A WATERSHED MANAGEMENT PLAN FOR OOSTANAULA RIVER AND FOUR TRIBUTARIES IN ROME, GEORGIA

A local stakeholder approved plan that outlines the framework for improving water quality in the East Rome Watershed Planning Area

Limestone Valley RC & D Council

Acknowledgements

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1 Contents

2 Executive Summary

The watersheds covered in this management plan are a contiguous group of four subwatersheds (HU 12). While the watersheds are contiguous on land, the water is split between two river systems that converge in urban Rome. Two watersheds, Dykes (HUC 031501041604) and City of Rome- Etowah River (HUC 031501041606) are in the Etowah River system. The remaining two watersheds, Dozier Creek- Oostanaula River (HUC 031501030603) and Woodward Creek (031501030602) are in the Oostanaula River drainage. The full planning area, referred to in this plan as the East Rome Watershed Planning Area, drains a 59,800 Acre or 93 square mile area. The counties within this planning area, in order of land mass, are Floyd, Bartow, and Gordon.

For the purpose of this plan, the HUC 12 watersheds will be looked at separately in terms of data and impairments but collectively in terms of programs, funding, and best management methods for water quality improvement. This approach allows for specificity of needs but also practicality of implementing needed solutions. Specific segments of the watersheds are listed by Georgia Environmental Protection Division (EPD) as “supporting” and others as “not supporting” their designated uses. Designated uses and EPD assessments are discussed in detail within this plan. Total Maximum Daily Load (TMDL) will also be discussed, described and implementations to address the needs will be proposed.

Previous watershed management plans for individual watersheds were utilized, updated and revised in the compilation of this broader document. Efforts were made to compile previous monitoring data for the watersheds. Current watershed conditions were also assessed to better help stakeholders assess needs within the watersheds. This monitoring focused on collection of fecal coliform, phosphorous, ortho-phosphate, nitrogen, and total suspended solids (TSS) data. Fecal coliform counts were determined to represent amounts of fecal contamination upstream of each site. TSS was used to represent potential erosion issues upstream of each site. In recent years, reducing NPS nutrient pollution has become a topic of interest in the Coosa Basin, including research into a potential nutrient trading program. Currently, EPD has proposed guidelines for water quality trading. Those guidelines will have impacts on aspects of water quality, such as nutrients. To provide baseline data for any future efforts, Nitrogen and Phosphorous were monitored at all sites. Samples were taken from eight sample sites within the watershed (**Error! Reference source not found.** Attempts were made to include samples from both wet and dry season to better capture influences of landscape on NPS. Additional details regarding monitoring and methods will be addressed in this document. Biotic and habitat-based data sets were relied upon heavily as a proxy for water quality impairments associated with biota. Biota reductions are most often directly correlative to sediment and erosion-based impairments in riparian zones and were viewed as such for the purpose of this plan.

Agricultural

Load reductions associated with agricultural land uses were identified as a key goal. Best Management Practices, through cost-shares with landowners, are a likely means by which these agricultural reductions can be realized. The agricultural practices implemented will vary according to the interests of the producers, but best management practices focused on water quality benefits were identified as important and will be addressed in this plan and in the associated budget proposal. Natural Resource Conservation Service programs will be a key contributor to the success of the agricultural load reduction component of this plan.

Residential

Fecal Coliform has been associated with failing septic systems, particularly in decentralized rural communities where septic is the primary waste treatment option. Addressing septic system issues and failures on residential and developed lands has been shown to have positive effects on reducing fecal Coliform bacteria loads in proximal waterbodies. Inclusion of cost-share for septic system repairs, prioritizing systems in proximity to streams and wet weather conveyances, will build further momentum. For this program component, it is anticipated that North Georgia Health District and local county health departments will play a key role. Additional "on-the-ground" conservation could likely be achieved through the implementation of green infrastructure and streambank stabilization in urban areas. Depending on location, these practices may be implemented in collaboration with local Utilities, county municipalities, or other willing partners in the watershed.

Outreach

Outreach is identified in this plan as a key to the successful implementation of “on-the-ground” projects. Multiple partnerships and outreach focused entities already exist in the watershed planning area and this document will provide them with a road map to further their work. Re-evaluation of the watershed conditions, through monitoring, was noted as an important aspect that could be supported through an outreach effort or funding request. A mix of outreach types and continued efforts to engage the public has been identified as a need and is specifically recommended for inclusion in any funding requests or cycles.

Urban

A portion of the City of Rome falls within the watershed planning area. Green infrastructure and urban planning are a key to future water quality improvements. While most of the watershed is a mix of agricultural and forest land, the anthropogenic effects of urban influences are very much a weighted factor in the water quality discussion. Stormwater, impervious surfaces, and other urban factors are considered in this plan and should be a water quality influence considered particularly the Southwestern area of the planning area is within Rome’s urban core.

Priority Areas

Geographic Information Systems (GIS) were extensively employed and allowed planners to perform Watershed-Scale Modeling and to identify key priority areas with the highest conservation and restoration values. A partnership with the University of Tennessee’s Interdisciplinary Geospatial Technology Lab produced a Landscape Conservation Suitability analysis as well as a Watershed Priority Index (WMPI), as developed by The Nature Conservancy and other various organizations. Products of these models can be used to focus implementation efforts for the greatest value in pollution reduction. Furthermore, conservation happens at the local level. To facilitate this, each parcel in the East Rome Watershed Planning Area was then scored based on inputs from the models. With this data implementation can be directed at projects that have the highest conservation value per implementation dollar.

Assessment protocols and funding

NRCS NWQI program funds will be allocated through NRCS NWQI/EQIP to address agricultural BMPs outlined in this WMP and beneficial to overall water quality. Additional funding should be applied for through available grant opportunities and leveraged community support. A Multiyear budget has been included in this plan based on anticipated funding through both NWQI and potential applications through Georgia EPD 319(h) funds. Assessments made of the watersheds are included throughout this document and are varied in form. Assessments follow generally accepted methodologies and include IBI, visual surveys, GIS analysis, conservation and restoration modeling, as well as community inputs assessing the social needs and conditions of the watershed.

The proposed implementation schedule includes all 319, NWQI or other funding-based grant activities including water quality monitoring, education and outreach activities, and conservation activities (e.g., agricultural Best Management Practices, septic system repairs, streambank stabilization, etc.). Each of these activities were assumed to continue through each grant implementation period. Four consecutive grant implementation periods were proposed, with the belief that it may allow for significant improvements within the watershed. After this period, it is expected that some impaired stream reaches will have been de-listed, and others will at least be improved and approaching compliance with state criteria. Additional funding could be applied for within the healthy watersheds initiative of GAEPD to maintain and continue improvements even once delisting has occurred on segments.

3 Plan Preparation and Implementation

The East Rome Watershed Planning Area (ERWPA) consists of four subwatersheds that drain to the Oostanaula and Etowah Rivers on the eastern side of Rome, Georgia. The subwatersheds consists of City of Rome-Etowah River (HU 031501041606), Dozier Creek - Oostanaula River (HU 031501030603), Dykes Creek (031501046004), and Woodward Creek (HU 031501030602). The ERWPA has a total of seven reaches that are assessed by the Georgia Environmental Protection Division for meeting state water quality standards (Table 13. Impaired Stream Segments within the Rome Project Area. A total of five of these reaches are designated as "Not Supporting" their respective designated uses. These segments are listed due to elevated fecal coliform levels as well as impaired biota, typically a result of excess sedimentation, and Fish Consumption Advisories (PCBs). The purpose of this Watershed Management Plan (WMP) is to propose a preferred set of Best Management Practices (BMPs) to implement and restore subwatersheds within the ERWPA. The plan will also propose a timeline on which to implement. The document is not regulatory in nature, but the preparation process educates stakeholders about the issues and provide suggestions for improvement. It also develops momentum within the community which can then contribute to the restoration effort. The ultimate goals of the planning and restoration process are for impaired segments to be (and remain) delisted and for the integrity of other segments to be maintained. The broader goal is to provide information for stakeholders and landowners in the watershed concerning watershed issues and restoration practices to help them manage the landscape to minimize water and soil resource concerns.

Limestone Valley Resource Conservation and Development Council (RC&D) has developed this plan as part of a National Water Quality Initiative (NWQI) grant to develop new as well as update and improve former Water Quality Management Plans to jumpstart restoration activities in the watershed.

The EPA has recommended nine key elements for watershed management plans to help ensure that stakeholder involvement and approval lead to an explicit prescription to eventually meet watershed restoration objectives.

Specifically, the nine key 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.

The nine elements provide a better framework for planning successful long-term watershed improvement plans. Utilizing the strategies within them increases the probability of successful implementation of restoration efforts.

Limestone Valley Resource Conservation and Development Council (RC&D) opted to develop a more extensive WMP that focuses more effort on specific watershed details, as well as a more comprehensive Geographic Information Systems (GIS) analysis that investigates several factors that exert an influence on NPS pollution loads. More focus on these details should lead to a more specific WMP that is founded on a greater understanding of the local physical and social environment. Compiling more extensive data should help determine 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. The process used to construct this document utilized extensive research on the watershed, including water quality monitoring and GIS analysis. Data regarding water quality, fish and macroinvertebrate assemblages, geology, soils, and land use were considered when conducting research on the watershed. The GIS component focused on analyzing riparian buffers, land use percentages, and housing densities. GIS and water quality monitoring were also tools to identify broad areas of likely NPS pollution sources and priority areas for installation of BMPs.

The development of the plan also relied upon the participation of a stakeholder group (

Table 1.), which consisted of members from local, state, and Federal government agencies, nonprofit groups, and the private sector. Additionally, a public meeting was advertised and held to request participation and feedback from all community members. The combined feedback of community members and organizational leaders will help ensure the long-term NPS pollution reduction strategies will be implemented successfully. Two stakeholder meetings and one public meeting were conducted in 2021 to better guide the planning process. Stakeholder members were invited to take part in the process based on professional interests, activity in the watershed and familiarity with previous stakeholder efforts. The general public and local governments were also made aware of the process and given the opportunity to participate in the group feedback. All members and attendees were informed of what was expected of them throughout the process, and those that wished to contribute more were allowed and encouraged to do so. Due to the Covid-19 concerns of some in the public, additional comments were also received via phone calls and email. A few stakeholders were consulted more regularly due to their expertise and willingness to provide additional support. It is also anticipated that some stakeholders may contribute significantly in the restoration process. Meetings focused on gathering input about potential problems and solutions, developing priorities, evaluating what BMPs might be met with the best public reception, and obtaining insight on the document. Finally, approval was sought for the Watershed Management Plan document to serve as the plan on which restoration and implementation efforts will follow.

Table 1 . Stakeholder Committee

Pam Traylor	District Conservationist	NRCS
Corey Babb	Compliance	Wood PLC
Ben Winkelman	Eco Center Director	Rome ECO center
Missy Phillips	Sustainability Coordinator	Bartow County
Mike Hackett	Director	Rome Sewer and Water
Cathy Borer	Professor	Berry College
Steve Hulsey	Utility Admin	Floyd County
Katie Owens	Field Director	The Nature Conservancy
Jesse Demonbreun-Chapman	Executive Director and River Keeper	Coosa River Basin Initiative
Katie Hammond	UGA Research Farm Director	UGA Extension
Scott Glassmeyer	Biologist	US Fish and Wildlife
Ani Escobar	Coosa Aquatic Biologist	GA DNR WRD

4 East Rome Watershed Planning Area Description

4.1 Location and Subwatersheds

The ERWPA (also referred to as "planning area") includes a large part of Floyd County, Georgia to the north, east and south of Rome and small parts of Gordon and Bartow Counties (

Figure 1). It is comprised of four HUC 12 areas, Dozier Creek-Oostanaula River Watershed Section, Dykes Creek watershed, City of Rome-Etowah River Watershed Section, and Woodward Creek watershed. The USGS has divided the nation's landscape into nesting areas based on river drainages and assigned Hydrologic Unit Code (HUC) numbers to each, with lower numbers for the largest units, and larger numbers assigned to the sub-watersheds within those areas. The four HUC 12 areas are part of the Coosa River basin, which drains a large part of northwest Georgia and part of Alabama. In Alabama, the Coosa River joins the Tallapoosa River to form the Alabama River. The Alabama River flows into the Mobile River, which enters the Gulf of Mexico at Mobile Bay. The four HUC 12 areas are listed in Table 2, with the assigned HUC number and size in acres and square miles. These four sub-watersheds are described below.

4.1.1 City of Rome-Etowah River Watershed Section:

This section of the Etowah River Watershed is the farthest downstream from its headwaters. The Etowah River begins in Lumpkin County, draining off slopes that rise over 3000 feet and cascading over several waterfalls in its headwaters before settling into a course west through the Piedmont and into the Ridge and Valley. Its winding path runs for 163 miles until it joins the Oostanaula River in Rome to form the Coosa, after traveling through five counties as well as the Lake Allatoona Reservoir. The section of the Etowah River watershed that is within the planning area drains the land from the point where Spring Creek enters the Etowah River to the Etowah's confluence with the Oostanaula River. All of the 17,376-acre area is within Floyd County and includes land within the city limits of Rome. It is the largest of the HUC 12 areas in this project. See
Figure 1.

4.1.2 Dozier Creek-Oostanaula River Watershed Section:

This HUC 12 area is a section of the Oostanaula watershed that includes the small Dozier Creek watershed. See Figure 1. The Oostanaula is formed when the Conasauga and Coosawattee Rivers join in Gordon County. It flows south into Floyd County to join the Etowah River in Rome, forming the Coosa River. The headwaters of Dozier Creek arise on Ward and Armstrong Mountains. After leaving the mountain upland, the stream flows through an open valley where two named tributaries enter the stream, Ward Creek from the north and Zuber Creek from the south. Ward Creek is monitored by the Georgia EPD, has been found to have good water quality, and, unlike Dozier Creek, is not on the EPD's list of impaired streams. Dozier Creek flows west into the floodplain of the Oostanaula River through a gap in a line of low ridges. The creek joins the river upstream of Rome. This 13,982-acre HUC 12 area lies entirely in Floyd County.

4.1.3 Dykes Creek Watershed:

This HUC 12 area comprises the whole watershed of Dykes Creek. Dykes Creek begins in Floyd County on the eastern side of Armstrong Mountain. The creek flows southward, draining the eastern sides of Armstrong and Ward Mountains, high points in the area. The creek continues south by southwest, impounded by a dam to form Halls Lake Reservoir in the Morrison Campground area and continuing

southward to the Etowah River. The total drainage area of the watershed is 11,189 acres, with the vast majority located in Floyd County, and 357 acres in Bartow County. It is the smallest of the sub-watersheds in this planning area. The upper part of Dykes Creek Watershed is over Knox Formation, containing Longview Limestone, Chepultepec Dolomite, and Copper Ridge Dolomite. This limestone can be porous and in dry years this causes the upper part of Dykes Creek to disappear below ground in late summer. The stream is perennial up to Morrison Campground, but may be intermittent above that point depending on rainfall levels. See
Figure 1.

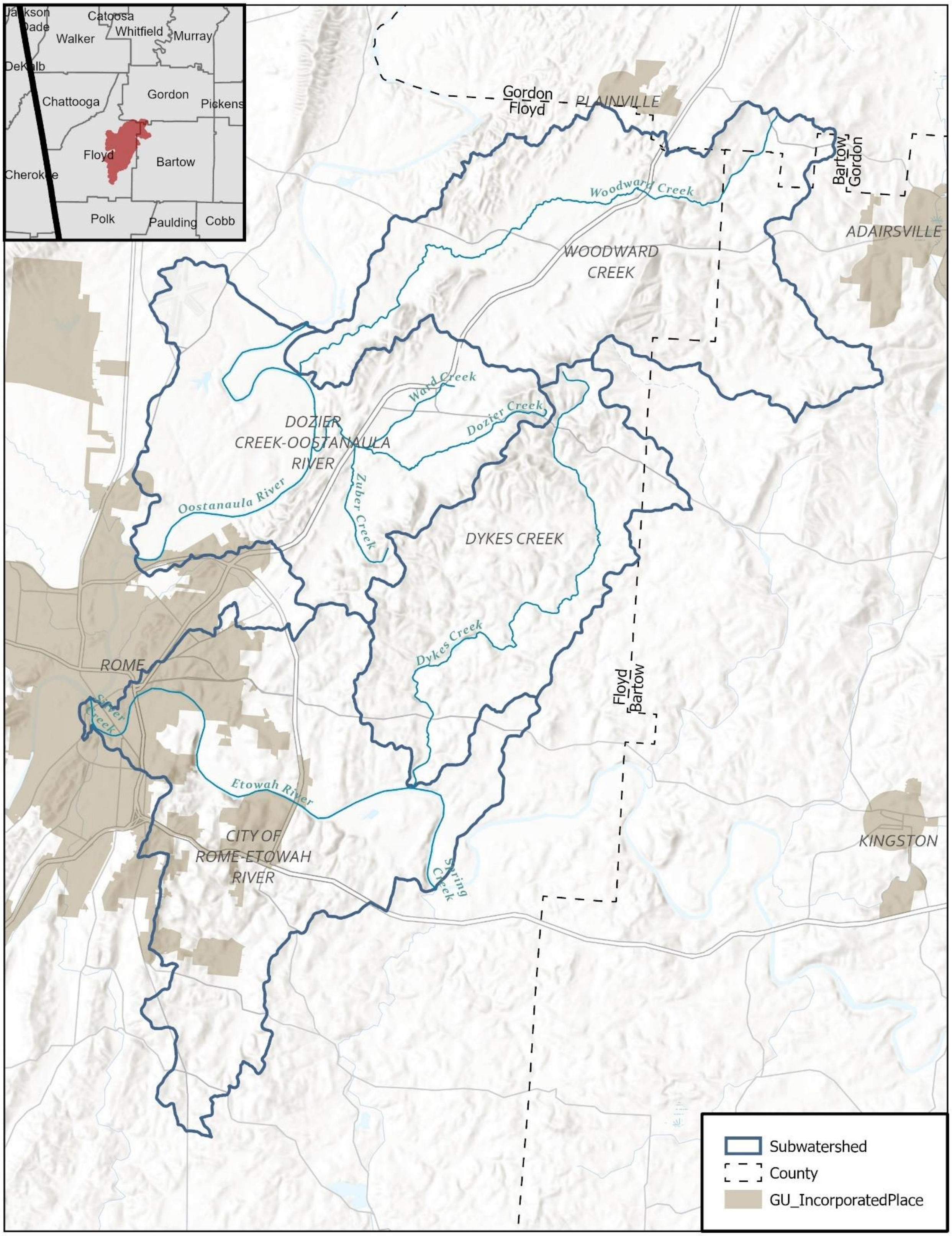
4.1.4 Woodward Creek watershed:

The extreme headwaters of Woodward Creek lie in Bartow and Gordon Counties, flowing west from an upland that includes Armstrong Mountain, Snow Springs Mountain, Boyd Mountain and Brownlee Mountain. The creek flows into Floyd County and joins the Oostanaula River upstream of Rome. Below the headwater region is an open valley that leads to the floodplain of the Oostanaula River through a line of low ridges. The creek drains a watershed area of 17,253 acres, with the HUC 12 covering all the Woodward Creek watershed. The area is shown in
Figure 1.

Table 2. HUC 12 watersheds in the Rome Area Project

City of Rome-Etowah River Watershed Section	031501041606	17,376/27
Dozier Creek-Oostanaula River Watershed Section	031501030603	13,982/22
Dykes Creek Watershed	031501046004	11,189/17
Woodward Creek Watershed	031501030602	17,253/27

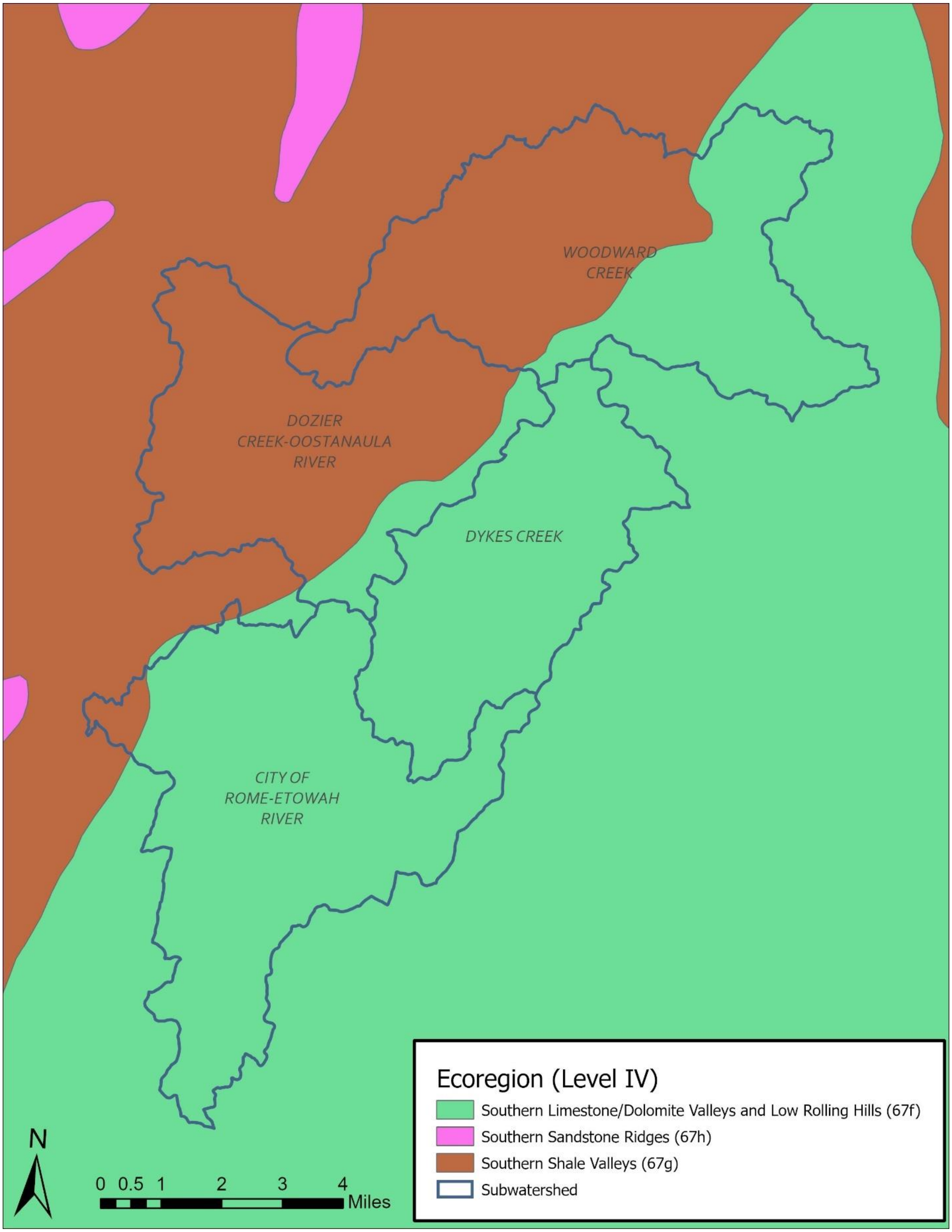
Figure 1. Overview of the Rome Area Watersheds and Vicinity.



4.2 Ecoregion and Physiographic Description

The Rome area is in the Ridge and Valley physiographic province of the Appalachian Mountains. The region's long ridges and broad valleys run on a northeastern trend through much of northwest Georgia. The long ridges in the Ridge and Valley physiographic region, shown as Southern Sandstone Ridges in Figure 2, are typically composed of chert and sandstone, yielding acidic soils, while the valleys are usually limestone or shale, yielding thicker, richer soils more suitable for agriculture. However, Armstrong and Ward Mountains, where the headwaters of Dozier Creek and Dykes arise, are capped with limestone and dolomite of the Knox Group, known for its Karst topography, with springs, sinkholes, and streams with underground sections, and in Figure 2 this area is shown as Southern Limestone/Dolomite Valleys and Low Rolling Hills. Further downslope a mixture shale and limestone of the Conasauga Formation is found. Near the Oostanaula River, the Southern Shale Valleys Ecoregion is comprised of lower hills and knobs, underlain by the Rome formation's shale, siltstone, sandstone, and quartzite and the limestone and limestone/shale outcrops of the Conasauga Formation. The Etowah River flows southwest out of the Piedmont, or Blue Ridge Mountain foothills, to the join the Oostanaula River at Rome, forming the Coosa River. As the path of the Etowah River approaches Rome, it flows over a wide expanse of low hills where the limestone-rich Knox Group formation continues as the underlying geology (Cressler 1970). This broad expanse is mapped here as southern Limestone/Dolomite Valleys and low Rolling Hills, also known as part of the Great Valley of the Ridge and Valley province. The Conasauga and Knox bedrock groups provide calcium carbonate-based geology that generates fertile agricultural soils in the valleys. This geology supported the once-rich diversity of mussels and snails found historically in the Coosa River and its tributaries.

Figure 2. Ecoregions of the East Rome Watershed Planning Area and Vicinity



4.3 Local Climate

The Soil Survey for Chattooga, Floyd, and Polk Counties (USDA 1978), describes a moist and temperate climate for Floyd County, with cool winters and warm to hot summers. Most of the precipitation falls as rain, with rare snowfall, except on the mountains. Dependably high rainfall leads to many perennial streams across the landscape, with the streamflow tracking rainfall. The University of Georgia's Weather Network (www.UGA.weather.edu) shows climate averages for Northwest Georgia Research and Education Center on Battey Farm Road in the Woodward Creek HUC12 watershed. Total annual precipitation is 54.39 inches, the coldest month is January with an average minimum of 31.5 F, and the warmest month is July with an average maximum temperature of 90.3 F.

The weather station at the Rome Airport, which is just inside the project area on the west side of the Oostanaula River, provides further information on local climate (Figure 3 and Figure 4). Rainfall is somewhat even across the year, but heavy winter and spring rainfall can lead to major runoff events, high stream flows, and flooding (Figure 3). This is due in part to low uptake of water by deciduous trees during the dormant season. Cool temperatures reduce evaporation as well, leaving soils saturated between rains. Figure 4 shows the actual air temperature for 2020, the normal range, and the record maximum and minimum temperatures, demonstrating a temperate climate reaching highs in the 80's and 90's in the summer and dipping only somewhat below freezing most of the winter.

Figure 3. Monthy rainfall at the RB Russel Airport, Rome Georgia. Climate Normal equals average for last 30 years. Source: National Weather Service NOAA

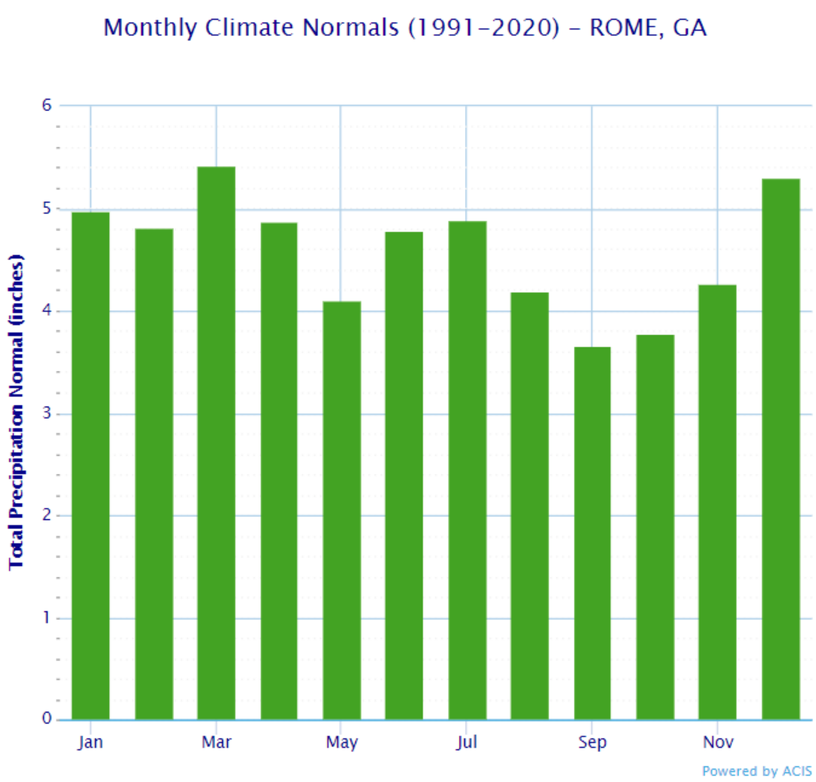
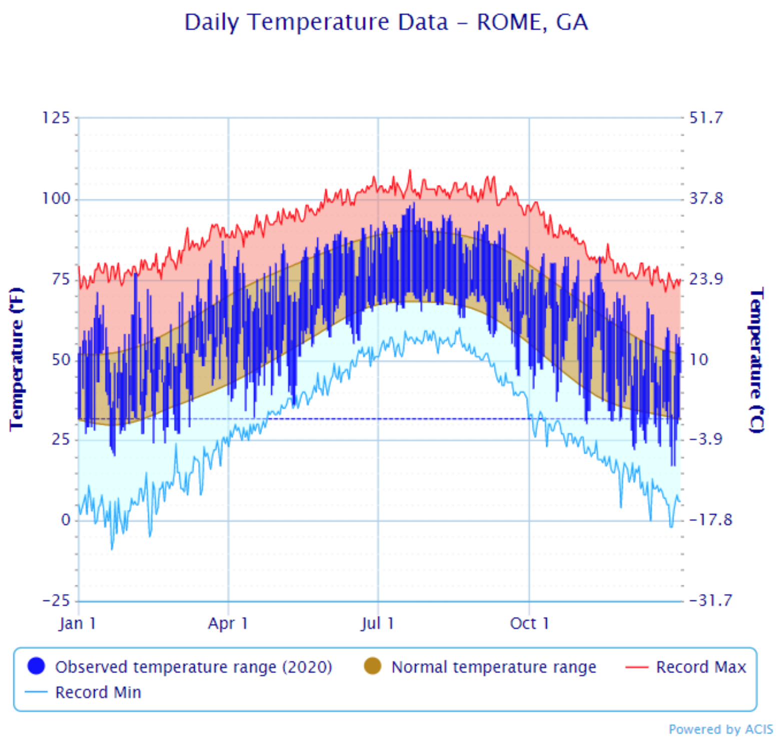


Figure 4. Air temperature for 2020, with normal and record maximum and minimum temperatures, RB Russel Airport, Rome Georgia Airport. Climate Normal equals average for last 30 years. Source: National Weather Service NOAA.



The US Geological Survey operates stream gages on rivers throughout the state to measure streamflow or discharge, water level, and many other parameters. The Oostanaula and Etowah Rivers are large enough to have several data collection stations along their courses. In the Dozier Creek-Oostanaula River HUC 12 area, USGS Station #02388500 is located on the Oostanaula River off Broadus Road on the north side of Rome. The Etowah River gaging station in the City of Rome Etowah HUC 12 area is USGS Station #02395980, located at the State Route 1 (GA 1) bridge over the Etowah River on the north side of Rome. Figures 5 and 6 show the discharge for the Oostanaula and Etowah Rivers respectively from 2015 to 2021, as well as the Median daily discharge over 46 years for comparison. This data shows late summer/fall lows and peaks from storm events. Table 3 summarizes the flow data for the period of record, showing minimum, mean, median and maximum flows. The two rivers are similar in their flows as they approach Rome to form the Coosa River.

Figure 5. Discharge of the Oostanaula River near Rome, Georgia from 2015-2021. Source: USGS.

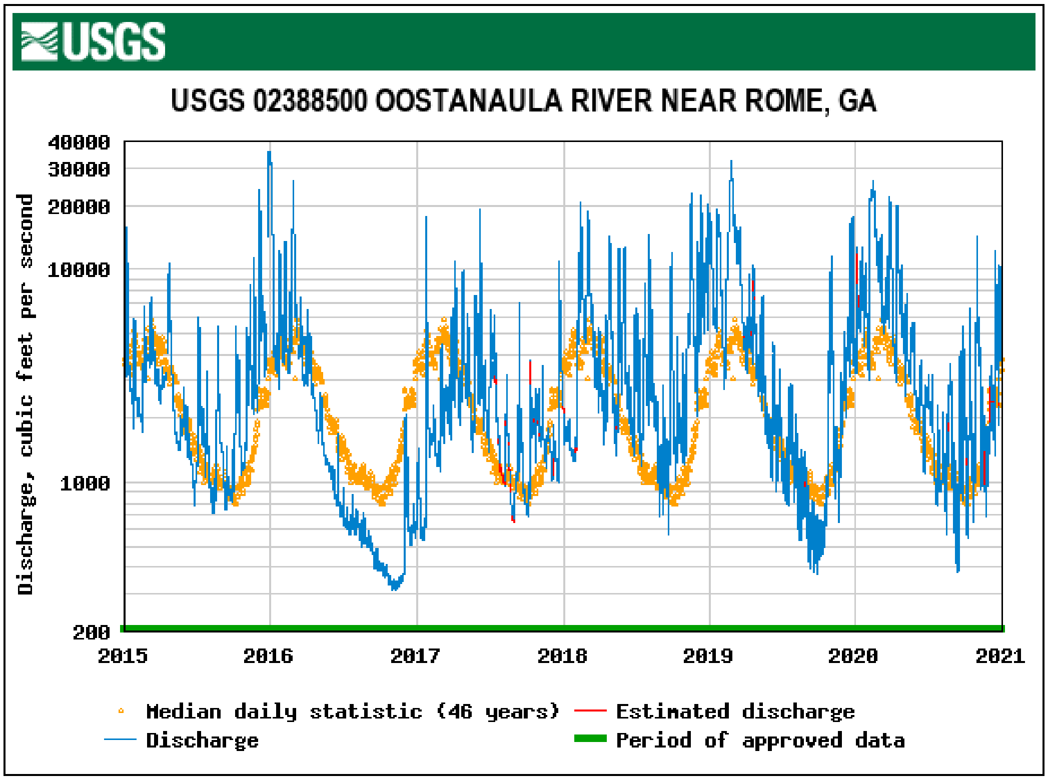


Figure 6. Discharge of the Etowah River at GA1 Loop near Rome, Georgia from 2015-2021. Source:USGS

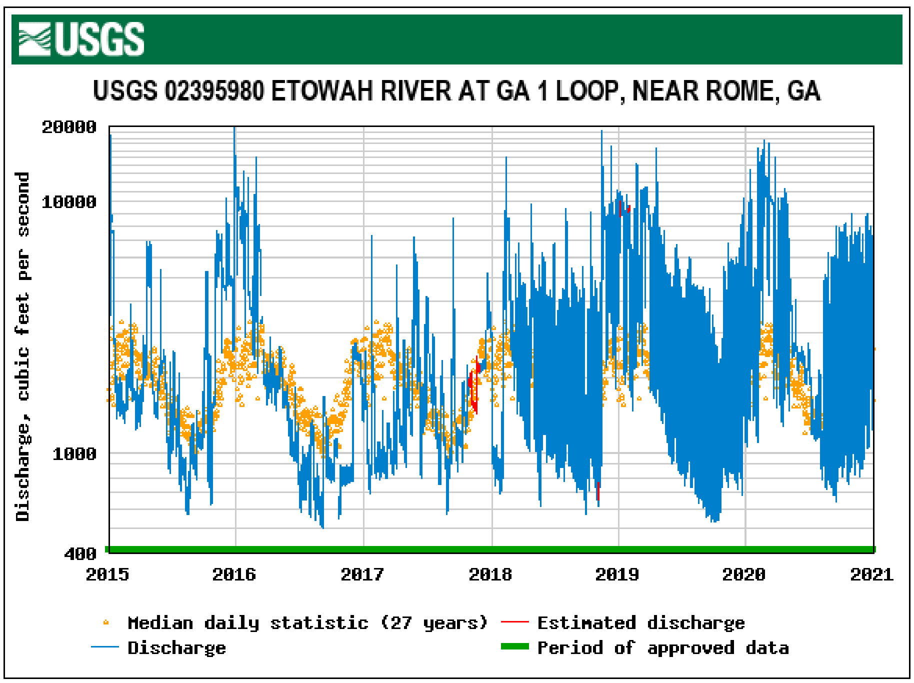


Table 3. Stream discharge of the Etowah River and Oostanaula River near Rome. Source: USGS

Stream Gage Site	Minimum	Median	Mean	Maximum
Etowah River at GA 1 Loop, near Rome, GA Site #02395980	549 (2012)	1,240	1,910	9,110 (2003)
Oostanaula River near Rome, GA Site # 02388500	520 (1986)	1,270	1,880	10,900 (2005)

Dozier, Dykes, and Woodward Creeks are much smaller streams. There is no USGS gage on Dozier Creek or Woodward Creek, but in the 1930's and 1940's the USGS operated a gage on Dykes Creek. Figure 7. Monthly mean discharge for Dykes at Fred Kelly Road for the years 1932-1942. Source USGS shows monthly mean discharge of Dykes Creek for 1932-1942 (the monthly mean of the daily mean cfs for those years).

The EPD measures instantaneous streamflow or discharge in the field when collecting water quality data. Table 4 below shows EPD field measurements made during fecal coliform sampling for Total Maximum Daily Load (TMDL) studies in the 2000's for these streams. These small streams have similar flow due to their similar watershed size, often flowing at less than 10 cfs, but with spikes in flow during storms or in wetter seasons.

Figure 7. Monthly mean discharge for Dykes at Fred Kelly Road for the years 1932-1942. Source USGS

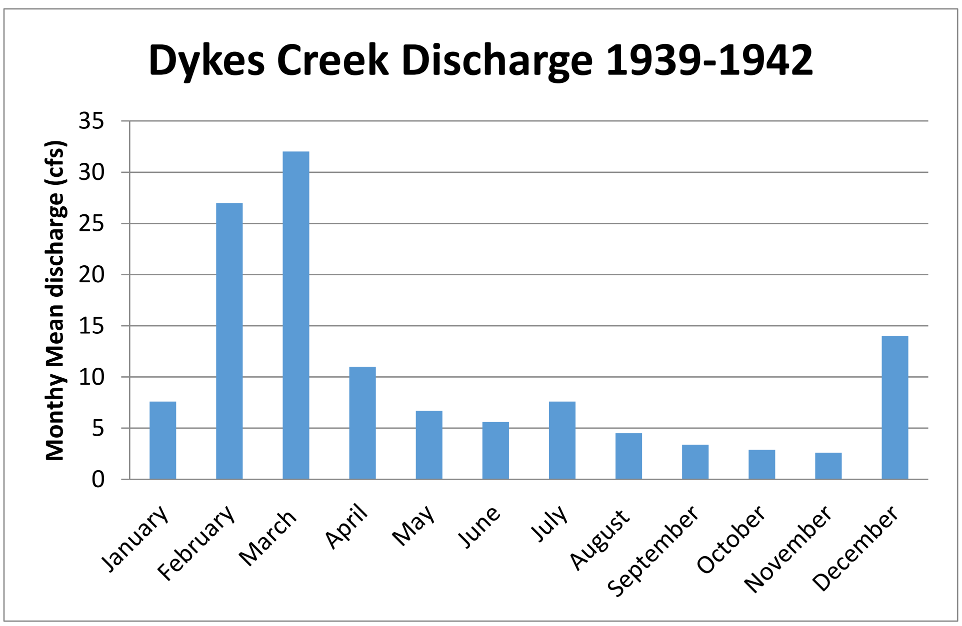


Table 4. Estimated Instantaneous Flow or Discharge. Dozier Creek near Bell's Ferry Road, Dykes near Kingston from the Georgia EPD TMDL study 2009. Woodward Creek at Bell's Ferry, Georgia EPD TMDL study 2004. (Georgia DNR 2009, Georgia DNR 2004).

July 20, 2005	8	6
July 27, 2005	6	
August 3, 2005	6	
August 10, 2005	4	
September 13, 2005	4	4
September 20, 2005	4	
September 27, 2005	4	
October 4, 2005	4	
June 14, 2005	6.5	13
June 21, 2005	6.7	
June 29, 2005	6.8	
July 12, 2005	32	
September 15, 2005	5.5	4.9
September 21, 2005	4.9	
September 28, 2005	4.7	
October 5, 2005	4.6	
February 27, 2001	20	16
March 12, 2001	10	
March 15, 2001	20	
March 19, 2001	15	
May 24, 2001	7	10
June 4, 2001	19	
June 13, 2001	10	
June 24, 2001	6	
July 30, 2001	6	5
August 7, 2001	4	
August 14, 2001	6	
August 21, 2001	4	
October 3, 2001	4	4
October 11, 2001	5	
October 25, 2001	3	
October 31, 2001	4	

4.4 Important Flora and Fauna

4.4.1 Natural Communities

In The *Natural Communities of Georgia*, (2013) authors L. Edwards et al classify the landscape using climate, geology, soils, topography, and hydrology, into areas with distinct vegetative and animal assemblages called Natural Communities. This system is used by the Georgia DNR to manage the rare plants and animals of Georgia, providing critical understanding of the habitat requirements of a species for its protection.

The forests of the Ridge and Valley Province are mixed conifer and hardwoods. This province, combined with the adjacent Cumberland Plateau, has a high diversity of natural communities because of the complex geology and topography, with a wide range of elevations and with more acid soils on the ridges and often rich calcareous soils in the valleys (Edwards et al. 2013).

The authors identify five forest types on the ridge slopes and uplands, depending on the exposure and soil: mesic forests, dry calcareous forests, acidic oak-pine-hickory forests, pine-oak woodlands, and montane longleaf woodlands and forests. Among these types, dry calcareous forests and acidic oak-pine-hickory forests now cover large areas. Dry calcareous forests occur over high calcium soils and include tree species such as chinquapin oak, Shumard oak, chalk maple, white ash, eastern red cedar, redbuds, elms, and hickories. Acid oak-pine-hickory forests occur over acidic rock such as sandstone, chert, and some shales, and the tree species include rock chestnut oak, southern red oak, scarlet oak, and some hickories, black gum, red maple, and pines.

Several natural communities are defined by rocky areas, open areas, or areas with high calcium. They are limited in distribution on the landscape. These include Calcareous Prairies and Barrens (Coosa Prairies); Calcareous Glades, Barrens, and Woodlands (Cedar Glades); Acid Glades and Barrens; Calcareous Cliffs; and Acidic Cliffs and Rock Outcrops. Many rare herbaceous plants are found in these unique areas.

Housing, urban development, industry and agriculture are dominant in the valleys, but several natural communities occurred there historically. In the low-slope areas approaching streams, and directly adjacent to streams and rivers, the flatwoods natural community and the floodplains, bottomlands, and riparian zone natural community would have been dominant, but are now reduced based on the above mentioned land uses. The flatwoods contain willow oak, white oak, Shumard oak, cherry bark oak, green ash, white ash, and sugarberry (hackberry). The forested floodplains, bottomlands and riparian zones, a natural community that is greatly restricted and degraded today, include cherrybark oak, willow oak, swamp chestnut oak, Shumard oak, overcup oak, water oak, sweet gum, red maple, river birch, sycamore, tulip-tree, green ash, and box elder. The ecology of these forested areas near streams are closely linked to the ecology of the water courses. These forests provide deciduous leaf litter as the food-base for the stream ecosystems, and cooling shade for stream water during Georgia's warm summers. The wood, both on the banks and in the stream, provides structure for a wide range of animals, including woodpeckers, beavers, bass, and turtles. Other functions provided by these forest communities are filtration of sediment, attenuation space for floodwaters, and improved infiltration of rainfall. The protection and restoration of riparian forests would improve these critical ecosystem services that they provide. Understanding which tree species naturally thrive in these critical streamside areas is essential to success in restoring vegetative buffers.

These two communities, the flatwoods natural community and the floodplains, bottomlands and riparian zone natural community are considered wetlands because they hold water seasonally. Three other types of wetlands in the Ridge and Valley are Calcareous Seepage Fens, Acidic Seepage Wetlands, and Sagponds and Sinkholes. These areas are rare on the landscape. Many rare plants inhabit these areas. Protecting these areas ensures the survival of these rare plants

4.4.2 Wildlife and Habitat

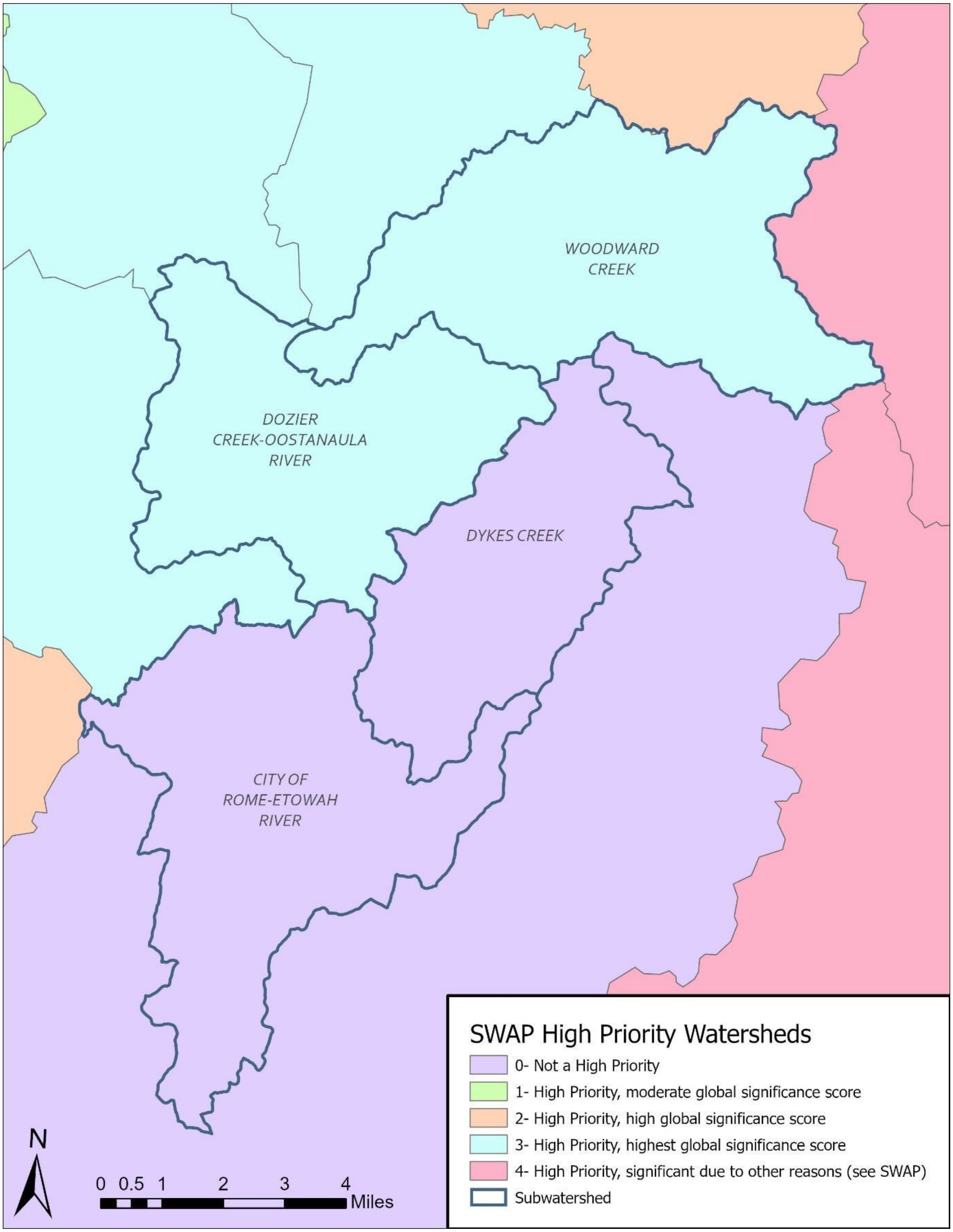
The Ridge and Valley province topography, with its steep slopes and valleys varying from narrow "pockets" to wide expanses containing whole cities, support the Natural Communities listed above, providing a range of varied habitats. In addition to mountain tops, steep slopes and flat riparian areas supporting the forest communities discussed above, the water courses range from small spring seeps to large rivers, providing habitat for a great diversity and volume of aquatic species, many of which are rare, as discussed in the Listed and Sensitive Species section.

In the northern part of Floyd County, the John's Mountain Wildlife Management Area on the Chattahoochee National Forest is managed by the Georgia DNR for diverse wildlife, including game and nongame species. Hunting for deer, black bear, turkey, and small mammals is permitted there. Extensive forested areas further south in the project area in Floyd County provide habitat for large mammals, including white-tail deer, coyotes, bobcats, and probably wild hogs and the occasional bear. Non-native wild hogs can be particularly destructive in riparian areas along small streams as they disturb the soil digging for plant roots. Smaller terrestrial mammals include raccoons, skunks, opossums, squirrels, mink, weasels, rabbits and many types of mice, voles, and rats. The rivers, creeks and reservoirs of the Ridge and Valley support aquatic mammals such as otters, beavers, and muskrats. Beaver dams have been observed on Woodward Creek and Dykes Creek. In summer 2021, A local landowner reported regular otter sightings in Dykes Creek. The Southern Appalachians overall have the highest diversity of salamander species in the world, contributing to a diverse Ridge and Valley amphibian assemblage, which also includes frogs and toads. Reptiles are comprised of a diverse array of turtles, snakes, and lizards. The Coosa River basin is well known for the diversity of its mollusk species, although currently diminished by extirpation and extinction due to habitat loss and pollution. Waterfowl that can be found on streams and rivers in the area include wood ducks and Canada Geese. Great Blue and Green Herons are common wading birds of the area. Raptors include many hawks, owls, osprey, bald eagles, and black and turkey vultures. Resident and migrant songbirds inhabit forest and open areas. In riparian areas breeding songbirds include the neotropical migrant Louisiana waterthrush, yellow warbler, common yellowthroat, and black-throated blue warblers. Resident kingfishers rely on fish, crayfish, and other small aquatic animals.

Georgia's 2015 version of the State Wildlife Management Plan (SWAP) updated the process of identifying high priority species and high priority habitats. This included prioritizing watersheds harboring high numbers of rare aquatic species with the goal of preserving their biotic diversity (Albanese et at 2015). The watersheds were divided at the HUC 10 level for this process. This process showed that the Ridge and Valley has a great diversity of fish and mussel species, many of which are rare. Woodward Creek HUC 12 and Dozier Creek-Oostanaula River HUC 12 both fall within the Lower Oostanaula HUC 10 (shown as Oostanaula 1 in the SWAP document), a High Priority watershed with the highest global significance score (see
Figure 8, SWAP High Priority Watersheds Map below). This score results from having important populations of many high priority aquatic animal species with high global rarity. The Lower Oostanaula is number six on the list of the highest priority watersheds.

Table 6 shows the current SWAP High Priority aquatic animal species for the lower Oostanaula River. Lying upstream of the Oostanaula, the top three HUC 10 watersheds for high priority aquatic animal species in the whole state are two sections of the Conasauga River Watershed and Holly Creek, which flows into the Conasauga River. Efforts to protect and restore riparian areas and encourage best management practices for agriculture and forestry will help protect these aquatic communities both within the project area and upstream, since the areas are connected by streamflow, and aquatic species can migrate.

Figure 8. Georgia DNR SWAP High Priority Watersheds



4.4.3 Fisheries

The Oostanaula and Etowah Rivers and the smaller tributary streams in this planning area provide a range of habitat conditions supporting a diverse array of fish. These include bass, sunfish, redhorse and other suckers, darters, shiners, catfish, sculpins, and brook lamprey.

The state of Georgia has a long-running Commercial Fishing Ban (also termed Fish Consumption Guidance or FCG) due to PCBs (polychlorinated biphenyls) in many streams in in the Rome area, including the stream reaches in this management plan, as shown in Table 5 (Georgia DNR EPD 2014). Throughout the Oostanaula River Watershed, streams have been impacted by PCBs (polychlorinated biphenyls), whose source was an industrial plant in Rome, GA, which operated from 1954 to 1998. The PCBs were used in the manufacture of electrical transformers. Details of fish consumption guidelines for the Oostanaula River and the Coosa River, which is formed by the confluence of the Oostanaula River and the Etowah River, can be found in the 2021 Georgia Sport Fishing Regulations, Freshwater Fish Consumption Guidelines: Rivers and Creeks (Georgia DNR 2021).

Table 5. Commercial Fishing Ban and Fish Consumption Guidance in the Rome Area Watersheds. Source: GAEPD.

Dozier Creek, Oostanaula River tributary (Floyd Co)	Commercial Fishing Ban (CFB)	3 miles	2005, revised 2009 & 2014
Dykes Creek, Headwaters to Etowah River	Commercial Fishing Ban (CFB)	7 miles	2009 & 2014
Etowah River, Highway 411 to Coosa River	Commercial Fishing Ban (CFB) Fish Consumption Guidance	21 miles	2005, revised 2009 & 2014
Oostanaula River Highway 140 to Coosa River	Commercial Fishing Ban (CFB) Fish Consumption Guidance	14 miles	2005, revised 2009 & 2014
Woodward Creek, Oostanaula River tributary (Floyd Co)	Commercial Fishing Ban (CFB)	8 miles	2005, revised 2009 & 2014

The streams of Dykes Creek watershed are designated as secondary trout stream waters, which means that they do not have reproducing trout populations, but stocked trout can survive their cooler waters flowing off Armstrong Mountain. In secondary trout streams the state criteria indicate that the water temperature cannot go more than 2 degrees Fahrenheit above natural temperatures. Fifty-foot buffers are required, and no impoundments are allowed without EPD approval.

4.4.4 Listed and Sensitive Species:

Species are a concern and worth consideration in terms of water quality as they are indicators that inform regarding conditions. Many times species can be used as a proxy for sediment loading or other degraded water quality parameters such as increased temperature. Many mollusks and fish in the Coosa Basin are in decline due to water quality issues, poor land use practices, channel alterations, and the construction of reservoirs. Georgia DNR provides extensive information online at the Georgia Biodiversity Portal for species that they monitor.

Table 6 shows the portal's listing of High Priority Species and their habitat requirements for the Lower Oostanaula River watershed, the HUC 10 area that encompasses Woodward Creek and Dozier Creek watersheds. This list includes three mussels, one snail, one dragonfly, and five fish that have Rare, Threatened or Endangered status. A discussion of distribution and conservation needs of these ten species with special status is included here.

The mollusks on this list are particularly susceptible to sedimentation and four have state Endangered status. The three mussels are the Southern Clubshell, the Alabama Spike (also federally Endangered), and the Rayed Kidneyshell (also federally Endangered). The Southern Clubshell (*Pleurobema decisum*) appears to be currently found only in Georgia in the Conasauga River and Salacoa Creek, although historically it was found in Georgia throughout the majority of the upper Coosa Basin. In Georgia, the Alabama Spike is currently found only in the Oostanaula River, and outside of Georgia is still found in a few river systems in Alabama and Mississippi, but was once widespread in the rivers of Alabama, Georgia, Mississippi, and Tennessee flowing into the Gulf. The Rayed Kidneyshell (*Ptychobranchus foremanianus)* appears to be found only in the Conasauga River and its tributaries and the mainstem Coosawattee River below Carters Reservoir, although historically it was found throughout the eastern Mobile River basin in the Black Warrior, Alabama, Cahaba, Coosa, and Tallapoosa rivers and their tributaries.

The sources of fine sediment are varied but include inadequate buffer zones, development, and agriculture. Fine sediment infiltrates the sand and gravel substrate that these species live in, degrading habitat. Eutrophication and degraded water quality from poor agricultural practices may also be a problem. The Southern Clubshell and the Rayed Kidneyshell may also suffer from poor water quality due to industrial effluent and sewage treatment plant discharges. The impoundment of the Coosawattee River by the Carters Reservoir dam may have caused the possible extirpation of the Alabama Spike from that river.

To make reintroduction efforts successful, sedimentation needs to be controlled in these rivers. For the Alabama Spike, the control of sediment in the Conasauga River is especially important since the Carters dam operations have appeared to affect the species so severely in the Coosawattee and Oostanaula. There are no dams on the Conasauga River.

The other mollusk with protected status in the Lower Oostanaula River is a small operculate or gilled snail, the Interrupted Rocksnail (*Leptoxis foremani)* once found in the Coosa River basin from the Middle Coosa River up to the headwaters in the Conasauga, Coosawattee, and Etowah rivers in Georgia, but now in Georgia only found in a short reach of the Oostanaula River in Gordon and Floyd Counties. It was once thought to be extinct but was rediscovered in the 1990's in the Oostanaula River in or just upstream of the river section in this project area and now has both state and federal endangered status. It has been propagated and reintroduced downstream in the Coosa River in Alabama. The Oostanaula River's condition is critically important for the survival of this snail in Georgia. The same issues of sedimentation are a threat to this small snail, as well as eutrophication and degraded water quality from agriculture. The water quality decline in the Oostanaula River since 2000 is an immediate problem, so every effort to control sediment in the Oostanaula would benefit this species' recovery. Improving habitat by reducing sediment throughout its former range would be benefit reintroduction efforts.

The Cherokee Clubtail Dragonfly (*Stenogomphurus consanguis) (note that the genus has recently been changed)* is aquatic in its larval stage and is found in the uppermost reaches of the watershed, in first-and second order streams, often spring-fed, with silty pool bottoms. It is found in the southern Appalachian region, but in Georgia it is known only from 10 streams in six counties in the northwest part of the state. Its state-status is Threatened. Protecting this species would involve reducing threats to the very small streams that it inhabits, such as impoundments, riparian buffer removal, and runoff of sediments, nutrients, and toxins from agriculture and development.

Four small fish who need clean streams to feed and breed have protected status in this watershed. Two of these are Cyprinids, (minnows), the Blue Shiner, (*Cyprinella caerulea*) and Lined Chub, (*Hybopsis lineapunctata*). Small to medium rocky streams are the preferred habitat of the Blue Shiner, which is state endangered and federally threatened. It was once known from the Coosa River system in Tennessee, Georgia and Alabama and the Cahaba River system in Alabama. In Georgia, the current collections are only in the upper Conasauga system and upper Holly Creek system. It is probably extirpated from the Etowah, Oostanaula, and Coosawattee systems. This fish lays its eggs in silt-free areas in rock crevices and possibly crevices in woody debris. This makes controlling sediment critical for successful reproduction. The population is declining as the habitat becomes degraded by sediment and flashy flows from stormwater runoff. Controlling stream habitat degradation from all kinds of development would increase the chances that this species will survive. Employing Best Management Practices for forestry and agriculture and on construction sites and bridge crossings would be a benefit.

The Lined Chub is listed as rare and is endemic to the Coosa and Tallapoosa River systems. In Georgia, the species is threatened by urbanization, impoundments, and lack of agricultural Best Management Practices. Working with farmers to implement BMP's would help decrease sediment, nutrient, and chemical runoff and increase forest cover.

The two darters, the Coldwater Darter (*Etheostoma ditrema*), and the Trispot Darter (*Etheostoma trisella*) are both state endangered. The Coldwater Darter is vulnerable to decline because its primary habitat is limestone springs and spring runs in the Ridge and Valley province. They are found with aquatic vegetation or organic debris, and disturbance of springs from herbicide application, recreational use, and water supply development is a threat. The Coldwater Darter is endemic to the Coosa basin in Georgia, Alabama, and Tennessee, but recent studies indicate that there may be three species, one of which is found mainly in Georgia. It was known from the Etowah, Conasauga, Coosa and Oostanaula systems, but now may be extirpated from the Etowah system. Protecting springs from sediment, pollutants, excessive water withdrawal, and destruction would be beneficial.

The Trispot Darter has federally threatened as well as state endangered status. Like the Coldwater Darter, its unique habitat needs also have probably contributed to its scarcity. It lives in the slackwater of larger streams and then leaves to spawn in small streams and seepage areas. This is another species endemic to the Coosa River system. In Georgia, it is has recently been found in the Conasauga system, the Coosawattee system, and the Oostanaula system. Protecting the small spawning streams from sediment, nutrients, and pesticides by restoring and maintaining riparian buffers would benefit this species. Removing barriers to the darter's movements, such as poorly installed culverts, and assuring that new culverts are properly designed would also help.

The River Redhorse is a large sucker whose distribution is widespread in the Eastern and Central United States but is limited in Georgia because impoundments have blocked the species' movements, leading to isolated populations. Therefore, this fish is designated as rare by the state. It is found in the Coosa drainage and Hiawassee drainage in Georgia. It spawns in riffle and run habitat over coarse gravel, so land disturbing activities that result in stream sedimentation are a threat, and every effort to maintain and restore riparian buffers and control sediment in the stream would help stabilize this species. New reservoirs and more water withdrawals could affect the riffle habitat it prefers.

Table 6. High Priority Aquatic Species in the Lower Oostanaula Watershed. Source: GA DNR Biodiversity Portal.

Species	State Status	Federal Status	State Rank	Habitat
Alabama Spike (mussel) *Elliptio arca*	Endangered	No US federal protection	S1	*Medium creeks to large rivers; sand and gravel substrate*
Southern Clubshell (mussel) *Pleurobema decisum*	Endangered	Listed Endangered	S1	*Large rivers to medium sized streams with flowing water; gravel with interstitial sand*
Rayed Kidneyshell (mussel) *Ptychobranchus foremanianus*	Endangered	Listed Endangered	S1	*Medium to large rivers in moderate to swift current; sand and gravel substrate*
Coosa Creekshell (mussel) *Villosa umbrans*	none	none	S2	*Gravel and sand substrates in shoal and riffle habitats*
Interrupted Rocksnail *Leptoxis foremani*	Endangered	Listed Endangered	S1	*Rocky shoals in current*
Brook Hornsnail *Pleurocera vestita*	none	none	S2	*Aquatic habitats*
Cherokee Clubtail (dragonfly) *Stenogomphurus consanguis*	Threatened	No US federal protection	S2	*Spring-fed moderately-flowing forest streams, especially where they drain small ponds*
Blue Shiner (fish) *Cyprinella caerulea*	Endangered	Threatened	S2	*Flowing runs and pools instreams with cool water and firm substrates*
Lined Chub (fish) *Hybopsis lineapunctata*	Rare	No US federal protection	S2	*Upland creeks over sandy substrate with gentle current*
Coldwater Darter (fish) *Etheostoma ditrema*	Endangered	No US federal protection	S1	*Vegetated springs and spring runs or small streams with spring influence*
Trispot Darter (fish) *Etheostoma trisella*	Endangered	Listed Threatened	S1	*Breeding: vegetated spring seepage areas. Nonbreeding: clear streams in vegetated shallow slackwater areas*
Lake Sturgeon (fish) *Acipenser fulvescens*	none	none	S3	*Large freshwater rivers and lakes over clean firm substrates*
Mooneye (fish) *Hiodon tergisus*	none	none	S1	*Usually found near the surface of large streams, rivers and swift tailwaters of locks and dams*
River Redhorse (fish) *Moxostoma carinatum*	Rare	No US federal protection	S3	*Swift waters of medium to large rivers*

The Dykes Creek watershed and the Rome-Etowah River watershed lie within the Spring Creek-Etowah River HUC 10 watershed (0315010416). Table 7 shows the DNR SWAP's High Priority Aquatic Species for this HUC 10 watershed. The species with Rare, Threatened or Endangered status in this watershed are the Etowah Crayfish, Blue Shiner, and River Redhorse (Table 7). See the above discussion of the status and habitat protection recommendations for the Blue Shiner and River Redhorse. The distribution status and conservation recommendations for the Etowah Crayfish follow.

The Etowah Crayfish is found only in the Etowah River system, mainly above Allatoona Dam, although three collections have been made below the dam. It has state threatened status. Development that leads to high stormwater flows with elevated water temperatures and sediment movement into the creek is a threat. Sediment can cover the rocks under which the crayfish rests. Competition from non-native crayfish transplanted by fishermen can also adversely affect this species.

Table 7. Protected Aquatic Species in the Spring Creek-Etowah River Watershed. Source: GA DNR Biodiversity Portal.

Rough Fatmucket (mussel) *Lampsilis straminea*	none	none	S2	*Small creeks to rivers in slow to moderate current; sand, sandy mud and gravel substrates*
Coosa Creekshell (mussel) *Villosa umbrans*	none	none	S2	*Gravel and sand substrates in shoal and riffle habitats*
Etowah Crayfish *Cambarus fasciatus*	threatened	none	S2	*Lotic habitats under rocks in flowing water*
Lake Sturgeon (fish) *Acipenser fulvescens*	none	none	S3	*Large freshwater rivers and lakes over clean firm substrates*
Blue Shiner (fish) *Cyprinella caerulea*	endangered	threatened	S2	*Flowing runs and pools instreams with cool water and firm substrates*
Mooneye (fish) *Hiodon tergisus*	none	none	S1	*Usually found near the surface of large streams, rivers and swift tailwaters of locks and dams*
Etowah Chub (fish) *Hybopsis sp 9*	none	none	S1 S2	*Generally in creeks and small to medium rivers over sand-silt bottom, usually in pools adjacent to riffle areas. Tends to occupy smaller streams in east than in west*
Least Brook Lamprey (fish) *Lampetra aepyptera*	none	none	S2	*Ammocoetes associated with mud, silt, and macrophytes; adults associated with sand and gravel*
Mountain Shiner (fish) *Lythrurus lirus*	none	none	S3	*Cool, clear streams in flowing water over sandy to rocky substrates*
River Redhorse (fish) *Moxostoma carinatum*	Rare	none	S3	*Swift waters of medium to large rivers*

4.5 Anthropogenic Features

4.5.1 Political Boundaries and Transportation Corridors

The project area covers 93 square miles in Northwest Georgia, most of which is in Floyd County, with small portions in Bartow and Gordon Counties (

Figure 1). All three of these counties have zoning to regulate development. Overall, the landscape is rural, but the Etowah River watershed includes the eastern part of the City of Rome, the county seat of Floyd County and a mid-sized city of more than thirty-six thousand people. There are no other incorporated cities in the project area, but there are several small communities, including Shannon, which was historically a mill village.

The city of Rome started out as a river-based transportation hub because of its location where the Oostanaula and the Etowah Rivers join to form the Coosa River. Steamboats carrying cotton, other agricultural goods, and passengers traveled these waterways in the 19th century. Steamboats could run down the Coosa to the Gadsden area, but below that point were rocky shoals that prevented navigation to the Alabama River and the Gulf. Keeping these rivers safe for navigation involved channel modifications like dredging, particularly on the Oostanaula and Coosa Rivers. In more recent years, power-generating dams have been installed along the Coosa River. Currently, eight power-generating dams have greatly altered its flow, and because these dams do not have locks, it is not possible to navigate straight through the stretch of the Coosa between Rome and Gadsden, Alabama. The Oostanaula, Etowah, and Coosa rivers are now popular for recreational boating. Railroad transportation became increasingly important in the second half of the 19th century and several rail lines served the Rome area. The only remaining railroad line, belonging to Southern Railway, runs from Dalton and crosses the project area at a diagonal from southwest to northeast near the path of SR 53.

The closest interstate highway, I-75, lies east of the project area, but several other highway routes serve Rome. Divided highways include US 27 running south from LaFayette and Summerville and SR 53 running southwest from Calhoun into Rome. The diagonal path of SR 53 traverses a valley area of the Ridge and Valley Province. SR 101 is another north-south route that originates in Rome and runs south toward Rockmart. There are three east-west routes in the project area. In the northern part of the project area, SR 140 is the best route between Adairsville and Armuchee. South of this is US 411/SR 20, linking Rome to Cartersville in the east and Cave Spring in the west. SR 293 is the main route from Rome east to Kingston.

4.5.2 Community Water Supply

Rome-Floyd Water and Sewer Department draws water from the Oostanaula River and Etowah Rivers for the City of Rome and parts of Floyd County beyond the city limits. The water intake on the Oostanaula River is located on the north side of Rome. This location is downstream of the Oostanaula River section that is in the project area. The intake on the Etowah River is located on the east side of Rome. This intake is in the City of Rome Etowah River HUC 12 watershed section in the project area. Floyd County Water Department withdraws water from Woodward Creek to supply the mill village of Shannon and surrounding residences and businesses. A textile mill (historically Brighten Mills, most recently Galey and Lord) used the water of this relatively small creek for process water. The mill closed in 2004, but the county acquired the water intake and water processing facility at that time. See Table 8 for details on these municipal water withdrawals. Three of the four watersheds in the planning area are on the Natural Resources Conservation Service's source water protection watershed list (FY21). Many residents in the rural parts of the project area rely on wells for water supply.

Upstream of the project area, many cities, including Dalton, Chatsworth, Calhoun, Ellijay, Cartersville, and Jasper withdraw water from rivers or reservoirs in the Coosa River Basin, making the surface waters of the watershed vital for water supply

Table 8. Municipal Water Supply in or near project area

Municipal Water Supply in or near project area			
Permittee	Water body	Max 24-hour withdrawal	Monthly average
Floyd County	Woodward Creek	0.8 MGD	0.7 MGD
City of Rome	Oostanaula and Etowah Rivers	18 MGD	16.4 MGD

4.5.3 Land Use and Development

Land use data for the Rome Project Area (Figure 9 and Table 9) is provided from USGS satellite National Land Cover Database, 2016 series (Dewitz 2019). The names of most of the natural and agricultural land cover types are self-explanatory. The land cover types involving human-caused development follow a continuum from "Developed, open space" to "Developed, High Intensity," based on the amount of human-made impervious surface. In the "Developed, open space" category, impervious surfaces account for less than 20% of total cover, and include single-family housing on large lots, parks, golf courses and vegetation on the verges of roads and other areas planted for recreation, erosion control, or landscaping. The "Developed, low intensity" is 20-40% impervious surfaces and "Developed, medium intensity" is 50-79% impervious surfaces. These two categories are usually single-family housing of increasing density. The "Developed, High Intensity" class has 80-100% impervious surfaces, and includes apartment complexes, row houses, and commercial/industrial development. To further characterize the area, maps of Tree Canopy Cover and Impervious surface are shown in

Figure 10 and

Figure 11, with corresponding percentage data in

Table 10 and

Table 11. Tree Canopy Cover is a US Forest Service product analyzing tree cover from the NLCD data on a fine scale. The Impervious product was developed from analyzing all types of urban impervious surfaces, such as paved roads and rooftops, using the USGS NLCD 2016 data.

Forest covers over half the project area, encompassing much of rural Floyd County (Table 9, combined deciduous, evergreen, and mixed forest). The uplands and slopes tend to be forested while the valleys hold the agricultural areas, larger transportation corridors, and urban areas. Tree canopy cover is widespread, but only 30% of the project area falls in the 90-100% range, which is very heavy tree cover (

Table 10,

Figure 10). Dense canopy cover, shown as the darkest green on the Tree Canopy Cover map can be found throughout the project area on the ridge-tops and slopes. Dykes Creek sub-watershed is the most extensively forested, with 61% combined deciduous, evergreen, and mixed forest land. Forty-one percent of the canopy cover in the Dykes watershed falls into the 90-100% coverage range. This density is more than any of the other sub-watersheds. This is sub-watershed contains the eastern slopes of Armstrong Mountain. The City of Rome-Etowah River sub-watershed has the least combined forested area, (44.1%), which is expected because it contains part of the urban area of Rome.

Agricultural use within the project area is dominated by hay and pasture, mainly cattle enterprises (Table 9, Figure 9). There are a few areas of cultivated crop fields and some very large hay/pasture areas along the Etowah River east of Rome in the City of Rome-Etowah sub-watershed in the flat, fertile floodplain. Within the project area, the Oostanaula River floodplain has pasture and limited cultivated fields in its floodplain. Pastures and hayfields cover large areas of the long valley trending northeast paralleling SR 53. The cultivated areas and large pastures along the Etowah River merit special consideration. In an undisturbed state, this area would have dense riparian forest to slow floodwaters, improve infiltration, filter contaminants, and lower temperatures in the summer by shading the water. Measures to improve water quality here could include improving the existing buffer, adding grass filter strips, and applying other agricultural best management practices.

Part of the city of Rome falls within the project area in the City of Rome-Etowah River sub-watershed. Since Rome developed in the 19th century around riverboat transportation, there is a large area of medium and high intensity development around the junction of the Oostanaula and Etowah Rivers in downtown Rome in that sub-watershed. The impervious surfaces map (

Table 11and

Figure 11) shows this area of highly impervious development, including parking lots, large stores, and dense roads and sidewalks. There are no other incorporated areas in the project area, but development is evident along the SR 53 highway, in the long northeastern-trending valley. This area of development crosses the Woodward Creek and Dozier Creek-Oostanaula River sub-watersheds. The development in or near the highway includes industry, convenience/gas stations, a regional distribution center, at least three schools, and a prison. The mill community of Shannon can be seen on the northern edge of the Dozier Creek-Oostanaula River sub-watershed on the SR53 corridor (

Figure 11). Another area of development outside the city is the RB Russell Regional Airport, located in the northwestern part of Floyd County in the Dozier Creek-Oostanaula River Sub-watershed, with the impervious asphalt runways being evident on the map. Along SR 293, the Kingston Highway, areas of the "Developed, Open Space" (pink) category indicate suburban and rural larger-lot homes in the southern part of the Dykes Creek sub-watershed. In fact, with so much forested land, the Dykes Creek watershed has the least amount of land in the Low, Medium, or High intensity Developed categories. However, the Woodward Creek sub-watershed has the least amount of land in any of the developed categories, indicating that it is farther from the suburban sprawl of Rome, and is a rural watershed, with extensive pasture, hayfields, rural residences, and limited development along the SR 53 corridor. However, this will probably change as the widening of SR 140 from Adairsville to four lanes is completed, stimulating housing development.

Overall, there is very little public land in the project area that would qualify as greenspace. Public park land includes ball fields in Shannon (Dozier Creek-Oostanaula River sub-watershed) and along SR 293/Kingston Highway (City of Rome-Etowah River sub-watershed). The Coosa Fairgrounds is located along the Etowah River in that watershed as well.

Table 9. Land cover of the four HUC 12 watersheds comprising the Rome Project Area, with combined total, USGS National Land Cover Dataset (NLCD 2016).

11	Open Water	295	1.7%	301	2.1%	34	0.3%	74	0.4%	703	1.2%
21	Developed, Open Space	3263	18.8%	1,394	10.0%	1,130	10.4%	1,140	6.6%	6,927	11.6%
22	Developed, Low Intensity	1405	8.1%	722	5.2%	156	1.4%	289	1.7%	2,573	4.3%
23	Developed, Medium Intensity	449	2.6%	315	2.2%	15	0.1%	80	0.5%	858	1.4%
24	Developed, High Intensity	224	1.3%	114	0.8%	4	0%	156	0.9%	497	0.8%
31	Barren Land	10	0.1%	20	0.1%	43	0.4%	20	0.1%	93	0.2%
41	Deciduous Forest	3,456	19.9%	3,301	23.6%	4,503	40.2%	4,531	26.3%	15,791	26.4%
42	Evergreen Forest	2288	13.2%	2,204	15.8%	1,338	12.0%	2,286	13.3%	8,117	13.6%
43	Mixed Forest	1,912	11.0%	1,642	11.7%	1,030	9.2%	2,044	11.8%	6,627	11.1%
52	Shrub/Scrub	374	2.2%	376	2.7%	405	3.6%	847	4.9%	2,002	3.3%
71	Herbaceous	420	2.4%	534	3.8%	767	6.9%	747	4.3%	2,468	4.1%
81	Hay/Pasture	2,939	16.9%	2,702	19.3%	1,696	15.2%	4,936	28.6%	12,273	20.5%
82	Cultivated Crops	308	1.8%	147	1.1%	0	0 %	2	0.0%	457	0.8%
90	Woody Wetlands	23	0.1%	151	1.1%	62	0.6%	81	0.5%	317	0.5%
95	Emergent Herbaceous Wetlands	10	0.1%	61	0.4%	7	0.1%	20	0.1%	98	0.2%
	Grand Total	17,376	100%	13,982	100%	11,189	100%	17,253	100%	59,800	100%

Figure 9. Rome Project Area Land Use, USGS National Land Cover Dataset (NLCD 2016)

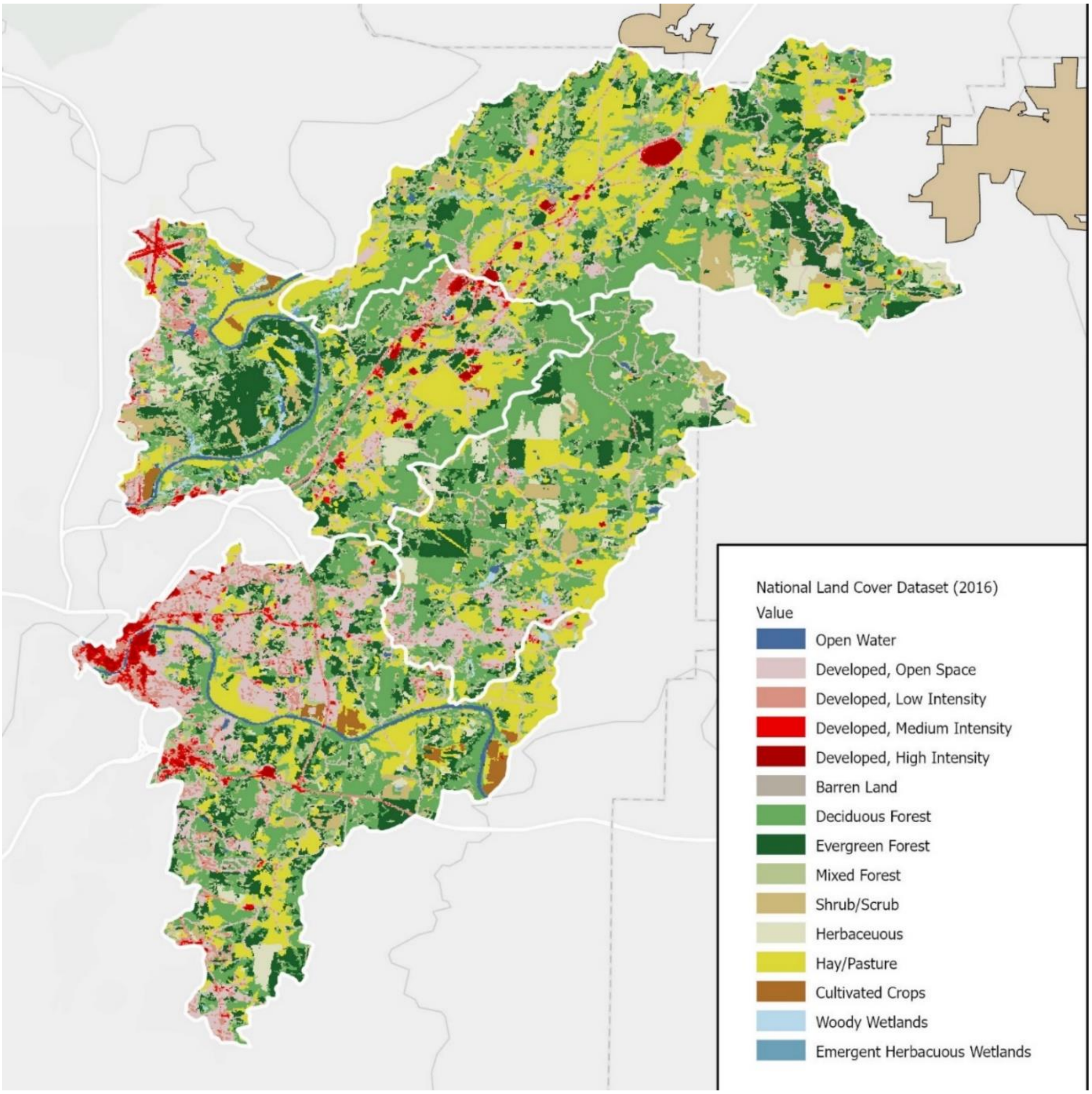


Table 10. Tree Canopy Cover for Rome Project Area, NLCD 2016 USFS TCC.

0%	25%	29%	17%	23%	24%
1-9%	0%	0%	0%	0%	0%
10-19%	6%	6%	4%	6%	6%
20-29%	3%	3%	2%	2%	3%
30-39%	6%	4%	4%	4%	5%
40-49%	7%	5%	5%	5%	5%
50-59%	6%	4%	5%	4%	5%
60-69%	6%	5%	5%	5%	5%
70-79%	7%	9%	6%	6%	7%
80-89%	9%	13%	11%	10%	10%
90-99%	24%	21%	38%	31%	28%
100%	2%	2%	3%	3%	2%
Grand total	100%	100%	100%	100%	100%

Figure 10. Tree Canopy in the Rome Project Area, (NLCD 2016 USFS Tree Canopy Cover)

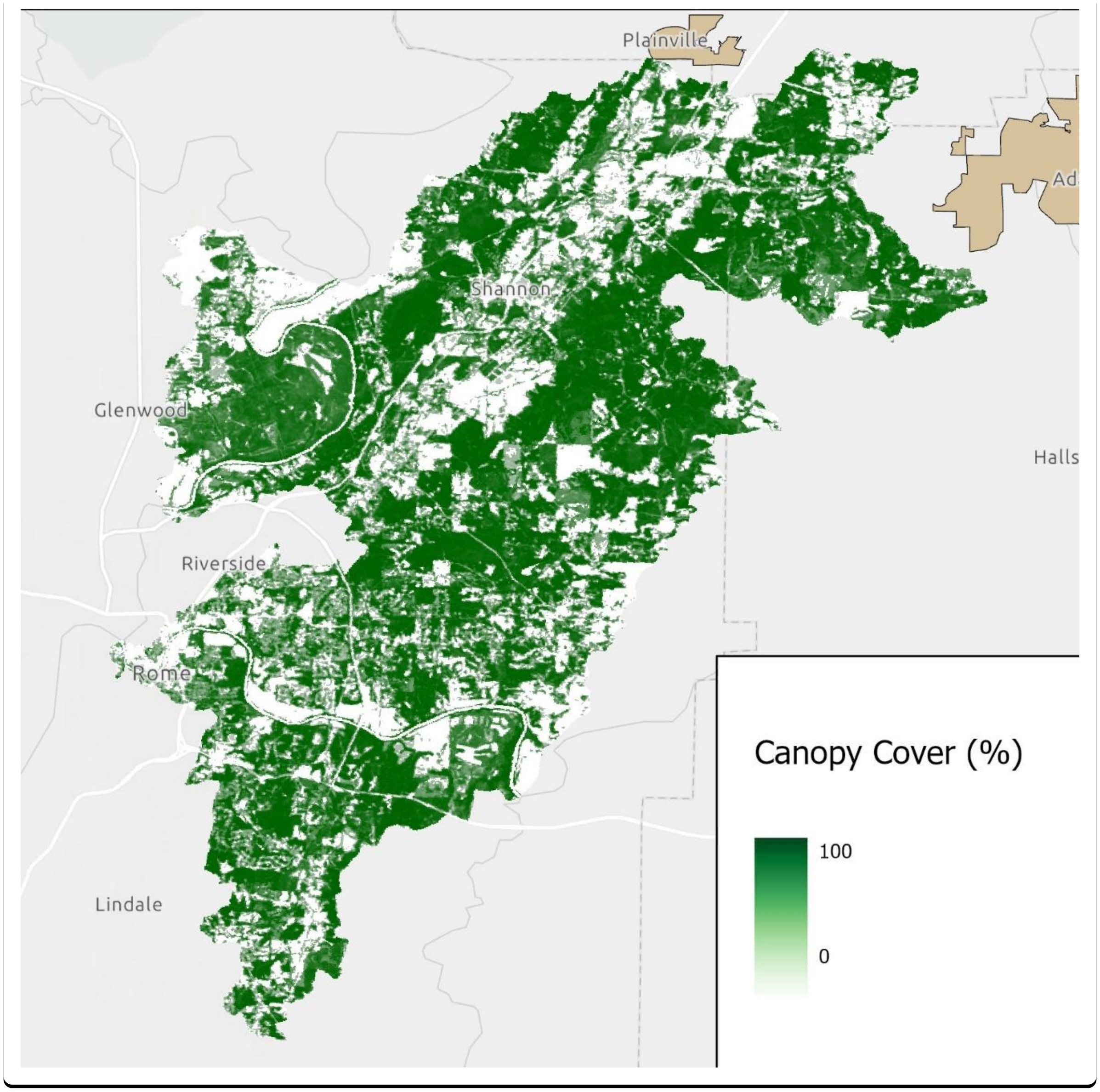
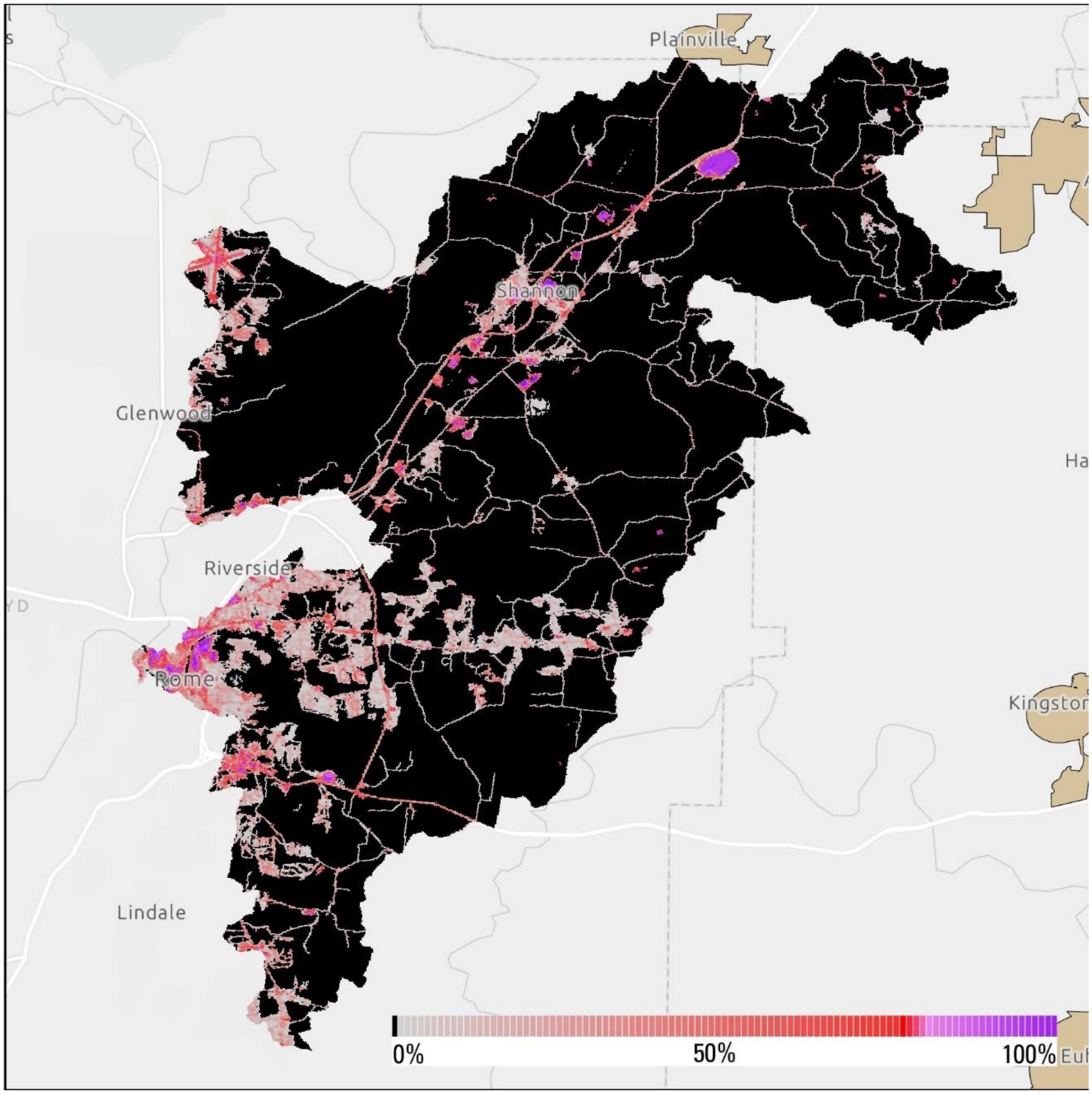


Table 11. Impervious surface percentage in Rome Project Area, NLCD 2016

0%	70%	82%	89%	91%	82%
1-9%	11%	6%	7%	5%	7%
10-19%	7%	4%	3%	2%	4%
20-29%	4%	2%	1%	1%	2%
30-39%	2%	2%	0%	0%	1%
40-49%	2%	1%	0%	0%	1%
50-59%	1%	1%	0%	0%	1%
60-69%	1%	1%	0%	0%	0%
70-79%	1%	1%	0%	0%	0%
80-89%	1%	0%	0%	0%	0%
90-100%	1%	0%	0%	1%	0%
Grand total	100%	100%	100%	100%	100%

Figure 11. Impervious Surfaces within the Rome Project Area, NLCD 2016



4.5.4 Active Groups within the Watershed

The following agencies and groups work with conservation issues in the Floyd County watersheds that comprise the project area. Federal and state agencies include the Natural Resources Conservation Service (NRCS), the Georgia Department of Natural Resources (DNR), and its Environmental Protection Division (EPD). University of Georgia Agricultural Extension has extension agents in Floyd, Bartow, and Gordon counties. The Limestone Valley RC&D has completed multiple conservation projects in the Coosa River Basin in Northwest Georgia and is partnering on this project. The Northwest Georgia Regional Commission has worked on the preparation of TMDL implementation plans, (including Dozier and Dykes Creek and the lower Oostanaula River), throughout the Coosa River Basin, in Georgia, and watershed management plans for Dykes Creek and Woodward Creek in this project area. The Floyd County Water Department withdraws drinking water from Woodward Creek. Rome Floyd Water and Sewer Department withdraws drinking water from the Etowah and Oostanaula Rivers. Both water utilities are concerned with good water quality for drinking water supply and the county is designated as a WaterFirst Community for its efforts in good water management. The Rome-Floyd ECO Center provides programs for K-12 students and beyond, teaching about aquatic ecosystems and water quality. The Keep Rome Floyd Beautiful organization holds cleanup events and educates the public about solid waste management and litter control. Both the ECO Center and the Keep Rome Floyd Beautiful are supported by the local government. Non-government conservation groups include the Nature Conservancy (Upper Coosa Basin project) and the Coosa River Basin Initiative (CRBI-Upper Coosa Riverkeeper). Rolling Hills Resource Conservation and Development Council also serves Floyd and Bartow Counties with conservation programs as well as an agricultural equipment rental program.

4.5.5 Socioeconomics and the watershed

Most of the East Rome watershed project area lies in Floyd County, but also covers small portions of Bartow and Gordon Counties. Several demographic and socio-economic parameters for the three counties are of interest in understanding how human demands on resources affect the watershed and what future impacts might be.

The population of all three counties has been climbing, as shown by the results of the last three decennial census counts (Table 2.5.5a). Bartow County has been experiencing suburban growth from Atlanta and passed the 100,000-person mark in the 2010 Census. Floyd County approached 100,000 residents in the 2020 Census, with its county seat, Rome, being the largest city in Northwest Georgia. Gordon County is a more rural county, with a total of 57,544 residents in the 2020 Census. The housing unit trends show Bartow County moving ahead as a bedroom community from 2000 to 2020, adding more than 13 thousand housing units in that 20-year period and surpassing Floyd County in both population and homes during that time. The Governor's Office of Planning and Budget projects the populations of all three counties will continue to climb steadily through 2060, with Bartow over 132,000 persons in 2060, Floyd over 110, 000, and Gordon over 64,000. This burgeoning population will put pressure on water resources, energy resources and infrastructure, and open space for agriculture, forestry, and recreation.

Table 2.5.5a. Population trends and housing trends, Bartow, Floyd, and Gordon Counties. US Census Decennial Census. Population projections, Georgia Governor's Office of Planning and Budget, 2020-2060 projections.

		Year	
	2000	2010	2020
Bartow County	76,019	100,157	108,901
Floyd County	90,565	96,317	98,584
Gordon County	44,104	55,186	57,544
		Year	
	2000	2010	2020
Bartow County	28,751	39,823	42,435

Floyd County	36,615	40,551	40,475
Gordon County	17,145	22,278	22,736
	Year		
	2030	**2040**	**2060**
Bartow County	120,882	135,726	164,699
Floyd County	102,066	105,089	110,708
Gordon County	61,511	63,190	64,573

With regard to race, all three counties have a large white majority (Table 2.5.5b). Floyd County has the largest percentage of minorities, and more rural Gordon County has the smallest minority population percentage. Those self-identifying as Hispanic or Latino regardless of race in the 2020 Census make up at least 10% of the population in each county, with Gordon County having the highest percentage at 15.6%.

Table 2.5.5b Race and Hispanic status, Bartow, Floyd, and Gordon Counties. US Census 2020 Decennial Census.

	County		
Race	**Bartow**	**Floyd**	**Gordon**
White	75.6%	70.5%	78.4%
Black or African American	10.6%	14.3%	3.7%
Other races and 2 or more races	13.8%	15.2%	17.8%
	County		
	Bartow	**Floyd**	**Gordon**
Hispanic or Latino regardless of race	9.9%	11.6%	15.6%

Since the vast majority of the planning area falls within the city of Rome and Floyd County, for the sake of brevity, the income, poverty and employment for that city and county will be discussed here. Rome has a poverty level of 25.1% and this is trending up as of 2020, while in the rural county the rate is 18.6% and is remaining relatively steady. The median income in Rome is $38,987, while for Floyd County overall, including the cities, it is $50,657. The median age of residents for the county as a whole is 38.5 years of age. Manufacturing is the dominant employment followed by healthcare and education.

Census data indicates that the majority of farms in the Floyd County reporting area are male owned at a rate of about 2:1. The production is skewed toward hay and cattle production with poultry playing a secondary but considerable part in the agricultural community. Although this data indicates poultry as a major county wide part of the ag economy, it was observed that only 12 poultry operations are present in the planning area with all but two being in the Dozier Creek sub watershed. Approximately 86% of all farms in the county sell less than $24,999 in product yearly. This fact establishes the fact that many of the operations are either hobby farms or bi-vocational households. 60% of farmers are age 35-65, 33% are over 65 and the remaining percentage group is under 35 years of age. 94% of all farms report being family-owned farm operations. This creates an excellent opportunity for partnership and conservation improvements as owners are present on the farm.

5 Watershed Conditions

5.1 Georgia Water Quality Criteria

Georgia approaches water quality regulation by assigning standards which the water should meet. The standards fall into two groups of criteria. The first type of criteria are general requirements of cleanness that apply to all waters. The following five narrative criteria are found in the Georgia Water Quality Standards approved January 2021:

a) All waters shall be free from materials associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits that become putrescent, unsightly or otherwise objectionable.

b) All waters shall be free from oil, scum and floating debris associated with municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

c) All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

d) Turbidity. The following standard is in addition to the narrative turbidity standard in “c” above: All waters shall be free from turbidity which results in a substantial visual contrast in a water body due to a man-made activity. The upstream appearance of a body of water shall be as observed at a point immediately upstream of a turbidity-causing man-made activity. That upstream appearance shall be compared to a point which is located sufficiently downstream form the activity to provide an appropriate mixing zone. For land disturbing activities, proper design, installation, and maintenance of best management practices and compliance with issued permits shall constituent compliance with this criterion.

e) All waters shall be free from, toxic, corrosive, acidic, and caustic substances discharged from municipalities, industries or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life. *This criterion is followed by an extensive list of chemicals and their instream concentration limits.*

The second set of criteria apply to the designated uses of a water body. The six designated uses in Georgia are listed below. The criteria, or instream water quality standards, vary in strictness depending on the designated use.

a) Drinking Water Supplies
b) Recreation
c) Fishing, Propagation of Fish, Shellfish, Game and Other Aquatic Life
d) Wild River
e) Scenic River
f) Coastal Fishing

The state standards varying with the designated use are bacteria, dissolved oxygen, pH, and temperature. For example, no change from natural conditions is allowed for state Outstanding National Resource Waters ONRW. The only Outstanding National Resource Water in Georgia is the Conasauga River within the Cohutta Wilderness Area of the Chattahoochee National Forest. This river is in the headwaters of the Coosa Basin. The US Fish and Wildlife service has petitioned Congress to add the Conasauga River/Jack's River in the Cohutta Wilderness to the Wild and Scenic River list, allowing further recognition of its pristine condition and providing another tool for its protection. For the Rome Project area's impaired rivers and streams, the designated uses are fishing, or drinking water supply plus fishing. These two designated uses have the same standards, as shown in Table 12.

Bacteria

For the drinking water and fishing designated uses, the state uses fecal coliform bacterial numbers to assess microbial problems in the water. There is a different threshold for the warm season compared to the cold season. Between the months of May and October, the fecal coliform levels as a geometric mean of at least four samples within an interval of 30 days cannot go above 200 colony-forming units per 100 milliliters (cfu/100 ml). From November and April, the 30-day geometric mean of at least four samples cannot go above 1000 cfu/100 ml or never more than 4000 cfu/100 ml in any one sample (instantaneous maximum). There is no instantaneous maximum for the warmer months. See Table 12. The difference in thresholds for the warm and cold seasons assumes more human water contact during the warmer months and is therefore stricter. Further discussion of sources of bacteria and controlling water-borne pathogens is found in the Fecal Coliform Impairments section below.

The bacterium *Escherichia coli* (*E. coli)* is a species of fecal coliform associated with disease outbreaks. Between 60% and 80% of fecal coliform bacteria in streams have been found to be *E. coli.* The US EPA has recommended that *E. coli* be used as an indicator species for recreational waters and the detection of health risks in those waters because *E. coli* is more closely associated with swimming-related gastrointestinal illnesses compared to fecal coliforms. Georgia has now adopted *E. coli* standards for freshwater areas with a designation of "recreation". None of the waters in the project area have the recreation designation, but *E. coli* measurements are used in the Georgia Adopt-A-Stream program as a proxy to fecal coliform because the test is relatively simple and can alert managers to the possible presence of disease-causing bacteria.

Dissolved Oxygen and Temperature

In Georgia's non-trout waters, the dissolved oxygen level must average at least 5 mg/l on a daily basis, but never fall below 4 mg/l. In streams designated as trout waters, the dissolved oxygen level daily average cannot drop below 6 mg/l, but never below 5 mg/l. Adequate levels of oxygen in the water are critical for the respiration of fish, aquatic macroinvertebrates, and mollusks. Trout have high oxygen requirements, so the state has stricter standards for trout waters. Among the streams in the Rome Project Area, Dykes Creek is the only trout stream. Oxygen can enter the water from photosynthesis of aquatic plants or at the water/air interface. When water tumbles over rocks or is otherwise mixed the process of aeration is accelerated. The dissolved oxygen in the water is closely linked with the water temperature because colder water holds more oxygen. According to the state standard, the temperature of a non-trout stream should never exceed 90° F (32.2°C). In secondary trout streams like Dykes Creek, the temperature should not be elevated more than 2° F above natural stream conditions. High temperatures approaching 90° F are exceedingly hazardous to aquatic life as the oxygen level drops. In general, in north Georgia streams, much lower temperatures than 90° F are expected. Warm water can enter the stream from a point source, such as a power-plant discharge, or from nonpoint sources such as runoff from parking lots and roof surfaces during hot weather. When the streamside forests that naturally occur in Georgia are cut, the stream loses beneficial shading and water temperatures increase. Subsequently, the oxygen level will go down. Other reasons for low oxygen values include raw sewage or other large amounts of organic matter in the water, because the bacteria consuming this organic matter respire and use up the available oxygen. If there are high levels of algae because of nutrient enrichment, the balance between respiration and photosynthesis may skew towards respiration at night or during cloudy weather, causing the oxygen level to drop. High temperatures would compound oxygen problems because bacterial and algal growth would be stimulated by higher temperatures.

pH

The pH standard in Georgia, a measure of the hydrogen ion concentration, falls between the range of 6 and 8.5. The pH varies naturally with bedrock composition over which the stream is flowing, and the expected natural range is between 6 and 8 in Georgia. Streams over limestone substrate would have a pH around 7, or neutral, while streams over more acidic bedrock, like sandstone, would have a slightly lower pH. Aquatic animals are adapted to a narrow range of pH and variation from this can be fatal. Point discharge of various chemicals could cause the pH to become very acid or very basic.

Table 12. Georgia's Water Quality Standards for bacteria, dissolved oxygen, pH, and temperature for streams in the Rome Project Area. Designated Uses in this project area are Drinking Water Supply and Fishing.

Drinking Water Supplies	May – Oct* < 200 colonies/100 ml as geometric mean**	5 mg/l or greater daily average Not < 4 mg/l at all times	Between 6.0 and 8.5	Less than 90° F or 32.2° C
Fishing	Nov – April < 1000 colonies/100 ml as geometric mean < 4,000 as instantaneous max	For non-trout waters 6 mg/l or greater daily average Not < 5 mg/l at all times For trout streams		No elevation of natural stream temperatures in primary trout streams, no elevation > 2° F in secondary trout streams

**The summer recreation season is defined as running from May through October. Most water-contact activities are expected to occur during these months.*

***Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200/100 mL (geometric mean) occasionally, then the allowable geometric mean of fecal coliform shall not exceed 300/100 mL in lakes and reservoirs and 500/100 mL in free-flowing freshwater streams.*

Additional Criteria: Biological Integrity, Commercial Fishing Ban/Fish consumption Guidelines

Georgia also evaluates its waters for biological integrity by monitoring for fish and macroinvertebrates. The state considers a water body impaired or not supporting its designated use if it does not have healthy populations of these groups of aquatic animals. Generally, the state attributes problems with the biotic communities to sediment, and that is the parameter that their Total Maximum Daily Load (TMDL) assessments focus on improving for streams with biotic community problems. However, other factors could contribute to fish and macroinvertebrate declines. The state periodically samples waterbodies for these aquatic animals and uses several metrics measuring species diversity and numbers of individuals to rate the health of the fish and macroinvertebrate communities. See the following section for further discussion of the impairments to the streams and rivers in the Rome Project Area.
As discussed previously in the Fisheries section of this document, Georgia has been monitoring the tissue of fish in the area around Rome for many years and has a Fish Consumption Guidelines because of PCBs (polychlorinated biphenyls) dispersed throughout the area during the second half of the twentieth century from industry in Rome. The Georgia DNR indicates that the level of PCBs is gradually decreasing in the fish tissue (Georgia DNR EPD 2014). The Georgia DNR has been managing this contaminant mainly as a point source by requiring the company responsible to clean up the plant site and nearby areas. However, since the PCBs in sludge could have been moved to soils in other parts of the Rome area, Best Management Practices that control erosion and movement of sediment into streams and rivers would help the PCB problem.

5.2 Georgia 's 305(b)/303(d) List of Impaired and Unimpaired Streams

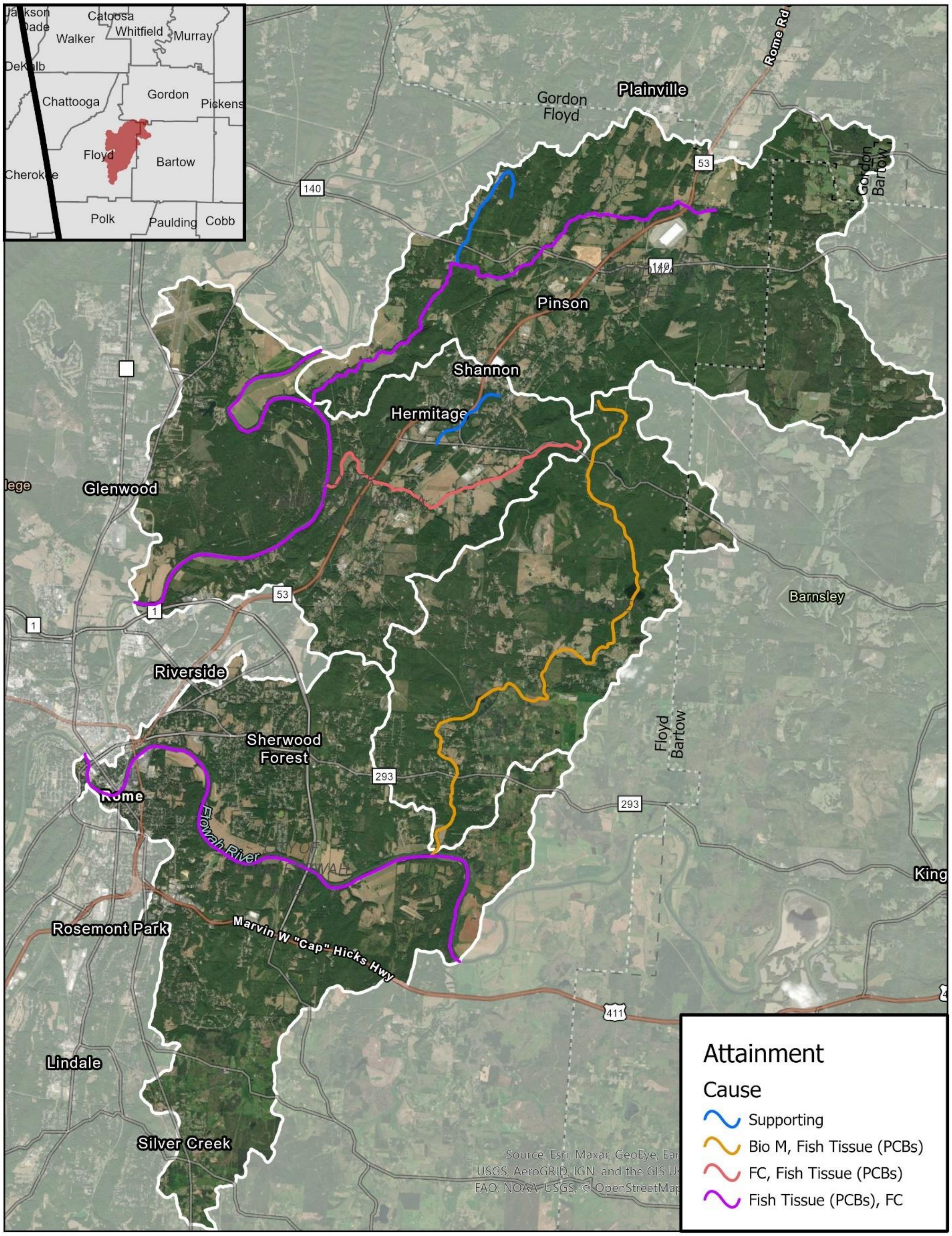
The state is required by the US EPA to assess water quality every two years in Section 305(b) of the Clean Water Act. According to the Act's Section 303(d), the state must use this information to create a list of impaired waters. This list has become known in Georgia as the 305(d)/303(b) Integrated Report because both unimpaired and impaired streams, rivers and other waterbodies are listed there, with the unimpaired shown as "supporting" the designated uses and impaired shown as "not supporting" the designated uses.

In the project area seven segments of streams and rivers are assessed by the Georgia EPD (Figure 12). Two streams, Ward Creek, which is a tributary to Dozier Creek, and an unnamed tributary to Woodward Creek are currently unimpaired, supporting the fishing designated use. The five waterbodies that are impaired are shown in Table 13. Georgia EPD completes Total Maximum Daily Load (TMDL) Evaluations to plan the recovery of its impaired streams. The TMDL Evaluation was done in 2009 for Dozier Creek and Dykes Creek (Georgia DNR EPD 2009). Subsequently, Dykes Creek was taken off the impaired list for fecal coliform. The Bio Macroinvertebrate Impairment is the current classification for Dykes Creek, and that TMDL was done in 2004 (US EPA Region 4. 2004). The impaired macroinvertebrate and fish communities were considered a product of heavy sedimentation. The TMDL was done in 2004 for Woodward Creek and the reaches of the Etowah River and Oostanaula River in the project area (Georgia DNR EPD 2004). The most recent update of the Total Maximum Daily Load for PCBs in fish tissue for all these waterbodies was in 2014 (Georgia DNR EPD 2014).

Table 13. Impaired Stream Segments within the Rome Project Area

Dozier Creek, Oostanaula River tributary	Fishing	Fecal Coliform, Commercial Fishing Ban (CFB)/Fish Consumption Guidance due to PCBs	3 miles	Fecal Coliform 2009; Commercial Fishing Ban (2005, revised 2009 & 2014)
Dykes Creek, Headwaters to Etowah River	Fishing	Bio Macroinvertebrate, Commercial Fishing Ban (CFB)/Fish Consumption Guidance due to PCBs	7 miles	Bio Macroinvertebrate (2004) Commercial Fishing Ban (2009, 2014)
Etowah River, Highway 411 to Coosa River	Drinking water supply, fishing	Fecal Coliform Commercial Fishing Ban (CFB)/Fish Consumption Guidance due to PCBs	21 miles	Fecal Coliform (2004) Commercial Fishing Ban (2005, revised 2009 & 2014)
Oostanaula River-Highway 140 to Coosa River	Drinking water supply, fishing	Fecal Coliform Commercial Fishing Ban (CFB)/Fish Consumption Guidance due to PCBs	14 miles	Fecal Coliform (2004) Commercial Fishing Ban (2005, revised 2009 & 2014)
Woodward Creek, Oostanaula River tributary	Drinking water supply, fishing	Fecal Coliform, Commercial Fishing Ban (CFB)/Fish Consumption Guidance due to PCBs	8 miles	Fecal Coliform (2004), Commercial Fishing Ban (2005, revised 2009)

Figure 12. Streams and Rivers that the Georgia EPD assesses for water quality in the Rome Project Area


Jackson
Dade
Catoosa
Whitfield
Walker
Murray
DeKalb
Chattooga
Gordon
Pickens
Floyd
Bartow
Cherokee
Polk
Paulding
Cobb
Plainville
Gordon
Floyd
Pinson
Shannon
Hermitage
Glenwood
Barnsley
Riverside
Sherwood Forest
Rome
Etowah River
Rosemont Park
Marvin W "Cap" Hicks Hwy
Lindale
Silver Creek
King
Floyd
Bartow
Gordon
Bartow
Attainment
Cause
Supporting
Bio M, Fish Tissue (PCBs)
FC, Fish Tissue (PCBs)
Fish Tissue (PCBs), FC

5.2.1 Impacted Biota Impairments

The state of GA lists water bodies for Biota-M (Macro invertebrates) and Biota-F (fish). These two listings are often proxy for water quality conditions that will not support those assemblages that are expected to be present based on reference sites and ecoregional aspects. Often the proxy condition contributing to low biota populations is sediment. Macroinvertebrate communities need sediment-free streambeds to thrive. Algae, which is a food source for many macroinvertebrates, grows better when not choked with sediment, and light can penetrate more effectively through clear water for photosynthesis. Leaf packs, another major food source, are available for feeding if not buried in sediment. A sediment-free streambed has space between the rocks for hiding, building retreats, and egg-laying. Large quantities of sediment can smother eggs by preventing oxygen from reaching them. Benefits proceed up the food chain because many fish feed on macroinvertebrates. Therefore, the US EPA and Georgia EPD link sediment loading to the health of fish and macroinvertebrate populations. By regulating the amount of sediment going into the stream, the state protects stream bottom habitat, and the organisms have space for laying eggs, feeding, and hiding from predators and the water is clear enough for fish to find food.

5.2.2 Fecal Coliform Impairments

Fecal coliform bacteria come from the feces of humans and other warm-blooded animals, which can include domestic animals and a wide range of wild animals, including deer, wild pigs, and geese. Therefore, land used for pasture, feedlots, and forest can be a source for animal fecal coliform bacteria. Fecal coliform bacteria are also present in human waste, and sources for this type of contamination can be failed septic systems and leaking sewer pipes. The fecal coliform bacteria can survive outside the bodies of animals and when found in the environment at low levels are not a cause for concern. When it rains, fecal material can wash into streams and lakes with storm water runoff. High level of fecal coliform in the water can be used as an indicator for disease-causing organisms that might be present in human and animal waste. It is cost-prohibitive to monitor water for all the different disease-causing organisms from fecal material on a routine basis. By monitoring fecal coliform bacteria, the potential incidence of disease-causing bacteria like *Salmonella*, and *Shigella* (both of which cause gastroenteritis), and *Pseudomonas aeruginosa* (which causes swimmer's ear and dermatitis), parasites like *Giardia* and *Cryptosporidium* (also causing gastroenteritis), and viruses like hepatitis A can be estimated.

When sources of fecal coliform contamination are from non-point sources like pastures, failed septic systems, and forest areas with wild animals, the fecal coliform has been shown to be higher in stream water during high flows (storm events) while low flows may show low levels of fecal coliform (Gregory and Frick 2000). Storm water runoff flushes accumulated fecal material off the landscape. The Woodward Creek and Dozier Creek watersheds have pasture, forest land, rural housing, and less suburban and urban development, so spikes in fecal coliform during storm flows could be expected in this watershed. In the more urban reaches of the Etowah and Oostanaula Rivers in the project area, low flows may show fecal coliform contamination from leaking or overflowing sewer lines.

5.3 Previous Monitoring/Resource Data Collected in Watershed

Because of the size of the Rome Project area, which includes part of the city of Rome, and the presence of two rivers and many smaller creeks, several agencies and organizations have past or ongoing efforts to monitor water quality and biological resources in the area, and the information is extensive.

The two water utilities that operate in the area, Floyd County Water Department and Rome-Floyd Water and Sewer Department must monitor their raw water at the intakes. The operator at the Floyd County water intake on Woodward Creek has indicated that their test for presence/absence of fecal coliform is always positive (Chris Cleary, Personal communication). Further information on the utilities' water monitoring can be obtained on their websites from their required annual water quality reports and from direct inquiry with the two utilities.

There are two active US Geological Survey gaging stations in the Rome Project Area, on the Oostanaula River off Broadus Road and the Etowah River at the SR 1 bridge, and one inactive site on Dykes Creek at Fred Kelly Road, as discussed in the Local Climate section 3.3 of this plan. The USGS collects extensive physical, chemical, and biological data at its gaging station sites. This information can be accessed at USGS website Water Quality Data for the Nation https://waterdata.usgs.gov/nwis/qw. For the Oostanaula site, historical values for parameters of interest to this study are available, including fecal coliform data and chemical/physical data. For the Etowah River site, chemical/physical data for the years 2005-2007 are available. Dykes Creek USGS data from 2005 include fecal coliform and chemical/physical measurements.

The state EPD has a volunteer water quality monitoring program, Georgia Adopt-A-Stream (AAS), where citizen scientists are trained to sample local streams and lakes to help establish base-line conditions and identify emerging water quality problems. The Coosa Basin Initiative has an ongoing effort to sample streams and rivers in Floyd County for many years for the Adopt-A-Stream program. Other volunteers have also sampled in the area. Volunteers enter their data on the AAS website. Data is publicly available by county at the website https://aas.gaepd.org/Region.aspx.

The US Environmental Protection Agency gathered water quality data in the region in the early 2000's for the development of the sediment Total Maximum Daily Load (TMDL) for Tallapoosa and Coosa River Basins and summary information on sediment measurements in Dykes Creek is available there (US EPA Region 4.2004).

The Northwest Georgia Regional Commission developed Watershed Management Plans for Dykes Creek (NWGRC 2015) and Woodward Creek (NWGRC 2020) as a part of grants funded by Georgia EPD. The Dykes Creek management plan has monthly turbidity and *Escherichia. coli* measurements from 2013 to 2014 for eight sites on Dykes Creek. The *E. coli* and turbidity measurements are found in Appendix E. Macroinvertebrates were sampled using the Georgia Adopt-A-Stream protocol once in each 2013 and 2014. These results are found in Appendix A. Two storm events were intentionally sampled in March and April of 2014. *E. coli* at the different sites and times was variable in non-storm events, often quite low or zero, but sometimes ranging into the hundreds. However, the two storm events show elevated values at all sites compared to the non-storm measurements, and in several cases into the thousands or "Too many to count" (TMTC). Turbidity was usually very low, except during the storm events. The macroinvertebrate samples showed Good to Excellent ratings in the lower reaches of Dykes Creek where there is flow throughout the year. As would be expected, in the middle reaches of the stream where the karst topography leaves the streambed dry during part of the year, the macroinvertebrate community was Poor or Fair when water was present. Aquatic insects can move back into the re-watered stream from upstream or downstream, but this would be a short timeframe, so the population is limited. It was, of course, not possible to sample for aquatic macroinvertebrates when the streambed was dry in the fall.

To develop the Woodward Creek Watershed Management Plan, the NWGRC investigators sampled seven sites on the creek in 2019 for fecal coliform and *E.coli* as well as pH, conductivity, water and air temperature, dissolved oxygen, macroinvertebrates, and conducted AAS stream habitat surveys. The results for the Bell's Ferry site, where the Georgia EPD also monitors for water quality, are found in Appendix E. A summary of the macroinvertebrate results and stream habitat survey results for all seven sites is also found in Appendix E. Fecal coliform levels were in the hundreds and above at this site, which lies at the bottom of the watershed. This site has a vegetated buffer, with pasture beyond the buffer on both sides. Other water quality parameters were in the expected range for this stream. The macroinvertebrate populations were "Good" to "Excellent" at all sites, while the stream habitat rating never reached the "excellent" range, being mostly "Good", except at the Plainville site, where it was "Fair".

All the data collected for the Dykes Creek and Woodward Creek Watershed Management Plans is also available on the Georgia AAS website. Information from both the Dykes and Woodward management planning process, conducted by NWGRC, have been coalesced and incorporated throughout this document.

5.3.1 Georgia EPD and WRD Monitoring Efforts

Fish, Mollusks, Crayfish, and a Dragonfly

Species Community and Distribution Monitoring
The Georgia DNR samples fish in waterbodies across the state. One of their purposes is to rate the streams against the standards for fish community for the 305(b)/303(d) list of impaired/unimpaired streams. The question answered with this sampling is whether the streams have an overall healthy fish community. Other sampling is done to understand the distribution of Georgia's diverse aquatic fauna, monitor protected species, and look for decline or recovery of their populations in a particular stream or group of streams. Dykes Creek was among the streams in the area sampled for fish in the last twenty year for the 305(b)/303(d) list. That sampling event in 2012 yielded twenty-nine fish species and an Index of Biotic Integrity (IBI) score of 42, giving it a "Fair" rating. This list of fish can be found in Appendix E, Table 59.

The Georgia DNR supplied recent results from their protected species monitoring which include lists of fish for Woodward and Dozier Creek, list of fish and mussels for the Etowah River, and list of fish, mussels, and crayfish for Dykes Creek. Considering these lists and the distribution records on the Georgia DNR Biodiversity Portal, the smaller streams, Woodward, Dozier, and Dykes Creeks have not yielded evidence of protected fish, mollusk, or crayfish species in at least ten years. The portion of the lower Etowah River that lies in the project area also does not have evidence of protected species. For the Oostanaula River in the project area, there are two protected mollusk species that might currently be present. The range of the recently rediscovered and endangered Interrupted Rocksnail is in or just upstream of the section of the Oostanaula River in the project area, as previously discussed in the Listed and Sensitive Species Section (2.4.4). In addition, the previously discussed Alabama Spike mussel, a Georgia endangered species, has been found in the Oostanaula River in Floyd County within the last five years.

The state Threatened Cherokee Clubtail Dragonfly is aquatic in its larval stage and its habitat needs are discussed in Section 2.4.4. The Cherokee Clubtail has been found in suitable small streams in the Oostanaula Watershed in Floyd County in the last 11-20 years.

PCB Levels in Fish Tissue

In additional to monitoring for aquatic species populations, EPD also has monitoring efforts related to PCB concentrations in fish tissues within this planning area. PCB contamination has been discussed in section Fisheries. The monitoring has indicated a downward trend in the level of PCBs in the tissue over time. For example, Channel Catfish from the lower Coosa River just above the state line in Georgia had an average of 20 mg/kg PCB in 1976 but it had declined to less than 1 mg/kg by 2002. However, the level of PCBs and extent of their occurrence still warrants Fish Consumption Guidance for the four streams and rivers in the project area (Georgia DNR EPD 2014).

Fecal Coliform and Chemical/Physical Parameters

The state collected fecal coliform and stream flow data in the Coosa Basin for the 2004 and 2009 Total Maximum Daily Load (TMDL) studies discussed previously (DNR EPD 2004, DNR EPD 2009). The 2004 study included streamflow levels and fecal coliform data for the Etowah River and Oostanaula River in the Rome project area, and data for Woodward Creek. The 2009 study included streamflow levels and fecal coliform data for Dozier Creek and Dykes Creek. The Etowah River was sampled for that study, but the location was upstream of the project area above Lake Allatoona. The Oostanaula River was also sampled upstream of the project area at Calhoun.

The EPD water quality tables below are an effort to show more recent water quality sampling results for the listed streams in the project area. The sites shown are locations where the EPD has completed the series of samples required to obtain geometric mean of the fecal coliform bacteria. Included are fecal coliform, basic physical/chemical parameters, and nutrients, if available, on the same sampling day. The tables show the sampling series of four samples in a month period used to calculate the fecal coliform geometric mean. This information was obtained from the Public Database Portal of Georgia Environmental Monitoring and Assessment System or GOMAS https://gomaspublic.gaepd.org/Home/GOMAS_Home. This is a small subset of the available information from the EPD's ongoing monitoring efforts utilized to determine which streams should be listed as impaired. However, not all recent sampling information is available on the portal; the most recent information for Dykes Creek is not available, so information from the 2000's and early 2010's is shown.

The data shown indicate that pH, conductivity, and dissolved oxygen are not the main concern in these streams. The water temperature in the summer is sometimes high, but never above the state limit of 32.2°C (90° F). Healthy water temperature is a key parameter for fish and other aquatic species also for controlling the growth of water-borne disease-causing microbes. As the climate continues to warm, forested riparian buffers will become even more important in keeping water temperatures from climbing to harmful levels.

These tables show that fecal coliform can be high in the summer or winter. The geometric means demonstrate that Dozier Creek, the Oostanaula River, and Woodward Creek do not meet the summer 200 cfu threshold for fecal coliform (Table 14,Table 16, and Table 18). Dykes Creek did not meet the summer 200 cfu threshold in 2005, but the data from the 2010' shows improvement (TablesTable 15 and Table 16). Dykes Creek is currently not listed for fecal coliform. The Etowah River at this location in 2020 does not show geometric means above the summer or winter thresholds for fecal coliform (Table 17).

Table 14. Georgia Water Quality Data for Dozier Creek at Bell's Ferry Bridge 2018

Fecal coliform cfu/100 ml	300	300	500	800		800	500	1300	80
	fecal coliform geometric mean: 435.6					fecal coliform geometric mean:451.6			
pH	8.01	7.53	7.62	7.45		7.64	7.58	7.58	7.65
Conductivity µs/cm	312.2	299.3	254.7	218.1		299.7	258.7	256.3	284.4
Water temp °C	7.41	10.36	8.47	11.85		17.77	20.47	19.94	20.46
Air temp °C	3	8	6	9		25	25	25	28
Dissolved Oxygen mg/L	11.49	10.71	11	10.38		9.02	8.07	8.29	8.38
Total Kjeldahl Nitrogen	0.26	n/a	n/a	0.22		n/a	0.31	n/a	0.23
Total Phosphorus by colorimetry	0.03	n/a	n/a	0.04		n/a	0.05	n/a	0.04
Dozier Creek at Bell's Ferry Bridge -Georgia EPD Water Quality Data continued									
	Sept/Oct 2018					**Nov 2018**			
Date	9/19	9/24	10/10	10/18		11/1	11/14	11/27	11/29
Fecal coliform cfu/100 ml	300	3000	300	500		500	2600	70	800
	fecal coliform geometric mean: 606.1					fecal coliform geometric mean:519.4			
pH	7.77	7.59	7.69	7.66		7.25	7.32	7.72	7.41
Conductivity µs/cm	312.8	297	313.8	320.5		329.5	223.6	286.4	290.3
Water temp °C	22.02	21.22	21.39	16.81		16.29	11.83	9.72	8.16
Air temp °C	30	24	26	17		18	6.5	3	5
Dissolved Oxygen mg/L	n/a	7.27	7.62	n/a		8.36	9.74	11.07	11.46
Total Kjeldal Nitrogen	0.25	n/a	n/a	n/a		0.22	n/a	n/a	n/a
Total Phosphorus by colorimetry	0.05	n/a	n/a	0.03		0.04	n/a	n/a	n/a

Table 15. Georgia EPD Water Quality Data for Dykes Creek at Kingston Highway 2005

Dykes Creek at Kingston Highway -Georgia EPD Water Quality Data								
	June/July 2005				Sept/Oct 2005			
Date	6/14	6/21	6/29	7/12	9/15	9/21	9/28	10/5
Fecal coliform cfu/100 ml	80	130	230	9000	70	220	300	500
	fecal coliform geometric mean: 383				fecal coliform geometric mean: 219			
pH	7.81	7.81	7.9	7.5	7.86	7.97	7.9	8.01
Conductivity µs/cm	204	200	207	128	219	220	218	219
Water temp °C	26.8	26.8	-	26.4	20	-	27.8	-
Air temp °C	3	8	6	9	25	25	25	28
Dissolved Oxygen mg/L	7.32	8.55	8.22	8.09	7.3	8.25	7.71	8.17
Total Nitrogen	0.407	0.407	0.417	0.508	1.08	0.38	0.48	0.18
Total Phosphorus as P	0.0161	0.0161	0.0293	0.0327	<0.02	<0.02	0.02	0.02

Table 16. Georgia EPD Water Quality Data for Dykes Creek at Dykes Creek Crossing off Fred Kelly Road, 2010-2014. Data is summarized as geometric means.

Dykes Creek Crossing 2010	38	87	107	96
Dykes Creek Crossing 2011	38	114	24	24
Dykes Creek Crossing 2012	24	24	20	31
Dykes Creek Crossing 2013	2008	190	130	not avail.
Dykes Creek Crossing 2014	600*			
*one sample only on Feb 4, 2014				

Table 17. Georgia EPD Water Quality Data for Etowah River at SR1 Loop Highway Bridge 2020.

Etowah River at SR 1 Loop Highway Bridge -Georgia EPD Water Quality Data												
	Feb/Mar 2020				July/Aug 2020				Nov/Dec 2020			
Date	**2/18**	**2/25**	**3/2**	**3/4**	**7/21**	**7/27**	**8/3**	**8/5**	**11/4**	**11/16**	**11/24**	12/1
Fecal coliform cfu/100 ml	150	300	110	230	50	40	20	40	40	170	100	800
	fecal coliform geometric mean: 183.7				fecal coliform geometric mean: 35.6				fecal coliform geometric mean: 152.7			
pH	6.94	6.72	6.98	6.56	7.42	n/a	7.63	7.3	6.77	6.65	6.64	6.49
Conductivity µs/cm	97.3	73.5	70.6	68.3	188.8	n/a	149.3	307.9	121.4	74.8	79.1	80.8
Water temp °C	11.22	10.32	10.4	11.01	25.35	25.27	25.2	25.08	17.32	16.85	15.44	13.11
Air temp °C	11	12	10	10	25	31	24	30	17	18	12	2
Dissolved Oxygen mg/L	9.99	1052	10.64	9.81	8.29	8.78	8.1	8.64	8.95	9.4	n/a	9.35
Total Kjeldahl Nitrogen	0.28	n/a	0.27	n/a	n/a	n/a	n/a	n/a	n/a	0.22	n/a	n/a
Total Phosphorus by colorimetry	0.05	n/a	0.05	n/a	n/a	n/a	n/a	n/a	n/a	0.03	n/a	n/a

Table 18. Georgia EPD Water Quality Data for Oostanaula River near Bell's Ferry 2018

Fecal coliform cfu/100 ml	100	230	130	2600	900	1000	190	300
	fecal coliform geometric mean: 296.9				fecal coliform geometric mean: 475.9			
pH	7.99	8.22	8.89	8.91	8.06	8.05	7.64	8.22
Conductivity µs/cm	131.8	105.9	96.8	109.4	93.5	70.8	92	94.6
Water temp °C	22.9	23.7	23.9	24.6	25.2	23.7	24.3	25
Air temp °C	27.2	22.2	25	25	25	22.8	26.67	25
Dissolved Oxygen mg/L	7.5	7.38	7.04	7.12	6.61	5.85	7.2	6.97
Nitrate mg/L	0.543	0.395	n/a	n/a	<0.05	0.037	n/a	n/a
Total Phosphorus mg/L	0.066	0.072	n/a	n/a	n/a	n/a	n/a	n/a

Table 19. Georgia EPD Water Quality Data for Woodward Creek at Gaines Loop Road, 2018

Fecal coliform cfu/100 ml	550	300	400	220		270	300	700	230
	fecal coliform geometric mean:339					fecal coliform geometric mean:338			
pH	7.72	7.46	6.82	7.28		7.51	7.2	7.34	7.49
Conductivity µs/cm	251.4	256.1	178.8	119.1		226.5	141.4	156.6	192
Water temp °C	6.85	9.13	7.44	11.45		18.38	19.98	19.18	19.35
Air temp °C	8	9	5	9		24	24	25	28
Dissolved Oxygen mg/L	11.68	9.93	10.71	9.92		7.89	7.5	7.9	7.9
Total Kjeldal Nitrogen	n/a	n/a	n/a	0.27		n/a	0.52	n/a	0.21
Total Phosphorus by colorimetry	n/a	n/a	n/a	0.05		n/a	0.09	n/a	0.03
Fecal coliform cfu/100 ml	500	5000	300	300		230	300	80	300
	fecal coliform geometric mean: 688.7					fecal coliform geometric mean: 201.7			
pH	7.69	7.52	7.6	7.48		7.02	7.03	7.46	7.05
Conductivity µs/cm	270.2	262.2	263.3	251.8		258.5	114.4	212.2	207.7
Water temp °C	22.96	22.51	22.23	16.36		15.9	-	8.64	9.39
Air temp °C	29.	22	25	16		18	7	3	2
Dissolved Oxygen mg/L	6.36	6.09	6.34	8.21		7.81	9.55	10.4	11.14
Total Kjeldal Nitrogen	0.02	n/a	n/a	n/a		n/a	n/a	n/a	n/a
Total Phosphorus by colorimetry	0.02	n/a	0.02	0.02		0.02	n/a	n/a	n/a

Macroinvertebrates

As discussed previously, Dykes Creek is listed as impaired for biota-macroinvertebrates. The data resulting in that listing could not be located on the Georgia Environmental Monitoring and Assessment System (GOMAS) Public Database Portal. The Georgia EPD has an interactive map of sampling sites called the Integrated Report Map Series on their website at https://gaepd.maps.arcgis.com/apps/MapSeries/index.html?appid=dea4c9c319d4461c8d5cef8e68957b1b. This map shows a record of EPD sampling for macroinvertebrates in 2018-2019 in Dykes Creek, which is not available on the portal. This map also shows that macroinvertebrates were sampled in 2018 in Woodward Creek by the EPD. This data is not available on the portal. Continued Monitoring could make this stream eligible for delisting with regard to the Biota Macroinvertebrate impairment.

5.4 Monitoring/Resource Data Collected for the Development of the WMP

5.4.1 Water Quality

Monitoring efforts were implemented as a means of establishing current watershed conditions and providing stakeholders with up-to-date water quality data. This monitoring focused on the collection of fecal coliform, total suspended solids (TSS), phosphorous, ortho-phosphate, and nitrogen data. Fecal coliform counts were determined to represent amounts of fecal contamination upstream of each site. TSS was used to represent potential erosion issues upstream of each site. In recent years, reducing NPS nutrient pollution has become a topic of interest in the Coosa Basin, including research into a potential nutrient trading program. To provide baseline data for any future efforts, Nitrogen and Phosphorous were monitored at all sites.

Samples were collected from 10 sites during the monitoring effort. Sampling was conducted during both wet and dry periods to document influences of landscape runoff during rainfall events and instream sources of NPS pollution during dry periods. 48 hour and 14-day precipitation total as well as discharge were included to characterize general weather conditions during sampling. This data was recorded from USGS gauging stations on the Etowah and Oostanaula Rivers close to the city of Rome.

Figure 13. Water Quality Sampling Sites on the Oostanaula River and Tributaries

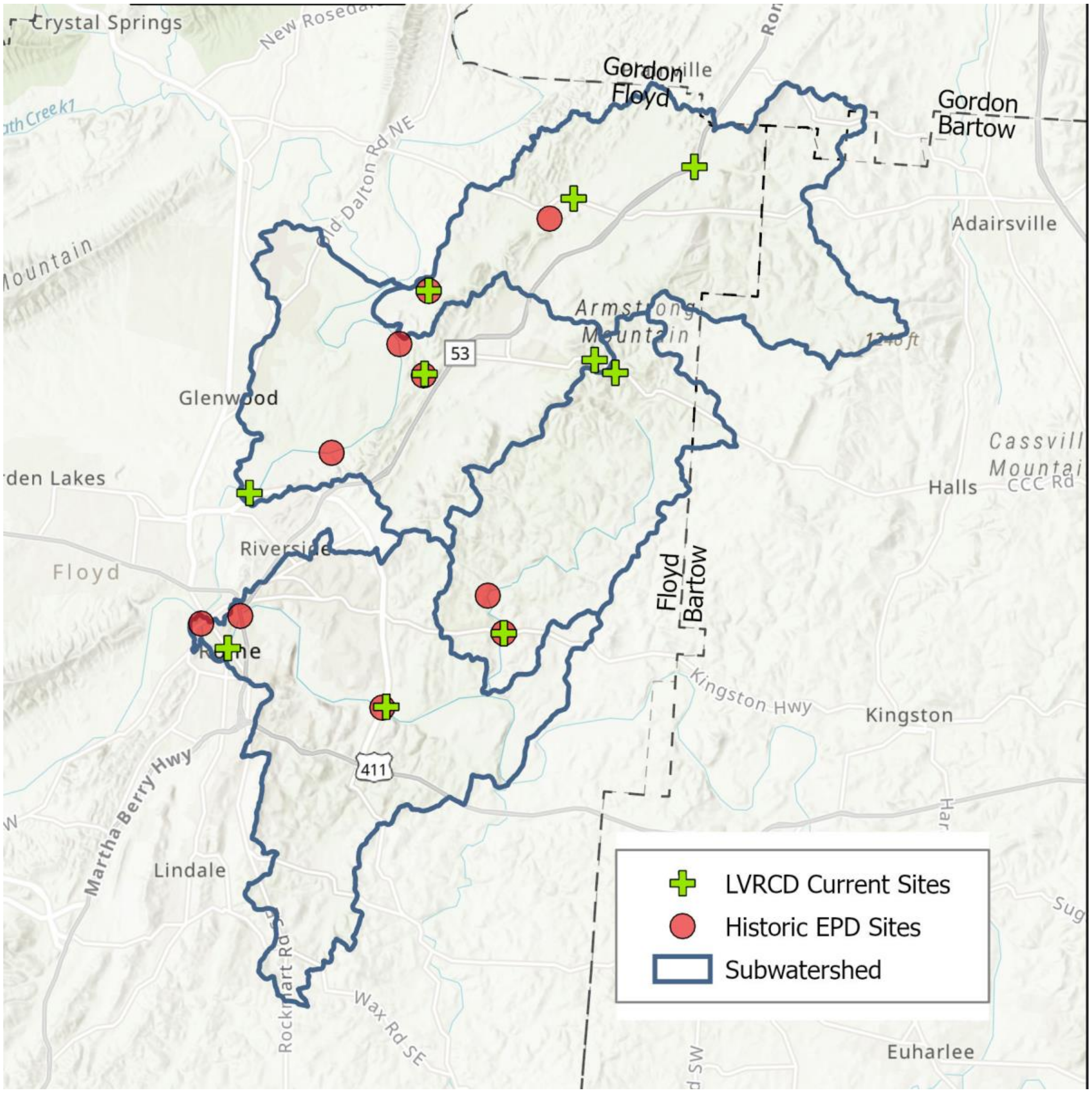


Table 20. USGS Precipitation and Discharge Data for the Gauging Station on the Oostanaula River near Rome, Georgia (USGS02388500)

48 Hour Rain Total (inch)	0.87	0.2	0.63	0	0	0
14 Day Rain Total (inch)	1.25	2.56	8.61	0.58	0	4.14
Discharge (cfs) @ 10AM	7560	5690	23900	2110	1530	2550

Figure 14. Discharge (cfs) for the USGS Gauge at the Oostanaula River near Rome, GA. January 2021 - July 2021

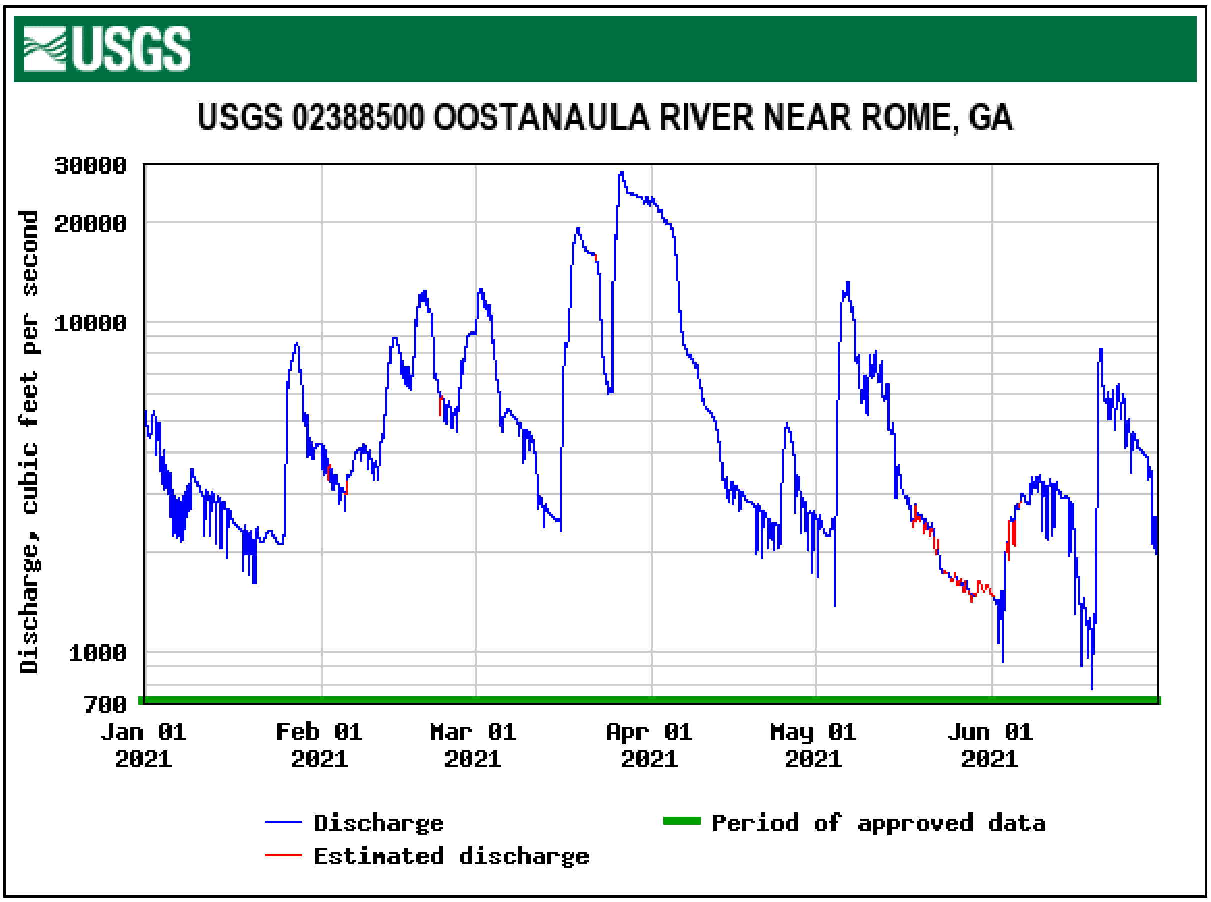


Table 21. Fecal Coliform Data Collected from the Oostanaula River and Tributaries During Planning Period

Etowah River 2	Er-2	2900	37	55	310	2400	200
Dykes Creek 9	DC-9	ND	ND	40	56	ND	16
Dykes Creek 1	DC-1	64	ND	60	44	48	54
Woodward Creek 1	WC-1	118	330	210	845	230	110
Woodward Creek 3	WC-3	118	155	260	70	530	1270
Woodward Creek 4	WC-4	146	290	240	250	570	510
Dozier Creek 1	DOC-1	27	ND	20	4	22	10
Dozier Creek 3	DOC-3	200	310	400	330	618	1030
Oostanaula River 1	OR-1	2000	230	130	36	80	73
Etowah River 1	ER-1	1200	94	782	310	1100	300

Figure 15. Fecal Coliform Data (CFU/100ml) Collected During the Planning Period

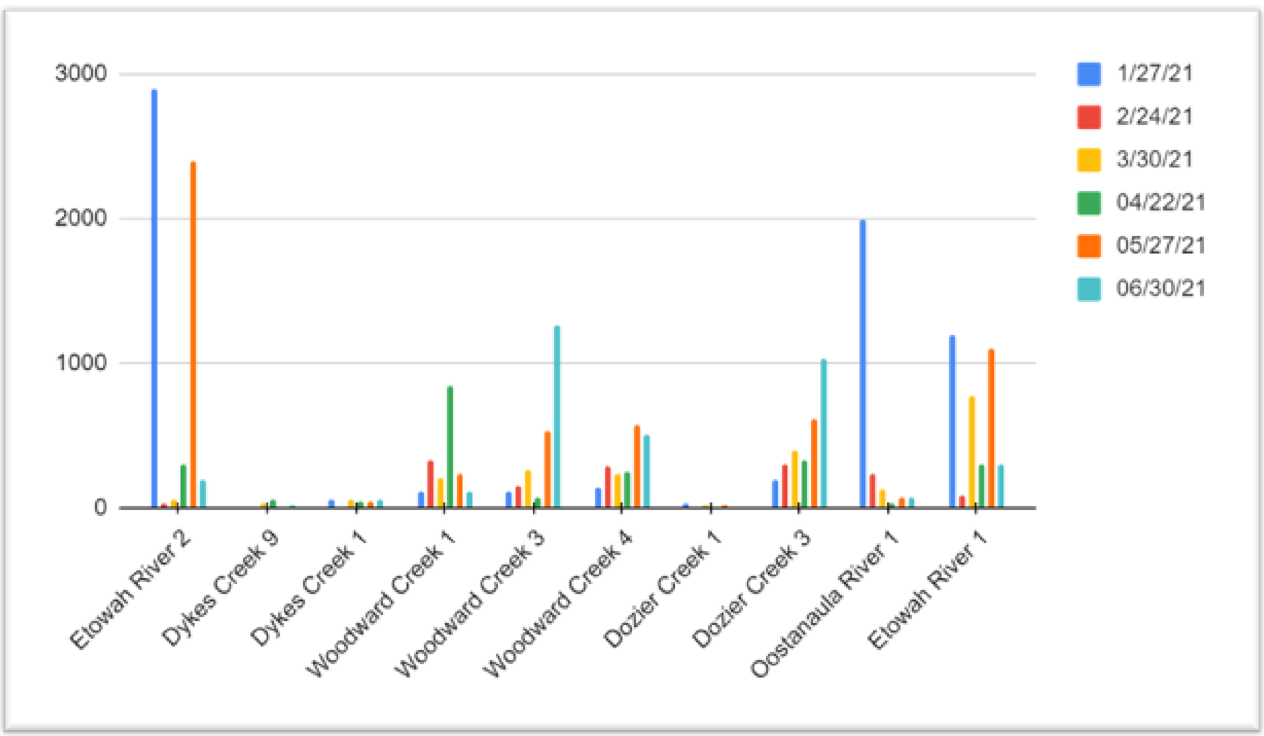


Figure 16. Total Suspended Solids Data Collected from the Oostanaula River and Tributaries During the Planning Period

Etowah River 2	Er-2	54.5	ND	14.5	12	9.5	9
Dykes Creek 9	DC-9	ND	ND	ND	ND	ND	ND
Dykes Creek 1	DC-1	ND	ND	ND	ND	ND	ND
Woodward Creek 1	WC-1	ND	ND	ND	5	ND	5.5
Woodward Creek 3	WC-3	8.5	6	11	18.5	6.5	5.5
Woodward Creek 4	WC-4	ND	7	13.5	6.5	ND	ND
Dozier Creek 1	DOC-1	ND	ND	ND	9	ND	ND
Dozier Creek 3	DOC-3	ND	ND	7.5	ND	ND	6
Oostanaula River 1	OR-1	93	21.5	23.5	8	10.5	19.5
Etowah River 1	ER-1	80	23	10	32.5	15	16.5

Figure 17. Total Suspended Solids Data (mg/L) Collected During the Planning Period

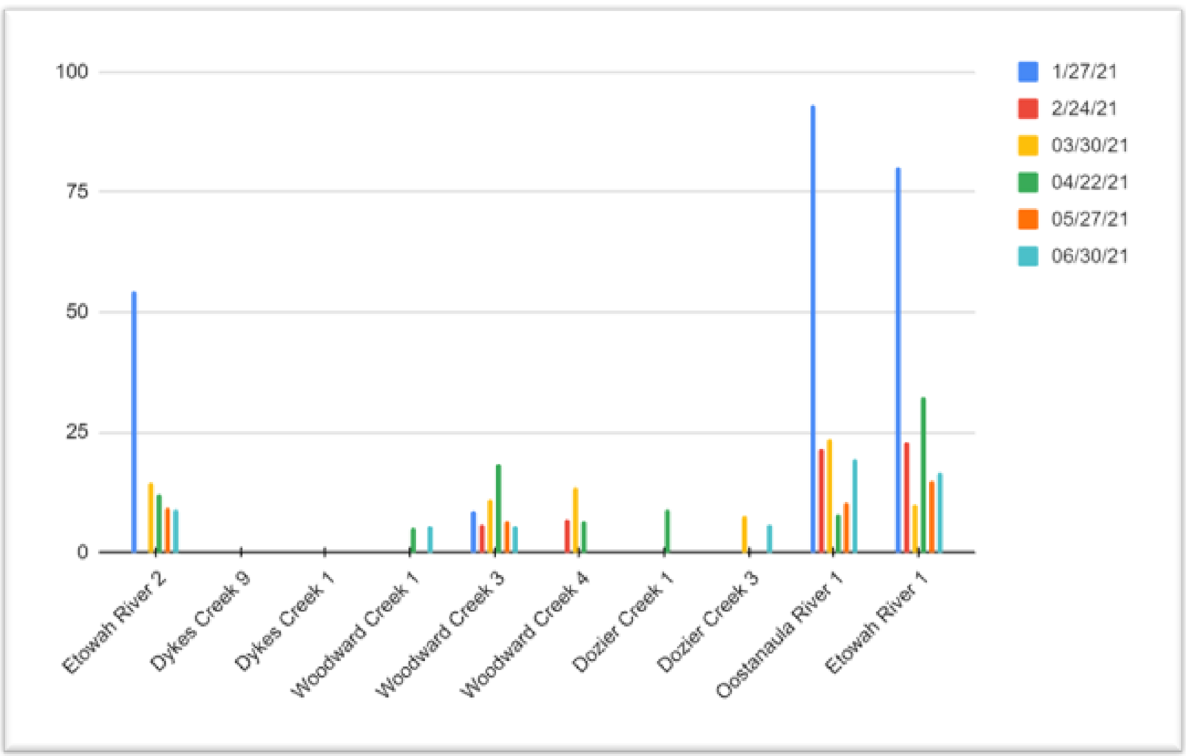


Table 22. Total Nitrogen Data Collected from the Oostanaula River and Tributaries During the Planning Period

Etowah River 2	Er-2	1.2	ND	ND	0.59	0.58	ND
Dykes Creek 9	DC-9	ND	ND	ND	ND	ND	ND
Dykes Creek 1	DC-1	ND	ND	0.87	ND	ND	ND
Woodward Creek 1	WC-1	ND	ND	0.98	0.56	0.63	ND
Woodward Creek 3	WC-3	1.4	1.4	1.5	1.5	1.4	1.2
Woodward Creek 4	WC-4	0.6	0.72	1	0.83	0.87	0.79
Dozier Creek 1	DOC-1	ND	ND	ND	1.3	ND	ND
Dozier Creek 3	DOC-3	1	1.5	2.7	1.3	1.2	1.4
Oostanaula River 1	OR-1	1	0.53	0.92	ND	ND	ND
Etowah River 1	ER-1	9.2	ND	1.1	0.59	0.52	ND

Figure 18. Total Nitrogen (mg/L) Data Collected During the Planning Period

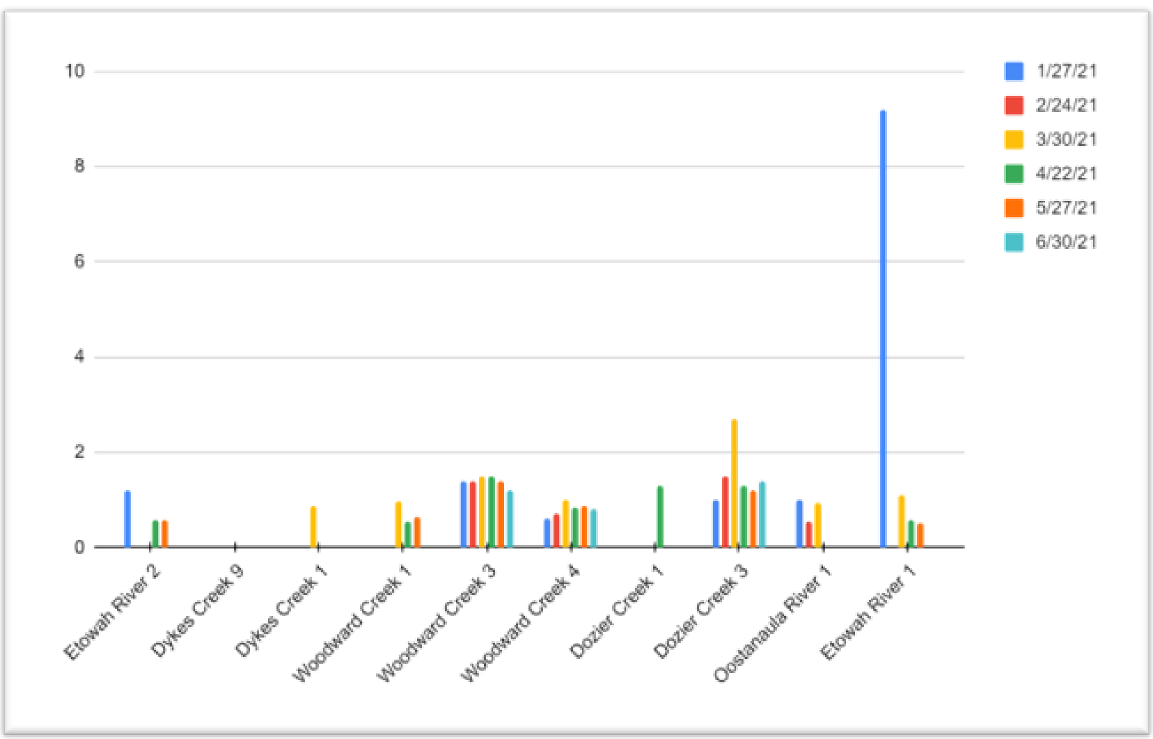


Table 23. Total Phosphorous Data Collected from the Oostanaula River and Tributaries During the Planning Period

Etowah River 2	Er-2	0.096	ND	0.054	ND	ND	ND
Dykes Creek 9	DC-9	ND	ND	ND	ND	ND	ND
Dykes Creek 1	DC-1	ND	ND	ND	ND	ND	ND
Woodward Creek 1	WC-1	ND	ND	ND	ND	ND	ND
Woodward Creek 3	WC-3	ND	ND	0.066	ND	ND	ND
Woodward Creek 4	WC-4	ND	ND	ND	ND	ND	ND
Dozier Creek 1	DOC-1	ND	ND	ND	ND	ND	ND
Dozier Creek 3	DOC-3	ND	ND	ND	ND	0.061	ND
Oostanaula River 1	OR-1	0.12	ND	0.1	ND	ND	ND
Etowah River 1	ER-1	0.11	ND	0.051	ND	ND	ND

Figure 19. Total Phosphorous (mg/L) Data Collected During the Planning Period.

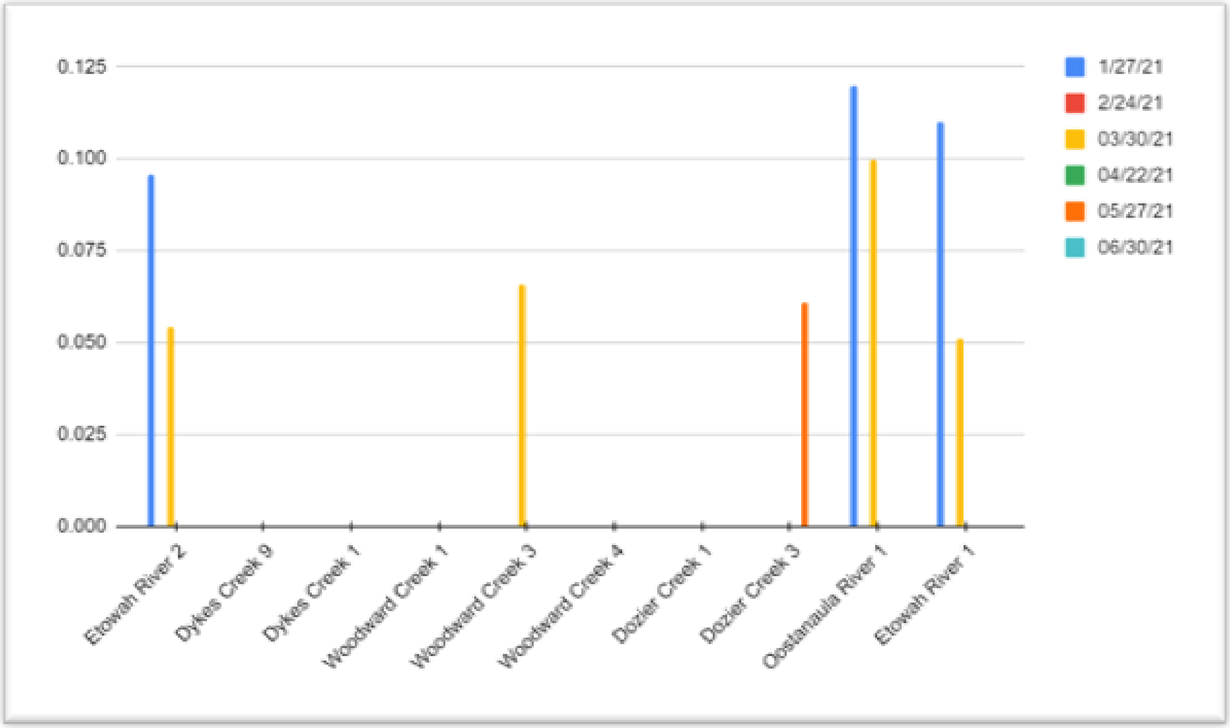


Figure 20. Ortho-Phosphate Data Collected from the Oostanaula River and Tributaries During the Planning Period

Etowah River 2	ER-2	ND	ND	ND	ND	ND	ND
Dykes Creek 9	DC-9	ND	ND	ND	ND	ND	ND
Dykes Creek 1	DC-1	ND	ND	ND	ND	ND	ND
Woodward Creek 1	WC-1	ND	ND	ND	ND	ND	ND
Woodward Creek 3	WC-3	ND	ND	ND	ND	ND	ND
Woodward Creek 4	WC-4	ND	ND	ND	ND	ND	ND
Dozier Creek 1	DOC-1	ND	ND	ND	ND	ND	ND
Dozier Creek 3	DOC-3	ND	ND	ND	ND	ND	0.026
Oostanaula River 1	OR-1	ND	ND	ND	ND	ND	ND
Etowah River 1	ER-1	ND	ND	ND	ND	ND	ND

Fecal coliform varied among sites and months sampled. Georgia EPD fecal coliform standards for flowing waters with designated uses of Drinking Water, Recreation, or Fishing are not to exceed a geometric mean of 1000 cfu/100 mL from November-April (low water contact period) and 200 cfu/100 mL from May through September (or if it is shown fecal is naturally higher than 200, should not exceed 500 cfu/100 mL). Only three sites were below these thresholds for each sampling event; DC-1, DC-9, and DOC-1. Mean concentrations (not geometric means) for these sites were 45, 19, and 14 cfu/100 mL, respectively. Three sites exceeded the GA EPD criteria for January (1000 cfu/100 mL); ER-1, ER-2, and OR-1. No samples exceeded the 1000 cfu threshold during the months of February-April. DOC-3, ER-1, Er-2, WC-3, and WC-4 exceeded the 500 cfu threshold in May; these same sites except ER-1 and Er-2 also exceed 500 cfu threshold for June (these 2 sites still exceeded the 200 cfu threshold). These are concentrations deemed not safe for swimming.

Of the nutrient parameters measured during monitoring, many samples were below the reported analytical detection limits. All but one and eight samples were below the detection limit for orthophosphate (reported as 0.2 mg/L) and TP (reported as 0.05 mg/L), respectively. However, both detection limits are above the EPA 25th percentile TP reference criteria of 0.01 mg/L for the Ridge and Valley ecoregion. Samples above the detection limit ranged from 0.54-0.12 mg/L. The highest measured TP concentrations were from site OR-1, followed by ER-1, and Er-2. Four of the TP samples exceeded a threshold for benthic algal growth (0.074 mg/L; EPA 2000, Evans-White et al. 2013). 27/56 TN samples were below detection limit (0.52 mg/L) with the majority of samples below detection from DC-1, DC-9, and DOC-9 (Figure 18). Again, the reported detection limit for TN exceeded the EPA 25th percentile for calculated TN (0.399 mg/L). Reported TN concentrations ranged from 0.52, to 9.2 mg/L. (site ER-1). Median TN concentration at site WC-3 was 1.4 mg/L and exceeded the benthic algae threshold (1.169 mg/L) each month. Site DOC-3 also exceeded the benthic algae threshold during each sample event except January (when it was 1.0 mg/L). The majority of NO2 + NO3 concentrations exceeded the detection limit (0.04 mg/L) except site DC-9 (5 below) and DOC-1 (4 below). Median NO2 + NO3 ranged from 0.05 to 1.27 mg/L. All samples reported above the detection limit exceed the EPA 25th percentile reference of 0.23 mg/L except for samples from DC-9 and DOC-1. Median concentrations at DOC-3 and WC-3 exceeded the benthic algae criteria for TN in all but 2 and 1 event, respectively.

The majority of streams monitored in this study likely experience excess nutrient loads. While many samples were below the reported detection limits, the detection limits for phosphorus and TN were higher than EPA 25th percentile concentrations. DC-9 and DOC-1 are the only 2 sites that typically had lower nutrient concentrations (but, TKN was elevated during one event in DOC-1). Thus, it is difficult to fully evaluate the nutrient state of these streams. However, NO2 + NO3 concentrations were elevated at all sites except for 2, suggesting chronic sources of nitrogen pollution. Further, multiple samples exceeded the TP detection limit of 0.05 mg/L. TP concentrations as low as 0.030 mg/L are typically associated with impaired ecosystem state (Evans-White and others 2013; Taylor and others 2014; Rosemond and others 2015). Excess nutrients can accelerate the decomposition of dead leaves and wood that provide the energy base for aquatic organisms (Ferreira and others 2015; Rosemond and others 2015) as well as alter macroinvertebrate communities (Evans-White and others 2009; Davis and others 2010; Cook and others 2017).

5.4.2 Biotic Monitoring

Fish Index of Biotic Integrity

To assess fish populations within the planning area watersheds, three sites were assessed to provide fish Index of Biotic Integrity (IBI) scores. LVRCD partnered with the Tennessee Aquarium Conservation

Institute to sample these sites. The function and role of IBI scores in assessing watershed health are explained in Section **Error! Reference source not found.**. Scores ranged from 34 – 42 which all fall into the “Fair" category.

Dozier Creek downstream of GA Hwy 53 - Dozier Creek was the smallest site sampled for drainage area above the sample site (9.81 sq. miles), but the largest site sampled in average stream width (7.9 m).**-** the IBI score for Dozier Creek was 34, which ranks this fish community as Fair (34-42). Attributes for this ranking are species richness declines as some expected species are absent; few, if any, intolerant or headwater intolerant species present; trophic structure skewed toward generalist, herbivorous, and sunfish species as the abundance of insectivorous cyprinid and benthic fluvial specialist species decreases. Riffle/run and glide/pool habitat assessment scores for Woodward Creek were 135 and 132 out of 200, respectively, indicating these habitats are somewhat degraded

Dykes Creek along Fred Kelly Road - Dykes Creek was the smallest site sampled in average stream width (6.3 m) but had an intermediate drainage area above the sample site compared to Woodward and Dozier Creeks (17.61 sq. miles). Based on these metrics and scoring criteria for the Coosa River drainage in the Ridge and Valley Ecoregion, the IBI score for Dykes Creek was 42, which ranks this fish community as Fair (34-42). Attributes for this ranking are species richness declines, as some expected species are absent; few, if any, intolerant or headwater intolerant species present; trophic structure skewed toward generalist, herbivorous, and sunfish species as the abundance of insectivorous cyprinid and benthic fluvial specialist species decreases. Riffle/run and glide/pool habitat assessment scores for Dykes Creek were 171 and 162 out of 200, respectively, indicating these habitats are in relatively good condition (Table 24. Fish Index of Biotic Integrity Ratings in the Planning Area Watersheds.). The IBI score of 42 is at the upper end of the Fair ranking, and this stream may have scored as Good if more of the darters that were present in the stream could have been netted and enumerated. The substrate in Dykes Creek was mostly boulders and cobble, even in the riffles, and this made seeing and netting stunned darters very difficult.

Woodward Creek on UGA cattle farm - Woodward Creek was the largest site sampled for drainage area above the sample site (28.07 sq. miles), but was second to Dozier Creek in average stream width (7.2 m). Based on metrics and scoring criteria for the Coosa River drainage in the Ridge and Valley Ecoregion, the IBI score for Woodward Creek was 34, which ranks this fish community as Fair (34-42). Attributes for this ranking are species richness declines as some expected species are absent; few, if any, intolerant or headwater intolerant species present; trophic structure skewed toward generalist, herbivorous, and sunfish species as the abundance of insectivorous cyprinid and benthic fluvial specialist species decreases. Riffle/run and glide/pool habitat assessment scores for Woodward Creek were 101 and 139 out of 200, respectively, indicating these habitats are somewhat degraded, with more degradation in the riffle/run habitat (Table 8); riffles were dominated by fine sediments (sand and small gravel).

Table 24. Fish Index of Biotic Integrity Ratings in the Planning Area Watersheds.

Fish IBI scores	34	42	34
Fish IBI rank	Fair	Fair	Fair

Macroinvertebrate Sampling

Dykes Creek does not meet state standards due to macroinvertebrate community impairments. To assess macroinvertebrate community for this project, the stream was sampled in June 2021 using the Georgia

Adopt-a-Stream protocol that gives a rapid assessment of stream water quality by looking at the number of macroinvertebrate groups, or taxa, rated for their sensitivity to pollution. This assessment is done in the field by identifying the organisms quickly to a basic level of classification, mainly class, order, or family and not to species, which would require microscopic examination. The overall Water Quality Index Score was 32, giving the stream an "Excellent" rating and showing that stream conditions allow a diverse array of aquatic insects and other invertebrates. At this site, results do not show a problem with sediment because large numbers and diversity of macroinvertebrates were observed. This result is shown in Table 25, along with results of stream macroinvertebrate sampling completed by the NWGRC at this site in 2013 and 2014. The sampling in 2013 and 2014 included several sites along the course of Dykes Creek, and the full results are in Appendix E, Table 56. On those sampling days the stream rated Excellent as well at Fred Kelly Bridge. Sampling in October 2013 shows that the creek was dry in the middle reaches, and that probably contributed to lower the index values at those middle reach sites when water was in the creek at these sites in May 2014. The stream never runs dry at Fred Kelly Bridge. This data suggests that the state may want to consider sampling macroinvertebrates in this stream soon for delisting purposes, taking into consideration the flow regime affected by karst topography.

Table 25. Macroinvertebrate Water Quality Score and Rating for Dykes Creek, at Fred Kelly Bridge, Floyd County, Georgia

Macroinvertebrate Water Quality Index Score and Rating	24/excellent	28/excellent	32/excellent
Conductivity (µs/cm)	220	-	220
pH	-	-	7
Water Temperature	17.8°C/64°F	-	21.8 °C/71°F
Dissolved Oxygen (mg/L or ppm)	-	-	6.75

5.4.3 Visual Survey

Visual surveys were conducted to evaluate current habitat and riparian zone conditions across the watersheds. These surveys took place during July 2021 at the same seven sites monitored for water quality (

Figure 13). The surveys assessed a variety of parameters such as stream depth, bank stability, canopy cover, substrate type, channel alteration, and riparian zone width. Photographs were also taken at each site to document current conditions and to provide a reference point for future assessments (Appendix D). The surveys followed the Georgia Adopt-A-Stream Visual Survey Manual which can be found on the Adopt-A-Stream website under the AAS Manuals section at https://adoptastream.georgia.gov/data-forms-2/aas-manuals.

The visual survey protocol was designed for the assessment of wadeable streams. For the purposes of this document, sites located on the Oostanaula and Etowah Rivers were omitted from the results since the size of these waterbodies did not allow for a safe and accurate assessment of these locations. Habitat scores and rankings were obtained by observing site conditions for parameters such as sediment deposition, presence of woody debris and leaf packs, channel flow status, embeddedness and other site characteristics. Each parameter was scored and the sum of all the scores provided the habitat ranking; either poor, fair, good, or excellent (

Table 26. Visual Survey Habitat Scores and Rankings for the Planning Area Watersheds). The Wentworth Pebble Count was used during these surveys to evaluate the composition of substrate at each site, often indicative of upstream conditions. This count provides a method for quantitatively characterizing the substrate particles in the streambed by identifying the percentage of silt, sand, gravel, cobbles and boulders (Table 27).

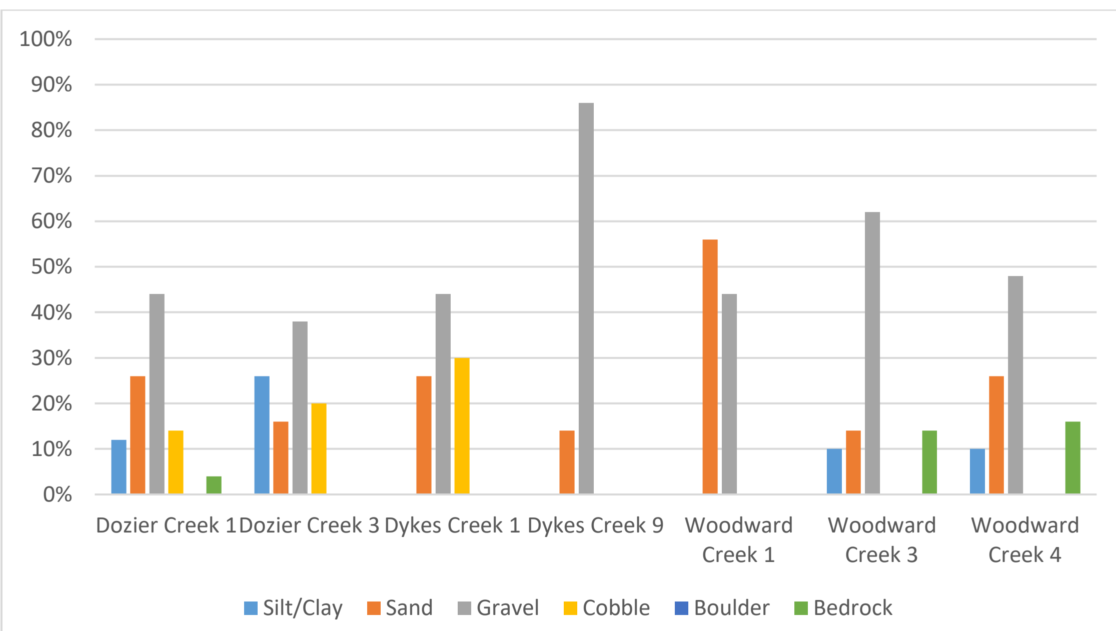
Table 26. Visual Survey Habitat Scores and Rankings for the Planning Area Watersheds

Dozier Creek 1	54	Good
Dozier Creek 3	67.5	Good
Dykes Creek 1	59	Good
Dykes Creek 9	58.5	Good
Woodward Creek 1	41.5	Fair
Woodward Creek 3	60	Good
Woodward Creek 4	65	Good

Table 27. Wentworth Pebble Count Results for the Planning Area Watersheds

Dozier Creek 1	12%	26%	44%	14%	-	4%
Dozier Creek 3	26%	16%	38%	20%	-	-
Dykes Creek 1	-	26%	44%	30%	-	-
Dykes Creek 9	-	14%	86%	-	-	-
Woodward Creek 1	-	56%	44%	-	-	-
Woodward Creek 3	10%	14%	62%	-	-	14%
Woodward Creek 4	10%	26%	48%	-	-	16%

Figure 21. Wentworth Pebble Count Results for the Planning Area Watersheds



The site at Woodward Creek 1, located by the UGA Cattle Farm, scored the lowest on the habitat ranking among the sites that were assessed. This site contained an inadequate riparian buffer due to the proximity of agricultural fields and the right-of-way for powerlines. There was also moderate to severe degradation in bank stability at this site, which is likely worsened by the lack of riparian zone. Though the remainder of the sites scored in this assessment were ranked high enough to fall into the "good" classification, the majority of the sites surveyed also contained inadequate riparian zones on at least one side of the stream.

5.5 Watershed-Scale Analysis

Analyzing spatial patterns and processes of land use at the watershed scale can assist planners in identifying critical areas for protection and restoration. To further understand these patterns in the context of the planning area, LVRCD partnered with the University of Tennessee (Chattanooga) Interdisciplinary Geospatial Technology (IGT) Lab to develop watershed-scale models. Their work is presented below in the following sections. These models will help identify key priority areas and parcels to target implementation for NPS reduction.

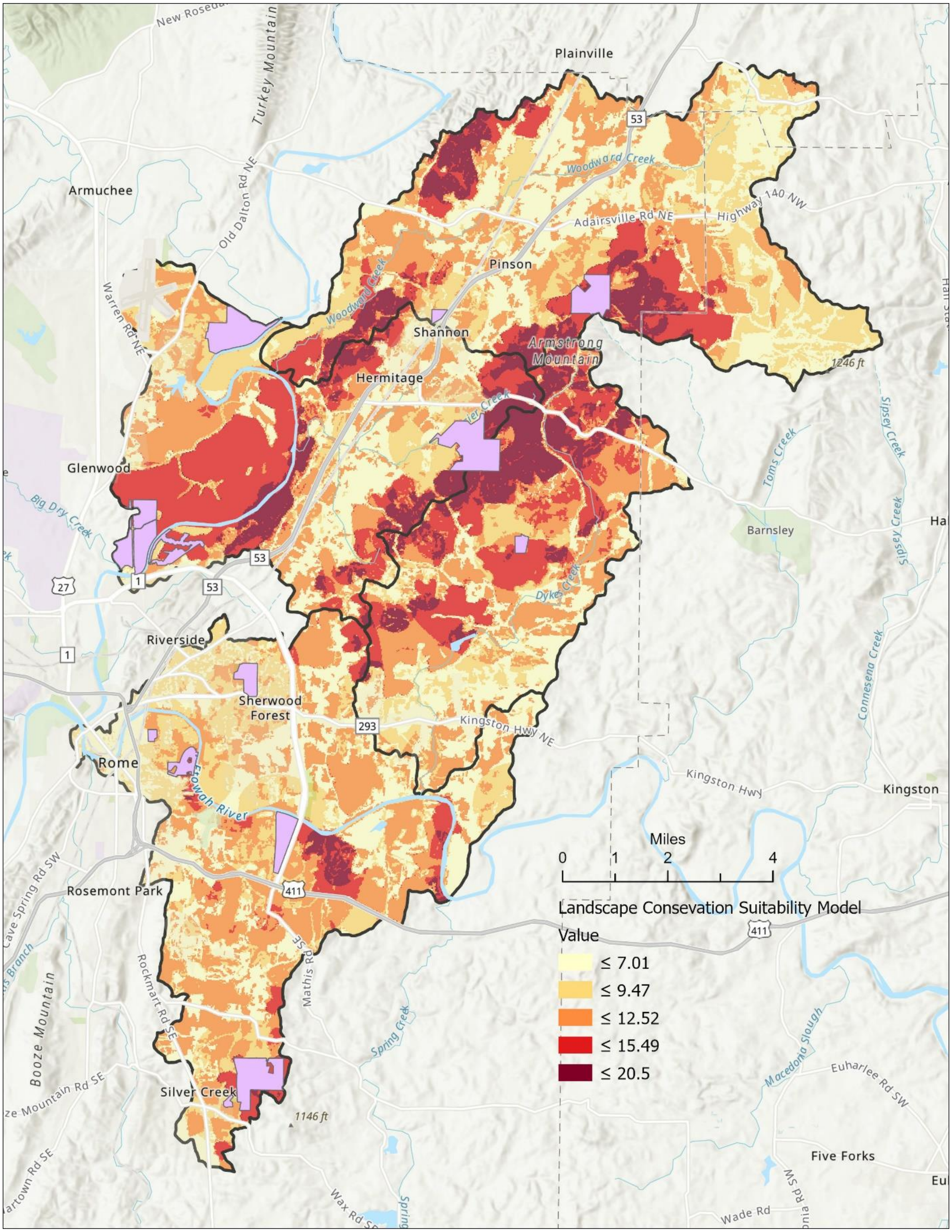
5.5.1 Landscape Conservation Suitability Analysis

The landscape conservation suitability model for planning area was originally developed for the Thrive Regional Partnership Natural Treasures Alliance by UTC's IGT Lab, with input from representatives of the Open Space Institute, The Nature Conservancy, and the Tennessee River Gorge Trust. This model prioritizes intact habitat cores, intact cores by connectedness, wildlife corridors, above average climate resilient lands, and areas near protected lands to identify the highest priority areas for habitat protection. Table 28 outlines a complete list of input data, attributes, and weighting that went into the final suitability analysis. These data were mapped and overlayed in GIS using a weighted overlay approach to produce the final suitability model for the planning area with potential scores ranging from 1-24, with higher scores being more ideal for conservation of wildlife habitat (Figure 22).

Table 28. Input Data and Weights for the Landscape Suitability Model

Esri Green Infrastructure Intact Habitat Cores	core score	1	https://www.arcgis.com/home/item.html?id=0d2f35395c3c43ecb7685df9be63dd84
Intact Habitat Cores by Connectivity Importance	pixel value based on between centrality	0.5	https://nation.maps.arcgis.com/home/item.html?id=fe42b11c901d4dbab8833c2415ed21b7
Habitat Fragments	present/absent	0.5	https://nation.maps.arcgis.com/home/item.html?id=c27ff9b9a80b44dcb94ac7ad084a1eca
Habitat Cost Surface (wildlife corridors)	value of cost service, lower value, higher priority for conservation	1	https://nation.maps.arcgis.com/home/item.html?id=98882d18558a4659962d2b39a49ae7ed
Climate Resilience	above average resilience scores	1	https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/resilience/Pages/default.aspx
Proximity to Protected Lands	distance (meters)	1	https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/protected-areas

Figure 22. Map of Landscape Conservation Suitability. Areas of high value (dark red) indicate lands with intact habitat, high resilience, and connectivity. These are areas that can sustain and protect ecosystems, species richness, viewsheds.



5.5.2 Watershed Management Priority Index

The Watershed Management Priority Index (WMPI) is a GIS model that allows stakeholders to analyze and overlay landscape attributes that affect water quality. The methodology used to create the WMPI for planning area has been implemented previously by the US Forest Service in their "Forest to Faucet" program, The Nature Conservancy, and other various conservation organizations. The WMPI contains two sub-models: A Restoration Priority Index (RPI; Figure 23) and a Conservation Priority Index (CPI; Figure 24). The general idea of these is to prioritize areas for conservation or restoration that can protect or enhance stream health. The main drivers of these models are land cover classes, soils types, and slopes. If an area with a high CPI value is converted from forest to impervious surface, it has potential to degrade water quality. Whereas if an area with a high RPI value is converted from agricultural landcover to natural landcover, it has the potential to improve water quality (i.e., stabilizing streams with riparian vegetation). Together, the CPI and RPI models can be used to analyze parcels for protection and enhancement of stream quality.

To create the WMPI for the planning area, UTC's IGT Lab collected readily available data for the region. Each of the 7 layers in the following chart (Table 29) were extracted and ranked on a scale of 1-3, with 3 being the most desirable. After processing and analysis, all 7 layers were then compiled in a weighted overlay to create the final index with scores ranging from 1-21, with higher scores being more suitable for conservation and restoration.

The WMPI methodology was adapted from The Nature Conservancy in analyzing the lower Savanah River, outlined in the report titled "Preserving Water Quality in the Savannah River" (Krueger & Jordan).

Table 29. Watershed Priority Index input data and weights.

Landcover Class	barren land, pasture/hay, cultivated crops = 3 shrub/scrub, grassland/herbaceous = 2	All Forest Types = 3	1	https://www.usgs.gov/centers/eros/science/national-land-cover-database?qt-science_center_objects=0#qt-science_center_objects
Streams Proximity	0-30m = 3 30-60m = 2 60-90m = 1	0-30m = 3 30-60m = 2 60-90m = 1	1	https://www.usgs.gov/centers/eros/science/national-land-cover-database?qt-science_center_objects=0#qt-science_center_objects
Wetlands Proximity	0-30m = 3 30-60m = 2 60-90m = 1	0-30m = 3 30-60m = 2 60-90m = 1	1	https://www.fws.gov/wetlands/
Soil Hydrologic Group	Group A = 1 Group B, C = 2 Group D, A/D = 3	Group A = 1 Group B, C = 2 Group D, A/D = 3	1	https://www.arcgis.com/home/item.html?id=cdc49bd63ea54dd2977f3f2853e07fff
Soil Erodibility-Kfactor	low = 1 moderate = 2 high = 3	low = 1 moderate = 2 high = 3	1	https://www.arcgis.com/home/item.html?id=cdc49bd63ea54dd2977f3f2853e07fff
Slope	high = 3 medium = 2 low = 1	high = 3 medium = 2 low = 1	1	https://www.usgs.gov/core-science-systems/national-geospatial-program/national-map
Active River Areas	material collection zones and FEMA 100-year flood zones = 3	material collection zones and FEMA 100-year flood zones = 3	1	https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/freshwater/floodplains/Pages/default.aspx

Figure 23. Map of WMPI Restoration Priority Index. Higher values indicate lands suitable for restoration or better land management practices to enhance/protect stream quality.

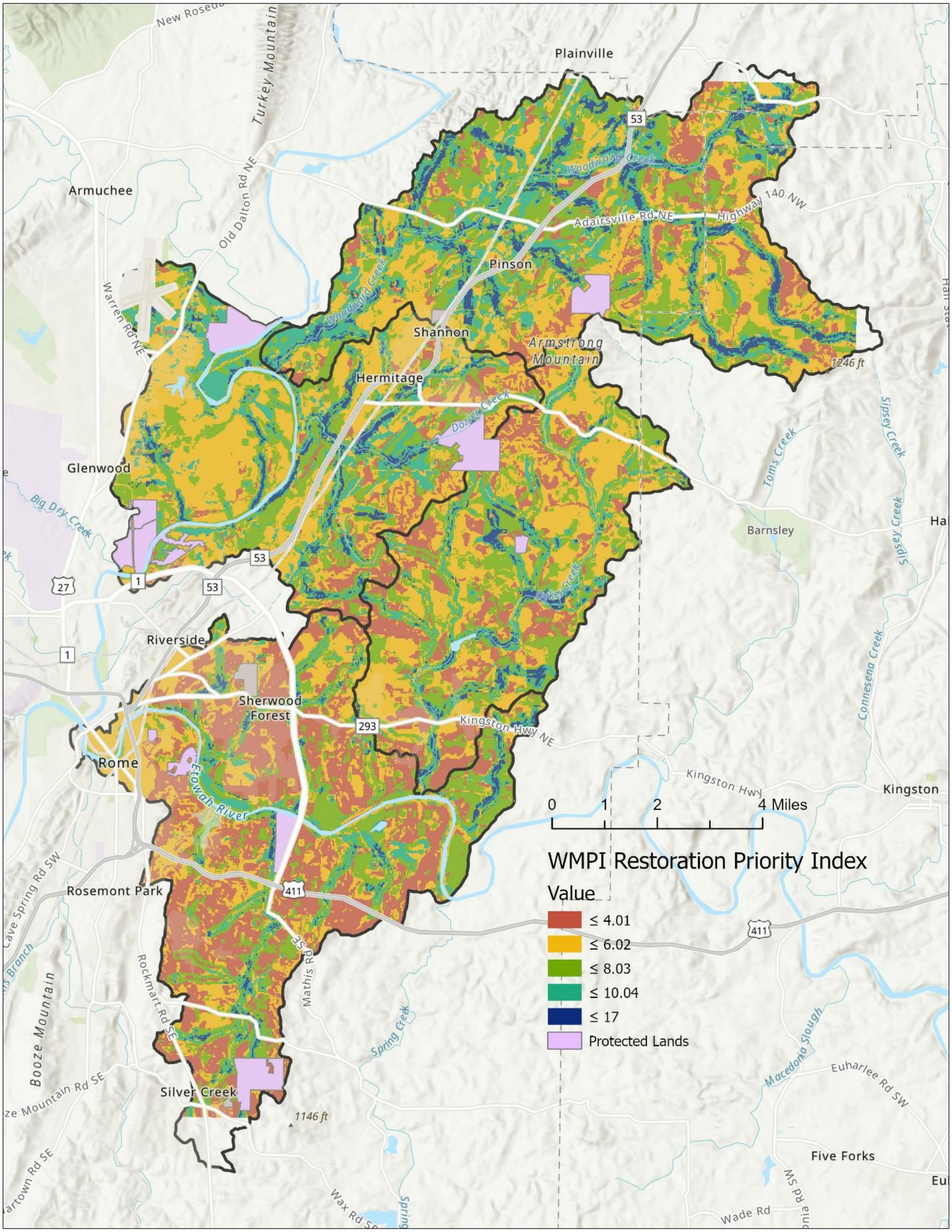
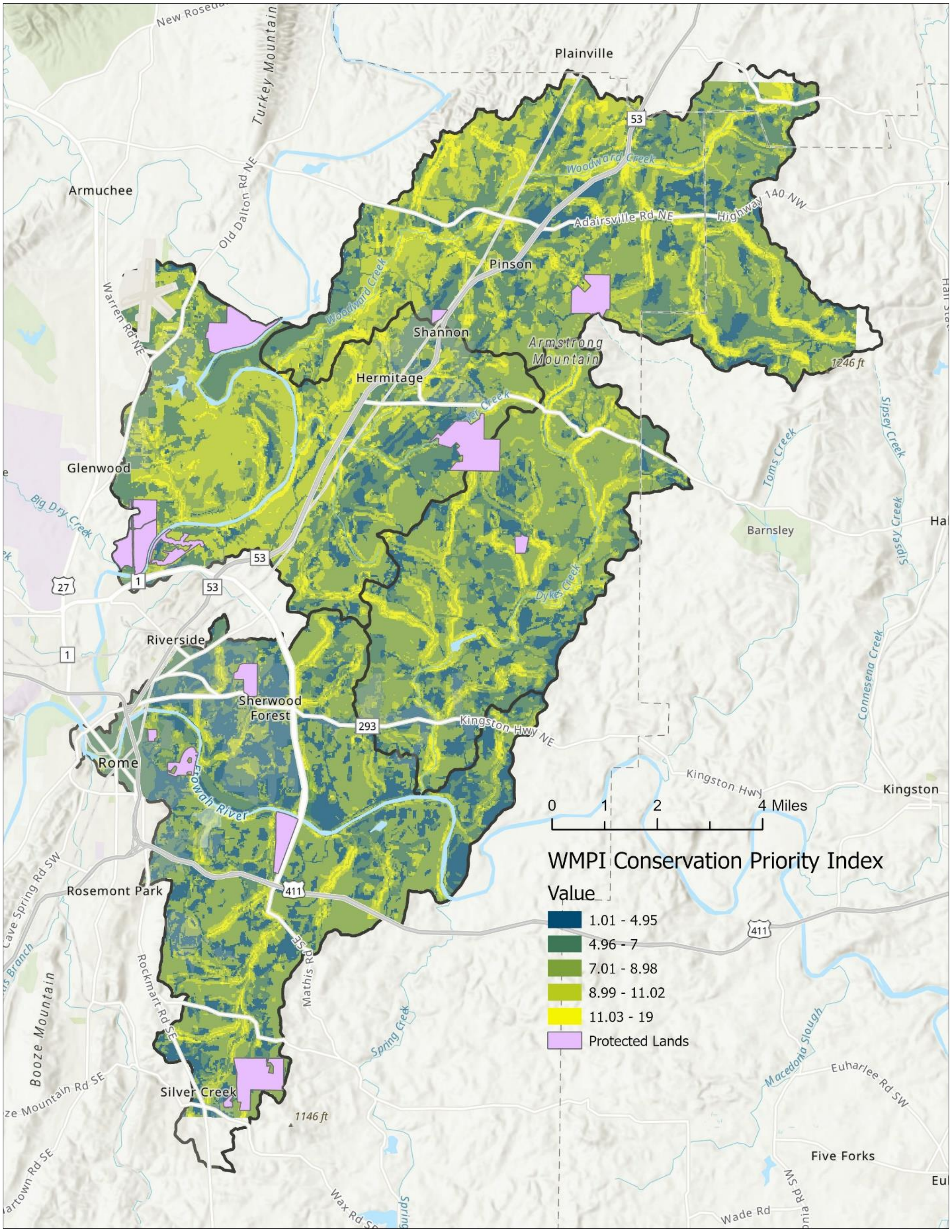


Figure 24. Map of WMPI Conservation Priority Index. Higher values indicate lands that if protected, can protect stream quality.



5.5.3 Riparian Buffer Analysis

The riparian area serves 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. They are critical to the health of waterways. In healthy stream systems, extensive root systems stabilize the soils close to streams and, most importantly, the stream banks. Without these root systems, erosion is more prevalent, and the banks often erode and collapse leading to sedimentation issues. 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.

For the development of the WMP, an analysis of the watershed Study Area was performed to assess the general condition of the riparian corridor regarding woody vegetation. This stream buffer analysis was completed due to the importance of vegetative buffer zones (i.e., riparian zones) for stream and water quality conditions. This analysis focused on defining the degree to which stream segments had sufficient canopy cover as determined by the National Land Cover Database (NLCD) Tree Canopy Cover Product (Dewitz 2019). The NLCD provides data on land cover and land cover change at a 30-meter resolution. Also, due to the relatively low-resolution of the data – 30 meters – this assessment is intended as a high-level metric to help identify watersheds within the study area that may require more analysis to identify potential stressors. The areas having insufficient riparian zones are depicted in red.

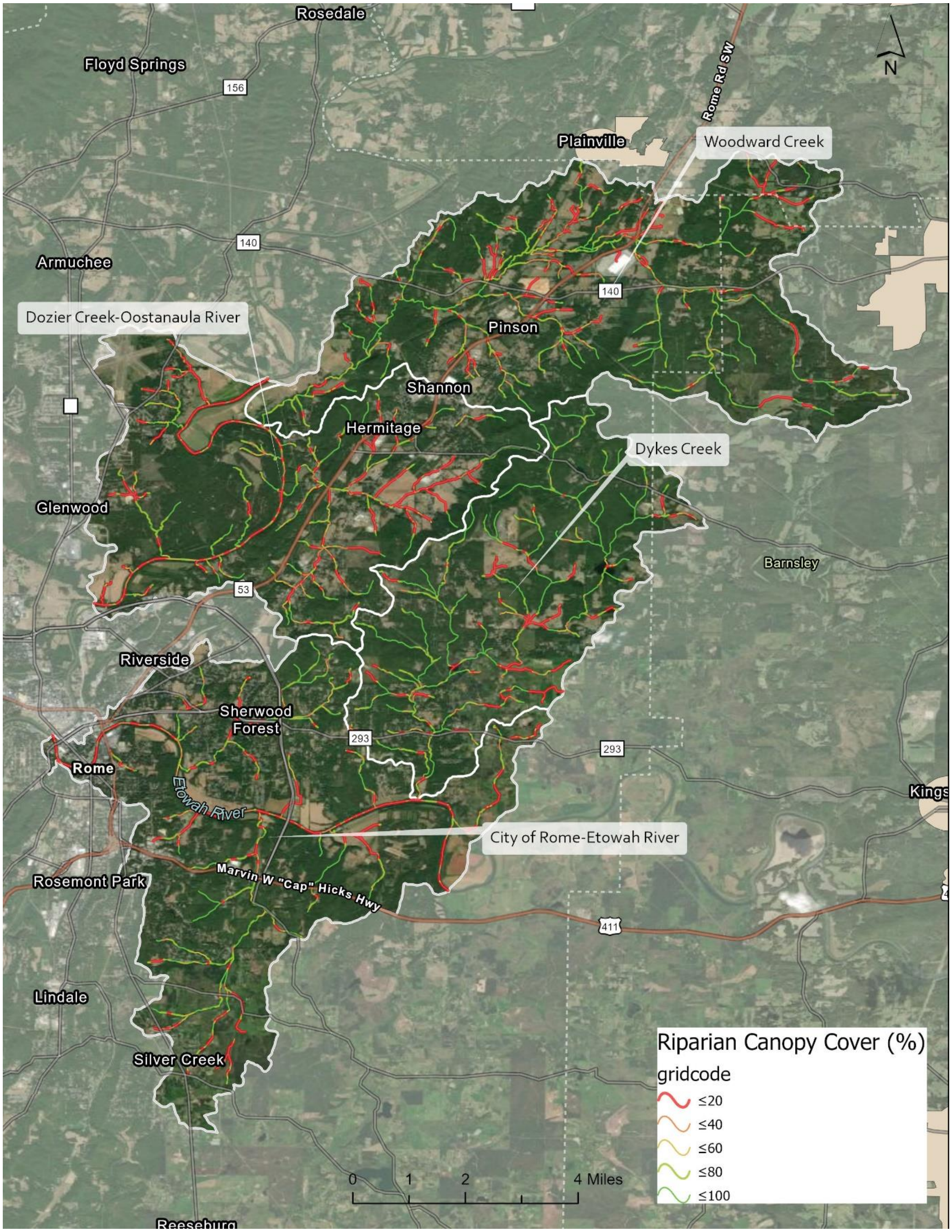
Table 30. Miles of Stream within the Planning Area and its Associated Canopy Cover (%)

City of Rome-Etowah River	14.6	10.1	7.0	9.3	10.4	51.4
Dozier Creek-Oostanaula River	17.6	11.0	7.8	9.3	10.0	55.7
Dykes Creek	7.8	4.4	5.9	8.3	25.9	52.3
Woodward Creek	16.0	11.3	9.2	15.2	24.0	75.8
Total	56.1	36.8	29.9	42.1	70.3	235.2

Table 31. Percent of Total Stream Length by Percent Canopy Cover within the Planning Area

City of Rome-Etowah River	28%	20%	14%	18%	20%	100%
Dozier Creek-Oostanaula River	32%	20%	14%	17%	18%	100%
Dykes Creek	15%	8%	11%	16%	50%	100%
Woodward Creek	21%	15%	12%	20%	32%	100%
Total	24%	16%	13%	18%	30%	100%

Figure 25. A map depicting riparian buffer condition within the Planning Area. Streams depicted in red represent areas within the riparian buffer that have less than 20% canopy coverage.



6 Pollutant Source Assessment

6.1 Nonpoint Sources

Nonpoint source pollution (NPS) encompasses a wide range of pollutants distributed across the landscape and washed into streams during rain events. These NPS impacts come from many diffuse sources, as opposed to point source pollution which originates from a single source. NPS pollutant sources are difficult to trace 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, seasonal shifts and other factors. The mixture of urban, suburban and rural lands in the greater Rome area make determining NPS impacts even more varied as the impacts can be as varied as the land uses. For the Purpose of this planning document NPS will be assumed to be the dominant contributor to water quality impact though pressure from urban point source factors may have additional impacts. Point source, being regulated, will not be a major consideration in the implementation and restoration strategies. Although the management of particular parcels will not be discussed within this plan, it is apparent that the most prevalent nonpoint source pollution issues in the watershed relate to insufficient riparian buffers along streams, livestock access to streams, failing septic systems, streambank erosion, stormwater runoff, undersized culverts, drainage ditches and tile drains from agricultural fields, continued urban development and suburban development as well as potentially other sources such as impervious surfaces and runoff related to development to name a few.

6.1.1 Agriculture

The Agricultural Land Use within the Rome Planning area, represented in this plan, account for 22% of the land area. This is a substantially significant land use and the area accounts for 12,730 acres. Of this only 457 acres are calculated as cultivated land. The remaining 12,273 acres are attributed to hay or pastureland, though these land uses may vary from year to year. Forestry, as an agricultural land use, was excluded from the agricultural NPS considerations for agriculture as forested land has little contribution to NPS as an overall land use. Farmland can be subdivided into use categories of livestock, cultivated cropland and industrial confinement operations, such as poultry houses, with each subgroup potentially contributing significantly to nonpoint source pollution loading.

Agricultural land use consisting of hay and pasture increases the likelihood that livestock are a contributor to fecal coliform levels in the watershed. While some farms fence their livestock from accessing the creek, many do not. Model farms such as the UGA research farm have installed exclusion fencing that limit livestock access from waterways. Although limiting livestock access reduced direct manure deposition in waterways, rain events do still wash pathogens from the adjacent fields and high use areas. These events result in fecal pathogens directly flowing into waterways. The effects of rain events and pathogen movement is particularly exacerbated where there are no filter strips of buffer zones along the field edge or waterway to provide filtration.

The density of Poultry house confinement operations, within the planning area, is low. Although, the surrounding areas, particularly North and Northeast, there is a significant density of poultry operations. It is likely that poultry litter is a major agricultural amendment, based on the surrounding availability and perceived relative low cost compared to other fertilizers. Based on these factors, availability and cost, it is likely to be applied to crop, hay, and pasture lands. It is also likely to be a prime contributor to the fecal coliform loading of the watershed based on normal application methods and proximity of agricultural lands to waterways. General NPDES land application system (LAS) permits are not required by the state for Animal Feeding Operations (AFO), such as poultry farms that apply dry litter, at the time of this writing. The number of poultry farms has dramatically increased over the past several years in the surrounding areas, though the density of operations within the planning area has not. The addition of Poultry litter to fields as an amendment through a LAS poses inherent risks beyond the transport of fecal coliform vectors. The application of Manure is most commonly planned based on Nitrogen need of the pasture, crop or hay field. Poultry litter contains approximately a 3 to 1 ratio of Phosphorus to Nitrogen, and this leads to Phosphorus loading of soils in areas where litter is annually applied. Phosphorus is a major contributor to eutrophication in waterbodies when particles bonded to the nutrient are transported to surface waters.

The pastured livestock that appears to be dominant in the watershed planning area is beef cattle. Generally, beef cattle are maintained in pastures except for winter feeding. Winter Feeding often occurs in a “sacrifice” paddock to reduce traffic on wet dormant grasses and allow for ease of hay or grain feeding. All classes of pastured livestock could contribute to raised levels of fecal coliform if feces left in pastures eventually washes into the streams during runoff events or fields become inundated in floodplains. When cattle, have continuous access to streams, they can directly deposit waste into streams. In addition, the access leads to trampling of riparian vegetation, loss of bank stability, and often the eventual collapse of stream banks. Bank instability issues often lead to continuous significant sediment loading into streams. In addition, the sediment itself is also a potential dwelling/ source/ load for pathogens. Since pathogens adhere to sediment particles and can survive longer while in sediment, the actual abundance of coliforms may be higher and more persistent than measured. (Burton, et al., 1987) Nutrients also adhere to sediment and enrich the water column leading to algal blooms and potentially toxic water conditions for humans, pests, and wildlife. These algal blooms are intensified by warming waters that are created when stream buffers no longer provide shade, compounding the issue rooted in livestock access to creeks.

6.1.2 Wildlife

Pollution contributions from wildlife is an often-debated topic. While it is true that wildlife is in essence, wild and natural. It is also true their population density of wildlife, range, and other factors contribute to how species interact with and affect their surroundings. Depending on these factors and the animals that are present within the watershed, wildlife contributions of fecal coliform and sediment to streams vary considerably. Based on the TMDL written for this section of Georgia and information provided by the Wildlife Resources Division of Georgia DNR, the animals that spend most of their time in and around aquatic habitats are the most important wildlife sources of fecal coliform bacteria. Potential contributors include aquatic mammals such as beaver, muskrat, and river otters, as well as waterfowl and others. Feral pig populations (*Sus scrofa*) may also contribute small amounts to pollution loads, though no stakeholders identified them as a problem. Populations of feral pigs are known to be in the area with troublesome populations documented north of the planning area in Chattooga County. The Coosa River Soil and Water Conservation District, that services the planning area, has an active trap rental program for feral pig population reduction.

Forested lands, comprising 51% of the planning area, are a prime habitat for wildlife and provide excellent corridors for wildlife travel. The volume of forested land relative to other land uses suggests that wildlife may be contributing to the fecal coliform load in those areas and downstream. Reduction of fecal coliform contributions from wildlife will not be a major focus of the plan. The plan will, instead, emphasize the reduction of anthropogenic induced sources of fecal coliform bacteria, sediment, nutrients, and other pollutants of human induced effects. .

6.1.3 Urban/Suburban Runoff

The East Rome Planning area has a large portion of land, 72%, devoted to forests and agriculture, but the remaining 28% is substantially developed land area. Differing land uses may contribute disproportionately to the pollution of waterways. In urban and suburban areas, the concentration of people, activities, and impervious surfaces may lead to more impacts on waterways both in the form of point and non-point sources of pollution. Urban areas in the past may have had many point sources of pollution, such as factories, but advances in wastewater management have led to a great reduction in these pollutants. Nonpoint sources of pollution are harder to recognize and address because the responsible parties are everyone living, working, shopping, and recreating in the city and its suburbs. All activities occurring in the city of Rome have a strong effect on the Oostanaula, Etowah, and Coosa Rivers because these rivers flow through the middle of the city.

Stormwater runoff from parking lots, streets, and large buildings can change stream morphology, causing downcutting of the streambed and bank failure during heavy flows from major rainfall events. Between storms, the streamflow may be very low because the channel has been cut deeply and the gradual release of groundwater into the stream that occurs in forested areas is disturbed by the excessive amount of impervious surface. Water entering the stream is warmer than in a forested area because it flows across parking lots and roads heated by the sun. These “flashy” streams do not provide good habitat for aquatic animals. Urban streams may be straightened or even piped underground to accommodate development, drastically altering their form and function in providing habitat, recreation, and high-quality water supply.

Land-disturbing activities are a consistent contributor of sediment to streams nationwide. Sediment from construction sites in both urban and suburban areas can enter waterways if erosion control measures are not installed or maintained during construction, further compounding water quality issues. These construction 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. Sediment either generated through increase flows or carried across impervious surfaces into water bodies often transports nutrients and pathogens that contribute to degraded water quality. Additional development as Rome continues to grow will only increase impacts on water quality from activities such as land clearing, impervious surface construction and other development related impacts. This source of sediment usually declines as homes and businesses are competed, lawns are seeded, and roads are paved. However, in the upper part of Dykes Creek watershed, an older residential subdivision with unpaved roads off Firetower Road has been a source of sediment to Dykes Creek.

After residential areas have been established, homeowners using fertilizer, insecticide, and herbicide may create further nonpoint runoff problems by overapplication, application on steep slopes, and application just before rainfall. Many areas of the Rome watershed have slopes with residential development. Herbicide may be applied directly to ditches by homeowners or county managers instead of mowing to control weeds. When storms occur, chemical residues are washed to the rivers and streams. These chemicals can be toxic to fish and mollusks. Stream buffers are required in residential areas and urban business areas but are often removed completely or reduced in width. The lack of buffers can be seen throughout the city limits of Rome, including publicly owned properties.

The Rome project area has a limited amount of publicly owned greenspace. There are privately owned forested areas, but their status can quickly change. Development of public greenspace that targets stream corridors benefits stream water quality and the community, allow flat areas for walking, biking, and river boating access. Extending and improving Rome's riverside greenways would benefit water quality.

Sewer lines are located along at least one creek, Silver Creek, in the city limits of Rome. This means leaks of sewage quickly enter the water. Electric power lines crossing or running along creeks mean that the streamside trees are permanently kept low or eliminated by maintenance crews. These powerline right of ways often have major streambank failure where the stream intersects the creek, yielding a continual source of sediment.

Lower population density in the northeast portion of the watershed would suggest that agricultural or wildlife contributors are the dominant fecal coliform influence in that area. However, areas closer to Rome and specifically along the highway routes US 27, GA 293, and US 411 have higher residential populations. The availability of sanitary sewer is a positive for these watersheds although many of the rural areas still rely on septic systems because sewer lines do not run to all areas of Floyd County. Failing septic systems contribute to fecal coliform loading as do breaches in sanitary sewer, either at facilities during flood events or in leaking or broken pipes. Old septic systems and additional new systems installed with increased development create a risk of continued septic system-induced fecal coliform pollution.

6.2 Point Sources

The Urban and suburban land uses associated with this planning area lend the area to have numerous point source conveyances. Point sources 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). Temporary NPDES permits may also be issued for construction in order to maintain water quality management practices while soil is disturbed. A query of the EPA PCS-ICIS database indicates there are 41 point sources in the watershed. Several of these 41 permits are temporary and related to construction. A few are possibly related egg washing agricultural poultry sites with the remainder being industrial. Many poultry farms operate dry manure management systems. Under current state rules dry manure operators are not required to permit their operations. Though permits are not required for dry poultry litter operations, nutrient management plans are considered best management practice and help to address nutrient application 4 R's (Right rate, Right time, Right source, Right place). The majority of this litter is managed with land application to fields, this process takes a nutrient point source and diffuses the nutrients to a non-point potential contributor. Operators managing egg washing poultry farms, liquid swine or other liquid manure management would be required to receive NPDES permitting.

7 Watershed Improvement Goals

7.1 Overall Objectives

7.1.1 Restoration

Reduction in Anthropogenic effects and enhancement of overall water quality are the general objectives of this WMP. Three stream segments and two river segments within this planning area have been placed on Georgia's 303 (d)/305 (b) list. Work on conservation and restoration practices with a goal of reducing water quality impacts is a key to successful implementation of this planning effort. A major component of the restoration efforts will include implementing cost share programs that incentivize landowners to address pollution sources on their privately-owned lands. Likewise, conservation best management practices will be targeted with incentive based initiatives to work with landowners on improving water quality on private lands. Reductions in relevant pollutants will be tracked through water quality monitoring and potentially by sampling fish or macroinvertebrate assemblages in the future. This sampling will help to establish if baseline conditions, set previously and through this planning effort, have improved. State-designated water quality collection and analysis protocols will be followed during periodic sampling events to improve water quality and de-list stream segments impaired various reasons, such as fecal loading. 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.

7.1.2 Anti-degradation

Water quality sampling data obtained during the formation of this WMP, made apparent that the planning area as a whole and in parts contained sources of fecal coliform and sediment as well as other mobile pollutants such as nutrients, and that in addition to the current impairments, other stream segments had at least some potential to be listed at some point as well. Due to this recognition, anti-degradation efforts were emphasized as a primary objective of restoration efforts. For this reason, 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.

7.1.3 Education

The Greater Rome area is uniquely positioned to provide education on water quality and quantity. The confluence of the Etowah and Oostanaula make Rome a natural education area, as so much water surrounds the city but it is also unique in that the City has the Rome ECO center. This center serves as a training center, environmental education facility and is equipped to provide facilities and staff for training. Educating local citizens on the uniqueness of their watershed, the NPS threats present in the area, and what can be done to address these issues is key to successfully implementing BMPs and watershed restoration. Education and outreach efforts are critical if watershed goals and objectives are to be reached. Involving local communities in the watershed improvement process is important to success and providing an opportunity for local stakeholders to gain an understanding of their watershed. Presentations at local events should be used as a means to reach a broad audience in the community. Adopt-a-stream programing can serve as an interface between education, agriculture, and the community. Other specific educational examples include demonstrating green infrastructure, engaging in stream cleanups, rain barrel workshops, native tree planting and canoe cleanup floats down local waterways. The Coosa River Basin Initiative(CRBI), based in Rome, offers many of these options and is a key player in the accomplishing educational objectives.

8 Pollution Reduction

8.1 Load Reductions

As defined by the EPA, a Total Maximum Daily Load is the calculation of the amount of a pollutant allowed to enter a waterbody so that it will meet water quality standards for a particular pollutant. The calculation is made up of Waste Load Allocation (WLA), Load Allocations (LA), and a Margin of Safety (MOS). WLAs represent point sources including NPDES discharges such as wastewater treatment facilities, CAFOs, and stormwater discharges. Load Allocations represent nonpoint sources of pollution, which are considered all sources that are not NPDES discharges as well as background sources. The MOS accounts for all uncertainty including seasonal variations, etc. After calculating the TMDL for a certain pollutant for a segment of stream, the current pollutant load for the stream can be calculated through water quality sampling. These two calculations can then be used to calculate the load reduction needed to meet water quality standards.

Although the state of Georgia has not adopted Water Quality Standards associated with nutrients and there are no current TMDLs for nutrients in Georgia, Lake Weiss, located just across the state line in Alabama, does have an EPA-approved TMDL for nutrient impairment. The Coosa River, of which the watersheds within the planning area are ultimately a tributary, drains to Lake Weiss. The TMDL calls for a 30% reduction in total phosphorus loads measured in the Coosa River at the state line. According to the TMDL, approximately 70% of TP is associated with nonpoint runoff. These reaches also have the previously discussed Fish Consumption Guidance due to PCBs (Table 13).

Load reductions for stream segments listed for fecal coliform within the planning area have been established under two TMDL evaluations—2004 and 2009. Allocations and projected load reductions for these stream segments are listed in Table 32. Because no WLAs are identified in the TMDL, it can be assumed that a majority of the load comes from nonpoint sources.

Table 32. Fecal TMDL Calculation and Load Reduction for the Rome Planning Area

Dozier Creek	2009	2.51E+12		1.90E+10	7.97E+11	9.06E+10	9.06E+11	64%
Dykes Creek*	2009	3.66E+12			1.72E+12	1.91E+11	1.91E+12	48%
Etowah River - Hwy. 411 to Coosa River	2004	4.14E+16		6.04E+14	1.56E+16	1.80E+15	1.80E+16	57%
Oostanaula River - Hwy 140 to Coosa River	2004	3.83E+14		7.93E+12	2.23E+14	2.56E+13	2.56E+14	33%
Woodward Creek	2004	3.23E+14			5.28E+13	5.87E+12	5.87E+13	82%

*Dykes Creek is not currently listed as of the writing of this plan (2021) though it has a TMDL for Fecal and has been listed for fecal in recent years.

The US EPA collected sediment data, biotic community data, and stream flow data in 2003 in the Coosa Basin and used sediment loading models to estimate the amount of sediment that would degrade the habitat enough to effect fish and insect populations. That study set the Total Maximum Daily Load (TMDL) for sediment of nine streams in the Coosa Basin, including Dykes Creek (US EPA Region 4. 2004).

The load is shown in Table 33 as 197 tons/year, which means sediment entering the stream cannot exceed that amount annually. To comply with this loading rate, the current estimated sediment load needs to be reduced by 90%. In the EPA study, the biological community showed slight to moderate impairment in Dykes Creek. Sediment movement in the stream was detected and considered excessive. As shown in Table 13, this led to the current impairment listing as Biota-macroinvertebrates, as well as the previously discussed Fish Consumption Guidance for PCBs.

Table 33. Total annual sediment load and required sediment load reductions from the US EPA TMDL Evaluations for Tallapoosa and Coosa River Basins (US EPA Region 4. 2004)

Dykes Creek	1908	0	13.22	13.22	197	90%

To analyze the potential load reductions that could be achieved through watershed restoration, a STEPL model—designed by the EPA—was built for Dykes Creek. The STEPL model (Spreadsheet Tool for Estimating Pollutant Load) is a spreadsheet tool that uses algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that could occur from the implementation of BMPs. Although the STEPL model is capable of modeling nutrients as well, for purposes of this plan we used the model to analyze the potential sediment load reductions that might be achieved during implementation of this watershed management plan for the EPD listed criteria. Future versions of this model will include Fecal Coliform loading but is not yet available within the tool.
The model requires land use and precipitation data to calculate outputs. The model calculates annual sediment load by using the Universal Soil Loss Equation (USLE) and sediment delivery ratio. Potential sediment loads for the HUC-12 watersheds within our planning area are presented in Table 33.
The STEPL model calculates potential load reductions through use of BMPs in multiple ways. When dealing with specific project-level BMPs, such as streambank stabilization at a particular site, STEPL allows the user to calculate a refined load reduction based on the length and height of the bank, soil type, as well as the severity of erosion. However, since specific individual applicants and projects have not been selected through the EQIP ranking process or other prioritization, this type of approach would not be suitable. Retrospective calculations can be tracked once projects are selected and this can help better inform goals and outcomes. Alternatively, STEPL can calculate potential load reductions by identifying a particular BMP—Stream bank stabilization, filter strips, etc—and applying that to a proportion of specific land-uses within each sub watershed based on proposed achievable percentages.
For this exercise, we assumed a Livestock Exclusion BMP would be applied to 40% of the pastureland area within each sub watershed. We also assumed a grass filter/buffer strip BMP could be applied to 40% of the cropland within the sub watersheds. Estimated loads and load reductions based on these assumptions are presented below. Based on this approach, initial rounds of implementation could potentially reduce loads by 1,008 tons/year. The addition of green infrastructure and Urban BMPs—not included in this model, but a significant factor contributing to non-point source sediment—could also significantly affect load reductions.

BMPs used for the proposed sediment reduction are highlighted in the budget breakdown as line item practices. These represent the modeled 40% implementations. It should be noted that only Dykes creek is listed for a sediment related parameter and as such is the only load reduction captured in this model.

BMP implementation in the non listed watersheds will support the goals of improving water quality through sediment reductions but will not result in a delisting. Also worth noting is based on data collected in this planning process, Dykes Creek is being considered for monitoring to delist.

Table representing modeled 40% BMP adoption on sediment loads

Watershed	**Sediment Load from TMDL (no BMP)**	**Sediment Load (with BMP)**	**Livestock Exclusion and Streambank Stabilization Application Rate on Pasture**	**Percent Reduction**
	tons/year	**tons/year**	**%**	**%**
Dykes Creek Watershed	1908	899.9	60	53
City of Rome-Etowah River Watershed Section	Not Applicable			
Dozier Creek - Oostanaula River Watershed Section				
Woodward Creek Watershed				
Total	1908	899.9	60	53

8.2 Existing Conservation Programs

As mentioned earlier in this document, Rome is uniquely positioned for both urban and agricultural conservation. Partner programs based in Rome such as CRBI and the Rome ECO center have equipped the greater Rome area with tools and capacity to launch water quality efforts in earnest. Currently, several conservation programs exist to assist landowners and managers in protecting natural resources and conserving water as well as soil, though are underutilized. Program partners range from nonprofit organizations to federal and state programs. Many of these conservation programs are utilized throughout the United States to conserve and protect natural resources. The WMP conservation program list will focus on those conservation efforts specifically addressing fecal coliform and/or sedimentation reduction and agricultural impacts. Aside from the UGA research farm in Woodward Creek, few BMPs have been adopted in these watersheds.

8.2.1 Current Structural Programs and Practices

A table of conservation programs and associated managing entities is included below (

Table 34. This list may not be exhaustive, though these are the known, successful, conservation opportunities. The programs range from forestry to agriculture and also present options for addressing stormwater infiltration measures and septic system rehabilitation. These management measures which assist in controlling pollutant loads resulting in decreased levels of fecal coliform, nutrients, and/or

sedimentation. Listed programs allow for development and implementation of voluntary conservation management plans.

Conservation practices planned and implemented within the watershed have been broken down into 2 groups, the Etowah and Oostanaula draining sub watersheds respectively. Data was looked at for the 5 year period prior to this plan development (2021). The Oostanaula planning area had 148 BMPs either planned as conservation technical assistance (CTA) or implemented through EQIP or CSP, programs of NRCS. Approximately 25% of these BMPS were herbaceous weed treatments, which negatively impact water quality. 30% were CTA planning and over 90% of the planned BMPs were grazing related. The Etowah planning area had a very similar percent of grazing BMPS with only 74 counts of assistance. Approximately 25% were CTA. The lack of installed practices over the past 5 years highlights an opportunity for partnership and improvement.

Table 34. Existing Structural Conservation Programs

Clean Water Act Section 319 Nonpoint Source Grants	US EPA, GA EPD	Makes Federal funding available for impaired watersheds to address nonpoint source pollution concerns and ultimately seek to move toward de-listing impairments.	Agriculture/ Residential/ Urban
Healthy Watershed Initiative	US EPA	Makes federal funding available to identify and protect healthy watersheds	Agriculture/ Residential/ Urban
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
Conservation Tillage Program	Limestone Valley RC&D, Limestone Valley SWCD (Gordon) as well as Rolling Hills RC&D (Bartow, Floyd)	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 but 90% for water quality priority practices) for landowners seeking to implement BMPs on their property.	Agriculture
Conservation Stewardship Program (CSP)	NRCS	A program that incentives conservation management practices with annual payments for completed conservation.	Agriculture
National Fish Passage Program	USFWS, National Fish Passage Program, SARP	Works to address barriers to the movements of aquatic organisms as well as improve aquatic habitats.	Biotic Communities
Septic System Permitting and Inspection Program	North Georgia Health District/ County Health Departments	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
Stream, Riparian Buffer, and Streambank Improvement Efforts	USFWS, Partners for Fish and Wildlife Program (implemented with local sponsoring partners)	Works to address stream habitat, riparian buffer, and streambank issues on private lands through a cost-share program aimed at areas key to fish and wildlife habitat improvement.	Agriculture/ Biotic Communities/ Residential
National Water Quality Incentive Program	NRCS –NWQI	Promote the conservation of agricultural lands for the improvement of water quality	Agriculture

Many programs also provide non-structural practices in the planning area and most are not unique to the area (Table 35). 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 and, making a real difference in both the cultural and natural landscape over time.

Table 35. Existing Non-Structural Conservation Programs

Army Corps of Engineers Regulatory Program	USACE	Conducts permitting for Section 404 of the Clean Water Act, which regulates the discharge of dredged or fill materials into US waters of the US, including wetlands.	All inclusive
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
Endangered Species Act	USFWS	Among other things, this act ensures projects with a Federal nexus avoid deleterious impacts on listed aquatic organisms and their habitat.	Impacted Biota/ Sedimentation
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
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
Land Conservation and Preservation	US Forest Service, TNC	Conservation and preservation of lands for appropriate management measures addressing water quality, aquatic organisms, and habitat.	All inclusive
UGA Cooperative Extension Program	Gordon Co./ Floyd co./ Bartow Co. Extension Office	Assists with general agricultural assistance, which includes providing suggestions for soil and water conservation.	Agriculture
Keep Bartow Beautiful	Keep America Beautiful affiliate	Education and restoration projects focused on stormwater, litter prevention, and general environmental protection.	All Inclusive
Coosa River Basin Initiative	CRBI	Educate and advocate for the improvement of water quality both in	All Inclusive

		the community and through legislative action.	
Soil and Water conservation Commission	GSWCC	A state of Georgia entity that promotes conservation through review of sediment and erosion control plans, promotion of conservation and support of local districts	Urban/Residential/ Agricultural
Soil and Water Conservation Districts	Coosa River S&W District, Limestone Valley S&W District	Promote Conservation, oversight of projects, management of flood control structures represent local counties as a state district.	All Inclusive

8.3 Proposed Conservation Program for the Planning Area Watersheds

Each HUC12 watershed has been assessed independently and a focused approach could be used to make gains in water quality in each respective HUC12. Although, focused efforts can and should be made, a comprehensive approach may result in more successful impacts. While the planning area is a contiguous land area, the watersheds represented drain into two separate River systems that converge in Rome. Work to address conservation in one system will not have impacts in the other and this should be considered when working toward basin specific goals. The following proposed program, the East Rome Watersheds Restoration Program (ERWRP), would be an endeavor partially funded by Clean Water Act (§319), NWQI and other grants (and assisted by in-kind donations of stakeholders, agencies, and non-governmental organizations). These funding sources would provide cost-sharing for practices that have been identified as a means to addressing water quality issues. This ERWRP would attempt to raise awareness of the water related issues in the area. It would also work to educate citizens about potential watershed solutions.

8.3.1 Proposed Structural Practices of the East Rome Watersheds Restoration Program

Community stakeholder feedback and data from visual surveys and water quality sampling indicated certain segments are more heavily impacted than others in the watershed. The listed segments as also varied based on historical impacts, PCBs, and current impacts related to things such as nutrients, fecal, and sediment loads. The two river systems and the associated smaller tributaries have a compounding downstream effect and water quality downstream of the planning area should be considered when planning practices and programs of improvement in the ERWRP. Within the respective rive systems the compounding affects are also of note, work in the HUC 12s will most likely have an effect of the HUC that it drains into and as such practices have a stacking benefit. To that point, BMP installations need to be implemented throughout the watershed in order to have the greatest effect. The highest priority restoration areas are identified in the modeling and depicted in the map previously shown in Section Watershed Management Priority Index (Figure 23. Map of WMPI Restoration Priority Index. Higher values indicate lands suitable for restoration or better land management practices to enhance/protect stream quality.These priority areas should be targeted for structural improvements but not limit the scope of the improvement area. Emphasis should be placed on each of the major sources of pollutants which include agriculture, failing septic systems, forestry and stormwater runoff.

Agricultural activity encompasses over 22% of land use within the planning area, based on this, the ERWRP could include a cost-share program that will help local farmers implement conservation practices.

Agricultural conservation practices should focus on reduction in Nutrient transport, fecal coliform loading, and/or sediment contributions to waterways. Grazing operations are a dominant agricultural use in the watershed, as such conservation practices focused on this land use should be prioritized for best results in water quality. Practices related to grazing include fencing, heavy use pads, alternative watering sources, forage enhancements and others as indicated by a positive score in the Conservation Physical Effects Scoring Sheet located in

Appendix . Practices with a positive score, identified in this NRCS developed matrix would reduce water quality impacts in the watershed. Projects that address erosion issues may include vegetative practices or structural improvements. Examples of vegetative improvements would be critical area planting, forested buffer, conservation cover, grassed waterways and others listed on the NRCS priority matrix. Erosion related examples of structural practices would be stream bank stabilizations, fencing, lined waterways and outlets to name a few. One practice of particular note would be riparian plantings either through Forest buffer planting (NRCS code 391) or riparian hedgerow planting (NRCS Code 422). These two practices help to establish shade and filtration that are both needed for stream health and water quality. Buffer condition being one major deficiency identified in both GIS analysis and visual surveys, buffer improvements have been identified as an area for potential high impact improvements. Ultimately, many types of agricultural BMPs will be installed as a part of the ERWRP. Any positively scoring practices identified in the Conservation Practice Physical Effects should be considered. Additionally, consideration should be given for long term impacts and suites of practices that work together for a net Long term positive effect. An example of this may be Forestry practices that incentivize site preparation(negative scoring) with tree establishment (positive, long term effects) The current level of adoption of conservation BMPS in the planning area leaves a large opportunity for improvement. Aside from the UGA extension research farm, along Woodward Creek, few operations have adopted recommended BMPs.

Failing septic systems were not specifically identified by the stakeholder group to be a potential contributor to the fecal coliform bacteria load in the watershed, although it is suspected based on data collected from residential septic repairs. The ERWRP could include a cost-share program to address this issue. High failure rates are said to occur for several reasons, including poorly percolating soils and outdated system. A cost-share program in the area would incentivize system repairs. Cost-share rates could vary according to the proximity of the failure to surface waters, socioeconomic factors, nature of the cost share program or other factors. Higher rates will generally be offered on projects that more significantly reduce pollutant loads.

Portions of the watershed were identified by stakeholders, during the July 2021 meeting, to have impacts from development. These areas are prime locations for the use of storm water management BMPs. Stormwater BMPs such as rain gardens, infiltration basins, bioswales, and other green infrastructure help to reduce the impacts of pulses of stormwater, created by impervious surfaces in developed areas. Offering green infrastructure and stormwater BMP cost-share opportunities to local groups, municipalities, businesses and homeowners would greatly increase the adoption of these practices and could reduce impacts created by development areas. Demonstration of green infrastructure installations would also assist with community adoption through education while reduce the stormwater impacts at the demonstration site.

The Lake Weiss TMDL for nutrient impairment calls for a 30% reduction in total phosphorus loads in the Coosa River at the Georgia-Alabama state line. Segments of planning area streams are not specifically listed for nutrients, due to the lack of water quality standards for nutrients in Georgia, but it should be noted that these segments are within the Upper Coosa drainage. Nutrients and BMPs for addressing nutrients, including Comprehensive Nutrient Management Plans, should be considered within the planning area based on the Upper Coosa TMDL. Specific BMPs for addressing Nutrients transported to surface waters can be found in the *Conservation Physical Effects Index* document located in appendix by referencing the Section, “field sediment, nutrient, and pathogen loss.” Nutrient trading is being studied in the Coosa Basin and may be a viable option for addressing nutrient loading on saturated fields in a nutrient trading program. A 2013 feasibility study of Nutrient trading viability in the Coosa basin is listed in the literature cited section and may serve as a resource in better understanding what a Nutrient trading program in the Coosa drainage may look like. This program is not yet operating but may become an option and should be considered in the future. As of 2021 Georgia EPD has published a guidance document related to building a nutrient trading program and it is expected to become a working program in 2022 and beyond.

8.3.2 Proposed Non-Structural Practices of the East Rome Watershed Restoration Program

As mentioned earlier in this document education and outreach is an important aspect of implementing a restoration plan, and Rome is specifically well positioned with key partners to engage in this key aspect. Additionally, demonstration sites are valuable in showcasing how conservation impacts community waterways and supply. The UGA research farm provides an ideal setting for this kind of demonstration site related to agriculture. Adoption of BMPs often starts with firsthand knowledge of the practices, process, and effects and attending trainings or demonstration sites are ways to develop that kind of firsthand knowledge. Creek clean up days, River floats, adopt-a-stream trainings, field days, workshops and news article are a few examples of effective outreach tools.

Utilizing the above-mentioned tools and methods an outreach plan should be developed for every grant related to improving the watershed. These outreach plans should identify annual or semi-annual events that will be held. The public should be encouraged to participate in the watershed improvement process. Although many of the streams within this watershed may be too small for floats or too remote for effective cleanups, other opportunities to connect community to creeks are possible. As a part of an outreach plan, press releases should be periodically issued to local newspapers or on community social media pages to highlight watershed opportunities as well as watershed issues and solutions. Promotions should also include local presentations to stakeholder groups in order to spawn interest in the restoration efforts 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). Success stories are a great way to publish information about improvements in the watershed and spotlight ongoing efforts.

9 Implementation Program Design

9.1 Management Strategies

Both structural and non-structural controls are the recommended strategic approach for implementing this WMP and managing a program within the watershed to address the fecal coliform and sediment issues. It is the intent of the proposed restoration program (ERWRP) to de-list segments within the watershed through restoration efforts. 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 local county health departments, particularly the Floyd, Gordon and Bartow County Health Departments. The NRCS can assist with technical assistance with respect to agricultural projects. Rome Sewer and Water Division and other stakeholders could assist with streambank projects, green infrastructure installations and water quality sample analysis. 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 a long-term investment of time and significant 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 40% of the critical areas within the watershed can be treated with BMP installations to reduce NPS pollution through the implementation Clean Water Act §319 grants meshed with NWQI grants and other funding. The recommended program, as outlined here, would cumulatively fund just over $1,400,000 worth of projects, excluding landowner contributions, and be implemented over the course of Ten years (including grant proposal submission periods). NQWI funding could be a significant portion of this funding total as the program addresses agricultural BMPs within priority watersheds, of which the 4 HUC 12s of this East Rome Planning area are. This proposed allocation of funds is similar to other restoration efforts that have been funded in the state. This restoration effort is to be a focused effort with priority being given to areas identified in the modeling, as they have the greatest potential impact on the overall water quality of each of the respective watersheds in the panning area. It is believed that multiple stream segments could be de-listed as a result of this effort, although there is a possibility that more funding could be necessary to accomplish that goal. Efforts specifically to address Sediment, nutrients and Fecal loading have the greatest likelihood of delisting.

9.2 Management Priorities Project Fund Allocation

The priorities for effective implementation of this restoration plan corelate to the land uses. As Forestry is already a dominant land use and has been shown to have little in the way of negative impacts on water quality, cost-share programs are to be developed for agricultural BMP installations (including cattle access control, streambank stabilization, riparian enhancement, etc.), septic repairs and pump outs, and stormwater improvement projects. Due to the upstream land use favoring forests and agriculture in this watershed, allocation of potential funds should favor Agricultural BMP's. Based on the segment listings having numerous fecal listings septic system repairs and pump outs should also be given a priority. Stormwater projects such as rain gardens and green infrastructure are appropriate especially in developed areas. All of these priorities can be tied to education and outreach and should be, though education and outreach should also be prioritized as a standalone priority. Adjustments to these priorities can be made when necessary to capitalize on momentum and address needs over time as the plan is implemented.

9.2.1 Cost-Share Rates and Priority Areas

Need and funding availability as well as conservation benefit should all be considered when assessing Agricultural BMPs. The cost share for such BMPs should then be set appropriately. NRCS programs historically have provided conservation cost share between 75% and 90%. NRCS Source Water Protection Priority Watersheds under the 2018 Farm Bill designate specific water quality improvement BMPs to automatically receive 90% cost share. Source water protection priority areas (every watershed in this planning area except Dykes Creek) also receive 90% cost share under the NRCS funding if the practices are priorities for water quality. EPA funded 319 projects in other watersheds in North Georgia have set agricultural cost share rates at 60%, though some have set rates higher in order to incentivize results. Different programs may provide rates that participants see as competing with each other, though the end goal of water quality improvements remains the same across the programs.

The concentration of Urban and suburban land uses in the planning area make stormwater projects a real interest. Historically in 319 projects across the area stormwater projects have been cost-shared upon at a rate of 60%. When the high costs of these practices are prohibitive, 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 biostabilization, and riparian planting projects may contribute to cost-share obligations. On private lands, the cost-shares should incentivize landowners with considerable streambank concerns to act to improve their properties while assistance is available. Additional Funding, while not assisting to reduce the match component, may be available from funders such as the Fish and Wildlife Partners Program. The Partners program is applicable when a priority watershed segment could have positive impacts on threatened or endangered species.

Demand, need and project budget should determine the cost share rate, this rate may be variable, but efforts should be made for consistency, for septic repairs and pump outs. Additionally, consideration should be given to the proximity a failing system has to a stream listed for fecal loads. Higher rates may be justified in hot spots along listed segments, when the budget allows. 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 planning area is necessary to maximize program participation by building important momentum within the local community. As the planning watersheds are broken into 2 separate drainage basins there may not be compounding effects on water quality as has been seen in other projects but the downstream impacts on the Coosa River will still be relevant and the benefits within each respective drainage should be cumulative as you move down stream.

9.3 Interim Milestones

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 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 an agricultural BMP cost-share Prioritization in the watershed.
MILESTONES:

- Hold meetings with the NRCS to review modeling and prioritize appropriate BMPs.
- Advertise the available Programs through local outlets
- Issue success stories

Agricultural BMPs should focus on NRCS designated water quality practices (updated yearly, 31 total as of 2021). Success stories may be developed with the public affairs specialists of funding agencies, nonprofits, or by grant sponsors. 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 #2: Create a septic system repair and pumpout cost-share program in the watershed.

MILESTONES:

- Identify local certified septic system contractors interested in participating in the program.
- Hold meetings with Public Health representatives to design program.
- Establish initial cost-share criteria based on proximity of system to state waters.
- Maintain the septic repair and pumpout program throughout the implementation process.

The repair process should involve the submission of bids from locally owned businesses with an interest in participating on grant projects. The homeowner should be allowed to choose which bid to accept. The rate of cost-share should be considered, when possible, on a sliding scale that will result in offering more assistance to projects that will likely result in the greatest load reductions.

OBJECTIVE #3: Create a Green Infrastructure project cost-share program in the watershed.

MILESTONES:

- Identify potential Green Infrastructure sites with load reduction and outreach as key factors
- Hold meetings with local industries, Utilities, and stormwater experts to consider sites
- Seek to incorporate volunteer or donated labor to cover cost-share contributions for projects.
- Advertise the available opportunities and locations
- Issue press releases for successful stormwater and streambank biostabilization projects.
- Maintain the program throughout the implementation process.

OBJECTIVE #4: Reduce pollution inputs through education and outreach.

MILESTONES:

- Promote activities to the public to learn more about the creek. Such as recreational uses of the creek, hands on educational programs, and citizen science programs.
- Provide volunteer opportunities for the public to assist with stream restoration and cleanup efforts.
- Promote Georgia's Adopt-A-Stream Program through training and resourcing local groups.
- Conduct presentations discussing watershed restoration efforts at local events.
- Publish information to the public about the restoration process and NPS pollution issues and solutions.

Education and outreach should be designed to raise the awareness of citizens in the area through media and "hands-on" events. Programs such as Adopt-a-Stream are an excellent opportunity to promote both the hands-on learning and also encourage ongoing stewardship. Stream cleanups, creek walks/floats, and rain garden and rain barrel 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 engage the public and ultimately lead to agricultural BMP and streambank stabilization projects, as well as septic system repairs.

OBJECTIVE #5: Implement BMPs to achieve load reductions

MILESTONES:

- Identify farmers willing to cost share on agricultural BMP projects
- Identify homeowners within targeted subwatersheds with failing or without proper septic systems.
- Implement septic repairs and pumpouts in the watershed.
- Implement agricultural BMPs in the watershed.
- Implement stormwater BMPs in the watershed.
- Estimate load reductions from projects when possible.
- Implement outreach and education activities

BMPs that address fecal coliform and sediment should be emphasized on agricultural lands. These include activities that restrict cattle access to the stream while providing alternative water sources, stabilize eroding areas, and enhancement of riparian zones. 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 urban sites that experience heavy flows from increased impervious surface cover. Green infrastructure and stormwater projects should be implemented in urban areas or areas with considerable impervious surfaces.

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 with sampling histories.
- Conduct Pre- and Post-BMP monitoring for large agricultural BMP projects near significant streams when appropriate.
- Sample to potentially de-list streams impaired for fecal coliform.
- Initiate WMP revisions.

Baseline data has been collected throughout this planning process at various locations within the watersheds. This data will 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 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 to 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. 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: Engage community leaders regarding stream health in the watershed and community impacts.

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.

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

9.4 Indicators to Measure Progress

Utilizing monitoring data from Adopt-a-stream, partner agencies, and EPD; progress can be quantified. Though quantification of progress is not the only indicator general success in the project, it does help identify areas of improvement in the goal of de-listing segments. Processes of delisting can be accelerated through consistent data gathering and specifically in the case of biota listings consistent monitoring by partners may initiate the de-listing process for EPD. Additional methods of tracking progress could be observed in terms of the number of completed projects (e.g., septic system, agricultural, stormwater, streambank stabilization, etc.), as well as outreach event attendance. It is hoped that the rate of participation 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. Water quality improvements should be monitored 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 delisting of segments impaired for fecal coliform standards. For stream segments impaired for poor biotic diversity, progress may be more difficult to indicate. IBI sampling may be conducted in order to measure changes in the biotic communities. Targeted water quality monitoring may potentially reveal changes that imply conditions for biota have improved over time, but Georgia DNR/EPD will be relied upon IBI scores for fish and macroinvertebrates to determine de-listing.

9.5 Technical Assistance and Roles of Contributing Organizations

The table below indicates partner organizations and roles as they relate in implementation of the ERWRP. Organizations seeking to implement this WMP should rely on technical expertise from the NRCS with respect to agricultural BMP implementation. The North Georgia Public Health District and local county public health departments should be relied upon 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 36. Table of Roles and Responsibilities for the Implementation of this Watershed Management Plan).

Table 36. Table of Roles and Responsibilities for the Implementation of this Watershed Management Plan

Rome Sewer and Water Division	Utility	Provide donated services in order to aid the restoration efforts. Analyze water samples for fecal coliform and TSS concentrations, which will be collected by project partners throughout implementation of this plan.
Gordon County Government	County	Provide local oversight, maps, and assistance
Floyd County Government	County	Provide local oversight, maps, and assistance.
Bartow County Government	County	Provide local oversight, maps, and assistance.
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 biotic monitoring at sites in the watershed that can reveal improvements or de-list impairments. Advise on aquatic resources.
Georgia Environmental Protection Division	State Agency	Administer Clean Water Act Section 319 Grants to provide funding for this restoration program. Conduct monitoring rotations at sites in the watershed for fecal coliform bacteria that can reveal improvements or aid in de-listing efforts.
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	Non-Profit, Community board directed	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. NWQI, EQIP and other Farm Bill program implementation.
North 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 Restoration Project and assist in marketing its outreach efforts.
US Fish and Wildlife Service	Federal Agency	Consult on any project that may potentially impact instream aquatic habitat. Provide Partners funding for eligible sections of the watershed. Provide landscape level plan support for revisions and prioritization. Provide training and data sets for aquatic organisms (SARP)
University of Georgia Cooperative Extension	State Agency	Assist in marketing efforts for program components and outreach events.
Coosa River Basin Initiative	Local Non-profit	Serve as a vehicle to promote the Restoration Project and assist in marketing its outreach efforts
Keep Bartow Beautiful	Bartow County Government	Outreach and education partner as well as advisor on Green Infrastructure
The Nature Conservancy	Nonprofit	Assist in marketing efforts for program components and outreach events.

9.6 Getting Started

Implementation of this watershed management plan could begin upon the approval and adoption of this plan. Impactful BMPs in 40% of the watershed by 2031 has been set as an implementation goal based on prioritization models. Funding may either expedite these goals or slow the process. Modeling for budget purposes was based on a 40% BMP adoption on applicable acres or footages along waterbodies. Education and outreach will be a key component of success in the first three years of implementation as the community is engaged and momentum is built. Multiple funding cycles and sources will be needed to fully realize this 2031 goal. De-listing segments will, ultimately, be a multi-agency, community driven, and multiyear process that is reliant on multiple funding sources.

10 Education and Outreach Strategy

Community participation and engaged stakeholders are needed to sustain any gains in water quality. Education and outreach are critical if the goals of improving the 4 distinct watersheds represented in the ERWRP planning area are to be realized. Strategizing to reach as many residents in the watershed as possible will enhance the education objectives and accomplish the outreach goals. Outreach should create a sense of shared ownership of the waterways. The greater number of participants that engage in the planning and implementation of restoration project, the greater likelihood of overall success.

The following is a list of sample events that could be held in the watershed. Match for grants could be generated through these events through calculating volunteer labor, supplies, or other in-kind donations. Flyers places in locally appropriate grocery stores, restaurants, and farm supply stores are a great way to get the word out, social media posts, partner list servs, and local media outlets are also great outreach options.

- Creek Days and Fishing Derbies
- Educational activities for farmers and citizens about the need for shading in the riparian zone and volunteer stabilization projects.
- Green Infrastructure is important not only for residents, but business and industry in the watershed. Hold workshops and select potential demonstration sites.
- Stormwater Mitigation Plans for industries, and municipalities
- Adopt a Stream workshops and Rivers Alive Clean ups
- Ecotourism: Creek Snorkeling, Creek Tubing, Birdwatching, Wildflower walks, paddling
- Investigate the potential for a Blue Way Trail on navigable waters
- Agricultural Tourism
- Small Farmer/ New farmer education workshops
- Workshops for DIY stream stabilization, rainwater collection systems, and green infrastructure.
- Litter awareness campaign with County or city governments or nonprofit partners
- Educational activities with scouts, 4H, Church youth groups and at schools.

The following described activities could also be done either with partners or though volunteerism.

Riparian Tree Plantings

Flyers and press releases would advertise the availability of trees and live stakes to be planted along streams in the 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. Outreach through clubs and school groups could offer digital training options for property owners on how to plant riparian areas. Riparian tree planting events with volunteers could also be held on the banks of streams and creeks in the watershed. The primary purpose would be to utilize volunteer labor to plant trees in an effort to increase the riparian buffer within the watershed, but also to increase education concerning the watershed. Community buffer planting events can aid in promoting the overall restoration of the watershed through informational literature and digital media.

Rain barrel and Rain Garden Workshops

This project is particularly of interest for the urbanized areas of the planning area and could be accomplished in partnership with the ECO center. Rain barrel workshops and classes offer citizens an opportunity to create their own BMP and learn about their watershed in the process. In the past, these events have generated overwhelming interest from local communities, and have attracted the most enthusiastic volunteers. Furthermore, rain barrels, or other rainwater collection devices, are desired by a diverse array of citizens including both farmers and homeowners, which is the exact demographic that is needed to implement BMPs on residential and agricultural lands. For the purposes of conducting outreach through a 319(h) grant project, this outreach activity would have the primary objective of incentivizing rain barrel construction and installation to reduce NPS pollution but would also serve as the sounding board from which to advertise other 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 specific water quality issues (with watershed map visual aids), and the opportunity to work to construct and take home a rain barrel for their home or barn. 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. Additionally, raingarden classes could demonstrate to citizens how landscaping and water can be integrated together in a manner that is both aesthetic and functional.

Adopt-A-Stream Workshops

Workshops focused on the Adopt-A-Stream curriculum help local citizens, groups and clubs engage in citizen science through an organized program. The data collected can be logged and utilized on the Adopt-A-Stream website for future use and provides the individuals collecting data with a sense of valuable contribution. Workshops can be held along creeks, at parks or anywhere surface water is available for demonstration of techniques. Educational workshops such as Adopt-A-Stream are important to engage interested citizens but also to educate citizens about the health or their watershed. Workshops and educational presentations such as Adopt-A-Stream should be a part of any grant outreach plan.

River’s Alive Cleanup

Rivers Alive cleanup events could be established across the planning area and beyond in order to provide outreach activities for volunteers in the local communities. This type of outreach is flexible and can allow for socially distanced contributions to the project as volunteers work within family groups or social pods. Many sites could be set up and volunteers report or log in through digital signup sheets or at selected trash collection drop off sites. Educational materials should be made available at each event or in the digital signup sheet to inform volunteers about the restoration project, any grants currently underway, and ways they can continue to help.

Water Quality Monitoring and Stream Cleanup Canoe Floats

Planned canoe floats with groups such as the New Echota River Alliance could be planned to pick up trash or offer educational programs. CRBI also offers canoe programs that could be focused on specific topics, fundraising for projects, or training. Adopt-a-stream training have been offered at the ECO center in the past and should be periodically in the future. These events and programs can be critical in engaging citizen scientist for monitoring effort but also raising interest in the waterways and the health of the community/ ecosystems. Volunteer labor and donated material values should be recorded and reported as matching funds for any applicable 319 grants.

11 Implementation Plan

Table 37. Implementation Timeline

Timeline: 12 years. 4 phases. First application for funding to be submitted summer of 2022.

	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Apply for funding	X			x			x			x		
Agricultural BMP installation		x	x	x	x	x	x	x	x	x	x	x
Stormwater BMP installation			x		x		x	x	x	x	x	x
Septic Tank rehab		x	x	x	x	x	x	x	x	x	x	
Streambank stabilization			x	x	x	x	x	x	x		x	
Nutrient Management plans		x	x	x	x	x	x	x	x	x		
Native species replanting in buffer zones and at park		x	x	x	x	x	x	x	x	x		
AAS training and network		x		x		x		x		x		x
Rivers Alive Cleanup	x	x	x	x	x	x	x	x	x	x	x	x
Education and Outreach activities	x	x	x	x	x	x	x	x	x	x	x	x
Reevaluate plan and update						x					x	

11.1 Estimates of Funding

Using data compiled for the development of this Watershed Management Plan, the following budget illustrates a comprehensive approach to watershed restoration and possible funding required to meet those goals. Because the watersheds in this WMP are adjacent and not part of one watershed, a summary budget (Table 38) table as well as individual budgets for each subwatershed (

Table 39-Table 42) are included below. Individual budgets are intended to streamline proposals for organizations planning to apply for funding in one subwatershed as opposed to the entire ERWPA.

Funding needs specifically targeted at NWQI Agricultural BMPs, focused on water quality, have been estimated at $70,000 per year minimum across the four-watershed area in order to begin addressing needs. Additional funding with less specifically targeted water quality goals may also benefit the watersheds but key NRCS practices were selected for the budget estimation based on known land uses within the watersheds and scores from the Conservation practice effects index (appendix A).

Table 38. Summary Implementation Budget for Four HUC-12 Subwatersheds Outlined in this WMP.

Agricultural BMP- Name (Code)	City of Rome-Etowah River	Oostanaula River - Dozier Creek	Dykes Creek	Woodward Creek
Fencing (382)	$54,924	$46,944	$32,857	$103,324
Watering Facility (614)	$39,832	$25,079	$16,228	$45,733
Heavy Use Area- Rock on geotextile (561)	$51,435	$32,385	$20,955	$59,055
Livestock Pipeline (516)	$23,895	$15,045	$9,735	$27,435
Riparian Forest Buffer (391)	$55,066	$26,640	$11,822	$24,187
Riparian Herbaceous cover (390)	$9,774	$11,821	$5,246	$10,733
Hedgerow Planting- Riparian Scenario (420)	$29,355	$35,503	$15,756	$32,234
Comprehensive Nutrient Management Plans (102)	$21,902	$27,876	$14,933	$79,446
Subtotal	$286,184	$221,293	$127,533	$382,146
Typical Cost-Share	75%	75%	75%	75%
Total Agricultural Treatment Cost	$214,638	$165,969	$95,649	$286,609
Septic System BMPs				
Conventional System Repair	$87,500	$87,500	$87,500	$87,500
Experimental System Installation	$21,000	$21,000	$21,000	$35,000
Subtotal	$108,500	$108,500	$108,500	$122,500
Typical cost-Share	50%	50%	50%	50%
Total Septic Treatment Cost	$54,250	$54,250	$54,250	$61,250
Green Infrastructure BMPs				
Conventional Stormwater Treatment	$160,000	$90,000	$60,000	$60,000
Experimental Stormwater Treatment	$150,000	$50,000	$30,000	$30,000
Subtotal	$310,000	$140,000	$90,000	$90,000
Typical cost-Share	60%	60%	60%	60%
Total GI Treatment Cost	$186,000	$84,000	$54,000	$54,000
Education and Outreach				

Education and Outreach Programs	$32,000	$32,000	$32,000	$32,000
Subtotal	$32,000	$32,000	$32,000	$32,000
Typical cost-Share	60%	60%	60%	60%
Total Education & Outreach	$19,200	$19,200	$19,200	$19,200
Total Watershed Treatment Cost Excluding Landowner Contributions (Cost-Share)	**$474,088**	**$323,419**	**$223,099**	**$421,059**

Table 39. Implementation Budget for the City of Rome- Etowah River Subwatershed (HUC 031501041606)

Agricultural BMP- Name (Code)	Quantity	Cost/Unit*	Total Cost
Fencing (382)	36,134	$1.52	$54,924
Watering Facility (614)	27	$1,475.25	$39,832
Heavy Use Area- Rock on geotextile (561)	40,500	$1.27	$51,435
Livestock Pipeline (516)	13,500	$1.77	$23,895
Riparian Forest Buffer (391)	88	$622.65	$55,066
Riparian Herbaceous cover (390)	18	$552.61	$9,774
Hedgerow Planting- Riparian Scenario (420)	23,114	$1.27	$29,355
Comprehensive Nutrient Management Plans (102)	4	$4,977.80	$21,902
Subtotal			$286,184
Typical Cost-Share			75%
Total Agricultural Treatment Cost			$214,638
Septic System BMPs	**Quantity**	**Cost/Unit**	**Total Cost**
Conventional System Repair	25.00	$ 3,500.00	$87,500
Experimental System Installation	3	$ 7,000.00	$21,000
Subtotal			$108,500
Typical cost-Share			50%
Total Septic Treatment Cost			$54,250
Green Infrastructure BMPs	**Quantity**	**Cost/Unit**	**Total Cost**
Conventional Stormwater Treatment	8.00	$ 20,000.00	$160,000
Experimental Stormwater Treatment	3	$ 50,000.00	$150,000
Subtotal			$310,000
Typical cost-Share			60%
Total GI Treatment Cost			$186,000
Education and Outreach	**Quantity**	**Cost/Unit**	**Total Cost**
Education and Outreach Programs	4.00	$ 8,000.00	$32,000
Subtotal			$32,000
Typical cost-Share			60%
Total Education & Outreach			$19,200
Total Watershed Treatment Cost Excluding Landowner Contributions (Cost-Share)			**$474,088**

*Cost/Unit based on 2021 NRCS Georgia Planning Estimator

Table 40. Implementation Budget for the Dozier Creek - Oostanaula River Subwatershed (HUC 031501030603)

Agricultural BMP- Name (Code)	Quantity	Cost/Unit*	Total Cost
Fencing (382)	30,884	$1.52	$46,944
Watering Facility (614)	17	$1,475.25	$25,079
Heavy Use Area- Rock on geotextile (561)	25,500	$1.27	$32,385
Livestock Pipeline (516)	8,500	$1.77	$15,045
Riparian Forest Buffer (391)	43	$622.65	$26,640
Riparian Herbaceous cover (390)	21	$552.61	$11,821
Hedgerow Planting- Riparian Scenario (420)	27,955	$1.27	$35,503
Comprehensive Nutrient Management Plans (102)	6	$4,977.80	$27,876
Subtotal			$221,293
Typical Cost-Share			75%
Total Agricultural Treatment Cost			$165,969
Septic System BMPs	**Quantity**	**Cost/Unit**	**Total Cost**
Conventional System Repair	25.00	$ 3,500.00	$87,500
Experimental System Installation	3	$ 7,000.00	$21,000
Subtotal			$108,500
Typical cost-Share			50%
Total Septic Treatment Cost			$54,250
Green Infrastructure BMPs	**Quantity**	**Cost/Unit**	**Total Cost**
Conventional Stormwater Treatment	3.00	$ 30,000.00	$90,000
Experimental Stormwater Treatment	1	$ 50,000.00	$50,000
Subtotal			$140,000
Typical cost-Share			60%
Total GI Treatment Cost			$84,000
Education and Outreach	**Quantity**	**Cost/Unit**	**Total Cost**
Education and Outreach Programs	4.00	$ 8,000.00	$32,000
Subtotal			$32,000
Typical cost-Share			60%
Total Education & Outreach			$19,200
Total Watershed Treatment Cost Excluding Landowner Contributions (Cost-Share)			**$323,419**

*Cost/Unit based on 2021 NRCS Georgia Planning Estimator

Table 41. Implementation Budget for the Dykes Creek Subwatershed (HUC 031501046004)

Agricultural BMP- Name (Code)	Quantity	Cost/Unit*	Total Cost
Fencing (382)	21,617	$1.52	$32,857
Watering Facility (614)	11	$1,475.25	$16,228
Heavy Use Area- Rock on geotextile (561)	16,500	$1.27	$20,955
Livestock Pipeline (516)	5,500	$1.77	$9,735
Riparian Forest Buffer (391)	19	$622.65	$11,822
Riparian Herbaceous cover (390)	9	$552.61	$5,246
Hedgerow Planting- Riparian Scenario (420)	12,406	$1.27	$15,756
Comprehensive Nutrient Management Plans (102)	3	$4,977.80	$14,933
Subtotal			$127,533
Typical Cost-Share			75%
Total Agricultural Treatment Cost			$95,649
Septic System BMPs	**Quantity**	**Cost/Unit**	**Total Cost**
Conventional System Repair	25.00	$ 3,500.00	$87,500
Experimental System Installation	3	$ 7,000.00	$21,000
Subtotal			$108,500
Typical cost-Share			50%
Total Septic Treatment Cost			$54,250
Green Infrastructure BMPs	**Quantity**	**Cost/Unit**	**Total Cost**
Conventional Stormwater Treatment	3.00	$ 20,000.00	$60,000
Experimental Stormwater Treatment	1	$ 30,000.00	$30,000
Subtotal			$90,000
Typical cost-Share			60%
Total GI Treatment Cost			$54,000
Education and Outreach	**Quantity**	**Cost/Unit**	**Total Cost**
Education and Outreach Programs	4.00	$ 8,000.00	$32,000
Subtotal			$32,000
Typical cost-Share			60%
Total Education & Outreach			$19,200
Total Watershed Treatment Cost Excluding Landowner Contributions (Cost-Share)			**$223,099**

Table 42. Implementation Budget for the Woodward Creek Subwatershed (HUC 031501030602)

Agricultural BMP- Name (Code)	Quantity	Cost/Unit*	Total Cost
Fencing (382)	67,976	$1.52	$103,324
Watering Facility (614)	31	$1,475.25	$45,733
Heavy Use Area- Rock on geotextile (561)	46,500	$1.27	$59,055
Livestock Pipeline (516)	15,500	$1.77	$27,435
Riparian Forest Buffer (391)	39	$622.65	$24,187
Riparian Herbaceous cover (390)	19	$552.61	$10,733
Hedgerow Planting- Riparian Scenario (420)	25,381	$1.27	$32,234
Comprehensive Nutrient Management Plans (102)	16	$4,977.80	$79,446
Subtotal			$382,146
Typical Cost-Share			75%
Total Agricultural Treatment Cost			$286,609
Septic System BMPs	**Quantity**	**Cost/Unit**	**Total Cost**
Conventional System Repair	25.00	$ 3,500.00	$87,500
Experimental System Installation	5	$ 7,000.00	$35,000
Subtotal			$122,500
Typical cost-Share			50%
Total Septic Treatment Cost			$61,250
Green Infrastructure BMPs	**Quantity**	**Cost/Unit**	**Total Cost**
Conventional Stormwater Treatment	3.00	$ 20,000.00	$60,000
Experimental Stormwater Treatment	1	$ 30,000.00	$30,000
Subtotal			$90,000
Typical cost-Share			60%
Total GI Treatment Cost			$54,000
Education and Outreach	**Quantity**	**Cost/Unit**	**Total Cost**
Education and Outreach Programs	4.00	$ 8,000.00	$32,000
Subtotal			$32,000
Typical cost-Share			60%
Total Education & Outreach			$19,200
Total Watershed Treatment Cost Excluding Landowner Contributions (Cost-Share)			**$421,059**

*Cost/Unit based on 2021 NRCS Georgia Planning Estimator

Table 43. A display of estimated financial requests for each of four multi-year 319 or NWQI grants sought by an organization attempting comprehensive watershed restoration. The proportions are derived by stakeholder recommendations, and the amounts were estimated using local knowledge, EPA statistics, NRCS cost estimates, and GIS analysis.

	Agricultural BMP and Stream bank	Septic System Rehab	Green Infrastructure and Urban Streambank
Proposal 1 - 2021	$228,860	$67,200	$113,400
Proposal 2 - 2024	$228,860	$67,200	$113,400
Proposal 3- 2027	$152,573	$44,800	$75,600
Proposal 4- 2030	$152,573	$44,800	$75,600
Total	**$762,866**	**$224,000**	**$378,000**

12 Summary of Nine Elements

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 Rome Planning Area has streams that fail to meet the criteria within the State of Georgia for pathogens and impacted biota, which respectively tend to result from fecal contamination and excessive sediment loads. Load reductions of these pollutants are necessary in three 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. Residential, urban, suburban, and agricultural populations daily contribute to NPS pollution in many cultural ways as well through habits, routines and practices. These non-structural and non-landscape driven NPS contributions are addressed through educational and outreach efforts outlined throughout this plan.

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 Load Reductions. 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 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 Existing Conservation Programs and Section Proposed Conservation Program for the Planning Area Watershed. WMP implementation will also aim to execute additional structural controls to include some combination of the agricultural practices, streambank stabilization efforts, stormwater infiltration measures 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 watershed.

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. 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 Natural Resource Conservation Service NWQI grants, Environmental Protection Agency (EPA) Section 319 grants administered by the Georgia Environmental Protection Division (EPD), in conjunction with in-kind services from Floyd County, North Georgia Health District, County Health Departments, landowners, 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 Education and Outreach Strategy. The more successful programs should remain standard practices for the duration of the implementation process. The recommended educational programs focus on water quality monitoring, green infrastructure demonstration, septic system maintenance, and stream cleanups, among others. Additional programs should be designed and implemented as necessary.

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

The proposed implementation schedule is found in Section Implementation Plan and initially estimates implementation activities to occur through 2030. 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 Interim Milestones. 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 entire Rome Planning Area. 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 2025 to evaluate successes and adaptations to the initial management measures recommended in this WMP. Section Indicators to Measure Progress 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. A partnership between EPA and NRCS has established monitoring schedules for NWQI watersheds that will also serve to monitor water quality improvements and better help track progress and inform adjustments that maybe needed, particularly in the agricultural implementation of BMPs.

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

In Section Indicators to Measure Progress, 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 Existing Conservation Programs) 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.

13 Glossary of Acronyms

AAS - Adopt-A-Streams

BMP - Best Management Practice

CNMP - Comprehensive Nutrient Management Plan

CRBI- Coosa River Basin Initiative

DNR - Department of Natural Resources

EPA - Environmental Protection Agency

EPD - Environmental Protection Division

GIS - Geographic Information Systems

IBI - Index of Biotic Integrity

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

TP- Total Phosphorus

WMP - Watershed Management Plan

NWQI- National Water Quality Incentive

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15 Appendix A

15.1.1 Conservation Effects Scoring Sheet

Conservation Practice Physical Effects

Legend to practice physical effects quantities found on page 6.

SWAPA+E	CART Category ↓	Resource Concern ↓ / Practice Name →	Access Control	Access Road	Agrichemical Handling Facility	Amendments for Treatment of Agricultural Waste	Animal Mortality Facility	Aqua-culture Ponds	Aquatic Organism Passage	Bedding	Brush Manage-ment	Building Envelope Improve-ment	Channel Bed Stabiliz-ation	Clearing & Snagging	Combustion System Improvement	Composting Facility	Conservation Cover	Conservation Crop Rotation	Constructed Wetland	Contour Buffer Strips	Contour Farming	Contour Orchard and Other Perennial Crops	Controlled Traffic Farming	Cover Crop	Critical Area Planting	Dam
		Practice Code →	472	560	309	591	316	397	396	310	314	672	584	326	372	317	327	328	656	332	330	331	334	340	342	402
Soil	Wind and water erosion	Sheet and rill erosion	3	1	0	0	0	0	0	2	1	0	0	0	0	0	4	4	0	3	2	4	0	4	5	0
		Wind erosion	1	0	0	0	0	0	0	0	1	0	0	0	0	0	4	4	0	0	0	0	0	4	5	0
	Concentrated erosion	Ephemeral gully erosion	4	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	3	5	0
		Classic gully erosion	4	1	0	0	0	0	0	0	1	0	2	0	0	0	1	0	0	0	0	0	0	0	4	2
		Bank erosion from streams, shorelines or water conveyance channels	5	0	0	0	0	0	0	0	0	0	2	2	0	0	1	0	0	0	0	0	0	0	4	1
	Soil quality limitations	Subsidence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Compaction	4	2	0	0	0	0	0	-1	0	0	0	0	0	0	3	2	0	0	0	0	4	2	2	0
		Organic matter depletion	1	0	0	1	0	0	0	-1	0	0	0	0	0	0	5	4	0	2	1	2	0	2	5	0
		Concentration of salts or other chemicals	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	-1
		Soil organism habitat loss or degradation	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	2	2	1	1
		Aggregate instability	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	1	2	1	2
Water	Weather resilience	Naturally available moisture use	3	0	0	0	0	0	0	-1	2	0	0	0	0	0	0	1	0	0	1	2	1	1	0	0
		Ponding and flooding	1	1	0	0	0	0	0	5	1	0	2	2	0	0	1	1	2	1	1	1	0	2	0	2
		Seasonal high water table	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	-1	-1	-1	0	1	0	-1
		Seeps	1	0	0	0	0	0	0	0	0	0	2	0	0	0	1	1	0	-2	-2	-2	0	1	0	-2
	Source water depletion	Surface water depletion	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	2
		Groundwater depletion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Inefficient irrigation water use	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	2
	Field sediment, nutrient and pathogen loss	Nutrients transported to surface water	1	0	0	2	2	-2	0	-2	0	0	0	0	0	2	4	2	4	2	2	2	0	2	2	0
		Nutrients transported to groundwater	1	0	0	2	2	-2	0	1	0	0	0	0	0	2	4	2	1	-1	-1	-1	0	2	2	-1
		Pathogens and chemicals from manure, biosolids or compost applications tranported to surface water	1	0	0	2	2	-2	0	-2	0	0	0	0	0	2	1	1	4	1	1	0	0	1	0	-2
		Pathogens and chemicals from manure, biosolids or compost applications tranported to groundwater	1	0	0	2	2	0	0	1	0	0	0	0	0	2	1	0	3	-1	0	0	0	2	0	0
		Sediment tansported to surface water	3	1	0	0	0	0	0	-1	2	0	1	-2	0	2	4	2	5	2	2	2	0	2	4	2
	Field pesticide loss	Pesticides transported to surface water	1	0	0	0	0	0	0	-2	-1	0	0	0	0	0	2	2	2	2	1	1	0	2	0	0
		Pesticides transported to groundwater	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	1	1	0	-1	-1	0	2	0	0
	Storage and handling of pollutants	Nutrients transported to surface water	1	0	0	2	2	-2	0	-2	0	0	0	0	0	2	4	2	4	2	2	2	0	2	2	0
		Nutrients transported to groundwater	1	0	0	2	2	-2	0	1	0	0	0	0	0	2	4	2	1	-1	-1	-1	0	2	2	-1
		Petroleum, heavy metals and other pollutants transported to surface water	1	0	0	2	0	0	0	-2	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
		Petroleum, heavy metals and other pollutants transported to groundwater	1	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Air	Air quality emissions	Emissions of airborne reactive nitrogen	1	0	1	4	0	0	0	-1	0	2	0	0	4	1	1	0	0	0	0	0	0	1	0	0
		Emissions of greenhouse gasses - GHGs	1	0	0	1	1	0	0	-1	1	2	0	0	2	1	4	1	1	1	0	1	0	4	1	0
		Emissions of ozone precursors	1	0	1	1	-1	0	0	-1	0	2	0	0	4	1	1	0	0	0	0	0	0	0	0	0
		Emissions of particulate matter (PM) and PM precursors	2	2	1	3	0	0	0	-1	0	2	0	0	4	1	2	1	0	1	0	0	0	3	2	0
		Objectionable odor	0	0	0	4	3	0	0	0	0	0	0	0	0	3	0	0	-1	0	0	0	0	0	0	0
Plant	Pest pressure	Plant pest pressure	5	0	0	0	0	1	0	-1	4	0	4	1	0	1	3	3	-2	3	0	3	0	4	4	0
	Degraded plant condition	Plant productivity and health	3	2	0	1	0	0	0	2	2	0	2	0	0	0	4	3	0	2	1	1	1	3	5	0
		Plant structure and composition	4	0	0	0	0	0	0	0	4	0	4	0	0	0	4	1	4	5	0	0	1	4	4	0
	Fire management	Wildfire hazard from biomass accumulation	3	4	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Animal	Livestock production limitation	Feed and forage balance	3	0	0	0	0	0	0	0	4	0	0	0	0	0	0	2	0	1	0	0	0	2	0	0
		Inadequate livestock shelter	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Inadequate livestock water quantity, quality and distribution	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	Terrestrial habitat	Terrestrial habitat for wildlife and invertebrates	4	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	1	1	2	1
	Aquatic habitat	Aquatic habitat for fish and other organisms	1	0	0	0	0	1	4	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0	1	2
		Elevated water temperature	3	0	0	0	0	-2	2	0	0	0	1	-1	0	0	1	0	0	0	0	0	0	0	0	0
Energy	Inefficient energy use	Energy efficiency of equipment and facilities	0	0	0	2	0	0	0	0	0	5	0	0	4	0	0	0	0	0	0	0	0	0	0	0
		Energy efficiency of farming/ ranching practices and field operations	0	1	0	1	0	0	0	0	0	0	0	0	1	2	1	1	0	1	1	1	0	1	0	0

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Conservation Practice Physical Effects

Legend to practice physical effects quantities found on page 6.

SWAPA+E	CART Category ↓	Resource Concern ↓ / Practice Name →	Deep Tillage	Dike	Diversion	Drainage Water Management	Dry Hydrant	Early Successional Habitat Development/ Mgt	Emergency Animal Mortality Management	Farmstead Energy Improvement	Fence	Field Border	Filter Strip	Fire-break	Fish Raceway or Tank	Fishpond Management	Forage Harvest Management	Forest Stand Improvement	Forest Trails and Landings	Grade Stabilization Structure	Grassed Waterway	Ground-water Testing	Heavy Use Area Protection	Hedge-row Planting	Herbaceous Weed Treatment	High Tunnel System	Irrigation Pipeline
		Practice Code→	324	356	362	554	432	647	368	374	382	386	393	394	398	399	511	666	655	410	412	355	561	422	315	325	430
Soil	Wind and water erosion	Sheet and rill erosion	1	0	1	0	0	0	0	0	1	4	4	-1	0	0	1	1	-1	0	0	0	2	0	4	0	0
		Wind erosion	0	0	0	2	0	0	0	0	0	4	4	-1	0	0	1	0	0	0	0	0	2	1	4	0	0
	Concentrated erosion	Ephemeral gully erosion	0	0	2	0	0	0	0	0	0	1	1	-1	0	0	0	1	-1	0	5	0	2	0	2	-1	0
		Classic gully erosion	0	1	2	0	0	0	0	0	0	0	0	-1	0	0	0	1	-1	2	4	0	2	0	2	0	2
		Bank erosion from streams, shorelines or water conveyance channels	0	-2	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2	1	0	0	0	4	0	0
	Soil quality limitations	Subsidence	-1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Compaction	5	0	0	-1	0	0	0	0	1	2	2	-2	0	0	3	-1	1	0	0	0	1	1	0	0	0
		Organic matter depletion	-4	0	0	2	0	0	0	0	0	4	4	-2	0	0	1	1	-1	0	3	0	0	2	0	0	0
		Concentration of salts or other chemicals	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0
		Soil organism habitat loss or degradation	1	0	0	0	0	0	0	0	1	2	1	-2	0	0	1	1	-1	2	2	0	-2	0	1	0	0
		Aggregate instability	1	0	0	0	0	0	0	0	1	1	1	-2	0	0	1	1	-1	2	3	0	1	0	1	0	0
Water	Weather resilience	Naturally available moisture use	2	0	2	0	-1	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	-1	0
		Ponding and flooding	0	2	2	-2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	3	0	-1	0	0	-3	0
		Seasonal high water table	2	-1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1
		Seeps	-2	-1	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Source water depletion	Surface water depletion	0	1	-1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	2	0	0
		Groundwater depletion	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	-1	0	-1	0	1	0	0
		Inefficient irrigation water use	2	0	2	0	-1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	3
	Field sediment, nutrient and pathogen loss	Nutrients transported to surface water	1	0	3	1	0	0	2	0	0	2	5	0	-1	0	1	1	1	0	2	0	1	2	0	0	1
		Nutrients transported to groundwater	-2	0	1	-1	0	0	2	0	0	1	2	0	-1	-2	0	2	0	0	0	0	0	0	0	0	0
		Pathogens and chemicals from manure, biosolids or compost applications tranported to surface water	0	0	1	1	0	0	2	0	2	1	3	0	-1	0	1	1	0	0	1	0	2	0	0	0	1
		Pathogens and chemicals from manure, biosolids or compost applications tranported to groundwater	0	0	0	1	0	0	2	0	0	0	1	0	-1	0	0	1	0	0	0	0	0	0	0	0	1
		Sediment tansported to surface water	0	0	2	0	0	0	0	0	0	2	5	-1	0	0	0	0	0	2	5	0	2	0	0	-1	1
	Field pesticide loss	Pesticides transported to surface water	0	2	1	2	0	0	0	0	0	2	2	0	0	0	2	0	0	0	2	0	0	1	-1	0	0
		Pesticides transported to groundwater	0	2	1	2	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Storage and handling of pollutants	Nutrients transported to surface water	1	0	3	1	0	0	2	0	0	2	5	0	-1	0	1	1	1	0	2	0	1	2	0	0	1
		Nutrients transported to groundwater	-2	0	1	-1	0	0	2	0	0	1	2	0	-1	-2	0	2	0	0	0	0	0	0	0	0	0
		Petroleum, heavy metals and other pollutants transported to surface water	0	0	1	2	0	0	0	0	0	0	4	0	0	0	1	1	0	0	1	0	0	0	0	0	0
		Petroleum, heavy metals and other pollutants transported to groundwater	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Air	Air quality emissions	Emissions of airborne reactive nitrogen	-1	0	0	0	0	0	-1	2	0	1	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0
		Emissions of greenhouse gasses - GHGs	-1	0	0	1	0	0	1	2	1	2	1	1	0	0	0	2	0	0	1	0	0	1	1	0	0
		Emissions of ozone precursors	-1	0	0	0	0	0	-1	2	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
		Emissions of particulate matter (PM) and PM precursors	-2	0	0	2	0	0	0	2	0	2	1	1	0	0	0	1	0	0	0	0	2	2	0	0	0
		Objectionable odor	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Plant	Pest pressure	Plant pest pressure	0	0	0	0	0	4	0	0	0	0	0	-1	0	4	0	3	1	0	4	0	0	4	4	0	0
	Degraded plant condition	Plant productivity and health	2	0	2	2	0	4	0	0	2	5	2	3	0	4	1	5	1	0	5	0	0	2	2	2	2
		Plant structure and composition	0	0	0	0	0	4	0	0	0	5	2	0	0	4	1	5	0	0	4	0	0	5	4	0	0
	Fire management	Wildfire hazard from biomass accumulation	0	0	0	0	2	0	0	0	0	0	0	5	0	0	0	5	3	0	0	0	0	0	1	0	0
Animal	Livestock production limitation	Feed and forage balance	2	0	0	4	0	1	0	0	3	0	0	0	0	0	2	2	1	0	1	0	0	0	4	0	0
		Inadequate livestock shelter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
		Inadequate livestock water quantity, quality and distribution	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Terrestrial habitat	Terrestrial habitat for wildlife and invertebrates	0	0	0	0	0	5	0	0	1	1	1	1	0	0	1	2	0	1	1	0	0	2	1	0	0
	Aquatic habitat	Aquatic habitat for fish and other organisms	0	-1	0	0	0	0	0	0	0	2	4	1	1	4	0	1	1	1	1	0	0	0	0	0	0
		Elevated water temperature	0	0	0	0	0	-2	0	-2	0	0	0	0	-1	0	0	1	0	0	0	0	0	1	0	0	0
Energy	Inefficient energy use	Energy efficiency of equipment and facilities	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
		Energy efficiency of farming/ ranching practices and field operations	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	0	1	0	1	0	0	0	0

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Conservation Practice Physical Effects

Legend to practice physical effects quantities found on page 6.

SWAPA+E	CART Category ↓	Resource Concern ↓ / Practice Name →	Irrigation Reservoir	Irrigation System, Micro-irrigation	Irrigation Water Management	Karst Sinkhole Treatment	Land Clearing	Land Smoothing	Lighting System Improvement	Lined Waterway or Outlet	Livestock Pipeline	Livestock Shelter Structure	Mulching	Nutrient Management	Obstruction Removal	Open Channel	Pasture and Hay Planting	Pest Management Conservation System	Pond	Pond Sealing or Lining, Compacted Soil Treatment	Pond Sealing or Lining, Flexible Membrane	Prescribed Burning	Prescribed Grazing	Pumping Plant	Recreation Area Improvement	Recreation Land Grading and Shaping
		Practice Code→	436	441	449	527	460	466	670	468	516	576	484	590	500	582	512	595	378	520	521A	338	528	533	562	566
Soil	Wind and water erosion	Sheet and rill erosion	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	2	0	0	0	2	4	0	1	0
		Wind erosion	0	0	2	0	0	0	0	0	0	0	4	0	0	0	1	2	0	0	0	2	4	0	1	0
	Concentrated erosion	Ephemeral gully erosion	0	0	0	4	0	1	0	5	0	0	0	0	0	0	0	2	0	0	0	1	3	0	1	0
		Classic gully erosion	2	0	0	4	0	0	0	2	0	0	0	0	0	0	0	2	2	0	0	1	1	0	1	4
		Bank erosion from streams, shorelines or water conveyance channels	1	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	1	0	0	1	3	0	1	2
	Soil quality limitations	Subsidence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	2	0	0
		Compaction	0	0	0	0	-1	-2	0	0	0	0	0	-1	-1	0	2	2	0	0	0	0	2	0	1	0
		Organic matter depletion	0	0	1	0	-3	-2	0	0	0	0	1	2	1	0	1	2	0	0	0	1	4	0	1	1
		Concentration of salts or other chemicals	0	1	2	2	0	-1	0	0	0	0	1	4	0	0	0	0	-1	1	1	-1	2	0	0	0
		Soil organism habitat loss or degradation	0	0	0	0	-3	-3	0	0	0	0	1	0	0	0	3	2	0	0	0	0	2	0	1	-3
		Aggregate instability	0	0	0	0	-4	-4	0	1	0	0	1	0	0	2	3	0	0	0	0	0	2	0	1	-3
Water	Weather resilience	Naturally available moisture use	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	2	2	2	0	2	2	0	0
		Ponding and flooding	2	2	0	-2	-1	2	0	2	0	0	1	0	0	5	1	0	2	0	0	1	1	2	1	2
		Seasonal high water table	-1	2	1	0	0	2	0	2	0	0	-1	0	0	2	0	0	-1	2	2	0	0	2	0	0
		Seeps	-1	2	0	0	0	2	0	2	0	0	-1	0	0	1	0	0	-2	1	1	0	0	2	0	0
	Source water depletion	Surface water depletion	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3	0	2	0	0	0	1	0	0	0
		Groundwater depletion	0	0	0	0	-2	0	0	-1	0	0	1	0	0	2	3	0	1	0	0	0	1	0	0	0
		Inefficient irrigation water use	2	4	5	0	0	2	0	0	0	0	2	0	0	0	0	0	2	2	2	0	0	2	0	0
	Field sediment, nutrient and pathogen loss	Nutrients transported to surface water	0	2	2	2	-1	1	0	0	0	3	2	5	0	-1	1	0	2	2	2	2	1	0	0	0
		Nutrients transported to groundwater	-1	2	2	2	0	2	0	2	0	0	0	5	0	0	0	0	-1	2	2	1	1	0	0	0
		Pathogens and chemicals from manure, biosolids or compost applications tranported to surface water	0	2	2	2	-1	0	0	0	0	2	0	4	0	0	1	0	-2	0	0	0	1	0	0	0
		Pathogens and chemicals from manure, biosolids or compost applications tranported to groundwater	0	1	2	2	0	0	0	0	0	0	0	4	0	0	0	0	0	2	2	0	1	0	0	0
		Sediment tansported to surface water	2	1	2	2	-1	1	0	5	0	2	2	0	0	0	1	2	2	0	0	1	2	0	1	2
	Field pesticide loss	Pesticides transported to surface water	0	2	2	2	-1	1	0	0	0	0	2	0	0	0	1	5	0	0	0	0	2	0	1	0
		Pesticides transported to groundwater	0	2	2	2	0	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1	0	1	0
	Storage and handling of pollutants	Nutrients transported to surface water	0	2	2	2	-1	1	0	0	0	3	2	5	0	-1	1	0	2	2	2	2	1	0	0	0
		Nutrients transported to groundwater	-1	2	2	2	0	2	0	2	0	0	0	5	0	0	0	0	-1	2	2	1	1	0	0	0
		Petroleum, heavy metals and other pollutants transported to surface water	0	1	2	0	-1	0	0	1	0	0	0	2	0	-1	1	0	0	0	0	1	0	0	0	0
		Petroleum, heavy metals and other pollutants transported to groundwater	0	1	2	2	0	0	0	0	0	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0
Air	Air quality emissions	Emissions of airborne reactive nitrogen	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	2	0	0
		Emissions of greenhouse gasses - GHGs	0	1	1	0	-1	-1	0	0	0	0	0	4	0	0	4	0	0	0	0	2	2	2	2	-1
		Emissions of ozone precursors	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	2	0	0
		Emissions of particulate matter (PM) and PM precursors	0	1	2	0	-1	0	0	0	0	0	2	2	0	0	1	2	0	0	0	0	2	2	1	0
		Objectionable odor	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	-1	1	0	0	0
Plant	Pest pressure	Plant pest pressure	0	1	1	0	-2	2	0	0	0	0	2	0	0	0	0	4	0	0	0	4	1	0	3	4
	Degraded plant condition	Plant productivity and health	2	2	2	0	2	2	0	0	2	0	2	4	0	0	1	0	2	1	1	5	5	2	1	3
		Plant structure and composition	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	4	4	0	1	0
	Fire [illegible]	Wildfire hazard from biomass accumulation	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	3	0
Animal	Livestock production limitation	Feed and forage balance	0	4	4	0	0	0	0	0	0	3	0	4	2	0	5	0	0	0	0	5	5	0	0	0
		Inadequate livestock shelter	0	0	0	0	-2	0	0	0	0	5	0	0	-1	0	0	0	0	0	0	-1	2	0	0	0
		Inadequate livestock water quantity, quality and distribution	4	0	0	0	0	0	0	0	5	0	0	0	0	0	0	2	5	4	4	0	0	5	0	0
	Terrestrial habitat	Terrestrial habitat for wildlife and invertebrates	0	0	0	0	-2	0	0	-1	0	0	1	0	0	0	4	2	2	0	0	2	2	0	0	-2
	Aquatic habitat	Aquatic habitat for fish and other organisms	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0
		Elevated water temperature	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Energy	Inefficient energy use	Energy efficiency of equipment and facilities	2	3	3	0	0	0	5	0	3	0	2	0	0	0	0	0	0	0	0	0	0	4	0	0
		Energy efficiency of farming/ ranching practices and field operations	0	0	0	0	1	0	0	0	2	0	1	0	1	0	0	1	0	0	0	1	1	0	0	0

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Conservation Practice Physical Effects

Legend to practice physical effects quantities found on page 6.

SWAPA+E	CART Category ↓	Resource Concern ↓ / Practice Name →	Residue and Tillage Management, No Till	Residue and Tillage Management, Reduced Till	Restoration and Management of Rare or Declining Habitats	Riparian Forest Buffer	Riparian Herbaceous Cover	Roof Runoff Structure	Roofs and Covers	Sediment Basin	Shallow Water Development and Management	Silvopasture Establishment	Spring Development	Sprinkler System	Stormwater Runoff Control	Streambank and Shoreline Protection	Stream Crossing	Stream Habitat Improvement and Management	Stripcropping	Structure for Water Control	Structures for Wildlife	Subsurface Drain	Surface Drainage, Field Ditch	Surface Drainage, Main or Lateral	Terrace	Trails and Walkways
		Practice Code→	329	345	643	391	390	558	367	350	646	381	574	442	570	580	578	395	585	587	649	606	607	608	600	575
Soil	Wind and water erosion	Sheet and rill erosion	4	4	2	3	2	1	0	0	0	4	0	0	0	0	0	0	4	0	0	4	1	0	5	1
Soil	Wind and water erosion	Wind erosion	5	4	2	2	2	0	0	0	0	3	0	2	0	0	0	0	4	0	0	-1	-1	-1	1	1
Soil	Concentrated erosion	Ephemeral gully erosion	0	0	2	1	1	3	0	2	0	3	0	0	2	0	0	0	0	0	0	4	2	2	4	1
Soil	Concentrated erosion	Classic gully erosion	0	0	0	3	0	1	0	2	0	2	1	0	0	0	0	0	0	0	0	1	0	0	2	4
Soil	Concentrated erosion	Bank erosion from streams, shorelines or water conveyance channels	0	0	0	4	4	1	0	0	0	2	1	0	3	4	2	5	0	0	0	1	0	0	1	2
Soil	Soil quality limitations	Subsidence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	-1	0	0	0
Soil	Soil quality limitations	Compaction	2	1	0	2	4	0	0	0	0	0	-1	-1	1	0	0	0	0	0	0	2	1	0	-1	2
Soil	Soil quality limitations	Organic matter depletion	2	2	0	4	4	0	0	0	1	3	0	0	0	0	0	0	2	0	0	-2	-2	0	2	0
Soil	Soil quality limitations	Concentration of salts or other chemicals	0	0	-1	1	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	2	0	0	0
Soil	Soil quality limitations	Soil organism habitat loss or degradation	4	3	0	5	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	-1	0
Soil	Soil quality limitations	Aggregate instability	3	2	0	4	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	1	-1
Water	Weather resilience	Naturally available moisture use	2	2	0	0	0	3	0	0	0	2	2	0	0	0	0	0	1	2	0	1	2	2	3	0
Water	Weather resilience	Ponding and flooding	2	1	0	-1	-3	-1	-1	2	2	2	1	2	4	0	0	0	1	2	0	4	2	2	4	2
Water	Weather resilience	Seasonal high water table	-1	0	0	2	2	1	0	-2	0	1	2	1	-1	0	0	0	0	0	0	4	2	2	-1	0
Water	Weather resilience	Seeps	-1	0	0	1	2	1	0	-2	0	1	2	0	-1	0	0	0	0	0	0	4	0	0	-1	0
Water	Source water depletion	Surface water depletion	0	0	0	3	0	0	0	0	1	3	0	0	-1	0	0	0	0	5	0	0	0	0	-1	0
Water	Source water depletion	Groundwater depletion	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	5	0	0	0	0	2	0
Water	Source water depletion	Inefficient irrigation water use	2	1	0	0	0	0	0	0	0	0	2	5	0	0	0	0	0	2	0	2	2	2	0	0
Water	Field sediment, nutrient and pathogen loss	Nutrients transported to surface water	2	2	0	5	5	2	0	5	1	3	0	2	2	1	1	0	1	0	0	-2	-2	-2	2	0
Water	Field sediment, nutrient and pathogen loss	Nutrients transported to groundwater	1	0	0	5	5	2	0	-1	1	2	0	1	0	0	0	0	0	0	0	1	1	1	-2	0
Water	Field sediment, nutrient and pathogen loss	Pathogens and chemicals from manure, biosolids or compost applications tranported to surface water	1	1	0	3	3	2	0	2	2	1	1	2	0	1	-3	0	1	0	0	0	-2	-2	2	1
Water	Field sediment, nutrient and pathogen loss	Pathogens and chemicals from manure, biosolids or compost applications tranported to groundwater	0	0	0	1	2	0	1	-1	-1	1	0	1	0	0	2	0	0	0	0	1	1	2	-1	0
Water	Field sediment, nutrient and pathogen loss	Sediment tansported to surface water	4	3	2	5	4	1	0	4	2	3	1	1	4	2	2	2	2	1	0	2	1	-1	2	2
Water	Field pesticide loss	Pesticides transported to surface water	4	4	0	3	2	0	0	2	0	2	0	2	0	0	0	0	2	0	0	2	0	0	2	0
Water	Field pesticide loss	Pesticides transported to groundwater	0	0	0	1	2	0	0	-1	0	1	0	2	0	0	0	0	0	0	0	2	1	0	-2	0
Water	Storage and handling of pollutants	Nutrients transported to surface water	2	2	0	5	5	2	0	5	1	3	0	2	2	1	1	0	1	0	0	-2	-2	-2	2	0
Water	Storage and handling of pollutants	Nutrients transported to groundwater	1	0	0	5	5	2	0	-1	1	2	0	1	0	0	0	0	0	0	0	1	1	1	-2	0
Water	Storage and handling of pollutants	Petroleum, heavy metals and other pollutants transported to surface water	0	0	0	3	2	0	1	2	2	1	2	1	2	0	0	0	0	0	0	0	-2	-2	2	0
Water	Storage and handling of pollutants	Petroleum, heavy metals and other pollutants transported to groundwater	0	0	0	1	1	0	1	-1	1	1	0	1	0	0	0	0	0	0	0	1	1	2	-1	0
Air	Air quality emissions	Emissions of airborne reactive nitrogen	2	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air	Air quality emissions	Emissions of greenhouse gasses - GHGs	4	3	1	3	2	0	4	0	0	2	0	1	0	1	0	1	0	0	0	0	0	0	0	0
Air	Air quality emissions	Emissions of ozone precursors	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air	Air quality emissions	Emissions of particulate matter (PM) and PM precursors	5	4	0	1	1	0	2	0	0	1	0	3	0	0	0	0	2	0	0	0	0	0	0	1
Air	Air quality emissions	Objectionable odor	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plant	Pest pressure	Plant pest pressure	0	0	4	3	4	0	0	0	1	0	0	1	0	4	0	4	0	0	0	0	0	0	0	0
Plant	Degraded plant condition	Plant productivity and health	2	2	4	5	5	0	0	0	2	5	2	2	0	4	0	4	2	0	0	2	2	2	2	0
Plant	Degraded plant condition	Plant structure and composition	0	0	4	5	4	0	0	0	4	-1	0	0	0	4	0	4	0	0	0	0	0	0	0	0
Plant	Fire management	Wildfire hazard from biomass accumulation	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Animal	Livestock production limitation	Feed and forage balance	0	0	2	0	4	0	0	0	1	3	2	4	0	1	2	0	1	0	0	4	4	4	0	1
Animal	Livestock production limitation	Inadequate livestock shelter	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Animal	Livestock production limitation	Inadequate livestock water quantity, quality and distribution	0	0	0	0	0	2	0	0	0	0	5	0	0	0	2	0	0	1	0	0	0	0	0	1
Animal	Terrestrial habitat	Terrestrial habitat for wildlife and invertebrates	1	0	5	5	2	0	0	-1	5	2	0	0	0	2	0	1	1	0	4	0	0	0	0	0
Animal	Aquatic habitat	Aquatic habitat for fish and other organisms	0	0	5	5	0	0	0	0	0	3	0	0	0	2	1	2	2	4	3	0	0	0	0	4
Animal	Aquatic habitat	Elevated water temperature	0	0	2	5	2	0	0	0	0	1	0	0	0	1	0	2	0	1	0	0	0	0	0	0
Energy	Inefficient energy use	Energy efficiency of equipment and facilities	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Energy	Inefficient energy use	Energy efficiency of farming/ ranching practices and field operations	4	3	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0

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Conservation Practice Physical Effects

Legend to practice physical effects quantities found on page 6.

SWAPA+E	CART Category ↓	Resource Concern ↓ Practice Name →	Tree/Shrub Establishment	Tree/Shrub Site Preparation	Tree/ Shrub Pruning	Underground Outlet	Upland Wildlife Habitat Management	Vegetated Treatment Area	Waste Facility Closure	Waste Recycling	Waste Separation Facility	Waste Storage Facility	Waste Transfer	Waste Treatment Lagoon	Water and Sediment Control Basin	Water Harvesting Catchment	Watering Facility	Water Well	Well Decommissioning	Wetland Creation	Wetland Enhancement	Wetland Restoration	Wetland Wildlife Habitat Management	Wildlife Habitat Planting (ac)	Windbreak/ Shelterbelt Establishment
		Practice Code→	612	490	660	620	645	635	360	633	632	313	634	359	638	636	614	642	351	658	659	657	644	420	380
Soil	Wind and water erosion	Sheet and rill erosion	5	-1	1	0	3	4	0	0	0	0	-1	0	0	0	2	2	0	0	0	0	0	2	1
		Wind erosion	5	-1	0	0	3	4	0	0	0	0	-1	0	0	0	2	2	0	0	0	0	0	0	5
	Concentrated erosion	Ephemeral gully erosion	4	-2	0	5	3	0	0	0	0	0	-1	0	2	0	2	2	0	0	0	0	0	0	2
		Classic gully erosion	2	-1	0	4	2	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0
		Bank erosion from streams, shorelines or water conveyance channels	2	0	0	-1	1	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
	Soil quality limitations	Subsidence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Compaction	2	-1	0	0	0	3	0	0	0	1	-1	1	0	0	0	0	0	0	0	0	0	0	2
		Organic matter depletion	4	-2	1	0	0	3	0	1	1	1	0	1	0	0	0	0	0	2	1	1	0	0	4
		Concentration of salts or other chemicals	1	0	0	0	0	-2	2	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1
		Soil organism habitat loss or degradation	5	-1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
		Aggregate instability	5	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
Water	Weather resilience	Naturally available moisture use	1	2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
		Ponding and flooding	0	0	0	4	-3	0	0	0	0	0	0	0	2	0	0	0	0	2	2	2	2	0	0
		Seasonal high water table	2	0	0	0	2	-2	0	0	0	0	0	0	-2	0	0	2	0	-1	0	0	0	0	2
		Seeps	2	0	0	0	0	-1	0	0	0	0	0	0	-2	1	0	0	0	0	0	0	0	0	2
	Source water depletion	Surface water depletion	3	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	3
		Groundwater depletion	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-2	0	0	0	0	0	0	0
		Inefficient irrigation water use	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	2	0	0	0	0	0	0	1
	Field sediment, nutrient and pathogen loss	Nutrients transported to surface water	1	0	1	-1	0	4	0	2	2	4	2	4	0	0	4	0	0	3	3	3	0	1	1
		Nutrients transported to groundwater	1	0	1	0	0	-2	0	2	2	2	2	2	-1	0	0	0	2	1	1	1	0	1	1
		Pathogens and chemicals from manure, biosolids or compost applications tranported to surface water	1	0	0	-1	0	5	0	0	2	2	2	4	0	0	2	-1	0	1	1	1	1	1	0
		Pathogens and chemicals from manure, biosolids or compost applications tranported to groundwater	1	0	0	0	0	0	2	2	2	2	2	2	-1	0	1	0	2	0	0	0	0	0	0
		Sediment tansported to surface water	3	-1	0	0	2	2	0	0	0	0	0	0	4	0	2	0	0	2	2	2	3	1	1
	Field pesticide loss	Pesticides transported to surface water	1	-1	1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	3
		Pesticides transported to groundwater	1	-1	1	0	0	0	0	0	0	0	0	0	-1	0	0	0	2	1	1	1	0	0	0
	Storage and handling of pollutants	Nutrients transported to surface water	1	0	1	-1	0	4	0	2	2	4	2	4	0	0	4	0	0	3	3	3	0	1	1
		Nutrients transported to groundwater	1	0	1	0	0	-2	0	2	2	2	2	2	-1	0	0	0	2	1	1	1	0	1	1
		Petroleum, heavy metals and other pollutants transported to surface water	1	0	0	1	0	0	0	0	2	0	0	0	0	0	1	0	0	2	2	2	0	0	1
		Petroleum, heavy metals and other pollutants transported to groundwater	1	0	0	0	0	0	0	0	2	1	0	1	-1	0	0	0	2	0	0	0	0	0	0
Air	Air quality emissions	Emissions of airborne reactive nitrogen	0	0	0	0	0	0	1	-1	1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	3
		Emissions of greenhouse gasses - GHGs	4	0	0	0	2	1	1	-1	1	-1	0	-3	0	0	0	0	0	1	1	1	1	0	4
		Emissions of ozone precursors	0	0	0	0	0	0	1	-1	2	-1	-1	1	0	0	0	0	0	0	0	0	0	0	0
		Emissions of particulate matter (PM) and PM precursors	1	0	0	0	2	0	1	-1	1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	4
		Objectionable odor	2	0	0	0	0	2	1	-1	4	-2	-1	-1	0	0	0	0	0	-1	-1	-1	-1	0	3
Plant	Pest pressure	Plant pest pressure	5	5	0	0	4	4	0	0	0	0	-1	0	0	0	0	0	0	4	4	4	4	0	1
	Degraded plant condition	Plant productivity and health	5	5	5	2	4	2	0	2	0	2	0	2	2	0	2	1	0	4	4	4	4	1	5
		Plant structure and composition	5	5	4	0	4	5	0	2	0	0	0	0	0	0	0	0	0	4	4	4	4	2	1
	Fire	Wildfire hazard from biomass accumulation	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Animal	Livestock production limitation	Feed and forage balance	0	0	0	0	2	1	0	1	0	0	0	0	0	0	2	2	0	2	2	2	2	0	1
		Inadequate livestock shelter	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
		Inadequate livestock water quantity, quality and distribution	0	0	0	0	0	0	0	0	1	0	0	0	0	5	5	5	0	0	0	0	0	0	0
	Terrestrial habitat	Terrestrial habitat for wildlife and invertebrates	5	0	2	0	5	0	0	0	0	0	0	0	2	0	2	0	0	2	2	2	5	5	3
	Aquatic habitat	Aquatic habitat for fish and other organisms	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4
		Elevated water temperature	1	0	0	0	0	0	0	0	0	0	0	0	-2	0	1	0	0	0	0	0	0	4	0
Energy	Inefficient energy use	Energy efficiency of equipment and facilities	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	3
		Energy efficiency of farming/ ranching practices and field operations	1	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	3

Conservation Practice Physical Effects

Legend to practice physical effects quantities found on page 6.

SWAPA+E	CART Category ↓	Resource Concern ↓ / Practice Name → / Practice Code →	Windbreak/ Shelterbelt Renovation	Woody Residue Treatment
			650	384
Soil	Wind and water erosion	Sheet and rill erosion	1	1
Soil	Wind and water erosion	Wind erosion	5	1
Soil	Concentrated erosion	Ephemeral gully erosion	2	1
Soil	Concentrated erosion	Classic gully erosion	0	1
Soil	Concentrated erosion	Bank erosion from streams, shorelines or water conveyance channels	0	0
Soil	Soil quality limitations	Subsidence	0	0
Soil	Soil quality limitations	Compaction	2	-2
Soil	Soil quality limitations	Organic matter depletion	4	-1
Soil	Soil quality limitations	Concentration of salts or other chemicals	1	0
Soil	Soil quality limitations	Soil organism habitat loss or degradation	5	1
Soil	Soil quality limitations	Aggregate instability	4	1
Water	Weather resilience	Naturally available moisture use	3	1
Water	Weather resilience	Ponding and flooding	0	0
Water	Weather resilience	Seasonal high water table	2	0
Water	Weather resilience	Seeps	2	0
Water	Source water depletion	Surface water depletion	3	1
Water	Source water depletion	Groundwater depletion	0	0
Water	Source water depletion	Inefficient irrigation water use	1	0
Water	Field sediment, nutrient and pathogen loss	Nutrients transported to surface water	1	0
Water	Field sediment, nutrient and pathogen loss	Nutrients transported to groundwater	1	0
Water	Field sediment, nutrient and pathogen loss	Pathogens and chemicals from manure, biosolids or compost applications tranported to surface water	0	0
Water	Field sediment, nutrient and pathogen loss	Pathogens and chemicals from manure, biosolids or compost applications tranported to groundwater	0	0
Water	Field sediment, nutrient and pathogen loss	Sediment tansported to surface water	1	1
Water	Field pesticide loss	Pesticides transported to surface water	3	0
Water	Field pesticide loss	Pesticides transported to groundwater	0	0
Water	Storage and handling of pollutants	Nutrients transported to surface water	1	0
Water	Storage and handling of pollutants	Nutrients transported to groundwater	1	0
Water	Storage and handling of pollutants	Petroleum, heavy metals and other pollutants transported to surface water	1	0
Water	Storage and handling of pollutants	Petroleum, heavy metals and other pollutants transported to groundwater	0	0
Air	Air quality emissions	Emissions of airborne reactive nitrogen	2	1
Air	Air quality emissions	Emissions of greenhouse gasses - GHGs	1	2
Air	Air quality emissions	Emissions of ozone precursors	0	1
Air	Air quality emissions	Emissions of particulate matter (PM) and PM precursors	2	1
Air	Air quality emissions	Objectionable odor	2	0
Plant	Pest pressure	Plant pest pressure	1	3
Plant	Degraded plant condition	Plant productivity and health	5	5
Plant	Degraded plant condition	Plant structure and composition	1	1
Plant	Fire management	Wildfire hazard from biomass accumulation	0	3
Animal	Livestock production limitation	Feed and forage balance	1	3
Animal	Livestock production limitation	Inadequate livestock shelter	5	1
Animal	Livestock production limitation	Inadequate livestock water quantity, quality and distribution	0	0
Animal	Terrestrial habitat	Terrestrial habitat for wildlife and invertebrates	3	0
Animal	Aquatic habitat	Aquatic habitat for fish and other organisms	4	0
Animal	Aquatic habitat	Elevated water temperature	0	0
Energy	Inefficient energy use	Energy efficiency of equipment and facilities	3	0
Energy	Inefficient energy use	Energy efficiency of farming/ ranching practices and field operations	3	0

Legend of Effects Quantification	
5	Substantial Improvement
4	Moderate to Substantial Improvement
3	Moderate Improvement
2	Slight to Moderate Improvement
1	Slight Improvement
0	Not Applicable
0	Neutral
-1	Slight Worsening
-2	Slight to Moderate Worsening
-3	Moderate Worsening
-4	Moderate to Substantial Worsening
-5	Substantial Worsening

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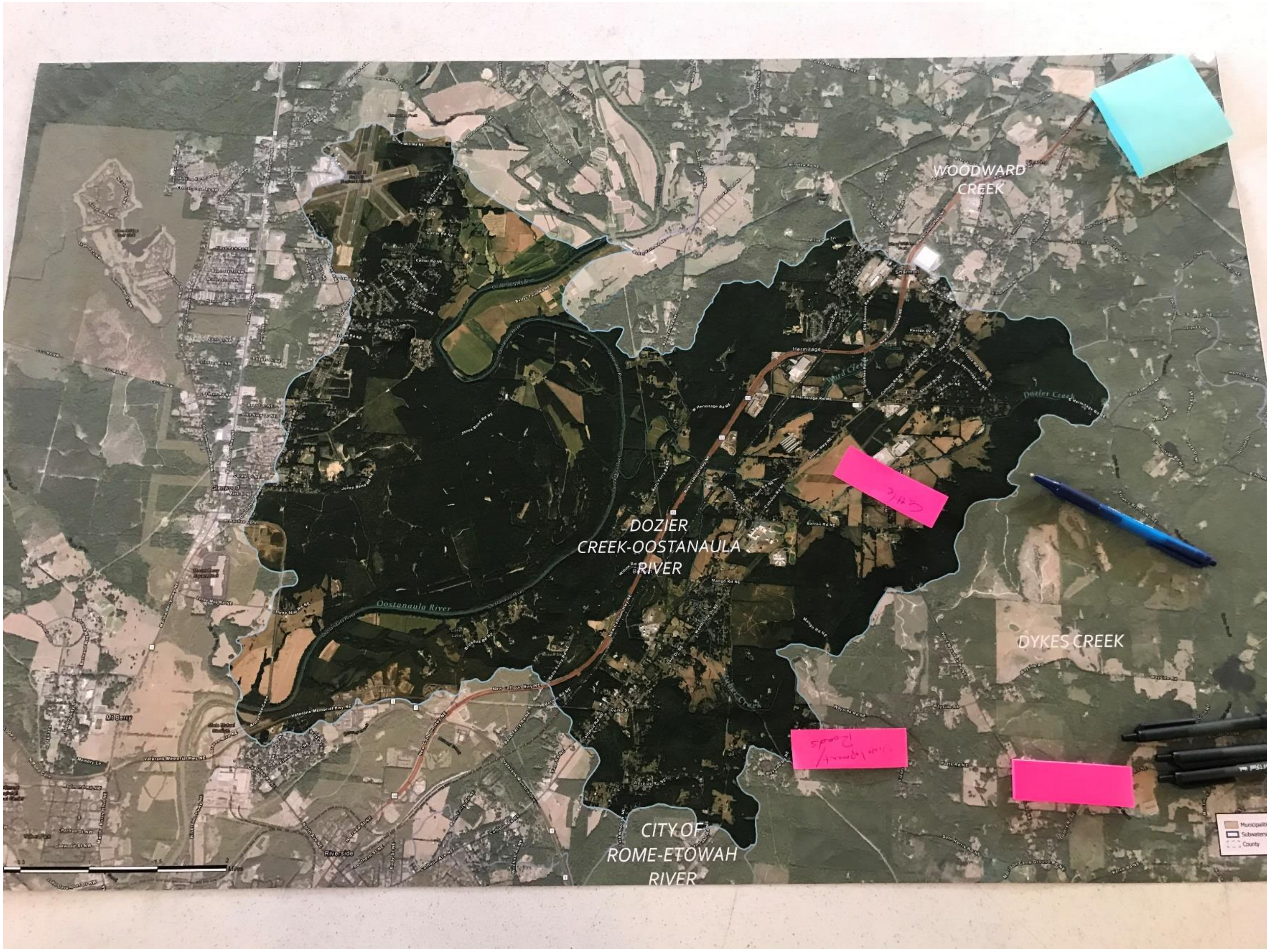
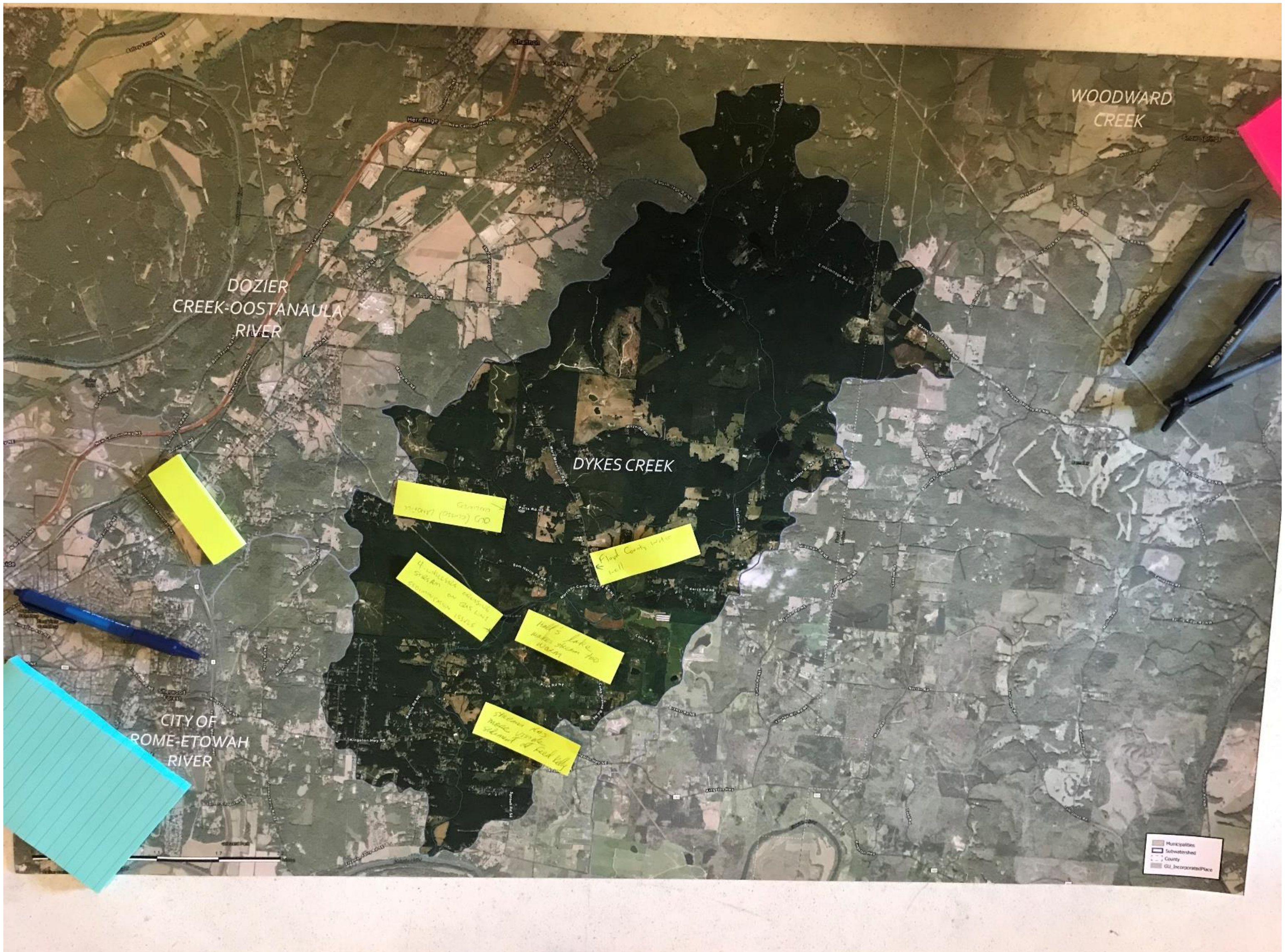
16 Appendix B

16.1.1 Stakeholder Meeting Notes

Notes and comments were generated in a group activity mapping exercise. Notes have been catalogued in the following pages as photographs of the maps.


WOODWARD CREEK
DOZIER CREEK-OOSTANAULA RIVER
Oostanaula River
DYKES CREEK
CITY OF ROME-ETOWAH RIVER


WOODWARD CREEK
DOZIER CREEK-OOSTANAULA RIVER
DYKES CREEK


WOODWARD CREEK
DOZIER CREEK-OOSTANAULA RIVER
DYKES CREEK
CITY OF ROME-ETOWAH RIVER

17 Appendix C

17.1.1 Biotic Monitoring

Oostanaula-Etowah River Watershed 2021 IBI report

Prepared by:

Bernie Kuhajda and Shawna Fix
Tennessee Aquarium Conservation Institute

For:

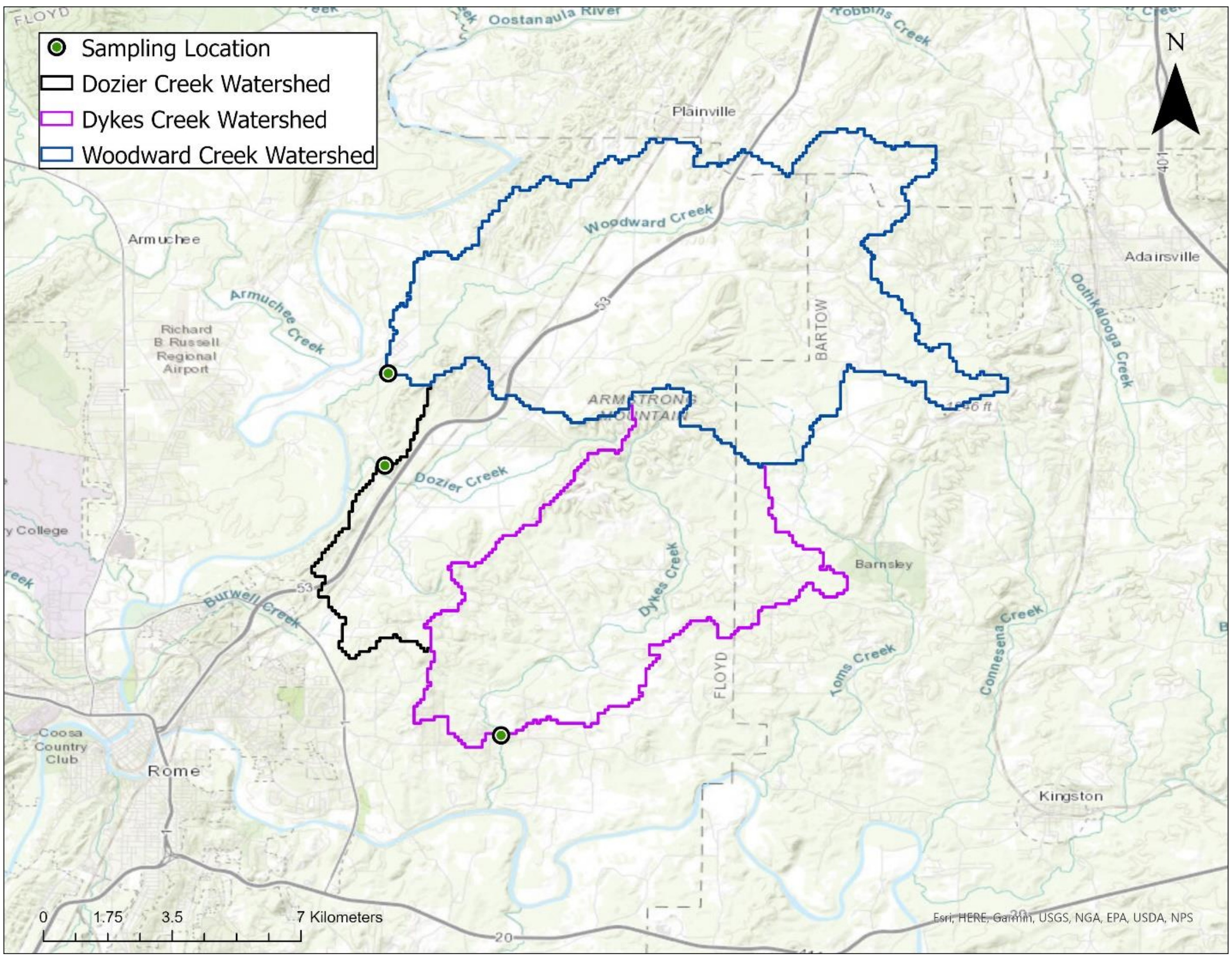
Limestone Valley RC&D

4 August 2021

Introduction

The purpose of this project is to provide current fish IBI scores on three sites in three different streams within the Oostanaula-Etowah River watershed in Floyd County, GA (Figure 26). Limestone Valley RC&D's mission is to enhance the communities within their eleven-county area by promoting conservation, water quality improvement, natural resource education and sustainable agriculture. The Tennessee Aquarium Conservation Institute was contracted by Limestone Valley to assist in these IBI surveys and write a report on the findings. Data will be used to inform management decisions within the Oostanaula-Etowah River watershed.

Figure 26. Sites (green and black dots) on three streams within the Oostanaula-Etowah River watershed sampled for this study. Dark and colored lines represent sub-watershed upstream of were sampling occurred.



Methods

Three streams within the Oostanaula-Etowah River watershed (Figure 26) were sampled following Georgia Department of Natural Resources' (GADNR) Standard Operating Procedures for Conducting Biomonitoring on Fish Communities in Wadeable Streams in Georgia (https://georgiawildlife.com/sites/default/files/wrd/pdf/SOP/streamsurvey_Part1.pdf). The Oostanaula-Etowah River watershed is within the Coosa River drainage in the Ridge and Valley physiographic province/ecoregion. Therefore fish IBI scoring criteria used in this study followed those specifically tailored for this region of Georgia (Scoring Criteria for the Index of Biotic Integrity and the Index of Well-Being to Monitor Fish Communities in Wadeable Streams in the Coosa and Tennessee Drainage Basins of the Ridge and Valley Ecoregion of Georgia, https://georgiawildlife.com/sites/default/files/wrd/pdf/SOP/streamsurvey_SOP_Part4_RidgeValley.pdf).

Each stream was sampled at a single site. Backpack shockers and dipnets were used for fish sampling. Fishes were held in containers with fresh creek water and aerators as they were identified to species and counted (Figure 2). Photo vouchers of most fish species were taken (Appendix A). Water quality (temperature (°C), DO (mg/L), conductivity (µS), pH, turbidity (NTU), and total dissolved solids (ppm)) were measured using a YSI multiport sonde (electronic probe).

Figure 27. Sorting, identification, and enumeration of fishes during IBI study in Dozier Creek 9 July 2021.

Prior to fish and water quality sampling, five stream transects were established at each site to obtain an average stream width (m). Other measurement taken at these transects included stream depth (m) at 1/4, 1/2, and 3/4 of stream width from a shoreline. Average stream width was needed to determine the length of the stream reach to be sampled for fishes at each site. Within the stream reach, the total number of pools, riffles, and bends, and the deepest pool were recorded. Other habitat assessments (riffle/run and glide/pool habitats) were also scored using GADNR protocols.

The three streams sampled include:

Woodward Creek on UGA cattle farm, ca. 0.4 mi upstream of Old Bells Ferry Road, 6.7 mi NE of Rome (34.34544, -85.10516), Floyd County, GA, 8 July 2021.

Dykes Creek along Fred Kelly Road NE, 4.7 mi E of Rome (34.25798, -85.08333), Floyd County, GA, 8 July 2021.

Dozier Creek downstream of GA Hwy 53, 5.3 mi NE of Rome (34.31802, -85.10726), Floyd County, GA, 9 July 2021.

Results and Discussion

Woodward Creek on UGA cattle farm, ca. 0.4 mi upstream of Old Bells Ferry Road (34.34544, -85.10516), Floyd County, GA, 8 July 2021

Woodward Creek was the largest site sampled for drainage area above the sample site (28.07 sq. miles), but was second to Dozier Creek in average stream width (7.2 m). The stream reach sampled for fishes in Woodward Creek was 251.3 m long, containing 5 pools, 6 riffles, and 2 bends. Stream width averaged 7.2 m and stream depth 0.40 m. The sampled reach flowed through a continuous riparian zone bordered by active grazing pasture, but some understory in a section of the riparian zone had been disturbed (grazing?). Some bank erosion was evident at several locations (Figure 28). Water quality parameters are given below in Table 44.

Table 44. Water quality parameters for Woodward Creek.

Water Quality Woodward Creek	
Elevation (ft)	620.1
Water Temp (°C)	23.1
DO (mg/L)	7.22
Conductivity (µS)	243.9
pH	6.5
Turbidity (NTU)	4.93
Total Dissolved Solids (ppm)	165

Fish sampling occurred from 14:02-14:50 and 15:13-15:55, with the one stop for fish identification and enumeration. Four backpack shockers were used in fish sampling. A total of 25 fish species in 7 families were collected, 24 of them native species. Total number of individuals was 246 (Table 45).

Figure 28. Woodward Creek on UGA cattle farm upstream of Old Bells Ferry Road, 1 July 2021.

Table 45.Fish species and number of specimens collected in Woodward Creek.

Species	Common Name	Specimen count	Family
Campostoma oligolepis	Largescale Stoneroller	15	Cyprinidae
Cyprinella venusta	Blacktail Shiner	9	Cyprinidae
Luxilus chrysocephalus	Striped Shiner	5	Cyprinidae
Notropis stilbius	Silverstripe Shiner	4	Cyprinidae
Hypentelium etowanum	Alabama Hog Sucker	7	Catostomidae
Moxostoma duquesnei	Black Redhorse	4	Catostomidae
Moxostoma erythrurum	Golden Redhorse	3	Catostomidae
Fundulus olivaceus	Blackspotted Topminnow	1	Fundulidae
Gambusia affinis	Western Mosquitofish	2	Poeciliidae
Cottus carolinae	Banded Sculpin	6	Cottidae
Ambloplites ariommus	Rock Bass	7	Centrarchidae
**Lepomis auritus*	Redbreast Sunfish	10	Centrarchidae
Lepomis cyanellus	Green Sunfish	36	Centrarchidae
Lepomis gulosus	Warmouth	7	Centrarchidae
Lepomis macrochirus	Bluegill	46	Centrarchidae
Lepomis megalotis	Longear Sunfish	26	Centrarchidae
Lepomis miniatus	Redspotted Sunfish	27	Centrarchidae
Micropterus coosae	Redeye Bass	4	Centrarchidae
Micropterus henshalli	Alabama Bass	3	Centrarchidae
Pomoxis nigromaculatus	Black Crappie	1	Centrarchidae
Etheostoma coosae	Coosa Darter	7	Percidae
Etheostoma jordani	Greenbreast Darter	5	Percidae

Etheostoma stigmaeum	Speckled Darter	2	Percidae
Percina kathae	Mobile Logperch	3	Percidae
Percina nigrofasciata	Blackbanded Darter	6	Percidae
	Total	**246**	

* = non-native species.

Calculated metrics that are used in scoring for fish IBIs are given in Table 50. Based on these metrics and scoring criteria for the Coosa River drainage in the Ridge and Valley Ecoregion, the IBI score for Woodward Creek was 34, which ranks this fish community as Fair (34-42). Attributes for this ranking are species richness declines as some expected species are absent; few, if any, intolerant or headwater intolerant species present; trophic structure skewed toward generalist, herbivorous, and sunfish species as the abundance of insectivorous cyprinid and benthic fluvial specialist species decreases. Riffle/run and glide/pool habitat assessment scores for Woodward Creek were 101 and 139 out of 200, respectively, indicating these habitats are somewhat degraded, with more degradation in the riffle/run habitat (Table 51); riffles were dominated by fine sediments (sand and small gravel).

<u>Dykes Creek along Fred Kelly Road NE (34.25798, -85.08333), Floyd County, GA, 8 July 2021</u>

Dykes Creek was the smallest site sampled in average stream width (6.3 m) but had an intermediate drainage area above the sample site compared to Woodward and Dozier Creeks (17.61 sq. miles). The stream reach sampled for fishes in Dykes Creek was 221.2 m long. This reach contained 4 pools, 3 riffles, and 1 bend. Stream width averaged 6.3 m and stream depth averaged 0.31 m. The sampled reach flowed through a continuous and dense riparian zone (Figure 29). A small (<0.5 m) concrete structure spanned the width of the stream within the lower fourth of the sampling reach. Water quality parameters are given in Table 46.

Table 46. Water quality parameters for Dykes Creek.

Water Quality Dykes Creek		
Elevation (ft)		671
Water Temp (°C)		22.5
DO (mg/L)		7.23
Conductivity (µS)		183.3
pH		7.0
Turbidity (NTU)		1.18
Total Dissolved Solids (ppm)		125

Fish sampling occurred from 9:17-10:30 and 11:00-11:55, which included one stop for fish identification and enumeration. Four backpack shockers were used in fish sampling. A total of 24 fish species in 7 families were collected, 22 of them native species. Total number of individuals was 568 (Table 47).

Figure 29. Dykes Creek along Fred Kelly NE Road, 1 July 2021

Table 47. Fish species and number of specimens collected in Dykes Creek.

Species	**Common Name**	**Specimen count**	**Family**
Campostoma oligolepis	Largescale Stoneroller	35	Cyprinidae
Cyprinella trichroistia	Tricolor Shiner	44	Cyprinidae
Luxilus chrysocephalus	Striped Shiner	3	Cyprinidae
Notropis xaenocephalus	Coosa Shiner	62	Cyprinidae
Semotilus atromaculatus	Creek Chub	3	Cyprinidae
Hypentelium etowanum	Alabama Hog Sucker	7	Catostomidae
Fundulus stellifer	Southern Studfish	1	Fundulidae
Gambusia affinis	Western Mosquitofish	4	Poeciliidae
Cottus carolinae	Banded Sculpin	195	Cottidae
Ambloplites ariommus	Rock Bass	9	Centrarchidae
**Lepomis auritus*	Redbreast Sunfish	10	Centrarchidae
Lepomis cyanellus	Green Sunfish	60	Centrarchidae
Lepomis gulosus	Warmouth	1	Centrarchidae
Lepomis macrochirus	Bluegill	9	Centrarchidae
Lepomis megalotis	Longear Sunfish	33	Centrarchidae
Lepomis miniatus	Redspotted Sunfish	42	Centrarchidae
**Lepomis cyanellus* x *L. ?*	Hybrid Sunfish	19	Centrarchidae
Micropterus coosae	Redeye Bass	14	Centrarchidae
Micropterus henshalli	Alabama Bass	1	Centrarchidae
Micropterus salmoides	Largemouth Bass	1	Centrarchidae
Etheostoma coosae	Coosa Darter	1	Percidae
Etheostoma jordani	Greenbreast Darter	2	Percidae
Percina kathae	Mobile Logperch	2	Percidae
Percina nigrofasciata	Blackbanded Darter	10	Percidae
	Total	**568**	

* = non-native species.

Calculated metrics that are used in scoring for fish IBIs are given in Table 50. Based on these metrics and scoring criteria for the Coosa River drainage in the Ridge and Valley Ecoregion, the IBI score for Dykes Creek was 42, which ranks this fish community as Fair (34-42). Attributes for this ranking are species richness declines as some expected species are absent; few, if any, intolerant or headwater intolerant species present; trophic structure skewed toward generalist, herbivorous, and sunfish species as the abundance of insectivorous cyprinid and benthic fluvial specialist species decreases. Riffle/run and glide/pool habitat assessment scores for Dykes Creek were 171 and 162 out of 200, respectively, indicating these habitats are in relatively good condition (Table 52). The IBI score of 42 is at the upper end of the Fair ranking, and this stream may have scored as Good if more of the darters that were present in the stream could have been netted and enumerated. The substrate in Dykes Creek was mostly boulders and cobble, even in the riffles, and this made seeing and netting stunned darters very difficult.

One historical fish IBI score is available for Dykes Creek in Floyd County. On 11 October 2012 the IBI score was the same as the 2021 score, 42, which is on the high end of a Fair ranking. No change in the IBI ranking over 9 years is likely due to the extensive dense riparian zone along the creek.

Dozier Creek downstream of GA Hwy 53, (34.31802, -85.10726), Floyd County, GA, 9 July 2021

Dozier Creek was the smallest site sampled for drainage area above the sample site (9.81 sq. miles), but the largest site sampled in average stream width (7.9 m). The stream reach sampled for fishes in Dozier Creek was 276 m long, containing 6 pools, 3 riffles, and notably 0 bends. Stream width averaged 7.9 m and stream depth 0.21 m. The sampled reach flowed through a narrow riparian zone bordered by a field on one side and a dirt road and waste treatment plant of the other side. Some bank erosion was evident at several locations (Figure 30). Water quality parameters are given below in Table 48.

Table 48. Water quality parameters for Dozier Creek.

Water Quality Dozier Creek	
Elevation (ft)	655.2
Water Temp (°C)	22.1
DO (mg/L)	7.9
Conductivity (µS)	296.3
pH	7.0
Turbidity (NTU)	8.75
Total Dissolved Solids (ppm)	204

Fish sampling occurred from 9:49-10:36 and 11:00-11:44, with the one stop for fish identification and enumeration. Five backpack shockers were used in fish sampling. A total of 25 fish species in 7 families were collected, 23 of them native species. Total number of individuals was 624 (Table 49).

Figure 30. Dozier Creek, 1 July 2021

Table 49. Fish species and number of specimens collected in Dozier Creek.

Species	Common Name	Specimen count	Family
Campostoma oligolepis	Largescale Stoneroller	85	Cyprinidae
Cyprinella venusta	Blacktail Shiner	2	Cyprinidae
Luxilus chrysocephalus	Striped Shiner	13	Cyprinidae
Notropis stilbius	Silverstripe Shiner	3	Cyprinidae
Notropis xaenocephalus	Coosa Shiner	6	Cyprinidae
Semotilus atromaculatus	Alabama Hog Sucker	3	Cyprinidae
Hypentelium etowanum	Black Redhorse	21	Catostomidae
Moxostoma duquesnei	Golden Redhorse	2	Catostomidae
Ictalurus punctatus	Channel Catfish	2	Ictaluridae
Gambusia affinis	Western Mosquitofish	5	Poeciliidae
Cottus carolinae	Banded Sculpin	86	Cottidae
Ambloplites ariommus	Rock Bass	6	Centrarchidae
**Lepomis auritus*	Redbreast Sunfish	9	Centrarchidae
Lepomis cyanellus	Green Sunfish	137	Centrarchidae
Lepomis macrochirus	Bluegill	89	Centrarchidae
Lepomis megalotis	Longear Sunfish	42	Centrarchidae
Lepomis microlophus	Redear Sunfish	7	Centrarchidae
Lepomis miniatus	Redspotted Sunfish	31	Centrarchidae
**Lepomis cyanellus* x *L.* ?	Hybrid Sunfish	38	Centrarchidae
Micropterus coosae	Redeye Bass	5	Centrarchidae
Micropterus salmoides	Alabama Bass	2	Centrarchidae
Etheostoma coosae	Coosa Darter	19	Percidae
Etheostoma jordani	Greenbreast Darter	6	Percidae
Percina kathae	Mobile Logperch	3	Percidae
Percina nigrofasciata	Blackbanded Darter	2	Percidae
	Total	**624**	

*= non-native species.

Calculated metrics that are used in scoring for fish IBIs are given in Table 50. Based on these metrics and scoring criteria for the Coosa River drainage in the Ridge and Valley Ecoregion, the IBI score for Dozier Creek was 34, which ranks this fish community as Fair (34-42). Attributes for this ranking are species richness declines as some expected species are absent; few, if any, intolerant or headwater intolerant species present; trophic structure skewed toward generalist, herbivorous, and sunfish species as the abundance of insectivorous cyprinid and benthic fluvial specialist species decreases. Riffle/run and glide/pool habitat assessment scores for Woodward Creek were 135 and 132 out of 200, respectively, indicating these habitats are somewhat degraded (Table 53).

Table 50. Calculated metrics used with scoring criteria to determine fish IBI scores for Woodward, Dykes, and Dozier Creek within the Oostanaula-Etowah River watershed.

	Woodward	Dykes	Dozier
Physiographic province/ecoregion	Ridge & Valley	Ridge & Valley	Ridge & Valley
Reach Length	251.3	221.2	276
Grand_Total_specimens	246	568	624
DBA (drainage basin area upstream of site)	28.07	17.61	9.81
log_10_DBA	1.45	1.25	0.99
Number of Individuals	246	568	624
Number of species	25	24	25
Total number of native fish species	24	22	23
Total number of benthic invertivore species	6	5	5
Total number of native sunfish species (DBA < 15 sq. mi)	5	5	5
Total number of native centrarchid species (DBA >15 sq. mi)	8	8	7
Total number of native insectivorous cyprinid species	3	3	4
Total number of round bodied sucker species	3	1	2
Total number of sensitive species (DBA < 15 sq. mi)	3	2	3
Total number of intolerant species (DBA > 15 sq. mi)	3	2	3
Evenness	84.69	72.15	76.08
% individuals as *Lepomis* species	61.79	30.63	56.57
% individuals as insectivorous cyprinid species	7.32	19.19	3.85
% individuals as generalist feeders/herbivore species (DBA < 15 sq. mi)	23.98	52.29	50.96
% individuals as top carnivore species (DBA > 15 sq. mi)	8.94	4.58	2.08
% individuals as benthic fluvial specialist species	17.48	38.20	22.28
Number of individuals collected per 200 meters	195.78	513.56	452.17
% individuals with external anomalies	0	0	0
Fish IBI scores	34	42	34
Fish IBI rank	Fair (34-42)	Fair (34-42)	Fair (34-42)

Woodward	Dykes	Dozier

Table 51. Riffle/run and glide/pool habitat assessment for Woodward Creek, Floyd County, GA.

Riffle/Run Habitat Assessment	**Score**	**Max score**
Epifaunal Substrate/Instream Cover	11	20
Embeddedness in Run Areas	8	20
Velocity/ Depth Combinations	10	20
Channel Alteration	11	20
Sediment Deposition	3	20
Frequency of Riffles	17	20
Channel Flow Status	17	20
Bank Vegetative Protection Left Bank	5	10
Bank Vegetative Protection Right Bank	6	10
Bank Stability Left Bank	1	10
Bank Stability Right Bank	4	10
Riparian Vegetative Zone	4	10
Riparian Vegetative Zone	4	10
Total	101	200

Glide/Pool Habitat Assessment	**Score**	**Max score**
Bottom Substrate/Available Cover	11	20
Pool Substrate Characterization	19	20
Pool Variability	14	20
Channel Alteration	13	20
Sediment Deposition	15	20
Channel Sinuosity	14	20
Channel Flow Status	17	20
Bank Vegetative Protection Left Bank	6	10
Bank Vegetative Protection Right Bank	8	10
Bank Stability Left Bank	2	10
Bank Stability Right Bank	5	10
Riparian Vegetative Zone	5	10
Riparian Vegetative Zone	10	10
Total	139	200

Table 52. Riffle/run and glide/pool habitat assessment for Dykes Creek, Floyd County, GA.

Riffle/Run Habitat Assessment	**Score**	**Max score**
Epifaunal Substrate/Instream Cover	20	20
Embeddedness in Run Areas	18	20
Velocity/ Depth Combinations	15	20
Channel Alteration	15	20
Sediment Deposition	20	20
Frequency of Riffles	12	20
Channel Flow Status	18	20
Bank Vegetative Protection Left Bank	9	10
Bank Vegetative Protection Right Bank	6	10
Bank Stability Left Bank	10	10
Bank Stability Right Bank	8	10
Riparian Vegetative Zone	10	10
Riparian Vegetative Zone	10	10
Total	171	200

Glide/Pool Habitat Assessment	**Score**	**Max score**
Bottom Substrate/Available Cover	19	20
Pool Substrate Characterization	20	20
Pool Variability	9	20
Channel Alteration	15	20
Sediment Deposition	20	20
Channel Sinuosity	8	20
Channel Flow Status	18	20
Bank Vegetative Protection Left Bank	9	10
Bank Vegetative Protection Right Bank	6	10
Bank Stability Left Bank	10	10
Bank Stability Right Bank	8	10
Riparian Vegetative Zone	10	10
Riparian Vegetative Zone	10	10
Total	162	200

Table 53. Riffle/run and glide/pool habitat assessment for Dozier Creek, Floyd County, GA.

Riffle/Run Habitat Assessment	**Score**	**Max score**
Epifaunal Substrate/Instream Cover	13	20
Embeddedness in Run Areas	14	20
Velocity/ Depth Combinations	10	20
Channel Alteration	18	20
Sediment Deposition	17	20
Frequency of Riffles	12	20
Channel Flow Status	18	20
Bank Vegetative Protection Left Bank	8	10
Bank Vegetative Protection Right Bank	7	10
Bank Stability Left Bank	5	10
Bank Stability Right Bank	4	10
Riparian Vegetative Zone	7	10
Riparian Vegetative Zone	2	10
Total	135	200

Glide/Pool Habitat Assessment	**Score**	**Max score**
Bottom Substrate/Available Cover	18	20
Pool Substrate Characterization	19	20
Pool Variability	10	20
Channel Alteration	18	20
Sediment Deposition	17	20
Channel Sinuosity	0	20
Channel Flow Status	18	20
Bank Vegetative Protection Left Bank	8	10
Bank Vegetative Protection Right Bank	6	10
Bank Stability Left Bank	7	10
Bank Stability Right Bank	2	10
Riparian Vegetative Zone	7	10
Riparian Vegetative Zone	2	10
Total	132	200

Acknowledgements

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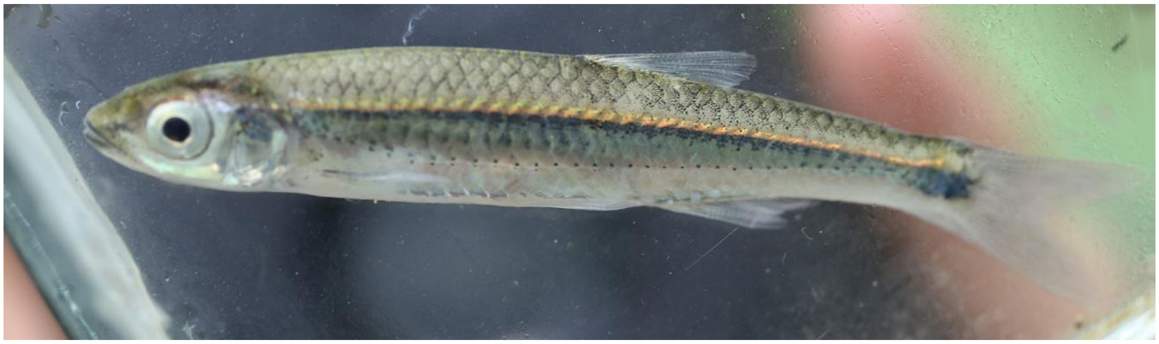
Photo vouchers of fishes collected as part of an IBI study on three streams in the Oostanaula-Etowah River watershed

Woodward Creek

Largescale Stoneroller *Campostoma oligolepis*, Woodward Creek GA, 8 July 2021

Blacktail Shiner *Cyprinella venusta*, Woodward Creek GA, 8 July 2021



Silverstripe Shiner *Notropis stilbius*, Woodward Creek GA, 8 July 2021

Black Redhorse *Moxostoma erythrurum*, Woodward Creek GA, 8 July 2021

Golden Redhorse *Moxostoma duquesnei*, Woodward Creek GA, 8 July 2021

Blackspotted Topminnow *Fundulus olivaceus*, Woodward Creek GA, 8 July 2021

Coosa Darter *Etheostoma coosae*, Woodward Creek GA, 8 July 2021

Greenbreast Darter *Etheostoma jordani*, Woodward Creek GA, 8 July 2021

Speckled Darter *Etheostoma stigmaeum*, Woodward Creek GA, 8 July 2021

Mobile Logperch *Percina kathae*, Woodward Creek GA, 8 July 2021

Blackbanded Darter *Percina nigrofasciata*, Woodward Creek GA, 8 July 2021

Dykes Creek

Largescale Stoneroller *Campostoma oligolepis*, Dykes Creek GA, 8 July 2021

Tricolor Shiner *Cyprinella trichroistia*, Dykes Creek GA, 8 July 2021

Coosa Shiner *Notropis xaenocephalus*, Dykes Creek GA, 8 July 2021

Alabama Hog Sucker *Hypentilum etowanum*, Dykes Creek GA, 8 July 2021

Southern Studfish *Fundulus stellifer*, Dykes Creek GA, 8 July 2021

Western Mosquitofish *Gambusia affinis*, Dykes Creek GA, 8 July 2021

Banded Sculpin *Cottus carolinae*, Dykes Creek GA, 8 July 2021

Shadow Bass *Ambloplites ariommus*, adult (top) & juvenile (Bottom) Dykes Creek GA, 8 July 2021

Green Sunfish *Lepomis cyanellus*, Dykes Creek GA, 8 July 2021

Hybrid Sunfish *Lepomis cyanellus* x *L.* ?, Dykes Creek GA, 8 July 2021

Warmouth *Lepomis gulosus*, Dykes Creek GA, 8 July 2021

Bluegill *Lepomis macrochirus*, Dykes Creek GA, 8 July 2021

Longear Sunfish *Lepomis megalotis*, Dykes Creek GA, 8 July 2021

Redspotted Sunfish *Lepomis miniatus*, Dykes Creek GA, 8 July 2021


Coosa Bass *Micropterus coosae*, Dykes Creek GA, 8 July 2021


Alabama Bass *Micropterus henshalli*, Dykes Creek GA, 8 July 2021


Blackbanded Darter *Percina nigrofasciata*, Dykes Creek GA, 8 July 2021

Dozier Creek

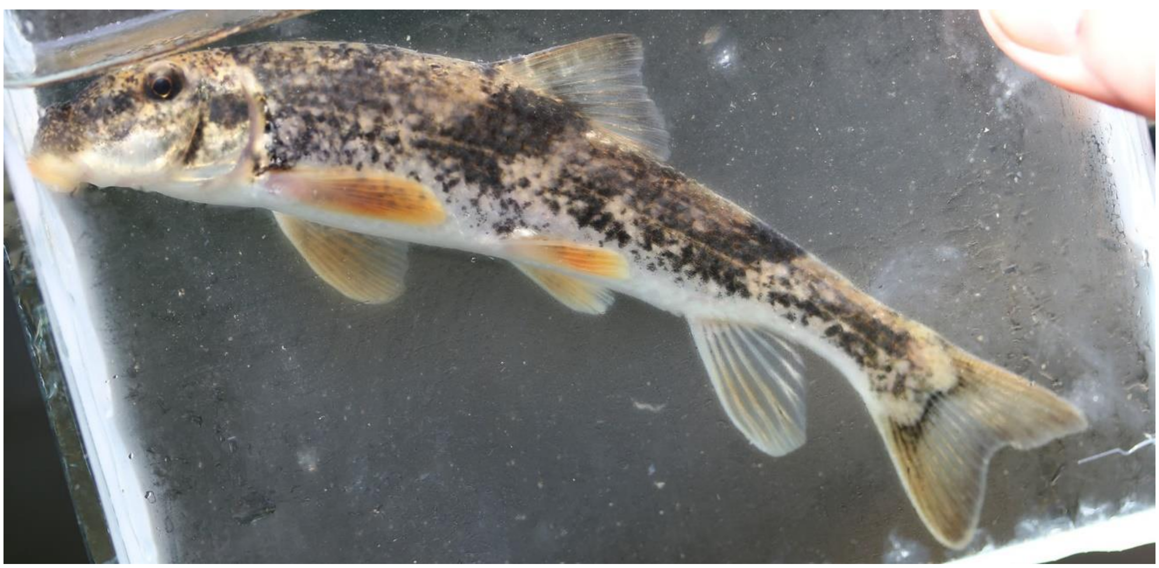
Largescale Stoneroller *Campostoma oligolepis*, Dozier Creek GA, 9 July 2021

Blacktail Shiner *Cyprinella venusta*, Dozier Creek GA, 9 July 2021

Striped Shiner *Luxilus chrysocephalus*, Dozier Creek GA, 9 July 2021

Silverstripe Shiner *Notropis stilbius*, Dozier Creek GA, 9 July 2021

Coosa Shiner *Notropis xaenocephalus*, Dozier Creek GA, 9 July 2021



Alabama Hog Sucker *Hypentelium etowanum*, Dozier Creek GA, 9 July 2021

Channel Catfish *Ictalurus punctatus*, Dozier Creek GA, 9 July 2021

Western Mosquitofish *Gambusia affinis*, Dozier Creek GA, 9 July 2021

Banded Sculpin *Cottus carolinae*, Dozier Creek GA, 9 July 2021


Shadow Bass *Ambloplites ariommus*, Dozier Creek GA, 9 July 2021


Redbreast Sunfish *Lepomis auritus*, Dozier Creek GA, 9 July 2021

Green Sunfish Hybrid? *Lepomis cyanellus*, Dozier Creek GA, 9 July 2021

Bluegill *Lepomis macrochirus*, Dozier Creek GA, 9 July 2021

Longear Sunfish *Lepomis megalotis*, Dozier Creek GA, 9 July 2021

Redspotted Sunfish *Lepomis miniatus*, Dozier Creek GA, 9 July 2021

Redeye Bass *Micropterus coosae*, Dozier Creek GA, 9 July 2021

Coosa Darter *Etheostoma coosae*, Dozier Creek GA, 9 July 2021

Greenbreast Darter *Etheostoma jordani*, Dozier Creek GA, 9 July 2021

Mobile Logperch *Percina kathae*, Dozier Creek GA, 9 July 2021

18 Appendix D

18.1.1 Visual Survey Photographs

Dykes Creek 9 Visual Survey Site, July 2021

Dykes Creek 1 Visual Survey Site, July 2021

Woodward Creek 1 Visual Survey Site, July 2021


Woodward Creek 3 Visual Survey Site, July 2021

Woodward Creek 4 Visual Survey Site, July 2021

Dozier Creek 1 Visual Survey Site, July 2021

Dozier Creek 3 Visual Survey Site, July 2021

Appendix E

18.1.2 Historical Data Collections

Table 54. Escherichia coli (E. coli) Bacteria Counts from Northwest Georgia Regional Commission Water Quality Monitoring. Sites are shown on the map in Figure 3.1. Sites are listed from downstream to upstream.

Dykes Creek *E. coli* Counts (cfu/100 ml)										
	Sampling Dates									
Site	8/29/13	9/12/13	10/8/13	11/21/13	12/12/13	1/26/14	2/19/14	3/17/14	4/7/14	5/5/14
Kingston Rd (DC 1)	0	133	66	33	167	0	33	1800	5733	0
Fred Kelly Rd (DC 2)	0	0	33	33	167	33	0	1567	TMTC	33
Morrison Campground Rd 1 (DC 3)	166	233	166	0	300	0	0	8200	8500	66
Morrison Campground Rd 2 (DC 4)	dry	dry	dry	dry	100	0	33	9133	8567	33
Gentry Rd tributary (DC 5)	0	0	dry	dry	500	67	100	TMTC	TMTC	33
Gentry Rd (DC 6)	dry	dry	dry	dry	100	0	33	233	2433	200
McClain Rd (DC 7)	dry	dry	dry	dry	67	0	0	400	2677	66
Wayside Rd (DC 8)	100	66	dry	dry	33	33	33	667	2100	0
E. Hermitage Rd (DC 9)	66	0	33	33	0	0	0	133	1533	1300

Table 55. Turbidity Measurements (NTUs) from Northwest Georgia Regional Commission Water Quality Monitoring. Sites are shown on the map in Figure 3.1. Values shown are the mean of three measurements taken at each site. Sites are listed from downstream to upstream..

Dykes Creek Mean Turbidity Measurements (NTU)										
	Sampling Dates									
Site	8/29/13	9/12/13	10/8/13	11/21/13	12/12/13	1/26/14	2/19/14	3/17/14	4/7/14	5/5/14
Kingston Rd (DC 1)	0.00	0.53	1.30	1.05	6.42	3.29	4.97	15.62	38.55	2.14
Fred Kelly Rd (DC 2)	0.07	1.70	0.49	0.98	6.12	3.53	4.17	15.81	66.00	1.39
Morrison Campground Rd 1 (DC 3)	0.14	0.87	1.36	1.32	6.67	2.86	5.67	18.73	39.71	0.98

Morrison Campground Rd 2 (DC 4)	dry	dry	dry	dry	8.33	6.66	6.94	19.71	83.26	2.60
Gentry Rd tributary (DC 5)	1.71	0.83	dry	dry	5.75	3.27	4.37	13.33	46.84	1.81
Gentry Rd (DC 6)	dry	dry	dry	dry	9.94	7.81	9.77	20.20	81.34	6.71
McClain Rd (DC 7)	dry	dry	dry	dry	9.50	7.81	11.04	19.51	72.55	7.55
Wayside Rd (DC 8)	4.11	4.50	dry	dry	9.85	8.35	9.34	17.68	63.06	8.20
E. Hermitage Rd (DC 9)	4.84	7.84	7.67	4.14	13.28	13.10	15.26	19.59	70.37	13.06

Table 56. Stream Macroinvertebrate assessment results for Dykes Creek, Floyd County Georgia, which was sampled in October 2013 and May 2014. Investigators: Kevin McAuliff and Gretchen Lugthart, Northwest Georgia Regional Commission. Method of sampling was Geo

	Date			
	October 10, 2013		May 20 and 21, 2014	
Location	Index Value	Water Quality rating	Index Value	Water Quality rating
Kingston Rd (DC 1)	25	Excellent	30	Excellent
Fred Kelly Rd (DC 2)	24	Excellent	28	Excellent
Morrison Campground Rd 1 (DC 3)	17	Good	28	Excellent
Morrison Campground Rd 2 (DC 4)	dry creek	-	14	Good
Gentry Rd tributary (DC 5)	dry creek	-	16	Good
Gentry Road (DC 6)	dry creek	-	2	Poor
McClain Rd (DC 7)	dry creek	-	12	Fair
Wayside Rd (DC 8)	dry creek	-	15	Fair
East Hermitage Rd (DC 9)	13	Fair	17	Good

Table 57. Water quality data and bacterial data for Woodward Creek at Bell's Ferry Bridge, Floyd County, Georgia. Investigators: Kevin McAuliff and Gretchen Lugthart, Kevin McAuliff and Alex Smith, Northwest Georgia Regional Commission.

NWGRC Woodward Creek, Bell's Ferry Rd Crossing Water Quality and Habitat data							
Date	1-8-19	4-3-19	4-11-19	6-26-19	8-7-19	8-8-19	12-5-19

Fecal coliform cfu/100 ml	111	200	-	-	1137	-	218
E. coli cfu100 ml	100	233	-	1566	600	-	100
pH	7	7		7	7		7
Conductivity µs/cm	160	220	-	280	220	-	260
Water temp °C	12.3	11.6		22.8	23.8	--	6.9
Air temp °C	11.5	5	-	21.7	23	-	3.5
Dissolved Oxygen mg/L	8.9	9	-	-	5.7	-	9.7

Table 58. Macroinvertebrate and stream survey data for Woodward Creek, all sites, Floyd County, Georgia. Investigators: Kevin McAuliff and Gretchen Lugthart, Kevin McAuliff and Alex Smith, Northwest Georgia Regional Commission. Macroinvertebrate assessment and

NWGRC Woodward Creek, Macroinvertebrate and Habitat data, all sites				
Stream Site	Macroinvertebrate Water Quality Index value	Macroinvertebrate Water Quality Rating	Stream Habitat Value	Stream Habitat Rating
Bell's Ferry Road Bridge	32	Excellent	58	Good
Shannon Water intake	30	Excellent	65.5	Good
Minshew Road Bridge	24	Excellent	54	Good
Gaines Loop Road Bridge	22	Good	65	Good
Plainville Road Bridge	24	Excellent	44	Fair
Autry Road Bridge	25	Excellent	54	Good
Buttrum Road Bridge Tributary	17	Good	57	Good

Table 59. Fish species collected in Dykes Creek by Georgia DNR, Stream Assessment for 305(b)/303(d) list of Impaired/Unimpaired Waters

Fish Species collected by Georgia DNR, Dykes Creek, 2012

Common name	Scientific Name
Shadow bass	*Ambloplites ariommus*
Largescale Stoneroller	*Campostoma oligolepis*
Banded Sculpin	*Cottus carolinae*
Tricolor shiner	*Cyprinella trichroistia*
Coosa Darter	*Etheostoma coosae*
Speckled Darter	*Etheostoma stigmaeum*
Southern studfish	*Fundulus stellifer*
Mosquitofish ---	*Gambusia sp.*
Alabama Hog Sucker	*Hypentelium etowanum*
Chestnut lamprey	*Ichthyomyzon castaneus*
Least brook lamprey	*Lampetra aepyptera*
Redbreast Sunfish	*Lepomis auritus*
Green Sunfish	*Lepomis cyanellus*
Warmouth	*Lepomis gulosus*
Bluegill	*Lepomis macrochirus*
Longear Sunfish	*Lepomis megalotis*
Redear Sunfish	*Lepomis microlophus*
Spotted Sunfish	*Lepomis punctatus*
Lepomis hybrid	*Lepomis spp.*
Striped Shiner	*Luxilus chrysocephalus*
Redeye Bass	*Micropterus coosae*
Spotted Bass	*Micropterus punctulatus*
Largemouth Bass	*Micropterus salmoides*
Spotted sucker	*Minytrema melanops*
Black redhorse	*Moxostoma duquesnei*
Silverstripe shiner	*Notropis stilbius*
Coosa shiner	*Notropis xaenocephalus*
Mobile Logperch	*Percina kathae*
Blackbanded Darter	*Percina nigrofasciata*
Black Crappie	*Pomoxis nigromaculatus*
Creek Chub	*Semotilus atromaculatus*
Index of Biotic Integrity (IBI)	42 -Fair