ROANOKE COUNTY
Total Maximum Daily Load (TMDL) Action Plan

For

Bacteria (E.coli) Reduction in the Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carvin Creek, and Lick Run

MS4 General Permit No. VAR040022
JULY 1, 2015

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I. EXECUTIVE SUMMARY

This Roanoke County Total Maximum Daily Load (TMDL) Action Plan for E.coli Reduction in the Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carvin Creek, and Lick Run (Bacteria Action Plan) has been prepared as required by Roanoke County's General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (General Permit No. VAR040022).

Roanoke County's strategy is to progressively implement Best Management Practices (BMPs) to decrease the amount of E.coli that enters County waters in order to meet Virginia state water quality standards for bacteria. Roanoke County will implement BMPs over multiple state permit cycles and demonstrate that adequate progress is being made to reduce E.coli discharges. As additional information is obtained from DEQ monitoring or other sources, an adaptive iterative approach will be used to modify BMPs implementation as appropriate.

Following is a tabulation of the BMPs that Roanoke County plans, at this time, to implement to decrease discharges of E.coli along with their planned implementation schedule. *Note that some of these BMPs are also effective in addressing the County's sediment wasteload allocations.

BMP Designation	BMP Name/Task	Implementation Dates
T-1*	Initial Streams Assessment and BMP Planning	Underway – Anticipated completion Aug 2018
T-2*	Enhanced Public Education and Outreach (Bacteria)	Underway
T-3*	Enhanced Employee Training (Bacteria)	Underway
T-4*	County Facilities Assessments and Corrections Screen Facilities/Schedule Assessments Perform 1/3 Assessments Perform 2/3 Assessments Perform all Assessments	 Completed By June 2015 By June 2016 By June 2017
T-5	Enhanced Illicit Discharge Detection and Elimination Program (Bacteria)	Begin July 2017
T-6*	Erosion and Sediment Control Enhanced Enforcement Evaluate Policies Implement Changes (If Needed)	 By June 2017 To Be Determined
T-7	Dog Waste Stations Determine Needs Install 20% Install 40% Install 60% Install 80% Install 100%	 By June 2016 By June 2017 By June 2018 By June 2019 By June 2020 By June 2021
T-8	Dog Waste Ordinance Research Ordinances and obtain Public Input Discuss with Board of Supervisors Prepare Ordinance for Board Consideration	 By June 2016 By Dec 2016 By June 2017

BMP Designation	BMP Name/Task	Implementation Dates (Start – Finish)
T-9	Onsite Sewage Disposal System Ordinance Research Ordinances and obtain Public Input Discuss with Board of Supervisors Prepare Ordinance for Board Consideration	 By June 2016 By Dec 2016 By June 2017
T-10*	Stream Buffers Research Ordinances Identify possibly Impacted Properties Obtain Public Input Discuss with Board of Supervisors Prepare Ordinance for Board Consideration	 By June 2017 By June 2017 By Dec 2017 By Dec 2017 By June 2018
*	Capital Improvements Identify Feasible Capital Projects Construction	 This will be an ongoing activity. Identify initial capital projects anticipated by July 2017 To Be Determined

***** Also included in the Roanoke County TMDL Action Plan for Sediment Reduction in the Roanoke River.

This Bacteria Action Plan has been prepared by Roanoke County staff and approved by the County Administrator. However, nothing in this Action Plan shall be construed as binding Roanoke County to any action until such time that the Roanoke County Board of Supervisors provides final approvals and/or appropriates funding for implementation.

This Plan commits to study, and consideration of new ordinances, but it does not commit the Board of Supervisors to adoption of any specific ordinance or requirement.

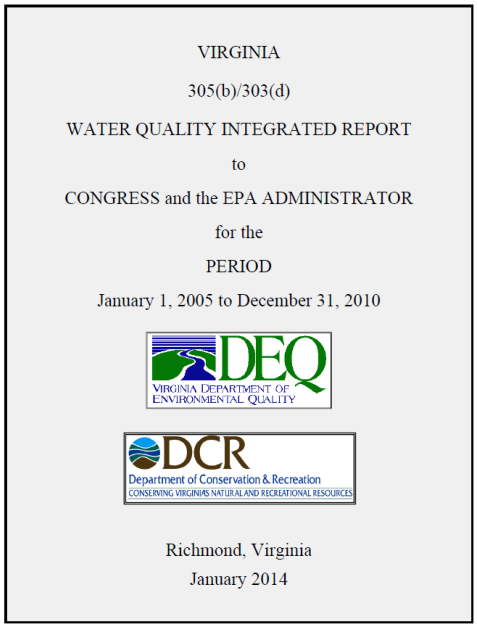
It is expected that this Bacteria Action Plan will be revised from time-to-time to add and/or delete proposed BMPs, revise estimated implementation dates, and to reflect new information. Revised Bacteria Action Plans will be submitted to DEQ with the MS4 Permit Program Annual Report that is due to DEQ by October 1 of each year.

II. BACKGROUND

A. General

The Virginia Department of Environmental Quality (DEQ) routinely monitors and tests the Commonwealth's waters (streams, rivers, lakes, and estuaries) to confirm that they meet Virginia's water quality standards (9 VAC 25-260-10). According to Virginia Water Quality Standards *"all state waters 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)."*

Where DEQ determines that a water does not meet Virginia's water quality standards, the water is termed "impaired". Impaired waters are listed on the Virginia Water Quality Assessment 305(b)/303(d) Integrated Report that is issued on even-number years to meet the requirements of the U.S. Clean Water Act sections 305(b) and 303(d) and the Virginia Water Quality Monitoring, Information and Restoration Act. *Roanoke County has 16 different streams, including the Roanoke River that have 28 identified impairments.*


VIRGINIA

305(b)/303(d)

WATER QUALITY INTEGRATED REPORT

to

CONGRESS and the EPA ADMINISTRATOR

for the

PERIOD

January 1, 2005 to December 31, 2010

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

DCR
Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

Richmond, Virginia

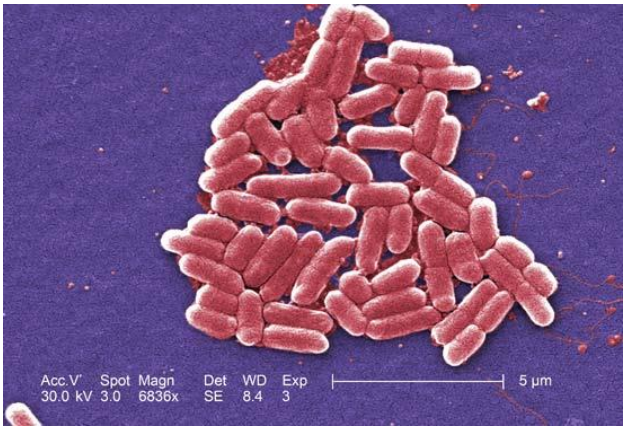
January 2014

DEQ performs studies on impaired waters to determine the "total maximum daily load" that the water can assimilate and still meet water quality standards. These studies are called TMDL studies. TMDL studies assign "waste load allocations" (WLAs) to permitted point sources of pollution. WLAs are numerical limits of a pollutant of concern that a permitted point source must meet by implementing appropriate strategies, or Best Management Practices (BMPs) using the adaptive iterative approach. BMPs may be implemented over multiple state permit cycles as long as adequate progress to reduce the pollutant of concern is documented.

Roanoke County has coverage under the Virginia General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4 Permit); General Permit No. VAR040022. Through this permit, all stormwater that passes through a County owned or operated storm drain or improved channel; and that are located within the urban parts of the County, as designated in the 2010 U.S. Census, are considered to be a point source discharge and are subject to WLAs, where appropriate.

Roanoke County has 10 streams, including the Roanoke River, located in its MS4 regulated area, and these have 13 TMDL WLAs. Of these WLAs, six are for E.coli. The six streams with E.coli WLAs are the Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carvin Creek, and Lick Run.

E.coli is a bacterium that is commonly found in the lower intestine of people and warm-blooded animals. It can survive for a limited time outside of the body, and it is used as an indicator organism for fecal contamination.



Section I.B. of the MS4 Permit requires Roanoke County to have an updated MS4 Program Plan that includes a specific TMDL Action Plan for pollutants allocated to the MS4 in approved TMDLs.

This specific TMDL Action Plan addresses reduction of E.coli discharged into the six streams with E.coli WLAs, and it is required by the MS4 permit to be prepared no later than July 1, 2015, and to be provided to the DEQ in the MS4 annual report due by October 1, 2015.

Although only 6 streams have E.coli WLAs, pollutant discharges into all the streams that are tributary to them must be decreased. Therefore, all of the Roanoke River's tributary streams in Roanoke County are impacted.

This TMDL Action Plan becomes effective and enforceable under Roanoke County's MS4 Permit 90-days after it is received by DEQ, unless DEQ specifically denies it in writing.

This Bacteria Action Plan has been prepared by Roanoke County staff and approved by the County Administrator. However, nothing in this Action Plan shall be construed as binding Roanoke County to any action until such time that the Roanoke County Board of Supervisors provides final approvals and/or appropriates funding for implementation.

Many of the proposed BMPs include new ordinances that require Board of Supervisors actions for adoption. This Plan commits to study and consideration of new ordinances, but does not commit the Board of Supervisors to adoption of any specific ordinance or requirement.

It is expected that this Bacteria Action Plan will be revised from time-to-time to add and/or delete proposed BMPs, revise estimated implementation dates, and to reflect new information. Revised Action Plans will be submitted to DEQ with the MS4 Permit Program Annual Report that is due to DEQ by October 1 of each year.

B. Watershed Descriptions

1. Roanoke River

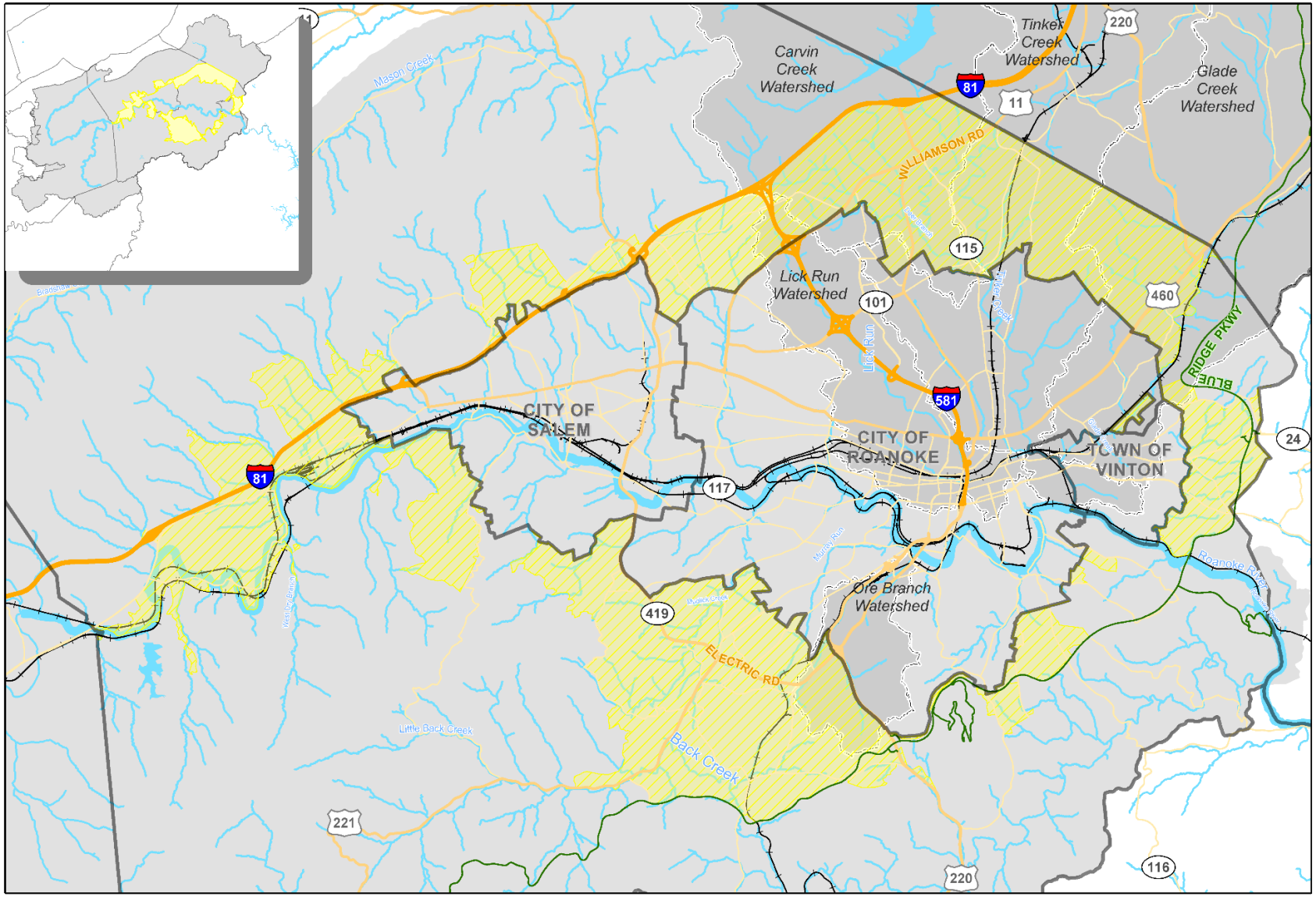
The Roanoke River originates in Montgomery County; flows through Roanoke County, Salem City, Roanoke City, Town of Vinton; then flows through Roanoke County again; and then into Bedford and Franklin Counties and Smith Mountain Lake.

All of Roanoke County, except for the northern part of the Catawba Valley, flows into the Roanoke River. Five streams flow into the Roanoke River that have their own E.coli WLAs – Tinker Creek, Carvin Creek, Lick Run, Glade Creek, and Ore Branch. For the purposes of this description, the watersheds of these five streams are nested within the Roanoke River

watershed. More detailed descriptions of the five tributary streams are contained further in this section.

Within Roanoke County, the watershed contains 50.5 square miles within the MS4 regulated area, and 174.4 square miles outside of the MS4 regulated area. There are approximately 13.2 miles of river, within the regulated MS4 area; and approximately 2.7 miles of river, outside of the regulated MS4 area. Within Roanoke County, the river is fed by approximately 122.2 miles of streams, with drainage areas of 100 acres or greater, within the regulated MS4 area; and approximately 315.5 miles of streams, with drainage areas of 100 acres or greater, outside of the regulated MS4 area. See Figure 1, Roanoke River Watershed Map.

See Figure 2, Roanoke River Monitoring Stations for locations of DEQ monitoring stations on the Roanoke River.



MS4 Area

Supplemental Watersheds

Roanoke River Watershed

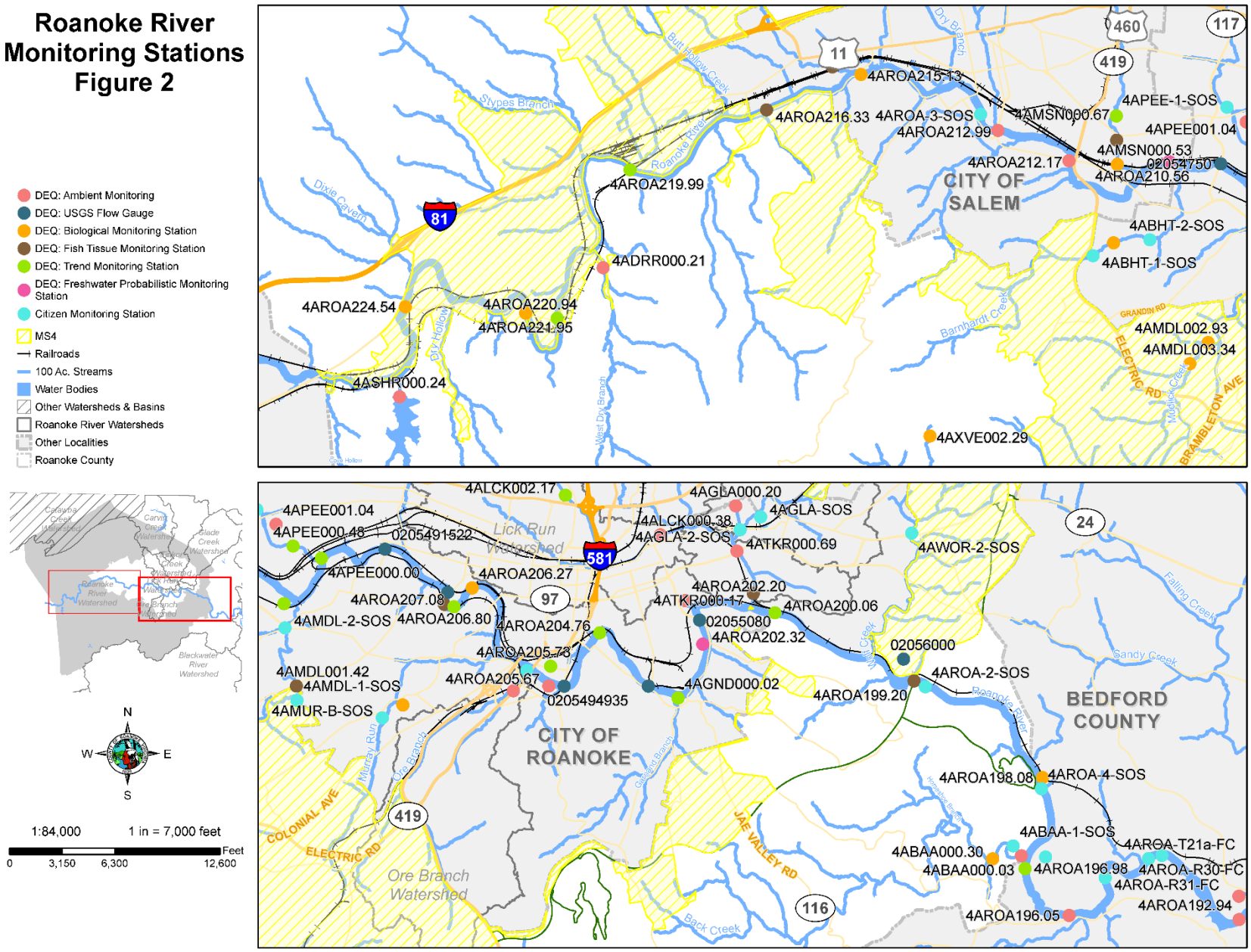
Roanoke River Watershed
Figure 1

1:126,720 1 in = 2 miles

0 1 2 4 Miles

N W E S

Roanoke River Monitoring Stations Figure 2

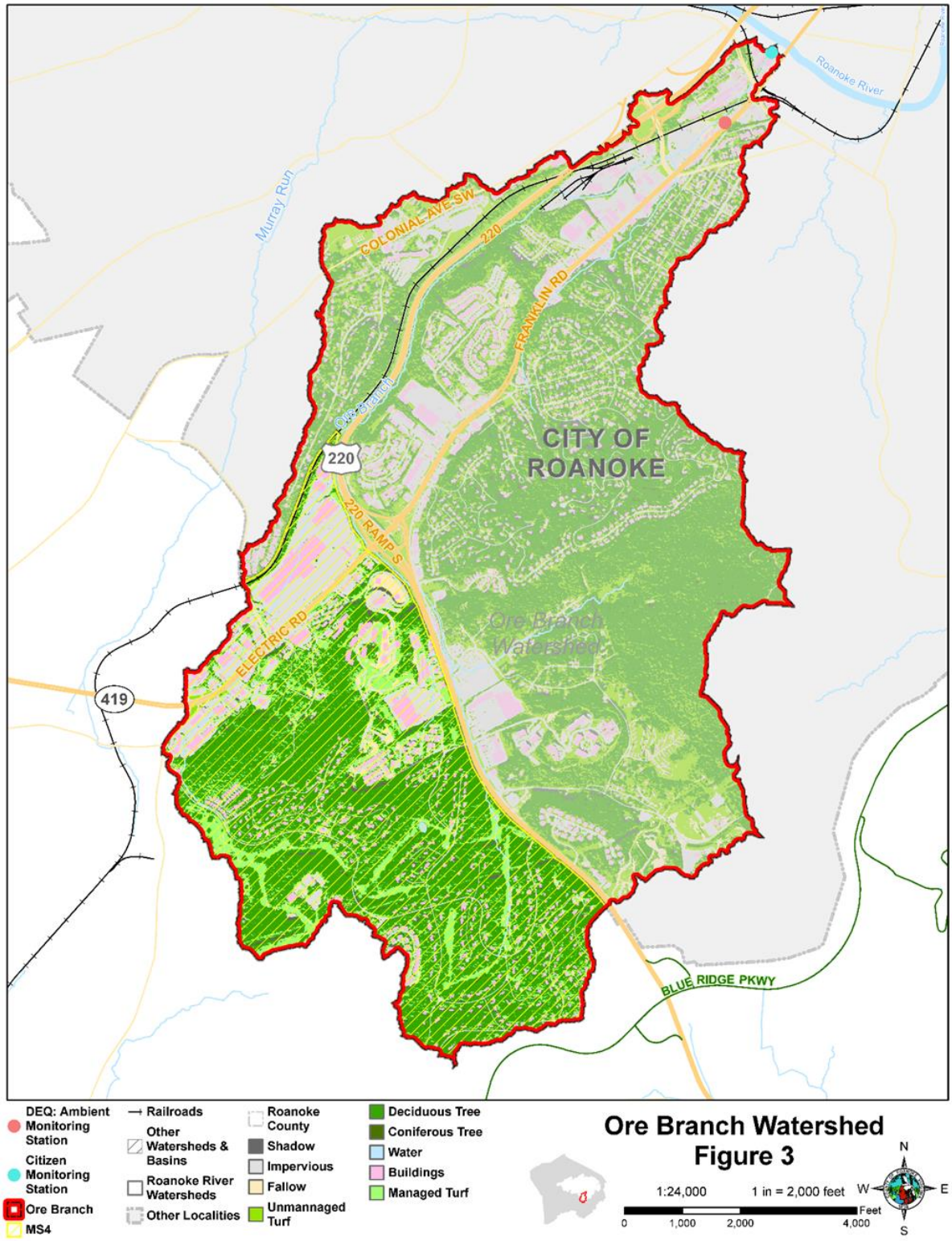


2. Ore Branch

Ore Branch originates in Roanoke County in the vicinity of Tanglewood Mall and Hunting Hills Subdivision. It then enters Roanoke City and flows alongside of the Roy L. Webber Expressway, to its discharge into the Roanoke River just upstream of the Franklin Road Bridge. The stream has been largely channelized and piped, with very little of the natural channel remaining.

Within Roanoke County, Ore Branch's 1.38 square mile watershed is totally contained within the County's MS4 regulated area. There are approximately 3.72 miles of stream, with drainage

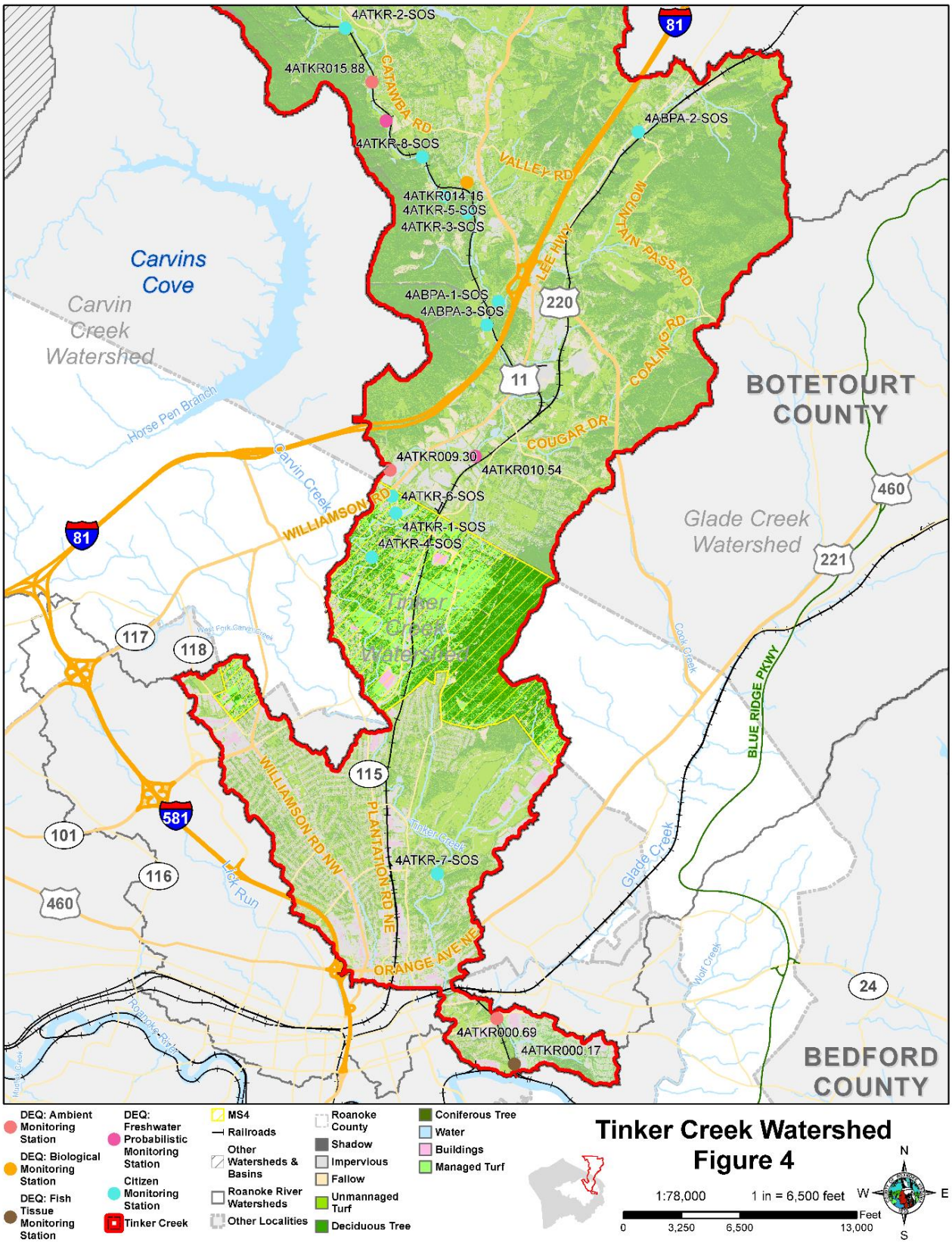
area of 100 acres or greater. See Figure 3, Ore Branch Watershed Map.



3. Tinker Creek

Tinker Creek originates in Botetourt County on Tinker Mountain, flows through the Hollins area of Roanoke County, then enters Roanoke City and discharges into the Roanoke River just downstream from the discharge from the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant. Tinker Creek forms the western boundary between the Town of Vinton and the City of Roanoke. Three streams flow into Tinker Creek that have their own E.coli WLAs – Carvin Creek, Lick Run, and Glade Creek. For the purposes of this description, these three streams will be addressed separately from Tinker Creek.

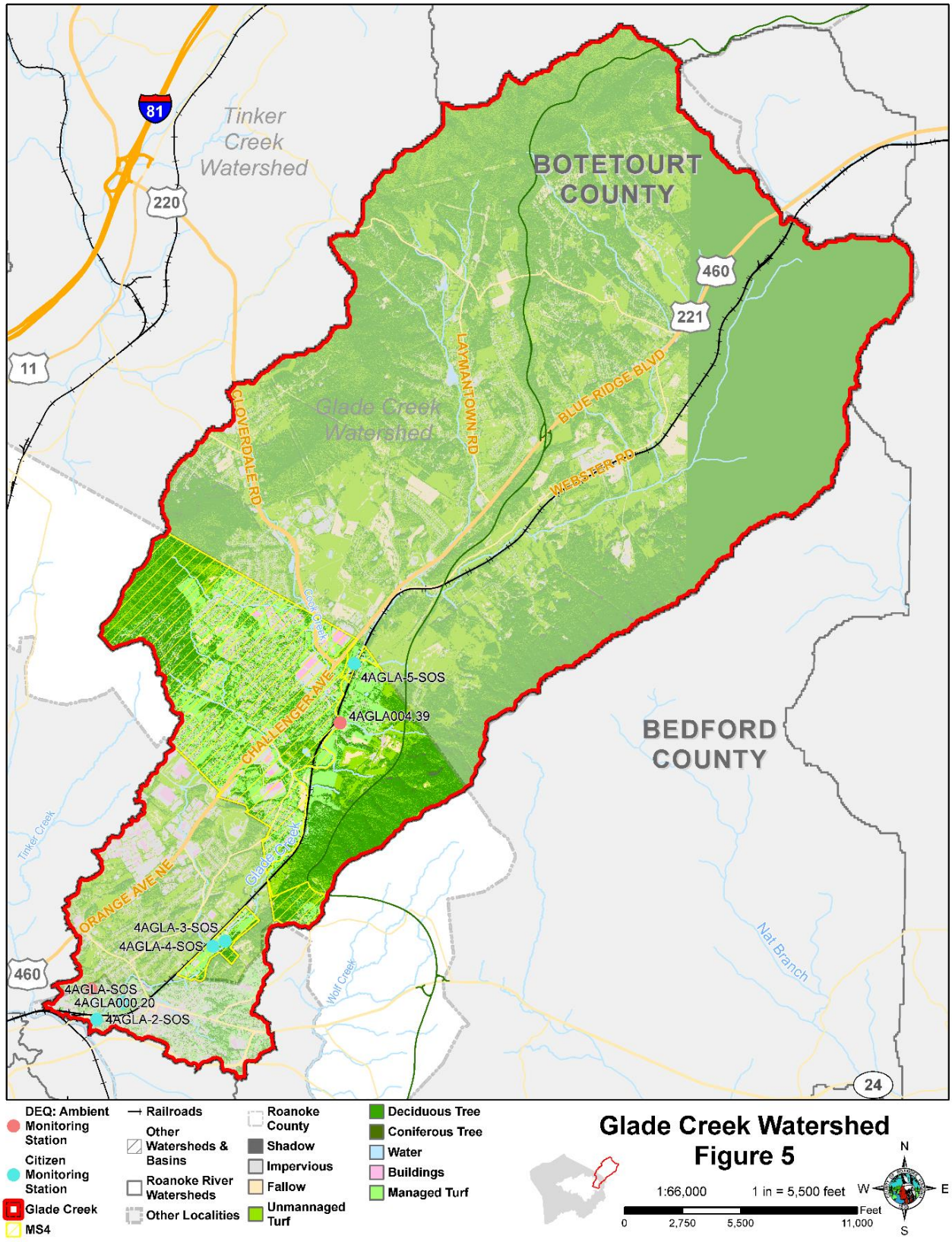
Within Roanoke County, Tinker Creek's 4.2 square mile watershed (excluding the before mentioned three streams) is totally contained within the County's MS4 regulated area. There are approximately 8.2 miles of stream, with drainage area of 100 acres or greater. See Figure 4, Tinker Creek Watershed Map.


4ATKR-2-SOS
4ATKR015.88
CATAWBA RD
4ATKR-8-SOS
4ABPA-2-SOS
VALLEY RD
4ATKR014.16
4ATKR-5-SOS
4ATKR-3-SOS
MOUNTAIN PASS RD
LEE HWY
Carvins Cove
Carvin Creek Watershed
4ABPA-1-SOS
4ABPA-3-SOS
220
COALING RD
11
BOTETOURT COUNTY
Horse Pen Branch
COUGAR DR
4ATKR009.30
4ATKR010.54
Carvin Creek
WILLIAMSON RD
4ATKR-6-SOS
4ATKR-1-SOS
4ATKR-4-SOS
460
Glade Creek Watershed
221
81
Turner Creek Watershed
117
118
West Fork Carvin Creek
Cook Creek
BLUE RIDGE PKWY
WILLIAMSON RD NW
PLANTATION RD NE
115
581
101
Tinker Creek
4ATKR-7-SOS
Glade Creek
116
Lick Run
460
ORANGE AVE NE
Wolf Creek
24
Roanoke River
4ATKR000.69
4ATKR000.17
BEDFORD COUNTY
DEQ: Ambient Monitoring Station
DEQ: Biological Monitoring Station
DEQ: Fish Tissue Monitoring Station
DEQ: Freshwater Probabilistic Monitoring Station
Citizen Monitoring Station
Tinker Creek
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Tinker Creek Watershed
Figure 4
1:78,000
1 in = 6,500 feet
Feet
0
3,250
6,500
13,000
N
W
E
S

4. Glade Creek

Glade Creek originates in Botetourt County near Curry Gap, flows through northeastern Roanoke County including Vinyard Park, a small portion of the City of Roanoke, northwestern Town of Vinton, and discharges into Tinker Creek across from Roanoke City's Fallon Park.

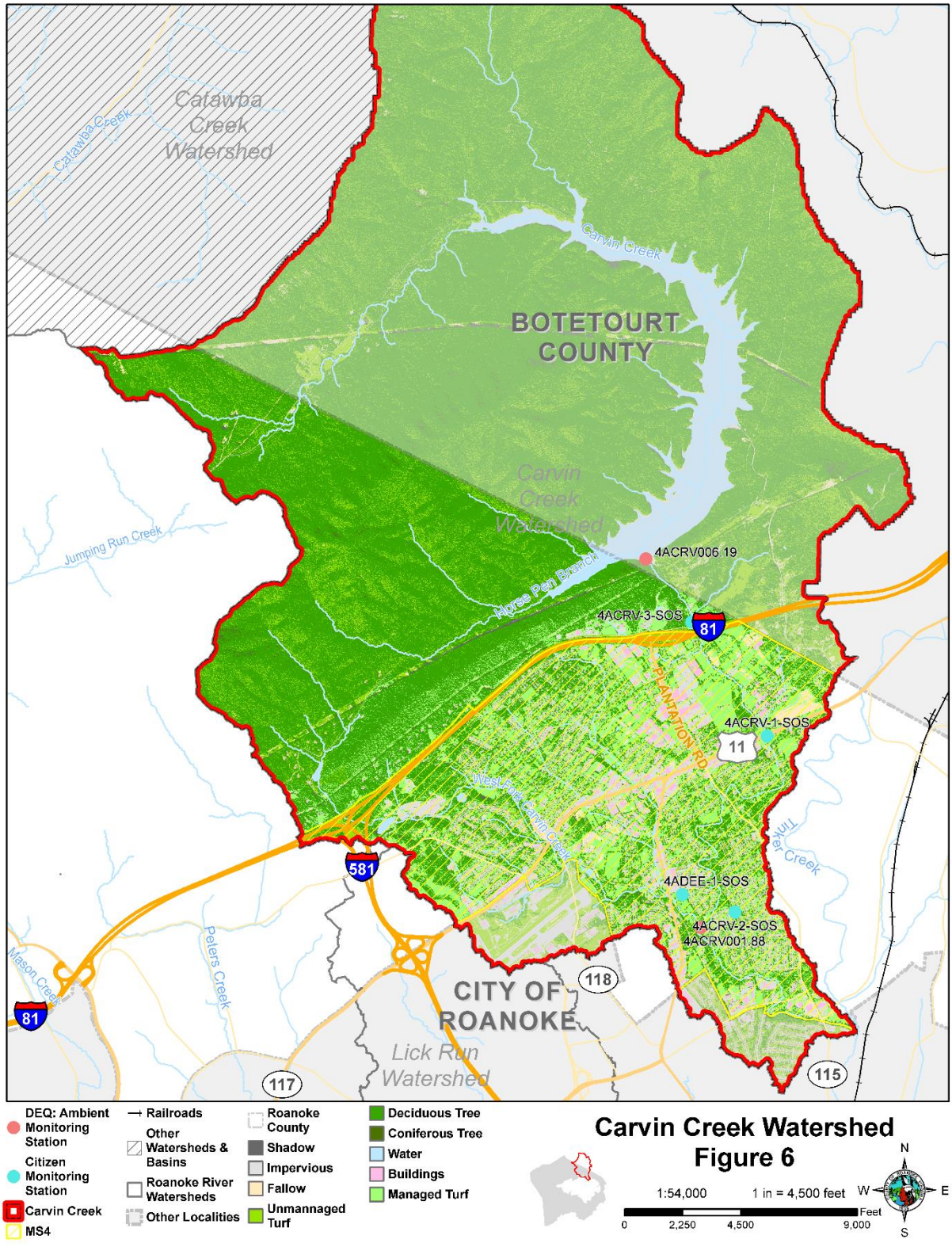
Within Roanoke County, the watershed contains 3.7 square miles within the MS4 regulated area, and 1.74 square miles outside of the MS4 regulated area. There are approximately 10.0 miles of stream, with drainage areas of 100 acres or greater, within the regulated MS4 area; and approximately 1.72 miles of stream, with drainage areas of 100 acres or greater, outside of the regulated MS4 area. See Figure 5, Glade Creek Watershed Map.


Tinker Creek Watershed
BOTETOURT COUNTY
BEDFORD COUNTY
Glade Creek Watershed
81
220
11
460
221
24
LAYMANTOWN RD
BLUE RIDGE BLVD
WEBSTER RD
CLOVERDALE RD
CHALLENGER AVE
ORANGE AVE NE
Cook Creek
Glade Creek
Tinker Creek
Wolf Creek
Nat Branch
4AGLA-5-SOS
4AGLA004.39
4AGLA-3-SOS
4AGLA-4-SOS
4AGLA-SOS
4AGLA000.20
4AGLA-2-SOS
DEQ: Ambient Monitoring Station
Citizen Monitoring Station
Glade Creek
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Glade Creek Watershed
Figure 5
1:66,000
1 in = 5,500 feet
Feet
0
2,750
5,500
11,000
N
S
W
E

5. Carvin Creek

Carvin Creek originates in Botetourt County on Tinker Mountain, flows through the Carvin Cove Reservoir, enters Roanoke County and flows through the Hollins area, and discharges into Tinker Creek near the intersection of Plantation Road and Hollins Road.

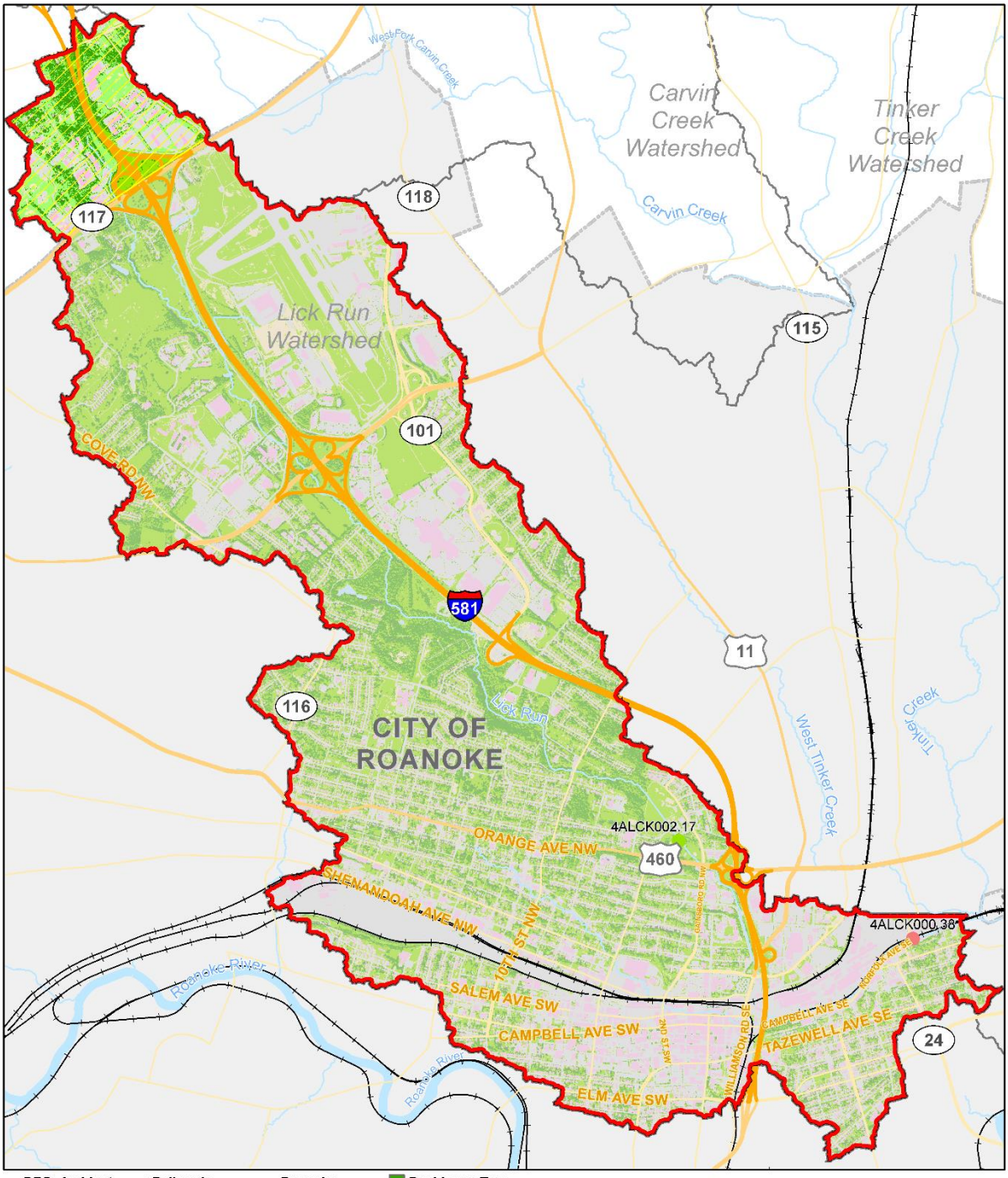
Within Roanoke County, the watershed contains 2.61 square miles within the MS4 regulated area, and 4.15 square miles outside of the MS4 regulated area. There are approximately 7.5 miles of stream, with drainage areas of 100 acres or greater, within the regulated MS4 area; and approximately 8.1 miles of stream, with drainage areas of 100 acres or greater, outside of the regulated MS4 area. See Figure 6, Carvin Creek Watershed Map.


Catawba Creek Watershed
Catawba Creek
Carvin Creek
BOTETOURT COUNTY
Carvin Creek Watershed
Jumping Run Creek
Horse Pen Branch
4ACRV006.19
4ACRV-3-SOS
81
PLANTATION RD
4ACRV-1-SOS
11
West Fork Carvin Creek
581
Tinker Creek
4ADEE-1-SOS
4ACRV-2-SOS
4ACRV001.88
Mason Creek
Peters Creek
118
CITY OF ROANOKE
Lick Run Watershed
117
115
DEQ: Ambient Monitoring Station
Citizen Monitoring Station
Carvin Creek
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Carvin Creek Watershed
Figure 6
1:54,000
1 in = 4,500 feet
0
2,250
4,500
9,000
Feet
N
W
E
S

6. Lick Run

Lick Run originates near the crossing with Peters Creek Road, then enters Roanoke City and flows to its discharge into Tinker Creek approximately a third of a mile upstream from the crossing of Walnut Avenue.

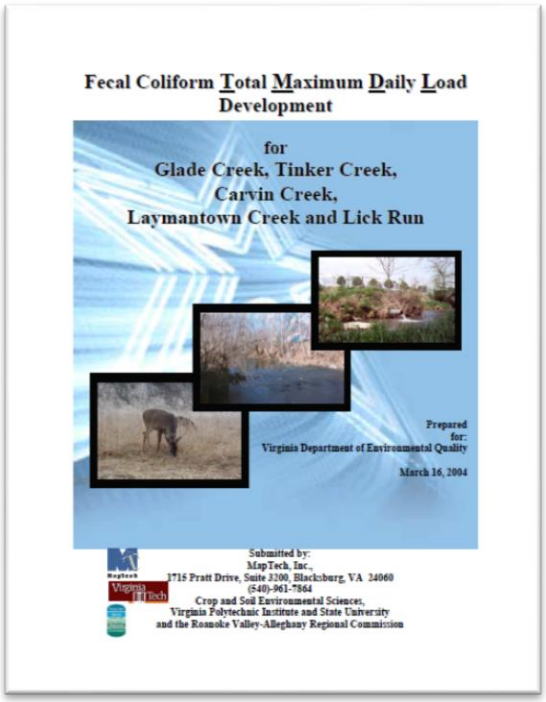
Within Roanoke County, Lick Run's 0.51 square mile watershed is totally contained within the County's MS4 regulated area. There are approximately 0.34 miles of stream, with drainage area of 100 acres or greater. See Figure 7, Lick Run Watershed Map.

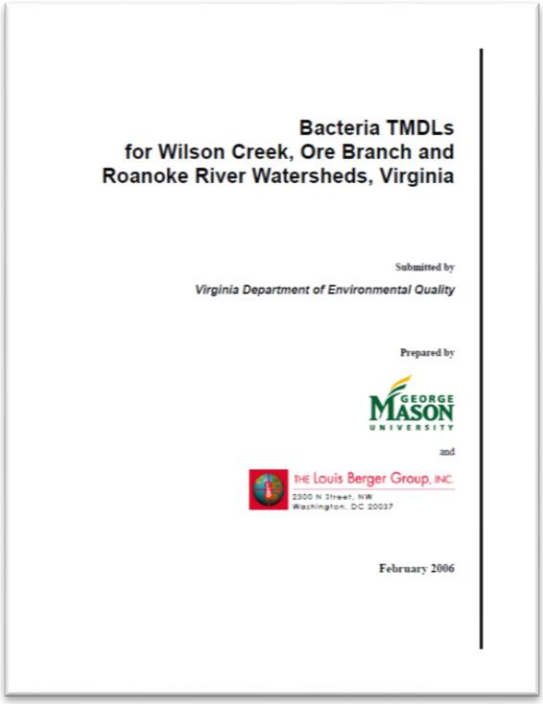

West Fork Carvin Creek
Carvin Creek Watershed
Tinker Creek Watershed
Carvin Creek
Lick Run Watershed
117
118
115
101
581
11
116
CITY OF ROANOKE
Lick Run
West Tinker Creek
Tinker Creek
COVE RD NW
ORANGE AVE NW
4ALCK002.17
460
SHENANDOAH AVE NW
10TH ST NW
4ALCK000.38
Roanoke River
SALEM AVE SW
CAMPBELL AVE SW
ELM AVE SW
WILLIAMSON RD SE
CAMPBELL AVE SE
TAZEWELL AVE SE
24
DEQ: Ambient Monitoring Station
DEQ: Trend Monitoring Station
Lick Run
MS4
Railroads
Other Watersheds & Basins
Roanoke River Watersheds
Other Localities
Roanoke County
Shadow
Impervious
Fallow
Unmannaged Turf
Deciduous Tree
Coniferous Tree
Water
Buildings
Managed Turf
Lick Run Watershed
Figure 7
1:36,000
1 in = 3,000 feet
0
1,500
3,000
6,000
Feet
N
S
W
E

C. Impairment and TMDL Wasteload Allocation

The Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carven Creek, and Lick Run were originally listed as “impaired” because they did not meet the Virginia water quality standard for fecal coliform bacteria. Since the initial listing, the state water quality standard has been changed from fecal coliform bacteria to E.coli bacteria.

The current Virginia water quality standard for E.coli to protect primary contact recreation (swimming) is a monthly geometric mean of 126 colony forming units per 100 milliliters (CFU/100 ml), based on a minimum of 4 monthly samples in a month. If insufficient samples are available to determine a valid geometric mean, then no more than 10% of the samples may exceed 235 CFU/100ml.





1. Roanoke River

The Roanoke River was initially listed as impaired in 1996 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock, runoff from urbanized high density areas, septic and other onsite treatment systems, sanitary sewer overflows, wet weather discharges (non-point source), and wildlife other than waterfowl. The Roanoke River is listed as impaired from the Spring Hollow Reservoir water intake, in west Roanoke County, to Smith Mountain Lake.

A TMDL study was performed and approved by U.S. EPA on 8/2/06 and the Virginia State Water Control Board on 6/27/07. During the TMDL study, the pollutant of concern was changed from fecal coliform to E.coli due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County was contributing 23,700,000,000,000 (2.37E+13) colony forming units per year and that an approximate **98.8% reduction** was required to remove the impairment. *Roanoke County's WLA was set at 284,000,000,000 (2.84E+11) colony forming units per year. The WLAs for Ore Branch and Tinker Creek are nested within the Roanoke River WLA.*

2. Ore Branch

Ore Branch was initially listed as impaired in 1996 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, runoff from urbanized high density areas, sanitary sewer overflows, wet weather discharges (non-point source), and wildlife other than waterfowl. Ore Branch is impaired for its entire length.

A TMDL study was performed and approved by U.S. EPA on 8/2/06 and the Virginia State Water Control Board on 6/27/07. During the TMDL study, the pollutant of concern was changed from fecal coliform to E.coli due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County was contributing 213,000,000,000 2.13E+11) colony forming units per year and that an approximate **99.5% reduction** was required to remove the impairment. *Roanoke County's WLA was set at 1,070,000,000 (1.07E+09) colony forming units per year.*

3. Tinker Creek

Tinker Creek was initially listed as impaired in 1998 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock grazing, runoff from urbanized high density areas, sanitary sewer overflows, wastes from pets, unspecified domestic waste, and wildlife other than waterfowl. Tinker Creek is impaired for its entire length.

A TMDL study was performed and approved by U.S. EPA on 8/5/04 and the Virginia State Water Control Board on 12/2/04. During the TMDL study, the pollutant of concern was changed from fecal coliform to E.coli due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County required an approximate **98% reduction** from developed lands. *Roanoke County's WLA was set at 536,000,000,000 (5.36E+11) colony forming units per year. The WLAs for Glade Creek, Carvin Creek, and Lick Run are nested within the Tinker Creek WLA.*

4. Glade Creek

Glade Creek was initially listed as impaired in 1998 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock grazing, runoff from urbanized high density areas, sanitary sewer overflows, wastes from pets, unspecified domestic waste, and wildlife other than waterfowl. Glade Creek is impaired for its entire length.

A TMDL study was performed and approved by U.S. EPA on 8/5/04 and the Virginia State Water Control Board on 12/2/04. During the TMDL study, the pollutant of concern was changed from fecal coliform to E.coli due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County required an approximate **96% reduction** from developed lands. *Roanoke County's WLA was set at 80,200,000,000 (8.02E+10) colony forming units per year.*

5. Carvin Creek

Carvin Creek was initially listed as impaired in 2002 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock grazing, runoff from urbanized high density areas, sanitary sewer overflows, wastes from pets, unspecified domestic waste, and wildlife other than waterfowl. Carvin Creek is impaired from just upstream of I-81 to the mouth of Carvin Creek on Tinker Creek.

A TMDL study was performed and approved by U.S. EPA on 8/5/04 and the Virginia State Water Control Board on 12/2/04. During the TMDL study, the pollutant of concern was changed from fecal coliform to E.coli due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County required an approximate **90% reduction** from developed lands. *Roanoke County's WLA was set at 4,070,000,000,000 (4.07E+12) colony forming units per year.*

6. Lick Run

Lick Run was initially listed as impaired in 2002 for fecal coliform. The likely sources were identified as discharges from municipal separate storm sewer systems, livestock grazing, runoff from urbanized high density areas, sanitary sewer overflows, wastes from pets, unspecified domestic waste, and wildlife other than waterfowl. Lick Run is impaired for its entire length.

A TMDL study was performed and approved by U.S. EPA on 8/5/04 and the Virginia State Water Control Board on 12/2/04. During the TMDL study, the pollutant of concern was changed from fecal coliform to E.coli due to changes in the Virginia water quality standards.

The TMDL study determined that Roanoke County required an approximate **99% reduction** from developed lands. *Roanoke County's WLA was set at 3,290,000,000 (3.29E+09) colony forming units per year.*

III. IMPLEMENTATION STRATEGY

For this permit cycle (July 1, 2013 – June 30, 2018), implementation largely consists of the development of this TMDL Action Plan, study of the County's streams, consideration of changes to ordinances, preparation and adoption of ordinances, and enhancements to existing MS4 Program BMPs required by the minimum control measures.

Detailed estimated implementation schedule for this permit cycle is provided in Section VI of this TMDL Action Plan. Further implementation this permit cycle, is constrained by lack of information, which will be addressed through ongoing stream assessments; and staff and budget constraints. Roanoke County is also coping with the fiscal impacts from implementing the new stormwater management regulations and serving as the Virginia Stormwater Management Program local authority, effective July 1, 2014; and the impacts from implementing additional MS4 Permit requirements that became effective with the current permit.

The overarching implementation strategy is to progressively implement BMPs to decrease the amount of E.coli that enters County waters. Roanoke County will implement BMPs over multiple state permit cycles and document that adequate progress is being made to reduce E.coli discharges.

As additional information is obtained from DEQ monitoring or other sources, an adaptive iterative approach will be used to modify BMPs implementation as appropriate.

IV. ONGOING AND PLANNED STUDIES AND MONITORING

The goal of this Bacteria Action Plan is to reduce E.coli discharged into the Roanoke River, Ore Branch, Tinker Creek, Glade Creek, Carvin Creek, and Lick Run to meet the Virginia water quality standards. The TMDL WLAs are a numeric tool used to gauge progress toward reaching this goal. Therefore, ongoing DEQ monitoring is an important tool to assess long-term progress in decreasing bacteria loads.

A. Roanoke County Outfall Inspections

Roanoke County as a part of its illicit discharge program, minimum control measure 3, inspects and field screens a minimum of 50 outfalls a year. These outfalls are dispersed throughout the MS4 regulated portion of the County. Where illicit discharges are detected, appropriate follow-up investigations will take place to locate and eliminate them. While this program will continue, it is unlikely that it will locate significant bacteria sources. To this date, all of our outfalls have been dry when inspected, and no illicit discharges have been detected.

B. DEQ Monitoring

DEQ has a number of monitoring stations set up in the Roanoke Valley that are periodically sampled and tested under various programs. These monitoring stations are indicated on the individual watershed maps. Many monitoring station locations are used by multiple sampling and testing programs.

The analytical information from these programs are assessed every 2-years (i.e. even numbered years) to identify and list "impaired and threatened waters" as required by Section 303(d) of the federal Clean Water Act. Each bi-annual assessment uses analytical information gathered over a 6-year sampling and testing cycle, with a 2-year lag (i.e. the 2014 assessment is based on data from 2012 – 2007). Long-term progress toward meeting state water quality standards will be based on the ongoing results of DEQ's monitoring programs.

Following is a brief discussion of DEQ's various monitoring programs.

1. Ambient Watershed Network

The ambient watershed network was originally established to monitor point source problems (primarily municipal wastewater treatment plants and industries). It has evolved into a watershed monitoring network. Monitoring stations are typically at bridges, or other locations, where convenient access is present for sampling. There is typically one station for each 6 digit Hydrologic Unit Code (HUC). These stations are used for screening level information. Only limited testing is performed including: **E.coli**, temperature, pH, conductivity, nitrogen, and phosphorus. Ideally, each station is sampled bimonthly over a two-year period (12 data points) within a 6-year assessment window. If sampling and testing are performed at a location under another program (e.g. biological or probabilistic), then sampling and testing under the Ambient Watershed Network may be skipped.

2. Trend Monitoring Stations

The trend monitoring stations have the longest continuous data records. Some of the monitoring stations were originally established in the 1940's. These stations are useful for looking for long-term trends. Testing includes: pH, temperature, dissolved oxygen, conductivity, fecal and **E.coli** bacteria, nitrogen, phosphorus, total suspended solids, total solids, and turbidity. They are sampled bimonthly every year.

3. Biological Monitoring

Biological monitoring consists of sampling and characterizing benthic macroinvertebrates. Benthic macroinvertebrates are organisms without backbones that are visible to the eye without the aid of a microscope, that live on, under, and around rocks and sediment on the bottoms of lakes, rivers, and streams. Many of the benthic macroinvertebrates have complex life cycles of one-year or more and they are extremely sensitive to pollutants. In essence, benthic macroinvertebrates are virtual "living recorders" of water quality conditions over time. By analyzing the presence, or absence, of various organisms, the overall ecological health of a stream can be assessed.

The Roanoke River, in the Roanoke Valley has 5 biological stations that are usually monitored each year, once in the spring and once in the fall. Other biological stations in the Roanoke Valley are monitored very infrequently.

This monitoring program does not measure for E.coli; therefore, it is not applicable to this TMDL Action Plan.

4. Freshwater Probabilistic Monitoring

The other monitoring programs are biased to finding and defining problems (i.e. monitoring stations are set up near industries or wastewater treatment plants). In order to obtain unbiased statewide water quality statistics, the freshwater probabilistic monitoring program was established. Fifty to sixty locations are randomly selected across the state for sampling in the spring and fall. This program performs the most comprehensive testing, including: pH, temperature, dissolved oxygen, conductivity, fecal and E.coli bacteria, nitrogen, phosphorus, dissolved metals, total suspended solids, total solids, turbidity, ions, cations, fish community, algae community, biological assessment, and quantitative physical habitat.

5. Citizen Monitoring

Various citizen groups volunteer to perform stream monitoring in various streams across the state. In most cases, the monitoring is biological and the results do not meet DEQ's rigorous quality control requirements. Therefore, these results are not used by DEQ in listing or delisting streams for impairments; but they might be useful to identify a potential problem that warrants further DEQ investigation.

In most cases, E.coli is not measured for; therefore, this program is not applicable to this TMDL Action Plan.

6. Fish Tissue Monitoring

Fish tissue monitoring is performed for special studies to determine if fish are accumulating any toxics, such as mercury or PCBs, which would warrant consumption advisories.

This program is not applicable to this TMDL Action Plan.

7. TMDL Monitoring

TMDL monitoring stations are established when special studies are performed to set a Total Maximum Daily Load (TMDL). The Roanoke Valley has TMDL monitoring stations that were used to set E.coli TMDLs.

Once a TMDL is established, this program becomes inactive.

8. Implementation Monitoring

A TMLD Implementation Plan is performed by DEQ after a TMDL has been established. Once a TMDL Implementation Plan is completed, DEQ performs implementation monitoring to assess progress towards meeting the TMDL. Usually the same stations that were used in the TMDL study are used for implementation monitoring.

Currently, DEQ is completing an Implementation Plan for the Upper Roanoke River Basin for sediment and E.coli. It is anticipated that implementation monitoring will occur after the Implementation Plan is completed.

This program will be the most important is accessing the progress toward lowering E.coli to meet the stream water quality standards.

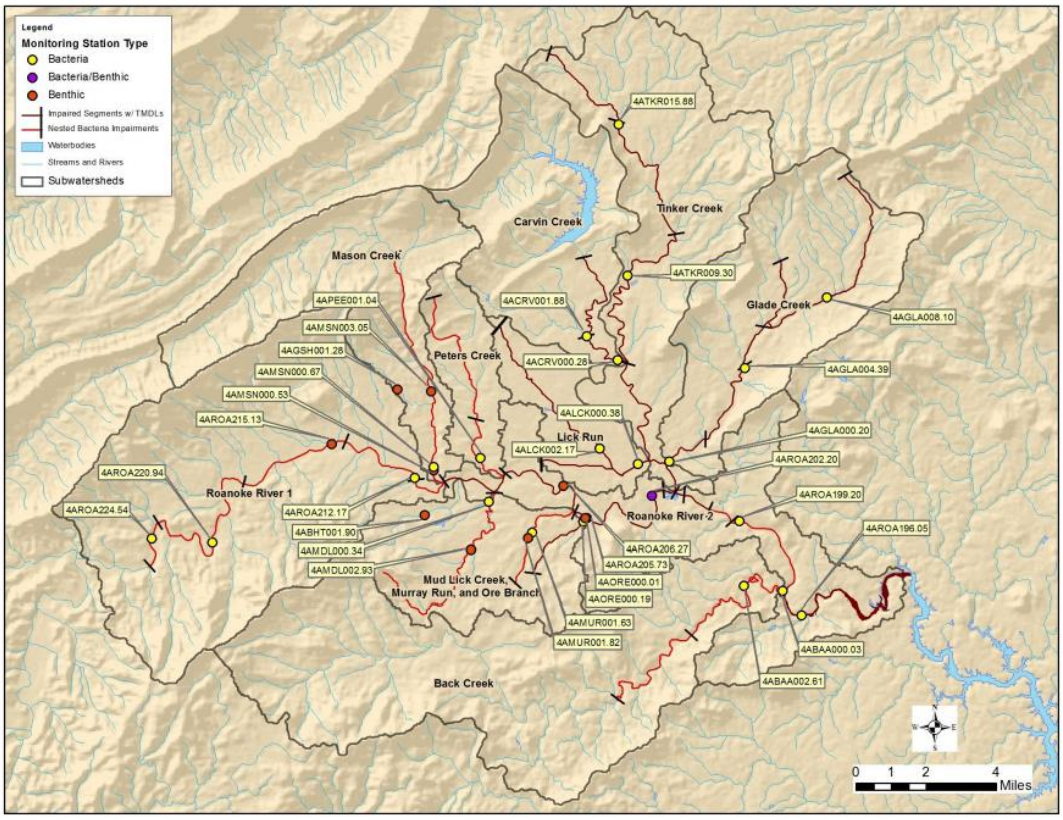


Figure 6-5: Monitoring Station Map for the Roanoke River Implementation Plan Part I

DEQ Proposed Monitoring Stations taken from the April 2015 draft of the Roanoke River Implementation Plan, Part 1

9. United States Geologic Survey (USGS) Monitoring

The USGS has several monitoring stations that record stream flow.

C. Stream Assessments

Lowering pollutant loadings to meet the waste load allocations will require significant public investment. In order to properly prioritize spending, Roanoke County proposes performing field and office investigations to document existing conditions and to identify opportunities for BMPs.

The entire length of the Roanoke River, in the Roanoke Valley, has TMDL WLAs. All of the streams in Roanoke County, except for the northern Catawba Valley area drains into the Roanoke River watershed. Therefore, it is important to understand the conditions of all of these streams in order to properly address all of the County's TMDL WLAs.

Stream Assessment is discussed further in Section VI.

V. COUNTY LEGAL AUTHORITIES

Section I.B. of the MS4 Permit requires Roanoke County to maintain a list of its legal authorities, such as ordinances, state and other permits, orders, specific contract language, and inter-jurisdictional agreements applicable to reducing pollutants contained in a WLA. Following is the listing for Roanoke County:

- Virginia General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4 Permit); General Permit No. VAR040022
- Roanoke County Code of Ordinances
    - Chapter 5, Animals and Fowl Ordinance
    - Chapter 8.1, Erosion and Sediment Control Ordinance
    - Chapter 23, Stormwater Management Ordinance
    - Chapter 24, Illicit Discharge Ordinance
    - Appendix A, Zoning Ordinance
- Roanoke County Contract Agreement with Clean Valley Council to provide certain Stormwater Education and Public Participation services to facilitate compliance with Minimum Control Measures 1 and 2 of the MS4 permit
- Contract with Pauley's Excavating & Demolition, Inc. to provide BMP Maintenance and Repair
- Contract with GKY & Associates, Inc.to provide Stream Assessments and Evaluation for Retrofits
- Stormwater Facility (BMP) Maintenance Agreements

VI. TMDL SPECIFIC BEST MANAGEMENT PRACTICES WITH IMPLEMENTATION SCHEDULE

The following BMPs have been specifically identified to reduce discharges of E.coli into County waterways. Also, many of the BMPs listed below are also effective in reducing sediment discharges. BMPs that specifically address TMDLs are designated with a "T" prefix.

A. Initial Streams Assessment and BMP Planning

BMP T1 – Initial Streams Assessment and BMP Planning
Roanoke County has approximately 135.4 miles of streams draining 100 acres or more, within its MS4 regulated area.

We propose to assess these streams to better understand their condition and to assist in determining the most cost-effective means of lowering pollutant loads.

In permit year 2014 – 2015, a consultant was hired to begin this task. This work includes office assessment using existing information, field assessment where appropriate, and prioritized recommendations for BMP implementation.

The initial stream assessments are in progress. At this time, Roanoke County anticipates that an initial assessment of the majority of streams within the MS4 area may be completed by August 2018.

Once the initial stream assessments are completed, Roanoke County will be better able to plan BMP capital improvements.

B. Enhanced Public Education and Outreach

BMP T2- Enhanced Public Education and Outreach (Bacteria)
This BMP will be implemented County-wide as an enhancement to the BMPs performed to satisfy Minimum Control Measure 1, Public Education and Outreach on Stormwater Impacts.

Roanoke County's Public Education and Outreach programs and materials have been enhanced by reshaping the programs and materials to focus on the County's three high-priority water quality issues: excess bacteria, sediments, and nutrients. BMP 1-7, entitled Targeted Education Program, describes the planned strategies that will be used to reach the various target audiences. The following table identifies the target audiences for bacteria reduction, the messages to be delivered, the planned delivery means, and the rationale for selecting the identified audiences.

This BMP was implemented beginning with the 2014/2015 permit year.

Table 1. Targeted Education Program for Bacteria (E.coli) Reduction

Priority ater y Issue	Target Audiences	Means to Determine Audience Size	Estimated Audience Size	Overall Messages	Means to Deliver Messages	Rationale
#2 TERIA	Restaurants	Business Licenses/ Yellow Pages	115	• Excessive bacteria hinders stream usage and contributes to algae overgrowth, which hurts aquatic life. • All wastewater to sanitary sewers. • Keep exterior trash receptacles and dumpsters covered and do not wash out into storm drain. • Clean kitchen hoods and floor mats;	• Mailer, annually • PSAs on local cable station	Uncovered dumpster containing garbage a dumpsters and greas floor mats that are ri out onto the paveme can contribute bacte our MS4, which disch

				properly dispose of wastewater.		directly to our strean
	Pet Owners (dogs/cats)	Pet Licenses	5,392 dogs 371 cats	• Excessive bacteria hinders stream usage. • Dog waste ends up in streams. • Pick up after your pet and properly dispose of waste.	• County Publication sent annually to Homeowners • PSAs on local cable station	Dog waste is a major source of bacteria in streams.
	Veterinarian Offices	Business Licenses/ Yellow Pages	13	• Excessive bacteria hinders stream usage. • Dog waste ends up in streams. • Pick up after your pet and properly dispose of waste.	• Brochures placed in Veterinarian offices, annually • PSAs on local cable station	Dog waste is a major source of bacteria in streams.
	Pet Stores/Pet Boarding/ Grooming	Business Licenses/ Yellow Pages	27	• Excessive bacteria hinders stream usage. • Dog waste ends up in streams. • Pick up after your pet and properly dispose of waste.	• Brochures placed in pet stores, annually • PSAs on local cable station	Dog waste is a major source of bacteria in streams.
	County Police and Firemen; Animal Control Officer	County Records		• Excessive bacteria hinders stream usage. • Dog waste ends up in streams. • Pick up after your pet and properly dispose of waste.	• In-house training	Dog waste is a major source of bacteria in streams; these Count employees own or ha dogs as part of their

C. Enhanced Employee Training

BMP T3 – Enhanced Employee Training (Bacteria)
This BMP will be implemented County-wide as an enhancement to the County employee training performed to satisfy Minimum Control Measure 6, Pollution Prevention and Good Housekeeping for Municipal Operations.

Roanoke County's employee training has been enhanced to recognize bacteria (E.coli) as a "high-priority water quality issue". Training courses included the following, as discussed in the Annual Report in BMP 6-4:

- **Recognition and Reporting Illicit Discharges** - all applicable field personnel will receive training on a biennial basis in the recognition and reporting of illicit discharges. Among many potential illicit discharges, sediment and bacteria are identified as potential pollutants in this training.

- **Good Housekeeping and Pollution Prevention Practices** - all employees that perform road, street, and parking lot maintenance, or are employed in and around maintenance and public works facilities and at recreational facilities will receive biennial training in good housekeeping and pollution prevention practices. Sediment and bacteria are identified as potential pollutants in this training.

  NOTE: *All employees who were required to take Good Housekeeping and Pollution Prevention Practices were required to read and follow the County's Standard Operating Procedures (SOPs). These procedures were designed to eliminate or minimize pollutant discharges in stormwater.*

- **Contractor Oversight for Environmental Compliance** – all supervisors who oversee Contractors that perform work for the County or employees involved in developing contracts for Contractors will take this training on a biennial basis. The training explains that all Contractors must have their own written good housekeeping and pollution prevention program, or they must comply with the County's written policies and SOPs. This training discusses the significance of soil erosion from construction sites, the potential harm to receiving waters, and the need to use effective erosion and sediment controls. It also discusses the need to carefully place and maintain portable toilets onsite to ensure bacterial wastes do not enter stormwater runoff. County employees who oversee Contractors working for the County must ensure compliance by Contractors.

- **Hazardous Materials (HAZ-MAT) Training** – although not directly related to sediment reduction, the County of Roanoke currently maintains basic hazardous materials training for its employees, including volunteers, in Fire and Rescue. All career (paid) staff are certified to HAZ-MAT Operations. HAZ-MAT certification does not expire from the Virginia Department of Fire Programs; however all career personnel receive annual, internal training on this topic as part of their career development training.

This BMP was implemented beginning with the 2014/2015 permit year.

D. Assess County Facilities

BMP T4 – County Facilities Assessments and Corrections

All County properties have been screened for conditions that could result in elevated discharges of bacteria. Those that have been determined to have a high potential will be inspected in the field and a site specific Stormwater Pollution Prevention Plan (SWPPP) will be prepared. Any potential sources of elevated sediment discharge will be eliminated and steps taken to assure that they do not reoccur. Possible sources of sediment are improper materials storage and disturbed soils,

The initial screening of properties, and estimated inspection schedule has been developed and is included in the MS4 Program Plan and as shown below. One log applies to Roanoke County properties; one applies to Roanoke Public School properties.

The site inspections and SWPPP preparation will be performed over a 3-year period with 1/3 performed in 2014 – 2015, 1/3 in 2015 – 2016, and the final 1/3 performed in 2016 – 2017.

For Permit Year 2 (2014 – 2015), SWPPPs were completed for the following facilities:

- Public Service Center at Kessler Mill
- Fleet Service Center
- Roanoke County Public Schools - Municipal Yards, covering the following sites
    - Small Engine Repair and Welding Shop
    - Transportation Dept. - Bus Maintenance Shop/parking Lot
    - Maintenance Dept. - Maintenance Shop, Warehouse, and Office

As can be seen from the logs below, five SWPPPs will be prepared in permit Year 3 (2015 – 2016) and six will be prepared in Permit Year 4 (2016 – 2017).

Roanoke County Public Schools - SWPPP PROGRAM PLAN AND LOG

Name of High-Priority Facility	Activities that make it High-Priority	High Potential of Discharging Pollutants (Yes or No)	Reasons for High Potential/ Or Not	Scheduled SWPPP Development	SWPPP Completion Date/or last Revision Date
Maintenance Dept. Shop, Office, Warehouse 702 South Market Street, Salem	Vehicle storage	No	Parking lot	7/1/15	June, 2015
Small Engine & Welding Shop 622 South Market Street, Salem	Vehicle storage	No	Parking lot	7/1/15	June, 2015
Transportation Dept. Bus Mintenance, Parking Lot 701 South Market Street, Salem	Vehicle maintenance	Yes	Exterior fueling & washing	7/1/16	June, 2015
Maintenance/Storage Facility Burton Center for Arts and Technology (BCAT)	Vehicle storage	No	Parking lot	7/1/16	
Cave Spring Bus Lot	Vehicle maintenance	Yes	Exterior fueling & washing	7/1/16	
Glenvar Bus Lot	Vehicle maintenance	Yes	Exterior fueling & washing	7/1/17	
Northside Bus Lot	Vehicle maintenance	Yes	Exterior fueling & washing	7/1/17	
Vinton Bus Lot	Vehicle maintenance	Yes	Exterior fueling & washing	7/1/17	

Roanoke County - SWPPP PROGRAM PLAN AND LOG

Name of High-Priority Facility	Activities that make it High-Priority	High Potential of Discharging Pollutants (Yes or No)	Reasons for High Potential/ Or Not	Department(s)	Scheduled SWPPP Development	SWPPP Completion Date/or last Revision Date
Kessler Mill Service Center	Store Equip/Fert; Public Works Yard	Yes	Exterior material and equipment storage	P,R,and T; GS, CD	By July 1, 2015	June, 2015
Starkey Park - Satellite Shop - Temporary storage	Store Fertilizers	No	No exterior storage, only ~3 pieces of equipment stored	P,R,and T		
Gearhart Maintenance Shop - Temporary Storage	Store fertilizers	No	No exterior storage, only ~3 pieces of equipment stored	P,R,and T		
Fleet Service Center	Vehicle maintenance	Yes	Heavy vehicle maintenance	GS	By July 1, 2015	June, 2015
#1 North County Fire and Rescue	Equipment washing, fueling activities	Yes	Exterior fueling and washing	F&R	By July 1, 2016	
#3 Cave Spring Fire	Equipment washing, fueling activities	Yes	Exterior fueling and washing	F&R	By July 1, 2016	
#5 Hollins Fire and Rescue	Equipment washing, fueling activities	Yes	Exterior fueling and washing	F&R	By July 1, 2016	
#6 Mount Pleasant Fire and Rescue	Equipment washing, fueling activities	Yes	Exterior fueling and washing	F&R	By July 1, 2017	
#9 Fort Lewis Fire and Rescue	Equipment washing, fueling activities	Yes	Exterior fueling and washing	F&R	By July 1, 2017	
EMS Training Facility	Chemicals used in training	Yes	Exterior training exercises with chemicals	F&R	By July 1 2017	

P,R, and T - Parks, Recreation, and Tourism
CD - Community Development
GS - General Services
F&R - Fire and Rescue

E. Enhanced Illicit Discharge Detection and Elimination Program

BMP T5 – Enhanced Illicit Discharge Detection and Elimination Program (Bacteria)
Roanoke County currently operates a state-compliant illicit discharge detection and elimination program. Roanoke County currently surveys 50 outfalls/year, employees are trained in spotting and reporting illicit discharges, and all reported illicit discharges are investigated for corrective action. We propose to enhance our program by selecting sites with elevated potential to discharge bacteria and performing site surveys to observe conditions (from public rights of way) and to speak with operators. Initially, we are considering businesses operating as veterinary clinics, kennels, pet stores, and restaurants. Beginning permit year 2017 - 2018, and continuing thereafter, a minimum of 15 businesses will be visited each permit year.
As noted in BMP T3, all applicable field personnel receive training on a biennial basis in the recognition and reporting of illicit discharges. Among many potential illicit discharges, sediment and bacteria are identified as potential pollutants in this training to ensure that field personnel are able to recognize and identify them in the field when such pollutants are encountered.

F. Erosion and Sediment Control Enhanced Enforcement

BMP T6 – Erosion and Sediment Control Enhanced Enforcement
Roanoke County currently operates a state-compliant erosion and sediment control program. When violations are observed, the County's priority is to work with the site operators to get the site back into compliance. Most of the time, deficiencies are corrected within a mutually agreed upon time-schedule without any formal compliance activities or fines. The County has proposed for permit year 2016 – 2017 to evaluate the current enforcement policies to determine if they should be stiffened to be stricter with shorter allowable correction periods and more frequent civil penalties. The annual report submitted by October 1, 2017 will report on the results of this evaluation and provide the implementation schedule, if appropriate.

G. Addressing Dog Wastes

It is believed that dog waste is one of the most significant sources of controllable bacteria. Nationally, there are 0.58 dogs per household (according to the American Veterinary Medical Association), and each dog, on average, generates 0.42 pounds of fecal material per day. Applying these national averages to Roanoke County gives a total of approximately 22,000 dogs that generate approximately 1,686 tons of fecal material per year.

Roanoke County currently has ordinances that prohibit dogs running at large, requires areas that house dogs be kept free of flies and nuisance odors, and prohibits depositing waste in public parks and recreation areas.

We have identified 4 areas where additional actions may be taken to decrease the discharge of bacteria from dog waste.

The first is to provide public education, which is addressed in **BMP T2**. The second is to enhance the illicit discharge detection and elimination program, which is addressed in **BMP T5**.

BMP T7 – Dog Waste Stations

The third is to increase the number of dog waste stations in public parks and greenways. We propose in permit year 2015 – 2016 to document where existing dog waste stations exist; determine locations where additional dog waste stations are needed; and develop internal policies for waste pickup.

The additional dog waste stations would be provided over a 5 year period (20% a year), beginning in permit year 2016 – 2017.

BMP T8 – Dog Waste Ordinance

The fourth would be to consider a new dog waste ordinance. This ordinance will require time to research what has been successful in other Virginia localities and time to communicate with the Board of Supervisors and the public. We propose in permit year 2015 – 2016 for staff to research other Virginia localities' ordinances and discuss them with the Board of Supervisors to obtain their general direction. If the Board of Supervisors gives general concurrence, staff will prepare a draft ordinance and hold public meetings to obtain public input. We anticipate that a proposed dog waste ordinance may be presented to the Board of Supervisors for their consideration during the permit year 2016 – 2017.

H. Addressing Improperly Operating Onsite Sewage Disposal Systems

BMP T9 – Onsite Sewage Disposal System Ordinance

Onsite sewage disposal systems predominately consist of septic tanks with drain fields. Roanoke County has approximately 12,056 septic tanks or other onsite sewage disposal systems that are distributed as follows:

Date Constructed	Before 1970	1970 - 1979	1980 - 1989	1990 - 2015	TOTAL
Within MS4 Area	2,670	1,328	615	631	5,244
Outside MS4 Area	2,521	1,080	1,135	2,076	6,812

Malfunctioning or poorly maintained onsite sewage disposal systems result in discharges of bacteria from human waste. Some localities in Virginia have enacted septic system pump out programs that require onsite systems to be inspected and pumped out at a stated frequency. The closest such program is in Franklin County, around Smith Mountain Lake.

We propose in permit year 2015 – 2016 for staff to perform additional research to further quantify onsite sewage disposal systems' locations in relationship to streams, research other Virginia localities' ordinances, and to discuss the issue with the Board of Supervisors to obtain their general direction. If the Board of Supervisors gives general concurrence, staff will prepare a draft ordinance and hold public meetings to obtain public input. We anticipate that a proposed Onsite Sewage System Disposal ordinance may be presented to the Board of Supervisors for their consideration during the permit year 2016 – 2017.

I. Stream Buffers/ No Mow Strips

BMP T10 – Stream Buffers/ No Mow Strips

Stream buffers can be effective in filtering stormwater runoff that sheet flows through the buffer, removing sediments, bacteria, and other pollutants. Unfortunately most of the land along County streams has already been developed, which limits where stream buffers could be provided. Roanoke County currently only has stream buffer requirements for new development along the Roanoke River (Roanoke River Overlay District).
We propose in permit year 2016 – 2017 to research similar ordinances, identify properties that border waterways in the County, and develop possible stream buffer criteria for new development. During permit year 2017 – 2018, public input will be sought and discussions will be held with the Board of Supervisors to obtain their direction. If the Board of Supervisors gives general concurrence, staff will prepare a draft ordinance and hold public meetings to obtain public input. We anticipate that a proposed Stream Buffer ordinance may be presented to the Board of Supervisors for their consideration near the end of permit year 2017 – 2018. In the event, that the Board of Supervisors decides not to enact any stream buffer ordinance, stream buffers/no mow strips will still be encouraged on a voluntary basis.

Additionally, in permit year 2017 – 2018, **BMP T2** will be expanded to include targeted education of the value of Stream Buffers/ No Mow Strips to property owners that are located along streams.

J. Capital Improvements

Roanoke County currently has two stream restoration projects under contract that are anticipated to significantly decrease in-stream erosion in the project areas. These two projects are 1) Restoration of Glade Creek in Vinyard Park, Phase 1; and 2) Restoration of Murray Run at Ogden Road. When completed, these two projects will have naturally restored approximately 4,000 linear feet of eroding stream.

At this time, Roanoke County does not have enough information on its streams to develop a valid capital improvement plan to identify future projects. We anticipate that by the end of permit year 2016 – 2017, enough evaluation of County streams may have been done to allow for the identification and prioritization of additional projects.

Stream Conditions Prior to Work
Stream Restoration of Mudlick Creek in Garst Mill Park, performed in 2008

Stream Conditions after Construction
Stream Restoration of Mudlick Creek in Garst Mill Park, performed in 2008

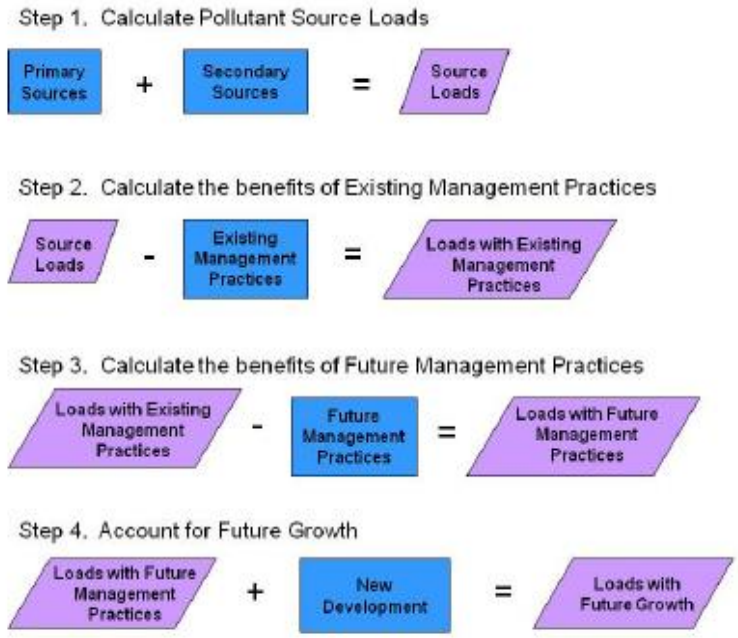
VII. PLAN ASSESSMENT METHODOLOGY

Section I.B. of the MS4 Permit requires Roanoke County to develop and implement a method to assess this TMDL Action Plan for its effectiveness in reducing the pollutant (E.coli) identified in the WLA. The evaluation shall use any newly available information, representative and adequate water quality monitoring results, or modeling tools to estimate pollutant reductions of E.coli from implementation of the MS4 Program Plan.

Roanoke County has been assessing pollutant loads using the Simple Method and watershed land uses as presented in its MS4 Annual Report.

Roanoke County plans on changing its plan assessment methodology to the Watershed Treatment Model, developed by the Center for Watershed Protection for the submission of the 2016 - 2017 annual report by October 1, 2017.

Roanoke County will also continue to review and evaluate any newly available information, including results of DEQ's ongoing water monitoring program, the County's outfall inspections, and the County's Stream Field Assessments.



Watershed Treatment Model Structure

VIII. ANNUAL REPORTING REQUIREMENTS

The MS4 Annual Report covers activities that occur from July 1st to June 30th, and it is due to DEQ by October 1st of each year.

The MS4 Annual Report will be updated to include this Bacteria Action Plan, a description of implementation activities, and an assessment of their effectiveness in lowering E.coli discharges.

IX. PERMIT REAPPLICATION REQUIREMENTS

Reapplication for coverage is due to DEQ at least 90 days before the expiration of the current General Permit on June 30, 2018. As a part of the reapplication submittal, this Bacteria Action Plan will be revised and submitted to indicate the BMPs that will be implemented in the next permit cycle.

At that time, the TMDL Action Plan will be revised to include an estimated end date for achieving the applicable wasteload allocation. This estimate will be for planning purposes only and will not be binding.