Impaired Waters Phase II Plan

City of Sandy Springs

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SWP&E
Sustainable Water Planning and Engineering, LLC

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0 Executive Summary

The City of Sandy Springs wants to have healthy watersheds that will provide clean, healthy water for this and future generations. Four of the City's streams (Crooked Creek, Long Island Creek, Marsh Creek, and Nancy Creek) are classified as impaired for not meeting state water quality standards for fecal coliform bacteria and for biota for fish habitat. The focus of this Plan is to establish an action list that, if implemented, will result in the City's streams meeting state water quality standards.

The City has a number of existing studies and plans that include ongoing actions to improve water quality as well as existing recommendations. This Plan leverages the ongoing activities as well as recommendations, compiling these into one consolidated action plan. Many of the ongoing activities are tied to regulations.

Meeting state water quality standards will be challenging. A few of the key challenges include:

1. **Cost**. Restoring impaired waterbodies is expensive. The cost to implement the water quality improvement projects recommended in the City's Watershed Improvement Plans totals over $110 million. The City's current annual budget provides for $250,000 for Green Infrastructure and sustainability projects. Even if all of these budgeted funds were allocated exclusively to watershed improvement projects, it would take over 400 years to implement these projects.
2. **Timeframe**. The cost will certainly drive the implementation schedule. The current water quality impairments are the result of decades of land use changes, urbanization, and aging infrastructure. There are no "quick fixes" to address these water quality issues. Patience is needed to realize the benefits of the ongoing and recommended projects and programs. For example, the re-development of commercial properties may reduce stream impairment because they will be required to comply with current stormwater ordinances that were not in place when originally developed.
3. **Shared Responsibility**. The City shares responsibility for these water quality challenges with other jurisdictions and with private property owners. For example, Fulton County is responsible for the sanitary sewer system, Fulton County Environmental Health is responsible for septic systems, and private property owners are responsible for their land. Additionally, three of the four impaired streams originate in another jurisdiction. A cooperative approach is needed as many of the potential pollutant sources are outside of the City's control.

Given the timeframe, cost, and complexity of meeting state water quality standards, this Plan recommends an adaptive management approach with a rolling five-year implementation plan. The City will implement cost-effective strategies over the five-year implementation plan and then re-assess conditions and effectiveness of those strategies. Every five years, a new implementation plan will reflect the information learned over the previous five years.

1 Impaired Waters Status and Background

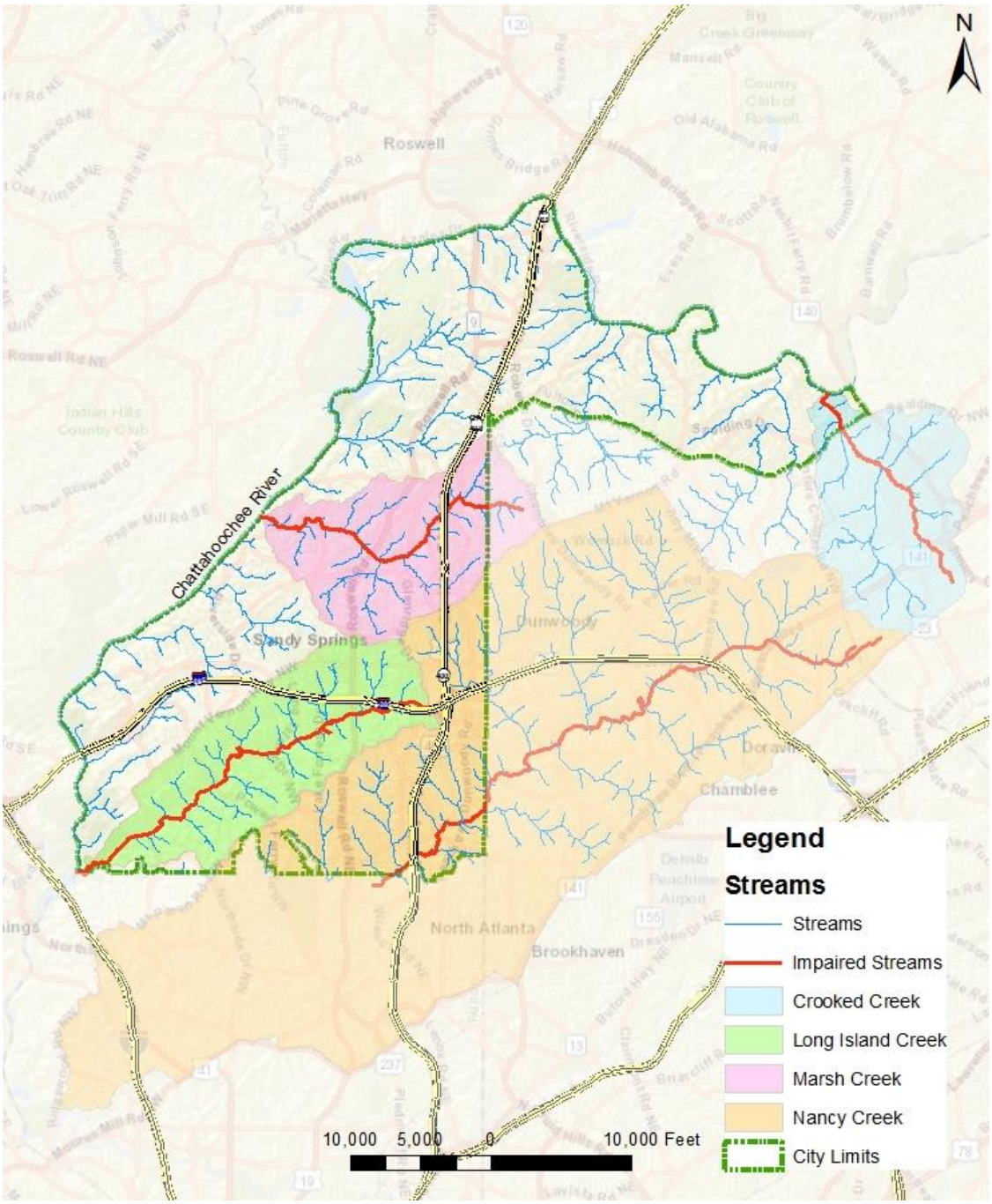
The Clean Water Act requires that each state designate beneficial uses of their waters and develop water quality standards to protect those uses. If a stream does not meet the water quality standard for its designated use, then it is classified as an "impaired waterbody". The Georgia Environmental Protection Division (EPD) is responsible for establishing designated uses and developing a list of impaired waterbodies every two years.

Four streams within the City of Sandy Springs (COSS) are currently classified as impaired waters: Nancy Creek, Crooked Creek, Marsh Creek, and Long Island Creek. This section provides an overview of the impaired waters status, describes the parameters of concern, and sets the foundation for this report.

1.1 Impaired Waters in Sandy Springs

There are four streams that are classified by the EPD as not meeting the criteria for their state-assigned "designated use". These streams include: Nancy Creek, Crooked Creek, Marsh Creek, and Long Island Creek (Figure 1-1). The designated use for all four of COSS's impaired streams is fishing, which allows for secondary contact recreation in or on the water. EPD regulations establish specific criteria for dissolved oxygen, pH, temperature, bacteria, and biological integrity that must be met in order to meet the fishing designated use. These four streams do not meet state standards for fecal coliform bacteria and for biota as a result of fish sampling. These parameters are explained in more detail in the following sections.

Figure 1-1. Impaired Streams in Sandy Springs



1.1.1 Bacteria

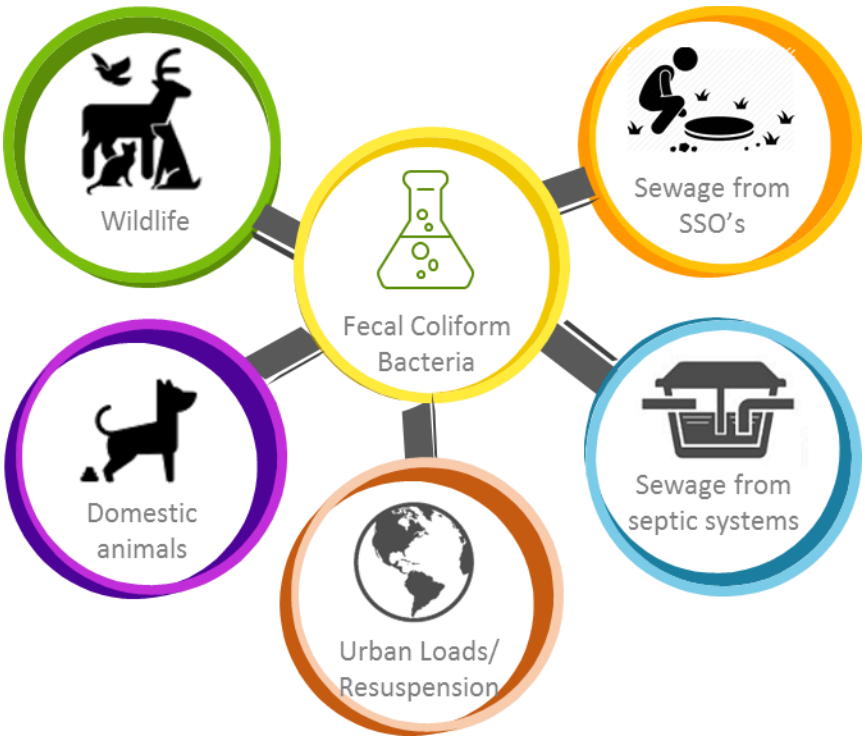
Fecal coliform bacteria is an indicator of the presence of potentially harmful pathogens in water. The greater the level of fecal coliform bacteria, the more likely a human is to become sick if that water is ingested. Fecal coliform bacteria are found in the intestines of warm-blooded animals

and many of these bacteria are not associated with human health risks. Fecal coliform bacteria is traditionally used as an indicator because pathogens are difficult and expensive to monitor.

Sources of fecal coliform bacteria include wildlife sources and human sources as presented in Figure 1-2. The wildlife sources include wild animals (i.e., racoons, deer, geese) as well as domestic animals (i.e., dogs, cats). Human sources include Sanitary Sewer Overflows (SSOs) and/or leaks from aging sewer systems, and sewage from failing septic systems. Finally, there are general sources that include urban loads and re-suspension that are a mixture of wildlife and human sources. Urban loads and re-suspension include sediment from streambank erosion, re-suspension of previously deposited fecal coliform bacteria, and runoff from streets and parking lots that may contain trace levels of fecal coliform bacteria.

The fecal coliform standard includes a summer standard geometric mean of 200 colonies/ 100mL which includes the months of May through October and a winter standard geometric mean of 1,000 colonies/ 100mL from November through April. The summer standard is lower to reflect the increased likelihood of recreation during these months. Additionally, no single sample can exceed 4,000 colonies/ 100mL. The geometric mean must include a minimum of four samples taken in a 30-day period at intervals not less than 24 hours.

Figure 1-2. Sources of Fecal Coliform Bacteria



When evaluating stormwater bacteria loads, it is important to note:

- Fecal coliform bacteria concentrations in sewage are two orders of magnitude greater than other urban stormwater concentrations.
- Anthropogenic sources of bacteria are more likely to cause human illness.
- Bacteria can survive and grow both within the storm sewer system and in stream sediment.
- Bacteria levels are strongly correlated to total suspended solids (TSS) in streams.
- The City of Sandy Springs does not manage the wastewater collection system and does not manage septic system permits or issues related to septic system failure.
- The City of Sandy Springs does work cooperatively with Fulton County on issues related to wastewater and Fulton County Environmental Health on issues related to septic systems.

1.1.1.1 *E.coli* Bacteria

EPD is in the process of changing the bacteria indicator from fecal coliform bacteria to *E. coli*, as their research shows that *E.coli* is a better indicator of the human health risk. The City currently analyzes samples for both fecal coliform bacteria and *E.coli* bacteria. This change is unlikely to change the impairment status of the four impaired waters.

1.1.1.2 Bacteria Water Quality Sampling Efforts

The City collects fecal coliform bacteria and E.coli samples following a geometric mean protocol at two stations: Crooked Creek and Nancy Creek. Fulton County collects fecal coliform bacteria and E.coli samples following a geometric mean protocol at three stations: Ball Mill Creek, Long Island Creek, and Marsh Creek. Through this sampling program, the City has shown that Ball Mill Creek meets the standards for its designated use. The sampling results for the other four locations are consistent with the state listing of impairment. Sampling result summaries are presented by watershed in Section 2.

Table 1-1: Fecal Coliform Bacteria Sampling Locations

Location	Fulton County	City of Sandy Springs
Ball Mill Creek	Yes	
Crooked Creek		Yes
Long Island Creek	Yes	
Marsh Creek	Yes	
Nancy Creek		Yes

1.1.1.2.1 Bacterial Source Tracking

In 2017, the City conducted a Bacterial Source Tracking (BST) study at five locations with the goal of determining whether the source of fecal coliform bacteria was human and/or dog. Samples were analyzed for human genes and dog-associated genes. Table 1-2 provides a high-level summary of the results in terms of whether human and/or dog fecal coliform were considered to be “low”, “moderate”, or “high”.

Table 1-2: BST Sampling Results

Location	Human Fecal Sources	Dog Fecal Sources
Ball Mill Creek	Low	Low to moderate
Crooked Creek	Low	Low to moderate
Long Island Creek	High	Moderate
Marsh Creek	Moderate	Moderate
Nancy Creek	Moderate to High	Moderate

The results of this study can help direct the types of projects and programs toward the known sources in the watershed. As the study only looked at human and dog sources of fecal coliform bacteria, there are a number of other sources such as deer, racoon, and geese that could be contributing to elevated levels. In the areas where human sources of fecal coliform bacteria are high, the report recommends that stream walks or other efforts to identify the likely sanitary sewer sources in the watershed.

1.1.2 Biota - Fish

Biota impairments are the result of low scores from fish and/or macroinvertebrate sampling. For the four COSS impaired streams, the source of the listing was low fish sampling scores. Fish samples are taken by the state Department of Natural Resources (DNR) Wildlife Resources Division (WRD). The WRD uses the Index of Biotic Integrity (IBI) and the Index of Well-Being (IWB) to identify affected fish populations and classify these populations (Excellent, Good, Fair, Poor, or Very Poor). Streams with overall ratings of “poor” or “very poor” are considered as “impaired for fish biota”. Generally, the low cause of IBI scores is the lack of fish habitat due to stream sedimentation; therefore, the state relates sediment load to habitat impairment.

Sources of sediment load include anthropogenic sources and natural sources as presented in Figure 1-3. Anthropogenic sources including runoff from active construction sites, runoff from urban areas such as parking lots and roadways, and other land sources such as runoff from homes and other private property. Natural sources of sediment load include bank erosion and

instream distribution of sediment, some of which is a natural process. The natural sources are often aggravated by urbanization and impervious surfaces within the watershed.

Figure 1-3. Sources of Sediment Load (Fish Biota Impairment)

One important consideration with regards to habitat, is that land use changes upset a stream's dynamic equilibrium. Given time, the stream will likely stabilize under a new equilibrium. The new equilibrium will likely follow a large adjustment in channel form that typically involves extreme bank erosion or incision. In a suburban and urban area, the natural evolution process is unacceptable because homes and businesses along these streams are substantially impacted by the erosion.

1.1.2.1 Habitat Assessments and Stream Walks

In 2017, the COSS completed a stream assessment inventory of 32-miles of main stem and tributary streams in Sandy Springs. The stream assessments included Nancy Creek, Crooked Creek, Marsh Creek, Long Island Creek, and Ball Mill Creek. These assessments evaluated the visual habitat conditions and noted maintenance needs within the assessed streams. Overall, the stream conditions rated as marginal to poor which is not uncommon for urban streams.

1.1.3 Total Maximum Daily Loads

The EPD, in conjunction with the Environmental Protection Agency (EPA), develops Total Maximum Daily Loads (TMDLs) for impaired waterbodies that estimate the load reduction needed to meet state standards. For the Biota-Fish TMDL, the state assigns total suspended solids (TSS) as an indicator for the biota-fish standard. The load reductions needed for each parameter for the COSS impaired streams is presented in Table 1-3.

Table 1-3: Estimated Load Reductions Needed to Meet State Standards

Impaired Stream	Bacteria Load Reduction	Biota – Fish (TSS) Load Reduction
Crooked Creek	77%[1]	0%[2]
Long Island Creek	50%[1]	38%[3]
Marsh Creek	60%[1]	0%[2]
Nancy Creek	84%[1]	35%[3]

1. "Revised Total Maximum Daily Load Evaluation for Seventy-Nine Stream Segments in the Chattahoochee River Basin for Fecal Coliform". EPD. November 2008.[i]
2. "Total Maximum Daily Load Evaluation for Twenty-Nine Stream Segments in the Chattahoochee River Basin for Sediment (22 Fish Community Impacted, 6 Macroinvertebrate Community Impacted, 1 Fish & Macroinvertebrate Community Impacted)". EPD. December 2017.[ii]
3. "Total Maximum Daily Load Evaluation for Twenty-Five Stream Segments in the Chattahoochee River Basin for Sediment (Biota Impacted)". EPD. January 2008.[iii]

It is important to note that EPD changed the method for calculating the sediment reduction needed to meet state water quality standards for biota between the two TMDLs. Crooked Creek and Marsh Creek do not have a recommended reduction in sediment but are still classified as impaired. The load reduction was not calculated in the TMDL because the streams are considered to be eroding and incising in order to create a new stable equilibrium. In theory, if the stream was allowed the space to continue this process and there was no further human interference, the stream would meet state biota standards. The conditions in Long Island Creek and Nancy Creek are similar, and it is expected that when the TMDLs are updated there will be no recommended load reduction for these watersheds as well. All four streams are still classified as impaired for not meeting state standards, regardless of the reduction identified in the TMDL.

1.1.4 Land Use and Impervious Area

Land use and impervious area are strongly correlated with water quality impacts. Understanding the types and density of land use is critical to assessing and recommending actions to improve impaired waterbodies. The three highest land use categories by percentage are shaded in Table 1-4 below for each watershed. The most common land uses in the watershed include multi-family residential uses, single-family homes, and conservation land in the Crooked Creek watershed.

Table 1-4. Percentage of Land Use by Category by Watershed within COSS

Land Use Category	Crooked Creek	Long Island Creek	Marsh Creek	Nancy Creek
Residential Detached	49.5	9.8	9.5	13.7
Residential Estate	6.8	20.4	1.7	4.1
Residential Multi-Unit	13.8	45.1	47.9	18.9
Residential Urban	0.0	0.4	0.0	0.3
Residential Townhouse	0.0	13.8	21.8	24.5
Residential Mixed Use	0.0	4.8	0.0	0.0
Perimeter Residential	0.0	0.0	14.1	21.1
City Springs	0.0	2.7	0.3	0.0
Commercial Corridor	0.0	0.0	0.1	0.0
Commercial Mixed Use	12.3	0.9	0.5	0.7
Perimeter Medical	0.0	0.2	0.0	8.4
Office Neighborhood	0.0	0.2	0.0	0.4
Shopfront Mixed Use	0.0	0.3	0.2	0.2
Office Mixed Use	0.0	0.4	1.5	1.5
Perimeter Mixed Use	0.0	0.2	1.7	5.3
Transit-oriented Development	0.0	0.0	0.2	0.0
Parks and Recreation	0.0	0.0	0.3	0.6
Conservation and Open Space	17.5	1.0	0.2	0.1
TOTALS	**100.0**	**100.0**	**100.0**	**100.0**
Land use data was provided in ArcGIS format by the COSS.				

Impervious area is another strong indicator of watershed health. Impacts are typically observed when impervious area exceeds 10-percent. Above 25-percent impervious area, habitat degradation is expected based on the Center for Watershed Protection analysis[iv]. All four watersheds have relatively high overall impervious percentages that are indicative of habitat challenges.

Table 1-5. Percentage of Impervious Area by Watershed

Watershed	% Impervious Area in COSS	% Impervious Area in Watershed
Crooked Creek	8.2%	25-50%
Long Island Creek	37.2%	37.2%
Marsh Creek	20%	25-50%
Nancy Creek	21%	30%
Impervious area within COSS was provided in ArcGIS format by the COSS. Impervious area for Crooked Creek and Marsh Creek are from the COSS Fecal Coliform Watershed Improvement Plan. The impervious area for Nancy Creek is from the City of Atlanta Nancy Creek Watershed Improvement Plan.		

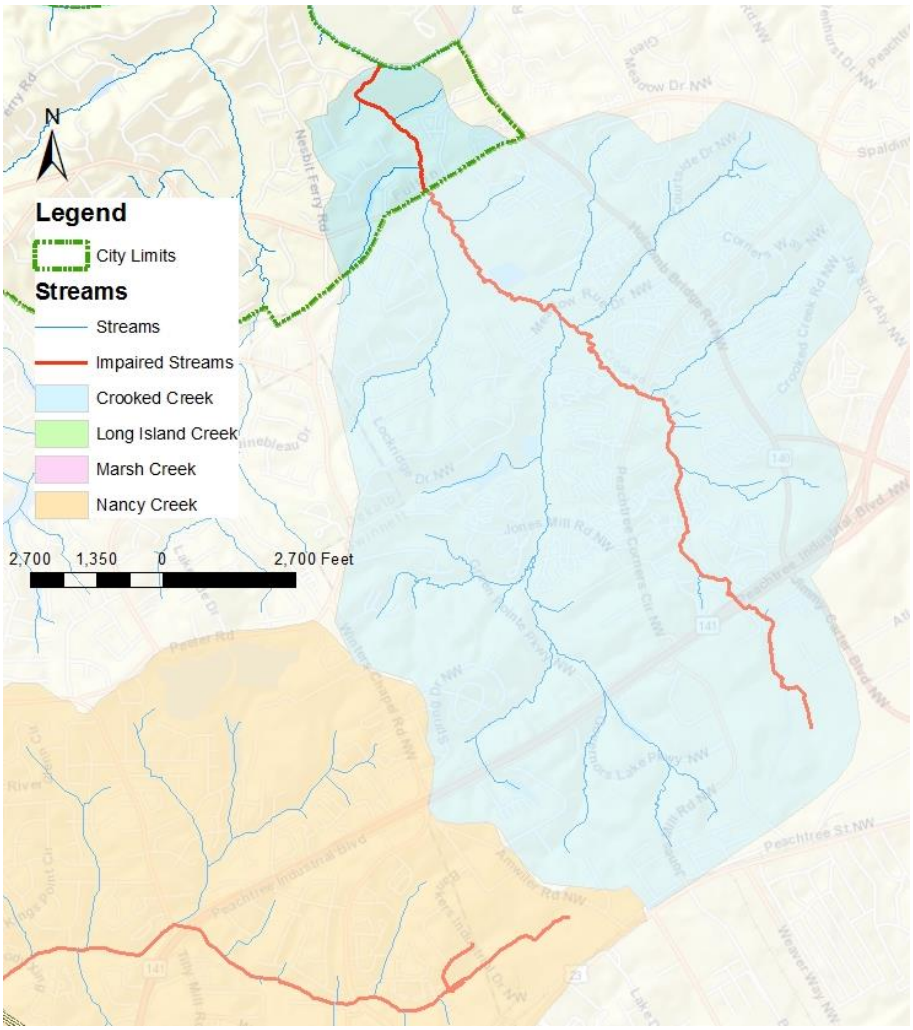
2 Watershed Profiles

This Section provides an overview of the watersheds that surround the impaired waterbodies. As these watersheds are described in greater detail in the Watershed Improvement Plans, this description is intentionally brief.

2.1 Crooked Creek

The Crooked Creek watershed is around 5,900 acres, of which only 3-percent is located within the City limits. The majority of the watershed is within Peachtree Corners in Gwinnett County. The Gwinnett County Crooked Creek wastewater treatment facility is located just upstream of the COSS city limit (Figure 2-1).

Figure 2-1. Crooked Creek Watershed



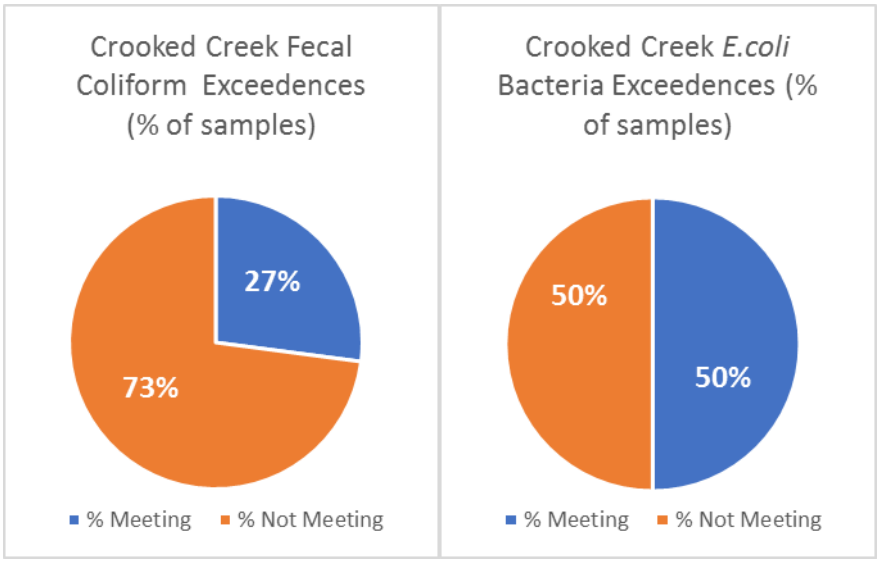
2.1.1 Crooked Creek Land Use and Impervious Area

Approximately 8.2-percent of the land area within the COSS portion of the Crooked Creek watershed is impervious area. The dominant land uses within COSS are: Residential detached, conservation and open space, and multi-unit residential. The impervious area within COSS is relatively low, but other studies show that the impervious area for the entire watershed are relatively high between 25 – 50-percent impervious area.

2.1.2 Crooked Creek Water Quality Data

The Bacteria TMDL[i] shows that a 77-percent reduction in fecal coliform bacteria is needed to meet state water quality standards. The COSS sampling results from 2015 to 2018 are consistent, showing that Crooked Creek meets the fecal coliform bacteria criteria only 27-percent of the time and the *E.coli* standard 50-percent of the time (Figure 2-2). The BST sampling results indicate that human and dog fecal coliform levels are low. The BST sampling noted that geese associated with the ponds in the watershed are a potential source. The Gwinnett County wastewater treatment plant is closely monitored and is not likely a significant source.

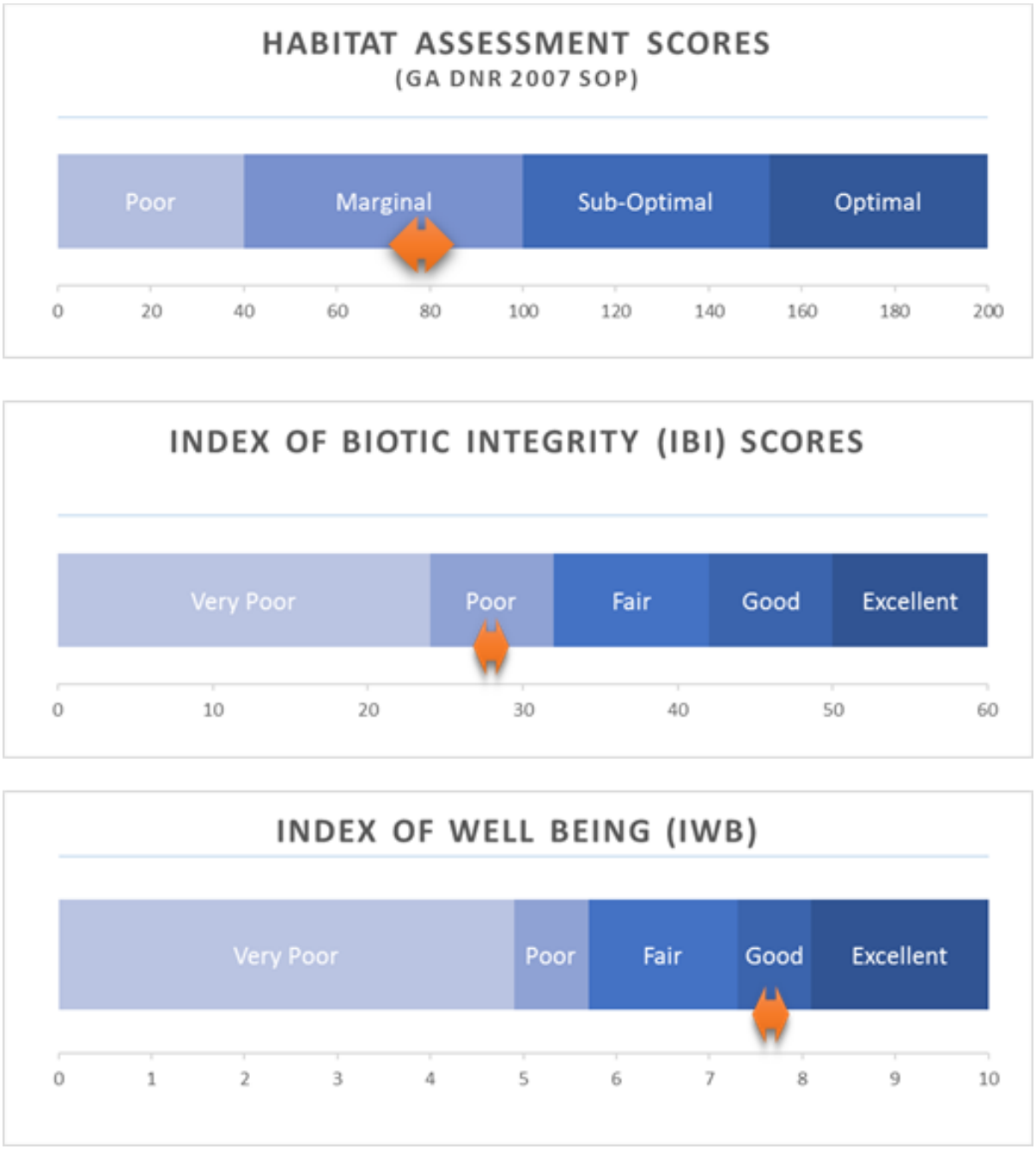
Figure 2-2. Percentage of Fecal Coliform Bacteria and *E.coli* Bacteria Samples that Exceed State Standards in the Crooked Creek Watershed



The TMDL for Biota/Sediment does not indicate a need to reduce sediment load, however the IBI score is about 15-percent lower than that needed to meet state standards[ii]. Additionally, the stream habitat analysis performed by the City shows that a 31-percent improvement in habitat

score is needed to improve from “marginal” to “sub-optimal”. The analysis noted that there is some stream buffer encroachment and that the buffer vegetation is compromised in areas. The habitat assessment also noted areas with instream erosion and alternations that are typical of a suburban/urban stream. A result of the information within the TMDL and the City’s sampling efforts related to habitat conditions is shown in Figure 2-3.

Figure 2-3: Comparative Habitat Rating for the Crooked Creek Watershed



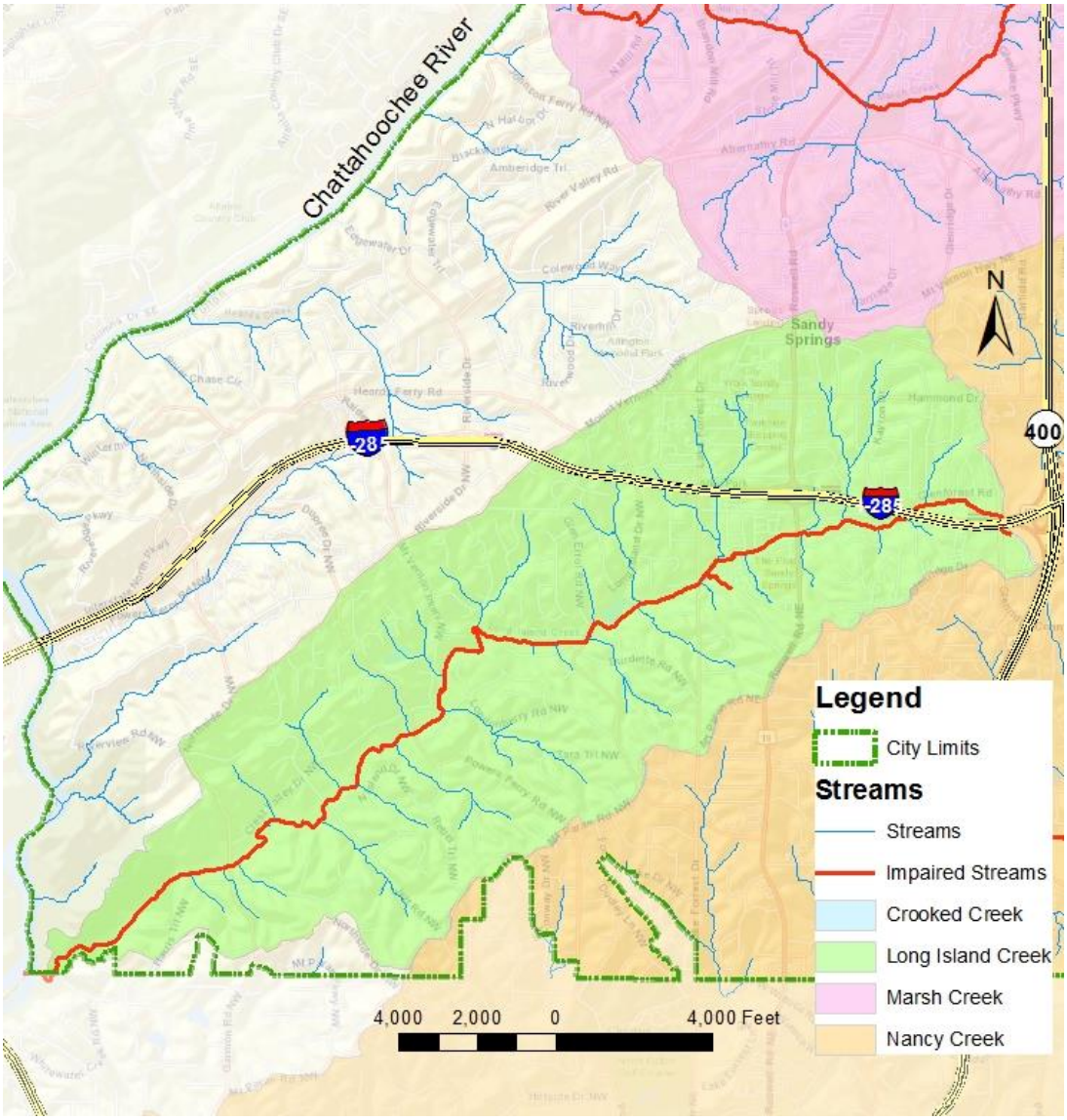
2.1.3 Crooked Creek Watershed Improvement Projects

There were no watershed improvement projects recommended in the Fecal Coliform Watershed Improvement Plan. Only a very small portion of the watershed is within the City limits.

2.2 Long Island Creek

The Long Island Creek watershed is around 4,200 acres and originates within the City limits. Only a very small portion of the watershed is located outside of the City limits (Figure 2-4).

Figure 2-4. Long Island Creek Watershed



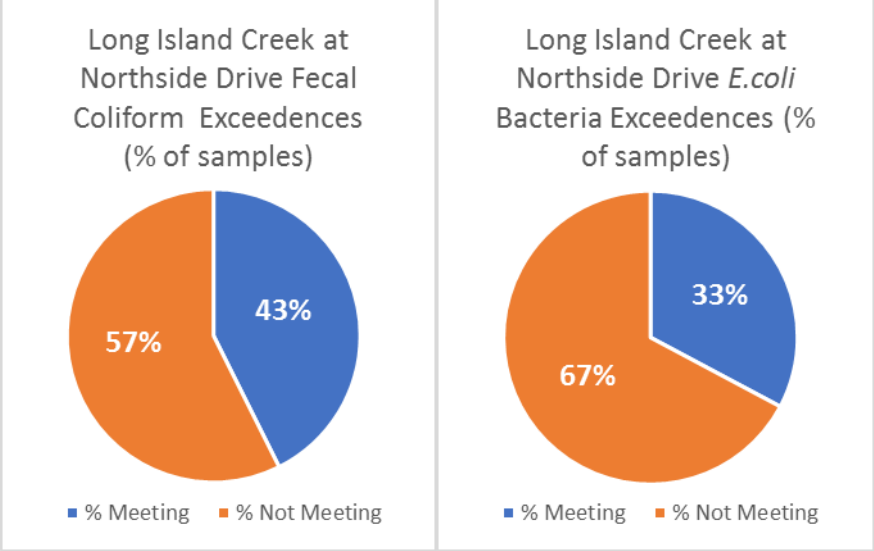
2.2.1 Long Island Creek Land Use and Impervious Area

Approximately 37.2-percent of the land area within the COSS portion of the Long Island Creek watershed is impervious area. The dominant land uses within COSS are: residential multi-unit, residential townhouse, residential estate, and residential detached. The impervious area includes approximately 5.1 miles of I-285. The impervious area within COSS is relatively high and above the 25-percent threshold where watershed impacts are expected.

2.2.2 Long Island Creek Water Quality Data

The Bacteria TMDL[i] shows that a 50-percent reduction in fecal coliform bacteria is needed to meet state water quality standards. The Fulton County sampling results from 2015 to 2018 are consistent, showing that Long Island Creek meets the fecal coliform bacteria criteria 43-percent of the time and the *E.coli* standard 33-percent of the time (Figure 2-5). The BST sampling results found a high level of human bacteria and a moderate level of dog bacteria.

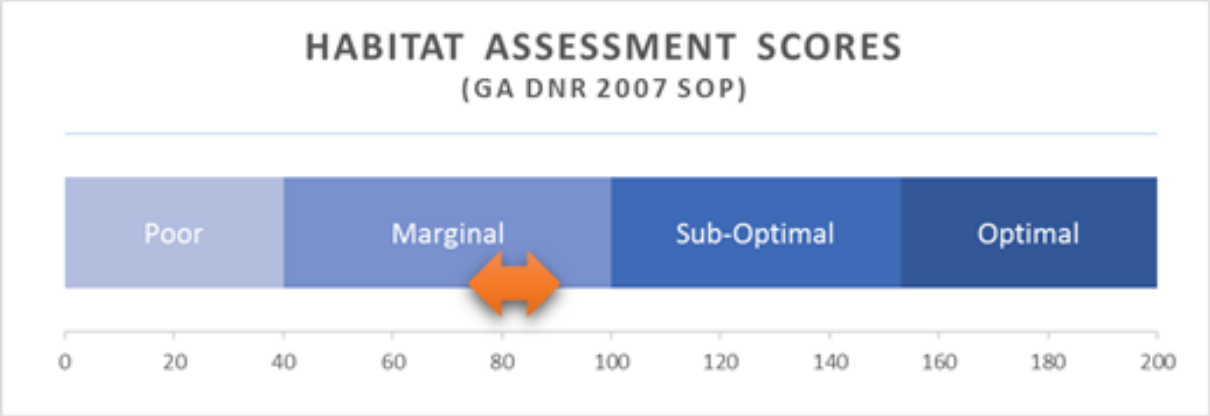
Figure 2-5. Percentage of Fecal Coliform Bacteria and *E.coli* Bacteria Samples that Exceed State Standards in the Long Island Creek Watershed

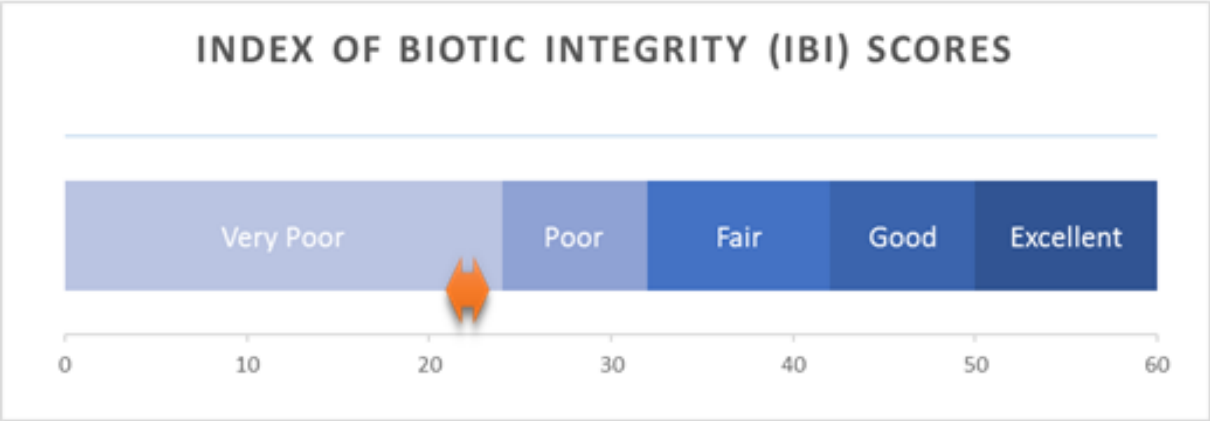


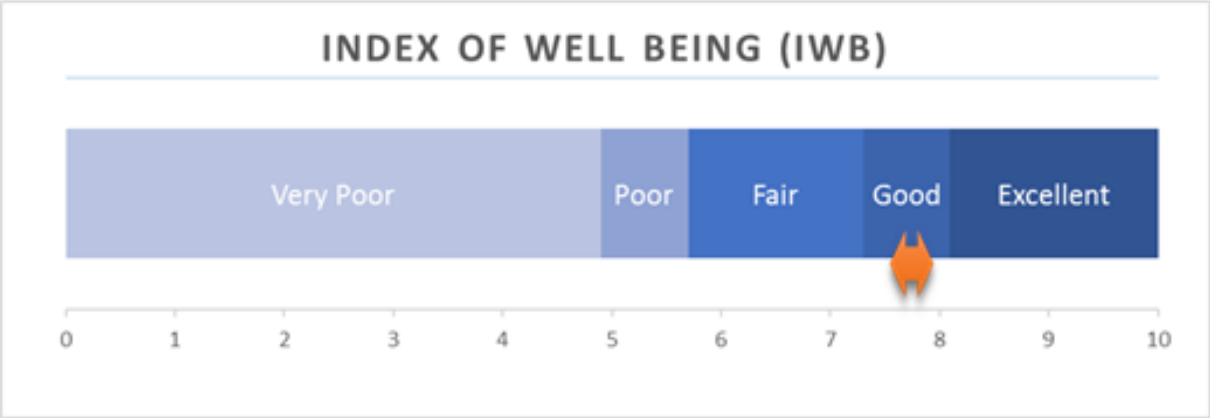
The TMDL for Biota/Sediment indicates that a 38-percent reduction sediment load is needed to meet state standards[ii]. Additionally, the stream habitat analysis performed by the City shows that a 29-percent improvement in habitat score is needed to improve from "marginal" to "sub-optimal". The analysis noted that there is some stream buffer encroachment and that the buffer vegetation is compromised in areas. The habitat assessment also noted areas with instream erosion and alternations that are typical of a suburban/urban stream. A result of the information

within the TMDL and the City's sampling efforts related to habitat conditions is shown in Figure 2-6.

Figure 2-6: Comparative Habitat Rating for the Long Island Creek Watershed



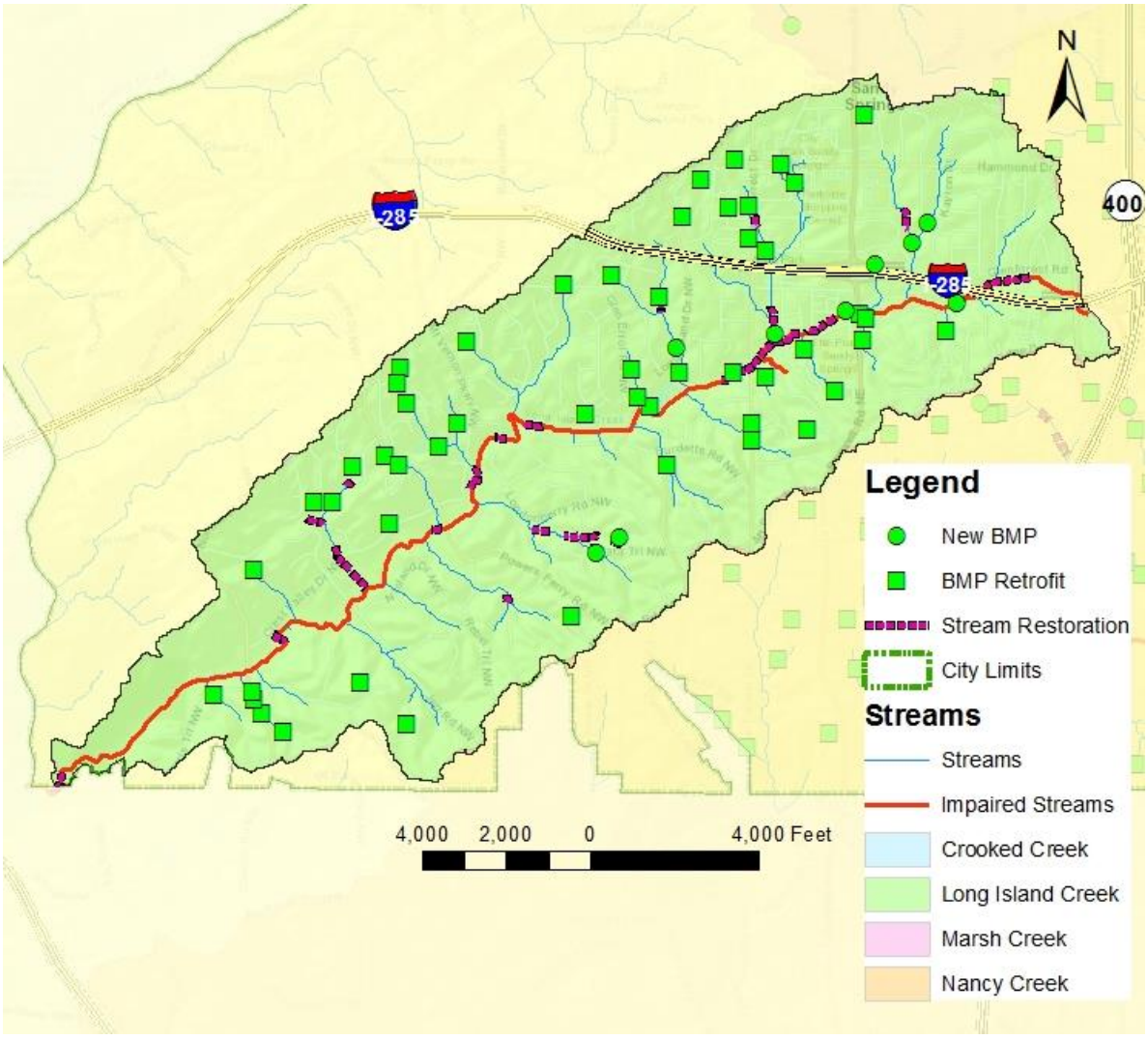




2.2.3 Long Island Creek Watershed Improvement Projects

There are 59 watershed improvement projects and 23 stream restoration projects recommended in the Long Island Creek Watershed Improvement Plan. These projects reflect an investment of almost $50 million.

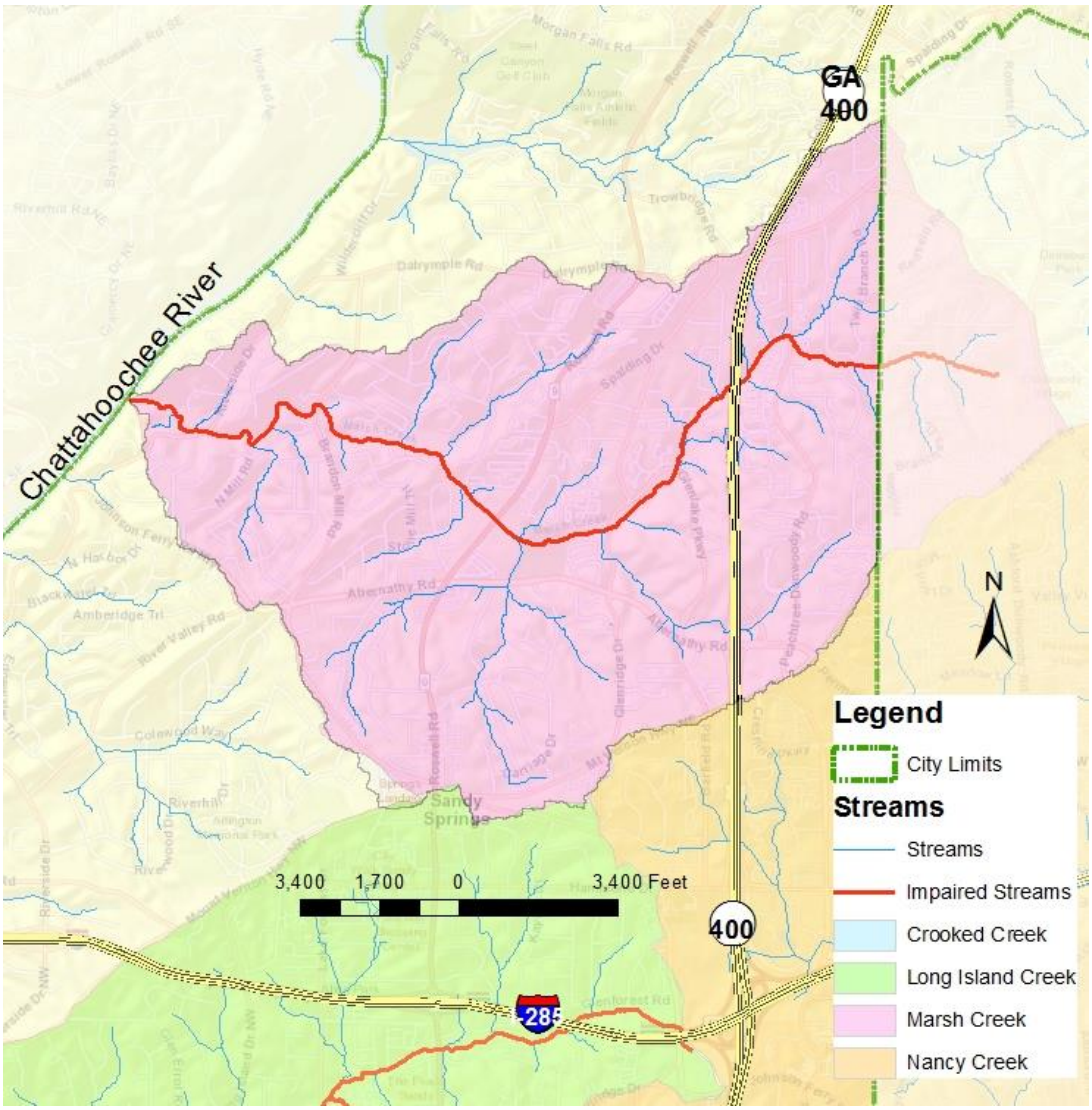
Figure 2-7. Long Island Creek Previously Recommended Watershed Projects



2.3 Marsh Creek

The Marsh Creek watershed is around 3,200 acres and originates in the City of Dunwoody, but only a small portion of the headwaters are outside of Sandy Springs (Figure 2-8).

Figure 2-8. Marsh Creek Watershed



2.3.1 Marsh Creek Land Use and Impervious Area

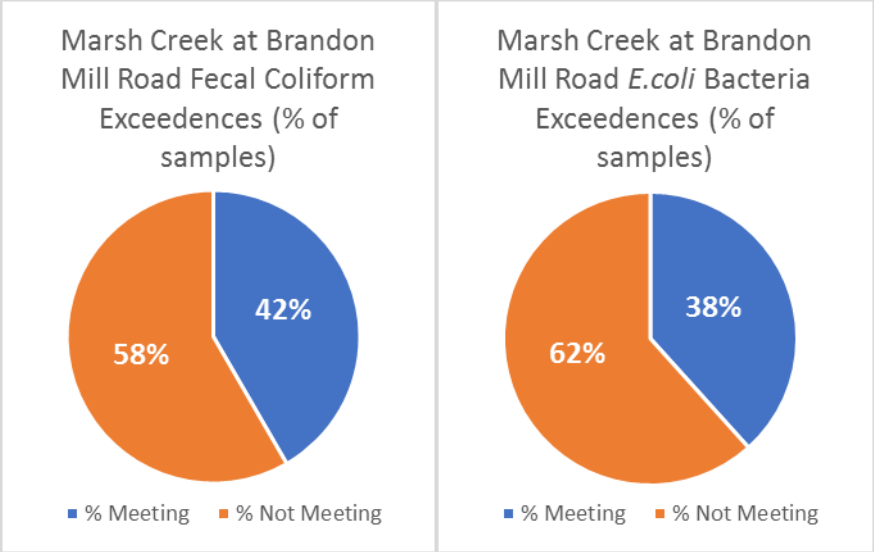
Approximately 20-percent of the land area within the COSS portion of the Marsh Creek watershed is impervious area. The dominant land uses within COSS are: residential multi-unit,

residential townhouse, and residential detached. The impervious area includes approximately 3.6 miles of GA-400. The impervious area within COSS is relatively high, above the 10-percent threshold at which watershed impacts are typically observed and just below the 25-percent threshold where watershed impacts are expected.

2.3.2 Marsh Creek Water Quality Data

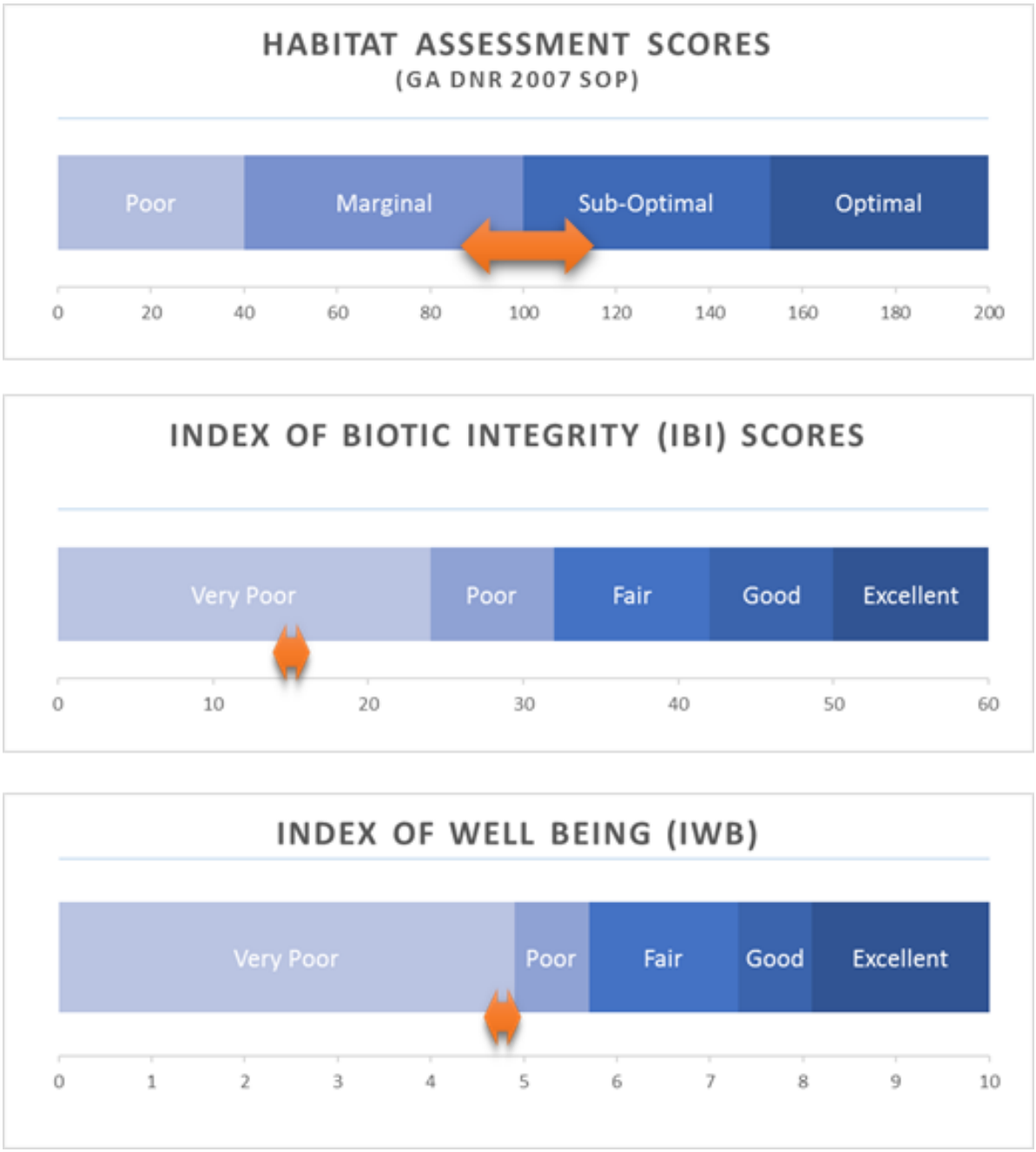
The Bacteria TMDL[i] shows that a 60-percent reduction in fecal coliform bacteria is needed to meet state water quality standards. The Fulton County sampling results from 2015 to 2018 are slightly better, showing that Marsh Creek meets the fecal coliform bacteria criteria 42-percent of the time and the *E.coli* standard 38-percent of the time (Figure 2-9). The BST sampling results found a moderate level of human bacteria, likely from sanitary sewer overflows (SSOs).

Figure 2-9. Percentage of Fecal Coliform Bacteria and *E.coli* Bacteria Samples that Exceed State Standards in the Marsh Creek Watershed



The TMDL for Biota/Sediment does not indicate a need to reduce sediment load, however the IBI score is about 35-percent lower than that needed to meet state standards[ii]. Additionally, the stream habitat analysis performed by the City shows that a 19-percent improvement in habitat score is needed to improve from "marginal" to "sub-optimal". The analysis noted that there is some stream buffer encroachment and that the buffer vegetation is compromised in areas. The habitat assessment also noted areas with instream erosion and alternations that are typical of a suburban/urban stream. A result of the information within the TMDL and the City's sampling efforts related to habitat conditions is shown in Figure 2-10.

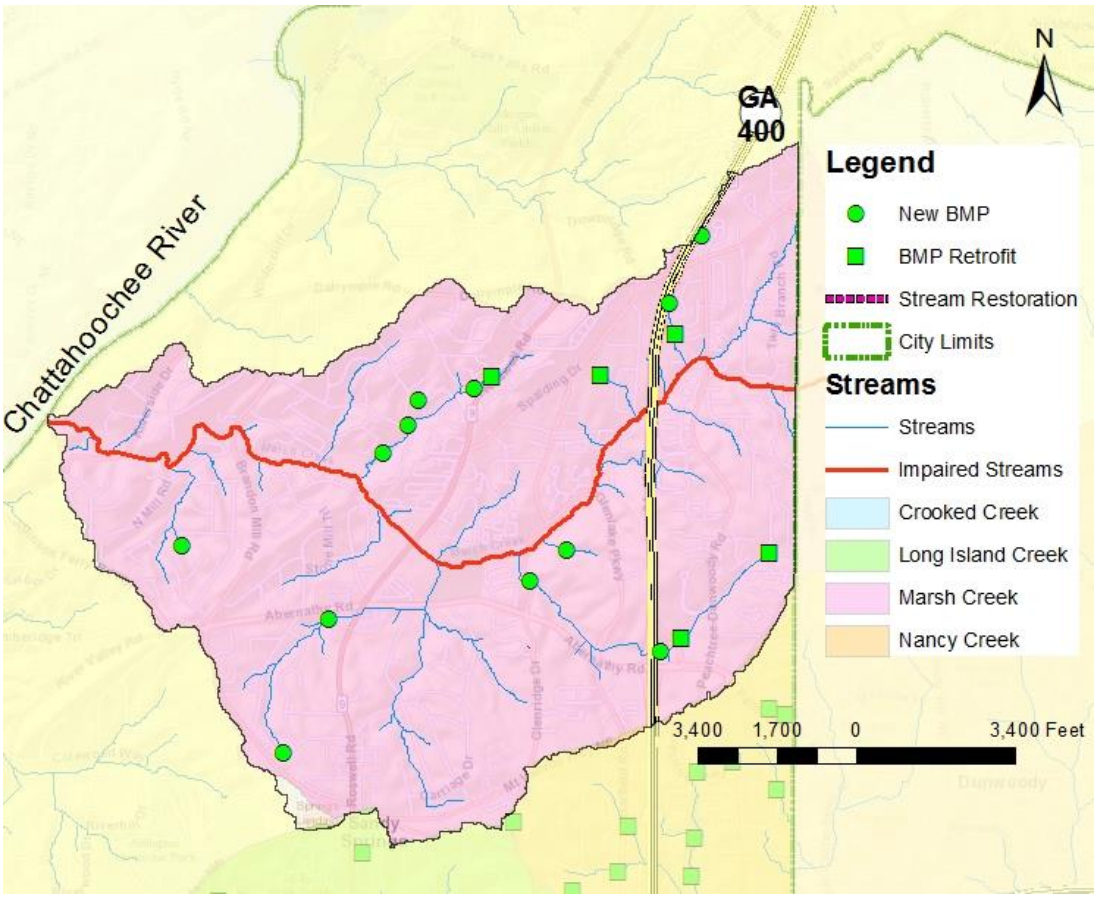
Figure 2-10: Comparative Habitat Rating for the Marsh Creek Watershed



2.3.3 Marsh Creek Watershed Improvement Projects

There are 18 watershed improvement projects recommended in the Fecal Coliform Watershed Improvement Plan. These projects reflect an investment of almost $21 million.

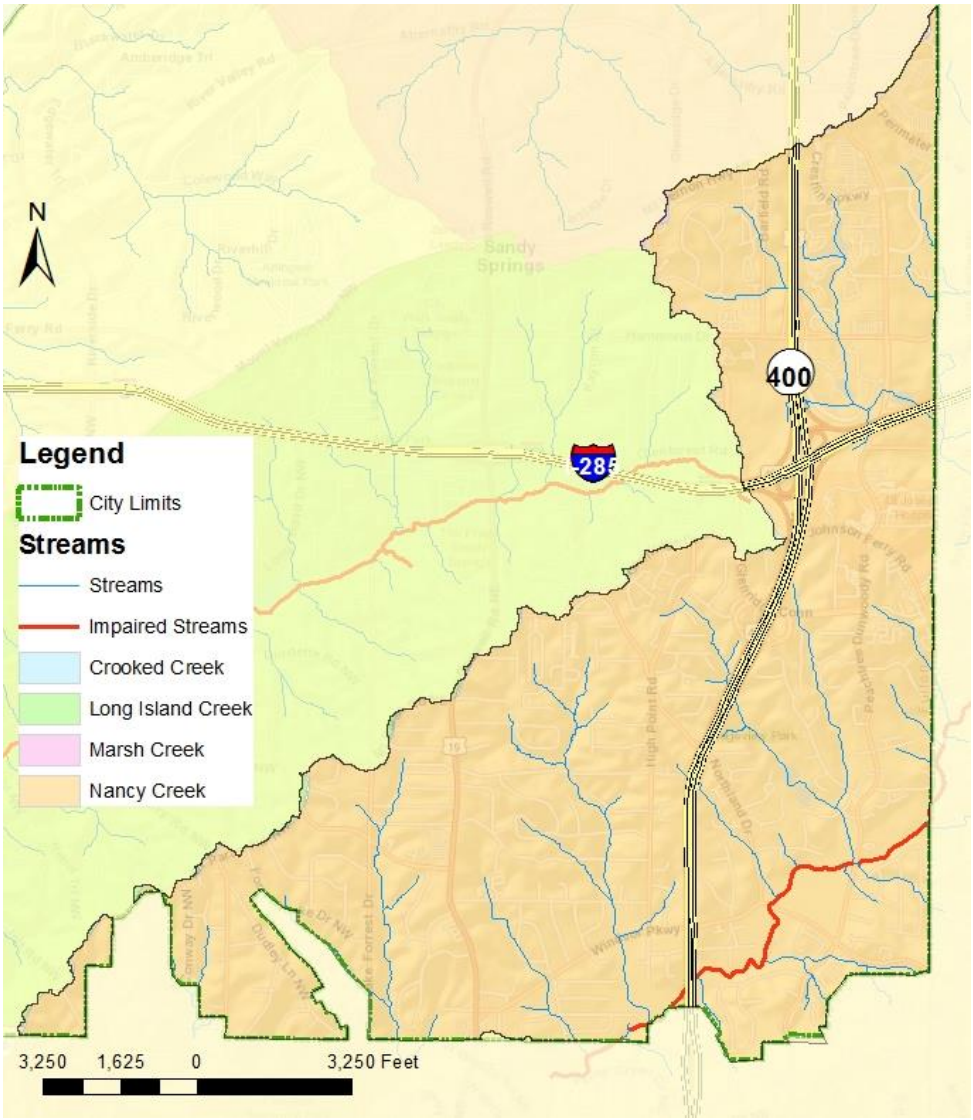
Figure 2-11. Marsh Creek Previously Recommended Watershed Projects



2.4 Nancy Creek

The Nancy Creek watershed is around 3,900 acres within Sandy Springs and flows through five jurisdictions prior to Sandy Springs. A small portion of the Nancy Creek mainstem flows through the southeastern portion of the City and several tributaries that originate within the City flow into Nancy Creek (Figure 2-12).

Figure 2-12. Nancy Creek Watershed



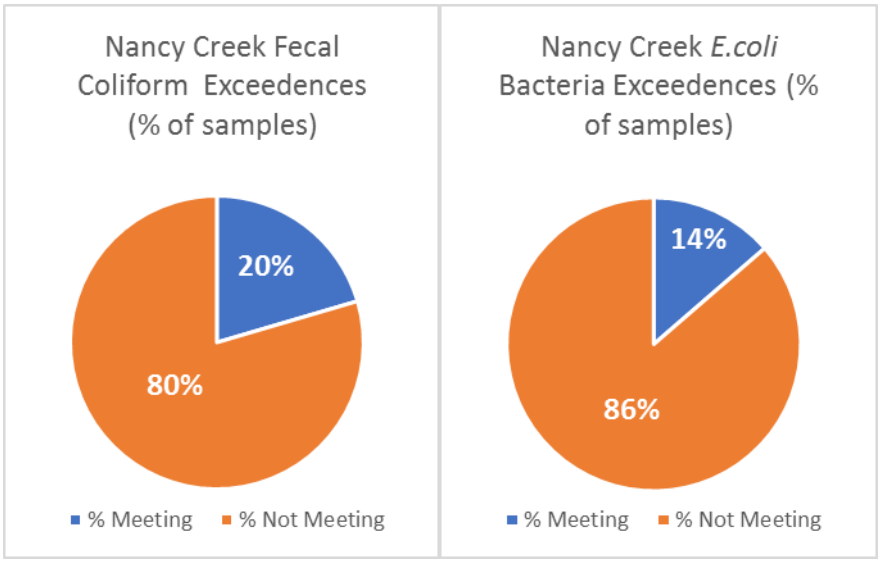
2.4.1 Nancy Creek Land Use and Impervious Area

Approximately 21-percent of the land area within the COSS portion of the Nancy Creek watershed is impervious area. The dominant land uses within COSS are: residential townhouse, perimeter residential, residential multi-unit, and residential detached. The impervious area includes approximately 3.6 miles of GA-400 and 0.8 miles of I-285. The impervious area within COSS is relatively high, above the 10-percent threshold at which watershed impacts are typically observed and just below the 25-percent threshold where watershed impacts are expected. The overall impervious area in the watershed exceeds the 25-percent threshold.

2.4.2 Nancy Creek Water Quality Data

The Bacteria TMDL[i] shows that an 84-percent reduction in fecal coliform bacteria is needed to meet state water quality standards. The COSS sampling results from 2015 to 2018 are consistent, showing that Nancy Creek only meets the fecal coliform bacteria criteria 20-percent of the time and only meets the *E.coli* standard 14-percent of the time (Figure 2-13). The BST sampling results found a high level of human bacteria, likely from sanitary sewer overflows (SSOs). The BST sampling results also found a moderate level of dog bacteria.

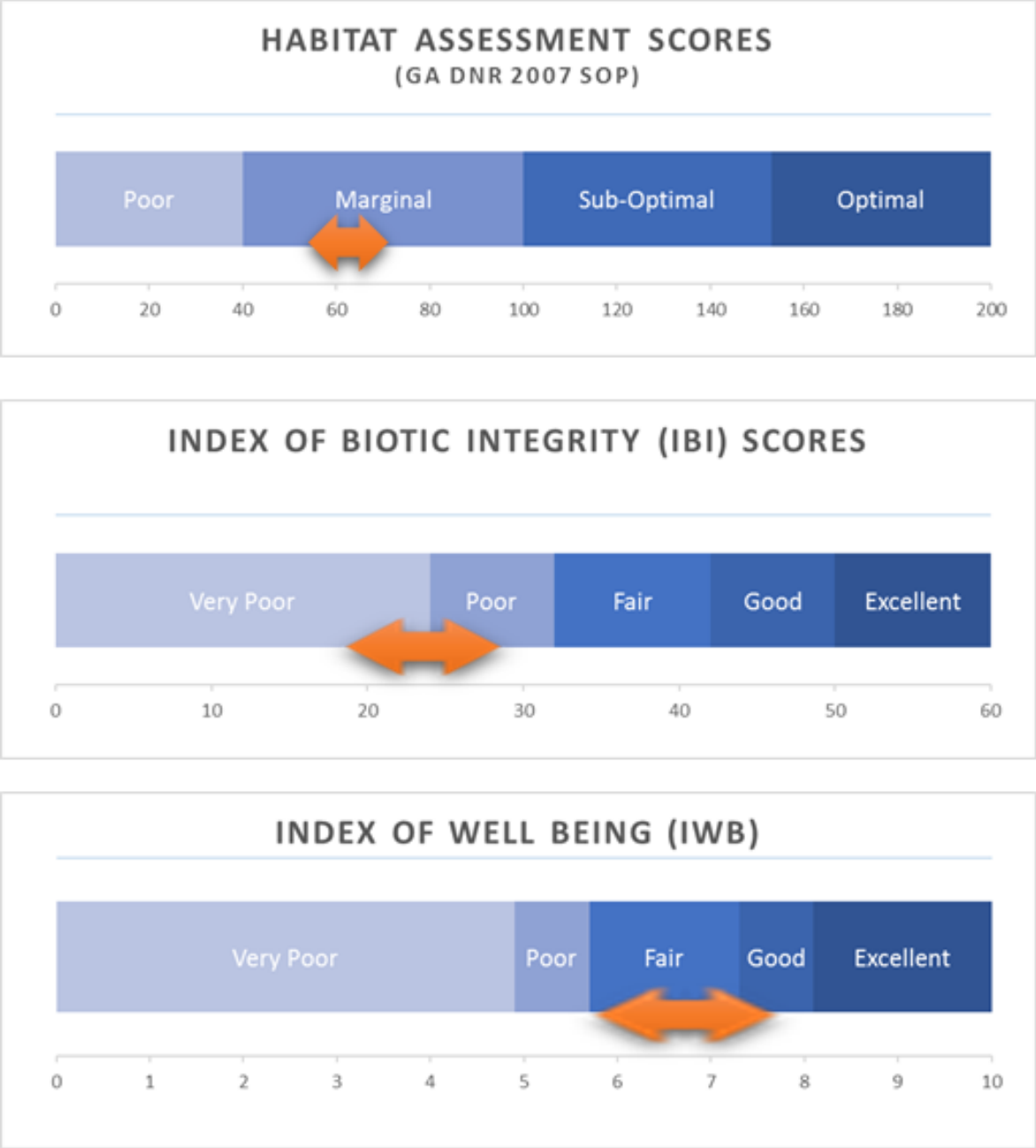
Figure 2-13. Percentage of Fecal Coliform Bacteria and *E.coli* Bacteria Samples that Exceed State Standards in the Nancy Creek Watershed



The TMDL for Biota/Sediment indicates that a 35-percent reduction in sediment load is needed to meet state standards[ii]. Additionally, the stream habitat analysis performed by the City shows that a 46-percent improvement in habitat score is needed to improve from "marginal" to "sub-

optimal". The analysis noted that there is some stream buffer encroachment and that the buffer vegetation is compromised in areas. The habitat assessment also noted areas with instream erosion and alternations that are typical of a suburban/urban stream. A result of the information within the TMDL and the City's sampling efforts related to habitat conditions is shown in Figure 2-14.

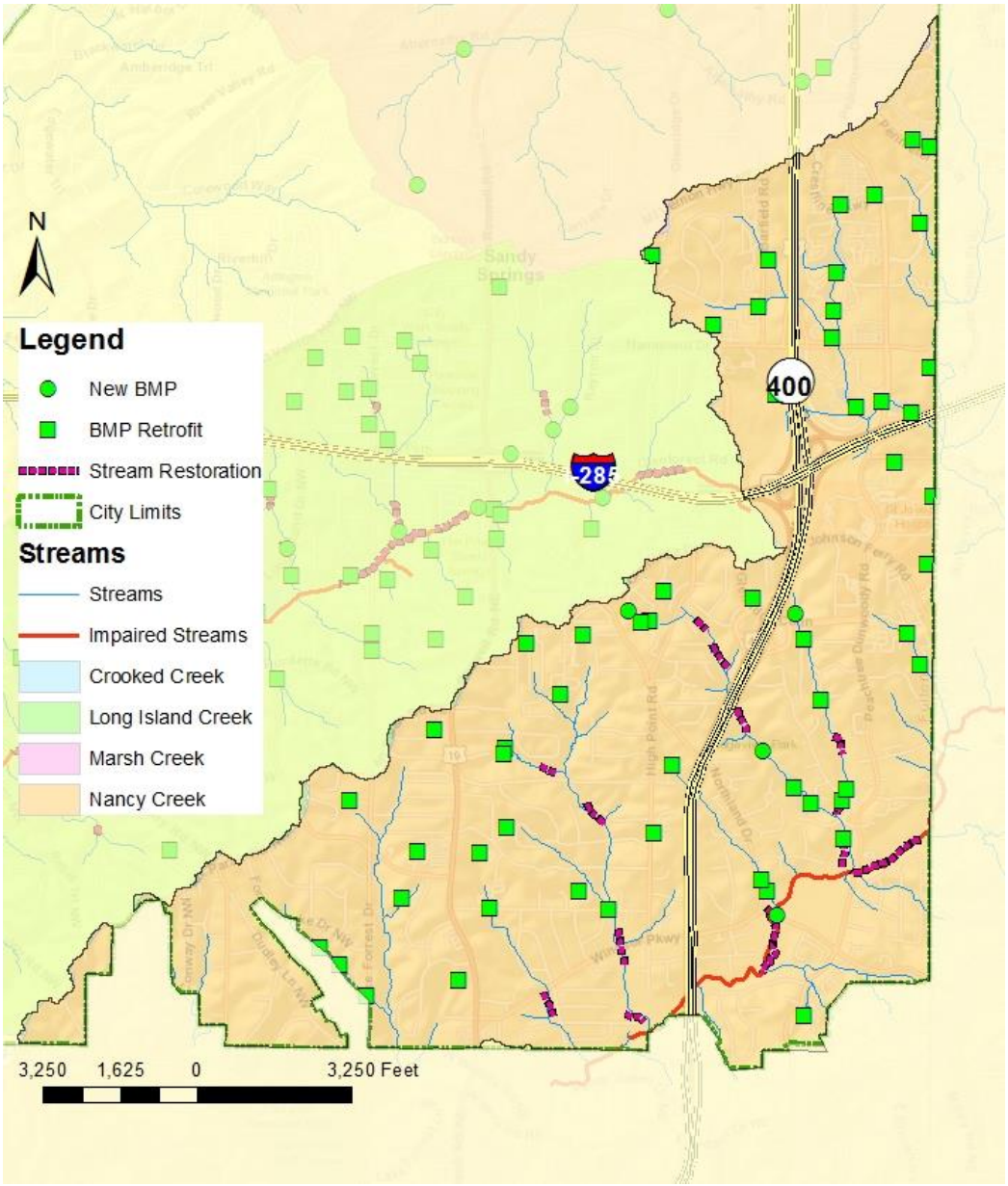
Figure 2-14: Comparative Habitat Rating for the Marsh Creek Watershed



2.4.3 Nancy Creek Watershed Improvement Projects

There are 60 watershed improvement projects and 15 stream restoration projects recommended in the Nancy Creek Watershed Improvement Plan. These projects reflect an investment of $40 million.

Figure 2-15. Nancy Creek Previously Recommended Watershed Projects



3 Water Quality Improvement Strategies

There are a number of different types of strategies that can improve water quality within the City limits, many of which are ongoing. These strategies range from educating the public, ordinance adoption and enforcement, operational actions, collecting and evaluating data, and implementing watershed improvement projects. This section identifies the strategies that the COSS currently employs to minimize water quality impairment, enhancements to existing strategies, and new strategies that the COSS may consider implementing.

3.1 Ongoing Water Quality Improvement Strategies

The City has a number of ongoing activities, programs, regulations, and actions that are intended to protect or restore water quality. Many of the ongoing actions are tied to regulatory requirements, such as the City's Municipal Separate Storm Sewer System (MS4) permit or the Metropolitan North Georgia Water Planning District (MNGWPD) Water Resource Management Plan requirements. The activities presented in Table 3-1 reflect the activities by the COSS in compliance with the existing Stormwater Management Plan (SWMP) and MS4 permit, which the City may modify within the terms of their MS4 permit as needed. Table 3-2 presents the activities within these two regulations that impact water quality but are the implementation responsibility of another governmental entity.

Table 3-1. Ongoing COSS Water Quality Improvement Strategies

Strategy	SWMP Reference	MNGWPD Reference	Relative Bacteria Reduction	Relative Sediment Reduction
Public Education & Outreach				
Stormwater Education	A.1	Watershed-12	Low	Low
Watershed Protection Web Resources	A.2		Low	Low
Stormwater Brochures	A.3		Low	Low
Targeted Business/ Industry Outreach	A.4		Low	Low
Storm Drain Decal Labeling	B.1		Low	Low
Stream Cleanups	B.2		Negligible	Low
World Water Monitoring Day	B.3		Low	Low
Operate a Community Call Center	B.4		Low	Low
Public Awareness to Reduce FOGs (Fats, Oils, and Grease)	A.2		Low	Negligible
Septic Tank Education Program		Integrated-11	Low	Negligible
Illicit Discharge Education	C.4		Low	Low
Regulatory				
Illicit Discharge Ordinance and Enforcement	C.1	Watershed-5	Low	Low
Illicit Discharge Detection and Elimination (IDDE) Plan	C.3		Low	Low
Citizen Complaint Response	C.5		Low	Low
Land Disturbance Permit Site Plan Review	D.2		Negligible	Moderate
Erosion & Sedimentation (E&S) Inspections	D.3	Watershed-2	Negligible	Moderate
Enforcement Procedures for E&S Violations	D.4		Negligible	Moderate
Employee E&S Certification	D.6		Negligible	Negligible
Post Construction Stormwater Management Ordinance	E.1	Watershed-1	Negligible	Moderate
New Flood Control Project Analysis	F.7		Negligible	Low
Septic System Planning		Integrated-8	Low	Negligible
Septic System Critical Area Management		Integrated-9	Low	Negligible
Septic System Septage Disposal		Integrated-10	Low	Negligible
Private Decentralized Wastewater Systems Ordinance		Integrated-11	Negligible	Negligible
Floodplain Management		Watershed-3	Low	High
Stream Buffer Protection		Watershed-4	Low	High
Litter Control		Watershed-6	Low	Low

Strategy	SWMP Reference	MNGWPD Reference	Relative Bacteria Reduction	Relative Sediment Reduction
Operational				
MS4 Outfall Inventory	C.2		Low	Low
Stormwater Control Inventory	E.2		Negligible	Low
Stormwater Facility Inspection	E.3		Low	Moderate
Stormwater Facility Maintenance	E.4		Low	Moderate
GI/LID Structure Inventory	E.5		Low	Low
GI/LID Program	E.6	Watershed-7	Low	Moderate
GI/LID Inspection and Maintenance Program	E.7		Low	Moderate
MS4 Inventory	F.1	Watershed-9	Negligible	Negligible
MS4 System Inspections	F.2	Watershed-9	Low	Low
MS4 System Maintenance	F.3	Watershed-9	Low	Moderate
Street Sweeping and Litter Pickup	F.4		Low	Moderate
Employee Training	F.5		Low	Low
Waste Disposal	F.6		Low	Moderate
Existing Flood Control Project Analysis	F.8		Low	Moderate
Municipal Facility Inspections	F.9		Low	Low
Emergency Response Plan Review	G.1		Negligible	Negligible
Impaired Waters Plan Review	G.2		Negligible	Negligible
Watershed Improvement Projects		Watershed-8	Moderate	High
Long-Term Ambient Trend Monitoring		Watershed-10	Negligible	Negligible
Macroinvertebrate Bioassessment		Watershed-11	Negligible	Negligible

Table 3-2. Ongoing Water Quality Improvement Strategies by Other Governmental Agencies

Strategy	SWMP Reference	MNGWPD Reference	Relative Bacteria Reduction	Relative Sediment Reduction
Ongoing Actions by Other Agencies				
Local Wastewater Master Plan		Integrated-4	Low	Low
Connections to Public Sewer		Integrated-5	Low	Low
Enhanced Reliability of Wastewater Pumping Stations		WW-1	Low	Low
Sewer System Inventory and Mapping		WW-2	Low	Low
Sewer System Maintenance Management		WW-3	High	Low
Sewer System Inspection Program		WW-4	High	Low
Sewer System Rehabilitation Program		WW-5	High	Low
Capacity Certification Program		WW-6	Low	Negligible
Grease Management Program		WW-7	Moderate	Low
Sewer System Overflow Emergency Response Program		WW-8	High	Low
Sewer System Inspection and Maintenance Training		WW-9	Low	Low
Local Public Education Program		WW-10	Low	Low

3.2 Previously Identified Water Quality Improvement Strategies

One of the goals for this Plan is to compile information and recommended projects from a number of previously completed reports and studies into one document that focuses on impaired waterbodies. This study did not include any new field work or data collection, but rather leverages the previous City investments into a focused presentation. The previous studies integrated into this Plan include:

- Fecal Coliform Watershed Improvement Plan, 2010
- Long Island Creek Watershed Improvement Plan, 2010
- Nancy Creek Watershed Improvement Plan, 2010
- Sandy Springs Bacterial Source Tracking Study, 2017
- City of Sandy Springs Stream Assessment, 2018

While almost all of the ongoing strategies outlined in Section 3.1 are tied to regulatory requirements, the recommendations in the plans and studies above are voluntary. The recommendations highlighted in this section are subdivided into those related to a watershed improvement plan and the other two studies which are related to water quality, as the recommendations in these plans are different in nature.

3.2.1 Watershed Improvement Plan Recommendations

The City has completed three watershed improvement plans that cover the watersheds surrounding the four impaired streams. The watershed improvement plans evaluated the existing watershed conditions, identified potential improvement projects, and modeled the benefits that would be achieved by implementing the recommendations.

Watershed improvement plans are long-term plans and many have 50 year or greater implementation timeframes. Because of these extended implementation timeframes, the recommended projects reflect the intensity and financial commitment that is likely needed to meet state water quality standards. The specific projects recommended in a watershed improvement plan often change due to changes in land use, federal regulations, and City objectives. For example, several of the stormwater projects in these three watershed improvement plans recommend modifications to existing online ponds which are currently very difficult to permit due to Federal regulations. Similarly, most of the recommended projects are located on private property and therefore not within the scope of the City's current stormwater Extent of Service/ Level of Service (EOS/LOS) Policy. The projects combined, however, are useful because they reflect the cost and intensity of projects that are likely needed to meet state standards.

Figure 3-1. Previously Recommended Watershed Improvement Projects in Impaired Watersheds

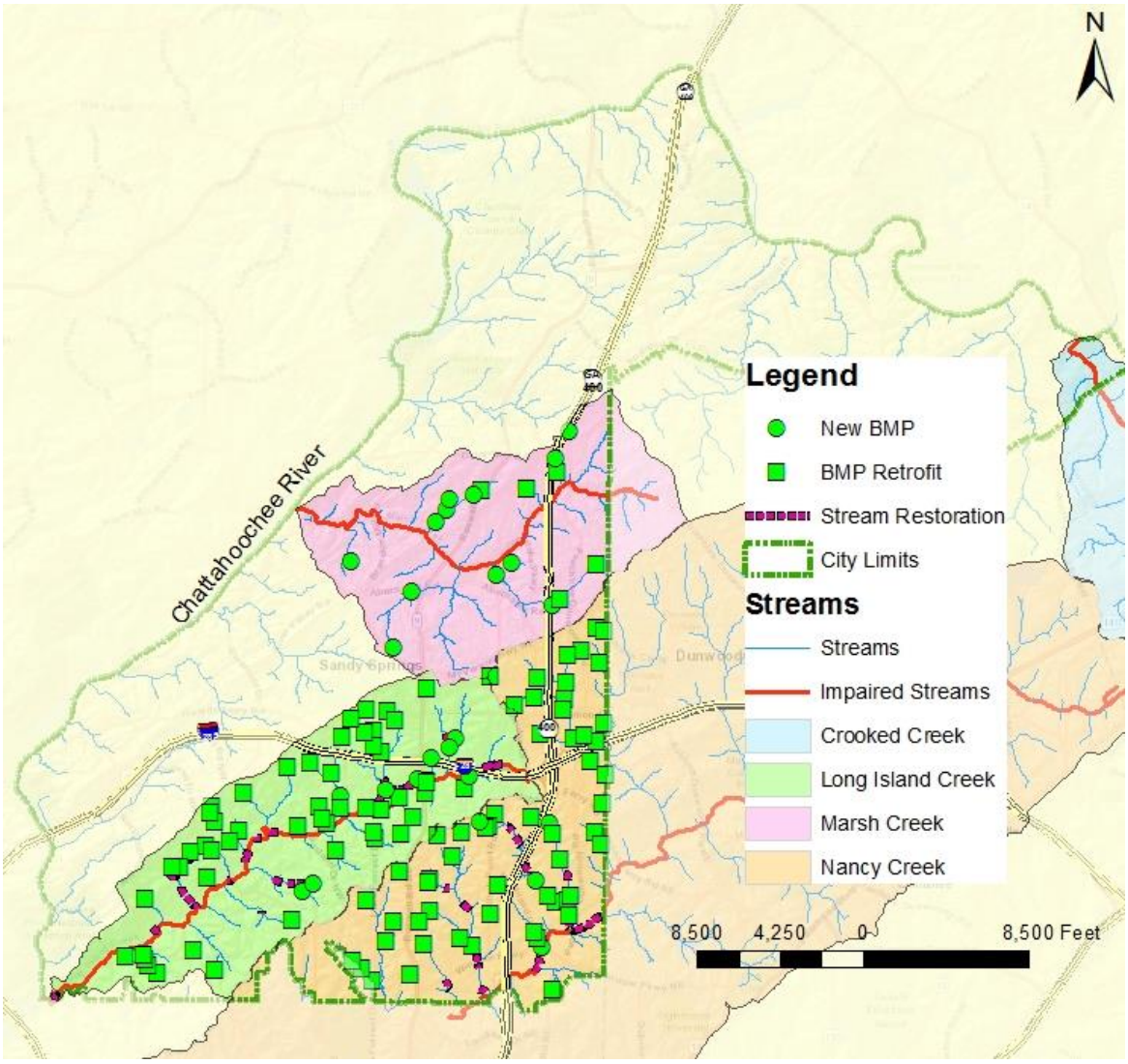


Table 3-3 and Table 3-4 present a summary of the individual recommended projects, to show the anticipated level of investment and the intensity of projects needed to meet state water quality standards. Table 3-3 shows summary of the stormwater control projects by watershed, also referred to as best management practices (BMPs). Table 3-4 shows a summary of stream restoration projects by watershed. The total investment is around $111 million, without adjustment for inflation from 2010 pricing.

Table 3-3. Recommended Stormwater Control Projects Within Existing WIPs

Watershed	Total Stormwater Projects	Estimated Cost ($)	Drainage Area Served (acres)	% on Publicly Owned Land	% with Permitting Challenges
Crooked Creek	0	$0	0	0%	0%
Long Island Creek	61	$36,714,000	3,739	0%	54%
Marsh Creek	18	$20,998,000	1,566	0%	89%
Nancy Creek	60	$31,580,000	4,706	2%	45%
TOTAL	**139**	**$89,292,000**	**10,011**	**2%**	**55%**

Table 3-4. Recommended Stream Restoration Projects Within Existing WIPs

Watershed	Total Stream Projects	Estimated Cost ($)	% on Publicly Owned Land*	Length of Stream (Miles)
Crooked Creek	0	$0	0%	0
Long Island Creek	23	$12,938,000	4%*	2.4
Marsh Creek	0	$0	0%	0
Nancy Creek	15	$8,673,000	13%*	1.6
TOTAL	**38**	**$21,611,000**	**8%***	**4.0**
* projects are only partly on public land due to street crossing or area of right-of-way				

The Fecal Coliform Watershed Improvement Plan recommends projects within a larger Crooked Creek drainage area that includes tributaries that are not directly tied to the state's impaired waters designation. Similarly, there are projects in the Fecal Coliform Watershed Improvement Plan that are classified as in the Marsh Creek watershed, but they are located on tributaries to the Chattahoochee that are not related to the Marsh Creek impaired water status. This Plan looks narrowly at the areas that are classified as impaired by the state.

3.2.2 BST Sampling Study Recommended Strategies

The following recommendations were extracted from the December 5, 2017 memorandum submitted to the City to summarize the BST sampling programs. Table 3-5 summarizes the recommendations by impaired waterbody.

Table 3-5. Recommended Strategies Extracted from the BST Sampling Study

Waterbody	Waterfowl BST Sampling and/or Removal Program	Stream walks	Review Sewer Lines for Leaks	Review Septic Tank Locations	Pet Waste Education/ Ordinances	Additional Dry Weather Human BST Sampling
Crooked Creek	Yes	Yes				
Long Island Creek		Yes	Yes	Yes	Yes	Yes
Marsh Creek		Yes	Yes	Yes		Yes
Nancy Creek	Yes	Yes	Yes	Yes	Yes	Yes

3.2.3 Stream Walk Assessment Recommended Strategies

The recommendations in Table 3-6 were extracted from the June 2018 Stream Walk Report.

Table 3-6. Recommendations from the Stream Walk Assessment (2017)

Strategy	Measures	Improves	Ongoing*
Public Awareness/ Public Involvement	Public Awareness to Reduce FOGs	Bacteria	Yes
	Industrial Facilities Focused BMPs	Sediment & Runoff	Yes
	Home Owner Education Workshops	Overall WQ	
	Stormwater Detention Basin Maintenance Education	Sediment & Runoff	
	School Education Activities	Overall WQ	Limited
Non-structural Measures	Sanitary Sewer Overflow Management	Bacteria	Fulton County
	Bacteria Monitoring	Bacteria	Yes
	Bacteria Source Tracking	Bacteria	One-time
	Future Stream Assessments (every 3 to 5 years)*	Overall WQ	
Structural Measures	Addressing Maintenance Issues	Sediment & Runoff	
	Stream Bank Restoration	Sediment & Runoff	
	Rain Gardens/Barrels Schools	Overall WQ	

Source: Sandy Springs Stream Assessment Report, Table 4-1.

*Information added for the purposes of this Plan.

3.3 Additional Water Quality Improvement Strategies

This Plan identifies five additional improvement strategies that are not recommended in the previous studies that are described in this section.

3.3.1 Collect Additional Bacteria Samples

There are two different methods for additional bacteria samples described in this section, based on the percentage of the watershed that is located in the City limits.

3.3.1.1 Additional Samples within the Geometric Mean

The bacteria standard is based on a geometric mean of a minimum of four samples collected within a 30-day period. A geometric mean uses the product of the values, whereas an arithmetic mean uses the sum of the values. The geometric mean is less influenced by large fluctuations between data points, which is why it is used for fecal coliform bacteria. Collecting more than four samples in the geometric mean can help modify any "spikes" in the sampling results, typical of an SSO event. Table 3-7 presents a hypothetical example, where the additional sample results allow the initial data set to meet the summer standard of 200 colonies/100mL, where the initial four samples did not meet the standard.

Table 3-7. Hypothetical Fecal Coliform Bacteria Geometric Mean Calculations (col/100mL)

Raw Data #1	Geo. Mean #1	Raw Data #2	Geo. Mean #2
200 1000 300 800	468	**200** 150 280 **1000** 400 100 150 180 **300** 100 150 100 **800** 100 50 220	193

Currently, the City spends approximately $5,000 per year on collecting quarterly geometric means with 4 samples per quarter or 16 samples per year at two stations. Therefore, it is estimated that collecting 16 samples per quarter would cost $10,000 per year per site. This Plan

recommends conducting this additional sampling on Marsh Creek for a period of two years to determine whether this sampling approach is effective. Marsh Creek is recommended because it is the closest to meeting water quality standards, has the highest fluctuation in fecal coliform bacteria results, and is mostly within the city limits. If the sampling strategy is effective, Long Island Creek may also benefit from this strategy in the future.

3.3.1.2 City Limit Sampling

Much of the Nancy Creek and Crooked Creek watersheds are located outside of the City limits. This sampling strategy suggests collecting quarterly geometric mean data at two locations, one near the upstream city limit and one near the downstream city limit. The difference between the two sample results would indicate the loading coming from the City. If the load is negligible, then the COSS is effectively managing sources within the City limits. If there is a load increase, then the City can focus on identifying and minimizing sources.

The sampling should be performed on the same day and would essentially add two new sampling stations to the existing sampling program. The additional cost for this sampling is estimated at $2,500 per year per stream (for the additional station).

3.3.2 Private Property Owner Education

The City has a robust education and outreach program that is required by the City's MS4 permit and the City also participates in the MNGWPD regional education program. One of the recommendations from the Nancy Creek Consolidated Watershed Based Plan that the City of Sandy Springs supported, is the creation of private property owner education. Specifically, the Nancy Creek Consolidated Plan recommended that the MNGWPD create a regional brochure that educated private property owners on their stormwater responsibilities including removal of trees that fall on streams on private property, maintenance of private stormwater controls/ponds, and the importance of maintaining a vegetated stream buffer in minimizing erosion. Similar educational messages are discussed in the Stream Walk Assessment Report, but were not explicitly listed as a recommendation. The City can either work with the MNGWPD or independently to create educational pieces for land owners.

The estimated cost for design and limited production of the brochure is $5,000.

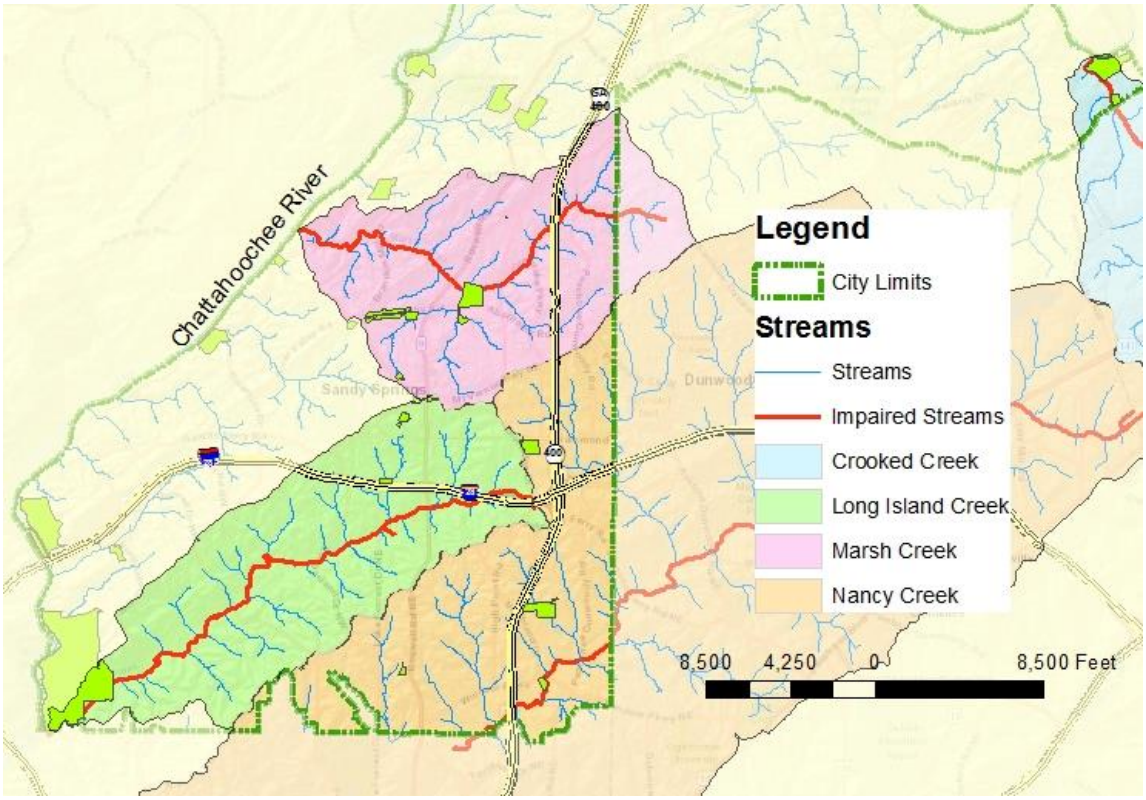
3.3.3 Identify Watershed Improvement Opportunities in Parks

There is only one project recommended in a City-owned park within the three adopted Watershed Improvement Plans and it is within Ridgeview Park in the Nancy Creek watershed. There are several projects previously recommended in the Watershed Improvement Plans that are located in and along recommended trails (or linear parks) from the Sandy Springs Trail Master Plan.

Parks, traditional and linear, present an excellent opportunity to integrate watershed improvement projects as it is City-owned land and the projects are highly visible by the public,

providing a secondary public education benefit. Figure 3-2 shows the park land within the COSS and the watersheds for the impaired streams.

Figure 3-2: Park Land within the COSS Impaired Watersheds



Similarly, large public investments are planned for along GA400 and I-285. These large investments create an opportunity to leverage construction activity and integrate watershed improvement projects.

This Plan recommends studying one or two parks or project areas to create a list of potential Green Infrastructure (GI) or other watershed improvement opportunities. A high-level screening study will provide the City with sufficient information for grant applications or for budgeting purposes. Once the best projects are selected by the City, these projects would be designed, permitted, and constructed. The cost of the GI screening study for one to two parks is estimated at $10,000.

3.3.4 Coordination

The City should alert the wastewater providers of a possible SSO when bacteria samples results are greater than 5,000 colonies/100mL. There are several instances where sampling data exceeds 5,000 colonies/100mL and a level this high is typically indicative of an SSO. High levels of bacteria in Marsh Creek, Long Island Creek, and Nancy Creek should be reported to

Fulton County. High levels of bacteria in Crooked Creek should be shared with Gwinnett County. High levels of bacteria in Nancy Creek should also be shared with DeKalb County. The wastewater staff may not be aware of the potential issue. The cost of implementation is negligible and this should be considered an ongoing activity.

3.3.5 Plan Review and Revision

With an adaptive management approach, it is important to periodically reassess conditions as projects and programs are implemented. This Plan should be reviewed and revised every five years. The Stream Walk Assessment should be done the year prior to the review (Year 4 of this Plan) so that the results are available. The review should evaluate the stream walk assessment results, water quality sampling results, and any trend changes noted in the history for each stream. The review should also consider the implemented strategies and whether new strategies are needed or whether existing strategies are not effective. Revisions should include a new 5-year implementation schedule. The budget for this task is estimated at $10,000.

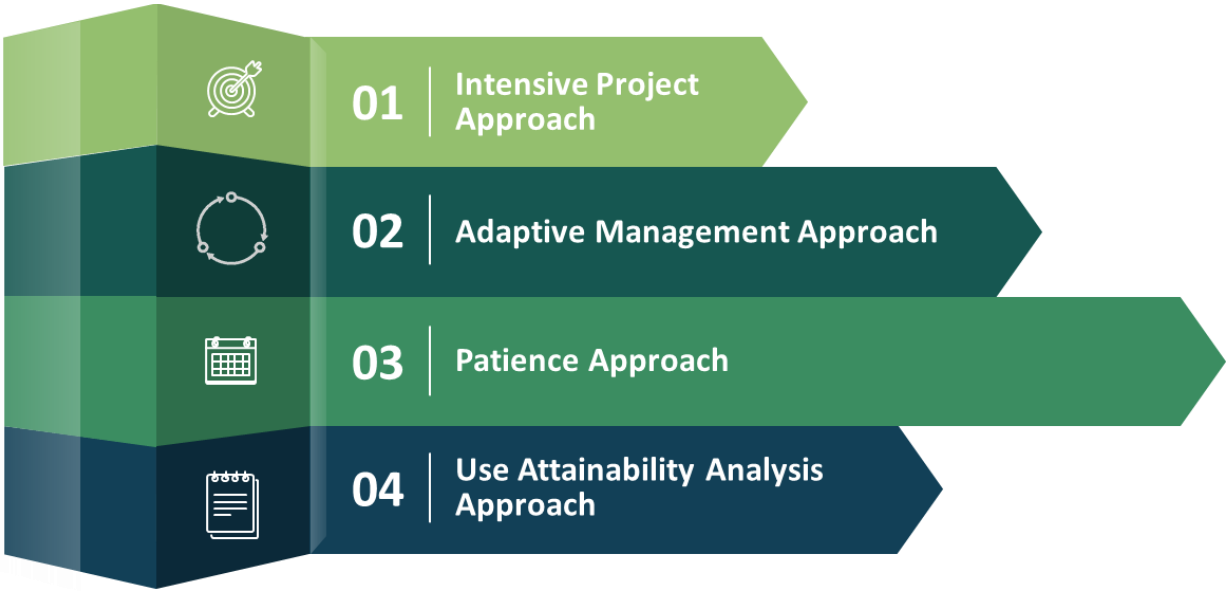
4 Implementation Plan

This section outlines the various approaches evaluated for implementation intensity and includes a recommended 5-year implementation plan. Following the first five years, the Plan should be reviewed and revised with a new 5-year implementation plan developed that adapts to the City priorities and information collected over the first five years.

4.1 Implementation Timeline Approaches

This Plan considered four approaches to the timeline for meeting water quality standards, as shown in Figure 4-1. The four approaches include an intensive project approach, the adaptive management approach, the patience approach, and the use attainability analysis approach. These approaches are described in further detail, with the recommendation to follow an adaptive management approach.

Figure 4-1: Implementation Timeline Approaches



4.1.1 Intensive Project Approach

Under the intensive project approach, all of the projects and programs in Section 2 would be completed as soon as possible based on staffing and funding. The benefit of this approach is that water quality impairment is addressed quickly and the City residents and businesses benefit from the improved environment and the reduced impact to private property of erosion. The

challenge with this approach is that achieving the designated uses is estimated to be $111 million, which exceeds the City's current and anticipated funding sources for such projects.

4.1.2 Adaptive Management Approach

Adaptive management refers to an iterative process, whereby the City would construct recommended projects that make sense based on available staffing and budgets and then assess the impact. The benefit to this approach is that it fits within the City's fiscally-conservative model and doesn't sacrifice funds from other City needs or priorities. Another benefit of this approach is that it allows for time to see how certain projects perform and better understand maintenance needs. At a slower pace, lessons learned can be transferred from one project to the next. The challenge to this approach is that the implementation timeframe is likely longer. The City is currently following an adaptive management approach and this Plan recommends continuing to follow this approach.

4.1.3 Patience Approach

The patience approach is a laisse faire approach to addressing water quality within the City limits. As presented in Section 1, streams are continually working to create an equilibrium. The erosion and downcutting that is problematic to private property owners, is the stream re-establishing equilibrium. The fecal coliform bacteria sources may be addressed as part of ongoing sanitary sewer system upgrades and as a result of increased public awareness to clean up after pets. The benefit of this approach is that it is the lowest cost alternative, as few projects would be implemented. The challenge is that the process of establishing a new stream equilibrium will not be acceptable to private property owners within the City and the timeframe is likely too long based on the City's sustainability interests.

4.1.4 Use Attainability Analysis Approach

The Clean Water Act includes provisions for a Use Attainability Analysis (UAA) that would assess whether the current designated use is achievable. The UAA process is a highly regulatory process in which it must be determined that it is socially and economically infeasible to meet the state-assigned designated use (i.e., fishing with secondary recreation contact) and that a new designated use is justified. The current standard allows for secondary recreation contact and instream recreation on streams in Sandy Springs is rare.

The UAA process would include public input as well as an intensive analysis of the economic need and the ability of the community to afford the need. Prior to 1986, EPD had an "urban stream" designated with a geometric mean fecal coliform standard of less than 2000/100 mL

and a maximum of 5000/100 mL. The impaired streams may meet water quality standards if this urban designation still existed. The benefits of this approach are that the cost may be lower, even though there would be funds needed to develop the potential justification. The challenge is that this approach is that it does not provide the community with an enhanced environment, it just changes the standard against which the sampling is judged. There is an additional challenge, in that this approach is not common in Georgia and there is no certainty that the new designated use would be considered justifiable by the state.

4.2 Implementation Plan

The recommended implementation actions for the next five years are presented in Table 4-1 as well as the anticipated costs to implement. No cost is identified for the ongoing activities. The sampling recommendations are positioned early in the implementation timeframe as they may guide actions beyond that point. Data for stream listing decisions will be due to the EPD in June 2021 for the 2022 list of impaired waters, so this allows sufficient time for the City to update the Sampling Quality Assurance Plan (SQAP) and collect the desired data.

The implementation of new GI features within parks is shows in years 2 and 3. This allows time for the recommended screening study. The timeframe may be adjusted if the City pursues grant funding for these projects. Grants provide helpful match money but can often slow the implementation timeframe for projects.

The final year of this five-year implementation plan includes the plan review and revision. The next five-year plan will be developed through this process.

Table 4-1. Five-Year Implementation Plan

Timeline	Actions	Estimated Cost
Year 1 2020-2021	Ongoing Water Quality Improvement Strategies (3.1)	
	Collect Additional Bacteria Samples in Marsh Creek (3.3.1.1)	$10,000
	Collect City Limit Bacteria Samples in Nancy Creek and Crooked Creek (3.3.1.2)	$5,000
	Private Property Owner Education – develop brochure (3.3.2)	$5,000
	GI Screening Study in one to two parks or project areas (3.3.3)	$10,000
	Design and construct a GI project in a park (3.3.3)	$200,000*
Year 2 2021-2022	Ongoing Water Quality Improvement Strategies (3.1)	
	Collect Additional Bacteria Samples in Marsh Creek (3.3.1.1)	$10,000
	Collect City Limit Bacteria Samples in Nancy Creek and Crooked Creek (3.3.1.2)	$5,000
	Design and construct a GI project in a park (3.3.3)	$200,000*
Year 3 2022-2023	Ongoing Water Quality Improvement Strategies (3.1)	
	Design and construct a GI project in a park (3.3.3)	$200,000*
Year 4 2023-2024	Ongoing Water Quality Improvement Strategies (3.1)	
	Perform Stream Walks	$25,000
	Design and construct a GI project in a park (3.3.3)	$200,000*
Year 5 2024-2025	Ongoing Water Quality Improvement Strategies (3.1)	
	Plan Review and Revision (3.3.5)	$10,000
	Design and construct a GI project in a park (3.3.3)	$200,000*

*Project implementation costs are variable, the number shown is for budgeting purposes

Footnotes:

[i] "Revised Total Maximum Daily Load Evaluation for Seventy-Nine Stream Segments in the Chattahoochee River Basin for Fecal Coliform". EPD. November 2008.
[ii] "Total Maximum Daily Load Evaluation for Twenty-Nine Stream Segments in the Chattahoochee River Basin for Sediment (22 Fish Community Impacted, 6 Macroinvertebrate Community Impacted, 1 Fish & Macroinvertebrate Community Impacted)". EPD. December 2017.
[iii] "Total Maximum Daily Load Evaluation for Twenty-Five Stream Segments in the Chattahoochee River Basin for Sediment (Biota Impacted)". EPD. January 2008.
[iv] Is Impervious Cover Still Important? Review of Recent Research. Thomas R. Schueler, Lisa Fraley-McNeal, Karen Cappiella. Journal of Hydrologic Engineering. ASCE. April 2000. pp309 – 315.