# CITY OF RICHMOND HILL

# STORMWATER CAPITAL IMPROVEMENT

# PROJECT SUMMARY & RECOMMENDATIONS

## CITY OF RICHMOND HILL, GEORGIA

## PREPARED FOR:

## CITY OF RICHMOND HILL

## J–25002

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## INTRODUCTION

The City of Richmond Hill is located southwest of the City of Savannah in Bryan County, Georgia. It is bounded by the Ogeechee River on the east and Elbow Swamp Wetlands on the west. Sterling Creek Canal, a large tributary of the Ogeechee River, flows throughout the City. In 2008, Carter & Sloope Consulting Engineers developed a Stormwater Master Plan for the City of Richmond Hill. The Carter & Sloope study was conducted in an effort to identify existing and future storm drainage infrastructure needs and water quality issues. The 2008 Study also defined a capital improvement project (CIP) list for use in implementing a future Storm Water Utility fee system for the City.

In the spring of 2014, the City of Richmond Hill received notice from the Georgia Environmental Protection Division (GA EPD) that the City would be required to participate in the State's Municipal Separate Storm Sewer System (MS4) stormwater discharge permit program. The City would be required to establish a comprehensive stormwater management program and develop a plan and program to control stormwater pollutions discharges to waters of the State. In an effort to provide the funding needed to afford compliance with MS4 requirements, the City of Richmond Hill is evaluating the possibility of creating and implementing a stormwater utility fee. Thomas and Hutton was retained by the City of Richmond Hill to review previous stormwater master plan documents (2008 Study) for present day applicability, review and identify areas with deficient drainage conveyances or flooding, perform field reconnaissance and create a capital improvement project list for potential stormwater projects.

Preliminary field reconnaissance was conducted to visually assess potential CIP projects as previously identified by the 2008 Study and through discussions with City staff, as well as generally assess the overall condition of the existing drainage systems throughout City's watersheds. Thomas & Hutton's assessments assumed the previous 2008 Study was accurate and that all recommendations within the study were valid. Thomas & Hutton assumes no liability for work previously performed by other Consultants. It should be noted that engineering design was not commissioned for this project and that recommendations are based on visual observation and previous work completed only. As such, further levels of analysis and design will be required for each identified project prior to project implementation.

Thomas & Hutton has compiled a Capital Improvement Project List based on discussions with City staff, field reconnaissance and review of the 2008 Study. The updated CIP list is provided in Appendix A, along with an exhibit of the CIP locations in Appendix B. This report summarizes each identified Capital Improvement Project. The CIP summary includes a description and location of each drainage systems, its existing condition, a proposed improvement or system maintenance and a preliminary engineer's opinion of probable budget. It should be noted that the preliminary budgets provided for each proposed maintenance/improvement project should be used for budgeting purposes only and may not reflect cost related to actual construction of the projects accurately.

Further surveying, design, engineering calculations and permits are needed prior to construction of the projects.

ID Number: 01

**Project Name: Conveyance Canals Bank Stabilization**
*Location: Basin 1, Northeast region of Richmond Hill*
*Source: Stormwater Master Plan, dated 2008 by Carter & Sloope Consulting Engineers*

**Description:**
Canal upgrades in Basin 1 are necessary to provide adequate conveyance for the 25-year, 24-hour design storm (minimum by current City standards). Further detailed study is required to define the nature and extent of improvements required as well as to refine the budgetary costs. Upon the determination of canal improvements, projects can be phased as needed to accommodate available budgets. Maintenance of the conveyance system should be considered as Phase 1 projects and should involve clearing debris from culverts as well as removing accumulated sediments in channels. Phase 2 projects should include canal widening and deepening required to provide a consistent channel bed slope from upstream to downstream and to provide the appropriate conveyance capacity to alleviate flooding of upstream tributary systems. Phase 3 may include bank stabilization treatment with structural rip-rap, concrete cloth and littoral planting. Property owner coordination and possible easement acquisition may be required for each improvement scenario.

ID Number: 02

**Project Name: Drainage System Improvement**
*Location: Basin 1, Residential areas along Spruce, Oleander, Laurel and Edgewood Streets*

**Description:**
The existing stormwater drainage systems along Spruce, Oleander, Laurel and Edgewood Streets appears to be in need of maintenance and improvements. The drainage system is located within an older residential development north of Ford Avenue and East of Interstate 95. The existing system consists of roadside swales/ ditches and driveway culverts that appear to discharge into a primary conveyance canal and ultimately Lost Swamp. There appear to be unused right-of-ways located within the subdivision that may be available for conveyance improvements and/or stormwater runoff treatment. From visual observation, it appears that the drainage system slope has an inconsistent bed slope with portions of the system holding water in the roadside swales/ditches. Many of the pipes are filled with debris. The City may consider replacing the existing drainage system with a new closed conveyance storm system with inlets and surface swales designed to intercept runoff as needed. Alternatively, the existing system can be improved by re-grading the existing swales/ditches and replacing driveway culverts so that a consistent bed slope may be achieved. Property owner coordination and possible easement acquisition will be required for each improvement scenario.



*Figure 1. Drainage System at Spruce Street*



*Figure 2. Drainage System at Spruce Street*

ID Number: 03

**Project Name: Conveyance Canals Maintenance**
*Location: Basin 2, Northwest region of Richmond Hill*

**Description:**
Continued maintenance of the canals in Basin 2 are necessary to provide adequate conveyance for the 25-year, 24-hour design storm (minimum by current City standards). Maintenance was recently performed on the conveyance system by clearing debris from the canals and culverts. In addition, some slope stabilization and canal widening was completed as part of the canal maintenance. Scheduled maintenance of the conveyance system should be executed in order to prevent blockages from occurring within the canals and avoid upstream flooding. Further detailed studies may be required if flooding persists in order to determine appropriate conveyance capacity and potential improvements.

ID Number: 04

**Project Name: Drainage System Improvement**
*Location: Basin 2, Residential areas along Camellia, Bonnie, Rosemont and Carter Streets*

**Description:**
The existing stormwater drainage systems along Camellia, Bonnie, Rosemont and Carter Streets appear to be in need of maintenance and improvements. The drainage system is located within an older residential development south of Ford Avenue and east of Interstate 95. The existing system consists of roadside swales/ditches and driveway culverts that appear to discharge into the Northwest Conveyance Canal and ultimately Ogeechee River. From visual observation, it appears that the drainage system slope has an inconsistent bed slope with portions of the system holding water in the roadside swales/ditches. Many of the pipes are filled with debris. The City may consider replacing the existing drainage system with a new closed conveyance storm system with inlets and surface swales designed to intercept runoff as needed. Alternatively, the existing system can be improved by re-grading the existing swales/ditches and replacing driveway culverts so that a consistent bed slope may be achieved. Property

owner coordination and possible easement acquisition will be required for each improvement scenario.



*Figure 3. Drainage System at Camellia Street*



*Figure 4. Clogged Culvert at Camellia Street*



*Figure 5. Drainage System at Rosemont Street*



*Figure 6. Outfall to Existing Ditch at Rosemont Street*



*Figure 7. Area without Drainage System*

ID Number: 05

**Project Name: Interstate 95 Culvert Crossing Replacement**
*Location: Basin 2, Northwest region of Richmond Hill along Sterling Creek Canal*

**Description:**
This project involves replacing the existing culvert underneath Interstate 95 where the Northwest Conveyance Canal discharges into Fort Stewart and ultimately outfalls into the Ogeechee River. The existing double 5' x 6' box culverts appear to be undersized and restrict canal flow. This project may consist of removing the existing box culverts and installing larger box culverts or the installation of two additional 5' x 6' box culverts to increase conveyance capacities. The increased flow capacity will help alleviate the flooding issues locally and upstream in the conveyance system. This design may require a substantial easement to accommodate the new infrastructure as well as for providing maintenance. Coordination with the Federal Highway Administration and the Georgia Department of Transportation will be required.

ID Number: 06

**Project Name: Northwest Conveyance Canal Maintenance**
*Location: Basin 2, Northwest region of Richmond Hill along Sterling Creek Canal*

**Description:**
This project generally consists of canal maintenance of the upper reaches of the Northwest Conveyance Canal in the vicinity north of Route 17 and adjacent White Oak and Live Oak residential communities. Maintenance was recently performed on the conveyance system by clearing debris from the canals and culverts. In addition, some slope stabilization and canal widening was completed as part of the canal maintenance. Scheduled maintenance of the conveyance system should be executed in order to prevent blockages from occurring within the canals and avoid upstream flooding. Further detailed studies may be required if flooding persists in order to determine appropriate conveyance capacity and potential improvements.

ID Number: 07

**Project Name: Camellia Street Pipe Crossing Replacement**
*Location: Basin 2, Northwest region of Richmond Hill along the Northwest Canal*

**Description:**
The existing pipes that cross underneath Camellia Street appear to be undersized and unmaintained. The crossing consists of two 36 inch and one 18 inch HDPE pipes which allow for conveyance of the Northwest Conveyance Canal. The pipes appear to be blocked by debris and sediment. Presently during heavy rain events the canal may overtop the culvert crossing. From visual observation, one of the 36 inch pipes is fully obstructed by sediment and overgrown vegetation and the other is partially obstructed. The 18 inch pipe appears to be completely buried. The two 36 inch pipes were observed as half full of stagnant water. The conveyance canal system upstream and downstream of the pipe crossing appears to have little slope. The project proposes to upgrade the existing pipes with properly designed and sized culverts (preliminary

sizing indicates triple 5' x 4' box culverts to accommodate the flows generated from the upstream contributing drainage area. Continued maintenance is recommended to keep the culvert crossing clear. In order to perform the project improvements and any future maintenance, gate access may need to be obtained and property owner coordination and easements may be required.



*Figure 8. Upstream End of 36" Pipes*



*Figure 9. Downstream End of 36" Pipes*

ID Number: 08

**Project Name: Channel Connection under Ford Avenue**
*Location: Basin 2, Northwest region of Richmond Hill*

**Description:**
This project involves an existing channel that collects stormwater from lots between Carter Street and Rosemont Street and flows north through a 36 inch culvert underneath Ford Avenue and ties into a primary conveyance canal located east of Spruce Street. The primary conveyance canal east of Spruce Street continues to flow to the northeast and eventually discharges into the Lost Swamp. There appears to be an easement and maintenance strip running alongside the primary conveyance channel. The primary conveyance canal on the north side of Ford Avenue appears to be stable and to have sufficient capacity to accommodate a substantial amount of stormwater run-off. The existing channel located between Rosemont and Carter Streets runs south of Ford Avenue and flows southwest where it discharges into the Northwest Conveyance Canal. Observations of the channel's present condition were unable to be made as it was inaccessible. It appears the 36 inch RCP connecting the two channels acts as an overflow equalizer pipe. This project proposes that the existing channel be connected by a larger culvert installed at lower elevations underneath Ford Avenue. The recommendation will allow a greater amount of stormwater to flow from south of Ford Avenue to the primary conveyance canal located north of Ford Avenue. The section of the channel that is south of Ford Avenue will be re-graded to provide a minimal slope between the Ford Avenue cross pipe and the discharge point to the Northwest Conveyance Canal. It is uncertain if easements are in place to maintain and/or improve this section of the system.



*Figure 10. Access from Spruce Street*



*Figure 11. Canal & Easement at Spruce Street*



*Figure 12. Canal & Easement at Richmond Way*



*Figure 13. Canal & Easement at Dee Henderson Rd*

ID Number: 09

**Project Name: Live Oak Subdivision Drainage Improvements**
*Location: Basin 2, Live Oak Subdivision*

**Description:**
The Live Oak Subdivision appears to have several storm drainage deficiencies. The Live Oak Community primary detention pond outfall appears to be obstructed causing the water surface elevation in the pond to be significantly higher than designed. It appears that the pond outfalls into a channel which crosses an adjacent property prior to discharging into the Northwest Conveyance Canal. To our knowledge, there is no easement in place on the outfall channel across the adjacent property. Therefore the outfall channel cannot be maintained. Due to normal water surface elevations in the ponds being higher than design elevations, the Live Oak storm drainage collection system, consisting of underground storm pipes and curb inlets, is inundated with water on a regular basis. During the time of our observations, the water level within the entrance curb inlet was at, or slightly above, the roadway gutter elevation (Figures 14 & 15). This project proposes that further investigation be conducted to determine the cause of flooding within the Live Oak Subdivision and recommend improvements to

alleviate inundation. Coordination with the adjacent property owners will be required to access downstream canals with suspected blockages.



*Figure 14. Curb Inlet at Live Oak Blvd*



*Figure 15. Curb Inlet Filled with Water*

ID Number: 10

**Project Name: White Oak Subdivision Drainage Improvements**
*Location: Basin 2, White Oak Subdivision*

**Description:**
The stormwater issues at White Oak are similar to those at Live Oak. The White Oak Community primary detention pond outfall appears to be obstructed causing the water surface elevation in the pond to be significantly higher than designed. It appears that the pond outfalls into a channel which crosses an adjacent property prior to discharging into the Northwest Conveyance Canal. The outfall channel may be obstructed. To our knowledge, there is no easement in place on the outfall channel across the adjacent property. Therefore the outfall channel cannot be maintained. In addition, from visual observation, it appears that numerous curb inlets within the neighborhood have not been constructed at the lowest elevations of the roadway gutters. The depressions may have also been caused by road settlement. Therefore portions of the system may hold water in the gutter and flood the roadway prior to the stormwater reaching the drainage system. This project proposes that further investigations be conducted to determine and alleviate inundation. Future improvements may include installing a channel and access easement from the existing detention pond to the Northwest Conveyance Canal, lower reach. Collaboration with the adjacent property owner may be required to complete future improvements.

ID Number: 11

**Project Name: Sterling Creek Increased Sizing and Bank Stabilization**
*Location: Basin 4, Central region of Richmond Hill along Sterling Creek Canal*
*Source: Stormwater Master Plan, dated 2008 by Carter & Sloope Consulting Engineers*

**Description:**
This project generally consists of increasing channel capacity and providing bank stabilization of the upper reaches of Sterling Creek, in the vicinity of the Main Street

Subdivision development. The improvements will offer increased detention volume capacity. By broadening and deepening Sterling Creek, which is highly channelized in this area, additional detention for large rain events can be realized. Given the necessary increase in the canal's width and depth, bank stabilization will be required along portions of this proposed project. This would include either a structural rip-rap or concrete cloth lining with littoral plantings as well as concrete matted side slopes depending on the location. It should be noted that this project may coincide with a roadway improvement (raised elevation and/or larger curb inlets) at the Main Street Subdivision entrance as well as other locations within the development.

ID Number: 12

**Project Name: Drainage System Maintenance**
*Location: Basin 4, Residential areas along Mimosa, Magnolia, Cherokee, and Wildwood Streets*

**Description:**
The existing storm drainage systems along Mimosa, Magnolia, Cherokee and Wildwood Streets appear to be in fair condition and may be sufficient for providing proper drainage in the area. The drainage system is located within an older residential development west of Ford Avenue and south of the railroad. The existing system consists of roadside swales/ditches and driveway culverts with brick headwalls. The existing drainage system along these streets appears to discharge west to Sterling Creek Canal. It is proposed that the roadside channels be re-shaped to original conditions and be sloped to be consistent from culvert to culvert. Regularly scheduled maintenance should be performed to clear debris from pipes and roadside swales.



*Figure 16. Typical Ditch & Swale System*



*Figure 17. Typical Pipe with Brick Headwall.*



*Figure 18. Ditch between Residential Homes*



*Figure 19. Outfall at Sterling Creek Canal*

ID Number: 13

**Project Name: Drainage System Improvement**
*Location: Basin 4, Residential areas along Maple and Ivey Streets*

**Description:**
The existing drainage system along Maple and Ivey Streets appears to be in need of maintenance and improvements. The drainage system is located within an older development that is primarily made up of residential homes. The existing system consists of roadside swale/ditches and driveway culverts that flow southwest into an existing canal that outfalls at Sterling Creek Canal. From visual observation, the drainage system along Maple Street appears inconsistently sloped with portions of the system holding water in the roadside swales/ditches. Many of the pipes are filled with debris. The section along Ivey Street from Ford Avenue south to the existing channel appears to have no drainage system constructed. A single 24 inch concrete culvert crossing connects the existing ditch under Ivey Street. The pipe appears to be partially blocked by a significant amount of debris. A more recent development with a constructed storm drainage system (appearing to be in good condition) is located south of the culvert crossing on Ivey Street. It is recommended the City of Richmond Hill consider replacing the existing drainage system with a new closed conveyance storm system with inlets and surface swales designed to intercept runoff as needed. Alternatively,

the existing system can be improved by re-grading the existing swales/ditches and replacing driveway culverts so that a consistent bed slope may be achieved. Property owner coordination and possible easement acquisition may be required for each improvement scenario.



*Figure 20. Drainage System at Maple Street*


*Figure 21. Area w/o Drainage System along Ivey St.*


*Figure 22. Debris at Upstream Pipe End Crossing*


*Figure 23. Debris at Downstream Pipe End Crossing*

ID Number: 14

**Project Name: Sterling Creek and Elbow Swamp Mapping of Natural Wetland Basin Limits and Buffer Enhancement Plan**

*Location: Basin 4, South central region of Richmond Hill*
*Source: Stormwater Master Plan, dated 2008 by Carter & Sloope Consulting Engineers*

**Description:**
The wetlands will require mapping to provide accurate storage capacity values and promote good management practices which will maintain natural basin/buffer function in storm water detention and conveyance. Mapping results should be analyzed for the suitability of future adjacent regional detention areas that may be constructed in the proximity of the City wastewater treatment plant.

ID Number: 15

**Project Name: Sterling Creek Tide Control Structure**
*Location: Basin 4, Southeast region of Richmond Hill along GA Route 144*

**Description:**
Sterling Creek outfalls into the Ogeechee River near the bridge crossing at GA Route 144. This area of the creek is tidally influenced and therefore can potentially limit the flow capacity and storage of Sterling Creek Canal when high tides coincide with rain events. The City should consider the construction of a tide control structure downstream of the existing GA 144 bridge. The project will include a cast-in-place concrete primary wall section with wing walls extending from upland bank to upland bank. The control structure should be fitted with four flap gates, approximately 60 inches to 72 inches in diameter each (sizing subject to design; alternative flap gates can be used). The installation of flap gates will assist in controlling tidal waters from entering Sterling Creek during high tides allowing for greater storage capacity in Sterling Creek during rain events during times of high tides. As high tides recede, the stored volume can be discharged into the tidal areas.


*Figure 24. Bridge Crossing at GA Route 144*


*Figure 25. Sterling Creek Canal*

ID Number: 16

**Project Name: Sterling Creek Floodplain Flap Gate**
*Location: Basin 4, Southeast region of Richmond Hill along GA Route 144*

**Description:**
Sterling Creek floodplains outfall into the Ogeechee River near the pipe crossing at GA 144. This area of the creek is tidally influenced and therefore can potentially limit the flow capacity and storage of Sterling Creek floodplains when high tides coincide with rain events. The installation of flap gates are recommended on the downstream ends of the two - 36 inch culverts crossing underneath GA 144. The installation of flap gates will assist in controlling tidal waters from entering Sterling Creek floodplains during high tides allowing for greater storage capacity during rain events that may coincide with times of high tide. As high tides recede, the stored volume can be discharged into the tidal areas. This project should be coordinated with any future GDOT widening projects that may be planned for GA 144.



*Figure 26. Upstream End of Pipes*



*Figure 27. Downstream End of Pipes*

ID Number: 17

**Project Name: Main Street Subdivision Entrance Road Drainage Improvements**
*Location: Basin 4, Main Street Subdivision*

**Description:**
This project consists of replacing the existing curb inlets and storm drain pipes under the Main Street Subdivision entrance road (Bristol Way South) with larger sized curb inlets and box culverts to accommodate more stormwater run-off along the street and in the canal. This area has seen significant roadway flooding and overtopping in the past. The culvert crossing consists of two 36 inch pipes (size estimated). At the time of observation, the pipes were clear of debris and approximately half full of standing water. Stormwater runoff generated from the entrance road is collected by roadway gutters, prior to entering the stormwater system through combination grate/curb inlets centered over the existing culvert crossing. It is proposed that the curb inlets on each side of the road be replaced with open throat curb inlet structures to allow for the maximum conveyance capacity into the system. It is also recommended the existing culverts be replaced with larger sized box culverts (preliminarily sized at double 5'x4' boxes; sizing subject to design) to allow for adequate conveyance through the crossing. It should be noted that this improvement alone will most likely not resolve the flooding issues occurring at this location, particularly during more severe rain events. Downstream improvements identified in this summary will have a significant impact on minimizing existing flooding issues occurring at this location. Further detailed engineering analysis is recommended to refine and provide an appropriate solution to the flooding issues at this location.



*Figure 28. Curb Inlet at Bristol Way South*



*Figure 29. Pipe Crossing at Bristol Way South*

ID Number: 18

**Project Name: Richmond Hill High School Stormwater Detention Facility**
*Location: Basin 4, Central region of Richmond Hill*

**Description:**
This project consists of acquiring land (immediately adjacent to Sterling Creek) behind Richmond Hill High School for the creation of additional stormwater detention which would assist in minimizing upstream flooding concerns along Sterling Creek Canal. The conceptual design of the project should focus on the stormwater quantity and quality benefit primarily, but may include additional recreational features such as an outdoor track desired by the high school, an arched pedestrian bridge over Sterling Creek Canal to provide access from the neighboring residential subdivision, public education, etc. Prior to starting this project, property acquisition will be required by the City.

ID Number: 19

**Project Name: Sterling Creek Canal Property Development**
*Location: Basin 4, Central region of Richmond Hill*

**Description:**
The City recently acquired property adjacent to Sterling Creek Canal in between the railroad and Timber Trail. The undeveloped land appears to be comprised mainly of woods and brush. This area is primarily recommended to be excavated and graded to provide additional stormwater runoff storage along the overbanks. Passive recreation features, pedestrian trails, nature trails, etc., should be included in the design as a secondary use for City residents to enjoy.

ID Number: 20

**Project Name: Timber Trail Pipe Crossing Improvements**
*Location: Basin 4, Central region of Richmond Hill*

**Description:**
This project involves drainage improvements to the culvert crossing under Timber Trail between Liberty Avenue and Harris Trail Road. The existing pipe crossing consists of

approximately four 24 inch concrete pipes. The conveyance system upstream of the pipe crossing appears to include a private stormwater system including two inline ponds and three parallel outfall pipes that flow into a narrow ditch and then discharge to the pipe crossing under Timber Trail. From observation, the pond outfall pipes appear to be lower in elevation than the pipes under Timber Trail. The ditch between the pond outfall and the Timber Trail pipe crossing is estimated to be approximately two feet wide and six inches deep and appears to be substantially undersized. From visual observation, water from the pond outfall appears to drain to only two of the four 24 inch pipes. Flow does not appear to reach the other 24 inch pipes as they are located outside of the ditch. Additionally three of the four pipes appear to be either fully or partially blocked by debris. The City has indicated that this area of the road may experience minor flooding. It is proposed that ditch between the pond outfall pipes and Timber Trail pipe crossing be widened and deepened to direct water to all four 24 inch pipes under Timber Trail. Any debris upstream and downstream of the pipe crossings will be removed.



*Figure 30. Stormwater Pond Outfall Pipes*



*Figure 31. Ditch to Pipe Crossing*



*Figure 32. Upstream End of Pipe Crossing*



*Figure 33. Downstream End of Pipe Crossing*

ID Number: 21

**Project Name: Melrose Subdivision Drainage System Improvements**
*Location: Basin 4, Melrose Subdivision*

**Description:**
Melrose subdivision is comprised of three streets: Boyd Drive, Sterling Drive, and Miner Drive. From visual observation, the subdivision appears to have an insufficient amount of curb inlets along Boyd Drive and Miner Drive. Between Sterling Drive and Timber Trail, Miner Drive and Boyd Drive appear to have only two curb inlets along the entire street length. These two roads also appear to be fairly flat with minimal sloping toward the curb inlets. The curb inlets from Boyd Drive appear to discharge to Sterling Creek Canal and it is suspected that stormwater runoff from Miner Drive discharges to Sterling Creek Canal as well. It was noted that there is an existing ditch that runs between the residential homes on Miner Drive and Boyd Drive. The ditch appears to have maintenance roads on both sides. It is proposed that the existing stormwater system of pipes and curb inlets be extended to provide more inlet capacity during storm events. The project also includes continued maintenance of the ditch between the residential homes on Miner Drive and Boyd Drive.


*Figure 34. Curb Inlets along Boyd Drive*


*Figure 35. Drain Pipe to Sterling Creek Canal*

ID Number: 22

**Project Name: Timber Trail Culvert Crossing Maintenance**
*Location: Basin 4, Central region of Richmond Hill*

**Description:**
The culvert crossing at Timber Trail located between Live Oak Drive and Boyd Drive consists of three box culverts. The upstream end of the culvert crossing has a maintenance strip along side of Sterling Creek. As a result of recent property acquisition by the City, the City now owns property immediately upstream of the culvert crossing. The top of bank on the side of the creek without the maintenance road appears to be lower in elevation. At the time of observation, debris was observed on the upstream end of the culvert crossing. On the downstream side, there also appears to be some overgrown vegetation and sedimentation. A new development was currently being constructed downstream. The new development had an outfall for its

stormwater system located immediately downstream of the Timber Trail culvert crossing. The culvert crossing generally appears in good condition. The City should remove all debris and sediment at both ends of the culvert crossing to ensure maximum function. It is proposed that an additional study of this area be performed to further evaluate flooding potential. This can be included in the stormwater storage design of the parcel recently acquired by the City of Richmond Hill.



*Figure 36. Upstream End of Culvert Crossing*



*Figure 37. Easement along Sterling Creek Canal*



*Figure 38. Downstream End of Culvert Crossing*



*Figure 39. Pipes Discharging near Culvert Crossing*

ID Number: 23

**Project Name: Turtle Hill Subdivision Drainage System Improvements**
*Location: Basin 4, Turtle Hill Subdivision*

**Description:**
The Turtle Hill Subdivision appears to have several storm drainage deficiencies. There is some concern that the existing detention ponds and the downstream conveyance system may be restricted. However, due to limited access, the detention ponds and conveyance system were unable to be observed. From visual observation, it was noted that curb inlets are not consistently placed at the lowest points along the streets. This may cause portions of the system to hold water in the gutter and flood the roadway. It is proposed that further investigations be conducted to determine the cause of flooding within the Turtle Hill Subdivision.



*Figure 40. Entrance to Turtle Hill Subdivision*




*Figure 41. Liberty Ave*

ID Number: 24

**Project Name: Railroad Crossing Improvements & Maintenance**
*Location: Basin 4, Central region of Richmond Hill*

**Description:**
This project involves the installation of additional culverts under the railroad tracks located north of the Melrose Community Subdivision and south of the Ivey Street Subdivision. From visual observation, three culverts presently convey water from the Sterling Creek Canal underneath the railroad. The culverts consist of two large metal pipes (approximately 96 inches in diameter) and one smaller concrete pipe (approximately 24 inches in diameter.) The invert elevations of these pipes appear to be slightly high and may restrict flow capacity. Furthermore, since the Sterling Creek Canal system as a whole has relatively little channel bed slope, it is beneficial to the system to maximize flow area that can be obtained at lower elevations. Ideally, the removal of the existing culverts and replacement with larger box culverts would increase the flow area at lower elevations, potentially reducing head loss through the culvert crossing. The reduction in head loss through this culvert crossing would directly benefit areas upstream. Alternative designs may be considered due to the restrictions that may be imposed by the railroad. Such alternative design may include the jacking and boring of metal culvert underneath the railroad tracks to provide additional flow area and capacity. The City should provide regularly scheduled maintenance to remove debris to maximize the flow potential of the culvert crossing. Access for maintenance is provided through a maintenance strip located alongside of the canal between Timber Trail and the railroad tracks.



*Figure 42. Pipe Crossing under Railroad Tracks*



*Figure 43. Easement along Sterling Creek Canal*



*Figure 44. Damaged Pipe to Sterling Creek*



*Figure 45. Clogged Pipe from Tributary Canal*

ID Number: 25

**Project Name: Piercefield Drive Drainage Improvements**
*Location: Basin 4, Central region of Richmond Hill*

**Description:**
An existing channel extends from Exit 87 off of Interstate 95 through the Piercefield Forest Subdivision and outfalls into Sterling Creek Canal. The existing channel crosses underneath Piercefield Drive at multiple locations. Overall the pipe/culvert crossings along Piercefield Drive appear to be in good condition, with two crossings having been recently replaced and improved. The improved crossings consisted of two box culverts with rip-rap placed along the side slopes of the earthen channel. The older pipe crossings typically consisted of either single or double concrete pipes. These pipes appear to be in good condition and have little to no debris blockage. The pipe crossing under Harris Trail Rd consists of approximately three 36 inch concrete pipes. Some sedimentation was observed on the upstream end of the pipes and the ditch on the downstream end of the pipes appears to be narrow. As most pipe crossings appear to be functioning properly, it is suspected that the pipe crossing at the upstream end of the channel may be undersized. It is proposed that further investigations be conducted to determine the cause of flooding within the Piercefield

Forest Subdivision. Additionally, the City should remove all debris at the Harris Trail Rd culvert crossing and widen the downstream ditch to accommodate larger flows.



*Figure 46. Old Pipe Crossing at Upstream Channel*



*Figure 47. Newly Constructed Culvert Crossing*



*Figure 48. Debris at Pipes at Harris Trail Road*



*Figure 49. Narrow Ditch at Harris Trail Road*

ID Number: 26

**Project Name: Exit 87 Green Space Improvements**
*Location: Basin 4, Southwestern region of Richmond Hill along I-95*

**Description:**
This project consists of the modification of green space around the highway off-ramp at Exit 87 from Interstate 95 to provide for stormwater management and detention. The project may include using the vegetation and other landscaping elements in this area for stormwater management and detention.

ID Number: 27

**Project Name: Mapping of Natural Wetland Basins**
*Location: Basin 5, Southeastern region of Richmond Hill along the Ogeechee River*
*Source: Stormwater Master Plan, dated 2008 by Carter & Sloope Consulting Engineers*

**Description:**
The Ogeechee River floodplain swamp will require an accurate mapping to promote food management practices which will maintain natural basin/buffer function in storm water detention, water quality, and conveyance.

## Ordinance/Design Guidance Recommendations

Thomas & Hutton has identified recommendations which, in our opinion, will provide overall benefits to the City of Richmond Hill as the City continues to grow. This effort was commissioned to determine potential Capital Improvement Projects and areas of historical flooding. The ordinance revisions and design guidance below should be considered to promote responsible practices for stormwater management as the City continues to grow. We recommend the City pursue the following:

- *Stormwater Ordinance Revisions*
  The current city stormwater ordinances reflect coordination with the Flood Damage Prevention Ordinance, provisions for detention to pre-development levels for the 2-, 10-, and 25 year, 24-hour design storms, provisions for downstream improvements if pre-developed flow levels cannot be maintained and minimal water quality requirements. It is recommended, and the MS4 program will require, the adoption of a volume control stormwater ordinance that emphasizes the use of green infrastructure and low impact design practices to reduce stormwater runoff generated from future site developments. Volume control ordinances encourage stormwater runoff to recieve water quantity management, quality treatment and volume reduction by the implementation of inline best management practices and reduction of impervous footprints. Since MS4 compliance will require the adoption of the Georgia Stormwater Management Manual (GSMM), which includes the Coastal Stormwater Supplement (CSS), the City should revise their ordinance to require conformance to volume based hydrology as soon as possible. The ordinance should state the stormwater requirements, applicability, exemptions and standards only and defer all technical information to a Local Stormwater Design Manual (LSDM). This method provides flexibility for staff approval of ever-evolving stormwater standards in the LSDM as opposed to having to gain Council approval to modify and adopt ordinance changes.

- *Local Stormwater Design Manual*
  We recommend the City create, and reference by revised stormwater ordinance, a Local Stormwater Design Manual (LSDM). The LSDM should act as a comprehensive tool for the application of stormwater management controls and

stormwater best management practices. The goal of the LSDM is to provide the technical information required to comply with the stormwater ordinance by providing guidance on how to achieve appropriate stormwater quantity and capacity, increased water quality and volume reduction practices. The LSDM should contain the minimum requirements for the planning, design, construction, operation and maintenance of stormwater handling facilities. The LSDM will also provide a consistent stormwater design approach throughout the City in the future.

Typical sections of the LSDM may include:

1. Introductions
2. Applicability and Exemptions
3. Design Submittal Requirements
4. General Design Criteria and Calculations
5. Green Infrastructure Practices Descriptions/Applicability
6. Stormwater Management Practice Descriptions/Applicability
7. Operations and Maintenance of Stormwater BMPs

The LSDM is an evolving document that may change with guiding stormwater principles and practices.

- *Basin Specific Requirements*
  As the City of Richmond Hill continues to grow and more land area is developed, it may be necessary to impose basin specific requirements to protect public health, safety and welfare. The Stormwater Ordinance Revisions and the LSDM should incorporate flexibility for the City to impose more restrictive stormwater requirements, should they be needed in the future. Examples of when more basin restrictive regulations are needed are noted below.
  - Undeveloped portions of the City that are proposed to be developed may discharge through older infrastructure that may not be appropriately sized to handle the additional volumes or may already be at peak capacity.
  - A water quality impairment may exist downstream.

  Impervious area caused by development increases stormwater runoff volumes. Typically, peak flows of design storm events are attenuated to pre-developed conditions once land is developed, however the volume of stormwater runoff to receiving streams is greater due to the change in hydrologic characteristics. Should the need to reduce additional stormwater runoff volume be required, the Stormwater Ordinance and LSDM should provide the City the flexibility it needs to appropriately monitor and control stormwater runoff volumes, if needed.

# CITY OF RICHMOND HILL

# STORMWATER CAPITAL IMPROVEMENT

# PROJECT SUMMARY & RECOMMENDATIONS

# APPENDIX A

**CONTENTS:**

CAPITAL IMPROVEMENT PROJECT LIST

J–25002

THOMAS & HUTTON

| ID | Basin Number | Project Name | Project Type | Project Factors | | | | | | | | Project Description | Cost Opinion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | In City R.O.W. or property? | Historical flooding? | Water quality benefit? | Requires property /easement acquisition? | Near a critical facility or access | Significant cost benefit ratio? | Interim strategies available? | Multi-jurisdictional? | | |
| 1 | Basin 1 | Conveyance Canals Bank Stabilization** | Improvement | Y | N | Y | N | Y | Y | N | Y | Project includes primary conveyance canal upgrades of structural rip-rap with littoral plantings overlay. Project to be completed in phases. Phase 1: clearing and sediment removal; Phase 2: excavation/deepening of canals; Phase 3: bank stabilization treatment | $200,000 to $700,000 |
| 2 | Basin 1 | Drainage System Improvement | Improvement | Y | Y | Y | ? | N | N | N | N | Project includes replacing existing ditch and swale drainage system with new underground storm drain system for residential areas along Spruce, Oleander, Laurel and Edgewood Streets. | $745,000 |
| 3 | Basin 2 | Conveyance Canals Maintenance | Maintenance | Y | Y | Y | N | N | Y | N | N | Maintenace was recently performed on the canals as well as some slope stabilization and canal widening. This project includes continued maintenance of the primary conveyance canal to prevent bloackages within the canals and avoid upstream flooding. Further studes may be required if flooding persists. | $100,000 to $200,000 |
| 4 | Basin 2 | Drainage System Improvement | Improvement | Y | Y | Y | ? | Y | Y | Y | N | Project includes replacing existing ditch and swale drainage system with new underground storm drain system for residential areas along Camellia, Bonnie, Carter and Rosemont Streets. | $1.2 million |
| 5 | Basin 2 | Interstate 95 Culvert Crossing Replacement | Improvement | N | N | N | N | N | Y | N | Y | Upgrade lower reach of canal near I-95 outfall. Project involves adding two additional 5' x 6' box culverts to accommodate Sterling Creek Canal flow. This design will require a substantial easement to accommodate the new infrastructure as well as for providing maintenance. | $1.5 Million |
| 6 | Basin 2 | Northwest Conveyance Canal Maintenance | Maintenance | Y | Y | Y | N | Y | Y | N | N | Maintenace was recently performed on the canals as well as some slope stabilization and canal widening. This project includes continued maintenance of the primary conveyance canal to prevent bloackages within the canals and avoid upstream flooding. Further studies may be required if flooding persists. | $150,000 to $450,000 |
| 7 | Basin 2 | Camellia Street Pipe Crossing Replacement | Improvement | Y | Y | N | ? | Y | Y | N | N | Project involves drainage improvements to the pipe crossing at the end of Camellia Street. Project includes replacing two 36 inch HDPE pipes with larger box culverts to accommodate Sterling Creek Canal flow and clearing of all debris with scheduled maintenance to follow. | $250,000 |
| 8 | Basin 2 | Channel Connection under Ford Avenue | Improvement | N | N | N | Y | N | Y | N | Y | Project includes constructing a larger culvert installed at lower elevations underneath Ford Avenue. The project involves re-grading the existing channel to direct flow away from Sterling Creek Canal and toward a tributary that outfalls into the Lost Swamp. | $550,000 |
| 9 | Basin 2 | Live Oak Subdivision Drainage Improvements | Improvement | N | Y | Y | Y | Y | N | N | N | Project includes conducting further investigations to determine cause of flooding within the Live Oak community. Coordination with adjacent property owner will be required to access canals downstream of detention pond with suspect blockage(s). | $75,000 for Study |

| ID | Basin Number | Project Name | Project Type | Project Factors: In City R.O.W. or property? | Historical flooding? | Water quality benefit? | Requires property /easement acquisition? | Near a critical facility or access | Significant cost benefit ratio? | Interim strategies available? | Multi-jurisdictional? | Project Description | Cost Opinion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Basin 2 | White Oak Subdivision Drainage Improvements | Improvement | N | Y | Y | Y | N | N | N | N | Project includes conducting further investigations to determine cause of flooding within the White Oak community. Coordination with adjacent property owner will be required to access canals downstream of detention pond with suspect blockage(s). | $75,000 for Study |
| 11 | Basin 4 | Sterling Creek Increased Sizing and Bank Stabilization** | Improvement | Y | Y | Y | N | Y | Y | N | N | Sterling Creek Canal needs improvements with both bank stabilization and increased detention volume capacity. Remediation will consist of broadening and deepening in the area of the Main Street Subdivision as well as complete bank stabilization. This project may coincide with a roadway improvement at the Main Street Subdivision entrance. | $500,000 to $875,000 |
| 12 | Basin 4 | Drainage System Maintenance | Maintenance | Y | Y | N | N | Y | N | Y | N | The project involves maintaining the existing swale and ditch system along the residential areas at Mimosa, Magnolia, Cherokee, and Wildwood Streets. Maintenance would involve re-shaping the roadside channels to original form and sloping them consistently from culvert to culvert, as well as clearing the channels of debris. | $50,000 |
| 13 | Basin 4 | Drainage System Improvement | Improvement | Y | Y | N | ? | N | N | Y | N | Project involves replacing the old swale system with new drainage system and adding drainage along areas without an existing system within residential areas at Maple and Ivey Streets. Property owner coordination and easement acquisition may be required. | $540,000 |
| 14 | Basin 4 | Sterling Creek and Elbow Swamp Mapping of Natural Wetland Basin Limits and Buffer Enhancement Plan** | Programmatic | | | | | | | | | Project involves mapping wetlands to provide accurate storage capacity values and promote good management practices which will maintain a natural basin/buffer function in storm water detention and conveyance. | $150,000 |
| 15 | Basin 4 | Sterling Creek Tide Control Structure | Improvement | N | N | Y | Y | N | Y | N | Y | Project includes constructing a complete tide control structure that consists of cast-in-place wall and wing-walls fitted with four tide regulated flap gates at the bridge crossing over GA Route 144. | 1.6 million |
| 16 | Basin 4 | Sterling Creek Floodplain Flap Gate | Improvement | N | N | Y | N | N | Y | N | Y | Project includes construction a tide control structure at the Sterling Creek floodplains outfall. The tide control structure consists of two 36 inch culverts fit with Flap Gates. Project may be completed as part of the proposed GDOT widening project. | $205,000 |
| 17 | Basin 4 | Main Street Subdivision Entrance Road Drainage Improvements | Improvement | N | Y | Y | ? | Y | Y | N | N | Project includes replacing the existing pipes with larger box culverts. The railroad crossing downstream appears to restrict the flow of water at lower stages. Existing curb inlets may be replaced with inlets having greater flow capacities. | $150,000 |

| ID | Basin Number | Project Name | Project Type | Project Factors: In City R.O.W. or property? | Historical flooding? | Water quality benefit? | Requires property /easement acquisition? | Near a critical facility or access | Significant cost benefit ratio? | Interim strategies available? | Multi-jurisdictional? | Project Description | Cost Opinion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | Basin 4 | Richmond Hill High School Stormwater Detention Facility | Improvement | N | N | Y | Y | N | Y | N | N | Project includes developing an area behind Richmond Hill High School near Sterling Creek to includes creating detention to alleviate upstream flooding. Additional features may include a pedestrian bridge over Sterling Creek, an outdoor track, and public education facilities. This project requires property acquisition by the City. | $1 Million |
| 19 | Basin 4 | Sterling Creek Canal Property Development | Improvement | Y | Y | Y | -- | Y | Y | N | N | Project includes planned development between the railroad tracks and Timber Trail. Development will involve passive recreation and stormwater management. | $500,000 to $750,000 |
| 20 | Basin 4 | Timber Trail Pipe Crossing Improvements | Improvement | Y | N | N | N | N | N | Y | N | Project involves drainage improvements to pipe crossing on Timber Trail between Liberty Ave and Harris Trail Rd. Project consists of deepening and widening the existing ditch between the upstream pond outfall pipes and pipe crossing (four 24 inch pipes) under Timber Trail. Any debris upstream and downstream of the pipes would be removed. | $80,000 |
| 21 | Basin 4 | Melrose Subdivision Drainage System Improvements | Improvement | Y | Y | N | N | N | N | Y | N | Project consists of installing additional curb inlets along Miner Drive and Boyd Drive to allow for more stormwater run-off drainage from streets. Maintenance of the ditch between residential homes on Miner and Boyd Drive will also be performed. | $1.1 million |
| 22 | Basin 4 | Timber Trail Culvert Crossing Maintenance | Maintenance | Y | N | N | N | N | Y | Y | N | Project involves the removal of all debris, overgrown vegetation, and sedimentation at the upstream and downstream ends of the culvert crossing under Timber Trail between Live Oak Drive and Boyd Drive. In addition, this project proposes further study be performed to evaluate flooding potential. | $10,000 |
| 23 | Basin 4 | Turtle Hill Subdivision Drainage System Improvements | Improvement | N | Y | N | Y | N | N | N | N | Project includes conducting further investigations to determine cause of flooding within Turtle Hill community. | $45,000 |
| 24 | Basin 4 | Railroad Crossing Improvements & Maintenance | Improvement & Maintenance | N | N | N | Y | N | Y | N | Y | Project involves removing the present crossing (two 96 inch pipes and one 24 inch pipe) and installing larger box culverts at lower elevations. The increased flow area and lower elevation provided by the additional culverts will provide significant head loss reduction at the crossing. Alternative designs may be considered due to the restrictions that may be imposed by the railroad. The project also includes maintenance to clear debris from or nearby the railroad crossing. | $400,000 |
| 25 | Basin 4 | Piercefield Drive Drainage Improvements | Improvements | Y | N | Y | N | Y | N | Y | N | Some culvert crossings along Piercefield Drive have been recently updated. The project involves maintaining the new structures and conducting further study to evaluate flooding potential of the older structures along the channel. Debris found at the Harris Trail Rd culvert crossing shall be removed and the downstream ditch widened. | $180,000 |

| ID | Basin Number | Project Name | Project Type | Project Factors: In City R.O.W. or property? | Historical flooding? | Water quality benefit? | Requires property /easement acquisition? | Near a critical facility or access | Significant cost benefit ratio? | Interim strategies available? | Multi-jurisdictional? | Project Description | Cost Opinion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Basin 4 | Exit 87 Green Space Improvements | Improvements | N | N | Y | Y | N | N | N | Y | Project involves the use of green space at Exit 87 off of I-95 for stormwater detention and management. | $100,000 |
| 27 | Basin 5 | Mapping of Natural Wetland Basins** | Programmatic | | | | | | | | | Project involves mapping the Ogeechee River Floodplain Swamp to promote good management practices which will maintain a natural basin/buffer function in storm water detention, water quality, and conveyance. | $150,000 |
| | | | | | | | | | | | | Total Cost of Improvement Projects | $12,120,000.00 |
| | | | | | | | | | | | | Total Cost of Maintenance Projects | $ 710,000.00 |
| | | | | | | | | | | | | Total Cost of Programmatic Projects | $300,000 |
| | | | | | | | | | | | | **Total Cost** | **$13,130,000.00** |

** Capital Improvement Project and Project Cost from Stormwater Master Plan dated 2008 by Carter & Sloope.

Costs for each project are preliminary and may not reflect cost related to actual construction of projects accurately. The costs listed above do not include costs associated with easement or property acquisition. Costs are to be used for budgeting purposes only. All projects are conceptual and subject to further engineering study and design. Conceptual projects identified and costs associated therewith may vary significantly after survey, engineering study and design.

Critical Facilities consist of water wells, water tanks, pump stations, and wastewater treatments plants within the City limits.

# CITY OF RICHMOND HILL

# STORMWATER CAPITAL IMPROVEMENT

# PROJECT SUMMARY & RECOMMENDATIONS

# APPENDIX B

**CONTENTS:**

CAPITAL IMPROVEMENT PROJECT EXHIBIT

J–25002

THOMAS & HUTTON

| ID | Basin | Project Name |
|---|---|---|
| 01 | 1 | Conveyance Canals Bank Stabilization |
| 02 | 1 | Drainage System Improvement |
| 03 | 2 | Conveyance Canals Maintenance |
| 04 | 2 | Drainage System Improvement |
| 05 | 2 | I-95 Culvert Crossing Replacement |
| 06 | 2 | NW Conveyance Canal Maintenance |
| 07 | 2 | Camellia St Pipe Crossing Replacement |
| 08 | 2 | Channel Connection under Ford Ave |
| 09 | 2 | Live Oak Subdivision Drainage Improvements |
| 10 | 4 | White Oak Subdivision Drainage Improvements |
| 11 | 4 | Sterling Creek Increased Sizing & Stabilization |
| 12 | 4 | Drainage System Maintenance |
| 13 | 4 | Drainage System Improvement |
| 14 | 4 | Sterling Creek and Elbow Swamp Mapping |
| 15 | 4 | Sterling Creek Tide Control Structure |
| 16 | 4 | Sterling Creek Floodplain Flap Gate |
| 17 | 4 | Main Street Subdivision Drainage Improvements |
| 18 | 4 | Richmond Hill High School Stormwater Detention |
| 19 | 4 | Sterling Creek Canal Property Development |
| 20 | 4 | Timber Trail Pipe Crossing Improvements |
| 21 | 4 | Melrose Subdivision Drainage Improvements |
| 22 | 4 | Timber Trail Culvert Crossing Maintenance |
| 23 | 4 | Turtle Hill Subdivision Drainage Improvements |
| 24 | 4 | Railroad Crossing Improvements & Maintenance |
| 25 | 4 | Piercefield Dr Drainage Improvements |
| 26 | 4 | Exit 87 Green Space Improvements |
| 27 | 4 | Mapping of Natural Wetland Basins |

Basin 1
Basin 2
Basin 3
Basin 4
Basin 5

Capital Improvement Projects
Basins
City Limits

0 600 1,200 2,400 3,600 4,800 6,000 Feet
1 inch = 1,200 feet

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

| Job Number: 25002.0000 | Produced: 6/24/2014 | Produced By: JLR | Modified: 7/31/2014 | Modified By: JLR |
|---|---|---|---|---|
| File: Z:\25002\25002.0000\GIS\Mxd\Capital Improvements Map - Revised.mxd | | | | Vertical Datum: |

Thomas & Hutton compiled the map information from the following sources:

| Data | Source | Date |
|---|---|---|
| Basins | Thomas & Hutton | 2014 |
| Aerial Photography | ESRI | Varies |
| City Limits | City of Richmond Hill | 2014 |

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# City of Richmond Hill
# Stormwater Capital Improvement
## Richmond Hill, Georgia
## Capital Improvement Project Map

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