Memo:

City of Statesboro, Stormwater Masterplan Update, March 2021

RE: Completion of Task Order No. 04: Preliminary Stream Restoration Assessment and Update for the City of Statesboro Stormwater Masterplan

Introduction & New Project Assessment

The City of Statesboro's Stormwater Masterplan was developed in 2017. Through this process, the City also updated its drainage Capital Improvement Program (CIP) list that were developed in 2015 as part of the City's Stormwater Utility Program. One component missing from the Stormwater Masterplan and CIP list is stream channel stabilization and restoration. Stormwater management and stream stabilization and restoration are closely linked. Without a sufficient floodplain or stable streambanks, urban stormwater runoff erodes stream channels, which can threaten infrastructure and public safety and create a source of non-point source pollution. If stabilization techniques are not properly designed and constructed, maintenance efforts to patch erosion are often repeated and can become more costly.

Due to this link and the importance to consider streams with stormwater projects, Goodwyn Mills Cawood (GMC) conducted a more thorough review and assessment of existing CIP projects that include erosion and stream restoration and stabilization components. In addition, GMC also included new CIP projects for other areas with erosion that are not currently on the CIP list. Lastly, the assessment included a review of grant opportunities to help finance future work.

The GMC project team met with Marcos Trejo, Stormwater Manager, on February 5, 2021, to review and discuss GMC's preliminary review of the City's CIP and to identify other areas with stream/channel erosion issues not currently on the list. This meeting also included a field tour of the new and existing projects.

Stream restoration was noted in the following existing CIPs:

- #45: Johnson Street near Johnson Avenue
    - The City has already started addressing this CIP, and it was designed last year.
- #49: Canal at Church Street & Donnie Simmons Road
    - The City has already started addressing this CIP, and the proposed 4-acre regional detention has been designed.
- #51: Gentilly Canal
    - This project is still an issue, and the site was visited during field assessment.

New project sites identified during the field tour included:

- 1. Blind Willie McTell Trail
- 2. Luetta Moore Park
- 3. Martin Luther King Jr. Drive Utility
- 4. Van Buren Street
- 5. Public Works Restoration

In addition to the five new project sites listed above, Project #51 "Gentilly Canal" was reassessed and the approach and cost were updated. During the site tour, there were several exposed utility crossings observed to be causing debris blockages or scour in the stream bed. As a result, an additional project was recommended to assess the condition of utility crossings citywide and to determine feasibility for stream restoration structures to provide grade control and build-up of sediment to cover exposed utility pipes. Project #3 "*Martin Luther King Jr. Drive Utility*" was one project deemed suitable for this approach.

For each project listed above, a one-page sumary sheet was created to describe the issue and proposed solution, and they are presented on the subsequent pages. A cost estimate was also developed based on the project scope and scale. Cost estimates included engineering design, surveying, permitting, and construction costs, and a 10% contingency was added to the construction cost line item. Easements and property acquisition were not included in the cost estimates. A summary of the project costs and lengths are presented in Table 1, and detailed cost estimate tables are included in Appendix A.

Table 1. *Summary of CIP Projects*

Project ID & Name	Project Cost	Project Type	Project Length (ft)
Project 1 - Blind Willie McTell Trail - Phase I & II	$405,500	Stream Restoration	1,050
Project 2 - Luetta Moore Park	$180,200	Stream Restoration	630
Project 3 - Martin Luther King Jr. Drive Utility	$85,360	Utility / Bank Stabilization	700
Project 4 - Van Buren Street	$60,920	Bank Stabilization	350
Project 5 - Public Works Restoration	$394,250	Stream Restoration	844
Project 6 - Gentilly Canal	$1,259,650	Stream Restoration	2,485
Project 7 – Utility Crossing Assessment	$17,500* (*varies with scope)*	GIS Mapping & Field Assessment	

BLIND WILLIE MCTELL TRAIL – PHASE I AND II

Phase II site location.

Phase I of the E. Grady Street city park stream restoration looking downstream.

2021 Cost Estimate:

$405,500

Date Engineering Procured:

Date Construction Started:

Date Construction Completed:

Project Description:

The unnamed tributary flowing through the City park, along Blind Willie McTell Trail, just south of E. Grady Street exhibits significant aggradation of sediment within the stream channel and erosion along the stream banks. The proposed project is divided into two phases, which are delineated by an associated railroad crossing, so that it can be completed in steps if full funding is not available. Thick, unsightly vegetation exists within the riparian corridor for Phase I (north).

The primary focus of the project is to utilize Priority 3 stream restoration techniques to address aggradation and bank erosion issues associated with the tributary. Additional project components include an aesthetically pleasing yet functional planting scheme with an educational component for visitors of the park. Identified permitting includes a Nationwide Permit through the U.S. Army Corps of Engineers and a Buffer Variance through the GA Environmental Protection Division.

Notes:

STORMWATER DIVISION

LUETTA MOORE PARK

Upstream view of the canal.

Downstream view of the canal adjacent to Luetta Moore Park.

2021 Cost Estimate:

$180,200

Date Engineering Procured:

Date Construction Started:

Date Construction Completed:

Project Description:

The canal adjacent to Luetta Moore Park requires dredging due to aggradation of sediment in the channel bottom. In addition, the banks experience sloughing despite being vegetated. It is also noted that beaver activity takes place upstream of the project site. A linear utility runs parallel to the canal, limiting the ability to alter the bank slope or flow path of the canal.

The primary project goal shall include providing Priority 4 Restoration (in-place stabilization) to address the erosion and sediment issues within the channel. The regraded bank will require vegetation or hard-armoring (such as rip-rap or Flexamat). In addition, adjacent properties shall be reviewed to determine if an adjacent land use is contributing heavy sediment loading to the canal. Finally, the beaver population upstream shall continue to be controlled to reduce upstream damming. Identified permitting includes a Nationwide Permit through the U.S. Army Corps of Engineers and a Buffer Variance through the GA Environmental Protection Division. The project exists within a regulatory floodway so a no-rise engineering analysis will be necessary to satisfy National Flood Insurance Program requirements.

Notes:

STORMWATER DIVISION

MARTIN LUTHER KING JR DRIVE UTILITY

Upstream view of the canal.

General view of exposed utility line.

2021 Cost Estimate:

$85,360

Date Engineering Procured:

Date Construction Started:

Date Construction Completed:

Project Description:

The canal adjacent to Martin Luther King Jr Drive (just north of W Main Street) contains an exposed utility line that is subject to the energy exhibited at base flow of the canal. This energy may negatively impact the lifespan of the utility line. In addition, the canal contains steep side slopes with sporadic armoring comprised of construction and demolition debris.

The primary goal of this project shall be to protect and stabilize the exposed utility line by constructing a rock structure (such as a cross vane or j-hook) in order to promote channel material to cover the exposed line. In addition, the cost estimate provided includes removal of existing construction and demolition debris occupying the channel and performing bank stabilization using denser armoring such as rip-rap or Flexamat. Identified permitting includes a Nationwide Permit through the U.S. Army Corps of Engineers and a Buffer Variance through the GA Environmental Protection Division. The project exists within a regulatory floodway so a no-rise engineering analysis will be necessary to satisfy National Flood Insurance Program requirements.

Notes:

STORMWATER DIVISION

VAN BUREN STREET

Downstream view of ditch.

2021 Cost Estimate:

$60,920

Date Engineering Procured:

Date Construction Started:

Date Construction Completed:

Upstream view of ditch.

Project Description:

A tributary to Little Lotts Creek flows adjacent to a stretch of Van Buren Street and exhibits excessive sediment loading and bank erosion. The watercourse exists between a road and residential neighborhood, so the option to alter the bank slope and/or flow path of the channel is not present.

The primary project goal shall include stabilizing the stream in-place using Priority 4 restoration techniques. In summary, armoring to the existing streambank will be provided utilizing rip-rap or Flexamat. Identified permitting includes a Nationwide Permit through the U.S. Army Corps of Engineers and a Buffer Variance through the GA Environmental Protection Division. The project exists within a regulatory floodway so a no-rise engineering analysis will be necessary to satisfy National Flood Insurance Program requirements.

Notes:

STORMWATER DIVISION

PUBLIC WORKS RESTORATION

Compromised hydrologic structure.

2021 Cost Estimate:

$394,250

Date Engineering Procured:

Date Construction Started:

Date Construction Completed:

Upstream view of project site.

Project Description:

The proposed project includes addressing bank erosion and sediment aggradation issues associated with a tributary to Mill Creek. The stream is experiencing excessive erosion and sloughing on its banks. In addition, the eroded bank shown above is encroaching onto an adjacent parking lot and associated hydrologic structures.

Project goals include utilizing natural channel design techniques (Priority 2 Restoration) to construct a new, stable channel within the available left floodplain overbank at the existing channel elevation. By utilizing this technique, the new channel will be moved from potentially impacting the adjacent parking area while also reducing sediment loading downstream. Identified permitting includes a Nationwide Permit through the U.S. Army Corps of Engineers and a Buffer Variance through the GA Environmental Protection Division.

Notes:

STORMWATER DIVISION

GENTILLY CANAL/#51

Drainage canal with severe erosion along the bank

Downstream view of Gentilly Canal.

2015 Cost Estimate:
$959,000

2017 Cost Estimate:
$1,025,440

2021 Cost Estimate:
$1,259,650

Date Engineering Procured:

Date Construction Started:

Date Construction Completed:

Project Description:

The drainage canal at Gentilly Road collects drainage from the majority of the city. Within the vicinity of the Statesboro Waste Water Treatment Plant, Gentilly Canal exists within a powerline easement and exhibits significant erosion within the stream channel resulting in aggradation of sediment. It is recommended that portions of the stream bank are stabilized through stream restoration techniques.

Initially, an in-depth assessment of the canal shall be performed utilizing the Bank Erosion Hazard Index (BEHI) to identify problem areas within the canal. Once identified, stream restoration measures shall be designed to address the erosion issues and to increase the overall stability of the canal. In addition, the existing maintenance road within the easement should be improved with gravel to provide ease of access for maintenance. Property may have to be purchased or easements obtained to complete the project, depending on the areas of interest identified. Identified permitting includes a Nationwide Permit through the U.S. Army Corps of Engineers and a Buffer Variance through the GA Environmental Protection Division. The project exists within a regulatory floodway so a no-rise engineering analysis will be necessary to satisfy National Flood Insurance Program requirements. There may be additional permitting components of this project as wetlands are suspected to be adjacent to the canal.

Notes:

STORMWATER DIVISION

UTILITY CROSSING ASSESSMENT

Example utility crossing at Gentilly Canal.

2021 Cost Estimate:

$17,500*
(*varies with scope*)

Date Engineering Procured:

Date Construction Started:

Date Construction Completed:

**An estimated cost was provided based on a contractor providing two weeks of field work on top of the GIS desktop assessment and review. Since the number of crossings citywide is not known, this project is recommended to be completed as an hourly contract with a not to exceed budget. The City can provide cost savings through support from Stormwater, Water/Sewer, and GIS Department staff.*

Example utility crossing just south of Donnie Simmons Way.

Project Description:

During the site tour, there were several exposed utility crossings observed to be causing debris blockages or scour in the stream bed. The energy on the utility lines may also negatively impact the lifespan. As a result, an additional project was recommended to assess the condition of utility crossings citywide. Utility lines can be protected and stabilized using a rock structure (such as a cross vane or j-hook) in order to promote channel material to cover the exposed line.

This assessment can be completed as a GIS mapping exercise where water and sewer infrastructure are overlaid on the ditch and stream/canal layer to locate all utility crossings. Once mapped, each site should be inspected to identify utility vulnerability and whether the elevations are conducive for stream restoration structures to provide build-up of sediment to cover exposed utility pipes. Construction of the most vulnerable and suitable locations is easy to get permitted through an emergency permit.

Notes:

STORMWATER DIVISION

Project Prioritization

The prioritization matrix from the Stormwater Masterplan was used as the basis for ranking these projects. It was amended slightly to better assess these projects from a stream restoration and stabilization perspective. The category weights remained constant from that used in the Stormwater Masterplan. The list below describes edits made to the matrix:

- City ROW/Easement
    - An additional category was added to describe if the projects is mostly or partially in the City ROW or easement.
- Flooding or Property Damage Potential
    - Combined Structural Flooding, Street Flooding, and Property Damage Potential into one category.
- Public Runoff Influence
    - Removed.
- City Goals / Plans
    - Revised criteria to focus on feedback from City Officials and Staff.
- Water Quality
    - Revised criteria to focus on water quality benefits of the project.
- Cost-Benefits
    - Revised criteria to include benefits of the project in addition to cost.

The matrix index results are presented on the next page, and the scores for equal weighting are also presented. Based on these results the projects were grouped into three tiers. The top tier included one project – Blind Willie McTell Trail - Phase I & II. The 2nd tier included Public Works Restoration, Gentilly Canal, and Martin Luther King Jr. Drive Utility. The 3rd tier included Luetta Moore Park and Van Buren Street.

PROJECT NAME	City ROW/ Easement	Flooding or Property Damage Potential	Ease of Construction	City Goals/Plans	Water Quality Benefits	Cost-Benefits	INDEX	Raw Score (equal weights)	General Ranking
Category Weights	**10**	**10**	**5**	**5**	**3**	**3**			
1. Blind Willie McTell Trail - Phase I & II	3	1	5	5	5	3	114.0	22	Tier 1
2. Luetta Moore Park	5	1	3	1	1	1	86.0	12	Tier 3
3. Martin Luther King Jr Drive Utility	3	3	1	3	3	3	98.0	16	Tier 2
4. Van Buren Street	3	3	1	1	1	1	76.0	10	Tier 3
5. Public Works Restoration	1	3	5	3	5	3	104.0	20	Tier 2
6. Gentilly Canal	5	1	3	3	3	1	102.0	16	Tier 2

Category	*Multiplier**	*Description*
City ROW/Easement	5	Fully in City ROW or City Easement
	3	Mostly in City ROW or City Easement
	1	Partially in City ROW or City Easement
	0	No portion of the project would be within a City ROW or Easement

Flooding or Property Damage Potential	5	Documented severve on a repeated basis
	3	Documented moderate on a repeated basis
	1	Minor on a repeated basis or limited basis
	0	No flooding/damage has occurred

** Combined Structural Flooding, Street Flooding, and Property Damage Potential*

Ease of Construction	5	Simplistic or straighforward construction process; space to work
	3	Difficult or extended effort construction process
	1	Complex/ time consuming construction process; confined working space

City Goals / Plans	5	Project or problem area has been identified as a High Priority by City Officials and Staff
	3	Project or problem area has been discussed/suggested
	1	Project or problem area has not been previously addressed
	0	Project is contrary to City goals/plans

** Revised to focus on feedback from City Officials and Staff*

Water Quality	5	Project would have substantial improvements to water quality in receiving stream
	3	Project would have moderate improvements to water quality in receiving stream
	1	Project would have minor improvements to water quality in receiving stream
	0	Project could have potential negative water quaity impact

** Revised to focus on water quality benefits of project*

Cost-Benefits	5	Project would be cost effective in implementation; and provides numerous benefits
	3	Project would have a moderate cost for implementation; and provides several benefits from other categories
	1	Project would have an elevated cost for implementation

Stream Restoration Techniques and Example Structures

This preliminary assessment evaluated various methods for stream restoration based on natural channel design methodology, taking into account constraints presented by the existing stream and surrounding land uses. The most critical aspect of stabilizing incised stream channels is to reestablish floodplain access for high flow events. The primary function of a floodplain is to dissipate energy during high flows by allowing water to spread out and decrease velocity. The result is greatly reduced shear stress in the active channel, resulting in less bed scour and streambank erosion. The following presents four restoration options in priority order for addressing incised alluvial streams. Each option is described below and summarized in Table 2 with advantages and disadvantages.

Priority 1 Restoration Option: Establish Bankfull Stage at the Historical Floodplain Elevation. For a Priority 1 restoration, the incised channel is re-established on the historical floodplain using the relic channel or by way of construction of a new morphologically stable channel (Figure 1). The channel is "lifted" to a higher elevation in order to connect with the historical floodplain. The new channel has the dimension, pattern, and profile characteristic of a stable form, and its floodplain is on the existing ground surface. The existing, incised channel is either filled in completely or filled in partially to create discontinuous oxbow lakes and offline wetlands that are level with new floodplain elevation.

The surrounding land use can be prohibitive of this restoration type. Priority 1 restorations typically result in higher flood elevations and require sufficient land for meandering, which can be a problem where flooding and land use issues exist. Also, constraints such as permanent culverts upstream or downstream of the restoration reach can render this approach infeasible.

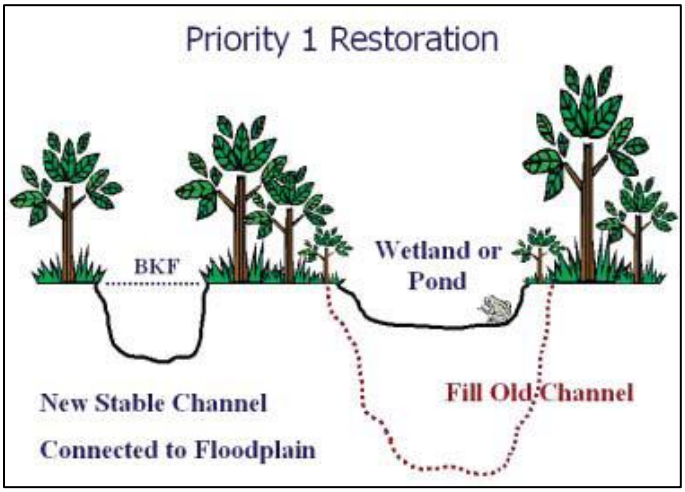


Figure 1. *Conceptual cross section of Priority 1 restoration (Doll et al, 2003).*

Priority 2 Restoration Option: Create a New Floodplain and Stream Pattern with the Stream Bed Remaining at the Present Elevation. In a Priority 2 restoration, a new, stable channel with the appropriate dimension, pattern, and profile is constructed at the elevation of the existing channel (Figure 2). A new floodplain is established, typically at a lower elevation than the historical floodplain. The new channel is typically a meandering channel with bankfull at the elevation of the new floodplain. This type of project can be constructed in dry conditions while streamflow continues in its original channel or is diverted around the construction site.

A major advantage of the Priority 2 approach is that flooding does not increase and may in some cases decrease as the floodplain is excavated at a lower elevation. Riparian wetlands in the stream corridor created by the excavation may be enhanced with this approach. Priority 2 projects typically produce more cut material than is needed to fill the old channel. This means that designers must consider the expense and logistics of managing extra soil material excavated from the floodplain. Surrounding land uses can limit the use of this approach if there are concerns about widening the stream corridor.

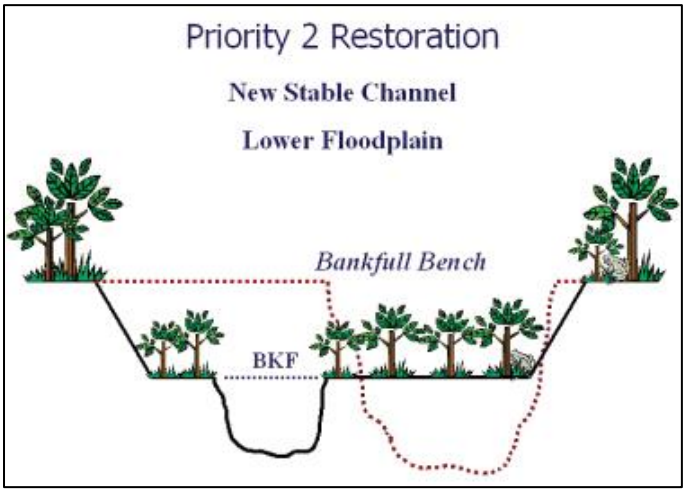


Figure 2. Conceptual cross section of Priority 2 restoration (Doll et al, 2003).

Priority 3 Restoration Option: Widen the Floodplain at the Existing Bankfull Elevation. Priority 3 restorations entail converting the existing unstable stream to a more stable stream at the existing elevation and with the existing pattern of the channel but without an active floodplain (Figure 3). This approach involves establishing proper dimension and profile by excavating the existing channel to change stream classification (e.g., convert streams classified as F and/or G to C or E classification). This restoration concept is implemented where streams are confined (laterally contained) and physical constraints limit the use of Priority 1 and 2 restoration. A Priority 3 restoration can produce a moderately stable stream system but may require structural measures and maintenance attention. For these reasons, it may be more expensive and more complex to construct depending on valley conditions and structure requirements.

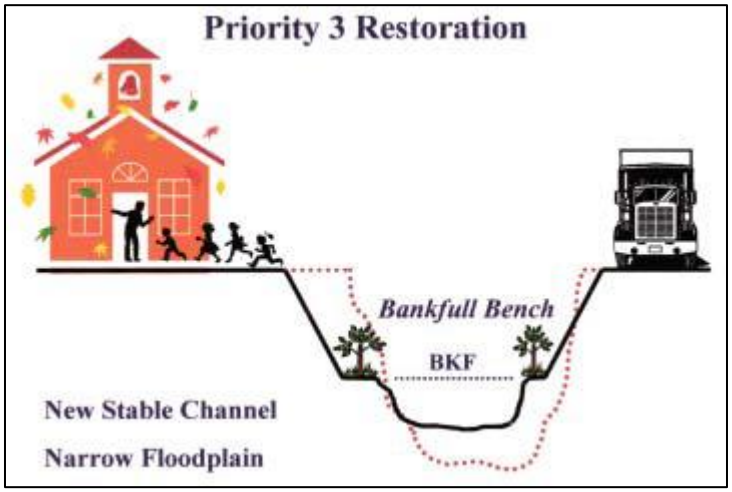


Figure 3. Conceptual cross section of Priority 3 restoration (Doll et al, 2003).

Priority 4 Restoration Option: Stabilize Existing Streambanks in Place. In a Priority 4 Restoration approach, the existing channel is stabilized in place by the use of stabilization materials and methods that have been used to decrease streambed and streambank erosion, including rip rap, gabions, and bio-engineering methods. This is a high-risk method due to the lack of address of existing excessive shear stress and velocity that has caused the current condition of the impaired channel. Also, it limits the aquatic habitat. This is the least desirable from a biological and aesthetic standpoint.

Table 2. *Advantages and disadvantages of restoration options for incised streams.*

Priority #	Advantages	Disadvantages
1	Results in long-term stable stream Restores optimal habitat values Enhances wetlands by raising water table Minimal excavation required	Increases flooding potential Requires wide stream corridor Unbalanced cut/fill May disturb existing vegetation
2	Results in long-term stable stream Improves habitat values Enhances wetlands in stream corridor May decrease flooding potential	Requires wide stream corridor Requires extensive excavation May disturb existing vegetation
3	Results in moderately stable stream Improves habitat values May decrease flooding potential Maintains narrow stream corridor	May disturb existing vegetation Does not enhance riparian wetlands Requires structural stabilization measures
4	May stabilize streambanks Maintains narrow stream corridor May not disturb existing vegetation	Does not reduce shear stress May not improve habitat values May require costly structural measures May require maintenance

The recommended restoration techniques include in-stream structures to provide grade control, bank stability, and enhanced habitat. Examples along stream banks to direct energy away from the bank while deep-rooted vegetation becomes established include: root wads (Figure 4), j-hooks (Figure 5), and log vanes (Figure 6). Another structure type that provides grade and flow direction control at the heads of riffles is a boulder cross vane (Figure 7). All of these structures enhance habitat by providing local scour holes and woody debris. The main intent of instream structure installation is to direct flow away from the banks, providing bank protection and improving stability.

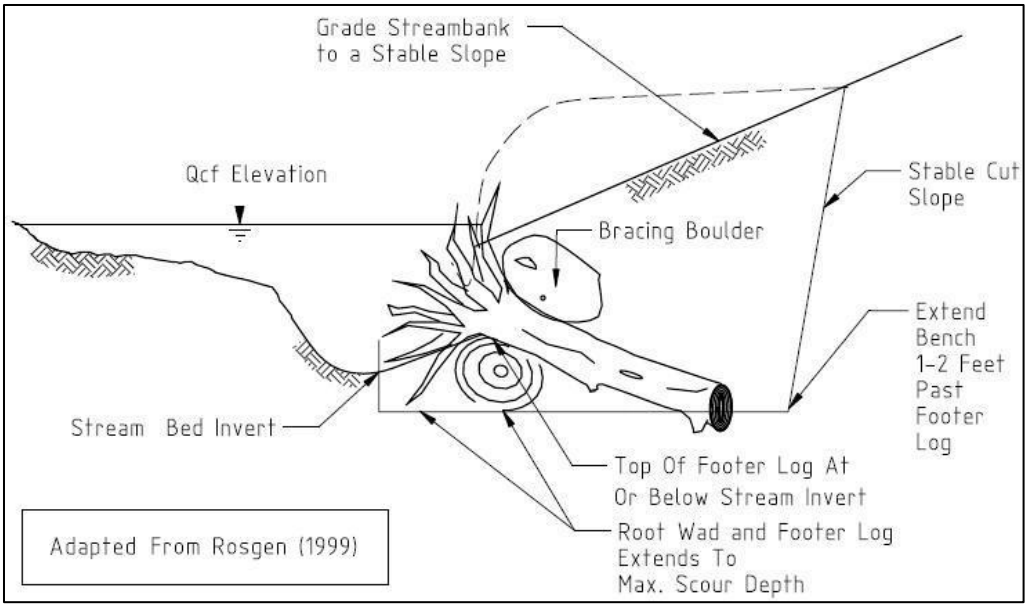


Figure 4. Schematic root wad cross section (from VDCR, 2004).

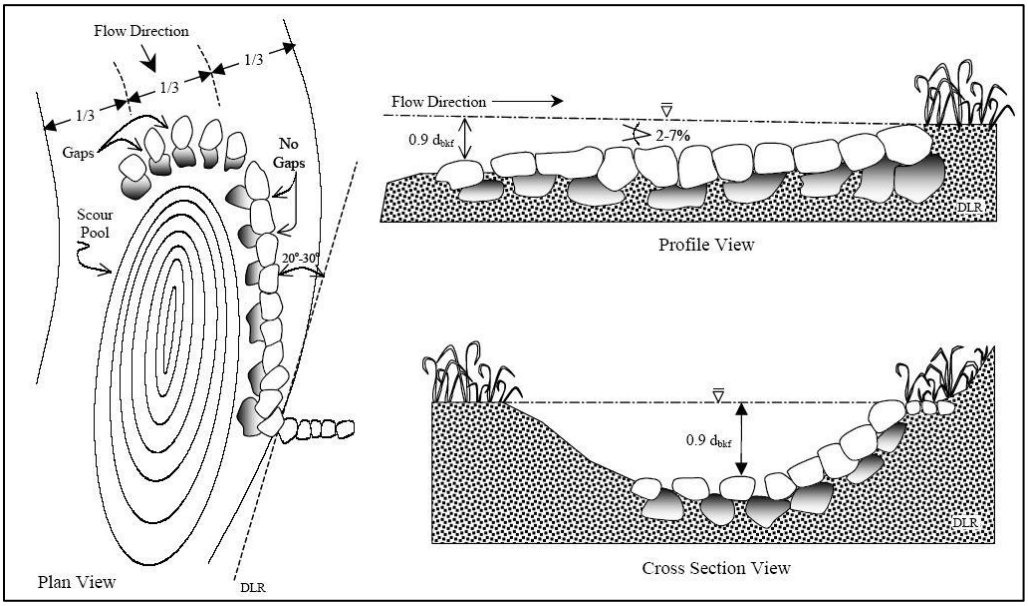


Figure 5. *Schematic j-hook vane cross section, profile, and plan view (from Rosgen, 2001b).*

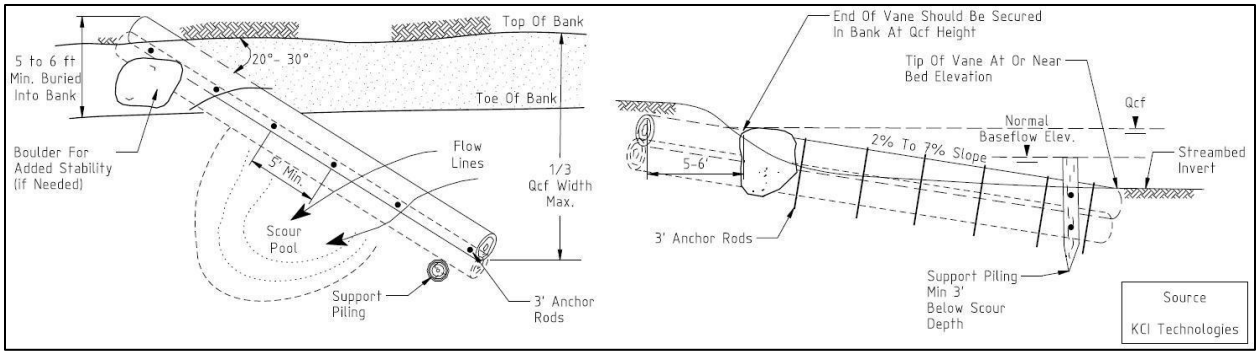


Figure 6. *Schematic log vane cross section and plan view (from VDCR, 2004).*

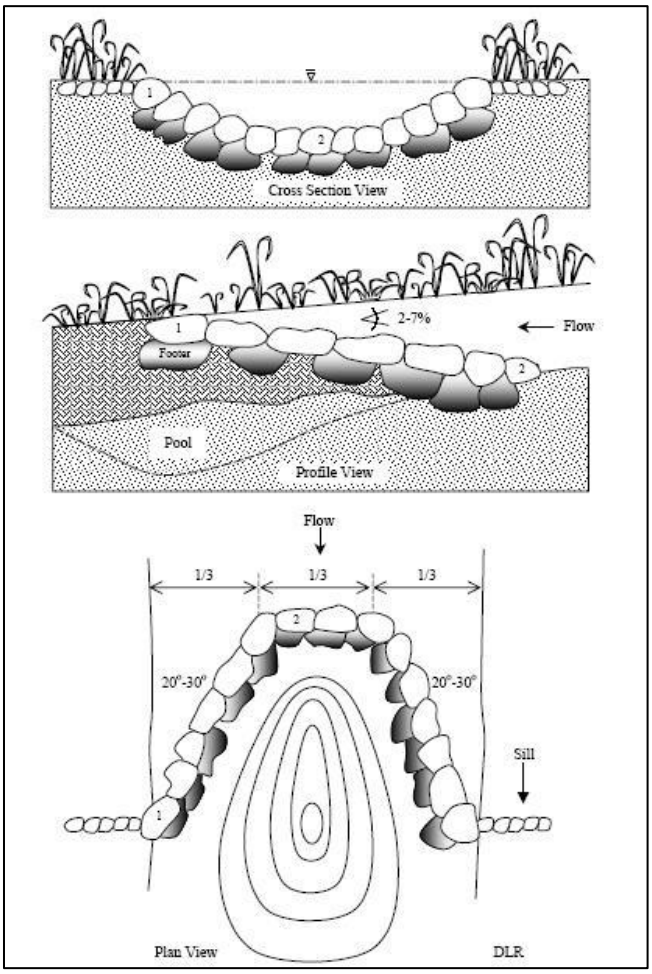


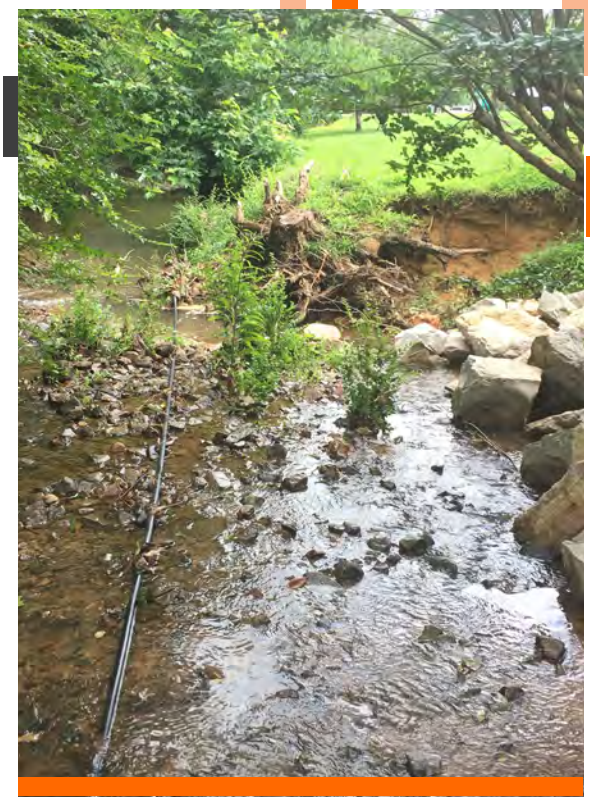
Figure 7. *Schematic cross vane cross section, profile and plan view (from Rosgen, 2001b).*

Similar Projects

As the proposed project cover a wide range of scales and conditions, examples of similar projects that GMC has design and constructed are described below, and a project sheet of each example is also included:

- McLellan Creek Bank Stabilization and Green Infrastructure
  - *Example*: Small-scale bank stabilization.
  - *Applicable Site*: Public Works
- Auburn University Parkerson Mill Creek Stream Restoration
  - *Example*: Stream restoration along highly-trafficked and visible site; "Priority 3" stream restoration site where floodplain was widened.
  - *Applicable Site*: Blind Willie McTell Trail
- Troy University Janice Hawkins Park
  - *Example*: Addition of sinuous channel and floodplain; "Priority 2" stream restoration site.
  - *Applicable Site*: Public Works
- D'Olive Creek Stream Restoration
  - *Example*: Large-scale stream restoration.
  - *Applicable Site*: Gentilly Canal
- City of Auburn Softball Field Streambank Stabilization
  - *Example*: Flexamat; streambank armoring ("Priority 4" stream restoration).
  - *Applicable Sites*: Luetta Moore Park, Martin Luther King Jr. Drive Utility, and Van Buren Street
- MWWSSB Sewer Line Crossing Stabilization
  - *Example*: Utility Stabilization.
  - *Applicable Site*: Martin Luther King Jr. Drive Utility, and Utility Crossing Assessment

After



Before

McLellan Creek Bank Stabilization and Green Infrastructure

Goodwyn Mills and Cawood (GMC) was hired to complete the design, permitting and construction of a bank stabilization project associated with McLellan Creek in Whitfield County, Georgia. The project was needed to address flood attenuation issues in the backyard of the landowner and to route and treat the stormwater received from the adjacent residential development (roofs, driveways, etc). The site work included stabilization of the existing bank through grading activities and enhancement of local stormwater drainage through the implementation of green infrastructure in the form of an enhanced dry swale. Additionally, the reduction in scour on the bank minimized sediment loads delivered by the bank downstream. Construction was completed within one week and led to improved conditions downstream by remediating ongoing erosion at the site utilizing Georgia 319 Program funding including a match from the Owner and subconsultant.

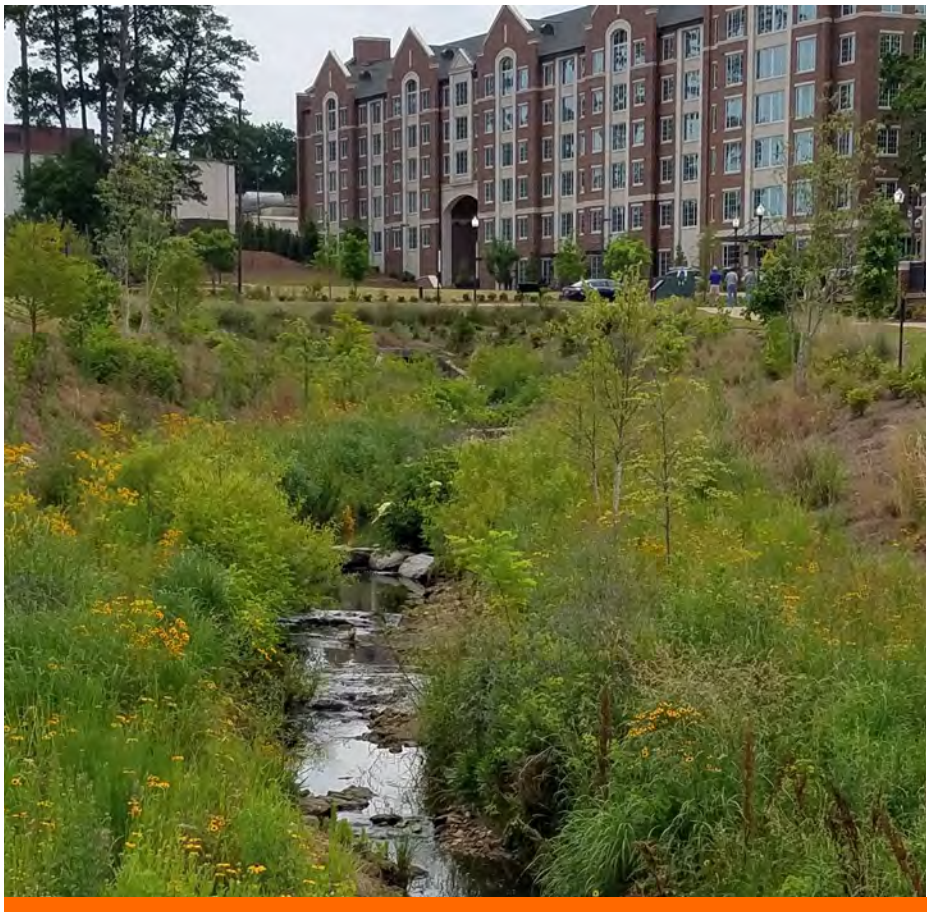
LOCATION Dalton, Georgia

SIZE 200 LF

STATUS Completed Summer 2018

COST $47,305

OWNER
Adam Kennon
Program Coordinator
Limestone Valley RD and D Council
(865) 306-2327



Auburn University Parkerson Mill Creek Stream Restoration

The Auburn University Parkerson Mill Creek restoration project entailed Priority 3 Restoration in urban areas to widen flood plains, cleaning out the stream, seeding and landscaping the surrounding grounds and adding an outdoor classroom. In addition to further demonstrating the University's commitment to sustainability, restoring the stream enhanced the overall aesthetic of the area, improved water quality, enriched the social and ecological functions, and promoted the biological livability of the landscape making the area available for environmental research and outdoor learning opportunities for students.

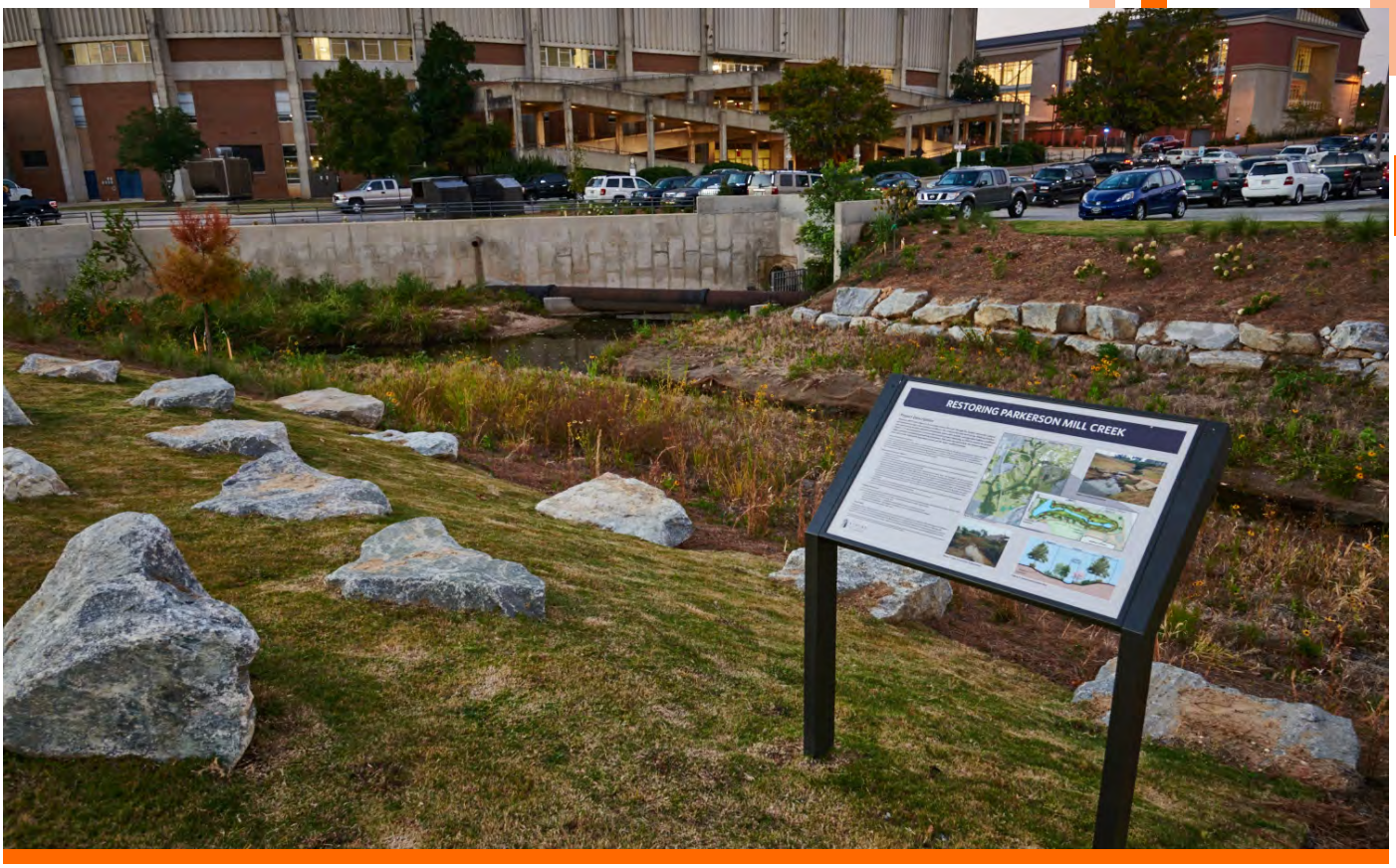
LOCATION Auburn, Alabama

SIZE N/A

STATUS Completed July 2014

COST N/A

OWNER
Auburn University
Jim Carroll
334-844-8406
jjc0019@auburn.edu



Auburn University's Parkerson Mill Creek Stream Restoration included an outdoor "classroom" where students learn about environmental stewardship and sustainable watershed management.

Troy University Janice Hawkins Park

Troy University developed Janice Hawkins Park as a buffer to the City of Troy. Janice Hawkins Park is a series of ravines filled with large oaks, tulip poplar, pines and red maple and wetlands. The area is home to diverse wildlife and habitat for birds. GMC provided design for invasive species removal and stream restoration within the 20-acre park. One measure of the park's success is demonstrated by students choosing it as the location to make a marriage proposal.

The restoration site included over 600 linear feet of impaired stream that was channelized, entrenched, disconnected from the floodplain, and bordered by invasive species. The project consisted of Priority 2 natural channel design restoration techniques. Over 1,900 linear feet of sinuous channel was constructed and over 2 acres of floodplain was cleared and graded. The new channel was constructed to have the correct width-to-depth ratio and bankfull height to allow the stream to reconnect to the surrounding floodplain. The new connectivity allows the stream to deposit nutrient and sediment loads on the adjacent floodplain, while dissipating flood flow energy to reduce down cutting and erosion. GMC assembled numerous public and private stakeholders to assist in restoring an additional stream reach on the property using EPA Section 319 funding.

LOCATION Troy, Alabama

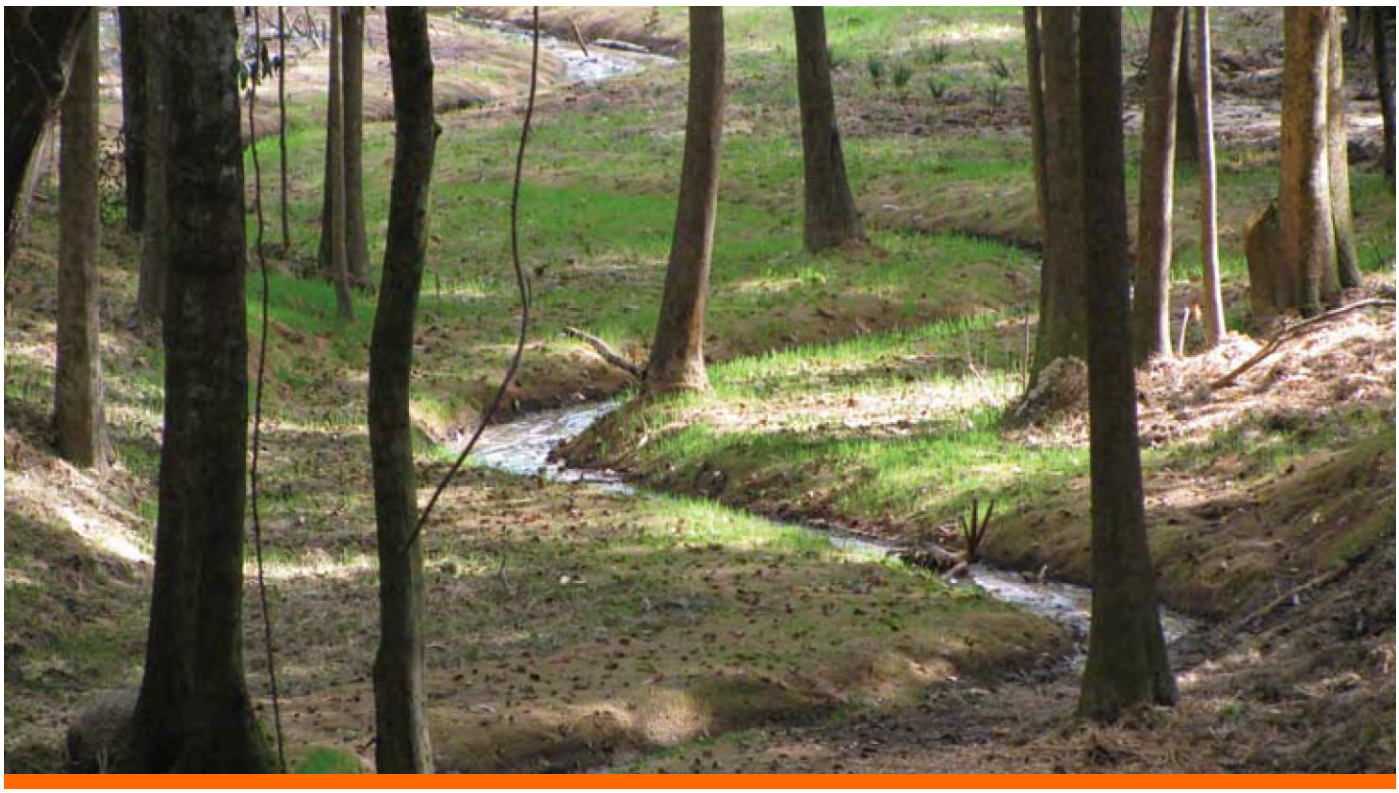
SIZE Over 1,900 linear feet of sinuous channel and over 2 acres of floodplain

STATUS Completed May 2009

COST $120,000

OWNER
Troy University
Mr. Mark Salmon
334-670-3342

Before



After

Troy University stream restoration in Janice Hawkins Park. The EPA 319-funded project consisted of Priority 2 natural channel design restoration techniques.

LOCATION Daphne, Alabama

SIZE Over 2,000 linear feet of sinuous channel

STATUS Completed 2016

COST $3,000,000

OWNER
Mobile Bay National Estuary Program
Roberta Swann
251-431-6409
rswann@mobilebaynep.com

D'Olive Creek Stream Restoration

This project consists of design for 2,236 linear feet of D'Olive Creek in Daphne, Alabama. The project extends from Interstate 10 at the northern (upstream) end to Highway 90 at the southern (downstream) end. The D'Olive Creek watershed drains part of the eastern shore of Mobile Bay, including parts of the cities of Spanish Fort and Daphne. The watershed is in transition from forested, agricultural, and residential land uses to residential and commercial development. The changes in land-use and impervious surfaces have impacted water quality and habitat in the watershed and Mobile Bay. Increasing runoff has influenced erosion and stream channel degradation leading to extensive sediment loads and destroying habitat. Based on field observations and predictive level assessment, it is estimated that the banks are eroding at an average rate between 2 and 4 feet per year. This results in an estimated 1,700 tons per year of sediment eroding from streambanks in the project reach. The estimated erosion rate per unit length is 0.77 tons/yr/ft.

GMC's objectives for this project were to design a self-sustaining, natural, stable river, reduce sediment deposition and supply through the reach, design a stream and floodplain to handle applied shear stresses without erosion, improve the riparian community throughout the reach, and to maintain the integrity and function of the culverts at I-10. The purpose of this project was to address the stability and departure of the creek and issues that occurred along this reach of D'Olive Creek. The design proposed to restore and stabilize the channel through natural channel restoration and best engineering practices. This was met through the design and construction of proper channel dimension, layout, and profile based on reference reach data and instream stabilizing structures. The design also mitigates sediment deposition downstream through channel stabilization and native vegetation installation. Finally, the channel and flood plain were designed to support historically high flows recorded during recent rain events. The GMC team provided construction management/ oversight throughout the entire construction period to ensure the as-built conditions were consistent with the project design.

City of Auburn Softball Field Streambank Stabilization

GMC, on behalf of the City of Auburn, provided professional engineering services for the design and construction of the stabilization of approximately 150 linear feet of streambank along Parkerson Mill Creek. These services included the production of detailed design drawings, construction specifications, tabulation of materials and quantities and construction oversite. In summary, a portion of Parkerson Mill Creek flows adjacent to a softball field within the vicinity of Interstate 85 in Auburn, Alabama. During a flood event, the energy associated with the stream exiting a box culvert just upstream of the project site had compromised the adjacent softball field. The storm flows had allowed the waters to destroy the adjacent bank and the fence of the softball field. GMC provided an innovative design solution that included the use of rock vane arm and Flexamat-reinforced slope to provide stabilization to the streambank.

LOCATION Auburn, Alabama

STATUS Completed January 2017

COST $50,200

CONTACT
Dan Ballard, PLA
Watershed Division Manager
City of Auburn
dballard@auburnalabama.org

GMC

MWWSSB Sewer Line Crossing Stabilization
Montgomery, Alabama

GMC was hired to implement an emergency stabilization of a 42-inch sewer main located along 3-Mile Creek in Montgomery, Alabama. The stream has a drainage area of approximately 11.7 square miles and drains the north central portion of the City of Montgomery. The sewer line is a main truck line from the City of Montgomery to the Treatment Plant, located north of the City of Montgomery. The sewer main was exposed, suspending approximately 2 feet from the channel bottom, with a scour pool downstream approximately 4 feet deep. The sewer main was in jeopardy of failing due to high stream flows and increased pressure on the pipe. GMC was able to stabilize the stream to create a permanent grade control structure without having to replace the pipe. This technique not only alleviated the failing condition of the sewer crossing, but stabilized the stream bed to prevent future degradation.

The approach for the project included a reach-wide stream assessment to determine proper channel dimension and profile based on watershed characteristics and local reference data. The appropriate channel dimension was used to size the rock cross vane structure and rock j-hook structure. The profile data was used to determine the appropriate spacing for the two structures. Spacing of the structures is essential in setting the stream on a path to repair itself. To effectively protect the sewer line, the stream needs the proper amount of room to dissipate its energy in scour pools while maintaining enough energy to carry the sediment load from upstream through the system.

LOCATION Montgomery, Alabama

SIZE 11.7 square miles

STATUS Completed 2013

COST $100,000

CONTACT
Montgomery Water Works & Sanitary Sewer Board
Bill Henderson
(334) 206-1600
bhenders@mwwssb.com

GMC

Potential Grant Funding

In November 2020, Georgia EPD released a new, draft TMDL Evaluation for six stream segments in the Ogeechee River Basin for sediment. One of the stream segments is just downstream of the Statesboro city limits – Little Lotts Creek. The TMDL describes the upper portion of the Little Lotts Creek watershed, that is includes about half of the City, as a "*not supporting watershed*" due to Sediment (for fish communities). A map from the draft TMDL is presented in Figure 8. If this TMDL is approved and finalized, it will enable the City of Statesboro to pursue Section 319(h) grant funds from Georgia EPD to implement non-point source pollution prevention projects, such as stream restoration. An intermediate step to be eligible for a Section 319(h) grant is to have a Watershed Management Plan that meets the U.S. EPA's nine elements for watershed planning. Sometimes there are grants available to write a watershed management plan. All stream restoration projects included in the Task Order #4 Assessment are within this watershed except for "*5. Public Works Restoration*."

Section 319(h) grant funds have a maximum grant request of $400,000 and require a minimum of 40% of the total project cost to be non-federal matching funds. Therefore, the minimum match required for a $400,000 grant request is $266,667. Grants can be matched with In-Kind personnel and fringe, state-funds (e.g., GDOT), stormwater utility funds, or a combination of those listed prior.

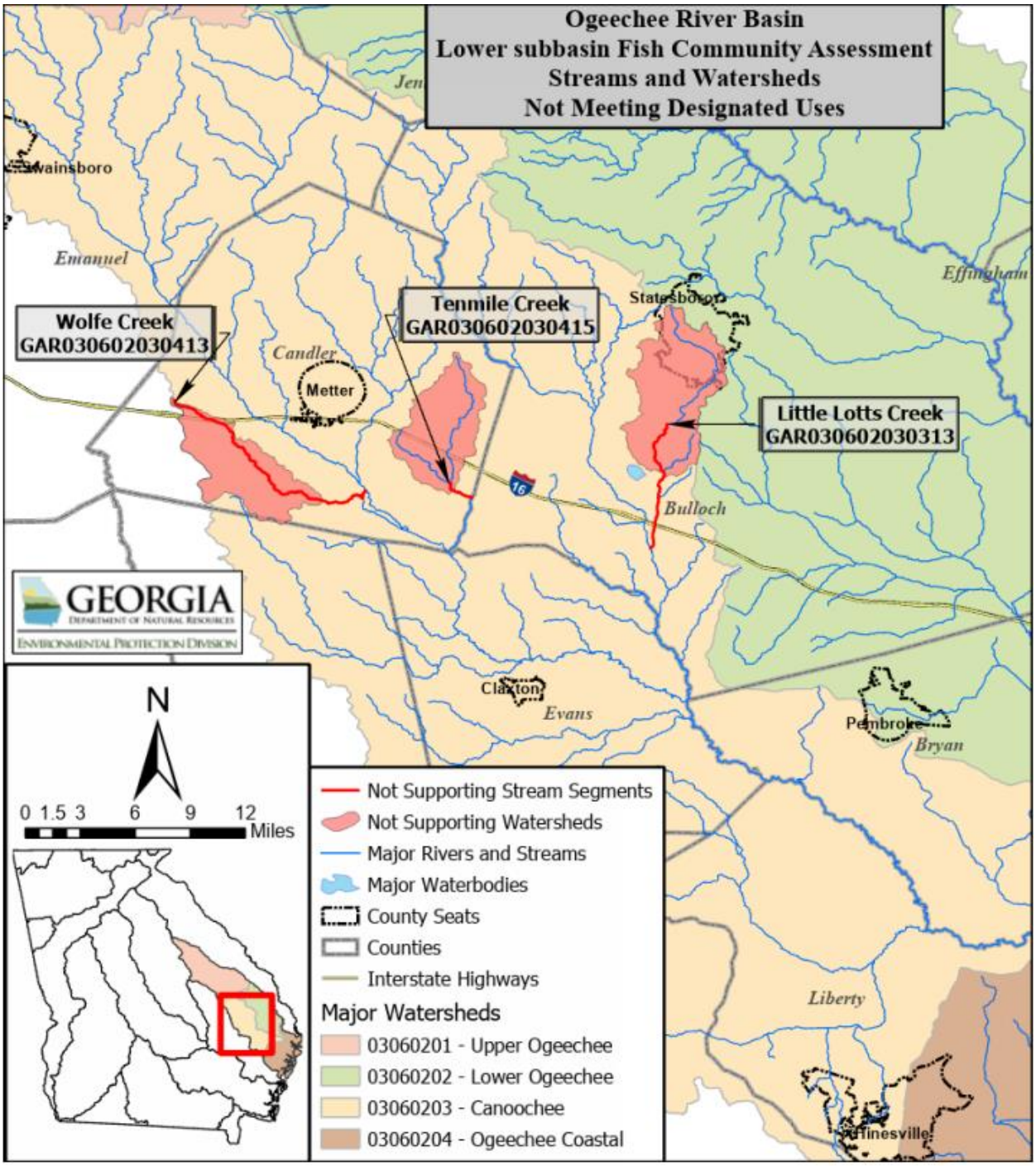


Figure 8. *Not Supporting Stream Segments and Watersheds from Draft TDML Evaluation for Six Stream Segments in the Ogeechee River Basin for Sediment (November 2020).*

Recommendations / Next Steps

Based on the preliminary stream restoration assessment, it is recommended that the City pursues the following action items over the next year:

1. In-depth assessment for Gentilly Canal and develop conceptual design
    a. This project is estimated to cost approximately $1.26M, so it is recommended to identify the most pressing sections for restoration and stabilization. This evaluation is performed utilizing the Bank Erosion Hazard Index (BEHI). This assessment is estimated to cost $12,500.
2. Track Ogeechee River Basin TMDL Evaluation status
    a. Once the TMDL Evaluation is approved, the City should work to create a Watershed Management Plan (WMP) for the HUC-12 watershed within the City Limits. Then, the City should apply for Section 319(h) Grants to address one of the projects in Little Lotts Creek watershed
3. Pursue design contract for Blind Willie McTell Trail project
    a. This project was identified as the highest priority project being the only one as Tier 1. Based on the construction cost and available funds, the construction may be phased in two sections.
4. GIS/field assessment of vulnerable water and sewer utilities at stream crossings
    a. There were a few suitable sites for this approach identified during the February 5th field visit, but the GIS assessment would allow for higher priority areas to be located. This project will require contractor support and coordination with Stormwater, Water/Sewer, and GIS staff.

As funds are available for additional projects, it is recommended to look at the Tier 2 sites – MLK Jr. Drive Utility, Public Works Restoration, and Gentilly Canal

1. Public Works Restoration was the highest ranked of the three. It would have been ranked higher but it is only partially in the City ROW or easement. The property owner of Save-A-Lot may be interested in sharing financial cost as the stream has already impacted their parking lot and could impact the building structure. This project has the most space and potential to implement natural channel design techniques
2. The Gentilly Canal was the next highest ranked project, and it has a large cost.
3. The lowest Tier 2 project is Martin Luther King Jr. Drive. This project has suitable elevations to be a good test case for protecting utility lines.

Appendix A – Opinion of Probable Cost Summary Sheets

Project 1 - Blind Willie McTell Trail - Phase I and II
OPINION OF PROBABLE COST

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
SECTION I - Construction					
1	Priority 3 Restoration	1,050	LF	$300.00	$315,000.00
				SUBTOTAL	**$315,000.00**
SECTION II - Design					
1	Engineering Design	10%		$315,000.00	$31,500.00
2	Survey	1	LS	$15,000.00	$15,000.00
				SUBTOTAL	**$46,500.00**
SECTION III - Permitting					
1	USACE NWP13 PCN	1	LS	$5,000.00	$5,000.00
2	GA EPD Buffer Variance	1	LS	$7,500.00	$7,500.00
				SUBTOTAL	**$12,500.00**
				10% Contingency	**$31,500.00**
				PROJECT TOTAL	**$405,500.00**

*Does not include cost of easement or property aquisition

Project 2 - Luetta Moore Park
OPINION OF PROBABLE COST

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
SECTION I - Construction					
1	Priority 4 Restoration	630	LF	$200.00	$126,000.00
				SUBTOTAL	**$126,000.00**
SECTION II - Design					
1	Engineering Design	10%		$126,000.00	$12,600.00
2	Survey	1	LS	$10,000.00	$10,000.00
				SUBTOTAL	**$22,600.00**
SECTION III - Permitting					
1	USACE NWP13 PCN	1	LS	$5,000.00	$5,000.00
2	GA EPD Buffer Variance	1	LS	$7,500.00	$7,500.00
3	FEMA No-Rise	1	LS	$6,500.00	$6,500.00
				SUBTOTAL	**$19,000.00**
				10% Contingency	**$12,600.00**
				PROJECT TOTAL	**$180,200.00**

*Does not include cost of easement or property aquisition

Project 3 - Martin Luther King Jr. Drive Utility
OPINION OF PROBABLE COST

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
SECTION I - Construction					
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Flexamat	2800	SF	$9.00	$25,200.00
3	Boulder Cross Vane	1	1	$7,500.00	$7,500.00
4	Earthwork	1	LS	$5,000.00	$5,000.00
5	Vegetation/Erosion Control	1	LS	$2,000.00	$2,000.00
				SUBTOTAL	**$47,200.00**
SECTION II - Design					
1	Engineering Design	20%		$47,200.00	$9,440.00
2	Survey	1	LS	$5,000.00	$5,000.00
				SUBTOTAL	**$14,440.00**
SECTION III - Permitting					
1	USACE NWP13 PCN	1	LS	$5,000.00	$5,000.00
2	GA EPD Buffer Variance	1	LS	$7,500.00	$7,500.00
3	FEMA No-Rise	1	LS	$6,500.00	$6,500.00
				SUBTOTAL	**$19,000.00**
				10% Contingency	**$4,720.00**
				PROJECT TOTAL	**$85,360.00**

*Does not include cost of easement or property aquisition

Project 4 - Van Buren Street
OPINION OF PROBABLE COST

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
SECTION I - Construction					
1	Mobilization	1	LS	$7,500.00	$7,500.00
2	Flexamat	2100	SF	$9.00	$18,900.00
3	Vegetation/Erosion Control	1	LS	$2,000.00	$2,000.00
				SUBTOTAL	**$28,400.00**
SECTION II - Design					
1	Engineering Design	20%		$28,400.00	$5,680.00
2	Survey	1	LS	$5,000.00	$5,000.00
				SUBTOTAL	**$10,680.00**
SECTION III - Permitting					
1	USACE NWP13 PCN	1	LS	$5,000.00	$5,000.00
2	GA EPD Buffer Variance	1	LS	$7,500.00	$7,500.00
3	FEMA No-Rise	1	LS	$6,500.00	$6,500.00
				SUBTOTAL	**$19,000.00**
				10% Contingency	**$2,840.00**
				PROJECT TOTAL	**$60,920.00**

*Does not include cost of easement or property aquisition

Project 5 - Public Works Restoration
OPINION OF PROBABLE COST

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
SECTION I - Construction					
1	Priority 2 Restoration	844	LF	$350.00	$295,400.00
				SUBTOTAL	**$295,400.00**
SECTION II - Design					
1	Engineering Design	15%		$295,400.00	$44,310.00
2	Survey	1	LS	$12,500.00	$12,500.00
				SUBTOTAL	**$56,810.00**
SECTION III - Permitting					
1	USACE NWP13 PCN	1	LS	$5,000.00	$5,000.00
2	GA EPD Buffer Variance	1	LS	$7,500.00	$7,500.00
				SUBTOTAL	**$12,500.00**
				10% Contingency	**$29,540.00**
				PROJECT TOTAL	**$394,250.00**

*Does not include cost of easement or property aquisition

Project 6 - Gentilly Canal
OPINION OF PROBABLE COST

Item	Description	Est. Qty.	Unit	Unit Price	Total Price
SECTION I - Assessment					
1	Field Work Associated with Detailed Stream Assessment	1	LS	$7,500.00	$7,500.00
2	Conceptual Plan Deliverable	1	LS	$5,000.00	$5,000.00
				SUBTOTAL	**$12,500.00**
SECTION II - Construction					
1	Priority 4 Restoration	2,485	LF	$300.00	$745,500.00
2	Connect to Existing Drainage Structure (concrete headwalls)	15	EA	$2,500.00	$37,500.00
				SUBTOTAL	**$783,000.00**
SECTION III - Design					
1	Engineering Design	15%		$783,000.00	$117,450.00
2	Survey	1	LS	$25,000.00	$25,000.00
				SUBTOTAL	**$142,450.00**
SECTION IV - Permitting					
1	USACE NWP13 PCN	1	LS	$5,000.00	$5,000.00
2	GA EPD Buffer Variance	1	LS	$7,500.00	$7,500.00
3	FEMA No-Rise	1	LS	$6,500.00	$6,500.00
				SUBTOTAL	**$19,000.00**
SECTION V - PAVEMENT					
1	10' Gravel Maintenance Road	8,500	SY	$24.00	$204,000.00
				SUBTOTAL	**$204,000.00**
				10% Contingency	**$98,700.00**
				PROJECT TOTAL	**$1,259,650.00**

*Does not include cost of easement or property aquisition