*Virginia Department of Environmental Quality*

# TMDL Implementation Plan for Hoffler Creek

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# 1.0 Introduction

When streams fail to meet water quality standards, Section 303(d) of the Clean Water Act and the Environmental Protection Agency's (EPA's) Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for each pollutant exceeding its standard. TMDLs represent the total pollutant loading that a waterbody can receive without violating water quality standards. The TMDL process establishes the allowable loadings of pollutants for a waterbody based on the relationship between pollution sources and instream water quality conditions. By following the TMDL process, states can establish water quality based controls to reduce pollution from both point and nonpoint sources to restore and maintain the quality of their water resources (EPA, 2011).

As required by the Clean Water Act and Virginia's Water Quality Monitoring, Information and Restoration Act (WQMIRA), VADEQ develops and maintains a listing of all impaired waters in the state that details the pollutant(s) causing each impairment and the potential source(s) of each pollutant. This list is referred to as the 303(d) List of Impaired Waters. In addition to 303(d) List development, WQMIRA directs VADEQ to develop and implement TMDLs for listed waters (WQMIRA, 1997). Once TMDLs have been developed, they are distributed for public comment and then submitted to the EPA for approval.

Once a TMDL is developed, the WQMIRA states that the "State Water and Control Board shall develop and implement a plan to achieve fully supporting status for impaired waters". The TMDL Implementation Plan (IP) describes the necessary control measures, which can include the use of better treatment technology and installation of Best Management Practices (BMPs), are implemented in a staged process.

## *1.1 Impairment Listing*

The segment VAT-G15E_HOF01A06 of Hoffler Creek was first listed as bacteria impaired on Virginia's 2008 303(d) Total Maximum Daily Load Priority List and Reports (VADEQ, 2008) due to exceedances of the state's recreational criteria for Enterococcus. This segment was also included on subsequent Virginia 303(d) Reports on Impaired

Waters and Virginia 305(b)/303(d) Water Quality Assessment Integrated Reports (VADEQ, 2010). The Hoffler Creek watershed is located in the tidal region of Virginia, within the Cities of Suffolk and Portsmouth, and empties into the James River, in the Hampton Roads Harbor (USGS Cataloging Unit 02080208) (**Figure 1-1**).

The estuarine bacteria-impaired segment of Hoffler Creek is 0.06 $mi^2$, is located along the southern shore of Hampton Roads Harbor (James River), and encompasses the entirety of Hoffler Creek. To the east of Hoffler Creek is Craney Island US Naval Reservation. Based on monitoring data for the 2010 Water Quality Assessment (2003 – 2008), the segment was found not to be supporting its recreational use goal due to exceedances of the enterococcus bacteria criteria. **Table 1-1** summarizes the details of the impaired segment as listed in the 2010 Integrated Assessment.

**Table 1-1: Impairment Summary for Hoffler Creek (VAT-G15E-06-03-BAC)**

| Cause Group ID | Assessment Unit | Stream Name | Area ($mi^2$) | Boundaries | Listing Station ID: | Impairment | Exceedance Rate* |
|---|---|---|---|---|---|---|---|
| VAT-G15E-06-03-BAC | VAT-G15E_HOF01A06 | Hoffler Creek | 0.06 | Located along south shore of Hampton Roads Harbor | 2-HOF000.44 | Enterococcus | 5 violate/8 obs. |

*Exceedance rate listed in Virginia's 2010 305(b)/303(d) Water Quality Integrated Assessment

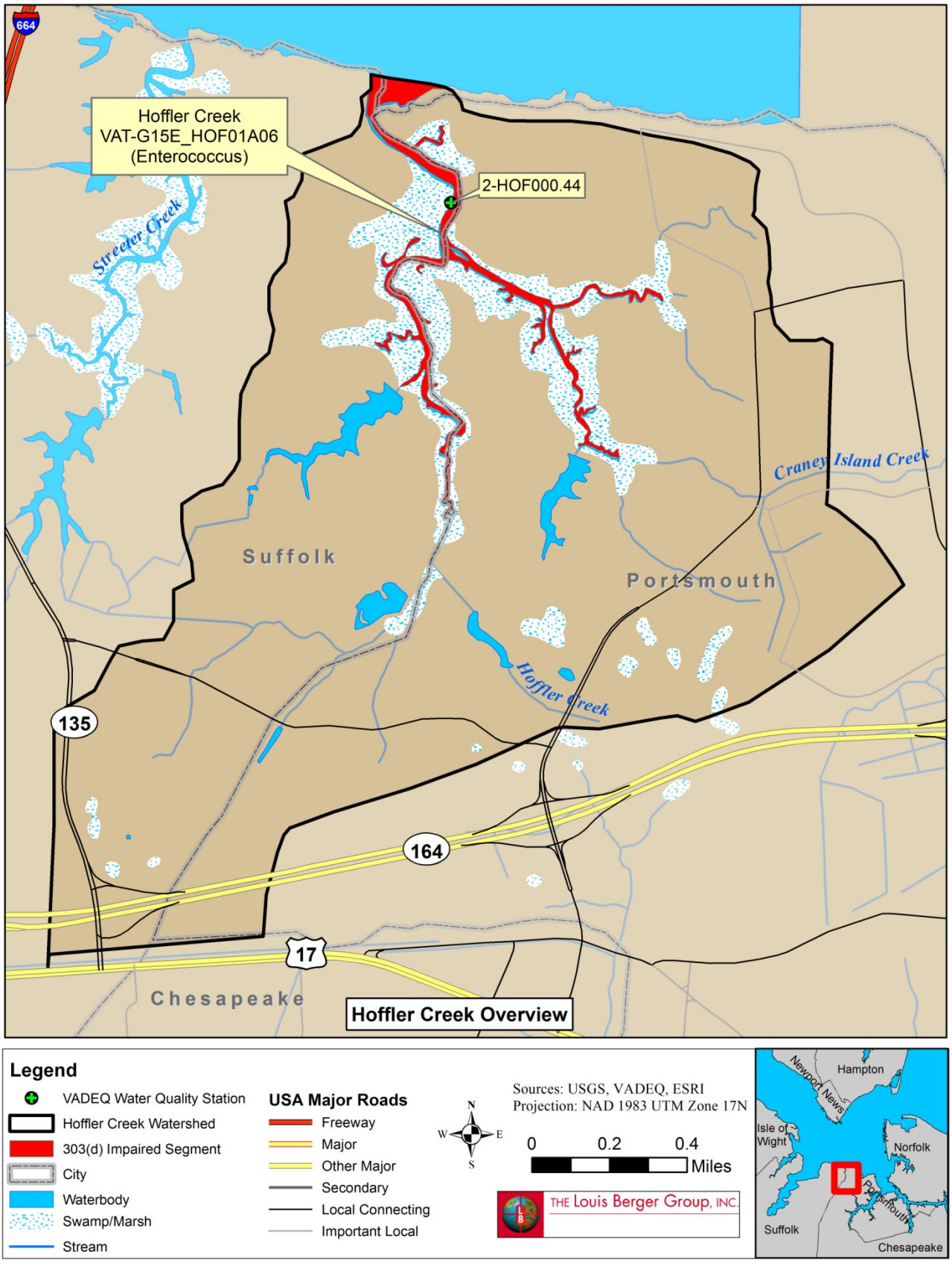


**Figure 1-1: Location of the Impaired Hoffler Creek Watershed**

## *1.2 Applicable Water Quality Standard*

Water quality standards include designated uses for a waterbody and water quality criteria necessary to support those designated uses. According to Virginia Water Quality Standards (9 VAC 25-260-5), the term *water quality standards* "means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect public health or welfare, enhance the quality of water, and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.)."

### 1.2.1 Designated Uses

According to Virginia Water Quality Standards (9 VAC 25-260-10):

> *"all state waters, including wetlands, are designated for the following uses: recreational uses (e.g., swimming and boating); the propagation and growth of a balanced indigenous population of aquatic life, including game fish, which might be reasonably expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish)."*

### 1.2.2 Applicable Water Quality Criteria

Effective February 1, 2010, VADEQ specified a new bacteria standard in 9 VAC 25-260-170.A. These standards replaced the existing fecal coliform standard of 9 VAC 25-260-170. For a non-shellfish supporting waterbody to be in compliance with Virginia bacteria standards for primary contact recreation in a saltwater or transition zone, the current criteria are as follows:

> *"Enterococci bacteria shall not exceed a monthly geometric mean of 35 CFU/100 ml in transition and saltwater. If there are insufficient data to calculate monthly geometric means in transition and saltwater, no more than 10% of the total samples in the assessment period shall exceed enterococci 104 CFU/100 ml."*

### 1.2.3 Wildlife Contributions

The Hoffler Creek TMDL indicates that even after the removal of all sources of bacteria (other than wildlife); the stream will not attain standards. **Table 1-2** depicts the existing and allocated bacteria loads and shows that the existing wildlife bacteria load from non-urban areas (1.44E+12) exceeds and is almost twice the projected TMDL load (7.96E+11). Therefore the current estimate of the wildlife bacteria load is significant enough to alone cause exceedances in the water quality standards.

**Table 1-2: Existing and Allocated Bacteria Loads in the Hoffler Creek Watershed**

| Source | | Existing Load (count/day) | % of Total Existing Load | Allocated Load (count/day) | Required Reduction (%) |
|---|---|---|---|---|---|
| LA | Livestock | 0.00E+00 | 0.0% | 0.00E+00 | - |
| | Wildlife | 1.44E+12 | 8.0% | 2.57E+11 | 82.0% |
| | Human | 0.00E+00 | 0.0% | 0.00E+00 | - |
| | Pet | 4.22E+12 | 23.4% | 0.00E+00 | 100.0% |
| | Sanitary Sewer Overflows | 2.06E+11 | 1.1% | 0.00E+00 | 100% |
| WLA | MS4 | 1.22E+13 | 67.5% | 5.39E+11 | 95.6% |
| **Total** | | **1.81E+13** | **100.0%** | **7.96E+11** | **95.6%** |

The Commonwealth of Virginia and USEPA are not proposing the elimination of wildlife to allow for the attainment of water quality standards. This is obviously an impractical action. Clearly, the reduction of wildlife or changing a natural background condition is not the intended goal of a TMDL implementation plan.

The Technical Working Group recognized the challenges associated with the complete elimination of pets' loads and the high wildlife loads as well as the potential uncertainties associated with the Hoffler Creek TMDL and recommended to explicitly consider all these challenging reductions and uncertainties in all steps of the implementation plan. In fact, totally eliminating the bacteria loads from pets will be extremely costly and will not achieve the targeted water quality standards. Addressing bacteria loads from wildlife is neither feasible nor recommended in this IP. Therefore the TMDL implementation plan for Hoffler Creek will follow an adaptive implementation approach consisting of an iterative process to continue and enhance the existing monitoring plan as well as

implement reasonable and practicable control actions. If, after implementation of these reasonable and practicable control options, violations of the water quality standard persist due to wildlife loadings, then a UAA may become necessary. An UAA will address the re-designation of the current swimming use in Hoffler Creek and will require the completion of a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors as described in the federal regulations under 40 CFR §131.10(g). The stakeholders in the watershed, the Commonwealth of Virginia, and USEPA will have an opportunity to comment on these special studies.

# 2.0 State and Federal Requirements for Implementation Plans

There are a number of state and federal requirements and recommendations for TMDL Implementation Plans (IPs). The goal of this chapter is to clearly define these and explicitly state if the elements are a required component of an approvable IP or are merely a recommended topic that should be covered in a thorough IP. This chapter has three sections that discuss the a) requirements outlined by the Water Quality Monitoring, Information, and Restoration Act (WQMIRA) that must be met in order to produce an IP that is acceptable and approvable by the Commonwealth, b) EPA recommended elements of IPs, and c) required components of an IP in accordance to Section 319 guidance.

## *2.1 State Requirements*

The TMDL IP is a requirement of Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), WQMIRA directs Virginia Department of Environmental Quality (DEQ) to "develop and implement a plan to achieve fully supporting status for impaired waters." In order for IPs to be approved by the Commonwealth, they must meet the requirements as outlined by WQMIRA. To meet the requirements of WQMIRA, IPs must include the following:

- Date of expected achievement of water quality objectives
- Measureable goals
- Necessary corrective actions
- Associated costs, benefits, and environmental impact of addressing the impairment.

## *2.2 Federal Requirements*

Section 303(d) of the CWA and current EPA regulations do not require the development of implementation strategies. EPA does, however, outline the minimum elements of an approvable IP in its 1999 "Guidance for Water Quality-Based Decisions: The TMDL Process". The listed elements include:

- a description of the implementation actions and management measures,

- a time line for implementing these measures,
- legal or regulatory controls,
- the time required to attain water quality standards, and
- a monitoring plan and milestones for attaining water quality standards.

## 2.3 Requirements for Section 319 Funding Eligibility

EPA develops guidelines that describe the process and criteria to be used to award Clean Water Act (CWA) Section 319 nonpoint source grants to states. Congress amended the CWA in 1987 to establish the 319 Nonpoint Source Management Program. Under Section 319, States, Territories, and Indian Tribes receive grant money, which supports a wide variety of activities, including the restoration of impaired waters. The guidance is subject to revision and the most recent version should be considered for IP development. The "Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2003" identifies the following nine elements that must be included in the IP to meet the 319 requirements:

1. Identify the causes and sources of groups of similar sources that will need to be controlled to achieve the load reductions estimated in the watershed-based plan;
2. Estimate the load reductions expected to achieve water quality standards;
3. Describe the NPS management measures that will need to be implemented to achieve the identified load reductions;
4. Estimate the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement the watershed-based plan.
5. Provide an information/education component that will be used to enhance public understanding of the project and encourage the public's participation in selecting, designing, and implementing NPS management measures;
6. Provide a schedule for implementing the NPS management measures identified in the watershed based plan;
7. Describe interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented;

8. Identify a set of criteria for determining if loading reductions are being achieved and progress is being made towards attaining water quality standards, and if not, the criteria for determining if the watershed-based plan needs to be revised; and
9. Establish a monitoring component to evaluate the effectiveness of the implementation efforts.

For more information on the requirements for Section 319-fund eligibility, refer to http://www.dcr.state.va.us/sw/ss319.htm and http://www.epa.gov/owow/nps/cwact.html.

# 3.0 Review of TMDL Development

The Hoffler Creek TMDL was completed in November 2011 and approved by EPA in December 2011. The following section reviews the watershed characterization, water quality monitoring, source assessment and primary cause of impairment, water quality modeling, and the allocations for the Hoffler Creek watershed.

## *3.1 Watershed Characterization*

### 3.1.1 Landuse

The Hoffler Creek watershed is located within the borders of the Cities of Suffolk and Portsmouth, Virginia. The watershed has a drainage area of 1,781 acres. **Table 3-1** lists the landuse percentages of the watershed. It can be seen that the watershed is dominated by developed land (71.9%) and wetland (12.4%). A map displaying the landuse in the Hoffler Creek area is shown in **Figure 3.1**.

**Table 3-1.: Land Use in the Hoffler Creek Drainage Area**

| General Land Use Category | NLCD 2006 Land Use Category | Acres | Total Acres | Percentage of Watershed | Total Percent |
|---|---|---|---|---|---|
| Developed | Developed High Intensity | 30.6 | 1,280.2 | 1.7% | 71.9% |
| | Developed Medium Intensity | 232.2 | | 13.0% | |
| | Developed Low Intensity | 559.9 | | 31.5% | |
| | Developed Open Space | 457.5 | | 25.7% | |
| Agricultural | Cultivated Crops | 4.9 | 8.3 | 0.3% | 0.5% |
| | Pasture/Hay | 3.3 | | 0.2% | |
| Forest | Deciduous Forest | 51.6 | 124.4 | 2.9% | 6.9% |
| | Evergreen Forest | 61.4 | | 3.4% | |
| | Mixed Forest | 11.4 | | 0.6% | |
| Wetland | Palustrine Emergent Wetland | 19.2 | 220.1 | 1.1% | 12.4% |
| | Palustrine Forested Wetland | 110.5 | | 6.2% | |
| | Palustrine Scrub/Shrub Wetland | 9.6 | | 0.5% | |
| | Estuarine Emergent Wetland | 79.5 | | 4.5% | |
| | Estuarine Scrub/Shrub Wetland | 1.3 | | 0.1% | |
| Water | Open Water | 106.3 | 106.3 | 6.0% | 6.0% |
| Other | Scrub/Shrub | 32.6 | 42.0 | 1.8% | 2.3% |
| | Grassland/Herbaceous | 8.9 | | 0.5% | |
| | Bare Land | 0.4 | | 0.0% | |
| **Total** | | **1,781.2** | | 100% | 100% |

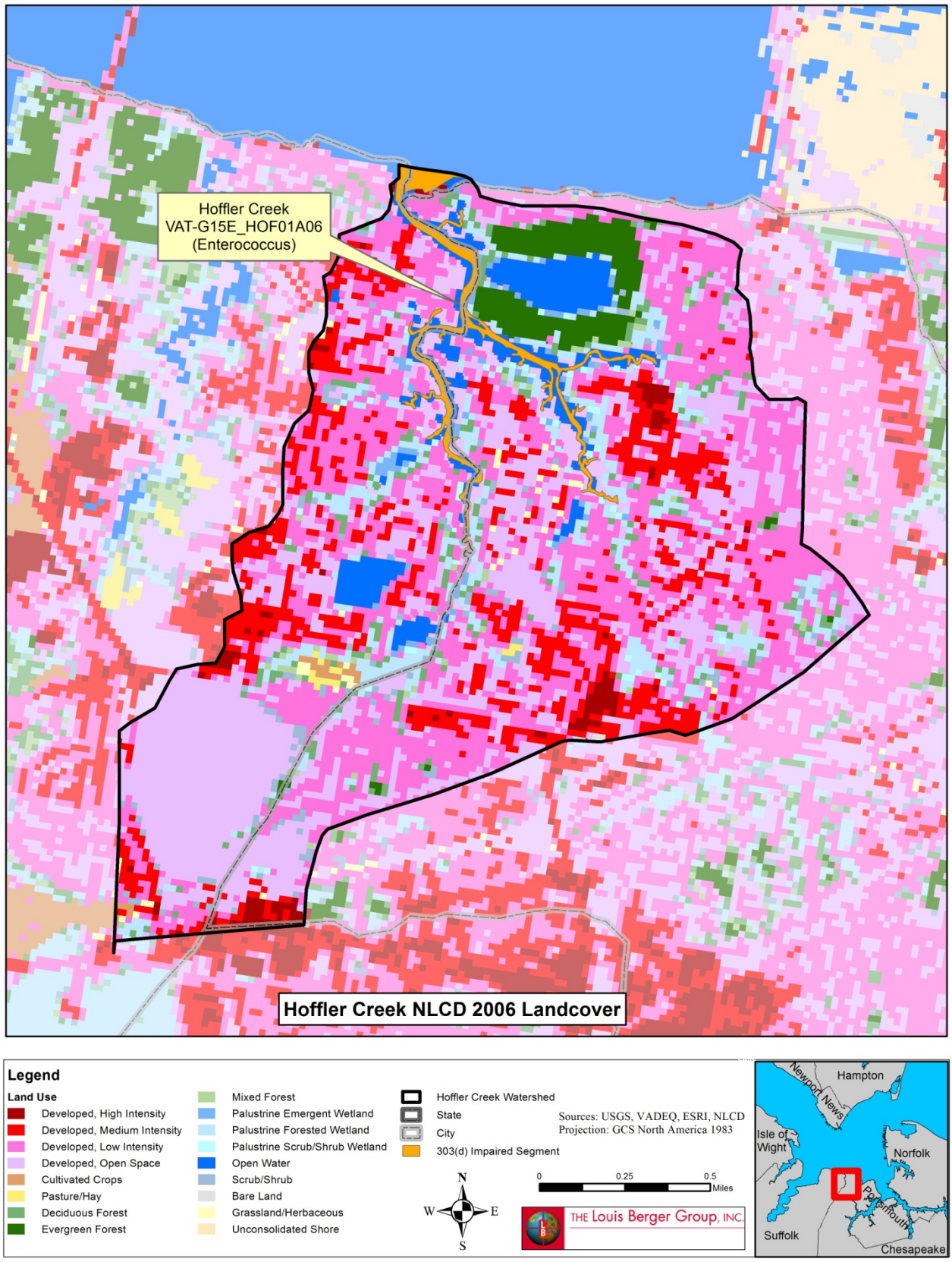


**Figure 3-1: Landuse of the Hoffler Creek Watershed**

### 3.1.2 Geology and Soils

The major hydrologic group within the Hoffler watershed is group D, with 64% of the watershed containing these soils. Soil group D is defined as having very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious cover. **Table 3-2** summarizes the total percentages of hydrologic groups for the Hoffler Creek Watershed.

**Table 3-2. Soil Hydrologic Groups in Hoffler Creek Watershed**

| Soil Hydrologic Group | Area (acres) | Percent of Watershed |
|---|---|---|
| B | 278.2 | 15.6% |
| B/D | 6.2 | 0.4% |
| C | 260.0 | 14.6% |
| D | 1,145.5 | 64.3% |
| (blank) | 91.3 | 5.1% |
| **Total** | **1,781.2** | **100.00%** |

### 3.1.3 Permitted Facilities (MS4s)

Municipal Separate Storm Sewer System (MS4) permits have been issued to cities within the Hoffler Creek Watershed. **Table 3-3** lists the MS4 permit holders located within the Hoffler Creek TMDL watershed. The majority (99%) of Hoffler Creek watershed is covered by these three MS4 permits.

**Table 3-3. MS4 Permits within the Hoffler Creek Watershed**

| Permit Number | MS4 Permit Holder | Phase I or II | Area within Hoffler Creek (acres) |
|---|---|---|---|
| VA0088668 | City of Portsmouth | I | 1,122 |
| VAR040029 | City of Suffolk | II | 640 |
| VAR040115 | VDOT | II | * |

* VA DEQ recommended the aggregation of VDOT's MS4 with the other MS4s (DEQ Central Office, Richmond correspondence August 29th, 2011 – MS4 aggregation language to be included in TMDL)

## *3.2 Water Quality Monitoring*

Environmental monitoring efforts for collecting bacteria data in the TMDL watershed has been conducted only by the Virginia Department of Environmental Quality (VA DEQ). All available data for bacteria, located within the TMDL watershed, were analyzed and

compared to VA DEQ bacteria standards for recreation use. VA DEQ collected bacteria samples for the indicators fecal coliform and enterococci at one water quality monitoring station. **Table 3-4** summarizes VA DEQ monitoring efforts for all bacteria indicators at station 2-HOF000.44.

**Table 3-4: Summary of Instream Monitoring Stations for Bacteria in the Hoffler Creek Watershed**

| Station ID | Stream | Indicator | Sample Date | |
|---|---|---|---|---|
| | | | First | Last |
| 2-HOF000.44 | Hoffler Creek | Fecal Coliform | 8/18/2005 | 12/9/2009 |
| | | E. coli | - | - |
| | | Enterococci | 8/18/2005 | 12/9/2009 |

**Table 3-5** shows the water quality sampling period of record, the number of samples, the minimum and maximum bacteria concentrations observed, and the total number and percentage of samples exceeding the enterococci criterion of 104 CFU/ 100 ml. Overall, the enterococci measurements collected between 2005 and 2009 exceeded the enterococci criterion 48% of the period. **Figure 3-2** presents all of the enterococci measurements taken at station 2-HOF000.44.

**Table 3-5: Summary of VA DEQ Enterococci Exceedances in the Hoffler Creek Watershed**

| Station ID | Number of Samples | Dates Sampled | | CFU/ 100 mL | | Total Exceed.* | Total % Exceed. |
|---|---|---|---|---|---|---|---|
| | | First | Last | Min | Max | | |
| 2-HOF000.44 | 21 | 8/18/2005 | 12/9/2009 | 25 | 2000 | 10 | 48% |
| *Exceedances of the Enterococci criterion of 104 CFU/100mL | | | | | | | |

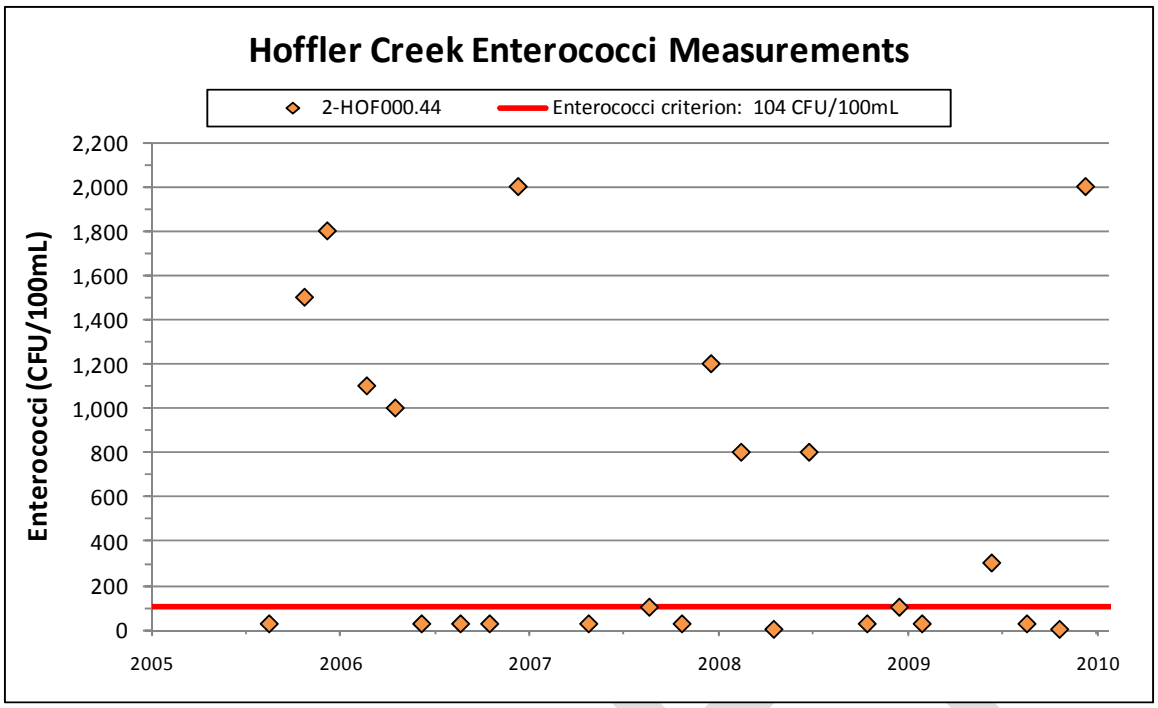


**Figure 3-2: Enterococci Measurements for the Hoffler Creek Watershed**

## *3.3 Source Assessment*

This section focuses on characterizing the sources that potentially contribute to the bacteria loading in the TMDL watershed. These sources include permitted facilities, septic systems/straight pipes, livestock, sanitary sewer overflows, wildlife, and pets.

Based on data obtained from VA DEQ, there are no individual permitted facilities and no general permits within the Hoffler Creek watershed. There are also no failing septic systems or straight pipes within the watershed. The NLCD 2006 indicated there was 8.3 acres of agricultural (cultivated crops and pasture/hay) land within Hoffler Creek watershed. When overlaid onto high resolution imagery, this agricultural land is actually developed land. Therefore, since there is no actual agricultural land, livestock will not be considered as a source of bacteria in this TMDL.

For bacteria sources originating from sanitary sewer overflows (SSOs), bacteria loads for the TMDL watershed were estimated based on measured SSO volume releases provided from the sanitary sewer overflow reporting system (SSORS) by VA DEQ. Time series of

daily accumulative SSO volume releases were developed for the time period between 2006 and 2011. The accumulative SSO volume releases were based on the net daily reported SSO releases only. The daily cumulative SSO volumes were used to develop a cumulative frequency distribution (CFD) curve. A CFD depicts the percentage of days for which the cumulative SSO volume was equaled or exceeded. The CFD also shows the range of available data for SSO volume that was released at a day of an incident for Hoffler Creek watershed.

**Table 3-6** details the wildlife estimates and **Table 3-7** shows the estimated number of pets within Hoffler Creek Watershed.

**Table 3-6: Hoffler Creek Watershed Wildlife Inventory**

| Wildlife | Population Estimate |
|---|---|
| Deer | 10 |
| Raccoon | 25 |
| Muskrat | 105 |
| Residential Geese | 40 |
| Canada Geese | 100 |
| Mallard | 20 |

**Table 3-7. Pet Inventory for the Hoffler Creek Watershed**

| Households | Dogs | Cats |
|---|---|---|
| 3,827 | 2,419 | 2,729 |

The EPA Bacterial Indicator Tool, a spreadsheet based analysis tool, was used to determine the relative contributions of enterococci loads from different nonpoint sources. The Tool employs user supplied land use acreage, animal population (livestock, wildlife, and pets), septic systems and unit load data to estimate the fecal coliform loads from various sources in a watershed environment. Relative contributions of fecal coliform loads from different nonpoint sources (including estimated SSO loads) were then calculated in the Hoffler Creek watershed as shown in **Table 3-8** and **Figure 3-3**. It is assumed that the distribution of enterococci load is identical to the distribution of fecal coliform load from the same source categories.

| Table 3-8.: Estimated Bacterial Contribution by Source in the Hoffler Creek Watershed | | | | |
|---|---|---|---|---|
| **Livestock** | **Wildlife** | **Human** | **Pets** | **SSOs** |
| 0.0% | 24.6% | 0.0% | 71.9% | 3.5% |

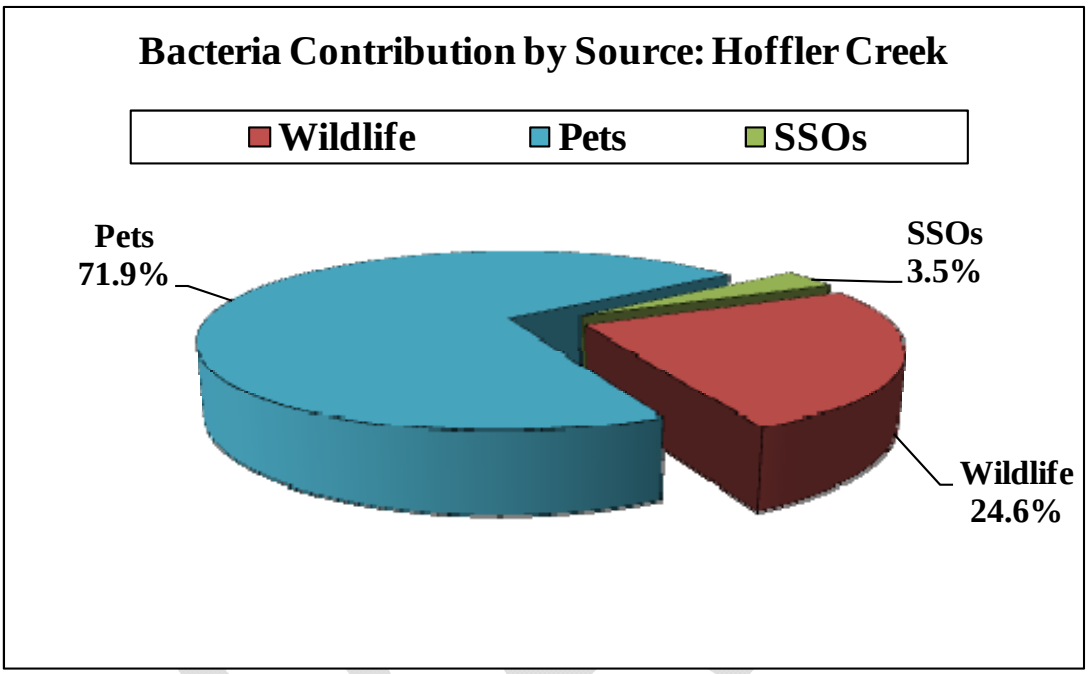


**Figure 3-3: Distribution of Bacteria Loads by Source in the Hoffler Creek Watershed**

## *3.4 Water Quality Modeling*

A simplified model approach, jointly developed by EPA, VA DEQ, VA DCR, Maryland Department of the Environment (MDE), VDH-DSS, Virginia Institute of Marine Sciences (VIMS), United States Geological Survey, Virginia Polytechnic University, James Madison University, and Tetra Tech, was selected to estimate present bacteria loads for small coastal basins, to calculate allocations and needed reductions of each source (VA DEQ, 2005, 2006). A spreadsheet model, which is run in Microsoft EXCEL, calculates estuaries bacteria loads based on steady state mass balance in the estuary over a tidal period (the prevailing tide in the estuary of Hoffler Creek is the lunar semi-diurnal (M2) tide with a tidal period of 12.42 hours). Tidal Exchange in the case of the Hoffler Creek segment is between this segment and the downstream open water segment. The

steady state condition of the model mirrors average condition of the estuary system and incorporates the following assumptions:

1. Water is incompressible
2. Water is completely mixed:
    a. Density variations because of temperature and salinity changes by saline and freshwater inflow are negligible
    b. Variations of bacteria concentration are negligible
3. The saline volume flowing into the estuary is based on an average tidal range, the surface area of the estuary, and an average fraction of incoming new ocean water
4. The volume of water flowing out the estuary is the sum of assumption Nr. 1, 2 and 3
5. Average freshwater flow is estimated based on observed freshwater flow per unit area from USGS flow gauge station in vicinity
6. The source precipitation and sink evaporation are negligible
7. Bacteria is decayed through a combined daily first order kinetic rate

## *3.5 TMDL Allocations*

### 3.5.1 Current and Allowable Load

Based on the simulation results from the simplified tidal prism bacteria model, enterococci loadings (daily load capacity of the bay) were estimated in the estuary of the Hoffler Creek in order to obtain the current load and allowable load. The current load is based on the maximum value of the geometric mean and the single sample maximum that was measured at monitoring station 2-HOF000.44. The allowable load is based on VA DEQ criteria for enterococci for the geometric mean and single sample maximum. However, only the single sample maximum was applied in this TMDL, since the geometric mean calculation requires at least four measurements per 30 days. The required percent load reduction for the Hoffler Creek watershed was estimated by subtracting the allowable load from the current load, dividing it by the current load, and multiplying it by 100. **Table 3-9** shows the estimated model results of the current load, allowable load, and reduction for the single sample maximum for the Hoffler Creek

watershed. The single sample maximum values were used to calculate the load allocation and the TMDL in the Hoffler Creek watershed.

**Table 3-9: Current Load, Allowable Load, and Required Reduction Based on the Single Maximum Value for the Hoffler Creek Watershed**

| Station | Maximum Enterococci (count/100mL) | Current Load (counts/day) | Allowable Load (counts/day) | Required Reduction (%) |
|---|---|---|---|---|
| 2-HOF000.44 | 2,000 | 1.81E+13 | 7.96E+11 | 95.6 |

### 3.5.2 Wasteload Allocation

Since no municipal permitted facilities discharge into the bacteria impaired watersheds, no waste load was allocated to permitted facilities. However, in order to account for future growth, one percent of the LA was allocated to the TMDL watershed. Waste load allocations were also applied to two MS4 permit holders in the Hoffler Creek watershed: the City of Portsmouth (VA0088668) and the City of Suffolk (VAR040029), which discharge runoff (including bacteria) into the estuary of Hoffler Creek. VADEQ recommended that the aggregation of the VDOT's MS4 WLA with Portsmouth and Suffolk's MS4 WLAs was the best course of action. The bacteria loads were allocated to the MS4 permit holders using an area weighted approach. Each MS4 permit holder was allocated a bacteria load based on the urban area that is covered in each TMDL watershed. **Table 4-2** presents the waste load allocation for each MS4 permit holder within the TMDL watershed.

**Table 3-10: Waste Load Allocation for MS4 Permit Holders Discharging within the Hoffler Creek Watershed**

| MS4 Permit Holder | MS4 Permit # | Existing Load* | Allocated Load* | Required Reduction |
|---|---|---|---|---|
| | | counts/day | counts/day | % |
| City of Portsmouth (Phase I) | VA0088668 | 7.60E+12 | 3.34E+11 | 95.6% |
| City of Suffolk (Phase II) | VAR040029 | 4.62E+12 | 2.03E+11 | 95.6% |
| **Total** | | **1.22E+13** | **5.36E+11** | **95.6%** |

* VADEQ recommended the aggregation of VDOT's MS4 WLA with the other MS4 WLAs (DEQ Central Office, Richmond correspondence August 29th, 2011 – MS4 aggregation language to be included in TMDL)

### 3.5.3 Load Allocation and TMDL

The reduction of loadings from non-point sources (livestock, wildlife, pet, failed septic system) including livestock, pets, and wildlife direct deposition, that are not covered under MS4 area and the non-urban area of the MS4 was incorporated into the load allocation. In addition, the total load from SSOs was included in the load allocation. The load allocation for the Hoffler Creek watershed is based on the proportion of the bacteria sources (livestock, wildlife, human, pets, and sanitary sewer overflows). The proportions were derived from bacteria loads that were estimated using EPA's bacteria indicator tool for bacteria loads originating from livestock, wildlife, human, and pets and spreadsheet calculations for bacteria loads originating from sanitary sewer overflows.

A complete reduction of all human sources (septic system, sanitary sewer overflows) is required, since enterococci from human sources are considered a serious concern in estuaries (VA DEQ, 2005). Reductions for wildlife are applied when the reduction of controllable loads (humans, livestock, and pets) does not achieve the water quality standard for the estuary (VA DEQ, 2005). However, the TMDL does not recommend reductions in wildlife populations. The enterococci TMDL allocations by different source categories that would meet the single sample maximum enterococci standard of 104 count/100mL for the Hoffler Creek watershed are presented in **Table 3-11**. A summary of the TMDL allocation plan is presented in **Table 3-12.**

**Table 3-11: Load Allocation and Required Reductions for the Hoffler Creek Watershed**

| Source | Current Load (count/day) | Allocated Load (count/day) | Required Reduction (%) |
|---|---|---|---|
| Livestock | 0.00E+00 | 0.00E+00 | - |
| Wildlife | 1.44E+12 | 2.57E+11 | 82% |
| Human | 0.00E+00 | 0.00E+00 | - |
| Pet | 4.22E+12 | 0.00E+00 | 100% |
| Sanitary Sewer Overflows | 2.06E+11 | 0.00E+00 | 100% |
| **Total** | **5.87E+12** | **2.57E+11** | **96%** |

**Table 3-12: Hoffler Creek Watershed TMDL Allocation Plan Loads (count/day)**

| WLA (MS4s within urban area and 1% of LA for future growth) | LA (SSOs, Non MS4s and non-urban MS4s) | MOS (Margin of Safety) | TMDL |
|---|---|---|---|
| **5.39E+11*** | **2.57E+11** | **IMPLICIT** | **7.96E+11** |

*consists of the loads from VAR0088668 of 3.34E+11, VAR040029 of 2.03E+11, and 1% of the LA load for future growth of 2.57E+09

# 4.0 Public Participation

Public participation is an important part in developing the implementation plan for any watershed. Watershed residents and officials who work in the area have an intimate knowledge of the attitude of the citizens, what is possible to implement and what is not possible. For this implementation plan the public participated in two public meetings and one steering committee meeting was held to properly identify the control measures needed to reduce bacteria levels in Hoffler Creek watershed.

The first implementation plan public meeting was held in conjunction with the final TMDL public meeting on September 27th, 2011. Attendee's included representatives from DEQ, The Louis Berger Group, the Hoffler Creek Wildlife Preserve, the City of Suffolk, and the City of Portsmouth. In this meeting the general approach for implementation actions in Hoffler Creek were discussed. The strategies included pollution prevention, mitigation measures, and indirect measures. The group discussed the possible location of an additional monitoring station. The group decided that in order to see which area of Hoffler Creek was contributing the most bacteria (if any) a site on one of the main branches of the creek must be selected.

The first steering committee meeting was held on February 10th 2012. Attendee's included representatives from DEQ, The Louis Berger Group, the Hoffler Creek Wildlife Preserve, the City of Suffolk, and the City of Portsmouth. In this meeting, specific pollution prevention, mitigation measures, and indirect measures were presented and a discussion on the feasibility of all suggested measures was held. The general consensus was that there were too many costly measures and there is a need to reevaluate the sources of bacteria within the watershed. Another consensus was to have a detailed monitoring plan and better estimates on pets to further understand the bacterial issues within Hoffler Creek. An additional monitoring location was selected and confirmed for the Implementation Plan.

The final public meeting was held on May 15th, 2012.

# 5.0 Implementation Actions and Milestones

Based on the results of the TMDL, the Hoffler Creek's bacteria impairment is primarily caused by wildlife and pet waste deposition in the watershed, as well sanitary sewer overflows. **Table 5-1** summarizes the estimation of existing and allocated bacteria loads in the Hoffler Creek watershed based on the TMDL report. These estimates indicate that the existing bacteria loads are dominated by MS4s (67.5%), pets from non-urban areas (23.4%), and wildlife from non-urban areas (8%).

**Table 5-1: Existing and Allocated Bacteria Loads in the Hoffler Creek Watershed**

| Source | | Existing Load (count/day) | % of Total Existing Load | Allocated Load (count/day) | Required Reduction (%) |
|---|---|---|---|---|---|
| LA | Livestock | 0.00E+00 | 0.0% | 0.00E+00 | - |
| | Wildlife | 1.44E+12 | 8.0% | 2.57E+11 | 82.0% |
| | Human | 0.00E+00 | 0.0% | 0.00E+00 | - |
| | Pet | 4.22E+12 | 23.4% | 0.00E+00 | 100.0% |
| | Sanitary Sewer Overflows | 2.06E+11 | 1.1% | 0.00E+00 | 100% |
| WLA | MS4 | 1.22E+13 | 67.5% | 5.39E+11 | 95.6% |
| **Total** | | **1.81E+13** | **100.0%** | **7.96E+11** | **95.6%** |

**Table 5-1** also shows that the TMDL requires a complete reduction of the bacteria loads from pets and from sanitary sewer overflows and an 82 percent reduction from the wildlife loads. The other key indication given by **Table 5-1** is that the existing wildlife bacteria load from non-urban areas (1.44E+12) exceeds and is almost twice the projected TMDL load (7.96E+11). Therefore the current estimate of the wildlife bacteria load is significant enough to alone cause exceedances in the water quality standards.

The Technical Working Group recognized the challenges associated with the complete elimination of pets' loads and the high wildlife loads, as well as the potential uncertainties associated with the Hoffler Creek TMDL and recommended to explicitly consider all these challenging reductions and uncertainties in all steps of the implementation plan. In fact, totally eliminating the bacteria loads from pets will be extremely costly and will not achieve the targeted water quality standards. Addressing

bacteria loads from wildlife is not feasible nor recommended in this IP. Therefore the TMDL implementation plan for Hoffler Creek will follow an adaptive implementation approach consisting of an iterative process that will include the following activities:

1. Continue and enhance the existing bacteria monitoring plan
2. Implement indirect control measures consisting of outreach and education
3. Establish pollution prevention measures such as SSO maintenance and pet waste stations
4. Measure and assess performance and refine/re-estimate the bacteria loadings from wildlife and pets
5. In light of the re-assessment of the bacteria loadings, identify additional reasonable and practicable implementation activities or recommend a Use Attainability Analysis for the Hoffler Creek watershed.

This adaptive implementation plan proposed for the Hoffler Creek watershed is in line with the recommendation of the USEPA and the National Research Council (USEPA 2006, NRC 2001). In fact, at the request of Congress, the National Research Council (NRC) established in 2001 a committee to examine the scientific basis of the United States Environmental Protection Agency's (USEPA) Total Maximum Daily Load (TMDL) program.

The most widely cited recommendation from the report was that, in the face of uncertainty, states should implement an adaptive implementation (AI) approach to achieve the TMDL targets and attain water quality standards (WQS). According to the NRC, the central theory of AI is that uncertainty can be reduced over time only by studying and/or modeling watershed and water quality responses to load reductions, implementing controls, and then carefully and methodically assessing the results in order to learn while doing. The "*learning"* in the Hoffler Creek watershed would be incorporated into improved analysis and refinement of the bacteria loadings from wildlife and pets that would confirm or refute the existing bacteria load estimates and reductions, and in turn, lead to more informed decision making.

AI was a way to make progress in meeting WQS while also reducing admittedly large uncertainties. The NRC report was clear: the initial TMDL loading restrictions and implementation plans might need to be revised, as new information is obtained. The following sections describe the key elements of the adaptive implementation plan in Hoffler Creek and provide the road-map that will potentially lead to the delisting of the bacteria impairment in Hoffler Creek.

## *5.1 Bacteria Monitoring Plan*

Increased and continued Monitoring in the Hoffler Creek watershed is the cornerstone of the proposed adaptive implementation plan. Continued monitoring is essential to evaluating the effectiveness of the initial implementation actions and will continue to guide the stakeholders to an adaptive management decision-making throughout the process. In other words, monitoring and evaluation provide a critical first step before implementing actions and will be critical as well in revising management objectives and actions to be more effective. The consensus between the members of the Technical Working Group is to perform bacteria monitoring in Hoffler Creek for an initial period of five years.

As the stewards of public funds which are growing increasingly limited, it is critically important that additional water quality monitoring throughout the implementation plan help focus the staged implementation of the measures proposed under this plan. VADEQ currently monitors Hoffler Creek using only one station (2-HOF000.44). Monitoring will continue here on a monthly or bi-monthly basis for the entirety of the implementation plan. An additional monitoring station has been proposed and is shown in **Figure 5-1**. This location will capture the bacteria coming from the right fork of Hoffler Creek. After data from this station has been analyzed, it will help shape the implementation process by further defining the area which is contributing the most bacteria. This will allow for targeting implementation actions to be the most effective in reducing bacteria to Hoffler Creek.

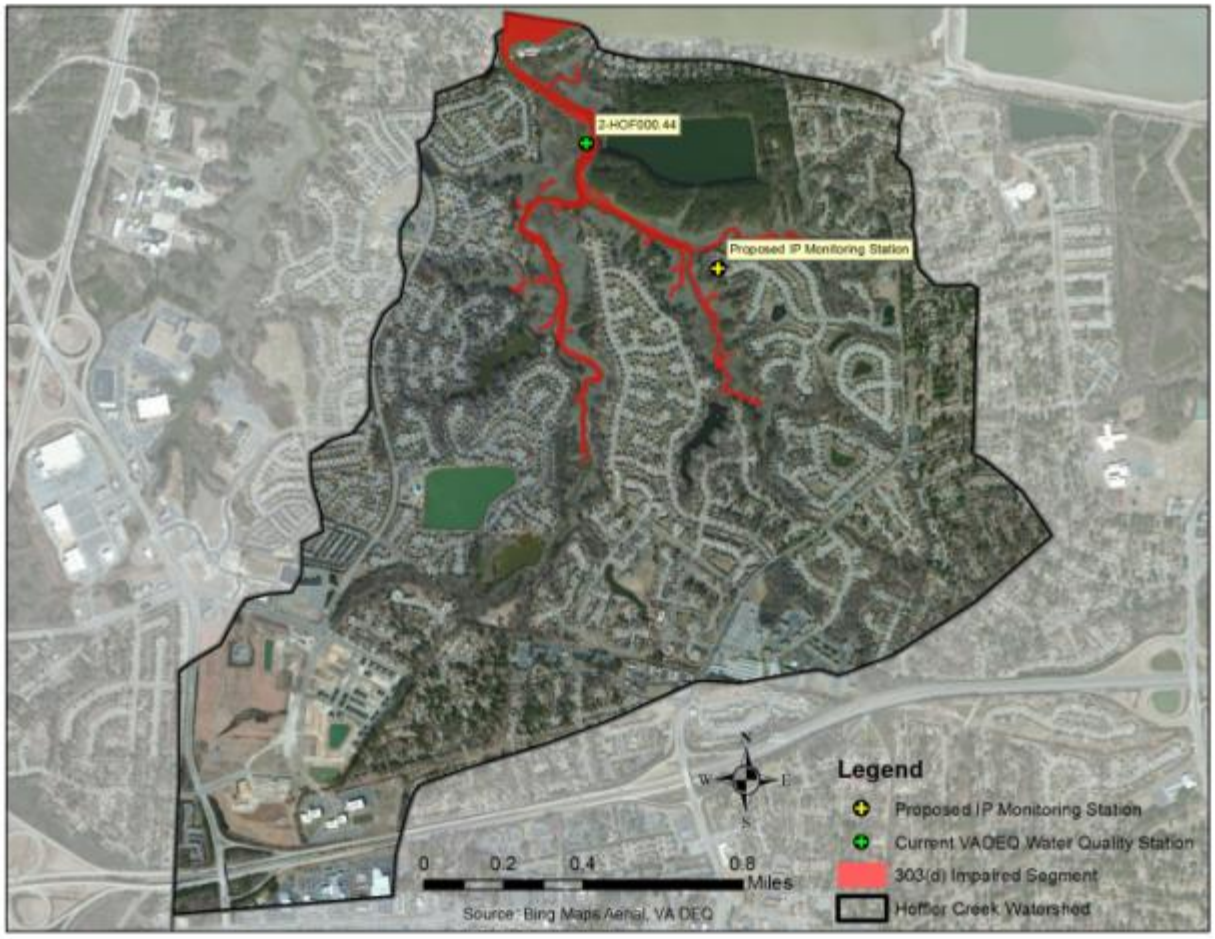


**Figure 5-1: Water Quality Stations for Hoffler Creek IP Monitoring**

## *5.2 Indirect Measures*

Indirect Measures are actions which do not remove or prevent bacteria from entering the watershed directly, but seek to change the attitudes and behavior of watershed residents to improve water quality in the long term. These indirect measures are the initial actions to be implemented in the Hoffler Creek watershed. Indirect Measures typically refers to outreach, educational programs, and signage. Bacteria reductions from indirect measures are the most cost-effective way in reducing bacterial pollution in the Hoffler Creek watershed. The following sections provide more details on the indirect implementation measures that will be put into practice concurrently with the bacteria monitoring plan in Hoffler Creek.

### 5.2.1 Pet Waste Education Program

The Hoffler Creek Wildlife Foundation and Preserve has been educating the communities of Suffolk and Portsmouth for many years and has a deep understanding of the citizens in the watershed and the avenues to reach the citizens. The Hoffler Creek Wildlife Foundation and Preserve produces newsletters and maintains a website (http://www.hofflercreek.org/). The water quality issues, specifically those relating to bacteria would be very appropriate to include in the newsletters and on the website and during any watershed tours provided around the preserve. In addition to the Hoffler Creek Wildlife Preserve, the homeowners associations in the area educate and inform the homeowners about the bacteria issues their pets are causing and emphasize to clean up after their pets to reduce bacteria in the watershed and make the water and area a cleaner, safer place to live. The City of Suffolk reported that the Burbage Grant Homeowner's Association has put out numerous publication encouraging citizens to pick up after their pets.

### 5.2.2 Signage

As observed during a watershed tour, the City of Suffolk has signage on the majority of its stormwater inlets instructing citizens "*No Dumping – Drains to Waterway*". Suffolk plans to place stormwater signs to the remaining curb inlets in Hoffler Creek. They could also be added to all the curb inlets in Portsmouth. To determine the number of signs needed for Hoffler Creek, GIS was utilized to determine the miles of road in both Suffolk and Portsmouth, and the number of curb inlets were extrapolated from that estimation. It was assumed that 90% of Suffolk's curb inlets already have the necessary signage. Since the majority of the roads in Portsmouth have open ditch and no curb inlets, it was estimated that a total of 21 curb inlets (out of an estimated 221 curb inlets in Suffolk) could have "*No Dumping – Drains to Waterway*" placed.

In addition to the no dumping signs, there were signs in the City of Suffolk directing citizens that "*All Pets Must be Kept on Leash – Please Clean up after your Pet*". These signs are sporadically installed along Respass Beach Road, which borders the watershed. No pet waste disposal stations were installed with the signage. The installation of the pet waste disposal stations will include signage directing watershed residents to pick up after their pets. The City of Suffolk reported that on their multi-use trails, there are a few pet waste stations, in addition to significant signage.


## *5.3 Pollution Prevention*

Pollution prevention refers to actions and installations that target bacteria at its source, and is often a cost effective way of reducing pathogens in stormwater.

### 5.3.1 *Sanitary Sewer Overflows*

Sanitary sewer overflows (SSOs) do not regularly occur in the watershed and when they do occur are for a short period of time. In the Hoffler Creek TMDL, from 2006-2011, there were six reported SSOs, accounting for approximately 3.5% of the bacteria load in the watershed. According to EPA, chronic SSOs occur for the following reasons:

- **Infiltration and Inflow** (I&I): too much rainfall or snowmelt infiltrating through the ground into leaky sanitary sewers not designed to hold rainfall or to drain property, and excess water inflowing through roof drains connected to sewers, broken pipes, badly connected sewer service lines
- **Undersized Systems**: Sewers and pumps are too small to carry sewage from newly-developed subdivisions or commercial areas
- **Pipe Failures**: blocked, broken or cracked pipes; tree roots grow into the sewer; sections of pipe settle or shift so that pipe joints no longer match; and sediment and other material builds up causing pipes to break or collapse
- **Equipment Failures**: pump failures, power failures
- **Sewer Service Connections**: discharges occur at sewer service connections to houses and other buildings; some cities estimate that as much as 60% of overflows comes from the service lines

- **Deteriorating Sewer System**: improper installation, improper maintenance; widespread problems can be expensive to fix develop over time, some municipalities have found severe problems necessitating billion-dollar correction programs, often communities have to curtail new development until problems are corrected or system capacity is increased.

Regardless of the cause, SSOs are a source of harmful bacteria within the Hoffler Creek watershed. The SSOs are associated with the sanitary sewer collections systems of the Hampton Roads Sanitation District (HRSD) and the municipalities within Hoffler Creek watershed (Suffolk and Portsmouth). Prior to the development of the Hoffler Creek Bacteria TMDL, consent orders were issued requiring HRSD and municipalities to evaluate their collection system and develop plans to eliminate SSOs. This TMDL Implementation Plan will not affect the execution of these orders. A summary of these orders and their requirements are described below.

The State Water Control Board issued HRSD and thirteen satellite municipal collection systems (the cities of Chesapeake, Hampton, Newport News, Poquoson, Portsmouth, Suffolk, Virginia Beach and Williamsburg; the counties of Gloucester, Isle of Wight, and York; the James City Service Authority; and the town of Smithfield) a special order by consent effective September 26, 2007. The overarching goal of the order is to reduce the occurrence of sanitary sewer overflows in the regional sanitary sewer system.

In general, the order provides for conducting a regional sanitary sewer system evaluation including flow, pressure, and rainfall monitoring and conducting Sanitary Sewer Evaluation Studies (SSES) in identified basins pursuant to the Regional Technical Standards (the regional Technical Standards are incorporated into the order as Attachment 1 and provide detailed requirements to ensure a consistent regional approach for completion of the work required by the order). Data obtained from the studies will be used in the development of a regionally integrated, calibrated and dynamic flow model. System maintenance is addressed by the development of Management, Operations, and Maintenance Programs for HRSD and each municipality. Deficiencies identified by the SSES must be considered and if appropriate, scheduled for rehabilitation or replacement in the development of Rehabilitation Plans. In addition, to address adequate capacity to

collect, convey, and treat peak flows in the regional sanitary sewer system during wet weather, a Regional Wet Weather Management Plan will be developed and implemented to define improvements in the regional system necessary to meet wastewater transmission and treatment needs to 2030.

To date, HRSD and the satellite municipalities have submitted flow monitoring plans for approval by DEQ and implemented flow monitoring for SSES basin identification. Flow Evaluation Reports and SSES Reports have been reviewed, approved, and implemented. Management, Operations, and Maintenance Plans have been submitted to DEQ and are in the review and approval process. By November 26, 2010, HRSD and each satellite municipality must have developed a calibrated dynamic flow model of their system. SSES field activities must have been be completed by November 26, 2011. Based on the results of the SSES field activities, the parties should have submitted Condition Assessment Reports and Rehabilitation Plans by November 26, 2012. DEQ, HRSD, and municipality representatives are currently discussing rehabilitation plan concepts for development of regionally consistent proposals. The final plan required by the consent order is submittal of the Regional Wet Weather Management Plan by November 26, 2013. The order also provides for submittal of annual progress reports on November 1.

The comprehensive evaluation of the HRSD sewage system will be sufficient in identifying the areas in which the system needs to be repaired to prevent sanitary sewer overflows within Hoffler Creek watershed.

### 5.3.2 *Proper Pet Waste Disposal*

The Hoffler Creek Bacteria TMDL determined 72% of the bacteria contribution was from pet waste. This is the largest source of bacteria from the TMDL and this section will describe the feasible and practicable pollution prevention measures that will reduce pet waste from its source utilizing dog parks and pet waste stations. The proper pet waste disposal BMPs are practicable and feasible implementation actions that needs to be implemented in the first stage of this implementation plan.

#### 5.3.2.1 Dog Waste Stations


Within Hoffler Creek watershed, there are no pet waste stations along the streets and sidewalks. The City of Suffolk reported that on their multi-use trails, there are a few pet waste stations, in addition to significant signage. On the main arteries, there are some signs encouraging residents to pick up after their pets but those signs do not contain receptacles for the waste. Through a GIS analysis, there are approximately 37.6 miles of road within Hoffler Creek watershed (1/3 in Suffolk and 2/3 in Portsmouth). Nearly the entire length of those roads is lined with single family homes, townhomes, and apartment complexes. Installing pet disposal units at a frequency of 1 per mile may encourage residents to dispose of their pet's waste properly. Through GIS analysis, there are approximately 37.6 miles of road in Hoffler Creek, so at a frequency of 1/mile, this would equal 37 pet waste stations (assuming 12 in Suffolk and 25 in Portsmouth).

#### 5.3.2.2 Dog Parks

The environment of a dog park may encourage patrons to pick up after their pets. Currently there are no known dog parks within the Hoffler Creek watershed. Through watershed tours it was observed that many dog owners exercise their pets on the sidewalks throughout the neighborhoods. Typically a dog park would be approximately 1 acre and consist of fencing, benches, a water fountain, a pet waste composter, and a water spigot for dog water bowls. Whilea dog parkmay benefit the water quality of Hoffler Creek watershed, it may also increase the value and appeal of the neighborhood by showing prospective and current residents they care about the community/watershed in which they reside.

This adaptive implementation plan includes the creation of dog parks; however, a detailed study will be developed to assess the feasibility of the creation of dog parks in

the Hoffler Creek watershed. Therefore only one dog park is initially included in this adaptive plan and this number should be revised and adjusted.

## 5.4 Assess Performance and Refine the Bacteria Sources

While the initial monitoring results are being assessed and the preliminary implementation actions (indirect measures and education) are being carried out; additional studies will be developed to refine the bacteria sources in the Hoffler Creek watershed. In fact, the Technical Working Group recommended that the refinement of the bacteria sources is necessary in light of the high estimated wildlife load and the complete reduction of the bacteria pets load in the TMDL. The refinement of the bacteria loadings from pets and wildlife is essential in determining whether additional implementation actions will result in achieving the water quality standards.

As it stands now in the TMDL, the pets and wildlife loads were estimated using national figures that might have overestimated the loads and consequently the required bacteria reductions. During this adaptive implementation plan, a more refined approach will be developed using local figures and data. Refining and revising the pets and wildlife loads estimate is intended to either confirm the initial estimates presented in the TMDL or provide lower figures on the bacteria loads that can be potentially and cost-effectively controlled. Such revision of the number of pets in the watershed has already been initiated using a collaborative approach between Suffolk and Portsmouth through the tracking of dog licenses issued in the watershed and to survey citizens about their pets and waste. It should be noted that these additional studies are intended to provide the necessary elements and information to assess the need of any additional and practical control measures in the Hoffler Creek watershed.

## 5.5 Identify Additional Cost-Effective Measures or Recommend a Use Attainability Analysis

The Hoffler Creek bacteria impairment is unique in light of the combination of controllable and uncontrollable loads. In fact, bacteria loads from pets are deemed controllable to some extent when using direct and indirect measures; however, bacteria

loads from wildlife are considered uncontrollable and are significant enough in the Hoffler Creek watershed to cause exceedances of the bacteria water quality standard (Section 5.0). After the re-evaluation of the bacteria loads in the watershed and the assessment of the monitoring data and the potential progress made through the implementation of the indirect measures, two scenarios can be envisioned:

1. **The revised bacteria loads from wildlife and pets are comparable to the initial estimates reported in the TMDL document:**

Under this scenario, the revised bacteria loads indicate that the wildlife component is still significant enough to alone cause exceedances in the water quality standards. Similarly, it indicates that the required reduction for the bacteria pet loads is still significant requiring additional costly mitigation measures.

Therefore, a Use Attainability Analysis (UAA) should be recommended since it has been confirmed that naturally occurring pollutant loading from wildlife prevent the attainment of the designated use. On-going implementation of cost-effective and reasonable BMPs identified in the TMDL Implementation Plan and Virginia Pollutant Discharge Elimination System (VPDES) permits shall continue so the response of the aquatic system to the implementation of these practices is included in the UAA study.

2. **The revised bacteria loads from wildlife and pets are lower than the initial estimates developed during the TMDL development**:

When the revised bacteria loads indicate that the TMDL wildlife component were overestimated and it allows the attainment of the designated use, the identification and implementation of additional mitigation measures are necessary to control the pets' bacteria load in the Hoffler Creek watershed.

The additional implementation activities amenable in reducing substantially the bacteria loads are mitigation measures applied to remove bacteria already deposited in the watershed, which stormwater runoff transports to the impaired stream. Mitigation measures are more expensive that pollution prevention due to the costs of installation and maintenance of the BMPs. In addition, since bacteria are deposited throughout the

watershed, there is a need for widespread coverage of the measures. While the costs of the mitigation measures are sometimes high, often these measures improve water quality in a variety of ways, such as reducing nutrients, sediment and heavy metals to the watershed. The manner in which they treat stormwater is by settling and filtering pollutants (detention ponds) or by biological/chemical processes (stormwater wetlands).

The Hoffler Creek watershed is largely developed (72% according to NLCD 2006), which limits the BMPs that can be selected to improve water quality by reducing bacteria. Therefore the following feasible and practical implementation actions are recommended when the revised bacteria loads from wildlife and pets are lower than the initial estimates developed during the TMDL development:

- **Retrofitting of Existing Stormwater BMPs**: The objective of retrofitting existing BMPs is to identifying existing facilities and structure that have "water quality retrofit" potential. Several techniques are used to retrofit existing stormwater management facilities to capture and treat additional volumes of rainfall runoff including the increase of the volume of the facility, modifying the structure that control the outflow to capture water from more frequently occurring events; adding wetlands or a permanent pool such as modifying a dry pond to a wet pond, and increasing the time of travel.

- **Creation of Stormwater Wetlands**: Stormwater wetlands are structural practices similar to wet ponds that incorporate wetland plants into the design. As stormwater runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake within the practice. Wetlands are among the most effective stormwater practices in terms of pollutant removal. Stormwater wetlands are designed specifically for the purpose of treating stormwater runoff, and typically have less biodiversity than natural wetlands in terms of both plant and animal life. Constructed wetlands can be useful in conjunction with other BMPs or they can function independently.

- **Buffer Strips:** Buffer strips are vegetated sections of land that are essentially flat or have low slopes designed to Buffer strips trap sediment, and enhance filtration of pollutants by slowing down runoff entering the local surface waters. The effectiveness of buffers for reducing bacteria pollution, however, is dependent on the type of vegetation and the width of the buffer. Typically, the wider the buffer, the more pollution reduced.

- **Constructed Oyster Reefs:** Oyster habitat effectively filters nutrients, algae, bacteria, fine sediments and toxins from the water and improves water quality. A typical adult oyster filters between 20 and 50 gallons per day. The reefs help stabilize the marshes protecting them from erosion and provide safe habitats for other marine animals that live in coastal estuaries. The Hoffler Creek Wildlife Foundation and Preserve recently implemented a similar project through a government grant. The "*Grass on the Half Shell*" project combines a "living shoreline" of marsh grasses and native plants to control erosion along with close to 30 tons of constructed oyster reefs.

## 5.6 Timeline of Implementation and Estimated Costs

A schedule outlining the key components of the adaptive management approach is provided in **Table 5-3.** The schedule also includes annual meetings of the stakeholders in Hoffler Creek with the intent to evaluate and discuss the progress towards achieving the goals of the Implementation Plan, discuss the bacterial load source re-evaluations, and to indentify additional opportunities for bacteria reductions that may not have been previously identified (minor adjustments to the plan). It is estimated that the implementation plan will span a period of 10 years where during the first 5 years the continued monitoring and re-evaluation process will be ongoing with limited indirect and pollution prevention measures being implemented along with the outreach and education component of the plan.

The study to re-evaluate the bacteria loads from the major sources (wildlife and pets) is scheduled to take place during years 3 to 5. The potential development of an UAA or the implementation of additional mitigation measures are scheduled to take place during the last 5 years of the implementation plan.

**Table 5-2: Schedule for the Adaptive Implementation Plan in Hoffler Creek**

| Activities | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Monitoring and Tracking of Progress | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Annual Meeting of Stakeholders | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Implement Indirect and Outreach and Education Measures | ● | ● | ● | ● | ● | | | | | |
| Implement Pollution Prevention Measures | ● | ● | ● | ● | ● | | | | | |
| Re-Evaluate the Bacteria Loads | | | ● | ● | ● | | | | | |
| Develop UAA if Needed | | | | | | ● | ● | | | |
| Minor Adjustments to the Implementation Plan | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Major adjustments if Needed; i.e., Additional Mitigation Measures | | | | | | ● | ● | ● | ● | ● |

**Table 5-3** summarizes the implementation actions, the number of required units, the cost per unit, and the total cost to implement all actions during the first 5 years of the implementation plan. Because of the iterative nature of this implementation plan the

costs for years 6 to 10 are not included (UAA and potential additional mitigation measures). These costs are for estimating purposes only: actual costs for design, construction and O&M should be adjusted at the time of project implementation. In addition, these costs reflect the estimated cost of implementing the project today and should also be adjusted to account for the actual date of implementation.

**Table 5-3: Cost of Implementation Actions**

| Category | IP Action | Unit | Number of Units | Cost per Unit | Total Cost | Source |
|---|---|---|---|---|---|---|
| Pollution Prevention | Sanitary Sewer Overflow Program | Program | 1 | | | |
| | Dog Park Construction/Maintenance | Park | 1 | $28,000 | $28,000 | PACES, 2011 |
| | Pet Waste Stations (w/ maintenance) | System | 37 | $260 | $9,620 | Zero Waste USA, 2011 |
| Indirect Measures | Pet Education Program | Program | 1 | $3,750 | $3,750 | Maptech, 2006 |
| | Signage | Sign | 21 | 200 | $4,200 | USA Blue Book, 2012 |
| Technical Assistance | Residential BMPs and Education | person-years | 10 | $25,000 | $250,000 | DCR, 2009 |
| Bacteria Loads Re-Evaluation | Technical Study | Study | 1 | $80,000 | $80,000 | Local Estimate |
| | | | | **Total Cost** | **$375,570** | |

## *5.7 Benefits*

The primary benefit of implementation is cleaner waters in Virginia, where the ultimate goal is to reduce the bacteria levels (specifically enterococci) to meet water quality standards. The pollution prevention measures have the potential to be very effective in reducing the bacteria entering Hoffler Creek. In implementing the indirect measures, the ultimate goal is to change the attitudes and behaviors of watershed residents, potentially providing the greatest benefit to water quality in Hoffler Creek. The mitigation measures will treat bacterial contaminated stormwater before entering the stream, in addition to removing other pollutants such as sediment and nutrients.

In addition to and as a result of reducing the amount of bacteria, stakeholders can anticipate benefits within their watersheds which may include:

- improved public health,
- improved aquatic life,

- improved recreational opportunities

It is hard to gage the impact that reducing bacterial contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, the incidence of infection from pollutant sources, through contact with surface waters, should be reduced considerably, and this should be noted.

On a larger scale, for watersheds located within the Chesapeake Bay watershed, reducing sediment and nutrients loads as a result of BMPs that are installed to improve benthic and bacteria water quality impairments will help obtain implementation goals in the Tributary Strategies.

The main objective of the IP is restoring water quality in our streams with additional benefits that may include continued economic vitality and strength. Healthy waters can improve economic opportunities for Virginians, and a healthy economic base can provide the resources and funding necessary to pursue restoration and enhancement activities. The residential and urban implementation actions recommended in the IP will often provide economic benefits to the landowner, along with the expected environmental benefits. Additionally, money spent by landowners, government agencies, and non-profit organizations in the process of implementing the IP will stimulate the local economy. An ancillary benefit is enhanced real estate values for homes and businesses located near water bodies with good water quality. The SSO evaluation/maintenance program will play an important role in improving water quality, since human waste can carry with it human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry.

Cleaner waters in Hoffler Creek will result in improved public health, conservation of natural resources, improved aquatic habitat, and greater economic opportunities for Virginians. These benefits add up to a better quality of life in the Commonwealth of Virginia; the recognition of these effects and their applicability in watersheds will help to ensure a successful implementation.

# 6.0 Stakeholders' Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL effort, in other words, improving water quality and removing streams from the impaired waters list. The purpose of this chapter is to identify and define the roles of the stakeholders who will work together to develop the IP. The roles and responsibilities of the major stakeholders are described below.

## *6.1 Federal Government*

The U.S. Environmental Protection Agency (EPA) has the responsibility of overseeing the various programs necessary for the success of the Clean Water Act. However, administration and enforcement of such programs falls largely to the states.

The Natural Resources Conservation Service (NRCS), part of The U.S. Department of Agriculture, is the federal agency that works hand-in-hand with the American people to conserve natural resources on private lands. NRCS assists private landowners with conserving their soil, water, and other natural resources. Local, state and federal agencies and policymakers also rely on the expertise on NRCS staff. NRCS is also a major funding stakeholder for impaired water bodies through the Conservation Reserve Enhancement Program (CREP) and the Environmental Quality Incentive Program (EQIP). For more information on NRCS, visit http://www.nrcs.usda.gov/.

## *6.2 State Government*

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. Currently, there are five state agencies responsible for regulating and/or overseeing statewide activities that impact water quality in Virginia. These agencies include: DEQ, DCR, Virginia Department of Agriculture and Consumer Services (VDACS), VDH, the Virginia Department of Forestry (DOF), and VCE.

**DEQ**: The State Water Control Law authorizes the State Water Control Board to control and plan for the reduction of pollutants impacting the chemical and biological quality of the State's waters resulting in the degradation of the swimming, fishing, shell fishing, aquatic life, and drinking water uses. For many years the focus of DEQ's pollution reduction efforts was the treated effluent discharged into Virginia's waters via the VPDES permit process. The TMDL process has expanded the focus of DEQ's pollution reduction efforts from the effluent of wastewater treatment plants to the pollutants causing impairments of the streams, lakes, and estuaries. The reduction tools are being expanded beyond the permit process to include a variety of voluntary strategies and BMPs.

DEQ is the lead agency in the TMDL process. The Code of Virginia directs DEQ to develop a list of impaired waters, develop TMDLs for these waters, and develop IPs for the TMDLs. DEQ administers the TMDL process, including the public participation component, and formally submits the TMDLs to EPA and the State Water Control Board for approval. DEQ is also responsible for implementing point source WLAs, assessing water quality across the state, and conducting water quality standard related actions.

**DCR**: DCR is authorized to administer Virginia's NPS pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the Clean Water Act. EPA is requiring that much of the §319 grant monies be used for the development of TMDLs.

Because of the magnitude of the NPS component in the TMDL process, DCR is a major participant the TMDL process. DCR has a lead role in the development of IPs to address correction of NPSs contributing to water quality impairments. DCR also provides available funding and technical support for the implementation of NPS components of IPs. The staff resources in DCR's TMDL program focus primarily on providing technical assistance and funding to stakeholders to develop and carry out IPs, and support to DEQ in TMDL development related to NPS impacts. DCR staff will also be working with other state agencies, Soil and Water Conservation Districts, and watershed groups to

gather support and to improve the implementation of TMDL plans through utilization of existing authorities and resources.

**VDACS**: The VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken, which may include civil penalties. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, *etc*. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures.

**VDH**: The VDH is responsible for maintaining safe drinking water measured by standards set by the EPA. Their duties also include septic system regulation and regulation of biosolids land application. Like VDACS, VDH is complaint driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. For TMDLs, VDH has the responsibility of enforcing actions to correct failed septic systems and/or eliminate straight pipes (Sewage Handling and Disposal Regulations, 12 VAC 5-610-10 *et seq*.).

DOF: The DOF has prepared a manual to inform and educate forest landowners and the professional forest community on proper BMPs and technical specifications for installation of these practices in forested areas (http://www.dof.state.va.us/wq/wq-bmp-guide.htm). Forestry BMPs are directed primarily to control erosion. For example, streamside forest buffers provide nutrient uptake and soil stabilization, which can benefit water quality by reducing the amount of nutrients and sediments that enter local streams.

Although the DOF's BMP program is intended to be voluntary, it becomes mandatory for any silvicultural operation occurring within a Chesapeake Bay Preservation Area (Chesapeake Bay Preservation Area Designation and Management Regulations,

9VAC10-20 et seq.). For more information on this regulation, visit http://www.dof.state.va.us/resources/wq-BMP-Chapter-10.pdf.

**VCE**: VCE is an educational outreach program of Virginia's land grant universities (Virginia Tech and Virginia State University), and a part of the national Cooperative State Research, Education, and Extension Service, an agency of the United States Department of Agriculture. VCE is a product of cooperation among local, state, and federal governments in partnership with citizens. VCE offers educational programs and technical resources for topics such as crops, grains, livestock, poultry, dairy, natural resources, and environmental management. VCE has published several publications that deal specifically with TMDLs. For more information on these publications and to find the location of county extension offices, visit www.ext.vt.edu.

## *6.3 Local Government*

Local government groups work closely with state and federal agencies throughout the TMDL process; these groups possess insights about their community that may help to ensure the success of TMDL implementation. These stakeholders have knowledge about a community's priorities, how decisions are made locally, and how the watershed's residents interact. Some local government groups and their roles in the TMDL process are listed below.

**Soil and Water Conservation Districts (SWCDs)**: SWCDs are local units of government responsible for the soil and water conservation work within their boundaries. The districts' role is to increase voluntary conservation practices among farmers, ranchers and other land users. District staff work closely with watershed residents and have valuable knowledge of local watershed practices.

**Planning District Commissions (PDCs)**: PDCs were organized to promote the efficient development of the environment by assisting and encouraging local governmental agencies to plan for the future. PDCs focus much of their efforts on water quality planning, which is complementary to the TMDL process. TMDL development and implementation projects are often contracted through PDCs. For more information on the PDCs located in Virginia, please visit http://www.institute.virginia.edu/vapdc/.

**County/City Government Departments**: City and county government staff work closely with PDCs and state agencies to develop and implement TMDLs. They may also help to promote education and outreach to citizens, businesses and developers to introduce the importance of the TMDL process.

## *6.4 Businesses, Community Groups, and Citizens*

While successful implementation depends on stakeholders taking responsibility for their role in the process, the primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens.

**Community Watershed Groups**: Local watershed groups offer a meeting place for river groups to share ideas and coordinate preservation efforts and are also a showcase site for citizen action. Watershed groups also have a valuable knowledge of the local watershed and river habitat that is important to the implementation process.

**Citizens and Businesses**: The primary role of citizens and businesses is simply to get involved in the TMDL process. This may include participating in public meetings (Section 5.1), assisting with public outreach, providing input about the local watershed history, and/or implementing best management practices to help restore water quality.

**Community Civic Groups**: Community civic groups take on a wide range of community service including environmental projects. Such groups include Ruritan, Farm Clubs, Homeowner Associations and youth organizations such as 4-H and Future Farmers of America. These groups offer a resource to assist in the public participation process, educational outreach, and assisting with implementation activities in local watersheds.

**Animal Clubs/Associations**: Clubs and associations for various animal groups (*e.g.*, beef, equine, poultry, swine, and canine) provide a resource to assist and promote conservation practices among farmers and other land owners, not only in rural areas, but in urban areas as well, where pet waste has been identified as a source of bacteria in water bodies.

Virginia's approach to correcting non-point source pollution problems continues to be encouragement of participation through education and financial incentives; that is, outside of the regulatory framework. If, however, voluntary approaches prove to be ineffective, it is likely that implementation will become less voluntary and more regulatory.

The benefits of involving the public in the implementation process are potentially very rewarding, but the process of doing so can be incredibly challenging. It is, therefore, the primary responsibility of these stakeholder groups to work with the various state agencies to encourage public participation and assure broad representation and objectivity throughout the IP development process.

# 7.0 Integration with Other Watershed Plans

Within the Hoffler Creek watershed there are three MS4 permits, the City of Suffolk and one the City of Portsmouth, and VDOT. These MS4 permits cover the majority of the watershed and have ongoing activities aimed to improve water quality in the Hoffler Creek watershed. The following section details these ongoing activities and their link to the Hoffler Creek TMDL IP.

## *7.1 Hoffler Creek Wildlife Preserve*

Hoffler Creek Wildlife Preserve is open six days a week all year. In 2010, more than 5,000 people of all ages visited the preserve to help build and maintain the facilities and to indulge their interest in history, art, science, music, kayaking, and, of course, wildlife. As an increasingly popular destination for environmental education and recreation, this 142-acre urban wildlife preserve offers models of practical ways to conserve and restore resources necessary for clean water and healthy habitat for both aquatic and terrestrial wildlife. Though fishing is not permitted at the preserve, the creation of an oyster wetland complex will provide additional spawning and nursery habitat as well as feeding grounds for a variety of fish species important to sports fishermen who catch fish in Hoffler Creek and in the Chesapeake Bay.

Grasses on the Half Shell is a grassroots initiative to restore natural resources in the Hoffler Creek watershed as part of the regional effort to restore health to the Chesapeake Bay. Grant funding will enable community volunteers to create an oyster wetland complex that will contribute to improved water quality and fisheries. The project promises to stabilize an eroding shoreline, restore wetland habitat, enhance habitat for juvenile fish, increase the oyster population, and promote living shorelines as a natural alternative to traditional stabilization techniques. The end result will be greater stewardship of the Bay and its tributaries.

## *7.2 City of Suffolk*

Within the Hoffler Creek watershed, Suffolk has actively worked with the Burbage Grant Homeowner's Association to restore the stormwater facilities serving the area and will

continue to monitor the facilities to assure performance. The city actively engages to educate all citizens on pet waste, storm drain awareness, lawn care, as well as illicit discharges. The city plans to target the Hoffler Creek watershed for involving the citizens in placing stormwater medallions on the storm drains. The Burbage Grant Homeowner's Association is also very involved and has sent out numerous publications about picking up pet waste. They have significant signage along there multi-use trail as well as some pet waste stations.

In addition to the activities specific to Hoffler Creek, the City of Suffolk has developed a program plan for their MS4 to address the Chesapeake Bay Implementation Plan. Although the activities outlined in the program plan identify areas and actions targeting nutrient reduction, these activities will inevitably help treat all stormwater pollutants including bacteria. This plan includes the following activities:

- Education
  - Educate citizens on techniques to reduce impacts of stormwater pollution on public waterways with an emphasis on impaired waters.
  - Distribute educational materials developed through HR STORM.
  - Maintain and enhance HR STORM Website, coordination with other educational programs, and distribution of e-newsletter.
  - Regional media campaign
  - "Scoop the Poop" Campaign
  - "Chesapeake Club" Campaign
- Illicit Discharge/Elimination
  - Storm Sewer System Map
  - Illicit Discharge Detection & Elimination Ordinance
  - Prevent or minimize the discharge of hazardous substances and oil in the MS4 stormwater discharge.
  - Continue Sanitary Sewer System improvements in coordination with SSO consent order
- Construction Site Storm Water Runoff Control
  - Local Erosion and Sediment Control Ordinance
    - Continue to implement the site plan review, LID implementation where deemed appropriate, construction site BMP, and inspection provisions of the local Erosion and Sediment Control Ordinance.
- Post Construction Storm Water Management in New Development and Redevelopment
  - Stormwater Management Ordinance

- Encourage the use of Low-Impact Development (LID)
- BMP Maintenance Agreements
- BMP Maintenance Program
- Site Inspection and Enforcement
- BMP Tracking
- Evaluation and Assessment

The plan outlined above is in line with all the measures suggested in this implementation plan. Though these actions primarily target nutrients, they will also work to reduce bacteria deliver to Hoffler Creek.

## *7.3 City of Portsmouth*

Within the Hoffler Creek watershed, Portsmouth currently has no specific activities to improve water quality, but have created an implementation strategy to reduce nutrients for the Chesapeake Bay Implementation Plan. In implementing BMPs to reduce nutrients, bacteria will also be reduced. The following is a list of potential reduction methods and their order of preference for the Chesapeake Bay Implementation Plan. Activities that have the potential to reduce bacteria in addition to nutrients are bolded and descriptions are directly from Portsmouth.

1. Take Credit for Progress BMPs
2. Fertilizer Load Reduction
3. **Future Redevelopment Reductions**
    a. In older, more established cities such as Portsmouth, redevelopment accounts for a large part of establishing new housing and commercial developments. This can be clearly seen in Portsmouth's Comprehensive Plan, which characterized only 7.5 percent of the City as vacant. The advantage to a nutrient and sediment reduction program is that redeveloped properties are typically either properties that were previously developed prior to Chesapeake Bay Preservation Act and currently lack structural BMPs or are served by BMPs but are required to decrease loads an additional amount as part of the redevelopment.
4. **Early Adoption of SW Regulations**
    a. Now that the new Virginia Stormwater Regulations have been put into effect, localities in the Bay watershed will have to adopt them in the next two years. The State has yet to publish any guidance on how localities should implement their stormwater management programs required by the regulations. However, certain aspects of the new regulations could be adopted early, paving the way for earlier load reductions. The first

aspect would be to adopt the Virginia Stormwater BMP Clearinghouse as the City's BMP design standard. This will allow the City to be at the forefront of BMP design standards instead of relying on the soon to be outdated 1999 Virginia Stormwater Management Handbook. Adoption of the Clearinghouse also allows the City to stay current with state required design standards as it will not have to readopt via ordinance every time there is a minor or major change.

b. The second aspect is to adopt the new pollution reduction requirements for new development and redevelopment. Similar to the arguments for FDR01, early adoption of these requirements increases the future load reduction of any new development and redevelopment

5. Reforestation Credits
6. Shoreline Restoration Credits
7. **Upgrade Existing BMPs (Restoration of Capacity/Functionality)**
   a. Conduct BMP Capacity and Functionality Evaluation
      i. Initially assess its larger and oldest BMPs, including those lakes that were constructed for flood control and aesthetic reasons.
   b. Restore BMP Capacity and Functionality
      i. Using the results of the evaluation, Portsmouth will develop a schedule to restore BMP capacity and functionality where it makes sense in terms of costs and benefits.
8. **Retrofit Existing Ponds to Improve Performance**
   a. Using the results of the evaluation (#7), Portsmouth will develop a schedule to retrofit existing ponds where it makes sense in terms of costs and benefits. The schedule will include design and construction.
9. **Credit for Mass Street Sweeping**
   a. The removal of sediment before it can reach the tributaries of the Chesapeake Bay has been practiced and reported by Portsmouth for over a decade. Until recently, little effort was made to quantify the pollutant load reduction beyond miles swept or pounds of debris collected. With recent efforts underway to better quantify the amount of pollutants removed per pound of debris, Portsmouth and other localities will be able to better plan and commit to debris removal programs from both its streets and storm sewers.
10. **Take Credit for Septic Hookups to Sanitary Sewer, Upgrades, and SSO Elimination Program**
    a. Portsmouth, like all Hampton Roads communities, is currently engaged in a program to evaluate and eliminate SSOs within the city. Initially, this looked like a promising way to get credit for activity that is going to take place during the course of the TMDL implementation. However, numbers presented by the Hampton Roads Sanitation District (HRSD) at a recent Regional Steering Committee meeting seem to indicate that

SSOs do not represent a significant load to the Bay for either nitrogen or phosphorus. However, Portsmouth should look at its SSO elimination program and determine the average annual volume and average nutrient concentrations associated with its SSOs.

**11. LID Retrofits on City Property**

a. The City will develop a BMP Retrofit Plan for public property which can be used to address the Chesapeake Bay TMDL and other requirements. Retrofit Plan elements will include; desktop retrofit analysis, retrofit reconnaissance, compile and evaluate potential retrofit inventory, conduct a water quality and water quantity assessment, and design and construction standards and procedures.

**12. LID Retrofits on Residential Property and City Streets**

a. The City will expand the BMP Retrofit Plan to include non-single family residential private property which can be used to address the Chesapeake Bay TMDL and other requirements. Retrofit Plan elements will continue to include; desktop retrofit analysis, retrofit reconnaissance, compile and evaluate potential retrofit inventory, conduct a water quality and water quantity assessment, and design and construction standards and procedures. Additional aspects that will be developed include an incentive or credit program to encourage the construction of retrofit BMPs on private property.

The activities outlined in this implementation plan fit well with Portsmouth's plan to reduce nutrients to the Chesapeake Bay. Portsmouth and Suffolk's plan to reduce nutrients to the Chesapeake Bay share many of the same activities, which will help facilitate the restoration of water quality in Hoffler Creek.

# 8.0 Potential Funding Sources

## *8.1 State and Local Funding Sources*

Hoffler Creek Wildlife Preserve – This wildlife preserve has applied for and been awarded a grant to help fund the educational goals of this implementation plan. These funds will be used for promotional materials. An additional grant application has been filed for funding of community-based habitat restoration projects. This grant was filed with the FishAmerica Foundation and NOAA Restoration Center. The specific project the grant was filed for is the *Grasses on the Half Shell* project, which aims to restore oyster reefs and wetlands in Hoffler Creek.

Virginia Forest Stewardship Program - The program is administered by the DOF to protect soil, water, and wildlife and to provide sustainable forest products and recreation. http://www.vdof.org/resources/f127_po.pdf

## *8.2 Federal Funding Sources*

EPA 319 Funds – EPA develops guidelines that describe the process and criteria to be used to award Clean Water Act Section 319 NPS grants to states. States may use up to 20% of the Section 319 incremental funds to develop NPS TMDLs as well as to develop watershed-based plans for Section 303(d) listed waters. The balance of funding can be used for implementing watershed-based plans for waters that have completed TMDLs. Implementation of both agricultural and residential BMPs is eligible. http://www.epa.gov/owow/nps/319/319stateguide-revised.pdf

Conservation Reserve Program (CRP) – The program offers annual rental payments, incentive payments for certain activities, and cost-share assistance to establish approved cover on cropland. Contract duration is between 10 and 15 years, and cost-share assistance is provided up to 50% of costs. http://www.nrcs.usda.gov/programs/crp/

Conservation Reserve Enhancement Program (CREP) – In Virginia, this is a partnership program between the USDA and the Commonwealth of Virginia, with the DCR being the lead state agency. The program uses financial incentives to encourage farmers to enroll in contracts of 10 to 15 years or perpetual easements to remove lands from agricultural production.
http://www.dcr.state.va.us/sw/crep.htm

Environmental Quality Incentives Program (EQIP) - The purposes of the program are achieved through the implementation of an EQIP plan of operation, which includes structural and land management practices on eligible lands. Contracts up to ten years are written with eligible producers. Cost-share is made available to implement one or more eligible conservation practices, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat. Incentive payments can be made to implement one or more management practices, such as nutrient management, pest management, and grazing land management.
http://www.nrcs.usda.gov/programs/eqip/

Forestry Incentives Program (FIP) – The purpose of this program is to encourage development, management, and protection of private forestland.
http://www.nrcs.usda.gov/programs/fip/

Small Watershed Program and Flood Prevention Program (Public Law 83-566) – The purpose of this program is to assist federal, state, local agencies, local government sponsors, tribal governments, and program participants to protect watersheds from damage caused by erosion, floodwater, and sediment, to conserve and develop water and land resources; and to solve natural resource and related economic problems on a watershed basis. The program empowers local people or decision makers, builds partnerships, and requires local and state funding contributions. Both technical and financial assistance is available for watersheds not exceeding 250,000 acres.
http://www.nrcs.usda.gov/programs/watershed/index.html

Wetlands Reserve Program (WRP) – The program provides an opportunity for landowners to receive financial incentives to enhance wetlands in exchange for retiring marginal lands from agriculture. The program offers three enrollment options: permanent easements, 30-year easement, and restoration cost-share agreement (10-year agreement where USDA pays 75% of the restoration costs). http://www.nrcs.usda.gov/programs/wrp/

Wildlife Habitat Incentives Program (WHIP) - USDA and the participant enter into a five to ten year cost-share agreement for wildlife habitat development. Cost-share up to 75% is available for the cost of installing practices. http://www.nrcs.usda.gov/programs/whip/

U.S. Fish and Wildlife Service Private Stewardship Program – Funds individuals or groups engaged in local, private, and voluntary conservation efforts to benefit federally listed, proposed, or candidate species, or other at risk species. http://endangered.fws.gov/grants/private_stewardship.html

U.S. Fish and Wildlife Service Conservation Grants – Funds states to implement conservation projects to protect federally listed threatened or endangered species and species at risk.

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