

Total Maximum Daily Load (TMDL) Action Plan
For Bacteria Reduction (*E. coli*) in the Roanoke River,
Ore Branch, Tinker Creek, Glade Creek,
Carvin Creek, and Lick Run

MS4 General Permit No. VAR040022



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I. EXECUTIVE SUMMARY

Roanoke County's "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 TMDL Action Plan) has been prepared and revised, as required by the Virginia Department of Environmental Quality's (DEQ) "General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems" (Permit # VAR040022). Roanoke County is subject to the requirements of this permit, effective November 1, 2018 through October 31, 2023.

Roanoke County's strategy to address the permit requirements is to progressively implement Best Management Practices (BMPs) to decrease the discharge of *E. coli* from the County's Municipal Separate Storm Sewer System (MS4) towards meeting the DEQ-assigned waste load allocation. Roanoke County will implement BMPs over multiple state permit cycles, using an adaptive iterative approach, to reduce *E. coli* discharges.

The following table shows the BMPs that Roanoke County plans to implement in this permit cycle to decrease discharges of *E. coli*, along with implementation dates for each. Note that some of these BMPs are also effective in addressing the County's sediment waste load allocations.

BMP #	BMP Name/Task	Implementation Date
B-1	Dog Waste Stations and Signage <ul style="list-style-type: none"> Develop a written plan of where to install Install at least 5 dog waste stations per year until plan is achieved 	July 2020 Ongoing
B-2*	Protect Stream Buffers: Ordinance <ul style="list-style-type: none"> Finalize ordinance language Present to Board of Supervisors for consideration Implement ordinance (if approved) 	July 2020 Fall 2020 Fall 2021
B-3*	Protect Stream Buffers: No-Mow Policy for County-owned Lands	Spring 2021
B-4	Public Education: Reducing Food Sources Accessible to Wildlife	July 2020
B-5	Public Education: Septic System Repair & Maintenance	Ongoing
B-6	Business Outreach: Eliminating Illicit Discharges	Ongoing
B-7*	Enhanced Public Outreach for Bacteria (<i>E. coli</i>)	Ongoing
B-8*	Enhanced Employee Training for Bacteria (<i>E. coli</i>)	Ongoing

* Also effective in reducing sediment discharge to the Roanoke River.

This Bacteria TMDL Action Plan was prepared by Roanoke County staff. Note that public input was sought through public advertisement and a comment period. The completed Plan was approved by the County Administrator. 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 appropriate necessary funding for implementation.

It is expected that this Bacteria TMDL Action Plan will be periodically revised to add, modify, or delete BMPs, to adjust estimated implementation dates, and to reflect new information as it becomes available. Progress regarding implementation of this plan will be included in the MS4 Annual Report that is submitted to DEQ by October 1st of each year in the permit term.

II. BACKGROUND

A. General

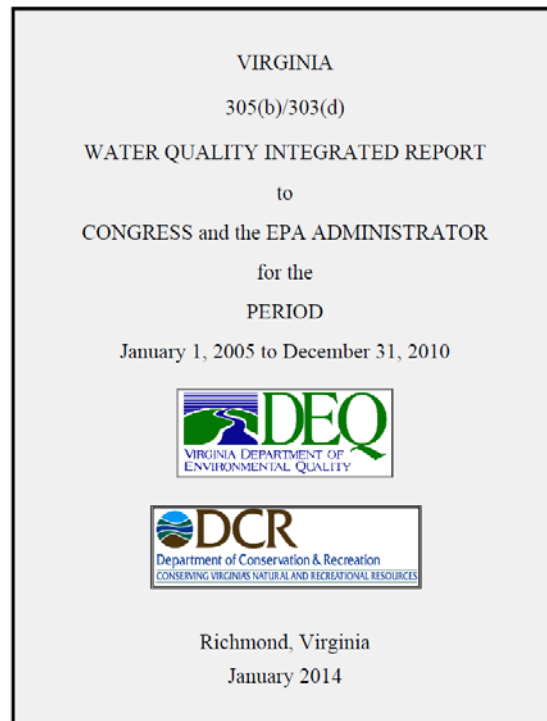
The Virginia Department of Environmental Quality (DEQ) routinely monitors and tests the Commonwealth's waters (i.e., streams, rivers, lakes, and estuaries) to confirm that they meet Virginia's water quality standards (9 VAC 25-260-10). According to the Virginia Water Quality Standards: *"all state waters 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-numbered 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, with 28 identified impairments.**

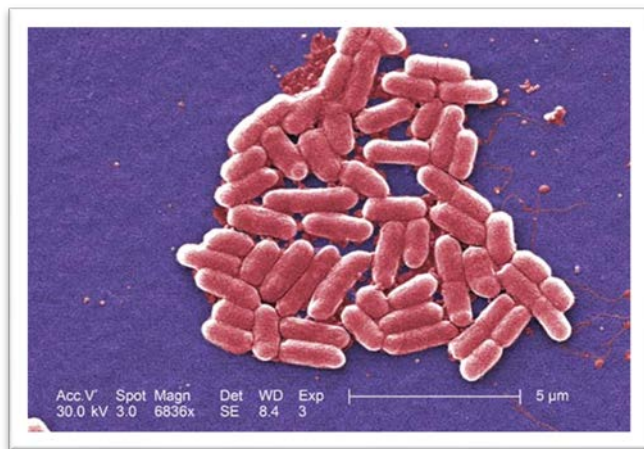
DEQ performs studies on impaired waters to determine the "Total Maximum Daily Load" that the water can assimilate and still meet water quality standards. These studies are called TMDL studies. TMDL studies assign "waste load allocations" (WLAs) to permitted point sources of pollution. WLAs are numerical limits of a pollutant of concern that a permitted point source must meet by implementing appropriate strategies, or Best Management Practices (BMPs) using an 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.

As previously noted, Roanoke County has coverage under the "Virginia General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems" (MS4 Permit); This MS4 Permit (General Permit No. VAR040022) is effective November 1, 2018 through October 31, 2023. Pursuant to this permit, all stormwater that passes through a County-owned or County-operated storm drain or improved channel that is located within the urban parts of the County, as designated in the latest decennial U.S. Census, is considered to be a point source discharge and, therefore, 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 humans 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.



E.coli bacterium is used as an indicator organism for fecal contamination.

Section II.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.

Although only 6 streams have *E. coli* WLAs, pollutant discharges into all of 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 Bacteria TMDL Action Plan has been prepared by Roanoke County staff. Public input was sought through public advertisement and a public meeting. The completed Plan was approved by the County Administrator. 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 necessary funding for implementation.

It is expected that this Bacteria TMDL Action Plan will be periodically revised to add, modify, or delete BMPs, to adjust estimated implementation dates, and to reflect new information as it becomes available. Progress regarding implementation of this plan will be included in the MS4 Annual Report that is submitted to DEQ by October 1st of each year in the permit term.

B. Watershed Descriptions

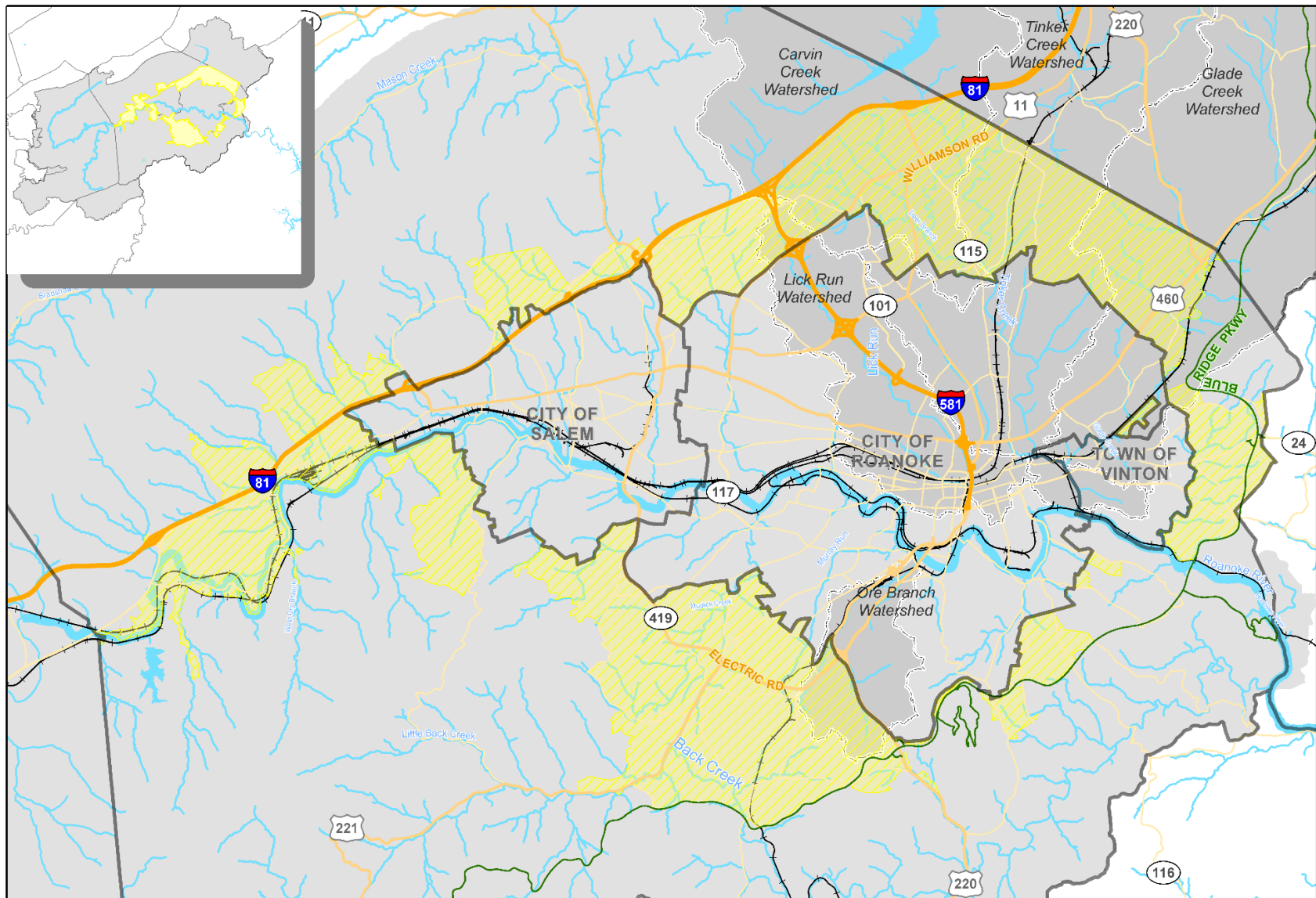
1. Roanoke River




The Roanoke River originates in Montgomery County and flows through Roanoke County, Salem City, Roanoke City, and the Town of Vinton. It 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 WLAs for *E. coli*: 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 but will be separately addressed in this plan.

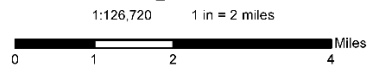
Within Roanoke County, the Roanoke River watershed contains 50.5 square miles within the MS4 regulated area and 174.4 square miles outside of the MS4 regulated area. There are approximately 13.2 miles of river within the regulated MS4 area and approximately 2.7 miles of river outside of the regulated MS4 area.

Within Roanoke County's regulated MS4 area, the Roanoke River is fed by approximately 122.2 miles of drainage ways having drainage areas of 100 acres or greater. There are approximately 315.5 miles of drainage ways having drainage areas of 100 acres or greater outside of the regulated MS4 area. See **Figure 1: Roanoke River Watershed Map**.



-  MS4 Area
-  Supplemental Watersheds
-  Roanoke River Watershed

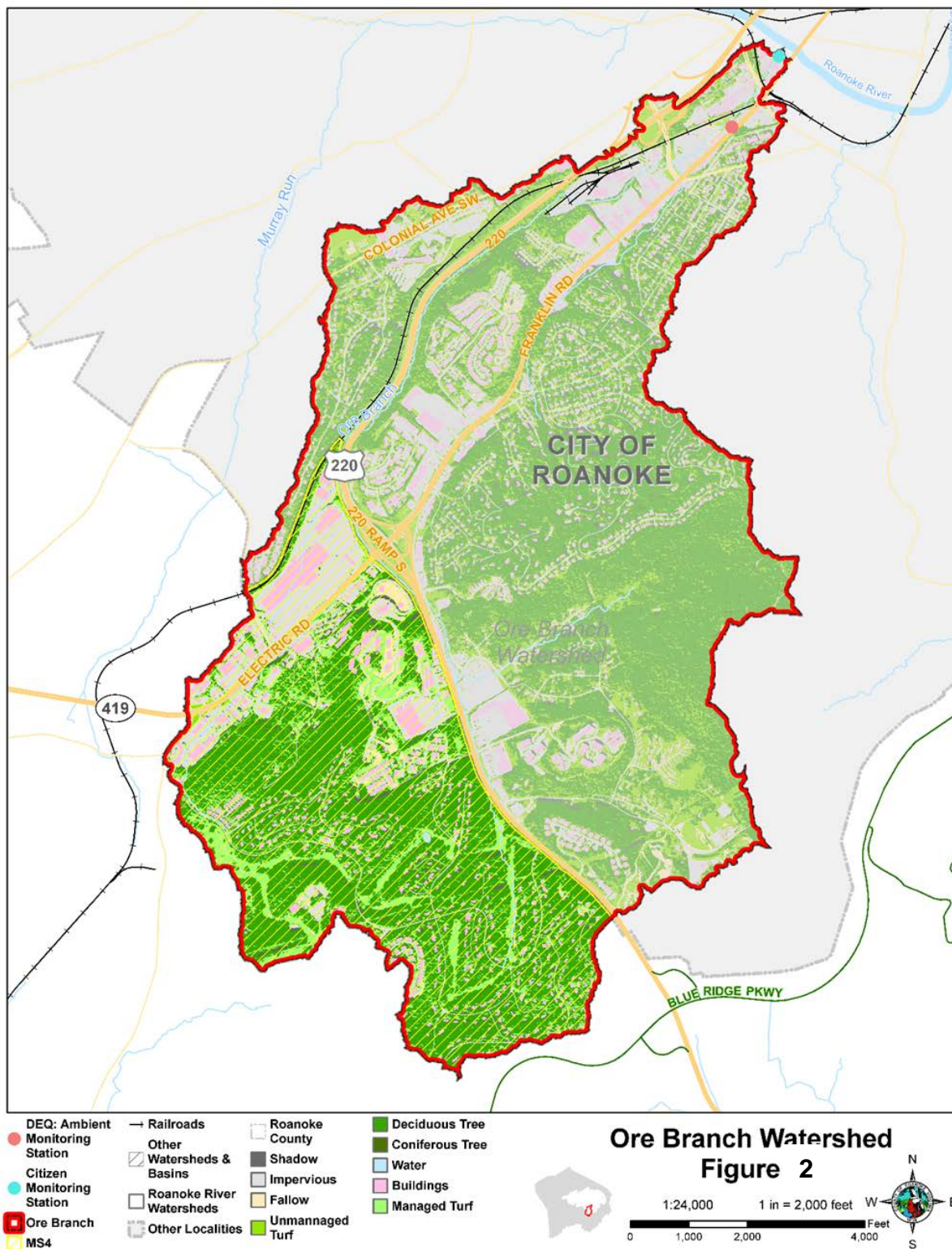
Roanoke River Watershed
Figure 1



2. Ore Branch

Ore Branch originates in Roanoke County in the vicinity of Tanglewood Mall and the Hunting Hills Subdivision. It then enters Roanoke City and flows beside 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, and very little of the natural channel remains.

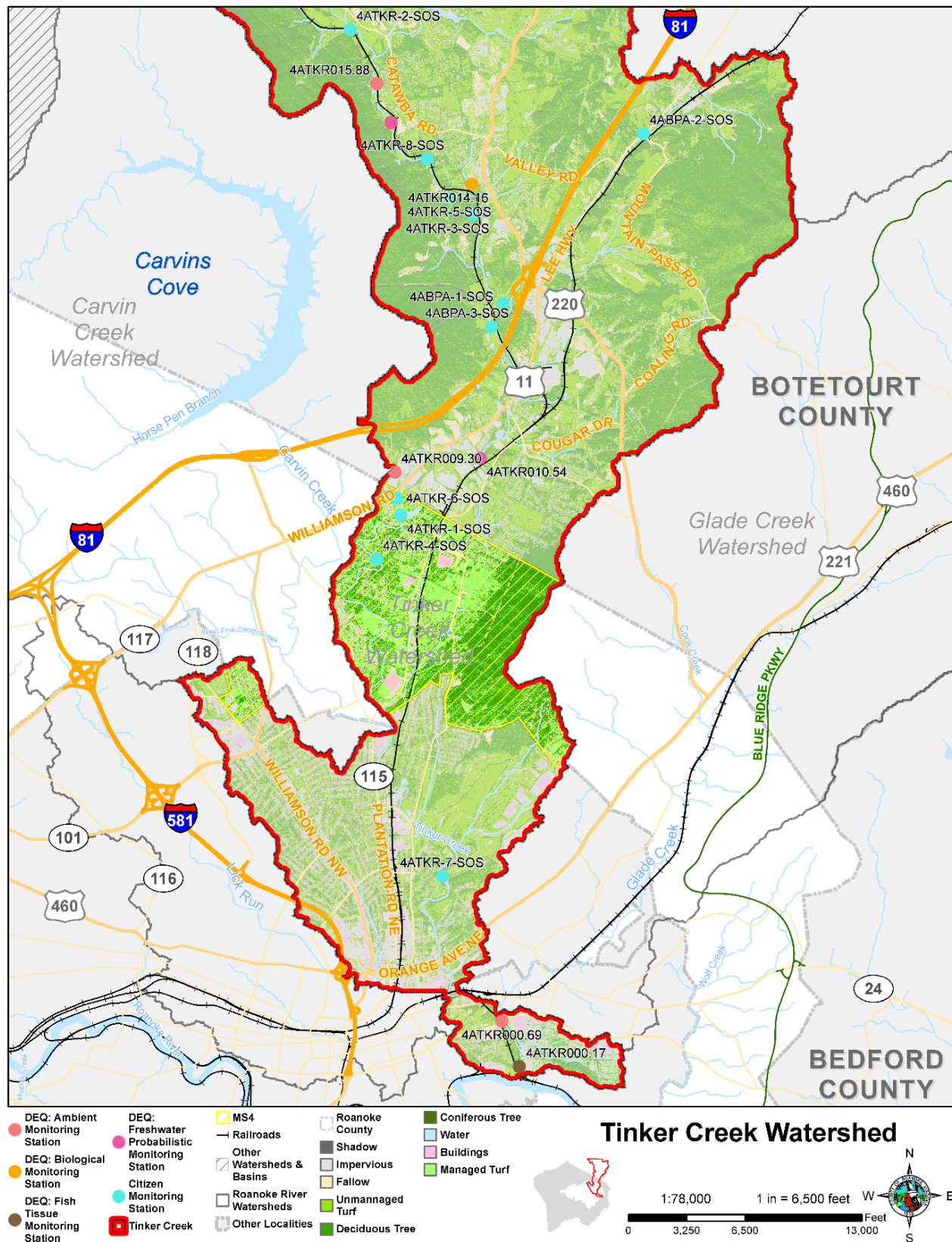
Within Roanoke County, Ore Branch's 1.38 square mile watershed is totally contained within the County's MS4 regulated area. There are approximately 3.72 miles of drainage ways having drainage areas of 100 acres or greater. See **Figure 2: Ore Branch Watershed Map**.



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's 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 WLA for *E. coli*: 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 three aforementioned streams) is totally contained within the County's MS4 regulated area. There are approximately 8.2 miles of drainage ways having drainage areas of 100 acres or greater. See **Figure 3: Tinker Creek Watershed Map**.



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 then it 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 drainage ways having drainage areas of 100 acres or greater within the regulated MS4 area. There are approximately 1.72 miles of drainage ways having drainage areas of 100 acres or greater outside of the regulated MS4 area. See **Figure 4: Glade Creek Watershed Map**.

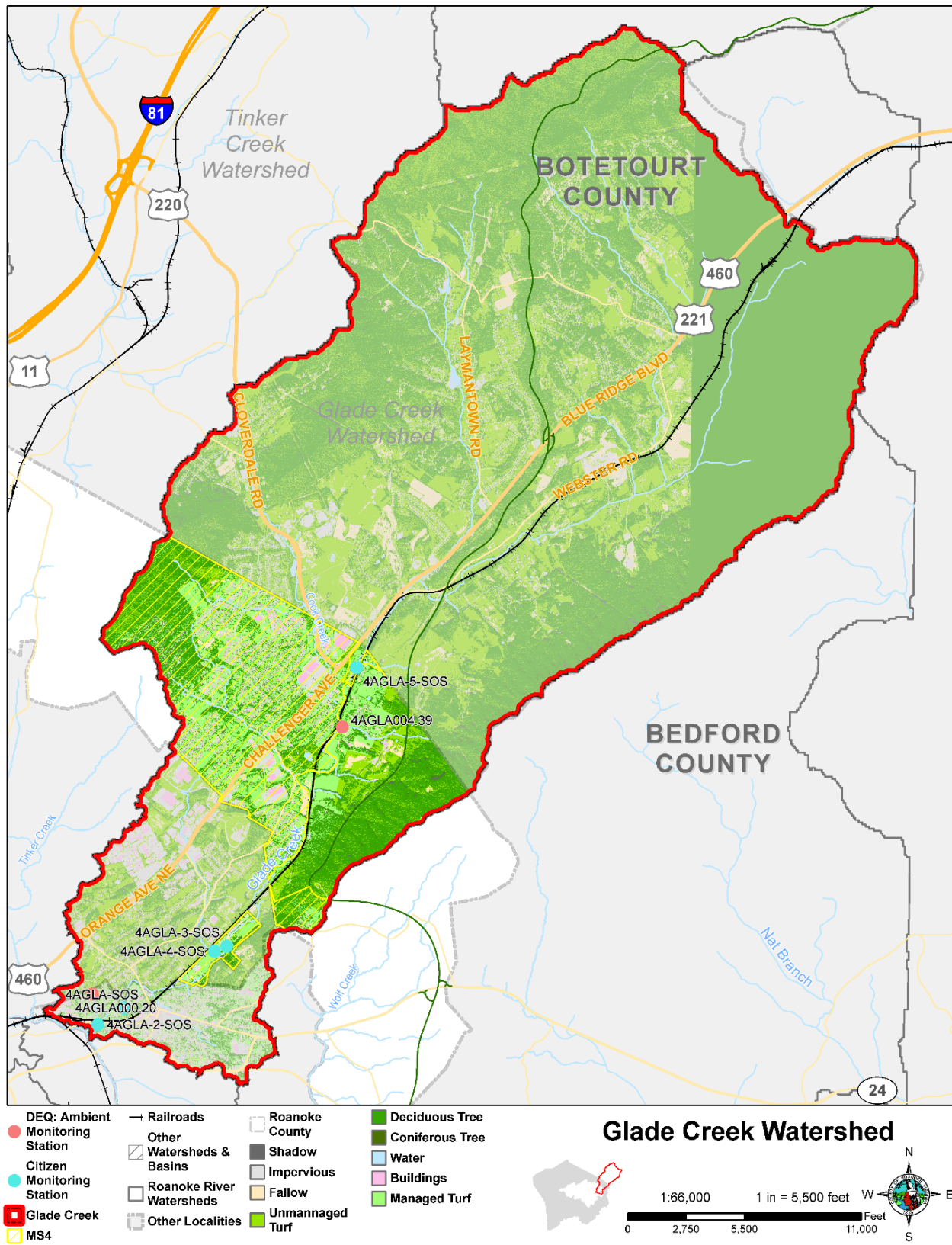


Figure 4

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 then it 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 drainage ways having drainage areas of 100 acres or greater within the regulated MS4 area. There are approximately 8.1 miles of drainage ways having drainage areas of 100 acres or greater outside of the regulated MS4 area. See **Figure 5; Carvin Creek Watershed Map**.

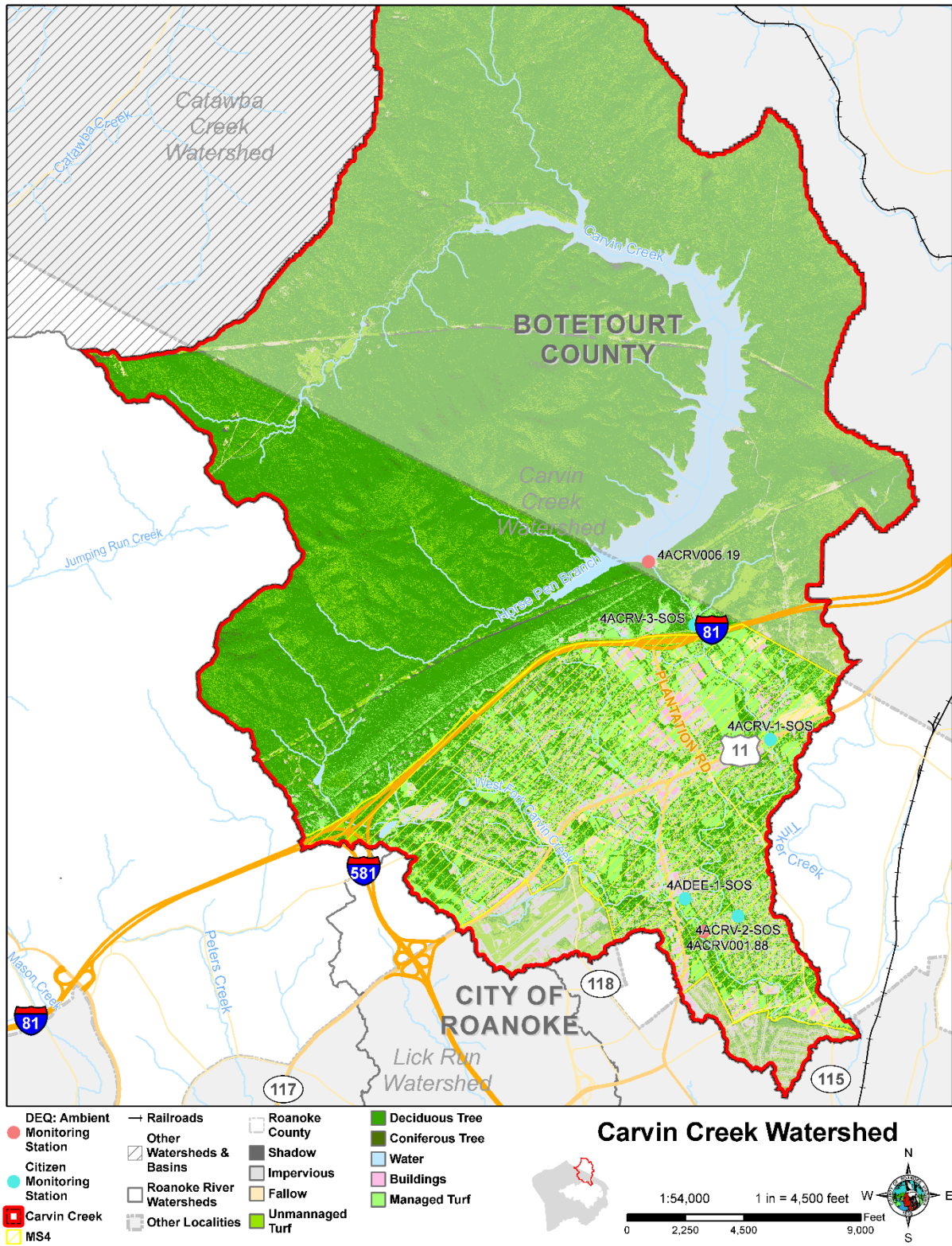


Figure 5

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 its crossing under 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 drainage ways having a drainage area of 100 acres or greater. See **Figure 6: Lick Run Watershed Map**.

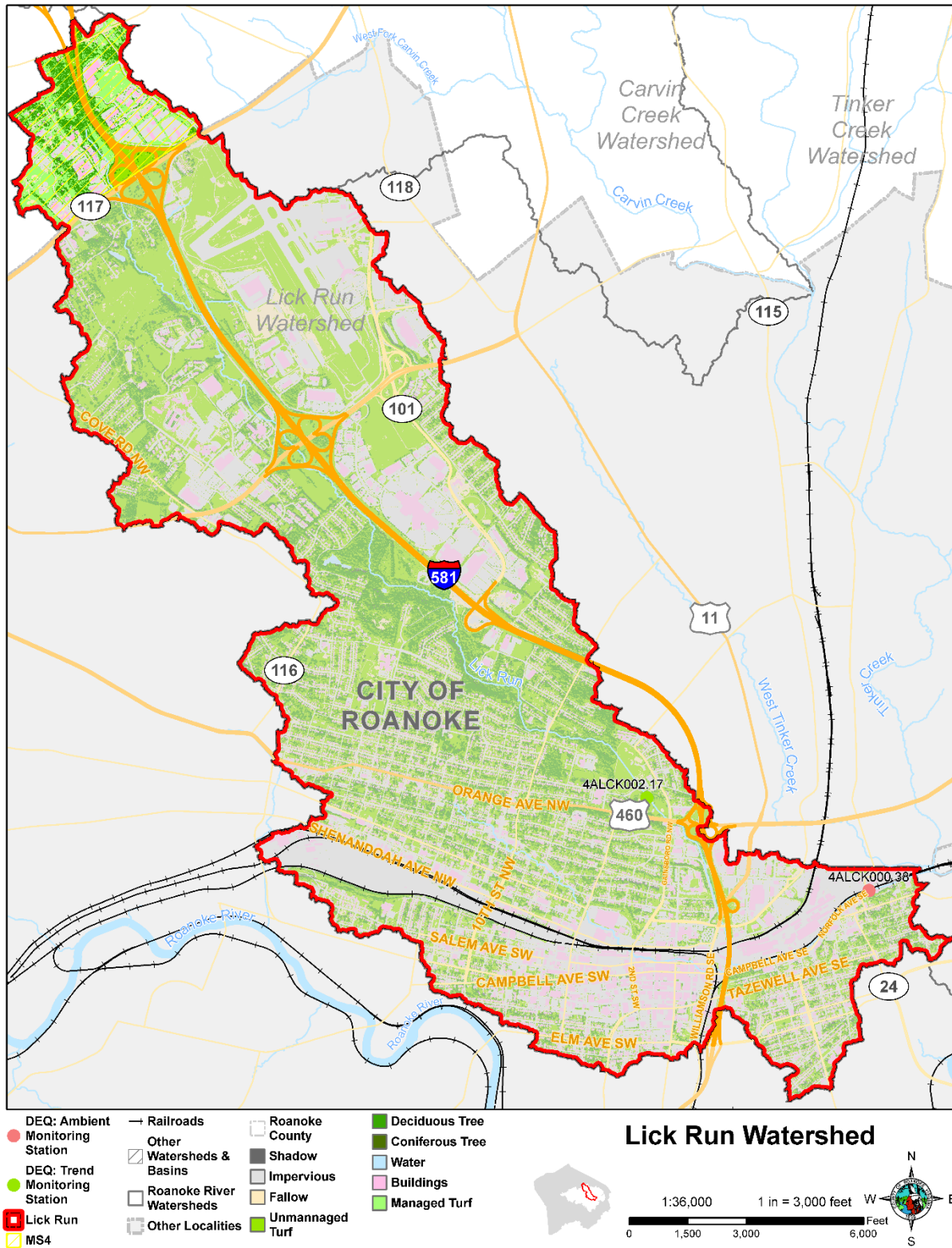
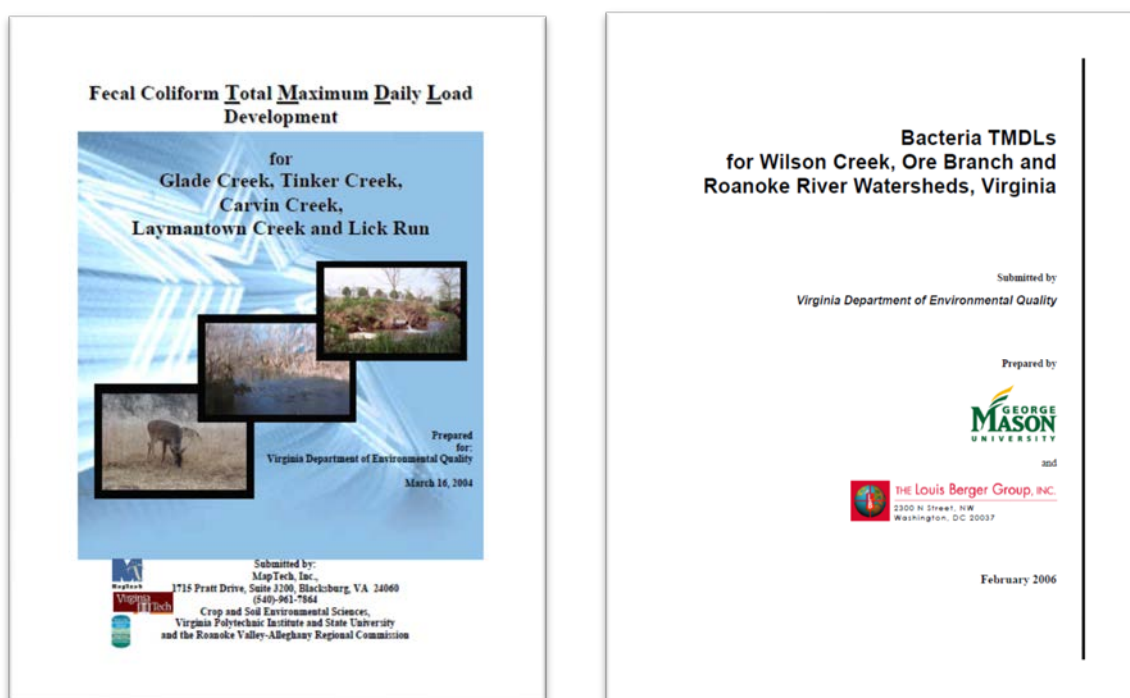


Figure 6

C. Impairments and TMDL Waste Load Allocations

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. After the initial listing, the state water quality standard was 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.

Bacteria TMDLs for Wilson Creek, Ore Branch and Roanoke River Watersheds, Virginia were 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 ($2.37\text{E}+13$) 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 ($2.84\text{E}+11$) 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.

Bacteria TMDLs for Wilson Creek, Ore Branch and Roanoke River Watersheds, Virginia was 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 ($2.13\text{E}+11$) 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 ($1.07\text{E}+09$) 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.

Fecal Coliform Total Maximum Daily Load Development for Glade Creek, Tinker Creek, Carvin Creek, Laymantown Creek and Lick Run was 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 ($5.36\text{E}+11$) 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.

Fecal Coliform Total Maximum Daily Load Development for Glade Creek, Tinker Creek, Carvin Creek, Laymantown Creek and Lick Run was 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.

Fecal Coliform Total Maximum Daily Load Development for Glade Creek, Tinker Creek, Carvin Creek, Laymantown Creek and Lick Run was 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.

Fecal Coliform Total Maximum Daily Load Development for Glade Creek, Tinker Creek, Carvin Creek, Laymantown Creek and Lick Run was 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.*

D. Significant Sources of *E. coli* Discharging into MS4

No specific localized significant sources of *E. coli* have been determined. The two TMDL studies identified the following as the most likely sources: 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), wastes from pets, unspecified domestic waste, and wildlife other than waterfowl.

Roanoke County has chosen to focus its efforts on the following strategies in an effort to lower the discharge of *E. coli* from its MS4 system:

Dog Waste Stations and Signage <ul style="list-style-type: none">• Develop a written plan describing where dog waste stations will be installed• Install at least 5 stations or signs per year, until plan is achieved
Protect Stream Buffers: Ordinance <ul style="list-style-type: none">• Finalize ordinance• Present to Board of Supervisors for consideration• Implement ordinance (if approved)
Protect Stream Buffers: No-Mow Policy for County-Owned Lands
Public Education: Reducing Food Sources Accessible to Wildlife
Public Education: Septic System Repair & Maintenance
Business Outreach: Eliminating Illicit Discharges
Enhanced Public Outreach for Bacteria (<i>E. coli</i>)
Enhanced Employee Training for Bacteria (<i>E. coli</i>)



Do not feed wild animals



Repair failing septic systems



Dog Waste Station with bags and trash can



Active citizen engagement: inspecting a drop inlet

III. BMPs DESIGNED TO REDUCE *E. coli*

The following Best Management Practices (BMPs) have been specifically identified to reduce discharges of *E. coli* from the County's MS4. Many of the BMPs listed below are also effective in reducing sediment discharges. Note that the highlighted categories shown below align with "Table 5 Strategies for Bacteria Reduction Stormwater Control/Management" in the MS4 Permit.

A. Domestic Pets

BMP B-1: Dog Waste Stations and Signage



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 from running at large, requires the areas where house dogs are kept to be free of flies and nuisance odors, and prohibits depositing waste in public parks and recreation areas.

Roanoke County has been implementing a variant of this BMP and has already installed 26 dog waste stations over several permit years. For the locations of existing "Mutt Mitt" dog waste stations, see the online map at <https://www.roanokecountyva.gov/2594/GIS-Mapping-Support>.

By July 1, 2020, Roanoke County will develop a written plan that describes where, on County property, dog waste stations will be installed. Each dog waste station will have signage reminding owners to pick up after their dogs. A minimum of 5 dog waste stations will be installed annually, until the conditions of the written plan are met.

BMP B-2: Protect Stream Buffers: Ordinance

Stream buffers can be effective in dissuading stream access and in filtering stormwater runoff that sheet flows through the buffer, which helps to remove sediment, bacteria, and other pollutants.

Roanoke County currently only has stream buffer requirements for new development along the Roanoke River (Roanoke River Overlay District). In order to expand stream buffer protection, the County has been working on proposed revisions to its Erosion and Sediment Control (ESC) Ordinance to require the maintenance or reestablishment of stream buffers whenever land disturbance activities require an Erosion and Sediment Control Permit.

The proposed changes to the ESC Ordinance will be finalized after additional interaction with stakeholders, which is set for the fall 2020. The final draft ordinance will be presented to the

Board of Supervisors by the winter 2020. If the Board approves the new stream buffer requirements, then the effective implementation date of the revised ordinance will likely be one year after adoption.

BMP B-3: Protect Stream Buffers: No-Mow Policy for County-owned Lands

The County owns significant property that is adjacent to streams. Historically, the County has mowed much of this property up to the top of stream bank. More recently, the County has recognized that this practice contributes to accelerated stream bank erosion and provides dogs with ready access to the streams.

The County will formalize its management of stream buffers on County-owned property in a written policy. The policy will balance the competing goals of providing adequate access to streams for the public, providing adequate views of the streams, excluding dogs, protecting stream banks, and providing vegetative filters. The policy will state general County criteria, but it will be flexible enough to allow variations in the field for proper overall park management.

The policy will be prepared by the end of calendar year 2020, with implementation occurring in spring 2021.

B. Wildlife

BMP B-4: Public Education: Reducing Food Sources Accessible to Wildlife

Roanoke County is blessed with natural beauty and an abundance of wildlife. However, problems often arise when wildlife can access food sources derived, either purposefully or inadvertently, from people. These problems include wildlife becoming dependent on people for food, increased potential for disease for both people and animals, increased property damage, and increased bacteria discharged from animal waste.

By July 2020, Roanoke County will expand its public education program to encourage citizens to reduce food sources accessible to wildlife. Typical messages will include:

- Keep trash cans covered and protected from animals
- Do not feed pets outdoors
- Secure bird feeders from squirrels, bears, and other animals
- Do NOT feed wild animals, including Canadian geese

C. Illicit Connections or Illicit Discharges to the MS4

BMP B-5: Public Education: Septic System Repair & Maintenance

Onsite sewage disposal systems predominately consist of septic tanks with drain fields. Roanoke County has over 12,000 septic tanks or other onsite sewage disposal systems, with approximately 45% of them installed prior to 1970.

Malfunctioning or poorly maintained onsite sewage disposal systems may result in discharges of bacteria from human waste.

Roanoke County currently incorporates messages in its public education program about the need to periodically pump out septic systems and to keep systems properly operating. Roanoke County will continue these messages.

BMP B-6: Business Outreach: Eliminating Illicit Discharges

Roanoke County conducts site inspections of targeted businesses that have an elevated potential to discharge bacteria, such as veterinary clinics, kennels, pet stores, restaurants, vehicle maintenance shops, and car washing facilities.

if the business owner is willing, County staff conduct an inspection of the selected facility and discuss ways to minimize illicit discharges in the day-to-day operations at the facility. If an actual or potential illicit discharge is identified, the County's inspection staff work with the business owner to eliminate or reduce the risk. A minimum of 15 businesses will be inspected each year.

BMP B-7: Enhanced Public Outreach for Bacteria (*E. coli*)

In accordance with the MS4 Permit requirements, Roanoke County's Public Education Program targets three high-priority water quality issues that contribute to the degradation of stormwater runoff and receiving waters: excess bacteria, excess sediment, and excess nutrients. The following BMPs, as outlined in the County's MS4 Program Plan, address these issues:

BMP 1-1: Stormwater Educational Resources - The County maintains a comprehensive listing of existing stormwater-related agencies and organizations along with pertinent educational programs and resources, which is made available to the public on the County's stormwater website.

BMP 1-2: Roanoke County Stormwater Newsletter - The County annually publishes and distributes a Stormwater Newsletter to every residence within Roanoke County.

BMP 1-3: Stream Monitoring and Education - Through the Clean Valley Council, Roanoke County provides stream monitoring and informational stream seminars for Roanoke County students and residents.

BMP 1-4: Stormwater Education Program for Schoolchildren - Through the Clean Valley Council, Roanoke County implements a stormwater education program for its schoolchildren. Different programs target appropriate grade levels.

BMP 1-5: Stormwater Public Awareness Program - Roanoke County implements a Stormwater Public Awareness Program that includes the distribution of stormwater merchandise, public service announcements, and other high visibility educational media.

BMP 1-6: Roanoke County Stormwater Webpage - Roanoke County maintains a Stormwater webpage as a means to inform the public on the various ways to reduce stormwater pollution, placing priority on reducing impacts to impaired waters and addressing other local water pollution concerns.

BMP 1-7: Targeted Education Program - Roanoke County implements a stormwater quality education program for specific (target) audiences. This BMP coordinates with **BMP 1-5: Stormwater Public Awareness Program**.

BMP 2-3: MS4 Program and Stormwater Pollution Prevention Website - Roanoke County maintains a webpage that is dedicated to the MS4 Program and Stormwater Pollution Prevention.

The aforementioned BMPs will be revised, where appropriate, to include messages from the Bacteria TMDL Action Plan: (1) Use of Dog Waste Stations; (2) Protecting Stream Buffers; (3) Reducing Food Sources Accessible to Wildlife; (4) Septic System Repair & Maintenance; and (5) Eliminating Illicit Discharges. This effort will also extend to training materials developed for County employees. See **BMP B-8: Enhanced Employee Training for Bacteria (*E. coli*)**.

Figure 7. Targeted Education & Outreach Program for Bacteria Reduction

High-Priority Water Quality Issue	Target Audiences	Means to Determine Audience Size	Estimated Audience Size	Overall Messages	Means to Deliver Messages	Rationale
BACTERIA	Restaurants	Business Licenses/ Yellow Pages	115	<ul style="list-style-type: none"> Excessive bacteria hinders stream usage and contributes to algae overgrowth, which hurts aquatic life. All wastewater must go to sanitary sewers. Keep exterior trash receptacles and dumpsters covered (and protected from animals) and do not wash out into storm drain. Clean kitchen hoods and floor mats; properly dispose of wastewater. Do not feed wild animals, including geese 	<ul style="list-style-type: none"> Mailer, annually PSAs on local cable station 	<p>Uncovered dumpsters containing garbage and dumpsters and greasy floor mats that are rinsed out onto the pavement can contribute bacteria to County MS4, which discharges directly to County streams.</p> <p>Feeding wildlife leads to increased bacteria discharged from animal waste.</p>
	Pet Owners (dogs/cats)	Pet Licenses	5,392 dogs 371 cats	<ul style="list-style-type: none"> Excessive bacteria hinders stream usage. Dog waste ends up in streams. Pick up after your pet and properly dispose of waste. When walking pets, use dog waste stations where available. Do not feed wild animals, including geese Keep trash cans covered and protected from animals Do not feed pets outdoors 	<ul style="list-style-type: none"> County Publication sent annually to Homeowners PSAs on local cable station 	<p>Dog waste is a major source of bacteria in County streams.</p> <p>Feeding wildlife leads to increased bacteria discharged from animal waste.</p>
	Veterinarian Offices	Business Licenses/ Yellow Pages	13	<ul style="list-style-type: none"> Excessive bacteria hinders stream usage. Dog waste ends up in streams. Pick up after pets and properly dispose of waste. Do not feed wild animals, including geese Keep trash cans covered and protected from animals Do not feed pets outdoors 	<ul style="list-style-type: none"> Brochures placed in Veterinarian offices, annually PSAs on local cable station 	<p>Dog waste is a major source of bacteria in County streams.</p> <p>Feeding wildlife leads to increased bacteria discharged from animal waste.</p>
	Pet Stores/Pet Boarding/ Grooming	Business Licenses/ Yellow Pages	27	<ul style="list-style-type: none"> Keep trash cans covered and protected from animals Do not feed pets outdoors 	<ul style="list-style-type: none"> Brochures placed in pet stores, annually PSAs on local cable station 	
	County Police and Firemen; Animal Control Officer	County Records	2	<ul style="list-style-type: none"> Excessive bacteria hinders stream usage. Dog waste ends up in streams. Pick up after your pet and properly dispose of waste. Do not feed wild animals, including geese Keep trash cans covered and protected from animals Do not feed pets outdoors 	<ul style="list-style-type: none"> In-house training 	<p>These County employees own or handle dogs as part of their work.</p> <p>Feeding wildlife leads to increased bacteria discharged from animal waste.</p>
	Septic System Owners	Tax Records	?	<ul style="list-style-type: none"> Keep septic system maintained; provide periodic pump out Repair failing septic system 	<ul style="list-style-type: none"> County Publication sent annually to septic system owners 	<p>Malfunctioning or poorly maintained onsite sewage disposal systems may result in discharges of bacteria from human waste.</p>

BMP B-8: Enhanced Employee Training for Bacteria (*E. coli*)

In accordance with the MS4 Permit requirements, Roanoke County's Public Education Program targets three high-priority water quality issues that contribute to the degradation of stormwater runoff and receiving waters: *excess bacteria, excess sediment, and excess nutrients*. Thus, Roanoke County has enhanced its employee training program to recognize bacteria (*E. coli*) as a "high-priority water quality issue." Training courses include the following, as outlined in the MS4 Program Plan:

- **Recognition and Reporting of Illicit Discharges** - 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.
- **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 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 are required to take the Good Housekeeping and Pollution Prevention Practices training are also required to read and follow the County's Standard Operating Procedures (SOPs). These procedures were designed to eliminate or minimize pollutant discharges in stormwater, and are detailed in BMP 6-5 of the MS4 Program Plan.

- **Contractor Oversight for Environmental Compliance** - all supervisors who oversee Contractors that perform work for the County or employees involved in developing contracts for Contractors 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** - 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.

The aforementioned BMPs and the County's Water-Quality Related SOPs will be revised, where appropriate, to include messages from the Bacteria TMDL Action Plan: (1) Use of Dog Waste Stations; (2) Protecting Stream Buffers; (3) Reducing Food Sources Accessible to Wildlife; (4) Septic System Repair & Maintenance; and (5) Eliminating Illicit Discharges.

IV. ANNUAL REPORTING REQUIREMENTS

The MS4 Annual Report will include a summary of actions conducted to implement this Bacteria TMDL Action Plan during the reporting period of July 1st - June 30th for each year of the permit term.

In accordance with the MS4 Permit, the report is submitted to DEQ by October 1st of each year.