Lookout Creek Watershed Management Plan

A Local Stakeholder and Georgia EPD Approved Plan that Outlines the Framework for Improving Water Quality in Lookout Creek

Acknowledgements

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Executive Summary

The Lookout Creek Watershed contains two stream segments that fail to meet criteria set in the State of Georgia. These stream impairments respectively stem from excessive fecal contamination and sedimentation (as well as habitat alterations) as indicated by poor biotic integrity. As a result of these impairments, meeting and maintaining load reductions of these nonpoint source pollutants are necessary within the watershed so that criteria can be met in the future. The need for a further effort to identify consistent sources of these pollutants and work towards addressing the load reductions led to the creation of this Watershed Management Plan for the Lookout Creek Watershed. The plan includes the Nine Elements as recommended by the Environmental Protection Agency, and outlines a process for implementing the load reductions necessary to lead to water quality improvement in the watershed. Development of the plan also featured a stakeholder-driven process to build momentum and partnerships with the local community that will assist in its implementation. The plan has been written by Limestone Valley Resource Conservation and Development Council as a deliverable associated with a Environmental Protection Agency Clean Water Act (§319) grant administered by the State of Georgia. Assuming 319 funding is available, Limestone Valley intends on leading the collaborative watershed improvement effort to help achieve the load reductions necessary.

The Lookout Creek Watershed Restoration Program has been proposed by Limestone Valley to focus on load reductions of fecal coliform bacteria and sediment from agricultural, residential, and more urbanized sources. The multi-faceted program was conceptualized to play on the strengths of the various project partners, and will complement existing conservation programs (e.g., Environmental Quality Incentives Program). As part of this program, agricultural lands have been identified for targeting load reductions through cost-shares with landowners interested in the installation of Best Management Practices. The agricultural practices implemented will vary depending on the interests of the farmers, but will likely include stream access control, stream crossings, heavy use area protection, and alternative watering systems for livestock, as well as streambank stabilization and riparian tree plantings. Natural Resource Conservation Service and landowners interested in voluntary conservation on their lands will be important contributors to the success of this program component. Residential lands will also be targeted to reduce the contributions of fecal coliform bacteria from human sources by addressing failing septic systems. This will include cost-shares on repairs of failing septic systems focused near streams and intermittent conveyances throughout the watershed. For this program component, it is anticipated that North Georgia Health District (specifically Dade and Walker County Environmental Health Departments)

will play a key role. Additional "on-the-ground" conservation will very likely be achieved through the implementation of stormwater practices such as streambank stabilization and other stormwater practices in the more urbanized Trenton area.

This Watershed Management Plan, in addition to detailing actual “on-the-ground” projects to be completed, outlines outreach activities for volunteers that were identified by the stakeholder group as having the potential to contribute toward the reduction of nonpoint source pollutant loads and/or further educate the community about watersheds and the importance of water quality, as well as soil and water conservation. The success of outreach and education efforts will be maximized through effective partnerships with several groups. Collectively, these educational and "on-the-ground” management measures will likely be implemented across multiple grants, with each grant also involving monitoring to reevaluate watershed conditions.

For the preparation of this watershed management plan, estimates were calculated to consider the time and funding from 319 sources likely needed to accomplish watershed improvement goals. Other sources of funding (mainly anticipated in the form of in-kind donations from agencies, non-governmental organizations, stakeholders, and landowners) were not estimated, but were assumed to contribute significantly to the improvement process. To come up with a financial estimate, the extent of work within the watershed needed for complete watershed treatment was first conceptualized using Geographic Information Systems analysis and inspection of aerial photography. Next, the extent of the total watershed treatment that would likely be necessary to result in the de-listing of impaired stream segments was estimated. Finally, the projects that these funds would finance were arranged in an implementation schedule that spans several years (including grant proposal submission periods). The proposed implementation schedule includes all grant activities including water quality monitoring, education and outreach activities, and project activities (e.g., agricultural Best Management Practices, septic system repairs, etc). Each of these activities will continue through each grant implementation period. Currently, it is anticipated that multiple grant implementation periods (with a maximum of four) would allow for significant improvements within the watershed. After this period of time, it is expected that the Lookout Creek fecal coliform impairment will have likely been de-listed and the impacted biota impairment along Gulf Creek will at least be improved, provided projects are completed in the Gulf Creek Subwatershed. Success in this endeavor will depend on a number of variables, and priorities will be evaluated and altered throughout plan implementation to maximize results.

1. Plan Preparation and Implementation

A brief overview of the purpose of the Watershed Management Plan has been provided below, as well as the objectives it aims to accomplish, some of the details of the plan development and stakeholder process, and ultimately how the plan will be implemented.

The presence of stream reaches within the Lookout Creek Watershed that fail to meet water quality criteria for the State of Georgia led to the development of this Watershed Management Plan (WMP). The purpose of the plan is to outline a feasible prescription and timeline to implement restoration of the Lookout Creek Watershed to the extent that these impaired stream reaches eventually meet all water quality criteria, and are de-listed from the Georgia 2010 Integrated 305(b)/303(d) List. The plan is not meant to be regulatory in nature, but is meant to serve as guidance for long-term restoration and WMP implementation efforts. In addition, the development of the plan seeks to involve a variety of stakeholders from the watershed in the development process, build community momentum, and encourage stakeholder participation in watershed restoration activities. Within the WMP, we sought to define the roles of such groups demonstrating a willingness to participate and contribute in various ways during the restoration process. The ultimate goals of the planning and restoration process are for impaired segments to eventually be and remain de-listed and for the integrity of other segments to be maintained so that they continue to meet the criteria for each designated use. Ultimately, a broader goal is to make stakeholders and landowners in the watershed more knowledgeable concerning watershed issues and how to go about managing the landscape to minimize water and soil resource concerns.

Figure 1.1.a. Dry Creek of the upper Lookout Creek Watershed in Georgia.

Limestone Valley Resource Conservation and Development (RC&D) Council has developed this WMP as part of a U.S. Environmental Protection Agency (EPA) Clean Water Act (§319) grant awarded by Georgia Environmental Protection Division (EPD). In most cases in the State of Georgia, WMPs are updates of historical Total Maximum Daily Load (TMDL) Implementation Plans; however, a previous TMDL Implementation Plan has not been constructed for the Lookout Creek Watershed making the first planning document for the HUC 10 watershed. As recommended by the EPA for all watershed planning documents, the Nine Elements of watershed planning (described below) are included in this WMP. The inclusion of these elements is recommended to help ensure stakeholder involvement and approval lead to an explicit prescription to eventually meet watershed restoration objectives. Specifically, the Nine Elements are as follows:

1. An identification of the sources or groups of similar sources contributing to nonpoint source (NPS) pollution to be controlled to implement load allocations or achieve water quality standards.

2. An estimate of the load reductions needed to de-list impaired stream segments;

3. A description of the NPS management measures that will need to be implemented to achieve the load reductions established in the TMDL or to achieve water quality standards;

4. An estimate of the sources of funding needed, and/or authorities that will be relied upon, to implement the plan;

5. An information/education component that will be used to enhance public understanding of and participation in implementing the plan;

6. A schedule for implementing the management measures that is reasonably expeditious;

7. A description of interim, measurable milestones (e.g., amount of load reductions, improvement in biological or habitat parameters) for determining whether management measures or other control actions are being implemented;

8. A set of criteria that can be used to determine whether substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised; and;

9. A monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under item (8) above.

This document, in addition to including the Nine Elements of watershed planning, is intended to focus significant effort on specific watershed details, as well as a comprehensive Geographic Information Systems analysis that investigates several factors that exert an influence on non-point source (NPS) pollutant loads. More focus on these details should lead to a greater understanding of the local physical and social environment and help ensure greater success in improving the watershed and better define priorities in the watershed for targeting Best Management Practice (BMP) Installations, allow for better long-term land use and riparian comparisons, and assist in the development of more discreet objectives and milestones.

This WMP was fairly difficult to construct and utilized extensive research on the watershed, including water quality monitoring and GIS analysis. The GIS component focused on analyzing riparian buffers, land use percentages, and housing densities. GIS and water quality monitoring were also used as tools to identify broad areas of likely NPS pollution sources and priority areas for installation of BMPs.

As mentioned previously, a stakeholder group (Table 1.1.a.), consisting of members of local, state, and Federal government, local utilities, nonprofit groups, and the private sector also contributed to the development of the plan. Some members were invited to take part in the process due to their professional expertise and interest in relevant disciplines and restoration efforts. Others were invited due to their interests in farming. Local governments were also made aware of the stakeholder process and given the opportunity to participate in the stakeholder group. Overall, we wanted a diverse group involved to provide different perspectives in the process.

Table 1.1.a. Stakeholders who participated in the development process for the Lookout Creek Watershed Management Plan.

WATERSHED ADVISORY COMMITTEE MEMBERS		
Name	**Main Affiliation**	**Email Address**
Susan Russell	Chattanooga Arboretum and Nature Center	srussell@chattanature.org
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Lloyd Gas	Coosa River Soil and Water Conservation District	lcbwg@aol.com
Linda Wilson	Dade County Citizen and Farmer	lanew@tvn.net
Verenice Hawkins	Dade County Citizen and Farmer	verenicehawkins@gmail.com
Mary Petruska	Tree City Board of Trenton	marypetruska@earthlink.net
Robin Ford Wallace	Dade Planet	robinfordwallace@tvn.net
Ted Rumley	Dade County Commissioner	trumley@dadega.com
Robert Goff	Dade County Commission	Rgoffy1@yahoo.com
Natalie Walls	Dade County Environmental Health Department	nawalls@dhr.state.ga.us
John Klepper	Dade County Environmental Health Department	jrklepper@dhr.state.ga.us
Doug Anderton	Dade County Water and Sewer Authority	danderton@mydadewater.com
Bobby Dunn	Georgia Forestry Commission	rdunn@gfc.state.ga.us
Cindy Askew	Natural Resource Conservation Service	Cindy.askew@ga.usda.gov
Joe Lee	Natural Resource Conservation Service	jlee@dade.ga.com
Katie Hammond	University of Georgia Cooperative Extension	khammond@uga.edu
Alan Painter	Citizen and State House Candidate	Alan@painter.com
Patti Nethery	Board of Health	Pnethery2002@gmail.com

A series of public meetings were conducted in 2014 with members of the stakeholder group in an effort to engage the public in the WMP development process and seek their input for the plan. Stakeholders were informed of the likely effect of the process on the community, and surveyed to ensure contributions were made to the development of the WMP and/or implementation process likely to follow. A few stakeholders were consulted more regularly due to their expertise and willingness to provide additional support in the process of developing the plan. It was also anticipated that some stakeholders may become project partners and contribute significantly in the restoration process. Meetings focused on gathering input about potential problems and solutions, discussing sampling data, developing priorities, evaluating what BMPs may be received locally with the best public reception, and obtaining insight on the WMP document itself. Finally, approval was sought for the document to serve as the plan on which implementation efforts follow to restore and maintain the watershed.

Implementation of this plan will likely depend on funding from Clean Water Act (§319) grants in addition to various assistance from other groups and focus to improve the watershed through several specific project components. These include educating the public about NPS pollution and watershed processes and reducing NPS pollution from agricultural lands, septic systems, and stormwater in the watershed.

Stakeholder assistance in some aspects of the restoration effort will be a key factor in success. Plan implementation will occur with respect to private property rights and rely on voluntary conservation, which involves participation from landowners in cost-shares to put in BMP practices that reduce NPS pollution on/from their properties. Most practices are mutually beneficial to the landowner and water quality, which helps incentivize participation. Although management of individual parcels is key to watershed restoration, a discussion regarding individual parcels has been avoided so as not to discourage participation, which could occur if directed criticisms over the management of specific private lands were included. Instead, the general NPS issues associated with specific land uses which predominate within the watershed are discussed, and the proposed project components are meant to address a number of NPS pollutant sources that occur on the landscape.

It will be a difficult endeavor to accomplish all the objectives of the plan through the voluntary conservation approach; however, by building momentum through a phased approach, and developing relationships in the community, the process should cumulatively achieve significant NPS pollution reduction. To our knowledge, Clean Water Act (§319) grants have not yet been implemented in the Lookout Creek Watershed. Developing this WMP on the front end of a potential effort will ensure restoration is designed in the most constructive way possible for the area. In addition, following an explicit document from the beginning and tracking the strengths and weakness of the process will allow the plan to evolve and make changes in strategies that are weaknesses in the process. To increase the chance of successful watershed restoration, a reassessment of the plan is scheduled every five years. This iterative process will allow for adaptive management where citizens and stakeholders can analyze project successes and failures, and provide opportunities for changes in restoration priorities.

2. Description of Lookout Creek Watershed

An extensive watershed background as it relates to the development of a WMP for the Lookout Creek Watershed in Northwest Georgia is found in the following section. The section is organized into three parts. The first part is a description of landscape features and includes the local watershed geography and geology in the area. The second part focuses on the local forests, wildlife, and fishes. The last describes anthropogenic features in the watershed (e.g., resource uses, political boundaries, etc.).

2.1 Landscape Features

Watershed Geography

The Lookout Creek Watershed (HUC 0602000112) originates in Dekalb County, Alabama, and drains nearly 120,000 acres altogether, most of which is rural landscape in Northwest Georgia, prior to entering the Tennessee River in Hamilton County, Tennessee, just southwest of Chattanooga. The watershed, depicted in Figure 2.1.a., drains much of western Lookout Mountain, all of Lookout Valley, and the eastern slopes of Sand Mountain. In Georgia, the catchment occupies a portion of Walker County and much of Dade County and includes the towns of Trenton, Wildwood, and Rising Fawn. The watershed is contained within the Ridge and Valley and Southwest Appalachian Level III Ecoregions, and contains significant forest (approximately 71%), and some pasture and hay activity (12%), according to the most recent land use analysis using National Land Cover Database (NLCD).

Lookout Creek originates as East Fork Lookout Creek and West Fork Lookout Creek, which come together just before flowing from Alabama into Georgia. It flows northeast following Lookout Valley in between Lookout and Sand Mountains. In Georgia, the valley is fairly narrow, especially in the upper watershed, although some meandering of Lookout Creek takes place. As the fairly narrow, linear nature of the watershed suggests, few major tributaries exist in the watershed. In Georgia, direct named tributaries to Lookout Creek include from upstream to downstream: Dry Creek, Gulf Creek, Hurricane Creek, Allison Creek, Crawfish Creek, Town Creek, Sitton Gulch Creek, McClain Branch, Squirrel Town Creek, McCollum Branch, Pope Creek, and Wauhatchie Branch. The subwatersheds of the creeks (more significant than branches) are contained in Figure 2.1.b.

Dry Creek drains a portion of the watershed in Alabama and confluences with Lookout Creek just across the Georgia border. Similar in size to the headwaters of Lookout Creek, the contributions of Dry Creek nearly double the size of Lookout Creek. Gulf Creek, which comes off of Lookout Mountain, next enters Lookout Creek from the east. Hurricane Creek, originating near the foot of Lookout Mountain, then contributes to Lookout Creek in the vicinity of Rising Fawn, Georgia. Allison Creek and then Crawfish Creek drain into Lookout Creek next both coming out of Alabama. In Trenton, Georgia, Town Creek enters Lookout Creek and drains much of the Trenton area and a portion of the slopes of Sand Mountain. Just north of Trenton, Sitton Gulch Creek, enters Lookout Creek from the slopes of Lookout Mountain and much of Cloudland Canyon State Park. McClain Branch, Squirrel Town Creek, McCollum Branch, Pope Creek, and Wauhatchie Branch then contribute to Lookout Creek in sequence from the west. Small portions of the Pope Creek and Wauhatchie Branch subwatersheds lie in Tennessee. Altogether, approximately 10,000 acres of the watershed lie across the Tennessee border.

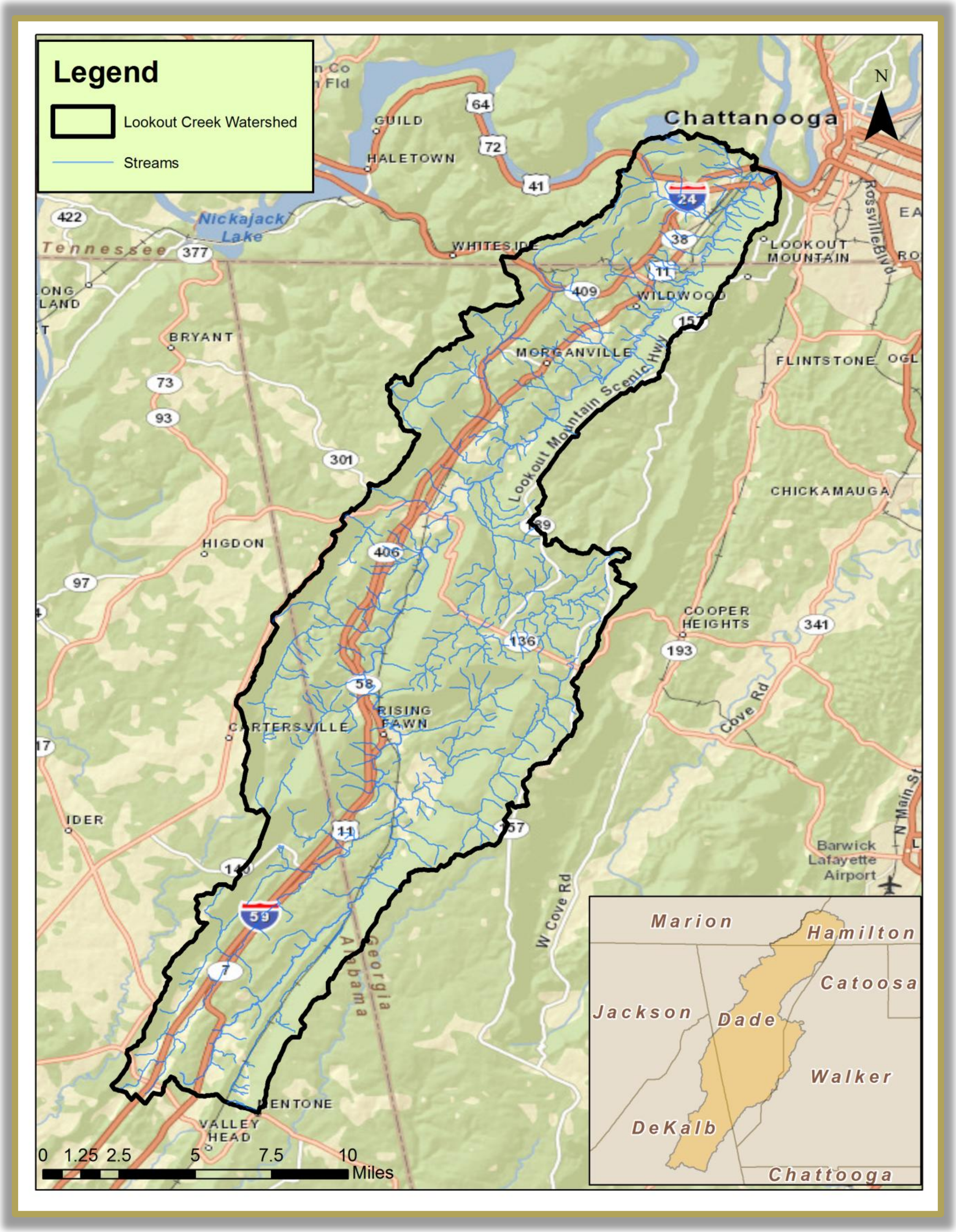


Figure 2.1.a. The Lookout Creek Watershed of the Tennessee River Basin.

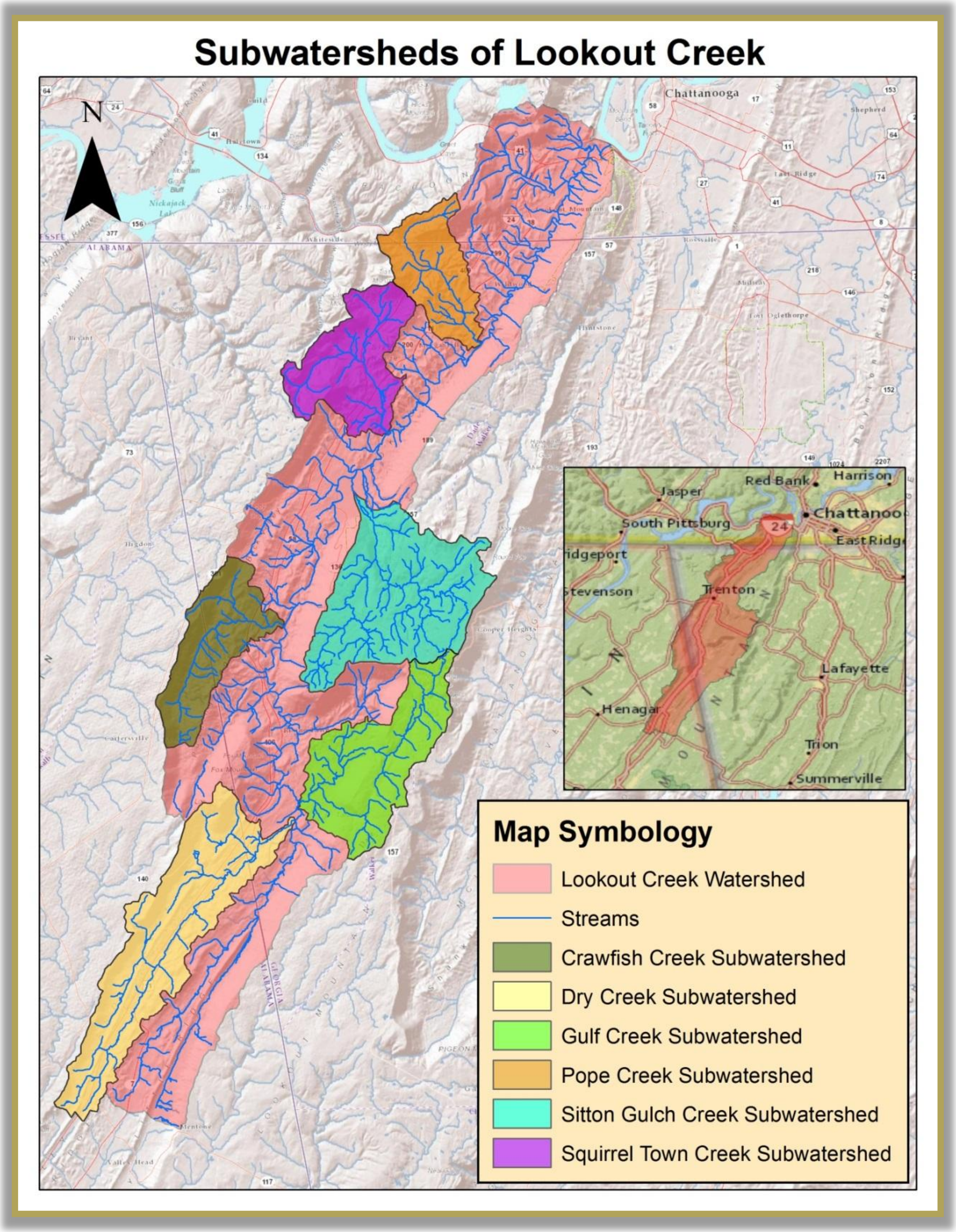
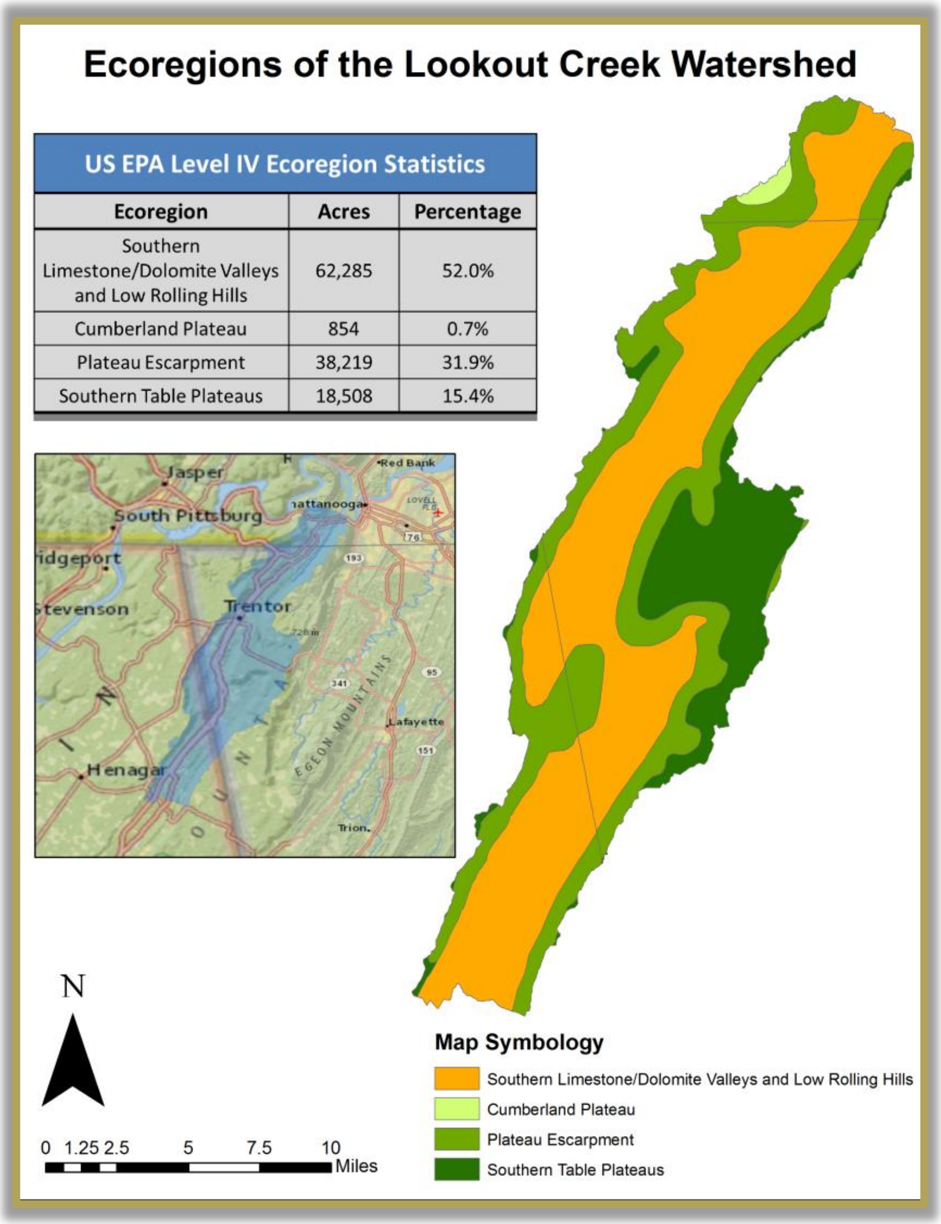


Figure 2.1.b. The Lookout Creek Watershed with the subwatersheds of significant tributaries outlined and identified.

Watershed Geology

The Lookout Creek Watershed contains portions of two Level III Ecoregions, the Ridge and Valley and the Southwestern Appalachians, which are depicted in Figure 2.1.c. The valley floor is part of the Ridge and Valley Ecoregion, which is generally characterized by relatively low-lying, northeast-southwest trending ridges and valleys. Geological materials vary and include limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. The region is also known for a diverse collection of aquatic habitats, as well as species of fish and other aquatic life. The portions of the Lookout Creek Watershed on the slopes and plateaus are part of the Southwestern Appalachians Ecoregion, which includes the Cumberland Plateau.



Ecoregion	Acres	Percentage
Southern Limestone/Dolomite Valleys and Low Rolling Hills	62,285	52.0%
Cumberland Plateau	854	0.7%
Plateau Escarpment	38,219	31.9%
Southern Table Plateaus	18,508	15.4%

Figure 2.1.c. The Lookout Creek Watershed showing the locations of ecoregions within its borders.

More specifically, the valley portion of the Lookout Creek watershed is composed of limestone and cherty dolomite with numerous caves and springs. Soils are diverse in productivity. The slopes of Lookout and Sand Mountains are known to be steep and forested with high gradient streams. Geologic materials on the slopes include Mississippian-age limestone, sandstone, shale, and siltstone, and Pennsylvanian-age shale, siltstone, sandstone, and conglomerate. The cliff faces are made up of huge, angular, blocks of sandstone with similar colluvium lining the bottom of the slopes. Where streams have cut into the slopes, limestone is exposed. Only a portion of the Lookout Mountain Plateau and small portions of the Sand Mountain Plateau lie within the watershed. These areas are very similar to the Cumberland Plateau. Geologic materials include Pennsylvanian-age sandstone caprock, shale layers, and coal-bearing strata.

2.2 Important Flora and Fauna

Forest Ecosystems

Approximately 70% of the Lookout Creek Watershed is forested. Forests in the valley consist of oak-hickory and oak-pine communities, with Eastern red cedars common in open areas. Mesic communities (e.g., beech-yellow poplar and sugar maple-basswood-ash-buckeye) are common along the slopes of Lookout and Sand Mountains. The ravines and gorges on the upper slopes (of Lookout and Sand Mountains) are described as mixed oak and chestnut oak communities. The plateaus of Lookout and Sand Mountains consist of mixed oak and oak-hickory communities with shortleaf pines.

Figure 2.2.a. The view of Sitton Creek Gulch from the top of Cloudland Canyon State Park.

Wildlife and Habitat

The Lookout Creek Watershed is primarily a rural environment with an abundance of forest and pasture that provide good habitat for wildlife. The wildlife of Northwest Georgia and their habitats are described in detail in the Soil Survey of Catoosa County, Georgia. Wildlife in woodland habitats can include wild turkey (*Meleagris gallopavo*), American woodcock (*Scolopax minor*), thrushes *(Turdidae* family*)*, woodpecker (*Picidae* family), and American black bear (*Ursus americanus)*. Pine and hardwood forests surrounding pasture make good habitat for white-tailed deer (*Odocoileus virginianus*), mourning dove (*Zenaida macroura*), raccoon (*Procyon lotor*), gray squirrel (*Sciurus carolinensis*), opossum (*Didelphis virginiana*), and fox (*Vulpes sp*.). Cropland, pasture, meadows, and other open areas with suitable food and cover are inhabited by Eastern cottontail rabbit (*Sylvilagus floridanus*), bobwhite quail (*Colinus virginianus*), meadowlark (*Sturnella magna*), field sparrow (*Spizella pusilla*), and red fox (*Vulpes vulpes*). Deer, rabbit, fox, quail, and other wildlife gain food and cover in the abundant native woody and herbaceous plants that occur in unmanaged pasture, old fields, young pine plantations, and thin woodland tracts. Waterfowl, otter (*Lontra canadensis*), beaver (*Castor canadensis*), bobcat (*Lynx rufus*), and raccoon inhabit forested wetlands, which occur mostly along streams. More open wetlands attract ducks and geese (*Anatidae* family), herons (*Ardeidae* family), shorebirds, and beaver.

Listed and Sensitive Species

According to Georgia Department of Natural Resources (DNR), the streams of the Lookout Creek Watershed are also home to several obligate aquatic species protected by the state of Georgia, some of which may be influenced by changes in the watershed. Known occurrences of these species in the watershed include the following: the green salamander (*Aneides aeneus*), blackbarred crayfish (*Cambarus unestami*), eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*), blackside snubnose darter (*Etheostoma duryi*), northern studfish (*Fundulus catenatus*), map turtle (*Graptemys geographica*), popeye shiner (*Notropis ariommus*), dusky darter (*Percina sciera*), Tennessee dace (*Phoxinus tennesseensis*), and southern cavefish (*Typhlichthys subterraneus*). Other rare aquatic species in Georgia known to occur in the watershed include the emerald shiner (*Notropis atherinoides*), scarlet shiner (*Lythrurus fasciolaris*), spotfin shiner (*Cyprinella spiloptera*), telescope shiner (*Notropis telescopus*), blueside darter (*Etheostoma jessiae*), and redline darter (*Etheostoma rufilineatum*). Improvements within the watershed would undoubtedly be positive for the outlook of these collective species.

Figure 2.2.b. The Tennessee Dace is a protected species in the watershed.

Fisheries

The most upstream portion of the Lookout Creek Watershed in Georgia has also been designated as year round trout waters over the years. According to Georgia DNR, Lookout Creek and its tributaries, upstream of Rising Fawn, in addition to Allison Creek, are designated by Georgia DNR as year-round trout streams, although it does not appear these streams are presently stocked according to the 2013 stocking schedule. According to DNR, these streams are open to trout fishing the last Saturday of March through the end of October each year. Such designations result in more strict regulations intended to minimize sedimentation and maintain forest buffers for temperature control. Current state regulations require the maintenance of a 50 foot vegetated buffer on either side of a trout stream with permits required for modifications within the buffer areas. People can also be regularly seen fishing in the vicinity of Sitton's (or Payne's) Mill in the middle portion of the watershed. They likely catch various sunfish (*Lepomis* spp.) and basses (*Micropterus* spp.). Further downstream near the confluence with the Tennessee River, anglers catch fishes more characteristic of Nickajack Reservoir of the Tennessee River, such as the black crappie depicted below in Figure 2.2.c.

Figure 2.2.c. A black crappie (Pomoxis nigromaculatus) sampled within lower Lookout Creek.

2.3 Anthropogenic Features

Political Boundaries

The Lookout Creek Headwaters (as well as Dry Creek and other tributaries) begin in Dekalb County, Alabama, prior to entering Georgia. In Georgia, the vast majority of the watershed lies in Dade County, although a small portion of Walker County is also contained in the eastern part of the watershed (Figure 2.3.a.). Lookout Creek eventually flows north into Tennessee, where approximately 10,000 acres in Hamilton County drain to Lookout Creek prior to its confluence with the Tennessee River. Two tributaries within the Lookout Creek Watershed in Tennessee are listed as impaired for pathogens, according to Tennessee's 2012 Proposed 303(d) List; however, this section of the watershed is not considered in this management plan since its development was funded through the State of Georgia.

Development is relatively sparse in the Georgia portion of the watershed with the exception of Trenton, and to a lesser extent, the unincorporated communities of Wildwood and Rising Fawn. Trenton and Wildwood each were considered to have populations of just over 1,900 individuals during the 2000 census,, and Trenton was said to have more than 2,300 individuals in the 2010 census. Trenton is the only community within Dade County with a sewer system. Elsewhere in the watershed in Dade and Walker Counties, residents rely on septic systems for onsite waste management.

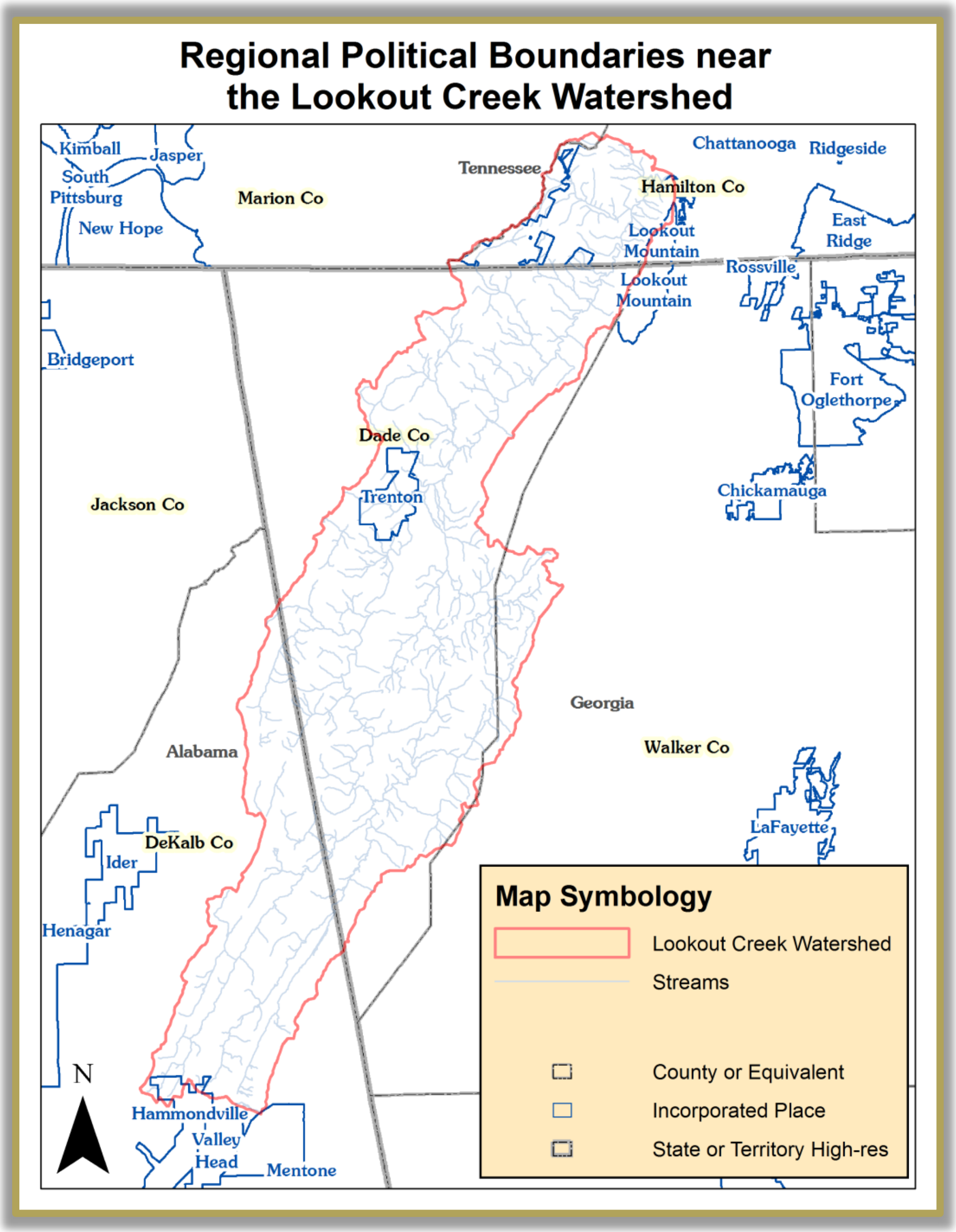


Figure 2.3.a. A map depicting the locations of state and county lines and incorporated cities in the Lookout Creek Watershed and the surrounding area.

Community Water Resources

Dade County Water and Sewer Authority provides drinking water to Trenton, Georgia, using Lookout Creek as its primary source of drinking water. In much of the watershed, however, people rely on wells as a water source for both domestic and livestock purposes. Livestock water sources also include streams and ponds, which is a topic of discussion found later in this document. For water treatment, Dade County Water and Sewer Authority runs a sewage treatment facility located in Trenton. Although a smaller treatment facility is also operated for the Alabama Welcome Center along Red River Branch of the Dry Creek Subwatershed, the vast majority of the watershed outside of Trenton has no sewer in close proximity and utilizes septic systems. None of the communities in the watershed are large enough to require a stormwater management permit and the management of a corresponding stormwater program.

Active Groups Within the Watershed

Several groups with a local presence are relevant to the conservation of the Lookout Creek Watershed and/or the larger Tennessee River Watershed. Federal entities relevant to the WMP development process and/or conservation efforts in the area include the EPA, the Farm Services Agency (FSA), and the Natural Resources Conservation Service (NRCS). State and local entities relevant to the conservation efforts in the area include the Alabama Department of Environmental Management (ADEM), Dade County Water and Sewer Authority, Georgia Association of Regional Commissions, Georgia Department of Natural Resources (DNR), Georgia Department of Public Health, Georgia Environmental Protection Division (EPD), Georgia Soil and Water Conservation Commission (GSWCC), Georgia State Parks, Tennessee Valley Authority, Tennessee Department of Environment and Conservation (TDEC), and University of Georgia Cooperative Extension. In addition, non-governmental organizations that contribute to local conservation efforts include the Chattanooga Arboretum and Nature Center at Reflection Riding, Friends of Cloudland Canyon, Georgia Land Trust, Limestone Valley RC&D Council, Lookout Creek Conservancy, Lookout Mountain Flight Park, and Tennessee River Rescue, among others. Most of these groups have already conducted actions relevant to conservation within the Lookout Creek Watershed, and others have improved local education regarding watershed science and water pollution. Groups conducting long-term programs, monitoring water quality, installing "on-the-ground" projects, implementing nonstructural practices, or those predicted to play a significant role in the implementation of this WMP are discussed further within the document.

3. Watershed Conditions

The section that follows will focus on introducing the state water quality standards and their importance, as well as impairments in the Lookout Creek Watershed, and sampling data from past and current monitoring endeavors. Assessments representative of current watershed conditions are also included.

3.1 Water Quality Standards and Impairments within the Lookout Creek Watershed

Georgia Water Quality Criteria

Georgia's water quality standards are made up of two different groups of criteria. The general criteria apply to all waters, and certain specific criteria exist for each of six designated uses. The general criteria are more qualitative in nature, and include:

- Waters shall be free of materials, oils, and scum associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits, produce turbidity, color, or odor, or that may otherwise interfere with legitimate water uses.

- Waters shall be free from toxic, corrosive, acidic, and caustic substances in amounts which are harmful to humans, animals, or aquatic life.

The six designated uses in Georgia, which can vary in strictness of standards, are:

- Drinking Water Supply
- Fishing
- Wild River
- Recreation
- Coastal Fishing
- Scenic River

The waters of the Lookout Creek Watershed are designated for Fishing. The numeric criteria associated with this designated use are found in Table 3.1.a. The water quality parameters associated with the numeric criteria are important for several reasons including minimization of human health risk and protection of aquatic fauna. When streams fail to meet water quality criteria for a given designated use, they are listed as impaired on the Georgia Integrated 303(d)/305(b) List.

Table 3.1.a. A description of the water quality criteria for waters designated for the use of fishing.

Fecal Coliform Bacteria	Dissolved Oxygen	pH	Temperature
May – Oct < 200 colonies/100 ml as geometric mean* Nov – April < 1000 colonies/100 ml as geometric mean < 4,000 as instantaneous max	< 5 mg/l daily average Not < 4 mg/l at all times	Between 6.0 and 8.5	< 90° F

**** The geometric mean of four samples collected from a site within a 30 day period.***

Impairments in the Lookout Creek Watershed

Sampling of water quality and biota, specifically fecal coliform counts and fish assemblages in this case, in the Lookout Creek Watershed has resulted in the placement of two stream segments on the Georgia Integrated 303(d)/305(b) List for failure to meet state criteria. These impaired stream segments account for approximately 20 miles of streams in the Georgia portion of the watershed. On Lookout Creek, the impaired segment is due to fecal coliform bacteria violations and occurs in the lower watershed (Figure 3.1.a.; Table 3.1.b.). On Gulf Creek, an impacted biota impairment stems from a poor Index of Biotic Integrity (IBI) score, which was revealed during local fish sampling endeavors by Georgia DNR.

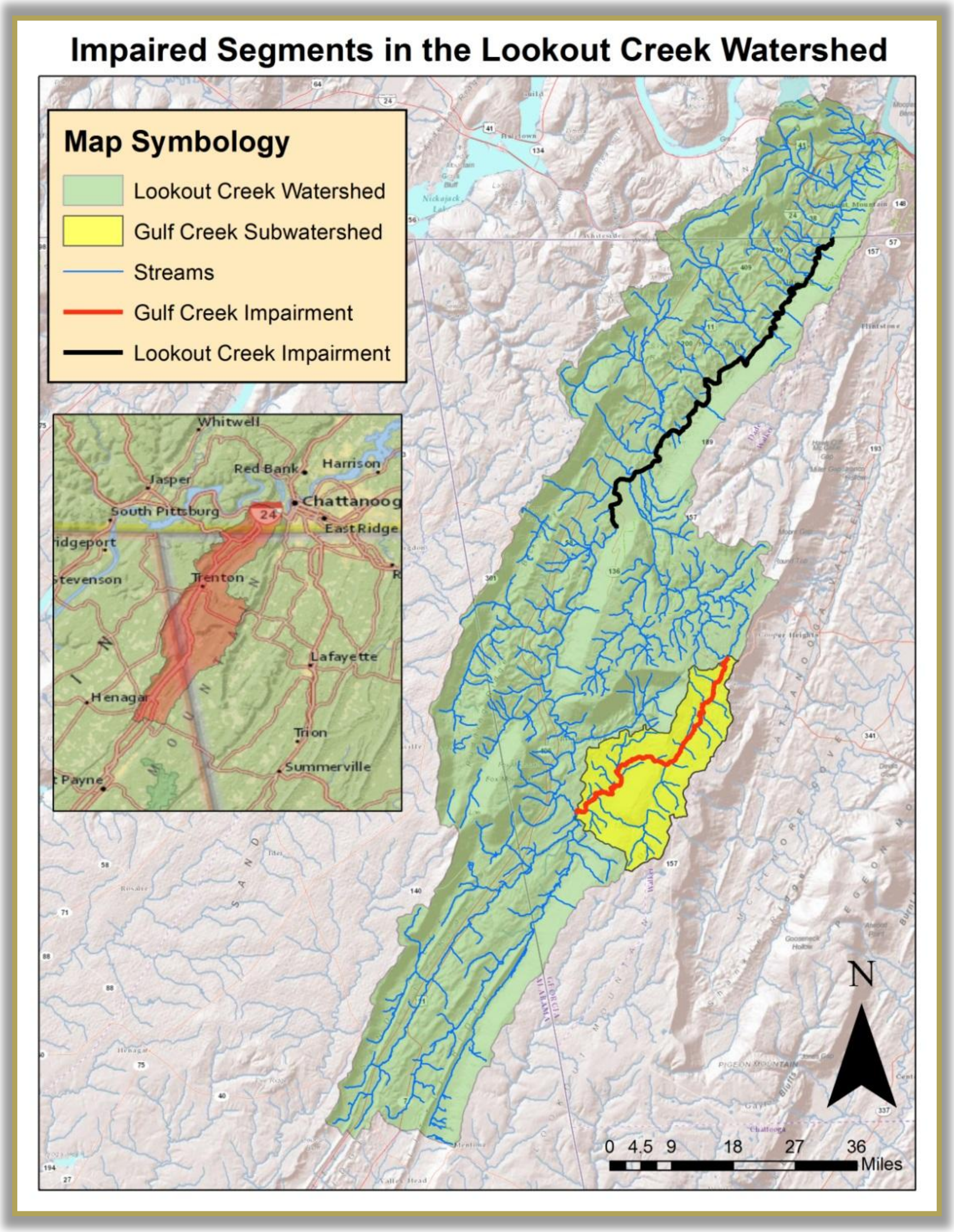


Figure 3.1.a. A map displaying the impaired segments found within the Lookout Creek Watershed.

Table 3.1.b. A table displaying the location and criterion violated for each impaired segment found within the Lookout Creek Watershed.

LOOKOUT CREEK WATERSHED IMPAIRED SEGMENTS		
Waterbody (Impaired Miles)	**County**	**Criterion Violated***
Lookout Creek (14 miles)	Dade, Walker	Fecal Coliform
Gulf Creek (6 miles)	Dade, Walker	Bio (F)

Bio (F) = Impacted biota characterization resulting from fish sampling.

Fecal Coliform Impairments

The impaired segment on the mainstem of Lookout Creek in the Lookout Creek Watershed has failed to meet state criteria due to frequently having high concentrations of fecal coliform bacteria. Although generally present in the environment and not alarming at low levels, high fecal coliform bacteria (and *Escherichia coli*) concentrations in streams are used as an indicator for significant fecal contamination and more importantly the human health risks and pathogens that often coincide with fecal contamination. For this reason, impairments are often described as pathogen impairments even though they result from high fecal coliform bacteria counts.

Although high fecal coliform bacteria concentrations can indicate a human health hazard, they are unlikely to exert negative effects on aquatic species. However, the nutrient enrichment that coincides with fecal contamination may result in indirect effects leading toward eutrophication of water bodies. Nutrient enrichment can result in heavy algal growth that can alter aquatic habitats and cause harmful dissolved oxygen fluctuations.

Sources of fecal coliform bacteria in streams include fecal contamination from humans, pets, livestock, and wildlife. More specifically, common causes of elevated fecal coliform counts in impaired rural watersheds include failing septic systems, livestock with direct stream access, applied manure, and natural areas with abundant wildlife. Relative proportions of contributors are watershed specific and hard to determine (as well as expensive).

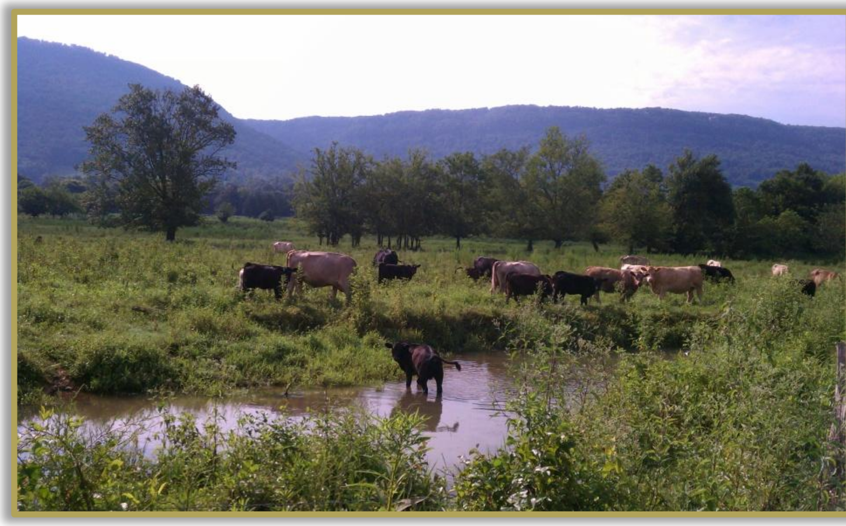


Figure 3.1.b. Cattle with direct access to streams can contribute to a high fecal coliform load, such as the loads found in lower Lookout Creek.

Impacted Biota Impairments

Within the Lookout Creek Watershed, one stream segment, six miles in length, is designated as impaired due to negatively impacted biota. This segment is located on Gulf Creek, from the headwaters to the confluence with Lookout Creek. A stream is considered impaired for impacted biota when sampling of fish or macroinvertebrates reveals negatively impacted assemblages as indicated by poor or very poor Index of Biotic Integrity or modified Index of Well Being (IWB) scores.

In general, low biotic integrity is caused by a lack of quality fish habitat that results from stream sedimentation. According to Georgia EPD, it is generally assumed that if the sediment loads are reduced to and maintained at acceptable levels, the streams will repair themselves over time. Other parameters (e.g., heavy metals, high temperatures, low dissolved oxygen levels) can adversely affect the aquatic communities, but the TMDL for this stream reach (and others in Georgia) identified the probable impairing pollutant as sediment. Although there are qualitative descriptions in Georgia's water quality criteria that address restrictions on turbidity (a measurement of water clarity that can be used to indicate suspended sediment in the water column), there is no numeric criterion to identify discrete thresholds beyond which violations can be determined for sediment loading. Instead, indices of biotic integrity are used to represent stream health or various levels of degradation.

Sediment pollution can originate from many sources including, but not limited to: eroding streambanks, construction sites, agricultural heavy use areas, and cropland. In urban areas, the prevalence of impervious surfaces can lead to increased stormwater runoff, which often results in increased erosion of streambanks, channel incision (down-cutting), and eventually habitat homogeneity. Negative implications for aquatic fauna that often result from these types of erosion can include the deposition of fine sediment, which contributes to a loss of habitat diversity, even eliminating certain habitat types, as well as other issues. The deposition of fine sediment on the stream-bottom can result in a change in interstitial spaces (areas between substrate particles), which can have a negative effect on aquatic insect communities and the fish species which feed upon them. Fine sediments also tend to reduce habitat complexity and cover up gravels which are critical areas for fish to spawn. Altogether, significant increases in sediment loads adversely impact the biotic community.

3.2 Available Monitoring/Resource Data from Recent Years

During the formation of this WMP, a significant effort was undertaken to acquire any recent data collected in the watershed. In the past, Georgia EPD, Georgia DNR Wildlife Resources Division (WRD), and Tennessee Valley Authority have conducted relevant monitoring within the Lookout Creek Watershed. A portion of monitoring data from these groups was made available for the purposes of this document, and a relevant subset is presented in this section.

Georgia Environmental Protection Division Monitoring Efforts

Georgia EPD periodically monitors water quality within the watersheds of the state to determine whether statewide criteria are being met. As part of this monitoring effort, Georgia EPD collected samples from Lookout Creek at New England Road from 1991 to 1994 to determine whether elevated fecal coliform counts were occurring. At times during this period, the counts at this site were high enough to suggest the potential of impairment for fecal coliform bacteria violations. In 2001, this site and an upstream Lookout Creek site at Old Cloverdale Road were sampled for fecal coliform counts according to the present listing/de-listing protocol. The data from the site along Lookout Creek at New England Road resulted in the listing of a

14 mile segment of Lookout Creek (from Trenton to the Tennessee state line) on the 303(d)/305(b) list of impaired waters for fecal coliform violations. The geometric means of the four samples for each 30 day period are presented below in Table 3.2.a. One 30 day period (in August and September) had a geometric mean above the allowable level that resulted in the impairment. The other site, the upstream Lookout Creek site at Old Cloverdale Road, met the criteria of the state for fecal coliform levels.

Table 3.2.a. The geometric means of fecal coliform counts (in colony forming units/100 mL) calculated from samples collected by Georgia EPD in 2001 from Lookout Creek at New England Road (LC-3).

FECAL COLIFORM GEOMETRIC MEANS				
	Feb./March	**May/June**	**Aug./Sept.**	**Nov./Dec.**
Lookout Creek at New England Road (LC-3) from 2001	306	186	319*	255

**** The geometric means from this time period resulted in impairment.***

In 2011, Georgia EPD again sampled the Lookout Creek site along New England Road according to the listing/de-listing protocol. The geometric means from the 30 day sampling periods, displayed in Table 3.2.b., again failed to meet the criteria of the state, this time for having two 30 day periods above allowable fecal coliform levels.

Table 3.2.b. The geometric means of fecal coliform counts (in colony forming units/100 mL) calculated from samples collected by Georgia EPD in 2011 from Lookout Creek at New England Road (LC-3).

FECAL COLIFORM GEOMETRIC MEANS				
	Feb./March	**May**	**July/Aug..**	**Nov./Dec.**
Lookout Creek at New England Road (LC-3) from 2011	140	579*	204*	153

**** The geometric means from these time periods maintained the stream as impaired.***

Georgia Wildlife Resources Division Monitoring Efforts

In addition to Georgia EPD's water quality monitoring efforts, Georgia WRD periodically monitors fish populations and lotic habitats (along with a few water quality parameters) to determine whether statewide criteria are being met. Data collected by WRD in 2002 in Gulf Creek led to the impairment for impacted biota. The fish sampling indices and habitat scores from this sampling effort are provided in Table 3.2.c.

Table 3.2.c A display of IBI and IWB scores from 2002 WRD fish assemblage assessments.

WRD Fish Sampling and Habitat Scores						
	Sampling Date	**IBI Score**	**IBI Category**	**IWB Score**	**IWB Category**	**Habitat Score**
Gulf Creek	6/18/02	26*	Poor*	7.5	Fair	70.12

**** The IBI score and its indication of poor biotic integrity led to the impacted biota impairment.***

IBIs, according to Georgia EPD, assess the biotic integrity of aquatic communities based on the functional and compositional attributes of fish communities. They consist of twelve metrics, which assess species richness and composition, trophic composition and dynamics, and fish abundance and condition. Each metric is scored by comparing its value to that particular scoring criterion of the regional reference site. Collectively, the metric scores are combined to reach an IBI score that can be classified as Excellent, Good, Fair, Poor, or Very Poor.

Comparatively, the modified IWB measures the health of the aquatic community based on the abundance and diversity of the fish community. The IWB is calculated based on the relative density of fish, the relative biomass of fish, the Shannon-Wiener Index of Diversity based on number, and the Shannon-Wiener Index of Diversity based on biomass. Similar to the IBI, these collective scores allow for a classification of Excellent, Good, Fair, Poor, or Very Poor. As of April 2013, the IWB is no longer a part of the Georgia DNR Biomonitoring Program.

Habitat assessments are also a part of the biomonitoring process conducted by WRD and help clarify the results of the biotic indices. The habitat assessment utilized by WRD is broken into three levels that describe: in-stream characteristics, channel morphology, and the riparian zone surrounding the stream. The total habitat scores indicate optimal conditions from 166 to 200, suboptimal conditions from 113 to 153, marginal conditions from 60 to 100, and poor conditions from 0 to 44. Gulf Creek (with a score of 70.12) lied in the lower end of the marginal range. Of note, the habitat assessment of Gulf Creek revealed negative attributes including embeddedness, sediment deposition, channel alteration, limited riparian cover, and a riffle frequency of zero and only one pool, both of which indicate a lack of sufficient habitat variation. This was revealed while the water quality monitoring component of the biomonitoring assessment revealed relatively good water quality conditions.

Monitoring/Resource Data Collected for the Development of the WMP

Recent efforts were made by Limestone Valley RC&D Council to determine current watershed and water quality conditions as part of the development of this plan. The sampling regimen developed was incorporated into a *Targeted Water Quality Monitoring Plan* (featured in Appendix A), and the contemporary data that resulted from carrying out this effort assisted stakeholders in making more informed decisions when determining priorities for the watershed.

This sampling focused on the determination of fecal coliform bacteria counts and levels of turbidity (or water clarity), as well as the following basic water quality parameters: temperature, dissolved oxygen, pH, and conductivity. Data were collected at nine sample sites (Figure 3.3.a.), three along Lookout Creek and six along significant tributaries near their confluence with Lookout Creek, to allow comparisons within the

Figure 3.2.a. Fish sampling with backpack electrofishing equipment.

watershed. Sampling occurred once a month for a year and alternated between wet weather and dry weather conditions as much as possible. This was orchestrated because wet weather samples better represent the NPS pollution flushed from the landscape during runoff events (and potentially when floodplains are inundated); whereas samples collected during dry events better reveal instream sources of NPS pollutants. Summer and winter samples were collected because state criteria for fecal coliform bacteria counts change seasonally.

Samples were also taken during two significant rainfall events at sites on Lookout Creek (LC2 and LC3) to determine the original sources of fecal coliform bacteria present (e.g., human, cattle) and the extent of their contributions. The lab analysis which utilized polymerase chain reaction (PCR) to identify bacteria specific to the guts of particular species was carried out by Source Molecular, Inc. of Miami, Florida.

In addition to collecting data on water quality, Limestone Valley RC&D Council and intern Amelia Atwell also led an effort to collect macroinvertebrates at the nine monitoring sites (and at three new tributary sites) within the watershed and identify them to determine the extent of diversity and stream health at each site. A portion of these data are included in this section, and a full report on this investigation has been included in the appendices.

The locations and GPS Coordinates for the monitoring sites are as follows. The mainstem sites along Lookout Creek are listed from upstream to downstream. The tributary sites are listed in the order that the streams confluence with Lookout Creek.

- Lookout Creek Site 1 (LC-1) at Old Cloverdale Road: 34.710739, -85.527256
- Lookout Creek Site 2 (LC-2) at Newsome Gap Road: 34.764975, -85.526422
- Lookout Creek Site 3 (LC-3) at Creek Road: 34.898106, -85.463961
- Dry Creek Site 1 (DC-1) at Cloverdale Road: 34.718381, -85.528075
- Gulf Creek Site 1 (GC-1) at Mason Road: 34.735513, -85.511776
- Crawfish Creek Site 1 (CC-1) at Highway 11: 34.808487, -85.542187
- Sitton Gulch Creek Site 1 (SGC-1) at Piney Road: 34.870379, -85.490061
- Squirrel Town Creek (STC-1) at New England Road: 34.910831, -85.473737
- Pope Creek Site 1 (PC-1) at Pope Creek Road: 34.940887, -85.421703

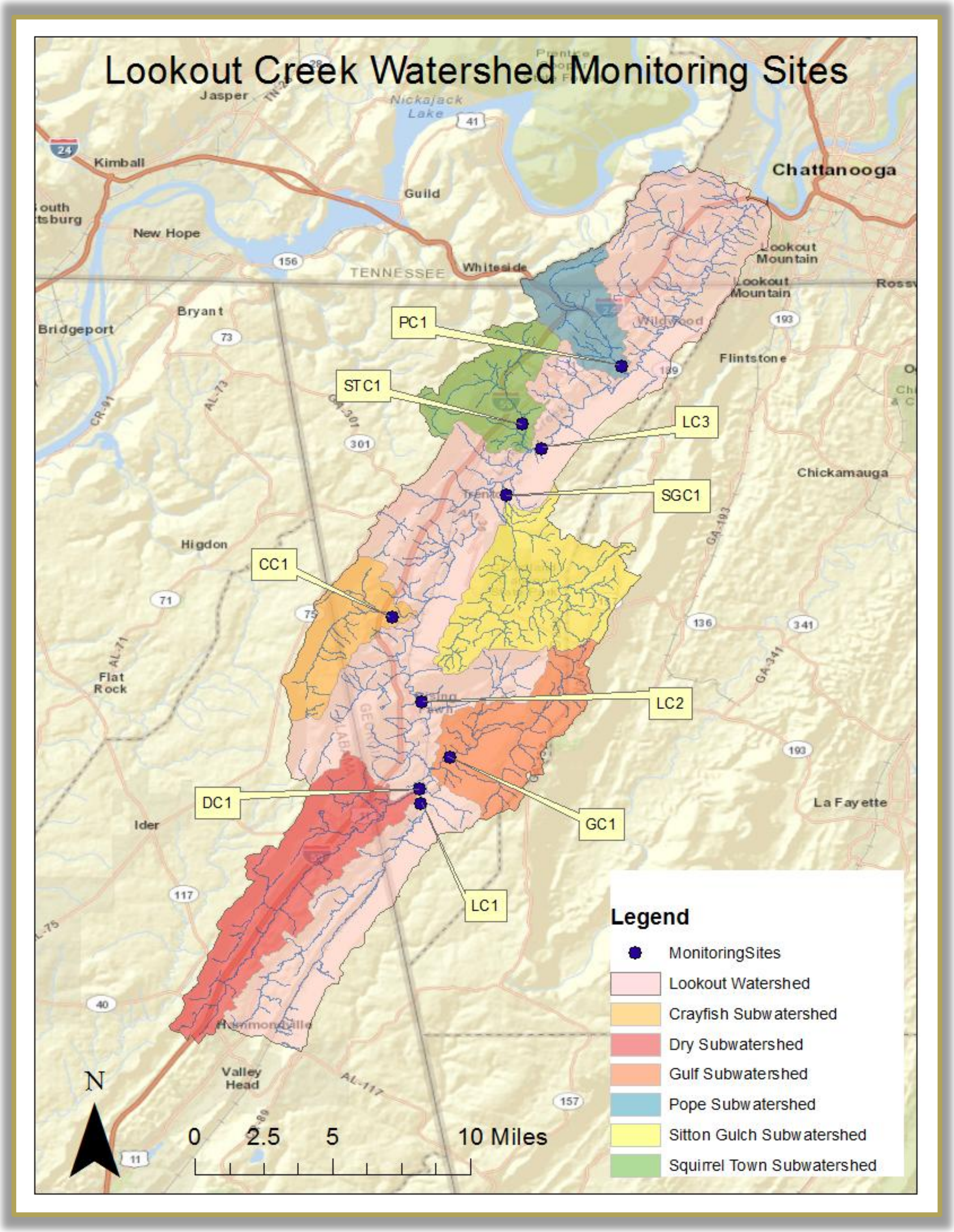


Figure 3.3.a. A display of the locations of the nine sample sites used during targeted monitoring in the Lookout Creek Watershed.

Fecal Coliform Sampling

Sampling the nine sites revealed additional information regarding fecal coliform bacteria and sediment sources in the watershed. The fecal coliform sampling data (Table 3.3.a.) revealed a few potential trends. In general, the greatest fecal coliform counts were found in Dry Creek, which had more than 1000 cfu/100 mL on six of twelve sampling events. Lookout Creek (LC-2 and LC-3) downstream of its confluence with Dry Creek and Pope Creek also had relatively high counts in comparison to the other sites. The lowest fecal coliform counts on average were recorded in Sitton Creek Gulch, which was found to be intermittent, and the upstream Lookout Creek site (LC-1) and Squirrel Town Creek site (STC-1).

Table 3.3.a. A display of geometric means (n = 12) of fecal coliform counts (in cfu/100 mL) calculated from samples collected in 2013 in the Lookout Creek Watershed.

GEOMETRIC MEANS OF FECAL COLIFORM COUNTS (2013)	
Site (code)	**Mean Fecal Coliform Counts**
Lookout Creek Site 1 (LC1)	148
Lookout Creek Site 2 (LC-2)	375
Lookout Creek Site 3 (LC-3)	304
Dry Creek Site 1 (DC-1)	913
Gulf Creek Site 1 (GC-1)	209
Crawfish Creek Site 1 (CC-1)	240
Sitton Gulch Creek Site 1 (SGC-1)*	48*
Squirrel Town Creek Site 1 (STC-1)	167
Pope Creek Site 1 (PC-1)	361

**** Sitton Gulch Creek was dry on five occasions and thus only sampled seven times.***

In Northwest Georgia, 2013 was a very wet year overall. Eight sampling events occurred after more than 0.25 inches of precipitation had fallen in the previous 48 hours. The geometric means and maximum counts from these wet weather events are depicted in Table 3.3.b. After dry periods, wet-weather events often result in higher bacteria counts due to overland flow flushing waste build-up from the landscape into creeks. Two of these occasions had greater than 0.5 inches of precipitation in the previous 24 hours. On one of these events, the sampling was completed after 2.25 inches of rainfall fell in the previous 24 hours, which resulted in the highest bacteria counts recorded at all sites.

Four sampling events were carried out when less than 0.25 inches of precipitation had occurred in the previous 48 hours, which is likely a better indicator of direct introduction of fecal contamination upstream. Three of these had no rainfall during the 48 hour period prior to sampling. Geometric means and maximum counts from these dry weather events are revealed in Table 3.3.c.

Table 3.3.b. A display of geometric means (n = 8) of fecal coliform counts (cfu/100 mL) calculated from samples collected during wet weather events in 2013 in the Lookout Creek Watershed.

GEOMETRIC MEANS AND MAXIMUM FECAL COLIFORM COUNTS (2013) FROM WET WEATHER SAMPLING EVENTS		
Site (code)	**Geometric Means**	**Maximum Counts**
Lookout Creek Site 1 (LC1)	145	15,910
Lookout Creek Site 2 (LC-2)	374	14,730
Lookout Creek Site 3 (LC-3)	403	20,920
Dry Creek Site 1 (DC-1)	1275	20,920
Gulf Creek Site 1 (GC-1)	235	10,610
Crawfish Creek Site 1 (CC-1)	270	13,850
Sitton Gulch Creek Site 1 (SGC-1)*	41*	290*
Squirrel Town Creek Site 1 (STC-1)	225	19,740
Pope Creek Site 1 (PC-1)	471	21,810

**** Sitton Gulch Creek was sampled during only five wet weather events due to its intermittency.***

Table 3.3.c. A display of geometric means (n = 4) of fecal coliform counts (cfu/100 mL) calculated from samples collected during dry weather events in 2013 in the Lookout Creek Watershed.

GEOMETRIC MEANS AND MAXIMUM FECAL COLIFORM COUNTS (2013) FROM DRY WEATHER SAMPLING EVENTS		
Site (code)	**Geometric Means**	**Maximum Counts**
Lookout Creek Site 1 (LC1)	156	290
Lookout Creek Site 2 (LC-2)	377	2110
Lookout Creek Site 3 (LC-3)	172	540
Dry Creek Site 1 (DC-1)	468	1600
Gulf Creek Site 1 (GC-1)	165	300
Crawfish Creek Site 1 (CC-1)	189	400
Sitton Gulch Creek Site 1 (SGC-1)*	71*	500
Squirrel Town Creek Site 1 (STC-1)	93	140
Pope Creek Site 1 (PC-1)	212	1130

**** Sitton Gulch Creek was sampled during only two dry weather events due to its intermittency.***

Recent sampling by GA EPD confirm that the fecal coliform impairment in the watershed is not ready to be de-listed. Moreover, the more recent fecal coliform count data collected by Limestone Valley is difficult to compare with the recent and historical EPD data due to a lack of congruency in sampling schedules, as well as a lack of data on precipitation, flows, and rainfall antecedent. Despite this, we can assume that the water quality is relatively similar at this time to the data collected by Georgia EPD in 2011. More importantly, we now have a more specific idea of the area in the watershed contributing most to the issue. The Dry Creek Subwatershed, in particular, which lies upstream of the impairment along Lookout Creek, seems to be the most significant contributor to fecal coliform loading in the watershed. Other areas are also contributing to the issue but on a lesser level. Still, the streams that drain these areas can exhibit high fecal coliform counts on occasion.

Sampling for Turbidity

The turbidity data (Table 3.3.e.) revealed higher turbidity (or reduced water clarity) in Pope Creek, as well as Dry Creek and the two lower sites along Lookout Creek. Most maximum measurements occurred during a substantial rain event when erosion and suspended sediment due to increased velocities are apparent. Outside of this event, the same trends were present overall. Interestingly, the four sites with the highest turbidity measurements were also those with the highest fecal coliform counts. Also of note, Gulf Creek, where the impairment for impacted biota is located, is not among the worst sites for water clarity. Perhaps, this is due to the low gradient of the stream after it comes off of Lookout Mountain and the beaver dam complexes in this general area maintaining reduced velocity and thus reduced sediment in the water column; however, it also may indicate much of the sediment issue affecting the aquatic habitat is historical in nature. Appendix B reveals the raw data collected at each site per sampling period.

Table 3.3.e. A display of geometric means (n = 12) from samples collected by Limestone Valley in 2013 in the Lookout Creek Watershed and measured for turbidity levels (in NTUs).

GEOMETRIC MEANS OF TURBIDITY MEASUREMENTS (2013)		
Site (code)	**Turbidity Means**	**Turbidity Maximums**
Lookout Creek Site 1 (LC1)	8.3	99.6
Lookout Creek Site 2 (LC-2)	12.4	55.4
Lookout Creek Site 3 (LC-3)	15.2	38.8
Dry Creek Site 1 (DC-1)	11.6	139
Gulf Creek Site 1 (GC-1)	9.6	23.6
Crawfish Creek Site 1 (CC-1)	9.9	96.3
Sitton Gulch Creek Site 1 (SGC-1)*	3.7	12.3
Squirrel Town Creek Site 1 (STC-1)	8.3	84.5
Pope Creek Site 1 (PC-1)	18.4	187

**** Sitton Gulch Creek was dry on five occasions and thus only sampled seven times.***

Microbial Source Tracking

Microbial Source Tracking (MST) is a set of methods used to determine the host (different animals or Human) that contributes fecal pollution to a variety of water bodies. The results are interpreted for each animal selected in general terms along a gradient as one of the following: below detectable limits, a trace contributor, a minor contributor, an important contributor, or a major contributor. Samples were collected for this analysis at two sites (LC-2, LC-3) on two separate occasions during rain events when fecal coliform bacteria were anticipated to be more abundant. The samples were mailed to Source Molecular Corporation for analysis to determine if cows and/or humans were contributing to the fecal coliform pollution found in Lookout Creek, and if so to what extent the respective contributions are. The data from the analysis is presented below in Table 3.3.f.

Table 3.3.f. A display of the results from microbial source tracking efforts to determine the relative contribution of human and cattle waste in Lookout Creek.

MICROBIAL SOURCE TRACKING RESULTS (2013)			
Site (code)	**Date**	**Results**	
		Human	**Cattle**
Lookout Creek Site 2 (LC2)	April, 2013	Minor Contributor	Important Contributor
Lookout Creek Site 2 (LC2)	November, 2013	Minor Contributor	Important Contributor
Lookout Creek Site 3 (LC-3)	April, 2013	Below Det. Limits	Below Det. Limits
Lookout Creek Site 3 (LC-3)	November, 2013	Major Contributor	Important Contributor

With the exception of one sample date, results indicate that humans and cattle are both contributing to the fecal coliform issues in the watershed. The severity of the contribution of each is variable, however, it does appear that at times these two groups account for the majority of fecal coliform pollution in the Lookout Creek watershed. Other groups of organisms may also be contributing, but additional testing to determine their contributions was cost-prohibitive.

Macroinvertebrate Sampling

Sampling of aquatic macroinvertebrates was also conducted to evaluate overall stream health in Lookout Creek and several tributaries. Aquatic macroinvertebrates are simply insects and other organisms found within streams and stream bottoms that are visible to the naked eye, yet often require a microscope to identify. This investigation was led by University of Tennessee at Chattanooga graduate student Amelia Atwell in an effort to conduct research on relationships between aquatic macroinvertebrates and watershed/water quality conditions while also complementing the plan development process. Whereas one water quality sample tends to merely represent the conditions at one instant at a particular location, the groups of organisms present and their abundances can indicate the water and habitat quality over longer periods of time. To explain, macroinvertebrates often live multiple years and vary in tolerance to different types of water quality and habitat degradation (e.g., reduced dissolved oxygen, nitrates, sedimentation, etc.). The presence of several groups of sensitive taxa (e.g., different families of mayflies, stoneflies, caddis flies, and water pennies) in healthy abundances with limited abundances of particularly tolerant taxa, such as nonbiting midge larva, blackfly larva, and tubifex worms, generally tend to indicate good overall stream health, whereas the presence of few groups of sensitive taxa in lower abundances with numerous pollution tolerant groups present at higher abundances would generally indicate reduced overall stream health.

States often use macroinvertebrate sampling to indicate stream health due to reduced costs in comparison to fish and often water quality sampling. Due to their close proximity in Chattanooga, staff from Tennessee Department of Environment and Conservation assisted in training us on their Standard Operating Procedures (which are similar to those used in Georgia). Utilizing these for the sampling process, we basically sought to sample bugs from four quality habitats over a 200 meter stream reach at each site, and determine the total number of macroinvertebrate families present, the total number of mayfly, stonefly, and caddis fly families present, and the total number of intolerant families present. These results were utilized to determine scores specific to each eco-region, which can be used to identify whether stream health is generally good, bad, or inconclusive, which typically leads to additional sampling according to a more robust procedure to determine whether the stream is impaired.

Results of the macroinvertebrate sampling efforts are shown in detail in the appendix. Overall, 55 families were collected including 11 intolerant families with at least one present at each site. Hurricane Creek had the greatest taxa richness (number of total families present) and was characterized as "very good". Otherwise, most of the tributaries within the watershed were characterized as "good" according to the macroinvertebrate biomonitoring data, with the exception of Gulf Creek, which was characterized as "poor", and Pope Creek, which was characterized as "inconclusive" and had the lowest taxa richness of any of the sites sampled.

Figure 3.3.b. Limestone Valley Intern Amelia Atwell sorts macroinvertebrates for identification.

<u>Additional Observations</u>

Dry Creek, in particular, was found to have the highest fecal coliform counts and is likely a significant contributor to the elevated counts within the downstream Lookout Creek segments and the impairment. According to some in the Trenton community, the elevated counts within Dry Creek may be a result of issues at the treatment facility at the Alabama Welcome Center (on I-59), which drains to a tributary to Dry Creek called Red River Branch. In order to preliminary investigate this hypothesis, we conducted sampling for fecal coliform bacteria on two occasions during wet weather at four sites in the general vicinity of the Alabama Welcome Center. Red River Branch was sampled upstream and downstream of the influence of the Alabama Welcome Center, in addition to Dry Creek upstream of the influence of Red River Branch, as well as downstream of its confluence. The results of this sampling effort are displayed in Table 3.3.g., yet despite our efforts reveal no definitive evidence as to whether or not the facility is a significant source of fecal coliform within the watershed.

Table 3.3.g. A display of the results from additional fecal coliform sampling in the general vicinity of the Alabama Welcome Center on I-59 to investigate the possibility that the facility may be a significant source of fecal coliform bacteria.

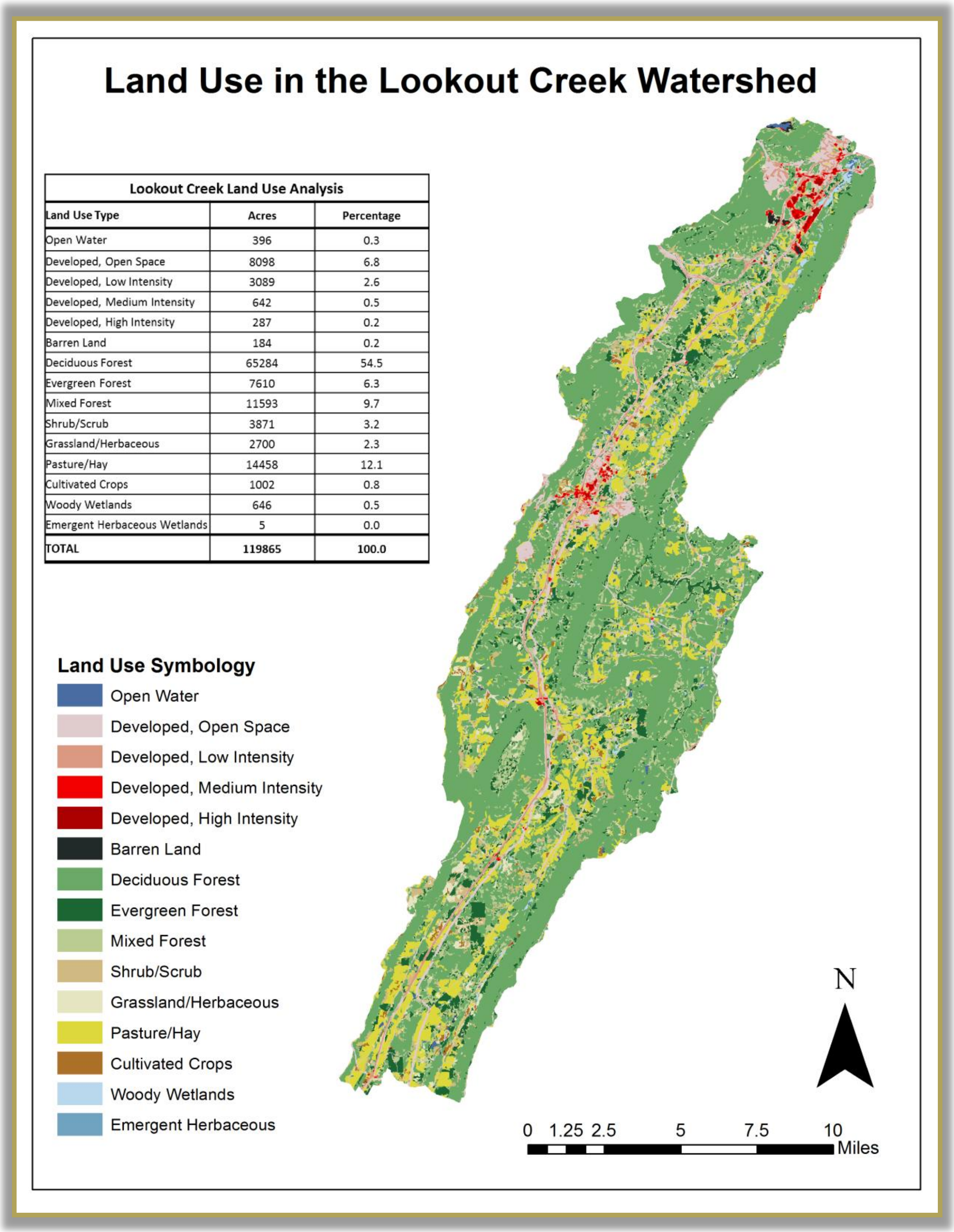
ADDITIONAL FECAL COLIFORM SAMPLING (2014)		
Site	**Fecal Coliform Counts (cfu/100 mL)**	
	3/17/14	**4/29/14**
Red River Branch Upstream	710	3,400
Red River Branch Downstream	970	3,700
Dry Creek Upstream	790	10,000
Dry Creek Downstream	2,500	12,000

Despite not having sampled fish in Gulf Creek, our observations have made the biotic issues a little more transparent. Gulf Creek has very few riffles and deep pools, which indicates a lack of sufficient habitat variation. In addition, Gulf Creek has a significant channel alterations, particularly from cattle, as well as limited riparian cover. Sediment deposition is widely apparent with some reaches being composed almost entirely of fine sediments. A portion of Gulf Creek relatively close to the confluence with Lookout Creek is also predominated by beaver dam matrix, which is a likely contributor to sediment deposition in the stream. Also, residents of Dade County informed us that at least some reaches of Gulf Creek dry out in most years. They postulated that perhaps intermittency was the reason for the characterization of poor biotic integrity in the creek.

3.4 Land Use Analysis

<u>Land and Resource Uses</u>

The Lookout Creek Watershed is dominated by forest, which accounts for over 70% of watershed land use. Parcels managed as forest are located throughout the watershed, but especially on the plateaus and slopes of Lookout and Sand Mountains. A moderate percentage of land (12.1%) and its resources are also devoted to livestock production in the Georgia portion of the watershed, especially within Lookout Valley. Other land uses are variable (and revealed in Figure 3.4.a.), yet primarily reflect the rural nature of the watershed. The county seat, Trenton, and especially Lookout Valley in the Tennessee portion of the watershed represent more developed areas. Much of the residential land use in the watershed occurs in the areas in and surrounding these communities as well as the communities of Wildwood and Rising Fawn. Residences are also consistently scattered along highways and county roads. In addition, Interstate 59, a four lane highway connecting Chattanooga and Birmingham runs through the center of the watershed from the Tennessee border to its headwaters. Interstate 24 runs across the upper portion of the watershed through Tennessee and Georgia. All of the land use types outlined likely exert some contribution to the current water quality conditions in the watershed, although significant variation in NPS contributions per land use exists from parcel to parcel depending on management.



Lookout Creek Land Use Analysis		
Land Use Type	Acres	Percentage
Open Water	396	0.3
Developed, Open Space	8098	6.8
Developed, Low Intensity	3089	2.6
Developed, Medium Intensity	642	0.5
Developed, High Intensity	287	0.2
Barren Land	184	0.2
Deciduous Forest	65284	54.5
Evergreen Forest	7610	6.3
Mixed Forest	11593	9.7
Shrub/Scrub	3871	3.2
Grassland/Herbaceous	2700	2.3
Pasture/Hay	14458	12.1
Cultivated Crops	1002	0.8
Woody Wetlands	646	0.5
Emergent Herbaceous Wetlands	5	0.0
TOTAL	119865	100.0

Figure 3.4.a. A map displaying the Lookout Creek Watershed's more prominent land uses and their percentages within the watershed. More detailed definitions of land uses are listed in Appendix C.

3.5

3.5 Riparian Buffer Analysis

For the development of the Lookout Creek WMP, a stream buffer analysis was also completed for the Lookout Creek Watershed due to the importance of vegetative buffer zones (i.e., riparian zones) on stream and water quality conditions. As the name indicates, these zones literally serve as a buffer between activities that occur on the landscape and the water in the stream by physically catching pollutants (e.g., sediment, nutrients, bacteria) from runoff during rain events.

Buffers also serve many other functions that are important to the health of the stream. One of the functions of sufficiently intact buffers is the mitigation of stream bank erosion, which is a common contributor of sediment to streams. The roots of the vegetation help to hold the sediment in place during high flows, making the banks more stable. The vegetation also provides shade for the stream, which aids in keeping the temperatures low (and dissolved oxygen high). Dense vegetation in the riparian zone also contributes falling dead and dying vegetation into the stream channel, providing diverse habitat for aquatic life.

Conducting an analysis of buffers within an impaired watershed has become an acceptable way to assess areas in need of restoration. Insufficient riparian buffers often indicate sources of NPS pollution. These areas could simply be a place where pollutants enter the stream through runoff, or even a place where livestock enters the stream (heavy use inhibits vegetative growth) thereby allowing direct introduction of NPS pollutants.

The stream buffer analysis was conducted using GIS software and recent aerial imagery. The purpose of this analysis was to identify areas of inadequate vegetation within a 100 foot buffer of all streams. Every tributary was analyzed with the software and aerial imagery (viewed with the naked eye), to confirm insufficient buffers. The areas having insufficient riparian zones are depicted in red in Figure 3.5.a. The percentage of inadequate buffer was also calculated and included. This information was used for estimating the technical and financial assistance needed to de-list the impaired segments (discussed later).

The buffer analysis shows several areas within the watershed lacking in riparian buffers. These areas include Dry Creek and upper Lookout Creek, Gulf Creek, lower Lookout Creek, and several tributaries in the lower watershed toward and within Tennessee. Much of this acreage lies on grazing lands where a lack of riparian buffers when combined with cattle access can increase bank erosion, and thus sediment introduction, into the Lookout Creek system. Improving these buffers would reduce bank erosion and sedimentation issues and improve water quality within the watershed.

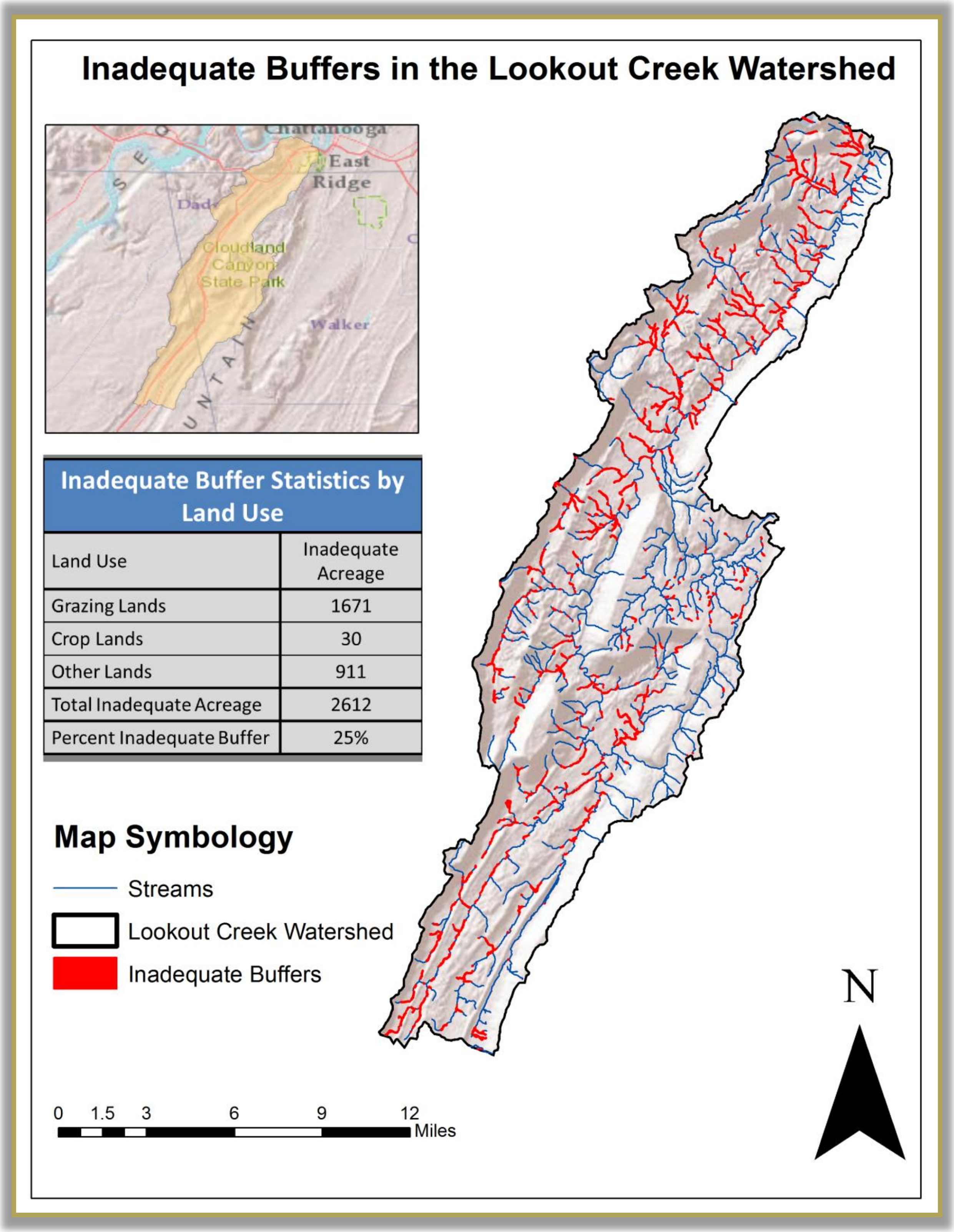


Figure 3.5.a. A map depicting the areas found to have insufficient riparian buffers (in red) within the Lookout Creek Watershed.

3.6 Structure Density Analysis

Additional GIS analysis was conducted to investigate the number of structures that occur within the watershed. This analysis generated the map in Figure 3.6.a. and the information in Table 3.6.a. Outside of the immediate Trenton area and the Lookout Valley area (at the northern end of the watershed), which are accommodated by sewer, the density of structures can be used to represent where septic systems are numerous and ultimately were fecal coliform contributions from failed septic systems may be significant. These data indicate that septic system contributions to fecal coliform counts may potentially be significant on the outskirts of Trenton, in the Rising Fawn area, along Highway 136, and in the Wildwood area.

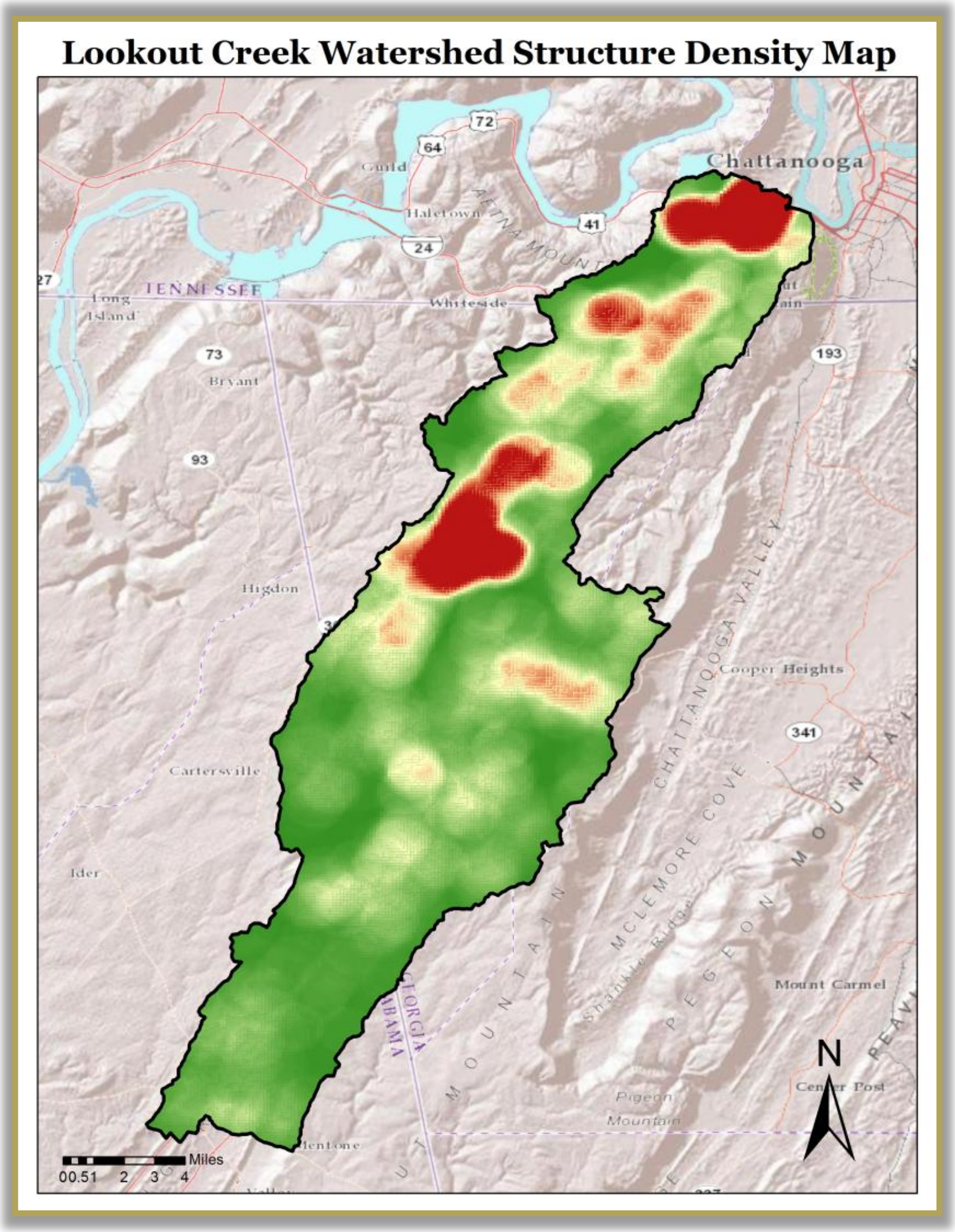


Figure 3.6.a. An image depicting the distribution of structures found in the Lookout Creek Watershed. Red depicts a high density area, whereas green reflects low density areas.

Table 3.6.a. A table showing the total numbers of each structure type counted within the Lookout Creek Watershed.

STRUCTURES WITHIN WATERSHED			
	Agricultural	**Commercial**	**Residential**
Lookout Creek Watershed	2785	906	6314

3.7 Impervious Surface Cover Analysis

Impervious surface cover was also investigated as an indicator of development and consequently where stormwater runoff has increased over time. This investigation was intended to provide some insight as to whether development is a contributor to the impairments, as well as consider the potential need for additional stormwater practices and management as additional development ensues. Impervious surface cover in the watershed is shown in Figure 3.7.a. The map indicates that the areas of Trenton and Lookout Valley in Tennessee will likely continue to encroach on the rural nature of the watershed over time. Although the data is from 2006, little development has occurred since as a result of the recent housing bubble and recession.

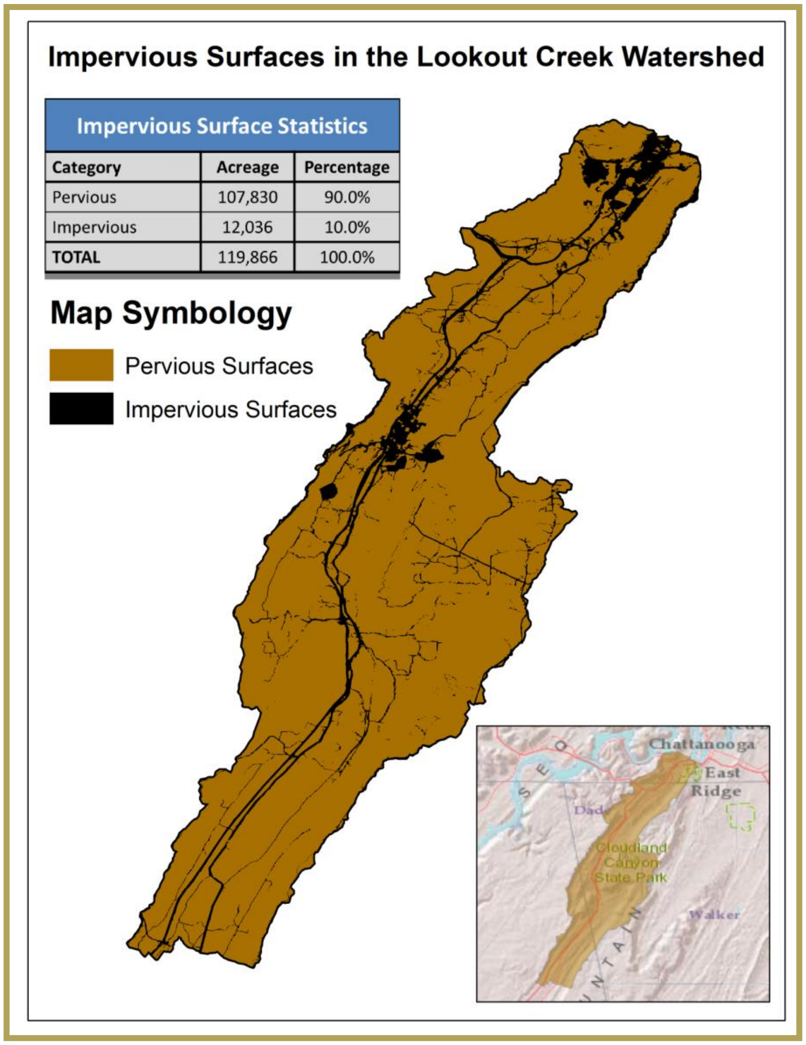


Figure 3.7.a. An image depicting impervious surfaces in the watershed have increased stormwater runoff.

4. Pollutant Source Assessment

This section of the WMP outlines the most likely sources of significant impairing pollutants within the watershed. The most significant issues in the watershed stem from excessive fecal coliform loads, and presumably sediment and habitat homogeneity, which more than likely led to the impacted biota impairment. The two major categories of pollutants addressed in this section are point and nonpoint sources. The quantity and type of pollutants found in a water body tend to be directly related to the land uses within the watershed. See Figure 3.4.a. for a map depicting the distribution of land uses throughout the watershed. The following information was gathered through both research and stakeholder input during WMP formation.

4.1 Nonpoint Sources

Nonpoint source pollution encompasses a wide range of pollutants distributed across the landscape and washed into streams during rain events, as well as those NPS pollutants deposited directly into streams from unregulated sources. These pollutant sources are difficult to identify and regulate since they are typically ubiquitous and originate from numerous land parcels with various owners. NPS pollution can also be quite variable over time due to variable land uses, management practices, grazing rotations, runoff events, and other factors. Despite several point sources in the watershed permitted under the NPDES program, it is still generally assumed that NPS pollution makes up a significant portion of the pollutant load in this watershed leading to impairments.

<u>Agriculture</u>

Agriculture makes up 12.9% of the land use within the Lookout Creek Watershed. Activities range from livestock grazing and hay production (pasture = 12.1%) to cultivation of crops (0.8 %). Many poultry operations are also located in the watershed. Agriculture, with the exception of forest, is the most dominant land use type; hence it likely plays a role in impairment issues. For this reason, stakeholders agreed that installing agricultural best management practices would likely help reduce fecal coliform bacteria and sediment loads within the watershed. These agricultural programs will not only lead to nonpoint source pollution reduction, but will do so in a way that is already accepted in the local community, while also assisting farmers in their management operations.

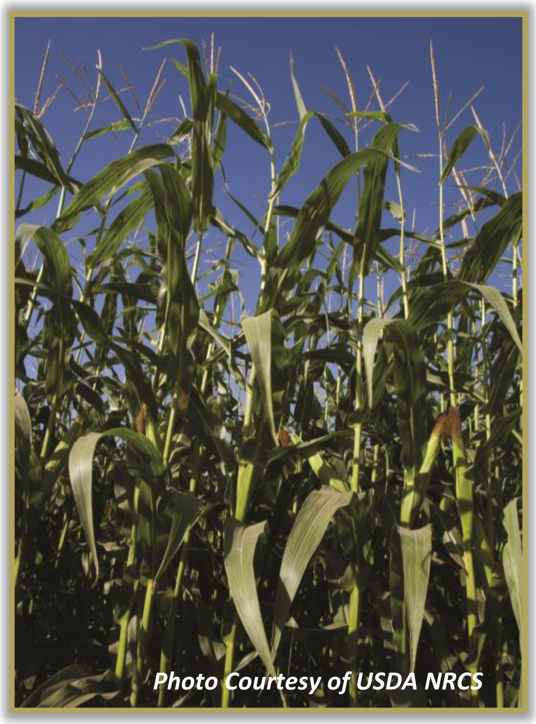


Figure 4.1.a. Cropland, a common contributor of NPS pollution in the U.S., accounts for only a small percentage of land use in the watershed.

With pastures representing approximately 12% of the land use in the watershed, livestock has the potential to be a significant contributor to NPS pollution in the form of both fecal coliform and sediment loads. Although dairy cattle, hogs, and poultry spend a large portion of their time confined (see CAFOs in 5.2), beef cattle spend the vast majority of their time in pastureland. In the pasture, cattle tend to deposit their feces upon the land, as well as create erosion issues and destroy vegetative cover when overgrazed. When significant feces builds up and erosion becomes more prevalent on the landscape, fecal coliform bacteria and eroded soil become more frequently captured by storm runoff and delivered into nearby waterways.

In addition to nonpoint sources of pollution derived from the landscape, beef cattle often have access to streams that run through pastureland, giving them the opportunity to deposit feces directly into waterways. This stream access also generally contributes to the sediment load through streambank erosion, which is often significant. When cattle destroy much the vegetation in the riparian zone, the streambank may collapse into the waterway, increasing the sediment load further and leaving the bank unprotected where it happens again and again.

Poultry operations are also fairly common throughout the watershed. Depending on the number of animals present, these operations can be classified as potential nonpoint sources (< 125,000 animals) or potential point sources (> 125,000 animals; see Permitted CAFOs in 5.2) which require an NPDES permit to operate. There are an abundance of poultry operations within the Lookout Creek Watershed, although none exceed the threshold above which NPDES permits are required. Despite this fact, these operations are still potential NPS contributors due to their production of large quantities of animal waste that is often applied to agricultural lands. According to Wang et. al. (2004), fecal coliform can survive for several months after animal waste excretion. This indicates that even aged manure could potentially be a significant contributor to the fecal coliform bacteria load when applied to the landscape.

Nearly 1% of the watershed is characterized as cropland. Despite this small percentage, croplands could still contribute significant amounts of pollutants (e.g., fecal coliform after manure application) into nearby waterways. Croplands can also factor into sediment loading. According to the National Research Council (1989), sediment deposition into surface waters is significantly related to cropland erosion within basins. Sedimentation, in addition to impacting aquatic biota, also leads to increased retention of fecal coliform bacteria as well as serves as an additional source of the bacteria during storm events.

Wildlife

Contributions of fecal coliform and sediment to streams from wildlife varies considerably depending on the animals present within the watershed (see 3.2). According to the Wildlife Resources Division of Georgia DNR, the animals that spend the majority of their time in and around aquatic habitats are the most important wildlife sources of fecal coliform bacteria. Waterfowl are considered to be significant contributors since they spend a large portion of their time on surface waters and deposit feces directly into the waterway. Other contributors include aquatic mammals such as beaver, muskrat, and river otters. Feral pig populations (*Sus scrofa*), known to exist along the floodplains of every major river in Georgia, have also been sighted locally. According to Kaller et. al. (2007), these animals can contribute both fecal coliform and sediment to waterways due to their numbers and behavior. Despite feral pigs and other animals that may be viewed as pests, wildlife populations are mostly naturally occurring and an indicator of the relative health of the environment. For this reason, minimization of fecal coliform contributions from wildlife will not be a major focus of the plan.

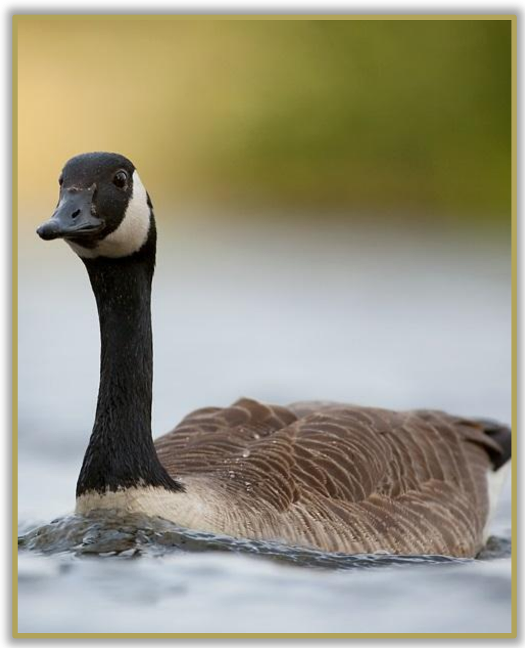


Figure 4.1.b. Wildlife can also contribute to a stream's fecal coliform load.

Urban/Suburban Runoff

Figure 4.1.c. A failing septic system can introduce pathogens into nearby streams. This system has effluent surfacing in the yard, the vast majority of which drains into a nearby tributary.

In more urbanized areas such as Trenton, sediment pollution can originate from many sources. Land-disturbing activities are a consistent contributor of sediment to streams nationwide. These activities include clearing, grading, excavating, or filling of land. Disturbance of land typically removes the vegetation, which exposes the surface sediment to rain events resulting in erosion and sediment delivery into streams. For example, conversion of forests to developed land (clearing) is often associated with water quality degradation.

In more urbanized areas, stormwater runoff can also contribute to erosion issues in streams. This type of runoff originates from developed land that contains higher proportions of impervious surface cover (rooftops, parking lots, roads, etc.). These surfaces concentrate large quantities of water into the stream quickly, resulting in stream bank erosion and incision. Eventually, as banks collapse, streams tend to widen and collect additional sediment, which can lead to losses in habitat variation and increased fecal coliform retention. Additional stormwater practices and other green infrastructure may be able to reduce these issues in the Lookout Creek Watershed.

In addition to introduction of sediment into waterways, fecal coliform contributions can also occur as a result of stormwater runoff. Domestic pets and urban wildlife populations contribute waste and subsequently fecal coliform bacteria to the landscape, which is often washed directly into streams during rain events. Similar contributions in urban environments often originate from leaks and overflows from sanitary sewer systems, illicit discharges, and leaking septic systems in areas not serviced by sewer.

With more than 5,000 septic systems in Dade County, stakeholders also identified failing septic systems as a probable contributor to the fecal coliform load in the watershed. Targeting these issues in the watershed should lead to water quality improvement, while also helping people in the community. It was decided by the stakeholder group that landowners experiencing septic system failures would likely be motivated to fix the issues, especially if cost-share assistance is available. Considering cost-share programs for septic system repairs have worked in other areas of Northwest Georgia, it seems this practice may again be implemented with success due to being seen as mutually beneficial to both members of the community and water quality improvement goals.

Forestry Practices

With approximately 70% of the Lookout Creek Watershed forested, forestry practices must have had some historical impact on the watershed in the form of erosion, siltation, and increased storm flows that generally occur after harvest. Although forestry practices presently are conducted in a way that very likely have a reduced effect on the environment, a high likelihood remains that some erosion, siltation, and increased storm flows still occur post-harvest on some parcels. Despite this being the case, these effects are generally minimized by avoidance of riparian zones and at least short-lived assuming a parcel is re-planted. In addition, much of the forest within the watershed lies on smaller plots. For these reasons, nonpoint source pollution in the watershed from harvesting timber is likely ongoing, yet relatively minor. Considering forest is the most healthy land use from a watershed standpoint, timber harvest when conducted using the industry's best management practices may be a net positive in that it at least incentivizes continuous retention of forest on private lands.

4.2 Point Sources

Point sources of pollution are those which are delivered to a waterbody via "discrete conveyances". These sources are regulated through the NPDES permitting system. Point sources typically include industrial sites, municipal separate storm sewer systems, and confined animal feeding operations (CAFOs). There are several permitted point sources in the watershed, but it is assumed that the majority of impairing pollutants result from NPS pollution.

Industrial Sites

Many industries are required to apply for an NPDES permit when discharging industrial storm water. There are four permits of this type located within the watershed. All of these sites are located in the middle portion of the watershed. Since all are in compliance with their NPDES permits, it is likely that industrial stormwater's contribution to stream impairment is minimal. Table 4.2.a. lists the industrial NPDES permits found within the watershed.

Table 4.2.a. A display of the locations of facilities that hold NPDES permits within the Lookout Creek Watershed.

INDUSTRIAL NPDES PERMITTEES –LOOKOUT CREEK WATERSHED	
FACILITY	**ADDRESS (TRENTON, GA)**
Bull Moose Tube Company	195 N. Industrial Drive
Gill Industries	505 N. Industrial Blvd.
IWG High Performance Conductors, Inc.	13230 N. Main Street
Medsource Trenton	13024 N. Main Street

According to the EPA (2011), Stormwater Phase I regulations (1990) require *medium* and *large* cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. Phase II (1999) requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges. There are no areas within the Lookout Creek Watershed that fall under phase I or Phase II regulations, and thus any stormwater issues found within the watershed must be considered non-point source pollution.

CAFO Permits

Confined animal feeding operations (CAFOs) are considered a point source of pollution by Georgia EPD and require an NPDES permit as they reach certain capacity thresholds. Although there are many poultry operations with the Lookout Creek Watershed, none are large enough (>125,000 birds) to require an NPDES permit and therefore are characterized as point source pollution. No dairy or swine operations are present within the watershed either. Thus, no operations are present in the watershed that are large enough to require an NPDES permit. Permitted CAFOs are therefore not considered to be a source of impairment in the Lookout Creek Watershed.

Wastewater Treatment Facilities

Wastewater treatment facilities within the Lookout Creek Watershed are located in Trenton (Trenton Water Pollution Control Plant) as well at the Alabama Welcome Center at the Alabama border on I-59. The Trenton WPCP holds an NPDES permit that allows for as much as 200 cfu/100 mL. According to historical data from 1998 to 2001 in the TMDL for the Tennessee River Basin, no violations were documented. Average fecal coliform discharges during 2001 were 42.8 cfu/100 mL, which suggests this facility is operating well within the limits of its permit. Regarding the Alabama Welcome Center, information on its NPDES permit was not found despite our efforts. As noted earlier in this document in Section 3.3, we did conduct a modest sampling effort to consider the potential that this facility could be partly responsible for the elevated fecal coliform counts in the Dry Creek Subwatershed, yet the data reveal no definitive evidence as to whether or not the facility is a significant source of fecal coliform within the watershed.

5. Watershed Improvement Goals

This section of the WMP outlines the overall goals for the watershed improvement process in the Lookout Creek Watershed. In addition, the minimum NPS load reduction objectives for each segment (as written in TMDLs) are included and describe the estimated necessary load reductions for streams to meet water quality criteria.

5.1 Overall Objectives

Restoration

The primary objective of this WMP is to outline a framework that will lead to the restoration of the Lookout Creek Watershed to the extent that compliance with state standards is achieved and maintained. Two segments are on Georgia's 303 (d)/305 (b) list, totaling twenty miles of impairments. A major component of restoration efforts will include implementing cost-share programs that incentivize landowners to voluntarily address pollution sources on their privately-owned lands. Reductions in relevant pollutants will be tracked through water quality monitoring and potentially biotic monitoring. State-designated water quality collection and analysis protocols will be followed during periodic sampling events in an effort to de-list the stream segment impaired for high fecal coliform bacteria counts. In addition, sampling rotations by monitoring groups (from Georgia EPD) should help indicate improvements in biotic integrity as they occur within the streams of the watershed.

Figure 5.1.a. Excluding cattle from streams can reduce the fecal coliform load in the watershed.

The restoration objectives outlined in this WMP were derived from the desires of the Watershed Advisory Committee and local stakeholders. The underlying concerns for these water quality issues within the group were variable; however, a general consensus was identified. The main concern of the stakeholder group appears to be the health hazard that fecal coliform contamination poses to the community. Ameliorating this issue, while bringing grant funding to the community, is the main goal. In addition, sedimentation issues that negatively affect aquatic organisms are to be reduced to preserve the biodiversity present within the watershed.

Anti-degradation

The stakeholder group recognized that the entire watershed contained sources of fecal coliform and sediment, as evidenced by the water quality sampling data obtained during the formation of this WMP. In addition to the current impairments, other stream segments appear to have the potential to be listed at some point as well. Also, considering the current impairment for fecal coliform is located on lower Lookout Creek, reduction of fecal coliform through voluntary conservation anywhere in the watershed can reduce the issue in this particular stream segment. Recognizing this information, anti-degradation efforts were emphasized as a primary objective of restoration efforts. For this reason, although certain areas may be prioritized over others, any cost-share program should be implemented on a watershed-wide basis. In addition, outreach efforts will be focused on the whole watershed to raise awareness of existing programs that make best management practices more affordable to private landowners and prevent further degradation of stream segments within the watershed.

Education

The third and final objective identified in this plan is to educate local citizens on the uniqueness of their watershed and its diverse fauna, the NPS threats present in the area, and what can be done to mitigate these issues. Education and outreach efforts are paramount if watershed goals and objectives are to be reached. Involving local communities in the watershed improvement process is a key to success, and providing an opportunity for locals to gain an understanding of the importance of watershed restoration needs to be a priority program component to supplement BMP installation efforts.

Presentations at local events would provide a means to reach a broad audience in the community. Creation of events with the sole purpose of gaining support was also suggested. Specific examples include stream cleanups, riparian tree planting events, and canoe cleanup floats down local waterways, each of which have been conducted in conjunction with the development of this plan.

5.2 Load Reduction Targets

The impaired segment along lower Lookout Creek is the result of past fecal coliform concentrations exceeding state standards. A TMDL was created for fecal coliform impairments in the Tennessee Basin that included this segment in 2003. This TMDL included an estimate of the reduction of fecal coliform loadings likely to result in de-listing of the segment. This percentage calculated, 37%, was the lowest by a significant margin of approximately twenty segments in that particular TMDL document, suggesting the bacteria concentrations are less severe and within closer reach of state criteria than in other similarly impaired Northwest Georgia streams.

Gulf Creek, the other impairment in the watershed, resulted from fish sampling efforts revealing degraded biota. It is assumed that sedimentation and habitat alterations were the main contributors to the state of the fish assemblage within Gulf Creek, but a TMDL completed in 2009 assessed sediment loading in the subwatershed and found reductions in sediment were not needed for the stream to recover. Instead, historical sedimentation and habitat alteration were described to be the likely cause of the degradation found in Gulf Creek. The TMDL claims that should the current estimated sediment loads be maintained without further degrdation, biotic assemblages will recover in time. Increases in riparian buffers and bank stability would enhance bank stability and further habitat degradation and accelerate this potentially lengthy recovery process.

6. Pollution Reduction

Management programs and strategies (structural and non-structural) that impact fecal coliform and/or sediment pollution and currently exist within the Lookout Creek Watershed are explored in this section. Structural practices are those that are engineered and result in a physical structure that is designed to reduce a specific type(s) of pollution. Non-structural practices are those that typically work to change the attitude or behavior of individuals. The section also explores a proposed program needed in the watershed for the previously identified restoration goals and objectives to be accomplished.

6.1 Existing Conservation Programs

Within the Lookout Creek Watershed, several existing structural conservation programs are currently implemented (See Table 6.1.a.), although none are generally unique to the area. Most programs that encourage water quality improvements are ubiquitous across Georgia, if not the nation. Only those that specifically relate to sediment and/or fecal coliform pollution reduction are displayed here. Some of these programs include non-structural components as well.

Table 6.1.a. A display of some of the existing structural programs and practices in the watershed.

Structural Measure	Responsibility	Description	Impairment Source Addressed
Conservation Tillage Program	Limestone Valley RC&D, Coosa River SWCD	Makes conservation tillage equipment available for rent within the watershed, helping producers plant their crops with minimal disturbance to the soil. This reduces erosion from cropland, and increases water retention and nutrients.	Agriculture
Environmental Quality Incentives Program (EQIP)	NRCS	Works to address resource concerns on agricultural lands. EQIP is a cost-share program (75% typically) for landowners seeking to implement BMPs on their property.	Agriculture
Conservation Reserve Program	FSA, NRCS	Addresses problem areas on farmland through conversion of sensitive acreage to vegetative cover such as establishing vegetative buffers along waterways. Conversion costs are shared with FSA, and the landowner receives an annual payment for maintaining the conversion.	Agriculture
Septic System Permitting and Inspection Program	North Georgia Health District	Septic system repairs and installations are permitted and inspected by North Georgia Health District Staff. This not only ensures that systems are functioning, but also that they are installed by a licensed individual according to state regulations.	Urban/Residential

Many programs also provide non-structural practices in the Lookout Creek Watershed (See Table 6.1.b.), and again, most are not unique to the area. These practices, although not physically reducing pollution, can arguably improve water quality as much or more than structural practices themselves. Changing behaviors and/or attitudes can be contagious, making a real difference in both the cultural and natural landscape over time.

Table 6.1.b. A display of existing non-structural programs in the Lookout Creek Watershed.

Non-Structural Measure	Responsibility	Description	Impairment Source Addressed
Georgia Water Quality Control Act (OCGA 12-5-20)	Georgia EPD	Makes it unlawful to discharge excessive pollutants into waters of the state in amounts harmful to public health, safety, or welfare, or to animals, birds, aquatic life, or the physical destruction of stream habitats.	All inclusive
Georgia Erosion and Sedimentation Act	Georgia EPD	Among other things, it prevents buffers on state waters from being mechanically altered without a permit.	All inclusive
Rules and Regulations for On-site Wastewater Management	Dade County Environmental Health Office	Enforcement and application of the regulations through permitting and inspection of new and repaired systems.	Suburban, Residential
Georgia Rules & Regulations of Water Quality Control for CAFOs 301 to 1,000 animal units	Georgia Department of Agriculture, Georgia EPD	Outlines the swine and non-swine Feeding Operation Permit Requirements. CAFOs in this category receive a land application system permit (LAS).	Agriculture
Conservation Technical Assistance Program	NRCS	Assists landowners with creating management plans for their lands, including but not limited to Farm and Forest Conservation Plans and Comprehensive Nutrient Management Plans (CNMPs).	Agriculture
UGA Cooperative Extension Program	Dade County Extension Office	Assists with general agricultural assistance, which includes providing suggestions for soil and water conservation.	Agriculture

6.2 Proposed Conservation Program for the Lookout Creek Watershed

In the Lookout Creek Watershed, the presence of impaired stream segments suggest that a new collaborative program (in addition to those already in existence) is very likely needed to approach compliance with state water quality standards in a more expedient manner. The following proposed program, the *Lookout Creek Watershed Restoration Program* (LCWRP), would be an endeavor partially funded by Clean Water Act (§319) grants (and assisted by in-kind donations of certain stakeholders, agencies, and non-governmental organizations) that would provide cost-shares on practices that have been deemed by the stakeholder group as a means to address the water quality issues within the watershed. In addition, this program would attempt to raise awareness of the issues in the area, as well as educate citizens about potential solutions to these local problems and the importance of water quality.

Proposed Structural Practices of the Lookout Creek Watershed Restoration Program

It was evident in the water quality data and stakeholder surveys that although certain segments are listed for fecal coliform and others for impacted biota, both pollutants of concern are present in excess at times throughout much of the watershed. These data, when combined with the anti-degradation objective as well as stakeholder survey results, indicate the need to implement BMP installations throughout the watershed instead of only those locations in close proximity to the impaired segments themselves. In addition, as stated previously, reductions in fecal coliform anywhere within the watershed will improve the water quality in the lower reaches of Lookout Creek. The stakeholders decided that at least some emphasis should be placed on the two major sources of pollutants which include agriculture, failing septic systems, and potentially stormwater as well (streambank stabilization, etc.).

Figure 6.2.a. Constructing heavy use area pads for cattle feeding or watering areas can reduce erosion and sediment loads in the watershed.

Since agricultural activity encompasses a large proportion of land use within the watershed, the LCWRP will include a cost-share program that will help local farmers afford conservation practices that reduce fecal coliform and/or sediment contributions to receiving waters. Many of these practices are also beneficial to landowners which will serve as additional motivation for participation in the program. Most of the agricultural lands within the watershed are used for grazing, so funds need to be available to assist farmers with an interest in voluntary conservation to restrict livestock stream access and provide alternative watering sources. These practices would reduce the fecal coliform load from direct sources and agricultural runoff in the watershed. Projects that address erosion issues will likely include streambank and heavy use area stabilization.

In addition, funds are needed to establish riparian buffers where they are absent. GIS analysis indicated that approximately 25% of the watershed has inadequate riparian buffers. Projects to improve riparian buffers would help reduce both fecal coliform and sediment pollution by acting as a physical barrier to runoff during rain events.

Figure 6.2.b. A septic system repair can reduce the fecal coliform load in streams. A cost-share program can help incentivize costly repairs.

Altogether, many types of agricultural BMPs will be installed as a part of the LCWRP. In general, however, projects that only marginally address the resource concerns will be avoided. A suite of agricultural BMPs may be installed as part of the restoration process assuming they collectively assist in sediment and/or fecal coliform load reductions.

The LCWRP will also include a cost-share program to address failing septic systems, since this issue was determined by the stakeholder group to be a significant contributor to the fecal coliform bacteria load in the watershed. High failure rates are said to occur for several reasons, including poorly percolating soils in some areas, outdated systems, and the low-income financial condition of a portion of the local population. A cost-share program in the area would help to incentivize more of the population to get their systems repaired. Cost-share rates are likely to vary according to the likely contributions of the failed systems to pollutant loads, and in the cases of impoverished families, financial conditions. In addition, greater public demand for septic system repairs will likely result in lower cost-shares offered in order to assist more homeowners, as well as result in greater water quality benefit per dollar. Although higher rates will generally be offered on projects that more significantly reduce pollutant loads, inclusion of other property owners to be eligible for lower cost-share rates will maximize program participation while building important momentum within local communities.

Water quality data and the frequency of flooding in the watershed led the stakeholders to also desire an emphasis on stormwater BMPs, especially streambank stabilization, should opportunities arise. A cost-share program would incentivize private landowners to implement streambank stabilization techniques, as well as riparian restoration and practices that mitigate stormwater quantity (retention ponds, etc.). Despite not being characterized as an MS4 and therefore not having stormwater management requirements, the City of Trenton could work with the LCWRP to improve stormwater management in the Town Creek Subwatershed by utilizing the labor of local trustees to serve as the primary cost-share contribution for stormwater management projects. This would be an innovative opportunity to put into motion to improve stormwater management in the community.

Proposed Non-Structural Practices of the Lookout Creek Watershed Restoration Program

Efforts to educate and inform the public about the importance of water quality will accompany the cost-share programs funded through the LCWRP. The idea is to invest in conservation practices while demonstrating their effectiveness to other landowners, with hopes that voluntary conservation and modern land management practices that address resource concerns become contagious in the community. At the least, the concepts and practices will slowly become more accepted as they become more commonplace over time. Local newspaper articles derived from the press releases, farm days, and workshops are all acceptable ways to spotlight the benefits of agricultural BMPs. Other efforts will offer educational opportunities during volunteer work days (riparian plantings, stream cleanups, etc.).

As a part of the LCWRP, an outreach plan will be developed for any and every grant that is received from the 319 program. This plan will identify annual or semi-annual events that will be held that encourage public participation in the watershed improvement process. These events could include canoe floats, stream cleanups, and the establishment of viable Adopt-A-Stream groups.

In addition, the new program should include promotion of the watershed improvement process to local stakeholders to further develop and maintain program momentum. Press releases should be periodically issued to local newspapers highlighting program details, and the watershed issues it attempts to resolve. Promotions should also include local presentations to stakeholder groups. These promotions would serve to maintain community interest in the restoration effort by reminding local groups of the benefits the implementation effort is seeking to provide (e.g., reduced human health risk and water treatment costs and increased financial assistance within the community). These stakeholders should be also updated as significant progress is made toward water quality goals in order to show them that the goals of the restoration efforts are attainable.

Figure 6.2.c. Volunteer events, such as stream cleanups, can keep stakeholders engaged while benefitting stream quality.

7. Implementation Program Design

The objective of this WMP is to outline implementation efforts needed to result in the long-term goal of de-listing the two impaired stream segments, while ensuring additional segments are not listed. This section of the WMP outlines specific restoration activities, how they relate to implementation milestones, and estimated dates of completion. In addition, costs associated with the measures needed for watershed restoration are estimated.

7.1 Management Strategies

The recommended strategy for implementation of this WMP is to create and manage a program that features both structural and non-structural controls within the watershed to address the fecal coliform and sediment issues. It is the intent of the proposed restoration program (LCWRP) to restore the watershed to the extent that impaired segments are eventually de-listed, while ensuring that additional segments are not listed. This should be accomplished by increasing the available agricultural BMP cost-share opportunities, creating a septic system repair cost-share program, assisting in the stabilization of problematic streambanks, improving local stormwater management, making available educational opportunities to encourage public participation in the watershed improvement process, and monitoring water quality to track improvements and potentially de-list impaired segments. Septic system failures will be identified and addressed with the technical assistance provided by the North Georgia Health District. The NRCS will assist with technical advisement with respect to agricultural projects and streambank projects. Other agencies and non-governmental organizations will make key contributions to outreach efforts, as well as other facets of the program. All participation in grant programs will be voluntary in nature, and great care should be taken to respect private property rights.

In order to de-list several stream segments through implementation of a number of small projects, it is likely that the investment of significant time and funding will be necessary. Assuming the behaviors and land management practices improve over time, the benefits of clean water can last generations. It has been estimated that approximately 25% of the critical areas within the watershed can be treated with BMP installations to reduce NPS pollution through the implementation of multiple Clean Water Act §319 grants. The program, as outlined here, would cumulatively fund a maximum of approximately $700,000 worth of projects and at this point has been designed to be implemented over the course of thirteen years (including grant proposal submission periods). This proposed allocation of funds is similar to other restoration efforts that have been funded in the state, yet is to be focused on a smaller geographic scale, which should lead to more pronounced improvements. It is believed that both stream segments could be de-listed as a result of this effort or even before its completion, although there is also a small possibility that more funding could be necessary to accomplish that goal.

7.2 Management Priorities

Project Fund Allocation

Cost-share programs are to be developed for agricultural BMP installations, septic repairs, and stormwater and streambank stabilization projects. Stakeholders were solicited as to how to allocate the funds between these projects within the watershed. Stakeholder opinions were variable, but analysis of responses resulted in approximately 55% of the potential funds being allocated to septic system repairs, 20% to agricultural BMPs, and 25% for stormwater and streambank stabilization projects. Due to high demand for septic system repairs and unknown demand for stormwater, streambank stabilization, and riparian planting projects, we have estimated 60% of the funds to be allocated toward septic system repairs and 40% for agricultural BMPs as well as stormwater, streambank stabilization, and riparian planting projects.

Cost-Share Rates

Agricultural BMPs addressing water quality concerns should generally be cost-shared upon at a rate of 60%. This rate is such that these projects adequately assist in providing matching fund contributions that count toward grant requirements, while remaining reasonably competitive with the NRCS EQIP program, which cost-shares at 75% on estimated project costs for projects that receive funding.

Stormwater, streambank stabilization, and riparian planting projects should also be cost-shared upon at a rate of 60%. This rate again allows completed projects to adequately assist in providing matching fund contributions that count toward grant requirements. When the high costs of these practices are prohibitive, perhaps a portion of the cost-shares could be offset by donated advisement, planning, and expertise. In addition, the utilization of donated labor to assist with or complete stormwater, streambank stabilization, and riparian planting projects may contribute to cost-share obligations. Trustees and/or citizens can contribute to such projects in this way especially in Trenton. On private lands, the cost-shares should incentivize landowners with considerable streambank concerns to act to improve their properties while assistance is available.

For septic system repair projects, cost-share rates should depend on the demand. If demand for repair assistance is high, cost-shares should be set at lower rates in order to accommodate as many projects as possible and achieve the greatest water quality improvement. The most ideal projects for water quality improvement will be those significantly addressing the pollutants in close proximity to streams within or just upstream of impaired reaches. However, inclusion of landowners from the entire Lookout Creek Watershed to be eligible for program cost-shares on projects that address water quality concerns is necessary to maximize program participation by building important momentum within the local community. In addition, since the problem areas are often in the downstream reaches, all areas of the Lookout Creek Watershed likely contribute to the impaired status of local stream segments, albeit to varying degrees.

Since certain septic system repair projects may address resource concerns more than others, variable cost-share rates will generally be utilized to reflect the anticipated water quality improvement. For example, a septic system within 100 feet of an impaired stream will generally receive a higher cost-share rate than one located much farther away. This method of incentivizing participation will bring about the greatest load reductions while maximizing the overall number of participants. Similarly, impoverished members of the community may be further incentivized with higher cost-share rates in order to ensure they get failing systems repaired.

7.3 Interim Milestones

To allow momentum to build in the community and ensure success, this WMP should be implemented for multiple years over several grants, each of which may have its own updated objectives and milestones according to changes in watershed conditions and/or management strategies. This section, however, seeks to outline objectives and milestones that could be used by any group (in any combination) seeking funds for restoration efforts in the watershed.

OBJECTIVE #1: Create a septic system repair cost-share program in the watershed.

MILESTONES:

- Identify local certified septic system contractors interested in participating in the program.
- Hold meetings with NGAHD representatives to design program.
- Establish initial cost-share criteria based on proximity of system to state waters.
- Hold a septic system installer's workshop to explain program details, and ensure standards for participation are understood.
- Maintain the septic repair program throughout the implementation process.

The repair process should involve the submission of bids from locally-owned businesses. These businesses should attend an installer's workshop to participate in grant projects. Bids should be requested from 3-5 contractors for each repair, and the specific businesses that receive the opportunity to bid should be determined by using a rotating list of approved contractors. The homeowner should be allowed to choose which bid to accept. The rate of cost-share should be on a sliding scale that will result in offering more assistance to projects that will likely result in the greatest load reductions.

OBJECTIVE #2: Create an agricultural BMP cost-share program in the watershed.

MILESTONES:

- Hold meetings with the NRCS to determine appropriate BMPs and cost-share rates.
- Advertise the available grant money through local media.
- Issue press releases for successful BMP installations.
- Maintain the agricultural BMP program throughout the implementation process.

Agricultural BMP installation should be on a strictly voluntary basis, and landowner confidence and satisfaction should be a primary focus. This will allow any program to develop a positive reputation in the area, which is hoped to eventually garner more conservation interest in the watershed.

OBJECTIVE #3: Create a stormwater project and streambank restoration cost-share program in the watershed.

MILESTONES:

- Hold meetings with the City of Trenton and stormwater experts to determine appropriate projects.
- Seek to incorporate trustee labor to cover cost-share contributions for projects in Trenton.
- Advertise the available grant money for projects on private lands through local media.
- Issue press releases for successful stormwater and streambank stabilization projects.
- Maintain the program throughout the implementation process.

Stormwater projects and streambank restoration efforts should be on a strictly voluntary basis, and community and landowner confidence and satisfaction should be a primary focus. This will allow any program to develop a positive reputation in the area, which is hoped to eventually garner more conservation interest in the watershed.

OBJECTIVE #4: Implement BMPs to achieve load reductions specified in the TMDL.

MILESTONES:
- Identify farmers willing to cost-share on agricultural BMP projects.
- Identify property owners willing to address streambank issues and inadequate riparian zones.
- Identify areas in Trenton where stormwater projects could be completed.
- Identify homeowners within targeted subwatersheds with failing or without proper septic systems.
- Implement septic repairs and pump-outs in the watershed as shown in Table 7.7.b.
- Implement agricultural BMPs in the watershed as shown in Table 7.7.b.
- Implement stormwater and streambank BMPs in the watershed as shown in Table 7.7.b.
- Estimate load reductions from projects when possible.

BMPs that specifically address fecal coliform should be emphasized on agricultural lands. These include activities that restrict cattle access to the stream while providing alternative water sources, and enhancement of riparian zones that may prevent animal waste and sediment from entering the stream during runoff events. Failing septic systems and "straight-pipes" should be identified and repaired to reduce the contribution of fecal coliform originating from residential areas. Streambank stabilization projects should be sought on agricultural land, as well as in urban areas that experience heavy flows from increased impervious surface cover. Stormwater projects should be implemented in urban areas as well.

OBJECTIVE #5: Reduce pollution inputs from suburban and rural areas through education and outreach.

MILESTONES:
- Provide opportunities for the public to assist with stream restoration and cleanup efforts.
- Provide opportunities for the public to participate in Georgia's Adopt-A-Stream Program.
- Conduct presentations discussing watershed restoration efforts at local events.
- Submit press releases to inform the public of the restoration process and NPS pollution issues and solutions.

A key component of the education and outreach portion of implementation should be designed to raise the awareness of citizens in the area through local media and "hands-on" events. Stream cleanups, creek walks/floats, and rainbarrel workshops should be planned to be offered to interested citizens in the area throughout any implementation effort. This ensures that the general public is provided the opportunity to not only learn about the watershed, but also participate in restoration events. These events should have the ability to not only educate and empower local citizens about water quality, but also effectively provide program outreach that can lead to agricultural BMP and streambank stabilization projects, as well as septic system repairs.

OBJECTIVE #6: Document changes in water quality throughout WMP implementation.

MILESTONES:
- Submit a targeted water quality monitoring plan for each grant received.
- Monitor several sites regularly, including at locations previously sampled by Georgia EPD.
- Conduct Pre- and Post-BMP monitoring for large agricultural BMP projects near significant streams.
- Sample to potentially de-list streams impaired for fecal coliform violations.
- Initiate WMP revisions.

Baseline data should be collected to determine the average concentrations of pollutants found at various locations within the watershed. This would allow for future comparisons when data is gathered to determine if improvements are measurable and if so, their significance. Targeted monitoring (accompanied by a Targeted Water Quality Monitoring Plan) should occur at least once for each grant that is received.

When large agricultural BMP projects are implemented near significant streams, an effort should be made to sample for the pollutants of concern before and after project completion. This may allow inferences to be made about what projects are most beneficial, as well as build local confidence on finding solutions to water quality issues.

A SQAP should be also written for each grant that is received. This will guide efforts to sample fecal coliform according the procedure necessary to "de-list" stream segments should standards be found to have been met.

Biological monitoring will also be conducted as part of regular Georgia DNR/EPD rotations and will provide insight on whether the local biotic integrity in the impaired segments is improving as water quality improvement activities take place in the Lookout Creek watershed. Additional biotic monitoring (e.g., fish IBIs and IWBs, etc.) could be conducted in conjunction with a university, or other qualified entity, to investigate whether the biotic community has improved in the impacted biota segments should funding be approved.

OBJECTIVE #7: Provide local community leaders with the knowledge to consider the effects management decisions may have on stream health in the watershed.

MILESTONES:

- Establish connections with local community leaders.
- Conduct presentations to community leaders discussing water quality issues and the solutions that BMPs can provide.
- Share water quality data and interpret the results with local community leaders for discussion purposes.

City and county personnel should be updated regularly through presentations at local meetings to keep up involvement and/or awareness during the restoration process.

7.4 Schedule of Activities

The following schedule provides the anticipated years for various objectives and milestones to be addressed in the WMP implementation process, assuming that a long-term comprehensive approach is pursued by the proposing organization and that funding needs are met.

Table 7.4.a. A display of milestone activities and a timeline in which they will each be addressed throughout the implementation of the WMP.

IMPLEMENTATION SCHEDULE													
MILESTONE ACTIVITY	**2014**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Submit §319 Proposal to GA EPD	X		X			X			X				
Create septic cost-share program		X											
Create an agricultural BMP cost-share program		X											
Install agricultural, stormwater, and streambank BMPs		X	X	X	X	X	X	X	X	X	X	X	X
Install septic system BMPs		X	X	X	X	X	X	X	X	X	X	X	X
Establish AAS Monitoring Group			X		X		X		X		X		X
Update County Commission/press releases			X		X		X		X		X		X
Conduct education/outreach Events		X	X	X	X	X	X	X	X	X	X	X	X
Conduct WQ monitoring (targeted)		X			X			X			X		
Conduct WQ monitoring (de-listing)				X			X			X			X
Reevaluate milestones				X			X				X		
Initiate reassessment of WMP						X					X		

7.5 Indicators to Measure Progress

The numbers of septic system projects, and agricultural, stormwater, streambank stabilization, and riparian planting projects completed as well as outreach event attendance should reveal progress that the implementation program is gaining momentum. Landowner participation rates can be another useful tool in determining the success of grant implementation. It is hoped that the rate will increase through subsequent years of watershed restoration due to education and outreach efforts, as well as the gradual acceptance of BMPs within the watershed. Education and outreach participation rates can be analyzed to help measure progress. It is anticipated that these rates will also increase through subsequent years as the events gain notoriety within the watershed.

Of more importance in the long run will be to measure how these projects have translated toward the goals of accomplishing the necessary load reductions and eventually de-listing the impaired segments within the watershed. For the stream segments impaired for high fecal coliform bacteria counts, tracking water quality improvements will best indicate progress toward reducing fecal contamination and eventually de-listing streams. Water quality improvements should be revealed using two water quality sampling regimes intermittently throughout the implementation process. Both types of water quality monitoring (targeted sampling and "de-listing" sampling) should be used to measure progress towards de-listing of segments impaired for exceeding fecal coliform standards.

For stream segments impaired for poor biotic diversity, progress may be more difficult to indicate. Targeted water quality monitoring may potentially reveal changes in TSS (total suspended solids) within the water column over time, but Georgia DNR/EPD will be relied upon to sample fish according to their scheduled rotations in order to determine whether biotic integrity has improved and to potentially de-list streams.

In addition, discussions have been had with the University of Tennessee at Chattanooga Biological and Environmental Sciences Graduate Department to work with them to assess the biotic integrity of the impacted biota segments should funding be provided. The group has the expertise and equipment to provide the assessments according to the same protocols, and working with them may allow a more immediate assessment (and potentially more frequent assessments focusing on temporal changes) of the impacted reaches than Georgia DNR/EPD can provide. It is not yet known, however, whether such an endeavor would result in de-listing should it reveal improved fish assemblages. Other than Georgia DNR/EPD, only Tennessee Valley Authority to our knowledge is known to have sampled biota locally that has resulted in impairments, although this implies their efforts could also result in de-listing impaired reaches. It is unknown whether the same deference is given to practiced fish ecologists at universities as well.

7.6 Technical Assistance and Roles of Contributing Organizations

This section will focus on the roles of various groups anticipated to contribute to make any restoration effort a success. Any organization seeking to aid in watershed restoration should rely on technical expertise from the NRCS with respect to agricultural BMP implementation, and the Northwest Georgia Public Health with respect to septic system BMPs. The program also relies on in-kind assistance with logistics and education/outreach activities from other groups listed below (Table 7.6.a.).

Table 7.6.a. The following groups are anticipated to contribute to implementation by taking on the roles described below. While working towards accomplishing conservation goals, many of these activities could count towards non-federal match contributions associated with any funded 319 projects.

Organization Roles and Responsibilities		
Organization Name	**Organization Type**	**Description of Role in Lookout Creek WMP Implementation**
Analytical Industrial Research Laboratories	Private Company	Provide discounted services in order to aid the restoration efforts. Analyze water samples for fecal coliform concentrations, which will be collected by project partners throughout implementation of this plan.
Environmental Protection Agency	Federal Agency	Provide EPA Clean Water Act Section 319 funds to Georgia EPD to administer through the state 319 grant program.
Georgia Department of Natural Resources	State Agency	Conduct monitoring rotations to sample sites in the watershed for fecal coliform bacteria and biota that can reveal improvements or aid de-listing efforts.
Georgia Environmental Protection Division	State Agency	Adminster Clean Water Act Section 319 Grants to provide funding for this restoration program.
Coosa River Soil and Water Conservation District	State Agency	Assist with marketing for agricultural BMPs in the watershed. Potentially help identify willing landowners in the watershed that are interested in the program.
Limestone Valley RC & D Council	Quasi-Governmental Organization	Lead implementation efforts including submitting grant applications, serving as grantee fulfilling reporting obligations, marketing program components, spearheading outreach efforts, managing finances, conducting monitoring, and managing projects.
Natural Resources Conservation Service	Federal Agency	Provide technical expertise for agricultural BMPs. This process will include multiple farm visits, the development of a conservation plan for the landowner, project supervision and project inspection. All projects will be installed according to NRCS specifications and standards.
Northwest Georgia Public Health District	State Agency	Provide technical expertise for septic system repairs. This process will include assessing, planning, permitting, and inspection of installed or repaired septic system components. Help may also be provided through identification of potential septic system repair projects. Assistance may also be provided during workshop preparation if applicable.
Northwest Georgia Regional Commission	State Agency	Provide technical assistance for implementation efforts in the watershed. Serve as a vehicle to promote the Lookout Creek Restoration Project and assist in marketing its outreach efforts.
Tree City USA	Non-profit	Serve as a vehicle to promote the Lookout Creek Restoration Project and assist in marketing its outreach efforts.
University of Georgia Cooperative Extension	State Agency	Assist in marketing efforts for program components and outreach events.
University of Tennessee at Chattanooga	Local university	Serve as a vehicle to promote the Lookout Creek Restoration Project and assist in marketing its outreach efforts.
Dade County Commission	County Org.	Provide in-kind assistance to any grantee through donated office space, meeting space, and potentially equipment/labor for certain types of projects.

7.7 Estimates of Funding

As discussed in Section 6, many programs are already offered within the Lookout Creek Watershed that aim to reduce NPS pollution. Despite the existence of these endeavors, impairments persist in the area. The estimates in this section for implementing the recommended comprehensive restoration program (LCWRP) are reliant on the 319 program as the main source of funding (in addition to key contributions from various groups as discussed above), and assume continuous consistent effort from the other programs previously mentioned in order for water quality improvements to occur.

In order to estimate the cost associated with the de-listing of impaired segments within the watershed using a comprehensive approach, an estimate of total watershed treatment was first calculated (Table 7.7.a.). The Total Watershed Treatment Table is an estimate of the cost of a hypothetical instantaneous treatment for fecal coliform and sediment reduction at all critical sites (estimated through statistics, or identified remotely). **The high cost associated with total watershed treatment may be alarming at first glance; however, it is not anticipated that total watershed treatment is necessary in order to de-list the majority of impaired segments.** Despite this fact, it is important to estimate the maximum restoration effort in the watershed based on actual watershed conditions and the amount of money needed to accomplish such an effort, so that lower estimates can be developed that are necessary to meet state criteria.

Many of the BMPs needed to de-list the stream were chosen by the Watershed Advisory Committee based on their expertise and knowledge of the area. The quantities of BMP**s** estimated in the Total Watershed Treatment Table were calculated using a variety of techniques. The septic system BMP needs were estimated based on information obtained from Dade County and failure statistics provided by the U.S. EPA. Agricultural BMP quantities were largely estimated through Geographic Information Systems analysis. Each tributary in the watershed was studied to determine the location of grazing lands and cropland. This information was coupled with an insufficient riparian buffer analysis to determine likely areas in need of BMPs. Many BMPs are often coupled with others, and the frequencies of these associations were calculated using conservative estimates. Streambank stabilization funding needs were estimated and stormwater and riparian planting project funds were added to this line item because they accomplish similar functions.

Efforts to begin working towards the de-listing of impaired stream segments are recommended to begin immediately with the approval of this WMP. **A goal of approximately 25% of total watershed treatment has been set to be accomplished by 2027, which is believed to likely be sufficient to de-list impaired segments.** In order to lay the framework to accomplish this, Table 7.7.b. was created to outline the recommended approach for fund requests, and collectively represents approximately 25% of the total watershed treatment costs excluding landowner contributions. Again, the costs associated with these tables do not include landowner contributions to the project, and are displayed at 60% of the total cost in order to better describe federal funding needs.

Table 7.7.a. An estimate of the cost associated with a hypothetical instantaneous watershed-wide treatment for fecal coliform and sediment reduction at all critical sites.

TOTAL WATERSHED TREATMENT TABLE			
Agricultural BMPs (Name - Code)	**Quantity**	**Cost/Unit**	**Cost Estimate**
Fence - 382	684,252	$1.31/lin.ft.	$896,370
Heavy use area (pad – concrete 3'x4' pad; w/ 614 below) - 561	1,000	4.02/sqft	$4,020
Heavy use area (pad – geotextile/gravel 50' x 50') - 561	25,000	$1.50/sqft	$37,500
Pipeline - 516	46,500	$1.71/lin.ft.	$79,515
Riparian forest buffer -391	400	$256.82/ac	$102,728
Riparian herbaceous cover - 390	400	$228.50/ac	$91,400
Streambank stabilization (and stormwater and riparian planting projects)	5,000	$67.27/lin.ft.	$336,350
Water well - 642	30	$4,569.00 each	$137,070
Watering facility - 614	93	$968.12 each	$90,035
Septic System BMPs (Name - Code)	**Quantity**	**Cost/Unit**	**Cost Estimate**
Conventional system repair (5,500 homes on septic)	500	$4000 each	$2,000,000
Experimental system installation	50	$7000 each	$350,000
TOTAL WATERSHED TREATMENT COST			**$4,124,988**
TOTAL TREATMENT COST EXCLUDING LANDOWNER CONTRIBUTIONS (60%)			**$2,474,992***

60% of Total Watershed Treatment Cost.

Table 7.7.b. A display of recommended financial requests for each of four 319 grants sought by an organization attempting comprehensive watershed restoration. The proportions are derived by stakeholder recommendations, and the sum of all activities is approximately 25% of total watershed treatment as displayed in figure 7.7.a.

	Septic System Funds	Agricultural/*Other Project Funds	TOTAL
Proposal 1 - 2015	**$80,000**	**$55,000**	**$135,000**
Proposal 2 - 2018	**$100,000**	**$55,000**	**$155,000**
Proposal 3 - 2021	**$100,000**	**$55,000**	**$155,000**
Proposal 4 - 2024	**$115,000**	**$60,000**	**$175,000**

*Includes Streambank Stabilization, Stormwater, and Riparian Projects

7.8 Getting Started

A goal of approximately 25% watershed treatment has been set to be accomplished by 2027 through the recommended comprehensive approach (assuming funding needs are met). This treatment prescription is believed to be enough to de-list the Lookout Creek segment, although Gulf Creek may be more difficult to improve unless multiple projects are completed in its watershed. Efforts to begin working towards the de-listing of impaired stream segments are recommended to begin immediately with the approval of this document by Georgia EPD and the US EPA.

8. Education and Outreach Strategy

Outreach associated with watershed restoration efforts should seek to put volunteers to work in ways that assist with cleaning up Lookout Creek, enhancing the riparian buffer, reducing non-point source pollution, and sampling water quality parameters. These events have been recommended, since they aid in raising awareness of local nonpoint source issues and lay the groundwork for implementation through the establishment of partnerships and identification of potential BMP projects. This idea is based on stakeholder opinions and Limestone Valley's past experience with implementing 319 grant projects, which revealed that the general public is one of the most valuable sources of information with respect to identifying both general and specific sources of pollutants. With each commitment from a citizen to volunteer their time, the likelihood of successful watershed restoration increases. The following descriptions are recommended events that could be held in and adjacent to the watershed. A value could be placed on many of these events through calculating volunteer labor, supplies, or other in-kind donations. This value, with all supporting documentation, could then be reported as match to the federal funds distributed through any applicable 319 grant.

Riparian Tree Plantings

Riparian tree planting events with volunteers could be held on the banks of streams and creeks in the Lookout Creek Watershed. It is anticipated that trees and the tools with which to plant them would be obtained through the use of grant funds or donations from non-federal sources. The volunteers to plant the trees could be acquired through newspaper articles and word-of-mouth. The primary purpose would be to utilize volunteer labor to plant trees in an effort to increase the riparian buffer within the watershed. Another purpose of this event is to identify potential BMP projects through personal interaction with volunteers that encourage them to assist in "spreading the word" about grant funds and opportunities. These events should include a presentation about the non-point source pollution issues that face Lookout Creek. Other educational materials on septic system repairs and maintenance, and stormwater practices (rainbarrels, raingardens) should be made available.

Rainbarrel Workshops

During past 319(h) grant implementation projects in Northwest Georgia, rainbarrel workshops have proven to be one of the more useful tools to garner public support for watershed restoration efforts. Through these past projects, the workshops not only develop a relationship with the local Coca-Cola plant that provides the barrels, but also assess the level of interest from the public. In the past, these events have generated overwhelming interest from local communities, and have attracted the most enthusiastic volunteers. Furthermore, rainbarrels are desired by a diverse array of citizens including both farmers and homeowners, which is the exact demographic that is needed to implement BMPs that address resource concerns on residential and agricultural lands.

For the purposes of conducting outreach thorugh a 319(h) grant project, this outreach activity would have the primary objective of incentivizing rainbarrel construction and installation to reduce NPS pollution, but would also serve as the sounding board from which to advertise available BMP funds. At these events, citizens should receive specific information about cost-share funds for projects that benefit both landowners and our natural resources, information about Lookout Creek's water quality issues (with watershed map visual aids), and the opportunity to work to construct and take home a free rainbarrel to affix to the guttering system of their home. Volunteers from these events should be encouraged to participate further in identifying potential BMP sites and assisting with other outreach events. Follow-up communications should be initiated to keep these interested citizens engaged throughout the implementation process. The barrels donated from Coca Cola, the parts used to retrofit them, and the homeowners' labor and time spent constructing rainbarrels are all values that could be calculated and compiled for matching purposes for any applicable 319 grant.

Adopt-A-Stream Workshops

These events are designed to train volunteers on how to use Adopt-A-Stream (AAS) monitoring equipment to sample water quality parameters and inform them of non-point source pollution issues. At these workshops, volunteers should be informed of the basics of water quality sampling and watershed science, as well as how to use the AAS website to enter all collected data from the stream that they choose to adopt. The hours that volunteers spend in the training workshop, along with subsequent hours of actual sampling, could be used to calculate a match value that could be reported with supporting documentation to Georgia EPD. In addition, volunteers should be given information advertising potential available cost-share funds for both agricultural projects and septic system repairs that reduce non-point source pollution. Some workshop components may be featured in events that fall under a different category (e.g., Water Quality Monitoring Canoe Float).

River's Alive Cleanup

As part of 319 planning efforts in the watershed, a partnership has been formed with Limestone Valley RC&D, UGA Cooperative Extension, and Tree City USA to host a river cleanup. It is planned that this cleanup event will occur annually, and (since many volunteers are from the watershed) could be continuously used as sounding board for advertising available BMP project funds while providing opportunities for NPS education. Volunteer labor and donated material values from sites within and near the Lookout Creek Watershed could be recorded and reported for matching purposes.

Water Quality Monitoring and Stream Cleanup Canoe Floats

These events should be designed to attract members of the local community to volunteer to clean up our local waterways from a canoe and/or sample water quality during a training session on how to use Adopt-A-Stream equipment for water quality sampling. These volunteers could paddle while picking up all accessible trash within the stream and on the banks, and/or sample water quality at several sites, while learning about the importance of varying water quality parameters, agricultural and residential runoff issues and how they pertain to Lookout Creek. Maps and handouts should be distributed at stops along the way to discuss pollution sources, BMPs, and steps they can take on their own property to reduce pollution. In addition, local aquatic fauna should be a topic of discussion in order to convey what could be at stake should pollution problems continue. Volunteer labor and donated material values will be recorded and reported as matching funds for any applicable 319 grant.

Summary of Nine Elements

The following is a summary of the Nine Elements addressed in the Lookout Creek Watershed as identified in the Watershed Management Plan (WMP).

1. An identification of the sources or groups of similar sources contributing to nonpoint source pollution to be controlled to implement load reductions or achieve water quality standards.

The Lookout Creek Watershed has streams that fail to meet the criteria within the State of Georgia for pathogens and impacted biota, which respectively result from fecal contamination and excessive sediment loads. Load reductions of these pollutants are necessary in two stream segments, so the WMP focuses on fecal coliform bacteria and sediment as the nonpoint source (NPS) pollutants of concern and identifies several consistent sources for these pollutants (discussed in detail in Section 4), each of which relates to land use. This WMP identifies agricultural lands for targeting load reductions of both fecal coliform bacteria and sediment pollution through the installation of Best Management Practices (BMPs; e.g., controlling livestock access to water sources, installing alternative watering sources, protecting heavy use areas, etc.). In addition, residences will be targeted for septic system repairs to reduce the contributions of fecal coliform bacteria from failing septic systems. Streambank stabilization and stormwater projects will be completed on agricultural and/or urban land when feasible.

2. An estimate of the load reductions expected for the management measures described under number 3 (below);

The load reductions recommended in Total Maximum Daily Load (TMDL) documents are featured in Section 5. Management measures that will be implemented to achieve load reductions include agricultural projects, stormwater and streambank stabilization projects, and septic system repairs. Agricultural BMPs will vary according to the interests of the farmers, and it is difficult to predict the frequency that each practice will be used during implementation, as well as where projects will be located, the current onsite conditions, and the significance of the NPS pollution at each site to be ameliorated. Septic system repairs will also be conducted as part of the WMP implementation process, especially in close proximity to blueline streams. However, the type of repairs, the proximity to streams, and the contributions to instream fecal coliform counts may vary for each septic repair project. Complicating matters further, conditions within the watershed will change over time. Due to the complexity involved in predicting the load reductions from the broad management measures provided below, the WMP instead seeks to focus on the completion of multiple projects and intermittently evaluating where the watershed is within the restoration process. Eventually, the management measures implemented should result in restoration to the extent that the necessary load reductions will be met and the impaired segments will be able to remain delisted.

3. A description of the NPS management measures that will need to be implemented to achieve the load reductions established in the TMDL or to achieve water quality standards;

A number of management measures including both structural and non-structural practices have already accomplished and will continue to accomplish various objectives. These practices are highlighted within Section 6. WMP implementation will also aim to execute additional structural controls to include some combination of the agricultural practices, streambank stabilization efforts, and a number of septic system repairs directed toward NPS load reductions (discussed in Chapters 6 and 7). The management measures should be implemented across several grants with each involving monitoring to gain updates on current watershed conditions and completing projects potentially according to changing priorities. In conjunction with these efforts, we recommend implementing non-structural controls geared towards promoting watershed improvements with educational involvement within the community (also described in Chapters 6 and 7).

4. An estimate of the amounts of technical and financial assistance needed, and/or the authorities that will be relied upon to implement the plan;

The groups responsible for each existing and new management measure are described within Section 7 of the WMP. Estimates of funding needs are indicated only for activities conducted exclusively for WMP implementation. In order to come up with an estimate, we first conceptualized the extent of work within the watershed potentially needed for complete watershed treatment. Next, we estimated the extent of that treatment that would likely result in the de-listing of impaired streams. We assumed completion of approximately 25% of total watershed treatment would suffice to meet this objective, and each series of projects and monitoring events may allow for a better estimate. The process used to estimate the financial resources utilized is described in greater detailed in Section 7, and was chosen due to the complexities of implementing load reductions "on the ground" through voluntary conservation practices. The anticipated sources of funding to achieve restoration goals are several Environmental Protection Agency (EPA) Section 319 grants administered by the Georgia Environmental Protection Division (EPD), in conjunction with in-kind services from Dade County, Northwest Georgia Health District, and volunteers from across the region.

5. An informational/educational component that will be used to enhance public understanding of and participation in implementing the plan;

Public education and outreach recommendations are identified in Section 8. The more successful programs should remain standard practices for the duration of the implementation process. The recommended educational programs focus on water quality monitoring, septic system maintenance, and stream cleanups, among others. Additional programs should be designed and implemented as necessary for successful implementation.

6. A schedule for implementing the management measures that is reasonably expeditious;

The proposed implementation schedule is found in Section 7 and initially estimates implementation activities to occur through 2026. This includes water quality monitoring and implementation activities (e.g., agricultural BMPs, and septic system repairs), in addition to education and outreach. Each of these activities will continue through each grant implementation period, although priorities may be reevaluated and subsequently altered with each grant period. Currently, we anticipate that four grant implementation periods may allow for the goals of the WMP to be accomplished.

7. A description of interim, measurable milestones (e.g., e.g., amount of load reductions, improvement in biological or habitat parameters) for determining whether management measures or other control actions are being implemented;

A number of goals and objectives are recommended as interim milestones proposed to implement the management measures of this watershed improvement plan. These are included in Section 7. The initial goals of the WMP include developing a septic system cost-share program, building momentum toward implementation of agricultural management practices, completing septic, stormwater, streambank stabilization, and agricultural projects that reduce pollutant loads, carrying out educational activities, and monitoring to observe where extra focus is necessary and maintain that load reductions are occurring as a result of implementation. Over the course of implementation, each grant will include interim milestones with more finite objectives for each of the overall goals (i.e., number of agricultural and septic projects, number of newspaper articles, number of Adopt-A-Stream (AAS) programs initiated, multiple years of water quality monitoring data, etc.).

8. A set of criteria that can be used to determine whether substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether the plan needs to be revised; and;

Several sources of the pollutants of concern will be addressed by WMP implementation. Water quality data collection is ongoing to determine priorities and current conditions and will continue intermittently to indicate how projects on the landscape are translating into water quality changes. Yet, it may be a few years before enough projects are completed in each subwatershed to significantly affect water quality. Therefore, throughout the implementation process, project types and locations will be documented to get an idea of the extent of water quality improvements as projects become more prevalent within each subwatershed and the Lookout Creek Watershed. This will allow management measures to be adapted to effectively address concerns that may arise with improvements in the implementation strategy. In the interim, continued monitoring of water quality and determination of the success of completed projects is necessary to determine if revisions are needed. At the least, revisions should be submitted in an addendum to this document in 2019 to evaluate successes and adaptations to the initial management measures recommended in this WMP. Section 7 includes how progress will be indicated and considers documenting the details of each project, load reductions per project when applicable, increased public interest, and changes in water quality that indicate progress toward the overall goal of de-listing impaired segments within the watershed.

9. A monitoring component to evaluate the effectiveness of the implementation efforts, measured against the criteria established under item (8).

In Section 7, the WMP recommends that two different monitoring protocols continue to be conducted within the watershed as the new management measures (and the ongoing programs discussed in Section 6) are implemented. One type of monitoring is identified as “Targeted Monitoring”, and involves sampling at specific sites in both wet and dry periods to help establish baseline conditions and monitor for improvements. The second type of monitoring is for “de-listing” purposes, and follows a strict procedure (regardless of weather) in an attempt to show that restoration has been achieved.

Glossary of Acronyms

AAS - Adopt-A-Streams

BMP - Best Management Practice

CNMP - Comprehensive Nutrient Management Plan

DNR - Department of Natural Resources

EPA - Environmental Protection Agency

EPD - Environmental Protection Division

GIS - Geographic Information Systems

IBI - Index of Biotic Integrity

IWB - Index of Well Being

LCWRP – Lookout Creek Watershed Restoration Program

NPS - Nonpoint Source

NRCS - Natural Resource Conservation Service

RC&D - Resource Conservation and Development Council

SQAP - Sampling and Quality Assurance Plan

TMDL - Total Maximum Daily Loads

WMP - Watershed Management Plan

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