APPENDIX B: PRIORITIZATION MATRIX TECHNICAL MEMORANDUM

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Technical Memorandum

Prepared for: City of Sandy Springs, Georgia

Project Title: Crooked Creek, Marsh Creek and a Portion of Long Island Creek Watershed Improvement Plan

Project No: 136766.300

Technical Memorandum

Subject: Prioritization Matrix for Watershed Improvement Projects

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1. INTRODUCTION

One of the key aspects of Watershed Improvement Planning is developing a Capital Improvement Plan (CIP) to meet specific water quality goals. When developing a CIP a sound approach must be employed to evaluate and prioritize potential projects. One method of evaluation is the development of a prioritization Matrix. The prioritization criteria contained in the matrix cover a range of considerations that are important in the implementation of a potential watershed improvement project. The City of Sandy Springs desires to prioritize potential projects based on an assessment management approach that includes the likelihood of failure or non-compliance of the project and the consequence of that failure. The criteria being used to rank projects include criteria such as the current condition of the structure or stream bank, the water quality and environmental benefits, permitting issues, as well as public acceptance of the project, among other factors. Therefore, by applying the criteria in a systematic method, each potential project may be objectively evaluated and compared.

Each project will be ranked for both the existing condition (likelihood of failure) and the proposed, improved condition (reduced likelihood of failure). The greater the difference between the existing condition and the proposed condition, the greater the improvement to watershed conditions. The consequence of failure generally doesn't change between the existing condition and proposed condition. For example, if the project is located on city property or within a TMDL listed watershed, it is still of greater consequence then projects not in those areas. Each project is scored twice, the difference is calculated and then the project score is divided by project cost. The project cost is applied to a 1 to 10 scale in order to compare different types of projects.

1.1 Prioritization Matrix

The following table outlines the prioritization criteria that will be applied to each potential project for the Crooked Creek, Marsh Creek and a Portion of Long Island Creek Watershed Implementation Plan. This table applies to existing as well as proposed conditions. There are 16 criteria that are grouped into 2 sections. Each criterion has a score range from 1 to 10, with 1 being low risk of failure/consequence, and 10 being high risk of failure/non-compliance and high consequence of failure. The process for assigning a score for each criterion is outlined in the next section of this memo.

In addition, Table 1 lists the weighting factor for each criterion. The weighting factor allows some prioritization criteria to be more significance in project evaluation than others. Each potential project is assigned a score for each criterion and then the criterion score are multiplied by the weighting factor. The sum of first section of the table is the Likelihood of Failure Score and the sum of the second part of the table is the Consequence of Failure Score.

The table is divided into a section for BMP criteria and weighting factors and a section of Stream Restoration criteria and weighting factors. The BMP columns in the table refer to both existing BMPs and new BMP.

It is generally not possible to develop evaluation criteria that are completely independent of each other and do not overlap to some extent. Some of the prioritization criteria presented may be considered as double counting certain project characteristics. For example, the storage volume of a BMP is scored in the Likelihood of Failure section, and is also scored under the Property Damage portion in the Consequence of Failure section. If this is a concern, the criterion may be simplified, weighting factors adjusted or score assessment methods altered.

Table 1. Prioritization Matrix - Likelihood and Consequence of Failure

Category	Criteria	BMPs Score Possibilities	BMPs Weighting Factor	BMPs Score x Weighting Factor	Stream Projects Score Possibilities	Stream Projects Weighting Factor	Stream Projects Score x Weighting Factor
Physical Condition (60%)							
	TSS Yield	1-10	0.2	0.2-2.0	1-10	0.25	0.25-2.5
	Bank Erosion	NA	NA	NA	1,2,3,4,6,8,10	0.30	0.3-3.0
	Fecal Coliform Yield	1-10	0.2	0.2-2.0	1-10	0.05	0.05-0.5
	Condition of Structure	1,2,4,5,6,8,10	0.2	0.2-2.0	NA	NA	NA
Performance (40%)							
	Storage Volume	1-10	0.35	0.35-3.5	NA	NA	NA
	Habitat Score	NA	NA	NA	1,2,3,4,6,8,10	0.35	0.35-3.5
	Work Order Requests	1,5,10	0.05	0.05-0.5	1,5,10	0.05	0.05-0.5
	Likelihood of Failure Score		**1.0**	**1.0-10.0**		**1.0**	**1.0-10.0**
Environmental (30%)							
	Compliance with regulations	10	0.1	1	5	0.1	0.5
	Fecal Coliform TMDL	1,10	0.1	0.1,1.0	1,10	0.1	0.1,1.0
	Biota TMDL	1,10	0.1	0.1,1.0	1,10	0.1	0.1,1.0
Social (40%)							
	Public Impact	NA	NA	NA	1,5,10	0.2	0.2-2.0
	City Property	1,5,10	0.2	0.2-2.0	1,5,10	0.2	0.2-2.0
	Urban/Rural Discharge Ratio	1,5,10	0.2	0.2-2.0	NA	NA	NA
Economic (30%)							
	Property Damage - based on field assessed conditions	NA	NA	NA	1,5,10	0.3	0.3-3.0
	Property Damage – based on BMP height	1,2,4,5,6,8,10	0.15	0.15-1.5	NA	NA	NA
	Property Damage – based on BMP volume	1-10	0.15	0.15-1.5	NA	NA	NA
	Consequence of Failure		**1.0**	**1.0-10.0**		**1.0**	**1.0-10.0**

1.2 Likelihood of Failure - Existing

The Existing Risk Score is developed based on the Likelihood of Failure Score and Consequence of Failure Score. There are 2 subdivisions in the Likelihood of Failure category – Physical Condition and Performance. Physical Condition is evaluated by assessing the TSS Yield and Fecal Coliform Yield; Bank Erosion for Streams Projects; and the Condition of the Structure for BMPs. The Performance division is evaluated by Work Order requests submitted to the City, the Habitat score for Stream Projects, and Storage Volume for the BMPs. The following section details how each criterion is evaluated for the existing conditions, and how a score is applied.

1.2.1 TSS Yield

The average annual Total Suspended Sediment (TSS) yield (lb/acre-year) for each BMP and stream project is determined using existing conditions results from the WIP Tools model. If the TSS Yield is:

- < 100 = 1
- 100 – 200 = 2
- 200 – 300 = 3
- 300 – 400 = 4
- 400 – 500 = 5
- 500 – 600 = 6
- 600 – 800 = 7
- 800 – 1,200 = 8
- 1,200 – 1,600 = 9
- >1,600 = 10

The weight factor for the TSS portion of the Likelihood of Failure score is 0.2 for BMPs and 0.25 for Stream Restoration Projects.

1.2.2 Bank Erosion

Bank Erosion scores only apply to Stream projects. Bank erosion ranges were recorded for both the left and right banks during the stream walk portion of Crooked Creek, Marsh Creek and a portion of Long Island Creek. The ranges recorded in the field are as follows: 0-25%, 25-50%, 50-75%, 75-100%. The quartiles refer to the percentage of exposed or bare soil on the stream bank. The ranges were converted to single values by using the lower end of the range for both the left and right banks. The percent exposed value for both the left and right banks were averaged to get a composite percent exposed for the project site. Possible percent exposed numbers and their scores are as follows:

- 0.00 = 1
- 12.5 = 2
- 25.0 = 3
- 37.5 = 4
- 50.0 = 6
- 62.5 = 8
- 75.0 = 10

In areas where no stream walk data was available the average bank erosion value for the assessed streams was used (25-50% category). The weight factor for the Bank Erosion portion of the Likelihood of Failure score is 0.30.

1.2.3 Fecal Coliform Yield

The average annual Fecal Coliform yield (cfu/acre-year) for each BMP and Stream project is determined using existing conditions results from the WIP Tools model. If the Fecal Coliform Yield is:

- < 2 = 1
- 2 – 3 = 2
- 3 – 4 = 3
- 4 – 5 = 4
- 5 – 6 = 5
- 6 – 7 = 6
- 7 – 8 = 7
- 8 – 9 = 8
- 9 – 10 = 9
- >10 = 10

The weight factor is 0.20 for BMPs and 0.05 for Stream Restoration projects.

1.2.4 Condition of Structure

The condition of the outlet control structure was obtained from Arcadis stormwater infrastructure inventory and is only applicable to BMP projects. The infrastructure inventory is currently underway and is not complete for the entire Crooked Creek, Marsh Creek and a portion of Long Island Creek Study Areas. During the infrastructure inventory, a text description for each stormwater structure was assigned. The text descriptions were assigned the following score:

- Excellent = 1
- Very Good = 2
- Good = 4
- No Data/ Inventory not complete = 5
- Fair = 6
- Poor = 8
- Immediate Repair = 10

Note that a score of 5 means that the infrastructure inventory has not been completed for a particular area or that the BMP was not included in the infrastructure inventory. The weight factor is 0.2.

1.2.5 Storage Volume

The Storage Volume criterion applies only to BMPs. Storage volume is used to evaluate how well a BMP performs providing water quality benefits and in protecting the downstream ecosystem. The water quality

volume (WQV) and channel protection volume (CPV) are used to make this assessment. These volumes are extracted from the results of the WIP Tools model. For existing BMPs the following scoring was used:

For Dry Extended Detention and Micropool Extended Detention:

- Dry Volume/Storage > CPV = 1
- Dry Volume/Storage > WQV and < CPV = linear interpolation between 1 and 10
- Dry Volume/Storage < WQV = 10

For Wet Pond Extended Detention and Shallow Wetland Extended Detention:

- Wet Volume > ½ WQV and Dry Volume/Storage > CPV + ½ WQV = 1
- Wet Volume > ½ WQV and Dry Volume/Storage < CPV + ½ WQV = linear interpolation between 1 and 10
- Wet Volume < ½ WQV = 10

For Wet Pond, Pond Wetland System, Pocket Wetland, and Shallow Wetland:

- Wet Volume > WQV and Dry Volume/Storage > CPV = 1
- Wet Volume > WQV and Dry Volume/Storage < CPV = linear interpolation between 1 and 10
- Wet Volume < WQV = 10

For New BMPs the existing volume is zero so the score is 10. The weighting factor for the storage volume is 0.35.

1.2.6 Habitat Score

Habitat Score only applies to Stream Projects. Brown and Caldwell conducted stream walks of Crooked Creek, Marsh Creek and a portion of Long Island Creek were conducted in the fall of 2009. During these stream walks, Habitat Assessments were taken in accordance with the Macroinvertebrate Biological Assessment of Wadeable Streams in Georgia SOPs (March 2007). Habitat Assessments were not performed at each potential project location, as a result the spatially closest habitat score within each watershed was assigned to each project. The ranges of possible scores were broken down into seven groups in order to transpose the scores into a 1-10 range as follows:

- 150-200 = 1
- 135-149 = 2
- 113-134 = 3
- 90-112 = 4
- 60-89 = 6
- 48-59 = 8
- 0-47 = 10

The weight factor for the Habitat Score portion of the Likelihood of Failure score is 0.35.

1.2.7 Work Order Requests

The Work Order criterion is applicable for both BMPs and Stream projects. A list of applicable work orders was obtained from the City of Sandy Springs. This listing included the address of the work order request.

The address was used to extract the parcel of the work order location. An overlay of the parcels and the project footprint was used to determine the number of the work order requests per project. This criterion was scored as follows:

- No work orders = 1
- 1 work order = 5
- More than 2 = 10

The weight factor for the Work Order Request portion of the Likelihood of Failure Score is 0.05.

1.3 Consequence of Failure - Existing

The Consequence of Failure area of risk assessment is the second component of the Existing Risk Score. It has 3 subdivisions – Environmental Consequence, Social Consequence and Economic Consequence. Environmental Consequence is measured for BMPs and Stream Restoration projects by assessing if it currently complies with regulations. Social Consequence is measured by assessing the number and type of property owners, and by assessing the existing urban/rural discharge ratio. Economic Consequence is measured by the potential risk to the property or structures. The following sections detail how each criterion is evaluated for the existing conditions, and how a score is applied.

1.3.1 Compliance with Regulations

This criterion assesses the potential to not be in compliance with regulations.

- Stream projects = 5
- BMP = 10

The weight factor for the Compliance with Regulations is 0.10.

1.3.2 Fecal Coliform and Biota Impacted TMDLs

Streams not meeting their designated uses are included on Georgia's 305b/303d list and TMDLs are generated for these streams. Streams may be listed for a single or multiple water quality parameter violations. In the City of Sandy Springs the streams with TMDLs are listed for Fecal Coliform or Fecal Coliform and Impacted Biota. These criteria are scored as follows:

- Project not on or upstream of TMDL Stream = 1
- Project on or upstream of TMDL Stream = 10

The weight factor for the Fecal and Biota portions of the Consequence of Failure is 0.10 each.

1.3.3 Public Impact

To determine the impact of failure in the social realm, more weight is given to a project if it spans over multiple parcels. This criterion only applies to Stream Restoration Projects.

- 1 parcel = 1
- 2 parcels = 5
- > 2 parcels = 10

The weight factor for the Public Impact portion of the Consequence of Failure is 0.20.

1.3.4 City Property

The social aspect of project failure is also greatly affected by the type of ownership of the property. The City of Sandy Springs desires to give weight to those properties that are owned, or partially owned by the City. These scores apply to both BMPs and Stream Restoration projects.

- Project property is not owned by the City = 1
- Project property is partially owned by the City = 5.
- Project property is wholly owned by the City = 10.

The weight factor for the City Property portion of the Consequence of Failure is 0.20.

1.3.5 Urban/Rural Discharge Ratio

The Urban/Rural discharge ratio is developed in the WIP Tools model and as the name implies is the ratio of the urban 1 year discharge to the rural 1-year discharge. The discharges are developed using USGS regression equations. This criterion applies only to BMP Projects. The score is assigned as follows:

- Urban/rural discharge ratio < 1.5 = 1
- Between 1.5 and 2 = 5
- > 2 = 10

The weight factor for the Urban to Rural flow ratio portion of the Consequence of Failure is 0.20.

1.3.6 Property Damage - Stream Projects

The Stream Projects were assessed in the field to determine a property damage score. The following scoring protocol was used:

- Stream damage contained within stream = 1
- Stream is causing property damage = 5
- Stream poses risk to structure = 10

Fences and sheds are considered property and structures are considered to be office or living quarters. For stream projects where no property damage information is available a score of 1 was assumed. The weight of the Property Damage score for Stream projects is 0.30.

1.3.7 Property Damage - Height

This criterion is based on the dam height and applies only to BMP projects. This data was obtained from the Arcadis infrastructure inventory. The following scores apply:

- < 6.25 = 1
- 6.25 - 13.5 = 3
- No Data or Inventory not complete = 5
- 13.5 – 18.75 = 7
- 18.75 – 26 = 9
- >26 = 10

If the BMP was not evaluated or the inventory is not complete for the BMP location and therefore the dam height is not known, a score of 5 is applied. For New BMPs the existing dam height is zero. The weight of the height of dam consideration for BMPs for the Property Damage portion of the Consequence of Failure is 0.15.

1.3.8 Property Damage – Volume

The total storage volume is used to determine the score for this criterion and as a result it is applicable only to BMP Projects. The total volume of the BMP in acre-feet is calculated by adding the wet volume and the dry (or storage) volume for each BMP. The following scale is used to develop the score:

- Less than 0.5 ac-ft = 1
- .5 – 1 = 2
- 1 – 2 = 3
- 2 – 6= 4
- 6. – 10.= 5
- 10 – 30= 6
- 30– 50= 7
- 50 – 70= 8
- 70– 100= 9
- > 100 = 10

For new BMPs the existing storage volume is zero. The weight factor is 0.15.

1.4 Likelihood of Failure – Proposed Conditions

In order to develop the Project Score the proposed Likelihood Score and proposed Consequence Score must be developed. In general, if most projects are implemented, it is assumed that where possible, the criteria will be met and the score will be lowered to the lowest possible level (1). Where this is not the case, WIP Tools or some other method of estimating the change impact will be used, and a detailed explanation will be given. All weighting will factors remain the same.

1.4.1 TSS Yield

Using the WIP Tools model each project is implemented in isolation. The TSS Yield as a result of the implemented project is extracted from the WIP Tools model. The score is applied using the same score divisions as used in the Existing conditions.

1.4.2 Bank Erosion

It is assumed that if a stream project is implemented, that the bank erosion levels will be stabilized and that a score of 1 will be achieved.

1.4.3 Fecal Coliform Yield

Similar to TSS Yield the WIP Tools model will be used to assess the Fecal Coliform Yield as the result of implementing a project. The same score divisions as used in the Existing conditions apply.

1.4.4 Condition of Structure

It is assumed that if the BMP project is implemented, that it will be moved up to a condition where the score will be 1.

1.4.5 Storage Volume

The proposed storage volume is based the volume modifications recommended for a particular BMP Project. Based on project recommendations a new BMP volume is calculated. Due to building structures and/or ownership constrains, not all BMPs may be able to achieve the volume necessary for channel protection benefits. The same scoring divisions outlined in the existing conditions are used to evaluate the proposed conditions storage volume.

1.4.6 Habitat Score

It is assumed that if the stream project is implemented that the Habitat Assessment Score will improve thus the assigned Habitat Score for the prioritization matrix will be reduced to a certain score based on the restoration level implemented.

- Level 1 restoration reduces the score by 3
- Level 2 and Level 3 reduce the score by 2
- Level 4 reduces the score by 1

Due to the urbanized condition of the study area, the minimum score that a project may obtain is a 2.

1.4.7 Work Order Requests

It is assumed that after a project is implemented that the work requests will be fulfilled and that there will no longer be any outstanding requests. A score of 1 is assumed.

1.5 Consequence of Failure – Proposed

The following section outlines the methods used to develop the consequence of failure score for the proposed conditions.

1.5.1 Compliance with Regulations

The scoring for the Compliance with Regulations portion of the Likelihood of Failure section does not change and the scores remain the same.

1.5.2 Fecal Coliform and Biota Impacted TMDLs

The scoring for the Fecal Coliform and Biota Impacted TMDLs portion of the Likelihood of Failure section does not change and the scores remain the same.

1.5.3 Public Impact

The scoring for the Public Impact portion of the Likelihood of Failure section does not change and the scores remain the same.

1.5.4 City Property

Barring the sale of property to the City in order to complete the project, the City Property portion of the Likelihood of Failure score does not change.

1.5.5 Urban/Rural Discharge Ratio

The proposed urban/rural discharge ratio is calculated with the WIP Tools model for the each project implemented in isolation. The same score divisions as used in the Existing conditions apply.

1.5.6 Property Damage - Stream Projects

It is assumed that if a Stream project is implemented, that the risk to property and structure will be eliminated and the score will be a 1.

1.5.7 Property Damage – Height

The scoring for the Property Damage – Height portion of the Likelihood of Failure section does not change and the scores remain the same.

1.5.8 Property Damage - Volume

As mentioned previously many BMPs may have larger proposed volumes based on the recommended retrofits. A score is assigned using the proposed total storage volume in the same score divisions outline in the existing conditions.

1.6 Project Score – Benefit Cost

After developing both the existing conditions and the proposed conditions scores the project score is calculated. The project score is determine as follows:

Benefit Cost Score= (Existing Likelihood Score x Existing Consequence Score) – (Proposed Likelihood Score x Proposed Consequence Score) / Scaled Project Cost

The Likelihood and Consequence scores are determined using the methods outlined in the previous sections. The Scale project cost is as follows:

- Less than $10,000 = 1
- $10,001 - $50,000 = 2
- $50,000 – $100,000 = 3
- $100,001 - $250,000 = 4
- $250,001 - $500,000 = 5
- $500,001 - $750,000 = 6
- $750,001 - $1.0M = 7
- $1.0M - $1.5M = 8
- $1.5M - $2.0M = 9
- > $2.0M = 10