WASTEWATER

2009 SUMMARY

There are an estimated 746 municipal wastewater treatment facilities serving over 2 million households in Virginia. The majority of these treatment facilities discharge treated wastewater into a receiving water body. This discharge has the potential to introduce excess nutrient concentrations into aquatic environments, resulting in ecosystem degradation. Additionally, the unintentional release of raw wastewater as a result of conveyance system malfunctions will also affect the environment. These combined issues have a negative impact ranging from a reduction in aquatic species, to declining public health, to economic losses through industry and recreational tourism. A good example of this negative impact is the decline of the Chesapeake Bay and its surrounding areas.

The Clean Water Needs Survey Report identified a $4.7 billion need for wastewater infrastructure in the State of Virginia, which is a 20% increase from the previously published report. Factors including aging infrastructure, regulations for greater reductions of nutrients, demands for providing service to a continuously growing population, and increases in materials and construction costs are all driving this need. To address this need, various federal, state, and local funding sources are supporting projects that focus on improvements to our current wastewater infrastructure. Unfortunately, residents of Virginia are made responsible for addressing this need as well, with a 65% increase in wastewater rates since 1998. With the continuing occurrence of sanitary sewer overflows high nutrient discharge violations, it is clear that improvements in wastewater system efficiency and reliability must be achieved through sustained funding and improved operations if we are to protect our valuable water resources.

The Commonwealth of Virginia had a documented funding need that exceeds $4.7 billion for its wastewater infrastructure1. These funds are necessary for upgrading and replacing aging facilities and infrastructure, compliance with mandated Clean Water Act (CWA) and Chesapeake 2000 agreement regulations, as well as keeping up with demands caused by continued population growth and economic development. Virginia's growth in population and economic development are creating a need for addressing issues of water quality degradation. The discharge of high nutrient loads into receiving waters has led to publicized fish kills, "dead zones", and a reduction in recreational water use, a result of which has been stricter basin-specific regulations. The state currently has a number of projects underway in different localities that are addressing some causes of these issues, but additional projects in other areas of the state are necessary. Increases in treatment costs, aging infrastructure, and reductions in state and local budgets are creating financial strains on individual utilities to remain compliant with strict state and federal regulations. Ultimately, the residents of Virginia will bear the burden of the utilities' financial strains with increased wastewater rates and higher taxes. If funding needs are not met, the state can expect a reduction in public health and environmental quality, which have seen vast improvements over the past thirty years.

INTRODUCTION AND BACKGROUND

The water quality of Virginia's creeks, streams, rivers, estuaries, and coastal waters are necessary for maintaining both human and environmental health, as well as sustained economic development. With over 3,000 square miles of surface water in the state, a large segment of the population lives in close proximity to a water body. A substantial portion of the Virginia economy is dependent on the availability of clean water. Fishing, agriculture, military installations, water-based tourism, ecotourism and shipbuilding attract large numbers of people and generate revenue for the state. For example, the

Chesapeake Bay, which is the largest estuary in the country, runs along much of the eastern portion of the state. It generates significant revenue for the state through both tourism and the fishing industry.

The quality of these surface waters is directly impacted by the management of the states wastewater treatment systems. The state has an estimated 744 municipal wastewater treatment facilities, serving approximately two-thirds of the households in the state, majority of which discharge treated effluent into a water body[2]. High nutrient levels in the effluent play a role in the high percentage of impaired bodies of water in the state (Table 1). The Chesapeake Bay had a 150 mile "dead zone" between Baltimore, MD and the York River in Virginia. This was a result of excess nutrients in the water, with the number one and predominant source attributed to surface water runoff. Wastewater treatment plants were cited as the number two cause of nitrogen pollution[4]. Of the wastewater plants discharging into the Chesapeake Bay, one quarter are located in Virginia[4]. With an estimated thirteen percent increase in the state's population over the next ten years, demands for adequate wastewater treatment and disposal are expected to place immense strains on current systems as well as drive up costs for system expansions and new facilities[5].

Our state utilizes many government entities with varying responsibilities to oversee our wastewater infrastructure. These responsibilities range from regulatory groups to groups that manage economic resources distributed to individual localities. For example, the Virginia Resources Authority is responsible for overseeing the distribution of low interest State Revolving Fund (SRF) loans for infrastructure. The distribution of state and local funds is impacted by the apparent need seen by the general public and its officials. Unfortunately in many cases, the population is unaware of the deteriorating condition of the wastewater system, and much needed economic support is routed elsewhere. Additionally, these loans help reduce the level of cost placed on individual localities. For instance, a small rural system must charge higher rates to residents due to a smaller local economy to cover costs, whereas a larger system can often avoid charging higher rates. These smaller localities could benefit from funds to improve their wastewater infrastructure. Seven percent of the population was serviced by small treatment systems and comprised fourteen percent of the total state need[1].

TABLE 1. IMPAIRED AREA BY WATERBODY TYPE 2004 - 2008

Waterbody Type	2004	2006	2008	% of Total*
Rivers & Streams 51,016 miles	6,931 miles	9,002 miles	10,543 miles	21%
Lakes 115,835 acres	89,834 acres	109,208 acres	94,044 acres	81%
Estuaries 2,305 miles	1,907 miles	2,216 miles	2,182 miles	95%

***** % of total is based on data from 2008 survey, Information taken from 2008 Water Quality Assessment by Virginia Department of Environmental Quality (VA DEQ)[3].

CONDITION AND ADEQUACY

By the year 2020, an estimated 13% of the nation's water and wastewater pipes will be classified as being in poor condition, 23% in very poor condition, and 9% beyond their lifespan[10]. Considering these

estimates, along with the estimated 13% increase in Virginia's population by 2020, it is evident that the state will have issues with regards to the conveyance of increased volumes of raw wastewater. Virginia is currently addressing this issue, with the Clean Water State Revolving Fund (CWSRF) providing loans for at least 5 plant expansion projects.

Table 2 provides a description of the design life in years of different components that make up wastewater infrastructure. In general, older pipe materials have longer useful life spans when compared to newer installed materials, however the tentative retirement dates align from oldest to newest materials. The types of material used in wastewater infrastructure follow historic trends revolving around population booms, infrastructure construction overhauls, and federal legislation. These historic periods include the 1890's, World War I, the "Roaring 20's", post-World War II, and the passing of the Clean Water Act in the early 1970's[15]. Based on these historic time periods and the estimated years of design life, much of the wastewater infrastructure is approaching or has surpassed the useful portion of its design life.

TABLE 2. APPROXIMATE DESIGN LIFE OF WASTEWATER INFRASTRUCTURE COMPONENTS

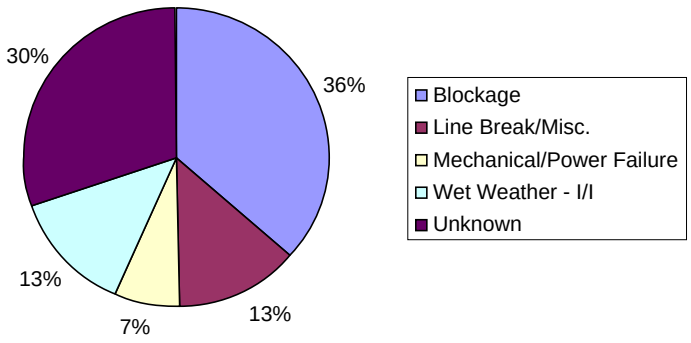
Components	Years of Design Life
Collection Systems	80-100
Treatment Plant-Concrete Structures	50
Treatment Plant-Mechanical & Electrical	15-25
Pumping Stations-Concrete Structures	50
Pumping Stations-Mechanical & Electrical	15
Interceptors	90-100

Data was taken from the Clean Water and Drinking Water Infrastructure Gap Analysis Report by the U.S. EPA[10].

A good indicator of the condition of a wastewater system is the frequency of sanitary sewer overflows (SSOs). The nation has an estimated 23,000 to 75,000 SSOs events each year, resulting in a loss of between 3 and 10 billion gallons of untreated wastewater[9]. Figure 1 provides a breakdown of the causes of SSO events for EPA region 3, which includes Virginia. One primary cause of SSOs can be attributed to aging infrastructure, which over time degrades and eventually fails.

This results in environmental and public health threats from the release of untreated wastewater. To address this issue, Virginia is currently funding 12 wastewater collection system rehabilitation projects which specifically address the following; replacing of out of date pipes and force mains, building new pump stations, and studies on the reduction of rainfall induced inflow and infiltration.

FIGURE 1. PERCENTAGE OF SSO EVENTS BY CAUSE FOR EPA REGION 3.



Data taken from 2004 Report on Control and Impacts of CSOs and SSOs by the U.S. EPA[9].

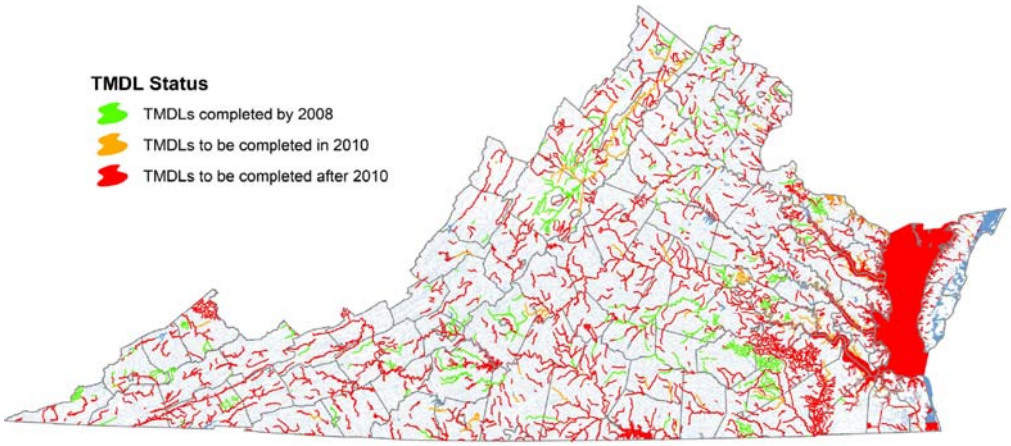
When assessing the condition of wastewater infrastructure, it is necessary to look at both existing structures as well as gaps where new structures are needed. A report by The Rural Community Assistance Partnership (RCAP) found that Virginia ranked 7th for highest percent of occupied rural housing units lacking complete plumbing facilities and 16th in the nation for highest percent of all occupied housing units lacking complete plumbing facilities[11]. The report also showed that between 1990 and 2000, the state had reduced the number of public housing units lacking complete plumbing facilities by 50%[11].

These statistics shed light on the need for the continued development of new wastewater treatment facilities for the population of Virginia, especially in rural areas.

Jurisdiction	% Total Bay Watershed Acreage	Nitrogen Delivered to Bay in 2008 (lbs. and % of total)	2011 Nitrogen-reduction Milestone (lbs./year decrease)	Phosphorus Delivered to Bay in 2008 (lbs. and % of total	2011 Phosphorus-reduction Milestone (lbs./year decrease)
Virginia	33.9%	70.6 million (27.2%)	3.4 million	8.6 million (48.4%)	470,000
Delaware	1.1%	4.5 million (1.8%)	292,072	332,000 (1.9%)	0
Dist. of Columbia	0.1%	354,000 (1.4%)	159,000	96,670 (0.5%)	Goal achieved
Maryland	14.4%	54.8 million (21.2%)	3.75 million	3.8 million (21.2%)	193,000
New York	9.7%	16.5 million (6.4%)	875,000	832,572 (4.7%)	86,700
Pennsylvania	35.2%	102.4 million (39.6%)	7.3 million	3.5 million (19.7%)	300,000
West Virginia	5.6%	6.6 million (2.6%)	42,254	623,833 (3.5%)	3,364

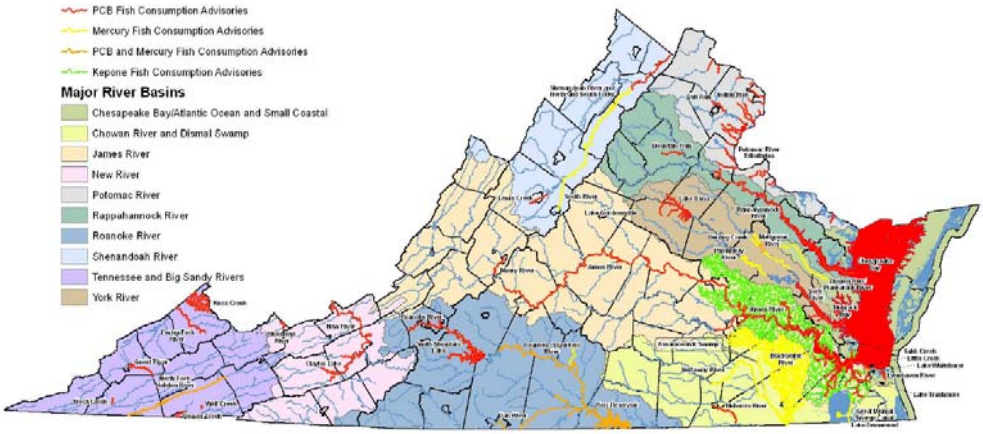
Chesapeake Bay 2011 Milestone Summary, (Source: Virginia Water Central Newsletter, August, 2009)

Achieving these reductions will not be easy, but VADEQ and VADCR are taking steps to address these challenges and as of 2008 have developed 546 Total Maximum Daily Load (TMDL) allocations for tributary segments within Virginia, with another 217 slated for completion by 2010. This still leaves over 1,500 TMDLs to be developed. In addition, new Chesapeake Bay TMDLs are currently being drafted which may require revisions to these existing TMDLs. Of the 546 TMDLs completed, only 68 Watershed Implementation Plans (WIPs) were completed by 2008, with work in progress on 24 more. Currently DEQ has allocated approximately $2 million/year for the TMDL program, and projects costs on the order of $19,000 per TMDL to develop tributary allocations. New federal mandates will require the Chesapeake Bay TMDLs to be completed by November of 2011, with implementation plans in effect by December 2012. **Current program funding is inadequate to meet these regulatory deadlines, with over $28 million required to address the non-bay TMDLs at this time, indicating this will require a 14 year effort at current funding levels.** The figure below highlights the extent of these outstanding requirements.



Virginia DEQ TMDL Status Report, (Source: VADEQ 2008)

These efforts to improve stormwater quality are targeted on making Virginia's water "fishable and swimmable" in accordance with the U.S. Clean Water Act enacted over 38 years ago. Today, all but one beach of the 44 beaches monitored in Virginia is "swimmable"; we have achieved 43% of our estuarine submerged aquatic vegetation goals; but still have a significant number of waterways which have fish consumption advisories posted, indicating there is still significant work to be done.



Virginia Waters Under VDH Fish Consumption Advisories, (Source: VADEQ 2008 305(b)/303(d) Report)

INVESTMENT NEEDS AND FUNDING DEDICATED

In the past, Virginia has made use of state and federal funding programs for maintenance of wastewater infrastructure in order to offset the cost for individual households. With rising costs for construction, maintenance, and necessary upgrades to public treatment facilities, these programs have provided a means for our state's localities to cost effectively comply with federal clean water regulations.

In the Clean Watershed Needs Survey the Environmental Protection Agency (EPA) reported a $4.7 billion need in our state, which is a twenty percent increase from the previous 2000 report[1]. The national average need for wastewater infrastructure per capita is $665. Virginia falls below the national average at $602 per capita[1]. It is necessary to address this need identified by the EPA in order to meet water quality and water-related public health goals of the Clean Water Act for the State of Virginia. The need is focused on upgrades and improvements for wastewater treatment plants, addition and rehabilitation of wastewater collection and conveyance systems, and the reduction of sanitary sewer overflows[1].

To address this need, the state has taken advantage of grant and low interest loan opportunities under the guidance of specific state agencies. For example, the Virginia Clean Water SRF Loan Program has provided over one billion dollars in loans since 1987, which has successfully funded over 250 wastewater projects through the state. In 2009, the state will be providing $186 million in bonds for 23 wastewater plant and infrastructure projects directly through this program[6]. Another example is the Water Quality Improvement Fund (WQIF), which through grants is funding 43 projects said to remove 8.5 million pounds of nitrogen and 0.9 million pounds of phosphorous annually from treatment plant effluents[12]. Table 3 provides a list of the major funding sources and dollar amounts the state will be benefiting from. A number of funding programs specifically target rural communities and small treatment systems. These funding programs provide economic assistance to struggling localities in the form of employment, as well as for the improvement of public and environmental health within the community by enhancing public facilities. These programs also encourage the development of economically and environmentally sustainable projects such as "green" infrastructure, alternative energy sources, and water reuse.

Unfortunately, it is clear that this level of funding falls short of the previously described need, placing a great deal of pressure on localities to find alternative sources of funding. The gaps in funding have led to increased public wastewater rates, with communities bearing 95% of clean water costs[14]. The average wastewater rate for the state in 2008 was $27.74, which equates a 9.5% increase from the previous year and a 65% increase since 1999[8]. The national average for that same year was slightly higher at $29.17[16]. Although Virginia falls well below the EPA's current measure of affordability for wastewater rates based on household income, the burden of increasing these rates during a time of economic hardship will be strongly felt.

ASCE 2009 National Infrastructure Report Card Needs – Wastewater Category (Source: 2009 ASCE IRC)

TABLE 3: FUNDING AGENCIES, FUNDING TYPES AND DOLLAR AMOUNT OF FUNDS ALLOCATED TO THE STATE OF VIRGINIA FOR FY 2009.

Funding Agency/Manager	Funding Type	Amount of Funding ($, million)
Virginia State Revolving Loan Fund[7]	Federal Stimulus Funding	77.0
Virginia State Revolving Loan Fund[6]	State Loans	187.0
Water Quality Improvement Fund[12]	Grant	592.8
American Recovery and Reinvestment Act[13]	Federal Stimulus Funding	80.2
Water Quality Improvement Funds[12]	Supplemental State Funding	10% Annual State Surplus
Virginia Nutrient Trading Program[12]	Nutrient Trading	520.0
Water Quality Improvement Funds[12]	Construction Bonds	250.0
Water Protection and Reinvestment Act (HR-3202)*	Federal Funded Trust Fund	10,000.0

*** Represents funding allocated at the national level**.

BASIS OF GRADE

The State of Virginia currently lacks the necessary statistical data on the condition of our wastewater infrastructure to determine an objectively measured grade. As a result of this, a subjective grade was determined from a panel of experienced professionals in the field of wastewater engineering. The subjective grade was based on the following:

- Comparison with the ACSE National Wastewater Report Card grade of D- based on:
    - The national and Virginia's per capita need.
    - Virginia's ranking of 16th in the nation for highest percentage of total occupied housing units lacking complete plumbing facilities.
    - The national and Virginia's monthly wastewater rates.
- Virginia is utilizing a number of state and federal resources to address the recognized $4.7 billion dollar wastewater infrastructure need. These include the Virginia SRLF, WQIF, grants, federal stimulus funds, construction bonds, nutrient trading program, and sewer rate increases by localities. These resources are funding projects that address current infrastructure issues. For example, projects funded under the WQIF grant program will reduce 8.5 and 0.9 million pounds of nitrogen and phosphorous each year from treatment plant effluents.
- It is assumed that the majority of Virginia's wastewater infrastructure was installed prior to the 1980's. A good indication of infrastructure age is the majority of SSOs occurring in Region 3 has been identified to be caused by blockages, line breaks, and mechanical failures, adding validity to the previous assumption. Using accepted materials lifespan estimates, along with these two points, it is clear that Virginia faces significant challenges to meet the needs of replacing an ageing wastewater infrastructure.

CONCLUSIONS AND RECOMMENDATIONS

In order to preserve the integrity of our wastewater systems, the following recommendations are made:

- **The Virginia Section of the American Society of Civil Engineers encourages local, state, and federal officials to support long-term funding of wastewater infrastructure projects designed to reduce the funding gap. The purpose of these funded projects is to improve the quality of both public and environmental health, while allowing for sustainable economic growth.**
- **Included in any future government stimulus packages and grants should be funding for projects specifically addressing wastewater infrastructure.**
- **State and localities should promote asset management projects that allow better oversight of current wastewater infrastructure and assessment of future needs.**
- **Implement a system organized by a centralized group that collects necessary wastewater infrastructure information to be used for future Virginia ASCE report cards. This information should include credible statistical data that would allow for an objective determination of a measured grade. This information will also improve how policy makers determine funding allocation to localities and/or the state based on locality/state specific data.**

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