ATTACHMENT 3

Upper Ocmulgee River Basin Profile

The Upper Ocmulgee River Basin encompasses 982 square miles along the southeastern edge of the Metro Water District, representing 20 percent of its total area and 33 percent of the overall Upper Ocmulgee River HUC-8 Basin. It includes portions of 30 cities and the following six counties: Clayton, DeKalb, Fulton, Gwinnett, Henry and Rockdale. Several of the larger cities located within the Upper Ocmulgee River Basin portion of the Metro Water District include Atlanta, Conyers, Lawrenceville, Snellville, Stockbridge and McDonough. Approximately 100 miles of Interstate 85, Interstate 75, Interstate 285 and Interstate 20 traverse the basin. It supplies drinking water to Rockdale, Henry and Clayton Counties in the District area (ARC, 2010).

Physical and Natural Features

Geography

The Ocmulgee streams and tributaries are classified as drinking or fishing, with the majority designated for fishing. The Upper Ocmulgee River Basin is entirely within the Piedmont province, which consists of a series of rolling hills and occasional isolated mountains. The Upper Ocmulgee River Basin includes portions of the Gainesville Ridge, Washington Slope and Winder Slope physiographic districts (Figure UO-1) (Metro Water District, 2002).

Hydrology and Soils

The headwaters of the Upper Ocmulgee River Basin originate in Clayton, DeKalb, Fulton and Gwinnett Counties and drain to the southeast through portions of Henry and Rockdale Counties. The Alcovy River, South River, Towaliga River and Yellow River are the main tributaries draining to this portion of the Metro Water District. This river basin includes one 8-digit HUC, ten 10-digit HUCs and forty 12-digit HUCs. While there are multiple smaller reservoirs, such as Big Haynes Creek, Blalock Lake, Lake Jodeco and Stone Mountain Lake in this basin, there are no major impoundments; however, Lake Jackson, a 4,570-acre Georgia Power-managed Project, is located just outside of and downstream of the Metro Water District. As such, it is influenced by the land cover and watershed conditions found within the Upper Ocmulgee River Basin. Jackson Lake is not supporting its designated use of recreation due to fish consumption guidelines for legacy polychlorinated biphenyl (PCB) contamination, which is attributed to urban runoff and nonpoint source pollution.

Two USGS flow stations were selected to characterize the hydrology in the Upper Oconee River Basin, or this overview are in the Ocmulgee basin. Stream discharges for the Alcovy River and its tributaries were characterized via USGS Station 02208450, Alcovy River above Covington, for a 43-year period of record. Annual flows at this station ranged from a low of 1.4 cubic feet per second (cfs) to a high of 1,060 cfs, with a mean of 124 cfs (USGS, 2015a). The South River at Klondike Road, near Lithonia, USGS Station 02204070, showed an annual flow ranging from a low of 58 cfs to a high of 861 cfs for a 39-year period of record, with a mean flow of 271 cfs (USGS, 2015b).

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An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia Environmental Protection Division [Georgia EPD], 2010). None of the Ocmulgee River Basin within the Metro Water District was selected as a priority aquifer for assessment.

The Upper Ocmulgee River Basin within the Metro Water District lies completely within the Piedmont geologic provinces. The aquifers in these provinces are in crystalline rocks that crop out in the northern portion of the basin and extend to the fall line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys, but generally provide insufficient yield for uses other than very low density residential and thus surface water is the primary source of potable water for the District. The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 84 areas, representing about 15 percent of the District, likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. There are approximately 162 square miles, 17 percent of the total basin area, of potential recharge areas within the Upper Ocmulgee River Basin (Table UO-1).

Table UO-1. Groundwater Recharge Areas within the Upper Ocmulgee River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Probable Areas of Thick Soil	Clayton	1
	DeKalb	13
	Gwinnett	65
	Henry	60
	Rockdale	23
Total Recharge Areas		162 [a]

[a] Minor differences in mapping methodologies may cause basin totals to vary slightly from county totals.

There are five soil associations that describe the soil types in the Upper Ocmulgee River Basin: Ashlar-Pacolet-Cecil, Ashlar-Wedowee-Appling, Cecil-Madison-Pacolet, Madison-Davidson-Pacolet and the "urban" soils that start in DeKalb, South Fulton and Clayton Counties (Table UO-2). The Cecil-Madison-Pacolet and Madison-Davidson-Pacolet associations were the most abundant, with the former types associated with moderate rolling hills and the latter with steeper terrain. These soils are well drained and highly weathered, having a red to yellowish-red subsoil (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; U.S. Department of Agriculture [USDA], 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964). The Ashlar-Pacolet-Cecil and Ashlar-Wedowee-Appling association was found primarily in South Gwinnett, DeKalb and Rockdale Counties and are characterized as soils that are deep to very deep with moderate to rapid permeability (Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Thomas, 1982; USDA, 1958).

Table UO-2. Major Soil Associations within the Upper Ocmulgee River Basin

Soil Association	Significance to Watershed Management
Ashlar-Pacolet-Cecil	Characteristics: Moderately deep and excessively drained. Significance to Watershed Management: Runoff is slow to rapid with moderately rapid permeability.
Ashlar-Wedowee-Appling	Characteristics: Consists of very deep, well drained soils; these soils are on narrow ridges and on side slopes of uplands. Significance to Watershed Management: Runoff is medium to rapid and internal drainage is medium; permeability is moderate.

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Table UO-2. Major Soil Associations within the Upper Ocmulgee River Basin

Soil Association	Significance to Watershed Management
Cecil-Madison-Pacolet	Characteristics: Associated with moderate rolling hills, well drained, highly weathered. Significance to Watershed Management: Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices.
Madison-Davidson-Pacolet	Characteristics: Associated with steep terrain, well drained, highly weathered. Significance to Watershed Management: Steep terrain may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more feasible for infiltration practices.
Urban soils	Characteristics: Highly disturbed and compacted soils. Significance to Watershed Management: Construction activities, compaction and surface sealing dramatically change soil properties and can sometimes result in a reduced ability to perform the critical functions or activities of natural soil (Scheyer, 2005). Water movement in urban soils can be influenced by infiltration into the soil surface (especially from rainfall), percolation within the soil drain lines from septic systems (important in the soil below the drain line and above a restrictive layer) and the permeability within the soil from the surface to a restrictive layer.

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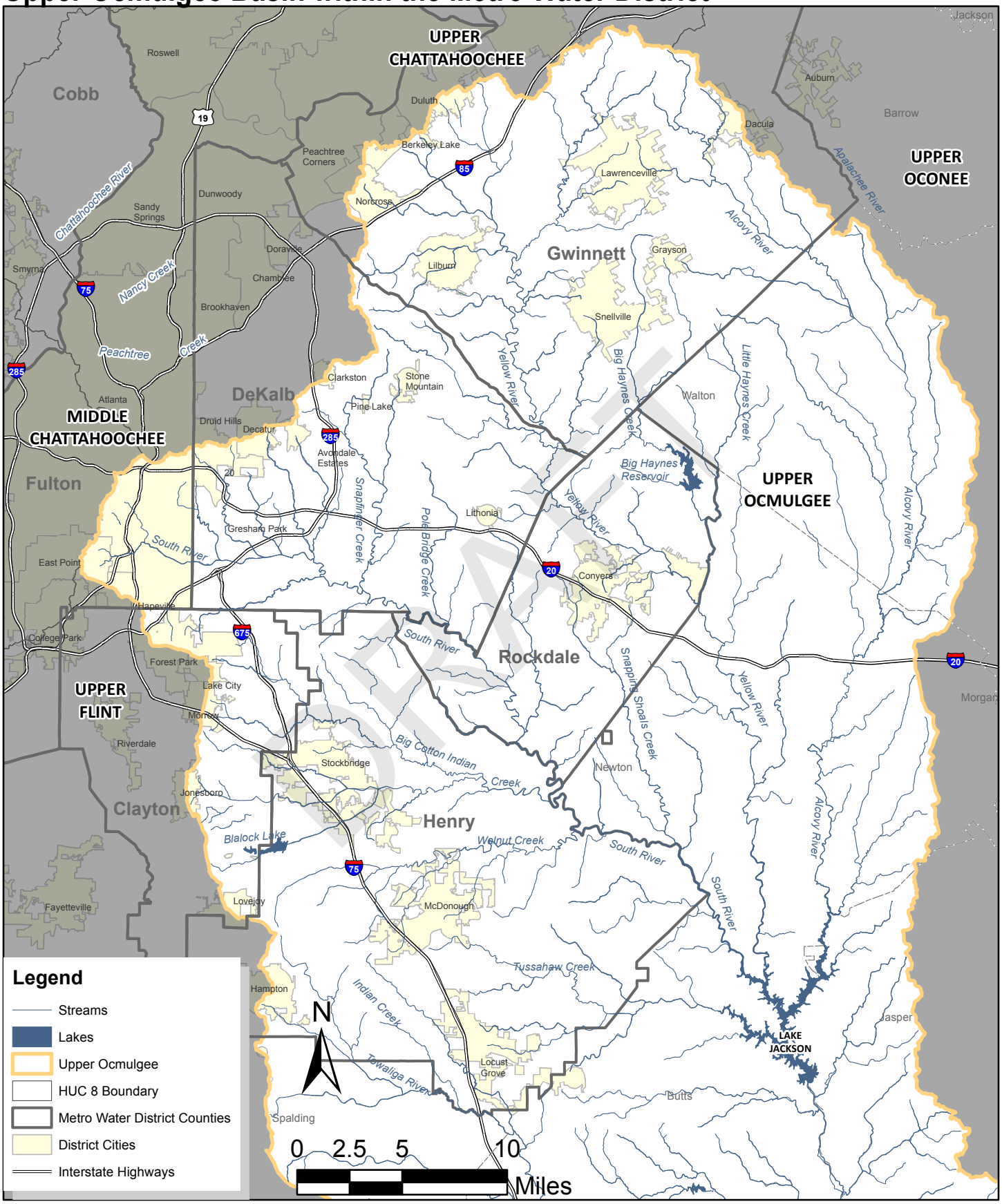
FIGURE OC-1
Upper Ocmulgee Basin within the Metro Water District



Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

Native Species

The Metro Water District is home to a number of native species that are considered threatened or endangered. Protecting watershed health is more than protecting water quality; it also includes protection of biological resources. Within the District, there are a number of protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that grow within or along the margins of rivers and streams. Table UO-3 lists the 13 protected species that are either aquatic or semi-aquatic and potentially found within the counties of the Upper Ocmulgee River Basin.

Table UO-3. Aquatic and Semi-Aquatic Protected Species in the Metro Water District

Fauna Type	Common Name	Status	Clayton	DeKalb	Fulton	Gwinnett	Henry	Rockdale
Bird	Bald Eagle	US					X	X
Fish	Cherokee Darter	US			X			
Fish	Altamaha Shiner	GA		X				
Fish	Highscale Shiner	GA	X					
Invertebrates	Chattahoochee Crayfish	GA					X	
Invertebrates	Gulf Moccasinshell	US			X			
Invertebrates	Shinyrayed Pocketbook	US			X			
Bird	Bachman's Sparrow	GA			X			
Bird	Peregrine Falcon	GA			X			
Fish	Bluestripe Shiner	GA			X			
Fish	Highscale Shiner	GA			X			
Invertebrates	Chattahoochee Crayfish	GA			X			
Invertebrates	Delicate Spike	GA			X			

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). There are no primary trout streams or secondary trout streams located within the Metro Water District portion of the Upper Ocmulgee River Basin.

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Land Use and Impaired Waterbodies Characteristics

Drinking Water Supply

The Upper Ocmulgee River Basin is the primary drinking water supply source for some of the Metro Water District, providing water to all or parts of three District counties, including Clayton, Henry and Rockdale Counties. Table UO-4 lists these water supply sources while Figure UO-2 shows the drinking water supply watersheds and those waters that are designated to meet state drinking water criteria within the Upper Ocmulgee River Basin. Most of Big Haynes Creek in Gwinnett and Rockdale Counties and a segment of the Yellow River in Rockdale County are expected to meet drinking water quality criteria, as are the following seven segments in Henry County: Big Cotton Indian Creek, Brown Branch, Little Cotton Indian Creek, Indian Creek, Pates Creek, Towaliga River and Tussahaw Creek (Georgia EPD, 2015).

Table UO-4. Upper Ocmulgee River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Using Source
W.J. Hooper Reservoir (Little Cotton Indian Creek)	Clayton County Water Authority
Blalock Reservoir (Pates Creek)	Clayton County Water Authority
Fargason Reservoir (Walnut Creek)	City of McDonough
Towaliga River Reservoirs (Strickland and Cole)	Henry County Water and Sewerage Authority
Gardner Reservoir (Indian Creek)	Henry County Water and Sewerage Authority
Rowland Reservoir (Long Branch)	Henry County Water and Sewerage Authority
Ocmulgee Reservoir	Henry County Water and Sewerage Authority
Tussahaw Creek Reservoir	Henry County Water and Sewerage Authority
Brown Branch	City of Locust Grove
Big Haynes Creek	Rockdale County

In addition, surface waters downstream of the Metro Water District serve as important water supply sources, including Lake Jackson. This further stresses the need for protection of surface water quality within the 15-County region as well as the need for coordination with communities upstream and downstream.

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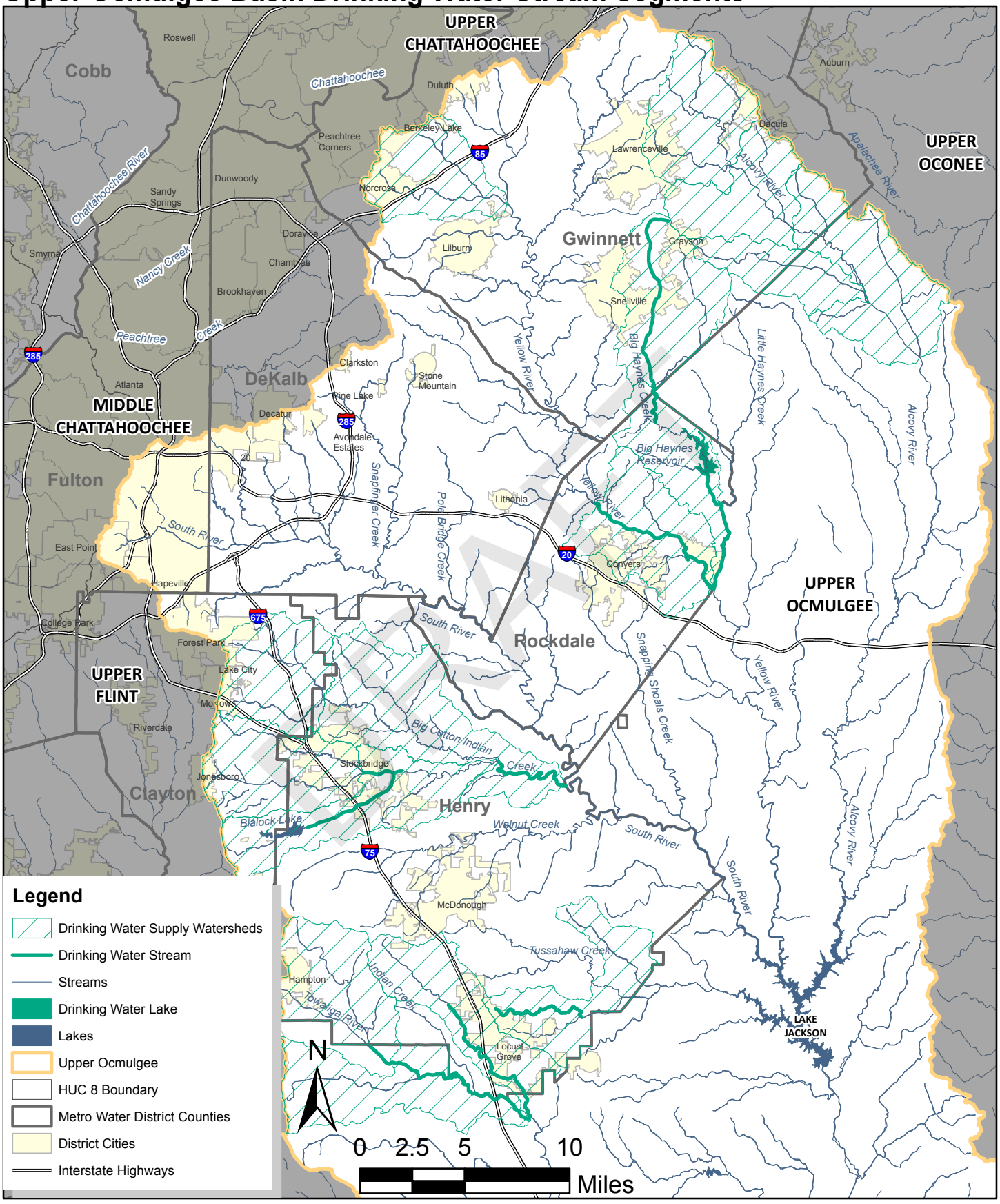
FIGURE OC-2
Upper Ocmulgee Basin Drinking Water Stream Segments



Source water assessments were performed for all drinking water supplies within the Upper Ocmulgee River Basin as required by the U.S. Environmental Protection Agency (EPA). The source water assessments determined the potential for pollution based on a number of watershed characteristics and assigned a susceptibility ranking to each source. The susceptibility rankings throughout the basin were low for Long Branch Creek and Pates Creek. Indian Creek and Big Cotton Indian Creek were assigned a susceptibility ranking of medium-high, while Walnut Creek, Towaliga River and Little Cotton Indian Creek were assigned a susceptibility ranking of medium. These susceptibility rankings indicate the urban and suburban nature of most of the watersheds within the Upper Ocmulgee River Basin and the number of potential pollutant sources within each source water watershed.

Land Cover/Land Use

The northern extent of the Upper Ocmulgee River Basin in Gwinnett and DeKalb Counties is predominantly suburban in character with more densely developed urban areas in the headwaters of the South River in the cities of Atlanta and Decatur. It is also traversed by stretches of five major interstates (85, 20, 285, 675 and 75) as well as Georgia 316 and the Stone Mountain Freeway and the resulting development associated with these corridors. Overall, the Upper Ocmulgee River Basin within the Metro Water District is predominantly residential, with 36 percent remaining undeveloped as agricultural or forest lands, open space, water or wetlands (Table UO-5, Figure UO-3).

Table UO-5. Upper Ocmulgee River Basin Land Cover / Land Use within the Metro Water District

Land Cover/Land Use	2010 Existing (%)	2040 Future (%)
Agricultural Lands	9	
Commercial	8	
Forest/Open Space	23	
High Density Residential	6	
Industrial/Institutional	3	
Low Density Residential	14	
Medium Density Residential	28	
Transitional/Extractive Lands	4	
Transportation and Utilities	2	
Water/Wetlands	3	
Undeveloped	36	25
Developed	64	75

Notes: Undeveloped = Agricultural, Forest / Open Space and Water / Wetlands

Data Source: Aggregated Land Cover categories from ARC's 2010 LandPro Geographic Information System (GIS) and 2040 Envision Data

The Plan 2040 Unified Policy Growth Map estimates that approximately 11 percent of the current forested and agricultural land will be developed in the next 25 years resulting in the Upper Ocmulgee River Basin being 75 percent developed (ARC, 2012). The relative percent distribution and general character of these growth areas are illustrated in Figure UO-4. Much of this growth is anticipated to occur in Henry and Rockdale Counties while infill development and redevelopment resulting in increased density is expected to continue in DeKalb and Fulton Counties.

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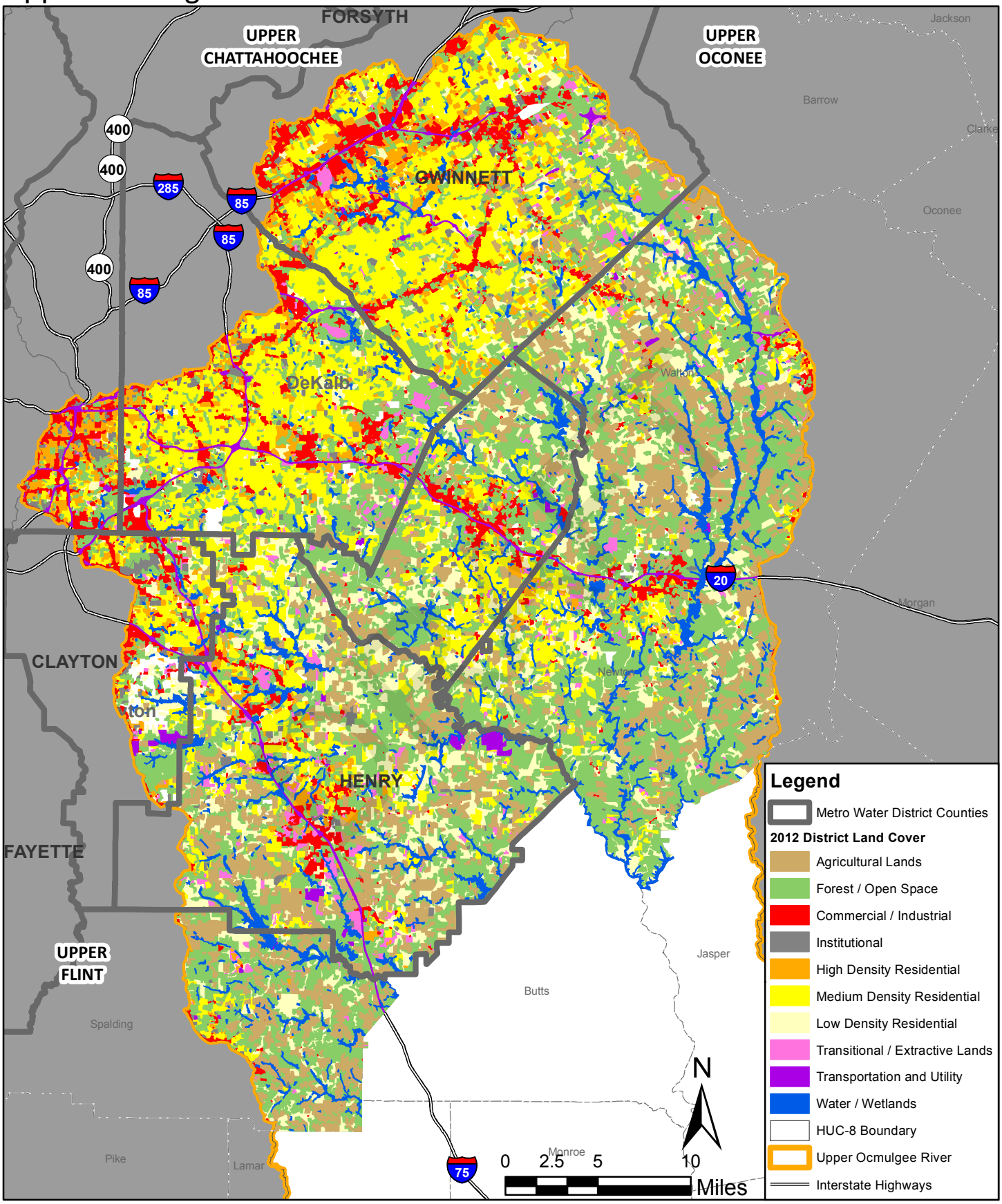
FIGURE OC-3
Upper Ocmulgee Basin 2012 Land Cover



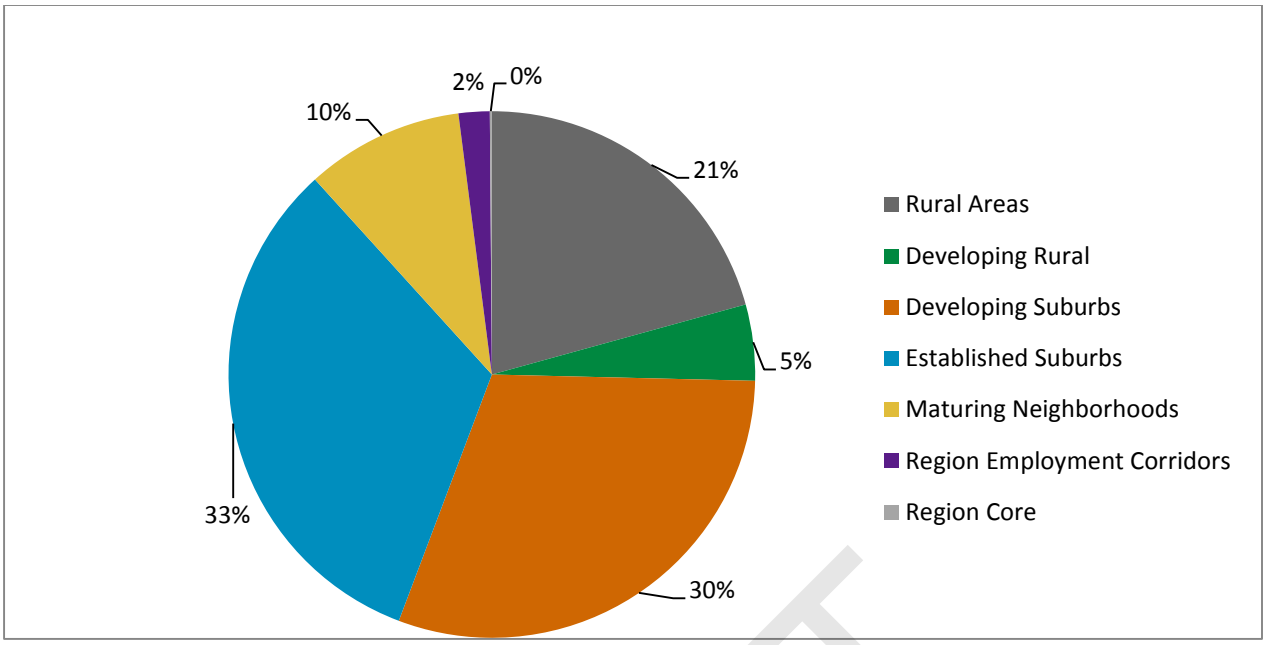


Figure UO-4. Upper Ocmulgee River Basin Future Growth Area Distribution

Note: Categories are defined in
http://documents.atlantaregional.com/plan2040/docs/lu_plan2040_development_guide_0711.pdf

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets and parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. “Total impervious area” quantifies all of the land surfaces impervious to rainfall for the particular land cover category while “effective impervious area” (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 Metro Water District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2016 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using the same methodology as in 2003, but using the 2010 land use/land cover. Attachment 10 lists HUC-12 watershed numbers and descriptions.

Of the 40 HUC-12s within the Metro Water District portion of Upper Ocmulgee River Basin, 18 had an EIA greater than 10 percent, primarily those HUCs that either straddle a major transportation corridor such as Interstate 85, Interstate 20 or the HUCs located within the more densely urbanized area within Interstate 285 (Figure UO-5). There were three HUC-12s with an EIA greater than 20 percent, including the headwaters of the South River in Fulton and Clayton Counties and Beaver Ruin and Sweetwater Creeks in Gwinnett

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County. There are portions of two HUC-12s, Snapping Shoals Creek and Dried Indian Creek, in Rockdale County near Conyers that have EIAs greater than 10 percent.

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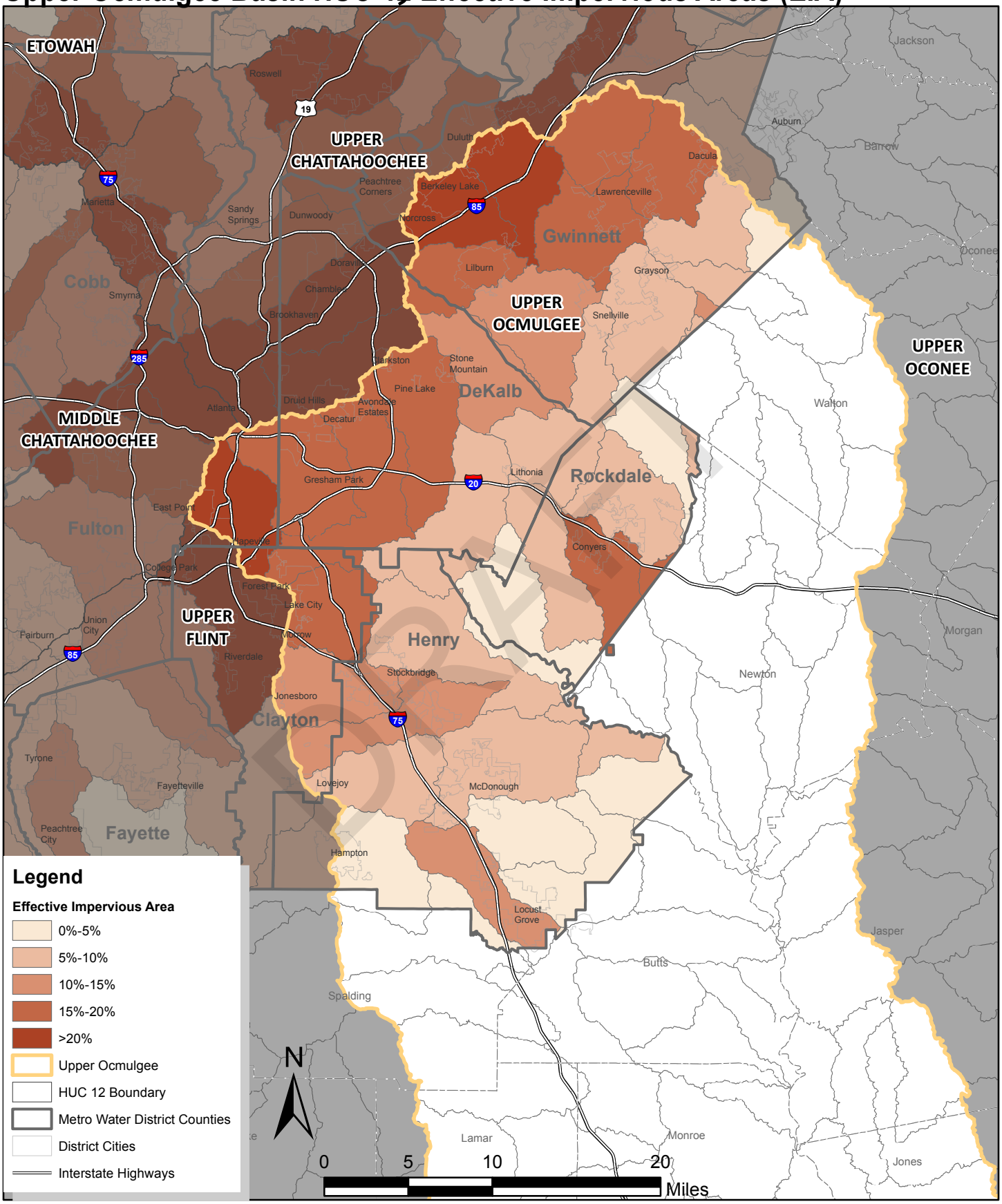
FIGURE UO-5
Upper Ocmulgee Basin HUC-12 Effective Impervious Areas (EIA)



Combined-sewer Overflow Areas

Combined sewer overflow (CSO) areas within the Upper Ocmulgee River Basin are limited to one small drainage area within the South River (HUC-12 # 30701030101) in the City of Atlanta. Major infrastructure improvement projects related to potential CSOs from the East Area CSO facilities during storm events as well as sanitary sewer overflows from the wastewater conveyance systems are ongoing and continue to reduce the bacteria contributions from these sources.

Impaired Waterbodies

Georgia EPD determines whether a waterbody is supporting its designated uses by collecting water quality data and comparing these data against the water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent and timeframe of the dataset that was used to list a waterbody. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

Within the Upper Ocmulgee River Basin, 406 miles or 80 percent of the 506 miles of streams assessed in the Metro Water District portion are listed as not supporting their designated uses based on the 2014 303(d) list due to the criterion summarized in Table UO-6 and graphically shown on Figure UO-6. Several streams are listed for violations of more than one parameter; therefore, the summation of impaired miles by parameter will not equal the miles of not supporting stream.

Table UO-6. Upper Ocmulgee River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2014 Assessed Streams
Fecal Coliform Bacteria	354	70
Biota (Fish Community)	101	20
Biota (Macroinvertebrate Community)	45	9
Fish Consumption Guidance (PCBs)	51	10
pH	3	1
Copper	12	2
Total Stream Mileage Listed	406	80
Total Stream Mileage Assessed for Possible Impairment	506	
Total Stream Mileage in Basin	766	

The majority of assessed streams (70 percent) in the Upper Ocmulgee River Basin do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution. These bacteria enter the stream from both anthropogenic and non-anthropogenic sources, including sanitary sewer overflows, leaking sewer lines, failing septic systems and pet/ wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds, and monitoring programs in Georgia have found levels that exceed state standards in urban, agricultural and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development. Biota listings typically indicate high sediment loads in streams, which decrease habitat quality for benthic macroinvertebrates and fish.

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Sediment sources include runoff from construction sites as well as from streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization.

The South River from Atlanta to Snapping Shoals Creek, downstream of the Metro Water District, is listed for Fish Consumption Guidance as a result of legacy PCB levels. The Ocmulgee River from Walnut Creek to Echeconnee Creek downstream of the District is also listed for Fish Consumption Guidance as a result of legacy PCB levels. Stone Mountain Creek from its headwaters to Stone Mountain Lake is listed for copper. This four-mile section is designated as a fishing stream and was added to the 2012 list.

Total maximum daily loads (TMDLs) and TMDL Implementation Plans have been developed to help jurisdictions address impaired streams and specific parameters of concern. More information on specific TMDLs in the Upper Ocmulgee River Basin can be found on the Georgia EPD website.

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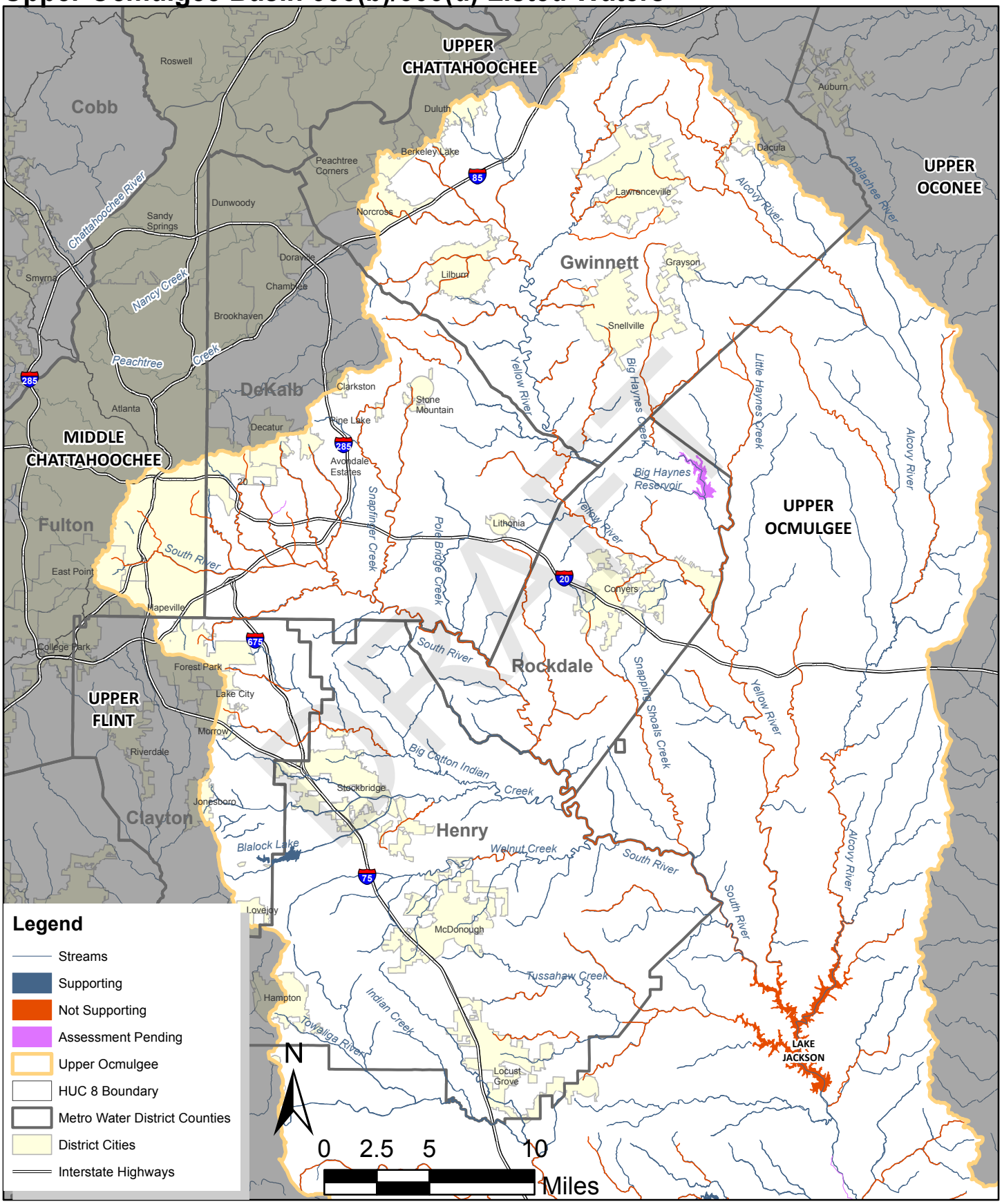
FIGURE UO-6
Upper Ocmulgee Basin 305(b)/303(d) Listed Waters



Management Issues and Recommendations

Initial Screening of Priority Areas

Within the Metro Water District, the proposed implementation actions will vary between basins depending on the existing land uses, water quality, stream and waterbody condition and other watershed-specific management issues. The timeframe for implementation will also vary based on a variety of factors such as TMDL listings, presence of source water watersheds and potential for significant development in the future. Priority areas, also known as critical areas per EPA guidance, were identified at the District level by HUC-12 watershed as an initial screening to enable communities to perform more detailed prioritizations on a subwatershed basis. The priority areas were identified at the HUC-12 level in Table UO-7, if they include a stream or waterbody on the 2014 303(d) list (TMDLs), water supply watersheds or existing EIA greater than 10 percent.

Table UO-7. Upper Ocmulgee River Basin Initial Screening of Priority Areas Based on HUC-12 Watersheds

Total HUC-12 Watersheds (Upper Ocmulgee River Basin)	Watersheds that Include a 303(d)-listed Stream Segment (TMDL)	Water Supply Watersheds [a]	Existing Effective Impervious Cover (EIA > 10%)
40	34	22	18
Percent of Total Watersheds	85%	55%	45%

[a] Water Supply Watersheds represent HUC-12 watersheds that drain to a water supply intake. Many of the HUC-12s do not actually contain any water supply intakes.

Management Issues and Recommended Strategies

Table UO-8 outlines management issues and strategies for the Upper Ocmulgee River Basin within the Metro Water District. These issues and strategies were used to inform and guide the more specific management measures and requirements found in Sections 5, 6 and 7. The recommended strategies presented in Table UO-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance, but are not presented here as mandatory requirements.

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Table UO-8. Upper Oconee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Source water quality	Source water watershed protection of small water supply watersheds.	• Implement source water protection measures in all water supply subwatersheds. • Continue collaborative efforts in small drinking water supply watersheds.
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation. 18 (45%) HUC-12 watersheds with EIA of > 10%. 11% shift from undeveloped to developed land cover (2010 - 2040).	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards. • Watershed improvement projects, such as stream restoration and streambank stabilization, are recommended in areas with failing streambanks to reduce instream sediment load contributions.
Inadequate stormwater controls on existing impervious cover	Much of the development in the basin occurred prior to current Georgia Stormwater Management Manual design standards. Limited resources and cost of maintaining and repairing stormwater infrastructure. Varying local strategies of funding stormwater management.	• Implement an asset management program to identify and prioritize maintenance and capital improvement projects to maximize benefit. • Consider updating stormwater controls during redevelopment. • Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment or other controls. • Consider dedicated funding sources such as stormwater utilities and seek out opportunities for grants, loans and partnerships.
Biota TMDLs	20% of the streams assessed had impaired fish communities and 9% of the benthic macroinvertebrate communities are impaired. Biota impairment in this basin are the result of high sediment loads, primarily associated with existing land uses, which is a concern for drinking water source supplies, biota and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Watershed improvement projects, such as stream restoration and streambank stabilization are recommended in areas with failing streambanks to reduce instream sediment load contributions. • Participate in efforts to educate agricultural stakeholders about the importance of implementing Best Management Practices for Georgia Agriculture Manual for animal production facilities (poultry) and grazing operations.
Bacteria TMDLs	70% of assessed stream segments in the Upper Ocmulgee River Basin (within the Metro Water District) are listed for fecal coliform.	• Identify bacteria sources through inspections, monitoring, source tracing and stream walks. • Educate public on pollution prevention, proper septic system maintenance, reporting a potential illicit discharge. • Address fecal coliform bacteria contributions from sanitary sewer overflows as outlined in the Wastewater Management Plan. • Regular maintenance to ensure proper functioning of decentralized systems (such as septic tanks).

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Table UO-8. Upper Oconee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
		• Coordinate with Georgia Department of Agriculture Livestock/Poultry Section on inspections, complaint investigations, nutrient management plan reviews and permit administrative support
Lake management	Within this basin, there are other public and privately-held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes by providing resources, links or other materials to assist with periodic activities such as inspections, water quality sampling or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.
South River	Urbanizing land-uses, aging infrastructure, and non-point source pollution are responsible for water quality impairments. These lead to a loss of recreational opportunities and poor water quality	• Work with local jurisdictions and other stakeholders to develop a framework for coordination and projects to address issues • Focus on nonpoint sources and what can be done to mitigate those impacts.

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. The Plan includes implementation actions related to watershed monitoring and conducting condition assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (5.F.1) and habitat and biological monitoring (5.F.2), as well as resource-specific implementation actions for TMDL Management (4.H.2). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during) and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Upper Ocmulgee River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.

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- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability and riparian condition over time.
- Conduct project monitoring to establish pre-, during- and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

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