City of Dunwoody Georgia

4800 Ashford Dunwoody Road
Dunwoody, Georgia 30338
dunwoodyga.gov | 678.382.6700

MEMORANDUM

To: Mayor and City Council

From: Cody Dallas, Senior Stormwater Engineer

Date: August 12, 2024

Subject: **Funding Authorization to Develop a Stormwater Model for the Marsh Creek Basin**

ACTION

Authorize the Mayor, City Manager, or designee to allocate up to $63,716 through the city's on-call design contract with Dewberry to complete a stormwater master model of the Marsh Creek drainage basin.

SUMMARY/DETAILS

The City of Dunwoody operates and maintains a stormwater infrastructure system, much of which was installed several decades ago. As with many aging infrastructure systems, there are instances where existing portions of the stormwater system in Dunwoody may be undersized due to being designed and constructed under less stringent guidelines of the past. Increased impervious area and changes in weather patterns has led to higher peak storm water flows and a need to review whether culverts are still sized appropriately in addition to replacing aging pipe.

In an effort to identify areas where the condition and capacity of the stormwater system do not meet the City's desired level of service (LOS), the City is proposing to conduct a pilot study of the Marsh Creek drainage basin (area north of Mount Vernon Road and west of Chamblee Dunwoody Road, bounded by city limits).

The study will provide a comprehensive stormwater system assessment of the basin utilizing advanced hydrologic modeling methods and tools to analyze various repair scenarios. This tool will allow staff to analyze the capacity of culvert sizes quickly and determine whether changes are needed during pipe replacement / rehabilitations. Marsh Creek drainage basin is an ideal study area as it is the smallest of the 9 drainage basins within Dunwoody and is representative of Dunwoody's general land use composition (majority area zoned residential with few private streets, as well as some concentrated commercial areas).

If approved by Council, this project will be funded from the stormwater utility operating budget.

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RECOMMENDED ACTION

Authorize the Mayor, City Manager, or designee to allocate up to $63,716 through its on-call design contract with Dewberry to complete a stormwater master model of the Marsh Creek drainage basin.

Basin Map

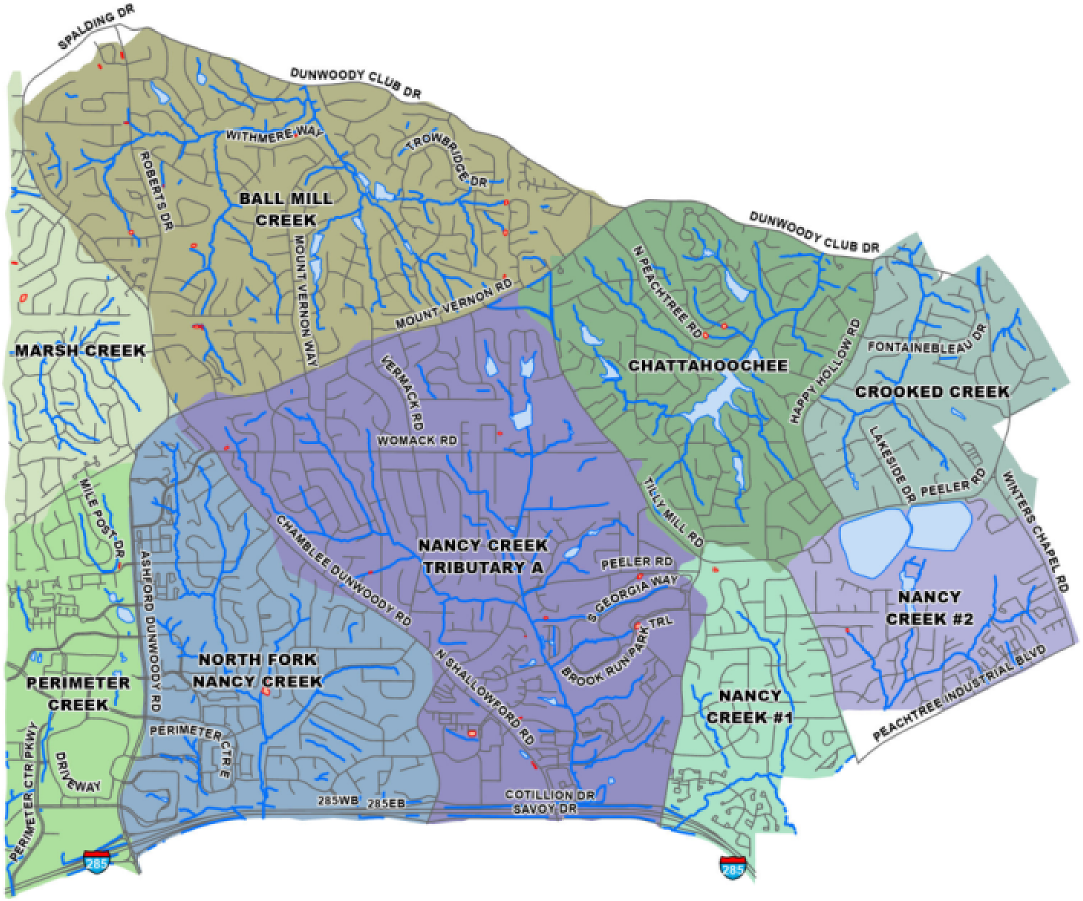
City of Dunwoody Georgia

Marsh Creek Drainage Study

August 12, 2024

Summary

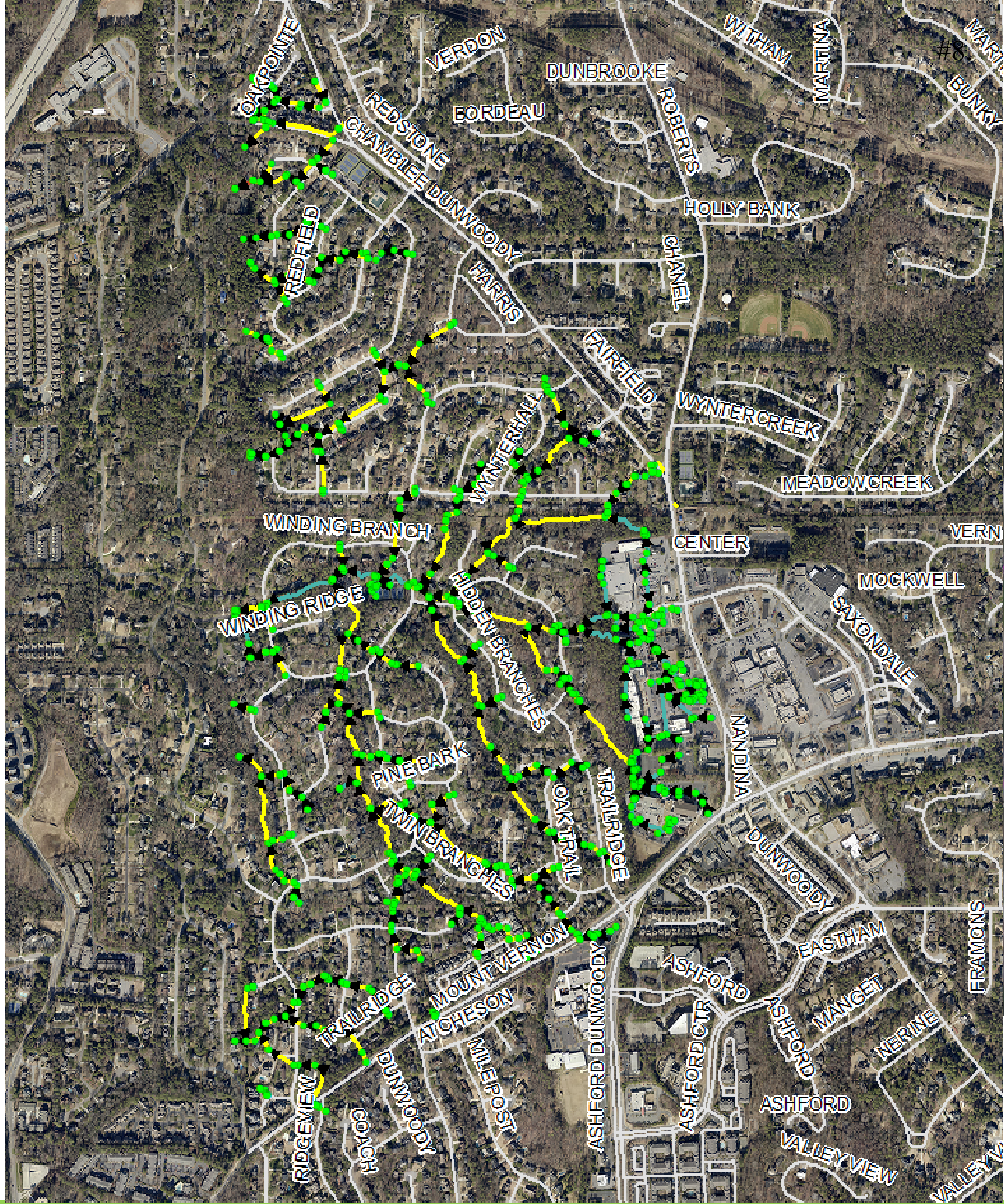
- The City is proposing to conduct a pilot study of the Marsh Creek drainage basin.
- Study will provide a tool to quickly analyze capacity and determine whether upgrades are needed during pipe replacement and rehabilitations projects.



Drainage Basin	Total Pipe Count	City-Maintained Pipes	Model Extent Pipes	Existing Model(s)	Total Pipes To Be Modeled
Marsh	460	312	320	4*	316

Background

- Areas constructed 40-50 years ago, under less strict stormwater regulations, have infrastructure in need of repair or replacement (due to condition, capacity, or both).
- Increased impervious area and increased frequency of high intensity storms.



Financial Impact

- This project will be funded from the stormwater utility operating budget.

<u>Enhanced CIP Planning</u>

- Quick access to existing capacity data.
- Prepared Scenarios for Rehabilitation/Replacement.
- Include easement requirements and construction area limits in scenarios.

Staff Recommendation

- Authorize the Mayor, City Manager, or designee to allocate up to **$63,716** through the City's on-call design contract with Dewberry to complete a stormwater master model of the Marsh Creek drainage basin.


City of
Dunwoody
Georgia

Dewberry

Dewberry Engineers Inc.
2951 Flowers Road South
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678.530.0022
678.530.0044 fax
www.dewberry.com

Date: July 1, 2024

To: Ms. Cody Dallas
Staff Engineer
City of Dunwoody

From: Emma Bones, PE
Dewberry

RE: Proposal for the Marsh Drainage Basin Stormwater Master Model

Dear Ms. Dallas:

Dewberry Engineers Inc. (Dewberry) is pleased to present this proposal to the City of Dunwoody (Dunwoody) for the Marsh Drainage Basin Stormwater Master Model.

Background

The City of Dunwoody (Dunwoody) operates and maintains a stormwater infrastructure system that is comprised of closed conduits (pipes, boxes, arches, etc.) and structures (inlets, junction boxes, headwalls, etc.). As part of an active asset management program, Dunwoody has completed and maintains an inventory database of its stormwater infrastructure that contains information such as the size, shape, material, type, and age of each closed conduit and structure. As with many aging infrastructure systems, not only do the systems fail as a result of the infrastructure being older than its materials estimated life span, but many were designed and constructed prior to recent guidelines and standards and do not have the adequate level of service capacity for conveyance.

Dunwoody would like to complete a pilot study in the Marsh Drainage Basin to conduct a comprehensive watershed stormwater infrastructure system assessment. The Marsh Drainage Basin is located along the western side of Dunwoody and is bounded by the City of Sandy Springs to the west, Mt. Vernon Road to the south, and Chamblee-Dunwoody Road to the east and north. Within Dunwoody, the Marsh Drainage Basin has a total area of approximately 500 acres. Study extents include all City-maintained closed conduits greater than 12” in diameter and hydraulically- connected non-closed conduits (open channels and streams) and non-City-maintained conduits downstream to the point where the system’s flow leaves the City’s boundary or enters Zone AE river line to include limited detail study streams and open channels. The following table provides an estimate of the total number of pipes in the drainage basin as well as the number of pipes to be modeled according to the study extents above.

Drainage Basin	Total Pipe Count	City-Maintained Pipes	Model Extent Pipes	Existing Model(s)	Total Pipes To Be Modeled
Marsh	460	312	320	4*	316

In general, the study will include both geospatial and hydrologic and hydraulic analyses of the City-maintained closed conduit system upstream of the 100-acre floodplain including:

- Horizontal and vertical connectivity of the existing pipe system;
- Hydrologic and hydraulic input development;
- Existing capacity level of service;
- Rehabilitation and replacement scenarios to meet desired level of service, and;
- Potential construction area limits and determination of easement needs.

The following scope of work identifies the tasks that Dewberry will provide for implementation of this program in the Marsh Drainage Basin.

Task 1: Inventory Database Enhancement

Horizontal Connectivity

Dewberry will review each conduit within the study extents to confirm connectivity and address any issues in order to provide an accurate representation of the stormwater system. This includes not only City-maintained closed conduits, but also includes non-City-maintained closed conduits that are part of the system connectivity. Following a system starting at its upstream limit and continuing down to the point where the system leaves Dunwoody or ties into the Zone AE river line, adjustments will be made one by one to correct closed conduit flow direction and closed conduit/structure locations based on aerial imagery, terrain information, and provided measure down values. Non-closed conduits, inclusive of wet and dry channels, detention basin lines, and lake lines, will also be reviewed for connectivity, and adjustments to the location of the open channel will be made to ensure it follows the lowest point of the terrain data. Representative transects for each non-closed conduit will be created from the terrain so that each non-closed conduit is assigned its own cross-sectional area to convey the flow through the system. The connections between structures, closed conduits, and non-closed conduits are then individually verified to ensure that the system elements are snapped. This will ensure top to bottom system connectivity.

Each element of the system will be assigned a unique ID number. Pipes and inlets with existing ID numbers provided by the City will remain the same, but newly added closed conduits and structures will be given a unique identifier. Dewberry will develop the new ID numbering system and provide it to Dunwoody for approval prior to implementing the system. These unique ID numbers will assist in identifying potential new inventory to be added to the City's database and will also eliminate redundancies in the model.

Vertical Alignment

Dunwoody has conducted measure down data collection for all accessible City-maintained closed conduits required within the Marsh Drainage Basin. Dewberry will use the most current raw LiDAR point data and terrain (GA Statewide collection from 2018-2019) to provide a detailed model of the ground surface since study limits extend to the very top of the watershed. Upon completion of the connectivity corrections, we will conduct a spatial analysis that assigns the terrain elevation to each end of the conduit at the structure. The current database includes structure rim elevations rounded to the nearest foot. These will be compared to the terrain data, and if in close agreement, will be replaced with the terrain data to the nearest tenth of a foot. If there is significant disagreement in the values (>1 ft), these areas will be reviewed manually to determine the most appropriate rim elevation. There are a handful of structures that include rim elevations with precisions to the tenths or hundredths. For these rim elevations, theses will be compared to the terrain elevation, and if in close agreement (<1 ft), the database rim elevation will be maintained.

Conduit upstream and downstream invert elevations are already populated for all City-maintained pipes. However, measure down inverts will need to be collected at critical locations for non-City-maintained pipes that connect and convey flow from City-maintained systems. Dewberry will request any As-built data from Dunwoody, and will update non-City maintained pipes with As-built data if available. If As-built is not available, Dewberry will collect additional information as needed and as described under **Field Work**. Once any additional measure downs are collected, we will run a routine that subtracts the measure down value from the assigned rim elevation, estimates upstream and downstream inverts for each closed conduit, and populates the result in the closed conduit inventory database. For open-end sections such as headwalls, plain end sections, and flared-end sections that do not have a surveyed invert, we will assign a measure down value of 0.0' and use the terrain to approximate the closed conduit's invert elevation at that point. Invert elevations for non-closed conduits will also be assigned on the terrain. Correct placement of structures and conduits is essential to assigning the correct terrain and invert values for all structures.

Like with connectivity corrections, the process to review and correct the upstream and downstream inverts is a conduit-by-conduit process. Inaccessible closed conduits with no measure down values must be assumed using engineering judgment so that they tie into the closed conduits with known measure downs. We will also check for negative slopes, closed conduits that do not have enough cover, and any measure downs/inverts and slopes that do not pass the reasonableness test in the system. Engineering judgment and/or field investigations, whichever is applicable, will be used to estimate the invert for these cases. To properly model and report embankment overtopping, we will update the rim elevations for the open-channel structures to match the overtopping elevation of the embankment. These vertical profile corrections are equally important to modeling the effectiveness of the system as correcting the connectivity. Additionally, a field will be created for each closed conduit to note the upstream and downstream source of the estimated and surveyed inverts, which will be updated as changes are made.

Similar to the method for estimating closed conduit inverts, we will then conduct an additional spatial analysis that determines the maximum, minimum, and average depths of each closed conduit. Invert elevations, calculated in 1-foot segments along the length of each closed conduit, will be subtracted from the corresponding ground elevation at each point. By subtracting the calculated invert elevations along the closed conduit segments from its corresponding ground elevation, we can determine depth every foot along the closed conduit between structures. Values for the minimum, maximum, and average trench depths necessary for typical open trench replacements will be calculated and populated for each closed conduit.

Easement Development

The largest difference reported for each closed conduit will represent the maximum depth for that closed conduit which will be used to estimate the optimal required permanent and temporary easement widths for planning purposes. A routine will be used that calculates the permanent (20' minimum) and temporary easement widths for each City-maintained closed conduit based on the criteria noted below. Please note that these calculations are independent of and do not include any analysis of the existing easement or right-of-way widths.

- Permanent Easement Width = Span + 6' +2*Maximum Depth
    - 20' minimum rounded up to nearest 5'
    - 6' allows for 3' each side of closed conduit for constructability
    - Permanent easement equation meets the minimum requirements of the development regulations and also factors in constructability
- Temporary Easement Width = Permanent Easement + 30'
    - 15' buffer each side for construction staging and access

Once easement needs are determined, permanent and temporary easement polygons will be drafted for each City-maintained closed conduit separately with the closed conduit assumed to be centered in both easements. Easement polygons will be clipped at the street right-of-way using the City's parcel geodatabase to establish the street right-of-way.

Trench Polygon Development

In addition to easement polygons, trench area polygons will be developed for each closed conduit and structure except for end sections, i.e. headwalls, flared end sections, plain end sections. Closed conduit trench areas will be based on the depth of closed conduit along the closed conduit's length using the criteria below. Trench area polygons will be determined and drafted for each closed conduit separately.

- Trench Top Width = Span + 6' +2*Depth

For structures, trench areas will be determined and polygons developed based on the criteria below. Depth of structures, with the exception of end sections, is required for this determination and can be developed from the estimated closed conduit inverts using the terrain. Structure trench areas can be assumed to be determined as either a circle or square.

- Structures: Trench Width = 15+2*Depth
    - Assumes 5' diameter or 5'x5' structure and allows 5' each side of structure

Easement polygons, and trench area polygons will be included as part of **Deliverables**.

Field Work

In addition to identified gaps in stormwater infrastructure data as described in **Horizontal Connectivity**, inconsistencies often occur between the stormwater inventory and the data provided by the surveyor or what is shown by the terrain or imagery. These inconsistencies require further evaluation, typically field investigations to determine and correct connectivity so that the dataset is truly representative of actual conditions. Additionally, active capital improvement projects (CIPs) are often discovered during field investigations. Dewberry will conduct field survey necessary to capture measure down depth data for identified gaps, clarify inconsistencies stormwater infrastructure data, and incorporate active CIPs.

Task 2: Level of Service (LOS) Analysis

As stated previously, Dunwoody's stormwater infrastructure inventory database contains information such as the size, shape, material (to set Manning's n), type, and age of each closed conduit and structure. Therefore, once system connectivity and profile have been established, we will conduct a hydrologic and hydraulic (H&H) analysis of the system to determine the flow capacity level of service for each closed conduit.

We will develop a SWMM5 engine based hydrodynamic rainfall-runoff simulation model using PCSWMM for the system developed in Task 1 for the following scenarios as described in more detail under **Modeling**.

- Existing System
- Cured-in-Place Pipe Rehabilitation
- Upgrade with RCP or HDPE to meet desired LOS

H&H modeling will be based on existing landuse conditions described under **Landuse** and hydrology described under **Hydrology** using dynamic wave hydraulic model formulations. This method allows time varying rainfall to be routed through the system, accounting for timing of the hydrographs, conduit storage, backwater, and losses in the system. This is the most accurate representation of actual conditions during a storm event.

Critical Storm Duration Analysis

As part of the pilot study, Dewberry will conduct a critical storm duration analysis to determine the storm durations that have the most significant impact on Dunwoody's stormwater infrastructure. Dewberry will setup a series of models that includes various storm depths and durations, and we will discuss the results with Dunwoody to determine the storm depths and durations that will be most critical to Dunwoody. Consideration for different durations and depths will be given to both closed system and larger culvert systems along open channels. Additionally, Dewberry will recommend a location for a single rainfall depth for the entire City. This will allow all future models to use the same rainfall depths and produce consistent results. The MSE5 distribution will be used for all hydrology modeling.

Landuse

Dewberry will develop a landuse shapefile layer for the Marsh Drainage Basin which encompasses an area of approximately 500 acres. Landuse is broken down into four categories: Impervious Cover, Woods, Open Space (lawns), and Open Water. Based on the shapefiles from Dunwoody and DeKalb County, Dewberry will need to add driveways, sidewalks, patios, pools, bodies of water, etc. to create an accurate landuse layer. We will ensure that the final landuse layer is seamless and covers the entire drainage area for the Marsh Drainage Basin.

Hydrology

Modeling begins with the development of subcatchments for each water-accepting inlet within GIS. While Dewberry is moving towards a more automated approach in subbasin delineation, there is still a manual review and correction process that is required. The recommended delineation approach is outlined bellowed.

Hydrological modeling begins with automated ArcGIS custom applications for subcatchment delineation and hydrologic parameter development created by Dewberry. Subcatchments will be developed for each structure that captures surface runoff, and flowpaths will be developed for each subcatchment from a digital elevation model (DEM) using flow accumulation methodology. Dewberry has developed a subcatchment automation method that has been scaled to effectively delineate highly granular stormwater systems and minimizes the need for manual rework of the subcatchments, which is the shortfall of most subcatchment automation tools when applied to stormwater system. Dewberry has found a solution to this problem through a combination of:

- Terrain modifications prior to watershed processing to verify that subcatchments are split down the center of crowned roadways, and that water is directed to and captured by curb and gutter as it would be in a real-world rainfall event
- Burning of portions of the stormwater system into the terrain data to verify that runoff flow enters the system at the proper surveyed locations
- Customization of pour point locations based on inlet type and the most probable flow pattern surrounding each type of inlet

Basins will be delineated using this approach for all water-accepting inlets associated with pipes that are 12 inches and larger, and the contributing drainage area from smaller upstream networks will be lumped into the first upstream 12-inch pipe in the system. Although automation properly delineates a vast majority of the watersheds, manual review and adjustment will be needed to correct some of the subcatchments and will be a necessary step in the process to verify the subcatchments and model results are as accurate as possible. Topology checks will be run to ensure that there are no overlapping subcatchments or gaps between the subcatchments.

Longest Flow Path (LFP) Delineation

Flow paths will be developed for each structure from a digital elevation model (DEM) using flow accumulation methodology, and LFPs will be manually adjusted as needed based on manual basin adjustments. Each subcatchment's longest flow path will be extracted and used to calculate each subcatchment's width and average slope.

Curve Number (CN) and Imperviousness

Once each subcatchment area is delineated, curve number (CN) values will be developed from the union of landuse with soils data and will be used for the infiltration method. Landuse is broken down into four categories: Impervious Cover, Woods, Open Space (lawns), and Open Water. By merging land cover with each hydrologic soil type in GIS, detailed CN and Impervious Area values can be determined to provide a return of runoff potential. This is particularly critical in that it captures all impervious areas down to the sidewalks that are typical in urban drainage systems, thus providing the most accurate account of runoff potential for each subcatchment in the study scope.

Hydraulics

Modeling parameters will be assigned to each closed conduit. These parameters include roughness values depending on closed conduit material, entrance and exit loss coefficients based on inlet structure type, bend angle, and downstream channel condition, and culvert codes depending on closed conduit material, shape, and inlet structure type. Roughness values will be assigned to non-closed conduits to for the channel and overbank areas based on the values recommended in the *USACE HEC-RAS Hydraulic Reference Manual*. The following Manning's 'n' values are to be used for each closed conduit material defined in the data dictionary.

- CO/AS/PL = 0.024 (corrugated steel pipe)
  - 0.026 if embedded
- PT/PVC/RL = 0.015 (high density polyethylene – HDPE pipe, polyvinyl chloride – PVC, and relined pipe)
  - 0.021 if embedded
- RC/CL/CI/CP = 0.013 (reinforced concrete –RCP, plain concrete, clay, and cast iron pipe)
  - 0.020 if embedded

Modeling

SWMM models treat each subcatchment as a non-linear reservoir. This means that surface runoff from a precipitation event is generated after depression storage, infiltration, and evaporation are accounted for. Outflow is then determined using Manning's equation by continuously updating the depth of runoff and numerically solving a water balance equation over the subcatchment. Subcatchment hydrographs are then routed through the system, and flow capacity LOS will be determined for each closed conduit by identifying the largest storm (smallest percent annual chance) event whose hydraulic grade line (HGL) is contained below the rim elevation of the closed conduit's upstream structure. For culverts, the flow capacity LOS will be determined by identifying the largest storm (smallest percent annual chance) event that does not overtop the road.

SWMM models for these watershed studies are setup to allow ponding on all structures that flood (HGL exceeds the rim elevation) so that no volume of runoff is lost from the system at the outfall. All flooding is ponded on top of the structure to a depth that is dependent on the surface area at the structure and reintroduced into the system as capacity permits. In reality, the excess water will pond and, in most cases, be conveyed overland to the next runoff accepting structure. In order to better represent flooding conditions both in the closed conduit and overland, overland flow will be modeled to convey flooded water on the structure to the next downstream runoff accepting structure for closed conduits that flood in the 25-year storm and culverts that overtop in the 100-year storm. Overland flow will be modeled as a non-closed conduit with a representative irregular channel transect that conveys the overland flow to the next downstream runoff receiving structure. These could include but are not limited to roadway curb and gutter sections, roadway/dam embankments, and open space areas with little to no defined channel cut from the terrain. The upstream elevation of each overland flow non-closed conduit will be set at the elevation that the water begins conveying to the downstream structure, and the downstream invert will be set at the rim elevation of the downstream structure.

Once the existing system model is stabilized and all return events are run, the LOS for each closed conduit in the study watershed will be assigned. Next, the following rehabilitation and replacement scenarios will be developed. For all scenarios, it is assumed that the existing horizontal and vertical alignment will be maintained. It also assumes that the existing structure type will be maintained, except that plain end sections are assumed to be upgraded to headwalls or flared end sections.

- Cured-in-Place Pipe Rehabilitation (CIPP)
  - For all City-maintained CO/AS/PL
    - Set Manning's 'n' as 0.015
    - No improvements to non-City maintained closed conduits
  - Maintain same closed conduit size (lining negligible)
  - Maintain closed conduit shape
  - Determine the LOS for each closed conduit for this rehabilitation scenario
- Upgrade with HDPE or RCP to meet desired LOS
  - For closed conduits not meeting desired LOS from CIPP/Replace like size scenarios
  - Desired LOS is 25-yr, 12-hr for closed, lateral and longitudinal systems
  - Desired LOS is 100-yr, 24-hr for culverts
  - Replace arch pipe with equivalent round diameter unless it is determined that arch concrete is the better solution
  - Replace Arch Spans with CONSPAN® or RC Box Culvert
  - HDPE limitations
    - 60-inch diameter maximum

        - Do not use for pipes under roads
        - Do not use where depth of the trench is greater than 20-feet
    - If a closed conduit requires an increase in size, match the increased size downstream for all connected closed conduit at a minimum regardless ownership or pipe LOS with the following exceptions
        - Principal spillway pipes and pipes associated with stormwater BMPs will not be upgraded.
        - Should the downstream inventory not be complete, Dewberry will coordinate with Dunwoody on actions to be taken for system specific study.

Task 3: Deliverables

Deliverables for all activities associated in this study include:

- H&H (SWMM) models for the following scenarios
    - Existing Landuse
        - Existing System
        - Cured-in-Place Pipe Rehabilitation
        - Replace like size with RCP or HDPE
        - Upgrade with RCP or HDPE to meet desired LOS
- Geodatabase with
    - Enhanced inventory and H&H LOS analysis results
    - All Subcatchment Areas and associated Flow Paths
    - Temporary and Permanent Easement Polygons
    - Trench Area Polygons

BUDGET AND SCHEDULE

Based on Dewberry's On-Call Stormwater Engineering and Design Services Contract, and the scope of work outlined above, a Labor Hour and Budget Schedule has been prepared and is attached. The total estimated not to exceed cost for providing these services is $63,716.00, and Dewberry anticipated the project can be completed 6 months after receiving NTP.

Thank you for allowing Dewberry the opportunity to provide professional engineering services on this project. If you have any questions or would like to discuss our proposal further please feel to Emma Bones at 678.537.8649 or via email at ebones@dewberry.com.

Regards,

Emma Bones, PE
Senior Project Manager
Dewberry

Sam Fleming, PE
Vice President
Dewberry

Ms. Cody Dallas
City of Dunwoody
Marsh Drainage Basin Stormwater Master Model
July 1, 2024

Labor Category / Task (Sub-Task)	Billable Rate - 2024 (2nd Year) ($/hour)	Estimated Hours	Costs
Task 1 - Inventory Database Enhancement			
Subtask 1.1 - Horizontal Connectivity			
Principal-in-Charge	$239.00	2	$478.00
Project Manager	$172.00	4	$688.00
Mid Level Engineer	$135.00	40	$5,400.00
	Task 1.1 Subtotal	*46*	*$6,566.00*
Subtask 1.2 - Vertical Alignment			
Principal-in-Charge	$239.00	2	$478.00
Project Manager	$172.00	4	$688.00
Mid Level Engineer	$135.00	32	$4,320.00
	Task 1.2 Subtotal	*38*	*$5,486.00*
Subtask 1.3 - Easement Development			
Project Manager	$172.00	2	$344.00
Mid Level Engineer	$135.00	4	$540.00
	Task 1.2 Subtotal	*6*	*$884.00*
Subtask 1.4 - Trench Polygon Development			
Project Manager	$172.00	2	$344.00
Mid Level Engineer	$135.00	4	$540.00
	Task 1.2 Subtotal	*6*	*$884.00*
Subtask 1.5 - Field Work			
Project Manager	$172.00	8	$1,376.00
Mid Level Engineer	$135.00	32	$4,320.00
	Task 1.3 Subtotal	*40*	*$5,696.00*
Subtask 1.6 - Connectivity QA/QC			
Project Manager	$172.00	2	$344.00
Senior Engineer	$156.00	8	$1,248.00
	Task 1.4 Subtotal	*10*	*$1,592.00*
		Task 1 Subtotal	*$21,108.00*
Task 2 – LOS Analysis			
Subtask 2.1 - Hydrology			
Principal-in-Charge	$239.00	2	$478.00
Project Manager	$172.00	4	$688.00
Mid Level Engineer	$135.00	40	$5,400.00
	Task 2.1.1 Subtotal	46	$6,566.00
Subtask 2.2 - Critical Storm Duration Analysis			
Principal-in-Charge	$239.00	4	$956.00
Project Manager	$172.00	16	$2,752.00
	Task 2.2 Subtotal	20	$3,708.00
Subtask 2.3 - Landuse			
Principal-in-Charge	$239.00	2	$478.00
Project Manager	$172.00	4	$688.00
Mid Level Engineer	$135.00	40	$5,400.00
	Task 2.2 Subtotal	46	$6,566.00

Ms. Cody Dallas
City of Dunwoody
Marsh Drainage Basin Stormwater Master Model
July 1, 2024

Labor Category / Task (Sub-Task)	Billable Rate - 2024 (2nd Year) ($/hour)	Estimated Hours	Costs
Subtask 2.4 - Hydraulics			
Principal-in-Charge	$239.00	2	$478.00
Project Manager	$172.00	2	$344.00
Mid Level Engineer	$135.00	24	$3,240.00
	Task 2.3 Subtotal	28	$4,062.00
Subtask 2.5 - H&H QA/QC			
Project Manager	$172.00	2	$344.00
Senior Engineer	$156.00	8	$1,248.00
	Task 2.4 Subtotal	*10*	*$1,592.00*
Subtask 2.5.1 Modeling Existing Conditions			
Principal-in-Charge	$239.00	2	$478.00
Project Manager	$172.00	8	$1,376.00
Mid Level Engineer	$135.00	36	$4,860.00
	Task 2.5.1 Subtotal	46	$6,714.00
Subtask 2.5.2 - Modeling Rehab/Replacement			
Principal-in-Charge	$239.00	2	$478.00
Project Manager	$172.00	8	$1,376.00
Mid Level Engineer	$135.00	36	$4,860.00
	Task 2.5.2 Subtotal	46	$6,714.00
Subtask 2.5.3 - Modeling QA/QC			
Project Manager	$172.00	2	$344.00
Senior Engineer	$156.00	8	$1,248.00
	Task 2.5.3 Subtotal	10	$1,592.00
		Task 2 Subtotal	*$37,514.00*
Task 3 - Deliverables			
Subtask 3.1 - Develop Database			
Principal-in-Charge	$239.00	2	$478.00
Project Manager	$172.00	8	$1,376.00
Mid Level Engineer	$135.00	24	$3,240.00
		Task 3 Subtotal	*$5,094.00*
		Total	***$63,716.00***