City of Virginia Beach

# Bacteria Total Maximum Daily Load Action Plan

## Final Approved by Virginia DEQ


STORMWATER MANAGEMENT

Public Works Department
VSMP MS4 Permit # VA0088676

July 2018 | Final

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# List of Abbreviations

| | |
|---|---|
| ac | acre(s) |
| Action Plan | Bacteria Total Maximum Daily Load Action Plan |
| BMP | best management practice |
| cfu | colony forming unit(s) |
| City | City of Virginia Beach |
| d | day(s) |
| DEQ | (Virginia) Department of Environmental Quality |
| DSS | Division of Shellfish Sanitation |
| EPA | U.S. Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right-to-Know Act |
| FIB | fecal indicator bacteria |
| FOG | fats, oils, and grease |
| GIS | geographic information system |
| IDDE | Illicit Discharge Detection and Elimination |
| LA | load allocation |
| Local Guidance | DEQ Guidance Memorandum GM-162006, *TMDL Action Planning for Local TMDLs as Required in the Small MS4 General Permit (VAR04) Effective July 1, 2013, and MS4 Individual Permits dated November 21, 2016* |
| LU | land use |
| MF | membrane filter |
| mL | milliliter(s) |
| MPN | most probable number |
| MS4 | municipal separate storm sewer system |
| N/A | not applicable |
| RM | river mile |
| SR | state route |
| SSES | sewer system evaluation study |
| SSO | sanitary sewer overflow |
| SWMF | stormwater management facility |
| TMDL | total maximum daily load |
| VDH | Virginia Department of Health |
| VDOT | Virginia Department of Transportation |
| VPDES | Virginia Pollutant Discharge Elimination System |
| WLA | wasteload allocation |
| yr | year(s) |

# Acknowledgements

This Action Plan was prepared for the City of Virginia Beach by:

Brown AND Caldwell essential ingredients®

# Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Melanie Coffey

Typed Name: Melanie Coffey, P.E.

Title: MS4 Permit Administrator

Date: 7-13-18

## Section 1

# Introduction

The City of Virginia Beach (City) is in coastal Virginia, and encompasses approximately 196,500 acres (ac) or 300 square miles. It is bordered by the cities of Norfolk and Chesapeake to the west, Chesapeake Bay to the north, Atlantic Ocean to the east, and Currituck County, North Carolina, to the south. There are three primary watersheds within the City, including the Chesapeake Bay, Southern Rivers, and Atlantic Ocean watersheds. The northern portion of the City drains to the Chesapeake Bay, the eastern portion drains to the Atlantic Ocean, and the southern portion drains to the Southern Rivers. The City, as well as the primary watersheds, is shown in Figure 1-1. The City has over 550 miles of streams within these three watersheds.

The City is permitted by the Virginia Department of Environmental Quality (DEQ) to discharge stormwater from the drainage system into the waterways within the primary watersheds. This permit is for the stormwater runoff from the residential, commercial, and industrial areas in addition to all of the roadways that are maintained by the City. This stormwater discharge permit is called a Municipal Separate Storm Sewer System permit or MS4 permit. The area of land that the City is responsible for controlling pollution runoff from in this permit is referred to as the MS4 service area.

The DEQ is responsible for monitoring our waterways to determine whether the waters can be used for swimming, fishing, and drinking in accordance with the state water quality standards. When waterways do not meet these standards, they are designated as impaired. DEQ develops total maximum daily load (TMDLs) reports in response to impaired waterbodies. The processes and procedures used to develop the TMDLs are documented in the report for each TMDL. During development of a TMDL report, the entire drainage area to the impaired waterbody is evaluated to determine the maximum loading that it can receive while still meeting water quality standards. All entities contributing to the impairment are assigned load allocations (LAs) or wasteload allocations (WLAs) depending upon which type of entity they are. If a municipal separate storm sewer system (MS4) permittee is within the drainage basin, they are assigned a WLA.

The MS4 permit requires the City to develop a TMDL Action Plan for the waterways that have an established TMDL that City has been assigned a WLA. This Bacteria TMDL Action Plan will address how the City will reduce bacteria in stormwater runoff for the waterways identified in the MS4 permit. Bacteria impairments were identified for ten watersheds. These watersheds are:

- Ashville Bridge Creek and Muddy Creek
- Beggars Bridge Creek
- Broad Bay and Linkhorn Bay
- Elizabeth River
- Hell Point Creek, Upper and Lower
- London Bridge Creek and Canal 2
- Lynnhaven Bay
- North Landing River
- Pocaty River
- West Neck Creek, Upper

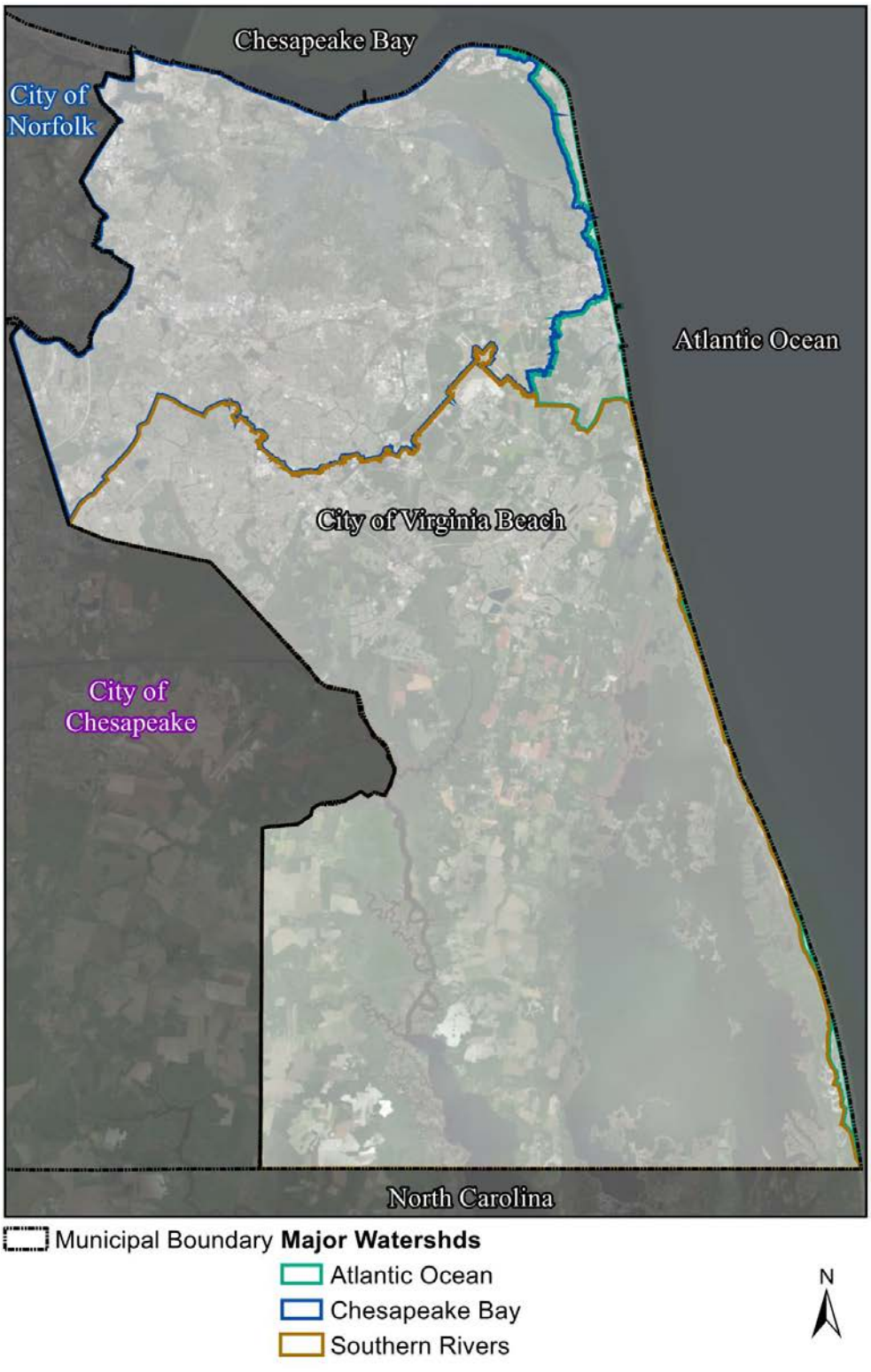


Figure 1-1. Primary Watersheds

The City has developed this bacteria TMDL Action Plan to address the watersheds with bacteria impairments with assigned WLAs described within Phase I MS4 Permit: VA0088676. The permit identifies specific elements that must be included in this Action Plan. The required elements within the permit are included in Table 1-1, along with the section of this Action Plan where they are addressed.

**Table 1-1. Overview of the Bacteria TMDL Action Plan Permit Requirements**

| Action Plan Section | Permit Section | MS4 Permit Section Requirement |
|---|---|---|
| 6 | Part I.D.2.(b)1 | Develop and maintain a list of its legal authorities such as ordinances, permits, order, specific contract language, and inter-jurisdictional agreements applicable to reducing the pollutant identified in a WLA. |
| 4 | Part I.D.2.(b)2 | Identify and maintain an updated list of all additional management practices, control techniques and system design and engineering methods, beyond those identified in Part I.B of this state permit, that have been implemented as part of the MS4 Program Plan that are applicable to reducing the pollutant identified in the WLA. |
| 7 | Part I.D.2.(b)3 | Enhance the public education and outreach and employee training programs to also promote methods to eliminate and reduce discharges of the pollutants identified in the WLA. |
| 5 | Part I.D.2.(b)4 | Assess all significant sources of pollutant(s) from facilities of concern owned or operated by the MS4 operator that are not covered under a separate VPDES industrial stormwater permit and identify all municipal facilities that may be a significant source of the identified pollutant. For the purpose of this assessment, a significant source of pollutant(s) from a facility of concern means a discharge where the expected pollutant loading is greater than the average pollutant loading for the land use identified in the TMDL. (For example, a significant source of pollutant from a facility of concern for a bacterial TMDL would be expected to be greater at a dog park than at other recreational facilities where dogs are prohibited). |
| 9 | Part I.D.2.(b)5 | Develop and implement a method to assess TMDL Action Plans for their effectiveness in reducing the pollutants identified in the WLAs. The evaluation shall use any newly available information, representative and adequate water quality monitoring results, or modeling tools to estimate pollutant reductions for the pollutant(s) of concern from implementation of the MS4 Program Plan. Monitoring may include BMP, outfall, or in-stream monitoring, as appropriate, to estimate pollutant reductions. The permittee may conduct monitoring, utilize existing data, establish partnerships, or collaborate with other MS4 permittees or other third parties, as appropriate. This evaluation shall include assessment of the facilities identified in Part I.D.2.b)4). The methodology used for assessment shall be described in the TMDL Action Plan. |
| 10 | Part I.D.2.(b)6 | Solicit public input on the draft TMDL Action Plan and consider public comments in development of the final TMDL Action Plan that is submitted to the Department for review and approval. |

| Table 1-1. Overview of the Bacteria TMDL Action Plan Permit Requirements | | |
|---|---|---|
| **Action Plan Section** | **Permit Section** | **MS4 Permit Section Requirement** |
| 8 | Part I.D.2.a | These TMDL Action Plans shall identify the best management practices and other interim milestone activities to be implemented during the remaining term of this state permit. The plan shall include an estimated end date for achieving the applicable wasteload allocations. |

DEQ has developed guidance to help municipalities develop Action Plans. The guidance titled, *TMDL Action Planning for Local Total Maximum Daily Loads as Required in the Small MS4 General Permit (VAR04) Effective July 1, 2013 and MS4 Individual Permits* dated November 21, 2016 (Local Guidance) was referenced during development of this Action Plan (DEQ 2016a).

Of the watersheds with assigned WLAs, there has been one Implementation Plan developed by the Hampton Roads Planning District Commission for the Broad Bay, Linkhorn Bay, and Lynnhaven Bay watersheds in June 2006. This Implementation Plan was developed with support from the City and DEQ. Implementation plans are documents that describe strategies to meet the TMDL allocations for all of the sources within the watershed. This Implementation Plan was reviewed while developing this Action Plan, and it was determined that the City has already implemented many of the programs listed within the plans. These efforts are identified as ongoing efforts within this plan.

This Action Plan describes the approach, bacteria sources, and WLAs within the bacteria TMDL reports, identified facilities of concern, actions that the City will take to reduce bacteria loadings from its MS4 service area in the form of non-structural and structural BMPs, methods to assess program implementation, and the City's legal authority for Action Plan implementation.

Section 2

# Water Quality Standards and Total Maximum Daily Loads

The City has reviewed the TMDL reports prepared by DEQ for impaired waterways within the City. This Action Plan was prepared with a focus on the bacteria impairments. This section describes how water quality standards are regulated in Virginia by DEQ and how pollutant loads and budgets are assigned to the City.

## 2.1 Virginia Water Quality Standards

Water quality standards are maximum pollution targets set for types of waterbodies. When waterbodies are meeting these targets, they are considered healthy and can be used for their intended purpose. Waterbodies should allow reasonable public use and support the growth of appropriate aquatic life. Virginia waters associated with the City are designated for the following uses (DEQ 2018):

- Recreational uses (e.g., swimming and boating)
- Propagating and growing a balanced aquatic life indigenous population, including game fish that may reasonably be expected and wildlife, and producing edible and marketable natural resources (e.g., fish and shellfish)

The Commonwealth of Virginia has adopted numerical regulations for bacteria for each designated use. A waterway is listed as impaired for bacteria if it exceeds the maximum bacteria levels defined for its listed uses. The criteria vary based on the type of water:

- **Saltwater and transitional waters**: Recreational uses are considered impaired when enterococci counts exceed a monthly geometric mean of 35 colony forming units (cfu) per 100 milliliters (mL). In cases where the data are insufficient to calculate a geometric mean, violation occurs when 10 percent of the enterococci samples exceed 104 cfu/100 mL.
- **Freshwaters**: Recreational uses are considered impaired when *E. coli* counts exceed a monthly geometric mean of 126 cfu/100 mL. In cases where data are insufficient to calculate a geometric mean, an impairment is determined when 10 percent of the total samples exceed 235 cfu/100 mL.
- **Shellfish waters**: An impairment occurs when the geometric mean of fecal coliform concentration exceeds a most probable number (MPN) or membrane filter (MF) of 14 per 100 mL.

Chapter 260 of the Virginia Administrative Code (9VAC25-260) includes additional details on Virginia water quality standards.

## 2.2 Approved TMDLs within the City

A TMDL is a budget for pollution a waterbody can receive while maintaining its designated use(s). The TMDL value for each waterbody is different, and depends on many complex factors. When the TMDL value for the waterbody is determined, the watershed is evaluated for all potential sources that may contribute bacteria. Once the sources are determined, a WLA is assigned to each contributor. An MS4 permittee, like the City, is one source that is evaluated and assigned a WLA.

The pollutant of concern being addressed through this Action Plan is bacteria. The following four approved TMDL documents identify WLAs associated with bacteria reduction requirements for watersheds either entirely or partially located within the City:

- *Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments* (MapTech 2014)
- *Development of Bacterial TMDLs for the Virginia Beach Coastal Area (London Bridge Creek & Canal #2, Milldam Creek, Nawney Creek, West Neck Creek (Middle), and West Neck Creek (Upper))* (MapTech 2005)
- *Lynnhaven Bay, Broad Bay and Linkhorn Bay Watersheds Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacteria Contamination* (DEQ 2004)
- *Bacteria Total Maximum Daily Load (TMDL) Development for the Elizabeth River Watershed* (Louis Berger Group, Inc. 2010)

Table 2-1 lists the approval dates, impairment listing, and pollutant of concern for each watershed by report. Figure 2-1 shows the bacteria TMDL watersheds within the City.

**Table 2-1. Watershed TMDL Overview**

| Report | Watershed | EPA Approval Date | SWCB Approval Date | Impairment Listing | Pollutant of Concern |
|---|---|---|---|---|---|
| 1 | Ashville Bridge Creek and Muddy Creek | 6/26/2014 | 12/11/2014 | Primary contact standards | Enterococci |
| | Beggars Bridge Creek | 6/26/2014 | 12/11/2014 | Primary contact standards | Enterococci |
| | Hell Point Creek, Upper and Lower | 6/26/2014 | 12/11/2014 | Primary contact standards | Enterococci |
| | North Landing River, Middle | 6/26/2014 | 12/11/2014 | Primary contact standards | *E. coli* |
| | Pocaty River | 6/26/2014 | 12/11/2014 | Primary contact standards | *E. coli* |
| 2 | London Bridge Creek and Canal 2 | 9/27/2005 | 9/27/2006 | Primary contact standards | *E. coli* |
| | West Neck Creek, Upper | 9/27/2005 | 9/27/2006 | Primary contact standards | Enterococci |
| 3 | Broad Bay, Long Creek, and Linkhorn Bay | 8/5/2004 | 12/2/2004 | Shellfish standards | Fecal coliform |

| Table 2-1. Watershed TMDL Overview | | | | | |
|---|---|---|---|---|---|
| Report | Watershed | EPA Approval Date | SWCB Approval Date | Impairment Listing | Pollutant of Concern |
| | Lynnhaven Bay | 8/5/2004 | 12/2/2004 | Shellfish standards | Fecal coliform |
| 4 | Upper Mainstem, Lower Southern Branch, Lower Eastern Branch Elizabeth River, Broad Creek, and Indian River | 7/20/2010 | 9/30/2010 | Primary contact standards | Enterococci |

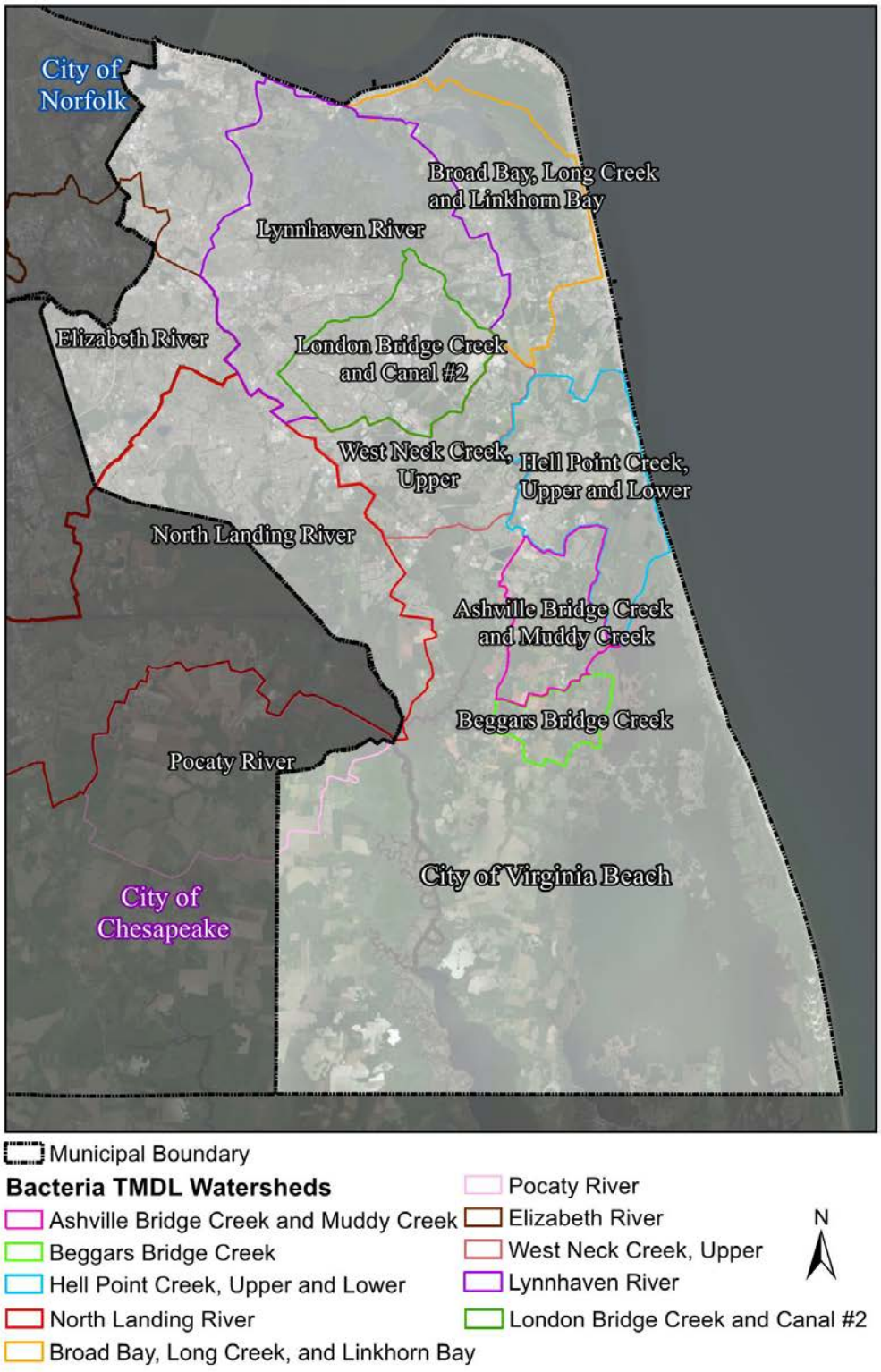


Figure 2-1. Bacteria TMDL watersheds

## Section 3

# Bacteria Sources and Wasteload Allocations

The DEQ-developed TMDL reports describe the sources of bacteria to each impaired waterbody. Potential sources of bacteria include domestic animals, humans, livestock, and wildlife. The TMDL reports also describe how each TMDL watershed was evaluated to determine the loading and allocations for each entity.

Understanding all the identified sources contributing to an impairment provides perspective on the overall issues and indications of potential solutions. This section summarizes the sources of bacteria found in each of the four TMDL reports. The bacteria source data in the published TMDL reports vary, thus not all information summarized in this section is available for the all TMDLs described in this Action Plan.

The TMDL reports also include the assigned WLA for each watershed in the City. These values are the specific targets required by the City's permit. This section summarizes the assigned WLA for each bacteria TMDL watershed. A discussion is also included regarding the MS4 service areas for each TMDL watershed. Understanding of the City-specific sources helps the City focus efforts where they can be most effective. Table 3-1 includes a summary of the existing loads, WLAs, and percent reduction required from the TMDL reports.

**Table 3-1. Bacteria TMDL Overview**

| Report | Watershed | Existing Loading (cfu/yr) | Assigned WLA (cfu/yr) | Percent Reduction (percent) |
|---|---|---|---|---|
| 1[a] | Ashville Bridge Creek and Muddy Creek | 2.86E+13 | 5.72E+11 | 98 |
| | Beggars Bridge Creek | 1.39E+13 | 4.17E+11 | 97 |
| | Hell Point Creek: Upper and Lower | 8.69E+13 | 1.74E+12 | 98 |
| | North Landing River: Middle | 3.86E+13 | 2.32E+12 | 94 |
| | Pocaty River | 1.01E+13 | 1.31E+12 | 87 |
| 2 | London Bridge Creek and Canal 2 | N/A | 1.82E+13 | 88 |
| | West Neck Creek: Upper | N/A | 7.81E+12 | 85 |
| 3 | Broad Bay, Long Creek, and Linkhorn Bay | 3.28E+11 | 9.35E+10 | 16.2 |
| | Lynnhaven Bay | 1.43E+13 | 9.01E+11 | 81.5 |
| 4 | Upper Mainstem, Lower Southern Branch, Lower Eastern Branch Elizabeth River, Broad Creek, and Indian River | 2.16E+14 cfu/d | 1.03E+13 cfu/d | 95 |

*a. This WLA aggregates the City's MS4 service area with that of VDOT.*

*yr = year(s), d = day(s).*

## 3.1 Back Bay, North Landing River, and Pocaty River TMDLs

The Back Bay, North Landing River, and Pocaty River TMDL study area contains seven bacteria impairments that were consolidated into five groups. A separate TMDL was developed for the following two freshwater impairments:

- North Landing River
- Pocaty River

The five remaining transitional and saltwater impairments were separated into the following three groups, each with a TMDL:

- Beggars Bridge Creek
- Ashville Bridge Creek and Muddy Creek
- Upper Hell Point Creek and Lower Hell Point Creek

Bacteria sources were identified and quantified in the study area, including both point and nonpoint sources. Bacteria sources included human, livestock, wildlife, and pets, as well as permitted point sources. Table 3-2 summarizes the sources described in the Back Bay, North Landing River, and Pocaty River TMDL reports.

**Table 3-2. Source Assessment Data from TMDL Reports: Back Bay, North Landing River, and Pocaty River**

| TMDL Watershed | Sources | Human Population [a] |
|---|---|---|
| Ashville Bridge Creek and Muddy Creek | Point sources (fecal matter): 1 individual permit, 3 domestic single-family home permits, 2 MS4 permits (Virginia Beach and Chesapeake) | 1,872 |
| Beggars Bridge Creek | | 444 |
| Hell Point Creek, Upper and Lower | | 23,061 |
| North Landing River (Middle) | Nonpoint sources: residential sewage disposal systems, land application of waste, livestock, wildlife, and pets | 114,172 |
| Pocaty River | | 4,007 |

a. *Source: Table 3.4, Page 3-7, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

### 3.1.1 Ashville Bridge and Muddy Creek

The portion of Ashville Bridge Creek within the City flows south before its confluence with Muddy Creek. Ashville Bridge Creek, from the lower portion of Ashville Bridge Creek between Hell Point and Muddy creeks (0.022 square mile), was listed as impaired on the 2006 303(d) list for not supporting

aquatic life and recreation/swimming uses. DEQ monitoring station 5BASH002.20 had a 25 percent bacteria standard violation rate per the 2010 assessment.

The portion of Muddy Creek within the City flows south–southeast before its confluence with North Bay. Muddy Creek, from the confluence with Ashville Bridge Creek to its mouth at the confluence with North Bay (0.04 square mile), was listed as impaired on the 2006 303(d) list for not supporting recreation/swimming use. DEQ monitoring station 5BMDY000.00 had a 41.7 percent bacteria standard violation rate per the 2010 assessment.

The Ashville Bridge and Muddy Creek drainage area within the City is 5,543 acres. This is the same as its overall watershed area because it is entirely within the City municipal limits. The MS4 service area within the watershed is 1,298 acres, which is 23 percent of the bacteria TMDL watershed area within the City boundary.

The total existing load, WLA, and required reduction for Ashville Bridge and Muddy Creek are presented in Table 3-3.

**Table 3-3. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: Ashville Bridge and Muddy Creek**

| Watershed | Existing Loading (cfu/yr)[a] | WLA (cfu/yr)[b] | Percent Reduction (percent)[a] |
|---|---|---|---|
| Ashville Bridge Creek and Muddy Creek | 2.86E+13 | 5.72E+11 | 98% |

a. *Source: Table 5.14, Page 5-26, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

b. *Source: Table 5.15, Page 5-27, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

Figure 3-1 shows the bacteria impaired watershed boundary and the City's MS4 service area within the watershed.

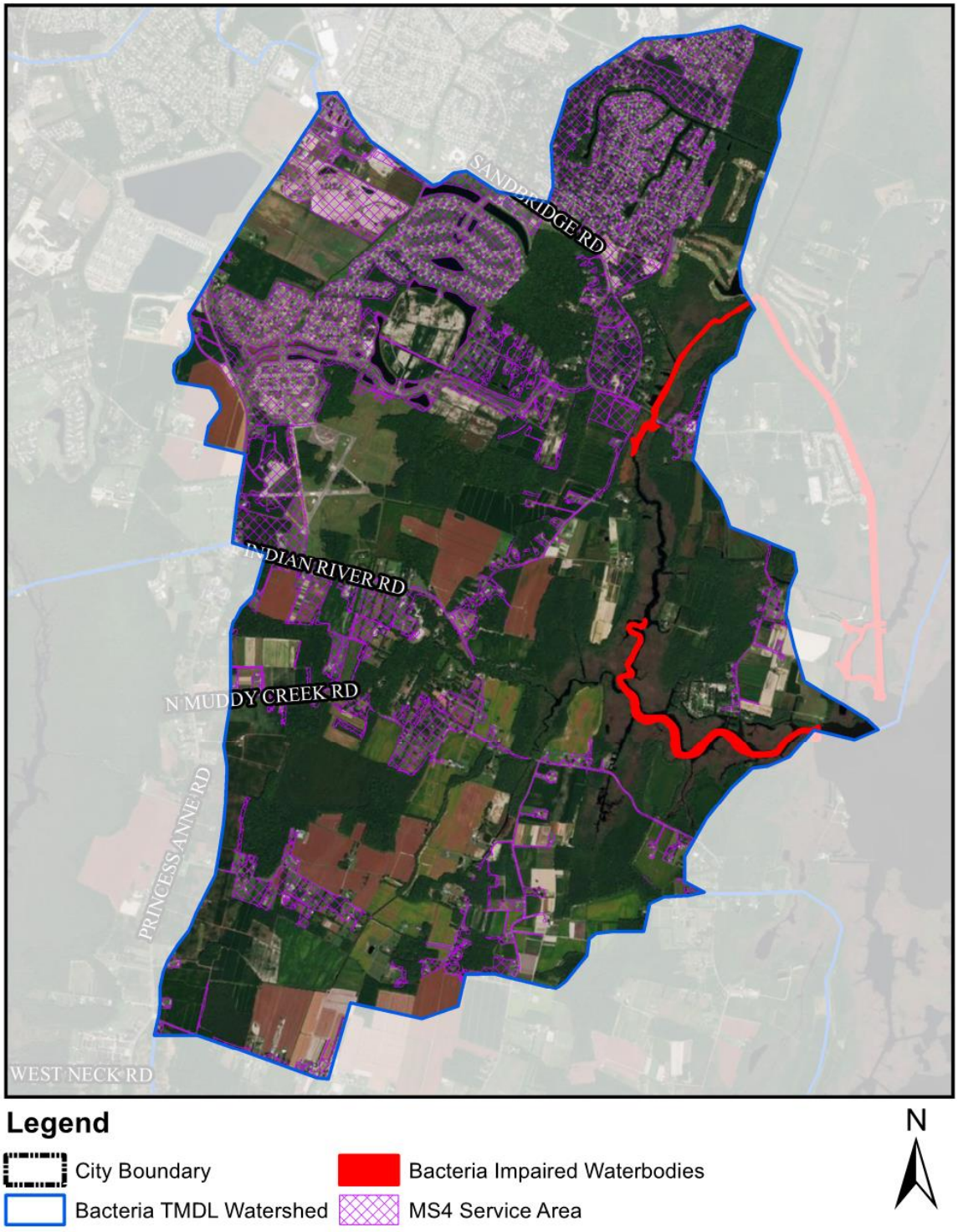


Figure 3-1. Ashville Bridge and Muddy Creek watershed and MS4 service area

### 3.1.2 Beggars Bridge Creek

The portion of Beggars Bridge Creek within the City flows east before its confluence with Shipps Bay. At the confluence of numerous unnamed tributaries (river mile [RM] 1.34) near Dawley Corners, Beggars Bridge Creek is listed as impaired downstream to the mouth at the confluence with Shipps Bay. An 0.033-square-mile area was listed as impaired on the 2006 303(d) list for not supporting the recreation/swimming use. DEQ monitoring station 5BBBC000.76 had a 31.4 percent bacteria standard violation rate per the 2010 assessment.

The Beggars Bridge Creek drainage area within the City is 2,733 acres. This is also the same as the overall watershed area because it is within City municipal limits. The MS4 service area within the watershed is 396 acres, which is 14 percent of the bacteria TMDL watershed area within the City boundary. The total existing load, WLA, and required reduction for Beggars Bridge Creek are presented in Table 3-4.

**Table 3-4. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: Beggars Bridge Creek**

| Watershed | Existing Loading (cfu/yr)[a] | WLA (cfu/yr)[b] | Percent Reduction (percent)[a] |
|---|---|---|---|
| Beggars Bridge Creek | 1.39E+13 | 4.17E+11 | 97 |

a. *Source: Table 5.10, Page 5-20, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

b. *Source: Table 5.11, Page 5-21, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

Figure 3-2 shows the bacteria-impaired watershed boundary and the City's MS4 service area within the watershed.

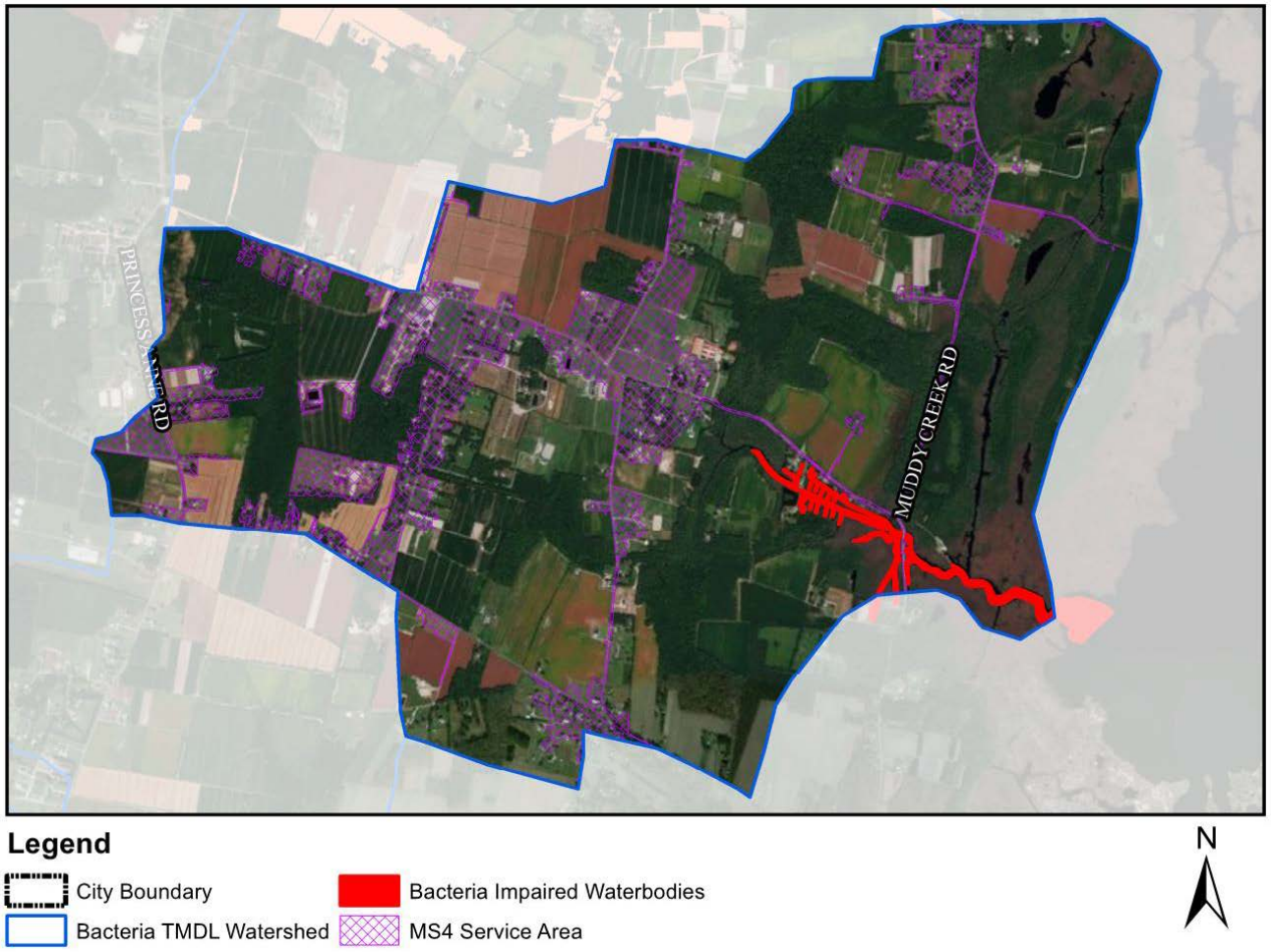


**Figure 3-2. Beggars Bridge Creek watershed and MS4 service area**

### 3.1.3 Hell Point Creek, Lower and Upper

The portion of Hell Point Creek within the City flows south before its confluence with North Bay. Hell Point Creek, from the intersection of the creek and canal upstream of the monitoring station to its mouth and confluence with North Bay (0.026 square mile), was listed as impaired on the 2004 303(d) list for not supporting the recreation/swimming use. DEQ monitoring station 5BHPC000.00 had a 38 percent bacteria standard violation rate per the 2010 assessment.

Hell Point Creek from the headwaters, west of Sandbridge Road, downstream to the intersection of the creek with the canal near the mouth (0.030 square mile) was listed as impaired on the 2006 303(d) list for not supporting the recreation/swimming use. DEQ monitoring station 5BHPC001.46 had a 27.8 percent bacteria standard violation rate per the 2010 assessment.

The Hell Point Creek, Lower and Upper drainage areas within the City are 9,959 acres. This is also the same as the overall watershed area because it is within City municipal limits. The MS4 service area within the watershed is 3,117 acres, which is 31 percent of the bacteria TMDL watershed area within the City boundary.

The total existing load, WLA, and required reduction for Hell Point Creek are presented in Table 3-5.

**Table 3-5. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: Hell Point Creek**

| Watershed | Existing Loading (cfu/yr)[a] | WLA (cfu/yr)[b] | Percent Reduction (percent)[a] |
|---|---|---|---|
| Hell Point Creek: Upper and Lower | 8.69E+13 | 1.74E+12 | 98 |

a. *Source: Table 5.18, Page 5-32, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

b. *Source: Table 5.19, Page 5-33, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

Figure 3-3 shows the bacteria-impaired watershed boundary, and the City's MS4 service area within the watershed.

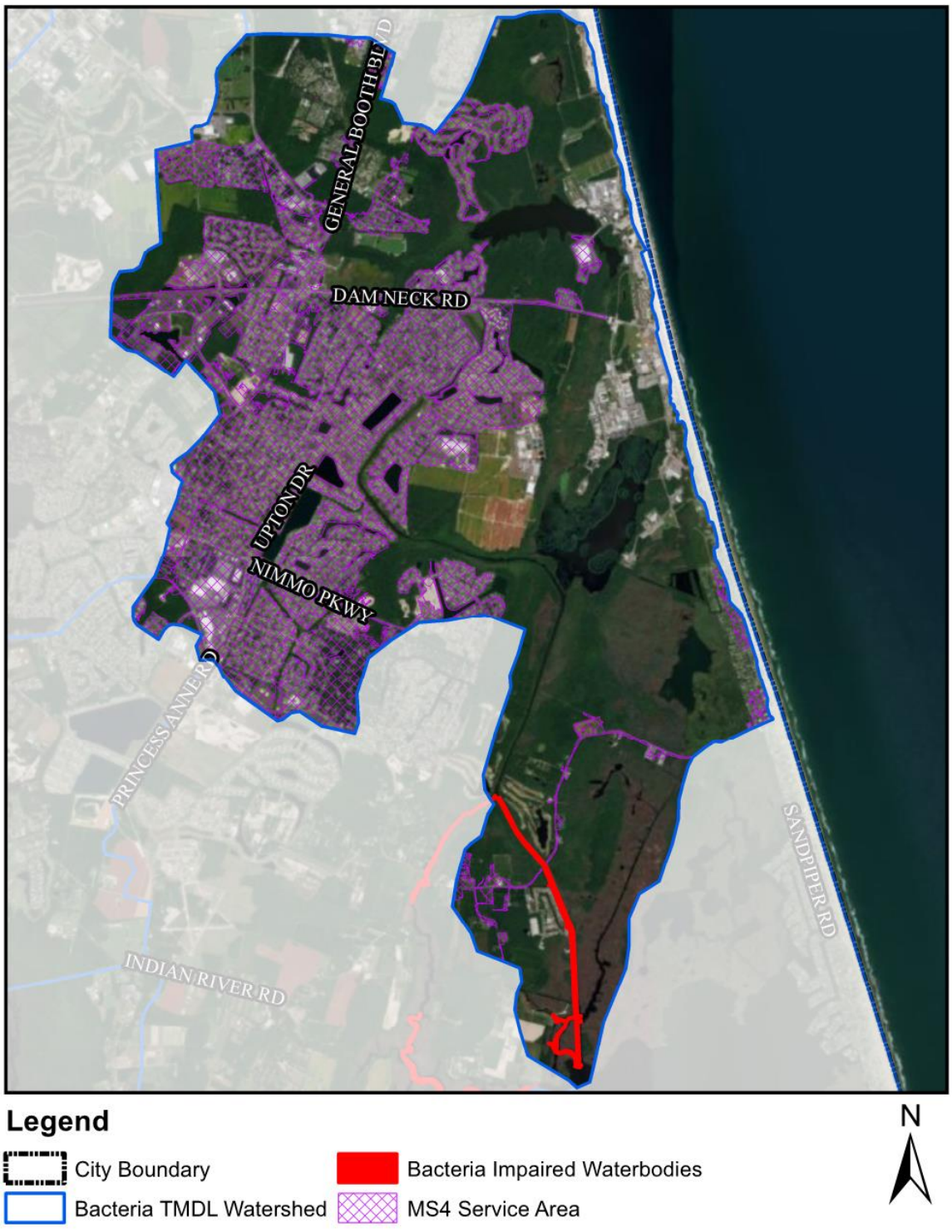


Figure 3-3. Hell Point Creek watershed and MS4 service area

### 3.1.4 North Landing River

The portion of North Landing River within the City flows southeast before the Virginia/North Carolina state line. The North Landing River from the area east of Fentress Landing Field, between the confluence with West Neck Creek and Pocaty River (1.43 stream miles), was listed as impaired on the 2006 303(d) list for not supporting the recreation/swimming use. DEQ monitoring station 5BNLR010.75 had a 22.2 percent bacteria standard violation rate per the 2010 assessment.

The North Landing River drainage area within the City is 17,091 acres. The overall watershed area is 41,856 acres. The MS4 service area within the watershed is 8,456 acres, which is 20 percent of the bacteria TMDL watershed area within the City boundary.

The total existing load, WLA, and required reduction for North Landing River are presented in Table 3-6.

**Table 3-6. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: North Landing River**

| Watershed | Existing Loading (cfu/yr)[a] | WLA (cfu/yr)[b] | Percent Reduction (percent)[a] |
|---|---|---|---|
| North Landing River: Middle | 3.86E+13 | 2.32E+12 | 94 |

a. *Source: Table 5.2, Page 5-8, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

b. *Source: Table 5.3, Page 5-9, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

Figure 3-4 shows the bacteria impaired watershed boundary and the City's MS4 service area within the watershed.

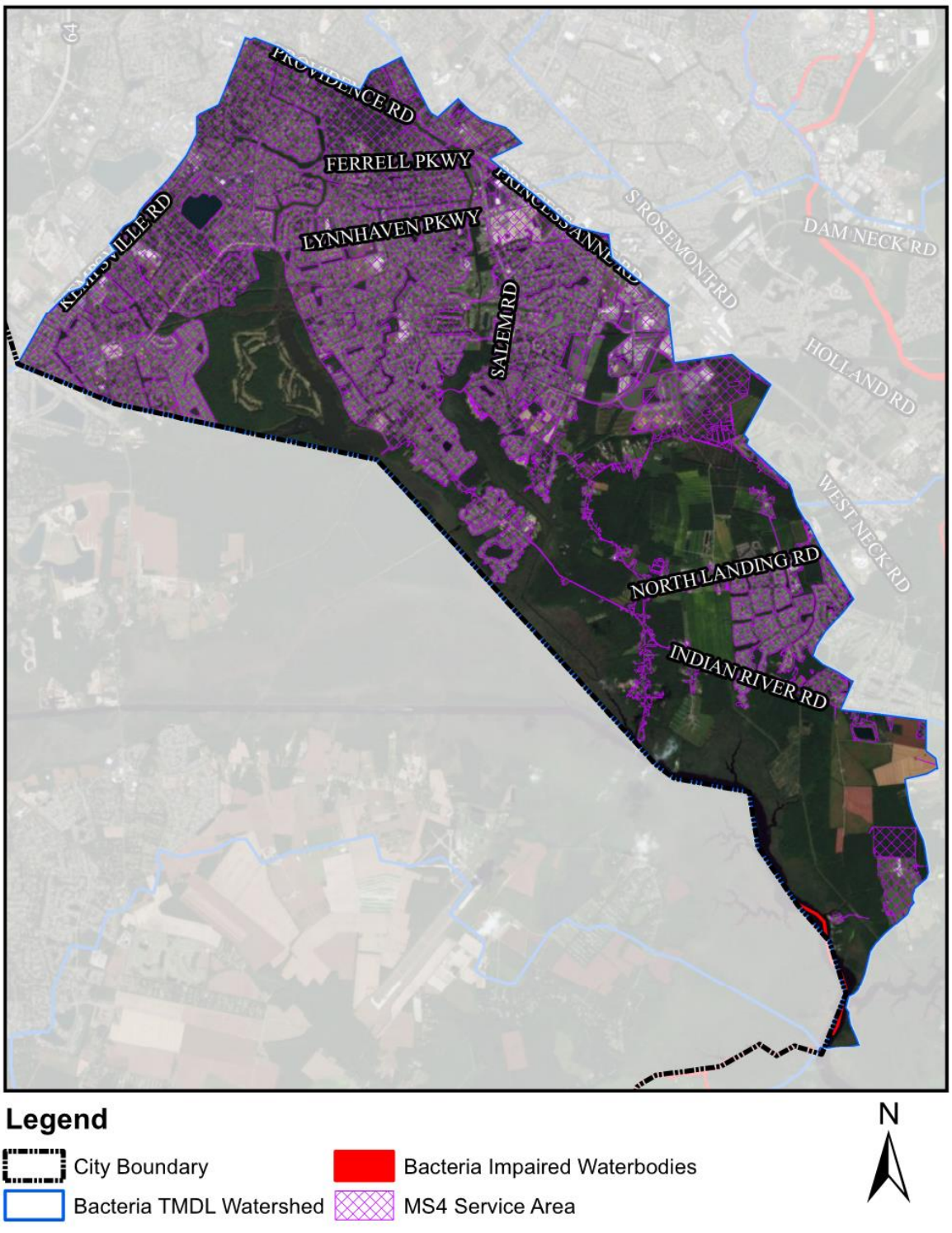


Figure 3-4. North Landing River watershed and MS4 service area

### 3.1.5 Pocaty River

The portion of the Pocaty River within the City flows northeast before its confluence with the North Landing River. The Pocaty River from the headwaters at RM 3.92 to its confluence with the North Landing River at RM 0.00 (7.24 stream miles) was listed as impaired on the 2002 303(d) list for not supporting the aquatic life use. The Pocaty River was added to the 2012 impaired waters list for not supporting the recreation/swimming use. DEQ monitoring station 5BPCT001.79 had a 14.7 percent bacteria standard violation rate per the 2010 assessment.

The Pocaty River drainage area within the City is 1,748 acres. The overall watershed area is 16,977 acres. The MS4 service area within the watershed is 62 acres, which is 0.30 percent of the bacteria TMDL watershed area within the City boundary.

The existing total load, WLA, and required reduction for Pocaty River are presented in Table 3-7.

**Table 3-7. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: Pocaty River**

| Watershed | Existing Loading (cfu/yr)[a] | WLA (cfu/yr)[b] | Percent Reduction (percent)[a] |
|---|---|---|---|
| Pocaty River | 1.01E+13 | 1.31E+12 | 87 |

a. *Source: Table 5.6, Page 5-14, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

b. *Source: Table 5.7, Page 5-15, Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments (MapTech 2014)*

Figure 3-5 shows the bacteria-impaired watershed boundary and the City's MS4 service area within the watershed.

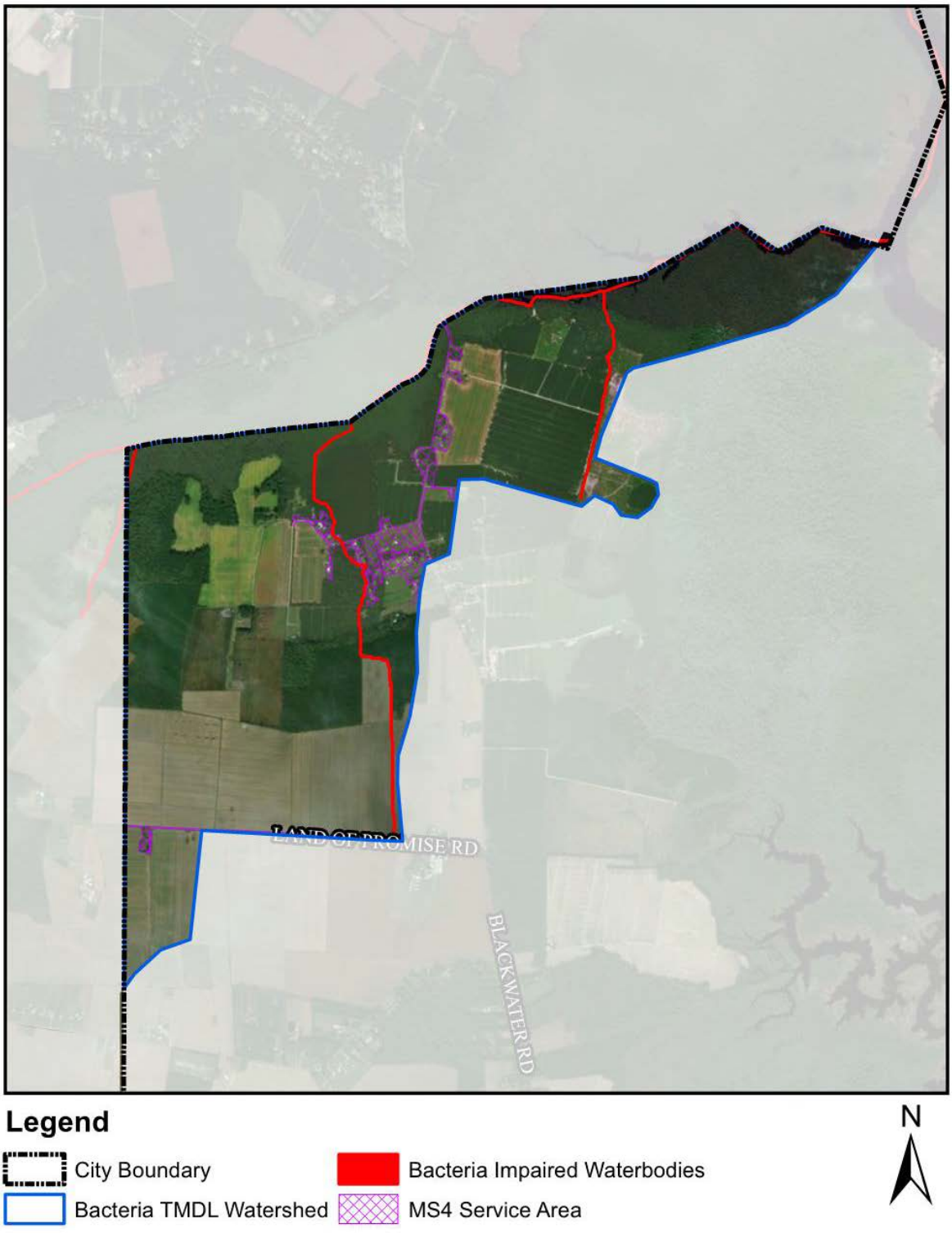


Figure 3-5. Pocaty River watershed and MS4 service area

## 3.2 Coastal Area TMDLs

The Coastal Area TMDLs study area contains six bacteria impairments that were consolidated into five groups. A separate TMDL was developed for the two freshwater impairments. The two groups with a WLA for the City include:

- London Bridge Creek and Canal 2
- West Neck Creek, Upper

Bacteria sources were identified and quantified in the study area, including both point and nonpoint sources. Sources of bacteria included human, livestock, wildlife, and pets, as well as permitted point sources. Table 3-8 summarizes the sources described in the coastal area TMDL report for the watersheds (MapTech 2005).

**Table 3-8. Source Assessment Data from TMDL Reports: Coastal Area TMDLs**

| TMDL Watershed | Sources | Human Population [a] | Page(s) in Report |
|---|---|---|---|
| London Bridge Creek and Canal 2 | Point sources (fecal matter): 2 MS4 permits (City and the Naval Station) | 42,792 | 3-2, 3-3, 3-4, 3-8 |
| West Neck Creek, Upper | Nonpoint sources: septic systems, land application of waste, livestock, wildlife, and pets | 29,343 | |

*a.* Source: Table 3.6, Page 3-8, *Development of Bacterial TMDLs for the Virginia Beach Coastal Area (London Bridge Creek & Canal #2, Milldam Creek, Nawney Creek, West Neck Creek (Middle), and West Neck Creek (Upper)) (MapTech 2005)*

### 3.2.1 London Bridge Creek and Canal 2

In the City, London Bridge Creek and Canal 2 flow north to Lynnhaven Bay. London Bridge Creek and Canal 2, between Shipps Corner and the confluence of Thurston Branch (0.11+ mile), was listed as impaired on the 1996 303(d) list for not supporting primary recreational uses. DEQ monitoring station 7LOB003.70 had a 59 percent bacteria standard violation rate per the 2002 assessment.

Within the City, the London Bridge Creek and Canal 2 drainage area is 8,592 acres. The MS4 service area within the watershed is 4,332 acres, which is 50 percent of the bacteria TMDL watershed area within the City boundary. The existing total load, WLA, and required reduction for London Bridge Creek and Canal 2 are presented in Table 3-9. Non-applicable (N/A) is noted where the values were not present in the published TMDL reports.

**Table 3-9. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: London Bridge Creek and Canal 2**

| Watershed | Existing Loading (cfu/yr) | WLA (cfu/yr)[a] | Percent Reduction (percent)[a] |
|---|---|---|---|
| London Bridge Creek and Canal 2 | N/A | 1.82E+13 | 88% |

a. *Source: Table 5.7, Page 5-24, Development of Bacterial TMDLs for the Virginia Beach Coastal Area (London Bridge Creek & Canal #2, Milldam Creek, Nawney Creek, West Neck Creek (Middle), and West Neck Creek (Upper)) (MapTech 2005)*

Figure 3-6 shows the bacteria-impaired watershed boundary and the City's MS4 service area within the watershed.

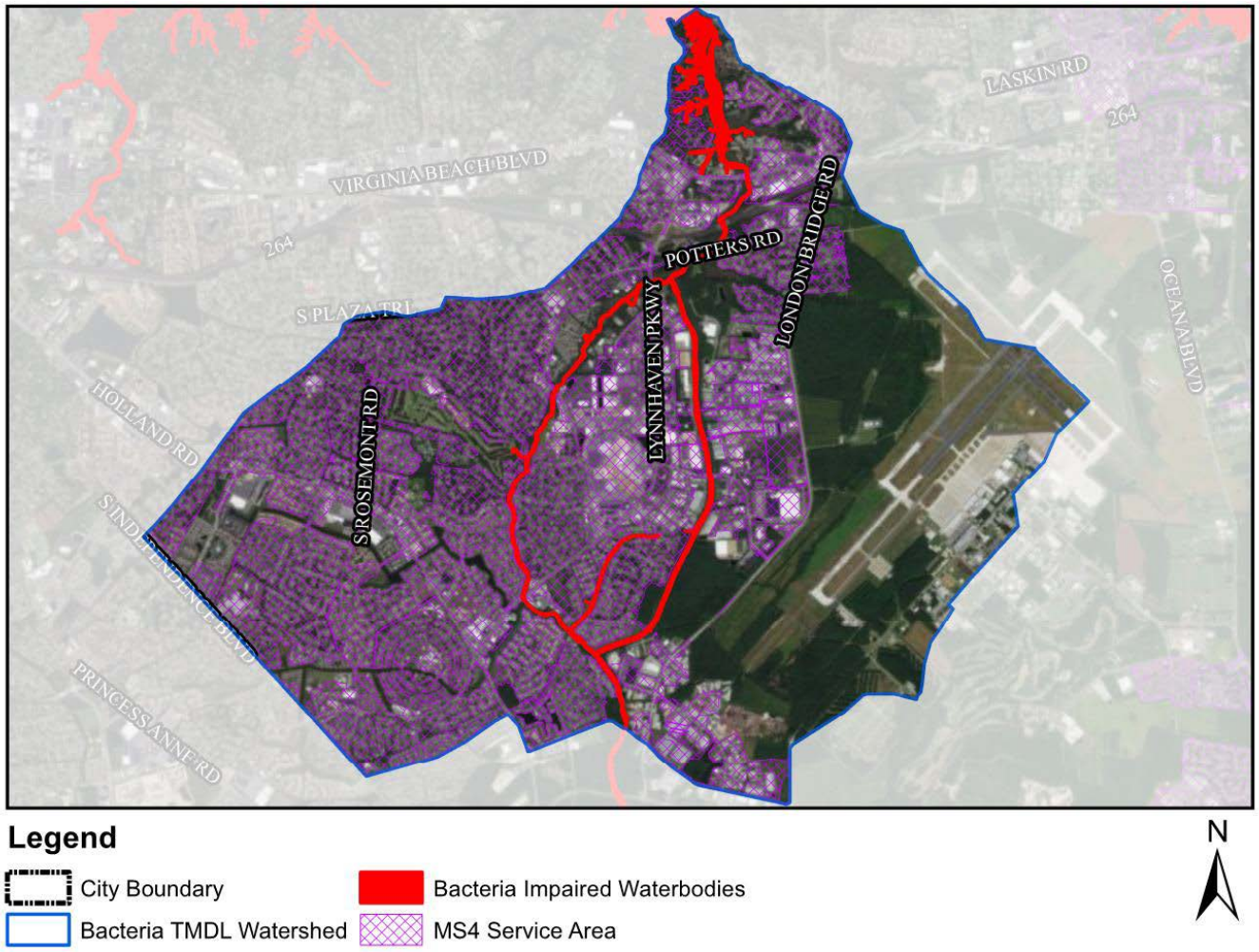


**Figure 3-6. London Bridge Creek and Canal 2 watershed and MS4 service area**

### 3.2.2 West Neck Creek, Upper

In the City, West Neck Creek, Upper flows south to West Neck Creek, Middle before its confluence with the North Landing River. West Neck Creek, Upper, from the Princess Anne Road crossing to its junction with London Bridge Creek (0.03+ mile), was listed as impaired on the 1998 303(d) list for not supporting primary recreational uses. DEQ monitoring station 5BWNC010.02 had a 31 percent bacteria standard violation rate per the 2002 assessment.

Within the City, the West Neck Creek, Upper drainage area is 8,753 acres. The MS4 service area within the watershed is 3,758 acres, which is 43 percent of the bacteria TMDL watershed area within the City boundary.

The total existing load, WLA, and required reduction for West Neck Creek, Upper are presented in Table 3-10.

**Table 3-10. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: West Neck Creek, Upper**

| Watershed | Existing Loading (cfu/yr) | WLA (cfu/yr)[a] | Percent Reduction (percent)[a] |
|---|---|---|---|
| West Neck Creek: Upper | N/A | 7.81E+12 | 85 |

a. *Table 5.8, Page 5-25, Development of Bacterial TMDLs for the Virginia Beach Coastal Area (London Bridge Creek & Canal #2, Milldam Creek, Nawney Creek, West Neck Creek (Middle), and West Neck Creek (Upper)) (MapTech 2005)*

Figure 3-7 shows the bacteria impaired watershed boundary and the City's MS4 service area within the watershed.

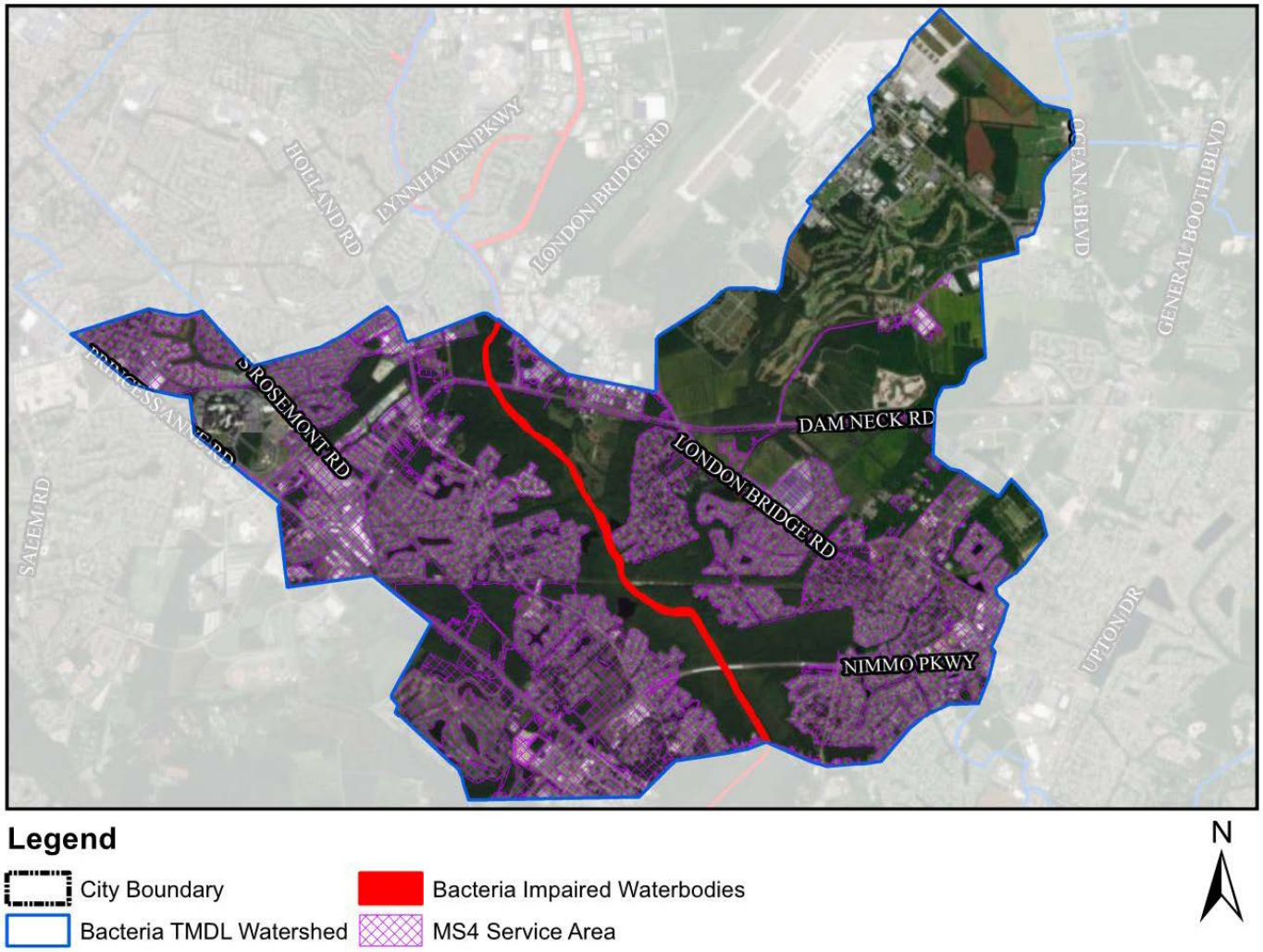


**Figure 3-7. West Neck Creek, Upper watershed and MS4 service area**

## 3.3 Lynnhaven Bay, Broad Bay, and Linkhorn Bay TMDLs

The Lynnhaven Bay, Broad Bay, and Linkhorn Bay TMDLs study area contains two impaired segments. A separate TMDL was developed for each impaired segment, including for:

- Lynnhaven Bay and its tributaries, including Long Creek
- Mill Dam Creek and Dell Cover portions of Broad Bay, and all of Linkhorn Bay

Bacteria sources were identified and quantified in the study area, including both point and nonpoint sources. Bacteria sources included human, livestock, wildlife, and pets, as well as permitted point sources. Table 3-11 summarizes the sources described in the Lynnhaven Bay, Broad Bay, and Linkhorn Bay TMDL report for the watersheds.

**Table 3-11. Source Assessment Data from TMDL Reports: Lynnhaven Bay, Broad Bay, and Linkhorn Bay TMDLs**

| TMDL Watershed | Sources | Human Population [a] | Page(s) in Report |
|---|---|---|---|
| Broad Bay, Long Creek, and Linkhorn Bay | Point sources (fecal matter): 1 MS4 permit (the City)<br><br>Nonpoint sources: septic systems, marinas, livestock, biosolids, wildlife, and pets | Population shown in persons per hectare (2.2 ac) | 16 |
| Lynnhaven Bay | | | |

a. *Source: Figure 3-1, Page 5, Lynnhaven Bay, Broad Bay and Linkhorn Bay Watersheds Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacteria Contamination (DEQ 2004)*

Both recreational and commercial shellfishing occur in this study area. Among these shellfish areas, two segments within the Lynnhaven, Broad, and Linkhorn bays have been regulated pursuant to Title 28.2 Chapter 8, Sections 228.2-803, 228.2-808, 32.1-20, and 9-6.14:4.1 B16 of the Code of Virginia by the Virginia Department of Health (VDH), Division of Shellfish Sanitation (DSS). VDH-DSS collects monthly samples at more than 2,000 stations in Virginia shellfish growing areas. Every 6 months, VDH-HSS determines if the data show that water quality standards have been met. If the water quality standards are exceeded, the shellfish area is closed for the harvest of shellfish that go directly to market.

Monthly sampling by VDH-DSS is conducted for a different purpose from that of the sampling conducted to develop the TMDLs for this study area. However, even though the purpose is different, this sampling can be used to help evaluate whether impairments evaluated during TMDL development are changing.

### 3.3.1 Broad Bay, Long Creek, and Linkhorn Bay

Broad Bay, Long Creek, and Linkhorn Bay are within the City and lie directly east of State Route (SR) 279. Broad Bay is bordered on the northeast by First Landing State Park, and to the east by U.S.

Highway 60. This tributary enters Lynnhaven Bay at its confluence with the Chesapeake Bay. Broad Bay, Long Creek, and Linkhorn Bay were listed as impaired on the 1998 303(d) list because of violations of Virginia State's water quality standards for fecal coliform bacteria in shellfish-supporting waters. Half of the VDH-DSS monitoring stations showed bacteria standard violations during the time frame used for TMDL development (January 2001 to February 2003).

Within the City, the Broad Bay, Long Creek, and Linkhorn Bay drainage area is 9,110 acres. The MS4 service area within the watershed is 3,296 acres, which is 36 percent of the bacteria TMDL watershed area within the City boundary.

The total existing load, WLA, and required reduction for Broad Bay, Long Creek, and Linkhorn Bay are presented in Table 3-12.

**Table 3-12. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: Broad Bay, Long Creek, and Linkhorn Bay**

| Watershed | Existing Loading (cfu/yr)[a] | WLA (cfu/yr)[a] | Percent Reduction (percent)[a] |
|---|---|---|---|
| Broad Bay, Long Creek, and Linkhorn Bay | 3.28E+11 | 9.35E+10 | 16.2 |

a. *Source: Table 5-7, Page 37, Lynnhaven Bay, Broad Bay and Linkhorn Bay Watersheds Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacteria Contamination (DEQ 2004)*

Figure 3-8 shows the bacteria-impaired watershed boundary, and the City's MS4 service area within the watershed.

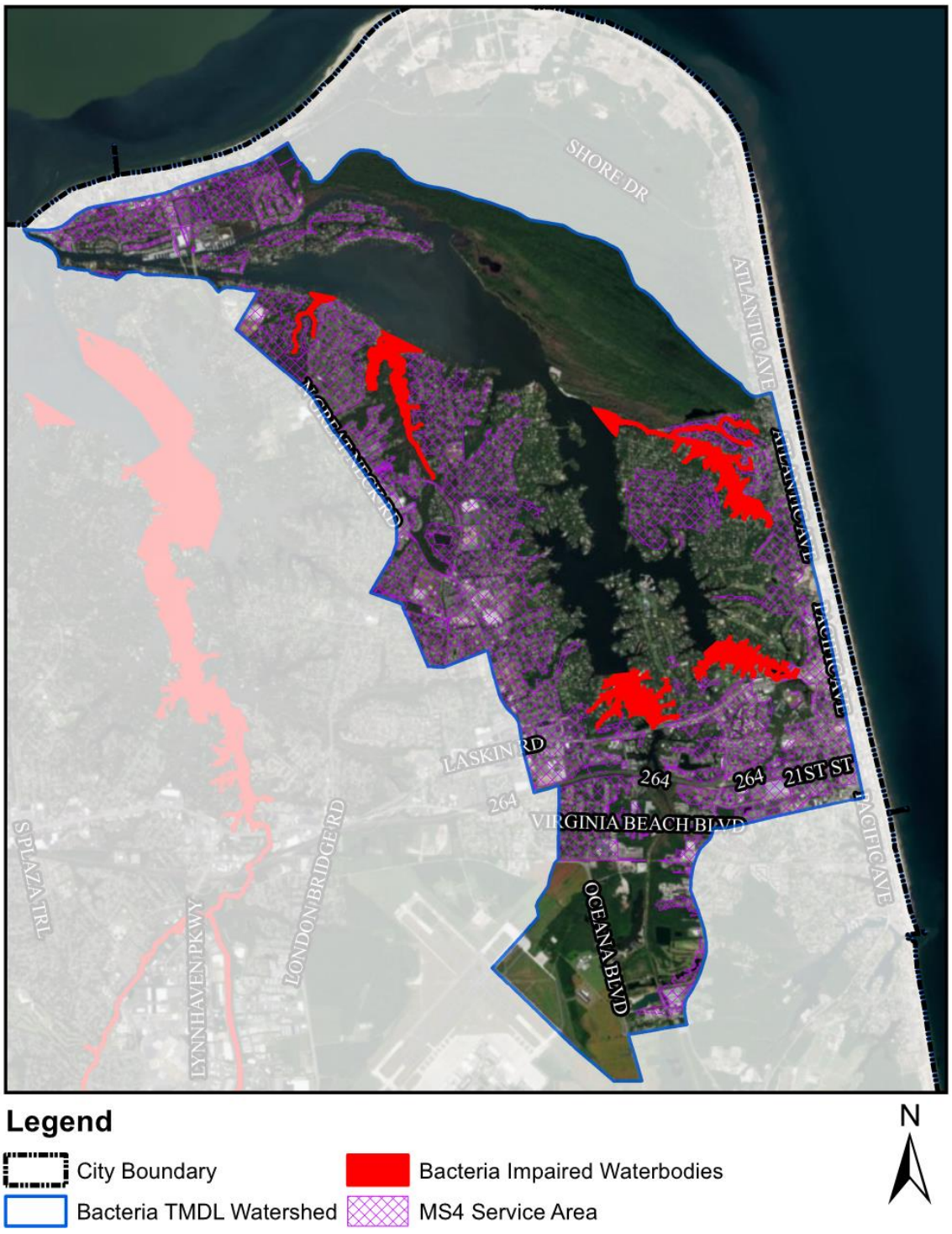


**Figure 3-8. Broad Bay, Long Creek, and Linkhorn Bay watershed and MS4 service area**

### 3.3.2 Lynnhaven Bay

The Lynnhaven River is within the City, and flows north from its headwaters bordering SR 264 (SR 44) to the south, SR 279 to the east, and SR 225 and SR 190 to the west to Lynnhaven Bay. Lynnhaven Bay was listed as impaired on the 1998 303(d) list because Virginia water quality standard violations for fecal coliform bacteria in shellfish-supporting waters. All the VDH-DSS monitoring stations showed bacteria standard violations during the time frame used for TMDL development (January 2001 to February 2003).

Within the City, the Lynnhaven Bay drainage area is 26,778 acres. The MS4 service area within the watershed is 10,979 acres, which is 41 percent of the bacteria TMDL watershed area within the City boundary.

The total existing load, WLA, and required reduction for Lynnhaven Bay are presented in Table 3-13.

**Table 3-13. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: Lynnhaven Bay**

| Watershed | Existing Loading (cfu/yr)[a] | WLA (cfu/yr)[a] | Percent Reduction (percent)[a] |
|---|---|---|---|
| Lynnhaven Bay | 1.43E+13 | 9.01E+11 | 81.5% |

a. *Table 5-6, Page 37, Lynnhaven Bay, Broad Bay and Linkhorn Bay Watersheds Total Maximum Daily Load (TMDL) Report for Shellfish Areas Listed Due to Bacteria Contamination (DEQ 2004)*

Figure 3-9 shows the bacteria-impaired watershed boundary, and the City's MS4 service area within the watershed.

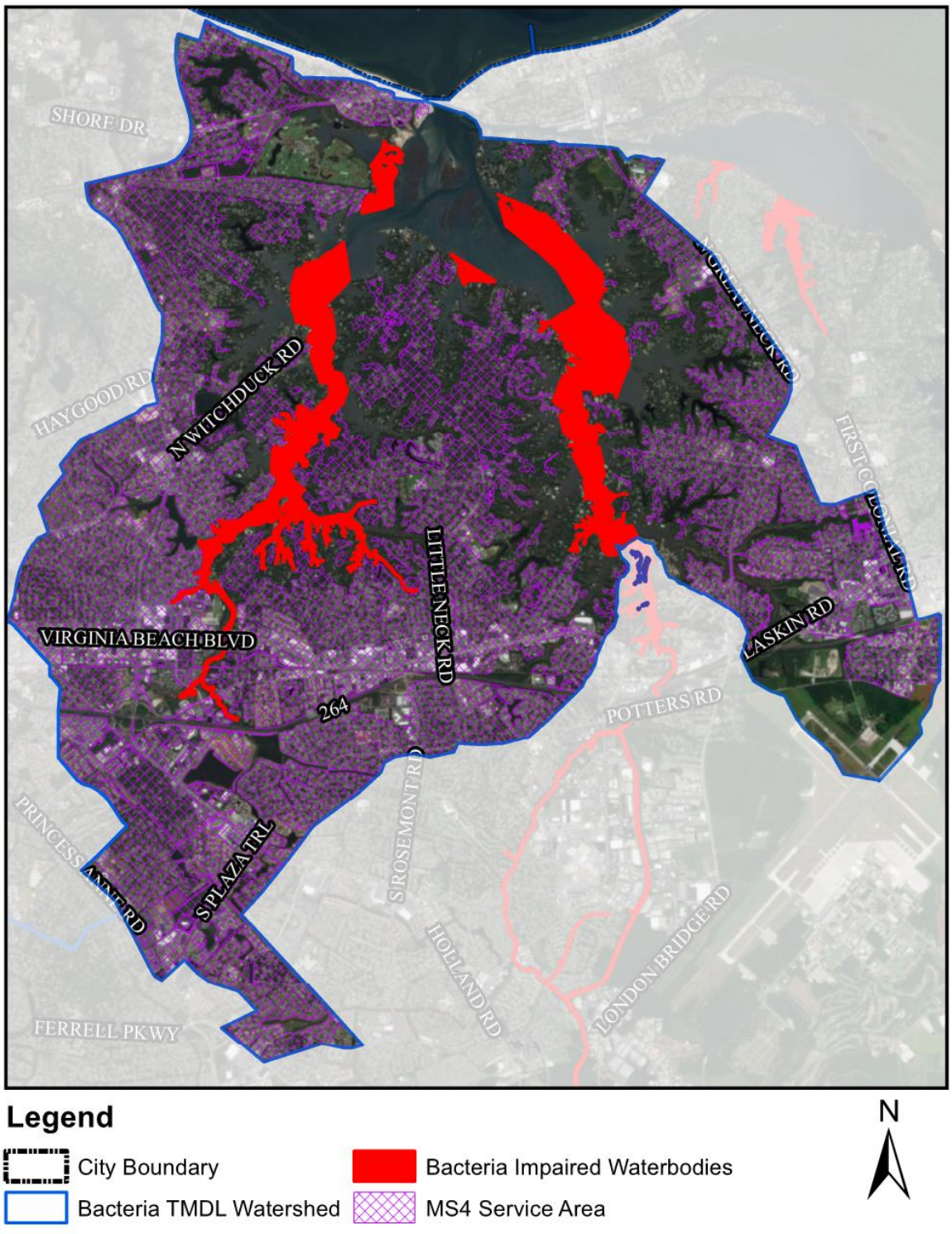


Figure 3-9. Lynnhaven Bay watershed and MS4 service area

## 3.4 Elizabeth River TMDL

The Elizabeth River TMDL study area contains nine impaired segments that were consolidated into four groups. A separate TMDL was developed for each group, including:

- Upper Mainstem, Lower Southern Branch, Lower Eastern Branch, Broad Creek, and Paradise Creek
- Lower and Upper Western Branch
- Upper Lafayette
- Indian River

The City MS4 area is only in the first group (Upper Mainstem, Lower Southern Branch, Lower Eastern Branch, Broad Creek, and Paradise Creek); therefore, that is the only group described in this Action Plan.

Bacteria sources were identified and quantified in the study area, and included permitted point sources and nonpoint source contributions from humans, livestock, wildlife, agricultural activities, and pets. Table 3-14 summarizes the sources described in the Elizabeth River TMDL report.

**Table 3-14. Source Assessment Data from TMDL Reports: Elizabeth River TMDL**

| TMDL Watershed | Sources | Human Population[a] | Page(s) in Report |
|---|---|---|---|
| Upper Mainstem, Lower Southern Branch, Lower Eastern Branch Elizabeth River, Broad Creek, Indian River | Point sources (fecal matter): 51 individual permitted facilities, 94 general permitted facilities, 8 MS4 permits (4 Phase I and 4 Phase II), SSOs<br><br>Nonpoint sources: septic systems, marinas, livestock, biosolids, wildlife, and pets | 48,298 | 2-25, 2-26 |

a. *Source: Table 2-26, Page 2-31, Bacteria Total Maximum Daily Load (TMDL) Development for the Elizabeth River Watershed (Louis Berger Group, Inc. 2010)*

The Elizabeth River watershed is the largest described in this Action Plan. Elizabeth River collects discharge from the west, south, and east branches, and then flows north to Chesapeake Bay. The impaired Elizabeth River segments were listed for recreation use because of criteria exceedances for *enterococcus* bacteria. Group 1 segments were listed as follows:

- Upper Mainstem (DEQ monitoring station: VAT-G15E_ELI01A06): first listed in 2006
- Lower Southern Branch (DEQ monitoring station: VAT-G15E_SBE03A06): first listed in 1998
- Lower Eastern Branch (DEQ monitoring station: VAT-G15E_EBE02A06): first listed in 1998
- Indian River (DEQ monitoring station: VAT-G15E_IND01A02): first listed in 2006
- Broad Creek (DEQ monitoring station: VAT-G15E_BRO01A02): first listed in 2006

Within the City, the Elizabeth River drainage area is 9,390 acres. The overall Elizabeth River watershed area is 82,666 acres. The City MS4 service area within the watershed is 6,739 acres, which is 8 percent of the bacteria TMDL watershed area within the City boundary.

The total existing load, WLA, and required reduction for the Elizabeth River are presented in Table 3-15.

**Table 3-15. Existing Load, WLA, Percent Reduction Required, and Calculated Reduction: Lynnhaven Bay**

| Watershed | Existing Loading (cfu/d)[a] | WLA (cfu/d)[a] | Percent Reduction (percent)[a] |
|---|---|---|---|
| Elizabeth River | 2.16E+14 | 1.03E+13 | 95 |

a. *Source: Table 4-4, Page 4-7, Bacteria Total Maximum Daily Load (TMDL) Development for the Elizabeth River Watershed (Louis Berger Group, Inc. 2010)*

Figure 3-10 shows the bacteria-impaired watershed boundary, and the City's MS4 service area within the watershed.

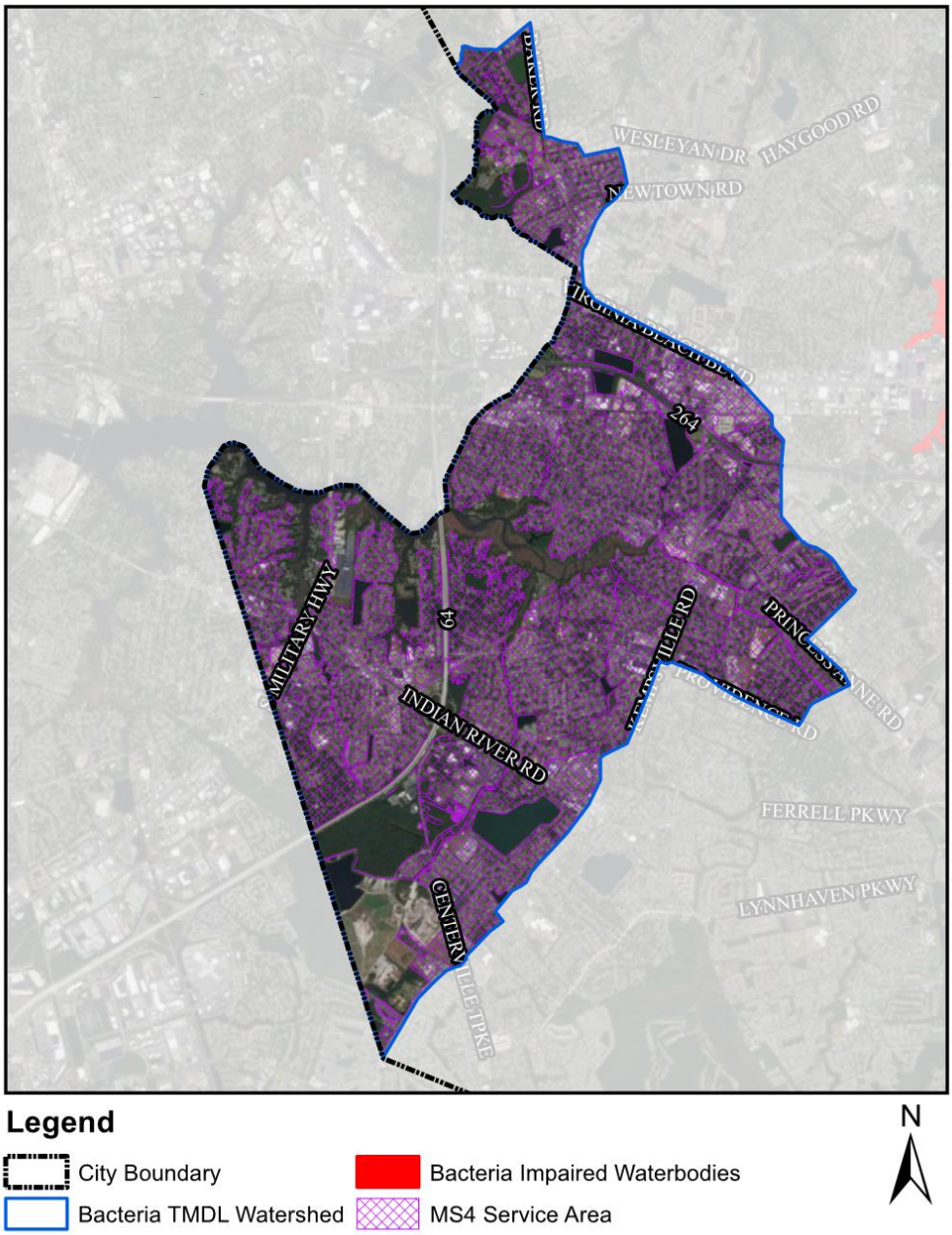


**Figure 3-10. Elizabeth River watershed and MS4 service area**

Section 4

# Strategies to Reduce Bacteria

The permit requires the City identify and maintain a list of all additional management practices, control techniques and system design and engineering methods, beyond those identified in the permit, that have been implemented as part of the MS4 Program Plan and are applicable to reducing bacteria.

The TMDL reports describe the sources of bacteria and reductions from each source. In general, the reports call for a high loading reduction for bacteria from humans, and similar reductions of bacteria from pets and livestock, with lower expectations for wildlife bacteria loading reduction.

The City implemented numerous non-structural and structural BMPs targeting various sources of bacteria. Each BMP in this Action Plan is discussed in terms of its potential to help reduce bacteria concentrations. Unless specifically discussed below, the non-structural BMPs are conducted, and subsequently reported, on a Citywide basis. Structural BMPs are reported based on the TMDL watershed that they are located in.

This section includes an annotated list of non-structural BMPs that the City has put into action since the date of the bacteria modeling referenced within each respective bacteria TMDL report.

## 4.1 Non-Structural BMPs

The City currently implements many non-structural BMPs, which are programmatic efforts meant to reach part of the population. Some are required by the permit, and some are above and beyond what is required. Sections 4.1.1 through 4.1.3 describe the non-structural BMPs.

### 4.1.1 Required by Permit

The following non-structural BMPs are required by the permit, they remove many pollutants including bacteria.

#### 4.1.1.1 Promote and Publicize Proper Pet Waste Disposal

The City promotes and publicizes information about proper pet waste disposal through its regional efforts. Reducing pet waste in a watershed reduces a source of fecal bacteria from entering surface waters. Information is publicized on the askHRgreen website about Scoop the Poop.

The City implements, through askHRgreen, a 3-week-long campaign to encourage Hampton Roads residents to clean up fallen leaves and pet waste before these materials end up in the storm drain. The campaigns aim to inform the public of the possible water quality and quantity consequences of not collecting leaves or pet waste before they reach the drain.

#### 4.1.1.2 Staff Training Program

The City provides biennial training for employees to help recognize illicit discharges and teach good housekeeping procedures. The training sessions will cover the following topics:

- Illicit discharges—recognition and reporting: Recognizing and reporting illicit discharges, defining what qualifies as an illicit discharge
- Good housekeeping and pollution-prevention practices: Practices to be employed during road, street, and parking lot maintenance, associated with City maintenance and public works facilities, and City recreation facilities

#### 4.1.1.3 Illicit Discharge Detection and Elimination Program

The City has implemented an Illicit Discharge Detection and Elimination (IDDE) program since 1996. To coordinate efforts among City departments, a Water Pollution Investigation Team was established that meets regularly to discuss and coordinate on illicit discharge-related issues including responsible parties, training, reporting, and enforcement. The team comprises representatives from Public Works, Public Utilities, Housing and Neighborhood Preservation, the Fire Department, the Police Department, and the City Attorney.

There are several established avenues for residents and visitors to contact the City to report suspected illicit discharges. Residents may contact the City through VB311, 9-1-1, directly to 757-385-1470, or through the VBWorks application.

#### 4.1.1.4 Sanitary Sewer Inspection

The City inspects the sanitary sewer system to assess the condition of the assets. This inspection helps to determine where repairs are needed.

### 4.1.2 Enhanced Permit Activities

The following non-structural BMPs are required by the permit; however, the City has gone above and beyond the minimum requirements for each activity, creating programs that are more effective at targeting pollution.

#### 4.1.2.1 Enhanced Pet Waste Education Program

The City distributes pet waste educational materials at public events, including pamphlets and giveaways. Proper pet waste disposal techniques are also advertised on askHRgreen.org. The City distributes outreach using three methods: (1) direct, (2) regional, and through (3) partners. The City partners with animal adoption agencies to reach additional residents by providing them with educational materials that are distributed with new dog adoptions.

#### 4.1.2.2 Pet Waste Disposal Stations

Pet waste stations are provided for residents at parks and trails in locations of high dog traffic as a place to properly dispose of pet waste. These stations are maintained by the City.

The City also funds a pet waste station grant program. A resident or organization can apply for a grant directly through the City, or on askHRgreen.org. These stations are maintained by the residents, typically through a homeowners' association or similar organization.

#### 4.1.2.3 Adopt-a-Drain Program

The City has recently implemented an Adopt-a-Drain program that allows residents to participate in keeping their local storm drains clear of debris. When residents adopt drains, they are responsible for sweeping and raking debris from around the drain, and properly disposing of the litter. Keeping litter out of the storm system helps to keep the drain from filling with debris during rain events. This

program is also focused on awareness of pollution in our stormwater system and "Only Rain down the Drain" messaging.

#### 4.1.2.4 Storm Drain Marker Program

The Storm Drain Marker Program was implemented to help increase public awareness of the environmental effects of dumping in storm drains. Volunteers adhere watershed-specific markers to storm drains in their neighborhood. The markers draw attention to the fact that water that runs off streets and buildings picks up litter, motor oil, excess fertilizers, and other pollutants as it makes its way into natural waters.

#### 4.1.2.5 Dry Weather Screening

Stormwater outfalls are inspected to detect illicit sewer connections and other potential pollution sources. The City screens a minimum of 50 stormwater outfalls (i.e., stations) annually. Inspections include outfall inspection (or the station where tidal influence does not allow for outfall inspection), in situ sampling, source tracking, source identification, and property owner education or enforcement actions as necessary.

Starting in 2018, the City plans to enhance its program by screening an additional 50 stations annually—totaling 100.

#### 4.1.2.6 Sanitary Sewer Rehabilitation and Improvement Projects

The City continues to implement a sanitary sewer rehabilitation program, which includes repairing and resolving defects in the system that may cause SSOs. In addition to finding and repairing defects, the City investigates locations (usually older developments) where the sanitary sewer is located above a storm sewer. These locations have a higher chance of sewage exfiltration into the storm drain. The City also has a capital improvement program for replacement of older sanitary sewer systems throughout the City to address aging infrastructure.

### 4.1.3 Above and Beyond Permit Requirements

The following non-structural practices are not required by the permit. These were identified to further reduce pollution.

#### 4.1.3.1 Septic-to-Sewer Conversions

Failing septic systems are a potential source of poorly treated or untreated sewage either into the storm sewer system or directly to receiving waters. The City implements a septic-to-sewer conversion program and provides funding to install sanitary sewers in existing developments that are currently being served by septic systems.

#### 4.1.3.2 Education and Outreach for Boaters on Proper Disposal Practices

The City installed and maintains two boat pump-out stations located at the Lynnhaven Marina and Rudee Inlet Boat Launch. These stations are provided so that recreational vehicles can dispose of sanitary waste in a manner that does not pollute waterways. The City performs education and outreach to residents to promote the use of these facilities over dumping and that they are free of charge.

The City also promotes the use of the Boater Pump Out Program for proper disposal of boat waste. The Boater Pump Out Program is also free to residents and is paid for by the Hampton Roads

Sanitation District, the Virginia Department of Health and the City of Virginia Beach. The emphasis on this program is to promote awareness of how bacteria affects our recreational use of the waters.

#### 4.1.3.3 Prohibit the Feeding of Waterfowl on Public Lands

The City implemented an ordinance that prohibits citizens from feeding any wildlife on public property. Wildlife includes all species of wild animals, wild birds, freshwater fish, and waterfowl. The ordinance is intended to discourage wildlife, specifically waterfowl, from residing in City water bodies, thereby reducing the chance that waterfowl fecal bacteria enter the water body.

## 4.2 Structural BMPs

This section describes current structural BMPs (stormwater management facilities [SWMFs]) treating the MS4 service area. In contrast with the non-structural practices discussed above, structural practices are physical elements installed or modified in the environment to restrict or contain bacteria sources or manage stormwater.

The City's MS4 Program Plan identifies potential structural BMPs for implementation. Implementing structural BMPs will also provide progress toward meeting the bacteria WLAs described in this Action Plan. Refer to Appendix C of the MS4 Program Plan for the current list of potential structural BMPs.

The following sub-section documents the structural practices implemented since the bacteria modeling data described in each of the TMDL reports. The data describing the facilities was collected on October 12, 2017.

### 4.2.1 Back Bay, North Landing River, and Pocaty River TMDLs

Modeling was completed for the Back Bay, North Landing River, and Pocaty River TMDLs in February 2013, and the U.S. Environmental Protection Agency (EPA) approved the TMDL report on June 26, 2014. The sub-sections below summarize the SWMFs implemented in the TMDL watersheds since February 2013.

#### Ashville Bridge and Muddy Creek

There are 11 SWMFs in the Ashville Bridge and Muddy Creek watershed treating stormwater from the MS4 service area. Table 4-1 shows the SWMF type, count, total drainage area treated, and MS4 service area treated.

This MS4 service area is 1,298 acres. Approximately 71 acres of the MS4 service area are treated by SWMFs installed since the TMDL, which equates to 5 percent of the MS4 service area being treated.

**Table 4-1. SWMF Summary: Ashville Bridge and Muddy Creek Watershed**

| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
|---|---|---|---|
| Infiltration structural BMPs | 3 | 1.4 | 1.4 |
| Permeable pavement | 1 | 12.5 | 12.5 |
| Wet pond | 7 | 66.6 | 57.4 |
| Total | 11 | 80.5 | 71.3 |

### Beggars Bridge Creek

There are currently no SWMFs in the Beggars Bridge Creek watershed treating stormwater from the MS4 service area. The MS4 service area in the Beggars Bridge Creek watershed is 396 acres, of which none are being treated by SWMFs installed since the TMDL.

### Hell Point Creek, Lower and Upper

There are 27 SWMFs in the Hell Point Creek, Lower and Upper watershed treating stormwater from the MS4 service area. Table 4-2 shows the SWMF type, count, total drainage area treated, and MS4 service area treated.

This MS4 service area is 3,117 acres. Approximately 51 acres of the MS4 service area are treated by SWMFs installed since the TMDL, which equates to 2 percent of the MS4 service area being treated.

**Table 4-2. SWMF Summary: Hell Point Creek, Lower and Upper Watershed**

| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
|---|---|---|---|
| Bioretention | 1 | 1.0 | 1.0 |
| Extended detention pond | 2 | 3.9 | 2.9 |
| Filtering manufactured device | 3 | 1.0 | 1.0 |
| Hydrodynamic manufactured device | 2 | 2.1 | 2.0 |
| Infiltration structural BMPs | 5 | 7.1 | 3.1 |
| Permeable pavement | 4 | 2.8 | 1.4 |
| Wet pond | 10 | 48.9 | 40.0 |
| Total | 27 | 66.8 | 51.4 |

### North Landing River

There are 40 SWMFs in the North Landing River watershed treating stormwater from the MS4 service area. Table 4-3 shows the SWMF type, count, total drainage area treated, and MS4 service area treated.

This MS4 service area is 8,456 acres. Approximately 240 acres of the MS4 service area are treated by SWMFs installed since the TMDL, which equates to 3 percent of the MS4 service area being treated.

**Table 4-3. SWMF Summary: North Landing River Watershed**

| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
|---|---|---|---|
| Bioretention | 5 | 4.2 | 4.2 |
| Extended detention pond | 5 | 11.3 | 11.3 |

| Table 4-3. SWMF Summary: North Landing River Watershed | | | |
|---|---|---|---|
| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
| Filtering manufactured device | 9 | 4.2 | 3.5 |
| Hydrodynamic manufactured device | 2 | 17.1 | 17.0 |
| Infiltration structural BMPs | 2 | 3.0 | 0.9 |
| Permeable pavement | 1 | 6.2 | 6.1 |
| Wet pond | 16 | 221.9 | 197.3 |
| Total | 40 | 267.9 | 240.3 |

**Pocaty River**

There are currently no SWMFs in the Pocaty River watershed treating stormwater from the MS4 service area. The MS4 service area in the Pocaty River watershed is 62 acres, of which none are being treated by SWMFs installed since the TMDL.

### 4.2.2 Coastal Area TMDLs

Modeling was completed for the Coastal Area TMDLs in March 2004, and EPA approved the TMDL report on September 27, 2005. The sub-sections below summarize the SWMFs implemented in the TMDL watersheds since March 2004.

**London Bridge Creek and Canal 2**

There are 201 SWMFs in the London Bridge Creek and Canal 2 watershed treating stormwater from the MS4 service area. Table 4-4 shows the SWMF type, count, total drainage area treated, and MS4 service area treated.

This MS4 service area is 4,332 acres. Approximately 325 acres of the MS4 service area is treated by SWMFs installed since the TMDL. This equates to 8 percent of the MS4 service area being treated.

| Table 4-4. SWMF Summary: London Bridge Creek and Canal 2 Watershed | | | |
|---|---|---|---|
| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
| Bioretention | 11 | 8.0 | 5.3 |
| Constructed wetlands | 2 | 1.1 | 1.1 |
| Extended detention pond | 57 | 122.2 | 73.2 |
| Filtering manufactured device | 40 | 28.8 | 19.1 |
| Hydrodynamic manufactured device | 23 | 29.6 | 26.1 |
| Infiltration structural BMPs | 29 | 34.5 | 26.9 |

| Table 4-4. SWMF Summary: London Bridge Creek and Canal 2 Watershed | | | |
|---|---|---|---|
| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
| Permeable pavement | 4 | 4.8 | 1.7 |
| Wet pond | 35 | 378.8 | 172.1 |
| Total | 201 | 607.8 | 325.5 |

**West Neck Creek, Upper**

There are 131 SWMFs in the West Neck Creek, Upper watershed treating stormwater from the MS4 service area. Table 4-5 shows the SWMF type, count, total drainage area treated, and MS4 service area treated.

This MS4 service area is 3,758 acres. Approximately 608 acres of the MS4 service area are treated by SWMFs installed since the TMDL, which equates to 16 percent of the MS4 service area being treated.

| Table 4-5. SWMF Summary: West Neck Creek, Upper Watershed | | | |
|---|---|---|---|
| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
| Bioretention | 7 | 29.1 | 7.8 |
| Extended detention pond | 40 | 107.9 | 83.3 |
| Filtering manufactured device | 25 | 8.0 | 7.4 |
| Infiltration structural BMPs | 16 | 11.8 | 10.4 |
| Permeable pavement | 1 | 3.8 | 1.0 |
| Sheet flow to a vegetated filter strip or conserved open space | 1 | 7.8 | 1.1 |
| Wet pond | 41 | 710.4 | 497.3 |
| Total | 131 | 878.8 | 608.3 |

### 4.2.3 Lynnhaven Bay, Broad Bay, and Linkhorn Bay TMDLs

Modeling was completed for the Lynnhaven Bay, Broad Bay, and Linkhorn Bay TMDLs in February 2003, and EPA approved the TMDL report on August 5, 2004. The sub-sections below summarize the SWMFs implemented in the TMDL watersheds since February 2003.

**Broad Bay, Long Creek, and Linkhorn Bay**

There are 208 SWMFs in the Broad Bay, Long Creek, and Linkhorn Bay watershed treating stormwater from the MS4 service area. Table 4-6 shows the SWMF type, count, total drainage area

treated, and MS4 service area treated. This MS4 service area is 3,296 acres. Approximately 203 acres of the MS4 service area are treated by SWMFs installed since the TMDL, which equates to 6 percent of the MS4 service area being treated.

**Table 4-6. SWMF Summary: Broad Bay, Long Creek, and Linkhorn Bay Watershed**

| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
|---|---|---|---|
| Bioretention | 42 | 8.6 | 6.2 |
| Extended detention pond | 49 | 134.8 | 112.4 |
| Filtering manufactured device | 30 | 17.2 | 14.9 |
| Hydrodynamic manufactured device | 19 | 19.3 | 9.8 |
| Infiltration structural BMPs | 42 | 27.4 | 25.1 |
| Permeable pavement | 20 | 4.3 | 4.3 |
| Wet pond | 6 | 62.8 | 30.5 |
| Total | 208 | 274.4 | 203.2 |

### Lynnhaven Bay

There are 289 SWMFs in the Lynnhaven Bay watershed treating stormwater from the MS4 service area. Table 4-7 shows the SWMF type, count, total drainage area treated, and MS4 service area treated. This MS4 service area is 10,979 acres. Approximately 515 acres of the MS4 service area are treated by SWMFs installed since the TMDL, which equates to 5 percent of the MS4 service area being treated.

**Table 4-7. SWMF Summary: Lynnhaven Bay Watershed**

| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
|---|---|---|---|
| Bioretention | 16 | 12.1 | 7.0 |
| Dry swales | 1 | 3.5 | 1.7 |
| Extended detention pond | 49 | 182.4 | 158.0 |
| Filtering manufactured device | 60 | 66.6 | 56.2 |
| Grass channels | 2 | 1.6 | 1.2 |
| Hydrodynamic manufactured device | 24 | 43.3 | 36.1 |
| Infiltration structural BMPs | 102 | 116.2 | 84.5 |
| Permeable pavement | 13 | 10.4 | 6.1 |
| Wet pond | 19 | 215.0 | 161.7 |

| Table 4-7. SWMF Summary: Lynnhaven Bay Watershed | | | |
|---|---|---|---|
| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
| Wet swales | 3 | 6.4 | 2.9 |
| Total | 289 | 657.5 | 515.4 |

### 4.2.4 Elizabeth River TMDL

Modeling was completed for the Elizabeth River TMDLs in June 2009, and EPA approved the TMDL report on July 20, 2010. This section summarizes the SWMFs implemented in the TMDL watershed since June 2009. There are 96 SWMFs in the Elizabeth River watershed treating stormwater from the MS4 service area. Table 4-8 shows the SWMF type, count, total drainage area treated, and MS4 service area treated. This MS4 service area is 6,739 acres. Approximately 193 acres of the MS4 service area are treated by SWMFs installed since the TMDL, which equates to 3 percent of the MS4 service area being treated.

| Table 4-8. SWMF Summary: Elizabeth River Watershed | | | |
|---|---|---|---|
| SWMF Type | Count | Combined Drainage Area (ac) | MS4 Service Area Treated (ac) |
| Bioretention | 10 | 13.4 | 13.3 |
| Constructed wetlands | 2 | 36.0 | 0.1 |
| Dry swales | 4 | 2.6 | 2.6 |
| Extended detention pond | 14 | 36.2 | 34.9 |
| Filtering manufactured device | 25 | 22.0 | 18.6 |
| Grass channels | 2 | 1.0 | 1.0 |
| Hydrodynamic manufactured device | 13 | 8.7 | 5.0 |
| Infiltration structural BMPs | 11 | 10.3 | 9.9 |
| Permeable pavement | 3 | 2.0 | 2.0 |
| Wet pond | 12 | 138.5 | 105.6 |
| Total | 96 | 270.7 | 193.0 |

### 4.2.5 Stormwater Management Facility Summary

Table 4-9 summarizes the structural BMP data presented in Section 4.2. The total number of SWMFs and the drainage area served by these facilities are also shown.

The percentage of MS4 area treated ranges from 0 percent in the Beggars Bridge Creek and Pocaty River watersheds to 16 percent in the West Neck Creek, Upper watersheds.

| Table 4-9. Current SWMF Count and Drainage Area | | | | |
|---|---|---|---|---|
| TMDL Watershed | Count | SWMF Combined Drainage Area (ac) | MS4 Service Area Treated (ac) | MS4 Service Area Treated (percent) |
| Ashville Bridge Creek and Muddy Creek | 11 | 80 | 71 | 5 |
| Beggars Bridge Creek | 0 | 0 | 0 | 0 |
| Broad Bay, Long Creek, and Linkhorn Bay | 208 | 274 | 203 | 6 |
| Elizabeth River | 96 | 271 | 193 | 3 |
| Hell Point Creek, Upper and Lower | 27 | 67 | 51 | 2 |
| London Bridge Creek and Canal 2 | 201 | 608 | 325 | 8 |
| Lynnhaven Bay | 289 | 657 | 515 | 5 |
| North Landing River | 40 | 268 | 240 | 3 |
| Pocaty River | 0 | 0 | 0 | 0 |
| West Neck Creek, Upper | 131 | 879 | 608 | 16 |
| Total | 1,003 | 3,104 | 2,206 | - |

The City's MS4 service area composes varying proportions of these watersheds; therefore, installing structural BMPs may have varying degrees of effectiveness for overall bacteria load reduction depending on the watershed where they are implemented.

For example, although the City currently has no structural BMPs in place in the Pocaty River watershed, the MS4 area composes less than 1 percent of that watershed, so structural BMPs installed there might never show an effect in the overall bacteria loadings to that river. At the other end of the spectrum, the City's MS4 area composes 50 percent of the London Bridge Creek and Canal 2 watershed, with structural BMPs in place providing stormwater management for roughly 8 percent of that area. Further, based on SWMF type, structural BMPs in that watershed can be presumed to have a proportionately greater potential effect on loadings than for some of the other watersheds.

Also, based solely on the proportions of the various watersheds within the MS4 area, installing additional structural BMPs in West Neck Creek, Upper (43 percent within MS4), Lynnhaven Bay (41 percent within MS4), Broad Bay and Linkhorn Bay (36 percent within MS4), and Hell Point Creek, Upper and Lower (31 percent within MS4) can be expected to have a larger proportional effect on the TMDL water bodies than the other watersheds.

Note that structural BMPs may still be appropriate and desirable in other watersheds. Most structural BMPs also yield other water quality and/or stormwater management benefits besides bacteria control.

### 4.2.6 Meadow Management (Riparian Buffer Grass/Shrub)

The City implemented a meadow management program whereby select locations adjacent to waterways are managed to help encourage meadow grass growth. Meadow management is a method of converting manicured lawn to meadows to provide a buffer to protect waterways while also establishing more efficient maintenance. Meadow management limits woody vegetation growth by biennial mowing, while allowing grassy, native vegetation to establish. These buffers provide filtering of stormwater runoff prior to entering waterways. As an added benefit, meadows adjacent to waterways also discourage certain waterfowl (e.g., as geese) from coming onshore and depositing fecal matter.

The City will evaluate the areas established under the meadow management program to determine the acreage provided adjacent to waterbodies in each of the impaired watersheds. Other locations for meadow management or installation of riparian buffers will also be evaluated.

## 4.3 BMP Effectiveness

Numeric bacteria reductions have not been calculated for the City's structural and non-structural management practices because limited data are available to document the effectiveness of non-structural BMPs on bacteria reduction.

One available resource is Appendix A of the *Guidance Manual for TMDL Implementation Plans* (DEQ 2017). Appendix A of this guidance manual lists the effectiveness of some of the BMPs described above. Tables 4-10 and 4-11 summarize the non-structural and structural BMP data found in Appendix A of the *Guidance Manual for TMDL Implementation Plans* (DEQ 2017).

Current data documenting the effectiveness of non-structural and structural BMPs to reduce bacteria are limited. Significantly more studies and representative data are needed for all SWMF types to increase the confidence of performance estimates regarding fecal indicator bacteria (FIB) (Urban Water Resources Research Council 2014). The City will evaluate the structural and non-structural practices that are being implemented to estimate efficiencies for these BMPs that are not listed in Tables 4-10 and 4-11. This data will be updated in the future as more data and/or research become available.

Hundreds of SWMFs have been installed throughout the City. SWMFs have varying abilities to reduce bacteria depending upon the type of SWMF, location, and ambient conditions. Because research is limited on removal rates for specific SWMF types, and because results can be highly variable considering location and ambient conditions, the City will track the number and type of SWMFs implemented, and the drainage area treated by the SWMFs.

| Table 4-10. Bacteria Reduction Efficiency: Non-Structural BMPs | |
|---|---|
| Non-Structural BMPs | Estimated Reduction Efficiency (percent) |
| Alternative waste treatment system | 100 |
| Connection to public sewer | 100 |
| Septic system pump-out | 5 |
| Repair septic system | 100 |
| Septic system installation/replacement | 100 |
| Pet waste disposal station | 75 |
| Pet waste management program | 50–70 |

| Table 4-11. Bacteria Reduction Efficiency: Structural BMPs | | |
|---|---|---|
| Structural BMP | Unit | Estimated Reduction Efficiency (percent) |
| Streambank protection and stabilization (e.g., riprap, gabions) | Linear foot | 0.075 |
| Infiltration trench | Per treated acre | 90 |
| Bioretention | Per treated acre | 90 |
| Rain garden | Per treated acre | 80 |
| Bioswale | Per treated acre | 80 |
| Filtering practice (e.g., sand filters) | Per treated acre | 35 |
| Constructed wetland | Per treated acre | 80 |
| Manufactured BMPs | Per treated acre | 80 |
| Wet pond | Per treated acre | 70 |
| Dry detention pond | Per treated acre | 30 |
| Riparian buffer: forest | Per treated acre | 57 |
| Riparian buffer: grass/shrub | Per treated acre | 50 |
| Urban land use conversion: turf to trees | Per treated acre | LU conversion |
| Rainwater harvesting | Per treated acre | LU conversion |
| Wetland restoration | acre | varies |

*LU = land use.*

Section 5

# Assessment of City Facilities

The City has evaluated all of the facilities owned or operated by the City to determine if any of the facilities may be a significant source of bacteria. A facility may be a significant source when the expected pollutant loading is greater than the average allocated pollutant load for the land use identified in the TMDL (DEQ 2016b). The TMDL reports document that points sources, septic systems, livestock, wildlife, and pets are sources of bacteria. In an urban area, humans, wildlife, and pets can be a source.

Because the pollutant of concern is bacteria, locations where fecal matter has the potential concentrate were reviewed. Facilities that were considered include dog parks, dog and equine training facilities, parks or trail systems where dogs may be walked or where waterfowl tend to congregate, and municipal facilities still served by septic systems.

The City has three dog parks within the City. These are located at Bayville Park, Woodstock Cove Park, and Red Wing Park. Each of these facilities require a dog park pass to use the facility and pet waste stations are located immediately adjacent to the parks. The City maintains these parks including routine park cleanup and maintenance.

The City also has several large parks and trail systems that may be a significant source of bacteria due to higher than average dog traffic. Pet waste stations are installed and maintained at these high dog traffic locations. These facilities will be further evaluated to determine if there is an adequate number of pet waste stations installed at each of these. The City also addresses human waste sources at parks by providing either permanent or temporary restroom facilities for visitors. For example, the Stumpy Lake Natural Area has a portable toilet and dog waste bag station located at the entrance to the trail system. Both of these are maintained by the City.

For parks and trail systems with, or adjacent to, open water, an ordinance is in place that prohibits feeding waterfowl. Signs are posted adjacent to open water stating not to feed the geese or ducks. The City also has a meadow management program that discourages the congregation of waterfowl using tall grasses adjacent to open water.

Facilities that have an animal care component were also identified for further assessment. The Virginia Beach Animal Care and Adoption Center is located at 341 S. Birdneck Road. The shelter is inspected annually by the Department of Agriculture and has been found to be 100% compliant on each annual inspection since opening in December 2011. The shelter impounds about 7,000 animals annually. The Police Special Operations have two work groups that involve animals. The Canine Unit and the Mounted Patrol. The Canine Unit has a training facility located at 2674 Leroy Road. The Mounted Patrol have a facility for their horses located at 2089 Indian River Road. This facility manages the manure generated by the horses using a forced air compost facility at this location.

The following City owned facilities were identified using a GIS data analysis to have the potential to be served by a septic system. These facilities will require further evaluation to determine if they have an active septic system.

- Lynnhaven House at 4405 Wishart Road
- Public Works Pungo Yard at 1848 Pleasant Ridge Road

## Section 6

# Legal Authority for TMDL Implementation

The permit indicates the City should develop and maintain a list of legal authorities applicable to reduce the pollutant of concern. The City has reviewed its current MS4 Program Plan, and determined that the authority as stated in the current MS4 Program Plan is sufficient for compliance with Action Plan requirements. Therefore, no new or modified legal authority is necessary.

The ordinances applicable to the bacteria TMDL Action Plan are listed below.

**Legal authority to control discharges to and from the MS4:**

- Chapter 6: "Beaches, Boats, and Waterways"
- Chapter 28: "Sewers and Sewage Disposal"
- Chapter 30: "Soil Removal, Other Land Disturbing Activities"
- Chapter 31: "Solid Waste"
- Appendix H: "Storm Sewer Discharge Ordinance"

**Ordinance(s) that require compliance with MS4 discharge regulation:**

- Chapter 6: "Beaches, Boats, and Waterways," Section 6-1. (violations of chapter generally) Section 6-29 (appointment of persons to enforce article I)
- Chapter 28: "Sewers and Sewage Disposal," Section 28-70 (Violations and Penalties) Section 28-70.1 (Civil Penalties) scheduled violations
- Chapter 30: "Soil Removal, Other Land Disturbing Activities," Section 30.75 (penalty for violation of article)
- Chapter 31: "Solid Waste," Section 31-2 (administration and enforcement of chapter) Section 31-2.1 (notice of violation, summons—authority to issue) Sec. 31-2.2 (notice of violation, summons—method of issuance) Section 31-3 (violations of chapter) Section 31-3.1 (civil penalties) Section 31-10 (unlawful storage and deposits generally) littering
- Appendix H: "Storm Sewer Discharge Ordinance," Section 7 (penalties)

**Ordinance(s) specifying City authority to carry out inspection, surveillance, and monitoring procedures:**

- Chapter 28: "Sewers and Sewage Disposal," Section 28 -69 (inspections)
- Chapter 30: "Soil Removal, Other Land Disturbing Activities," Section 30-62 (right of entry)
- Appendix H: "Storm Sewer Discharge Ordinance," Section 6 (inspections and monitoring)

**Ordinance(s) prohibiting discharges to the MS4 which are not authorized by the permit:**

- Appendix H: "Storm Sewer Discharge Ordinance," Section 7 (penalties)

**Ordinance(s) prohibiting dumping of used motor vehicle fluids, household hazardous wastes, sanitary sewage, grass clippings, leaf litter, and animal wastes into the MS4:**

- Chapter 5: "Animals and Fowl," Section 5-534 (allowing dogs or horses to urinate or defecate on public or another person's private property)
- Chapter 5: "Animals and Fowl," Section 5-547 (feeding wildlife on publicly owned property)
- Chapter 6: "Beaches, Boats, and Waterways," Section 6-5(g) (pet waste prohibitions and control)
- Chapter 28: "Sewers and Sewage Disposal," Section 28-66 (prohibited discharges)
- Chapter 31: "Solid Waste," Section 31-10 (unlawful storage and deposits generally) littering
- Appendix H: "Storm Sewer Discharge Ordinance," Section 5 (prohibitions)

## Section 7

# Enhancements to Programs

The permit specifies enhancing public education and outreach and employee training programs to target the pollutant of concern. In addition to the current programs that the City is implementing as described in Section 4.1, the City plans to consider several other programs to implement in future permit terms. The City will evaluate these programs and identify three program enhancements during this permit cycle. The three new programs selected will be implemented and evaluated for effectiveness using an adaptive iterative approach. Based on the evaluation of effectiveness, some programs may not continue forward into future permit cycles and others may be added throughout the implementation of this Action Plan.

The list of programs, along with brief descriptions, is included below.

**Geese Management Program**

A geese management program may include alternative methods to geese management, as referenced in *Pathogens in Urban Stormwater Systems* (Urban Water Resources Research Council 2014). Management techniques include habitat modification, deterrence measures, dispersion measures, chemical repellents, reproductive controls, and relocation.

**Targeted Waste Management Outreach for Stables, Kennels, and Livestock Farms**

Stables, kennels, and livestock farms represent a potential source of concentrated amounts of animal fecal matter. An education and outreach program may be developed to target these facilities. The program would focus on proper techniques for waste storage and disposal to limit the potential for bacteria to reach the stormwater system.

**Promote Septic System Maintenance**

Septic systems, when not properly maintained, represent a direct source of human fecal bacteria. This education and outreach program would focus on proper maintenance of septic systems. The EPA promotes SepticSmart Week that contains an outreach toolkit that could be used to develop this program.

**Enhanced Pet Waste Management Outreach**

The City currently implements an enhanced pet waste program that includes educational materials, pet waste station installations, and media campaigns. Pet waste management education has a high the potential to provide significant reductions to the bacteria pollution in stormwater runoff. The City will consider additional strategies to expose more residents to educational messages about responsible pet ownership.

**Targeted Outreach on Reduction of Food Sources Accessible to Urban Wildlife**

The City will consider outreach targeted to reduce food sources to urban wildlife other than geese. Potential food sources for urban wildlife include gardens, garbage, domestic animals, and pet food.

### Implement a Rooftop Disconnection Program to Reduce Bacteria from Rooftops

The City currently encourages homeowners to consider rooftop disconnection through the various homeowner pledge programs. The City will consider additional avenues for educational programs to try to reach a larger audience.

### Targeted Outreach for Appropriate Recreational Vehicle Dumping Practices

Waste dumped from recreational vehicles is a direct source of human fecal bacteria. Because there are many camping and tourist locations within the City where recreational vehicles may be used, this could be an effective educational and outreach program directed toward anyone using a recreational vehicle. This program would target both visitors and residents of the City.

### Targeted Outreach to Discourage Residents from Feeding Waterfowl

The City currently enforces an ordinance that prohibits feeding waterfowl on public property. Additional educational components, such as signage and media campaigns, for the program will be considered.

### Inspection Program for Facilities with Potential Significant Pollution

There are types of businesses within the City that have the potential for a higher than average bacteria loading. These include pet supply retail stores, doggie day care facilities, pet grooming facilities, and restaurants with outdoor facilities. An inspection program could include the identification of facility types with a potential to have a higher than average bacteria loading and targeted education on good housekeeping practices that the facility may use to reduce the potential for bacteria to be discharged through the stormwater system.

## Section 8

# Implementation Schedule

BMPs and other interim milestone actives will be implemented during the remaining term of the MS4 permit to address reductions in bacteria. The City will continue to implement the ongoing programs (non-structural BMPs) identified in Section 4.

The potential program enhancements identified in Section 7 will be evaluated during this permit term. The three program enhancements selected for implementation in the next permit cycle will be identified in the annual report following completion of this milestone.

The proposed structural BMPs identified in the City's MS4 Program Plan will be implemented according to the schedule for each project. The project status information will be posted on the City's website and each annual report will contain a current web link. The City is in the process of identifying additional structural BMPs for implementation during this permit cycle. These will be included in the annual report once implementation has begun.

The permit requires an estimated end date for achieving the WLAs. The City estimates an end date of 40 to 50 years, or 8 to 10 permit cycles, to achieve the WLAs based on the limited data available regarding BMP efficiencies and measure of effectiveness at the time of this plan development.

The Local Guidance specifies that "Demonstration of adequate progress may be achieved through tracking, monitoring, and/or reporting of BMP implementation, and/or other strategies as approved by DEQ as part of the TMDL Action Plan." Updates to this plan are anticipated in future permit cycles. As the overall tracking process continues during this MS4 permit term, the City will have a better ability to document its progress. This will allow for the development of more definitive WLA achievement dates for individual facets of the Action Plan, and for the plan overall.

| Table 8-1. Implementation Schedule | |
|---|---|
| BMPs | Schedule / Milestone |
| Enhanced Pet Waste Education Program | Ongoing |
| Pet Waste Disposal Stations | Ongoing |
| Staff Training Program | Ongoing |
| Illicit Discharge Detection and Elimination Program | Ongoing |
| Sanitary Sewer Inspection | Ongoing |
| Sanitary Sewer Rehabilitation and Improvement Projects | Ongoing |
| Adopt-A-Drain Program | Ongoing |
| Storm Drain Marking Program | Ongoing |
| Enhanced Dry Weather Screening Program | Ongoing |
| Septic to Sewer Conversion Program | Ongoing |
| Education and Outreach for Boaters on Proper Disposal Practices | Ongoing |
| Prohibit the feeding of waterfowl on Public Lands | Ongoing |
| Assess City Facilities for significant pollution sources | 6/30/2019 |
| Evaluate potential program enhancements and identify three for the next permit cycle | 6/30/2020 |
| Identify potential structural BMPs for the next permit cycle | 12/30/2020 |
| Evaluate and Modify the estimated end date for achieving the WLA based on information obtained during this permit cycle | 12/30/2020 |

For planning purposes, the City will continue to implement the ongoing programs identified in the next permit term. These programs may be modified or enhanced based on the measurement of effectiveness in reducing bacteria in the watersheds. The three new and/or enhanced non-structural BMPs will be implemented during the next permit term. A variety of structural BMPs will continue to be implemented in the next permit term.

As required by the permit, and/or as appropriate, the City will update this Action Plan to reflect modifications to the non-structural BMPs described herein, as well as any new types of structural BMPs. An adaptive iterative approach will guide the City's program revision methodology.

## Section 9

# Methods of Assessment

The permit indicates that the City must develop and implement methods to assess the Action Plan for its effectiveness in reducing the pollutants identified in the waste load allocations and it should include an assessment of the facilities of concern.

The City will assess the effectiveness of its efforts by tracking and reviewing the BMPs documented in this Action Plan as part of the MS4 permit annual report. If during the review, bacteria concentrations are higher than that expected from a similar land use, the City will adopt an adaptive iterative approach to implementing through modification of ongoing BMPs or adding new BMPs.

The City will determine the effectiveness of their efforts by review of DEQ's ambient water quality data. DEQ has approximately 33 water quality monitoring stations throughout Virginia Beach. The BMPs identified in the plan are expected to be effective at reducing bacteria in the impaired watersheds. As these BMPs are implemented and water quality data is evaluated, the City will continue to review new sources of data and methods to determine if less effective BMPs could be replaced with new BMPs that may be more effective in reducing bacteria.

## Section 10

# Public Involvement Process

The City supported public involvement with the development of this document. A public information meeting was held on May 2, 2018 to discuss the City's TMDL action planning efforts. There were about 23 people in attendance at this meeting. The meeting initiated a three-week-long public comment period in May 2018 to allow the public and stakeholders to review the draft Action Plan. The draft plan was posted on the City's website at www.vbgov.com/stormwater-program.

There were no comments received during the comment period regarding this Action Plan.

## Section 11

# References

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DEQ. 2018. "Designated uses," accessed online at: http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityStandards/DesignatedUses.aspx (accessed January 26).

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MapTech, Inc. 2014. *Total Maximum Daily Load Development for the Back Bay, North Landing River, and Pocaty River Watersheds E. coli, and Enterococci Due to Recreation Use Impairments, and Total Phosphorus Due to Low Dissolved Oxygen in Aquatic Life Use Impairments,* May.

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Virginia State Water Control Board. 2011. 9 VAC 25-260: Virginia Water Quality Standards, https://www.epa.gov/sites/production/files/2014-12/documents/vawqs.pdf, January.