IMPROVING ONSITE WASTEWATER SYSTEM MANAGEMENT IN PD 16 AND THE RAPPAHANNOCK AREA HEALTH DISTRICT

Abstract

Increasing property owner compliance with the mandatory 5-year septic system inspection and/or septic tank pump-outs required under Virginia's Chesapeake Bay Preservation Act (CBPA), related state regulations and local CBPA ordinances would help Virginia achieve its Chesapeake Bay TMDL goal to reduce Nitrogen (N). Moreover, better septic system maintenance would reduce bacteria pollutant loadings to meet local impaired stream TMDLs throughout the region. Through this study, researchers create spatial data files locating properties on sewer and septic, and examine public records of septic tank pump-outs and alternative system operating and maintenance services to delineate a potential spatial pattern of non-compliance. Finally, authors define a program of targeted public education, financial incentives and regulatory enforcement efforts that could, if implemented, significantly affect higher compliance with CBPA pump-out ordinances and enhance local and regional water quality.

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Disclaimer

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Introduction

Under the Virginia Department of Environmental Quality's (VDEQ) Chesapeake Bay TMDL WIP III program, a review of local onsite sewage (septic) treatment system management efforts to identify program opportunities for pollutant load reductions is required for regions and localities in Tidewater Virginia. With "septic" programs, the primary pollutant of interest under the Chesapeake Bay TMDL is Nitrogen (N); however, local impaired stream TMDLs for the bacteria standard could also benefit from this program review and resulting implementation programs. All of PD 16 (see Figure 1, including the City of Fredericksburg, and the Counties of Caroline (with the Towns of Bowling Green and Port Royal), King George, Spotsylvania and Stafford) falls under the scope of the WIP III's implementation program. Additionally, a number of stream segments in each of the PD16 localities are currently listed as impaired for the bacteria standard (see Appendix A), adding significance to efforts to improve septic system management practices at all levels.

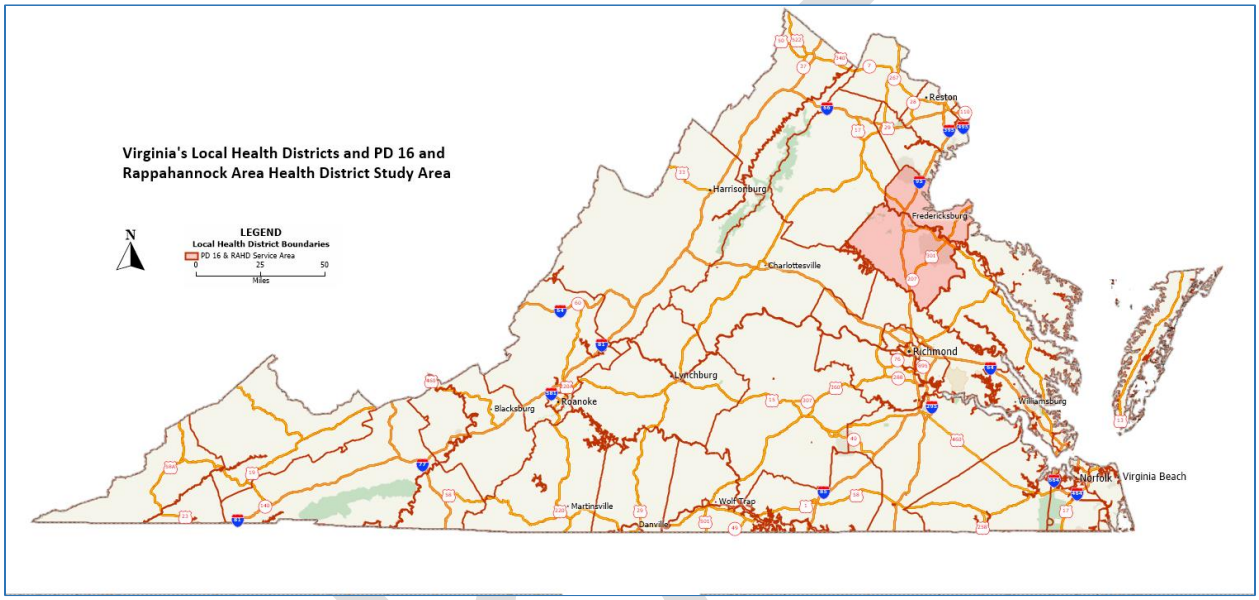


Figure 1. PD 16 and RAHD Service Area Location

Health and Environmental Considerations Related to Onsite Sewage Disposal Systems[1]

An onsite sewage disposal system (or "septic tank" system) can serve as a satisfactory sewage disposal device. Properly installed on a suitable lot, an onsite system presents few hygienic problems. However, the use of onsite systems on lots with limited soil permeability and/or a high level of water saturation, or other limiting conditions (such as system failure), presents a wide array of health and environmental concerns.

What causes septic systems[2] to fail[3]?

- Failure of the outlet tee clogs the drainfield with solids and does not allow grey water to leech into the soil. Sewage has nowhere else to go so it backs up into your house.
- Adding water to the drainfield at a rate faster than it can percolate down through the soil. This includes having leaky fixtures or a roof downspout that empties near your drainfield.

[1] This section has been abstracted from 9/2/1992 memorandum written by VDH Commissioner Dr. Robert B. Stroube, M.D., M.P.H. to VDH Health District Directors and other VDH personnel, found online at: http://www.vdh.virginia.gov/content/uploads/sites/20/2016/05/GMP-002-glh.pdf

[2] The average septic system will last 20-25 years if properly maintained, and the cost of proper maintenance is relatively inexpensive in comparison to repairing or replacing an entire system. The overall cost of ownership could also be reduced by advocating regular pump-outs which cost about $300 compared to the $3,000-$25,000 cost of a repair or replacement system. Source: Virginia DEQ, "Guidance Manual for Total Maximum Daily Load Implementation Plans", page 50.

[3] Source: Culpeper SWCD, "*Financial Assistance to Help You Maintain Your Septic System*" brochure.

- Physical damage to the drainfield or distribution box caused by digging, tilling, or cars & heavy machinery passing over them.
- Adding substances like grease, paint, and large amounts of cleaning solution kill the bacteria that break down sewage solids. This causes solids to buildup faster than normal and can easily clog the inlet/outlet tees and the drainfield.
- Woody plants growing on or near the drainfield. Their roots can easily clog the drain lines by growing into them.
- No regular pumping maintenance based on septic tank size and the number of people living in your home. Example: 2 people using a 1,000 gallon tank should be pumped every 4 -6 years.
- Non-biodegradable or slow to degrade items like products that contain plastics and heavier paper products.

Primary problems stemming from the defective functioning of these systems include the numerous health risks to humans caused by direct exposure to improperly treated sewage, and the great possibility of contamination of water supplies and shellfish grounds. The use of septic tanks on lots with low soil permeability, or with a high water table, or other limiting conditions, may result in the risk of having partially treated human waste reach the ground level where it may become present on the ground's surface or find its way into adjacent ditches or waterways. There is also the possibility that a malfunctioning system will cause the sewage to back up into plumbing fixtures and become present in a dwelling. Once this waste is exposed, the possibility of humans contracting any of a number of diseases from infectious agents in human excrement is greatly multiplied. This is particularly true of children, many of whom are unable to understand the dangers of raw sewage. These diseases may be contracted by humans through direct exposure to the untreated waste or through contact with a number of creatures which may have been exposed to it, including dogs, cats, rats, flies, cockroaches, fleas and a host of others.

Health hazards may also arise due to a faulty septic tank system, if human waste contaminates a water supply or a shellfish ground. Many diseases, can be caused by drinking contaminated water or eating seafood which has been removed from contaminated water. Contamination of a shellfish harvest ground may also have serious economic ramifications. Once contamination is discovered in the shellfish ground, it must be condemned, and the taking of any more shellfish from the area must be prevented until it is shown that the water meets the minimum standards for water quality.

After exposure to improperly treated sewage, the diseases humans may possibly contract are myriad. Some of these diseases are addressed below in an attempt to illustrate the seriousness of exposure to improperly treated human sewage. This list should not be viewed as a comprehensive and complete listing of all health hazards that may result from an improperly functioning septic tank system. The following are diseases which can be related to exposure to improperly treated human waste: ***Salmonellosis, Shigellosis, Cholera, Viral hepatitis A, Sporadic viral gastroenteritis, Epidemic viral gastroenteritis,*** *and* ***Amebiasis***.

This is hardly an encompassing list of all diseases which may result from the improper disposal of human feces and urine. However, the list does cover a broad range of the types of diseases which may result from improper disposal. One characteristic that all of the above diseases have in common is that the sanitary disposal of human feces is a recommended preventive measure. Therefore, it is clear that taking the necessary measures to ensure that septic tank systems function properly is of extreme importance.

Public Health and Water Quality

Prior to the enactment of the Chesapeake Bay Preservation Act (CBPA), which involved local governments in Tidewater Virginia in some aspects of septic program administration (discussed further under "Local Implementation of the CBPA in PD 16 and RAHD Service Area" below), the Virginia Department of Health has had, and continues to have, the primary role of administering Virginia's onsite wastewater system program regulations[4].

A few summary points to emphasize VDH's role with respect to onsite wastewater system management and the challenges of accurate septic permit record management are:

- VDH is responsible for the review and approval of all onsite sewage system permit applications, including conventional and alternative systems.

- VDH retains the authority to issue septic ticket summons for violations of State sewage treatment regulations; while local governments are responsible for enforcing any local violation of the local ordinance enacted to impose the State-mandated CBPA septic pump-out requirement.

- At the time VDH receives an onsite permit application, the final permanent address for the structure may not be known by the applicant or assigned by local government. Once the final address is assigned, there is no notification given to VDH to update the permit with the final address,

- Subsequent changes in parcel ownership, a subdivision of a parcel for which a permit has been issued, or revisions to development plans after onsite sewage system permit(s) have been issued may result in a change in the tax parcel identification number or the address used on the original permit, making it difficult to trace and link older septic permits to specific parcels of land or structures.

- Originally-issued septic construction permits lapse in 18 months unless extended or a certification letter (for conventional systems only) is issued for the proposed system. VDH has the authority to revoke (or amend) an issued permit when (i) conditions such as house location, sewage system location, sewerage system location, well location, topography, drainage ways, or other site conditions are changed from those shown on the application; (ii) conditions are changed from those shown on the construction permit; or (iii) more than 18 months elapse from the date the permit was issued.

- Certification letters do not expire and convey with the land in the event the property is sold between the time the certification letter is issued and a construction permit is requested.

- VDH has considerable administrative burden in its responsibility to:
  - review and approve septic construction permit applications of all types,
  - perform construction inspections for systems not developed pursuant to a design certified by a licensed professional engineer or onsite soil evaluator,
  - Monitor AOSS compliance, review and catalog annual alternative system operating and maintenance reports,
  - investigate OSS system complaints, and
  - pursue enforcement actions for non-compliant systems or licensed operators.

[4] VDH onsite septic regulations found online at: *http://www.vdh.virginia.gov/environmental-health/onsite-sewage-water-services-updated/regulations-and-current-regulatory-activity/*

Within the PD16/RAHD service area, the historic and on-going pace of land development (largely outside existing public sewer service areas) produces a heavy volume of OSS construction permit applications (ranking the region as having the highest number of permit applications in the State). Considering the work load burden created by new development (see Table 1 below), the added number of existing conventional and alternative onsite sewage systems impose difficult challenges on VDH staff at regional and local levels to perform the duties assigned by State law.

History of Septic Permit Issuance in PD 16

The RAHD regional health district provided spreadsheet files for each locality with the tax parcel identifier and (for many records) the expected address for the site structure served by the proposed permit and the year in which the permit was issued. The table and figure that follow summarize these data to illustrate annual trends in septic permit issuance throughout PD 16.

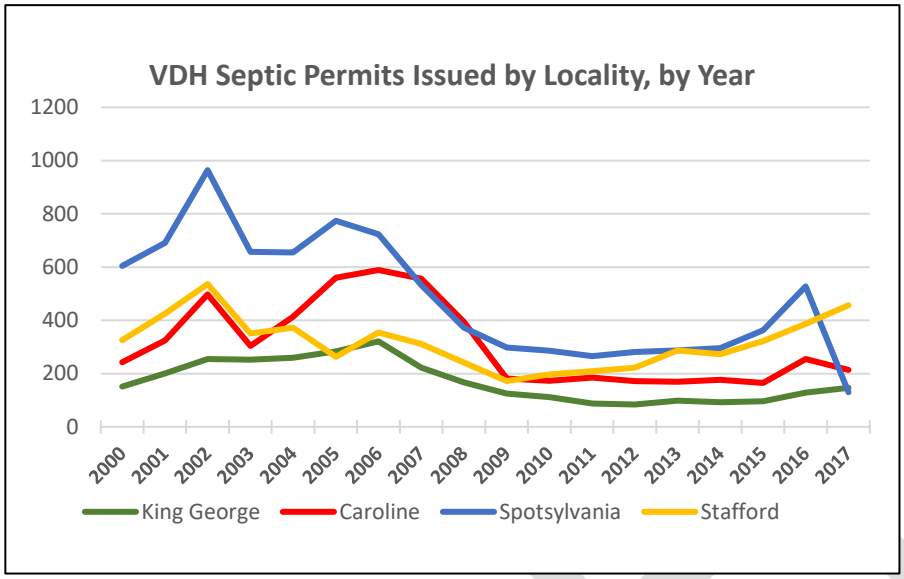
Table 1 *VDH Septic Permits Issued, by Year*

Year	Onsite Sewage System Permits Issued					
	King George	Caroline	Spotsylvania	Stafford	City	PD 16 TOTAL
2000	151	243	605	326	NO DATA REPORTED	**1,325**
2001	201	324	691	425		**1,641**
2002	255	497	964	536		**2,252**
2003	252	304	657	351		**1,564**
2004	260	413	655	372		**1,700**
2005	283	560	774	263		**1,880**
2006	321	589	723	355		**1,988**
2007	222	556	532	311		**1,621**
2008	167	394	373	241		**1,175**
2009	125	181	298	172		**776**
Pre-Recession 10 Yr. Ann. Avg.	**224**	**406**	**627**	**335**		**1,592**
2010	112	173	286	197		768
2011	88	185	266	209		748
2012	84	172	281	222		759
2013	98	169	287	287		841
2014	93	176	296	273		838
2015	96	165	363	322		946
2016	128	255	527	387		1,297
2017	146	214	130	456		946
Post-Recession 8 Year Total	**845**	**1,509**	**2,436**	**2,353**	**0**	**7,143**
Post-Recession 8 Yr. Ann. Avg.	**106**	**189**	**305**	**294**	**0**	**893**
18 yr. Grand Total	**3,082**	**5,570**	**8,708**	**5,705**	**0**	**23,065**

Source: VDH-RAHD, Local Septic Permits Issued Files by Locality, October, 2018.

The most recent eighteen year history of septic permits issued for each locality in the study area is illustrated in Figure 2. The 2009 housing recession caused a collapse in septic permit applications (most dramatically in Caroline and Spotsylvania counties). The post-recession recovery of the housing market and septic permit issuance has been most pronounced in Stafford. Between 2016 and 2017, both Caroline and Spotsylvania counties again saw a significant drop in the number of septic permits issued; while Stafford County and King George County saw a steady increase.

Figure 2 Septic Permits Issued in RAHD Service Area by Year and Locality



The Chesapeake Bay Preservation Act (CPBA)

The Chesapeake Bay Preservation Act (CBPA) was enacted by the Virginia General Assembly in 1988 as a critical element of Virginia's non-point source management program. Virginia's CBPA program, developed as a result of the CBPA Regulations promulgated under the Act, is designed to improve water quality in the Chesapeake Bay and other waters of the State by requiring the use of effective land management and land use planning. At the heart of the CBPA is the concept that land can be used and developed to minimize negative impacts on water quality. The first sentence of the CBPA serves as a theme for the entire statute:

> *"Healthy state and local economies and a healthy Chesapeake Bay are integrally related; balanced economic development and water quality protection are not mutually exclusive."*

The CBPA is to enhance water quality and still allow reasonable development to continue. The CBPA balances state and local economic interests and water quality improvement by creating a unique cooperative partnership between state and Tidewater local governments to reduce and prevent non-point source pollution. The Act recognizes that local governments have the primary responsibility for land use decisions, expands local government authority to manage water quality, and establishes a more specific relationship between water quality protection and local land use decision-making.

The CBPA Program is the only program in Virginia state government that comprehensively addresses the effects of land use planning and development on water quality. It is also the only program that has as one of its core elements a requirement to assist local governments with land use planning to meet water quality goals and the development of land use ordinances and comprehensive plans.

CBPA Implementation

The Chesapeake Bay Preservation Area Designation and Management Regulations were originally adopted in 1989 and were amended in 1991, 2001 and in 2012.

The CBPA charges the State Water Control Board (SWCB) with the following responsibilities:

- *Promulgating and keeping current regulations that establish criteria for local Bay Act programs*
- *Ensuring that local government comprehensive plans, zoning ordinances, and subdivision ordinances are in compliance with the CBPA regulations*
  These land use ordinances and plans comprise the local CBPA program and must meet the requirements of the regulations.
- *Providing technical and financial assistance to Tidewater local governments*
  Technical assistance has been provided in a number of ways, including: publications, research projects, provision of computer equipment, providing training for local government planners and engineers, and other direct staff assistance. Financial assistance has been provided through:
  (1) a competitive grants program for localities and planning district commissions that began in 1990,
  (2) a grant program for Soil and Water Conservation Districts in Tidewater to develop agricultural soil and water quality conservation plans on farmlands within Chesapeake Bay Preservation Areas, and
  (3) dedication of many regional coastal zone management planning grants to Virginia's Planning District Commissions under Virginia's Coastal Zone Management Program to fund local projects to implement requirements of the CBPA and CBPA Regulations.

- *Providing technical assistance and advice to regional and state agencies on land use and water quality protection*
  The Virginia Department of Environmental Quality's Chesapeake Bay Local Assistance Division staff help the SWCB and Tidewater local governments, planning district commissions, and Soil and Water Conservation Districts participating in the program. The staff also provides assistance in other regional efforts, including the development of watershed restoration plans and participation on committees and work groups of the Chesapeake Bay Program.

CBPA Programs at the Local Level

The lands that make up Chesapeake Bay Preservation Areas are those that have the potential to impact water quality most directly. Generally, there are two types of environmentally sensitive lands: Resource Protection Areas (RPAs), and Resource Management Areas (RMAs). RPAs protect and benefit water quality, while RMAs have the potential to damage water quality without proper management. By carefully managing land uses within these areas, local governments help reduce the water quality impacts of non-point source pollution and improve the health of the Chesapeake Bay.

Each Tidewater locality must adopt a program based on the Chesapeake Bay Preservation Act and the Chesapeake Bay Preservation Area Designation & Management Regulations. The Act and regulations recognize local government responsibility for land use decisions and are designed to establish a framework for compliance without dictating precisely what local programs must look like. Local governments have flexibility to develop water quality preservation programs that reflect unique local characteristics and embody other community goals. Such flexibility also facilitates innovative and creative approaches in achieving program objectives. The regulations address non-point source pollution by identifying and protecting certain lands called Chesapeake Bay Preservation Areas. The regulations use a resource-based approach that recognizes differences between various land forms and treats them differently.

Local CBPA programs include:

1. A map generally depicting Chesapeake Bay Preservation Areas.
2. An ordinance containing performance criteria pertaining to the use, development and redevelopment of land, including a requirement that properties on septic in the locally-defined RPA area pump-out their septic tanks at least once every five years.

3. A comprehensive plan or revision that incorporates the protection of Chesapeake Bay Preservation Areas and of the quality of state waters.
4. A zoning ordinance that incorporates measures to protect the quality of state waters.
5. A subdivision ordinance that incorporates measures to protect the quality of waters of the state.
6. A plan of development process prior to the issuance of a building permit to assure that the use and development of land in Chesapeake Bay Preservation Areas is accomplished in a manner that protects the quality of state waters.

Under the Chesapeake Bay Preservation Area Designation & Management Regulations promulgated to implement the CBPA, the specific pertinent language of the regulations state:

> *"7. Onsite sewage treatment systems not requiring a Virginia Pollutant Discharge Elimination System (VPDES) permit shall:*
>
> *a. Have pump-out accomplished for all such systems at least once every five years.*
>
> *(1) If deemed appropriate by the local health department and subject to conditions the local health department may set, local governments may offer to the owners of such systems, as an alternative to the mandatory pump-out, the option of having a plastic filter installed and maintained in the outflow pipe from the septic tank to filter solid material from the effluent while sustaining adequate flow to the drainfield to permit normal use of the septic system. Such a filter should satisfy standards established in the Sewage Handling and Disposal Regulations (12VAC5-610) administered by the Virginia Department of Health.*
> *(2) Furthermore, in lieu of requiring proof of septic tank pump-out every five years, local governments may allow owners of onsite sewage treatment systems to submit documentation every five years, certified by an operator or onsite soil evaluator licensed or certified under Chapter 23 (§ 54.1-2300 et seq.) of Title 54.1 of the Code of Virginia as being qualified to operate, maintain, or design onsite sewage systems, that the septic system has been inspected, is functioning properly, and the tank does not need to have the effluent pumped out of it."*

Local Implementation of the CBPA in PD 16 and RAHD Service Area

In response to the CBPA and its Regulations, local governments in the study area have all enacted a local Chesapeake Bay ordinance (see a summary of local ordinance provisions in Appendix C), including mandatory provisions for septic system inspections and/or pump-outs. The Counties of King George, Spotsylvania and Stafford, through ordinances enacted by the County Board of Supervisors (as well as by the City of Fredericksburg City Council), all chose to designate the entire County (or City) as the CBPA. However, Caroline County limited the CBPA ordinance application to the defined RPA area (i.e. the area within a 100-foot buffer from the stream edge of any perennial stream in the County or the minimum required under the CBPA regulations).

In PD 16, King George, Spotsylvania and Stafford Counties have included both plastic filter and system inspection options allowed under the CBPA Regulations in their local CBPA Ordinance, while Caroline County has only allowed the inspection option under their CBPA program. Where localities have allowed the plastic filter option (1) above, there is no requirement under the Regulations or the enacted local ordinances that the property owner (or installer) report (to either the locality or VDH) the installation and use of such plastic filters (which effectively legally exempt the property from the mandatory 5-year pump-out requirement). Moreover, there is no searchable database within VDH to identify efficiently such properties in order to exclude them from local septic pump-out notification. Consequently, local governments are most likely notifying some properties which, if they elected to have such a filter installed as part of the original design or as an easy system retro-fit, are no longer subject to the pump-out requirement. Property owners receiving the public notification may not realize or may

have forgotten that their system has a qualifying filter and proceed to order a pump-out which may not yet be needed.

Another possible scenario, which could help explain the low public response to the pump-out notification observed in some areas, is that property owners, knowing that their system has a filter and thus are exempt from complying with the mandatory pump-out notification, may simply be ignoring the notice. Moreover, since there has been no visible enforcement of the local CBPA ordinance in any of the localities, some property owners have been emboldened to ignore these notifications, whether they have a filter or not.

In the development of the regional Chesapeake Bay TMDL WIP III response for PDC 16, two county staff representatives (King George and Caroline) proposed that the State amend the CBPA (or otherwise affect a) transfer of local responsibilities for septic pump-out notifications and enforcement of the local CBPA pump-out ordinance to the Virginia Department of Health to unify septic program administration from permit issuance through oversight of septic system maintenance. This program philosophy has been echoed in the Accomack-Northampton, Northern Neck and Middle Peninsula PDC areas. On their behalf, Delegate M. Keith Hodges has pre-filed a bill for the 2019 General Assembly session which provides (in rough draft form):

> *"The Virginia Department of Health shall develop a transition plan and guidelines for the administration of the inspection and pump-out frequency and enforcement by the Department as set forth in the Chesapeake Bay Preservation Act and all requirements related thereto for localities eligible under §15.2-7600 (Rural Coastal Virginia Community Enhancement Authority)[5]. Pump-out and inspection shall not be performed by the Department. The goal of this legislation is for the Department to assume the responsibilities of the localities under the Chesapeake Bay Act in the Rural Coastal Virginia Community Enhancement Authority."*

With support for such a change in septic program administration already advocated by two local government staff members in PD 16, it is conceivable that local delegates may be persuaded to seek amendment of Del. Hodges' bill to broaden its areal extent to include some or all of PD 16 (and beyond). However, even if all septic administration at the local level is turned over eventually to VDH for all the localities under the CBPA, there would still be need for and value in better coordination between local government, licensed OSS operators and VDH. The need for this continued and enhanced coordination is to help maintain septic permit records with information updates for events that may occur after the original permit is issued. Such events include, but may not be limited to:

- Local assignment of a permanent address different than any temporary address used on the permit,
- The transference of the permit, under a certification letter, to a new property owner,
- A subdivision of a parcel referenced by an older tax map number on the permit,
- A connection of a property with a conventional septic system to a public or community sewer system,
- A local re-definition of the CBPA RPA and RMA areas, (thereby affecting the properties subject to the CBPA pump-out requirement) and/or

[5] ***§ 15.2-7600. Authority created; name.***

The Rural Coastal Virginia Community Enhancement Authority, hereinafter referred to as the Authority, is created as a body politic and corporate, a political subdivision of the Commonwealth. As such it shall have, and is hereby vested with, the powers and duties hereinafter conferred in this chapter. The Authority, if approved by the respective governing bodies, may consist of up to 12 of the counties within the Northern Neck, Middle Peninsula, and Accomack-Northampton planning districts as follows: Accomack, Essex, Gloucester, King and Queen, King William, Lancaster, Mathews, Middlesex, Northampton, Northumberland, Richmond, and Westmoreland.

- An onsite conventional system retro-fit to add a qualifying plastic filter.

VDH is currently working on a replacement system to the **V**irginia **EN**ironmental **I**nformation **S**ystem (**VENIS**) which was developed for the public posting of operation and maintenance (O&M) data for alternative onsite sewage systems (AOSS) and alternative discharging sewage systems (ADSS). The source of these data are private sector operators who submit required reports to VDH. Use of the VENIS database is limited to VDH personnel, consequently, sharing the data requires extraction from VENIS, and converting and reposting it in a location and format that is accessible to stakeholders. However, the data conversion process does nothing to standardize or correct incomplete or erroneous data taken from the O&M reports, including (but not limited to):

- Incomplete or misspelled street addresses
- Missing zip code information
- Missing or inaccurate locality identification
- Missing treatment system type description

Recognizing the problems and limitations of the existing VENIS software, VDH is developing a replacement system[6] for AOSS O & M data reporting which contemplates:

- Conversion to the new system in April, 2019 and discontinuing use of VENIS as of that date.

- Transferring legacy VENIS data to the new system, with some automated, batch edits to partially clean up old data.

- Implementing measures to help standardize data for key fields and auto-populating some fields based on the input of certain key data fields.

- Adding map coordinates to the data record and adding a hyper-link to allow the location and viewing of the property on Google Maps.

- Providing user training in the VDH district and local offices to explain the system changes and the importance of basic data standardization, while recognizing the need for some system flexibility at the district level for some data prioritization and certain data reporting more important at the district and local levels.

[6] Source: RDS, LLC telephone interview with VDH –OEHS Data Management Director Sonal Iyer, 12/11/2018.

Profile of PD 16 Locality Wastewater Management, By Locality

In order to develop a full profile of the number and location of onsite wastewater systems (vs. properties connected to public or private sewer systems), project researchers assembled various address or tax parcel lists from the regional health district (RAHD) and local governments. The methodology of processing these files, containing almost 500,000 records, is summarized in Appendix B.

City of Fredericksburg

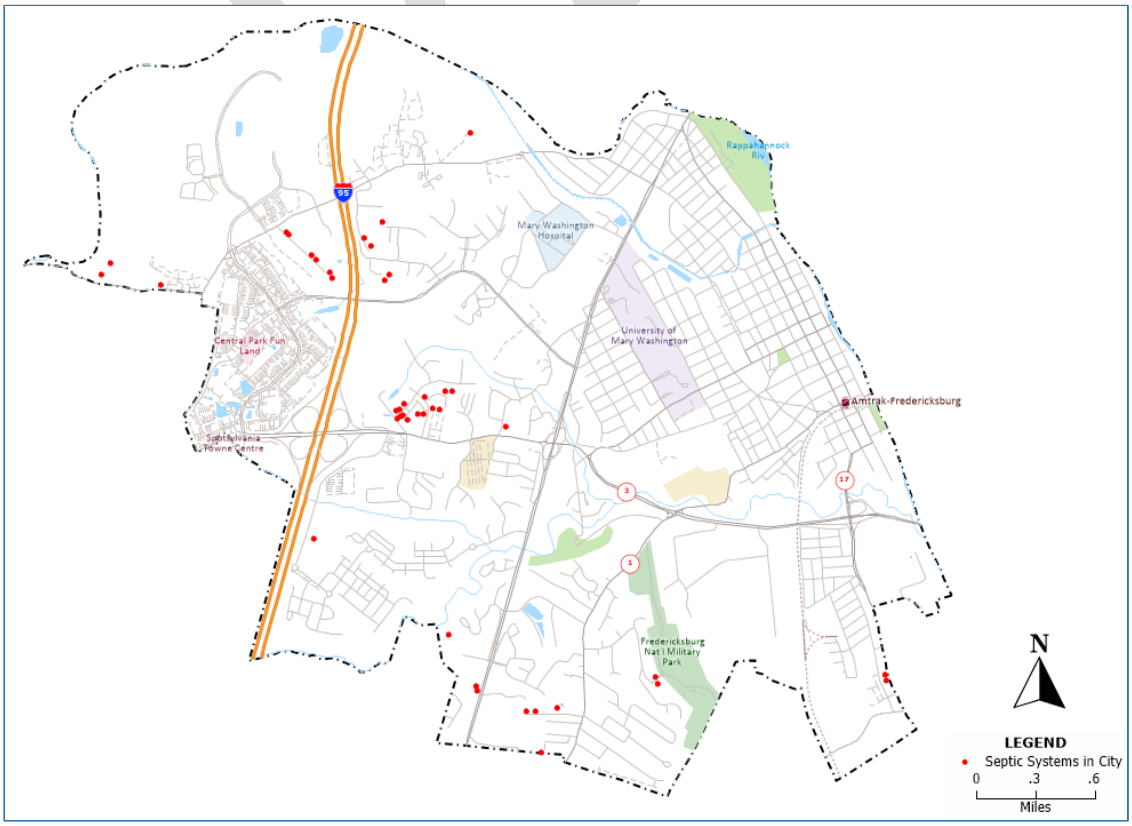
The City, designated under the EPA's MS-4 program, has the lowest number of septic-served properties in the region, reporting only 42 properties in the City still served by a septic system, with the remaining improved properties all connected to the City sewer system (see Figure 3). A review of the City's pump-out notification history and voluntary property owner responses shows a 23.8 percent compliance rate (based on 20% annual average of locality total) with the 5-year pump-out requirement.

Table 2. Comparative Onsite Wastewater Data, for Fredericksburg City, 2017

Wastewater Management System Indicator	No. of Properties
Total Improved Property Addresses	**9,272**
# on Sewer	9,230
# on Conventional Septic or Alternative Onsite Wastewater	42
2017 Total Eligible Septic Systems	42
2017 Septic Pump-Outs Reported to DEQ-CBLAD	37
2017 Onsite O & M Records Reported by VDH	3
2017 Septic Pump-Outs Reported in Chesapeake Bay CAST model	0
2017 Pump-Out Notice Address List (Total Records)	42
2017 Actual Inspections or Pump-outs Reported to Locality	2
2017 Actual Pump-Outs as Percent of 20% of Total Septic Inventory	23.81%

Source: Compiled by RDS, LLC from DEQ-CBLAD, VDH and local sources.

Figure 3. Septic Properties in City of Fredericksburg, 2017



Caroline County

In contrast to the City of Fredericksburg where there are relatively few, but well-known, property locations on septic systems; the challenge in Caroline County is differentiating between the comparatively small number (172) of properties that, due to their location in the County's designated Chesapeake Bay Preservation Area, are notified of and comply with the 5-year septic pump-out requirement (reporting their actions to the County) and accounting for the remaining number of properties throughout the County which may, without County notice or prompting, voluntarily arrange septic pump-out service as needed each year without notifying the County (see Figure 4).

However, Caroline County is unique in the region in that the County wastewater treatment plant maintains a wastewater tank manifest which catalogs the date and operator name of every septic effluent pump truck that arrives to discharge a tank load (typically 1,000-2,000 gallons), and the customer name and address served by the truck prior to its arrival at the treatment plant. In light of the significant distance involved to haul pumped tank loads anywhere else and the lack of any alternative, designated legal disposal location in the County, it is assumed that the manifest represents a significant percentage of, if not all, pump-out jobs performed in the County. This database was found to represent a far more comprehensive picture of septic maintenance activities throughout the County than just the septic pump-out notification list. The latter represents all addresses in the Town of Port Royal and the remaining properties effected by the County's limited definition of the CBPA RPA, where 5-year septic system inspections or pump-outs are mandatory. As such, the manifest history is presumed to provide a closer approximation of the locality-wide pump-out compliance response reported by the other counties in the Region.

Table 3. Comparative Onsite Wastewater Data for Caroline County, 2017

Wastewater Management System Indicator	No. of Properties
Total Improved Property Addresses	12,163
Properties on Sewer (estimated, includes both County & Bowling Green WWTP & Dawn)	2,352
Properties on Conventional Septic System	9,621
Properties on Alternative Onsite Sewage System	190
2017 Total Eligible Septic	9,621
2017 Septic Pump-Outs Reported to DEQ-CBLAD	88
2017 Onsite O & M Records Reported by VDH with Unique Address & Unique Service Date	260
2017 Septic Pump-Outs Reported in Chesapeake Bay CAST model	20
2017 Pump-Out Notice Address List (Total Records)	242
2017 Pump-outs Reported on County WWTP Pumper Manifest Log	756
2017 Actual Inspections or Pump-outs Reported to Locality	28
2017 Actual Pump-Outs as Percent of 20% of Locality Notification Inventory	58.3%

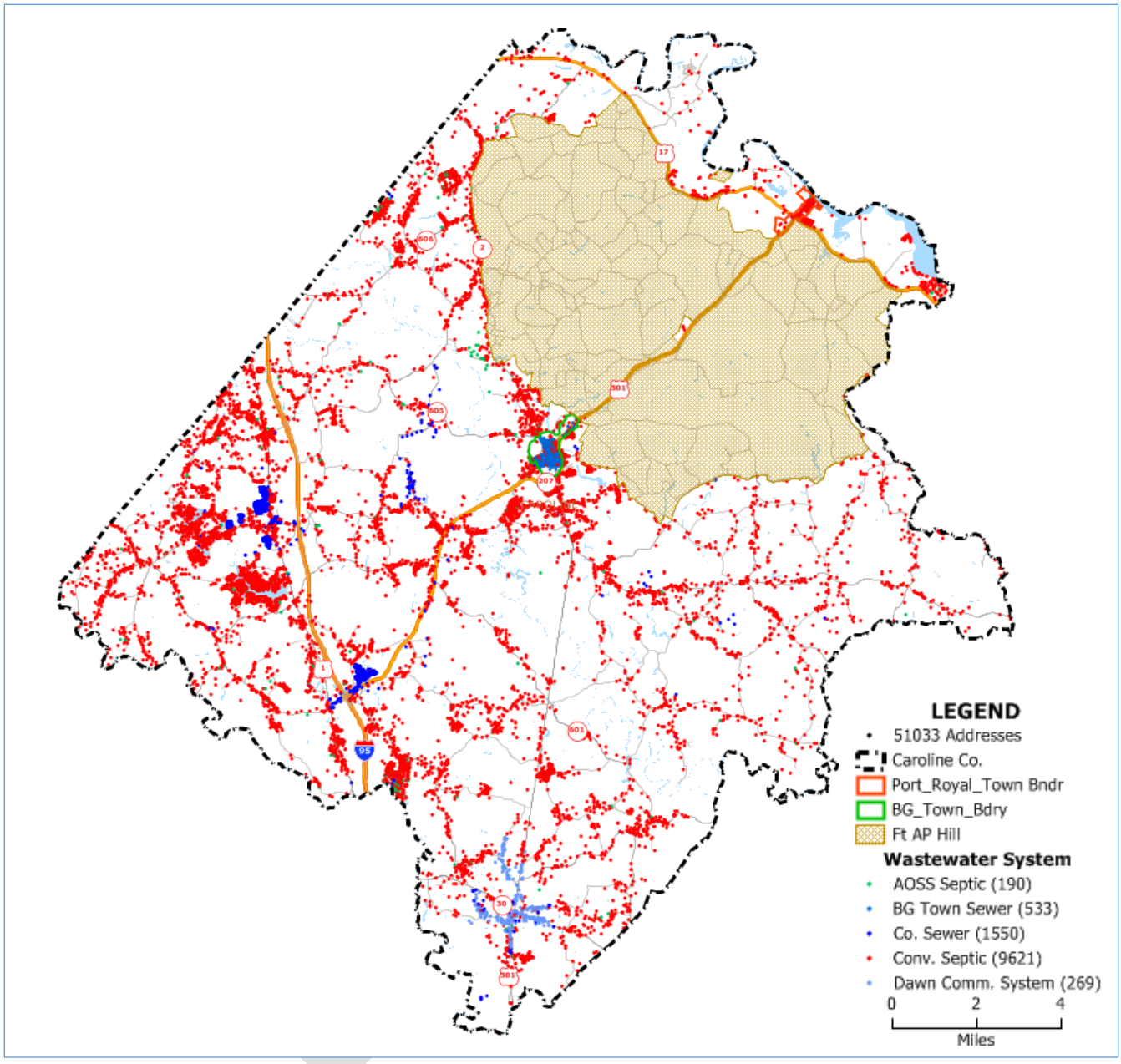
Source: Compiled by RDS, LLC from DEQ-CBLAD, VDH and local sources.

Closer examination of the addresses found on the 2017 WWTP pumper truck manifest helped determine the total number of properties that were subject to and complied with the pump-out requirement even though they may not have notified the County of the septic service performed on their property that year. Of the 242 property addresses on the County RPA pump-out notification list, 177 of the addresses where found on the County's WWTP pumper manifest list as having been served in 2017, representing a 73.14 percent compliance rate within the County's defined RPA area, in contrast to the 28 properties that responded to the County pump-out notification by returning to the County some documentation of their compliance.

As of June, 2018 there were a total of 1,850 unique onsite sewage system properties in Caroline County reported through VDH's VENIS Operating and Maintenance database. Among the 177 unique property addresses included in the 2017 WWTP pumper manifest, the majority of systems served (160 properties, or 90.39 percent of those listed) are believed to be conventional onsite sewage systems (COSS), with only 17

alternative onsite sewage systems (AOSS) reporting O & M service which resulted in sewage effluent dumped at the County WWTP.

Figure 4. CAROLINE COUNTY WASTEWATER TREATMENT



King George County

King George County has three primary forms of wastewater treatment: a) a small County-operated wastewater treatment plant and sewer system, b) the wastewater treatment plant and sewer system operated by the federal Naval Surface Weapons Center-Dahlgren, and c) onsite sewage systems (both COSS and AOSS) (see Figure 5). All structures within the perimeter of NSWC-Dahlgren were presumed to be connected to the naval base's WWTP. Any other structure addresses not found in the sewer account customer list provided by the King George Sanitation Authority were assumed to be served by an onsite system of some kind. Table 4 provides a profile of King George County's wastewater treatment situation.

Table 4. Comparative Onsite Wastewater Data for King George County, 2017

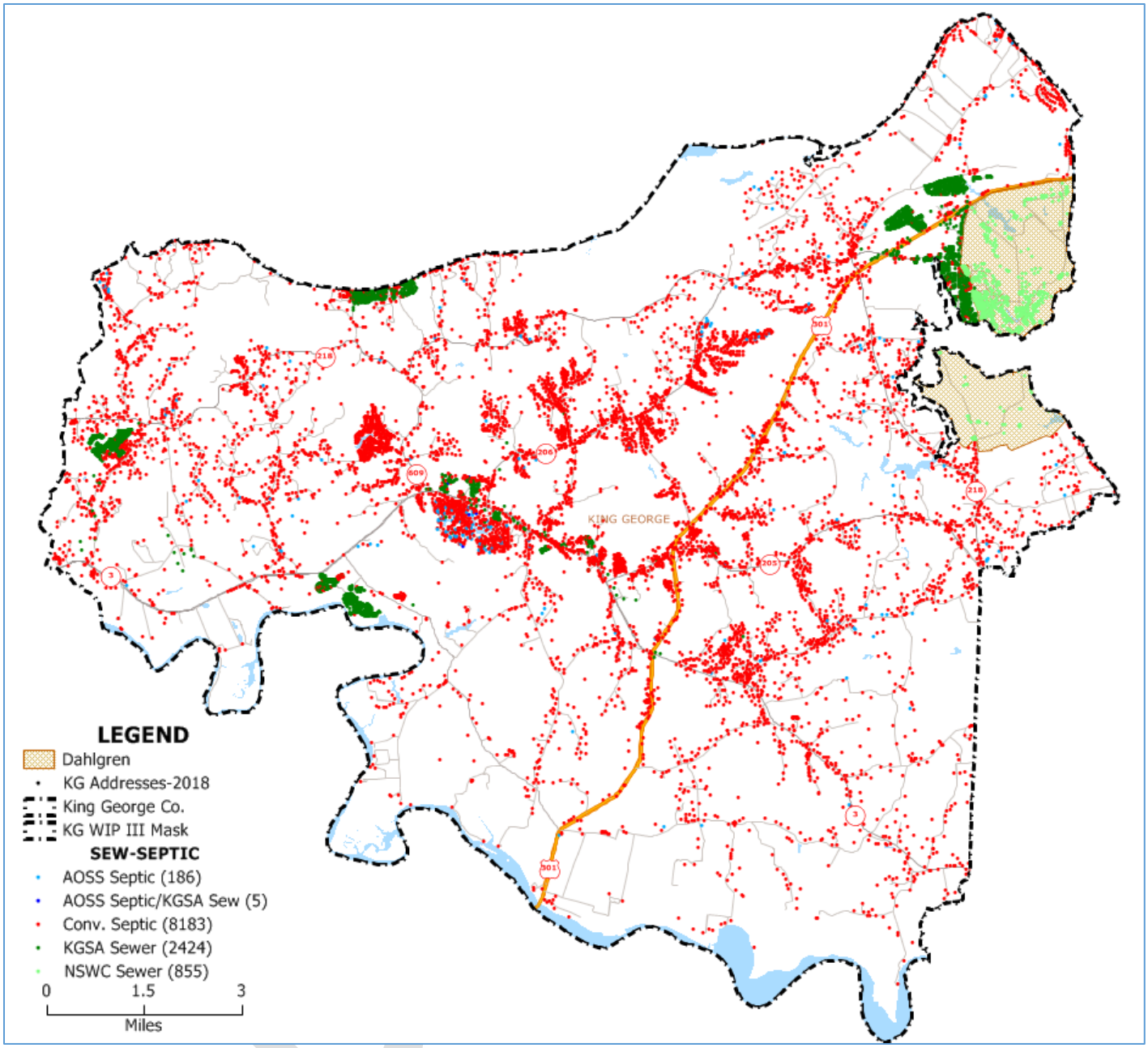
Wastewater Management System Indicator	**No. of Properties**
Total Improved Property Addresses	**11,653**
Number of Properties on County or Private *(i.e. NSWC-Dahlgren)* Sewer	3,279
Number of Properties on Alternative Onsite Sewage System	186
Number of Properties on Conventional Septic System	8,183
2017 Total Eligible Septic	8,183
2017 Septic Pump-Outs Reported to DEQ-CBLAD	303
2017 AOSS O & M Records Reported by VDH	194
2017 Septic Pump-Outs Reported in Chesapeake Bay CAST model	17
2017 Pump-Out Notice Address List (Total Records)	6,115
2017 Actual Inspections or Pump-outs Reported to Locality	427
2017 Actual Reported Pump-Outs as Percent of Total 923 Notifications	46.26%

Researchers compared the master address list of 6,115 improved properties provided by the County with the list of addresses of those properties that had confirmed (and provided a receipt for) performing a septic tank system inspection or pump-out in 2017. There were 923 notification reminders sent out in 2017, the actual number of confirmed responses (427) represents a 46.26 percent compliance rate for 2017. However, considering the number of notifications returned from vacant properties, the actual compliance rate is nearly 49 percent. The 133 VDH OSS O&M records for King George County reported in 2016 or 2017 involved service to some type of alternative OSS.

Table 5. Summary of King George County Septic Pump-Out Notification & System Service Response

Year Septic System Serviced	**Issuance Year of CBPA Septic Pump-Out Notification Letters**											
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018 YTD**	**Unknown**	**Grand Total**
Unknown	2	22	17		3	241	151	68	198	2	41	745
1905										1		1
1944							1					1
2004										1		1
2005		2				5	1			1		9
2006			3			7	6			8		24
2007		5	3			20	15		1			44
2008		1	2			22	13		12	3		53
2009	13	30	14	1		3	11	3	8	1	613	697
2010		52	13			20	66	1	23	5	20	200
2011	1	10	225	2	1	23	26		28	12	1	329
2012		13	14	855	1	37	34	5	5	18	1	983
2013		10	3	69	321	52	60	7	18	1	3	544
2014		7	6	8	5	429	83	18	41	4	3	604
2015		5	2	12	1	33	668	24	67	4		816
2016		10	20	15	6	3	20	129	99	14		316
2017		6	7	56	5	4	4	8	434	17		541
2018		2	9	13	7	2	2		17	60		112
No Response							1			94		95
Grand Total	**16**	**175**	**338**	**1,031**	**350**	**901**	**1,162**	**263**	**951**	**246**	**682**	**6,115**

Figure 3. King George County Wastewater Treatment



Spotsylvania County

Improved properties in Spotsylvania County are either connected to public sewer (about 55.4 percent) or private onsite sewage systems (about 44.6 percent). This breakdown is based on matching a list of all properties connected to County sewer (provided by the County Utilities Department) with the County master address list for all improved properties maintained by the County GIS Department. Additionally, for further validation, the address list (coded with sewer connections) was matched against an inventory provided by the County Real Estate Assessment office which coded all parcels connected to either County water or County sewer. Finally, the Code Compliance Office provided a list of tax parcel numbers for properties assumed to be served by septic from their master septic pump-out notification database. This list was found to contain 119 properties which are served by County sewer.

It is noteworthy that Spotsylvania's Code Compliance Office declined multiple requests (both for this study and the concurrent Mattaponi Bacteria TMDL study) to provide the actual septic pump-out notification address list and corresponding pump-out history documented by property owners' response to the pump-out notification. County staff would not release the number of completed pump-outs reported for 2017, but indicated that 20 percent of the notification list was contacted each year. As shown below in Table 6, the number of pump-outs reported for 2017 to VDEQ's Chesapeake Bay Local Assistance Division was 3,392. If this number is accurate it represents an impossible 104 percent compliance by the 20 percent of property addresses which allegedly received notification from the County's master list of 16,176 addresses (which was found to contain 119 addresses on County sewer).

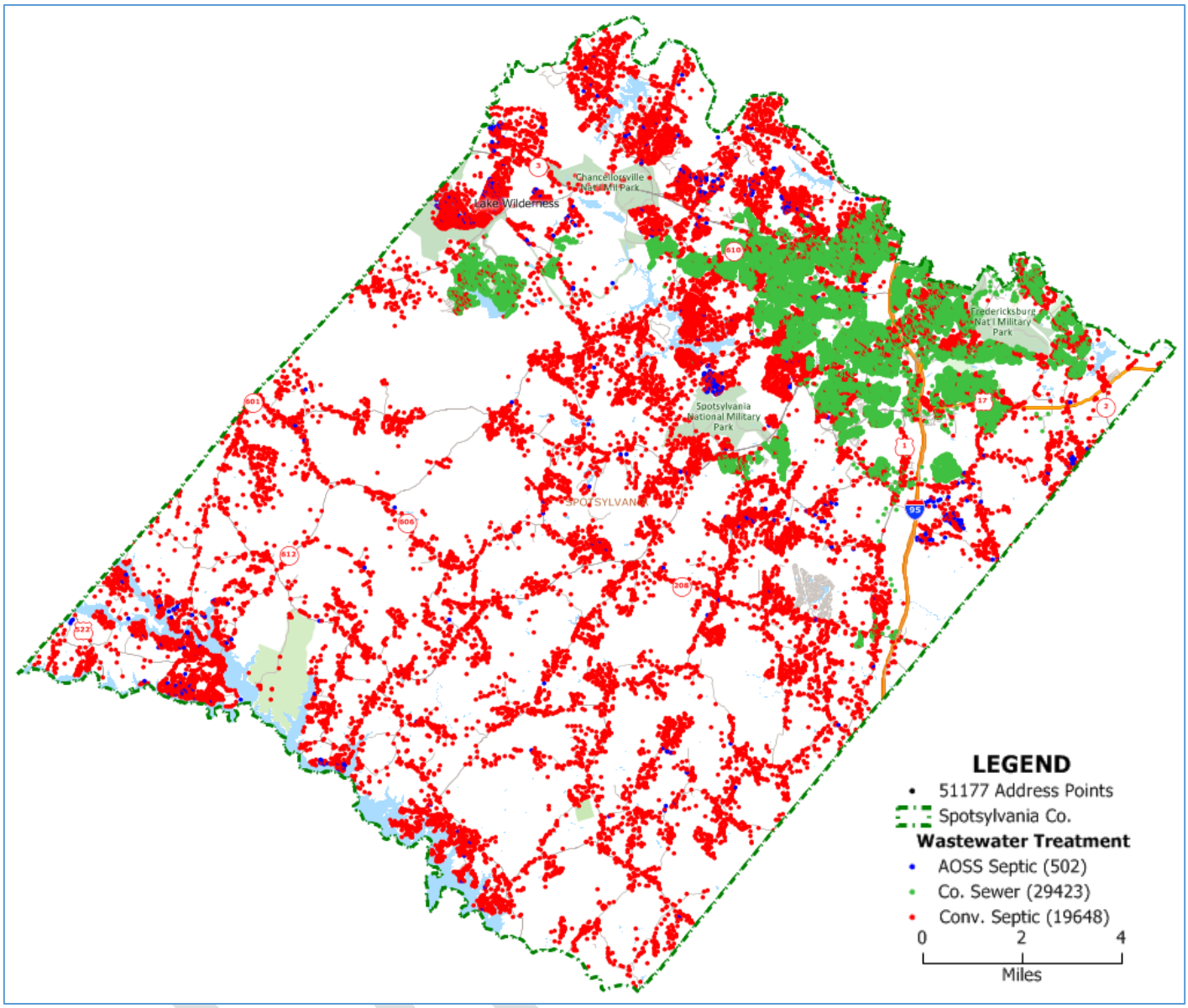
When asked for the reason that the County could not release their septic pump-out notification address list and pump-out history, researchers were told that the release would violate their license agreement for the Carmody Software[7] data management program that the County uses to generate notification mailings and to record responses received. It is unfortunate that the County is unwilling to share this public data so that analysis of the non-response pattern (i.e. properties that received notification but did not follow-up with the County with evidence of a completed system inspection or pump-out) could help identify areas where additional educational and/or promotional efforts and/or incentives (e.g. for low-income households) could leverage a higher number of completed system inspections and pump-outs.

Table 6. Comparative Onsite Wastewater Data for Spotsylvania County, 2017

Wastewater Management System Indicator	**No. of Properties**
Total Improved Property Addresses	49,573
Number of Properties on County Sewer	29,423
Number of Properties on Alternative Onsite Sewage System	502
Number of Properties on Conventional Septic System	19,648
2017 Total Eligible Septic Properties (within 5 year pump cycle)	19,648
2017 Septic Pump-Outs Reported to DEQ-CBLAD by County	3,392
2018 Unique Onsite O & M Records Reported by VDH	502
2017 Septic Pump-Outs Reported in Chesapeake Bay CAST model	48
2017 Pump-Out Notice Address List (Total Records)	16,176
2017 Actual Inspections or Pump-outs Reported to Locality	Not Provided
2017 Actual Reported Pump-Outs as Percent of 20% of Locality Notification Inventory	Undeterminable

[7] Project researchers contacted and spoke with Carmody Software President Scott Carmody on several occasions and were advised that the company had no objection to the County sharing data exported from their proprietary system in a generic Excel format. In fact, this export function is built into the data management program and was used by the County to generate the list of tax parcel identification numbers associated with each record in the system which was provided ultimately as a partial response to the project data request. Researchers have asked Mr. Carmody to notify the County of their corporate authorization to release the data, but whether this communication and authorization of data release ever occurred is unknown. Given the nature of the County's responses to earlier requests, researchers did not push the issue further with a FOIA request.

Figure 4 Spotsylvania County Wastewater Treatment



Stafford County

Improved properties in Stafford County[8] are either connected to public sewer (about 60.2 percent) or private onsite sewage systems (about 38.3 percent, see Table 8 below and Figure 7). This breakdown is based on matching a list of all properties connected to the County sewer system (provided by County Utilities Department) with the County master address list for all improved properties maintained by the County GIS Dept.

Stafford has divided the County into 5 notification areas and each year sends a pump-out reminder notification to all the properties in one of these areas, so that within 5 years all properties receive a CBPA compliance notification. Based on the completed number of pump-outs which occurred in calendar year 2017 that were reported to CBLAD, the County's 2017 estimated overall compliance rate is 62.28 percent, based on using 20 percent of the County's total notification list. However, for 2017, there were 2,014 completed system inspections or pump-outs from a specific notification list of 2,347 property addresses, representing an actual compliance rate last year of 85.8 percent, the highest in the PD 16 study area. A year-by-year breakdown of the number of pump-out notices and the resulting service response is shown in Table 7.

Table 7. Summary of Stafford County Septic Pump-Out Notification & System Service Response

Septic System	Issuance Year of CBPA Pump-Out Notification Letter								
Year Serviced	**2008**	**2009**	**2013**	**2014**	**2015**	**2016**	**2017**	**Unknown**	**Grand Total**
2008	1								1
2009	14	1							15
2013			1,443					2	1,445
2014			613	926				1	1,540
2015			5	779	1,184			15	1,983
2016			1	6	624	1,121		32	1,784
2017			1		10	1,067	460	29	1,567
2018			2	2		10	1,567	43	1,624
Unknown			198	153	184	190	341	300	1,366
Grand Total	15	1	2,263	1,866	2,002	2,388	2,368	422	11,325

Table 8. Comparative Onsite Wastewater Data for Stafford County, 2017

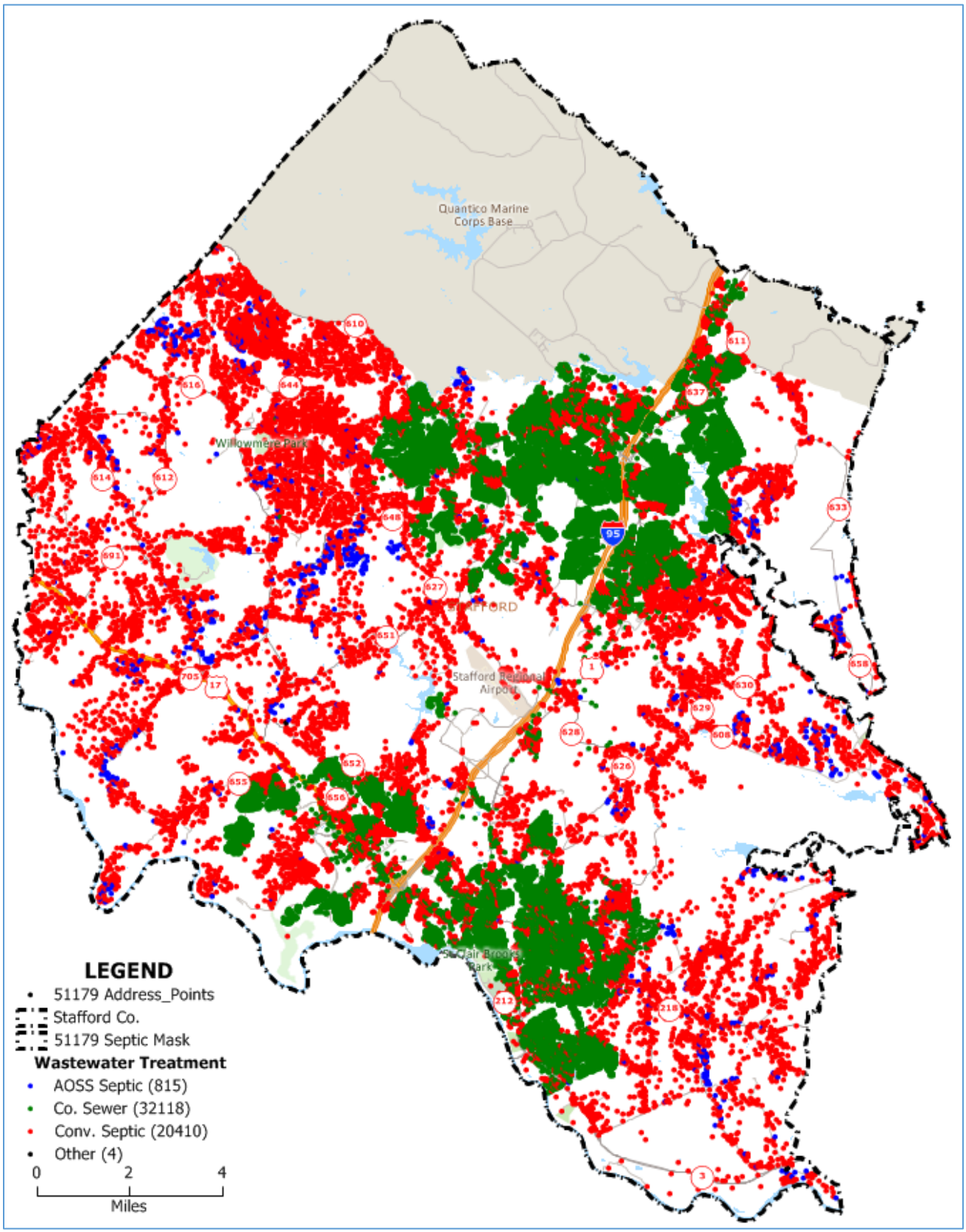
Wastewater Management System Indicator	**No. of Properties**
Total Improved Property Addresses	53,343
Number of Properties on County or Private Sewer	32,118
Number of Properties on Alternative Onsite Sewage System	815
Number of Properties on Conventional Septic System	19,648
2017 Total Eligible Septic	19,648
2017 Septic Pump-Outs Reported to DEQ-CBLAD	2,211
2018 AOSS O & M Records Reported by VDH	872
2017 Septic Pump-Outs Reported in Chesapeake Bay CAST model	33
2017 Pump-Out Notice Address List (Total Records)	2,347
2017 Actual Inspections or Pump-outs Reported to Locality	2,014
2017 Actual Reported Pump-Outs as Percent of 20% of Locality Notification Inventory	62.28%

Stafford County has instituted a limited public assistance program for onsite waste management, referred to as the County's "Pump & Haul" program. Through this program, residents unable to cover the cost of private septic system services can apply to the County to be included in this public assistance program which requires

[8] This analysis does not include properties within the boundaries of US Marine Corps Base-Quantico.

the County Board of Supervisors approval of each property application. There are currently 17 properties in the County served by the "Pump & Haul Program".

Figure 5 Stafford County Wastewater Treatment



Onsite Sewage Treatment Systems and BMP Opportunities

The Chesapeake Bay TMDL water quality modelling for the WIP III process is driven by inputs summarized in the Chesapeake Assessment Scenario Tool (CAST) model. The "baseline" for the next model run is 2017 as the mid-point of the 2010-2025 TMDL plan implementation period. The CAST model contains a dataset of Best Management Practices ("BMPs") recognized by the model which can positively affect water quality by reducing pollutant loadings of Nitrogen (N), Phosphorus (P) and Sediment (S). For this study, the focus of attention is on the suite of "septic sector" BMPs or onsite wastewater treatment practices which can, along with all the other BMPs available, improve Chesapeake Bay water quality.

Correcting 2017 Base Year Data

		2017 CAST DATA					
LAPG BMPs	Unit	Caroline	Fredericksburg City	King George	Spotsylvania	Stafford	**PD16**
Septic Pumping	**systems**	**20**	**-**	**17**	**48**	**33**	**118**
Septic Denitrification-Conventional	systems	18	-	52	85	191	345
Septic Connection	systems	1	-	5	2	5	13
Septic Secondary Treatment Conventional	systems	55	-	121	166	242	584
Septic Secondary Treatment Enhanced	systems	2	-	1	8	11	22
Septic Denitrification-Enhanced	systems	3		1	5	2	12
Septic Effluent - Enhanced	systems	0		1	1	1	3

Source: VDEQ, CAST, "Best Data Available"

		2017 CAST DATA: **CORRECTION**					
LAPG BMPs	Unit	Caroline	Fredericksburg City	King George	Spotsylvania	Stafford	**PD16**
1. Septic Pumping	**systems**	**756[1]**	**2[2]**	**656[3]**	**3,392[4]**	**2,211[5]**	**6,831**
2. Septic Denitrification-Conventional (i.e. AOSS)	**systems**	**460[6]**	**-**	**194[6]**	**670[6]**	**872[6]**	**2,195**
~~3. Septic Connection~~	~~systems~~	~~1~~	~~-~~	~~5~~	~~2~~	~~5~~	~~13~~
~~4. Septic Secondary Treatment Conventional~~	~~systems~~	~~55~~	~~-~~	~~121~~	~~166~~	~~242~~	~~584~~
~~5. Septic Secondary Treatment Enhanced~~	~~systems~~	~~2~~	~~-~~	~~1~~	~~8~~	~~11~~	~~22~~
~~6. Septic Denitrification-Enhanced~~	~~systems~~	~~3~~		~~1~~	~~5~~	~~2~~	~~12~~
~~7. Septic Effluent - Enhanced~~	~~systems~~	~~0~~		~~1~~	~~1~~	~~1~~	~~3~~

Septic Pumping & Denitrification Correction Data Sources:

1. Caroline County WWTP Wastewater Pump Trunk Manifest, Dept. of Public Utilities, 2018. Staff Contact: David Nunnally, Planning Dept.
2. City of Fredericksburg, Planning Services Division, Community Planning & Building Department, 2018. Staff Contact: Kevin Utt
3. King George County, Department of Community Development, 2018. Pump-out Notification & Response Summary. Staff Contact: Brad Hudson
4. VDEQ, CBLAD Section, Daniel Moore, Staff Liaison to Spotsylvania County for CBPA compliance.
5. Stafford County, Dept. of Public Works, 2018. Staff Contact: Paul Santay.
6. Local VDH AOSS O & M Data Base, provide by Brent McCord, RAHD, and processed by RDS, LLC.

The correction of the Septic Pumping BMP data reported in CAST represents an increase of 6,713 system pump-outs in 2017 over the erroneous 118 pump-outs reported for the region in the CAST system[9]. **Significantly, recent (2017) septic system inspection/pump-outs efforts last year represent 94.66 percent of the region's target for 2025 under the Chesapeake Bay WIP II program.**

[9] If VDEQ had used the data reported by localities to VDEQ's CBPA local assistance division, the regional total shown in CAST would have been 6,031 pump-outs. While lower than the best data available, the CBLAD data would have provided a much closer approximation of 2017 pump-out activity.

For the other listed Septic Sector BMPs (i.e. # 3 – 7), researchers have been unable to find any source that provides a means to tally other performed septic services as described. Consequently, it is recommended that these undocumented and unverified BMPs be deleted from the BMP input deck as shown in the previous page.

In 2011, VDH began using the Virginia Environmental Information System (VENIS) to collect and catalog annual operating and maintenance service performed on alternative onsite sewage systems (AOSS). The VENIS data document a total of 9,608 unique alternative onsite sewage systems throughout the Region. A breakdown of the systems in use throughout the Region, by type of treatment system, is presented in Table 9. Upon consulting the VDH-RAHD environmental health manager, it was determined that all of these systems provide some level of denitrification over conventional systems and can be reported in the CAST program as an additional correction to the BMP input deck. The net change to the other septic sector BMPs represents a net increase of 274 AOSS systems throughout the Region to be reported in CAST.

The regional Health District Environmental Manager provided a file of all Alternative Onsite Sewage System Operating and Maintenance (O&M) Records received by the District from 2011 through Nov 15, 2018 which contained 10,391 O&M records throughout the District. This file was enhanced to standardize the addresses on all O&M records and all records were correctly coded for the locality associated with the address. Using the Excel Pivot Table function, a list of unique addresses in each locality was developed and tabulated. Without detailed knowledge of the type of system and specific system design, the aggregate number of unique AOSS properties in each county was used to replace the CAST values for the "**Septic Denitrification-Conventional"** BMP per the guidance in the CAST BMP definitions.

Table 9. PD 16 O&M Data: Alternative OSS Treatment Systems (2011- 2nd Qtr. 2018)

System Type	Caroline Co.	King George Co.	Spotsylvania Co.	Stafford Co.	PD 16 Total
Advanced Septic			3		**3**
Aerotech				2	**2**
Aqua Safe ATU			1	3	**4**
Aquarobic Mini Plant	4				**4**
Best 1			5	35	**40**
Bio Barrier	2	1	11	8	**22**
Biomicrobics MicroFAST	91	60	319	269	**739**
Bionest			1	4	**5**
Clearstream	12	15	4	24	**55**
Clearstream ATU	4	3	5	24	**36**
Delta Environmental Products, DF Series	2		26	18	**46**
Ecoflo	24	92	33	58	**207**
EcoPod	13	21	347	115	**496**
Enviro-Flo			3		**3**
EZ Treat Sandfilter	14	5	27	37	**83**
Hoot			51	25	**76**
Microfast	3				**3**
Multiflo FTB	1	4	13		**18**
None	89	137	429	358	**1,013**
Norweco Singulair ATU	16	12	18	12	**58**
Orenco Advantex	740	219	945	1,532	**3,436**
Puraflo	140	139	393	882	**1,554**

System Type	Caroline Co.	King George Co.	Spotsylvania Co.	Stafford Co.	PD 16 Total
Septic Tank Only	666	117	446	248	**1,477**
Unspecified	31	24	102	63	**220**
Whitewater ATU			4	4	**8**
Grand Total	**1,852**	**849**	**3,186**	**3,721**	**9,608**

Note: The above record count tally of unique treatment system types and locality summarizes multiple service records at common addresses on different service dates. These address-level data are available online in Excel spreadsheet form on a quarterly and annual basis.

Projecting 2025 Septic Pump-Out Targets and BMP Goals

The CAST model provides a projection (source unknown) of the number of available septic systems in each locality (and the region as a whole) which could be targeted for additional BMP actions in the septic sector. From Table 10, it is obvious that the current estimated number of onsite systems in each locality and the region exceed the target number for WIP 2 program implementation. Moreover, the future targets for 2025 pump-outs and other BMP actions fail to take into consideration the natural increase to the onsite sewage system inventory associated with continued population and economic growth in the study area from 2017 through 2025.

Table 10. WIP 2 Forecast of Septic Systems Available for Septic Sector BMP Actions

	2025 Available					
LAPG BMPs	**Caroline**	**Fredericksburg City**	**King George**	**Spotsylvania**	**Stafford**	**PD16**
Septic Pumping	**9,939**	**18**	**7,631**	**15,690**	**12,621**	**45,899**
Septic Denitrification-Conventional	9,939	18	7,631	15,690	12,621	45,899
Septic Connection	10,952	20	8,408	18,046	13,904	51,331
Septic Secondary Treatment Conventional	9,939	18	7,631	15,690	12,621	45,899
Septic Secondary Treatment Enhanced	9,939	18	7,631	15,690	12,621	45,899
Septic Denitrification-Enhanced	9,939		7,631	15,690	12,621	45,881
Septic Effluent - Enhanced	9,939		7,631	15,690	12,621	45,881
CURRENT ONSITE SYSTEMS TOTAL	**10,186**	**42**	**8,399**	**22,099**	**21,224**	**61,950**

Summarizing previous analysis (see Table 1) below, the PD 16/RAHD service area has averaged over 834 newly-issued septic permits each year over the last 8 years. This growth factor is not reflected in the WIP 2 calculations of systems available in 2025 for septic sector BMP actions.

Permit Issuance Trend	Onsite Sewage System Permits Issued, 2010-2017					
	Caroline	Fredericksburg City	King George	Spotsylvania	Stafford	PD 16 TOTAL
Post-Recession 8 Year Total	1,509	0	370	2,436	2,353	6,668
Post-Recession 8 Yr. Annual Average	189	0	46	305	294	834

With eight more years of household and business growth (with corresponding growth in issued septic permits), the future target number of available onsite sewage systems for BMP actions is significantly higher (see Table 10). The projection for target systems also needs to consider the relative number (or percent) of permits which are conventional septic vs. alternative onsite sewage systems since the latter are subject to

annual O&M service. Moreover, there is a time lag between the issuance of a septic permit and the actual construction and occupancy of a residence or commercial property.

Considering these circumstances the total potential increase of systems available for BMP application is reduced by a factor of 50 percent to account for:

- newer systems installed between 2021 and 2025 which would not yet be subject to the CBPA 5-year pump-out requirements, or
- those installations that represent alternative systems which, by law, are subject to annual inspection and maintenance contracts and/or may not require routine pump-outs, and
- the inevitable lag time between septic permit issuance and the final construction and occupancy of the building served by the onsite septic system.

Since Alternative OSS installations are not subject to the 5 year pump-out schedule, the relative number and percentage of AOSS installations as compared to conventional septic properties is a factor that affects the growth in the number of target conventional systems subject to the 5-year pump-out requirement (see Table 11). For WIP III forecasting purposes, the recent 2-year average share of AOSS installations to total septic permits issued in each locality will be used to discount the projection of total additional conventional septic systems for 2025 shown in Table 11.

Table 11. VDH Septic Permits Issued; AOSS as Share of Total, 2016-2017

Septic Permits	Caroline	King George	Spotsylvania	Stafford	Total
2016					
AOSS Installations	26	5	45	37	113
Total Permits Issued	255	128	524	387	1294
AOSS Pct. of Total	**10.20%**	**3.91%**	**8.59%**	**9.56%**	**8.73%**
2017					
AOSS Installations	26	14	8	51	99
Total Permits Issued	214	146	130	456	946
AOSS Pct. of Total	**12.15%**	**9.59%**	**6.15%**	**11.18%**	**10.47%**
2- Year Average					
AOSS Installations	52	19	53	88	212
Total Permits Issued	469	274	654	843	2240
AOSS Pct. of Total	**11.09%**	**6.93%**	**8.10%**	**10.44%**	**9.46%**

Source: Compiled by RDS, LLC based on VDH Septic Permits Issued History and VDH VENIS O & M Data.

The final forecast of available septic systems in 2025 throughout the Region is presented in Table 12 and the two WIP III goal scenarios for BMP actions in the Septic Sector are presented in Table 13. While maintaining the status quo would exceed the WIP 2 goals for the region, it is believed that a more aggressive program, supported by Virginia and federal cost share funding assistance from the WQIF and local TMDL funding, will not only enhance Chesapeake Bay water quality, but help address the bacteria impairments of many local streams throughout the region.

Table 12. 2025 Forecast of Available Septic Systems for BMP Actions

	2025 Available COSS & AOSS					
LAPG BMPs for Onsite Sewage Systems (OSS)	Caroline	Fredericks-burg City	King George	Spotsylvania	Stafford	**PD16**
Septic Pumping (under WIP 2)	**9,939**	**18**	**7,631**	**15,690**	**12,621**	**45,899**
CURRENT ONSITE SEPTIC SYSTEMS TOTAL	**10,186**	**42**	**8,399**	**22,099**	**21,224**	**61,950**
Estimated Total Conventional Onsite Septic Systems (COSS)	**8,336**	**42**	**7,550**	**18,914**	**17,503**	**52,345**
Estimated Total Alternative Onsite Sewage Systems (AOSS) (Septic Denitrification)	**1,850**	**0**	**849**	**3,185**	**3,721**	**9,605**
Overall AOSS Percent of Total Septic Systems	**18.16%**	**0.00%**	**10.11%**	**14.41%**	**17.53%**	**15.50%**
Annual Average Septic Permits Issued, 2010-2017	190	0	50	305	295	2,160
AOSS Installations as Percent of Total Permits Issued, 2016 - 2017 Average	11.08%	0.00%	6.90%	8.01%	10.44%	
Projected Total Septic Permits To Be Issued, 2018-2025	1,520	0	400	2,440	2,360	6,720
Projected COSS Permits To Be Issued, 2018-2025	1,352	0	372	2,245	2,114	6,082
Projected AOSS Permits To Be Issued, 2018-2025	168	0	28	195	246	638
50% Discount Factor for New COSS less than 5 years old, not yet needing Pump-outs	676	0	186	1,122	1,057	**638**
Projected 2025 COSS for 5-year septic pumping	**9,012**	**42**	**7,736**	**20,036**	**18,560**	**65,315**
Projected 2025 AOSS (Septic Denitrification)	**2,018**	**0**	**877**	**3,380**	**3,967**	**10,243**
Total OSS Systems	**11,030**	**42**	**8,613**	**23,417**	**22,527**	**75,558**

Source: Compiled by RDS, LLC

Table 13. WIP III Goal Options for BMP Implementation

	2025 COSS & AOSS Goals: Current Rate vs. BMP Goal					
LAPG BMPs for Onsite Sewage Systems (OSS)	Caroline	Fredericks-burg City	King George	Spotsylvania	Stafford	**PD16**
Septic Pumping BMP						
Current Annual Septic Pump-out Compliance (5-year rotation)	73.14%	25.00%	50.00%	50.00%	85.80%	55.75%
Projected Annual BMP Target for Septic Pump-outs @ Current Rate – Status Quo Scenario	**1,318**	**2**	**774**	**2,004**	**3,185**	**7,282**
BMP Goal for Septic Pump-out Compliance	75.00%	90.00%	75.00%	90.00%	90.00%	62.65%
Projected Annual BMP Target for Septic Pump-outs @ BMP Goal – Aggressive Scenario	**1,352**	**8**	**1,160**	**3,607**	**3,341**	**9,467**
Septic Denitrification BMP (AOSS O & M)						
Current AOSS O & M Compliance Rate (estimated)	14.05%	0	22.85%	21.04%	23.43%	20.74%
Projected annual BMP Target for AOSS O & M (septic denitrification) **– Status Quo Scenario**	**284**	**0**	**200**	**711**	**930**	**2,125**
BMP Goal for annual AOSS O & M (septic denitrification)	50.00%	0.00%	50.00%	50.00%	50.00%	50.00%
Projected Annual BMP Target for AOSS O & M @ BMP Goal – Aggressive Scenario	**1,009**	**0**	**438**	**1,690**	**1,984**	**5,121**

Spatial Analysis of Septic Notification Program Non-Response

At the outset of this study, several structural, socio-economic and environmental factors were hypothesized to influence (positively or negatively) the likelihood of property owners complying with the local notification reminder of the CBPA septic system 5-year inspection and/or pump-out requirement. These factors are enumerated below.

Structural Indicators	**Socio-Economic Indicators (**Block Group Level)	**Environmental Indicators**
Age of Home or Business Structure	Median Household Income	NRCS Type C&D Soils
Age of Septic System	Pct. of Families in Poverty	Proximity to RPA
Size of Structure or No. of Bathrooms	Number Of Families on Public Assistance	Proximity to Wetlands
Assessed Value of Improvements	Educational Attainment (less than High School diploma or higher)	

As mentioned earlier, the pump-out notification address list and historic data on completed pump-outs was not provided by Spotsylvania County, making the spatial analysis of those properties which did not respond to the County's pump-out notification impossible. The County-wide and non-response patterns for the other three counties is discussed further below. Limited county-wide analysis of Spotsylvania County's septic inventory is also provided.

Overview of Indicators

Structural Indicators

Age of Sewage Treatment System (Age of Structure and/or Age of Septic Permit): The local real estate records for property date of construction and VDH records for septic permit issuance date were both found to be incomplete, with many records having only one date to indicate the presumptive age of the building and/or septic system. In some cases, the septic permit issuance date is more recent than the date for the year the structure was built, representing (most likely) a permit issued to replace or upgrade an older or failing septic system. The latest date for the septic permit issuance was used to determine the approximate age of the current treatment system installation; however, if no date for the septic permit issuance was available, the year of the property improvement's construction was used as a surrogate date. It is unknown whether this date (taken from the tax parcel data) represents the building permit year or the year of the certificate of occupancy.

Properties with older septic systems may not have had systems properly sited and designed to address poor soil conditions, or may have reached the end of their useful life and require a system re-build or replacement.

Size of Structure (square feet)/ No. of Bathrooms: The size of the home (square feet) and/or the number of bathrooms are used as proxy indicators of the number of persons and associated level of water consumption which puts a load demand on the installed septic system.

Assessed Value of Improvements: The assessed value of the improved property (not including land value) is taken as a proxy for the property owner's ability to afford periodic pump-outs and system maintenance.

Socio-Economic Indicators (Block Group Level)

While researchers recognize the significant potential of auto-correlation of the following socio-economic variables, the combination of these factors may help differentiate sub-county conditions and are anticipated to increase the likelihood that income and general education levels may be seen as factors in property owner compliance with legally-mandated septic system maintenance. These data are taken from the Census Bureau's American Community Survey 5-year average dataset for 2012-2016.

Median Household Income (MHI): The median household income for the neighborhood (represented by the census block group) is used as a general indicator of areas of lower average incomes (and corresponding reduced affordability of septic system maintenance). Areas of comparatively lower median household income are presumed to have a higher incidence of need for financial assistance for septic maintenance.

Percent of Families At or Below Poverty Level: The percent of families in the block group which live at or below the poverty level is used, in combination with these other indicators, as a general indicator of areas where there is a larger concentration of families for which the affordability and/or the understanding of the importance of proper septic system maintenance may be limited.

Number of Households Receiving Public Assistance: The number of households in the block group area receiving public assistance is used as a proxy for the potential that homeowners (or renters) may need and/or qualify. Areas with higher values are presumed to have greater need for public septic financial assistance. This indicator helps prioritize sub-county areas (i.e. block groups) where septic financial assistance may be needed to incentivize a higher septic pump-out response rate.

Educational Attainment: In order to identify areas of higher concentrations of persons with lower educational attainment, the percent of persons over age 25 with less than a high school diploma or higher education level was calculated from the 2012-2016 census data at the block group level. Areas with higher values are presumed to have greater need for targeted public education to explain proper usage of septic systems and the importance of proper septic system maintenance.

Environmental Indicators

NRCS Type C or D Soils: Soils with slower infiltration characteristics (i.e. NCRS hydrology ratings of "C", "D", "A/D". "B/D" or "C/D") are less desirable for the siting and installation of onsite wastewater treatment (septic) systems. The hydrology rating for the soils at the property address location is used in this study as an indicator that similar soils may be pervasive throughout the site and require special septic system location and design to compensate for any marginal soil conditions in the area of the planned drainfield.

Table 7-6. Hydrologic Soil Groups

Hydrologic Group	Number	Description
A	1	well- to excessively drained sands and gravels (high infiltration rates)
B	2	moderately well- to well-drained soils with moderate textures (moderate infiltration rates)
C	3	moderately to poorly drained soils with moderately fine to fine textures (slow infiltration rates)
D, A/D, B/D, C/D	4	poorly drained soils with very fine texture (very slow infiltration rates)
A/C, B/C, 2, VAR	----	

Source: "https://archive.epa.gov/epawaste/hazard/web/pdf/2-chap07.pdf

Proximity to RPA (linear feet): A property address' proximity to the edge of the locally-defined resource protection area (RPA) is used as an indicator of greater environmental and water quality risk from possible seepage from a failing or malfunctioning system. Ideally, this distance would be calculated based on the local topography and natural drainage paths from origin to the edge of stream; however, the direct straight-line distance from the property address location to the closest RPA edge was used as a proxy for the natural drainage path distance.

Proximity to Wetlands (linear feet): A property address' proximity to the edge of the closest feature in the National Wetland Inventory (NWI) database is used as an indicator of greater environmental and water

quality risk from possible seepage from a failing or malfunctioning system. Ideally, this distance would be calculated based on the local topography and natural drainage paths from origin to the edge of the closest wetland area; however, the direct straight-line distance from the property address location to the closest NWI feature edge was used as a proxy for the natural drainage path distance.

Proximity to Bacteria Impaired Stream Segments (linear feet): Properties closer to stream segments identified with bacteria impairments, particularly those with older conventional septic systems in areas of poorer soils and lower income residents, are of higher priority for targeted septic maintenance promotion and financial assistance to ensure that seepage of bacteria-contaminated effluent does not drain into nearby streams. Ideally, this distance would be calculated based on the local topography and natural drainage paths from origin to the edge of the designated stream edge; however, the direct straight-line distance from the property address location to the closest bacteria-impaired stream segment edge was used as a proxy for the natural drainage path distance.

Caroline County

The County's pump-out notification list currently includes 242 addresses, including all of the Town of Port Royal (70 addresses) and the remaining 172 addresses that are located in or touch the County's defined Resource Protection Areas (RPAs). It has been previously shown that 73.14 percent of the notified properties in 2017 actually received septic pump-out service (although only 28 percent notified the County as requested).

In 2017, there were 32 properties which received a pump-out notification letter but failed to respond to the County with documentation of any septic maintenance services. For these properties, an analysis of the selected indicators may reveal a pattern of factors which offer insight into the circumstances behind their action (i.e. inaction). For consistency with the other county data provided in this study, County-wide analysis also is presented here to provide the County some larger insight to the potential impact of enhanced County-wide septic system management.

Structural Indicators

Age of Treatment System

Estimated Age of OSS Unit	AOSS Septic		Sewer Systems (Co., Bowling Green & Dawn)		Conv. Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
0 - 9 Years	56	29.5%	81	3.4%	664	6.9%	**801**	**6.6%**
10 - 19 Years	107	56.3%	123	5.2%	1,903	19.8%	**2,133**	**17.5%**
20 - 29 Years	6	3.2%	77	3.3%	1,935	20.1%	**2,018**	**16.6%**
30 - 39 Years	7	3.7%	122	5.2%	1,167	12.1%	**1,296**	**10.7%**
40 - 49 Years	9	4.7%	101	4.3%	1,273	13.2%	**1,383**	**11.4%**
50 - 64 Years	2	1.1%	142	6.0%	632	6.6%	**776**	**6.4%**
65 and Over	2	1.1%	180	7.7%	831	8.6%	**1,013**	**8.3%**
Age Unknown	1	0.5%	1,526	64.9%	1,216	12.6%	**2,743**	**22.6%**
Grand Total	**190**	**100.0%**	**2,352**	**100.0%**	**9,621**	**100.0%**	**12,163**	**100.0%**

Pump-Out Notification Non-Respondents

Within the limited mailing list for pump-out notifications, there were seven properties which were too new (less than 5 years) to warrant sending a CBPA pump-out notice. Over a third (34.4%) of the septic property systems were over 30 years in age.

`Age of Conv. Septic System	Non-Responsive Properties	Pct. of Total
2 - 4 Years	7	21.9%
5 - 19 Years	7	21.9%
20 - 29 Years	3	9.4%
30 - 39 Years	7	21.9%
40 Years & Over	4	12.5%
No Permit Data	4	12.5%
Grand Total	**32**	**100.0%**

Size of Structure and No. of Bathrooms

Building Size	AOSS Septic		Sewer Systems (Co., Bowling Green & Dawn)		Conv. Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
0 or Unknown Sq. Ft.	7	3.7%	225	9.6%	1,434	14.9%	**1,666**	**13.7%**
Under 500 Sq. Ft.	1	0.5%	1	0.0%	36	0.4%	**38**	**0.3%**
500 - 999 Sq. Ft.	25	13.2%	172	7.3%	1,300	13.5%	**1,497**	**12.3%**
1,000 - 1,499 Sq. Ft.	59	31.1%	462	19.6%	3,307	34.4%	**3,828**	**31.5%**
1,500 - 1,999 Sq. Ft.	41	21.6%	529	22.5%	1,804	18.8%	**2,374**	**19.5%**
2,000 - 2,499 Sq. Ft.	30	15.8%	443	18.8%	812	8.4%	**1,285**	**10.6%**
2,500 - 2,999 Sq. Ft.	9	4.7%	210	8.9%	340	3.5%	**559**	**4.6%**
3,000 - 3,499 Sq. Ft.	5	2.6%	77	3.3%	187	1.9%	**269**	**2.2%**
3,500 - 3,999 Sq. Ft.	6	3.2%	26	1.1%	127	1.3%	**159**	**1.3%**
4,000 - 4,499 Sq. Ft.	2	1.1%	10	0.4%	51	0.5%	**63**	**0.5%**
4,500 - 4,999 Sq. Ft.	1	0.5%	25	1.1%	18	0.2%	**44**	**0.4%**
5,000 - 9,999 Sq. Ft	2	1.1%	68	2.9%	147	1.5%	**217**	**1.8%**
10,000 - 19,999 Sq. Ft.		0.0%	66	2.8%	22	0.2%	**88**	**0.7%**
20,000 Sq. Ft. & Over	2	1.1%	38	1.6%	36	0.4%	**76**	**0.6%**
Grand Total	**190**	**100.0%**	**2,352**	**100.0%**	**9,621**	**100.0%**	**12,163**	**100.0%**

Number of Bathrooms	Conv. Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
0.0 - 0.5	1,748	18.2%	18	9.5%	499	21.2%	**2,265**	**18.6%**
1.0 - 1.5	3,183	33.1%	42	22.1%	495	21.0%	**3,720**	**30.6%**
2.0 - 2.5	3,793	39.4%	107	56.3%	864	36.7%	**4,764**	**39.2%**
3.0 -3.5	696	7.2%	19	10.0%	407	17.3%	**1,122**	**9.2%**
4.0 - 4.5	109	1.1%	4	2.1%	40	1.7%	**153**	**1.3%**
5.0 - 7.5	36	0.4%		0.0%	13	0.6%	**49**	**0.4%**
9 - 12	20	0.2%		0.0%	20	0.9%	**40**	**0.3%**
15 - 19.5	1	0.0%		0.0%	8	0.3%	**9**	**0.1%**
Unknown	35	0.4%		0.0%	6	0.3%	**41**	**0.3%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Assessed Value of Improvements

Building Assessed Value	Conv. Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
No Data	621	6.5%	5	2.6%	192	8.2%	**818**	**6.7%**
Under $49,999	1,365	14.2%	6	3.2%	123	5.2%	**1,494**	**12.3%**
$50,000 - $59,999	410	4.3%	2	1.1%	65	2.8%	**477**	**3.9%**
$60,000 - $69,999	525	5.5%	8	4.2%	89	3.8%	**622**	**5.1%**
$70,000 - $79,999	583	6.1%	12	6.3%	95	4.0%	**690**	**5.7%**
$80,000 - $89,999	602	6.3%	5	2.6%	80	3.4%	**687**	**5.6%**
$90,000 - $109,999	1,117	11.6%	24	12.6%	176	7.5%	**1,317**	**10.8%**
$110,000 - $124,999	650	6.8%	25	13.2%	162	6.9%	**837**	**6.9%**
$125,000 - $139,999	576	6.0%	12	6.3%	158	6.7%	**746**	**6.1%**
$140,000 - $149,999	332	3.5%	14	7.4%	102	4.3%	**448**	**3.7%**
$150,000 & Over	2.84	0.0%	77	40.5%	1,110	47.2%	**4,027**	**33.1%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Socio-Economic Indicators (Block Group Level)

Median Household Income

Median Household Income (By Block Group)	**Conv. Septic**		**AOSS Septic**		**Sewer Systems**		**Grand Total**	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
Under $50,000	974	10.1%	35	18.4%	391	16.6%	**1,400**	**11.5%**
$50,000 - $59,999	4,767	49.5%	122	64.2%	413	17.6%	**5,302**	**43.6%**
$60,000 - $69,999	2,652	27.6%	22	11.6%	734	31.2%	**3,408**	**28.0%**
$70,000 & Over	1,213	12.6%	10	5.3%	810	34.4%	**2,033**	**16.7%**
MHI Unknown	15	0.2%	1	0.5%	4	0.2%	**20**	**0.2%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Percent of Families At or Below Poverty Level

Pct. of Families At or Below Poverty Level (By Block Group)	**Conv. Septic**		**AOSS Septic**		**Sewer Systems**		**Grand Total**	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
0.0 %	1,426	14.8%	12	6.3%	236	10.0%	**1,674**	**13.8%**
2.54 %	314	3.3%	6	3.2%	196	8.3%	**516**	**4.2%**
3.0 - 3.99 %	621	6.5%	3	1.6%	766	32.6%	**1,390**	**11.4%**
6.0 - 9.99 %	2,058	21.4%	41	21.6%	540	23.0%	**2,639**	**21.7%**
10.0 - 13.99 %	2,816	29.3%	75	39.5%	389	16.5%	**3,280**	**27.0%**
14.0 - 19.99 %	1,550	16.1%	19	10.0%	10	0.4%	**1,579**	**13.0%**
22.0 - 31.99 %	821	8.5%	33	17.4%	211	9.0%	**1,065**	**8.8%**
100 %	15	0.2%	1	0.5%	1	0.0%	**17**	**0.1%**
Unknown		0.0%		0.0%	3	0.1%	**3**	**0.0%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Number of Households Receiving Public Assistance

Households Receiving Public Assistance (By Block Group)	Conv. Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
0	3,710	38.6%	50	26.3%	601	25.6%	**4,361**	**35.9%**
8 - 12	1,231	12.8%	28	14.7%	206	8.8%	**1,465**	**12.0%**
16 - 18	751	7.8%	44	23.2%	171	7.3%	**966**	**7.9%**
23 - 24	1,460	15.2%	47	24.7%	203	8.6%	**1,710**	**14.1%**
30 - 45	1,899	19.7%	14	7.4%	1,164	49.5%	**3,077**	**25.3%**
79	570	5.9%	7	3.7%	4	0.2%	**581**	**4.8%**
Unknown					3	0.1%	**3**	**0.0%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Educational Attainment Level

Pct. of Persons Age 25+ Without High School Diploma (by Block Group)	AOSS Septic		Conv. Septic		Sewer		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
5.0 - 9.99	839	8.7%	6	3.2%	194	8.2%	**1,039**	**8.5%**
10.0 - 14.99	2,243	23.3%	26	13.7%	616	26.2%	**2,885**	**23.7%**
15.0 - 19.99	2,474	25.7%	79	41.6%	1,330	56.5%	**3,883**	**31.9%**
20.0 - 24.99	3,525	36.6%	73	38.4%	207	8.8%	**3,805**	**31.3%**
28.10	532	5.5%	6	3.2%	2	0.1%	**540**	**4.4%**
32.82	8	0.1%		0.0%		0.0%	**8**	**0.1%**
Unknown					3	0.1%	**3**	**0.0%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Environmental Indicators

NRCS Type C&D Soils

NRCS Hydrology Group	Conv. Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
A	415	4.3%	3	1.6%	1	0.0%	**419**	**3.4%**
B	4,700	48.9%	94	49.5%	1,378	58.6%	**6,172**	**50.7%**
C or D	4,506	46.8%	93	48.9%	973	41.4%	**5,572**	**45.8%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Proximity to RPA

Distance to RPA	Conv. Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
0 - 49 Feet	159	1.7%	4	2.1%	20	0.9%	**183**	**1.5%**
50 - 99 Ft.	136	1.4%	6	3.2%	26	1.1%	**168**	**1.4%**
100 - 149 Ft.	166	1.7%	2	1.1%	35	1.5%	**203**	**1.7%**

Distance to RPA	Conv. Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
150 - 199 Ft.	165	1.7%	2	1.1%	36	1.5%	**203**	**1.7%**
200 - 249 Ft.	141	1.5%	5	2.6%	37	1.6%	**183**	**1.5%**
250 - 299 Ft.	153	1.6%	5	2.6%	41	1.7%	**199**	**1.6%**
300 - 349 Ft.	151	1.6%	2	1.1%	54	2.3%	**207**	**1.7%**
350 Ft. & Over	8,550	88.9%	164	86.3%	2,100	89.3%	**10,814**	**88.9%**
Distance Unknown					3	0.1%	**3**	**0.0%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Pump-Out Notification Non-Respondents

An analysis of non-responding septic properties shows that 12 of 32 (37.5%) are within 50 feet of the RPA boundary and 9 of 12 are on A or B soils, representing a lower risk of system failure. One quarter (8/32) of the non-responding properties are located on lots with C or D soils.

Distance to RPA	NRCS Soil Group			
	A	**B**	**C or D**	**Grand Total**
0 - 49 Ft.	**1**	**8**	3	**12**
50 - 99 Ft.		3	2	5
100 - 149 Ft.		1	1	2
150 - 199 Ft.		2	1	3
200 - 299 Ft.		2	1	3
Over 1000 Ft.		7		7
Grand Total	**1**	**23**	**8**	**32**

Proximity to wetlands

Distance to NWI Wetlands	Conv. Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
0 - 49 Ft.	68	0.7%	3	1.6%	12	0.5%	**83**	**0.7%**
50 - 99 Ft.	226	2.3%	8	4.2%	69	2.9%	**303**	**2.5%**
100 - 149 Ft.	447	4.6%	16	8.4%	80	3.4%	**543**	**4.5%**
150 - 199 Ft.	517	5.4%	13	6.8%	120	5.1%	**650**	**5.3%**
200 - 249 Ft.	468	4.9%	10	5.3%	126	5.4%	**604**	**5.0%**
250 - 299 Ft.	465	4.8%	10	5.3%	122	5.2%	**597**	**4.9%**
300 - 349 Ft.	496	5.2%	11	5.8%	108	4.6%	**615**	**5.1%**
350 Ft. & Over	6,934	72.1%	119	62.6%	1,712	72.8%	**8,765**	**72.1%**
Unknown					3	0.1%	**3**	**0.0%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Pump-Out Notification Non-Respondents

Almost 60 percent (19/32) of the non-responding properties are within 99 feet of the closest wetland; however, almost 79 percent (15/19) of these are on Type B soils, lowering the risk of effluent run-off from failing septic systems reaching a nearby wetland.

Distance to NWI Wetlands	NRCS Soil Group			
	A	**B**	**C or D**	**Grand Total**
0 - 49 Ft		**8**	1	**9**
50 - 99 Ft.		**7**	3	**10**
100 - 149 Ft.	1	5	2	**8**
150 - 199 Ft.		3	2	**5**
Grand Total	**1**	**23**	**8**	**32**

King George County

The County pump-out notification list contained 6,115 records. There were 915 properties notified in 2017, of which 434 properties responded to the County notification, representing a 2017 "gross" compliance rate of 47.4 percent. However, 26 property owner addresses were invalid; consequently the effective "net" compliance rate for 2017 was 48.8 percent. Researchers noted that some properties (19) received pump-out notifications in 2017 which had already reported a system pump-out within the previous 5 year cycle. Also, some addresses receiving notification were found to be connected to the County sewer system or had an alternative onsite septic system, exempting them from the 5-year pump-out and notification mandate.

Structural Indicators

Age of Treatment System

Estimated Treatment System Age	AOSS Septic		Conventional Septic		Co. & NSWC Sewer		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 4 Years	45	23.6%	387	4.7%	3	0.1%	**435**	**3.7%**
5 - 9 Years	30	15.7%	469	5.7%	5	0.2%	**504**	**4.3%**
10 - 19 Years	108	56.5%	2,369	29.0%	10	0.3%	**2,487**	**21.3%**
20 - 29 Years	1	0.5%	1,414	17.3%	42	1.3%	**1,457**	**12.5%**
30 - 39 Years	1	0.5%	835	10.2%	3	0.1%	**839**	**7.2%**
40 - 49 Years	1	0.5%	732	8.9%	1	0.0%	**734**	**6.3%**
50 - 64 Years	1	0.5%	381	4.7%	1	0.0%	**383**	**3.3%**
65 Years & Over	2	1.0%	642	7.8%			**644**	**5.5%**
No Permit Data	2	1.0%	954	11.7%	3,214	98.0%	**4,170**	**35.8%**
Grand Total	**191**	**100.0%**	**8,183**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Size of Structure and No. of Bathrooms

Building square footage data were not available from the County online tax parcel file used for this study. A request for this information from the Office of the Commissioner of Revenue was not filled in time to complete this analysis.

Estimated No. of Bathrooms	AOSS Septic		Conventional Septic		Co. & NSWC Sewer		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 0.5	7	3.7%	1,434	17.5%	1,021	31.1%	**2,462**	**21.1%**
1 - 1.5	7	3.7%	1,607	19.6%	545	16.6%	**2,159**	**18.5%**
2 - 2.5	104	54.5%	3,499	42.8%	1,085	33.1%	**4,688**	**40.2%**
3 - 3.5	61	31.9%	1,274	15.6%	515	15.7%	**1,850**	**15.9%**
4 - 4.5	10	5.2%	258	3.2%	75	2.3%	**343**	**2.9%**
5 - 6.5	2	1.0%	99	1.2%	14	0.4%	**115**	**1.0%**
7 or more		0.0%	5	0.1%	24	0.7%	**29**	**0.2%**
No Bath Data		0.0%	7	0.1%		0.0%	**7**	**0.1%**
Grand Total	**191**	**100.0%**	**8,183**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Assessed Value of Improvements

Improved Property Assessment	Conventional Septic		AOSS Septic		Co. & NSWC Sewer		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total
No Data	787	9.6%	24	12.6%	944	28.8%	**1,755**	**15.1%**
Under $49,999	710	8.7%	2	1.0%	132	4.0%	**844**	**7.2%**
$50,000 - $59,999	187	2.3%		0.0%	62	1.9%	**249**	**2.1%**
$60,000 - $69,999	239	2.9%	2	1.0%	58	1.8%	**299**	**2.6%**
$70,000 - $79,999	279	3.4%		0.0%	87	2.7%	**366**	**3.1%**
$80,000 - $89,999	274	3.3%		0.0%	79	2.4%	**353**	**3.0%**
$90,000 - $109,999	538	6.6%	7	3.7%	154	4.7%	**699**	**6.0%**
$110,000 - $124,999	461	5.6%	4	2.1%	149	4.5%	**614**	**5.3%**
$125,000 - $139,999	413	5.0%	8	4.2%	109	3.3%	**530**	**4.5%**
$140,000 - $169,999	937	11.5%	22	11.5%	238	7.3%	**1,197**	**10.3%**
$170,000 & Over	3,358	41.0%	122	63.9%	1,267	38.6%	**4,747**	**40.7%**
Grand Total	**8,183**	**100.0%**	**191**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Socio-Economic Indicators (Block Group Level)

Median Household Income

Median Household Income (by Block Group)	Conventional Septic		Co. & NSWC Sewer		Co. &NSWC Sewer		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total
$45,000 - $49,999	641	7.8%	88	2.7%	7	3.7%	**736**	**6.3%**
$50,000 - $69,999	1,606	19.6%	1,494	45.6%	26	13.6%	**3,126**	**26.8%**
$80,000 - $89,999	2,345	28.7%	492	15.0%	35	18.3%	**2,872**	**24.6%**
$91,818	918	11.2%	270	8.2%	17	8.9%	**1,205**	**10.3%**
$102,794	614	7.5%	513	15.6%	19	9.9%	**1,146**	**9.8%**
$111,648	947	11.6%	419	12.8%	68	35.6%	**1,434**	**12.3%**
$112,212	1,108	13.5%	1	0.0%	19	9.9%	**1,128**	**9.7%**
Unknown	4	0.0%	2	0.1%			**6**	**0.1%**
Grand Total	**8,183**	**100.0%**	**3,279**	**100.0%**	**191**	**100.0%**	**11,653**	**100.0%**

Percent of Families At or Below Poverty Level

Percent of Families At or Below Poverty Level (by Block Group)	AOSS Septic		Conventional Septic		Sewer		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total
0	17	8.9%	924	11.3%	270	8.2%	**1,211**	**10.4%**
.01 - 3.99	91	47.6%	3,085	37.7%	1,651	50.4%	**4,827**	**41.4%**
4.0 -6.99	57	29.8%	2,421	29.6%	1,267	38.6%	**3,745**	**32.1%**
7.0 -9.99	26	13.6%	1,747	21.3%	89		**1,862**	**16.0%**
16.0 & Over		0.0%	2	0.0%		0.0%	**2**	**0.0%**
Unknown	0	0.0%	4	0.0%	2	0.1%	**6**	**0.1%**
Grand Total	**191**	**100.0%**	**8,183**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Number of Households Receiving Public Assistance

Number of Households Receiving Public Assistance (by Block Group)	AOSS Septic		Conventional Septic		Sewer		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total
0	58	30.4%	3,590	43.9%	1,852	56.5%	**5,500**	**47.2%**
5	11	5.8%	687	8.4%	1	0.0%	**699**	**6.0%**
12	19	9.9%	1,578	19.3%	489	14.9%	**2,086**	**17.9%**
15	16	8.4%	761	9.3%	3		**780**	**6.7%**
17	68	35.6%	948	11.6%	419	12.8%	**1,435**	**12.3%**
19	19	9.9%	615	7.5%	513	15.6%	**1,147**	**9.8%**
Unknown	0	0.0%	4	0.0%	2	0.1%	**6**	**0.1%**
Grand Total	**191**	**100.0%**	**8,183**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Educational Attainment Level

Pct. of Persons Age 25+ Without High School Diploma (by Block Group)	AOSS Septic		Conventional Septic		Sewer		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total
Under 5 Percent	85	44.5%	1,877	22.9%	1,431	43.6%	**3,393**	**29.1%**
5 - 7.99 Percent	54	28.3%	2,953	36.1%	1,005	30.6%	**4,012**	**34.4%**
8 - 9.99 Percent	41	21.5%	2,154	26.3%	752	22.9%	**2,947**	**25.3%**
12 - 16.99 Percent	11	5.8%	1,192	14.6%	89	2.7%	**1,292**	**11.1%**
17 Percent & Over		0.0%	3	0.0%		0.0%	**3**	**0.0%**
Unknown		0.0%	4	0.0%	2	0.1%	**6**	**0.1%**
Grand Total	**191**	**100.0%**	**8,183**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Environmental Indicators

NRCS Type C&D Soils

NRCS Hydrology Group	Conventional Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total
A	801	9.8%	14	7.3%	56	1.7%	**871**	**7.5%**
B	5,301	64.8%	100	52.4%	1,157	35.3%	**6,558**	**56.3%**
C or D	2,081	25.4%	77	40.3%	2,066	63.0%	**4,224**	**36.2%**
Grand Total	**8,183**	**100.0%**	**191**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Pump-Out Notification Non-Respondents

NRCS HYDROLOGY GROUP	AOSS Septic		Conventional Septic		Sewer Systems		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total
A		0.0%	17	9.6%		0.0%	**17**	**9.2%**
B	1	25.0%	109	61.6%	2	66.7%	**112**	**60.9%**
C or D	3	75.0%	51	28.8%	1	33.3%	**55**	**29.9%**
Grand Total	**4**	**100.0%**	**177**	**100.0%**	**3**	**100.0%**	**184**	**100.0%**

Observations:

Of the 184 addresses which received septic pump-out notification reminders from the County in 2017 without returning a response to the County, 7 properties were either on alternative septic or connected to the County sewer system and should not have received a notice (although the County would have difficulty determining those properties with alternative septic systems).

Almost 29 percent (51/177) of the properties with conventional septic systems appear to be on C or D soil where, absent proper maintenance, septic failure is more likely to occur and have more adverse environmental impact. More than 71 percent of the conventional septic systems are sited on lots with soil with good infiltration characteristics needed for conventional septic operation.

Proximity to RPA

Distance to Closest RPA	Conventional Septic		AOSS Septic		Co. & NSWC Sewer		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 49 Ft.	499	6.1%	22	11.5%	313	9.5%	**834**	**7.2%**
50 - 99 Ft.	425	5.2%	15	7.9%	296	9.0%	**736**	**6.3%**
100 - 149 Ft.	431	5.3%	14	7.3%	274	8.4%	**719**	**6.2%**
150 - 199 Ft.	444	5.4%	13	6.8%	259	7.9%	**716**	**6.1%**
200 - 249 Ft.	444	5.4%	14	7.3%	248	7.6%	**706**	**6.1%**
250 - 299 Ft.	458	5.6%	11	5.8%	213	6.5%	**682**	**5.9%**
300 - 349 Ft.	453	5.5%	10	5.2%	225	6.9%	**688**	**5.9%**
350 Ft. & Over	5,029	61.5%	92	48.2%	1,451	44.3%	**6,572**	**56.4%**
Grand Total	**8,183**	**100.0%**	**191**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Pump-Out Notification Non-Respondents

For the 177 conventional septic system properties that received notification in 2017 without returning a response to the County, only 9 (or about 5 percent) were located on C or D soil types within 100 feet of the County RPA.

Distance to RPA	NRCS Hydrology Group							
	A		B		C or D		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 49 Ft.		0.0%	2	1.1%	**4**	**2.3%**	**6**	**3.4%**
50 - 99 Ft.		0.0%	3	1.7%	**5**	**2.8%**	**8**	**4.5%**
100 - 149 Ft.		0.0%	8	4.5%	2	1.1%	**10**	**5.6%**
150 - 199 Ft.		0.0%	6	3.4%	5	2.8%	**11**	**6.2%**
200 - 249 Ft.		0.0%	4	2.3%	7	4.0%	**11**	**6.2%**
250 - 299 Ft.	2	1.1%	2	1.1%	3	1.7%	**7**	**4.0%**
300 - 349 Ft.	1	0.6%	3	1.7%	7	4.0%	**11**	**6.2%**
350 Ft. & Over	14	7.9%	81	45.8%	18	10.2%	**113**	**63.8%**
Grand Total	**17**	**9.6%**	**109**	**61.6%**	**51**	**28.8%**	**177**	**100.0%**

Proximity to Wetlands

Distance to Closest NWI Wetland	Conventional Septic		AOSS Septic		Co. & NSWC Sewer		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 49 Ft.	72	0.9%	3	1.6%	52	1.6%	**127**	**1.1%**
50 - 99 Ft.	167	2.0%	4	2.1%	110	3.4%	**281**	**2.4%**
100 - 149 Ft.	324	4.0%	17	8.9%	174	5.3%	**515**	**4.4%**
150 - 199 Ft.	346	4.2%	15	7.9%	238	7.3%	**599**	**5.1%**
200 - 249 Ft.	409	5.0%	12	6.3%	286	8.7%	**707**	**6.1%**
250 - 299 Ft.	445	5.4%	12	6.3%	241	7.3%	**698**	**6.0%**
300 - 349 Ft.	435	5.3%	14	7.3%	220	6.7%	**669**	**5.7%**
350 Ft. & Over	5,985	73.1%	114	59.7%	1,958	59.7%	**8,057**	**69.1%**
Grand Total	**8,183**	**100.0%**	**191**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Pump-Out Notification Non-Respondents

For the 177 conventional septic system properties that received notification in 2017, only 3 (or less than 2 percent) were located on C or D soil types within 100 feet of NWI-delineated wetlands in the County.

Distance to Wetlands	NRCS Hydrology Group							
	A		B		C or D		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 49 Ft.		0.0%		0.0%	**1**	0.6%	**1**	**0.6%**
50 - 99 Ft.		0.0%	**1**	0.6%	**2**	1.1%	**3**	**1.7%**
100 - 149 Ft.		0.0%	**1**	0.6%	**2**	1.1%	**3**	**1.7%**
150 - 199 Ft.		0.0%	**3**	1.7%	**4**	2.3%	**7**	**4.0%**
200 - 249 Ft.		0.0%	**7**	4.0%	**2**	1.1%	**9**	**5.1%**
250 - 299 Ft.		0.0%	**7**	4.0%	**6**	3.4%	**13**	**7.3%**
300 - 349 Ft.		0.0%	**3**	1.7%	**5**	2.8%	**8**	**4.5%**
350 Ft. & Over	17	9.6%	**87**	49.2%	**29**	16.4%	**133**	**75.1%**
Grand Total	**17**	**9.6%**	**109**	**61.6%**	**51**	**28.8%**	**177**	**100.0%**

Spotsylvania County
Structural Indicators

Age of Treatment System

Estimated Age of OSS Unit	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
0 - 9 Years	144	28.7%	872	3.0%	1,119	5.7%	**2,135**	**4.3%**
10 - 19 Years	307	61.2%	8,869	30.1%	4,515	23.0%	**13,691**	**27.6%**
20 - 29 Years	21	4.2%	7,433	25.3%	4,158	21.2%	**11,612**	**23.4%**
30 - 39 Years	4	0.8%	3,853	13.1%	2,058	10.5%	**5,915**	**11.9%**
40 - 49 Years	2	0.4%	1,608	5.5%	1,505	7.7%	**3,115**	**6.3%**
50 - 64 Years	2	0.4%	187	0.6%	551	2.8%	**740**	**1.5%**
65 and Over	1	0.2%	209	0.7%	412	2.1%	**622**	**1.3%**
Age Unknown	21	4.2%	6,392	21.7%	5,330	27.1%	**11,743**	**23.7%**
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Observations:
The estimated age of the OSS unit is based on the reported date of issuance of septic permits and/or the year the structure's building permit or occupancy permit was issued[10]. Twenty-seven (927) percent of the properties on conventional septic lack either date information to establish or estimate the age of the wastewater treatment system. With almost 2,500 properties on conventional septic systems believed to be over 40 years old, these older systems may warrant closer attention for possible adverse impact on the environment.

Size of Structure

Building Size (Square Feet)	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
Sq. Footage Unknown	25	5.0%	1,655	5.6%	3,338	17.0%	**5,018**	**10.1%**
Under 500 Sq. Ft.			3	0.0%	7	0.0%	**10**	**0.0%**
500 - 999 Sq. Ft.	5	1.0%	1,773	6.0%	1,302	6.6%	**3,080**	**6.2%**
1,000 - 1,499 Sq. Ft.	58	11.6%	8,324	28.3%	4,865	24.8%	**13,247**	**26.7%**
1,500- 1,999 Sq. Ft.	79	15.7%	5,658	19.2%	3,418	17.4%	**9,155**	**18.5%**
2,000 - 2,499 Sq. Ft.	90	17.9%	4,528	15.4%	2,497	12.7%	**7,115**	**14.4%**
2,500 - 2,999 Sq. Ft.	88	17.5%	2,717	9.2%	1,632	8.3%	**4,437**	**9.0%**
3,000 - 3,499 Sq. Ft.	69	13.7%	1,412	4.8%	898	4.6%	**2,379**	**4.8%**
3,500 - 3,999 Sq. Ft.	33	6.6%	596	2.0%	396	2.0%	**1,025**	**2.1%**
4,000 - 4,499 Sq. Ft.	18	3.6%	260	0.9%	213	1.1%	**491**	**1.0%**
4,500 - 4,999 Sq. Ft.	16	3.2%	141	0.5%	109	0.6%	**266**	**0.5%**
5,000 - 9,999 Sq. Ft.	21	4.2%	389	1.3%	295	1.5%	**705**	**1.4%**
10,000 - 19,999 Sq. Ft.			457	1.6%	205	1.0%	**662**	**1.3%**
20,000 - 89,999 Sq. Ft.			376	1.3%	174	0.9%	**550**	**1.1%**
Over 90,000 Sq. Ft.			1,134	3.9%	299	1.5%	**1,433**	**2.9%**
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

[10] It is unclear whether the "Year Built" field in the tax parcel file represents the date of the building permit or the date of the occupancy permit.

Observations:

Square footage data were missing from 10.1 percent of all County online tax parcel records.

Address-level data on the number of bathrooms per structure was unavailable from the County's online public data sources.

Assessed Value of Improvements

Building Valuation	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
Valuation Unknown	21	4.2%	641	2.2%	1,309	6.7%	**1,971**	**4.0%**
Under $74,999	17	3.4%	2,438	8.3%	4,417	22.5%	**6,872**	**13.9%**
$75,000 - $149,999	47	9.4%	11,992	40.8%	5,638	28.7%	**17,677**	**35.7%**
$150,000 - $249,999	168	33.5%	8,732	29.7%	4,148	21.1%	**13,048**	**26.3%**
$250,000 - $499,999	216	43.0%	2,312	7.9%	2,526	12.9%	**5,054**	**10.2%**
$500,000 - $749,999	25	5.0%	403	1.4%	300	1.5%	**728**	**1.5%**
$750,000 - $999,999	6	1.2%	167	0.6%	192	1.0%	**365**	**0.7%**
$1M - $2.49M	2	0.4%	480	1.6%	297	1.5%	**779**	**1.6%**
$2.5M - $4.99M		0.0%	730	2.5%	124	0.6%	**854**	**1.7%**
$5M - $9.99M		0.0%	629	2.1%	172	0.9%	**801**	**1.6%**
Over $10 Million		0.0%	899	3.1%	525	2.7%	**1,424**	**2.9%**
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Socio-Economic Indicators (Block Group Level)

Median Household Income

Median HH Income (Block Group)	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
Under $49,999	4	0.8%	1,843	6.3%	1,328	6.8%	**3,175**	**6.4%**
$50K - $59.9K	10	2.0%	270	0.9%	1,290	6.6%	**1,570**	**3.2%**
$60K - $69.9K	24	4.8%	6,668	22.7%	3,672	18.7%	**10,364**	**20.9%**
$70K - $89.9K	317	63.1%	8,236	28.0%	7,916	40.3%	**16,469**	**33.2%**
$90K - $109.9K	69	13.7%	7,901	26.9%	3,246	16.5%	**11,216**	**22.6%**
$110K - $124.9K	18	3.6%	1,392	4.7%	1,136	5.8%	**2,546**	**5.1%**
Over $125,000	60	12.0%	2,712	9.2%	1,029	5.2%	**3,801**	**7.7%**
MHI Unknown		0.0%	401	1.4%	31	0.2%	**432**	**0.9%**
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Percent of Families At or Below Poverty Level

Percent of Families at or below Poverty Level (Block Group)	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
0 .0 - 1.99 Percent	231	46.0%	7,550	25.7%	7,188	36.6%	**14,969**	**30.2%**
2.0 - 2.99 Percent	32	6.4%	5,459	18.6%	2,563	13.0%	**8,054**	**16.2%**
3.0 - 4.99 Percent	56	11.2%	2,489	8.5%	2,415	12.3%	**4,960**	**10.0%**
5.0 - 7.99 Percent	84	16.7%	8,254	28.1%	2,927	14.9%	**11,265**	**22.7%**
8.0 - 19.99 Percent	95	18.9%	4,460	15.2%	3,258	16.6%	**7,813**	**15.8%**
Over 20 Percent	4	0.8%	1,210	4.1%	1,296	6.6%	**2,510**	**5.1%**
Unknown			1	0.0%	1	0.0%	**2**	**0.0%**
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Observations:

Almost 1,300 conventional systems are located in block group areas of the County where more than 20 percent of the families have incomes at or below the poverty level, suggesting the possibility of approximately 260 properties which may not receive adequate maintenance attention due to the limited financial means of the property owner or resident (in the case of rental properties).

Number of Households Receiving Public Assistance

Households Receiving Public Assistance (By Block Group)	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
0 - 9 Households	278	55.4%	13,714	46.6%	8,554	43.5%	**22,546**	**45.5%**
10 - 19 Households	125	24.9%	6,241	21.2%	7,085	36.1%	**13,451**	**27.1%**
20 - 29 Households	94	18.7%	5,273	17.9%	2,965	15.1%	**8,332**	**16.8%**
30 - 39 Households	1	0.2%	3,351	11.4%	594	3.0%	**3,946**	**8.0%**
40 - 49 Households	4	0.8%	844	2.9%	450	2.3%	**1,298**	**2.6%**
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Over a 1,000 conventional septic systems are located in block group areas where thirty or more households in the block group receive public assistance, representing households with greater potential need for financial assistance to maintain their septic system.

Educational Attainment Level

Pct. of Persons Age 25+ Without High School Diploma (by Block Group)	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
0 - 2.99 Percent	45	9.0%	2,791	9.5%	1,258	6.4%	4,094	8.3%
3.0 - 6.99 Percent	120	23.9%	10,627	36.1%	3,041	15.5%	13,788	27.8%
7.0 - 8.99 Percent	141	28.1%	1,335	4.5%	3,882	19.8%	5,358	10.8%
9.0 - 14.99 Percent	110	21.9%	10,550	35.9%	6,588	33.5%	17,248	34.8%
15.0 - 19.99 Percent	73	14.5%	2,414	8.2%	2,938	15.0%	5,425	10.9%
20.0 - 29.9 Percent	10	2.0%	1,705	5.8%	1,237	6.3%	2,952	6.0%
30 Percent & Over	3	0.6%		0.0%	703	3.6%	706	1.4%

Pct. of Persons Age 25+ Without High School Diploma (by Block Group)	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
Unknown			1	0.0%	1	0.0%	2	0.0%
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Observations:

Almost 10 percent of the conventional septic system inventory throughout the County is located in block group areas with the highest rates of low education attainment (i.e. less than high school diploma), suggesting a need for some targeted public education in these areas to improve public understanding of the importance of adequate septic system maintenance and the "Do's and Don'ts" for septic systems to avoid system failure from system abuse.

Environmental Indicators

NRCS Type C or D Soils

NRCS Hydrology Group	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
A	38	7.6%	2,830	9.6%	694	3.5%	**3,562**	**7.2%**
B	352	70.1%	16,426	55.8%	14,839	75.5%	**31,617**	**63.8%**
A or B Sub-Total	***390***	***77.7%***	***19,256***	***65.4%***	***15,533***	***79.1%***	***35,179***	***71.0%***
C	80	15.9%	6,967	23.7%	3,024	15.4%	**10,071**	**20.3%**
B/D	7	1.4%	2,188	7.4%	468	2.4%	**2,663**	**5.4%**
C/D	10	2.0%	65	0.2%	162	0.8%	**237**	**0.5%**
C or D	1	0.2%	346	1.2%	130	0.7%	**477**	**1.0%**
D	14	2.8%	601	2.0%	331	1.7%	**946**	**1.9%**
Other Sub-Total	***112***	***22.3%***	***10,167***	***34.6%***	***4,115***	***20.9%***	***14,394***	***29.0%***
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Observations:

Approximately 21 percent of the conventional septic systems in the County are sited on properties with marginal soils for septic operation (i.e. not A or B type).

Proximity to RPA

Distance to RPA	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
0 - 49 Ft.	32	6.4%	296	1.0%	543	2.8%	871	1.8%
50 - 99 Ft.	22	4.4%	335	1.1%	473	2.4%	830	1.7%
100 - 149 Ft.	19	3.8%	353	1.2%	401	2.0%	773	1.6%
150 - 199 Ft.	15	3.0%	363	1.2%	362	1.8%	740	1.5%
200 - 249 Ft.	18	3.6%	438	1.5%	425	2.2%	881	1.8%
250 - 299 Ft.	18	3.6%	422	1.4%	334	1.7%	774	1.6%
300 -349 Ft.	12	2.4%	409	1.4%	338	1.7%	759	1.5%

Distance to RPA	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
350 Ft & Over	366	72.9%	26,807	91.1%	16,772	85.4%	43,945	88.6%
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Observations:

Over 5 percent of the conventional septic system inventory is located within 100 feet of the edge of the County-defined Resource Protection Area. Depending on slope, soil and ground cover conditions, Nitrogen in septic effluent runoff (from failing systems) may reach the RPA's perennial stream and be carried downstream. Septic system designers, installers and maintenance companies have reported (through the survey conducted for this study) that 5 – 10+ percent (on average) of all systems are failing throughout the region, adding to the potential environmental risk from systems closer to such environmentally-sensitive areas.

Proximity to NWI-Delineated Wetlands

Distance to NWI Wetlands	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
0 - 49 Ft.		0.0%	1	0.0%	2	0.0%	**3**	**0.0%**
50 - 99 Ft.		0.0%	9	0.0%	9	0.0%	**18**	**0.0%**
100 - 149 Ft.		0.0%	20	0.1%	16	0.1%	**36**	**0.1%**
150 - 199 Ft.		0.0%	29	0.1%	21	0.1%	**50**	**0.1%**
200 - 249 Ft.	1	0.2%	23	0.1%	19	0.1%	**43**	**0.1%**
250 - 299 Ft.		0.0%	48	0.2%	16	0.1%	**64**	**0.1%**
300 - 349 Ft.		0.0%	56	0.2%	29	0.1%	**85**	**0.2%**
350 Ft. & Over	501	99.8%	29,237	99.4%	19,536	99.4%	**49,274**	**99.4%**
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

Observations:

The vast majority (99.4 percent) of all conventional septic systems in the County are 350 feet or more from the closest edge of areas delineated as wetlands in the National Wetland Inventory. Wetlands typically serve as areas which clean surface water through the absorption of dissolved nutrients in the surface waters that flow into these natural wetland areas.

Stafford County

Structural Indicators

Estimated Age of Treatment System

Estimated Age of OSS Unit	Co. Sewer		Conventional Septic		Alternative Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*Pct. of Total*
Age 0 - 9 Years	4,839	15.1%	2,538	12.4%	448	55.0%	**7,829**	**14.7%**
Age 10 - 19 Years	9,289	28.9%	4,011	19.7%	331	40.6%	**13,631**	**25.6%**
Age 20 - 29 Years	8,937	27.8%	2,746	13.5%	3	0.4%	**11,686**	**21.9%**
Age 30 - 39 Years	4,091	12.7%	2,401	11.8%	5	0.6%	**6,497**	**12.2%**
Age 40 - 49 Years	2,877	9.0%	2,012	9.9%	11	1.3%	**4,900**	**9.2%**
Age 50 - 64 Years	950	3.0%	1,073	5.3%	6	0.7%	**2,029**	**3.8%**
Age 65 & Over	887	2.8%	1,846	9.0%	6	0.7%	**2,739**	**5.1%**
Age Unknown	248	0.8%	3,783	18.5%	5	0.6%	**4,036**	**7.6%**
Grand Total	**32,118**	**100.0%**	**20,410**	**100.0%**	**815**	**100.0%**	**53,347**	**100.0%**

Pump-Out Notification Non-Respondents

Estimated Age of OSS Unit	Co. Sewer		Conventional Septic		Alternative Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
Age 0 - 9 Years	3	16.7%	87	8.8%	14	46.7%	**104**	**10.0%**
Age 10 - 19 Years	3	16.7%	201	20.4%	15	50.0%	**219**	**21.2%**
Age 20 - 29 Years		0.0%	163	16.5%		0.0%	**163**	**15.7%**
Age 30 - 39 Years		0.0%	152	15.4%		0.0%	**152**	**14.7%**
Age 40 - 49 Years	2	11.1%	177	17.9%		0.0%	**179**	**17.3%**
Age 50 - 64 Years	1	5.6%	83	8.4%	1	3.3%	**85**	**8.2%**
Age 65 & Over	9	50.0%	107	10.8%		0.0%	**116**	**11.2%**
Age Unknown		0.0%	17	1.7%		0.0%	**17**	**1.6%**
TOTAL	**18**	**100.0%**	**987**	**100.0%**	**30**	**100.0%**	**1,035**	**100.0%**

Observations:

The 48 properties connected to sewer or an alternative septic system should not be receiving a septic pump-out notification. Alternative septic systems are legally obligated to have annual inspections (and are serviced as needed, based on inspection). The County pump-out notification address list should be screened to remove any sewer or alternative septic property records.

Well-maintained septic systems are reputed to have an average useful life expectancy of 25-30 years, depending heavily on the system design, maintenance history, and soil quality for the drainfield. Including those properties lacking any license or construction date, over 50 percent of conventional septic properties failing to respond to the pump-out notification are estimated to be more than 30 years old, only slightly less than the county-wide average of 54.5 percent.

Size of Structure and Number of Bathrooms

Building Size	Co. Sewer		Conventional Septic		Alternative Septic		Grand Total	
	# of Properties	*Pct. of Total*	*# of Properties*	*Pct. of Total*	*# of Properties*	*Pct. of Total*	***# of Properties***	***Pct. of Total***
Under 500 Sq. Ft.		0.0%	9	0.0%	51	0.2%	**60**	**0.1%**
500 - 999 Sq. Ft.	7	0.9%	682	2.1%	1,058	5.2%	**1,747**	**3.3%**
1,000 – 1,499 Sq. Ft.	75	9.2%	8,824	27.5%	4,097	20.1%	**12,996**	**24.4%**
1,500 – 1,999 Sq. Ft.	50	6.1%	6,298	19.6%	2,339	11.5%	**8,687**	**16.3%**
2,000 – 2,499 Sq. Ft.	81	9.9%	7,219	22.5%	1,826	8.9%	**9,126**	**17.1%**
2,500 – 2,999 Sq. Ft.	135	16.6%	4,371	13.6%	1,451	7.1%	**5,957**	**11.2%**
3,000 – 3,499 Sq. Ft.	152	18.7%	2,611	8.1%	1,094	5.4%	**3,857**	**7.2%**
3,500 – 3,999 Sq. Ft.	134	16.4%	930	2.9%	660	3.2%	**1,724**	**3.2%**
4,000 – 4,499 Sq. Ft.	77	9.4%	292	0.9%	309	1.5%	**678**	**1.3%**
4,500 – 4,999 Sq. Ft	42	5.2%	104	0.3%	169	0.8%	**315**	**0.6%**
5,000 – 9,999 Sq. Ft.	56	6.9%	183	0.6%	214	1.0%	**453**	**0.8%**
10K – 19.9K Sq. Ft.	4	0.5%	74	0.2%	70	0.3%	**148**	**0.3%**
20K – 89.9K Sq. Ft.		0.0%	99	0.3%	69	0.3%	**168**	**0.3%**
90K & over Sq. Ft.		0.0%	24	0.1%	9	0.0%	**33**	**0.1%**
Unknown	2	0.2%	398	1.2%	6,994	34.3%	**7,398**	**13.9%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**
Mean Avg. Sq. Ft.	**2,147**		**2,054**					

Number of Bathrooms	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*	# Properties	*Pct. of Total*
(blank)	4	0.5%	968	3.0%	7,749	38.0%	**8,725**	**16.4%**
0-.99		0.0%	9	0.0%	36	0.2%	**45**	**0.1%**
1-1.99	22	2.7%	2,558	8.0%	3,213	15.7%	**5,793**	**10.9%**
2-2.99	197	24.2%	13,626	42.4%	5,102	25.0%	**18,925**	**35.5%**
3-3.99	261	32.0%	12,911	40.2%	2,918	14.3%	**16,090**	**30.2%**
4-4.99	252	30.9%	1,634	5.1%	1,092	5.4%	**2,978**	**5.6%**
5-5.99	59	7.2%	372	1.2%	248	1.2%	**679**	**1.3%**
6-6.99	17	2.1%	36	0.1%	39	0.2%	**92**	**0.2%**
7-7.99	3	0.4%	1	0.0%	9	0.0%	**13**	**0.0%**
8-8.99		0.0%	1	0.0%	3	0.0%	**4**	**0.0%**
9-9.99		0.0%	1	0.0%	1	0.0%	**2**	**0.0%**
10-12		0.0%	1	0.0%		0.0%	**1**	**0.0%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**
Mean Avg. # of Bathrooms			**2.82**		**2.44**			

Pump-Out Notification Non-Respondents

Building Size	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
Under 500 Sq. Ft.		0.0%		0.0%	**2**	0.2%	**2**	**0.2%**
500 - 999 Sq. Ft.	**2**	6.7%	**3**	17.6%	**101**	10.2%	**106**	**10.2%**
1,000 - 1,499 Sq. Ft.	**9**	30.0%	**6**	35.3%	**348**	35.3%	**363**	**35.1%**
1,500 - 1,999 Sq. Ft.	**2**	6.7%	**4**	23.5%	**174**	17.6%	**180**	**17.4%**
2,000 - 2,499 Sq. Ft.	**1**	3.3%	**1**	5.9%	**128**	13.0%	**130**	**12.6%**
2,500 - 2,999 Sq. Ft.	**5**	16.7%	**1**	5.9%	**96**	9.7%	**102**	**9.9%**
3,000 - 3,499 Sq. Ft.	**7**	23.3%	**2**	11.8%	**79**	8.0%	**88**	**8.5%**
4,000 - 4,999 Sq. Ft.	**4**	13.3%		0.0%	**27**	2.7%	**31**	**3.0%**
5,000 - 6,999 Sq. Ft.		0.0%		0.0%	**14**	1.4%	**14**	**1.4%**
12,000 - 35,999 Sq. Ft.		0.0%		0.0%	**1**	0.1%	**2**	**0.2%**
Sq. Ft. Unknown		0.0%		0.0%	**17**	1.7%	**17**	**1.6%**
Grand Total	**30**	**100.0%**	**17**	**100.0%**	**987**	**100.0%**	**1,035**	**100.0%**
Pct. of Total	**2.9%**		**1.6%**		**95.4%**		**100.0%**	
Mean Avg. Size	**2,518**		**1,617**		**2,038**			

Note: One commercial property (35,000 sq. ft.) on sewer was omitted from the above to avoid skewing the average building size. Average size based on those property records with reported square footage.

Number of Bathrooms	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0		0.0%			1	0.1%	**1**	**0.1%**
1 - 1.5 Baths	3	10.0%	6	33.3%	273	27.7%	**282**	**27.2%**
2 - 2.5 Baths	7	23.3%	8	44.4%	394	39.9%	**409**	**39.5%**
3 - 3.5 Baths	11	36.7%	2	11.1%	214	21.7%	**227**	**21.9%**
4 - 4.5 Baths	7	23.3%	1	5.6%	49	5.0%	**57**	**5.5%**
5 - 6.5 Baths	2	6.7%		0.0%	26	2.6%	**28**	**2.7%**
8		0.0%		0.0%	1	0.1%	**1**	**0.1%**
No Baths Reported		0.0%	1	5.6%	29	2.9%	**30**	**2.9%**
Grand Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1035**	**100.0%**
Avg. No. of Baths	**3.2**		**2.0**		**2.3**			

Observations:

Non-responding properties appear to be smaller across all three wastewater treatment groups than the County average, both in terms of average building square footage and average number of bathrooms. This would suggest lower potential water consumption (on average) than the other homes (larger on average) throughout the County which have reported periodic septic inspections and pump-outs.

Assessed Value of Improvements

Building Assessment ($1,000)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*	# Properties	*Pct. of Total*
$0 - $74.9	9	1.1%	853	2.7%	1,694	8.3%	**2,556**	**4.8%**
$75K - $149.9	36	4.4%	6,985	21.7%	3,636	17.8%	**10,657**	**20.0%**
$150K - $249.9	127	15.6%	15,696	48.9%	4,342	21.3%	**20,165**	**37.8%**
$250K - $499.9	525	64.4%	7,933	24.7%	4,125	20.2%	**12,585**	**23.6%**
$500K - $749.9	108	13.3%	187	0.6%	550	2.7%	**847**	**1.6%**
$750K - $999.9	4	0.5%	79	0.2%	272	1.3%	**355**	**0.7%**
$1M - $2.49M	2	0.2%	133	0.4%	730	3.6%	**865**	**1.6%**
$2.5M - $4.99M	2	0.2%	54	0.2%	804	3.9%	**860**	**1.6%**
$5M - $9.99M		0.0%	53	0.2%	549	2.7%	**602**	**1.1%**
$10M & over		0.0%	98	0.3%	3,623	17.8%	**3,721**	**7.0%**
Unknown	2	0.2%	47	0.1%	85	0.4%	**134**	**0.3%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**
Average Bldg. Assessment	**$369,279**		**$223,239**		**$224,086**		**$225,777**	

Notification Non-Respondents

Building Assessed Value ($1,000)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
$0 - $74.9	1	3.3%	4	22.2%	118	12.0%	**123**	**11.9%**
$75 - $149.9	5	16.7%	7	38.9%	316	32.0%	**328**	**31.7%**
$150 - $249.9	7	23.3%	2	11.1%	319	32.3%	**328**	**31.7%**
$250 - $499.9	15	50.0%	3	16.7%	207	21.0%	**225**	**21.7%**
$500 - $749.9	2	6.7%		0.0%	24	2.4%	**26**	**2.5%**
$750 +		0.0%	2	11.1%	3	0.3%	**5**	**0.5%**
Grand Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1035**	**100.0%**
Average Bldg. Assessment	**$296,070**		**$435,089**		**$190,701**		**$198,005**	

Observations:

County-wide, the average building assessed values are highest for properties on alternative septic systems, followed by properties on conventional septic and sewer.

For the non-responding properties, the 18 properties on sewer skew the average assessed building values of the entire group. A comparison of average building values for only conventional septic properties shows the non-responsive properties have a significantly lower (-14.9 percent) average value than the County average.

Socio-Economic Indicators (Block Group Level)

Median Household Income

Median Household Income (for Block Groups)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*	***# Properties***	***Pct. of Total***
$43,750 - 49.999		0.0%	941	2.9%	180	**0.9%**	**1,121**	**2.1%**
$50,000 - 59,999	1	0.1%	2,334	7.3%	1,760	**8.6%**	**4,095**	**7.7%**
$60,000 - 69,999	15	1.8%	4,806	15.0%	3,350	**16.4%**	**8,171**	**15.3%**
$70,000 - 89,999	129	15.8%	6,630	20.6%	4,012	**19.7%**	**10,773**	**20.2%**
$90,000 - 109,999	180	22.1%	6,424	20.0%	3,111	**15.2%**	**9,715**	**18.2%**
$110,000 - 124,999	195	23.9%	5,618	17.5%	4,277	**21.0%**	**10,091**	**18.9%**
$125,000 - 139,999	44	5.4%	2,701	8.4%	1,263	**6.2%**	**4,008**	**7.5%**
$140,000 - 149,999	131	16.1%	459	1.4%	1,258	**6.2%**	**1,849**	**3.5%**
Over $150,000	120	14.7%	2,181	6.8%	1,139	**5.6%**	**3,440**	**6.4%**
Unknown		0.0%	24	0.1%	60	**0.3%**	**84**	**0.2%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**

Pump-Out Notification Non-Respondents

Median Household Income (by Block Group)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	**% of Total**	**# Properties**	**% of Total**	**# Properties**	**% of Total**	**# Properties**	**% of Total**
$43,750 - $69,999		0.0%	1	5.6%	39	**4.0%**	**40**	**3.9%**
$70,000 - $89,999	5	16.7%	4	22.2%	251	**25.4%**	**260**	**25.1%**
$90,000 - $109,999	7	23.3%	5	27.8%	192	**19.5%**	**204**	**19.7%**
$110,000 - $124,999	11	36.7%	8	44.4%	273	**27.7%**	**292**	**28.2%**
$125,000 - $139,999	2	6.7%		0.0%	77	**7.8%**	**79**	**7.6%**
$140,000 - $149,999	3	10.0%		0.0%	86	**8.7%**	**89**	**8.6%**
Over $150,000	2	6.7%		0.0%	69	**7.0%**	**71**	**6.9%**
Grand Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1,035**	**100.0%**

Observations:

Comparing the frequency distribution by percentage shown above (in red) for Conventional Septic properties between the County-wide group and the non-responsive group, there is a much lower share of the non-response group that is located in neighborhoods of lower median income. Expressed another way, the non-responsive group (on average) tends to be located in neighborhoods of higher median income than the County average distribution.

Percent of Families At or Below Poverty Level

Percent of Families At or Below Poverty Level (by Block Group)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	Pct. of Total	# Properties	Pct. of Total	# Properties	Pct. of Total	# Properties	Pct. of Total
0 - 1.99 Percent	487	59.8%	14,664	45.7%	8,321	40.8%	**23,473**	**44.0%**
2.0 - 2.99 Percent	70	8.6%	3,127	9.7%	1,641	8.0%	**4,840**	**9.1%**
3.0 - 4.99 Percent	128	15.7%	4,859	15.1%	4,662	22.8%	**9,650**	**18.1%**
5.0 - 7.99 Percent	107	13.1%	4,864	15.1%	2,626	12.9%	**7,597**	**14.2%**
8.0 - 19.99 Percent	23	2.8%	3,908	12.2%	2,929	14.4%	**6,860**	**12.9%**
Over 20 Percent		0.0%	696	2.2%	231	1.1%	**927**	**1.7%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**

Pump-Out Notification Non-Respondents

Percent of Families At or Below Poverty Level (by Block Group)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total
0 - 1.99 Percent	20	66.7%	8	44.4%	400	40.5%	**428**	**41.4%**
2.0 - 2.99 Percent	4	13.3%	2	11.1%	86	8.7%	**92**	**8.9%**
3.0 - 4.99 Percent	3	10.0%	4	22.2%	227	23.0%	**234**	**22.6%**
5.0 - 7.99 Percent	3	10.0%	3	16.7%	200	20.3%	**206**	**19.9%**
8.0 - 19.99 Percent		0.0%	1	5.6%	72	7.3%	**73**	**7.1%**
Over 20 Percent		0.0%		0.0%	2	0.2%	**2**	**0.2%**
Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1,035**	**100.0%**

Observations:

The non-response group, compared to the County average, has a larger share of properties in neighborhoods (i.e. census block groups) with higher rates of families living at or below the poverty level, with the largest concentration of difference in the 3 – 7.99 percent poverty level groups. These non-response properties, however, are not located generally in the poorest neighborhoods in the County.

Number of Households Receiving Public Assistance

County-wide

Households Receiving Public Assistance (by Block Group)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	Pct. of Total	# Properties	Pct. of Total	# Properties	Pct. of Total	# Properties	Pct. of Total
0 - 9 Households	480	58.9%	19,042	59.3%	12,643	61.9%	**32,167**	**60.3%**
10 - 19 Households	64	7.9%	6,184	19.3%	3,115	15.3%	**9,363**	**17.6%**
20 - 29 Households	66	8.1%	2,725	8.5%	1,786	8.8%	**4,579**	**8.6%**
30 - 39 Households	192	23.6%	1,693	5.3%	1,902	9.3%	**3,787**	**7.1%**
40 - 49 Households	13	1.6%	2,474	7.7%	964	4.7%	**3,451**	**6.5%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**
Estimate of HH on Public Assistance	**9**		**340**		**216**		**565**	

Pump-Out Notification Non-Respondents

Households Receiving Public Assistance (by Block Group)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 9 Households	**19**	63.3%	**10**	55.6%	**676**	68.5%	**705**	**68.1%**
10 - 19 Households	**2**	6.7%	**2**	11.1%	**97**	9.8%	**101**	**9.8%**
20 - 29 Households	**3**	10.0%	**4**	22.2%	**64**	6.5%	**71**	**6.9%**
30 - 39 Households	**6**	20.0%	**1**	5.6%	**117**	11.9%	**124**	**12.0%**
Over 40 Households		0.0%	**1**	5.6%	**33**	3.3%	**34**	**3.3%**
Grand Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1035**	**100.0%**

Observations:

The non-response group, compared to the County average, has a lower share than the County average in the percent of properties located in neighborhoods (i.e. block groups) with the highest concentrations of households (i.e. over 40 per block group) receiving public assistance.

Educational Attainment Level

Percent of Persons Age 25+ with Less Than High School Diploma (by Block Group)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*
0 - 2.99 Percent	44	5.4%	9,386	29.2%	2,724	13.3%	**12,155**	**22.8%**
3.0 - 6.99 Percent	372	45.6%	11,532	35.9%	6,531	32.0%	**18,436**	**34.6%**
7.0 - 8.99 Percent	145	17.8%	7,388	23.0%	5,188	25.4%	**12,721**	**23.8%**
9.0 - 14.99 Percent	171	21.0%	2,894	9.0%	3,603	17.7%	**6,670**	**12.5%**
15.0+ Percent	83	10.2%	918	2.9%	2,364	11.6%	**3,365**	**6.3%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**
Average Percent	**8.22%**		**5.85%**		**8.35%**			

Pump-Out Notification Non-Respondents

Percent of Persons Age 25+ with Less Than High School Diploma (by Block Group)	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 2.99 Percent	3	10.0%	9	50.0%	78	7.9%	**90**	**8.7%**
3.0 - 6.99 Percent	15	50.0%	6	33.3%	403	40.8%	**424**	**41.0%**
7.0 - 8.99 Percent	2	6.7%	3	16.7%	170	17.2%	**175**	**16.9%**
9.0 - 14.99 Percent	6	20.0%		0.0%	277	28.1%	**283**	**27.3%**
Over 15 percent	4	13.3%		0.0%	59	6.0%	**63**	**6.1%**
Grand Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1,035**	**100.0%**

Observations:

Across all wastewater system types, the non-response group has a higher share (33.4%) of properties located in neighborhoods (i.e. block group areas) with higher levels of households (over 9 percent) receiving public assistance than the County-wide average (18.8%).

The difference between the non-response group and the County-wide average among properties on conventional septic is less pronounced, with 34.1% of the non-response group septic properties in the higher public assistance rate (over 9 percent) block groups than the County average (29.3%).

Environmental Indicators

NRCS Type C or D Soils

NRCS SOIL GROUP	Alternative Septic		Co. Sewer		Conv. Septic		Total	
	# Properties	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*
A	23	2.8%	3,043	9.5%	1,563	7.7%	**4,629**	**8.7%**
B	418	51.3%	15,950	49.7%	11,389	55.8%	**27,760**	**52.0%**
C or D	374	45.9%	13,125	40.9%	7,458	36.5%	**20,958**	**39.3%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**

Pump-Out Notification Non-Respondents

NRCS SOIL GROUP	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
A		0.0%		0.0%	46	4.7%	**46**	**4.4%**
B	17	56.7%	9	50.0%	636	64.4%	**662**	**64.0%**
C or D	13	43.3%	9	50.0%	305	30.9%	**327**	**31.6%**
Grand Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1,035**	**100.0%**

Observations:

Overall, the non-response group properties with Conventional or Alternative Septic systems tend to be located on sites with better soils (A & B) than the County-wide average, with lower percentages of properties on sites on C or D soil types.

Proximity to RPA

Distance to RPA	Alternative Septic		Co. Sewer		Conv. Septic		Total	
	# Properties	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*
0 - 49 Ft.	31	3.8%	866	2.7%	614	3.0%	**1,511**	**2.8%**
50 - 99 Ft.	55	6.7%	888	2.8%	526	2.6%	**1,470**	**2.8%**
100 - 149 Ft.	33	4.0%	838	2.6%	478	2.3%	**1,349**	**2.5%**
150 - 199 Ft	28	3.4%	959	3.0%	576	2.8%	**1,563**	**2.9%**
200 - 249 Ft.	30	3.7%	1,049	3.3%	597	2.9%	**1,676**	**3.1%**
250 - 299 Ft	21	2.6%	1,018	3.2%	642	3.1%	**1,681**	**3.2%**
300 - 349 Ft.	31	3.8%	1,073	3.3%	599	2.9%	**1,703**	**3.2%**
Over 350 Ft.	586	71.9%	25,427	79.2%	16,378	80.2%	**42,394**	**79.5%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**
Average (Mean) Distance (Ft.)	**844**		**917**		**989**			

Pump-Out Notification Non-Respondents

Distance to RPA	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 49 Ft.	4	13.3%	1	5.6%	36	3.6%	**41**	**4.0%**
50 - 99 Ft.		0.0%		0.0%	24	2.4%	**24**	**2.3%**
100 - 149 Ft.	1	3.3%	1	5.6%	22	2.2%	**24**	**2.3%**
150 - 199 Ft.		0.0%		0.0%	26	2.6%	**26**	**2.5%**
200 - 249 Ft.		0.0%		0.0%	32	3.2%	**32**	**3.1%**
250 - 299 Ft.		0.0%		0.0%	40	4.1%	**40**	**3.9%**
300 - 349 Ft.	3	10.0%	2	11.1%	31	3.1%	**36**	**3.5%**
Over 350 Ft.	22	73.3%	14	77.8%	776	78.6%	**812**	**78.5%**
Grand Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1,035**	**100.0%**

Observations:

The non-response property group on Conventional Septic fairly closely mirrors the County-wide pattern of distance to the closest RPA feature from the property address, with 6 percent of the properties within 100 feet of the RPA compared to 5.6 percent County-wide.

Proximity to Wetlands

County-wide

Distance to Wetlands	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 49 Ft.	7	0.9%	265	0.8%	162	0.8%	**434**	**0.8%**
50 - 99 Ft.	16	2.0%	495	1.5%	356	1.7%	**867**	**1.6%**
100 - 149 Ft.	27	3.3%	595	1.9%	464	2.3%	**1,086**	**2.0%**
150 - 199 Ft.	35	4.3%	640	2.0%	579	2.8%	**1,254**	**2.4%**
200 - 249 Ft.	43	5.3%	698	2.2%	563	2.8%	**1,304**	**2.4%**
250 - 299 Ft.	34	4.2%	819	2.5%	652	3.2%	**1,505**	**2.8%**
300 - 349 Ft.	41	5.0%	865	2.7%	775	3.8%	**1,681**	**3.2%**
Over 350 Ft.	612	75.1%	27,741	86.4%	16,859	82.6%	**45,216**	**84.8%**
Grand Total	**815**	**100.0%**	**32,118**	**100.0%**	**20,410**	**100.0%**	**53,347**	**100.0%**
Mean (Avg.) Distance (Ft.)	**785**		**1,078**		**897**			

Pump-Out Notification Non-Respondents

Distance to Wetlands	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 49 Ft.	**1**	3.3%		0.0%	**5**	0.5%	**6**	**0.6%**
50 - 99 Ft.	**2**	6.7%	**1**	5.6%	**15**	1.5%	**18**	**1.7%**
100 - 149 Ft.	**1**	3.3%		0.0%	**24**	2.4%	**25**	**2.4%**
150 - 199 Ft.	**3**	10.0%		0.0%	**29**	2.9%	**32**	**3.1%**
200 - 249 Ft.	**3**	10.0%		0.0%	**30**	3.0%	**33**	**3.2%**
250 - 299 Ft.		0.0%		0.0%	**39**	4.0%	**39**	**3.8%**
300 - 349 Ft.	**4**	13.3%		0.0%	**49**	5.0%	**53**	**5.1%**
Over 350 Ft.	**16**	53.3%	**17**	94.4%	**796**	80.6%	**829**	**80.1%**
Grand Total	**30**	**100.0%**	**18**	**100.0%**	**987**	**100.0%**	**1,035**	**100.0%**

Observations:

The non-response property group on Conventional Septic fairly closely mirrors the County-wide pattern of distance to the closest wetland feature from the property address, with 2 percent of the properties within 100 feet of the closest wetland compared to 2.5 percent County-wide.

Overall, the vast majority (over 80 percent) of all conventional septic properties are 350 feet or more from the closest wetland area.

Septic Implications for Bacteria TMDL Implementation Plans

The Region's stream networks and those segments with bacteria impairments are shown in Figure 6. Each locality in the Region has stream sections that have bacteria impairments which, under the U.S. Clean Water Act, create restrictions on recreational and other uses of the waterways until the impairments are removed. In Virginia, typical sources of fecal bacterial impairments may include:

- agricultural run-off from grazing lands, unfenced streams, and livestock pens,
- bio-solids derived from animal and human manure (also a source of Nitrogen and Phosphorus),
- natural animal sources from wildlife, and
- seepage from failing onsite wastewater treatment (septic) installations.

Figure 6. Stream Segments in PD 16 with Bacterial Impairments

Locality	Total Mileage of Bacteria-Impaired Streams	Percent of Regional Total Bacteria-Impaired Stream
Caroline Co.	188.91	57.1%
City of Fredericksburg	5.28	1.6%
King George Co.	30.66	9.3%
Spotsylvania Co.	56.33	17.0%
Stafford Co.	49.60	15.0%
PD 16 Total	**330.78**	**100.0%**

Source: Calculated by RDS, LLC from DEQ Stream Network data.

Provided below are a series of tables which summarize the number of improved properties, by type of wastewater treatment system and by distance from any local streams with bacterial impairment. The Mattaponi River Bacterial TMDL Implementation Plan study, currently underway, should soon (Spring 2019) provide an analysis of sources and recommended corrective actions to address in this particularly watershed that traverses Spotsylvania and Caroline Counties and encompasses parts of 6 counties, from Orange County all the way to portions of three counties east of Caroline Co. Along with BMPs to address and limit agricultural sector sources, it is anticipated that enhanced septic system management may be recommended by this TMDL Implementation Plan (as it is in other similar bacteria impairment studies) to reduce pollution from the residential septic sector.

City of Fredericksburg

With only 42 septic systems in the City, it is presumed for this study that these systems are not major contributors to the bacteria impairment of Hazel Run and unnamed tributaries (5.28 miles, as the one stream segment physically located in the City), since most of the properties are considerable distance from Hazel Run, which flows west to east, before reaching the Rappahannock River, an impaired segment which is physically part of Stafford County.

Caroline

Proximity to Bacteria-Impaired Streams

Distance to Bacteria-Impaired Stream	Conventional Septic		AOSS Septic		Sewer Systems		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	***# Properties***	***% of Total***
0 - 49 Ft.	92	1.0%	3	1.6%	4	0.2%	**99**	**0.8%**
50 - 99 Ft.	80	0.8%	1	0.5%	4	0.2%	**85**	**0.7%**
100 - 149 Ft.	95	1.0%	2	1.1%	3	0.1%	**100**	**0.8%**
150 - 199 Ft.	82	0.9%		0.0%	7	0.3%	**89**	**0.7%**
200 - 249 Ft.	74	0.8%	1	0.5%	14	0.6%	**89**	**0.7%**
250 - 299 Ft.	76	0.8%		0.0%	10	0.4%	**86**	**0.7%**
300 - 349 Ft.	71	0.7%	3	1.6%	13	0.6%	**87**	**0.7%**
350 Ft. & Over	9,051	94.1%	180	94.7%	2,294	97.5%	**11,525**	**94.8%**
Distance Unknown		0.0%		0.0%	3	0.1%	**3**	**0.0%**
Grand Total	**9,621**	**100.0%**	**190**	**100.0%**	**2,352**	**100.0%**	**12,163**	**100.0%**

Caroline County has the most mileage (188.91 miles) and majority share (57.1 percent) of impaired streams in the region. About 2 percent (176 properties) of all septic systems are located within 100 feet of bacteria-impaired streams throughout the County, with another 1 percent (97 properties) within the next 50 feet away. More focused investigation of the age of these systems, their maintenance history, site soil conditions and other factors before concluding that they don't contribute to the bacterial violations.

King George

Proximity to Bacteria-Impaired Streams

King George has the second smallest share of bacteria-impaired stream mileage (30.66 miles, 9.3 percent) in the region. Ninety-eight (100, or 1.2 percent) properties on conventional or alternative septic are located within 100 feet of the closest bacteria-impaired stream in the County.

Distance to Closest Bacteria-Impaired Stream	Conv. Septic		AOSS Septic		Co. & NSWC Sewer		Grand Total	
	# Properties	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*	*# Properties*	*% of Total*
0 - 49 Ft.	56	0.7%		0.0%		0.0%	**56**	**0.5%**
50 - 99 Ft.	42	0.5%	2	1.0%		0.0%	**44**	**0.4%**
100 - 149 Ft.	48	0.6%		0.0%		0.0%	**48**	**0.4%**
150 - 199 Ft.	46	0.6%	1	0.5%		0.0%	**47**	**0.4%**
200 - 249 Ft.	57	0.7%	1	0.5%		0.0%	**58**	**0.5%**
250 - 299 Ft.	50	0.6%	1	0.5%		0.0%	**51**	**0.4%**
300 - 349 Ft.	40	0.5%		0.0%		0.0%	**40**	**0.3%**
350 Ft. & Over	7,844	95.9%	186	97.4%	3,279	100.0%	**11,309**	**97.0%**
Grand Total	**8,183**	**100.0%**	**191**	**100.0%**	**3,279**	**100.0%**	**11,653**	**100.0%**

Spotsylvania

Proximity to Bacteria-Impaired Streams

Distance to Closest Bacteria-Impaired Stream	AOSS Septic		Co. Sewer		Conventional Septic		Grand Total	
	# Properties	% of Total	# Properties	% of Total	# Properties	% of Total	**# Properties**	**% of Total**
0 -49 Ft.	1	0.2%	56	0.2%	45	0.2%	**102**	**0.2%**
50 - 99 Ft.	1	0.2%	56	0.2%	55	0.3%	**112**	**0.2%**
100 - 149 Ft	3	0.6%	58	0.2%	43	0.2%	**104**	**0.2%**
150 - 199 Ft		0.0%	49	0.2%	38	0.2%	**87**	**0.2%**
200 - 249 Ft.	1	0.2%	54	0.2%	30	0.2%	**85**	**0.2%**
250 - 299 Ft.		0.0%	48	0.2%	44	0.2%	**92**	**0.2%**
300 - 349 Ft.		0.0%	43	0.1%	42	0.2%	**85**	**0.2%**
350 Ft. & Over	496	98.8%	29,059	98.8%	19,351	98.5%	**48,906**	**98.7%**
Grand Total	**502**	**100.0%**	**29,423**	**100.0%**	**19,648**	**100.0%**	**49,573**	**100.0%**

With less than 1 percent of all conventional and alternative septic systems (or 186 properties) located under 200 feet from bacteria-impaired stream segments throughout the County, there may be less concern for these properties being a major source of bacteria-contaminated effluent flow. However, more focused investigation of the age of these systems, their maintenance history, site soil conditions and other factors before concluding that they don't contribute to the bacterial violations.

Stafford

Proximity to Bacteria-Impaired Streams

Distance to Closest Bacteria-Impaired Stream	Alternative Septic		Co. Sewer		Conventional Septic		Total	
	# Properties	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*	*# Properties*	*Pct. of Total*
0 - 49 Ft.	5	0.6%	265	0.8%	49	0.2%	**319**	**0.6%**
50 - 99 Ft.	6	0.7%	281	0.9%	62	0.3%	**349**	**0.7%**
100 - 149 Ft.	7	0.9%	269	0.8%	55	0.3%	**331**	**0.6%**
150 - 199 Ft.	5	0.6%	252	0.8%	69	0.3%	**326**	**0.6%**
200 - 249 Ft.	3	0.4%	225	0.7%	52	0.3%	**280**	**0.5%**
250 -299 Ft.	1	0.1%	206	0.6%	133	0.7%	**340**	**0.6%**
300 - 349 Ft.	3	0.4%	232	0.7%	62	0.3%	**297**	**0.6%**
Over 350 Ft.	785	96.3%	30,388	94.6%	19,928	97.6%	**51,105**	**95.8%**
Grand Total	**815**	100.0%	**32,118**	100.0%	**20,410**	100.0%	**53,347**	**100.0%**
Mean (Avg.) Distance (Ft.)	**7,731**		**4,324**		**6,967**			

While the number of properties throughout the County within 100 feet of a bacteria-impaired stream is limited to 111 conventional septic systems (only .5 percent of all conventional septic systems) and only 11 alternative septic systems, the County's more rugged terrain with steeper slopes in some areas may contribute to a greater chance of untreated effluent flow from more distant failing systems reaching the streams, particularly during heavy rainfall events. More focused investigation of the age of these systems, their maintenance history, site soil conditions and other factors is needed before concluding that they don't contribute to the bacterial standard violations.

The Onsite Sewage System Sector: Licensed Operators' Perspectives

Project researchers developed a survey of licensed onsite sewage system operators to elicit their findings in the field on common problems with septic systems observed and their preferences on possible program changes. The survey was developed and made available online and then, to boost the response rate, a mailed-out version was sent to all companies identified that are located in or work in the study area. The final response of 6 completed surveys was disappointing, but still provides program insights worth considering. A list of the 25 companies surveyed (see Appendix D) and a complete summary of the survey results (see Appendix E) are provided in the Appendices.

A. Contractor Ranking of strategies to increase public compliance with and reporting of required septic maintenance efforts

#1: 5/6 Consistent local government enforcement of civil penalties for violation of local CBPA ordinance.
#2: 4/6 Establish and implement public assistance program for low-income households to provide cost-share for required on-site wastewater system maintenance.

If there are there other onsite wastewater program suggestions you would like to make, please describe here:

a) Contractor ability to access VDH records would be helpful
b) Pumpers need 24/7 / 365 dump disposal access
c) Alternative system owners need better set-up by the designers and installers

B. General incidence of onsite wastewater system failure when visiting a site for inspection or pump-out services

Two-thirds (66%) of survey respondents indicated that 5—10 percent (or higher) of all septic systems are failing when visiting a property to perform an inspection or pump-out. Based on the regional total estimate of 61,950 septic systems (for both conventional and alternative systems), respondents' feedback suggests there are between 3,100 – 6,200+ systems currently failing in the region that warrant repair or replacement attention. Targeting financial incentives through a cost-share program (for septic system maintenance, repair or replacement) to properties in close proximity to impaired steam segments has been shown to be an effective strategy in reducing bacteria and nitrogen loadings and restoring these waterways to a cleaner, natural state.

C. Contractor ranking of top causal factors that contribute to onsite wastewater system failure in coastal and Tidewater Virginia.

#1: (5/6) Property owners' indifference to adequate system maintenance (e.g. inspections, pump-outs, etc.)
#2: (4/6) Poor soil conditions for the septic drain field location

In light of the #1 ranking of property owners' indifference to adequate system maintenance (and proper operation), it would seem that a public education program to raise public awareness of the importance of proper system use and maintenance should be part of the overall regional program.

D. VDH Coordination with DPOR's WWWOOSSP Board

The Board for Waterworks and Wastewater Works Operators and Onsite Sewage System Professionals (WWWOOSSP Board) licenses individuals who operate water and wastewater treatment facilities, as well as onsite soil evaluators, onsite sewage system installers, and onsite sewage system operators. The 11-member

board is composed of licensed practitioners, the director of the Virginia Department of Health's Office of Water Programs, the executive director of the State Water Control Board, and one citizen. VDH-RAHD staff reported that, through their investigations of onsite sewage system complaints and review of submitted onsite septic designs that some licensed operators need additional training in one or more aspects of system planning and implementation. One of the common pre-requisites of licensure is the applicant's completion of VDH's onsite sewage system training program.

Licensed operators that responded to the survey had several comments about the complexity of the relationship between VDH, DPOR's WWWOOSSP Board, and other licensing entities for related disciplines.

Onsite Sewage System Financial Assistance Programs

There are many onsite sewage system financial assistance programs, summarized below.

A. Grant Program Options

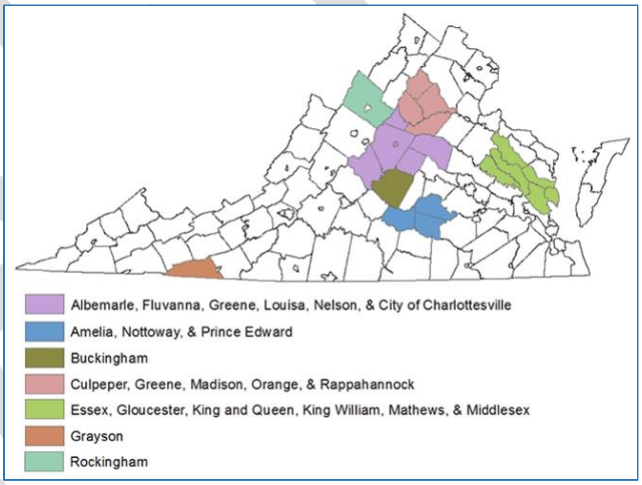
1. USDA Rural Development Single Family Housing Repair Loans and Grants
   This program provides grants and low interest loans to very-low income homeowners to repair, improve, or modernize their homes to remove health and safety hazards. Loans and grants can be combined for up to $27,500 in assistance.

2. Virginia Department of Health Indemnification Fund

   VDH's Indemnification Fund provides homeowners with funding assistance for repairing or replacing an onsite sewage system or components that failed within 3 years of installation due to the negligence of VDH. Funding is available up to $30,000 and is reimbursed to the homeowner following repair or replacement of the onsite sewage system or components.

3. Virginia Water Quality Improvement Fund (WQIF)

   Local assistance to repair, replace, or pump out a septic system is available in several areas of the state (see figure at right) through community grants awarded from the Virginia Water Quality Improvement Fund. Despite having the highest density of onsite systems and the highest growth rate in septic systems, the PD16/RAHD service area has not received any financial assistance grants to support low-income household maintenance of onsite systems. This program has operated as a competitive grant program with inconsistent funding levels provided by the Virginia General Assembly to meet the demand throughout Tidewater Virginia.



   Community and environmental advocates are urging the Commonwealth under the TMDL WIP III program to take the funding commitment given to point source pollution reduction under the Chesapeake Bay program (allowing the Commonwealth to achieve and surpass 2017 CB 40 % TMDL target reductions) and make commensurate investments in nonpoint programs to achieve the 2025 60% TMDL load reduction targets.

4. Nonpoint Source TMDL Implementation Funding

   Since 2001, Virginia has been operating a comprehensive Nonpoint Source TMDL Implementation Program, primarily funded through federal EPA Section 319(h) funds. Upon completion of TMDL Implementation Plans, watershed areas may be eligible to receive funding to complete comprehensive, multi-year TMDL implementation projects. The purpose of the projects is to implement on-the-ground activities or Best Management Practices, BMPs, in order to improve water quality and meet water quality standards. The goal of these projects, through restoration and protection efforts, is to meet water quality standards and associated TMDLs.

Through Section 319 of the Clean Water Act, Virginia is awarded grant funds to implement the nonpoint source programs. DEQ administers the money, in coordination with the advisory committee, to fund watershed projects, demonstration and educational programs, nonpoint source pollution control program development, and technical and program staff. As the lead agency in Virginia for nonpoint source pollution control programs, DEQ also coordinates other nonpoint source initiatives, such as the Chesapeake Bay Program and the Coastal Nonpoint Source Pollution Control Program. Within the TMDL program, projects that receive funding for residential septic BMPs need to follow DEQ's Nonpoint Source Best Management Practice Guidelines.

The experience of the Culpeper SWCD "Residential Cost-Share" program[11] for septic assistance is illustrative of the potential impact of leveraging federal and state grant programs with private landowner investments to address regional nonpoint pollution problems. Initially funded with a combination of specific stream TMDL implementation grants and a district-wide WQIF grant in 2015, this program offers financial assistance to all residents in the 5 county conservation district to remedy septic system malfunctions and perform preventative maintenance. The Culpeper SWCD seeks out grants from both state and federal sources to assist landowners with the implementation costs for projects that both protect and improve local stream health. In FY 2017-2018, the District allocated $330,898 in residential cost share funding to 649 needed projects in the Upper Hazel, Rapidan, Robinson and Upper York TMDL watersheds and elsewhere in the District.

The Culpeper program focuses outreach efforts for septic system maintenance in impaired watersheds that have a Total Maximum Daily Load (TMDL) Implementation Plan. The property owner's cost share is 50% of approved costs including pump out, repairs, replacements and new systems or drainfields. In watersheds with a Virginia TMDL on local waters, the WQIF guidelines allow higher levels of cost-share subsidy for low-income household financial assistance for onsite sewage system (septic) pump-out service, repair or replacement (up to 80 percent of total cost) where septic systems are recommended through a TMDL Implementation Plan as a BMP to achieve the TMDL goal and mitigate the impairment.

Table 14. Culpeper SWCD Septic Cost Share Program Reimbursement Limits

Septic Maintenance Services	Cost Share Payment Policy
Septic Pump-out	50% of cost or $150 max (up to $240 for low income)
Septic Pump out & Inspection	50% of cost or $1000 max (up to $1600 for low income)
Repair (alternative systems not eligible)	50% of cost or $2500 max (up to $4,000 for low income)
Conventional system installation	50% of cost or $4000 max (up to $6,400 for low income)
Conventional system with pump	50% of cost or $5000 max (up to $8,000 for low income)
Engineered/ Alternative system installation	50% of cost or $12,000 max (up to $19,200 for low income)

5. Virginia Community Development Block Grant Program

The Virginia Community Development Block Grant (CDBG) program, administered by the Virginia Department of housing and Community Development, provides funding to eligible units of local government for planning and implementing projects that address critical community development needs, including housing, infrastructure and economic development. The goal of the CDBG Program is to improve the economic and physical environment in Virginia's communities through activities which primarily benefit low- and moderate-income persons, prevent or eliminate slums and blighting conditions or meet urgent needs which threaten the welfare of citizens. This program was used to support the development of a community sewer system for the Dawn community in Caroline County.

[11] See: http://www.culpeperswcd.org/wp-content/uploads/annual-report-2017.2018.pdf

Under this program, eligible localities may apply for Planning Grants for project development or Community Improvement Grants for project implementation.

Units of local government in non-entitlement localities are the only eligible recipients of VCDBG funding. Localities may partner with planning district commissions, nonprofit organizations and other entities to undertake project activities.

6. Southeast Rural Community Assistance Project, Inc. (SERCAP)

SERCAP helps small rural towns and communities needing aid in upgrading their water and wastewater systems. SERCAP also provides training and technical assistance to rural residents for operation and maintenance of those systems, for capacity building and for economic development in their communities.

Funding is made available to low-income individuals and communities in the form of grants and loans in order to rehabilitate housing, build water and wastewater infrastructure, assist in small business development, and to finance development projects of small rural governments.

SERCAP recently released a new and improved application in a fillable pdf format for a simplified application process. You can find it here: SERCAP Universal Application

B. Loan Program Options

1. Virginia Department of Housing and Community Development, Indoor Plumbing Rehabilitation

The Indoor Plumbing Rehabilitation (IPR) program provides zero percent interest, subsidized loans in eligible localities for the installation of indoor plumbing to owners of substandard housing where indoor plumbing does not exist or where the existing waste water disposal systems have failed. Loan repayments are determined by the homeowner's ability to make payments.

2. Federal Housing Administration (FHA) 203(K) REHAB MORTGAGE INSURANCE

Section 203(k) insurance enables homebuyers and homeowners to finance the purchase (or refinancing) of a house and the cost of its rehabilitation through a single mortgage or to finance the rehabilitation of their existing home.

203K Program-Eligible Home Improvement Expenses

- structural alterations and reconstruction **(including sewer system connection)**
- modernization and improvements to the home's function
- elimination of health and safety hazards
- changes that improve appearance and eliminate obsolescence
- reconditioning or replacing plumbing; **installing a well and/or septic system**
- adding or replacing roofing, gutters, and downspouts
- adding or replacing floors and/or floor treatments
- major landscape work and site improvements
- enhancing accessibility for a disabled person
- making energy conservation improvements

Section 203(k) insures mortgages covering the purchase or refinancing and rehabilitation of a home that is at least a year old. A portion of the loan proceeds is used to pay the seller, or, if a refinance, to pay off

the existing mortgage, and the remaining funds are placed in an escrow account and released as rehabilitation is completed. The cost of the rehabilitation must be at least $5,000, but the total value of the property must still fall within the FHA mortgage limit for the area. The value of the property is determined by either: (1) the value of the property before rehabilitation plus the cost of rehabilitation, or (2) 110 percent of the appraised value of the property after rehabilitation, whichever is less.

Many of the rules and restrictions that make FHA's basic single family mortgage insurance product (Section 203(b)) relatively convenient for lower income borrowers apply here. But lenders may charge some additional fees, such as a supplemental origination fee, fees to cover the preparation of architectural documents and review of the rehabilitation plan, and a higher appraisal fee.

3. Local-Option Septic System Repair Loans

In 2013, the Virginia General Assembly enacted HB 1443 (which was codified as § 15.2-958.6) that enables local governments to adopt a local ordinance to provide a local septic repair loan program and establish local terms to qualify for and repay the loan. According to the bill's Chief Patron Del. M. Keith Hodges, no locality in Virginia has yet exercised the delegated authority to establish such a local-option septic repair loan program.

FINDINGS AND RECOMMENDATIONS

This project has assembled and cross-referenced multiple State and local data files, representing over 466,000 records, to identify the type of onsite wastewater system in place on each improved property. Moreover, where local pump-out notification data have been provided, the project has identified properties which failed to report a system inspection or pump-out after receiving notification(s) from local government. The project then compared these "non-reporting" properties with some county-wide trends using various physical, environmental and socio-economic factors that could impact the performance of onsite sewage treatment systems and their relative risk to the environment and the water quality of local and State waters. Provided below is a summary of the key findings from this data assimilation and analysis.

FINDINGS

A. VDEQ

1. Data provided in the Chesapeake Bay program CAST model on septic sector BMPs was found to be either grossly in error (in the case of reported septic system pump-outs) or unsubstantiated by any alternative identifiable source (for all other septic sector BMPs).

2. The 2017 CAST data on septic pump-outs failed to include the locally-reported pump-outs provided to DEQ's Chesapeake Bay Local Assistance Division office.

3. The methodology inherent with the CAST model projections for WIP II septic sector BMPs failed to adequately consider the historic trends in septic permit issuance and the growth in alternative septic systems, as well as the overall population and economic growth projected for PD 16.

B. VDH and Rappahannock Area Health District (RAHD)

1. The RAHD recently completed a project to scan all septic permit files and build a spreadsheet file of addresses for all issued septic permits.

   a) Researchers identified numerous problems with the developed septic permit list, citing incomplete data entries, erroneous addresses, numerous misspellings, out-of-date tax parcel numbers, lack of OSS description (e.g. conventional or alternative), missing issuance dates, etc.

   b) In spite of the short-comings inherent with the lists provided, project researchers were able to locate a significant percentage (80+ percent, varying by locality) of all records in each of the four counties.

2. The RAHD and local health departments have experienced high volumes a septic permit applications over the last 18 years and the added responsibility to oversee annual inspections of alternative systems, combined with investigating anonymous complaints about failing systems, has made it difficult for the department, with existing resources, to fulfill its statutory duties.

3. The low compliance rate for private landowners with alternative systems to procure annual system inspections and maintenance services and/or the incomplete reporting of these inspections and maintenance calls by licensed AOSS operators through the VENIS O & M reporting system demonstrates a potentially wide-spread violation of State regulations for these alternative systems.

4. The RAHD staff would like to coordinate with related regional agencies (e.g. GWRC, SWCDs, etc.) and improve information-sharing so that septic permit records are kept up-to-date with local property records and results from septic pump-out notifications. While such coordination is deemed desirable, without some facilitation through shared information/systems and/or increased staffing support and State-local collaboration, it would seem unlikely to occur organically.

5. RAHD's septic system record-management efforts would benefit from adding or sharing GIS mapping and spatial analysis functionality with local governments or partner regional agencies.

6. RAHD reports receiving 100+ anonymous complaints each year about failing or non-compliant septic systems. Private OSS operators and the general public apparently aren't aware (generally) of this opportunity as most (5/6) surveyed operators support the idea of establishing an anonymous, "whistle-blower" system to report septic violations.

7. VHD staff report the need for more technical training of septic site evaluators, designers, and installers to improve onsite septic design and siting to produce custom systems that perform well in spite of more complex site conditions (e.g. challenging soils, slope, depth to water table, and proximity to impaired streams, RPA and wetland areas) are larger considerations in proper site design and installation.

8. Researchers found numerous problems with address and other data reported through the system, evidencing a lack of any system for address data standardization and validation during data entry. The lack of any apparent VDH follow-up or investigation of those properties with alternative septic systems with an erratic annual reporting history of AOSS maintenance calls indicates either a maintenance compliance issue with the AOSS property owners, a maintenance record reporting problem by the licensed AOSS operators or both; but VDH lacks the resources to do adequate follow-up to determine which is the responsible party in violation of AOSS regulations.

9. State Code allows an exemption from the 5-year mandatory septic pump-out requirement if a VDH-approved plastic filter has been installed in the outflow pipe between the septic tank and the drainfield. Except perhaps on the original site design, there is no public record of which septic systems may have this feature that exempts them from the 5 year pump-out requirement. Consequently it is unknown how many septic notifications are issued by local governments "in error" due to the lack of reporting of this system feature that exempts them from the CBPA pump-out program.

10. VDH is working on a replacement, targeted to be activated in April 2019, to the VENIS AOSS O&M record reporting system. Current records in the system were found to be replete with misspellings, incomplete addresses, mistaken locality coding, missing system treatment type, and other shortcomings.

C. Regional: Public and Private Sectors

1. GWRC has in-house GIS capability, a successful agency track-record of securing federal and state grants to provide various types of community and homeowner assistance (e.g. environmental planning, energy conservation and foreclosure assistance) and experience in coordinating college interns to provide relative low-cost, but high-quality, planning and GIS assistance.

2. The private real estate marketplace is increasingly emphasizing and/or requiring septic system inspections and certifications before home purchase loan applications are approved by public and private mortgage underwriters.

3. Local environmental planning staff in the Region advocate re-assigning local septic pump-out notification and tracking under the Chesapeake Bay Preservation Act to the Virginia Department of Health to unify VDH's permitting, oversight and enforcement roles in onsite sewage management. This sentiment is echoed in three other PDCs (Northern Neck, Middle Peninsula and Accomack-Northampton) and championed by Del. M. Keith Hodges who has introduced a bill for the 2019 General Assembly to affect this transfer in these three PDCs through VDH's development of a transition plan to assume local governments' septic notification and tracking roles under the CBPA.

4. Local licensed onsite sewage system operators view consistent enforcement of State and local septic management regulations and the implementation of a regional septic maintenance/repair financial assistance program as the most important strategies to increase private landowner compliance with septic inspection and pump-out requirements.

5. Local licensed onsite sewage system operators estimate that 5 – 10+ percent of all septic systems in the Region are failing. This failure rate represents a range of 3,100 – 6,200+ systems in need of major repair or replacement.

6. Local licensed onsite sewage system operators report poor soil conditions for many septic sites and property owner indifference to proper use and maintenance of their onsite septic system as the leading causes of septic system failure. These problems point to the need for better training for site designers and a public education program to inform property owners on the proper use of their onsite sewage system and the importance of periodic inspections and maintenance pump-outs.

D. Local Governments

1. Caroline County

a) During the course of the project, the County's GIS staff and consultants provided data files to support the project; however, County parcel mapping and address file corrections and updates were on-going throughout the project, making the final project results incomplete at best as new addresses or parcel edits were unavailable for processing.

b) The effective county-wide compliance rate in 2017 through voluntary pump-outs for 20 percent of all septic systems was 58.3 percent; while the compliance rate for the CBPA area was 78.3 percent.

c) The Town of Bowling Green failed to respond to requests to supply the Town's sewer customer list.

d) A total of 12,163 improved properties were identified county-wide, 2,352 (or 19.3 %) on public sewer, 190 (or 1.6 %) on alternative septic and 9,621 (or 79.1 %) on conventional septic systems.

e) There are 188.71 miles of bacteria-impaired streams throughout the County, including the Mattaponi River currently under a TMDL Implementation Plan development.

f) In 2017, the pump-out compliance rate for the County's designated RPA (based on notification responses from property owners) was 11.5 percent; however, the actual compliance rate was 73.14 percent, based on property pump-outs reported through the County Wastewater Treatment Plant's pumper truck manifest system.

2. King George County

a) A total of 11,653 improved properties were identified county-wide, 3,284 (or 28.1 %) on public sewer, 186 (or 1.6 %) on alternative septic and 8,183 (or 70.2 %) on conventional septic systems.

b) There are 30.66 miles of bacteria-impaired streams throughout the County.

c) The effective pump-out compliance rate for 2017 was 48.8 percent.

d) The County's process for pump-out notification appears to be contacting property owners which have already reported an inspection or pump-out within the last five years and should be excluded from the notification process for 5 years from their last reported inspection or pump-out.

3. Spotsylvania County

a) A total of 49,573 improved properties were identified county-wide, 29,423 (or 59.4 %) on public sewer, 502 (or 1.0 %) on alternative septic and 19,648 (or 39.6 %) on conventional septic systems.

b) There are 56.33 miles of bacteria-impaired streams throughout the County, including the Mattaponi River currently under a TMDL Implementation Plan development.

c) This project reviewed three related but separate, and somewhat inconsistent, data files provided by the County; including the County Utilities Department's sewer customer address list, the County Real Estate Assessment Office list of parcels connected to either County water or sewer, and the Code Compliance Office list of tax parcels on septic pump-out notification list. 119 "septic" parcels on the latter list were found on the County sewer customer address list.

d) The County declined repeated requests to share the septic notification address list and pump-out response history maintained by Code Compliance staff, as well as the total number of pump-outs reported annually to VDEQ's CBLAD office. Moreover, the County declined to share this information to support the development of the Mattaponi Bacteria TMDL Implementation Plan.

e) The 2017 pump-out response number reported to DEQ's CBLAD staff could not be validated but is suspected to be in error as it represents 104 percent of the number of properties that represent 20 percent of the County's full pump-out notification address list.

f) The current Mattaponi Bacteria TMDL Implementation Plan effort, which covers roughly half the County, provides indications of failing and/or poorly-maintained septic systems as a potential source of bacterial contamination of local streams and the Chesapeake Bay.

4. Stafford County

a) A total of 53,353 improved properties were identified county-wide, 32,118 (or 60.2 %) on public sewer, 815 (or 1.5 %) on alternative septic and 20,410 (or 38.3 %) on conventional septic systems.

b) The effective septic pump-out compliance rate for 2017 was 85.5 percent.

c) There are 49.6 miles of bacteria-impaired streams throughout the County (with another 9.6 miles of bacteria-impaired streams within USMC-Quantico boundary outside the County jurisdiction).

d) The County currently provides septic pump-out financial assistance, on a limited basis, to seventeen (17) households scattered throughout the County. County staff expressed the County's desire to find a means to repair or replace these systems to relieve the County of this annual cost burden.

5. City of Fredericksburg

a) A total of 9,272 improved properties were identified city-wide, 9,230 (or 99.5 %) on public sewer, 0 (or 0 %) on alternative septic and 42 (or .5 %) on conventional septic systems.

b) The effective septic pump-out compliance rate for 2017 was 23.8 percent.

c) There are 5.28 miles of bacteria-impaired streams in the City.

RECOMMENDATIONS

A. VDH / RAHD

1. Work with VDPOR's Board for Waterworks and Wastewater Works Operators and Onsite Sewage System Professionals (WWWOOSSP Board) to review current licensing and training standards to ensure adequate training certifications are obtained and maintained by licensed operators.

2. Report problems observed when investigating complaints related to the performance of a licensed operator to the WWWOOSSP Board for evaluation and appropriate disciplinary action.

3. Amend regulations to require all issued septic permits, by type, and conventional septic inspections and pump-out services to be reported through an online database system (to be developed) which is pre-populated with the statewide E-911 address database (and its periodic updates) to ensure consistent and accurate address reporting and the creation of a longitudinal database that records the service history on every septic system and can be edited by local government or VDH, as needed, to update for address or tax map number changes, system modifications, etc.

B. Regional

1. Convene a regional discussion between VDH-RAHD, GWRC, the Tri-County/City SWCD and the Hanover-Caroline SWCD and the Central Virginia Housing Coalition to define an appropriate lead agency and coordinating mechanisms with partner agencies and local governments to define an effective regional septic maintenance program strategy prior to any future DEQ announcement of competitive WQIF or local TMDL funding opportunities.

2. Create a program to support septic pump outs that identifies responsible parties and appropriate enforcement actions.

3. Develop a pilot regional program that would help local governments and VDH better coordinate their respective efforts to monitor and maintain septic systems in the GWRC region. Program components should include:

    a. A more robust marketing campaign to educate local residents in the importance of proper use and periodic maintenance of their respective septic systems,

    b. Explore mechanisms in which both local governments and VDH can better track the maintenance of these systems, and

    c. Positioning the Region to pursue WQIF and local TMDL septic system cost-share financing assistance to assist property owners, particularly lower-income homeowners, in maintaining their respective private onsite conventional and/or alternative septic systems.

C. Local

1. Caroline County

a. Evaluate expanding the County's CBPA definition to include reference to impaired stream segments or follow the example of neighboring localities and expand the CBPA definition to be a County-wide 5-year inspection or pump-out requirement under the CBPA.

b. Continue the use of the wastewater pump truck manifest system to supplement information collected from respondents' to the County's periodic pump-out notification. Use the manifest system data to report pump-out actions completed over the past year for CBLAD reporting,

c. Work with the Commissioner of Revenue to amend tax parcel data to collect and maintain the type of wastewater system serving each property (and all addressable structures on the property) in order to establish an accurate database for septic maintenance tracking (whether by the County or VDH).

d. Support regional application for WQIF and TMDL septic implementation program cost-share financial assistance to address septic maintenance, repair and replacements needs throughout the County.

e. Foster Va. CDBG and/or WQIF application(s) on behalf of the Town of Port Royal to plan and develop a community wastewater system similar to the Dawn Community system to replace the

70+ small private septic systems with capacity to support additional Town residential and commercial development.

f. Provide a response deadline in each notification letter and in the second notification letter, provide explanation of consequence of non-compliance.

2. King George County

a. Work with the Commissioner of Revenue to amend tax parcel data to collect and maintain the type of wastewater system serving each property (and all improved, addressable structures on the property) in order to establish an accurate database for septic maintenance tracking (whether by the County or VDH).

b. Amend the data attributes of the public tax parcel shapefile to add the square footage of the main building on each parcel.

c. Support regional application(s) for WQIF and TMDL septic implementation program cost-share financial assistance to address septic maintenance, repair and replacements needs throughout the County.

d. Screen annual septic pump-out notification list to filter out any property addresses which have either reported a septic system inspection or pump-out within the 5 years prior to the mailing date or have been connected to the County Sanitation Authority sewer system during that same timeframe.

e. Provide a response deadline in each notification letter and in the second notification letter, provide explanation of consequence of non-compliance.

3. Spotsylvania County

a. Work with the Commissioner of Revenue to amend tax parcel data to collect and maintain the type of wastewater system serving each property (and all addressable structures on the property) in order to establish an accurate database for septic maintenance tracking (whether by the County or VDH).

b. Support regional application(s) for WQIF and TMDL septic implementation program cost-share financial assistance to address septic maintenance, repair and replacements needs throughout the County.

c. Provide a response deadline in each notification letter and in the second notification letter, provide explanation of consequence of non-compliance.

d. Update existing Carmody software database for septic pump-out notifications by cross-referencing with County Utilities Department sewer account database and real estate assessment database for properties connected to sewer or on septic.

4. Stafford County

a. Work with the Commissioner of Revenue to amend tax parcel data to collect and maintain the type of wastewater system serving each property (and all addressable structures on the property) in order to establish an accurate database for septic maintenance tracking (whether by the County or VDH).

b. Support regional application(s) for WQIF and TMDL septic implementation program cost-share financial assistance to address septic maintenance, repair and replacements needs throughout the County.

c. Provide a response deadline in each notification letter and in the second notification letter, provide explanation of consequence of non-compliance.

APPENDICES

Appendix A: Stream Segments in PD 16 with Bacteria Impairment

CAUSE_GRP_CODE	WATER_NAME	CAUSE_LOCATION_MEM	CAUSE_MEMO	County	TMDL_COMPLETION_DATE
F22R-04-BAC	Beverly Run		E. coli bacteria criterion excursions (3 of 12 samples - 25.0%) from station 8-BEV006.78, at Route 630.	CAROLINE CO	7/19/2016
F22R-02-BAC	Doctors Creek	Begins at the confluence with Tanyard Swamp and continues downstream until the confluence with Maracossic Creek.	E. coli bacteria criterion excursions (4 of 12 samples - 33.3%) from station 8-DOC000.69, at Route 644.	CAROLINE CO	7/19/2016
F22R-01-BAC	Maracossic Creek	Begins at the confluence with Beverly Run and continues downstream until the confluence with the Mattaponi River.	E. coli bacteria criterion excursions (8 of 36 samples - 22.2%) from station 8-MAR003.24, at Route 627.	CAROLINE CO	7/19/2016
F18R-02-BAC	Matta River	Begins at the confluence with an unnamed tributary to the Matta River, approximately 0.5 rivermile upstream from the Route 632 bridge, and continues downstream until the confluence with the Poni River, forming the Mattaponi River.	E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 8-MTA001.69, at Route 632 and (3 of 22 samples - 13.6%) from station MTA008.96, at Route 646.	CAROLINE CO	7/19/2016
F17R-02-BAC	Mattaponi River	Begins at the confluence with an unnamed tributary, draining from Goose Pond, and continues downstream until the confluence with Polecat Creek at the outlet of waterbody F17R.	2014 Assessment: E. coli bacteria criterion excursions (3 of 22 samples - 13.6%) from station 8-MPN083.62, at Route 301.	CAROLINE CO	7/19/2016
E21R-07-BAC	Mill Creek	Begins at the confluence with Peumansend Creek, at rivermile 6.06, and continues downstream until the tidal waters of Mill Creek.	2012 Assessment: E. coli bacteria criterion excursions (4 of 20 samples - 20.0%) from station 3-MIC0001.66 at Route 17.	CAROLINE CO	
F19R-02-BAC	Motto River	Begins at the confluence with an unnamed tributary, approximately 0.5 rivermile upstream from Route One, and continues downstream until the confluence with another unnamed tributary (streamcode XCF), downstream from I-95.	E. coli bacteria criterion excursions (2 of 8 samples - 25.0%) from station MOT002.62 at Route 1.	CAROLINE CO	7/19/2016
E21R-05-BAC	Mount Creek	Begins at the confluence with West Branch and continues downstream until the confluence with the Rappahannock River.	2012 Assessment: E. coli bacteria criterion excursions (3 of 18 samples - 16.7%) from station 3-MTC001.94 at Route 17.	CAROLINE CO	5/5/2008
F20R-02-BAC	Polecat Creek	Begins at the headwaters of Polecat Creek and continues downstream until the confluence with Stevens Mill Run.	E. coli bacteria criterion excursions (3 of 22 samples - 13.6%) from station 8-PCT010.10, at Route 652.	CAROLINE CO	7/19/2016
F17R-03-BAC	Poni River	Begins at the confluence with an unnamed tributary and continues downstream until the confluence with the Matta River, forming the Mattaponi River	E. coli bacteria criterion excursions (3 of 22 samples - 13.6%) from station 8-PNI002.43, at Route 606.	CAROLINE CO	7/19/2016

CAUSE_GRP_CODE	WATER_NAME	CAUSE_LOCATION_MEM	CAUSE_MEMO	County	TMDL_COMPLETION_DATE
E21R-11-BAC	Portobago Creek	Segment begins at the confluence of two intermittent tributaries around rivermile 6.66 and extends downstream to the end of the free-flowing waters.	2014 Assessment: E. coli bacteria criterion excursions (3 of 11 samples - 27.3%) from station 3-PBC003.09 at Route 17.	CAROLINE CO	
F21R-03-BAC	Reedy Creek	Begins at the headwaters of Reedy Creek and continues downstream until the start of Reedy Millpond.	2014 Assessment: E. coli bacteria criterion excursions (3 of 23 samples - 13.0%) from station 8-RDY003.43, at Route 648.	CAROLINE CO	7/19/2016
F21R-03-BAC	Reedy Creek	Begins at the headwaters of Reedy Creek and continues downstream until the start of Reedy Millpond.	2014 Assessment: E. coli bacteria criterion excursions (3 of 23 samples - 13.0%) from station 8-RDY003.43, at Route 648.	CAROLINE CO	7/19/2016
E21R-02-BAC	Ware Creek	Segment begins at the confluence with an unnamed tributary to Ware Creek, just downstream from Burma Road, and continues downstream until the confluence with the Rappahannock River.	2012 Assessment: E. coli bacteria criterion excursions (2 of 17 samples - 11.8%) from station 3-WAE000.72 at Route 17.	CAROLINE CO	5/5/2008
E20R-02-BAC	Hazel Run	Begins at the Route 95 crossing and continues downstream until the confluence with the Rappahannock River.	E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 3-HAL001.44 at the Route 1 Business (Lafayette Boulevard) crossing. Additional E. coli bacteria criterion excursions at citizen stations 3HAL-1-ALL (4 of 11 samples - 36.4%) and 3HAL-6-ALL (10 of 11 samples - 90.9%).	FREDERICKSBURG	5/5/2008
E19R-02-BAC	Mine Run	Begins at the headwaters of Mine Run and continues downstream to the upper end of the Motts Run Reservoir.	E. coli bacteria criterion excursions (6 of 12 samples - 50.0%) from station 3-MIN002.14 at Route 620 (Spotswood Furnace Road).	FREDERICKSBURG	
E20E-01-BAC	Rappahannock River	Begins at the fall line at Route 1 and continues downstream until the outlet of waterbody VAN-E20E.	E. coli bacteria criterion excursions (2 of 6 samples - 33.3%) from station 3-RPP104.47, located 200 yards below Massaponax STP. E. coli bacteria criterion excursions (14 of 65 samples - 21.5%) from station 3-RPP106.01, located upstream from the Fredericksburg Country Club. E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 3-RPP110.57, located at Route 1.	FREDERICKSBURG	5/5/2008
E20R-05-BAC	Unnamed Tributary to Hazel Run	Segment begins at the headwaters of the unnamed tributary, and continues downstream to the confluence with Hazel Run.	E. coli bacteria criterion excursions (4 of 11 samples - 36.4%) from citizen monitoring station 3XHN-7-ALL.	FREDERICKSBURG	5/5/2008
E20R-06-BAC	Unnamed tributary to Hazel Run	Segment begins at the headwaters of the unnamed tributary, and continues downstream to the confluence with Hazel Run.	E. coli bacteria criterion excursions (2 of 11 samples - 18.2%) from citizen monitoring station 3XIA-9-ALL .	FREDERICKSBURG	5/5/2008
A29E-03-BAC	Chotank Creek	Includes the tidal portion of Chotank Creek, from its headwaters until the fire road crossing inside of Caledon State Park.	Enterococci bacteria criterion excursions (3 of 12 samples - 25.0%) at station (1aCHN002.97) at the fire road in Caledon State Park.	KING GEORGE CO	
A29E-02-BAC	Fairview Beach/Potomac River	Includes all of Fairview Beach on the Potomac River.	Sufficient excursions from the geometric mean enterococci criterion (12 of 18 samples) were recorded at the Virginia Department	KING GEORGE CO	3/31/2015

CAUSE_GRP_CODE	WATER_NAME	CAUSE_LOCATION_MEM	CAUSE_MEMO	County	TMDL_COMPLETION_DATE
			of Health station (VA351214) at Fairview Beach. VDH issued a total of 22 new and/or continued public beach closure advisories for Fairview Beach from 2009 to 2014. These advisories were based on the results of enterococci bacteria sampling at station VA351214 at Fairview Beach.		
E21R-03-BAC	Gingoteague Creek	Begins at the confluence with an unnamed tributary to Gingoteague Creek, at rivermile 2.99, and continues downstream until tidal waters, near the confluence with the Rappahannock River.	E. coli bacteria criterion excursions (2 of 10 samples - 20.0%) from station 3-GIN002.64 at Route 625.	KING GEORGE CO	
E21R-10-BAC	Jetts Creek	Segment begins at the confluence of Boom Swamp with Jetts Creek, and continues downstream to the end of the free flowing waters.	2014 Assessment: E. coli bacteria criterion excursions (3 of 12 samples - 25.0%) from station 3-JET003.49 at Route 625.	KING GEORGE CO	
E21R-06-BAC	Lambs Creek	Begins at the confluence with Popcastle Creek and continues downstream until tidal waters, near the confluence with the Rappahannock River.	2014 Assessment: E. coli bacteria criterion excursions (4 of 12 samples - 33.3%) from station 3-LAM000.57 at Route 3.	KING GEORGE CO	5/5/2008
E21R-01-BAC	Muddy Creek	Begins at the confluence with an unnamed tributary to Muddy Creek, approximately 0.7 rivermile downstream from Route 218, and continues downstream until the confluence with the Rappahannock River.	2012 Assessment: E. coli bacteria criterion excursions (3 of 7 samples - 42.8%) from station 3-MUY001.43 at Route 3.	KING GEORGE CO	5/5/2008
A30E-01-BAC	Williams Creek	Begins at the head of tide of Williams Creek and continues downstream until the extent of the Section C area described in VDH Notice and Description of Shellfish Area Condemnation Number 001A-36, Upper Machodoc Creek, effective May 15, 2012.	2014 Assessment: Enterococci bacteria criterion excursions (3 of 11 samples - 27.3%) from station 1aWLL001.30, at Route 206 and excursions (4 of 6 samples - 66.7%) from station 1aWLL002.21, at Route 301.	KING GEORGE CO	12/18/2008
A30E-01-BAC	Williams Creek	Begins at the head of tide of Williams Creek and continues downstream until the extent of the Section C area described in VDH Notice and Description of Shellfish Area Condemnation Number 001A-36, Upper Machodoc Creek, effective May 15, 2012.	2014 Assessment: Enterococci bacteria criterion excursions (3 of 11 samples - 27.3%) from station 1aWLL001.30, at Route 206 and excursions (4 of 6 samples - 66.7%) from station 1aWLL002.21, at Route 301.	KING GEORGE CO	12/18/2008
F15R-02-BAC	Brock Run	Begins at the confluence with Aunt Sarah Spring Creek and continues downstream until the confluence with the Ni River.	E. coli bacteria criterion excursions (4 of 10 samples - 40.0%) from station 8-BRK000.06, at Jackson Trail off Route 613.	SPOTSYLVANIA CO	7/19/2016
F16R-02-BAC	Glady Run	Begins at the headwaters of Glady Run and continues downstream until the confluence with the Po River.	E. coli bacteria criterion excursions (2 of 11 samples - 18.2%) from station 8-GDY003.00, at Route 649	SPOTSYLVANIA CO	7/19/2016

CAUSE_GRP_CODE	WATER_NAME	CAUSE_LOCATION_MEM	CAUSE_MEMO	County	TMDL_COMPLETION_DATE
E20R-02-BAC	Hazel Run	Begins at the Route 95 crossing and continues downstream until the confluence with the Rappahannock River.	E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 3-HAL001.44 at the Route 1 Business (Lafayette Boulevard) crossing. Additional E. coli bacteria criterion excursions at citizen stations 3HAL-1-ALL (4 of 11 samples - 36.4%) and 3HAL-6-ALL (10 of 11 samples - 90.9%).	SPOTSYLVANIA CO	5/5/2008
E20R-03-BAC	Massaponax Creek	Segment begins at the confluence with an unnamed tributary to Massaponax Creek, approximately 0.25 rivermile upstream from the Route 639 bridge, and continues downstream until the confluence with another unnamed tributary, at rivermile 2.68.	2014 Assessment: E. coli bacteria criterion excursions (6 of 10 samples - 60.0%) from station 3-MAP007.97 at the Route 1 crossing and excursions (5 of 9 samples - 55.6%) from station 3-MAP009.42 at the Route 639 crossing.	SPOTSYLVANIA CO	5/5/2008
E20R-03-BAC	Massaponax Creek	Segment begins at the confluence with an unnamed tributary to Massaponax Creek, approximately 0.25 rivermile upstream from the Route 639 bridge, and continues downstream until the confluence with another unnamed tributary, at rivermile 2.68.	2014 Assessment: E. coli bacteria criterion excursions (6 of 10 samples - 60.0%) from station 3-MAP007.97 at the Route 1 crossing and excursions (5 of 9 samples - 55.6%) from station 3-MAP009.42 at the Route 639 crossing.	SPOTSYLVANIA CO	
E20R-04-BAC	Massaponax Creek	Begins at the confluence with an unnamed tributary, approximately 1.1 rivermiles downstream from Route 673, and continues downstream until the confluence with another unnamed tributary, approximately 0.25 rivermile upstream from Route 639.	2014 Assessment: E. coli bacteria criterion excursions (7 of 7 samples - 100.0%) from station 3-MAP010.37) at Route 208 (Courthouse Road) .	SPOTSYLVANIA CO	5/5/2008
F18R-03-BAC	Mat River	Begins at the confluence with an unnamed tributary at rivermile 2.14 and continues downstream to the confluence with the Ta River to form the Matta River.	E. coli bacteria criterion excursions (2 of 16 samples - 12.5%) from station 8-MAT001.87 at Route 647.	SPOTSYLVANIA CO	7/19/2016
F18R-02-BAC	Matta River	Begins at the confluence with an unnamed tributary to the Matta River, approximately 0.5 rivermile upstream from the Route 632 bridge, and continues downstream until the confluence with the Poni River, forming the Mattaponi River.	E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 8-MTA001.69, at Route 632 and (3 of 22 samples - 13.6%) from station MTA008.96, at Route 646.	SPOTSYLVANIA CO	7/19/2016
E19R-02-BAC	Mine Run	Begins at the headwaters of Mine Run and continues downstream to the upper end of the Motts Run Reservoir.	E. coli bacteria criterion excursions (6 of 12 samples - 50.0%) from station 3-MIN002.14 at Route 620 (Spotswood Furnace Road).	SPOTSYLVANIA CO	
F09R-02-BAC	Music Branch	Begins at the headwaters of Music Branch and continues downstream until the confluence with Northeast Creek.	E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 3-MUS000.57, at Route 677.	SPOTSYLVANIA CO	8/2/2006

CAUSE_GRP_CODE	WATER_NAME	CAUSE_LOCATION_MEM	CAUSE_MEMO	County	TMDL_COMPLETION_DATE
F09R-01-BAC	Northeast Creek	Begins at the headwaters of Northeast Creek and continues downstream until the confluence with another unnamed tributary to Northeast Creek, approximately 0.67 rivermiles upstream from Route 622.	E. coli bacteria criterion excursions (4 of 23 samples - 17.4%) from station 8-NST011.67. E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 8-NST007.84, at Route 614.	SPOTSYLVANIA CO	8/2/2006
F09R-01-BAC	Northeast Creek	Begins at the headwaters of Northeast Creek and continues downstream until the confluence with another unnamed tributary to Northeast Creek, approximately 0.67 rivermiles upstream from Route 622.	E. coli bacteria criterion excursions (4 of 23 samples - 17.4%) from station 8-NST011.67. E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 8-NST007.84, at Route 614.	SPOTSYLVANIA CO	8/2/2006
F07R-03-BAC	Plentiful Creek	Begins at the confluence with an unnamed tributary to Plentiful Creek, upstream from the Route 601 bridge, and continues downstream until the confluence with Lake Anna.	2014 Assessment: E. coli bacteria excursions (3 of 12 samples - 25.0%) from station 8-PLT002.82, at Route 653.	SPOTSYLVANIA CO	11/4/2005
F16R-01-BAC	Po River	Begins at an unnamed tributary to the Po River and continues downstream until the confluence with the Ni River, forming the Poni River.	2014 Assessment: E. coli bacteria criterion excursions (3 of 23 samples - 13.0%) from station 8-POR004.13, at Route 1.	SPOTSYLVANIA CO	7/19/2016
E20E-01-BAC	Rappahannock River	Begins at the fall line at Route 1 and continues downstream until the outlet of waterbody VAN-E20E.	E. coli bacteria criterion excursions (2 of 6 samples - 33.3%) from station 3-RPP104.47, located 200 yards below Massaponax STP. E. coli bacteria criterion excursions (14 of 65 samples - 21.5%) from station 3-RPP106.01, located upstream from the Fredericksburg Country Club. E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 3-RPP110.57, located at Route 1.	SPOTSYLVANIA CO	5/5/2008
E20E-01-BAC	Rappahannock River	Begins at the fall line at Route 1 and continues downstream until the outlet of waterbody VAN-E20E.	E. coli bacteria criterion excursions (2 of 6 samples - 33.3%) from station 3-RPP104.47, located 200 yards below Massaponax STP. E. coli bacteria criterion excursions (14 of 65 samples - 21.5%) from station 3-RPP106.01, located upstream from the Fredericksburg Country Club. E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 3-RPP110.57, located at Route 1.	SPOTSYLVANIA CO	5/5/2008
E20E-01-BAC	Rappahannock River	Begins at the fall line at Route 1 and continues downstream until the outlet of waterbody VAN-E20E.	E. coli bacteria criterion excursions (2 of 6 samples - 33.3%) from station 3-RPP104.47, located 200 yards below Massaponax STP. E. coli bacteria criterion excursions (14 of 65 samples - 21.5%) from station 3-RPP106.01, located upstream from the Fredericksburg Country Club. E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 3-RPP110.57, located at Route 1.	SPOTSYLVANIA CO	5/5/2008
F07R-06-BAC	Terrys Run	Begins at the headwaters of Terrys Run and continues downstream until the confluence with Horsepen Branch.	2014 Assessment: E. coli bacteria criterion excursions (2 of 8 samples - 25.0%) from station 8-TRY010.80, at Route 692.	SPOTSYLVANIA CO	11/4/2005

CAUSE_GRP_CODE	WATER_NAME	CAUSE_LOCATION_MEM	CAUSE_MEMO	County	TMDL_COMPLETION_DATE
E20R-05-BAC	Unnamed Tributary to Hazel Run	Segment begins at the headwaters of the unnamed tributary, and continues downstream to the confluence with Hazel Run.	E. coli bacteria criterion excursions (4 of 11 samples - 36.4%) from citizen monitoring station 3XHN-7-ALL.	SPOTSYLVANIA CO	5/5/2008
F09R-07-BAC	Unnamed tributary to Northeast Creek	Begins at the headwaters of an unnamed tributary to Northeast Creek and continues downstream until the confluence with Northeast Creek, approximately 0.46 rivermiles upstream from the Route 208 crossing.	E. coli bacteria criterion (3 of 12 samples - 25.0%) from station 8-XIA000.89, at Route 659.	SPOTSYLVANIA CO	8/2/2006
E18R-02-BAC	Wilderness Run	Begins at the confluence of North Wilderness Run and South Wilderness Run and continues downstream until the confluence with the Rapidan River.	E. coli bacteria criterion excursions (7 of 11 samples - 63.6%) from station 3-WIL004.00 at Route 3.	SPOTSYLVANIA CO	12/5/2007
A29R-01-BAC	Accokeek Creek	Begins at the confluence with an unnamed tributary to Accokeek Creek, approximately 0.33 rivermile downstream from Route 1 at rivermile 8.62, and continues downstream until the end of the free-flowing waters.	2012 Assessment: E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 1aACC006.13, at Route 608.	STAFFORD CO	9/26/2013
E10R-03-BAC	Alcotti Run	Begins at the headwaters of Alcotti Run and continues downstream until the confluence with Deep Run.	E. coli bacteria criterion excursions (3 of 12 samples - 25.0%) from station 3-ALC002.74 at Route 614.	STAFFORD CO	5/26/2004
A27R-01-BAC	Aquia Creek	Begins at the confluence with Cannon Creek, approximately 0.1 rivermile downstream from Route 610, and continues downstream until Smith Lake (Aquia Reservoir).	E. coli bacteria criterion excursions (4 of 32 samples - 12.5%) at station 1aAUA014.51, at the Route 641.	STAFFORD CO	
A27R-02-BAC	Aquia Creek	Begins at the headwaters of Aquia Creek and continues downstream until the confluence with Cannon Creek, approximately 0.1 rivermile downstream from Route 610.	E. coli bacteria criterion excursions (2 of 10 samples - 20.0%) from station 1aAUA023.09, at Route 644.	STAFFORD CO	
A28R-01-BAC	Austin Run	Begins at the confluence with an unnamed tributary to Austin Run, just upstream of the Route 1 crossing, and continues downstream until the confluence with Aquia Creek.	E. coli bacteria criterion excursions (3 of 12 samples - 25.0%) from station 1aAUS001.60, at Route 1 (Jefferson Davis Hwy), and E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 1aAUS000.49, at the end of Aquia Dr.	STAFFORD CO	9/26/2013
A28R-01-BAC	Austin Run	Begins at the confluence with an unnamed tributary to Austin Run, just upstream of the Route 1 crossing, and continues downstream until the confluence with Aquia Creek.	E. coli bacteria criterion excursions (3 of 12 samples - 25.0%) from station 1aAUS001.60, at Rt. 1 (Jefferson Davis Hwy), and E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 1aAUS000.49, at the end of Aquia Dr.	STAFFORD CO	9/26/2013

CAUSE_GRP_CODE	WATER_NAME	CAUSE_LOCATION_MEM	CAUSE_MEMO	County	TMDL_COMPLETION_DATE
E20R-01-BAC	Claiborne Run	Begins at the Route 1 crossing of Claiborne Run and continues downstream until the confluence with the Rappahannock River.	E. coli bacteria criterion excursions (3 of 12 samples - 25.0%) from station 3-CLB000.50 at Route 3.	STAFFORD CO	5/5/2008
E10R-01-BAC	Deep Run	Begins at the headwaters of Deep Run and continues downstream until the confluence with the Rappahannock River.	E. coli bacteria criterion excursions (17 of 32 samples - 53.1%) from station 3-DPR001.70 at Route 17; fecal coliform bacteria criterion excursions (2 of 7 - 28.6%) from station 3-DPR004.93 at Route 752 (2006 Assessment); and E. coli bacteria criterion excursions (4 of 20 - 20.0%) from station 3-DPR008.98 at Route 634.	STAFFORD CO	5/26/2004
E19R-01-BAC	Horsepen Run	Begins at headwaters of Horsepen Run and continues downstream to the confluence with the Rappahannock River.	E. coli bacteria criterion excursions (4 of 12 samples - 33.3%) from station 3-HOR000.50 at Route 655 (Holly Corner Road).	STAFFORD CO	
E20R-07-BAC	Little Falls Run	Begins at the headwaters of Little Falls Run and continues downstream until the confluence with the Rappahannock River.	E. coli bacteria criterion excursions (4 of 12 samples - 33.3%) from station 3-LIA002.27 at Route 682 (Colebrooke Road).	STAFFORD CO	5/5/2008
E19R-02-BAC	Mine Run	Begins at the headwaters of Mine Run and continues downstream to the upper end of the Motts Run Reservoir.	E. coli bacteria criterion excursions (6 of 12 samples - 50.0%) from station 3-MIN002.14 at Route 620 (Spotswood Furnace Road).	STAFFORD CO	
E21R-01-BAC	Muddy Creek	Begins at the confluence with an unnamed tributary to Muddy Creek, approximately 0.7 rivermile downstream from Route 218, and continues downstream until the confluence with the Rappahannock River.	2012 Assessment: E. coli bacteria criterion excursions (3 of 7 samples - 42.8%) from station 3-MUY001.43 at Route 3.	STAFFORD CO	5/5/2008
A26R-04-BAC	North Branch Chopawamsic Creek	Begins at the headwaters of North Branch Chopawamsic Creek and continues downstream until the confluence with Middle Branch.	E. coli bacteria criterion excursions (3 of 11 samples - 27.3%) from station 1aNOR009.87, at the MCB-1 bridge crossing.	STAFFORD CO	9/26/2013
A29R-02-BAC	Potomac Creek	Begins at the confluence with an unnamed tributary to Potomac Creek, at rivermile 9.12, and continues downstream until the east end of swamp.	E. coli bacteria criterion excursions (2 of 11 samples - 18.2%) at station 1aPOM008.24, at Route 626 (Potomac Run Road), and E. coli bacteria criterion excursions (2 of 8 samples - 25.0%) at station 1aPOM006.72, at Route 608.	STAFFORD CO	9/26/2013
A29R-02-BAC	Potomac Creek	Begins at the confluence with an unnamed tributary to Potomac Creek, at rivermile 9.12, and continues downstream until the east end of swamp.	E. coli bacteria criterion excursions (2 of 11 samples - 18.2%) at station 1aPOM008.24, at Route 626 (Potomac Run Road), and E. coli bacteria criterion excursions (2 of 8 samples - 25.0%) at station 1aPOM006.72, at Route 608.	STAFFORD CO	9/26/2013
A29R-03-BAC	Potomac Run	Begins at the headwaters of Potomac Run and continues downstream until the confluence with Long Branch.	E. coli bacteria criterion excursions (16 of 18 samples - 88.9%) from station 1aPOR000.40, at Route 648.	STAFFORD CO	9/26/2013

CAUSE_GRP_CODE	WATER_NAME	CAUSE_LOCATION_MEM	CAUSE_MEMO	County	TMDL_COMPLETION_DATE
E20E-01-BAC	Rappahannock River	Begins at the fall line at Route 1 and continues downstream until the outlet of waterbody VAN-E20E.	E. coli bacteria criterion excursions (2 of 6 samples - 33.3%) from station 3-RPP104.47, located 200 yards below Massaponax STP. E. coli bacteria criterion excursions (14 of 65 samples - 21.5%) from station 3-RPP106.01, located upstream from the Fredericksburg Country Club. E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 3-RPP110.57, located at Route 1.	STAFFORD CO	5/5/2008
E20E-01-BAC	Rappahannock River	Begins at the fall line at Route 1 and continues downstream until the outlet of waterbody VAN-E20E.	E. coli bacteria criterion excursions (2 of 6 samples - 33.3%) from station 3-RPP104.47, located 200 yards below Massaponax STP. E. coli bacteria criterion excursions (14 of 65 samples - 21.5%) from station 3-RPP106.01, located upstream from the Fredericksburg Country Club. E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 3-RPP110.57, located at Route 1.	STAFFORD CO	5/5/2008
E20E-01-BAC	Rappahannock River	Begins at the fall line at Route 1 and continues downstream until the outlet of waterbody VAN-E20E.	E. coli bacteria criterion excursions (2 of 6 samples - 33.3%) from station 3-RPP104.47, located 200 yards below Massaponax STP. E. coli bacteria criterion excursions (14 of 65 samples - 21.5%) from station 3-RPP106.01, located upstream from the Fredericksburg Country Club. E. coli bacteria criterion excursions (8 of 35 samples - 22.9%) from station 3-RPP110.57, located at Route 1.	STAFFORD CO	5/5/2008
A26R-07-BAC	Unnamed tributary to Potomac River	Begins at the headwaters of the unnamed tributary and continues downstream until its confluence with the Potomac River	E. coli bacteria criterion excursions (4 of 12 samples - 33.3%) at station 1aXLF000.13, at Route 633 (Arkendale Road).	STAFFORD CO	9/26/2013
E21R-12-BAC	White Oak Run	Begins just downstream from the Route 604 crossing and continues downstream until the confluence with Muddy Creek.	E. coli bacteria criterion excursions (2 of 12 samples - 16.7%) from station 3-WHT000.35 at Route 601.	STAFFORD CO	

Appendix B: Onsite Wastewater ("Septic") Property Database Development

Neither VDH or any of the local governments in the regional project area had a comprehensive and current list of properties on conventional and alternative septic systems to share with project researchers for conducting this study, so the development of a spatial layer of addresses (and associated tax parcels) served by onsite wastewater systems (both conventional and alternative) became a priority deliverable for the project. To develop this "septic" property inventory, thousands of land, address, septic permit, onsite wastewater system operating and maintenance (O&M) records[12] were processed, cross-referenced and amended with additional information pertinent to the study. The following table summarizes the data collected and processed in this study.

Locality Area	Land, Address, Septic Permit and Onsite Wastewater System O & M Records Processed							
	Structure Address Points	**Tax Parcel Centroids***	**VDH Septic Permit Address List**	**Local Septic Pump-Out Notification Address List**	**Local Pumper Tank Manifest**	**Local Sewer Account Master Address List**	**VDH Onsite O & M Records**	**Total**
Caroline Co	12,634	24,837	12,593	242	3,383	1,268	1,852	**56,809**
Fredericksburg	9,365	8,422	0	44	N/A	9,320	0	**27,151**
King George Co.	11,653	13,817	7,167	6,115	N/A	2,397	849	**41,998**
Spotsylvania Co.	49,574	63,246	18,473	**Not Provided**	N/A	31,134	3,186	**165,613**
Stafford Co.	53,347	57,210	15,456	11,325	N/A	34,170	3,721	**175,229**
GWRC (PD 16) Total	**136,573**	**167,532**	**53,689**	**17,726**	**3,383**	**78,289**	**9,608**	**466,800**

*GIS-calculated tax parcel centroids were used to provide approximate location of structure and septic system if VDH record had no structure address or the temporary structure address not found in local government final address lists but a septic permit had been issued for the parcel.

Researchers found some overlap in septic system data between local septic pump-out notification and response history data (see green highlighted column above) and VDH's onsite wastewater system Operating & Maintenance (O&M) database (see blue highlighted column above). When a property address appeared on both lists, it was assumed to be an alternative system subject to annual O & M service and improperly listed on the conventional septic pump-out notification list or an active sewer account.

Researchers also found some properties on local sewer customer account lists which also were reported as having an alternative OSS installation. It was not within the scope of this study to definitively resolve these inconsistencies but certainly is an area for local government follow-up to establish the true type of wastewater system in such cases of contradictory evidence.

[12] The VDH "VENIS" onsite wastewater O&M system data online are updated quarterly by VDH personnel using maintenance reports filed with VDH by licensed onsite wastewater operators.

A. Spatial Septic Layer Development

1. VDH Septic Permit List Enhancement: Standardized formatting of address field data and Tax Map Number in VDH Excel file of issued septic permits, then converted to Maptitude bin file.

2. Geo-coding VDH Septic Permit Lists: Build VDH Septic Permit Layers by address and tax parcel for each locality from VDH Septic permit list.
   a) Caroline: 100% of 13,872 VDH records processed, 12,593 (90.78%) located. Remaining 1,279 (9.22%) records either failed to match tax parcel number and/or represent vacant lot with no matching structure address.
   b) Spotsylvania: 100% of VDH 22,988 records processed, 18,473 (80.36%) located. Remaining 4,515 (19.64%) records either failed to match tax parcel number and/or represent vacant lot with no matching structure address.
   c) King George: 7,167 VDH records developed from the smaller original list provided. 6,804 (94.89%) located by property address or property centroid.
   d) Stafford: 15,456 VDH records provided and processed, 12,263 (79.34%) located. Remaining 3,193 (20.66%) records either failed to match any current tax parcel number or represent a matched tax parcel that is a vacant lot with no matching structure address.
   e) City of Fredericksburg: No VDH data available.

   Discussion: VDH septic permit records were located by an iterative process following this sequence:
   a) matched the enhanced permit address to the County master address layer, ("Co. Address Pt.") or
   b) matched the Tax Map ID number (MAP_PIN) to the County tax parcel file and assigned the permanent property address to the VDH record, and then following Step a) ("Co. Address Pt.") or
   c) matched the MAP_PIN number to the MAP_PIN number of the parcel centroid file (created to provide proxy point location) and assigned the centroid coordinates to the VDH septic permit ("Parcel Centroid")
   d) Unlocated VDH records were then reviewed to see if other location information (e.g. Subdivision Name and Lot number) provided an indirect way of correcting the original MAP_PIN and assigning address and location coordinates.

3. Tag all matching addresses & tax parcels in each locality with VDH septic permit status
   a) Spotsylvania: declined to release County septic pump-out notification address list with pump-out history
   b) City of Fredericksburg: No VDH data, City provided shp file for the 44 known septic sites.

4. **Build local sewered property layers (by address & tax parcel) (4 counties) & map**
   a) Caroline: Matched County address file with list of sewer customers and addresses in subdivisions on County sewer system. Request for Bowling Green sewer customer list was unsuccessful. Once addresses with sewer were located, associated tax parcel tagged for sewer.
   b) Spotsylvania: Request for Spotsylvania Co. sewer customer list denied. County 911 address file to sewer customer list joined to assign sewer accounts by address and

associated tax parcel tagged for sewer. County provided list of properties on sewer and septic to validate initial septic inventory.

c) King George: KG Sanitation Authority provided list of all sewer-connected property addresses to identify on County 911 address file. Remaining addresses assumed to be on septic except on NSWC-Dahlgren property where Navy sewer connection assumed.
d) Stafford: County Public Utilities provided sewer customer list which was used to tag 911 address file for sewer account addresses. Balance of Co. 911 address file assumed to be on septic.
e) City of Fredericksburg: 911 Master address file tagged for 42 septic properties, then the balance of master City address file tagged as a sewer connection.

5. **Link VDH Septic Layer with sewered property layer to flag converted/closed septic sites on VDH layer & update layer**

6. **Selected PD16 records from VDH VENIS database of Alternative OSS Operation & Maintenance reports, tagged local address lists to identify properties throughout the region connected to Alternative OSS.**

7. **Link updated VDH septic layer with septic pump-out notification and confirmation history**

8. **GIS scoping meeting with VDH personnel to assess GIS requirements, resource constraints, etc.**

9. **Provide geocoded VDH septic layers to RAHD.**

10. **Assist VDH-RAHD personnel with using GIS program.**

11. **Analyze non-responding properties to define areas for strategic public education, financial assistance/intervention and/or strengthened local policy enforcement**
    a) Age of system (based on age of permit & house), size and assessed value of property improvements.
    b) Areas of C or D soils
    c) Proximity to RPA & wetlands, topography effects
    d) Proximity to Impaired local streams for bacteria standard
    e) ACS 5-year average household income, Percent of Families in Poverty and number of households receiving public assistance (block group level)

12. **Prioritize neighborhoods** for possible PR outreach (before increased ordinance enforcement) and strategic septic maintenance financial assistance, system repair or conversion to mass drain field.

Appendix C. Virginia Onsite Wastewater Laws and Regulations

A. STATE LAW AND REGULATIONS

1. GENERAL LAW

The Virginia Department of Health is responsible for implementing State law and regulations pertaining to all onsite wastewater systems.

12 VAC 5-650-40. Administration.

Section 32.1-30 of the Code of Virginia requires each county and city to establish and maintain a local department of health that is responsible for enforcing all health laws of the Commonwealth and regulations of the board. With the concurrence of each county and city government affected, the commissioner may create a district health department (e.g. the Rappahannock Area Health District) composed of such local health departments. The commissioner appoints the local or district health director in those localities that enter into a contract with the department for the operation of the local or district health department. In such localities the local or district health director is responsible for implementing this chapter. The authority to implement this chapter is hereby delegated to local and district health directors who are employees of the department; such local and district health directors may delegate to subordinates as they deem necessary. Nothing in this section may be construed as limiting the commissioner's authority to delegate his powers as provided in law.

12 VAC 5-650-50. Conduct Declared Unlawful.

The following conduct is hereby declared unlawful and subject to civil penalties in accordance with this chapter:

1. Violation of any provision of 12VAC5-610, the Sewage Handling and Disposal Regulations or successor regulation promulgated by the board, including failure to comply with the provisions, requirements, conditions, or standards contained in a construction permit or in an operating permit.
2. Violation of any provision of 12VAC5-640, the Alternative Discharging Sewage Treatment Regulations for Individual Single Family Dwellings or successor regulation promulgated by the board, including failure to comply with the provisions, requirements, conditions, or standards contained in a construction permit or in an operating permit.
3. Failure to comply with any order issued by the board or commissioner.

12 VAC 5-650-60. Uniform Schedule of Civil Penalties.

A. There is hereby established a uniform schedule of civil penalties for the following violations of the board's regulations:

1. Install or cause to install, modify or cause to modify, use or operate an onsite or alternative discharging sewage system without a permit issued by the commissioner: $100 for the first violation, $150 for each additional violation.
2. Discharge treated or untreated sewage on the surface of the ground or into the waters of the Commonwealth without a permit: $100 for the initial violation, $150 for each additional violation.
3. Fail to obtain or keep a contract for operation, maintenance, or monitoring of an onsite or alternative discharging system to the extent that such contract is a requirement of the board's regulations: $50 for the initial violation, $100 for each additional violation.
4. Fail to submit to the department a laboratory test result, or an inspection or other report to the extent that such report is a requirement of the board's regulations: $50 for the initial violation, $100 for each additional violation.
5. To the extent such activities are not regulated by another agency of the Commonwealth, engage in unlawful transportation or handling of sewage or septage: $100 for the initial violation, $150 for each additional violation.
6. Any unlawful act described in 12VAC5-650-50 not specifically described in this subsection: $25 for the initial violation, $50 for each additional violation.

B. The department may not charge civil penalties pursuant to this chapter for activities related to land development.

C. The department may not charge civil penalties pursuant to this chapter for an unoccupied structure unless such structure contributes to the pollution of public or private water supplies or the contraction or spread of infectious, contagious, or dangerous diseases.

12 VAC 5-650-80. Civil Summons Ticket.

A. The department must prepare a civil summons ticket for use in implementing this chapter.

B. In addition to any information the department deems necessary, the ticket must contain the following information:

1. A statement notifying the recipient that he may make an appearance in person or in writing by mail to the department prior to the date fixed for trial in court;
2. A statement that any person so appearing may enter a waiver of trial, admit liability, and pay the civil penalty established for the offense charged;
3. The physical address, hours of operation, and mailing address for the local or district health department responsible for issuing the civil summons;
4. A statement that civil penalties may be paid only by cashier's check or certified check made payable to the Treasurer of Virginia; and
5. The date fixed for trial in general district court.

12 VAC 5-650-90. Authority to Issue Civil Summons Ticket; Penalties Collected.

A. Any employee of the department who has been delegated authority pursuant to this chapter may issue a civil summons ticket in accordance with this chapter.

1. The civil summons ticket may be delivered in person after presentation of proper credentials.
2. The department may deliver a civil summons ticket in any other manner provided by law.

B. All civil penalties collected pursuant to this chapter shall be credited to the Environmental Health Education and Training Fund established pursuant to § 32.1-248.3 of the Code of Virginia.

12 VAC 5-650-100. Requirements for Civil Summons Ticket.

A. Before the department may issue any civil summons ticket pursuant to this chapter, the following must occur:

1. The department shall notify the alleged violator as required in the board's regulations;
2. At least 30 days shall have passed from the date the alleged violator received notice of the violation; and
3. The violation must remain uncorrected.

B. Violations arising from the same operative set of facts shall not be charged more than once in any 10-day period nor shall the department charge more than one civil penalty from the same set of operative facts.

Appendix D: Summary of PD 16 Locality Codes and Zoning Ordinance Provisions Related to the Chesapeake Bay Preservation Act Requirements for Septic Pump-Out

Caroline County

1. County Code[13]

Chapter 92: Sewers Part 2 Sewage Disposal
Article III Private Sewage Disposal Systems

§ 92-10 Sewage disposal system construction permit required.

It shall be unlawful for any person to install or repair or have, allow or contact to install or repair a septic tank system in the County individually or for another person without first obtaining a sewage disposal system construction permit. The system shall be approved, as set out below, by the County Health Department. Permits for new systems and for repairs to existing systems shall be issued by the County Health Department.

§ 92-11 Permit application; site inspection fee.

A. The application for a permit required by § 92-10 shall be made to the Health Department, and the applicant shall furnish the following:

(1) Descriptions, locations and dimensions of the land or lot on which the septic tank and distribution system is to be installed.
(2) Approximate location of the proposed dwelling on such lot.
(3) Number of bedrooms in the proposed dwelling.
(4) Whether the dwelling will have automatic laundry, dishwasher or garbage disposal.
(5) Description of the type of water supply.
(6) When required, a plat showing the location of existing buildings, water supply and sewage disposal.
(7) Percolation tests of specific lots to determine soil characteristics are required by the Department. Percolation test procedures shall be in accordance with State Health Department regulations.
(8) Plat showing sites to be inspected, including primary and secondary drainfield sites.

B. Prior to issuance of the sewage disposal construction permit, a site inspection shall be completed by the Health Department for each construction site. A site inspection fee of $175 for each site to be inspected shall be payable to the County upon the filing of an application for a permit.

C. No fee shall be charged for issuance of a permit to repair a sewage disposal system.

D. The sites shown on the plat required with the permit application shall be staked on the lot by the applicant. The Health Department shall complete the site inspection on that site, including primary and secondary drainfield sites. If that site is not approved, the Health Department shall be payable to the County upon the filing of an application one other site on the same lot, located as shown on a substitute plat by the applicant.

§ 92-14 Specifications; inspection and approval.

A. The entire septic tank system shall be built in accordance with the design plans shown on the permit and in accordance with State Health Department regulations. The size and type of the sewer line from the building to the septic tank, including all necessary connections, shall be subject to inspection and

[13] Source: https://ecode360.com/CA1335

approval. Inspection and final approval of the septic tank system, including house sewers, is a responsibility of the Health Department.

B. The Health Department shall inspect a septic tank system and the Building Inspector shall inspect the portion of the system connecting the tank to fixtures within the structure after completion and prior to backfilling.

C. A re-inspection fee of $25 will be charged for each failed inspection by the Health Department; provided, however, that no re-inspection fee shall be charged for the first two failed inspections. Re-inspection fees shall be charged to the applicant and shall be paid at the Building Department.

D. When a re-inspection is preauthorized by Health Department personnel, no re-inspection fee shall be charged. The Health Department Director or his designee may waive the re-inspection fee for other good cause shown.

E. No final inspection for certificate of occupancy shall be scheduled until all Health Department re-inspection fees which are due are paid in full at the Building Department.

§ 92-15 Installation and repair.

A. It shall be unlawful for any person to install or repair or to contract to install or repair an individual sewage disposal system or any part thereof without first having obtained an annual permit from the Health Department.

B. This permit shall be renewed annually between January 15 and January 15 of the next year.

C. The annual permit may be revoked at any time by the Health Department for failure to comply with the provisions of this Part 2.

D. Bond.

(1) All persons contracting to install or repair for another or installing or repairing for another an individual sewage disposal system shall furnish bond payable to the penalty of $5,000, with surety approved by the County Attorney and conditioned to indemnify and save harmless the County, as well as any other person, from all expenses and damages that may be caused by any neglect or defective or inadequate work done by such person so furnishing bond. Such bond shall be deposited with the Building Inspector.

(2) The bond must certify that it is a continuing bond, in effect until the County Administrator is notified by the bonding company that the bond has been canceled.

(3) The bonding company will further certify that the bond will extend six months beyond the cancellation date to cover work previously performed.

(4) When work with reference to which a bond is required under this subsection shall be deemed defective or inadequate by the Health Department, and if the person responsible for such work fails to correct the defective or inadequate work to the satisfaction of the Health Department within 10 days after written notice from the Health Department to do so, the bond in question shall be forfeited, and the principal and surety on such bond shall be and become liable thereupon and shall pay so much on account of such bond as may be necessary to perfect such work and, in addition thereto, shall pay any and all damages which may be occasioned to any person by reason of defective or inadequate work.

§ 92-16 Pumping and disposal of sludge.

A. It shall be unlawful for any person to dispose of or allow his property, either real or personal, to be used for the disposal of the sludge and/or other material removed from any sewage disposal system, including a septic tank system, in violation of any local, state or federal law or regulation.

B. Bond.

(1) All persons contracting to pump and/or dispose of for another or pumping and/or disposing of another's sludge and other materials from any sewage disposal system, including septic tank systems, shall furnish bond payable to the County in the penalty of $5,000, with surety approved by the County Attorney and conditioned to indemnify and save harmless the County, as well as any other person, from all expenses and damages that may be caused by any neglect or defective or inadequate work done by such person so furnishing bond. Such bond shall be deposited with the Building Inspector.

(2) The bond must certify that it is a continuing bond, in effect until the County Administrator is notified by the bonding company that the bond has been canceled.

(3) The bonding company will further certify that the bond will extend six months beyond the cancellation date to cover work previously performed. The bond required for this subsection may be the same bond as the bond required for § 92-15 of this Part 2.

C. Disposal in County disposal system.

(1) It shall be unlawful to dispose of sludge and/or other material removed from septic tanks or other sources into any part or portion of a County disposal system except with written permission of the Director and in accordance with State Health Department regulations. The depositing of such waste into a County sewage disposal system will be at designated locations and under such conditions as may be promulgated by the Director and the Health Department. The sludge or other material shall be carefully deposited into the receptacles, and the surface of the ground, manholes, tanks or other receptacles into which the deposit is made shall be maintained in a clean condition. Any spillage or sludge or other material on the surface shall be promptly and completely removed by placing it in the manhole. Such waste shall not be deposited so as to be exposed to the atmosphere or endanger any water supply.

(2) Persons, firms or corporations engaged in the business of disposing of sewage, sludge or other material removed from septic tanks, portable tanks and other sources may dispose of such waste material in accordance with the following provisions:

(a) No material may be deposited into the County's sewage system without consent of the County and payment of the fee set forth in Subsection C(2)(b) of this section.

(b) Any persons, firms or corporations disposing of sewage sludge or other material shall be liable for a charge of $35 per 1,000 gallons or fraction thereof; provided, however, any person, firm or corporation disposing of pump and haul sewage that had not been mixed with any other material shall be liable for a charge of $4.60 per 1,000 gallons or part thereof. Any person, firms or corporations disposing of any pump and haul sewage mixed with other material shall be liable for a charge of $35 per 1,000 gallons or fraction thereof.

(c) The rate as defined above shall be applied to the total of the material disposed of during the billing period.

(d) Any persons, firms or corporations disposing of sewage sludge or other material shall complete and have on file an application for permission to discharge truck-hauled waste into the County's sewage system and submit to the County, by the 10th of each month, completed septic tanks and waste disposal forms for the preceding month.

(e) All equipment used in the pumping, hauling and discharging of sewage sludge or other materials shall meet the requirements of the State Health Department regulations.

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2. County Zoning Ordinance[14]

Article XV. Supplemental Regulations
SECTION 17 – Chesapeake Bay Preservation Area Overlay District (Adopted 05/12/92; as amended 12/13/16)
17.8 Performance Standards for Chesapeake Bay Preservation Areas.
B. General Performance Standards for Development and Redevelopment.
(7) All on-site sewage disposal systems not requiring a VPDES permit shall be:
(a) pumped out at least once every five years, as provided in Chapter 92 of the Caroline County Code.

(b) For new construction, a reserve sewage disposal site with an equivalent capacity at least equal to that of the primary sewage disposal site shall be provided, in accordance with Chapter 92 of the Caroline County Code. This requirement shall not apply to any parcel recorded prior to October 1, 1989, if the parcel does not have sufficient area to accommodate a reserve sewage disposal site, as determined by the local Health Department. Building and/or construction of impervious surfaces shall be prohibited on the area of all sewage disposal sites until the structure is served by public sewer or an on-site sewer treatment system that operates under a permit issued by the State Water Control Board.

Article XX. Violations and Penalties

Section 1 - Complaints Regarding Violations. Whenever a violation of this Ordinance occurs, or is alleged to have occurred, any person may file a written complaint, fully stating the causes and basis thereof, with the Zoning Administrator. The Zoning Administrator shall record properly such complaint, immediately investigate, and take action thereon as provided by the Ordinance.

Section 2 - Violation and Penalties. Any person, whether as owner, lessee, principal, agent, employee or otherwise, who violates any of the provisions of this Ordinance or permits any such violation or fails to comply with any of the requirements hereof, or who erects any building or uses any building or any land in violation of any detailed statement or plan submitted by him and approved under the provisions of this Ordinance, shall be guilty of a misdemeanor, and, upon conviction thereof, shall be subject to a fine not to exceed $250.00. Each day upon which such violation continues shall constitute a separate offense.

Any building erected contrary to any of the provisions of this Ordinance and any use of any building or land which is conducted, operated or maintained contrary to any of the provisions of this Ordinance shall be and the same is hereby declared to be unlawful. The Zoning Administrator may initiate injunction, mandamus, abatement or any other appropriate action to prevent, enjoin, abate or remove such

[14] Source: https://co.caroline.va.us/270/Zoning-Ordinance

erection or use in violation of any provision of this Ordinance. Such action may also be instituted by any property owner who may be particularly damaged by any violation of any provision of this Ordinance.

Upon becoming aware of any violation of any provision of this Ordinance, the Zoning Administrator shall serve notice of such violation on the person committing or permitting the same, and if such violation has not ceased within such reasonable time as the Zoning Administrator has specified in such notice, the Zoning Administrator shall institute such action as may be necessary to terminate the violation. The remedies provided for in this section are cumulative and not exclusive and shall be in addition to any other remedies provided by law.

Town of Bowling Green[15]

Article I Zoning Ordinance
Division 3 Districts Section 3-106.
Establishment of districts.

(a) For the purpose of this article, the incorporated area of Bowling Green, Virginia, is hereby divided into the following districts:

(1) Agricultural/Conservation/Historic Preservation District A-1
(2) Residential District R-1
(3) Residential District R-2
(4) Residential District R-3
(5) Planned Unit Development District PUD
(6) Business District B-1
(7) Business District B-2
(8) Industrial District M-1
(9) Chesapeake Bay Preservation Overlay District CBPD

Division 12 Chesapeake Bay Preservation Area
Section 3-159. Performance standards.

(b) General performance standards for development and redevelopment throughout the Town of Bowling Green, including Chesapeake Bay Preservation Areas.

(5) All on-site sewage disposal systems not requiring a VPDES permit shall be pumped out at least once every five years, in accordance with the provisions of the Caroline County Ordinance for Sewage and Sewage Disposal. Alternatives for pumpout are also permitted, including the installation of a plastic filter in the outflow pipe from the septic tank as long as the filter satisfies the standards established in the Sewage Handling and Disposal Regulations under 12 VA C 5-6-10 et seq. as administered by the Virginia Department of Health, or owners of on-site treatment systems may submit, every five years, documentation certified by a sewage handler permitted by the Virginia Department of Health that the septic system has been inspected and is functioning properly and does not need to be pumped out.

Division 18 Penalties.
Section 3-193. Violations and penalties.

Any person, firm or corporation, whether as principal, agent, employed or otherwise, violating, causing or permitting the violation of any of the provisions of this article shall be guilty of a misdemeanor and, upon conviction thereof, may be fined up to $250. Such person, firm or corporation shall be deemed guilty of a separate offense for each and every day during which any

[15] Source: http://www.townofbowlinggreen.com/document_center/Public%20Documents/Final_Code_of_Bowling_Green_082310_0.pdf

portion of any violation of this article is committed, continued or permitted by such person, firm or corporation and shall be punishable as herein provided

Town of Port Royal

[RESERVED]

City of Fredericksburg[16]

Chapter 1: General Provisions

§ 1-14. General penalty; continuing violations.

[Code 1991, § 1-6]

A. Wherever in this Code, or in any ordinance or resolution of the City, or rule or regulation or order promulgated by any officer or agency of the City under authority duly vested in him or it, any act is prohibited or is declared to be unlawful or a misdemeanor, or the doing of any act is required, or the failure to do any act is declared to be unlawful or a misdemeanor, and no specific penalty is provided for the violation thereof, the violation of any such provision of this Code or any such ordinance, resolution, rule, regulation or order shall be punished as a Class 1 misdemeanor by a fine not exceeding $2,500, or by imprisonment in jail for a period of not exceeding 12 months, either or both. Each day that a violation of this Code or any such ordinance, resolution, rule, regulation or order shall continue shall constitute, except where otherwise provided, a separate offense.

B. Whenever in this Code or in any ordinance or resolution of the City, or in any rule or regulation or order promulgated by any officer or agency of the City under authority duly vested in him or it, it is provided that a violation of any provision thereof shall constitute a Class 1, 2, 3 or 4 misdemeanor, such violation shall be punished as follows:

(1) Class 1 misdemeanor. A Class 1 misdemeanor shall be punished by a fine of not more than $2,500, or by confinement in jail for not more than 12 months, either or both.
(2) Class 2 misdemeanor. A Class 2 misdemeanor shall be punished by a fine of not more than $1,000, or by confinement in jail for not more than six months, either or both.
(3) Class 3 misdemeanor. A Class 3 misdemeanor shall be punished by a fine of not more than $500.
(4) Class 4 misdemeanor. A Class 4 misdemeanor shall be punished by a fine of not more than $250.

Chapter 74: Utilities.

§ 74-139. Septic tanks.

[Code 1991, § 18-84; Ord. No. 08-17, 6-10-2008]

A. No septic tank shall be constructed or maintained within the City limits except with a permit granted by the City Manager, upon the recommendation of the Health Officer. Such septic tank shall be installed and maintained in conformity with specifications laid down by the Health Officer according to the rules and regulations of the state board of health. All septic tanks and other on-site sewage treatment systems not requiring a Virginia Pollutant Discharge Elimination System (VPDES) permit shall have pump-out accomplished at least once every five years, in accordance with a schedule and regulations to be established by the Director of Building and Development Services.

§ 74-236. Hauled wastewater.

[Code 1991, § 18-120]

[16] Source: https://ecode360.com/FR3526

A. Only septic tank waste (referred to in this section as "septage") originating in the City will be accepted into the municipal wastewater system. Such septage shall be discharged at a designated receiving structure within the City's treatment plant area, at such times as are established by the DPW, provided such wastes do not contain toxic or hazardous pollutants and such discharge does not violate any other requirements established by the county or the City. Permits for individual vehicles to use such facilities shall be issued by the DPW, prior to any such discharge.

§ 74-1. Penalty.
[Code 1991, § 18-1]
Unless otherwise specified, any person who shall violate any of the provisions of this chapter shall be guilty of a Class 3 misdemeanor. Any such person shall furthermore be liable for all damage, loss and expense suffered or incurred by the City as a result of such violation.

King George County

1. County Code[17]
   Chapter 1 - GENERAL PROVISIONS
   Sec. 1-12. - Classification of and penalties for violations; continuing violations.
   a) Whenever in this Code or in an ordinance of the county it is provided that a violation of any provision thereof shall constitute a Class 1, 2, 3 or 4 misdemeanor, such violation shall be punishable as follows:

      (1) Class 1 misdemeanor. Confinement in jail for not more than 12 months and a fine of not more than $2,500.00, either or both.
      (2) Class 2 misdemeanor. Confinement in jail for not more than six months and a fine of not more than $1,000.00, either or both.
      (3) Class 3 misdemeanor. A fine of not more than $500.00.
      (4) Class 4 misdemeanor. A fine of not more than $250.00.

   (b) Whenever in any provision of this Code or in any other ordinance of the county any act is prohibited or is made or declared to be unlawful or an offense or misdemeanor, or the doing of any act is required, or the failure to do any act is declared to be unlawful or an offense or a misdemeanor, where no specific penalty is provided for the violation of such provision and such violation is not described as being of a particular class of misdemeanor, such violation shall constitute a Class 1 misdemeanor and be punishable as prescribed in subsection (a)(1) of this section.

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2. ZONING ORDINANCE
   ARTICLE 6. - VIOLATIONS AND PENALTIES
   Sec. 6.1. - Violations.
   Any person who violates any of the provisions of this ordinance or permits any such violation, or fails to comply with any of the requirements hereof, or who erects any structure on any land in violation of any plan submitted and approved under the provisions of this ordinance, shall be subject to a civil penalty as follows:

First violation:	$100.00
Second and each subsequent violation:	$250.00

[17] https://library.municode.com/va/king_george_county/codes/code_of_ordinances?nodeId=12064

Each day which the violation is found to have existed shall constitute a separate offense. However, in no event shall specified violations arising from the same operative set of facts be charged more frequently than once in any ten-day period. In no event shall a series of specified violations arising from the same operative set of facts result in penalties which exceed a total of $5,000.00.

6.1.1. *Violations.*

Any structure erected contrary to the provisions of this ordinance and use of any building or land which is conducted, operated or maintained contrary to the provisions of this ordinance are hereby declared to be unlawful. The zoning administrator may initiate injunctions, mandamus, abatement or any other appropriate action to prevent, enjoin, abate or remove such erection or use in violation of this ordinance.

6.1.2. *Notice of violation.* Upon becoming aware of any violation of the provisions of this ordinance, the zoning administrator shall serve notice on such person committing or permitting the same, and if such violation has not ceased within a reasonable time as specified in the notice, he shall institute such action as may be necessary to terminate the violation.

(Ord. of 2-19-2008; Amend. of 11-18-2008)

ARTICLE 8. CHESAPEAKE BAY PRESERVATION AREA OVERLAY DISTRICT

Sec. 8.3. - Purpose and intent.

(a) This ordinance is enacted to implement the requirements of Code of Virginia, § 62.1-44.15:67 et seq. (The Chesapeake Bay Preservation Act) and amends the King George County Zoning Ordinance. The intent of the board of supervisors and the purpose of the Overlay District is to: (1) protect existing high quality state waters; (2) restore all other state waters to a condition or quality that will permit all reasonable public uses and will support the propagation and growth of all aquatic life, including game fish, which might reasonably be expected to inhabit them; (3) safeguard the clean waters of the commonwealth from pollution; (4) prevent any increase in pollution; (5) reduce existing pollution; and (6) promote water resource conservation in order to provide for the health, safety, and welfare of the present and future citizens of King George County.

(b) This district shall be in addition to and shall overlay all other zoning districts where they are applied so that any parcel of land lying in the Chesapeake Bay Preservation Area Overlay District shall also lie in one or more of the other zoning districts provided for by the zoning ordinance. Unless otherwise stated in the overlay district, the review and approval procedures provided for in article 7 and chapters 4 and 6 of the county Code shall be followed in reviewing and approving development, redevelopment, and uses governed by this article.

(c) This article is enacted under the authority of Code of Virginia, § 62.1-44.15:67 et seq. (The Chesapeake Bay Preservation Act) and Code of Virginia, § 15.2-2283.

8.11.2. *General performance standards for development and redevelopment.*

5. All on-site sewage disposal systems not requiring a Virginia Pollutant Discharge Elimination System (VPDES) permit shall:

a. Have pump-out accomplished for all such systems and provide written proof to the King George County Zoning Administrator that the system has been pumped by a licensed septic hauler on a form and in the manner set forth by the zoning administrator at least once every five years;

1. In lieu of being required to pump-out the effluent from the system, if approved by the Virginia Department of Health at the time of installation the owner may install and maintain a plastic filter in the outflow pipe from the septic tank to filter solid

material from the effluent while sustaining adequate flow to the drainfield. The filter must meet the standards in the Sewage Handling and Disposal Regulations (12VAC5-610) administered by the Virginia Department of Health.

2. In lieu of being required to provide proof of septic tank pump-out every five years, the property owner may submit documentation every five years, certified by a sewage handler permitted by the Virginia Department of Health, that the septic system has been inspected and is functioning properly, and that the tank does not need to have the effluent pumped out of it.

Spotsylvania County[18]

Code of Ordinances
Supplement 112
Online content updated on August 13, 2018

Sec. 1-11. - Classification of and penalties for violations; continuing violations.

(b) Whenever in any provision of this Code or in any other ordinance of the county or any rule or regulation promulgated by an officer or agency of the county, under authority duly vested in such officer or agency, any act is prohibited or is made or declared to be unlawful or an offense or misdemeanor, or the doing of any act is required, or the failure to do any act is declared to be unlawful or an offense or a misdemeanor, where no specific penalty is provided for the violation of such provisions and such violation is not described as being of a particular class of misdemeanor, such violation shall constitute a Class 1 misdemeanor and be punished as prescribed in subsection (a)(1) of this section.

(c) Notwithstanding any other provision of this section or any other section of this Code, no penalty shall be imposed for a violation of this Code or any other ordinance or any rule or regulation referred to in this section that is greater than the penalty provided by state law for a similar offense.

(d) Each day any violation of this Code or any other ordinance or any rule or regulation referred to in this section shall continue shall constitute a separate offense, except where otherwise provided.
(Code 1980, § 1-7; Ord. No. 1-1, 1-22-91; Ord. No. 1-2, 4-23-91)

Chapter 6A - CHESAPEAKE BAY PRESERVATION

Sec. 6A-5. - Designation of Chesapeake Bay Preservation Area (CBPA).

(a) The board of supervisors hereby designates all of Spotsylvania County, Virginia, as a CBPA. The CBPA is further delineated on the CBPA map as resource protection areas (RPAs) and resource management areas (RMAs).

Sec. 6A-10. - Performance standards.

(b) *General performance criteria.*

(1) All on-site sewage disposal systems not requiring a VPDES permit shall be pumped out at least once every five (5) years, in accordance with the requirements of the Virginia Department of Health.

a. As an alternative to the mandatory pump-out, the owner shall have the option of having a plastic filter installed and maintained in the outflow pipe from the septic tank to filter solid material from the effluent while sustaining adequate flow to the drainfield to permit normal use of the septic system. Such a filter shall satisfy standards established in the Sewage

[18] Source: https://library.municode.com/va/spotsylvania_county/codes/code_of_ordinances

Handling and Disposal Regulations (12 VAC 5-610) administered by the Virginia Department of Health.

b. Furthermore, in lieu of providing proof of septic tank pump-out every five years, owners of on-site sewage treatment systems may submit documentation every five years, certified by a sewage handler permitted by the Virginia Department of Health, that the septic system has been inspected, is functioning properly, and the tank does not need to have the effluent pumped out of it.

(2) A reserve sewage disposal site with a capacity at least equal to that of the primary sewage disposal site shall be provided, in accordance with the requirements of the health department. This requirement shall not apply to any lot or parcel recorded prior to October 1, 1989 if such lot or parcel is not sufficient in capacity to accommodate a reserve sewage disposal site, as determined by the health department. Building or construction of any impervious surface shall be prohibited on the area of all sewage disposal sites or on an on-site sewage treatment system which operates under a permit issued by the State Water Control Board, until the structure is served by public sewer.

Sec. 6A-21. - Violations.

(a) Any person who: (i) violates any provision of this ordinance or (ii) violates or fails, neglects, or refuses to obey any local governmental body's or official's final notice, order, rule, regulation, or variance or permit condition authorized under this ordinance shall, upon such finding by an appropriate circuit court, be assessed a civil penalty not to exceed five thousand dollars ($5,000.00) for each day of violation. Such civil penalties may, at the discretion of the court assessing them, be directed to be paid into the treasury of the county for the purpose of abating environmental damage to or restoring Chesapeake Bay Preservation Areas therein, in such a manner as the court may direct by order, except that where the violator is the county, itself or its agent, the court shall direct the penalty to be paid into the state treasury.

(b) With the consent of any person who: (i) violates any provision of this ordinance related to the protection of water quality in Chesapeake Bay Preservation Areas or (ii) violates or fails, neglects, or refuses to obey the director notice, order, rule, regulation, or variance or permit condition authorized under this ordinance, the director may provide for the issuance of an order against such person for the one-time payment of civil charges for each violation in specific sums, not to exceed ten thousand dollars ($10,000.00) for each violation. Such civil charges shall be paid into the treasury of the county for the purpose of abating environmental damage to or restoring Chesapeake Bay Preservation Areas therein, except that where the violator is the county, itself or its agent, the civil charges shall be paid into the state treasury. Civil charges shall be in lieu of any appropriate civil penalty that could be imposed under subdivision (a) of this subsection. Civil charges may be in addition to the cost of any restoration required or ordered by the director.

(c) In addition to, and not in lieu of, the penalties prescribed in subsection (a) hereof, the director may apply to the circuit court for an injunction against the continuing violation of any of the provisions of this chapter and may seek any other remedy authorized by law.

(Ord. No. 6A-3, 2-10-04; Ord. No. 6A-5, 10-10-06)

Stafford County

Code of Ordinances[19]
Supplement 85
Online content updated on July 26, 2018

Sec. 1-11. - Classification of and penalties for violations; continuing violations.

(a) Whenever in this Code or any other ordinance of the county or any rule or regulation promulgated by any officer or agency of the county, under authority duly vested in such officer or agency, it is provided that a violation of any provision thereof shall constitute a Class 1, 2, 3 or 4 misdemeanor, such violation shall be punished as follows:
   (1) *Class 1 misdemeanor:* By a fine of not more than two thousand five hundred dollars ($2,500.00), or by confinement in jail for not more than twelve (12) months, or by both such fine and confinement.
   (2) *Class 2 misdemeanor:* By a fine of not more than one thousand dollars ($1,000.00) or by confinement in jail for not more than six (6) months, or by both such fine and confinement.
   (3) *Class 3 misdemeanor:* By a fine of not more than five hundred dollars ($500.00).
   (4) *Class 4 misdemeanor:* By a fine of not more than two hundred fifty dollars ($250.00).

(b) Whenever in any provision of this Code or in any other ordinance of the county or any rule or regulation promulgated by an officer or agency of the county, under authority duly vested in such officer or agency, any act is prohibited or is made or declared to be unlawful or an offense or misdemeanor, or the doing of any act is required, or the failure to do any act is declared to be unlawful or an offense or a misdemeanor, where no specific penalty is provided for the violation of such provision and such violation is not described as being of a particular class of misdemeanor, such violation shall constitute a Class 1 misdemeanor and be punished as prescribed in subsection (a)(1) above.

(c) Notwithstanding any other provision of this section or any other section of this Code or any ordinance, rule or regulation, no penalty for the violation of this Code or other ordinance, rule or regulation of the county shall exceed that prescribed by state law for a like offense.

(d) Each day any violation of this Code or any other ordinance, rule or regulation referred to in this section shall continue shall constitute a separate offense, except where otherwise provided.

(Code 1979, § 12-1; Ord. No. 091-16, 5-7-91)

Chapter 27B - CHESAPEAKE BAY PRESERVATION AREA

Sec. 27B-3. - Areas of applicability (district boundaries).

The CBPA shall apply to all appropriate land in Stafford County. The geographic information system (GIS) maps show the general location of CRPAs and shall be consulted by persons contemplating activities in the county prior to engaging in a regulated activity. The CRPA maps, as amended, together with all explanatory matter thereon, are adopted by reference and declared to be part of this chapter.

Sec. 27B-8. - General performance criteria.

General performance criteria for development in CBPAs

(7) All on-site sewage disposal systems not requiring a Virginia Pollution Discharge Elimination System (VPDES) permit shall be pumped out at least once every five (5) years.

(8) A reserve sewage disposal site with a capacity at least equal to that of the primary sewage disposal site shall be provided. This requirement shall not apply to any lot or parcel recorded prior to October 1,

[19] Source: https://library.municode.com/va/stafford_county/codes/code_of_ordinances

1989. If a parcel was platted on or before August 1, 1991, the parcel shall be required to provide the reserve sewage disposal site to the greatest extent practical, as determined by the local health department. Building or construction of impervious surface shall be prohibited on the area of all sewage disposal sites or on an on-site sewage treatment system which operates under a permit issued by the appropriate state agency, until the structure is served by public sewer.

Sec. 27B-16. - Penalties.

(b) Civil violations:

(1) Any person who violates the provisions of this chapter, violates or fails, neglects or refuses to obey any final notice, order, rule, regulation, variance or permit condition shall, upon such finding by the circuit court, be assessed a civil penalty not to exceed five thousand dollars ($5,000.00) for each day of violation. Such civil penalties may, at the discretion of the court assessing them, be directed to be paid to the county into a fund dedicated to the purpose of abating environmental damage to or restoring CBPAs, in such a manner as the court may direct by order, except that where the violator is the county itself, or its agent, the court shall direct the penalty be paid into the state treasury.

(2) With the consent of any person who violates any provision of this chapter related to protection of water quality in a designated CBPA, or violates or fails, neglects or refuses to obey any county or board notice, order, rule, regulation, variance or permit condition authorized under the county Code or Virginia law, the county may provide for an issuance of an order against such person for the one-time payment of civil charges for each violation in specific sums, not to exceed ten thousand dollars ($10,000.00) for each violation. Such civil charge shall be paid into the county treasury for the purpose of abating environmental damage to or restoring CBPAs, except where the violator is the county, or its agent, the civil charges shall be paid into the state treasury. Civil charges shall be in lieu of any appropriate civil penalty that could be imposed under subsection (b)(1) of this section. Civil charges may be in addition to any cost of restoration required or ordered by the county.
(Ord. No. O14-11, 12-16-14)

Appendix E: Licensed Septic Installers, Inspectors & Pump & Haul Contractors Operating in PD 16[20]

Mitchells Septic Services
212 Freedom Ct
Fredericksburg, VA 22408
(540) 891-5277

A&S Environmental,Inc.
451 Central Rd, Ste. B
Fredericksburg, VA 22401
(540) 371-6630
jsawdy@asenviro.com

Rapidan Plumbing Inc.
5110 Park Dr
Fredericksburg, VA 22408
(540) 898-7867/(540) 373-4053
rapidanservice@gmail.com

Plumbing Innovators
Fredericksburg, VA
(540) 295-8876
richie@plumbinginnovators.com

American Tank Cleaning
Fredericksburg, VA
(540) 226-3133
info@americantankcleaning.com

Rick A. DeBernard Excavating
186 Fisher Ln
Fredericksburg, VA 22405
(540) 371-0962
debernardexcavating@verizon.net

Martin Septic LLC
10607 Mockingbird Ln
Spotsylvania, VA 22553
(540) 582-7912

Joe Wheeler's Septic Service
13005 Grant Ct
Spotsylvania, VA 22551
(540) 972-3434

J & G Septic Service
12480 Tower Hill Rd
Midland, VA 22728
(540) 671-3960
jimmy@jgseptic.com

Dominion Septic, Inc.
13282 Sillamon Rd
Goldvein, VA 22720
(540) 737-1008
dstewart@dominionseptic.com

M&M Soil Consultants. Inc.
706 Sophia St
Fredericksburg, VA 22401
(540) 373-3414
mmsoilglen@verizon.net

Drainfield Solutions
Septic System Service
15384 Nelson Hill Rd
Milford, VA 22514
(804) 448-0992
Michele.ware@drainfieldsolutions.com

Doug's Septic Services
22484 Mattaponi Trail
Milford, VA 22514
(804) 448-4968

G H Watts Construction
17485 Richmond Tpke.
Milford, VA 22514
(804) 633-9778
kate@ghwatts.com

C&W Hanover Septic
6017 Mechanicsville Tpke
Mechanicsville, VA 23111
(804) 746-2749
cwhanoverseptic@gmail.com

Dillon's Septic Tank Services
305 S Washington Hwy # 14
Ashland, VA 23005
(804) 798-4471

Atlee Sewage Disposal
9346 Guenevere Pl
Mechanicsville, VA 23116
(804) 559-4705

Watkins Septic Services
10492 Gould Hill Rd.
Hanover, VA 23069
(804) 746-2455
Fax: 804-781-0372

Anytime Pumping Septic Service
Mechanicsville Tpke.
Mechanicsville, VA 23111
(804) 559-7999

Buddy's Septic & Sewer Service
6021 Barkers Mill Rd.
Mechanicsville, VA 23111
(804) 730-8619
penny@udumpwepump.com

Johnston Septic Services
Mechanicsville, VA 23111
(804) 379-7101
roberta@jlbishopcontractor.com

Old Dominion Onsite, Inc.
116 Sylvia Rd., Unit E
Ashland, VA 23005
(804) 746-7794

Obsidian Onsite
Services/Engineering, Inc.
Joel Pinnix, PE
P.O. Box 100
Tappahannock, VA 22560
(804) 347-7176
(804) 925-1484
obsidianonsite@verizon.net
joelpinnix@obsidianengineering.com

Rollins Enterprises
10558 Kings Hwy
King George, VA 22485
(540) 775-2442

Pro. Plumbing Solutions Inc.
10176 Kings Hwy
King George, VA 22485
(540) 709-7995
info@myplumbingsolutions.com

[20] Compiled from online research using Google.com. Not intended to represent a complete list of all licensed operators.

GEORGE WASHINGTON REGIONAL COMMISSION

REGIONAL ONSITE WASTEWATER CONTRACTOR SURVEY

The George Washington Regional Commission (PD16) is assisting local governments in its service area develop a program response to the USEPA and VDEQ's Chesapeake Bay TMDL Watershed Implementation Plan-Phase III, which requires an assessment of existing local septic system management programs to identify possible strategies to improve landowner compliance with required septic pump-outs under Virginia's Chesapeake Bay Preservation Act in order to reduce sources of Nitrogen pollution to the Bay and its tributaries. Moreover, there are local TMDL studies underway by VDEQ to develop an implementation plan to reduce bacterial pollution in local waterways in the Region.

We are asking wastewater sector service providers working in the Region to provide input and feedback by completing the following anonymous survey to help the Region define practical strategies to achieve increased public awareness of and compliance with mandated septic maintenance programs to support both federal and state government TMDL efforts.

If you already responded to this survey online, thank you for your response and do not bother completing and returning this form.

The courtesy of returning your reply by Friday, November 2nd would be greatly appreciated!

TOTAL ONLINE & MAILED BACK RESPONSES: 6

A. Which of the following on-site wastewater-related services does your company provide? *(check all that apply)*

- 4/6 On-site soil testing and evaluation
- 5/6 Site excavation/site restoration
- 4/6 Conventional septic system design
- 4/6 Alternative septic system design
- 5/6 Conventional septic system installation
- 4/6 Alternative septic system installation
- 6/6 Conventional septic system inspection
- 5/6 Alternative septic system inspection
- 2/6 Conventional septic system pump-out
- 5/6 Alternative septic system pump-out
- 4/6 Conventional septic system repair/upgrade/replacement
- 4/6 Alternative septic system repair/upgrade/replacement

B. Does your company provide on-site wastewater (i.e. septic-related) services in: *(check all that apply)*

- 4/6 City of Fredericksburg
- 6/6 Caroline County
- 5/6 King George County
- 6/6 Spotsylvania County
- 6/6 Stafford County

C. Currently, the performance of on-site wastewater services (e.g. inspections and/or pump-outs) is required once every 5 years in areas subject to CBPA regulations. However, the voluntary reporting of actual completed septic maintenance services is estimated regionally at roughly 53 percent of the properties annually notified of the 5-year septic pump-out/inspection requirement**.**

Please rank (for possible effectiveness) the following list of possible strategies to increase public compliance with and reporting of required septic maintenance efforts (1 = most effective, 10 = least effective)

#1: 5/6 Consistent local government enforcement of civil penalties for violation of local CBPA ordinance.

#2: 4/6 Establish and implement public assistance program for low-income households to provide cost-share for required on-site wastewater system maintenance.

#3 (tie): 3/6 Implementation of local public awareness and education campaign about CB and local water quality and importance of proper onsite wastewater (septic) system maintenance.
#3 (tie): 3/6 Improved coordination between VDH and local governments of septic system management program.
#3 (tie): 3/6 Require all licensed onsite wastewater service contractors to file reports of all completed work.

2/6 Improved coordination between local governments' septic maintenance notification efforts, private contractors' system maintenance activities and property owner reporting of septic program compliance.
2/6 Assign complete oversight of septic maintenance programs to VDH and regional health districts.

1/6 Regional coordination of VDH regional office oversight and local government administration of onsite wastewater programs
1/6 Random local government enforcement of civil penalties for violation of local CBPA ordinance
1/6 Requiring all on-site wastewater pump-out operators to report address origin(s) for each tank load of wastewater and corresponding discharge location (e.g. filing a wastewater tank "manifest").

D. If there are there other onsite wastewater program suggestions you would like to make, please describe here:

a. *Contractor ability to access VDH records would be helpful*
b. *CBPA Pump Outs are ineffective. They do not increase or maintain the functionality of a primary septic tank system. The reduction in Nitrogen to the Bay Tidal Waters is on the order of 234 lbs per 10,000 systems - hardly more than a sneeze.*
c. *Pumpers need 24/7 / 365 dump disposal access*
d. *Alternative system owners need better set-up by the designers and installers*

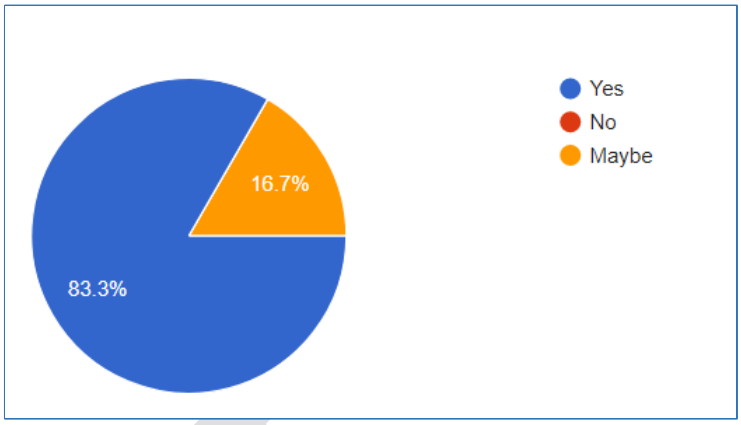
E. It has been alleged by one knowledgeable contractor that there are *unlicensed wastewater (sewage) lagoons scattered across the rural landscape of Tidewater Virginia. Are you or is anyone in your company aware of any of such pollution sites being located in any of the following localities? *(check all that apply):***

City of Fredericksburg
Caroline County
King George County
1/6 Spotsylvania County
Stafford County

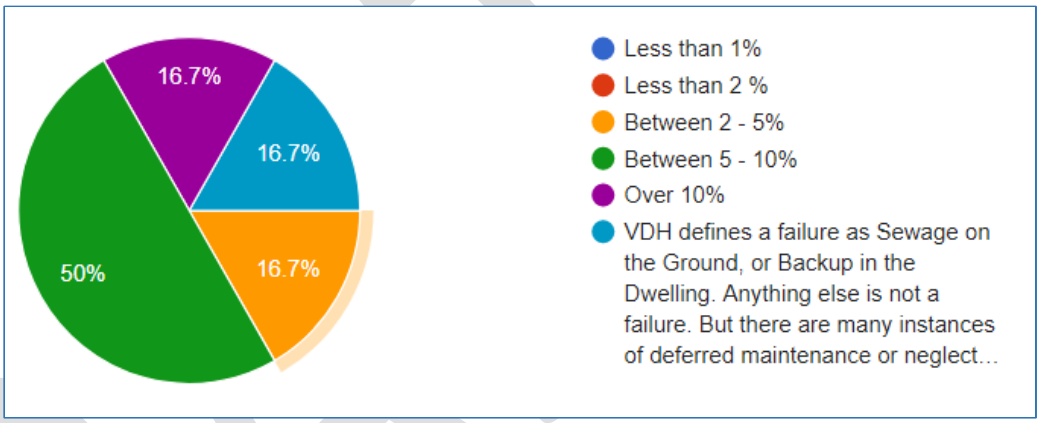
OTHER RESPONSES:

*"*Not **unlicensed** - but unlined. There are several - most that were permitted prior to the current 2000 regulations. **In addition, there are wastewater treatment plants that have no nutrient removal requirements. So any septage discharged in one of these small, exempted plants simply pass the N into the receiving waters**."*

F. Should there be a public, confidential "whistleblower" reporting program to report such sites so that the proper authorities can pursue corrective action and/or removal of unlicensed wastewater lagoons?



G. In your company's experience working in coastal and tidewater Virginia, what is the general incidence of onsite wastewater system failure when visiting a site for inspection or pump-out services?



H. In your experience, which of the following possible causal factors contribute to onsite wastewater system failure in coastal and Tidewater Virginia? ***(check all that apply)***

#1: 5/6 Property owners' indifference to provide adequate system maintenance (e.g. inspections, pump-outs, etc.)

#2: 4/6 Poor soil conditions for the septic drain field location

#3 (tie) 3/6 Property owners' ability to afford proper system maintenance (e.g. inspections, pump-outs, etc.)
#3 (tie) 3/6 Uninformed property owners' abuse of system through indifferent disposal of chemicals and other pollutants.
#3 (tie) 3/6 Faulty design or installation

2/6 System obsolescence

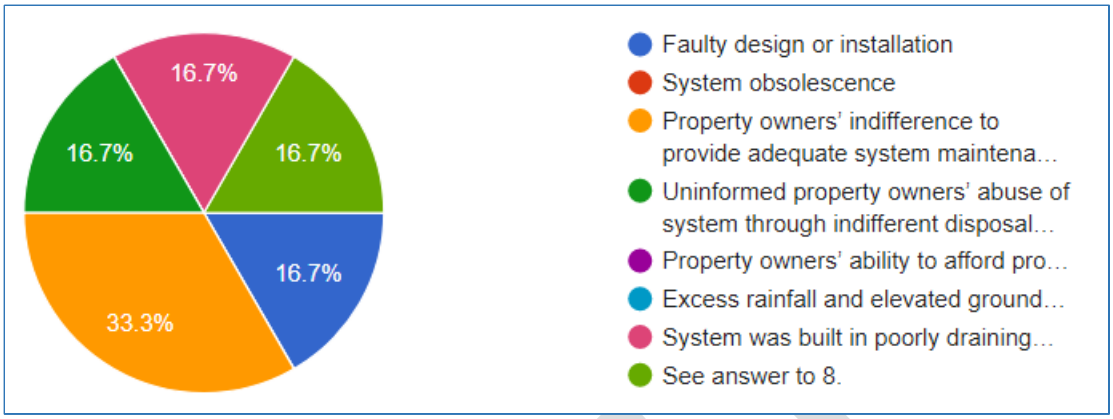
1/6 Excess rainfall and elevated groundwater table and/or excessive household water usage.

Other: (1/6)

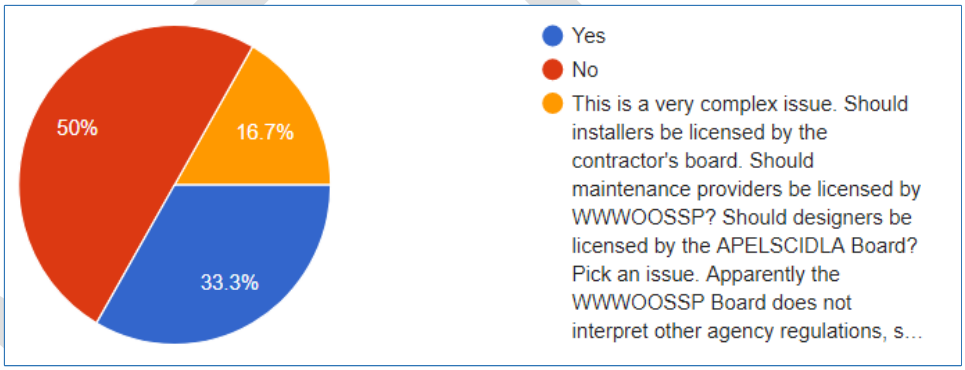
a) Excess Water Usage
b) Age. Old systems at the end of their service life.
c) Another common finding is new or expanded dwellings being served by an older system.

I. In your experience, which of the following causal factors contributes <u>the most</u> to onsite wastewater system failure in coastal and Tidewater Virginia?

Please provide your ranking, e.g. 1= most causality, 8= least causality



J. In your opinion, does the Virginia DPOR and its Board for Waterworks and Wastewater Works Operators and Onsite Sewage System Professionals (WWWOOSSP Board) provide adequate oversight of Onsite Sewage System Professionals?



Full text of write-in response:

"This is a very complex issue. Should installers be licensed by the contractor's board? Should maintenance providers be licensed by WWWOOSSP? Should designers be licensed by the APELSCIDLA Board? Pick an issue. Apparently the WWWOOSSP Board does not interpret other agency regulations, so it would be improbable that they could find a licensee incompetent because they have no basis for the licensee's competence."

K. Any other comments, suggestions or program recommendations you would like to make?

Respondent #4:

"Is this survey focused on the CBPA, DPOR or VDH? It's difficult to tell.

The CBPA is ineffectual. But maybe someday there will be a water quality study that proves the CBPA requirements are meaningful – in the meantime, I guess we live (with) the infringement on individual's property rights.

DPOR has issues – see question 10. The onsite professionals should be regulated by different boards – but for now, WWWOOSSP's incompetence is the best we can do.

VDH has about a 10% compliance rate for their Alternative Septic System inspection program. THIS SHOULD BE THE FOCUS of every locality in the Chesapeake Watershed. VDH has had 9 years to develop and implement the program. They have FAILED. Their misuse of resources and misguided priorities should the focus of a JLARC investigation!

***Question: Do 5-year pump outs improve wastewater treatment**?*

The short answer is no. A typical household septic tank holds 1,000 gallons. Average water use is about 250 gallons per day per dwelling. The required retention time for primary treatment is 48 hours. Therefore, the depth of sludge

would have to displace 500 gallons of volume before the required retention time is reduced. It would take 20 years of average use to accumulate 500 gallons of sludge.

Question: Do pump outs reduce Nitrogen to the Chesapeake Bay?
There is some minuscule reduction in Nitrogen because of pump outs. But it is not significant. For example, a county with 10,000 septic systems enforcing a pump out program that pumps 20% of the septic systems each year would result in a GROSS Nitrogen reduction of about 1,000 lbs per year. However, the NET Nitrogen reduction is only about 234 lbs. (Note: The NET reduction is the amount of Nitrogen reduction to the Bay Tidal Waters due to natural attenuation as modeled by the EPA. See the attached model for the math.) Is a 234 lb. annual reduction meaningful? Is it worth an annual $500,000 cost to the homeowners? Is $2,136 per pound of N a cost-effective solution?

Question: Can the Health Department better manage and enforce a pump out program?
Currently, VDH is mandated to enforce an annual inspection program for about 25,000 alternative septic systems. The program has been in place for the past 9 years. VDH claims that they are 40% compliant for all new systems (about 400 out of 1,000 new systems per year). When the older, legacy systems are included, VDH's compliance is closer to 10% (out of 23,176 alternative systems, only 4,858 had an inspection within the past two years – 2016 & 2017. That's an annual compliance rate of 10%). The pump out program is part of the Chesapeake Bay Protection Act which is enacted at the local level as a County Ordinance. I don't believe VDH has any statutory authority to enforce this ordinance. It seems doubtful that VDH could effectively manage another 500,000 systems given their inadequate capability at managing a meager 25,000."

Respondent #5:

"1) VDH needs to report unlicensed installers & operators.
2) VDH needs to do a better job at reviewing permits & soil work.
3) Local VDH staff don't trust regional VDH staff
4) VDH, in general, doesn't know anything about alternative systems & should not be near an operating system.
5) Pumpers probably don't report a lot of the systems they pump because of the honor system at some dump stations."

L. OPTIONAL: If you would like to receive a copy of the results of this survey and/or the WIP III project report, please provide your contact information below:

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Appendix G: List of Research Project Deliverables

A. For VDH-Rappahannock Area Health District (RAHD)

   1. Geo-coded "VDH Septic Permits Issued" Spreadsheet Files , by Locality, (4, .shp and .xls)

B. For GWRC and Localities

   1. Enhanced County Address Point File with Type of Wastewater Treatment & other attributes (.shp & .xls)
   2. Enhanced County Tax Parcel file with Type of Wastewater Treatment & other attributes (.shp)
   3. Enhanced County Tax Parcel Centroid File with Type of Wastewater Treatment & other attributes (.shp)