
D. GRASONVILLE FISHERIES	1 2		405 1,115 405 1,115	74 77	12 15	GOOD GOOD		
E. SAULSBURY BROS.	1 & 2	COLUMBIA	405 1,115	70	12	GOOD		
F. MARYLAND PLASTICS	1	CALVERT	316 1,153	265	4	GOOD		
G. MULHOLLAND-HARPER	1	CALVERT	387 1,129	240	6	GOOD		
H. JOHN N. WRIGHT, JR., INC.	1 2 3	CALVERT CALVERT CALVERT	318 1,125 318 1,125 318 1,125	210 280 280	8 8 8	GOOD GOOD GOOD		
I. J.R.D. CANNERS	1	N/A	328 1,128	60	6	GOOD		
J. PET, INC.	1			306	5		2,000	
VI. RECREATIONAL								
A. MARTINAK STATE PARK	1	PINEY POINT	377 1,131	380	8	GOOD	50,000 ELEVATED	
B. TUCKAHOE STATE PARK	1	N/A	419 1,104	251	6	GOOD	50,000 ELEVATED	
C. LAKE BONNIE	1 2	COLUMBIA PINEY POINT	435 1,148 435 1,148			GOOD GOOD		

TABLE 3-2

INVENTORY OF EXISTING COMMUNITY AND MULTI-USE WATER SUPPLY SYSTEMS, CONTINUED

OWNER	WELL NUMBER	AQUIFER	COORDINATE LOCATION NORTH	COORDINATE LOCATION EAST	DEPTH (FEET)	DIAMETER (INCHES)	WATER QUALITY	STORAGE CAPACITY (GALLONS)	COMMENTS
D. HOLIDAY PARK	1	COLUMBIA	430	1,150			GOOD		
	2	COLUMBIA	430	1,150			GOOD		
	3	COLUMBIA	430	1,150		4	GOOD		

TABLE 3-3 INVENTORY OF EXISTING PUBLIC AND/OR PRIVATE COMMUNITY AND OTHER MULTI-USE WATER TREATMENT FACILITIES

OWNER-OPERATING AGENCY	WATER SOURCE	TYPE OF TREATMENT PLANT	RELATED PLANT CAP. (mgd)	AVERAGE PRODUCTION (mgd)	MAX. PEAK FLOW (mgd)	STORAGE CAPACITY (mgd)	PLANNED EXPANSION AND DATE
I. Public Community (Municipal)							
A. Denton-Commissioners	3 Wells	Chlorination	1.3	0.39	0.69	0.700	New Well - 1995
B. Federalsburg-Commissioners	5 Wells	Chlorination	1.9	0.525	0.65	0.45	None
C. Greensboro-Commissioners	4 Wells	Chlorination	1.5	0.202	N/A	0.20	Additional Storage-1992
D. Preston-Commissioners	2 Wells	Chlorination	0.115	0.10	1.07	0.150	New Well - 1991
E. Ridgely - Commissioners	2 Wells	Chlorination	0.7	0.180	N/A	0.200	None
II. Private Community A. Nelpine Heights C & P Development Co.	2 Wells	Chlorination	0.03	0.01	N/A	0.002	
III.Recreational A. Martinak State Park - Maryland Department of Natural Resources-Park Service	1 Well	Chlorination	0.29	0.002	0.02	0.05	
B. Tuckahoe State Park-Maryland Department of Natural Resources Park Service	1 Well	Chlorinaton	0.05	0.002	0.006	0.05	

TABLE 3 - 4
INVENTORY OF WATER PROBLEM AREAS

WATER SERVICE AREA	POPULATION (1992)	NATURE OF PROBLEM	PLANNED CORRECTION AND DATE (if known)
I. Election District No. 1			
A. Town of Goldsboro	188	Cross-contamination* Nitrate concentrations increasing On-site sewage systems contaminating surface and groundwater	Community sewerage system & water system
B. Town of Henderson	90	Poor well production Public water from Caroline MHP into Town not in compliance	New community water system in 1993
C. Town of Marydel	155	On-site sewage systems contaminating surface surface and groundwater	Community water & sewerage systems
II. Election District No. 2			
A. Town of Greensboro	1253	Distribution lines of inadequate size, water main leaks, uneven distribution of uneven distribution of chlorine, lack of fire hydrants in some areas	New water lines & fire hydrants- 1991
III. Election District No. 3			
A. Town of Denton	227	Need to replace inadequate water lines for fire flow and pressure; insufficient well capacity for Town; need to install a new well to replace Well #2	Replace water lines -- 1993; new well-1995
IV. Election District No. 4			
A. Town of Preston	437	Distribution lines of inadequate size limit expansion on outskirts of Town, corrosion of galvanized pipe	New water lines
B. Bethlehem	150	Cross-contamination* On-site sewage systems contaminating surface and groundwater	Deep wells and community sewage disposal methods

TABLE 3 - 4 INVENTORY OF WATER PROBLEM AREAS - CONTINUED

WATER SERVICE AREA	POPULATION (1992)	NATURE OF PROBLEM	PLANNED CORRECTION AND DATE (if known)
IV. Election District No. 4 (continued)			--
C. Jonestown	265	Cross-contamination*	Deep wells and improved sewage disposal methods or community systems
D. Tanyard	25	Cross-contamination*	Deep wells and improved sewage disposal methods or community systems
E. Choptank	125	Cross-contamination*	Deep wells and improved sewage disposal methods or community systems
V. Election District No. 5			
A. Town of Federalsburg	2365	Some streets have inadequate water lines not enough water storage in summer months	Water system loops & construction additiona water tower for summer demand storage
VI. Election District No. 6			
A. West Denton	100	Cross-contamination*	Improved sewage disposal methods or community system - 1993
VII. Election District No. 7			
A. Trinity/Boonsboro	114	Cross-contamination*	Water service by Town of Ridgely - 1994 Improved sewage disposal methods or community sewerage

*Cross-contamination -Shallow wells in close proximity to sub-surface sewage disposal system.

TABLE 3-5
PROJECTED WATER DEMANDS AND PLANNED CAPACITY FOR EXISTING AND/OR PLANNED COMMUNITY WATER SYSTEMS

WATER SERVICE AREA	GPCD	1990					1995				
		POPULATION			CAP. (MGD)		POPULATION			CAP.(MGD)	
		TOTAL	SERVED	UNSERVED	DEMAND	PLANNED	TOTAL	SERVED	UNSERVED	DEMAND	PLANNED
CAROLINE COUNTY	-	27,035	9,759	17,276	-	-	28,500	11,079	17,421	-	-
ELECTION DISTRICT NO.1	-	2,689	789	2,099	-	-	2,843	939	1,904	-	-
TEMPLEVILLE	-	66	0	66	-	-	66	0	66	-	-
MARYDEL	-	143	0	143	-	-	155	0	155	-	-
HENDERSON	100	125	0	125	.013	.023	150	150	0	.015	.023
GOLDSBORO	-	185	0	185	-	-	190	0	190	-	-
HARMON SUBDIVISION	70	54	54	0	0.004	0.004	54	54	0	0.004	0.004
CAROLINE ACRES MHP	56	390	390	0	0.020	0.021	390	390	0	0.020	0.0407
HILLTOP TRAILER PARK	75	48	48	0	0.004	0.012	48	48	0	0.004	0.012
THE CEDARS M.H.P.	75	297	297	0	0.022	0.035	297	297	0	0.022	0.035
ELECTION DISTRICT NO. 2	-	3,974	1,498	2,599	-	-	4,177	1,498	2,679	-	-
GREENSBORO	170	1,441	1,441	0	0.245	1.5	1,441	1,441	0	0.245	1.5
DENNY TAYLOR'S M.H.P.	75	57	57	0	0.004		57	57	0	0.004	
ELECTION DISTRICT NO. 3	-	5,304	3,043	2,557	-	-	5,551	3,043	2,508	-	-
DENTON	114	2,977	2,977	0	0.340	1.3	2,977	2,977	0	0.340	1.3
TOWER MOBILE COURT	75	66	66	0	0.005	0.032	66	66	0	0.005	0.032

TABLE 3-5
PROJECTED WATER DEMANDS AND PLANNED CAPACITY FOR EXISTING AND/OR PLANNED COMMUNITY WATER SYSTEMS

WATER SERVICE AREA	GPCD	1990					1995				
		POPULATION			CAP. (MGD)		POPULATION			CAP.(MGD)	
		TOTAL	SERVED	UNSERVED	DEMAND	PLANNED	TOTAL	SERVED	UNSERVED	DEMAND	PLANNED
ELECTION DISTRICT NO. 4	-	3,846	847	2,999	-	-	4,049	960	3,089	-	-
PRESTON	159	437	437	0	0.079	0.684	550	550	0	0.055	0.972
NELPINE HEIGHTS	125	80	80	0	0.01	0.03	80	80	0	0.01	0.03
MOBILE MANOR MHP	75	150	150	0	0.013	0.03	150	150	0	0.013	0.03
HOLLY COVE M.H.P.	75	60	60	0	0.005	0.06	60	60	0	0.005	0.06
SWANNS M.H.P.	75	18	18	0	0.001	0.002	18	18	0	0.001	0.002
NELPINE M.H.P.	75	57	57	0	0.004	0.01	57	57	0	0.004	0.01
MARSH CREEK M.H.P.	75	45	45	0	0.003	0.003	45	45	0	0.003	0.003
ELECTION DISTRICT NO. 5	-	4,397	2,548	1,849	-	-	4,519	2,803	1,716	-	-
FEDERALSBURG	230	2,365	2,365	0	0.550	0.550	2,620	2,620	0	0.500	1.9
LIBERTY TRAILER PARK	75	60	60	0	0.005	0.008	60	60	0	0.005	0.008
MEADOWBROOK COURT	75	60	60	0	0.005	0.008	60	60	0	0.005	0.008
SHADY PINES TRAILER PARK	75	24	24	0	0.005	0.014	36	36	0	0.005	0.014
SHADY ACRES	75	27	27	0	0.002	0.002	27	27	0	0.002	0.002
ELECTION DISTRICT NO. 6	-	1,826	0	1,826	-	-	1,948	0	1,948	-	-
HILLSBORO	-	164	0	164	-	-	190	0	190	-	-
WEST DENTON	-	150	0	150	-	-	125	0	125	-	-
ELECTION DISTRICT NO. 7	-	2,439	1,034	1,405	-	-	2,561	1,034	1,527	-	-
RIDGELY	100	1,034	1,034	0	0.103	0.7	1,034	1,034	0	0.103	0.7
ELECTION DISTRICT NO. 8	-	1,928	0	1,928	-	-	2,050	0	2,050	-	-

TABLE 3-5
PROJECTED WATER DEMANDS AND PLANNED CAPACITY FOR EXISTING AND/OR PLANNED COMMUNITY WATER SYSTEMS

WATER SERVICE AREA	GPCD	2000					2005				
		POPULATION			CAP. (MGD)		POPULATION			CAP.(MGD)	
		TOTAL	SERVED	UNSERVED	DEMAND	PLANNED	TOTAL	SERVED	UNSERVED	DEMAND	PLANNED
CAROLINE COUNTY		29,700	10,579	19,121	-	-	30,600	-	-	-	-
ELECTION DISTRICT NO.1	-	2,960	964	1,996	-	-	-	-	-	-	-
TEMPLEVILLE	-	66	0	66	-	-	66	0	66	-	-
MARYDEL	-	160	0	160	-	-	165	0	165	-	-
HENDERSON	100	165	165	0	0.017	0.023	185	185	0	0.019	0.023
GOLDSBORO	-	200	0	200	-	-	210	0	210	-	-
HARMON SUBDIVISION	70	54	54	0	0.004	0.004	54	54	0	0.004	0.004
CAROLINE ACRES MHP	56	400	400	0	0.022	0.0407	400	400	0	0.022	0.0407
HILLTOP TRAILER PARK	75	48	48	0	0.004	0.012	48	48	0	0.004	0.012
THE CEDARS M.H.P.	75	297	297	0	0.022	0.035	297	297	0	0.022	0.035
ELECTION DISTRICT NO. 2	-	4,348	1,498	2,850	-	-	-	-	-	-	-
GREENSBORO	170	1,441	1,441	0	0.245	1.5	1,441	1,441	0	0.245	1.5
DENNY TAYLOR'S M.H.P.	75	57	57	0	0.004		57	57	0	0.004	
ELECTION DISTRICT NO. 3	-	5,772	3,045	2,727	-	-	-	-	-	-	-
DENTON	114	2,977	2,977	0	0.340	1.3	2,977	2,977	0	0.340	1.3
TOWER MOBILE COURT	75	66	66	0	0.005	0.032	66	66	0	0.005	0.032

TABLE 3-5
PROJECTED WATER DEMANDS AND PLANNED CAPACITY FOR EXISTING AND/OR PLANNED COMMUNITY WATER SYSTEMS

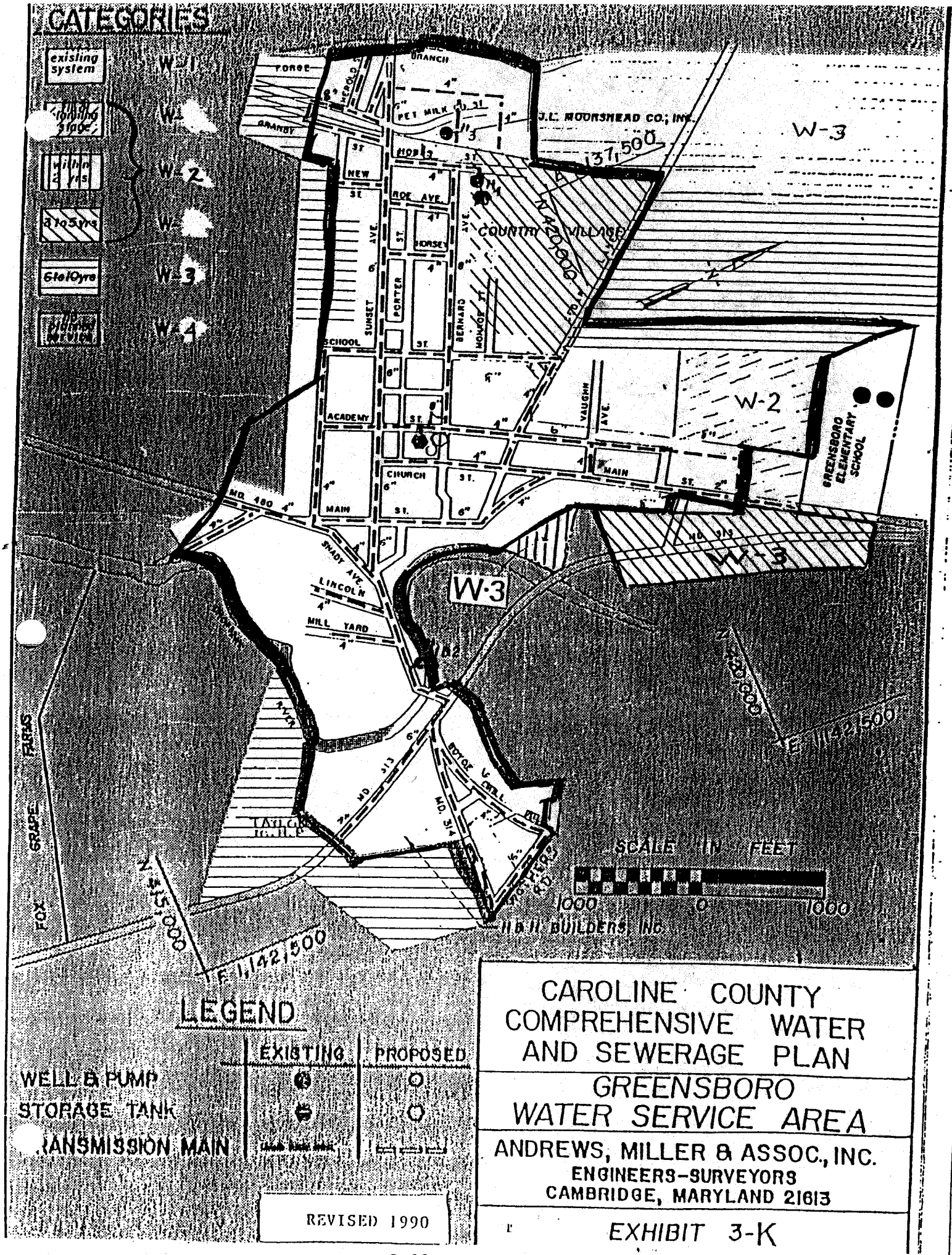
WATER SERVICE AREA	GPCD	2000					2005				
		POPULATION			CAP. (MGD)		POPULATION			CAP.(MGD)	
		TOTAL	SERVED	UNSERVED	DEMAND	PLANNED	TOTAL	SERVED	UNSERVED	DEMAND	PLANNED
ELECTION DISTRICT NO. 4	-	4,220	847	3,373	-	-	-	-	-	-	-
PRESTON	159	600	600	0	0.060	0.972	650	650	0	0.065	0.972
NELPINE HEIGHTS	125	80	80	0	0.01	0.03	80	80	0	0.01	0.03
MOBILE MANOR M.H.P.	75	150	150	0	0.013	0.03	150	150	0	0.013	0.03
HOLLY COVE M.H.P.	75	60	60	0	0.005	0.06	60	60	0	0.005	0.06
SWANNS M.H.P.	75	18	18	0	0.001	0.002	18	18	0	0.001	0.002
NELPINE M.H.P.	75	57	57	0	0.004	0.01	57	57	0	0.004	0.01
MARSH CREEK M.H.P.	75	45	45	0	0.003	-	45	45	0	0.003	-
ELECTION DISTRICT NO. 5	-	4,600	2,891	1,709	-	-	-	-	-	-	-
FEDERALSBURG	230	2,720	2,720	0	0.525	1.9	2,770	2,770	0	0.550	1.9
LIBERTY TRAILER PARK	75	60	60	0	0.005	0.008	60	60	0	0.005	0.008
MEADOWBROOK COURT	75	60	60	0	0.005	0.008	60	60	0	0.005	0.008
SHADY PINES TRAILER PARK	75	24	24	0	0.005	0.014	36	36	0	0.005	0.014
SHADY ACRES	75	27	27	0	0.002	0.002	27	27	0	0.002	0.002
ELECTION DISTRICT NO. 6	-	2,028	300	1,728	-	-	-	-	-	-	-
HILLSBORO	-	200	0	200	-	-	210	0	210	-	-
WEST DENTON	-	100	100	0	-	-	100	100	0	-	-
ELECTION DISTRICT NO. 7	-	2,641	1,034	1,607	-	-	-	-	-	-	-
RIDGELY	100	1,034	1,034	0	0.103	0.7	1,034	1,034	0	0.103	0.7
ELECTION DISTRICT NO. 8	-	2,131	0	2,131	-	-	-	-	-	-	-

Plan 3-5A.1/jh

TABLE 3-6 - IMMEDIATE, 5, AND 10 YEAR PRIORITIES FOR WATER DEVELOPMENT

WATER SERVICE AREA	LOCATION	DESCRIPTION	ESTIMATED COST	COUNTY PRIORITY ASSIGNED
I. Election District #1				
A. Henderson		Construction of Public Water System	350,000	W-2
B. Goldsboro		Improvement of Individual Water Supplies		W-2
II. Election District #2				
A. Greensboro		System Rehabilitation-Looping and Replacement of Water Line, New Fire Hydrants, New Storage Tank		W-1
"	417,000/1,141,500	Service to Taylor T.P.		W-3
"	419,000/1,140,500	Extension of Service to Elmore Court		W-3
III.Election District #3				
A. Denton		New Well		W-2
"		Replace Inadequate Water Lines		W-2
IV. Election District #4				
A. Preston	320,000/1,113,000	Extension of Service S.E. to Reeds Villa * S.W. to Corporate Limits		W-3
V. Election District #5				
A. Federalsburg		Additional Storage Tank		W-2
VI. Election District #6				
A. West Denton		Extension of Community Water Service From Denton		W-2

E 147,500
N 455,000
E 152,500
N 455,000
W-2
CAROLINE ACRES MOBILE HOME PARK
ALL DISTRIBUTION LINES SHOWN ARE 1 1/2" DIA.
E 147,500
N 450,000
CATEGORIES
existing system
W-1
final planning stage
within 2 yrs.
W-2
3 to 5 yrs.
6 to 10 yrs.
W-3
no planned service
W-4
Out-of-Date as of Dec 2002 See Amendments
LEGEND
EXISTING
PROPOSED
WELL & PUMP
STORAGE TANK
REVISED 1990
CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN
HENDERSON WATER SERVICE AREA
ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613
EXHIBIT 3-J

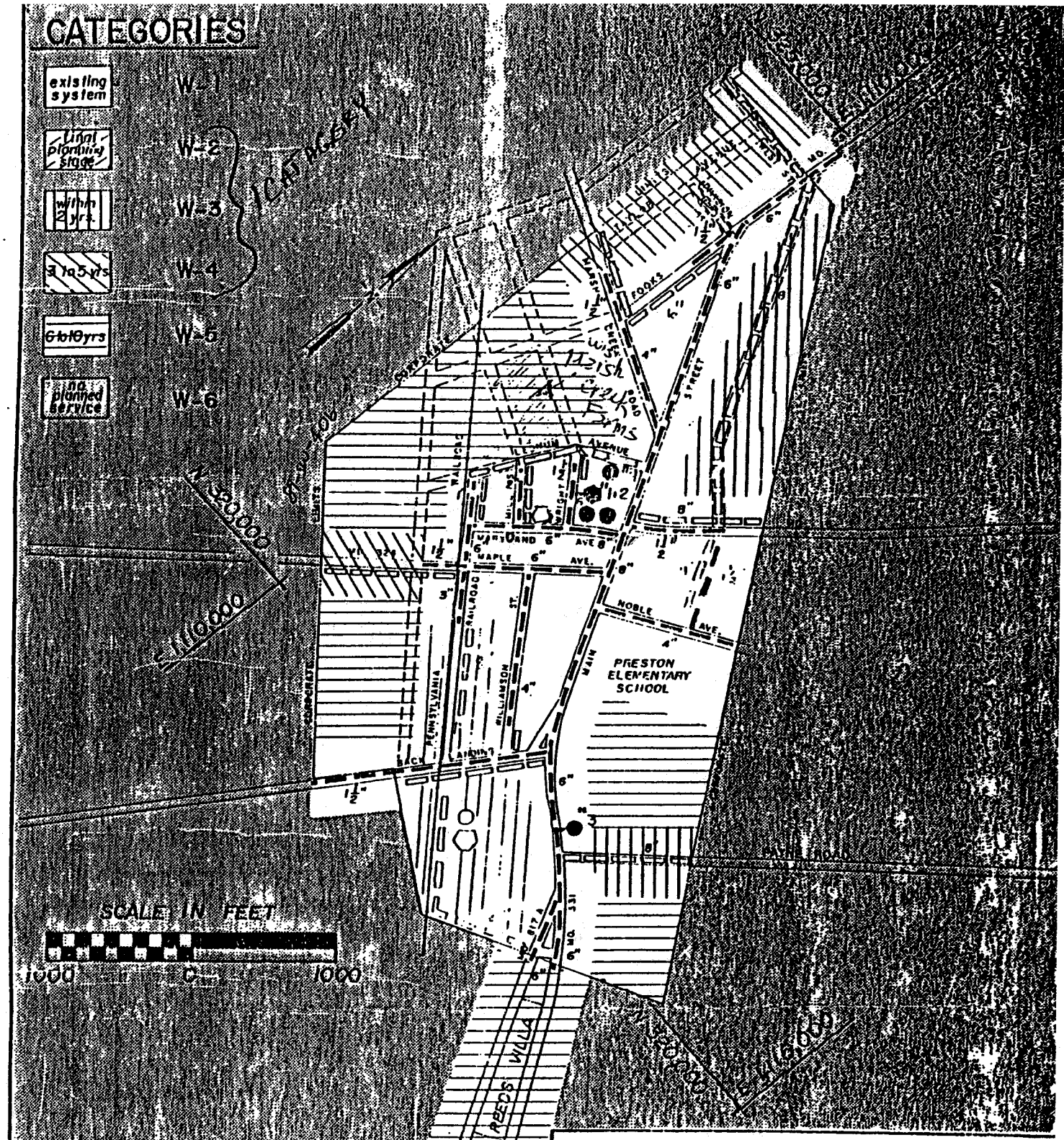


CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN

GREENSBORO WATER SERVICE AREA

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

EXHIBIT 3-K

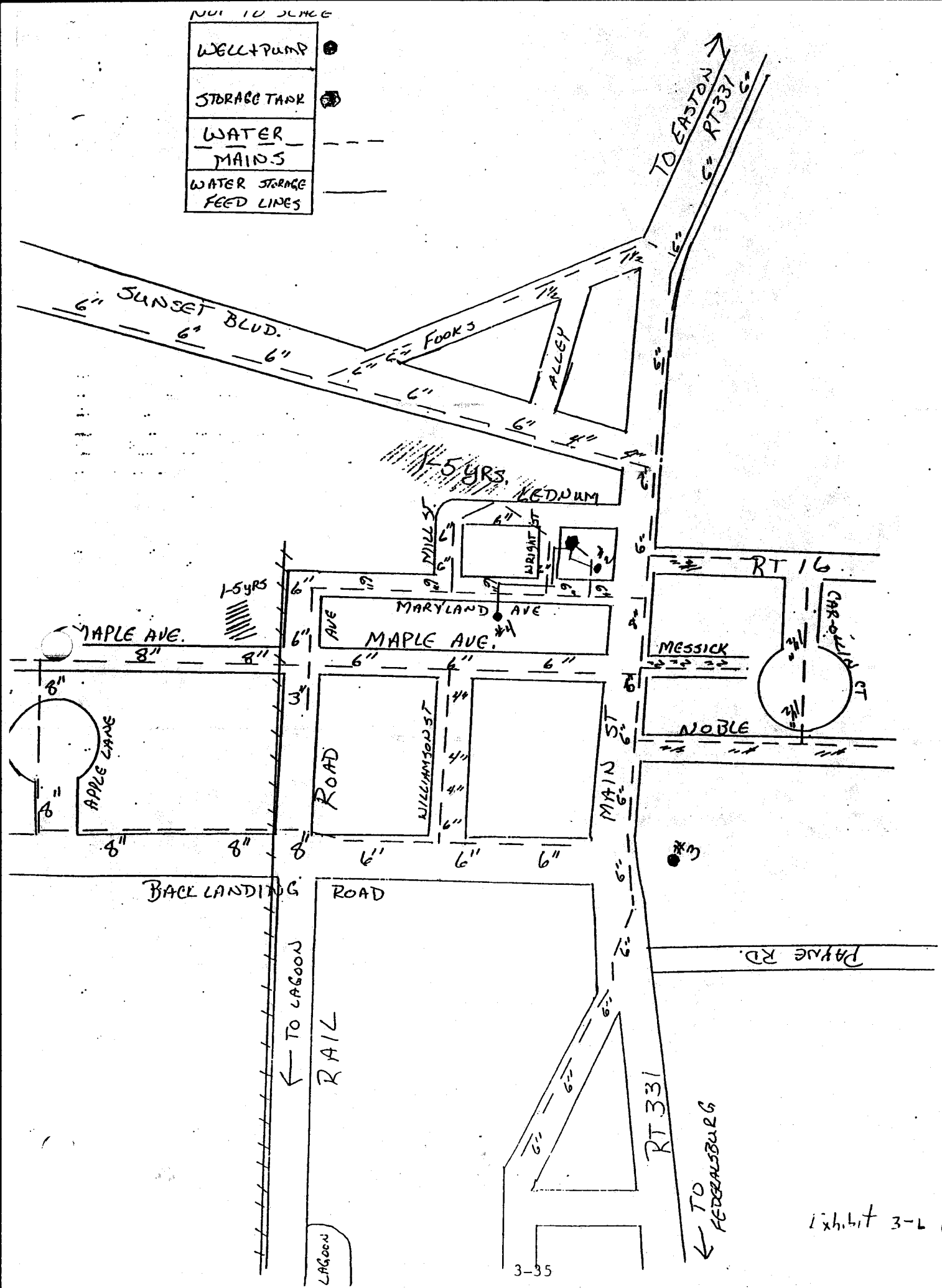


CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN

PRESTON WATER SERVICE AREA

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

EXHIBIT 3-L



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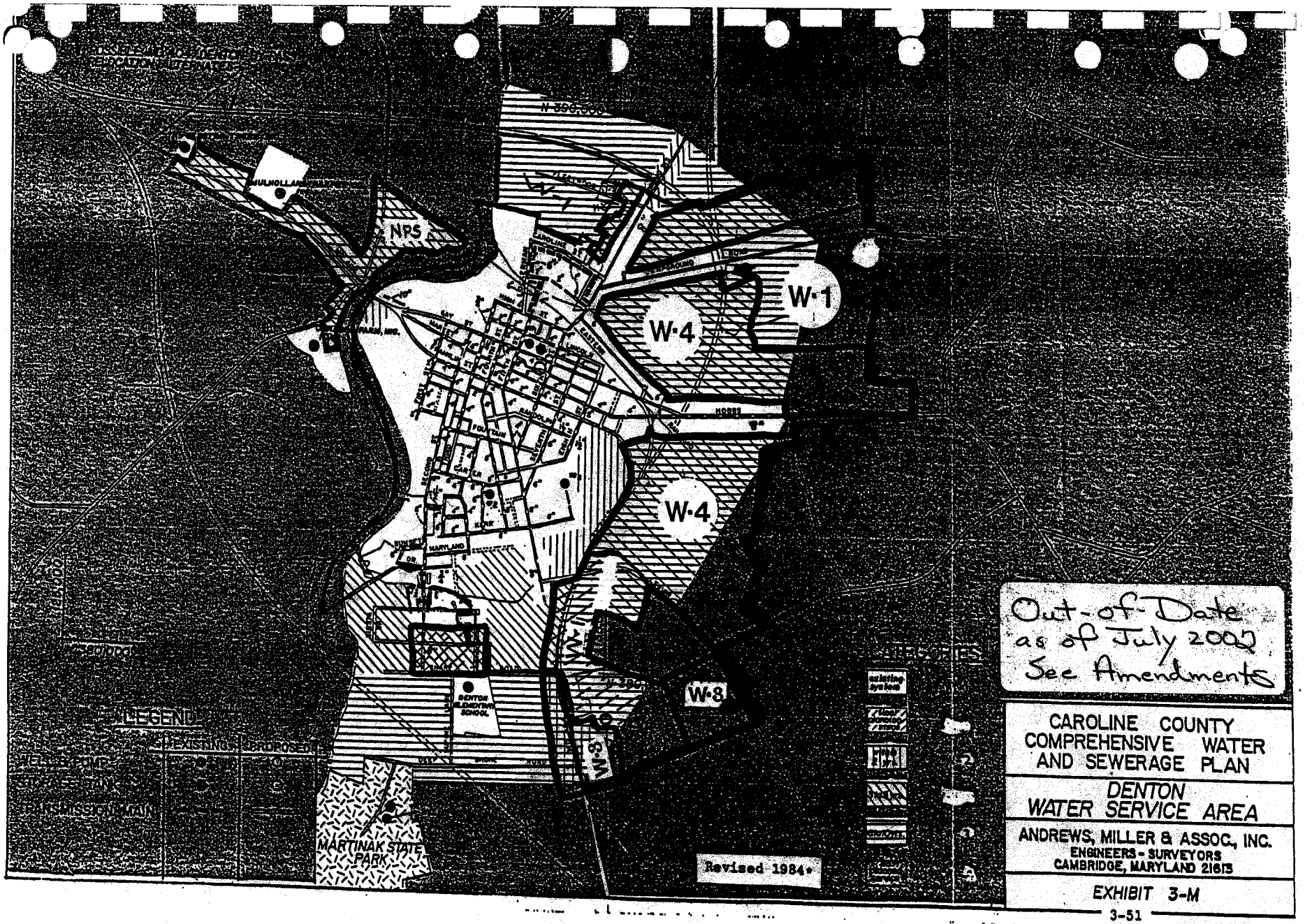
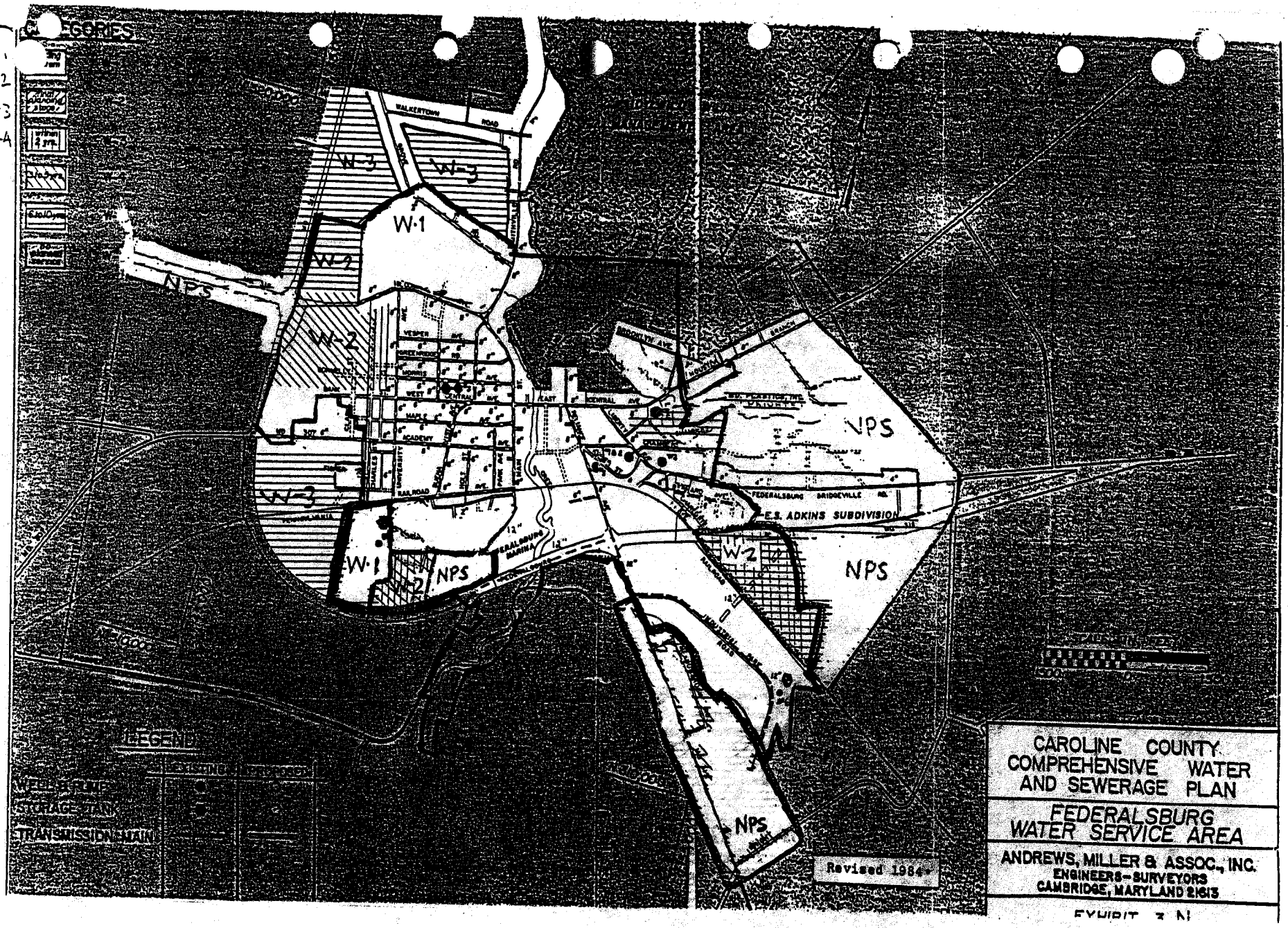

NPS
W-1
W-4
W-4
W-8
W-8
DENTON ELEMENTARY SCHOOL
MARTINAK STATE PARK
LEGEND
EXISTING
PROPOSED
CATEGORIES
Revised 1984
Out-of-Date as of July 2002 See Amendments
CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN
DENTON WATER SERVICE AREA
ANDREWS, MILLER & ASSOC., INC.
ENGINEERS - SURVEYORS
CAMBRIDGE, MARYLAND 21613
EXHIBIT 3-M
3-51

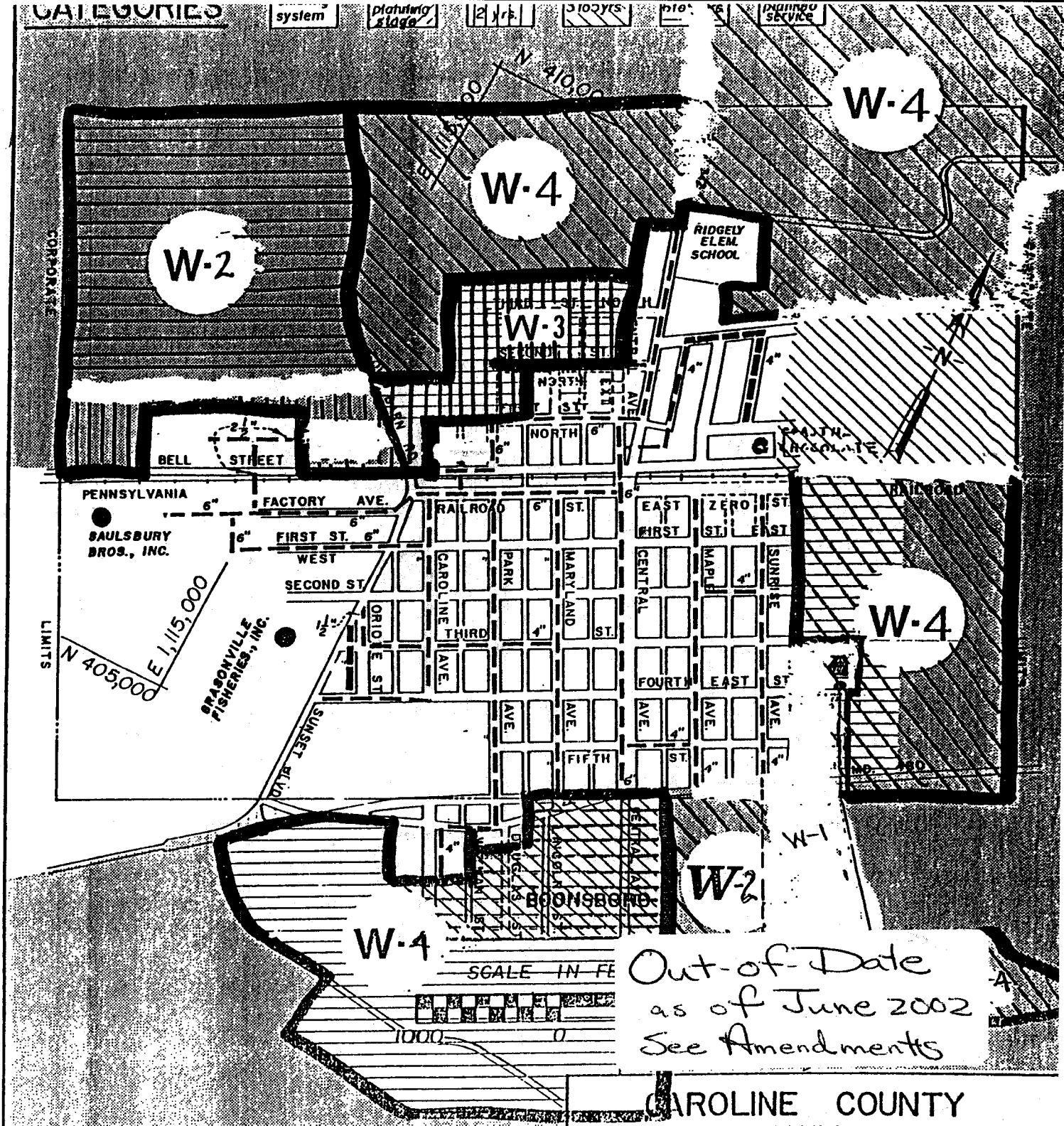


CAROLINE COUNTY
COMPREHENSIVE WATER
AND SEWERAGE PLAN

FEDERALSBURG
WATER SERVICE AREA

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

EXHIBIT 2 N



LEGEND

	EXISTING	PROPOSED
WELL & PUMP	⊕	⊙
STORAGE TANK	⊕	⊙
TRANSMISSION MAIN	———	▭▭▭

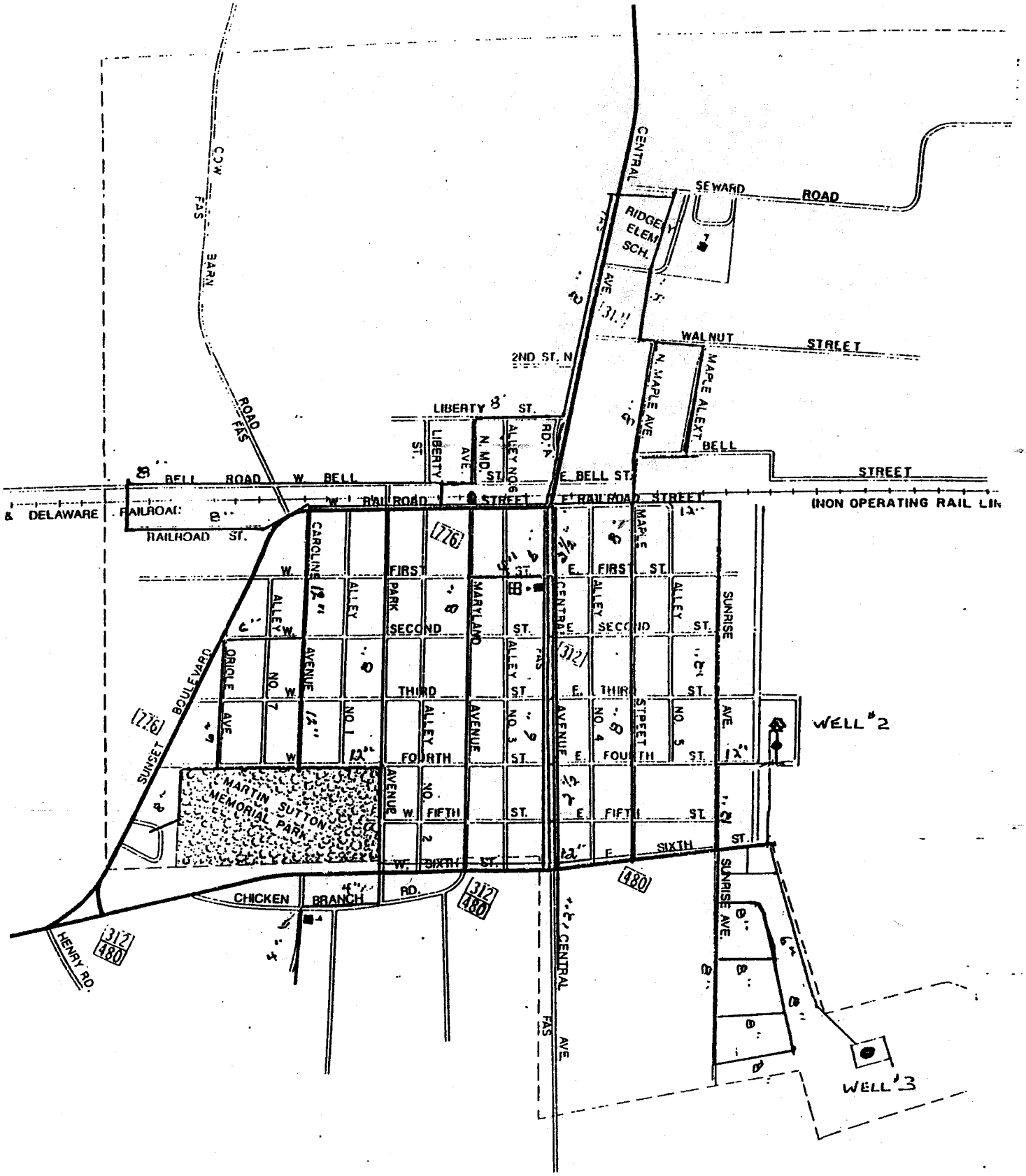
Revised 1986

CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN

RIDGELY WATER SERVICE AREA

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

EXHIBIT 3-0



WATER SYSTEM

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CHAPTER 4

SEWERAGE

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CHAPTER 4

SEWERAGE

4.1 GENERAL

This Chapter contains a description of existing public and private on-site, community, institutional, commercial and industrial sewerage systems and conditions affecting these and future systems. Sewerage demands used in this chapter are based on past and present use, population projections, industrial and agricultural trends, public reaction to expansion, hydrogeologic conditions, and political and financial contingencies. A detailed description of on-site systems is presented in Chapter 5.

Caroline County experienced a 17% growth rate in the last decade. From all indications, this trend should continue with the resulting demand for adequate sewerage systems. The comprehensive sewerage plan need not imply that a County-wide regional sewerage system should be the ultimate goal. Rather, it is the intent of this Chapter to point out and encourage sound and cooperative planning between the County and its incorporated municipalities and private developers. Due to the rural and agricultural nature of most of Caroline County, it is believed that the best solution for sewerage management lies in a

combination of annexation by the towns, and on-site sewerage systems. Currently the County is not anticipating the creation of any sanitary districts to provide community sewerage service to those areas identified as failing septic tank areas. The lack of a sanitary commission also limits potential use of shared facilities. Both innovative and shared facilities do not encourage growth adjacent to existing community systems, which is contradictory to the Comprehensive Development Plan. The selected alternative is to encourage annexation by the towns and improve and correct existing on-site systems.

In those portions of the County where private community systems are permitted, they should be designed and constructed in conformance with established local, state and federal standards. Recognition by this Plan of privately initiated community systems shall be reevaluated as part of the amendment process in terms of consistency with both Plan policies and implementation schedules.

The continued use of individual on-site systems in areas of satisfactory soils should be promoted through zoning and development regulations and in conjunction with applicable Health Department regulations. Where on-site disposal facilities are permitted, it is the expressed intent of this Plan to assure to the maximum extent possible that pollution will not occur. In this context, it must be completely and satisfactorily documented to the applicable review and approval agencies that the installation of on-lot disposal facilities will not create or increase health hazards or adversely affect the environment. (Refer to a detailed discussion in Chapter 5).

The growth pattern in Caroline County is projected and encouraged to be mainly peripheral expansion in and around existing population centers. However, there is also a strong demand for sparsely developed individual lots and some isolated clusters of development. Therefore, it is apparent and esential that all sewerage activities in the County be carefully monitored and coordinated by the Caroline County Health Department and Planning Department. The Comprehensive Development Plan further describers planning objectives that shall be recognized in sewerage development.

4.2 WATER QUALITY

4.2.1. Surface Water

As discussed in Chapter 3, nearly 2 percent of Caroline County is covered by surface water. The Maryland Department of the Environment has set standards requiring all of these waters to be free of substances that float, produce sludge deposits, create objectionable changes in taste, odor, visual appearance, are toxic, or otherwise are clearly harmful and undesirable (see Exhibit 4-A). These standards, however, do not assure the absence of pollution.

All surface waters in Caroline County have been delineated by the State as Use I waters. Exhibit 4-B outlines the specific standards set for this water use designation. In addition to these specific numerical standards, pollutants such as heavy metals, pesticides and nutrients are controlled through such site-specific mechanisms as individual NPDES or State discharge permits.

The County is divided into two major drainage basins, namely, the Nanticoke River Basin and the Choptank River Basin. Both rivers and their tributaries are important spawning grounds for striped bass and other species of fish, and for shellfish propagation. In addition, these rivers provide excellent recreational areas and serve as sources for agricultural and industrial water supplies. It is evident, therefore, that the water quality in all the County's waterways must be maintained at a high level and protected from the discharge of inadequately treated sewage, industrial wastes, urban area runoff, agricultural runoff, pleasure boat wastes, and other sources of pollution. Exhibit 4-D (attached) provides a portion of the 305(b) report, MARYLAND WATER QUALITY INVENTORY, 1987-1989, for these basins. The Choptank River Basin (02-13-04) extends into Dorchester, Talbot, Caroline and Queen Anne's Counties, Maryland, and Kent County, Delaware. Currently, eleven community wastewater collection and treatment facilities and several industrial, commercial, and institutional establishments discharge to the surface waters of this drainage basin.

Sampling of the Choptank River Basin indicates generally fair to good water quality throughout the watershed. However, low dissolved oxygen and high bacterial values are recorded. High levels of nitrogen and phosphorus must also be monitored and addressed within the watershed. This is probably attributable to inadequately treated domestic, and municipal and industrial wastewater, and runoff from urban and agricultural land. Surface water discharges in the upper reaches of the watershed above Greensboro shall be restricted. Land application of wastewaters shall be utilized to protect the water quality.

The Nanticoke River Basin (02-03-03) extends into Dorchester, Caroline, Wicomico and Somerset Counties in Maryland and Sussex and Kent Counties, Delaware. Currently eleven Community wastewater collection and treatment facilities (Maryland-7, Delaware-4) and numerous industrial, commercial and institutional establishments discharge to the surface waters of this drainage basin.

The water quality of the Nanticoke River Basin is generally good. The most common violation is high bacteria counts. The Marshyhope Creek Sub-Basin (02-13-03-05) has an area of approximately 157 square miles with 60 per cent in Delaware. The watershed becomes a tidal stream, near Federalsburg and drains to the Nanticoke River main stem (02-13-03-04). Based on nutrient measurements, this segment is an enriched system.

4.2.2 Groundwater

As discussed in Chapter 3, proper groundwater quality management is essential in Caroline County. Disposal of residual wastes on the land and in subsurface sites may result in the deterioration of groundwater quality through gradial flow of liquid wastes or leaching of solid wastes from disposal sites. Management is important on a County, individual, community, commercial, and industrial basis.

4.2.2.1 Individual Septic Tanks

When located in close proximity to shallow wells, both failing septic tank systems as well as adequate septic tanks located in fast percolation soils, are causes of cross-contamination. Proper site evaluation, design, and installation on a per home basis, extension of central sewage collection system service, and proper operating procedures and maintenance of such systems are methods of alleviating groundwater quality problems brought on by these individual systems. Caroline County has come to grips with these problems by limiting the densities of developments in poor soils, and by requiring deep wells in some locations. (See Chapter 5). All lots on individual systems in areas designated S4 and S5 must have a sewage reserved area (SRA) to replace or renovate the system. The lack of an SRA increases the need for community facilities, and increases health concerns from failing systems.

4.2.2.2 Sewerage Collection and Treatment Systems

Leakage, or exfiltration, through faulty joints in sewer lines in close proximity to domestic water lines or wells is a potential cause of cross-contamination, and source of contamination to the unconfined groundwater. Methods of eliminating exfiltration are: 1) proper sewer construction, 2) internal and external inspection and repair programs at regular time intervals, and 3) exclusion of discharge of materials damaging the sewers.

Because of high treatment costs involved in meeting stringent surface water effluent limitations, land or subsurface disposal is a potentially economical alternative for nearly all new community sewerage systems in Caroline County. The favorable soils, climate and extreme rural nature of the area are also advantageous factors. Proper site evaluation, construction, and continuous monitoring of each system are methods of assuring good groundwater quality. Land application is the preferred effluent application process and is the necessary option in the upper reaches of the watershed where point sources will be restricted.

Community systems must encourage water saving to reduce wastewater volumes. This reduces the need to upgrade system capacity, and allows for a greater number of connections to the system which reduces cost per customer. The advantage is to also reduce wastewater volume that must be assimilated in the ecosystem (generally surface waters). New and replacement construction can be

managed toward this goal by requiring low flow plumbing fixtures at permit issuance. Providing monetary incentives for low water use and distributing or installing aftermarket water saving devices must be encouraged.

4.3 POINT SOURCE DISCHARGE

A point source discharge is any discernable, confined conduit, including pipes, ditches, channels, sewers, tunnels, vessels or other floating craft from which pollutants are discharged. Types of point source discharges are: 1) sanitary sewerage system discharge outfall, 2) industrial waste discharge outfall, 3) combined sanitary and storm sewer discharge outfall, 4) separated storm sewer discharge outfalls, and 5) groundwater heat pump discharge. All of the above must apply for an individual National Pollution Discharge Elimination System (N.P.D.E.S.) Permit with the exception of the separated storm sewer discharge and watersource heat pumps discharging to waters of the State. An N.P.D.E.S. permit (required Federally, but administered through the State MDE specifies allowable discharge limitations, where applicable, of biochemical oxygen demand (BOD), suspended solids, coliform organisms, pH, dissolved oxygen, nitrogen, phosphorous, temperature, flow, heavy metals and pesticides.

Secondary treatment for any sewage treatment plant is the required minimum for compliance with existing regulations (see Exhibit 4-C). To control the introduction of non-domestic wastes into publicly owned sewage treatment plants, pretreatment standards have been established for industries which discharge into public systems.

Watersource heat pumps are a relatively new potential point source of pollution in Caroline County. A detailed discussion of watersource heat pumps is provided by Exhibit 4-E and Table 4-1.

4.4 NON-POINT SOURCE DISCHARGE

A non-point source discharge is where a specific outfall to surface waters or ground water cannot be identified. Types of potential pollutants in non-point source discharges are sediment, litter and debris, plant nutrients, pesticides, heavy metals, organic materials, oil and grease, and pathogenic bacteria. Table 4-3 lists problem areas associated with storm drainage outfalls and non-point sources while the following are potential water quality pollutants:

4.4.1 Small Point Discharges

Small point discharges not covered by the National Pollution Discharge Elimination System permit process are considered to be non-point source dischargers. To insure favorable water quality in the County, all of these sources should be inventoried and evaluated as to effluent limitation standards.

4.4.2 Natural Sources

The discharge of stormwater through streams or drainage ditches during times of high rainfall are the main contributors of sediment, nutrients, litter, and debris to the surface waters of Caroline County. Comprehensive stormwater management regulations have been adopted by the County and each municipality. An effort to control shoreline erosion should also be implemented in order to reduce the amount of sediment input.

4.4.3 Agricultural Activities

Agricultural activities presently occupy approximately 60 percent of Caroline County's total acreage. This is also the major contributor to non-point source pollution of surface waters. The major pollutants are sediment, nutrients, feed lot and pasture runoff, and pesticides. Methods of pollutant reduction are: 1) changing cropping patterns, 2) changing methods and/or frequency of

application of pesticides and fertilizers, 3) changing cultivation patterns 4) substituting biological for chemical methods of pest control, 5) installing terraces, 6) installing grassed waterways and filter strips, 7) installing sediment traps, basins, or debris dams, 8) diversion of runoff, and 9) treatment of feedlot wastes. It has been determined that if the water quality of the County's waters are to be improved, then the implementation of agricultural practices which minimize nutrient run-off is essential.

4.4.4 Silvacultural Operations

Three major silvacultural (forestry) activities which create water pollution are: 1) road and trail construction, 2) disease and pest control and, 3) harvesting. Methods of reduction of these discharges are: 1) proper design and construction of roads, 2) reduction in the quantity of pesticides, 3) change in pattern of harvesting (avoid clear cutting), 4) rapid replanting of burned areas, and 5) change in harvesting methods (avoid bulldozing).

4.4.5 Park, Golf Course, and Similar Activities

These activities often create the same types of discharge as in agricultural and silvacultural activities with the majority of pollution coming from nutrient runoff and organic loading due to leaves and debris. Methods of discharge improvement or reduction would also be the same as agricultural and silvacultural activities.

4.4.6 Construction Activities

Surface water runoff containing sediment is the major pollutant caussed by this activity. Reduction of sedimentation pollution can be accomplished by 1) minimizing amount of bare land exposed at one time, 2) proper site development, 3) using the least soil disturbing equipment as possible, 4) diverting runoff, 5) trapping sediment in basins, and 6) revegetating as soon as possible.

4.4.7 Non-Concentrated Storm Runoff From Urban/Suburban Areas

Techniques of control of this discharge are the same as for agricultural, silvacultural, and park area activities.

4.4.8 Subsurface Disposal of Liquid Wastes

The majority of residents and commercial and industrial establishments of Caroline County are serviced by individual septic tank systems. Groundwater quality in shallow formations is dependent on the efficient operation of these numerous systems. Proper design, site evaluation, installation, and maintenance of these systems is important for the elimination of groundwater pollution.

4.4.9 Hydrographic Modifications

Because of the high groundwater table found in many areas of Caroline County, improved drainage is necessary for many activities. Residential, commercial and industrial development, agriculture, forestry and highways all benefit from improved drainage. Often drainage is improved by the construction of multi-purpose channels. Improved drainage of farm land can allow for better soil conservation methods to be implemented; and drainage ditching on individual farms is intended to remove excess water from fields within 24 hours to prevent damage to crops. These projects should be undertaken only after careful consideration has been given to all the potential impacts of the project. Even though there are benefits to be gained from channelization projects, there may be adverse water quality impacts. There are specific safeguards that should be taken when channels are constructed, including: 1) replanting of stream banks, 2) "natural-like" reconstruction of the stream beds, 3) sediment traps, 4) limited clearing on one side, and 5) maintenance corridors. Proper maintenance of the channels after construction will also reduce adverse water quality impacts.

Stream channel deterioration and modifications create substantial surface water pollutants. Controlling stream flow instead of increasing channel capacity is a favorable method of reducing pollution. When modifications are necessary, however, proper design, construction, and materials should be used to avoid instability of the channel.

4.4.10 Dredging Activities

Current dredging practices typically result in the creation of substantial surface water pollution either directly or indirectly through leaching or runoff of spoils. Dredging only during times that would least affect shellfish or other aquatic life is a method of reducing the effects of this operation. Improved techniques for dredging and better design, construction and maintenance of spoil containment sites are methods to reduce adverse impacts.

Salt water intrusion could occur into the Choptank Aquifer along the Choptank River up to Martinak State Park and along Tuckahoe Creek up to Wayman Wharf due to dredging near major pumping centers such as the Town of Choptank, or Williston.

4.5 MARINAS

Although boating is not a major activity in Caroline County, the potential water quality problems associated with marinas and pleasure boats warrant special discussion and consideration. Table 4-10 lists the marinas and public landings in Caroline County and their corresponding sewerage facilities.

The use of pump-out facilities presents special problems at marinas. Due to the addition of special chemicals (fungicides, bacteriacides, pH controls etc.) to the on-board holding tanks, when these wastes are pumped out to a central treatment plant at a marina or discharged directly to a public sewer there is a tremendous

and potentially upsetting shock load effect on biological treatment processes. Neutralization, equalization and other pretreatment methods are necessary prior to direct treatment. Yet, connection to public owned treatment works is still the best method for disposal of pumpout wastes.

All of the County's marinas have on-shore facilities but no pumpout facilities.

4.6 SLUDGE GENERATION AND DISPOSAL

Sludge to be disposed in Caroline County is generated from five municipal wastewater treatment plants, and the licensed waste haulers (scavengers). The Maryland Department of the Environment manages sludge disposal practices, especially at the existing municipal plants. The local Division of Environmental Health issues Scavenger (Septage Hauler) Permits to waste haulers pumping out individual on-site septic tanks.

Municipal sludge from Federalsburg and Ridgely is approved for disposal at the Hobbs Road Landfill where it is mixed with soil and used in the cover of the cells. One scavenger also utilizes the Greensboro Sewage Treatment Plant.

Sludge from an out-of-County sewage treatment plant is applied to agricultural land in Caroline County. Permits for the land application of sewage sludge are issued by the State Waste Managment Administration. Land application of sewage sludge is expected to increase in the future, but special consideration should be given to appropriate site review, application practices, and careful monitoring of the land after the sludge has been applied.

Septage disposal is currently managed as an agricultural fertilizer and soil conditioner in its untreated condition as pumped directly from the septic tanks. The County, in accordance with MDE requirements in COMAR 26.04.06, is evaluating methods to pre-treat the septage prior to final utilization to control bacterial and viral contamination and ascertain proper application rates, if land applied. Private treatment facilities and public facilities, distance for haulers, and costs are considered in this decision.

4.7 EXISTING AND FUTURE COUNTY SEWERAGE SERVICE

4.7.1 Caroline County

Central sewage collection and treatment facilities are presently provided by the five incorporated Towns of Denton, Federalsburg, Greensboro, Preston, and Ridgely and the private communities of Caroline Acres Mobile Home Park and Cedar Acres Mobile Home Park. These systems currently serve 33 percent of Caroline County residents (1990 population - 27,035). Individual septic tanks serve the remainder of the population. These individual systems are generally adequate in Caroline County because of the sparse population and predominantly porous soil types with fast liquid percolation. However, in areas of high density, non-porous soils, and in areas of high groundwater tables these systems prove inadequate over extended periods of time. These areas are summarized in Table 4-2.

The following sections discuss existing and future sewerage systems and conditions in each election district. Detailed information on existing sewerage systems is

contained in Table 4-2 (Inventory of Existing Community and Individual Sewerage Problem Areas), Table 4-3 (Inventory of Existing Public and/or Private Community and Other Multi-Use Sewerage Treatment Plants) and Table 4-6 (Projected Sewerage Demands and Planned Capacity for Existing and/or Planned Public or Private Community Sewerage Systems).

Future sewerage systems in Caroline County are described in detail in Table 4-6 (Projected Sewerage Demands and Planned Capacity for Existing and/or Planned Public or Private Community Sewerage Systems) and Table 4-7 (Immediate, 5 and 10 year Priorities for Sewerage Development). A general discussion is included below:

BY 1995 - Approximately 37% of the County's total population will be served by central sewerage systems. The Tilghman Bros. Mobile Home Park is expected to be served by the Town of Federalsburg. The Caroline Acres Mobile Home Park is expected to expand by 37% to serve a total population of 329 persons. Systems are expected to be expanded in Denton, Ridgely, Greensboro, Federalsburg and Preston.

BY 2000 - Approximately 40% of the County's total population will be served by central sewerage systems. Marydel, and Henderson will probably construct community sewerage systems.

BY 2005 - About 41% of the total population will be served by community sewerage systems.

4.7.2 Election District No.1 (Henderson)

The Henderson Election District (1990 population - 2888) currently has 76% of its residents serviced by individual sewage disposal systems. The Caroline Acres Mobile Home Park and Cedar Acres Mobile Home Park serves the remainder of the population of this district with a centralized sewage collection and treatment facility.

Failing septic systems are found in the towns of Marydel, Henderson and Goldsboro. The town of Goldsboro has completed a 201 Facility Study to determine the feasibility of constructing a central sewerage system. Although the study recommends implementation of a central sewerage system, the residents have elected not to proceed with implementation.

In the future, the Caroline Acres Mobile Home Park will expand to serve a population of 400 persons by the year 2000. The failing individual systems will be corrected as needed. A community sewerage system may be constructed at Henderson and Marydel.

4.7.3 Election District No 2 (Greensboro)

The Greensboro Election District (1990 population - 4097) currently has 65% of its total population served by individual sewage disposal systems. The remainder of the population is served by the Town of Greensboro sewerage system.

In the future, the town of Greensboro is not expected to need to expand its sewage treatment plant. Minor rehabilitation of the Town's sewerage system is ongoing. Existing small mains will be replaced with 8" lines. The vacuum pumps will be removed from the lift stations. Extension of service to currently unserved areas of town will occur as development proceeds.

4.7.4 Election District No. 3 (Denton)

Currently 46% of the Denton Election District's total population (1990 population - 5,600) is serviced by individual sewage disposal systems. The only central sewerage system in this District is operated by the Town of Denton.

By 1993, Denton is expected to upgrade its sewage treatment plant to adequately serve proposed projects and improve discharge quality. Additional areas may also be annexed in the future.

No new central sewerage systems are proposed for this district.

4.7.5 Election District No. 4 (Preston)

In the Preston Election District approximately 76% of the population (1990 population - 3,476) is serviced by individual sewage disposal systems. The remainder of the population is serviced by the Town of Preston. The Preston Sewage Treatment Plant was upgraded and expanded in 1988.

The areas of Jonestown, Bethlehem and Tanyard have been identified as having failing septic systems. As part of the Preston 201 Facilities Plan, a separate innovative central sewerage system was proposed for Jonestown. However because the system was not supported by the majority of residents and there was no compelling public health justification for a central system, the County has decided not to proceed with the project. (see Exhibits 4-H & 4-I)

It has also been determined that there is no economically feasible central sewerage system which could be provided to the Bethlehem-Tanyard area. Problems with failing septic systems will be corrected on an individual basis (see Exhibits 4-H & 4-I)

No new central sewerage systems are planned, unless one or more of the mobile home parks in this district decide to expand.

4.7.6 Election District No. 5 (Federalsburg)

The Federalsburg Election District (1990 population - 4,443) is the most densely populated district in the County. Of the total population, 74% is served by individual sewage disposal systems. The Town of Federalsburg serves the remainder of the population.

The Town of Federalsburg owns and operates a Secondary Wastewater Treatment Plant (trickling filters with anaerobic digestion) off of Reliance Avenue along with the related collection system. This system was installed as an upgrade for the town in 1963.

The Collection system is made up of 6,8,10,12,18 and 21 inch gravity sewers with 6 and 12 inch force mains conveying to the treatment plant from 3 pumping stations. There are also 2 lift stations, an ejector station on North Main St. and a submersible lift station on East Central Avenue.

A proposed upgrade of equipment with **Flow Equalization** will allow the existing system to better treat the erratic flows it is presently receiving.

The Main Street/Central Avenue Storm Drain and Sewer Project will replace and separate the present 65 year old storm drain and sewer lines on Central Ave. and Main St. This project will prevent discharge of excess rainfall into Marshyhope Creek, relieve water backups and excess spillage in streets and business establishments and reduce the possibility of drinking water contamination.

In the future, if upgrading and expansion of the Federalsburg sewage treatment plant is undertaken, then annexation and extension of service to areas adjoining the town may be feasible. Several areas north, and west of town have been identified as failing septic tank areas; connection to the town's sewerage system is the preferred solution to this problem. By 1995, the Tilghman Bros. Mobile Home Park is expected to be provided with central sewerage by the town.

4.7.7 Election District No. 6 (Hillsboro)

The entire Hillsboro Election District (1990 population - 1904) is serviced by individual septic systems.

There are several multi-use sewage or industrial waste treatment facilities in this Election District, including:

1) Tuckahoe Shopping Center
2) Hitchler Industries
3) Mulholland - Harper Co., Inc.

There are no new central facilities planned in this district unless Denton incorporates West Denton and extends facilities.

4.7.8 Election District No. 7 (Ridgely)

The Ridgely Election District (1990 population - 2700) currently has 63% of its total population serviced by individual sewage disposal systems. The Town of Ridgely serves the remainder of the population.

The existing sewerage treatment plant for the Town of Ridgely was recently up-graded to include dechlorination and postaeration as required by MDE. A lift station has been constructed on Bell Street, west of Cow Barn Road to provide sewerage service for existing industry within Town limits. The Green Ridge Subdivision, south of MD Rt. 480 and east of Central Avenue has been partially completed. A pumping station with a 6" force main has been located at the south end of Sunrise Avenue to serve the area.

The Town intends to replace its existing sewage treatment plant. They have purchased the Albert White Farm adjoining Belle, Cow Barn, and Peaviner Roads to construct a sewerage treatment and disposal process consisting of a 0.24 million gallon facultative lagoon and spray irrigation system. Also included is the construction of new force mains and pumping stations.

Three plots on the farm totaling 56 acres have been designated as the spray areas. The new system should be completed by the Fall of 1993.

The Town plans to service the area south of Cow Barn Road as a result of the construction of the new STP.

There are several multi-use sewage or industrial waste treatment facilities in this Election District including:

1) The Benedictine School

2) Saulsbury Brothers, Inc.

3) North Caroline High School

No new central sewerage systems are planned for this district.

Ridgely may incorporate and/or extend into the Trinity-Boonsboro area to address septic system problems.

4.7.9 Election District No. 8 (American Corner)

The American Corner Election District (1990 population - 1927) is the least densely populated district in the County. The entire population is serviced by individual sewage disposal systems. There are no concentrated sewage disposal problem areas within the District.

There are several multi-use sewage or industrial waste treatment facilities in this Election District, including:

1) Col. Richardson Middle and High Schools
2) Earle LeGates, Co. Inc. (Seasonal Cannery)
3) J.F.D. Canners, Inc. (Seasonal Cannery)

No new central sewerage systems are planned for this district.

Title 26
DEPARTMENT OF THE ENVIRONMENT

Subtitle 08 WATER POLLUTION

Chapter 02 Water Quality

Authority: Environment Article, §§9-313, 9-314, 9-316, 9-319, 9-320, and 9-325, Annotated Code of Maryland

.01 Surface Water Quality Protection.

A. Purpose. To protect surface water quality, this State shall adopt water quality standards to:

(1) Protect public health or welfare;

(2) Enhance the quality of water;

(3) Protect aquatic resources; and

(4) Serve the purposes of the Federal Act.

B. Water Quality Standards.

(1) The surface water quality standards consist of two parts:

(a) Designated uses of the waters of this State; and

(b) Water quality criteria to protect the designated uses.

(2) Water quality standards shall, wherever attainable, provide water quality for the designated uses of:

(a) Water contact recreation;

(b) Fishing;

(c) Propagation of fish, other aquatic life, and wildlife; and

(d) Agricultural and industrial water supply.

(3) Waters of this State shall be protected for the basic designated uses in Regulation .02A.

(4) Water quality standards shall consider the use and value of public water supplies.

(5) Regulations .02-.08 of this chapter implement this State's water quality standards by:

(a) Defining and establishing specific designated uses for the surface waters of this State;

(b) Assigning a designated use to all surface waters;

(c) Establishing water quality criteria for each designated use;

(d) Defining this State's antidegradation policy;

(e) Defining this State's criteria for mixing zones; and

(f) Defining other water quality protective policies.

.02 Designated Uses.

A. General.

(1) Waters of this State shall, wherever attainable, be protected for the basic uses of water contact recreation, fishing, protection of aquatic life and wildlife, and agricultural and industrial water supply as identified in Use I.

(2) The determination of the designated use of a water body shall include consideration of the following factors:

(a) Existing conditions; and

(b) Potential uses which may be made possible by anticipated improvements in water quality.

(3) The actual uses of surface water are not limited to those designated in this chapter. Any reasonable and lawful use is permitted provided that the surface water quality is not adversely affected by the use.

B. Specific Designated Uses.

(1) Use I: Water Contact Recreation, and Protection of Aquatic Life. This use designation includes waters which are suitable for:

(a) Water contact sports;

(b) Play and leisure time activities where individuals may come in direct contact with the surface water;

(c) Fishing;

(d) The growth and propagation of fish (other than trout), other aquatic life, and wildlife;

(e) Agricultural water supply; and

(f) Industrial water supply.

(2) Use I-P; Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply. This use designation includes:

(a) All uses identified for Use I; and

(b) Use as a public water supply.

(3) Use II: Shellfish Harvesting Waters. This use designation includes waters where:

(a) Shellfish are propagated, stored, or gathered for marketing purposes; and

(b) Actual or potential areas for the harvesting of oysters, softshell clams, hardshell clams, and brackish water clams.

(4) Use III: Natural Trout Waters. This use designation includes waters which have the potential for or are:

(a) Suitable for the growth and propagation of trout; and

(b) Capable of supporting self-sustaining trout populations and their associated food organisms.

(5) Use III-P: Natural Trout Waters and Public Water Supply. This use designation includes:

(a) All uses identified for Use III waters; and

(b) Use as a public water supply.

(6) Use IV: Recreational Trout Waters. This use designation includes cold or warm waters which have the potential for or are:

(a) Capable of holding or supporting adult trout for put-and-take fishing; and

(b) Managed as a special fishery by periodic stocking and seasonal catching.

(7) Use IV-P: Recreational Trout Waters and Public Water Supply. This use designation includes:

(a) All uses identified for Use IV waters; and

(b) Use as a public water supply.

.03 Surface Water Quality Criteria.

A. Applicability.

(1) Surface water quality criteria shall apply:

(a) In fresh water streams and rivers:

(i) For toxic substances, under the conditions stipulated in Regulations .03-2A and .05A, and

(ii) Under design stream flow for all other substances;

(b) In tidal waters:

(i) For toxic substances, under the conditions stipulated in Regulations .03-2A and .05A, and

(ii) Under average tidal conditions during design stream flows for all other substances.

(c) Outside of any mixing zones which may be designated by the Department.

(2) If the natural water quality of a stream segment is not consistent with the criteria established for the stream then:

(a) The natural conditions do not constitute a violation of the water quality standards; and

(b) The water quality to be maintained and achieved is not required to be substantially different from that which would occur naturally.

B. General Water Quality Criteria. The waters of this State may not be polluted by:

(1) Substances attributable to sewage, industrial waste, or other waste that will settle to form sludge deposits that:

(a) Are unsightly, putrescent, or odorous, and create a nuisance, or

.03-3 Water Quality Criteria Specific to Designated Uses.

A. Criteria for Use I Waters - Water Contact Recreation and protection of Aquatic Life.

(1) Bacteriological. There may not be any sources of pathogenic or harmful organisms in sufficient quantities to constitute a public health hazard. A public health hazard will be presumed:

(a) If the fecal coliform density exceeds a log mean of 200 per 100 milliliters, based on a minimum of not less than five samples taken over any 30-day period;

(b) If 10 percent of the total number of samples taken during any 30-day period exceed 400 per 100 milliliters; or

(c) Except when a sanitary survey approved by the Department of the Environment discloses no significant health hazard, §A(1)(a) and (b) does not apply.

(2) Dissolved Oxygen. The dissolved oxygen concentration may not be less than 5 milligrams/liter at any time.

(3) Temperature.

(a) The maximum temperature outside the mixing zone determined in accordance with Regulation .05 of this chapter or COMAR 26.08.03.03-.05 may not exceed 90 deg. F (32 deg. C) or the ambient temperature of the surface waters, whichever is greater.

(b) A thermal barrier that adversely affects aquatic life may not be established.

(4) pH. Normal pH values may not be less than 6.5 or greater than 8.5.

(5) Turbidity.

(a) Turbidity may not exceed levels detrimental to aquatic life.

(b) Turbidity in the surface water resulting from any discharge may not exceed 150 units at any time or 50 units as a monthly average. Units shall be measured in Nephelometer Turbidity Units.

(6) Toxic Substance Criteria. All toxic substance criteria to protect:

(b) Interfere directly or indirectly with designated uses;

(2) Any material, including floating debris, oil, grease, scum, sludge, and other floating materials attributable to sewage, industrial waste, or other waste in amounts sufficient to:

(a) Be unsightly,

(b) Produce taste or odor,

(c) Change the existing color,

(d) Change other chemical or physical conditions in the surface waters,

(e) Create a nuisance, or

(f) Interfere directly or indirectly with designated uses;

(3) High-temperature or corrosive substances attributable to sewage, industrial waste, or other waste in concentrations or combinations which:

(a) Interfere directly or indirectly with designated uses, or

(b) Are harmful to human, animal, plant, or aquatic life;

(4) Acute toxicity from any discharge; and

(5) Toxic substances attributable to sewage, industrial wastes, or other wastes in concentrations outside designated mixing zones, which:

(a) Interfere directly or indirectly with designated uses, or

(b) Are harmful to human, plant, or aquatic life.

(a) Fresh water aquatic organisms apply in waters designated as fresh water in Regulation .03-1B;

(b) Estuarine or salt water aquatic organisms apply in waters designated as estuarine or salt waters as specified in Regulation .03-1B; and

(c) The wholesomeness of fish for human consumption apply in fresh, estuarine, and salt waters.

B. Criteria for Use I-P Waters - Water Contact Recreation, Protection of Aquatic Life and Public Water Supply. The following criteria apply:

(1) The criteria for Use I Waters in §A(1)-(5); and

(2) Toxic Substance Criteria. All toxic substance criteria:

(a) For protection of fresh water aquatic organisms apply; and

(b) To protect public water supplies and the wholesomeness of fish for human consumption apply.

C. Criteria for Use II Waters - Shellfish Harvesting.

(1) Bacteriological. There may not be any pathogenic or harmful organisms in sufficient quantities to constitute a public health hazard in the use of waters for shellfish harvesting. A public health hazard will be presumed:

(a) If the most probable number (MPN) of fecal coliform organisms exceeds a median concentration of 14 MPN per 100 milliliters;

(b) If more than 10 percent of samples taken exceed 43 MPN per 100 milliliters for a 5-tube decimal dilution test or 49 per 100 milliliters for a 3-tube decimal dilution test; or

(c) Except when a sanitary survey approved by the Department of the Environment discloses no significant health hazard, §C(1)(a) and (b) does not apply.

(2) Dissolved oxygen-same as Use I waters.

(3) Temperature-same as Use I waters.

(4) pH-same as Use I waters.

(5) Turbidity-same as Use I waters.

(6) Toxic Substance Criteria. All toxic substance criteria to protect:

(a) Estuarine or salt water aquatic organisms apply in accordance with the requirements of Regulation .03-1B; and

(b) The wholesomeness of fish for human consumption apply.

D. Criteria for Use III Waters - Natural Trout Waters.

(1) Bacteriological-same as Use I waters.

(2) Dissolved Oxygen. The dissolved oxygen concentration may not be less than 5 milligrams/liter at any time, with a minimum daily average of not less than 6 milligrams/liter.

(3) Temperature.

(a) The maximum temperature outside the mixing zone determined in accordance with Regulation .05 of this chapter or COMAR 26.08.03.03-.05 may not exceed 68 deg. F (20 deg. C) or the ambient temperature of the surface waters, whichever is greater.

(b) A thermal barrier that adversely affects aquatic life may not be established.

(4) pH-same as Use I waters.

(5) Turbidity-same as Use I waters.

(6) Total Residual Chlorine (TRC). Except as provided in COMAR 26.08.03.06, the Department may not issue a permit allowing the use of chlorine or chlorine containing compounds in the treatment of wastewaters discharging to Use III and Use III-P waters.

(7) Toxic Substance Criteria. All toxic substance criteria to protect:

(a) Fresh water aquatic organisms apply; and

(b) The wholesomeness of fish for human consumption apply.

E. Criteria for Use III-P Waters - Natural Trout Waters and Public Water Supplies. The following criteria apply:

.04 Anti-Degradation Policy.

A. Certain waters of this State possess an existing quality which is better than the water quality standards established for them. The quality of these waters shall be maintained unless:

(1) The Department determines a change is justifiable as a result of necessary economic or social development; and

(2) A change will not diminish uses made of, or presently possible, in these waters.

B. To accomplish the objective of maintaining existing water quality:

(1) New and existing point sources shall achieve the highest applicable statutory and regulatory effluent requirements; and

(2) Nonpoint sources shall achieve all cost effective and reasonable best management practices for nonpoint source control.

C. The Department shall discourage the downgrading of any stream from a designated use with more stringent criteria to one with less stringent criteria. Downgrading may only be considered if:

(1) The designated use is not attainable because of natural causes;

(2) The designated use is not attainable because of irretrievable man-induced conditions; or

(3) Controls more stringent than the effluent limitations and national performance standards mandated by the Federal Act, and required by the Department, would result in substantial and widespread economic and social impact.

D. The Department shall provide public notice and opportunity for a public hearing on the proposed change before:

(1) Permitting a change in high quality waters; or

(2) Downgrading any stream use designation.

E. Water which does not meet the standards established for it shall be improved to meet the standards.

D. SUB-BASIN 02-13-03: NANTICOKE RIVER AREA

(1) Use I-P: None
(2) Use II: All estuarine portions of tributaries except:
(a) Blackwater River and tributaries

From 1083.1/192 to 1084.2/191.6 — Above mouth

(b) Transquaking River and tributaries

From 1085.2/196.3 to 1088/197 — Above mouth

(c) Nanticoke River and tributaries

From 1126/194 to 1128.2/191.2 — Above line from Runaway Pt. to Long Pt.

(d) Wicomico River and tributaries

1147.9/160.5 — Above ferry crossing at White Haven

(e) Monie Creek

1138.7/146.7 — Above mouth

(3) Use III: None
(4) Use III-P: None
(5) Use IV: None
(6) Use IV-P: None

E. SUB-BASIN 02-13-04: CHOPTANK RIVER AREA

(1) Use I-P: None
(2) Use II: All estuarine portions of tributaries except:
(a) Choptank River and tributaries

From 1099.3/308 to 1101/306.5 — Above line from Bow Knee Pt. to Wright Wharf

(b) Tred Avon River and tributaries

1057.6/341.6 — Above Easton Pt.

(3) Use III: None
(4) Use III-P: None
(5) Use IV: None
(6) Use IV-P: None

EXHIBIT 4-C

STANDARDS FOR SECONDARY TREATMENT
(COMAR 26.08.01.01.B (80)

Secondary Treatment means the treatment of sewage to produce effluent equal to or better than the following quality:

(a) Five day biochemical oxygen demand:
(i) 30 mg/l - average for a 30 day period
(ii) 45 mg/l - average for a 7 day period

(b) Total suspended solids:
(i) 30 mg/l - average for a 30 day period
(ii) 45 mg/l - average for a 7 day period

(c) Bacterial control:
As required to meet water quality standards.
Chlorine discharges:
For sewage treatment works discharging into Use I waters, the limit shall be the nondetectable level (COMAR 26.08.03.06C)

Exhibit 1-P

Watersource Heat Pumps

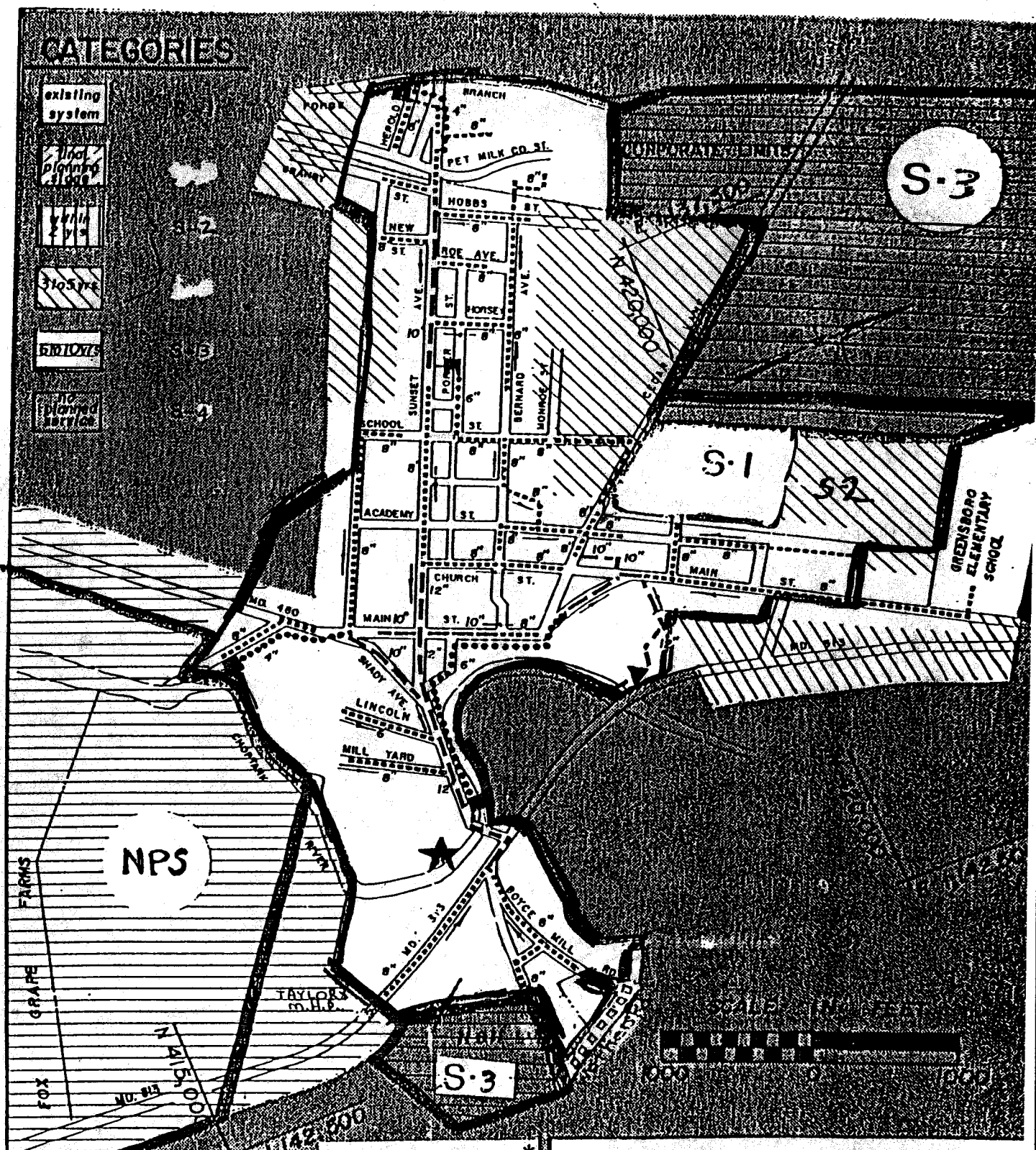
Heat pumps are basically reverse cycle air conditioners. Instead of using compressed freon liquid for cooling, hot freon from the compressor is used for heating. The heat pump extracts heat from the water circulated through it and a fan distributes the heat through a duct to the home.

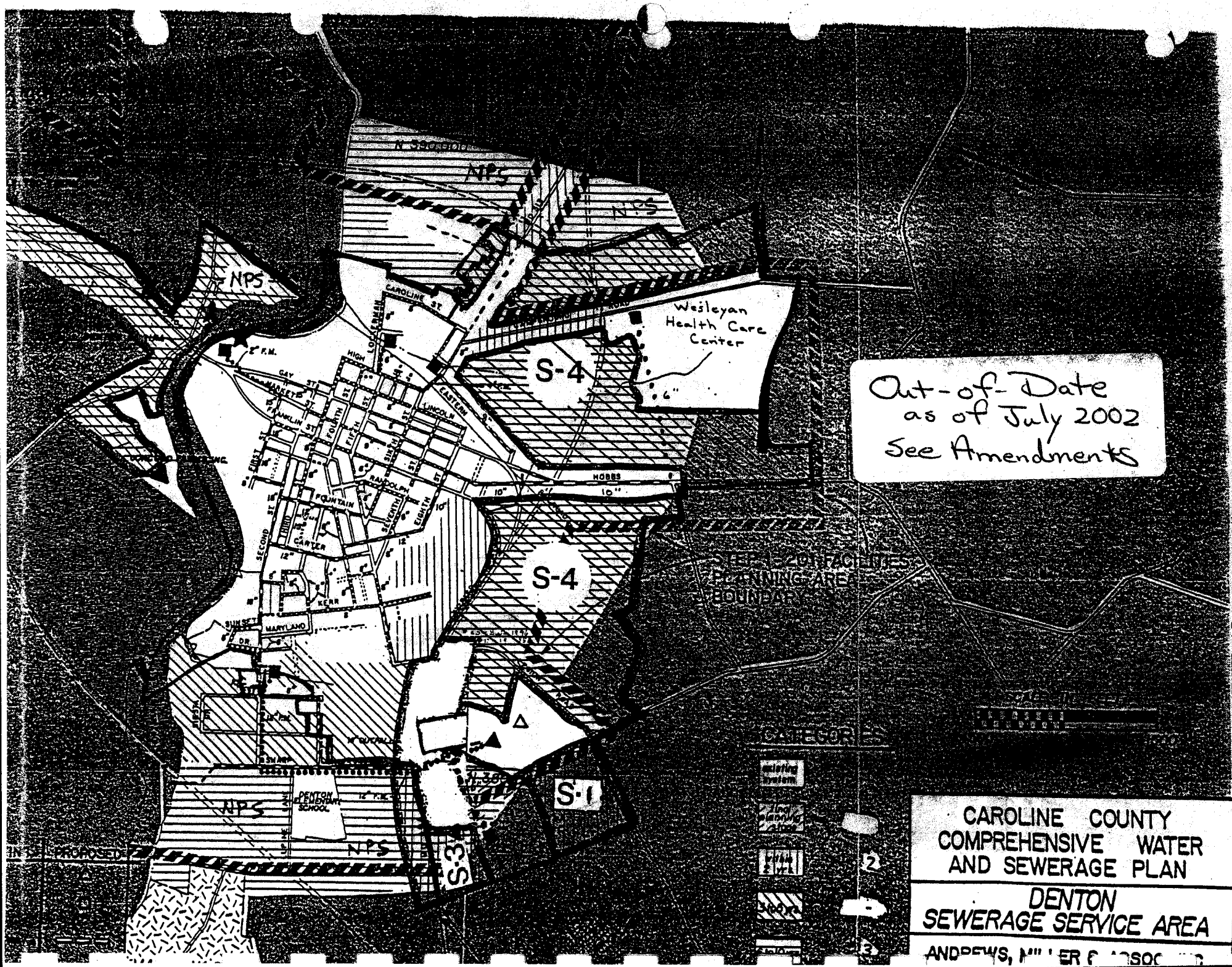
Watersource heat pumps are more efficient than airsource heat pumps. Airsource units become less efficient as the air temperature gets progressively colder. Water to air heat pumps are preferred because the temperature of water sources fluctuates less than the air temperature. Groundwater is preferred over streams, ponds, and rivers since groundwater temperature is relatively constant year round. Also, groundwater generally has a superior water quality over surface waters and pretreatment is usually not necessary.

In the past, water from the well used for the groundwater heat pump was discharged to the nearest ditch or stream. An average home uses approximately 8,000 gallons of groundwater per day per heat pump unit. This is equivalent to the daily domestic use of 27 homes. Some homes use multiple heat pumps and water usage is equivalently multiplied. For example, a home requiring 3 heat pumps may use approximately 24,000 gallons of water each day, or the equivalent of 80 homes, the size of a small municipality.

Groundwater is a limited resource that must be conserved. Special care must be taken to protect the aquifer from contamination. In general, adequate volume of water is available throughout the County from the unconfirmed groundwater, but some areas and confined aquifers are more susceptible to potential contamination and excessive withdrawal of available water. Protection of existing supplies must be exercised. If water is withdrawn from a confined aquifer, it should be returned to that aquifer and not wasted, and thereby reducing the contamination potential.

Applications for Groundwater Heat Pumps are received by the Caroline County Health Department, Environmental Health Division for conformance with the General Permit and the Water and Sewerage Plan. The Division also has the responsibility for issuance of Well Construction Permits, and coordination between the applicant and the Water Resources Administration of DNR for Groundwater Appropriation Applications. All withdrawal of confirmed aquifer water requires recharge back to the aquifer.

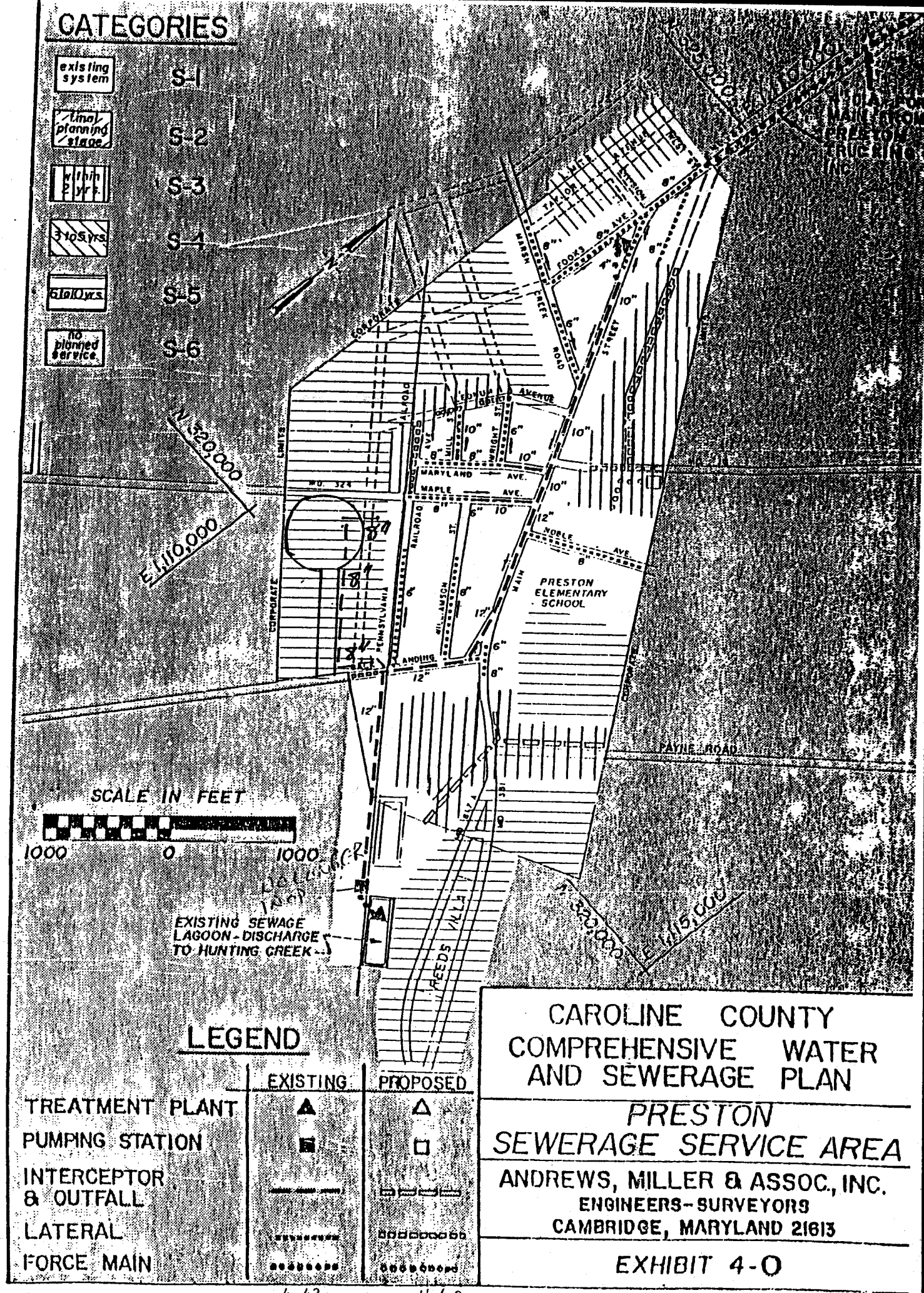

CATEGORIES
existing system
3to5yrs
S-1
S-2
S-3
S-4
NPS
Revised 1984*
LEGEND
EXISTING
PROPOSED
TREATMENT PLANT
PUMPING STATION
INTERCEPTOR & OUTFALL
LATERAL
CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN
GREENSBORO SEWERAGE SERVICE ARE
ANDREWS, MILLER & ASSOC., INC
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613
EXHIBIT 4-M



CAROLINE COUNTY
COMPREHENSIVE WATER
AND SEWERAGE PLAN

DENTON
SEWERAGE SERVICE AREA

ANDREWS, MILLER & ASSOC.



CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN

PRESTON SEWERAGE SERVICE AREA

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

EXHIBIT 4-O

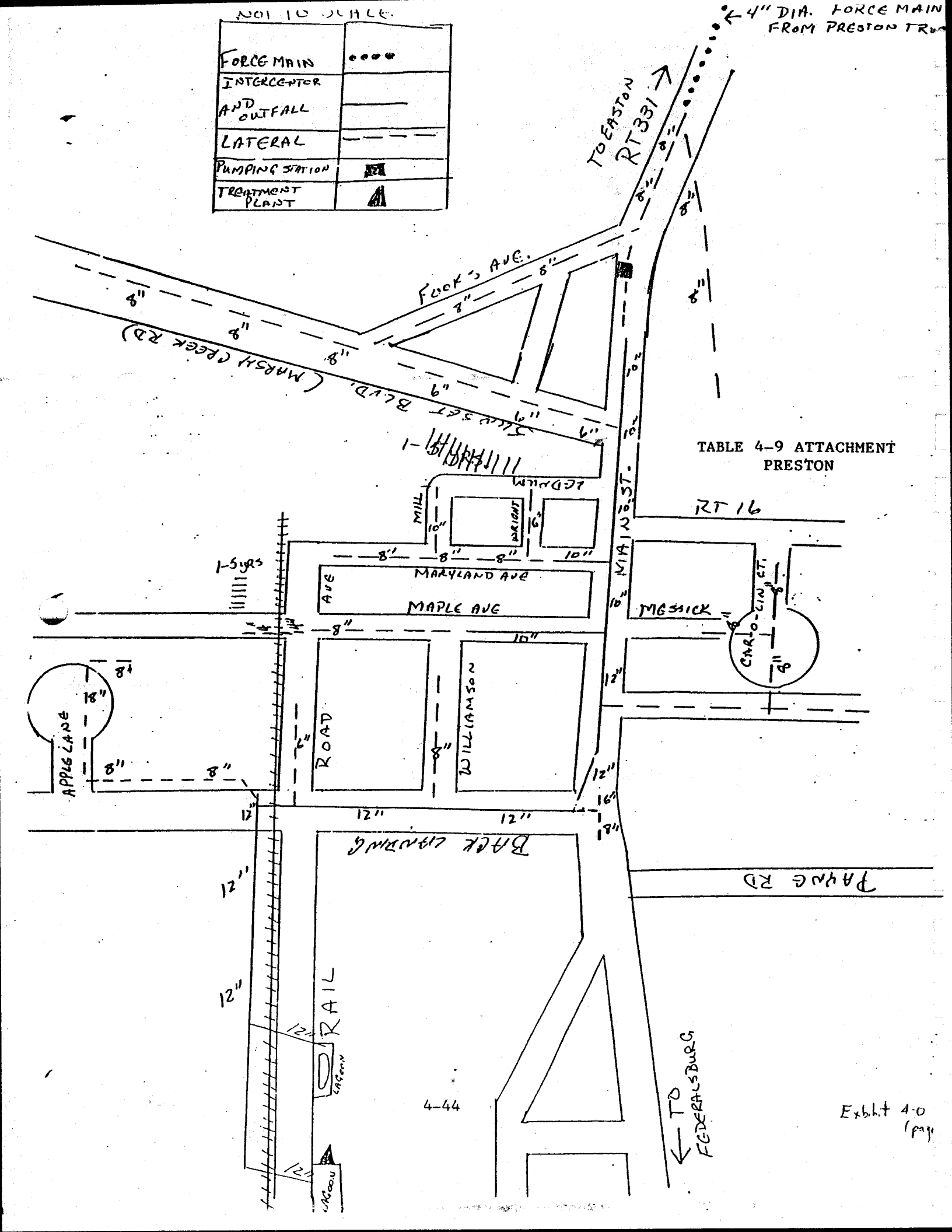
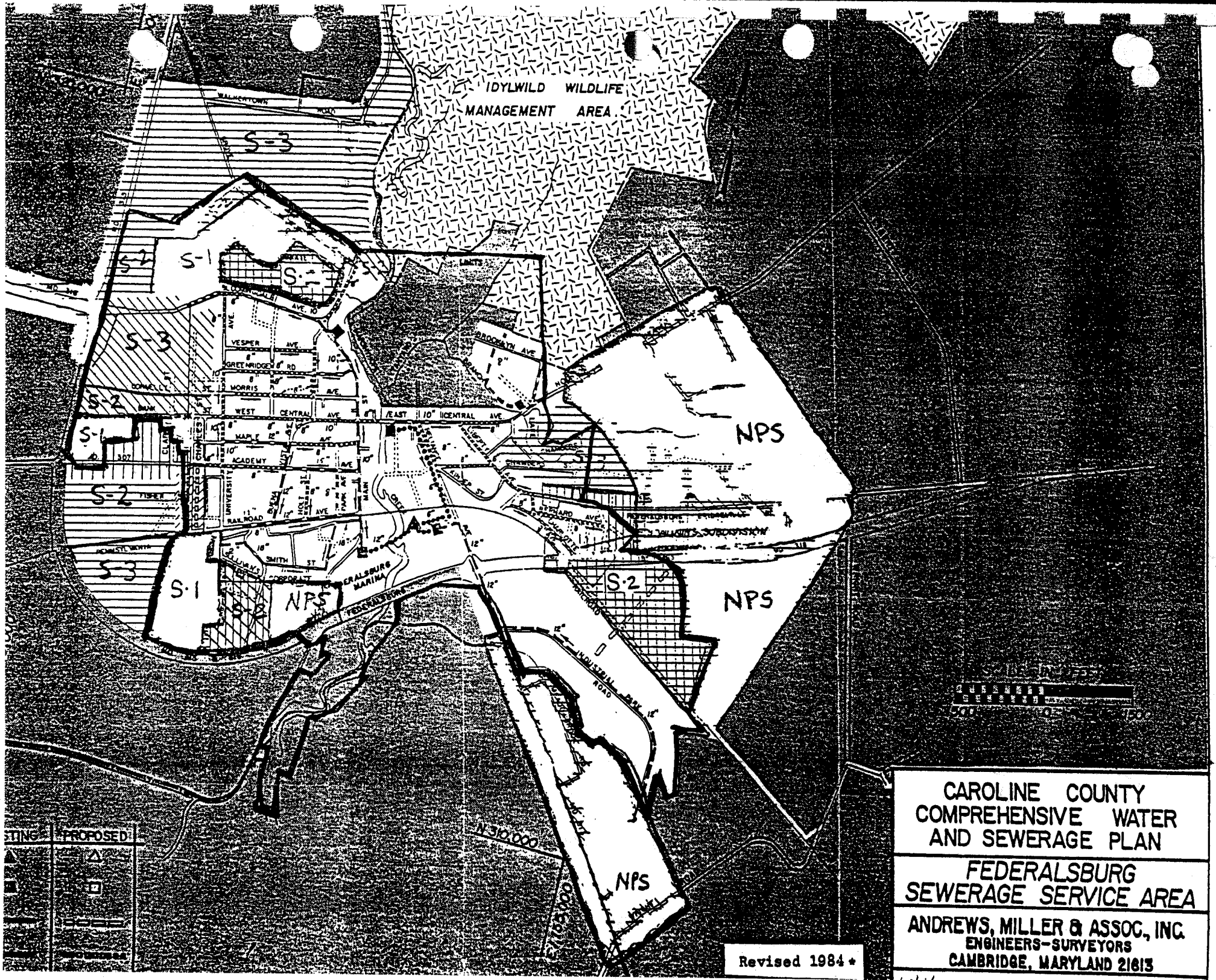


TABLE 4-9 ATTACHMENT
PRESTON



Revised 1984 *

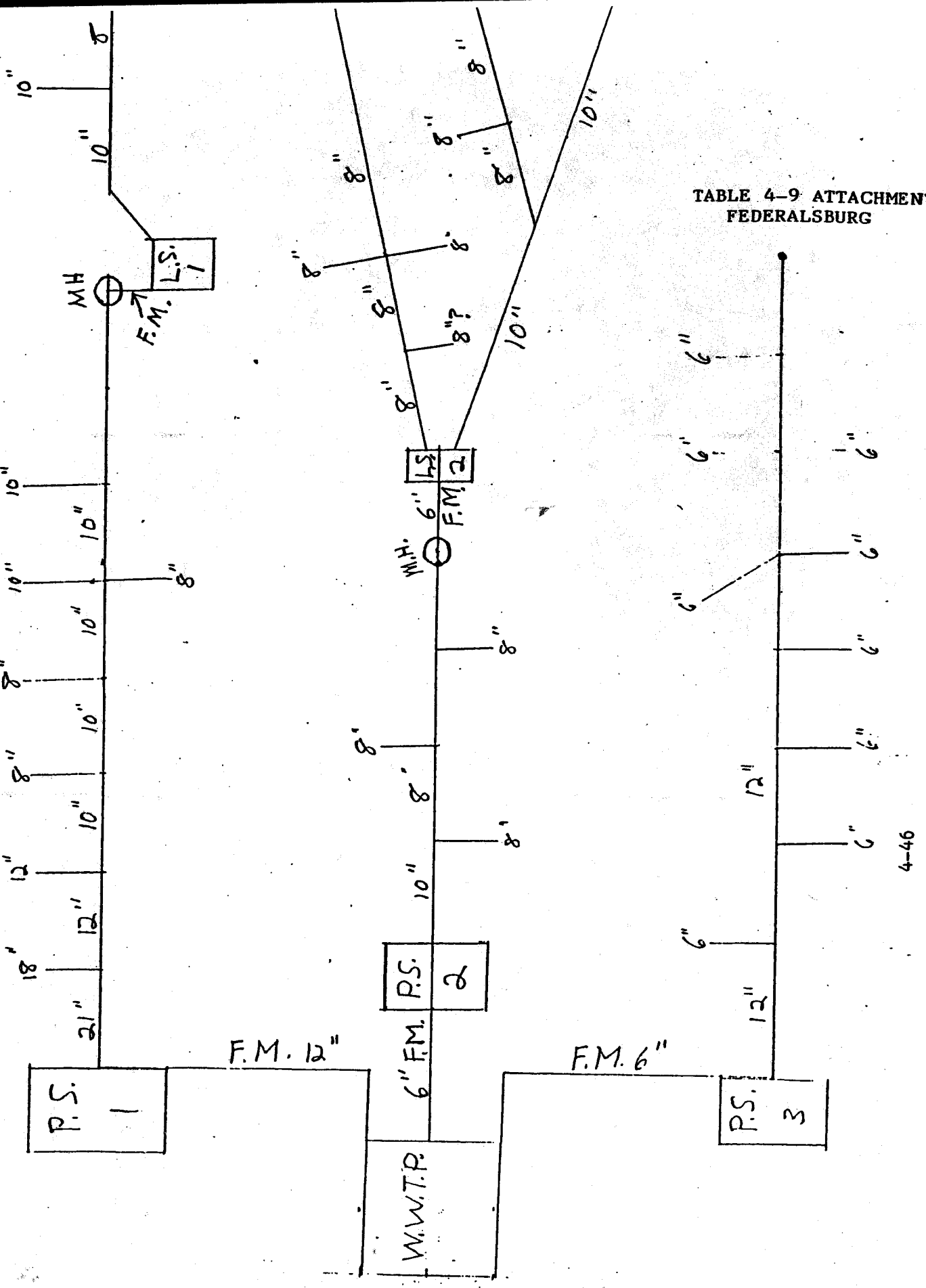
CAROLINE COUNTY
COMPREHENSIVE WATER
AND SEWERAGE PLAN

FEDERALSBURG
SEWERAGE SERVICE AREA

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

4-43

TABLE 4-9 ATTACHMENT
FEDERALSBURG



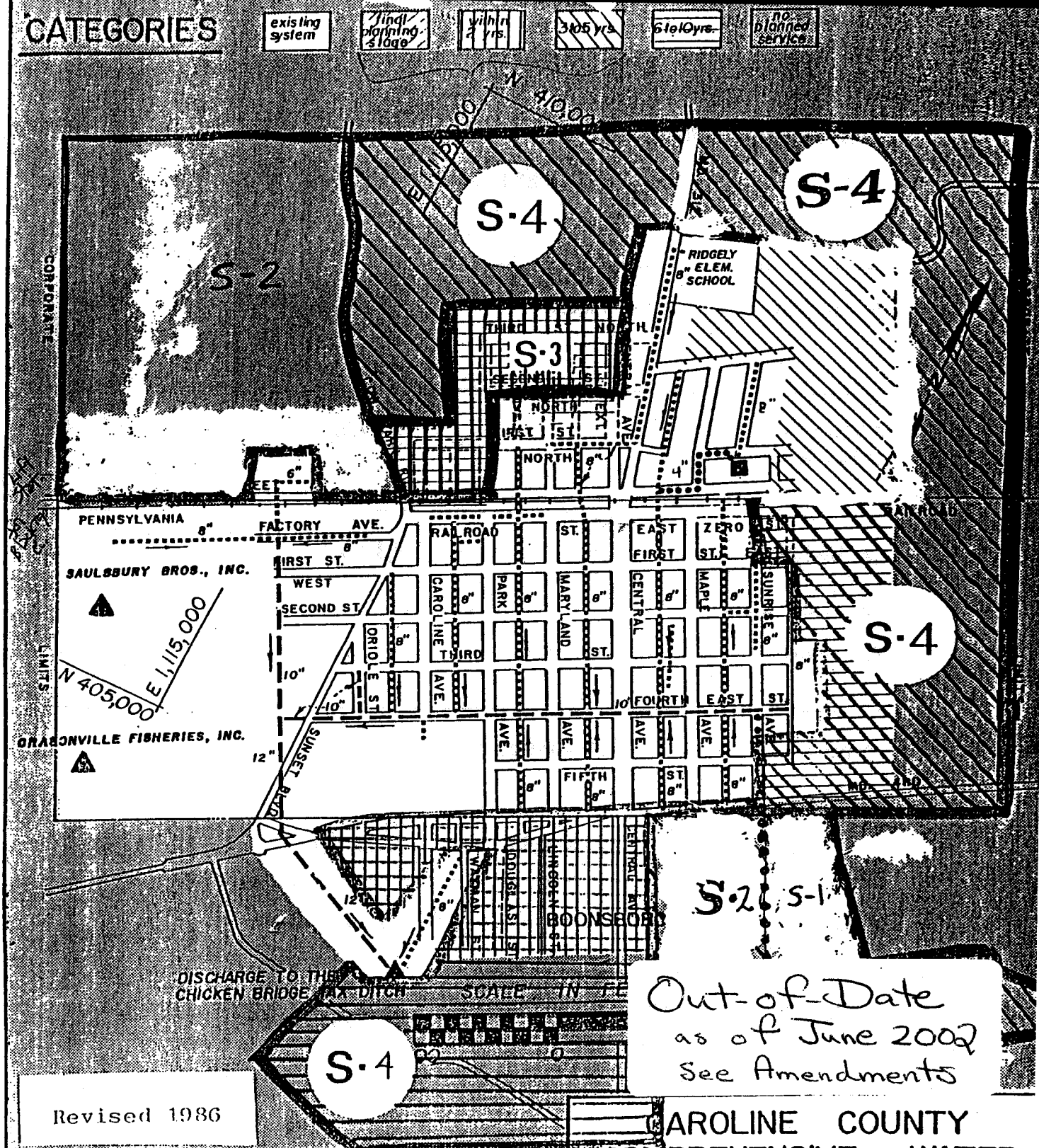

CATEGORIES
existing system
final planning stage
within 2 yrs.
3 to 5 yrs.
6 to 10 yrs.
no planned service
S-1
S-2
S-3
S-4
RIDGELY 8" ELEM. SCHOOL
CORPORATE LIMITS
PENNSYLVANIA
FACTORY AVE.
SAULSBURY BROS., INC.
GRANONVILLE FISHERIES, INC.
N 405,000 E 1,115,000
FIRST ST.
WEST
SECOND ST
THIRD
FOURTH
EAST
ZERO
RAILROAD
NORTH
CAROLINE
PARK
MARYLAND
CENTRAL
MAPLE
SUNRISE
ORIOLE
SUNSET BLVD.
FIFTH
WOODLAWN
DOUGLAS
LINCOLN
CENTRAL AVE.
BOONSBORO
DISCHARGE TO THE CHICKEN BRIDGE TAX DITCH
SCALE: IN FE
Revised 1986
Out-of-Date as of June 2002 See Amendments
LEGEND
EXISTING
PROPOSED
TREATMENT PLANT
PUMPING STATION
INTERCEPTOR & OUTFALL
LATERAL
FORCE MAIN
CAROLINE COUNTY COMPREHENSIVE WATER AND SEWERAGE PLAN
RIDGELY SEWERAGE SERVICE AREA
ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613
4-49
EXHIBIT 4-Q

TABLE 4-1
GEOLOGIC FORMATIONS AND THEIR GROUNDWATER HEAT PUMP
USE AND RESTRICTIONS PROPERTIES

Formation	Aquifer	Use Properties Codes	Restrictions Codes
Pleistocene & Pliocene Series		1,2,7,8,9	1,2,3,4,7
St. Mary's		2,3,4,5,9,11	1,2,5,6,10
Choptank	Frederica	3,4,5,10,11	1,5,6,10
Calvert	Federalsburg	3,4,5,10,11	1,5,6
	Cheswold	3,4,6,10,11	1,5,6
Piney Point		1,6,10,12,13,14	1,5,6,7,8
Aquia		3,6,10,11,14,15	1,5,7,8
Matawan through Patuxent		15, 16	1,9

Table 4-1 (cont'd)

Use Properties Codes:

1. In general, high transmissibility
2. Generally acidic and irony
3. In general, lower transmissibility
4. Lenticular (reducing potential yield)
5. Recharge may require second well
6. One well system may be possible
7. Water quality may require pretreatment
8. Surface discharge may be possible
9. Seasonally fluctuating water temperatures
10. Consistent year-round water temperatures
11. Limited aquifer boundaries or geometry
12. Adequate aquifer boundaries or geometry
13. Localized limitations with pumping levels
14. Greater pump depths required in some areas
15 Increased cost to drill to aquifer depth
16. Adequate data on aquifer not available

Table 4-1 (cont'd)

Restrictions Codes:

1. General
   a. Completion of application (s) with the Caroline County Health Department, DHMH, and/or WRA where required.
   b. Discharge prohibited to storm drains, sewers, combined storm-sewers.
   c. Water appropriation in or within 200 feet of incorporated municipalities or water service districts utilizing the proposed aquifer for the primary source of water.
   d. Water treatment shall be a process resulting in water consistent with the quality derived from the aquifer.
   e. Backflow devices if well will also serve domestic uses. Heat pump unit as a plumbing fixture, appurtenance, or appliance requires plumbing permit.
   f. Water appropriation within 200 feet of adjacent wells utilizing the proposed aquifer as the source of water.
   g. Health Department has an option to make an exception to any restrictions regarding water appropriation and discharge.
2. Water appropriation within 200 feet of saline waters.
3. Surface discharge to poor drainage areas, control of erosion.
4. Surface discharge to saline waters.
5. Appropriation of water from confined aquifer requires discharge to same aquifer.
6. Limited by restrictions of aquifer use Zone I.
7. Limited by restrictions of aquifer use Zone II.

Table 4-1 (cont'd)

8. Limited by restrictions of aquifer use Zone III.

9. Aquifer data limited.

10. Brackish water encroachment one mile protection area to saline water.

TABLE 4-2 – INVENTORY OF SEWERAGE PROBLEM AREAS

SEWERAGE SERVICE AREA	NATURE OF PROBLEM	POPULATION	PLANNED CORRECTION & DATE (if known)
I. COMMUNITY			
A. Town of Denton	Inability to meet NPDES permit limits, Infiltration/Inflow	2977	STP upgrade and expansion - 1994, I/I reduction
B. Town of Federalsburg	Infiltration/Inflow	2365	Grouting and repair of sewer lines, I/I reduction
C. Town of Greensboro	Infiltration/Inflow	1441	Replacing small sewer lines with 8" lines
D. Town of Preston	None	437	None
E. Town of Ridgely	Inability to meet NPDES permit limits	1034	Construction of new STP-1993
II. INDIVIDUAL			
A. Election District #1			
1. Goldsboro	Individual Septic Systems Failures	185	Correct or replace individual systems where possible
2. Marydel	Individual Septic Systems Failures	143	Correct or replace individual systems where possible
3. Mt. Zion	Individual Septic Systems Failures	75	Correct or replace individual systems where possible
4. Henderson	Individual Septic Systems Failures		Correct or replace individual systems where possible
B. Election District #2			
C. Election District #3			
1. Denton Outskirts	Failing Septic Systems	125	Annexation by Town of Denton and connection to town sewerage systems - 1994

TABLE 4-2 - INVENTORY OF SEWERAGE PROBLEM AREAS-CONTINUED

SEWERAGE SERVICE AREA	NATURE OF PROBLEM	POPULATION	PLANNED CORRECTION & DATE (if known)
D. Election District #4			
1. Bethlehem	Individual Septic System Failures	150	Correct or replace individual systems where possible
2. Cedar Lane Subdivision	Individual Septic System Failures		Correct or replace individual systems where possible
3. Choptank	Individual Septic System Failures	125	Correct or replace individual systems where possible
4. Jonestown	Individual Septic System Failures	252	Correct or replace individual systems where possible
5. Linchester	Individual Septic System Failures	50	Correct or replace individual systems where possible
6. Tanyard	Individual Septic System Failures	225	Correct or replace individual systems where possible
E. Election District #5			
1. Federalsburg- Outskirts - North, South and West of Town	Individual Septic System Failures	353	Annexation of Town of Federalsburg and connection to town sewerage system -- 1994
	Tilghman's Trailer Park	56	Block grant applied for
F. Election District #6			
1. West Denton Area	Individual Septic Failures	100	Correct or replace individual systems where possible - central sewerage system-2000
G. Election District #7			
1. Boonsboro/Trinity	Individual Septic System Failures	114	Correct or replace individual systems where possible

TABLE 4-3

INVENTORY OF EXISTING COMMUNITY AND MULTI-USE SEWERAGE TREATMENT PLANTS

OWNER AND OPERATING AGENCY	TYPE OF TREATMENT	NPDES NUMBER	PLANT COORDINATE LOCATION NORTH	PLANT COORDINATE LOCATION EAST	PLANT POINT OF DISCHARGE	CAPACITY (MGD)	AVERAGE FLOW (MGD)	PEAK FLOW (MGD)
I. PUBLIC COMMUNITY								
A. DENTON, COMMISSIONERS	3 STABILIZATION LAGOONS (1964) CHLORINATION	85-DP-0537	381	1,136	CHOPTANK RIVER	0.45	0.416	0.45
B. FEDERALSBURG, MAYOR & COUNCIL	HIGH RATE TRICKLING FILTER SYSTEM (1964) WITH BROMINE CHLORIDE DISINFECTION SYSTEM (1982)	87-DP-0595	315	1,151	MARSHYHOPE CREEK	0.74	0.361	0.74
C. GREENSBORO, COMMISSIONERS	HIGH RATE TRICKLING FILTER SYSTEM (1971) CHLORINATION/DECHLORINATION	89-DP-0597A	419	1,140	CHOPTANK RIVER	0.28	0.144	0.28
D. PRESTON, COMMISSIONERS	STABILIZATION LAGOONS (1965), CHLORINATION (1974), NEW STABILIZATION LAGOON (1985)	89-DP-0525A	319	1,113	HUNTING CREEK, A TRIBUTARY TO CHOPTANK RIVER	0.115	0.060	0.102
E. RIDGELY, COMMISSIONERS	CONTACT STABILIZATION (1970) CHLORINATION/DECHLORINATION, NEW STP BY FALL OF 1993	92-DP-0530	404	1,117	CHICKEN BRIDGE TAX DITCH, A TRIBUTARY TO CHOPTANK RIVER	0.20	0.098	0.20
II. PRIVATE COMMUNITY								
A. CAROLINE ACRES MHP, EDMUND E. RACZ	2 STABILIZATION LAGOONS	91-DP-1264	451	1,148	SPRAY IRRIGATION	0.024	0.013	N/A
B. WALKER'S TRAILER PARK	PACKAGE TREATMENT PLANT	85-DP-1669	466	1,153	DRAINAGE DITCH TO TIDY ISL. CREEK	0.015	0.006	N/A

TABLE 4-3

INVENTORY OF EXISTING COMMUNITY AND MULTI-USE SEWERAGE TREATMENT PLANTS, CONTINUED

OWNER AND OPERATING AGENCY	TYPE OF TREATMENT	NPDES NUMBER	PLANT		CAPACITY (MGD)	AVERAGE FLOW (MGD)	PEAK FLOW (MGD)
			COORDINATE LOCATION NORTH EAST	POINT OF DISCHARGE			
III. COMMERCIAL							
A. TUCKAHOE SHOPPING CENTER, INC.	STABILIZATION LAGOON	76-DP-1282	420 1,000	SPRAY IRRIGATION	0.00001	0.00001	N/A
IV. INSTITUTIONAL							
A. NORTH CAROLINE HIGH SCHOOL, CAROLINE COUNTY BOARD OF EDUCATION	ACTIVATED SLUDGE (EXTENDED AERATION) CHLORINATION	80-DP-0657	393 1,130	CHOPTANK RIVER	0.024	0.007	0.008
B. COLONEL RICHARDSON MIDDLE AND HIGH SCHOOLS, CAROLINE COUNTY BOARD OF EDUCATION	ACTIVATED SLUDGE CHLORINATION	84-DP-1455	338 1,135	WOLF PIT BRANCH, A TRIBUTARY TO MARSHYHOPE CREEK	0.05	0.006	0.008
C. BENEDICTINE SCHOOL	ACTIVATED SLUDGE (EXTENDED AERATION)	NONE	427 1,116	GROUNDWATER PERCOLATION BASINS	0.01	0.007	N/A
V. INDUSTRIAL							
A. EARLE LEGATES, CO., INC.	STABILIZATION LAGOON	90-DP-0887	346 1,120	SPRAY IRRIGATION	0.05	0.05	0.05
B. FEDERAL INDUSTRIES (HITCHLER INDUSTRIES)	SOLVENT RECOVERY	88-DP-0290	389 1,126	UNNAMED TRIBUTARY OF THE CHOPTANK RIVER	0.072	0.005	0.03
C. SAULSBURY BROTHERS, INC.	SETTLING TANK FOR SOLIDS REMOVAL, NON-CONTACT COOLING WATER	90-DP-0507	405 1,115	TRIBUTARY OF CHOPTANK RIVER AND SPRAY IRRIGATION	0.01 0.00005	0.01 0.00001	0.035 0.00001

TABLE 4-3

INVENTORY OF EXISTING COMMUNITY AND MULTI-USE SEWERAGE TREATMENT PLANTS, CONTINUED

OWNER AND OPERATING AGENCY	TYPE OF TREATMENT	NPDES NUMBER	PLANT		CAPACITY (MGD)	AVERAGE FLOW (MGD)	PEAK FLOW (MGD)
			COORDINATE LOCATION NORTH EAST	POINT OF DISCHARGE			
D. JOHN N. WRIGHT, JR., INC.	SEEPAGE LAGOON	89-DP-0556	318 1,125	SPRAY IRRIGATION	1.25	0.03	N/A
E. MULHOLLAND-HARPER CO.	TREATED METAL CLEANING RINSE WATER	88-DP-0047A	389 1,128		0.0025	0.0025	0.0025
F. MARYLAND PLASTICS, INC.	WASTES FROM PLASTICS CLEANING	87-DP-0392	316 1,152	TANYARD BRANCH			

TABLE 4 - 5

WATER QUALITY PROBLEMS DUE TO STORM DRAINAGE OUTFALLS AND TO NON-POINT SOURCES

SERVICE AREA	NATURE OF PROBLEM	REACH AFFECTED
I. Election District No. 1		
A. Marydel	Failing septic systems on small lots; high water table; runoff to storm drainage system.	Choptank River
B. Goldsboro	Failing septic systems due to small lots, high groundwater table & poor percolation which discharge to storm drainage system.	Choptank River
II. Election District No. 2		
A. Greensboro	Urban runoff to storm drain system;	Choptank River
III. Election District No. 3		
A. Denton	Urban runoff to storm drain system; inadequate drainage and erosion problems in several areas of Town	Choptank River
IV. Election District No. 4		
A. Preston	Urban runoff to storm drain system; system overflows bypass	Hunting Creek
B. Jonestown	Failing Septic Systems	Hunting Creek
C. Bethlehem	Failing Septic Systems	Choptank River
D. Cedar Lane Subdivision	Failing Septic Systems	Choptank River
E. Tanyard	Failing Septic Systems	Choptank River
F. Choptank	Failing Septic Systems	Choptank River & Hunting Creek
G. Linchester	Failing Septic Systems	Hunting Creek
V. Election District No. 5		
A. Federalsburg	Excessive infiltration and inflow urban runoff to storm drain system	Marshyhope Creek
B. Outskirts of Federalsburg	Failing Septic Systems	

TABLE 4 - 5 - WATER QUALITY PROBLEMS DUE TO STORM DRAINAGE OUTFALLS AND NONPOINT SOURES, CONTINUED

SERVICE AREA	NATURE OF PROBLEM	REACH AFFECTED
VI. Election District No. 6		
A. West Denton Area	Failing Septic Systems	Choptank River
VII. Election District No. 7		
A. Ridgely	Excessive Infiltration and Inflow Urban runoff to storm drain system	Choptank River and Tuckahoe Creek
B. Trinity/Boonsboro	Failing Septic Systems	Choptank River

TABLE 4-6
PROJECTED SEWERAGE DEMANDS AND PLANNED CAPACITY FOR EXISTING AND/OR PLANNED SEWERAGE SYSTEMS

SEWERAGE SERVICE AREA	GPCD	1990					1995				
		POPULATION			CAP. (MGD)		POPULATION			CAP.(MGD)	
		TOTAL	SERVED	UNSERVED	DEMAND	PLANNED	TOTAL	SERVED	UNSERVED	DEMAND	PLANNED
CAROLINE COUNTY	-	27,035	9,759	17,276	-	-	28,500	10,091	18,409	-	-
ELECTION DISTRICT NO.1	-	2,689	789	2,099	-	-	2,843	803	2,040	-	-
TEMPLEVILLE	-	66	0	66	-	-	66	0	66	-	-
MARYDEL	-	143	0	143	-	-	155	0	155	-	-
HENDERSON	-	125	0	125	-	-	150	0	150	-	-
GOLDSBORO	-	185	0	185	-	-	190	0	190	-	-
CAROLINE ACRES MHP	50	390	390	0	0.013	0.024	390	390	0	0.013	0.057
WALKERS MHP	50	297	297	0	0.009	0.015	297	297	0	0.009	0.015
ELECTION DISTRICT NO. 2	-	3,974	1,498	2,599	-	-	4,177	1,557	2,580	-	-
GREENSBORO	100	1,441	1,441	0	0.144	0.280	1,441	1,441	0	0.144	0.280
ELECTION DISTRICT NO. 3	-	5,304	3,043	2,557	-	-	5,551	3,111	2,440	-	-
DENTON	140	2,977	2,977	0	0.416	0.450	2,977	2,977	0	0.416	0.900
ELECTION DISTRICT NO. 4	-	3,846	847	2,629	-	-	4,049	941	3,108	-	-
PRESTON	180	437	437	0	0.079	0.115	550	550	0	0.099	0.115
MOBILE MANOR MHP	-	150	0	150	-	-	150	0	150	-	-
HOLLY COVE MHP	-	60	0	60	-	-	60	0	60	-	-
JONESTOWN	-	265	0	265	-	-	265	0	265	-	-

TABLE 4-6
PROJECTED SEWERAGE DEMANDS AND PLANNED CAPACITY FOR EXISTING AND/OR PLANNED SEWERAGE SYSTEMS

SEWERAGE SERVICE AREA	GPCD	1990					1995				
		POPULATION			CAP. (MGD)		POPULATION			CAP.(MGD)	
		TOTAL	SERVED	UNSERVED	DEMAND	PLANNED	TOTAL	SERVED	UNSERVED	DEMAND	PLANNED
ELECTION DISTRICT NO. 5	-	4,397	2,548	1,849	-	-	4,519	2,645	1,874	-	-
FEDERALSBURG*	150	2,365	2,365	0	0.361	0.740	2,600	2,600	0	0.360	0.750
TILGHMAN BROS. MHP	-	45	0	45	-	-	45	45	0	BY	TOWN
ELECTION DISTRICT NO. 6	-	1,826	0	1,826	-	-	1,948	0	1,948	-	-
HILLSBORO	-	164	0	164	-	-	190	0	190	-	-
WEST DENTON	-	150	0	150	-	-	125	0	125	-	-
ELECTION DISTRICT NO. 7	-	2,439	1,034	1,405	-	-	2,561	1,034	1,473	-	-
RIDGELY	95	1,034	1,034	0	0.098	0.200	1,034	1,034	0	0.098	0.240
BOONSBORO	-	109	3	106	-	-	109	3	106	-	-
ELECTION DISTRICT NO. 8	-	1,928	0	1,927	-	-	2,050	0	2,050	-	-

* EXCLUDES COMMERCIAL AND INDUSTRIAL USAGE

TABLE 4 - 7 IMMEDIATE, 5, AND 10 YEAR PRIORITIES FOR SEWERAGE DEVELOPMENT

SEWERAGE SERVICE AREA	COUNTY PRIORITY ASSIGNED	LOCATION	DESCRIPTION	ESTIMATED COST
I. Election District #1				
A. Marydel	S-2		Investigating Community Sewerage System	
B. Caroline Acres Mobile Home Park	S-2	452,000/1,148,000	Sewer Extensions for M.H.P. addition	
"	S-3	452,000/1,148,000	Service to Industrial Park	
"	S-2	452,000/1,148,000	Expand Spray Irrigation System	
C. Henderson	S-3		Investigate Community Sewerage System	
II. Election District #2				
A. Greensboro	S-2	419,000/1,140,500	Sewer Extension to Elmore Court and Area North of Academy Street	
"	S-2		Replacement of small sewer mains with 8 inch lines	
"	S-2		Remove vacuum pumps from lift stations	
III.Election District #3				
A. Denton	S-2	380,000/1,135,000	Lagoon Expansion	
IV. Election District #4				
A. Preston	S-3	322,000/1,112,500	Extension of service within town limits and south of Reeds Villa	

TABLE 4-7 IMMEDIATE, 5, AND 10 YEAR PRIORITIES FOR SEWERAGE DEVELOPMENT, CONTINUED

SEWERAGE SERVICE AREA	COUNTY PRIORITY ASSIGNED	LOCATION	DESCRIPTION	ESTIMATED COST
V. Election District #5				
A. Federalsburg	S-2	315,000/1,150,000	Plant Expansion	
"	S-2	315,000/1,150,000	Plant Flow Equalization	
"	S-2	313,000/1,146,000	Extension of service to Tilghman Brother's M.H.P.	
VI. Election District #6				
A. West Denton	S-3	387,000/1,130,000	Community Sewerage System	
VII.Election District #7				
A. Ridgely	S-2		Extension of Service Souther of Cow Barn Road	
"	S-3	405,000/1,117,500	Extension of Service to Trinity-Boonsboro Area	
"	S-2		New Spray Irrigation STP	$2,000,000

TABLE 4-8
FLOW DATA - WASTEWATER TREATMENT FACILITIES

NAME OR SERVICE AREA	DESIGN PARAMETERS Hydraulic (mgd)	Organic (ppm) BOD	SS	FLOW Avg. Day* (mgd)	Max. Day & Date (mgd)	DEVELOPMENT OCCUPANCY UNITS Existing*	Anticipated BPI UC	NUC	Planned No BPI
Town of Denton	0.450	611 lb/day	-	0.416		1,005	(gpd) <10R (2,800)		16R-(4,500) 1 N-(30,000) 1 C-(5,000) 1 I-(40,000)
Town of Federalsburg	0.740	250	250	0.361	1.179 (5/11/90)	1,033	11 (1,600)		40R-(11,000) 2 I-(51,000)
Town of Greensboro	0.280	-	-	0.144	0.76 (1977)	770	<10R (<2,800)		32R-(9,000)
Town of Preston	0.115	-	-	0.079	0.197 (2/10/77)	210	<10R (<2,800)		50R 11
Town of Ridgely	0.200	200 mg/l	200 mg/l	0.098	0.80 pump overflow to bypass	410	<25R		23R
Caroline Acres Mobile Home Park	0.023	-	-	0.013	-	52	<48R (7,000)		
Walkers MHP	0.015	-	-	0.010	N/A	12			

*Per Effective Date of Plan
R-Residential
I-Industrial
N-Institutional
C-Commercial

BPI - Building Permits Issued Per Effective Date of Plan
UC - Building Permits Issued Per Effective Date of Plan Under Construction
NUC - Building Permits Issued Per Effective Date of Plan Not Under Construction

TABLE 4-10 - MARINA FACILITIES

MARINA NAME LOCATION OWNER	TYPE	NUMBER OF SLIPS	SEWAGE DISPOSAL SYSTEM		WATER SYSTEM
			ON-SHORE	BOAT SERVICE	
Choptank Marina Choptank, Preston Commissioners of Caroline County	Public Marina Boat Ramp	72	Holding Tank	None	Deep Well
Choptank River Yacht Club West Denton Choptank River Yacht Club, Inc.	Private Yacht Club	4	Septic System	None	Deep Well
Daniel Crouse Memorial Park Denton Commissioners of Denton	Public Landing Boat Ramp	0	Public Sewer	None	Public Water
Federalsburg Marina Federalsburg Mayor and Council of Federalsburg	Public Landing Boat Ramp	23	Public Sewer	None	Public Water
Greensboro Boat Ramp Greensboro Commissioners of Greensboro	Public Landing Boat Ramp	0	Chemical Toilet	None	None
Ganey's Wharf Ganey's Wharf Road Commissioners of Caroline County	Public Landing Boat Ramp	0	Holding Tank	None	None
Hillsboro Boat Ramp Hillsboro Commissioners of Caroline County	Public Landing Boat Ramp	0	Chemical Toilet	None	None
Martinak State Park Denton State of Maryland (DNR) MD Park Service	Public Landing Boat Ramp	0	Septic System	None	Deep Well

1992

Caroline County

Groundwater Protection

Report

CHAPTER 5

GROUNDWATER PROTECTION REPORT

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5.1 Introduction

On November 18, 1985, a revision of the Maryland State Regulations Governing "Sewage Disposal and Certain Water Systems for Homes and Other Establishments in the Counties of Maryland Where a Public Sewage System is not Available." (Comar 26.04.02) became effective. These regulations specifically provide for the management of on-site sewage systems to limit degradation of the groundwater and surface water resources of the state. Control of the polluting effects of on-site sewage systems was lacking in the prior regulations and thus our groundwater resources have been affected. In particular, nitrate nitrogen contamination has increased to levels above Public Health Service recommended drinking water levels. In Caroline County this contamination is evident in the upper part of the Columbia Aquifer.

The revised regulations specify four feet of unsaturated soil must be established between the bottom of the seepage field; i.e., the tile lines, of a septic system and the highest level of the groundwater so as to minimize the septic system induced groundwater contamination. This protection distance is difficult to maintain in Caroline County and throughout the Eastern Shore on a year-round basis. To address this issue, the regulations provide each local county government the opportunity to prepare a protection report to determine and delineate areas where less than four feet of unsaturated soil may be permitted. The report shall set density, design, and construction requirements of on-site sewage disposal systems to minimize degradation of our groundwater resources. That is the challenge of this report.

To establish the density, design, and construction requirements necessary to protect our drinking water, this report will examine

numerous factors involved with the polluting effects of septic system wastewater. The scope of this report will include an evaluation of:

a. The effect of water withdrawal from existing shallow wells and deep wells.

b. The density and construction of existing septic systems.

c. Land-use factors and other sources of contamination.

d. Available aquifers and their characteristics.

e. Aquifer water quality.

f. Soil conditions and the affects on percolating wastewater.

5.2 Geology - Regional Setting and Lithology

Caroline County occupies a north central location on Maryland's Eastern Shore; part of the Atlantic Coastal Plain that extends from Long Island, N.Y., southward to the Gulf of Mexico (Figure 1). The Atlantic Coastal Plain has been subsiding since the Early Mesozoic Period, resulting in a seaward slope on the surface of the crystalline basement rocks.[1] Sediments eroded from the uplifted areas north of the Fall Line, consisting of clay, silt, sand, and gravel constitute the present unconsolidated sediments. These sediments have been mapped and divided into geologic units on the basis of lithology and paleontology (Table 1, Table 2 and Figure 2).

The depths of these sediments are greater than 2000 feet at Caroline County. A well through these sediments may penetrate eight water-bearing formations. However, the available water and its quality is little known below 500 feet.

5.2.1 Hydrogeologic Properties

Chapter 3, pages 3-2 through 3-10, provides a brief description of the aquifers and their characteristics in Caroline County. The hydrogeologic properties of these aquifers is summarized in Table 3. It must be noted that this table provides some of the most recent data regarding the formations of the Columbia Aquifer, their relationship to the formations in the Miocene Series, and is the geologic stratigraphy used in the report. More detailed characteristics of the major formations with emphasis toward susceptibility from sources of contamination is described in section 5.3.

Table 4 provides data on the estimated yields of aquifers in Caroline, Dorchester, and Talbot Counties as reported by Hulme and Murphy.[2] Over 95% of all wells in Caroline County are developed in the Columbia, Choptank, and Calvert formations. This is primarily due to the cost to drill into the older formations, the lack of an areal water bearing formation in the Aquia, and poor knowledge of aquifer characteristics in the Magothy and Raritan formations. Currently 50% of the wells in Caroline County are confined aquifer wells. This number has been increasing in the past 5 years because water quality in the Columbia Aquifer is increasing in nitrate-nitrogen levels above the maximum limit of 10.0 ppm. This places an extra burden on the Choptank and Calvert Formations whose total sustained yield is a meager 8.4 mgd.[2] So too, these aquifers have a sustained yield of only 6000 gpd per square mile. Therefore, the Columbia, which can provide 60% of all available groundwater, must be protected against continuing water quality degradation.

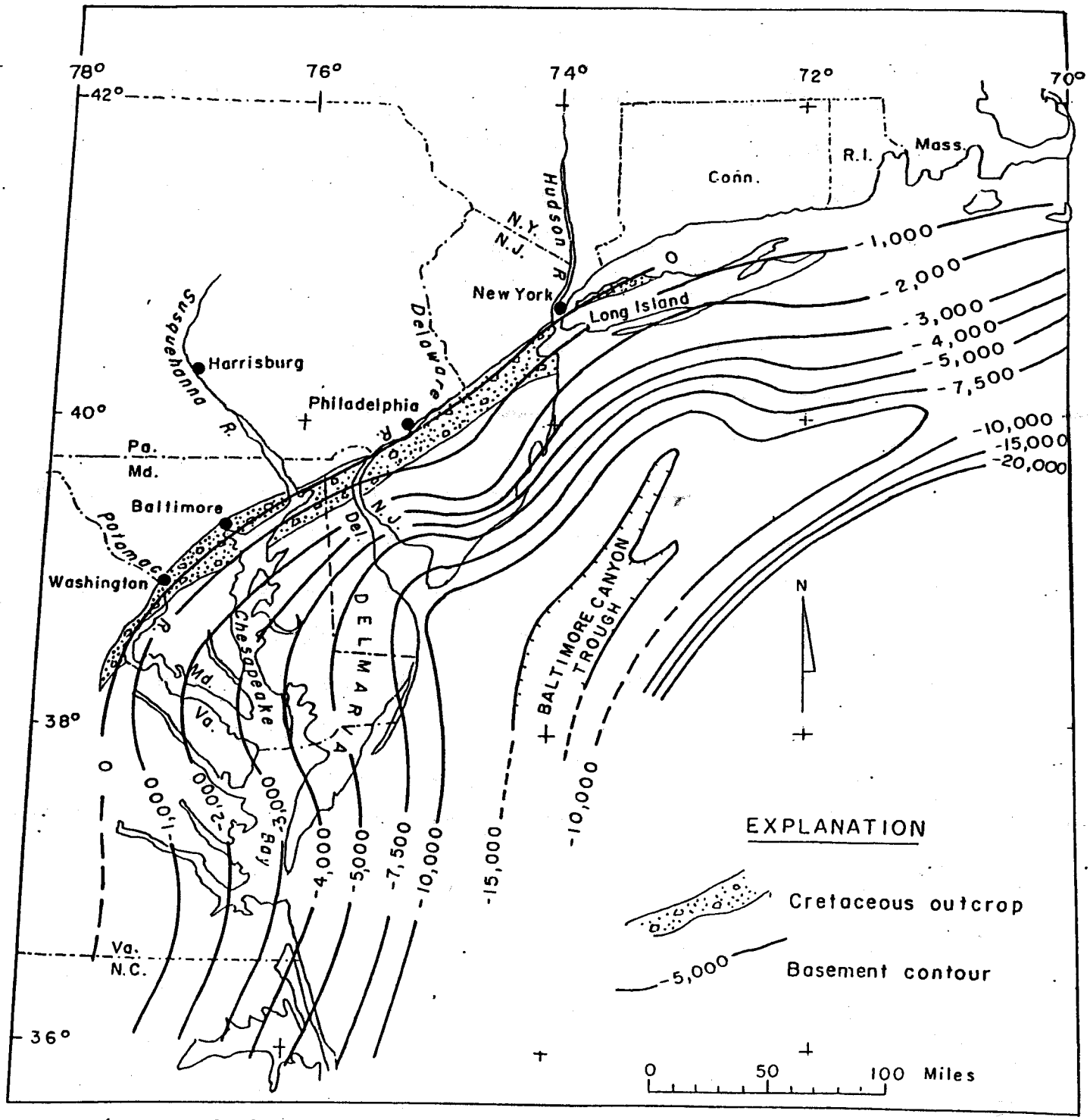


Figure 1 - Maryland occupies a south-central position in the Chesapeake-Delaware Embayment, which extends from Long Island to North Carolina (from Maher, 1971, plate 4).

Source: A User's Guide for the Artesian Aquifers of the Maryland Coastal Plain, Part 1, by Harry Hanson

Table 1. — Coastal Plain stratigraphic nomenclature and aquifers of the Eastern Shore of Maryland.

System	Series (Group)	Geologic Unit	Thickness (feet)	Hydrogeologic Unit(s)	Dominant Lithologic Character
QUATERNARY & TERTIARY (?)	Holocene	Holocene deposits	0 - 40	---	Soil, alluvial sand and silt, dune sand, and peat. Disconformable base.
	Pleistocene and Pliocene (?) (Columbia Group)	Shoreline complex	0 - 230	Columbia aquifer	Lenticular deposits of sand, silt, clay, and peat. Some beds of coarse sand and fine gravel. Tan; some gray and blue clay.
		Salisbury Formation: Beaverdam Fm. and Pensauken Fm. of Owens and Denny (1979)			Beaverdam Sand: Light gray to light tan, fine to coarse grained, moderately sorted, feldspathic sand. Pensauken Formation: Light tan to orange tan, medium to coarse grained, moderately to poorly sorted, pebbly feldspathic sand.
?	?	?			
TERTIARY	Miocene (Chesapeake Group)	Upper Miocene Aquifer Complex	0 - 50	Upper confining bed	Lenticular silts, clays, and fine sands. Green-blue silt and fine gray sand most common, but occasionally includes blue-green pebbly clay.
			0 - 80	Pocomoke aquifer	Sand, gray or tan-gray; coarse and pebbly generally, but locally fine.
		Yorktown and Cohansey Formations (?) of Rasmussen and Slaughter (1955)	0 - 85	Lower confining bed	Blue and gray clayey silt and sand; some peat. Some beds of shell and calcite and/or limestone.
				Ocean City aquifer	Coarse gray sand, fine gravel.
			0 - 240	Manokin aquifer	Fine to very coarse gray sand, and some lignite or peat. Some silty sand and clay. Occasional beds of shell and/or "rock".
		St. Marys Formation	0 - 190	Confining layer	Gray fossiliferous clay, silt, fine sand, and silty and sandy clay.
		Choptank Formation	0 - 240	Frederica aquifer and confining layer	Gray fine sand. Thin beds of shell and calcite. Green or brown clay and fine sand. Thin beds of shell and calcite or limestone.
		Calvert Formation	0 - 680	Chesapeake aquifer and confining layers	Gray sand and diatomaceous silt and clay. Shell beds.
	Eocene	Piney Point Formation	0 - 220	Piney Point aquifer	Olive-green to greenish-gray quartz sand, slightly to moderately glauconitic; shell beds.
		Nanjemoy Formation	0 - 294	Confining layer	Gray to dark gray, glauconitic, silt, sand, and clay.
	Paleocene	Aquia and Hornerstown Formations (undivided)	0 - 165	Aquia aquifer	Green to brown, fine to coarse grained, glauconitic sand; interstratified with grayish-green silt and clays; calcite cemented sands and fossil beds.
		Brightseat Formation	0 - <100	Confining layer	Dark gray clay and fine, silty, micaceous sand.
CRETACEOUS	Upper Cretaceous	Matawan and Monmouth Formations (undivided)	0 - 960 ?	Matawan-Monmouth aquifers	Dark greenish-gray to reddish-brown, fine to occasionally coarse quartz sand. Facies may be glauconitic, micaceous, shelly and/or clayey.
		Magothy Formation	<50 - 100	Magothy aquifer	Light gray to white "sugary", medium to coarse grained quartz sand and fine gravel; interbedded dark gray clays in upper part.
	Lower Cretaceous (Potomac Group)	Patapsco Formation	<50 - 1,750	Aquifers and confining layers	Interbedded, variegated (gray, brown, and red) silt and clay, and argillaceous, subrounded, fine to medium quartz sand.
		Arundel and Patuxent Formations (undivided)	<50 - 2,950	Aquifers and confining layers	White to light gray to orange brown, moderately sorted, angular and subrounded quartz sand; also gray to ocherous silt and clay beds, which occur in amounts ranging from less than 25% to greater than 75% of formation.
JURASSIC (?)	---	Unnamed	0 - 135	---	White quartzite conglomerate, dark gray, reddish-green and apple green shales, sandy shales, and arkosic sandstones. Does not outcrop on the Eastern Shore.
PALEOZOIC (?) & PRECAMBRIAN	Basement Complex			---	Believed to be chiefly schist, granite, gabbro, and gneiss.

1/ The nomenclature is that of the Maryland Geological Survey.

2/ Compiled from Rasmussen and Slaughter (1957), Hansen (1972; oral commun., 1982), and Weigle (1974).

Source: The Columbia Aquifer of the Eastern Shore of Maryland, by Joseph Bachman, MGS Report of Investigations No.40.

TABLE 2

Paleontology of Samples from Wells and Outcrops in Caroline, Dorchester, and Talbot Counties

	Depth (feet)	Formation and series	Paleontology
Well Car-Dc 122 Permit 11234 Location—West Denton Paleontologist—Druid Wilson	40–45	St. Marys, Miocene	*Pecten* (*Lyropecten*) sp. fragment *Anadara* cf *idonea* (Conrad) fragment *Corbula inaequalis* Say *Astarte* sp. *Teinostoma* cf *greensboroense* Martin Barnacle fragment Coral fragment
	45–50	St. Marys, Miocene	*Pecten* (*Lyropecten*) sp. fragment *Corbula inaequalis* Say *Siphonalia* cf *marylandica* Martin fragment *Vrosalpinex* cf *cinereus* (Say) fragment *Crucibulum pileolum* (Lea) *Turritella plebeia* Say Barnacle fragment Coral fragment
	50–55	St. Marys, Miocene	*Pecten* (*Lyropecten*) sp. fragment *Corbula inaequalis* Say *Turritella* cf *variabilis* Conrad Barnacle fragment
	55–60	St. Marys, Miocene	*Corbula inaequalis* Say Gastropods indeterminate fragments Barnacle
	60–65	St. Marys, Miocene	*Turritella plebeia* Say Barnacle fragments
	65–68	St. Marys, Miocene	*Pecten* (*Lyropecten*) sp. fragments *Uzita* cf *marylandica* Martin Barnacle
	82–87	Choptank, Miocene	*Yoldia* cf *laevis* (Say) fragment Pelecypod indeterminate fragments *Turritella* sp.
	87–92	Choptank, Miocene	*Callocardia* cf *subnasuta* (Conrad) fragment *Turritella variabilis* var. *cumberlandian* Conrad *Dentalium caduloide* Dall
	92–97	Choptank, Miocene	*Pecten* (*Lyropecten*) sp. fragments *Astarte* sp. fragment *Corbula inaequalis* Say Pelecypod indeterminate fragment Barnacle fragment
			"Because of the meagerness of the evidence the age assignments . . . cannot be regarded as very certain."—Druid Wilson

TABLE 2—*Continued*

	Depth (feet)	Formation and series	Paleontology
Car-De 122—*Continued*	Above 192	St. Marys and Choptank, Miocene	Ruth Todd, micropaleontologist says: "the following boundaries are recognizable on the basis of the Foraminifera The uppermost samples, down to the 321–331′ sample, are Miocene; those from the 192–197′ sample downward probably being Calvert and the higher ones questionably St. Marys and Choptank. Below 331 feet an abrupt change of lithology to coarse quartz grains coincides with the lowest good Miocene. The first Eocene forms encountered are in the 370–374′ sample. The samples in the interval between the lowest good Miocene (331 feet) and the highest Eocene (370 feet) contain only rare Miocene specimens probably by contamination from above. Samples between 370 and 488 feet contain Eocene, probably Jackson, forams, in some samples largely obscured by Miocene specimens from above. No diagnostic forms were found in the interval from 488 to 516 feet. In the 516–520′ sample Wilcox Eocene species appear and they continue downward to the 604–609′ sample. In the 609–615′ sample the first Paleocene is encountered and it continues downward to the 850′8″–852′2″ sample and possibly lower, though with a change in facies below 852′2″. The first definite Upper Cretaceous forams were observed in the 922′2″–932′8″ sample and they continue to the bottom of the well. The interval between 852′2″ and 922′2″ might possibly be Upper Cretaceous also, but, discounting the probable contamination by Paleocene specimens from above, the fauna in this interval still has more of a Paleocene than an Upper Cretaceous flavor."
	192–197	Calvert, Miocene	
	197–331	Calvert, Miocene	
	331–370	Eocene	
	370–488	Piney Point, Eocene (Jackson group equivalents)	
	488–516	Nanjemoy(?), Eocene	
	516–520	Aquia, Eocene	
	604–609	Aquia, Eocene	
	609–615 to 852.2	Paleocene	
	922.2–932.8	Upper Cretaceous	
Denton	360–391	Eocene	*Ostrea sculptrata* (Richards, 1945, p. 901)

Source: The Water Resources of Caroline, Dorchester , and Talbot Counties, by Wm. C. Rasmussen, et.al Maryland Geological Survey Bulletin No. 18.

Table 3 --Summary of geologic units aquifer names, and water-bearing properties of the shallow sediments in the central Delmarva Peninsula

System	Series	Formation	Aquifer	Hydrogeologic Properties
Quarternary	Pleistocene	Kent Island Formation	Columbia aquifer	Sand, medium- to coarse-grained, and gravel 30 to 230 ft thick; tan, silty; reported yields from 1 to 4,000 gal/min. Clay and silt predominant in Omar Formation and Walston Silt.
		Correlative Units: Parsonsburg Sand		
		Correlative Units: Sinepuxent Formation		
		Correlative Units: Ironshire Formation		
		Correlative Units: Omar Formation		
		Correlative Units: Walston Silt		
Tertiary	Pliocene	Beaverdam Sand		
	Miocene	Pensauken Formation		
		Chesapeake Group: Yorktown and Cohansey (?) Formations	Pocomoke aquifer	Sand, gray, coarse; 0-100 ft thick; reported yields 5-650 gal/min.
			Manokin and Ocean City aquifers	Sand, gray, coarse; 0-250 ft thick; reported yields 5-1,000 gal/min.
		Chesapeake Group: St. Marys Formation		
		Chesapeake Group: Choptank Formation	Frederica aquifer	Sand, 0-150 ft thick; reported yields 5-200 gal/min.
			Federalsburg aquifer	Sand, fine to coarse, gray, silt and shells; 0-100 ft thick; reported yields 4-150 gal/min.
		Chesapeake Group: Calvert Formation	Cheswold aquifer	Sand, 0-150 ft thick; yields 5-300 gal/min.
	Eocene	Piney Point Formation	Piney Point aquifer	Sand, green gray, glauconitic; 20-270 ft thick; reported yields 5-625 gal/min.
		Nanjemoy Formation		
	Paleocene	Aquia and Brightseat Formations	Aquia aquifer	Sand, green-gray, glauconitic; 0-250 ft thick; reported yields 4-350 gal/min.
Cretaceous	Upper Cretaceous	Monmouth Formation and older units		

adapted from: Bachman L. Joseph, Nitrate in the Columbia Aquifer, Central Delmarva Peninsula, USGS Report 84-4322.

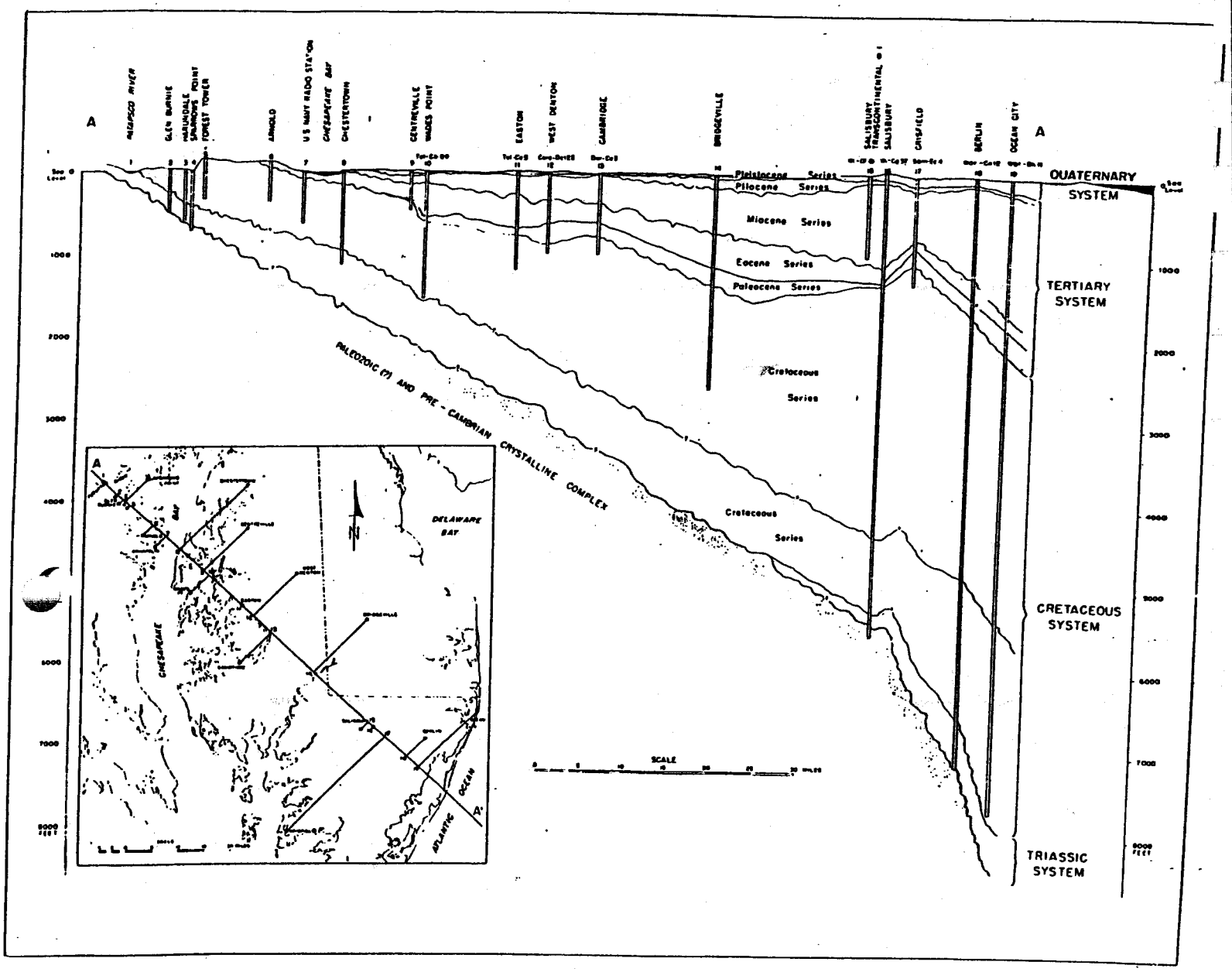


Figure 2 - Geologic cross-section showing seaward thickening of sedimentary wedge beneath Coastal Plain Maryland (from Rasmussen and Slaughter, 1955, plate 1).

Source: A User's Guide for the Artesian Aquifers of the Maryland Coastal Plain, Part 1, by Harry Hanson.

TABLE 4

Estimates of Sustained Yields of Aquifers in Caroline, Dorchester and Talbot Counties

Aquifer	Areal extent (square miles)	Sustained yield per square mile (gallons a day)	Total sustained yield (million gallons a day)
Pleistocene and Pliocene(?) series	600	100,000	60.0
St. Marys formation	400	1,000	.4
Choptank formation	600	6,000	3.6
Calvert formation	800	6,000	4.8
Piney Point formation	900	20,000	18.0
Aquia greensand	500	12,000	6.0
Magothy and Raritan formations	1,200	6,000	7.2
Total			100.0

Source: The Water Resources of Caroline, Dorcherster, and Talbot Counties, MGS Bulletin No.18.

5.3 Aquifer Characteristics

While the aquifers of the Miocene, Pliocene, and Pleistocene formations are primarily used in Caroline County, they are also the formations most susceptible to contamination by wastewater disposal practices of Caroline County residents.

Exhibit 3 shows the aquifers in Caroline County in cross-section from Cleaves Forks in northern county to Federalsburg in southern county. The figure is schematic in its lithologic characteristics, intended to show the water bearing sandy sections of each formation which act as aquifers and the clayey and silty sections of each formation which act as aquicludes. The figure was prepared using 17 geologic logs of the U.S. Geological Survey (USGS) and Maryland Geologic Survey (MGS) and supplemented with 4 logs from local well drillers. These logs are shown at the end of this chapter and are referenced throughout this report by their respective identification numbers. This figure is presented to also show there is no known direct recharge to the confined aquifers of Caroline County beneath the mantle of overlying sands of the Columbia aquifer.

The Calvert, Choptank, and St. Mary's formations subcrop beneath the sands of the Columbia aquifer. The St. Mary's formation is primarily an aquiclude providing an extensive barrier of clay over the underlying Frederica aquifer. However, the mantle of clays beneath the Columbia aquifer overlying the Frederica and Federalsburg aquifers is thin and probably acts as a weak aquiclude providing recharge from the Columbia aquifer to these formations (wells: CO-AD 17, Care-Ad 2, 2/11/40, Care Bd 45, 8/3/38).

Since the Upper Cretaceous series is poorly known and not used in Caroline County, and the wells of the Paleocene series are limited to very few wells in northern county, overlain by extensive sections of clay, these series will not be discussed in detail in this report.

5.3.1 Piney Point Formation

The Piney Point formation is an extensive quartz sand, slightly to moderately glauconitic, medium to coarse textured with some shell debris, and ranging from brown and olive green to green in color. Some strata of clay exist and are particulary evident near Ridgely in the county.

The Piney Point underlies all of Caroline County. The top of the water yielding formation is approximately 275 feet below the surface at Templeville and 450 feet below the surface at Federalsburg. The formation is truncated in the subsurface along an irregular line extending from north of Leonardtown in St. Mary's County to north of Greensboro in Caroline County. The updip portion was erosionally bevelled during an Oligo-Miocene withdrawal of the sea. The transgression appears to have been "rapid" as evidenced by the thin, poorly differentiated littoral beds at the base of the Miocene[4] (well Care - Bd 6). Such thin areas in northern Caroline County probably allow both aquifers to function as one unit.[5] Since the Piney Point does not outcrop the leaky aquiclude of the base of the Miocene is the principal source of recharge.[6] Therefore, protection of the Cheswold Aquifer in northern Caroline County is necessary to protect the water quality of the Piney Point aquifer.

In most places the coarse sand composing the upper portions of the formation are very permeable. The sands become progressively fine grained and therefore less permeable downward.[7] The effective thickness ranges from 50 feet at Templeville to 100 feet at Denton to 75 feet at Federalsburg.

5.3.2 Calvert Formation

The Calvert formation is comprised of two aquifers, the Cheswold and Federalsburg. These, along with the Choptank, St. Mary's, and Yorktown formations, are of marine origin, deposited between 12 and 25 million years ago. After deposition these Miocene sediments were eroded prior to or during deposition of the overlying pliocene and pleistocene deposits. Therefore, the deposits subcrop below a thin veneer of Quaternary deposits[8] (Figure 4).

The Calvert formation overlies the Piney Point and underlies the Choptank formation. It is predominantly a gray silt, slightly glauconitic in the upper part and diatomaceous in the lower part.[9] It contains several thin beds of medium to very fine quartzose sand with extensive shell fragments. The formation dips generally southeasterly, and thickens generally to the east. It is approximately 75 feet to 150 feet thick at Caroline County (Exhibit 3). The water-bearing aquifers are lenticular and may be found at the base of the overlying Frederica aquifer or at the base of the underlying Piney Point aquifer and probably function with these aquifers at these locations (wells: Care-Bd 6, Care-Cd 2). The factors of erosion during deposition of these aquifers contribute to this unconformity in physical characteristics.

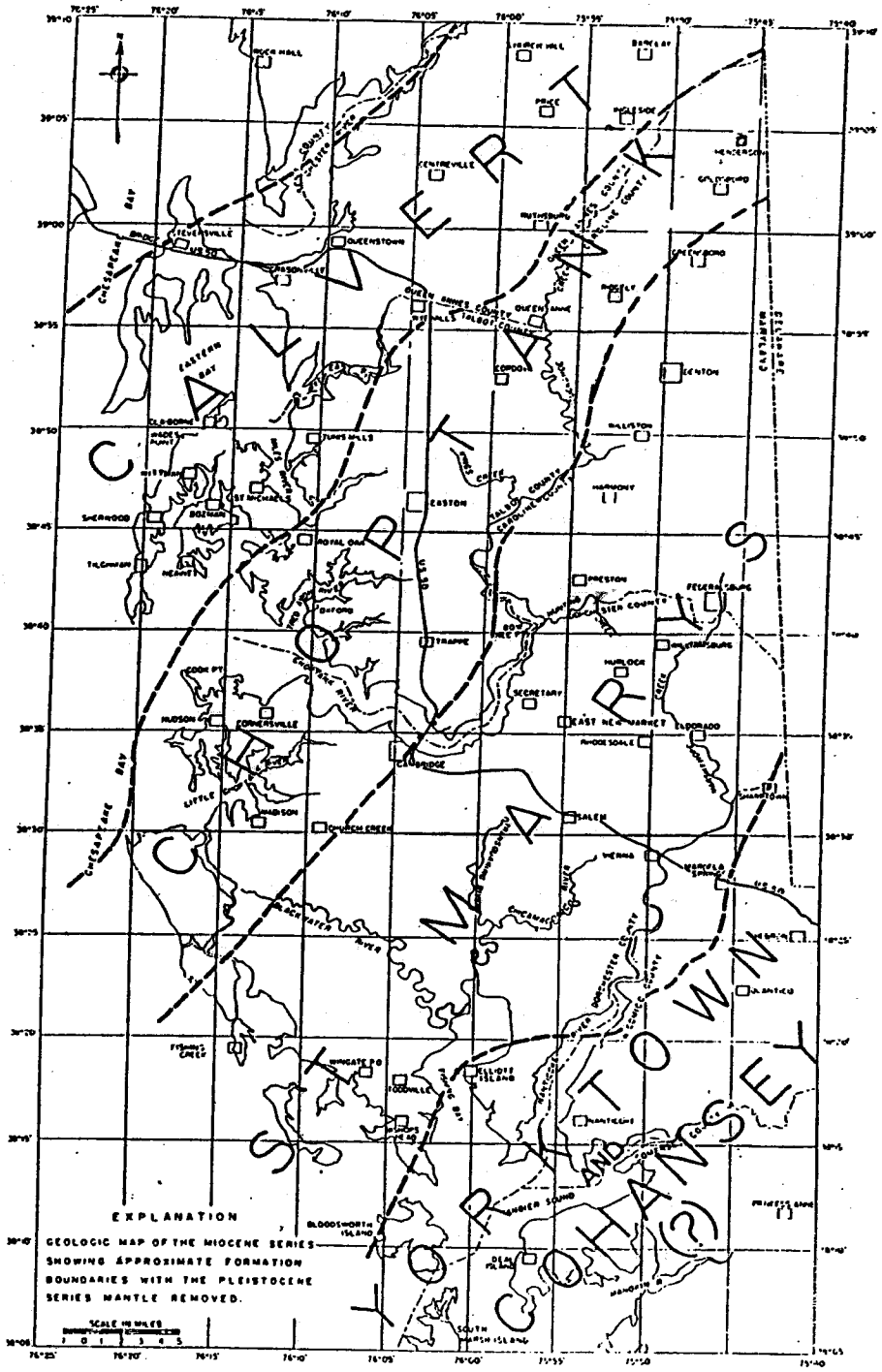


FIGURE 4 Geologic Map of the Miocene Series in Caroline, Dorchester, and Talbot Counties.

Source: The Water Resources of Caroline, Dorchester, and Talbot Counties, MGS Bulletin No.18.

The recharge opportunity for sands in the Calvert formation can be described only in general terms. The recharge belt of the Calvert is covered by the Quaternary deposits which are probably more permeable than the Calvert formation itself.[10] Clay and silt of varying thickness appears to cover both the Cheswold and Federalsburg aquifers at Caroline County (Exhibit 3). The water table in the overlying Quaternary system attains a year-round height above sea level of approximately 50 feet (70 feet during the wet season). These levels could provide the hydraulic drive to replenish water to the lenticular water-bearing formation through the overlying clays and silts. The silts of the Calvert formation have a high porosity and may store water in sufficient quantity and release it at a slow but sufficient rate to replenish the sand lentils and sustain a moderate amount of pumping. The overlying Choptank formation is, in general, more permeable than the Calvert Formation and probably transmits recharge to it.[11]

5.3.2.1 Cheswold Aquifer

The Cheswold aquifer is the basal sandy unit of the Calvert formation. The top of the unit can be found at the base of the Quaternary deposits at the northern tip of Caroline County (easterly edge of the subcrop boundary) to approximately 325 feet below the surface at Federalsburg.

The Cheswold is overlain by the Federalsburg aquifer and is separated from the Federalsburg by silts and clays.

Up-dip, the Cheswold aquifer directly overlies the Piney Point aquifer, but down-dip they are separated by a generally eastward

thickening layer of silt and clay. In areas where the two aquifers are connected or separated by only a thin layer of silt and clay the Cheswold aquifer may be recharging the Piney Point aquifer[12] (well: Care - Bd 6).

5.3.2.2 Federalsburg Aquifer

The Federalsburg aquifer ranges in thickness from about 50 feet at the updip in northern Caroline County to approximately 100 feet at Federalsburg. It is generally overlain and underlain by silts and clays but at places may be so thin so as to function as a unit with the Cheswold aquifer or the Frederica aquifer of the Choptank formation (well: Care - Dd 1).

The Federalsburg aquifer comprises the first major subcrop area of Caroline County. It lies north and west of a line crossing the County from just north of Goldsboro to just west of Tanyard. Figure 3 shows that a thin mantle of silt and clay overlays the water bearing sands. This mantle ranges in thickness from 3 feet to 50 feet (wells: CO-AD17, Care-Ad2, 2/11/40, Care Bd45, 8/3/38). This was also confirmed by selecting three wells in each of the 10,000 square-foot blocks of the Maryland Coordinate System in Caroline County (42 wells), all of which identified a confining mantle averaging 20 feet in thickness.

Recharge to the aquifer is probably as described in Section 5.3.2. There are no major users in the updip portion of the aquifer, only domestic use and some agricultural use for chicken houses.

5.3.3 Choptank Formation

Lithologically, the Choptank formation may be summarized as gray and brown silt and sand, containing shell and Foraminifera. Lenticular zones of gray sandy silt and shell function as aquicludes, probably leaky or capable of releasing some water from storage under differential head.[13] The formation averages 100 feet in thickness where it is present beneath the County.

The Choptank formation overlies the Calvert formation, and underlies the St. Mary's formation. The Choptank subcrops beneath the Quaternary deposits adjacent to the Federalsburg aquifer subcrop zone in a band approximately 5 miles wide along two lines from just north of Goldsboro to just west of Tanyard and just north of Greensboro to just west of Preston. The formation probably outcrops along the Choptank River where the river has cut through the Quaternary deposits.

The subcrop zone appears to be covered by a mantle of clay and silt (wells: Care-Bd 6, CO-BD 16, Care-Cd 2), ranging from 15 feet to 35 feet in thickness, and provides reasonable protection from wastewater disposal activities at the surface. The recharge is thus expected to mirror that of the Federalsburg aquifer (section 5.3.2.2).

The Frederica aquifer is the major waterbearing unit of the Choptank formation. The Frederica aquifer overlies the Federalsburg aquifer and is separated from it by a silty clayey interval which is quite thin in the updip area. Where the interval is thin, there may be a hydraulic connection between the two aquifers.[14] The Frederica aquifer is overlain by the St. Mary's Formation which is primarily an aquiclude.

5.3.4 St. Marys Formation

The St. Marys formation is a clayey silt and silty clay with some very fine sand, shells, and Foraminifera, that usually functions as an aquiclude.[15] The formation has no known outcrops, the eroded surface being completely buried beneath the Pleistocene and Pliocene deposits. It ranges in thickness from 0 feet at the updip portion to greater than 100 feet downdip in the southern half of Caroline County.

The St. Marys yields small quantities of water to very few wells, primarily domestic use.

The St. Marys provides considerable protection from contamination to the Frederica aquifer where it overlies the Choptank Formation. Only in the updip area may the silt and silty clays be thin enough to warrant additional consideration where they may allow minimal recharge to the Frederica aquifer (well: Care-Cd 2).

5.3.5 Columbia Aquifer Group

In this report the term "Columbia aquifer" is used for the water-yielding surficial sediments of the Pleistocene, Pliocene, and possibly late Miocene Series (Table 3). Formations that are considered represented in Caroline County are the Parsonsburg Sand, Kent Island Formation, Beaverdam Sand, and Pensauken Formation.

The location of these four formations has not been well defined in Caroline County. Bachman has established a generalized geology identifying the Pensauken Formation and Beaverdam Sands[17] as the major geological groups of the Columbia aquifer at Caroline County. The USGS is establishing geological maps of the Eastern Shore counties, for which Queen Annes County, Talbot County, and Dorchester

County, which border Caroline County have been prepared. Based on these publications Figure 5 has been prepared to provide a generalized geology of the Columbia group at Caroline County. This information has been incorporated on the cross-sectional lithology map of Exhibit 3.

The Columbia aquifer is primarily sand and ranges from 22 feet in thickness at Cleaves Fork in northern Caroline County to 80 feet near Federalsburg but is more generally 50 feet in thickness. Two sediment filled channels (paleochannels) have been identified near the towns of Harmony and Ridgely with a thickness of about 80 feet (Figure 3).[18]

Exhibit 3 shows that no subcropping sands of the Chesapeake Group have been identified at the base of the Columbia aquifer (also refer to sections 5.3.2 through 5.3.4). Plat 3 - Part 1 of the recent report by Bachman[19] indicates a subcropping sand of unknown areal extent in the area of Greensboro. However, a review of the lithologic logs of the same report does not show such a subcrop or at least must be considered to be of very limited areal extent.

The Choptank River has cut through the base of the Columbia aquifer probably as far north as the intersection of Tuckahoe Creek and possibly sporadically for several miles further north along either body of water, and provides a potential area for salt water intrusion to the Columbia.

The Columbia aquifer is unconfined in the County. Thin surficial clays reported by drillers are hard to interpret. It is unclear whether they are part of the Columbia aquifer or part of the soil system, and whether they actually confine ground water in the aquifer.

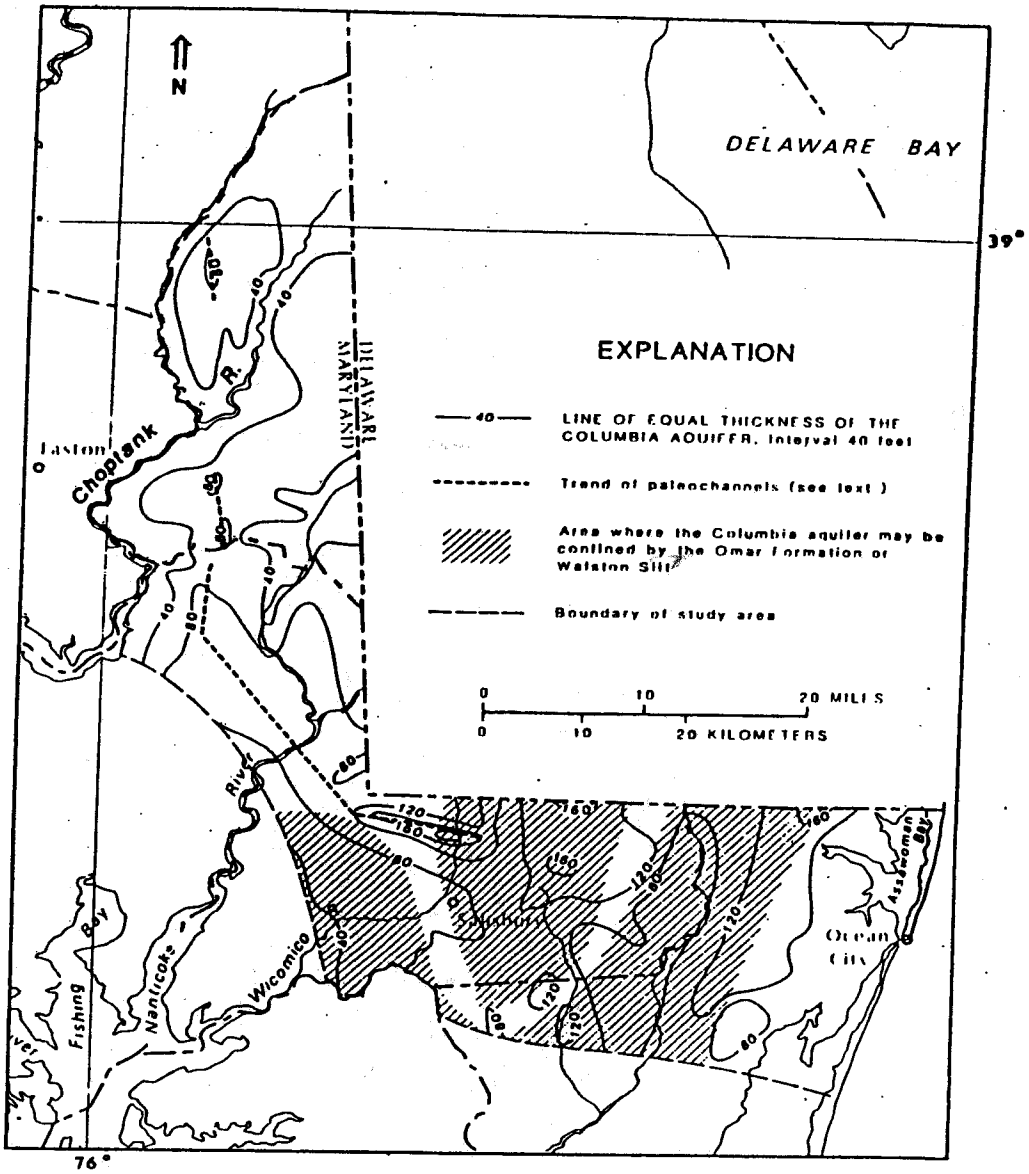
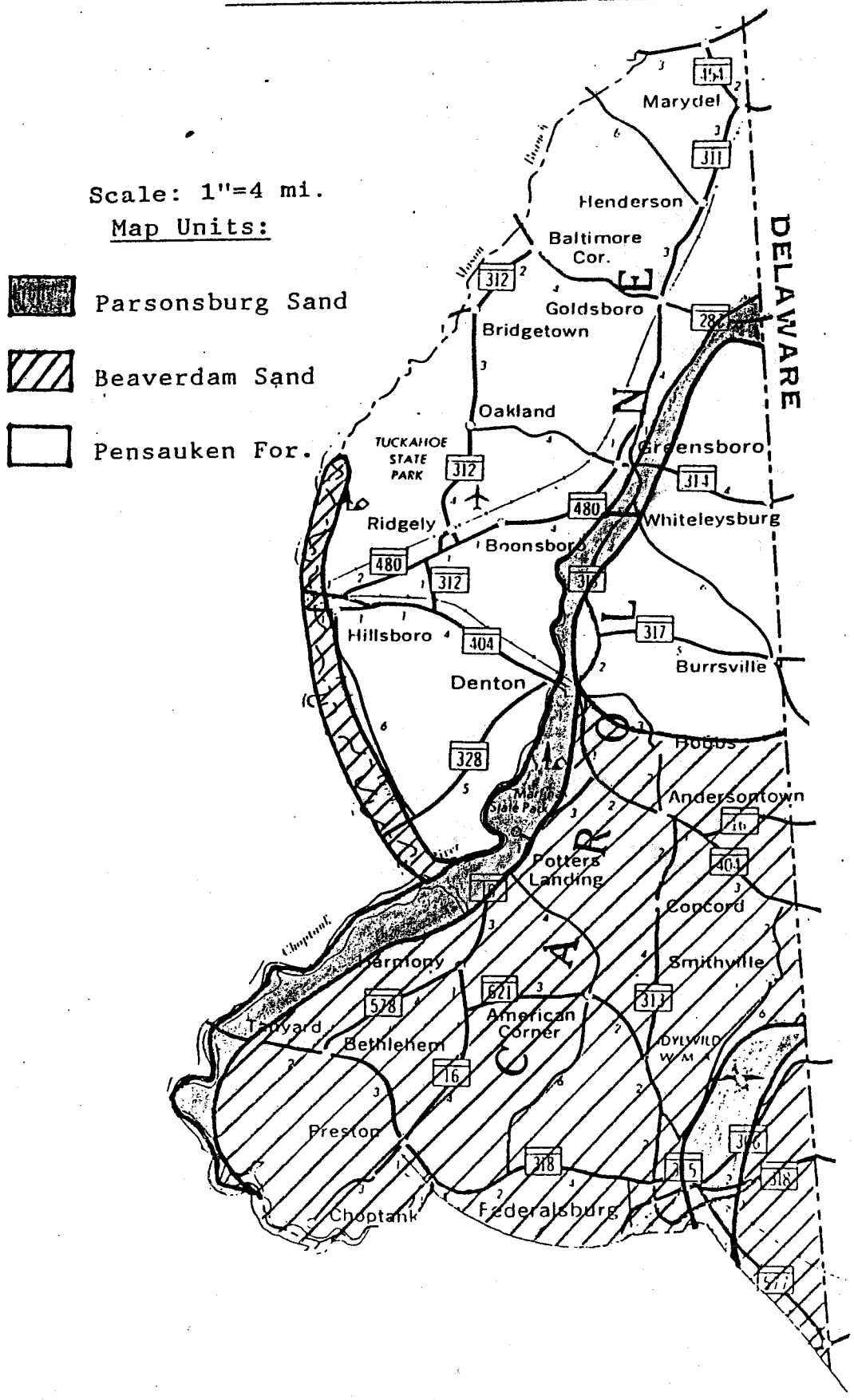


Figure 3-- Thickness of the Columbia aquifer in the study area.

Source: Bachman, L. Joseph, Nitrate in the Columbia Aquifer, Central Delmarva Peninsula, Maryland, USGS Water Resources Investigations Report 84-4322.

FIGURE 5

GEOLOGIC MAP OF CAROLINE COUNTY



A clay layer 4 feet thick has been identified and reported by Bachman (well: CO-FD 31, 61/1/457). Its areal extent was not identified, but is not logged in wells two miles north or south of this location (wells: Care - Ee 1, 61/1/457). It, therefore, appears to be a lenticular deposit in the Pensauken formation. It is located beneath the Marshyhope Creek and logged 17 feet below the ground level. It is probably saturated in the sands above this level on a year-round basis although no local well records identified a well above this clay layer.

The Columbia is relatively thin in Caroline County, and there is considerable relief on the water table due to the topography. The three major waterways (Choptank River, Tuckahoe and Marshyhope Creeks) provide discharge points generally less than 4 miles from the source of recharge, which is primarily infiltrating precipitation.[22]

Since the Columbia aquifer is primarily sand, and there is no protective cover of low permeability sediments, it is highly vulnerable to contamination.[23] Land use activity; e.g., farming, and housing, plays a major role in the contamination of this unconfined water source. Major impacts are seen in the watershed and unconfined water supply wells. Well water quality is discussed in section 5.4. The short groundwater flow system of the Columbia in Caroline County results in the elevation of phosphorus and nitrogen in the Choptank watershed at 8-13 times the natural forested rate for phosphorus, and 2.8 to greater than 3.3 times the natural forested rate for nitrogen, from both point and non-point sources of contamination.[24]

5.3.5.1 Pensauken Formation

The Pensauken formation is the basal unit of the Columbia aquifer. It underlies all of Caroline County and overlies unconformably the St. Mary's, Frederica, and Federalsburg aquifers. Whether it is late Miocene or early Pliocene is not a matter of concensus among researchers.

The Pensauken formation is a light tan to orange tan, medium to coarse grained, pebbly, subarkosic sand. It is believed to be of fluvial origin with deposition initiated within discrete channels which later infilled to form a coalescing sand sheet.[25] The sand is nonfossiliferous and pollen assemblages appear to confirm a Tertiary age.[26]

The Pensauken formation represents the most significant formation of the Columbia aquifer at Caroline County. The other formations are superimposed on the Pensauken and probably represent less than 15% of all unconfined wells in the county. The sands of the Pensauken probably produce water in some wells in conjunction with the underlying Miocene marls. The water table is within 4-16 feet of the ground surface, fluctuating with the seasonal variability in rainfall. Only 1% of the shallow wells in the county are less than 20 feet in depth probably due to the water table drop in the dry summer conditions.

The importance of the Pensauken as an available water source, the reduced expense necessary to drill to the supply, and the ease of obtaining water make it a valuable resource to protect for future users.

5.3.5.2 Beaverdam Sand

The Pensauken formation is overlain by thin sediments of the Beaverdam sand. These sediments range from 0 feet to possibly 30 feet in thickness near Concord. They are estimated to cover 40% of the county, located primarily from Denton southward, except where contact exists with the Parsonsburg sand and Kent Island formations, and along Tuckahoe Creek to the head of tide (Figure 5).

The Beaverdam sand is an unconsolidated white to buff medium-grained sand;[27] or orange to red-brown in color where weathered.[28] This latter condition is prevalant in the well drained surficial sands of the lower county. The formation has a channel-fill type of deposition, and is nonfossiliferous in Caroline County.

The Beaverdam formation, primarily due to its thin nature, is estimated to be utilized as a water supply in 10-15% of the unconfined wells in the County.

5.3.5.3 Kent Island Formation

In Caroline County the presence of the Kent Island formation is probably limited to a small area along the west side of Marshyhope Creek and the east side of Tuckahoe Creek. It overlies the Pensauken formation with a thin veneer of interbedded silt, clay, and sand. Few wells, if any, are expected to be located in the formation.

5.3.5.4 Parsonsburg Sand

The Parsonsburg sand is another "veneer" overlying the Pensauken formation, composed predominantly of poorly sorted, brown,

medium-grained sand.[29] It is generally less than 15 feet in thickness and located in a strip averaging a mile in width along the east bank of the Choptank River and Marshyhope Creek. Few wells, if any, are expected to be located in the formation.

The major significance of the Parsonsburg sand, Kent Island formation, and Beaverdam sand is their interconnection with the Pensauken formation. All waste disposal practices and other human activities at the land surface affect the water table and must be managed to protect the aquifer water quality.

5.4 Aquifer Water Quality and Quantity

This section will address the quality and quantity of the available water in each of the aquifers discussed in section 5.3. The existing and potential use and problems related thereto will also be discussed.

The groundwater withdrawal by type of use in Caroline County is shown on Table 5. Farm irrigation represents almost half of the daily use of groundwater, followed by 20% for public and 15% for individual domestic wells. The County ranks 15 of the 24 Maryland jurisdictions in water consumption, primarily due to farm irrigation use which far outranks all other jurisdictions.[30]

Water quality ranges for areas of varying sizes in each aquifer in the County have been determined by the USGS. These areas and ranges are shown for each aquifer on Exhibits 3-A through 3-G.

Table 5

Caroline County Groundwater Withdrawal By Type Of Use

Type of Use	Withdrawal (mgd)
Water Distribution Systems	1.484
Domestic	1.110
Residential Heat Pumps	N/A
Farm Irrigation	3.590
Other Irrigation	0.010
Livestock Watering	0.540
Commercial	0.134
Industrial	0.436
Mining	--
Power Plants	--
Total	7.304

5.4.1 Piney Point Aquifer

Approximately one-third of the potable water use in Caroline County is for the municipalities of Denton, Greensboro, and Ridgely. Another major use is farm irrigation. Few domestic wells utilize the aquifer due to its depth and resultant cost to obtain water from the aquifer.

Water productivity and quality knowledge is primarily limited to data from municipal users. Ranges for water quality parameters reflect the Piney Point's lack of an outcrop zone,[31] i.e., pH of 8.4 to 8.5, and iron of .02 to .04 ppm. Sodium for calcium cation exchange has occurred resulting in naturally softened groundwater (hardness: 26-47ppm). Chlorides are low, generally less than 25 ppm, and fluoride levels averaging 1.0 ppm are optimum and generally not a concern.

Water treatment is not necessary. The only major water quality parameter of concern is the level of sodium, ranging from 175-200 ppm.

Storage coefficients are high (.0003-.0004) primarily due to the thick sand accumulation in the Piney Point beneath Caroline County, and being along an axis from Cambridge through Denton to Dover, Delaware. Transmissibility is exceptional at 37,500 to 40,000 gpd/ft.

Contamination of the aquifer in Caroline County would primarily be from abandoned wells that have not been sealed or incorrectly sealed. This can be from wells in the Piney Point aquifer, and in the overlying Miocene deposits as future pumpage increases.

5.4.2. Cheswold Aquifer

Groundwater use of the Cheswold aquifer is projected at less than 1% of the total groundwater withdrawal in Caroline County.[32] The water quality is not significantly different from the Federalsburg and Frederica aquifers to warrant the additional expense in well construction into the Cheswold aquifer. Wells that are constructed into the Cheswold aquifer are primarily due to localized limited availability of water in the Federalsburg and Frederica aquifers where water bearing sands in these aquifers are thin and water production considered inadequate by the driller.

The coefficient of storage is generally expected less than .0001[33] while the transmissivity ranges from 200 to 4,000 ft/day due to increased thickness of the water-bearing sands in the downdip area.[34]

The water is moderately hard, alkaline, low in chloride, and somewhat irony.

5.4.3 Federalsburg Aquifer

Approximately 11% of the wells in Caroline County obtain groundwater from the Federalsburg aquifer. The town of Federalsburg is the only major user, while the other wells are primarily domestic supplies.

Water quantity is moderate as described for the Cheswold aquifer, and generally adequate for domestic use.

Water quality ranges are shown on Exhibit 3-E. In the downdip portion the aquifer, water quality is considered representative of confined aquifer conditions. The pH is above 7.0, nitrate is less than 1.0 ppm, and hardness also increases. High iron levels and

sulfate odors cause some well owners to treat the water supply. In the updip portion water quality is similar, however, a few wells are identified with high nitrate levels. In a random selection of Health Department records of 16 wells considered screened in the Federalsburg aquifer, one well had a nitrate level of 2.2 ppm and another 4.9 ppm. Bachman sampled 175 wells from aquifers underlying the Columbia and found 2% had concentrations exceeding 3.0 ppm. He comments that conditions favoring high nitrate concentrations in the underlying aquifers are similar to those favoring high nitrate concentrations in the Columbia Aquifer: presence of a significant component of vertical groundwater flow, absence of confining layers and a nearby source of nitrate. Vertical leakage of recharge water through the leaky aquiclude of the formation at the base of the Columbia may permit nitrate contamination from localized sources of pollution such as chicken manure storage piles, especially where the aquiclude is relatively thin (refer to recharge discussion of section 5.3.2).

5.4.4 Frederica Aquifer

An estimated 30% of the wells in Caroline County obtain groundwater from the Frederica aquifer, primarily domestic use. Saulsbury Brothers at Ridgely is the only large user (over 100,000 gpd).

Little is known about the aquifer characteristics. Reported specific capacities range from 3 to 11 gpm/foot of drawdown. Reported yields of wells range from 5 to 200 gpm.[35,36] The transmissibility of the Choptank formation was computed to be about 6,000 gpd/foot and

the coefficient of storage to be about 0.003 in a short aquifer test at West Denton.[37]

The water quality is very irony in northern Caroline County near its intake belt and about 1ppm in southern Caroline County. Treatment is necessary if iron staining is to be controlled. Chlorides are low while hardness and dissolved solids increase downdip (Exhibit 3-F).

As in the Federalsbsurg aquifer, nitrate levels can be a concern in the updip portion. Fifty-one wells of the Health Department records considered to be screened in the Frederica showed one well with a nitrate concentration of 5.2 ppm. (mean = 0.4, median = 0.2).

5.4.5 St. Marys Aquifer

Because the St. Marys formation is predominantly silt and silty clay and usually functions as an aquiclude, very few wells produce water from the limited sand and shell stratas. These wells are located primarily at Hillsboro and West Denton.

Open hole wells tested at West Denton, which also produced water from the underlying Frederica aquifer had an average specific capacity of 2.1 gpm/foot of drawdown. Maximum test yield was 40 gpm.[38]

The water in the St. Marys is of the calcium bicarbonate type, hard, low in chloride, moderate in dissolved solids, and almost neutral. Iron can be a problem.[39]

5.4.6 Columbia Aquifer

The unconfined wells of the Columbia aquifer provide water to half of the wells in Caroline County. Table 4 dramatically illustrates another of the major factors of importance of the Columbia

aquifer. 60% of the available water in the midshore tri-county area is in the Columbia aquifer.[2]

Unfortunately, the sandy nature of the Columbia makes it highly susceptible to contamination. Nitrate nitrogen is already threatening continued use of the aquifer for potable drinking water purposes (section 5.4.6.4).

The following sections will address the water quality and quantity of the four identified formations in the Columbia Aquifer followed by a section addressing nitrate-nitrogen contamination. Information regarding each of the formations in Caroline County is incomplete. Future research by the MD Geological and U.S. Geological Surveys, and water quality ranges based on local health department historical records will supplement this data.

5.4.6.1 Pensauken Formation

Transmissity in the Pensauken formation ranges from 100 to 50,000 square feet per day and the storage coefficient from 0.10 to 0.15. Most areas of the formation probably produce water in conjunction with overlying younger sediments of the Pleistocene and Pliocene series where they are present. Large scale development potential exists throughout most of the formation where the "head" remains sufficiently high during the dry period of the year. Locally, problems have resulted in adjacent shallow wells "drying-up" during the summer near large users, primarily agricultural irrigation wells.

The water is slightly acidic, average 5.7, but ranges from 4.0 to 6.5. The corrosive effects of low pH has created concerns for high lead levels from contact with lead piping in older homes and lead

solder in most other homes without plastic piping. Iron can be a problem and may require treatment but is generally moderate (.046 ppm).[40] The water is soft (35 ppm. hardness), low in chlorides (<25 ppm) and low in dissolved solids (<130 ppm).

Nitrate levels are a major concern for future potable use of the formation (section 5.4.6.4). So too, salt water intrusion must be considered. Along the shore of the Choptank River where saline conditions prevail and the water table is near sea level, the lowering of the water table by pumping could easily cause salt water intrusion.[41]

5.4.6.2 Beaverdam Sand

Water yielding properties of the Beaverdam Sand are not well known. The only large user in the County, a well at Federalsburg, obtains water from more than one formation. Water quantity is more than sufficient for the driven wells used as domestic water supplies.

The water quality is considered typical of the unconfined water wells of the Pensauken formation.

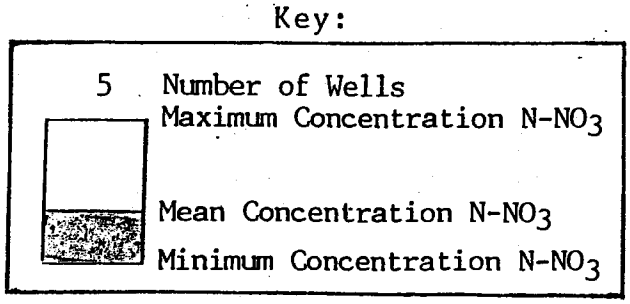
5.4.6.3 Kent Island Formation and Parsonsburg Sand

These formations are poorly known in Caroline County, having been classified on only a few well logs.[42] Due to their limited or thin nature, very few wells are expected to produce water from the formations. Water quality and quantity may be expected to be similar to that of other unconfined water supplies in the County.

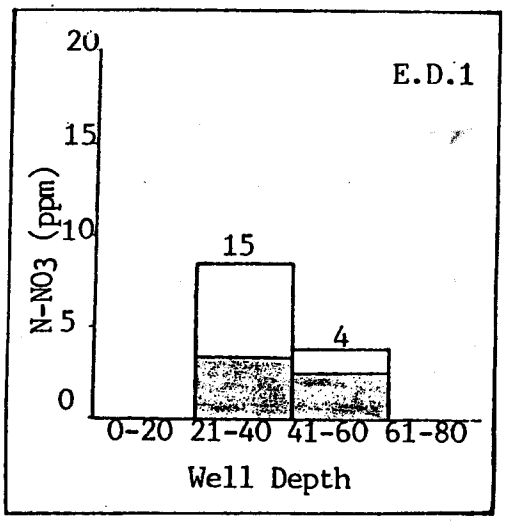
5.4.6.4 Nitrate Contamination in the Unconfined Aquifer

FIGURE 6

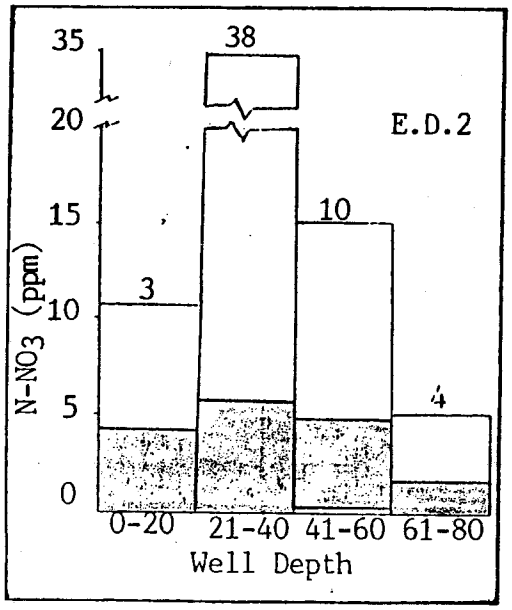
NITRATE-NITROGEN CONCENTRATION IN THE COLUMBIA AQUIFER BY E.D. & WELL DEPTH



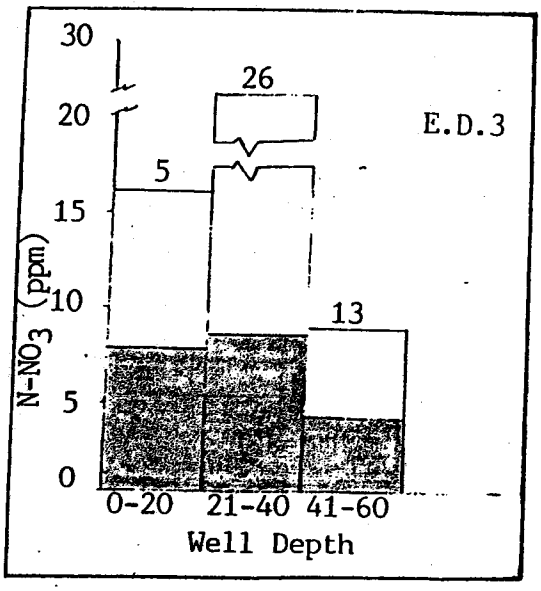
E.D.1 - HENDERSON



E.D.2 - GREENSBORO



E.D.3 - DENTON



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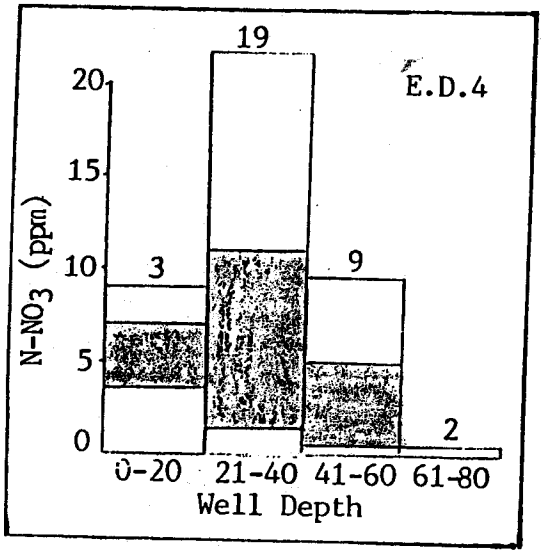

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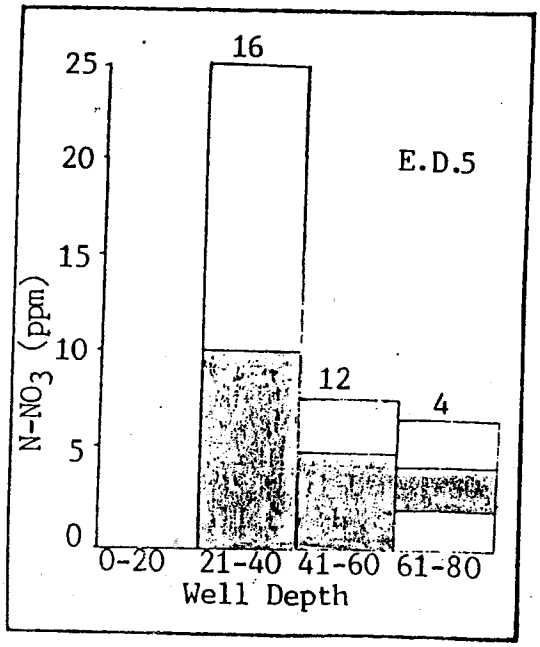
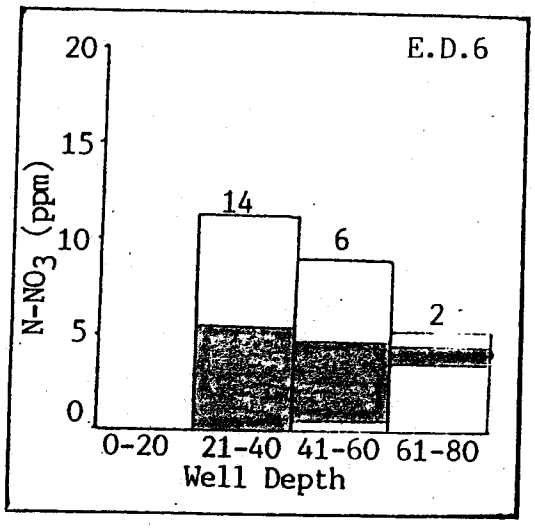
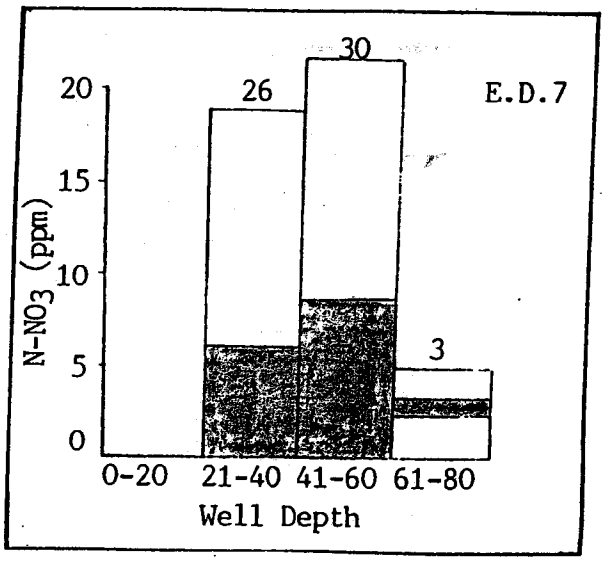


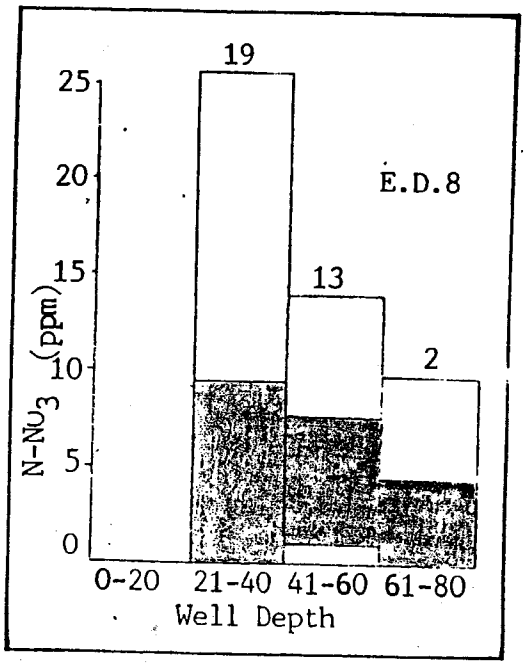
E.D.6 - HILLSBORO



E.D.7 - RIDGELY



E.D.8 - AM. CORNER



Nitrate is the most common contaminant reported in the Columbia aquifer. It does not occur naturally in high concentrations, but enters the aquifer from human activities at the surface, including septic systems, agricultural fertilizers, and animal waste stockpiles.[45] Nitrate levels above 3 or 4 ppm are considered indicative of a nearby pollution source.[43] Nitrate concentrations above 10 ppm violate the safe drinking water standards and may cause methemoglobinemia in infants and young livestock. The presence of nitrate may also indicate the presence of other forms of contamination.[44]

To review the extent of nitrate contamination in the County, one-half (447) of the unconfined wells installed during the period 1975 through 1984 were analyzed. Nitrate concentrations were observed between 0 and 5 ppm in 40% of the wells, between 5 and 10 ppm in 28%, and greater than 10 ppm in 32% of the wells. The mean concentration for all wells was 5.5 ppm. The results of this analysis by well depth for each election district is shown on Figure 6.

Overall, the nitrate concentrations tend to be higher in the shallow groundwater, and tend to decrease with increasing depth. The USGS has published a report on nitrate in our area in which the relationship of lower nitrate to increased depth of well was examined. The correlation was found to be statistically significant.[46]

High nitrate concentrations are a major problem in the Preston, American Corner, and Federalsburg election districts. The mean nitrate concentrations are between 5 and 10 ppm in most of the categories of well depths (0-20', 20-40', etc.). Fourty percent of

the wells in these election districts do not meet the drinking water standard for nitrate.

In the Ridgely, Hillsboro, Denton, and Greensboro election districts, nitrate concentrations range generally less than 7 ppm, but greater than 4 ppm. These levels clearly suggest the areas are affected by waste disposal activities.[47] One out of every four new shallow wells in these areas cannot be expected to meet the drinking water standards.

Henderson election district had the lowest mean nitrate concentrations (3.2 ppm), a level still suggesting evidence of impact from human activities at the surface. The lower levels observed may reflect the soil hydrologic group. Based on the soil hydrologic groups of the Maryland Department of Planning, Bachman, in his study of nitrate in the Columbia aquifer, reports a significant difference for the lower median nitrate concentrations of the more poorly drained type C and D soils as compared to the more well- drained type A and B soils.[48,49] This same hypothesis was tested using the 5-minute quadrangles established by Bachman, randomly selecting unconfined well records for each quadrangle, and determining the soil hydrologic class for each quadrangle based on the Caroline County Agricultural Soils Map (Figure 7). Quads 1, 2, and 3 (Figure 8) comprise all of the Henderson election district and the northern corners of the Ridgely and Greensboro election districts and were identified as type C and D poorly drained soils. The remainder of the County quads were identified as type A and B well drained soils. The analysis confirmed a significant difference (probability 0.01 percent) between the soil

FIGURE 7

Showing the Agricultural Soils
generalized from the 1916 MGS soils map

CAROLINE COUNTY

MARYLAND

Scale: 1"=4 mi.

KEY:

sands

loamy sands

sandy loams

loams

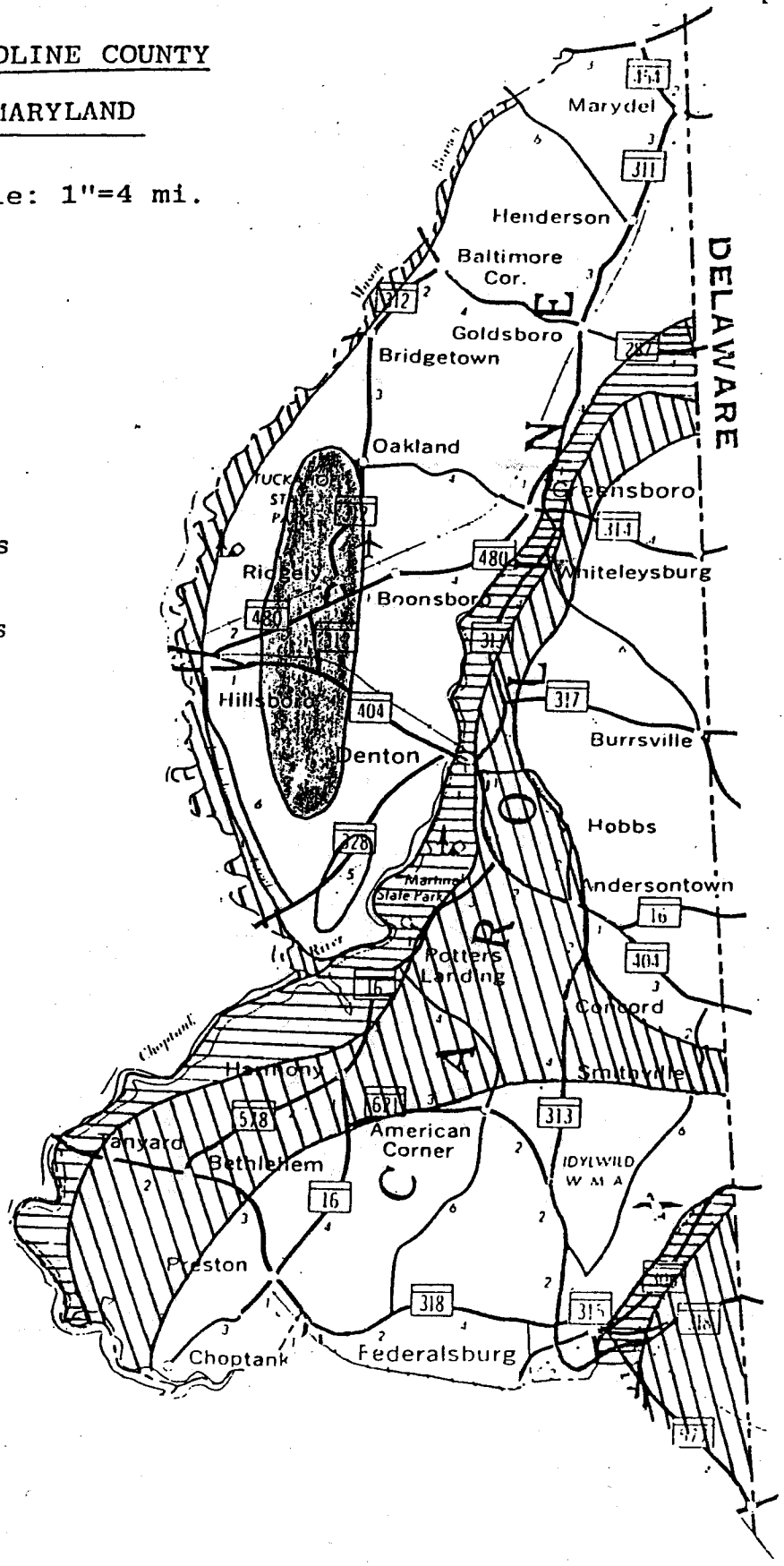
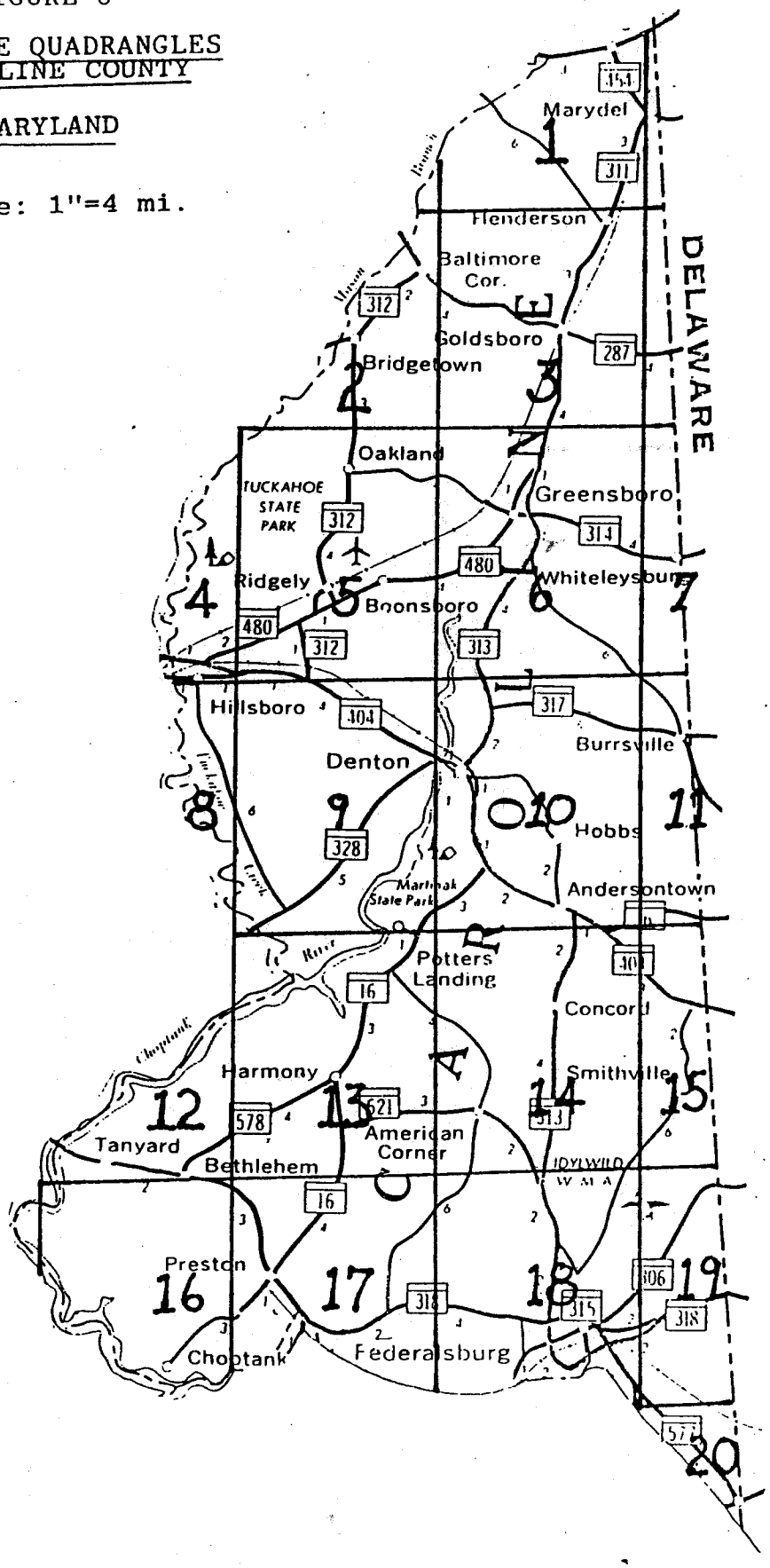


FIGURE 8

5 MINUTE QUADRANGLES
CAROLINE COUNTY

MARYLAND

Scale: 1"=4 mi.



group medians, and probably is a contributing factor for the lower nitrate levels in the upper county.

5.4.6.5 Land Use Impacts on Nitrate

Bachman has statistically evaluated nitrate concentrations with respect to land use as the source of contamination. Nitrate concentrations appear to be strongly associated with land use and the differences statistically significant.

Nitrate concentrations tend to be highest at sites near chickenhouses. Other agricultural land uses, predominantly waste storage piles, and urban land uses, predominantly septic tank effluent in high density areas (such as in Goldsboro) have the next highest concentrations. Lawn and garden fertilizer could also be significant sources of nitrate in high density areas. Wooded sites have the lowest concentrations. Agricultural and wooded sites that have homes with on-site sewage systems tend to have higher nitrate concentrations than sites of the same land use without a sewage system.[50]

The highest nitrate levels in Caroline County are located predominantly at animal raising operations. Many small clusters of homes are also identified as having high nitrate concentrations, including Goldsboro, Trinity, Hillsboro, Harmony, Newton, Bethlehem, Choptank, Jonestown, American Corner, and Houston Branch Road nearest Federalsburg. The effect of land use on nitrate is highly visible when reviewing these high density areas. All are located in generally well-drained to moderately well-drained soil conditions except Goldsboro, which is located within the area identified in Section 5.4.6.4 as poorly drained and generally expected to have a lower

nitrate concentration but which has a record of high nitrate in the shallow wells.

Land use in the County has changed very little. Figures for the period 1973 to 1981 show less than a 5% change in the land use. Agricultural uses comprise 61% of Caroline County's 205,000 acres, followed by forest use on 28%, urban use on 7%, and wetlands comprising 4%.

Although agriculture is the largest single land use, statistical analysis by Bachman does not indicate that fertilizer, whether inorganic or manure, results in an extremely high concentration in groundwater at a site. The key of best management practices is to control nitrate contamination from manure and fertilzers through nutrient management. Nitrogen application rates should be limited to the amount used by the crop.

Manure storage structures may be the most significant development toward improvement of the water quality in the County. Nitrate levels in the County have been found at over 80 and 100 ppm near animal raising operations, primarily chicken houses.

5.4.7 Existing Well Inventory

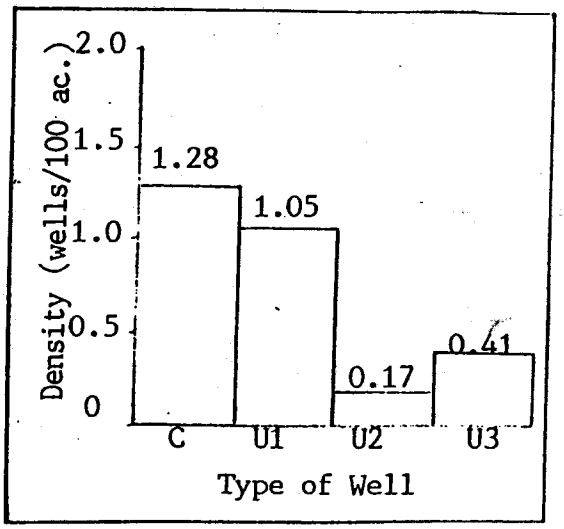
Well density in the County is very low. The density of all wells (agricultural, domestic, commercial, etc.) is estimated at 20-25 wells per square mile or approximately 8000 well systems in the County. However, regardless of the number of wells, each must be maintained so that it does not become a conduit that will permit contamination to be transferred directly from the surface or near surface sources to within the aquifers.

FIGURE 9

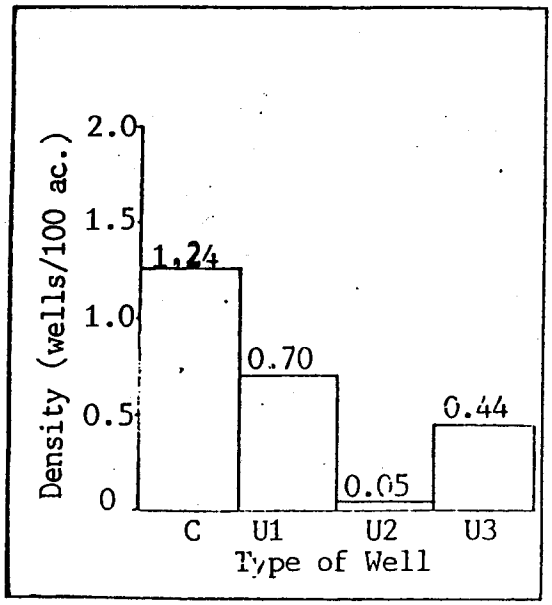
DENSITY OF EXISTING INDIVIDUAL WATER SUPPLY WELLS

Key:
C - CONFINED AQUIFER WELLS
U1 - UNCONFINED AQUIFER WELLS $0 \leq N\text{-}NO_3 < 5$
U2 - UNCONFINED AQUIFER WELLS $5 \leq N\text{-}NO_3 < 10$
U3 - UNCONFINED AQUIFER WELLS $N\text{-}NO_3 \geq 10$

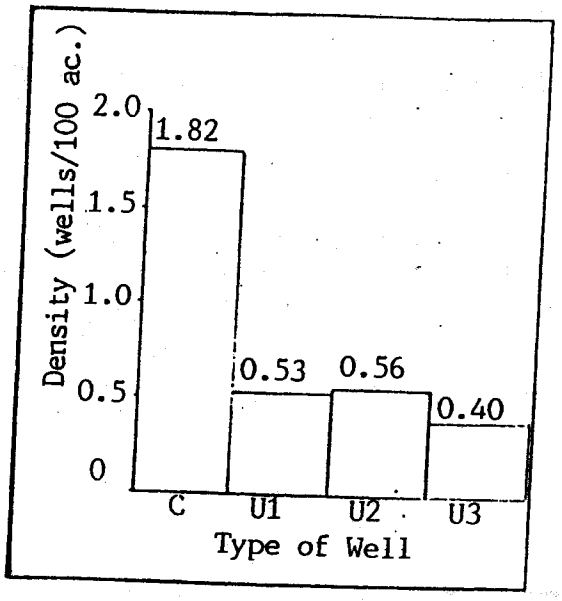
E.D.1 - HENDERSON



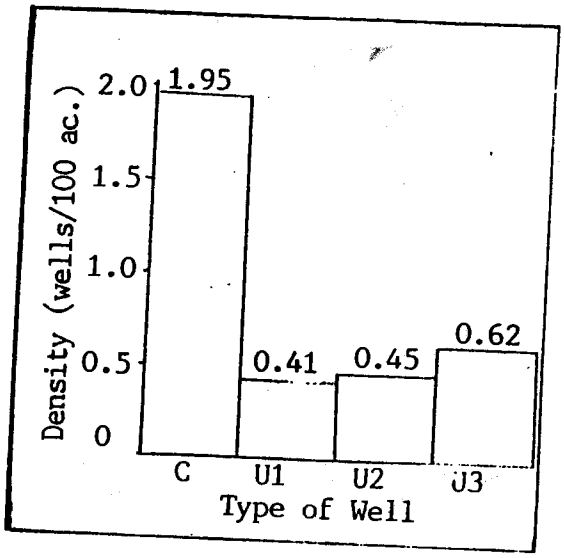
E.D.2 - GREENSBORO



E.D.3 - DENTON



E.D.4 - PRESTON



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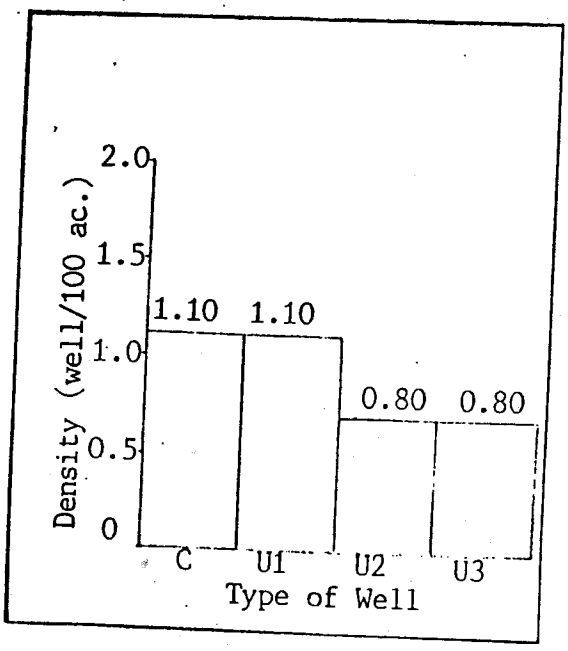
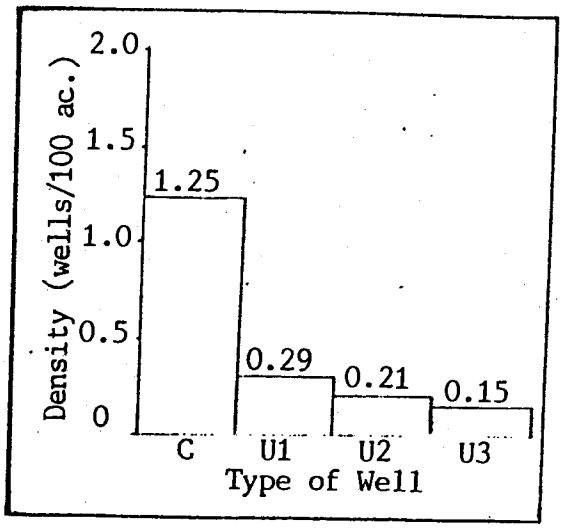
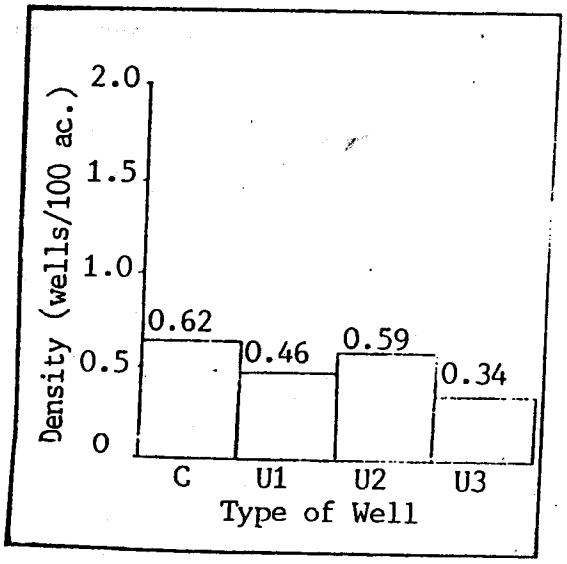


E.D.6 - HILLSBORO



E.D.7 - RIDGELY



E.D.8 - AM. CORNER

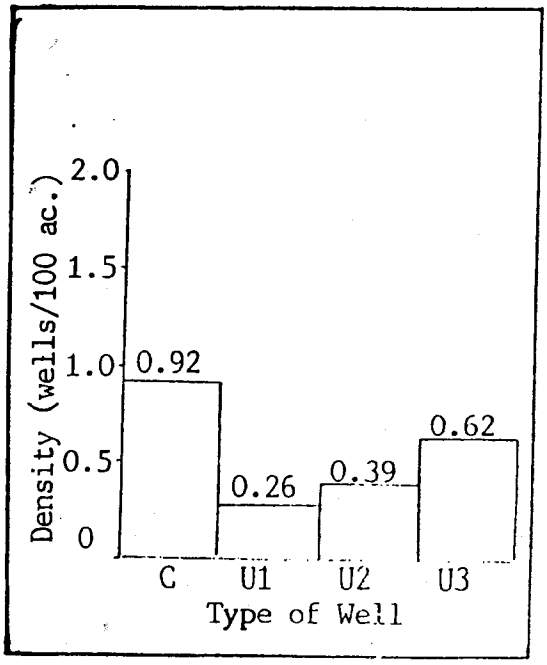


Figure 9 shows the densities of water suppy wells used for potable purposes. These densities were determined by randomly selecting 50% of the well records in each election district for the nine year period 1976 through 1984, and determining the percentage of the wells in each of four categories (Table 6). Since the random sample was considered representative of the total number of wells in each election district, these percentages were used to determine the number of structures in each election district for each well category based on the total number of structures in each election district utilizing on-site water systems. In order to compare these numbers, since each election district varies in size, they were re-computed based on the average number of wells to be expected in an area of 100 acres. The unconfined aquifer categories specifically were keyed to nitrate-nitrogen levels due to public health concerns for this contaminant and its representative value of the human activities contributing to contamination of the Columbia aquifer.

Table 6 - Well Density Categories

Confined Aquifer Wells; undifferentiated (C)

Unconfined Aquifer Wells (U1) with $N\text{-}NO_3$ greater than 0, but less than 5 ppm

Unconfined Aquifer Wells (U2) with $N\text{-}NO_3$ equal to or greater than 5 but less than 10 ppm

Unconfined Aquifer Wells (U3) with $N\text{-}NO_3$ equal to or greater than 10 ppm

The density of these wells, from greatest to least occurrence by election district and by type of well, is as follows: (refer to Exhibit 2-D, p2-20 for location of the Election Districts).

Table 7
Both Confined and Unconfined Wells

Election District	# wells/100 ac.
5 Federalsburg	3.80
4 Preston	3.43
3 Denton	3.31
1 Henderson	2.91
2 Greensboro	2.43
8 American Corner	2.19
7 Ridgely	2.01
6 Hillsboro	1.90

Confined Wells Only

Election District	# wells/100 ac.
4 Preston	1.95
3 Denton	1.82
1 Henderson	1.28
6 Hillsboro	1.25
2 Greensboro	1.24
5 Federalsburg	1.10
8 American Corner	0.92
7 Ridgely	0.62

Unconfined Wells Only (U1+U2+U3)

Election District	# wells/100 ac.
5 Federalsburg	2.70
1 Henderson	1.63
3 Denton	1.49
4 Preston	1.48
7 Ridgely	1.39
8 American Corner	1.27
2 Greensboro	1.19
6 Hillsboro	0.65

A cursory review of these lists shows the Federalsburg election district has the highest density of all wells and ranks first for the density of unconfined wells. So too, from Figure 9, Federalsburg has the highest density of unconfined wells with nitrate greater than 10 ppm. This data, however, is not considered representative of the nitrate contamination in the Columbia aquifer. Table 8 was prepared by establishing ratios of the of U1 wells to U2 + U3 wells.

Table 8

Ratios of U1: U2 + U3 Wells by Election District

Election District	
8 American Corner	1: 3.88
4 Preston	1: 2.61
7 Ridgely	1: 2.02
3 Denton	1: 1.81
5 Federalsburg	1: 1.45
6 Hillsboro	1: 1.27
2 Greensboro	1: 0.70
1 Henderson	1: 0.55

This data more accurately reflects the soil hydrologic conditions contributing to nitrate contamination described in Section 5.4.6.4. Henderson election district and the northern third of the Greensboro election district comprise the poorly drained hydrologic soil groups, while the remainder of the County is predominantly well drained hydrologic soil groups. Nitrate in the Federalsburg election district is not distributed in high concentrations at all depths as in the American Corner and Preston election districts (also refer to Figure 9) and ranks below the districts with respect to wells with high nitrate levels.

5.5 Aquifer Characterization & Water Quality Assessment Summary & Discussion

Based on the observations and findings of the various hydrogeologic factors and the occurrence of recognized nitrate contamination, the following summary will establish the basis of the groundwater protection strategy of this report. Development of soil treatment zones, density, design, and construction requirements of on-site sewage systems are built upon this foundation.

(1) Abundant sources of nitrogen and existing hydrogeologic conditions allow nitrate to enter the groundwater in Caroline County. High nitrate concentrations are present in the unconfined groundwater in all parts of the County, under all land uses and soil types but, in general, tend to be:

(a) less in the poorly drained hydrogeologic soil groups in the 5-minute quadrangles north of the 39th paralle just north of Greensboro;

(b) greatest near livestock raising operations, primarily chicken houses and chicken manure storage piles (It is clear that domestic wastewater should not be managed independently of agricultural waste management practices), and

(c) less at the deeper depths of the Columbia aquifer.

(2) The Columbia aquifer represents the largest single source of water supply, currently providing water to 50% of the wells in Caroline County. Although 32% of the unconfined wells do not meet drinking water standards for nitrate, new wells or deepened existing wells may locate water meeting the standards. The tremendous

availability of water from the Columbia (60%) compared to all other aquifers combined dictates the need to protect the aquifer for the future. On-site septic system design standards must consider the contamination potential. No area of the aquifer appears confined or less subject to this and other sources of contamination.

(a) Based on the identified contamination, minimum well depths in each election district can be established by this report to reduce the potential for constructing a water supply not meeting minimum drinking water standards for nitrate. These minimum depths are shown in Table 9.

Table 9

Election District	Min. Well Depth (ft.)	Estimated Failure Rate ($N\text{-}NO_3$ above 10 ppm)
1 Henderson	20'	5%
2 Greensboro	40'	25%
3 Denton	40'	10%
4 Preston	40'	10%
5 Federalsburg	40'	10%
6 Hillsboro	40'	10%
7 Ridgely	60'	5%
8 American Corner	60'	10%

The estimated failure rate; that is, nitrate greater than 10 ppm is subjective. However, only Greensboro election district has nitrate ranging above 10 ppm at the minimum 40 foot depth. The local hydrogeology and sources of contamination will still result in unacceptable nitrate levels in some wells in all election districts.

The current Regulations Governing Well Construction, COMAR 26.04.04, do not allow the use of nitrate treatment devices since an

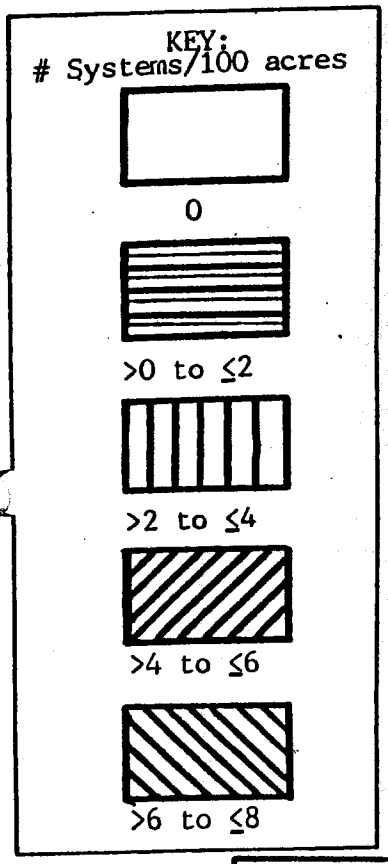
Map 4
Density of Existing On-Site
Sewage Disposal Systems
With ≥4 ft. of Unsaturated Soil

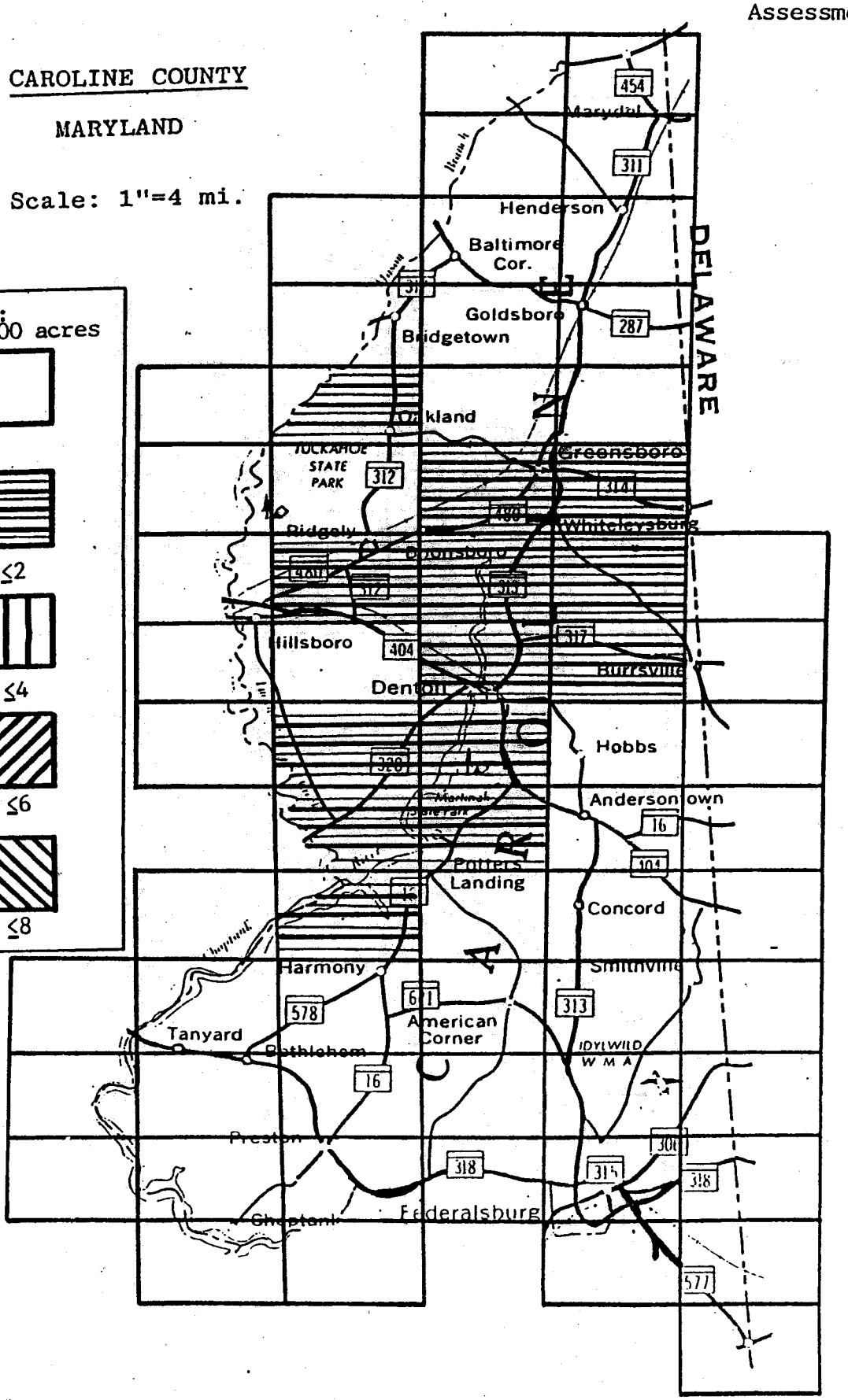
May 1986

CAROLINE COUNTY

MARYLAND

Scale: 1"=4 mi.





Assessment Map #

1-2
4-5
6-8
9-11
12-15
16-19
21-25
26-30
31-35
36-39
40-44
45-50
51-56
57-62
63-66
67

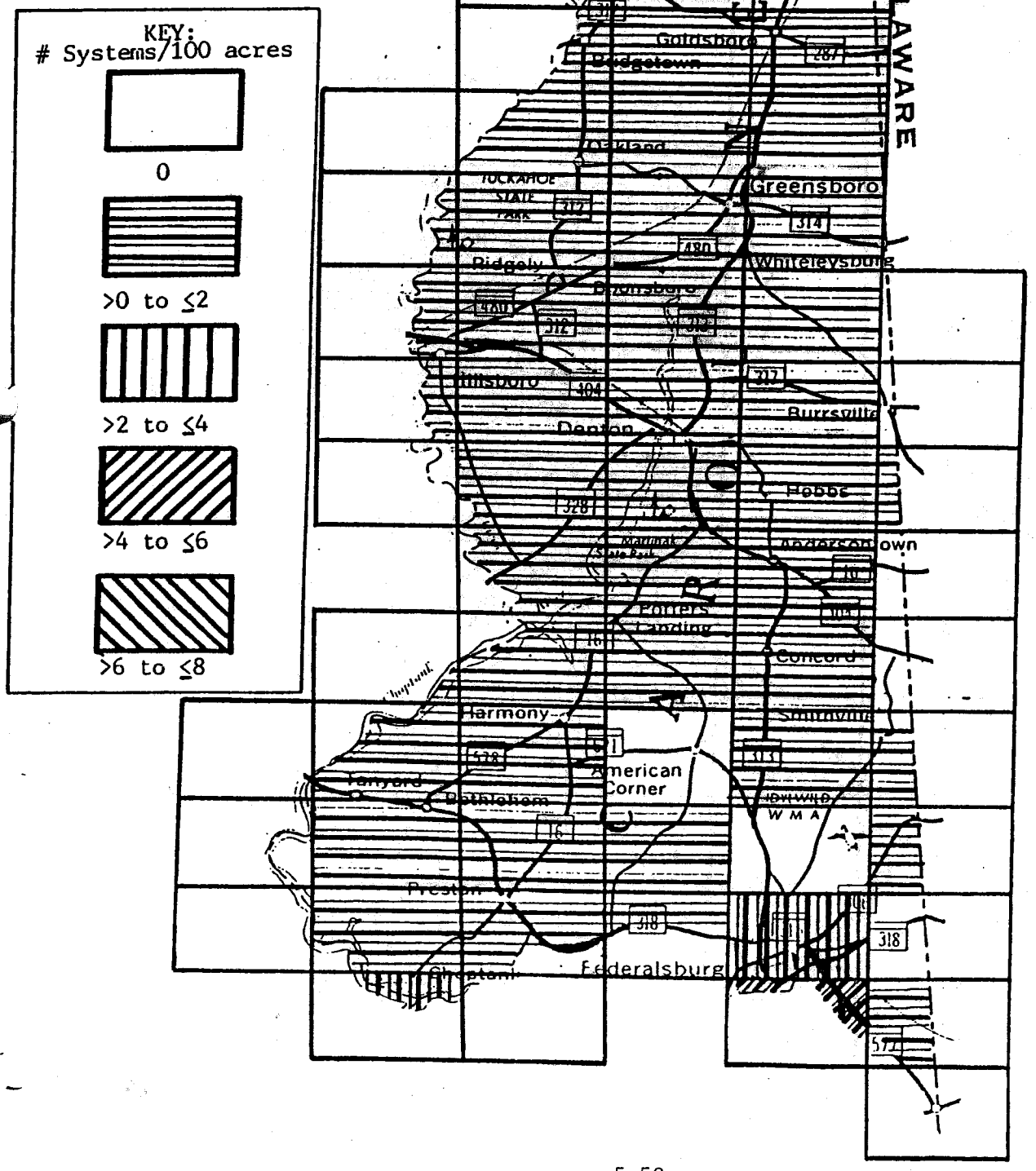
Map 5
Density of Existing On-Site
Sewage Disposal Systems
With ≥2ft to ≤4ft of Unsaturated Soil

May 1986

CAROLINE COUNTY

MARYLAND

Scale: 1"=4 mi.



Assessment Map #

1-2
4-5
6-8
9-11
12-15
16-19
21-25
26-30
31-35
36-39
40-44
45-50
51-56
57-62
63-66
67

Map 6

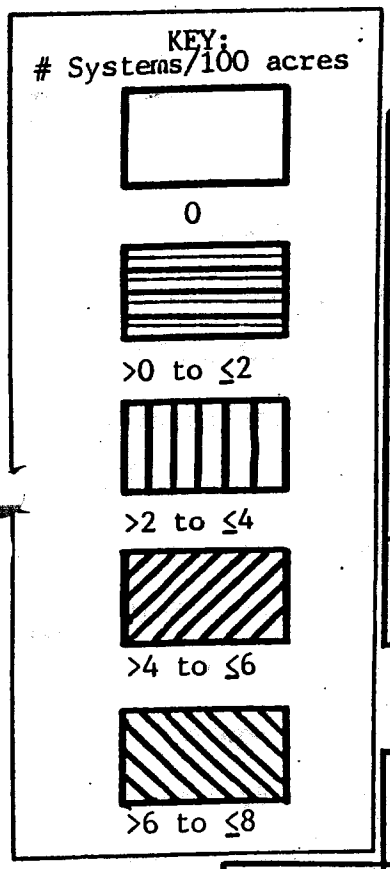
Density of Existing On-Site
Sewage Disposal Systems
With <0ft to <2ft of Unsaturated Soil

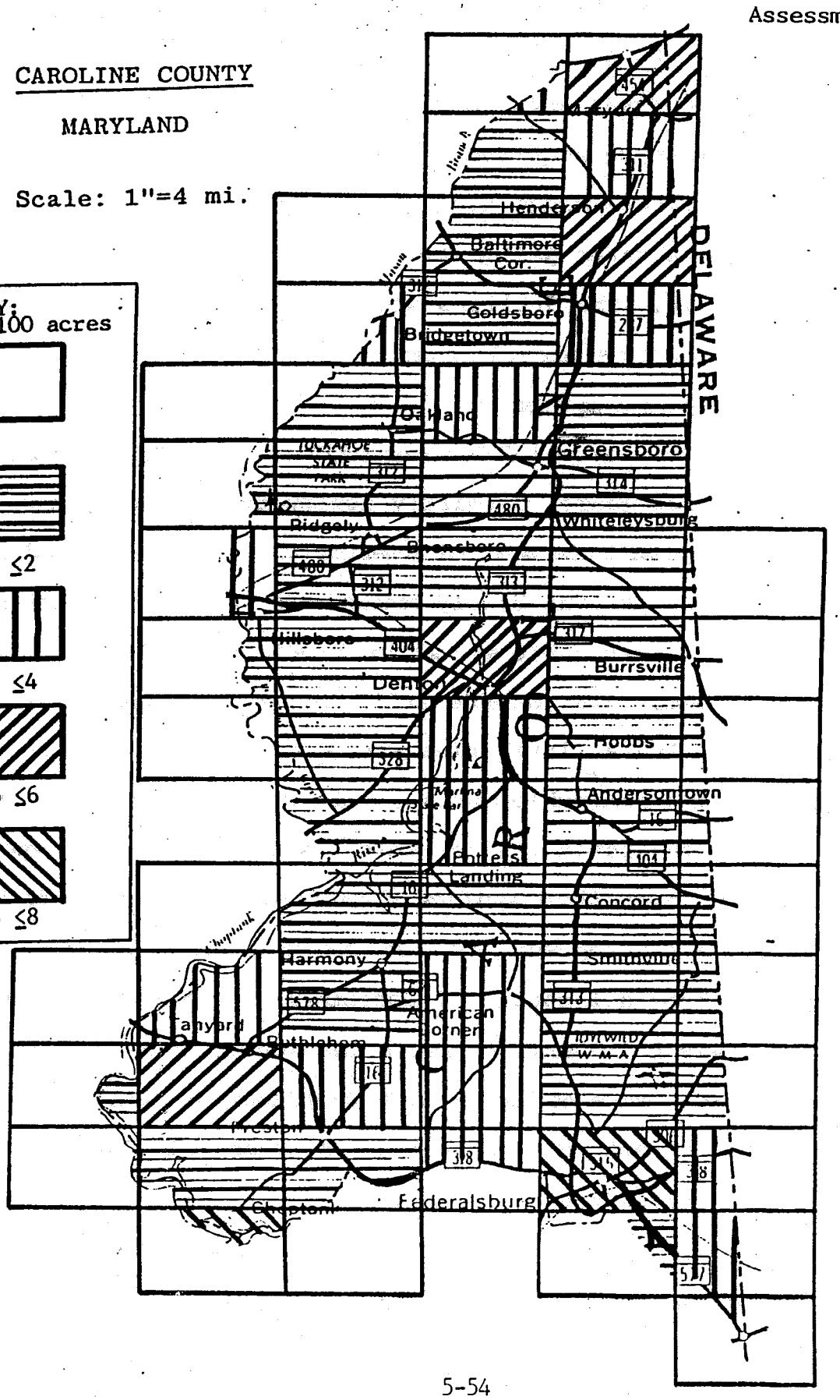
May 1986

CAROLINE COUNTY

MARYLAND

Scale: 1"=4 mi.





Assessment Map #

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21-25

26-30

31-35

36-39

40-44

45-50

51-56

57-62

63-66

67

alternative confined aquifer for a source of water is available. Therefore, it is prudent to issue well construction permits for Columbia aquifer wells strictly on a test well basis only. The well driller must be required to submit a sample of water for nitrate analysis before connecting the well to the building. Wells not meeting the water quality standards shall be abandoned and sealed by the driller. The drillers should be careful to disclose this information to their client before entering into a contract to drill into the Columbia aquifer.

(3) The potential for user conflict in the Columbia aquifer is high. Large users, primarily agricultural irrigation wells, in conjunction with the seasonal lowering of the water table and shallow domestic wells that barely penetrate the water table, occasionally lower the water table so that local wells become dry or the shallow suction pumps are not able to lift the water. Current knowledge on the agricultural irrigation pumpage is increasing since irrigation wells are now required to have a groundwater appropriation permit.[55]

(4) The potential for water from the Columbia aquifer to contaminate confined aquifers of the Choptank and Calvert formations along the subcrop belts, also requires the protection of the Columbia aquifer from all source of contamination. There are currently no large users in the subcrop zones in the County. These areas should be restricted to users of less than 10,000 gallons per day.[56]

The effect of connection between the Columbia and the recharge belts has not been sufficiently tested. The MGS and USGS well logs, and cross-sectional mapping shown on Exhibit 3, does not indicate an unconfined region of connection. However, this

data also does not indicate potential regions of more intensive vertical leakage through the confining beds; therefore, any wastewater management scheme must be conservative so as to protect the aquifers. The MGS and USGS should be requested to evaluate this connection. Again, groundwater pollution management (e.g., septic system discharges, manure storage piles) must not allow continued degradation of the Columbia Aquifer. There is no limited surficial aquifer that can be designated for wastewater disposal in Caroline County. Proper protection of the Columbia aquifer from further degradation from septic systems is examined in Section 5.5.

(5) The water quality data in this report is based on norms established by the MGS and USGS with limited water quality data from the Health Department records. More specific ranges and means for the confined aquifers from the Health Department records can be established if desired.

(6) The USGS is currently developing geologic data maps for the Eastern Shore. When this data is available for Caroline County, the depth and extent of the formations in the Columbia aquifer may be appropriately revised in this report.

5.6 Development of Soil Treatment Zones, Density, Design and Construction Requirements

The previous sections of this report have identified that nitrate-nitrogen contamination is occurring from waste disposal activities in the upper levels of the water in the Columbia Aquifer and that protection of the Columbia Aquifer will limit potential contamination of the older aquifers beneath the Columbia aquifer. Coupled with the described hydrogeologic characteristics, the importance of the significant quantity of available water from the Columbia and the need to protect it for potable water uses dictates that all of Caroline County must be treated uniformly in a management strategy for use of on-site sewage disposal systems. (The management of other sources of contamination to the Columbia Aquifer are not within the scope or purpose of this report.)

In Caroline County on-site sewage disposal systems must be designed to maximize protection of the water quality in the Columbia Aquifer. The following sections will address the ability of the soil in Caroline County to treat wastewater, and result in the development of soil treatment zones, density, design and construction requirements for these on-site sewage disposal systems.

5.6.1 General Soil Conditions

Sandy soil textures dominate the soil horizons in Caroline County. The Department of Agriculture's Soil Survey of Caroline County classifies 3% of the soil as sand, 20% loamy sand, 53% sandy

loam, 18% loam, and 6% for all other soil textures.[57] The sandy nature of the soil is responsible for rapid rates of infiltration, low moisture holding capacity, and considerable leaching. The leaching produces soils which are low in pH, generally 4.5 to 6.0. Since the clay portion is generally low, the cation exchange capacities of the soils are low (2-10 meg/100g, averaging 5.1 meg/100g). Organic matter fractions of the soils are also very low and limited to the first few inches of the soil profile.

5.6.2 Inventory of Existing Septic System Density

The density of existing septic systems in Caroline County was determined for each of the County's 67 maps of the State Division of Assessments and Taxation. A percentage of the County Health Department records for each map were randomly selected. Each record was reviewed to determine the depth of unsaturated soil (soil thickness below the bottom of the seepage trench to the highest observed water table) and placed in one of the three following categories:

1) greater than 4 ft. of unsaturated soil
2) 2-4 ft of unsaturated soil
3) less than 2 ft. of unsaturated soil

The total number of structures not on public sewage systems on each map, prepared by the Caroline County Zoning Department, was used to determine the number of structures in each of the three unsaturated soil categories. This was determined based on the percentage of septic systems in each of the three categories from the records that were selected. The mathematical assumption is: if 50% of the septic

system records randomly selected have greater than 4 ft. of unsaturated soil, then 50% of the total houses have 4 ft. of unsaturated soil. The density of homes per 100 acres was then computed.

The percentage of Health Department records randomly selected ranged from 10% to 40% for each Assessment Map. This was determined by the staff evaluating each quadrant of the assessment map and categorizing it into one of the four soil associations of the General Soils Map of the Department of Agriculture Soil Survey of Caroline County Maryland. The number of soil associations determined for each map (1-4) dictated the percentage of records to be randomly selected (10-40%). Thus, the greater the soil variation on each map the more records that were selected.

The results of this inventory are shown on Maps 4, 5, and 6. As with the well inventory, the overall system density is very low, averaging one system/36 acres Countywide, and ranging from one system/9 acres where population centers affect the averages to one system/404 acres.

Overall, 8% of the County Health Department records reflect septic systems providing at least four feet of unsaturated soil on a year-round basis, 29% provide 2-4 feet of unsaturated soil, and 63% provide less than two feet of unsaturated soil (including direct groundwater penetration). Obviously the greatest percentage of systems do not provide much groundwater protection from septic system wastewater contamination. Health Department policy in the decade from 1975 to 1985 had been to provide a minimum of one foot of unsaturated soil, however, many systems installed prior to that penetrate the groundwater during the wet season.

Map 4 shows the few Assessment maps where systems with four feet of unsaturated soil were identified. These systems are primarily located along the high, well-drained soils of the upper Choptank River north of the intersection with Tuckahoe Creek.

Map 5 shows that densities of systems with two to four feet of unsaturated soil are generally evenly distributed throughout the County; however, at a low density of less than two systems/100 acres. Increased population density at the towns of Choptank and Federalsburg account for the few maps (61, 63, 65) with higher densities.

Map 6 reflects that the permitting of systems with less than two feet of unsaturated soil has also been throughout the County. Population centers primarily account for the numerous maps with greater than 2 systems/100 acres. Replacement of these systems must consider increasing the depth of unsaturated soil.

5.6.3 Problems Associated with On-site Septic Systems

Disposal of wastewater from on-site septic systems into the soil presents several potential problems which will be reviewed in this report. Emphasis will be placed on the hazards to human health from pathogenic bacteria, viruses, and high nitrate concentrations in our drinking water. Eutrophication of surface waters from nitrogen and phosphorus are also major concerns. Unfortunately, improvements in groundwater quality may require several decades for natural dilution and/or discharge to surface water of the contaminants. The need for a broad management approach intended to protect the aquifer is necessary.

5.6.4 Wastewater Contaminants and Their Movement in Groundwater

5.6.4.1 Pathogens

The disposal of human wastes in a soil may present a hazard due to the presence of pathogenic organisms. Pathogen survival rates outside the human body, and movement of pathogens in the soil are the factors of concern.

Some of the diseases caused by pathogens in sewage include cholera, salmonellosis, shigellosis, pulmonary tuberculosis, amoebic dysentery, typhoid fever, polio, aseptic meningitis, and infectious hepatitis.[59] It is evident wastewater disposal shall consider the potential for disease transmission in order to protect the public health.

In general, pathogenic microbes are host specific and they fare badly outside the host. The environment of the septic tank is not conducive to pathogen safety. Bacteria removal from septic tanks has been reported at approximately 40-50%. Far fewer viruses appear to survive the septic tank environment.[60] Future studies are needed to adequately assess pathogen survival in septic tanks.

Pathogen survival in the soil is determined by factors including soil texture, pH, moisture content, temperature, and competition from native soil microflora. Most studies of pathogen survival in the soil are based on laboratory lysimeter tests and surface-applied wastewaters. Miller reviewed extensive data and effectively summarized the data by developing a table to show the large discrepancy in estimated pathogen survival times. The ova of

parasitic worms (Ascaris sp.) were the most persistent organisms observed, ranging from 2.5 to 7 years in survival. Salmonella survival rates ranged from 1-85 days while Enteroviruses survived up to 170 days. The wide ranges reflect differences in soil type and environmental conditions of the experiments.

Important conclusions can be drawn from pathogen survival research that must be considered in Caroline County.

a) Pathogens can be expected to contaminate groundwater from on-site wastewater systems.

b) While survival times of viruses in soils is tentative at best, virus survival in soils should exceed bacterial survival times. Survival times are shorter in loamy soils than in sandy soils.[62]

Movement of pathogens in soils is basically related to the soil type and hydraulic considerations. Also the size of the given pathogen greatly influences its movement through the soil.

Pathogenic worm ova and protozoa cysts generally exceed the mean pore diameter of soils and are considered to be removed near the soil-effluent interface by the physical process of filtering. Ascaris ova and Entamoeba cysts have been reported to travel less than 24 inches.

Pathogenic bacteria and viruses are small enough to move through soil pores and their movement is related to the hydraulic conductivity and adsorption processes in the soil. Differences in the type and amount of clay are also important for adsorption processes in determining the specific surface area and cation exchange capacity (CEC) of soils in various textural classes.

While both 1:1 and 2:1 type crystal lattice clays exist in Caroline County, the former predominate, mainly kaolinite. The effective surface area of kaolinite clays are restricted and, therefore, have low CEC's. Bitton tested the adsorption of poliovirus to a soil contamining 28% kaolinite. The soil displayed a good retention toward viruses and no breakthrough occurred even after applications of eight pore volumes of groundwater. The type of cation on the exchange complex is also important. Trivalent cations serve as a bridge between the negatively charged clay particles and the viruses.

The soil texture as determined in the field during soil tests with help determine the relative percentage of clay. Sandy loams, which are classified on over 53% of the County, may have 15% to 20% clays while sands and loamy sands may range from 0-15%.

Soil pH has been found to be inversely related to adsorption. Generally, low pH values result in greater adsorption. Low pH in Caroline County soils should contribute to greater adsorption potential.

While virus movement in soil has not been extensively studied, work with soil columns has shown viral movement restricted to the top two cm of the soil column. However, up to five percent of the applied virions passed through the columns in some cases. In a study conducted in Florida it was reported that viruses in wastewater which was used for irrigation of a test plot moved through 1.5 m of a sandy soil. The work noted that 71 cm of rainfall in a three month period resulted in virus isolation from monitoring wells at a depth of 6.1 m. Other studies have shown that adsorbed viruses can be desorbed by

rainfall and retain their infectivity in the adsorbed state up to six months. However, virus inactivation can be accelerated by a decrease in soil moisture. Thus, a potential management scheme can be adopted to reduce virus contamination of groundwater. That is, alternating seepage fields to allow drying of the rested seepage field. Since there is no practical test that can assess the potential of a soil to retain viruses and in light of the questionable practicality of routinely requiring dual seepage fields, no seepage field should be allowed to be inundated with groundwater during the year.

An increase in flow rate will result in a decrease in viral and bacterial adsorption since saturated pores may reduce chances for pathogen contact with soil particles. Work with coliform bacteria has indicated that coliforms may move up to 65 m in a coarse gravel-sand, but much shorter distances are common in finer soils. Movement of fecal coliform bacteria from septic tank effluent in three soils (2 sandy loams, and a loamy sand) has been reported. These soils had slowly permeable subsurface horizons and thus effluent movement was restricted to the horizontal direction. In the sandy loam soils, total and fecal coliform numbers decreased from 11 and 1.3 x 10^6/100 ml to 11 and 2.5 x 10^3/100 ml in a distance of 6.1 m, respectively. The remaining two sites exhibited large reductions in both total and fecal coliforms within 13.5 m. In studies regarding a septic field in a permeable soil, it was found that bacteria moved approximately 3.0 m in three days, and 9.1 m in 10 days. In a study comparing median fecal coliform counts for seasonally saturated seepage fields, the median counts were 560 MPN vs 1300 MPN, respectively. Although the 95% confidence intervals overlapped, the

data clearly suggest improved treatment of wastewater by providing unsaturated soil conditions.

Although there is considerable variation among investigators as to the specific mechanisms involved in the soils removal of pathogens, the evidence suggests that effluents can be applied to soils of fine to medium texture without causing contamination of the groundwater with pathogens provided several feet of unsaturated soil is provided between the seepage field and the ground water. Horizontal movement of contaminants must also be considered to protect water supplies and surface water quality. A horizontal separation distance of 100 feet for confined aquifer wells to sewage reserved areas is required in COMAR 26.04.02 where less than a four foot treatment zone is allowed. This is an increase of 50 feet of separation. This is adequate provided the additional regulatory requirement of grouting through the disposal aquifer is enforced. The separation distance of 100 feet should also be incresed by at least 50 feet based on the reported travel of bacteria in groundwater.

5.6.4.2 Organic Compounds

Effluents contain a variety of natural and synthetic organic compounds, collectively expressed in terms of the biochemical oxygen demand (BOD). Effluent renovation requires oxygen not only for the carbonaceous materials, but also for the oxidation (nitrification) of the nitrogenous materials consisting of organic or ammomia nitrogen. A value of 0.17 pounds of BOD per person per day is often used as a design effluent load. Diluting this load into 100 gallons of water results in an average BOD of about 200 mg/l. Good quality effluents from efficient septic tanks have a BOD in the range of 20 to 60 mg/l. Poorer quality effluents from heavily loaded systems (due to less dilution and/or heavy organic loads; e.g., from garbage grinders) may have a BOD ranging up to 150 to 200 mg/l and higher.

The well drained soils in the County with an adequately designed and installed effluent disposal field (above the water table) are capable of providing an adequate oxygen supply for BOD reduction. This oxygen supply is furnished via the unsaturated soil pores by diffusion and/or dissolved oxygen percolating into the zone of the oxygen-demanding substrate.[71] High reduction rates, 60-75%, can be expected.[72] The high decomposition is not unexpected since it must be realized this material has undergone an anaerobic stabilization process in the septic tank, but has not been subjected to aerobic process until it is applied to the soil. Obviously, the anaerobic conditions created by saturation of the seepage field by the water table would not allow significant BOD reduction and would contribute

to the earlier failure rate associatd with these systems from solids clogging the soil-trench wall interface.

Other organic constituents occasionally attributed to septic effluents include gasoline and phenols. These substances can travel great distances in the soil. Therefore, soils do not provide an effective medium for renovating effluents containing these compounds, especially industrial effluents.

The USGA has been conducting a study of pesticide and herbicides in groundwater on the Eastern Shore. Atrazine, alachlor, and cyanazine are most commonly detected. Five percent (5%) of the samples with pesticides or herbicides were above recommended maximum levels. Current emphasis is to focus on monitoring shallow groundwater near the water table elevation to more fully assess the fate and transport of pesticides in our groundwater.

5.6.4.3 Nitrogen

In the septic tank proteinaceous compounds are converted to ammonium by ammonification. The effluent emitted from the septic tank in the seepage field includes ammonium and organic nitrogen with small amounts of nitrate and nitrite (Table 10). Organic nitrogen comprises about 20% of the total N. The organic nitrogen is generally immobilized in an organic mat or crust developed under the tile disposal field. The crust contains entrapped bacteria and a variety of organic and inorganic solids contained in the effluent. The bacteria in the crust degrade the various forms of organic nitrogen that are present into ammonia which is removed by the flushing action of the effluent.

TABLE 10: Septic Effluent Quality as Reported by Various Investigators
(All parameters are expresed as mg/l of effluent except pH)

	NH_4-N	NO_3+NO_2-N	Organic-N	Total-N	PO_4	Total-P	Average
Robeck et al. (1964)	22	0.12	5.4	27.5	---	----	7.8
Hickey and Duncan (1966)	37	----	3.4	40.4	---	----	7.26
Preul (1967)	25	0.1	10	35.1	---	20	7.25
Popkin and Bendixen (1968)	24.6	0.21	5.6	30.4	---	----	----
Thomas and Bendixen (1969)	25.4	<0.1	7.9	33.4	---	----	7.7
Bouma et al. (1972)	----	----	---	80	---	10	----
Walker et al. (1973)	66.3	----	13.7	80	---	----	6.4
Magdoff et al. (1974)	----	----	---	42	---	21	7.5
Otis and Boyle (1976)	35.6	0.5	---	52.2	11.6	15.2	----
Sauer et al. (1976)	20.0	0.3	---	20.3	9.8	----	----
Viraraghavan and Warnock (1976)	97	0.026	---	97.3	---	11.6	6.9
Otis et al. (1977)	19.2	0.3	4.4	23.9	8.7	10.2	----
Silbermann (1977)	27	0.2	8.0	35.2	---	18	7.1
Mean of Reported Values	36.3	0.2	7.3	43.1	10.0	15.1	7.2

(From: Douglas, L. A., and Trela, J. J., Soils, Septic Systems and Carrying Capacity in the Pine Barrens, Journal Series Paper, New Jersey Agricultural Experiement Station, Rutgers University, New Brunswick, New Jersey, 1978.)

The nature of the nitrogen transformations after the effluent leaves the crust are governed by the redox potentials in the underlying zones. In a well-drained soil the effluent would move downward toward the watertable by unsaturated flow under oxidative (aerobic) conditions. When aerobic conditions prevail in soils the process of nitrification is pronounced and the ammonium in the effluent would be converted to nitrate.[74] The efficiency of nitrification is high and the conversion is rapid and essentially complete within 3 feet of travel in sandy soils under aerobic conditions.

The nitrogen contribution from septic systems to the groundwater in low density areas (less than 2 people/acre) would not supply significant nitrogen to groundwater of typical watersheds. In areas of higher population density, the nitrate contributed to groundwater may be significant both in terms of nitrate toxicology to infants and livestock as well as increased eutrophication of surface waters from the contaminated groundwater.[75]

If the soil is poorly-drained (high water table) anaerobic conditions prevail and water movement is by saturated flow. Under these conditions nitrification is minimal and nitrogen will remain in the ammonium form.

The process of denitrification is the principal process occurring in soil which actually removes nitrogen from the effluent, giving off gaseous nitrous oxide or elemental nitrogen. Denitrification only occurs in the presence of denitrifying bacteria, under anaerobic conditions when a carbon source (soil organic matter or effluent organics) and nitrate are present. Denitrifying bacteria

are ubiquitous in soils. Carbon sources are present in limited amounts in soils under tile disposal beds as naturally occurring soil organic matter in the subsoils and as dilute solutions of soluble low molecular weight organic compounds from the effluent. Nitrates are produced when ammonium rich effluents are oxidized under aerobic conditions while denitrification is an anaerobic process requiring near saturated conditions. Hence, denitrification can only occur after the ammonium in the effluent has been oxidized to nitrate by nitrification. Physically this can be accomplished by passing the effluent through sequential oxidative and reductive cycles. The efficiency of denitrification decreases drastically as the texture of the soil becomes coarser (sandy) and the rate of percolation increases. The low potential for denitrification in sandy soils is the result of aerobic conditions produced by free internal drainage.

Furthermore, a submerged seepage field will not permit nitrification to occur. Because of the cationic nature of ammonia, the cation adsorption capacity of the soil will prevent movement of ammonia significant distances from the source. While this mechanism may appear as an asset toward effluent renovation, fluctuations of the groundwater and/or conversion to aerobic conditions will initiate the oxidation or nitrification process.[77] It has been noted that the increase in nitrate in the groundwater is actually greatest as the water table rises in the fall season, dissolving nitrate which is formed during the summer.[78]

As noted earlier, there are some soils that have loamy and clayey subsoils. When these subsoils extend to depths such that effluents from septic systems will pass through them, significant

denitrification should be induced by the lower percolation rates and the ability of the matrix to develop low redox potentials. The efficiency of denitrification under these conditions has been experimentally determined at 30% and 32%. The first estimate of denitrification includes nitrogen lost through volatilization of ammonia and the latter was considered by the investigators to be an overestimate of the long-term denitrification due to the depletion of naturally occurring soil organic matter which was currently fueling denitrification but would soon be exhausted. It seems probable that the experimental denitrification value of 30% represents an optimum, and that under field conditions considerably lower values would not be uncommon.

The anionic forms of nitrogen (nitrate and nitrite) will move freely in the aquifer with ground water flow. The only significant mechanism of attenuation is dilution.

5.6.4.4 Phosphorus

The phosphorus emitted from a septic system originates in detergents, cleaning agents, and organic wastes.

Table 10 lists the concentration of phosphorus reported by various investigators.

Approximately 70% of the total phosphorus in a septic effluent occurs as dissolved inorganic phosphorus. The remainder occurs in a variety of organic forms.

A considerable amount of literature indicates that phosphorus is readily removed from solutions and fixed in soils. Fixation is a process where readily soluble compounds are converted into less soluble forms by reaction with inorganic or organic components in the soil and, thereby, becoming less mobile. However, there is diverse opinion in the literature as to the specific nature of phosphorus fixation.

Phosphorus chemistry, when applied to the soil, allows some insight into the factors affecting phosphorus fixation by soils.

The iron and aluminum hydrous oxides occur in the clay sized fraction of soils as coatings on the surfaces of soil particles and sometimes on soil aggregates. Many investigators consider these hydrous oxides to be the most active agents of phosphorus fixation in acid soils. Since hydrous oxides of iron and aluminum occur in association with the alumino-silicate clay minerals, which also fix phosphorus, there should be a correlation between the amount of clay in a soil (soil texture) and the soils ability to fix phosphorus.

Specifically, as the clay contents of soils increase so will phosphorus fixing capacity.

The interdependence between soil texture and phosphorus fixing capacity is accentuated when the effect of texture on soil permeability and the relationship between phosphorus fixation and equilibration time is examined. Experimentally determined isotherms indicate that the amount of phosphorus fixed by soils is a function of the length of time the phosphorus solution is in contact with the soil. Generally, the higher the clay content of a soil the lower will be its permeability. Hence, soils with significant clay contents have a high potential to fix phosphorus, not only due to the presence of large amounts of alumino-silicates and hydrous oxides, but also due to their lower rates of percolation which allow sufficient time for the phosphorus in solution to react with the soil. Soil pH is an important parameter affecting phosphorus fixation.

In acid soil, phosphorus is fixed by hydrous oxides of aluminum, iron, and manganese and by soluble forms of aluminum, iron and manganese. This tendency toward fixation by aluminum, iron and manganese increases below pH 6. In alkaline soils, fixation of phosphorus is mainly by calcium as calcium phosphate. This reaction rapidly increases as the pH becomes greater than 7. Soils having pH values between 6 and 7 have comparatively weaker phosphorus fixing capacity. The soil's organic matter may contribute significantly to phosphorus retention by anion exchange.

Soil drainage may have an important effect on phosphorus fixation by regulating the redox potential of the soil matrix. In well-drained soils oxidative conditions prevail and iron occurs predominantly as

ferric ions which have low solubility. Comparatively, wet soils are dominated by ferrous iron which has a much greater solubility than ferric iron; hence, wet soils show an increased iron activity which may increase the rate of iron phosphate formation.

The efficiency of phosphorus removal from effluents applied to the soil has been reported in the literature as good (60%) to excellent (90%+) by several investigators.[80] Miller reports a study by Sawhney and Hill on two sandy soils in Connecticut which indicate that a 30 cm section of coarse textured soil surrounding a trench would require about 2.3 years and 15 years of P-saturation. They conclude that P in wastewater can travel several feet in a sandy soil and small amounts of P can be released into the groundwater. But even these small concentrations are subject to subsequent adsorption by the soil at increasing distances from the source. Sawhney and Hill also report that although there is a finite capacity for soils to sorb P, this capacity is enhanced through drying.[81]

A study on Florida soils reported poor phosphorus removal (20%) in sand texture soils that had no P sorption capacity or buffering capacity.[82]

Based on this information it must be expected that sand and loamy sand textures in Caroline County, which by nature are low in native phosphorus, have small amounts of organic matter and clay (primarily kaolinite), high percolation rates and low buffering capacities resultantly have lower ability to fix phosphorus. Maximizing unsaturated soil thickness beyond 30 cm is necessary to limit groundwater and ultimately surface water contamination. Sandy loam texture soil should be effective in phosphorus fixation requiring a

longer period of time for saturation and limiting the groundwater contamination.

5.6.4.5 Salts

The dissolved solids load in effluents is in the range of 200 to 400 mg/l. These effluents contain a variety of salts, many of which form ions in solution. These include Ca^{++}, Mg^{++}, Na^{+}, K, Cl^{-}, $SO_4=$, PO_4^{-3}, NO_3, $CO_3^{=}$, as well as other and more complex ionic molecules. Because of the eutrophic nature of N and P and because of the toxic nature of N in drinking water, these two salt constituents have already received attention. Except for the regeneration phenomenon ascribed to P adsorption, soils posess a finite exchange capacity and, therefore, have a fixed capacity per unit volume to remove these ions. This soil volume eventually becomes saturated and eventually contributes little toward effluent renovation with respect to these constituents. Additional soil volume is, therefore, needed to effect continued renovation since recharging the soil is not practical as in the case with water softener exchange resins.

Hills has illustrated this finite capacity of soils to renovate effluent salt contents. Table 11 contains the ionic concentration of the renovated water compared to the simulated effluent after passing through one meter of soil. The soils were loaded at the rate of two inches/week over a two year period. As would be expected and as found by others, the cations are initially more effectively removed than the anions. Also, greater clay content and resulting cation exchange (sorption) capacity is more effective in the renovation process. Of

Table 11: Ionic Concentrations in Sewage Effluent, Renovated Water Passing Through Soil Systems, and Groundwater Supplies in Connecticut

Medium	% clay	CEC meq/100g	Nutrients, ppm							
			NO_3-N	PO_4-P	SO_4-S	Cl	Na	K	Ca	Mg
Sewage effluent			5	8	20	49	45	12	40	19
			Passing Through Soil Columns After Two Years							
Paxton	5-10	6-22	5	0	22	55	41	2	9	4
Buxton	20-30	12-23	8	0	16	37	30	3	8	4
Chesire	5-10	5-10	5	0	21	50	38	2	14	4
Merrimac	0-3	3-8	3	0	25	59	47	11	12	6
Hadley	0-5	3-8	6	0	20	54	40	<1	13	3
Stockbridge	10-20	7-11	9	0	20	50	41	<1	20	14

(From: Miller, Fred P., and Wolf, Duane C., "Renovation of Sewage Effluents by the Soil," Individual Onsite Wastewater Svstems, Ann Arbor Science Publishers, Ann Arbor, Michigan, 1977.)

course, PO_4-P is a special case because of its insolubility in the presence of Fe, Al, or Ca compounds and the nature of the regeneration of the sorption mechanism.

The soluble anions (e.g., SO_4=. Cl^-, NO_3^-)are not removed from the effluent (unless the NO_3-N is denitrified) and contribute to the mineralization of the groundwater. Furthermore, the renovation of the salts, including the cationic species decreases with time in the effluent.

The ionic composition of the renovated water will eventually be the same as that of the effluent as the equilibrium between the cation exchange complex and the soil solution is reached. While ion exchange may initially affect the quality of the percolate or renovated water, the equilibrium will eventually yield a percolate of similar ionic quality as that of the effluent. The hydraulic character and exchange capacity of the soil will only influence the time to reach the equilibrium, not the eventual water quality.[83]

5.6.4.6 Movement of N and P in Groundwater

Previous discussions on the renovation of septic system effluents in soils concluded that both nitrates and phosphates are potential contaminants of the ground water. The objective here is to consider the processes contributory to the attenuation of nitrates and phosphates in the zone of saturation (below the water table). There are two basic categories of processes contributing to attenuation, physical and chemical.

Nitrate is a highly mobile and soluble ion which most often moves with the ground water by mass flow. There are a few chemical processes which could reduce the concentration of nitrates in the ground water. Most significant among these are denitrification and sorption by anion exchange. The anion exchange capacity of the coarse quartzose sediments in the Columbia aquifer system is nil. The zone of saturation is characterized by anaerobic conditions which would be conducise to significant amounts of denitrification if denitrifying bacteria had a carbon source to fuel the reaction. However, carbon sources capable of fueling denitrification only occur in trace amounts, hence, denitrification is insignificant. A review of subsurface biological activity in relation to groundwater pollution concluded that microbial activity is possible in subsurface zones (eg. aquifers) but information quantifying the numbers of bacteria or their potential for interaction with pollutants is wanting. In general, however, the numbers of microorganisms occurring in these zones are low.

Phosphorus reactions with sediments are controlled by the same mechanisms described for soils. Under the perpetual reducing conditions below the water table the activity of iron is increased and the formation of iron phosphate precipitates should be accentuated. The potential for phosphorus removal is dependent upon specific chemical properties of the sediment that contribute to phosphorus fixation, such as the amount of clay, hydrous oxides of iron and aluminum, permeability, rate and distance of ground water flow, and pH, among others previously listed.

The efficiency of renovation is contingent upon the contaminants in the effluent contacting sufficient reactive materials to accomplish removal. This implies that the distance of travel, the amount of reactive surfaces or materials in the sediments which accommodate the flow, the concentration of the contaminant in the effluent, and the rate of ground water movement relative to the rate of reaction between contaminants and attenuating mechanisms in the sediments, are important factors controlling effluent renovation.

The primary physical mechanism responsible for a decrease in the concentration of contaminants in the groundwater is dilution. Dilution is accomplished by mixing the contaminated water with infiltrating rain water or groundwater with lower concentrations of contaminants.

A study on the movement of septic system contaminants in a water-table aquifer in sandy sediments with low hydraulic gradients (1.3 m/km or 0.22%) was made in Wisconsin (Walker et al., 1973). The investigations reported that nitrate concentrations decreased with increasing depth into the aquifer indicating that most of the ground

water flow is within the upper 3-5 feet (1-1.5 meters) of the aquifer. (The effluent moves as a slug along the top of the water table). Nitrate concentrations in the water table below the septic systems were as high as 40 mg/l and required 70 meters (330 feet) of travel to reduce them by dilution, to 10 mg/l. The authors made two highly significant conclusions: 1) The high nitrate concentrations in the groundwater would severely restrict the density of development on sandy soils due to additive effects of a series of homes. Hence, it is not acceptable to assume rapid dilution in the aquifer as a part of the waste treatment process; and 2) The density of homes is particularly important in judging the relative impact of septic system nutrients on the nutrient status of the groundwater, streams and lakes in watersheds dominated by sandy soils.[91] The authors indicated nitrate concentrations from a septic system serving a family of four in sandy soils would be equal to the natural N loading rates if one dwelling were located on every 6 acres. The potential for pollution is evident with higher population densities.[92]

5.6.5 Estimating the Groundwater Quality Impacts

The primary objective of on-site wastewater treatment systems is to provide acceptable treatment and disposal of domestic wastewater with minimal impact upon the quality of local water resources. The properties of the soil resource play a vital role in determining what these potential impacts may be. It is important to also consider the properties of the ground-water system, which serves as the ultimate medium of disposal for the treated effluent, and its relation to local surface water bodies (streams and lakes). It is the integrated

properties of these three components (soils, ground water, and surface water) which determine the potential of the natural system to assimilate man-made wastes while minimizing threats to public health and environmental quality. There are two principal issues of concern: the ability of the soil to accept and treat septic tank effluent; and the impact of the treated effluent upon the local surface and ground-water resources.

Historically, the determination of land suitability for septic systems has been a site specific process, with emphasis on the evaluation of soil properties for acceptance and treatment of the effluent produced from an individual septic system, and little consideration given to the possible impacts on water quality from a single system or many systems. Even with recent increased concern for threats to the ground-water resource, it appears that little distinction has been made between the isolated impact of individual septic systems, and the cumulative, long-term impact of hundreds or thousands of systems upon local or regional ground-water quality. This problem needs to be addressed in order to effectively manage and protect the quality of the groundwater resource. It is proposed that there is a tolerable "loading rate" of nitrates to an aquifer which, if not exceeded, will prevent ground-water nitrate concentrations from reaching unacceptable levels.

Ground-water pollution from septic systems may develop in an insidious manner. The first 10, 100, or even 1000 septic systems in an area may not create any apparent degradation in water quality, as the ground-water system may have sufficient dilution capacity to mitigate the impact of the added nitrate loading. If another 1000

systems are added, some contamination may become noticeable, but still remain within acceptable limits. However, the addition of another 1000 septic systems might overload the system, exceeding its capacity to adequately dilute the incoming nitrates, resulting in an intolerable level of pollution. Again, the contribution of any one septic system is relatively innocuous, yet their cumulative impact may be substantial. There appears to be insufficient recognition that aquifers have a limited capacity to acceptably dilute a continuously increasing amount of wastewater nitrate.

There are a number of complex numerical models which have been developed to predict pollutant flow within and impact upon aquifers, but in general they demand a high level of mathematical competence, computer access, and often require a more detailed knowledge of aquifer characteristics than is available (e.g. values for coefficient of storage, dispersivity). Given the complexity and diversity of the major components of such models (e.g. soils, geology, climate) it would seem unlikely that detailed models developed in a single area can be applied successfully to other areas. Further, local governing bodies, public health officials, sanitarians and planners, typically do not have the resources that would allow them to use such models. They could benefit from a simplified model that would illustrate the mechanics of the natural system of interest, and help them estimate the potential impacts of septic systems on ground-water quality.

With these considerations, the model presented here, as developed by Bauman and Schafer, makes it possible to obtain an approximation of

the potential impacts of septic system nitrates on ground-water quality.

Simplifying assumptions are used to facilitate development of a model that can be utilized in the decision making process. The initial step is to define a geographical area or unit of interest, i.e. determine the boundaries of the unit system. Then two mass balance equations must be developed, one for the water budget of this system, and one for the nitrogen budget. By determining the amount of nitrate entering the system (all nitrogen inputs are assumed to be in the form of nitrates), and the volume of water that is discharged at the system boundary, an estimate can be made of the average nitrate concentration of the ground water as it leaves the system. Use of the model is restricted to isotropic and homogeneous water table aquifers composed of unconsolidated sediments.

The model considers three main sources of water nitrate to a ground-water system (Figure 10) which has reached a steady state condition with regards to these inputs. At the upgradient boundary ground water (Wg) enters the system containing some level of nitrate-nitrogen (Ng). Both natural precipitation (hereafter referred to as natural recharge, Wr), and septic system effluent (We) percolate through the soil to the ground-water system, each contributing some nitrogen to the aquifer (Nr and Ne respectively). Complete mixing within a prescribed depth increment of the aquifer is assumed. No other inputs of water or nitrogen are considered. Impacts of such potential additional inputs from agricultural fertilizer, feedlots, etc. are not considered, as a large subdivision setting is assumed, and the intent of this analysis is to examine the ground-water

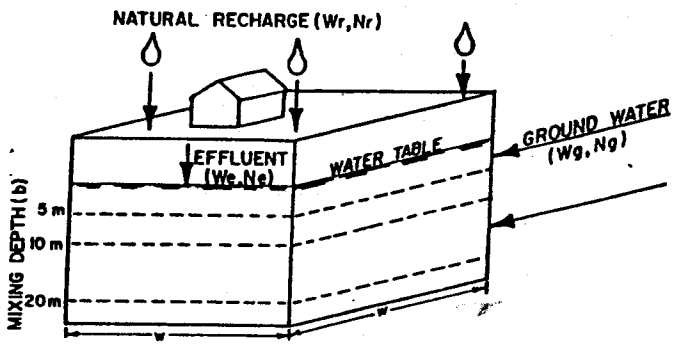


Figure 10 - Schematic Representation of Model Inputs

pollution potential from septic systems alone. It is further assumed that the only output from the system is through the gradient boundary (i.e. there is no consumptive use of the water removed by domestic wells penetrating the aquifer; that is, it is all returned via septic systems, and there are no other wells removing water from the system). With these preconditions, and evaluating the system over a time period of one year, values needed for mass balance considerations are simply calculated.

The ground-water volume entering the system at its upgradient boundary can be calcuated using Darcy's Law:

$$Q = Wg = Kb(dh/dl)w$$

where Q = volume of flow (m/yr), K = the hydraulic conductivity of the aquifer (m/yr), b = aquifer thickness (m), dh/dl = the hydraulic gradient (slope of the water table), and w = aquifer width (m). K can be estimated through knowledge of the particle size distribution of the geologic material comprising the aquifer or through field measurement techniques. Likewise, the hydraulic gradient can be established by field measurement of the piezometric surface at several locations, or can be estimated. The width (w) of the aquifer is defined by the areal extent to the system of interest (Figure 10).

Aquifer thickness can be set without knowledge of the actual depth of the aquifer using the rationale that limited mixing of influent nitrates occurs within the aquifer. This tendency for influent nitrate to remain stratified in the upper portions of the aquifers has been noted by both Hill (1982),and Spruill (1983). With this assumption, the depth of such mixing can be estimated to obtain a value for b, now defined as depth of mixing. If the actual aquifer

thickness were used, greater dilution of nitrate would erroneously be calculated as much of the aquifer may remain relatively isolated from the influent nitrate. Complete mixing will be assumed within this prescribed thickness. Nitrate-N concentrations for ground water entering the system can be obtained from existing data or estimated.[94] Precipitation contributing to recharge of the water table can be estimated using the method of Trela and Douglas[95] where the average annual infiltration minus a factor (recommended as the standard deviation of the mean infiltration) to decrease the deleterious effects of increased potential contamination from the septic effluent in low rainfall years. Nitrate concentration of the recharge water must be estimated. The volume of effluent passing to the water table can be calculated based on gallons/capita/day. The nitrate content of the effluent can be based on the estimated concentration upon reaching the water table through various soil textures. Parameters used and a sample calculation follow.

Therefore, the estimated impact to the groundwater system is an elevation of the nitrate level by 3.46 mg/l (5 to 8.46 mg/l) in the upper 5 m of the water table in this model. Figure 11 illustrates the effect on the groundwater nitrate concentration by varying the lot size and providing for estimated denitrification based on the potential from soil texture influences (Section 5.5.4.3).

Figure 11 presents a basis upon which groundwater protection criteria in Caroline County can be established. The curves are conservative in nature based on the paramenters selected; in particular:

Table 12

Parameters and values used to estimate local impact of nitrate

Wg: Groundwater entering upgradient boundary
Hydraulic conductivity (K) - 3154 m/yr (based on Bauman and Shafer estimate values and high transmissibilities of the Columbia Aquifer)
Hydraulic gradient (dh/dl) - 0.01 (also after Bauman and Shafer, and based on steeper head gradients in the County)
Aquifer mixing thickness (b) - 5m
Aquifer width (w) - 284 m (one side of a square 20 acre parcel)

Ng: Background nitrate in groundwater - 5 mg/l (identified County average)

Wr: Natural recharge - 15 in/yr (.75 m/yr)

Nr: Nitrate in recharge - 3 mg/l (estimate; after Bauman and Shafer)

We: Septic system effluent - 310, 834 l/yr (based on 75 g/p/d x 3 people per family; County average is 2.1 people per family).
20, 10, 5, 4, and 3 families/20 acres corresponding to 1, 2, 4, 5 and 6.6 acre lots, respectively, are examined.

Ne: Nitrate in effluent - 60 mg/l for sand texture soils (100% influent). 60 mg/l represents the mean and one standard deviation of Table 10 so as to provide a more conservative estimate of the nitrate concentration.
-54 mg/l for loamy sand texture soils (based on estimated maximum 10% reduction)
-42 mg/l for sandy loam texture soils (based on estimated maximum 30% reduction)

Sample Calculation
(for a 20 acre subdivision; 284 m x 284 m)

Wg: K = 3154 m/yr, dh/dl = 0.01, w = 284 m, b = 5 m; =
(3154 m/yr) (0.01) (284 m) (5 m) (1000 l/m^3) =
44.8×10^6 l/yr

Wr: based on 15 in/yr or 0.375 m/yr
(284 m) (284 m) (0.375 m/yr) 1000 l/m^3) =
30.2×10^6 l/yr

We: assuming 20 houses or one family/acre
(20) (310,834 l/yr) = 6.2×10^6 l/yr

Total Water Input (Wt = Wg + Wr + We)
44.8×10^6 l/yr + 30.2×10^6 l/yr + 6.2×10^6 l/yr =
81.2×10^6 l/yr

Ng: background nitrate level of 5 mg/l
(44.8×10^6 l/yr) (5 mg/l) = 224×10^6 mg/yr

Nr: assuming 3 mg/l nitrate level in recharge water
(30.2×10^6 l/yr) (3 mg/l) = 90.6×10^6 mg/yr

Ne: based on 60 mg/l nitrate entering groundwater
for sand texture soils
(6.2×10^6 l/yr) (60 mg/l) = 372×10^6 mg/yr

Total Nitrate Input: (Nt = Ng + Nr + Ne)
224×10^6 mg/yr + 90.6×10^6 mg/yr + 372×10^6 mg/yr =
686.6×10^6 mg/yr

Nitrate in Groundwater Exiting System: (Nt/Wt)
686.6×10^6 mg/yr / 81.2×10^6 l/yr = 8.46 mg/l

a) 75 gal/person/day representing the 97th percentile of typical wastewater volumes. The average wastewater production is reported 45/gpcd,[86]

b) 3 persons/residence vs the average of 2.2 persons/residence in Caroline County,

c) 60 mg/l nitrate concentration vs reported average of 43 mg/l (Table 10), and

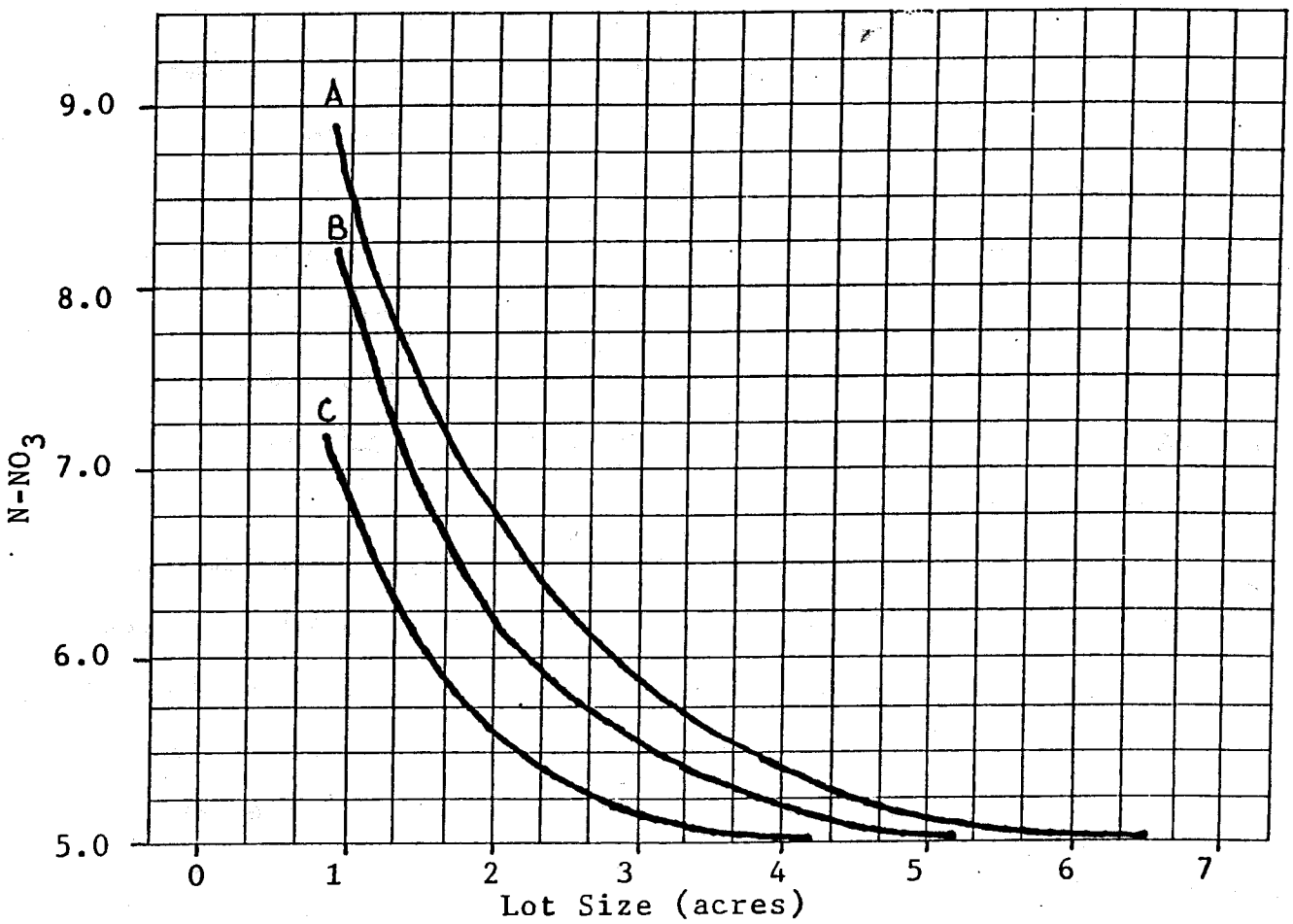
d) 15 in/yr infiltration rate vs an estimated 18 in/yr or more in the sandy soils in Caroline County.

Given that comprehensive hydrogeologic studies have not been conducted at any specific site in the County and their limited potential for extrapolation to establish general county-wide criteria then such conservatism is necessary and beneficial to insure that the potential adverse impacts of septic systems are minimized.

FIGURE 11

Groundwater Nitrate Influences vs. Density for Three Soil Textures

A = 60 mg/l nitrate entering groundwater through sand texture soils (0% nitrate reduction)
B = 54 mg/l nitrate entering groundwater through loamy sand texture soils (10% nitrate reduction)
C = 42 mg/l nitrate entering groundwater through sandy loam texture soils (30 % nitrate reduction)



5.6.6 Soil Treatment Zones and Density Criteria for On-Site Systems

Establishing soil treatment zones and density criteria requires weighing the estimate of contamination versus the health and environmental consequences of such contamination. Based on the aforegoing discussion, the critical soil textures of concern in the County are the sand, loamy sand and sandy loam textures. Heavier or finer texture soils with an adequate unsaturated soil zone beneath the septic system create as much concern for successful removal of the wastewater volume as concern for successful effluent renovation.

Table 13 presents minimum soil treatment zones based on the potential effluent renovation of the soil texture combined with a minimum unsaturated soil thickness beneath the bottom of the seepage trench excavation of the on-site sewage system. The maximum density with regard to the projected effect to the Columbia aquifer from the percolating wastewater through each soil treatment zone is also presented. All criteria are based on the soil conditions in Caroline County as previously described.

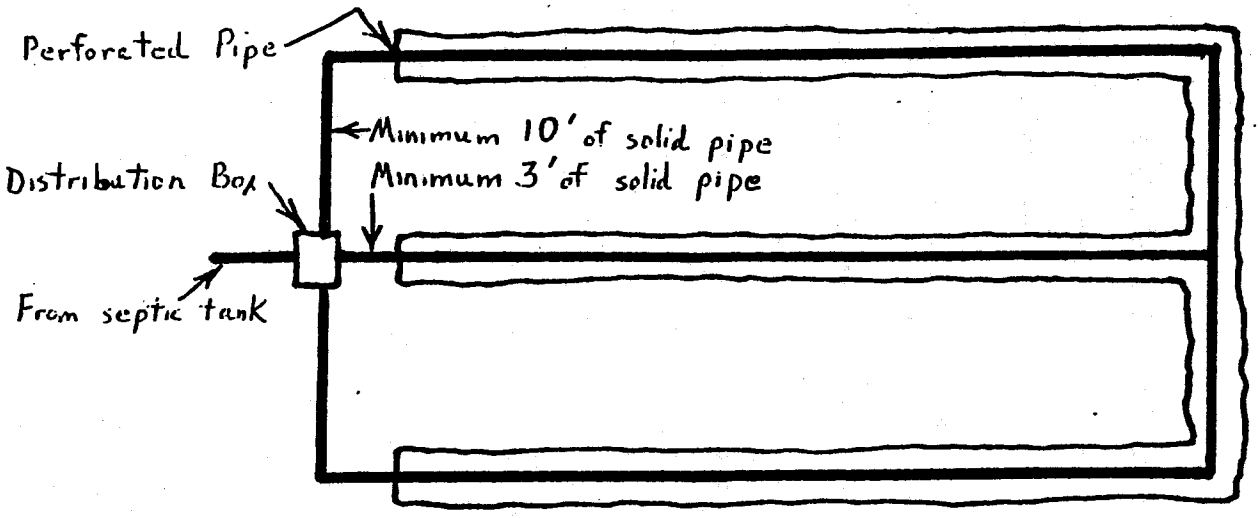
Allowing less than a 2 acre lot density for loamy sand and less than a 1.5 acre density for sandy loam cannot be justified without a site specific hydrogeological evaluation. Figure 11 shows that these densities are allowing projected nitrate increases of 0.7 - 1.2 ppm. Increasing density further dramatically increases projected nitrate levels. It is fair to assume only developers of major subdivisons will want to consider the high cost of having a hydrogeologic study performed to determine if increased density at the proposed site can be justified by not creating increased contamination of the

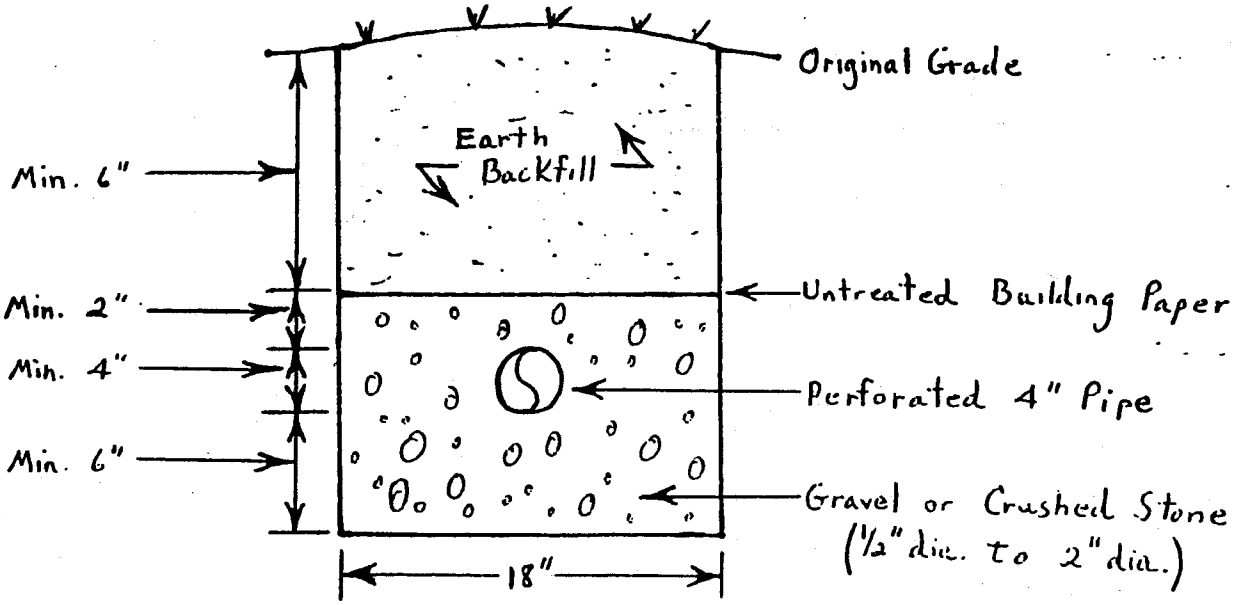
TABLE 13

Soil Treatment Zones, Density, and General Wastewater Attenuation Parameters

Soil Treatment Zone		Density	Pathogen, Phosphorus, Nitrate Treatment - general
Soil Texture	Minimum Unsturated Thickness	(Minimum Lot Size)	(figures in parenthesis represent estimated treatment in %)
sand, loamy sand, sandy loam or finer texture	≥4 ft.	Adequate to comply with all codes and regulations	1. Pathogen removal poor in sand increasing to good in sandy loam. 2. Phosphorus removal poor in sand increasing to good (100%) in sandy loam. 3. Nitrate removal poor in sand (0%) increasing to maximum 30% reduction in sandy loam.
loamy sand, or finer texture	≥3 ft. but <4 ft	2 acres	1. Pathogen removal fair increasing to good in finer texture soils. 2. Phosphorus removal fair (60%) increasing to good (100%) in sandy loam. 3. Nitrate removal poor (10-15%) increasing to maximum 30% reduction in sandy loam. Tow acre density allows minimal nitrate contamination.
sandy loam, or finer texture	≥2 ft. but <3 ft.	2 acres	1. Pathogen removal considered fair with an unsaturated soil thickness of 2 ft. to good with 3 ft. of unsaturated soil. 2. Phosphorus removal good (100%). 3. Nitrate removal poor (30%). 1.5 to 2 acres allows minimal nitrate contamination.
	≥3 ft. but <4 ft.	1.5 acres	
sand loamy sand	≥2 ft. but <4 ft. ≥2 ft. but <3 ft.	4 acres	1. Pathogen removal poor in coarser texture with minimal 2 ft. of unsaturated soil to good in all textures as unsaturated depth increases sand texture becomes finer. 2. Phophorus removal poor in coarse textures with minimal 2 ft. of unsaturated soil to good in all textures as unsaturated depth increases and texture becomes finer. 3. Nitrate removal poor (0-30%) dependent upon soil texture and unsaturated soil depth. Four acres allows minimal nitrate and phosphorus contamination.

FIGURE12





CONVENTIONAL SEEPAGE TRENCH

groundwater or surface waters. In fact, no major subdivision should be allowed without a hydrogeologic study, regardless of lot density, to ascertain protection of the water quality.

In no soil texture group is less than a two foot treatment zone acceptable. Allowing two foot treatment zones for sand and loamy sand textures requires that most effluent treatment be as dilution, requiring greater than 6 and 5 acres, respectively, per Figure 11, to significantly reduce contamination potential. However, accepting up to a 0.4 ppm projected nitrate influence, which is reasonable, allows establishment of minimum four acre lot sizes.

An additional factor which will minimize the potential contamination of the aquifer, beyond the conservative parameters selected to determine the densities in Table 13, is to maximize the depth of unsaturated soil toward the upper range of each soil treatment zone during septic system construction. For example, if an on-site system was being constructed on a site in a sand texture soil with a 4.5 foot water table (depth to groundwater from the surface) a 1.5 feet deep seepage trench can be installed providing 3 feet of unsaturated soil vs. installing a 2.5 foot deep seepage trench with the minimum 2.0 foot of unsaturated soil.

5.6.7 Septic System Design and Construction Criteria

On-site sewage system construction criteria must be based on the capability of the design to meet the groundwater protection criteria. Yet, the groundwater protection criteria may also dictate some of the sewage system specifications. For example, a property with a loamy sand soil texture would be required to have a minimum of 3 feet of

unsaturated soil beneath the seepage trench. The minimum depth of a seepage trench is considered 1.5 feet, comprised of 1.0 foot of gravel depth and 0.5 feet of original soil backfill. Therefore, a 1.5 foot trench plus 3 feet of unsaturated soil dictates the lot must have a water table no higher than 4.5 feet to meet both the minimum trench depth and unsaturated soil thickness of loamy sand.

Maximizing the unsaturated soil thickness beneath a seepage trench often results in maximum seepage trench depths of 1.5 feet. However, on many properties there is a very shallow organic horizon and it has become practice of the local Health Department to allow trench depths shallower than 1.5 feet so long as the minimum one foot of gravel in this trench is in contact with an acceptable soil horizon (usually the A horizon). In these cases a minimum of 6 inches of fill is placed over the gravel portion of the trench, which elevates the soil surface above the original soil surface. This may allow the water table to be as much as 6 inches higher than would normally be required. In the example above, a maximum 4.0 foot water table would permit installation of the conventional seepage trench (also refer to Figure 12).

Section 5.6.4.5 describes the finite capacity of a soil to remove ions in solution in the sewage effluent. Soil volume exposed in seepage trenches can be increased for the same square feet of required trench bottom absorption area (per COMAR 26.04.02) by using narrower trench widths. For example, a three bedroom home on a property whose percolation rate is 1 inch / 5 minutes requires 375 square feet of trench bottom absorption area. Using 1.5, 2.0, and 3.0 foot wide trenches requires 250, 187.5, and 125 ft. of seepage trench,

respectively. All three total trench lengths require the same cubic footage of gravel backfill, however, the square foot of trench sidewall exposed in these three trench widths is 503, 379, and 256 square feet (1 foot of required sidewall assumed). The 1.5 foot trench provides twice the soil sidewall volume of 3 foot trenches for contact of sewage effluent after the bottom of the trenches become encrusted. Also the loading rate per square foot of sidewall is reduced 50% providing an expected increased lifespan for the 1.5 foot trench system (1.76 gal/ft for 3.0 ft. wide trenches vs 0.89 gal/ft for 1.5 ft. wide trenches in the above example).

Distributing wastewater over the larger area required for the longer total length of 1.5 ft. wide trench systems probably reduces the potential mounding of the wastewater above the seasonal high water table which would reduce the unsaturated treatment zone. Whenever a construction site allows establishing an unsaturated soil zone greater than the minimum this should be required to reduce the number of days during each wet season that unsaturated soil zones are at minimum thickness due to either this potential mounding effect, or excessive high water tables from abnormally high rainfall conditions.

The typical conventional system shown in Figure 12 shows the use of a distribution box. Although distribution boxes are often criticized because they poorly divide, or distribute, incoming wastewater, they provide a location to examine, conduct maintenance, repair, or add to the seepage system. Poor distribution leading to high loading rates or premature failure may be limited by connecting the ends of the tile lines together with additional piping. This allows wastewater to flow from the end of a line receiving a higher

volume wastewater to the ends of adjacent lines (if the elevation differences of the inverts of the ends of adjacent tile lines are less than one diameter of the tile pipe).

In summary, conventional seepage systems using typical seepage trenches in Caroline County must provide the minimum thickness of unsaturated soil and maximize the soil exposure, which is available from narrower trench widths.

Currently, the Caroline County Health Department distributes a pamphlet to property owners for each new or repaired septic system (Figure 13). The education of the public, encouraging proper operation and maintenance of these on-site systems must be an on-going effort.

NO COST WATER CONSERVATION MEASURES

Make sure faucets are tightly shut when not in use.

Do not run tap water while brushing teeth or shaving.

Take shorter showers (turn shower water off while washing hair).

Wash vegetables in a bowl in one sink rather than continuously running water.

Fix leaking faucets and toilets.

Keep cold water in the refrigerator rather than running water for long periods to obtain cooler water.

Run dishwasher and washing machine only with a full load and use water saving cycles if equipped.

Reduce water volume in the toilet tank. Use plastic quarter bottles filled with a few stones, placed in the tank so as not to interfere with flushing. Do not use bricks because they may deteriorate and foul the flushing mechanism.

Install water saving toilets, sink faucets, and shower heads.

FIGURE 13

5-98

CAROLINE COUNTY HEALTH DEPARTMENT

Sanitary Construction Completion Notification

The sewage disposal system installed on the property of:

_____

has been constructed in accordance with the specifications set forth on the Application for permit in compliance with the Regulations and Specifications of the Maryland State Department of Health and Mental Hygiene and the Caroline County Health Department; permission is hereby given to place the system in operation. This notification does not in any way guarantee operation of the system.

Permit No._____

Final Inspection_____
(date)

Sanitarian_____

OPERATION OF YOUR INDIVIDUAL SEWAGE SYSTEM

The conventional septic tank system treats and disposes underground all the human wastes and wastewater from your sinks, bathtubs, toilets, and washing machines from your home. Properly operated, it will reduce the potential for surface water and well pollution prevent unsightly, smelly nuisances, and help prevent the spreading of harmful disease.

The septic tank is a large rectangular box which separates sewage into three components - scum, liquid, and sludge. The greases and fats (scum layer) float to the top and are retained in the tank and the liquid sewage which is left (including bacteria, and dissolved and suspended solids) passes on onto the seepage field.

The seepage field, usually composed of a distribution box and an underground irrigation system of pipes with sand and/or stone filled trenches or pits, the surrounding soil. The soil filters out the contaminants (removing large quantities of harmful bacteria and other impurities) before the sewage water again reaches our streams and wells.

YOUR RESPONSIBILITY

REMEMBER: EVEN A PROPERLY DESIGNED SYSTEM IS LIMITED IN USEFUL LIFE depending on soil variability, the number of persons and appliances on the system and changes in sewage flow. Because these conditions change, no one can guarantee length of operation of the system. Just as we replace or repair our cars when worn, the septic system must be replaced or repaired when it is no longer functioning. Lack of maintenance alone can cause a well disigned system to breakdown.

PROPER MAINTENANCE AND AWARENESS of how to use the system CAN HELP TO EXTEND THE SEPTIC SYSTEM'S USEFUL LIFE, AND SAVE YOU MONEY.

HOMEOWNER'S CHECKLIST FOR LONGER USEFUL LIFE:

1. Make your family aware that they should not put the following materials in your septic system: paper, rags, rubber, plastics, coffee grounds, grease or fats, or chemicals other than those used for laundry and washings.
2. Insist that your family exercise water conservation when bathing or showering. Avoid unnecessary water use. Remember, the system can be overloaded.
3. Space wash loads out over the week Do not do all the wash at once. When washing clothes, try to use full loads.
4. Contract a licensed scavenger to pump out your septic tank when it is needed. Letting the scum and sludge layers in the tank get too thick may allow discharge into the tielines which will destroy their ability for liquid seepage into the soil. Flushing yeast or other advertised chemicals in the tank will not redice the scum and sludge layers. These do not substitute for cleaning. HAVE YOUR SEPTIC TANK PUMPED OUT EVERY FEW YEARS.
5. Know where your septic system is located and protect it from being crushed by vehicles. Do not plant trees or shrubs on or near the system to protect it from roots destroying the tile lines. Record the location of your system on this handout and keep it for future reference (you may want to tape it to the electrical box for easy locating later).
6. Do not build over the septic system or areas; which are dedicated for future seepage fields.

Caroline County Health Department
P.O. Box 10
Denton, MD 21629
479-3666

5.6.8 Alternative On-Site Sewage Systems

Non-conventional sewage systems, generally, are seepage systems that rely on an innovative or experimental design to allow the disposal of the wastewater. Such systems must often be installed to more exact construction standards on properties where conventional systems are not expected to function, often at increased costs for construction, operation, and maintenance.

The Maryland Department of the Environment (MDE) limits the use of innovative systems until they have been proven by experimentation. Systems that function hydraulically and provide proper treatment of wastewater are reclassified as conventional and allowed to be installed under the criteria specified by MDE for site evaluation, design, operation, and maintenance. Designs currently being evaluated or planned for experimentation include a) alternating two tile fields; and b) low pressure pipe disposal fields. These and other systems are described in the EPA Design Manual entitled "On-site Wastewater Treatment and Disposal Systems."[88]

MDE has classified sand mounds as conventional technology. The criteria have been incorporated in the regulations, COMAR 26.04.02. The permitting of sand mounds provides an approved option for some sites that cannot meet conventional on-site tile line system criteria.

The use of alternative technology should not be used to spur development, nor as panacea to existing problems. Use of alternative technology could cause a proliferation of development on marginal land presently viewed as sensitive or critical areas, including flood

plains. In addition they may create problems in regards to existing land use or growth management plans already in place.

Long term data on use of alternative technology to protect groundwater resources and expected system life and usefulness is not available, and will limit evaluation of these systems as potential conventional technology.

5.6.9 Guide for Textural Classification

Figure 14 shows the soil textural classes of the United States Department of Agriculture. Field personnel, from soil scientists to sanitarians, use a working knowledge of these textural classes as part of site evaluations. USDA personnel are routinely evaluated in continuing education seminars for consistency in identifying these textures under field conditions.

The MD State Health Department will continue to provide educational assistance to "standardize" or potentially "certify" local Health Department staffs in these soil textures. These and other continuing education processes must be used to maintain staff proficiency and competency in soil texture identification.

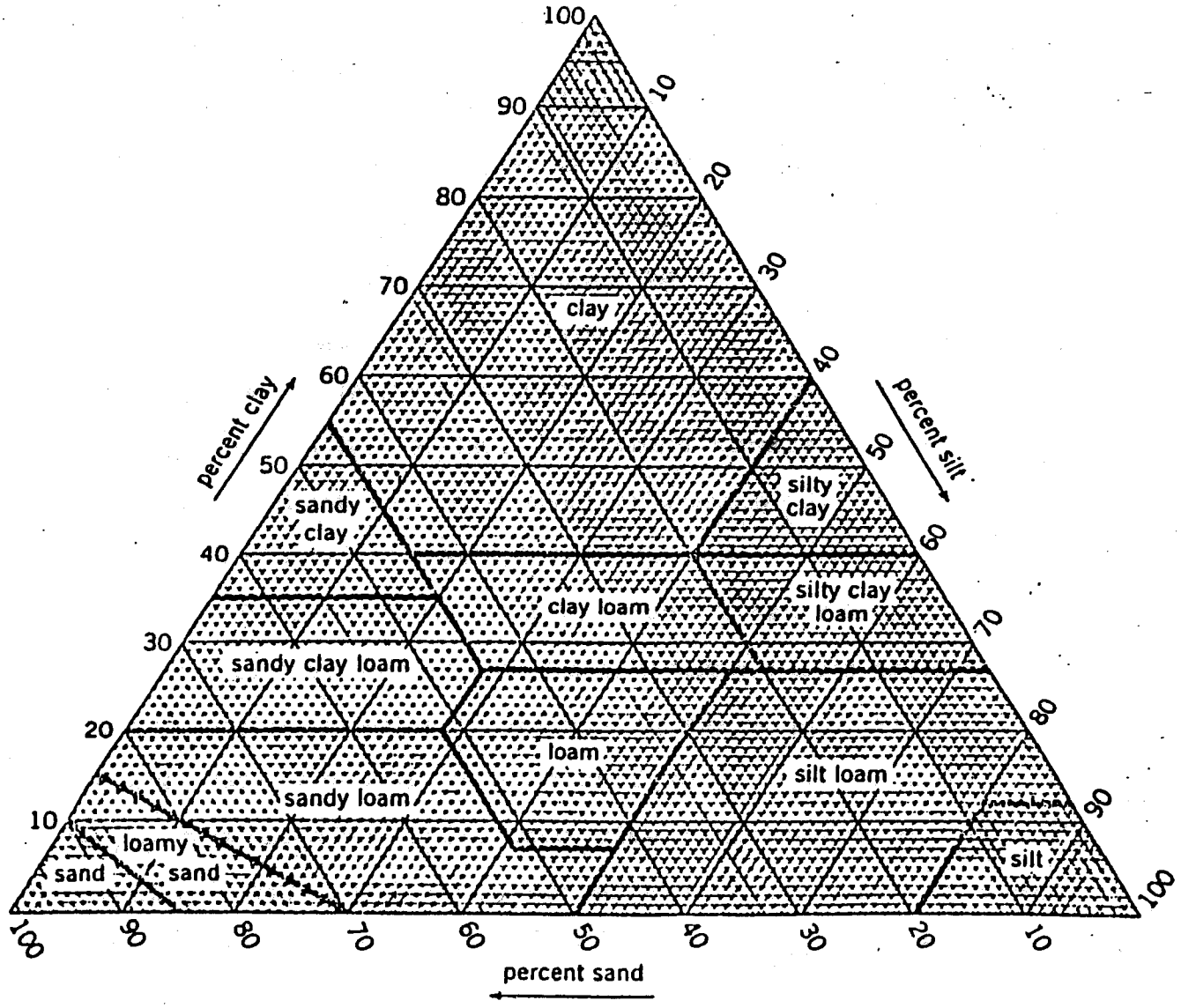
5.6.10 Soil Treatment Zone, Density, Design, and Construction Conclusions

The variety of soils and their associated properties (texture, ion exchange capacity, pH, drainage, hydraulic conductivity, etc.) precludes the generalization of the soil to accept and renovate septic effluents.

Septic effluents can be adequately discharged into soil and renovated as the effluent percolates through the soil. In well

FIGURE 14

GUIDE FOR TEXTURAL CLASSIFICATION



aerated, moderately coarse to medium textured soils the crusted soil-effluent interface governs the hydraulic conductivity of the system. The soil beneath the crust operates at hydraulic conductivities below saturation. Such soils have the capacity to remove a high percentage of the phosphate in the effluent. Similar high removal rates have been noted for BOD, COD, NH_4 -N, and various microorganisms including coliforms, fecal coliforms and pathogens. Aerobic conditions in the soil enhance the degradation of oxygen demanding organic loads and promote biological oxidation of ammonia resulting in nitrate formation. Unless denitrified, nitrate will percolate to the groundwater along with other soluble salt ions such as Cl^- and $SO_4^=$ and ultimately many of the soluble cations. Therefore, the major environmental impact of a well designed and functioning septic system will be the injection of salt ions into the groundwater. In areas of low density installations this is not significant. But in high density areas significant contaminant concentrations could result, with nitrate being the most important concern because of its potential toxicity in drinking water and contribution to water quality degradation through eutrophication.[89]

A model to project groundwater impacts from varying development densities has been presented (section 5.6.5), based on the estimated potential reduction of nitrate contamination through sand, loamy sand, and sandy loam soil textures with two to greater than four feet of unsaturated soil depth below the septic system to the groundwater. Also, the need to limit the depth of seepage trenches to provide the necessary unsaturated soil thickness has been described in section 5.6.7. The depth to the water table for groundwater protection that

is summarized on Table 14 dictates the need to evaluate a site and clearly report any options to the property owner so the owner may make a decision suitable to his or her plans.

Since the Maryland State Department of the Environment has approved use of sand mounds as conventional technology the impact of lot size requirements in this report has been reduced. Future reclassification of innovative system designs to conventional use will probably reduce the high impact of cost that is associated with the sand mound systems.

The concepts for attenuation of wastewater described in this report can be expected to require revisions as more definitive data and research become available. Hydrogeologic data from site evaluation investigations for major subdivisions in this and other Eastern Shore counties, and adjacent county groundwater protection reports, will be the primary source of this data. Site specific investigations may also be necessary toward redefining general groundwater protection criteria for Caroline County.

TABLE 14

Water Table Ranges Bassed on the Soil Treatment Zone Criteria

Soil Texture	Minimum Unsaturated Soil Thickness	Min. Lot Size (acres)	Water Table Range (based on proposed system)		
			Conventional Trenches (18" depth)	Conventional Trenches plus 6" fill	Alternative System Designs (Sand Mound only)
sand, loamy sand, sandy loam, or finer texture	≥4 ft.	*	66"+	60"+	24" *
loamy sand or finer texture	≥3 ft. but <4 ft.	2	54" to 65"	48" to 53"	
sandy loam or finer texture	≥2 ft. but <3 ft.	2	42" to 53"	36" to 41"	
	≥3 ft. but <4 ft.	1.5	54" to 63"	48" to 53"	
sand	≥2 ft. but <4 ft.	4	42" to 65"	36" to 41"	
loamy sand	≥2 ft. but <3 ft.		42" to 53"		

* lot size shall be adequate to comply with all codes and regulations, generally 0.5 to 1.0 acres

5.7 Groundwater Protection Criteria

Table 13 delineates the requirements that have been determined necessary to protect the quality of the groundwater and surface water resources in Caroline County. These criteria are based on the evaluation of the potential groundwater impacts from on-site septic systems for the hydrogeologic conditions in Caroline County.

This report has shown that the County must be managed as a unit and not divided into separate management areas. This is based on a policy of nondegradation of the unconfined groundwater by controlling septic system densities to maintain the water quality, especially in the recharge zones of the confined aquifers beneath the County and in the deeper depths of the unconfined aquifer. Protection of the water quality in all aquifers, and the high quantity of available water in the unconfined aquifer, is paramount to maintaining adequate future supplies of potable water.

These criteria are adequate for the overall protection of the water resources in the County and can be used acceptably for the small scale housing land use activities generally proposed. Larger scale development (major subdivisions using on-site septic systems) must develop site specific hydrogeological data to ascertain water quality protection. To illustrate this point, the following two examples are presented. The first is a proposed high density (1 acre) development that is underlain by a perched water table caused by a clay layer under the property and allowing limited unsaturated soil beneath proposed septic systems. Discharge of this surficial aquifer is to a nearby stream or wetlands. It is unlikely such an aquifer could ever

serve as a drinking water source, therefore, a greater degree of degradation may be acceptable if the surface water can assimilate the discharged groundwater with little adverse effect. By contrast, consider a similar development proposed above a deeper (thicker) aquifer used for potable water by an existing adjacent development, or that discharges to a nearby beach or shellfish area. The potential for increased risk for drinking water contamination, or bathing or food source hazards, is substantial. Accordingly, care should be exercised in determining an acceptable housing density, and/or alternative methods of sewage treatment should be investigated. As in this report, the following factors must be considered to evaluate the impact of septic systems on groundwater quality:[90]

a. depth to the water table
b. hydraulic conductivity of the aquifer
c. groundwater gradient and direction of flow
d. aquifer thickness and effective mixing thickness
e. background nitrate-nitrogen concentration of groundwater
f. potential for denitrification
g. density of septic systems
h. present and potential use of aquifer
i. impact on down-gradient users
j. leakage of contamination to other aquifers
k. nutrient status of surface waters in discharge areas
l. present and future land use.
m. number of wells in the aquifer and volume of water pumped
n. length of flow path to surface discharge areas or downgradient users.

The hydrogeologic study criteria for major development proposals are described in Exhibit 5. The study will usually preceed preliminay plan submittal for major subdivision proposals, in particular to determine acceptable density. Preliminary soil borings on selected areas of a property can be of assistance in the decision to proceed with a hydrogeologic study.

Exhibit 6 describes the criteria for most development projects, e.g., subdivisons of less than 5 lots. Individual on-site septic systems that are generally, but not restricted to, wastewater flows of less than 600 gallons per day shall comply with these criteria. These criteria are established by this report to supplement the requirements of the Regulations Governing Sewage Disposal Systems for Homes and Other Establishments in the Counties of Maryland Where a Public Sewage System is Not Available, COMAR 26.04.02, in accordance with the requirements for groundwater protection reports, Section .04C (3).

Exhibit 5

Caroline County
Hydrogeologic Study
Outline and Minimum Requirements
For Major Project Proposals

I. Site and Project Description (Similar to a detalled preliminary plan)

A. Location

B. Topography (minimum two-foot contours)

C. Soils (USDA Soil Classification)

D. Scaled plan of lot(s) with dimensions and locations of well(s) and sewage disposal area(s)

E. Location of any existing wells or sewage disposal systems within 100 feet of subdivision property boundary

F. Estimated sewage volume

II. Hydrogeology

A. Identify saturated substratum proposed for discharge, upper and lower confining layers by texture, thickness, depth, and areal extent

B. Potential for proposed discharge stratum to serve as a water supply (based on physical and/or chemical quality); potential must be limited to consider discharge

C. Groundwater contours in saturated zone proposed for discharge

D. Determine unsaturated hydraulic conductivity when less than a 4 foot treatment zone is proposed, indicate zone thickness, and texture. Direct groundwater penetration shall not be allowed.

E. Indicate depth and stratum from which potable water supplies will be obtained

III. Control Steps

A. Depth of wells and required grouting depth to assure separation of waste disposal stratum and water supply stratum

B. Depth of sewage disposal trenches and minimum thickenss of treatment zone between trench bottom and water table.

C. Separation distances from sewage disposal systems to wells and any sewage disposal system design modifications to be required (e.g., pretreatment, dosing, alternating valves, etc.)

D. Develop densities appropriate to protect the integrity of the unconfined aquifer.

Exhibit 6

Groundwater Protection Report Requirements for On-Site Sewage Disposal Systems

I. Soil treatment zone and density requirements

A. The Guide to Soil Textures Classification of the U.S. Department of Agriculture issued herein to describe soil textures.

B. The soil treatment zone of the sewage reserved area is comprised c a) an unsaturated thickness of soil below the bottom of t irrigation (tile) field; and, b) a soil texture consiste throughout this depth. These criteria and a minimum lot size a required to sufficiently attenuate sewage effluent. These thr criteria are as follows:

	SOIL TREATMENT ZONE		DENSITY
	Soil Texture	Unsaturated Thickness	(Minimum Lot Size
1.	sand, loamy sand, sandy loam, or finer texture	> 4 ft.	Adequate to comply with all codes and regulations
2.	loamy sand, or finer texture	≥ 3 ft. to < 4 ft.	2 acres
3.	sandy loam, or finer texture	≥ 2 ft. to < 3 ft.	2 acres
4.	sandy loam, or finer texture	≥ 3 ft. to < 4 ft.	1.5 acres
5.	loamy sand	≥ 2 ft. to < 3 ft.	4 acres
6.	sand	≥ 2 ft. to < 3 ft.	4 acres

C. Additional requirements

1. The soil texture and unsaturated thickness within the sewag reserved area which requires the larger minimum lot size shall b used to establish construction requirements.

2. Two compartment septic tanks shall be provided for sites meetin Sections I.B.2 through I.B.6.

3. Well separation distances from all sewage reserved areas a other sources of contamination:

a. Confined aquifer wells:

GPR Section	Distance (ft)
I.B.1	50
I.B.2-6	100

b. Unconfined aquifer wells:

GPR Section	Distance (ft)
I.B.1	100
I.B.2-6	150

4. The well driller applying for the Permit to Drill Well sha submit a scaled drawing showing compliance with the separati distances.

5. Confined aquifer wells shall be grouted through the dispos aquifer. Comar 26.04.04.07G, Well Construction Regulation describes minimum grout requirements.

6. Minimum depth of unconfined aquifer wells

Caroline County Election District	Minimum Depth (ft)
a. Henderson	20
b. Greensboro	40
c. Denton	40
d. Preston	40
e. Federalsburg	40
f. Hillsboro	40
g. Ridgely	60
h. American Corner	60

7. Unconfined aquifer well permits shall be issued on a test wel basis only. The criteria for conversion of test wells to production wells are described in Comar 26.04.04.06F.

   a. The driller shall submit a well-head water sample fo chemical analysis prior to written request for approval fo conversion.

8. Sewage Reserved Areas - general provisions

   a. Surface water sources and channels, such as streams an ditches, which penetrate the disposal aquifer shall be 15 feet from any sewage reserved area for sites meeting Section I.B.2 through I.B.6.

   b. Maximum treatment zones shall be established for all on-sit systems of Section I.B.

c. All sewage reserved areas should be separated by a mini distance of 60 feet, or distances as may be deemed necessa

d. When permitted, establishing the minimum soil treatment z unsaturated thickness may not restrict a property owner f providing acceptable fill material to: 1) adequately cov an on-site system; or, 2) meet less restrictive requiremen of Section I.B.

(1) All required fill shall be acceptably placed on t sewage reserved area prior to issuance of any Permit Construct.

(2) The minimum depth of the trench bottom using th provision shall be 12 inches below the original grou surface.

e. The Sewage Reserve Area (SRA) shall be of sufficient size a useable shape to allow construction of the initial and t replacement septic systems. The minimum SRA for conventiona tile line systems is based on the following criteria:

Percolation Rate	Maximum Wastewater Volume (MWV, in gal/day) an Required Minimum SRA size (in ft^2 based on 1.5 f wide trenches at 10 ft. c-c)							
(min/in)	MWV	Ft^2	MWV	Ft^2	MWV	Ft^2	MWV	Ft^2
2	300	10,000	450	10,000	600	10,000	750	10,0(
3	300	10,000	450	10,000	600	10,000	750	10,0(
4	300	10,000	450	10,000	600	10,000	750	11,00(
5	300	10,000	450	10,000	600	10,000	750	11,00(
6-10	300	10,000	450	10,000	600	11,000	750	14,0(
11-15	300	10,000	450	11,000	600	14,000	750	17,00(
16-30	300	10,000	450	14,000	600	17,000	750	23,00(

(1) The minimum size of SRA's shall be based on a wastewate volume of at least 600 gallons per day.

(2) When an area does not exist that will not allow a MWV o at least 600 gpd then a MWV that is less than 600 gpd or the use of trenches no wider than 2 feet so as to allow a MWV of 600 gpd may be approved at the discretion of th Caroline County Health Department.

f. The SRA shall be a minimum of 5 feet from property lines.

II. Construction requirements

A. Conventional tile lines systems

1. Two compartment septic tanks shall be provided as requi red Section I.C.2.

2. 1.5 foot trench widths must be used to determine the total tren length. Use of wider trench designs must be approved by t Caroline County Health Department.

3. Trenches must be located 10 foot center to center from adjace trenches. Use of trench centers less than 10 feet must approved by the Caroline County Health Department.

4. Tile line slope must be 0% to assist in maintaining the maximu possible unsaturated soil thickness.

5. The ends of the tile lines should be connected with additiona trench or solid tile pipe to facilitate transfer of wastewater t all tile lines.

6. Design techniques providing increased effectiveness of the zon of unsaturated soil in renovating wastewater may be required.

7. SRA's with percolation rates equal to or greater than 1 inch i 20 minutes shall use a dosing chamber to distribute the waste- water in the tile line system.

B. Other conventional system technologies (e.g. mounds) may b approved as provided by regulation, Comar 26.04.02.

C. Additional design criteria for larger wastewater generators generally but not restricted to greater than 600 gallons per day, o wastewaters not typical of domestic on-site systems will be a specified by Maryland Department of the Environment and the Carolin County Health Department. These may include requirements for lo flow plumbing fixtures, contracts with licensed septage haulers, flo meters, stormwater control, increase depths of unsaturated soil improved distribution techniques, et. al.

D. Unimproved lots legally established prior to November 18, 1985, tha were approved by the Caroline County Health Department shall compl with the soil treatment zone requirements only of Section I.B. t construct a conventional tile line system, otherwise, a conventiona mound system or an approved alternative system shall be utilized.

1. The minimum SRA size shall be based on Section I.C.8.e. unles designated at time of approval but in no case shall the SRA b less than 10,000 sq ft.

E. Unimproved lots legally established prior to November 18, 1985 without approval by the Caroline County Health Department shal comply with all requirements of Section I.B.

1. The minimum SRA size shall be based on Section I.C.8.e. but no case shall the SRA be less than 10,000 sq ft unless location of the lot is within an area designated S-2 for sewera service.

F. Best available sewage technologies and lot area must be utilized wh performing construction activity on existing systems on impro lots, e.g., repair, replacement, addition, renovation, etc.

1. Conventional tile lines may be used when the percolation rate not grater than 30 minutes per inch and there exists a minin unsaturated soil treatment zone beneath the trench bottom a water table (STZ) of 6 inches.

2. Sand-lined trenches may be used when the percolation rate is r greater than 30 minutes per inch and the STZ is less than inches.

3. Conventional mounds may be used when the percolation rate greater than 30 minutes per inch but not greater than 60 minute per inch.

4. The water table determination may be accepted by the Carolin County Health Department based on the soil conditions an historical data when permits are issued for construction activi on existing systems on improved lots.

III A hydrogeology study and sewer system design criteria may be required the discretion of the Caroline County Health Department, especially f commercial, industrial, major subdivisions, and other wastewate generators. The study shall show proof the proposed system(s) will nc contaminate the groundwater.

IV. Minor variances to the well separation and surface water distanc requirements of this plan may be granted by the Caroline County Healt Department, provided the public health and environment is protected.

A. Soil and site conditions to attenuate wastewater or that provic protection of the public health, but not specifically addressed i this Plan, will be delineated as deemed necessary by the Caroline County Health Department. Approval by the Maryland State Department of Health and Mental Hygiene may be required.

APPENDIX

I. Bibliography

II. Geologic Logs of Exhibit 3

III. Aquifer Formation Maps

Appendix I

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Well logs of Exhibit 3 from Rasmussen Wm. C., et.al, The Water Resources of Caroline, Dorchester, and Talbot Counties.

	Thickness (feet)	Depth (feet)
Care-Ad 2 (Altitude: 74 feet)		
Pleistocene and Pliocene(?) series:		
Sand, white and brown	20	20
Clay, dark brown	12	32
Miocene series:		
Choptank formation:		
Sand, fine, gray	3	35
Clay, dark gray	25	60
Clay and shells	5	65
Clay, dark gray	15	80
Clay, light green	19	99
Sand, fine; shells and some clay	3	102
Calvert formation:		
Clay, gray	118	220
Sand and clay, black, white and green	32	252
Missing	23	275

Care-Bd 45 (Altitude: 55 feet)		
Miocene(?) series:		
Choptank formation:		
Clay and sand	20	20
Sand, coarse, gray and white; clay	18	38
Sand, coarse, gray and white	7	45
Clay, brown	21	66
(Screen 35.5–45.5 feet)		

	Thickness (feet)	Depth (feet)
Care-Bd 6 (Altitude: 60 feet) P 5007		
Pleistocene series:		
Sand, yellow, and gravel	37	37
Miocene series:		
Choptank(?) formation:		
Clay, blue	13	50
Clay, tough, blue-black	20	70
Sand, coarse; gravel; shells	20	90
Clay, tough, black	30	120
Calvert(?) formation:		
Sand, gray; shells; water 60 gpm. with 100 feet drawdown	30	150
Clay, blue-black; sand, fine	30	180
Sand, argillaceous, fine, hard	120	300
Eocene series:		
Piney Point(?) formation:		
Sand, argillaceous, coarse to fine	100	400
Aquia(?) greensand:		
Sand, argillaceous, coarse, dry	180	580
(Uncased hole 178–580 feet)		

Care-Cd 2 (Altitude: 20 feet) P 1672		
Pleistocene series:		
Sand and clay	24	24
Clay, brown	9	33
Pliocene(?) series:		
Sand and gravel	10	43

Miocene series:		
Choptank(?) formation:		
Sand and shells	33	76
Clay, brown	76	152
Calvert(?) formation:		
Sand, gray (water)	41	193
Clay, brown	77	270
Eocene series:		
Sand, gray (water)	33	303
(Screen 279–303 feet)		

Care-Cd 4 (Altitude: 40 feet) P 10276

Pleistocene and Pliocene(?) series:		
Sand	16	16
Gravel	7	23
Clay, brown	4	27
Miocene series:		
St. Marys(?) formation:		
Clay, blue	73	100
Choptank(?) formation (top based on care-Dc 122):		
Clay, blue	20	120
Hard	10	130
Clay, brown	44	174
Sand	16	190
Hard	2	192
Sand	20	212
Calvert(?) formation:		
Clay	127	339
Eocene(?) series:		
Sand	35	374
(Screen 340–360 feet)		

Care-Dd 1 (Altitude: 42 feet)

Pleistocene(?) series:		
Missing	12	12
Miocene series:		
St. Marys formation (based on Dc 122):		
Clay	58	70
Shells	3	73
Marl	38	111
Choptank(?) formation:		
Missing	73.5	184.5
Rock	3	187.5
Sand	4.5	192
Clay	6	198
Rock	3	201
Clay	1.3	202.3
Rock	2	204.3
Clay	4.1	208.4
Rock	2	210.4
Sand	1.4	211.8
Rock	.5	212.3
Calvert(?) formation:		
Clay	46.2	258.5
Rock	21.5	280
Missing	10	290
Sand	25	315
Clay, green	43	358
Gravel and shells (not free)	3	361
Eocene series:		
Piney Point formation:		
Sand (water)	39	400

Care-Ee 1 (Altitude: 40 feet) P 8211	Thickness (feet)	Depth (feet)
Recent and Pleistocene series:		
Soil; sand; gravel	21	21
Miocene series:		
St. Marys formation:		
Clay, soft, blue	49	70
St. Marys and Choptank formations:		
Clay, blue	80	150
Choptank formation:		
Shells; sand (water)	20	170
(Uncased hole 106–170 feet)		

Dor-Bg 18, test well (Altitude: 40 feet)	Thickness (feet)	Depth (feet)
Pleistocene series:		
Sand, medium, silty, buff	5	5
Sand, coarse to medium, buff to red-brown	5	10
Sand, very coarse to medium, buff	5	15
Sand, coarse to medium, buff	6	21
Sand, coarse to medium; grit, buff	5	26
Sand, coarse to medium, buff	5	31
Pliocene(?) series:		
Sand, medium, orange	5	36
Sand and granules	4	40
Miocene series:		
St. Marys and Choptank formations:		
Clay, buff	2	42
Clay, buff and gray	5	47
Clay, gray	47	94
Clay, some sand, gray	21	115
Sand, medium, clayey, gray; shell fragments	21	136
Sand, medium, gray; shell fragments	74	210
Calvert(?) formation:		
Clay, sandy, gray	5	215
Clay, sandy, gray; shell fragments	7	222
Sand, very fine, silty, clayey, gray	9	231
Clay, sandy, gray and red; shell fragments	5	236
Sand, very fine, silty and clayey, red	5	241
Sand, very fine, silty	6	247
Sand, fine, silty, buff; shell fragments; black particles	5	252
Sand, very fine, silty, buff	5	257
Sand, very fine, silty; clay at 263 feet, buff	7	264
Sand, very fine, silty; clay ending at 265 feet, buff; shell fragments	5	269
Sand, medium to fine, gray; shell fragments; black particles	4	273
Sand, very fine, silty, clayey, gray-brown	5	278
Sand, very fine, silty, gray-brown; shell fragments	6	284
Sand, very fine, silty, gray; particles of gray and brown clay	7	291
Sand, medium to fine, gray-brown; shell fragments	3	294
Sand, very fine, silty, clayey, gray-brown	16	310
Sand, medium, silty, gray-brown; shell fragments	5	315
Sand, medium to fine, gray-brown; shell fragments; clay particles, gray	4	319
Clay, sandy; shell fragments	5	324
Sand, very fine, silty, clayey, brown	5	329
Sand, medium to fine, silty, brown-gray; clay particles brown; shell fragments	5	334
Clay, sandy, gray and red	3	337
Sand, very fine, silty; clay, lumpy, gray	5	342
Sand, fine, silty, gray-brown; shell fragments	5	347
Sand, fine, gray-brown; shell fragments	5	352
Sand, fine to very fine, silty, gray-brown	4	356
Sand, medium to fine; shell fragments	2	357
Sand, fine, very silty, gray-brown	3	360
Rock, very hard; sand, fine, silty; rock particles	1.5	361.5

Care-Fd 8 (Altitude: 40 feet) P 5468

Recent and Pleistocene series:		
Soil, sand, and gravel	10	10
Sand, coarse, white and gray; gravel	20	30
Miocene series:		
St. Marys formation:		
Clay	4	34
Sand, coarse, white	9	43
Sand, coarse, yellow; gravel	16.5	59.5
Clay, dark gray	36.5	96
St. Marys and Choptank formations:		
Clay, gray; sand, fine; shells	50.5	146.5
Choptank formation:		
Shells; sand, fine; clay	57.5	204
Clay, brown	20	224
Clay, brown; sand; shale	11.4	235.4
Calvert(?) formation:		
Hardpan; sand, fine	1.6	237
Sand, fine; clay	8.8	245.8
Clay, green; shells; sand, fine, hard	16.2	262
Clay, brown	7	269
Sand, coarse, gray and white; shells	29.7	298.7
(Screen 273–299 feet)		

Well logs of Exhibit 3 from Wilson, John, The Columbia Aquifer of the Eastern Shore of Maryland, MGS Report of Investigations No. 40.

Well	Lithology	Thickness (feet)	Depth to base (feet)
	CAROLINE COUNTY		
CO-AD 17	(Altitude: 75 ft.): Auger hole (Geologist's log)		
	Sand, medium, some clay and silt, tan brown	1	1
	Sand, medium, clean, tan to orange brown	4	5
	Sand, medium, light tan, with some white and orange clayey sand clasts	4	9
	Sand, medium, silty, light tan	13	22
	Sand, by "feel" of rig and from gamma log; increasing clay content with depth	23	45
	Sand, silt to medium, very clayey, medium gray and brown	.5	45.5*
	Sand, silt to medium, some clayey matrix, orange brown	.8	46.3*
	Sand, silt to medium, very clayey, olive green	.5	46.8*
	Sand, by "feel" of rig	3.2	50
	COMMENTS:		
	*Cored intervals described in log; 45 ft to 47 ft; recovery 22 in.		
	Ran gamma log to 46 ft.		
	Base of Columbia Group is at 22 ft below land surface and 53 ft above sea level. Based primarily on gamma log.		

CO-BC 16 (Altitude: 62 ft.): Hydraulic Rotary (Driller's log)

Lithology	Thickness (feet)	Depth to base (feet)
Sand, clayey, brown	4	4
Clay, brown	4	3
Sand, brown, slightly clayey	7	15
Sand, brown with small gravel	29	44
Sand, brown, free	20	64
Sand, crusty, brown	2	66
Clay, green	9	75

COMMENTS:

Base of Columbia Group is at 66 ft below land surface and 4 ft below sea level.

Well	Lithology	Thickness (feet)	Depth to base (feet)
CO-CC 54	(Altitude: 50 ft.): Hydraulic Rotary (Geologist's log)		
	Sand, very fine to granule, clayey matrix, poorly sorted, arkosic, light gray and orange tan	7	7*
	Sand, fine to some coarse, range silt to small pebble, clayey matrix, poorly sorted, arkosic, light gray; some very fine, black, opaques present	5	12*
	Sand, silt to medium, range silt to coarse, clayey matrix, moderately well sorted, micaceous, light gray with some orange stained layers	5	17*
	Sand, fine to medium, range silt to coarse, clayey matrix, well sorted, micaceous, light gray	5	22*
	Sand, very fine to medium, clayey matrix, very well sorted, micaceous, light gray with some orange stained layers	5	27*
	Sand, fine to very coarse, range silt to small pebble, some clay matrix, poorly sorted, light gray	4	31*
	Sand, fine to granule, range silt to small pebble, some clayey matrix, orange tan	1	32*
	Sand, fine to pebbly, range silt to medium pebble, some clayey matrix, very poorly sorted, arkosic, orange tan	5	37*
	Sand, medium to small pebble, range silt to small pebble, poorly sorted, arkosic, orange tan	6	43
	Ironstone, reported by driller	2	45
	Clay, plastic, tough, gray with maroon mottling	7	52*
	Clay, silty, dark gray and orange brown	5	57*
	Clay, silty and fine sandy, medium gray with some brownish staining	5	62*
	Clay, silty, medium brown, interbedded with 1/8 in. to 1/4 in. layers of gray, very fine to medium sand	5	67*
	Clay, silty, brownish gray, interbedded with 1/16 in. to 1/4 in. beds of gray, very fine to fine quartz sand at 1/4 in. to 2 in. intervals	15	82*
	Clay, silty, medium gray, interbedded with 1/16 in. to 1/8 in. beds of gray, very fine to fine quartz sand at 1/4 in. to 2 in. intervals	10	92*
	Sand, fine to coarse, silty, moderately sorted, abundant shell fragments	30	122*

COMMENTS:

*Cored intervals described in log: 5 ft to 7 ft; 10 ft to 12 ft; 15 ft to 17 ft; 20 ft to 22 ft; 25 ft to 27 ft; 30 ft to 32 ft; 35 ft to 37 ft; 50 ft to 52 ft; 55 ft to 57 ft; 60 ft to 62 ft; 65 ft to 67 ft; 80 ft to 82 ft; 90 ft to 92 ft; 120 ft to 122 ft.
No gamma log run. Electric log run to 123.6 ft.
Base of Beaverdam Formation at 31 ft below land surface, 19 ft above sea level. Base of Columbia Group is at 45 ft below land surface, 5 ft above sea level.

Well		Lithology	Thickness (feet)	Depth to base (feet)
CO-CD	56	(Continued)		
		Sand, fine to medium, range silt to coarse, gray, possible fill	1	1
		Sand, fine to very coarse, range silt to small pebble, very poorly sorted, granules plentiful, orange tan	2	3
		Sand, fine to very coarse, range silt to small granule, moderately sorted, beige	2	5
		Sand, fine to very coarse, range silt to granule, moderately sorted, orange tan	10	15
		Sand, from "feel" of rig and from gamma log; no representative cuttings	20	35
		Sand, very coarse, range fine to medium pebble, poorly sorted, orange tan	.2	35.2*
		Sand, coarse to small pebble, range fine to small pebble, poorly sorted, orange tan	.8	36*
		Gravel, from "feel" of rig	2	38
		Sand, clayey, from "feel" of rig	2	40
		Clay, sandy, augers "tight", slight kick on gamma log; no representative cuttings	2	42
		Sand, from "feel" of rig and from gamma log; no representative cuttings	7	49
		Clay, augers "tight", kick on gamma log	11	60
		Clay, slightly silty, plastic, medium gray	2	62*

COMMENTS:

*Cored intervals described in log:
35 ft to 36 ft - recovery 12 in.
60 ft to 62 ft - recovery 24 in.
Ran gamma log to 58.5 ft
Driller reports entering clay at 53.5 ft below land surface.
Gamma log shows contact at 49 ft below land surface
The best estimate of the base of the Columbia Group is at 49 ft below land surface and 8 ft above sea level.

Well		Lithology	Thickness (feet)	Depth to base (feet)
CO-DD	48	(Continued)		
		Sand, fine to pebbly, range silt to medium pebble, very poorly sorted, tan beige	8	15
		Gravel or ironstone, from "feel" of rig	1	16
		Sand, fine to pebbly, range silt to medium pebble, very poorly sorted, pumpkin orange tan	4	20
		Sand, fine to very coarse, range silt to small pebble, poorly sorted, pumpkin orange tan	10	30
		Sand, fine to medium, range silt to small granule, moderately sorted, bright pumpkin orange	10	40
		Clay, silty, light to medium gray, interbedded with gray plastic clay	20	60
		Clay, slighly plastic, pure, medium light gray with slight reddish brown mottling	2	62*
		Clay, from "feel" of rig and from gamma log	3	65

COMMENTS:

*Cored intervals described in log: 60 ft to 62 ft; recovery 21 in.
Ran gamma log to 65 ft
Base of Columbia Group is at [illegible] ft below land surface and 5 ft above sea level.

CO-DD 49 (Altitude: 42 ft.): Auger hole (Geologist's log)

Sand, fine to coarse, range silt to medium pebble, poorly sorted, pebbles common, brown	2	2
Sand, fine to coarse, range silt to small granule, moderately sorted, dark orange tan	.5	2.5
Sand, medium to very coarse, range very fine to medium pebble, very poorly sorted, pebbles common, gray beige	.5	3
Sand, fine to coarse, range silt to granule, moderately sorted, dark orange tan	1	4
Sand, medium to granular, range silt to small pebble, poorly sorted, dark orange tan	8	12
Sand, fine to very coarse, range silt to small pebble, poorly sorted, dark orange tan	4	16
Gravel, from "feel" of rig	1	17
Sand, medium to very coarse, range silt to medium pebble, poorly sorted, dark orange tan	3	20
Sand, fine to coarse, range silt to small granule, poorly sorted, dark orange tan	4.5	24.5
Gravel, from "feel" of rig, rig jumped	.5	25.0
Sand, fine to coarse, range silt to granule, moderately sorted, orange tan	4	29
Clay, silty, light grey	2.5	31.5
Clay, silty and fine to medium sandy, medium gray, some carbonaceous inclusions	2	33.5*
Clay, interbedded silty clay and clayey sand, medium to light gray, from "feel" of rig and from gamma log	11.5	45

COMMENTS:

*Cored intervals described in log; 31.5 ft to 33.5 ft; recove . 20 in.
Ran gamma log to 43 ft
Base of Columbia Group is at 29 ft below land surface and 13 ft above sea level

CO-ED 28 (Altitude: 50 ft.): Auger hole (Geologist's log)

Sand, fine to medium, range silt to small granule, moderately sorted, beige	1	1
Sand, fine to coarse, range silt to small pebble, poorly sorted, small pebbles common, grayish tan	1.5	2.5
Sand, fine to coarse, range very fine to granule, moderately sorted, tan	1	3.5
Sand, fine to medium, range very fine to coarse, well sorted, orange tan	1	4.5
Sand, medium to coarse, range very fine to small pebble, moderately sorted, light orange tan	2.5	7
Sand, fine to coarse, range silt to small pebble, moderately sorted, grayish tan	7	14
Sand, fine to very coarse, range silt to small pebble, moderately sorted, tan	6	20
Sand, medium to coarse, range very fine to granule, moderately sorted, orange tan	5	25
Sand, medium to coarse, range very fine to granule, moderately sorted, orange tan	5	30
Sand, medium to very coarse, range very fine to pebble, orange tan; driller reports thin pebble layers from 36 ft to 40 ft	15	45
Sand, clayey, from "feel" of rig and from gamma log	5	50
Sand, fine, very clayey, with thin laminae of dark gray clay	2	52*
Clay, plastic, gray, with beds of gray, fine to medium grained, sandy clay	3	55
Clay, plastic, silty, light gray	5	60

COMMENTS:

*Cored interval described in log; 50 ft to 52 ft; recovery 16 in.
Ran gamma log to 60 ft
Base of Columbia Group is at 45 ft below land surface and 5 ft above sea level.

CO-FD 31 (Altitude: 50 ft.): Auger hole (Geologist's log)

Sand, medium, silty, brown orange	5	5
Sand, medium, silty and clayey, brown orange	2	7
Sand, medium, silty and clayey, brown orange; driller reports gravel layer at 16 ft	10	17
Clay, gray	3	20
Clay, silty, tacky, light gray with lense of medium to coarse orange sand	.8	20.8*
Sand, medium to gravel, range silt to large pebble, very poorly sorted, orange tan with some ironstone layers and dark iron red beds, 1/4 in. to 3/4 in. thick; bottom 2 in. of core is brown, coarse to granular, peaty smelling sand	1.2	22*
Sand, medium to coarse, with some silt and gravel, orange brown	17	39
Clay, from "feel" of rig	6	45
Clay, pure, dark gray	1.25	46.25*
Sand, silty to fine, well sorted, clayey matrix, light medium grey interbedded with dark gray, silty clay	.75	47*
Sand/clay, interbedded, from "feel" of rig	8	55

COMMENTS:

*Cored intervals described in log;
20 ft to 22 ft - recovery 24 in.
45 ft to 47 ft - recovery 24 in.
Base of Columbia Group is c. 39 ft below land surface and 11 ft above sea level.

The following well logs of Exhibit 3 are from records of the Caroline County Health Department.

(THIS NUMBER IS TO BE PUNCHED IN COLS. 3-8 ON ALL CARDS)

FILL IN THIS FORM COMPLETELY
PLEASE PRINT OR TYPE

COUNTY NUMBER 2-11-40

Date Received (WRA use only)

DATE WELL COMPLETED 9-4-80

Depth of Well 130 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WE" 7-3-1

Greeley (last name) Grace (first name)

STREET OR RFD Stafford Ld TOWN Mayfield

SUBDIVISION SECTION LOT

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	Check if water bearing
Topsoil	0	1	
Tan Sand	1	11	
White Sand	11	19	
Tan Sand	19	34	
Blue Clay	34	37	
Gray Sand Shell	37	57	
Gray Clay	57	63	
Gray Sand-Shell & Clay	63	71	
Gray Clay & Shell Frag	71	106	
Gray Sand Shell Frag	106	130	

GROUTING RECORD

WELL HAS BEEN GROUTED (Circle Appropriate Box) yes Y no N

TYPE OF GROUTING MATERIAL

CEMENT CM BENTONITE CLAY BC

NO. OF BAGS 2 NO. OF POUNDS 10

GALLONS OF WATER 50

DEPTH OF GROUT SEAL (to nearest foot)

from 3 ft. to 28 ft.

(enter 0 if from surface)

CASING RECORD

casing types (insert appropriate code below)

ST STEEL PL PLASTIC CO CONCRETE OT OTHER

MAIN CASING TYPE	Nominal diameter top(main)casing (nearest inch)	Total depth of main casing (nearest foot)
PL	2	130

OTHER CASING (if used)

EACH CASING	diameter inch	depth (feet) from	to

SCREEN RECORD

screen type or openhole (insert appropriate code below)

ST STEEL BR BRASS BRONZE HO OPEN HOLE PL PLASTIC OT OTHER

C 2 (seq. no.)

EACH SCREEN		DEPTH (nearest ft.)	
1	PL	113	130
2			
3			

SLOT SIZE 1 10 2 3

DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK from 113 to 130

IF WELL DRILLED WAS FLOWING WELL CIRCLE BOX F

C 3 (seq no)

PUMPING TEST

HOURS PUMPED (nearest hour) 6

PUMPING RATE (gal. per min. to nearest gal.) 10

METHOD USED TO MEASURE PUMPING RATE Bucket

WATER LEVEL (distance from land surface)

BEFORE PUMPING 9

WHEN PUMPING 25

TYPE OF PUMP USED (for test)

A air P piston T turbine

C centrifugal R rotary O other (describe below)

J jet S submersible

PUMP INSTALLED

DRILLER WILL INSTALL PUMP (CIRCLE APPROPRIATE BOX) YES Y NO N

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS EXCEPT HOME USE

TYPE OF PUMP (WRITE APPROPRIATE LETTER IN BOX - SEE ABOVE: (A, C, J, P, R, S, T, O)

CAPACITY: GALLONS PER MINUTE (to nearest gallon)

PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft)

CASING HEIGHT (circle appropriate box and enter casing height)

+ above LAND SURFACE

− below 1 (nearest foot)

LOCATION OF WELL ON LOT

SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND/OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)

N

CIRCLE APPROPRIATE BOX

A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED

E ELECTRIC LOG OBTAINED

P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT I HAVE COMPLIED WITH ALL CONDITIONS STATED ON THE ABOVE-CAPTIONED "PERMIT TO DRILL WELL", AND THAT INFORMATION CONTAINED IN THIS REPORT IS TRUE, ACCURATE, AND COMPLETE TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF.

DRILLERS IDENT. NO. 20

DRILLER'S SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

SITE SUPERVISOR (sign of driller or journeyman responsible for sitework if different from permittee)

WRA USE ONLY (NOT TO BE FILLED IN BY DRILLER)

T (E.R.O.S.) W Q

TELESCOPE CASING LOG INDICATOR OTHER DATA

State Office Building
ANNAPOLIS, MARYLAND 21401

DEPARTMENT OF
WATER RESOURCES

8-3-38

MUST BE SUBMITT
WITHIN 30 DAY
AFTER COMPLET
OF THE WELL

WELL COMPLETION REPORT

WELL DESCRIPTION

WELL LOG
State the kind of formations penetrated, their color, their depth, their thickness, and if water-bearing

	FEET from ___ to ___
Surface material	0 - 5
Yellow sand	5' - 31'
Blue clay	31' - 47'
Grey sand	47' - 110'
Brown clay	110' - 135
Grey sand	135 - 176
Blue clay	176 - 247
Grey sand	247 - 347

CASING AND SCREEN RECORD
State the kind and size and position of casing, liner, shoe, screen, and other accessories (if no casing used, give diameter of well).

	DIAM. (inches)	FEET from ___ to ___
Casing	4	0 - 181'
No casing	4	181 - 347

Permit Number Co-165
Owner Eug. E. D.
Address Woodcrest
Subdivision
Section ___ Lot ___

PUMPING TEST
Hours Pumped 1½
Type of Pump Used Jet
Pumping Rate
Gallons per Minute 3

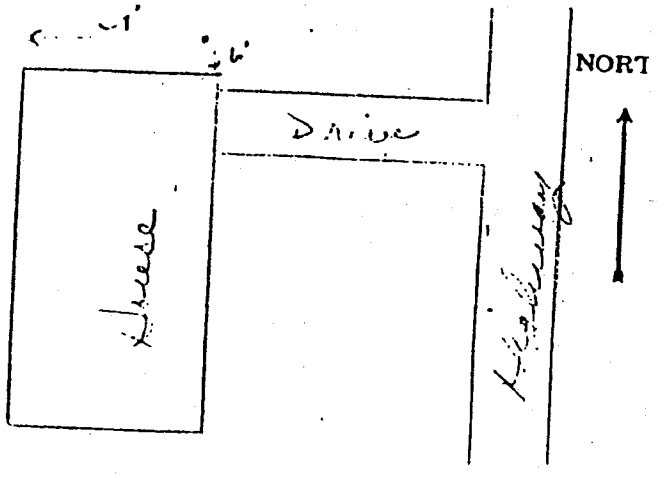
WATER LEVEL
(Distance from land surface water)
Before Pumping 17
When Pumping 75

APPEARANCE OF WATER
Clear ✓ Cloudy ___
Taste
Odor

Height of Casing Above Land Surface

PUMP INSTALLED
Type Jacuzzi
Capacity
Gallons per Minute 20
Gallons per Hour
Pump Column Length 105

LOCATION OF WELL ON LOT
Show permanent structures such as building(s), septic tank, and/or other landmarks and indicate not less than 2 distances (measurements) to well.



DATE WELL WAS COMPLETED
2-1-68

I hereby affirm that this report contains no willful misrepresentations or falsifications and that information given in this report is true, accurate and complete to the best of my knowledge and belief.

Norris C. Pusey, Well Driller

Well Driller License No.: 138

IN COLS. 3-8 ON ALL CARDS) | PLEASE PRINT OR TYPE | NUMBER

DATE Received | DATE WELL COMPLETED 03 12 83 | Depth of Well 345 (TO NEAREST FOOT) | PERMIT NO. FROM "PERMIT TO DRILL

OWNER [illegible]
ET OR RFD [illegible] last name [illegible] first name TOWN [illegible]
SUBDIVISION SECTION LOT

WELL LOG
Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	Check if water bearing
Brn sand & clay	0	6	
gravel	6	10	
yellow clay	10	29	
brn sand & gr	29	37	
gray clays	37	215	
gray sand	215	294	✓
gray clays	294	330	
gray sand	330	347	✓
	3		

C.9030

SHANNAHAN ARTESIAN WELL CO., INC.
P.O. BOX 730
ST. MICHAELS, MARYLAND 21663

CIRCLE APPROPRIATE LETTER
- A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
- E ELECTRIC LOG OBTAINED
- P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 10.17.13 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS IDENT. NO. 24
DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD
WELL HAS BEEN GROUTED (Circle Appropriate Box) YES N no
TYPE OF GROUTING MATERIAL
CEMENT CM BENTONITE CLAY BC
NO. OF BAGS 6 NO. OF POUNDS 60
GALLONS OF WATER 36
DEPTH OF GROUT SEAL (to nearest foot)
from 04 ft. TOP to 40 ft. BOTTOM
(enter 0 if from surface)

CASING RECORD
casing types insert appropriate code below
ST STEEL CO CONCRETE PL PLASTIC OT OTHER

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
ST	04	281

OTHER CASING (if used)

EACH CASING		diameter inch	depth (feet) from	to
	PL	4	211	221
	PL	4	292	335

SCREEN RECORD
screen type or open hole insert appropriate code below
ST STEEL BR BRASS BRONZE HO OPEN HOLE PL PLASTIC OT OTHER

C 2

EACH SCREEN		DEPTH (nearest ft.)	
1	PL	287	212
2	PL	333	343
3			

SLOT SIZE 1 20 2 3
DIAMETER OF SCREEN 04 (NEAREST INCH)

GRAVEL PACK from to
IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

DEP USE ONLY (NOT TO BE FILLED IN BY DRILLER)
T TELESCOPE CASING | (E.R.O.S.) LOG INDICATOR | WQ OTHER DATA

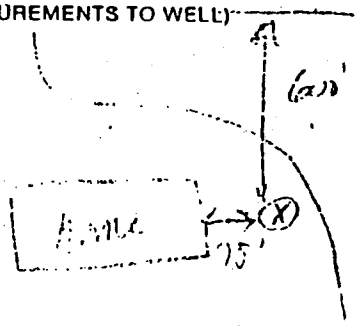
C 3

PUMPING TEST
HOURS PUMPED (nearest hour) 01
PUMPING RATE (gal. per min. to nearest gal.) 11
METHOD USED TO MEASURE PUMPING RATE Bucket
WATER LEVEL (distance from land surface)
BEFORE PUMPING 20
WHEN PUMPING 30

TYPE OF PUMP USED (for test)
A air P piston T turbi
C centrifugal R rotary O other (desc below
J jet S submersible

PUMP INSTALLED
DRILLER WILL INSTALL PUMP (CIRCLE) (YES or NO) YES N
IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS EXCEPT HOME USE.
TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX - SEE ABOVE: J
CAPACITY: GALLONS PER MINUTE (to nearest gallon) 12
PUMP HORSE POWER 03
PUMP COLUMN LENGTH (nearest ft.) 13
CASING HEIGHT (circle appropriate box and enter casing height) + above – below LAND SURFACE 01 (nearest foot)

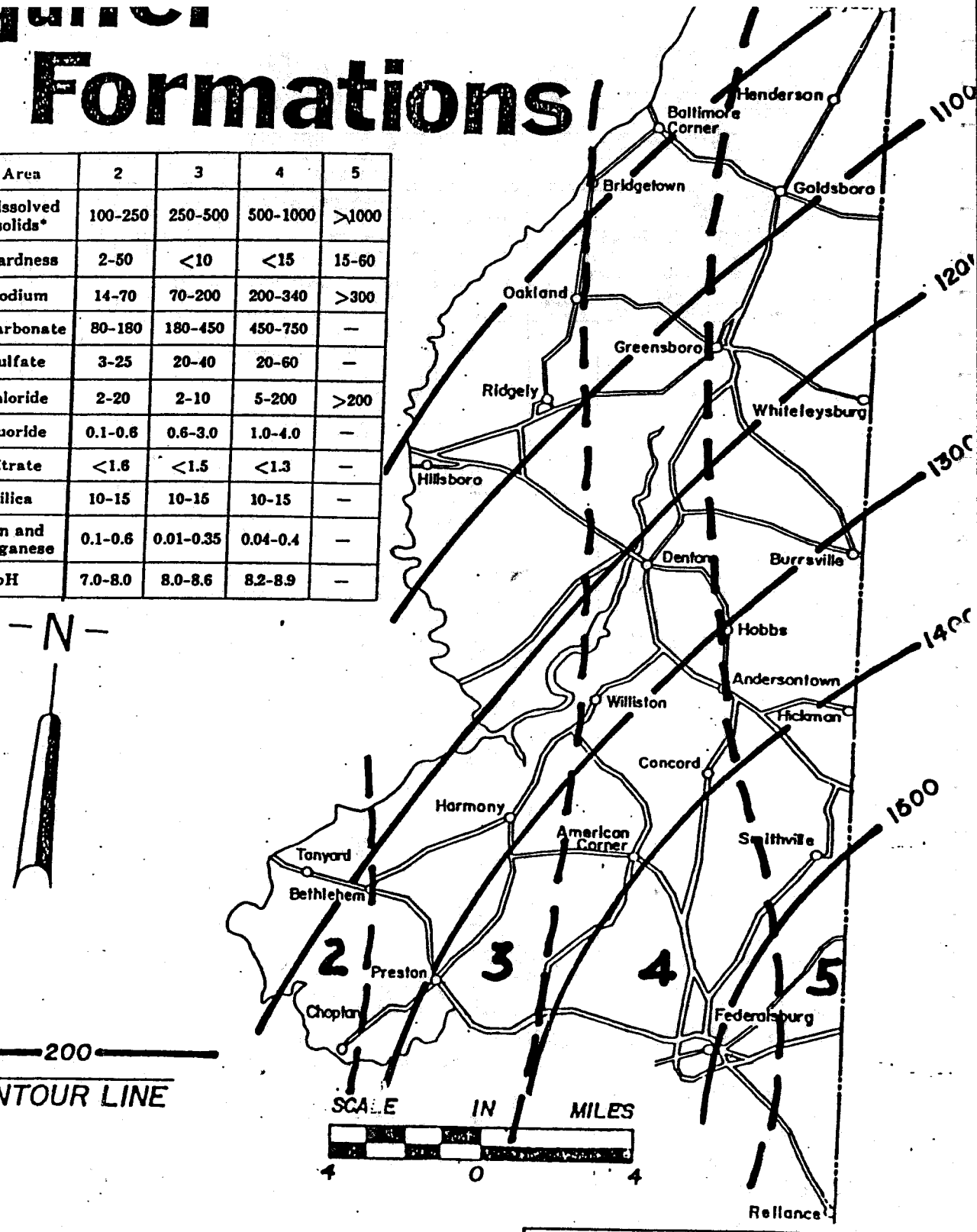
LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH A BUILDING, SEPTIC TANKS, AND/OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



HEALTH 5-131

Aquifer Formations

Area	2	3	4	5
Dissolved solids*	100-250	250-500	500-1000	>1000
Hardness	2-50	<10	<15	15-60
Sodium	14-70	70-200	200-340	>300
Bicarbonate	80-180	180-450	450-750	—
Sulfate	3-25	20-40	20-60	—
Chloride	2-20	2-10	5-200	>200
Fluoride	0.1-0.6	0.6-3.0	1.0-4.0	—
Nitrate	<1.6	<1.5	<1.3	—
Silica	10-15	10-15	10-15	—
Iron and manganese	0.1-0.6	0.01-0.35	0.04-0.4	—
pH	7.0-8.0	8.0-8.6	8.2-8.9	—



NOTE:
CONTOUR LINES SHOW DEPTH OF AQUIFER BELOW SEA LEVEL.

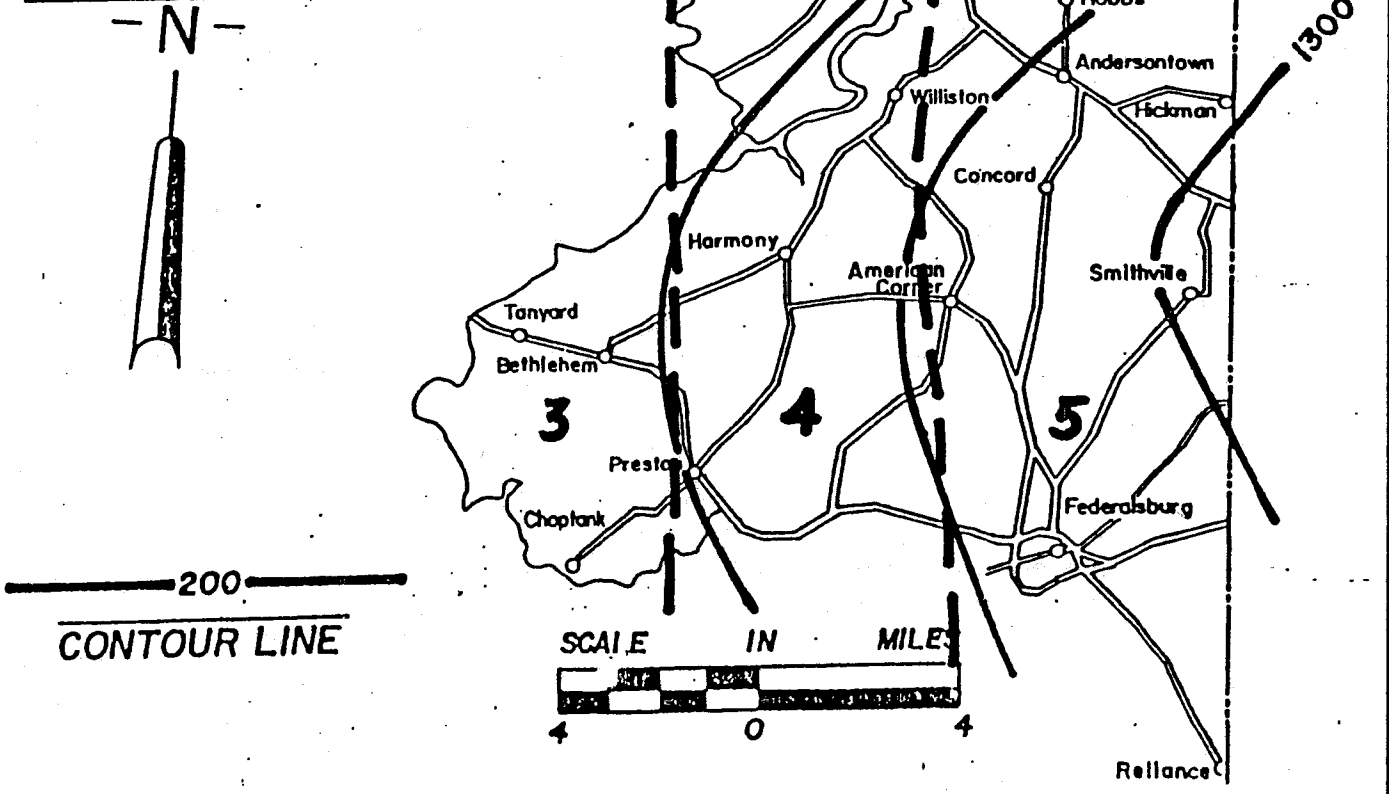
CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

PATAPSCO – RARITAN

(NON-MARINE CRETACEOUS)

Aquifer Formations

Area	3	4	5
Dissolved solids*	250-500	500-1000	>1000
Hardness	<20	—	<20
Sodium	>95	—	>400
Bicarbonate	>250	—	>900
Sulfate	>10	—	>60
Chloride	<10	—	>50
Fluoride	>1.0	—	>5.0
Nitrate	<2	—	<2
Silica	>10	—	>10
Iron and manganese	<1	—	<1
pH	>7.0	—	>8.0



NOTE:
CONTOUR LINES SHOW DEPTH OF AQUIFER BELOW SEA LEVEL.

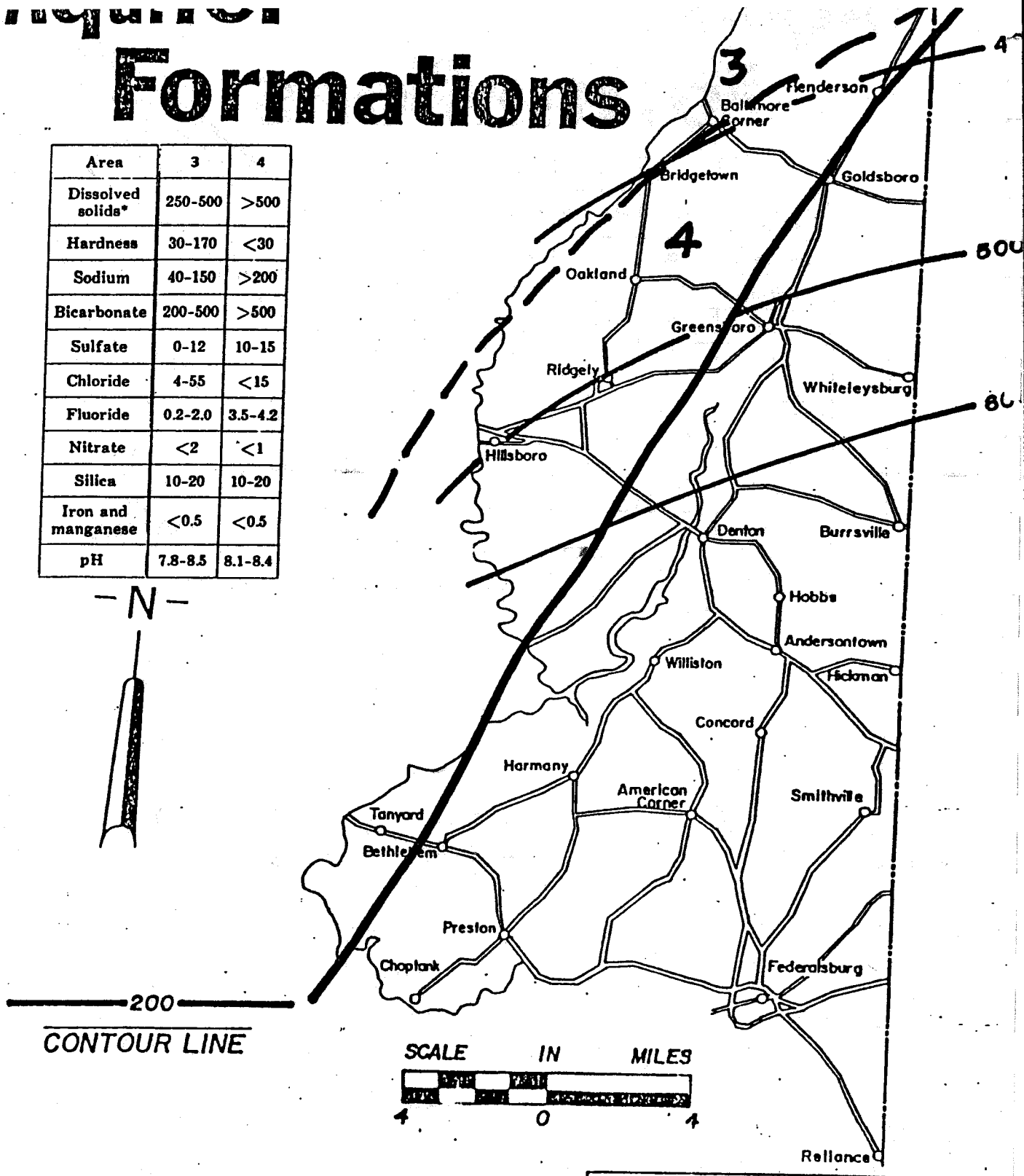
CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

MAGOTHY

ANDREWS, MILLER & ASSOC., INC
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

Aquifer Formations

Area	3	4
Dissolved solids*	250-500	>500
Hardness	30-170	<30
Sodium	40-150	>200
Bicarbonate	200-500	>500
Sulfate	0-12	10-15
Chloride	4-55	<15
Fluoride	0.2-2.0	3.5-4.2
Nitrate	<2	<1
Silica	10-20	10-20
Iron and manganese	<0.5	<0.5
pH	7.8-8.5	8.1-8.4



NOTE:
CONTOUR LINES SHOW DEPTH OF AQUIFER BELOW SEA LEVEL.

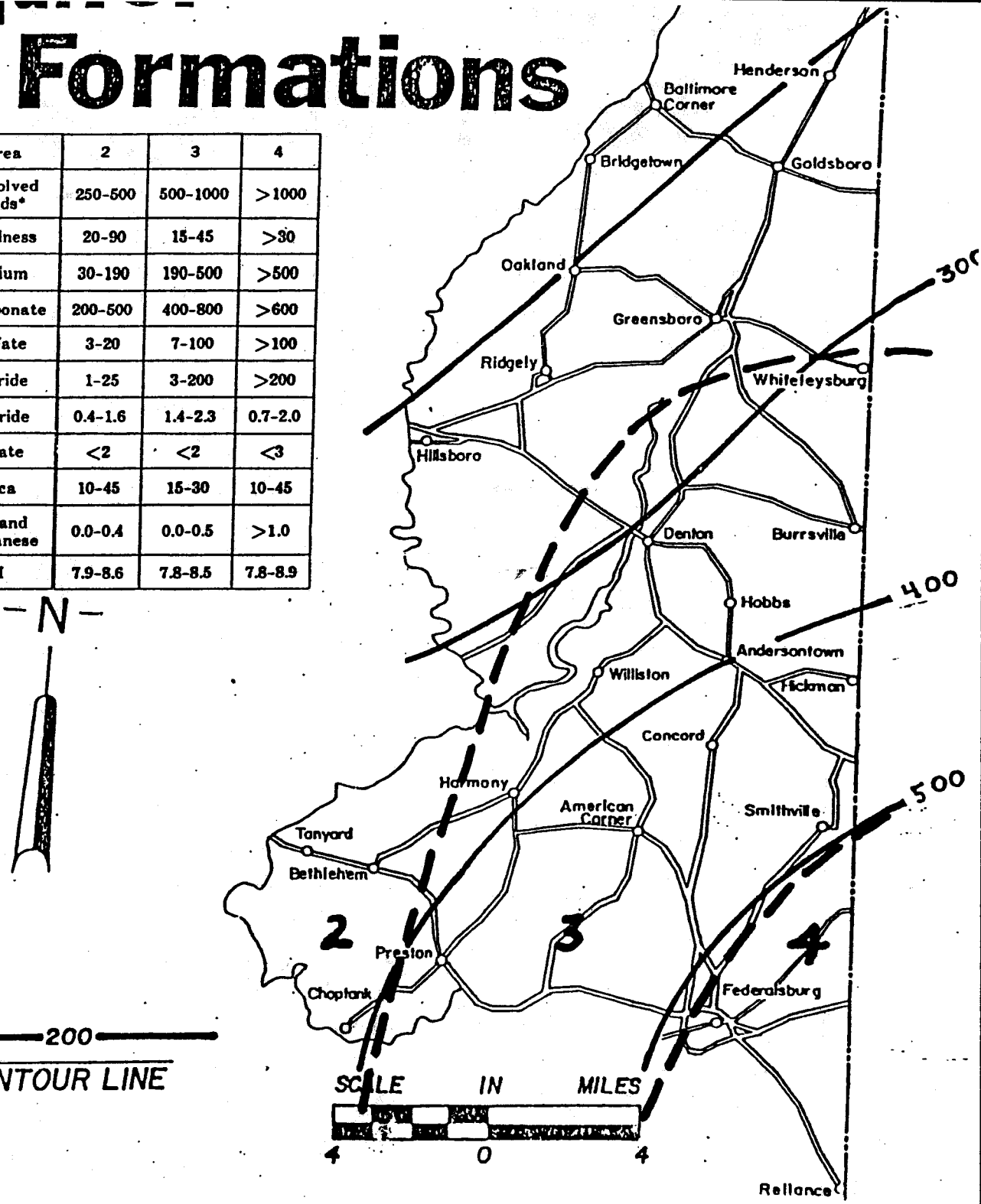
CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

AQUIA GREENSAND

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS - SURVEYORS
CAMBRIDGE, MARYLAND 21613

Formations

Area	2	3	4
Dissolved solids*	250-500	500-1000	>1000
Hardness	20-90	15-45	>30
Sodium	30-190	190-500	>500
Bicarbonate	200-500	400-800	>600
Sulfate	3-20	7-100	>100
Chloride	1-25	3-200	>200
Fluoride	0.4-1.6	1.4-2.3	0.7-2.0
Nitrate	<2	<2	<3
Silica	10-45	15-30	10-45
Iron and manganese	0.0-0.4	0.0-0.5	>1.0
pH	7.9-8.6	7.8-8.5	7.8-8.9



NOTE:
CONTOUR LINES SHOW DEPTH OF AQUIFER BELOW SEA LEVEL.

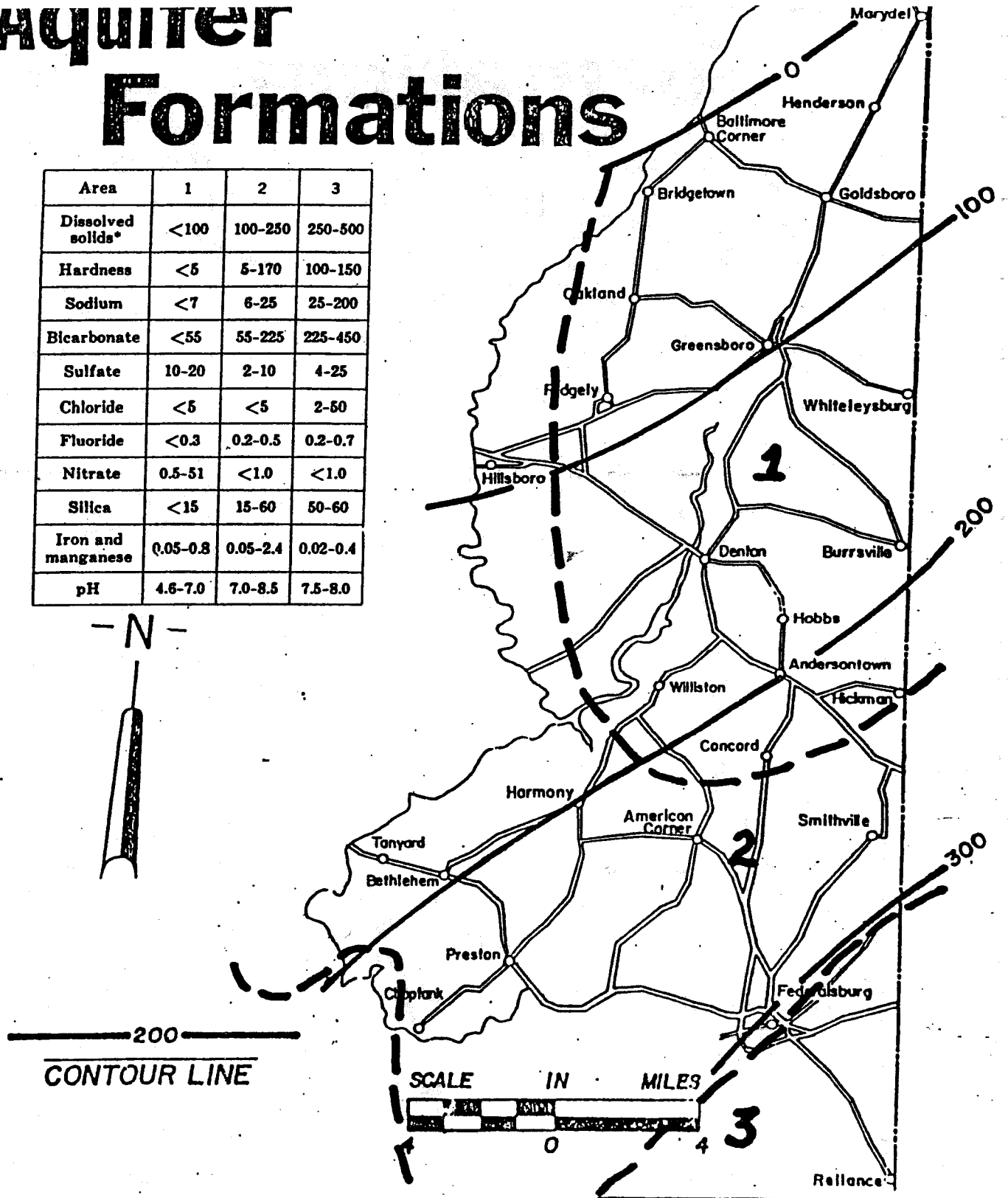
CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

PINEY POINT

ANDREWS, MILLER & ASSOC., INC.
ENGINEERS-SURVEYORS
CAMBRIDGE, MARYLAND 21613

Aquifer Formations

Area	1	2	3
Dissolved solids*	<100	100-250	250-500
Hardness	<5	5-170	100-150
Sodium	<7	6-25	25-200
Bicarbonate	<55	55-225	225-450
Sulfate	10-20	2-10	4-25
Chloride	<5	<5	2-50
Fluoride	<0.3	0.2-0.5	0.2-0.7
Nitrate	0.5-51	<1.0	<1.0
Silica	<15	15-60	50-60
Iron and manganese	0.05-0.8	0.05-2.4	0.02-0.4
pH	4.6-7.0	7.0-8.5	7.5-8.0



NOTE:
CONTOUR LINES SHOW DEPTH OF AQUIFER BELOW SEA LEVEL.

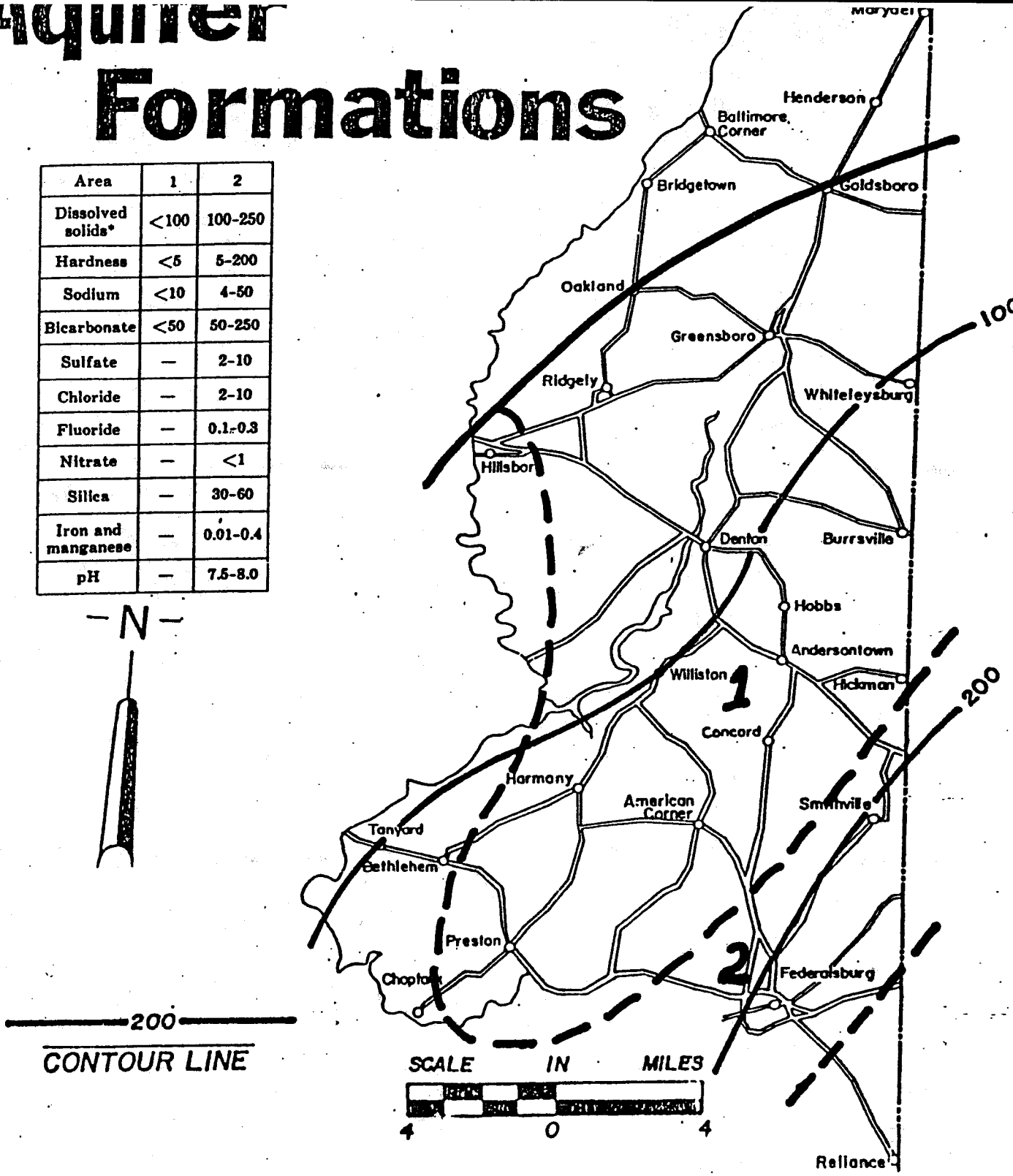
CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

CALVERT

(CHESWOLD, FEDERALSBURG)

Aquifer Formations

Area	1	2
Dissolved solids*	<100	100-250
Hardness	<5	5-200
Sodium	<10	4-50
Bicarbonate	<50	50-250
Sulfate	—	2-10
Chloride	—	2-10
Fluoride	—	0.1-0.3
Nitrate	—	<1
Silica	—	30-60
Iron and manganese	—	0.01-0.4
pH	—	7.5-8.0



NOTE:
CONTOUR LINES SHOW DEPTH OF AQUIFER BELOW SEA LEVEL.

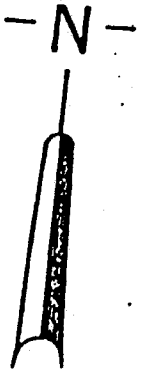
CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

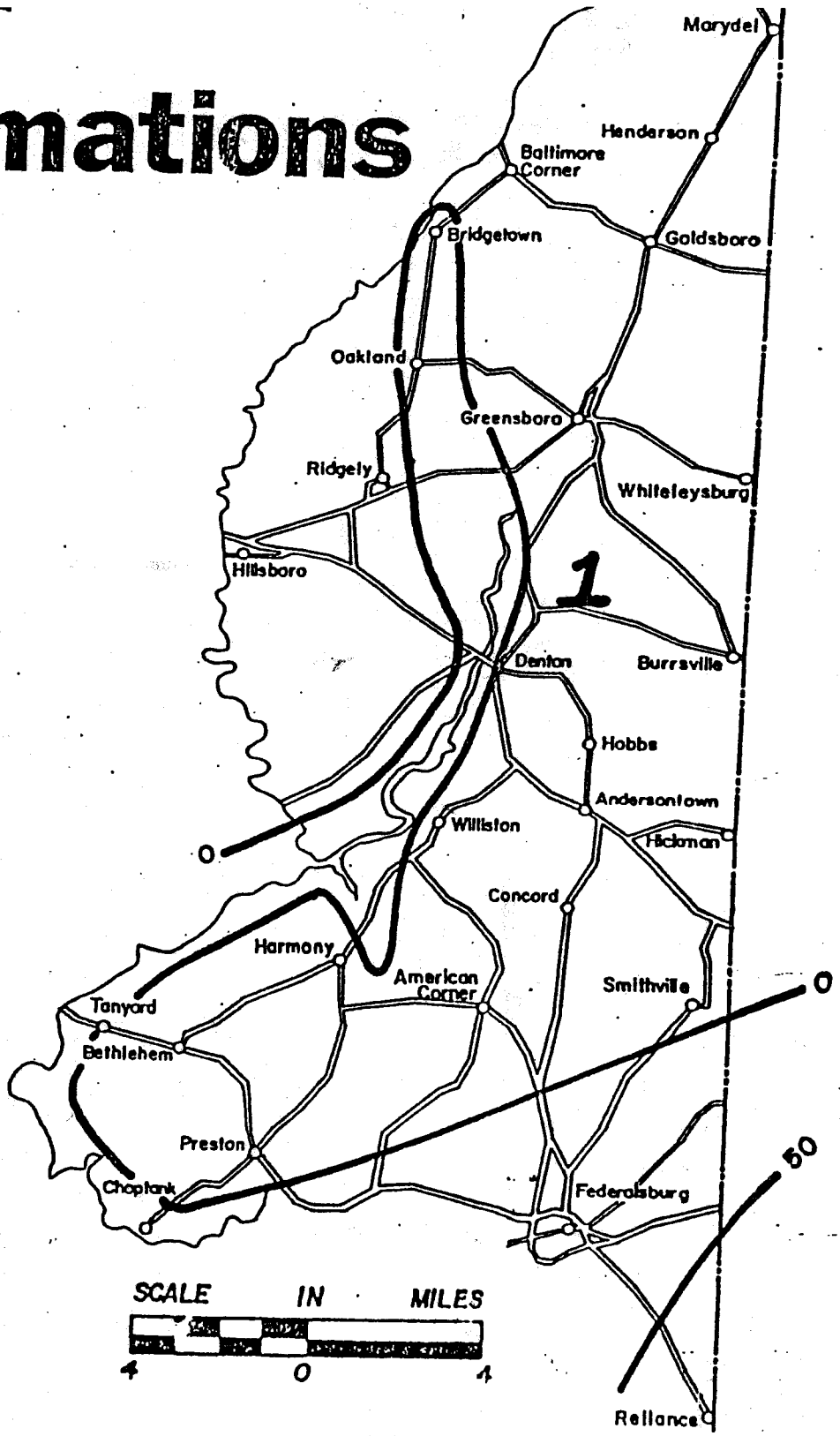
CHOPTANK

(FREDERICA)

Aquifer Formations

Area	1
Dissolved solids*	<100
Hardness	<35
Sodium	2-20
Bicarbonate	5-40
Chloride	5-20
Fluoride	<0.2
Silica	10-30
Iron and manganese	0.02-21
pH	5.4-7.0





200
CONTOUR LINE

SCALE IN MILES
4 0 4

NOTE:
CONTOUR LINES SHOW DEPTH OF AQUIFER BELOW SEA LEVEL.

CAROLINE COUNTY
COMPREHENSIVE WATER AND SEWERAGE PLAN

PLIOCENE-PLEISTOCEN

COLUMBIA
(QUATERNARY)