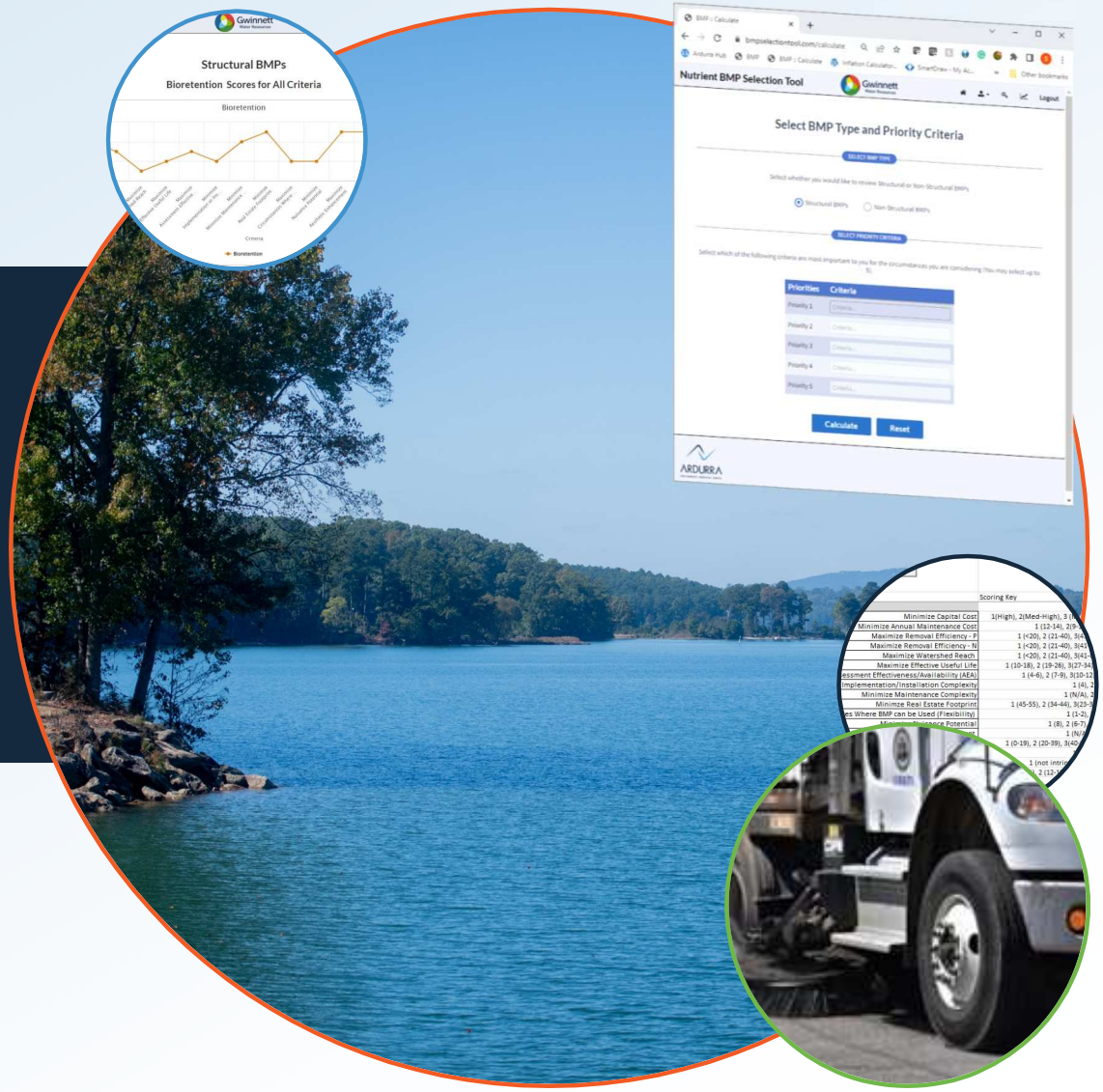
THE GOOD, THE BAD, & THE UGLY:

Selecting The Right Nutrient Reduction BMP

SESWA Annual Conference
October 6, 2022



Gwinnett Water Resources

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AGENDA

- Project Background and Description
- Project Approach
- Project Deliverables
- Project Challenges
- Lessons Learned
- Tool Implementation: Lake Lanier Watershed
- Questions

Gwinnett Water Resources

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INTRODUCTION TO GWINNETT COUNTY

- *Population: 963,000*
- *Located to the NE of Metro Atlanta*
- *SW Utility Annual Revenues: $29M*
- *FTE's Assigned to Stormwater Management: 78.5*
- *Miles of 303(d) Listed Streams: 202*
- *Water Source: Lake Lanier*
- *Gwinnett County contributes 0.31% to the total area of the Lake Lanier Watershed*
- *Gwinnett Population within Lake Lanier Watershed:*
  - *6,901*
- *Lake Lanier Impaired for Chlorophyll a*

Gwinnett Water Resources

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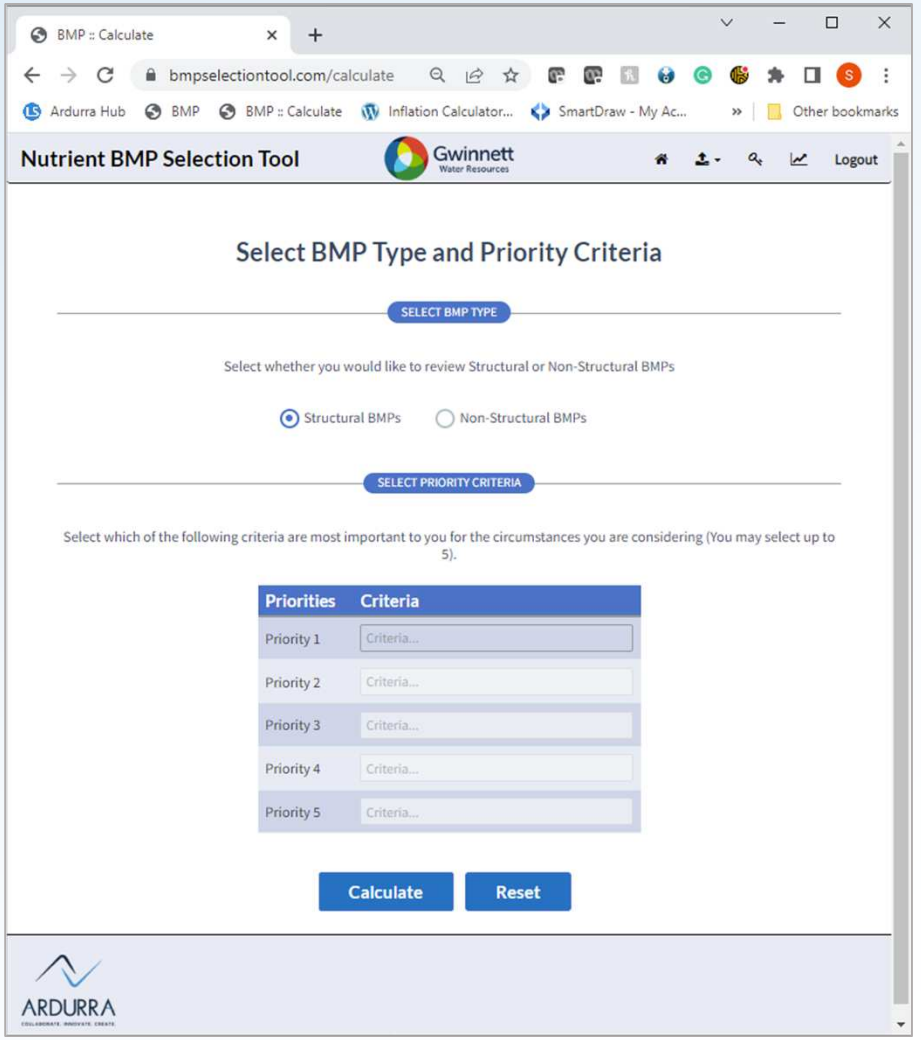
PROJECT BACKGROUND & DESCRIPTION

- Basic Project Description
  - *Inventory Structural (S) and Non-Structural (NS) Nutrient Reduction BMPs*
  - *Research and characterize BMPs to allow for differentiation and selection*
  - *Present data in a user-friendly decision support tool*
  - *Begin with the end in mind: Initial Introduction of Tool*



Gwinnett Water Resources

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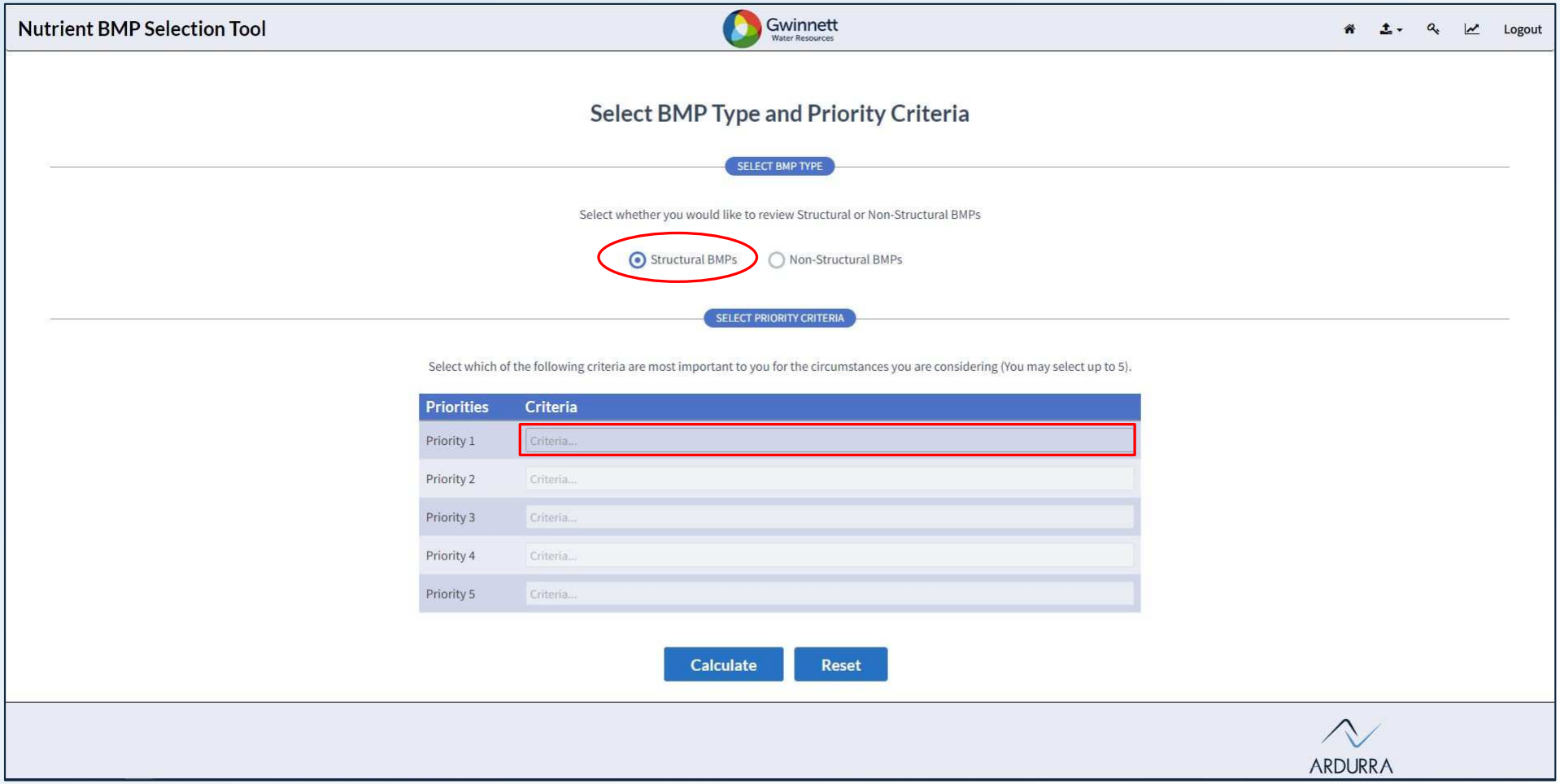
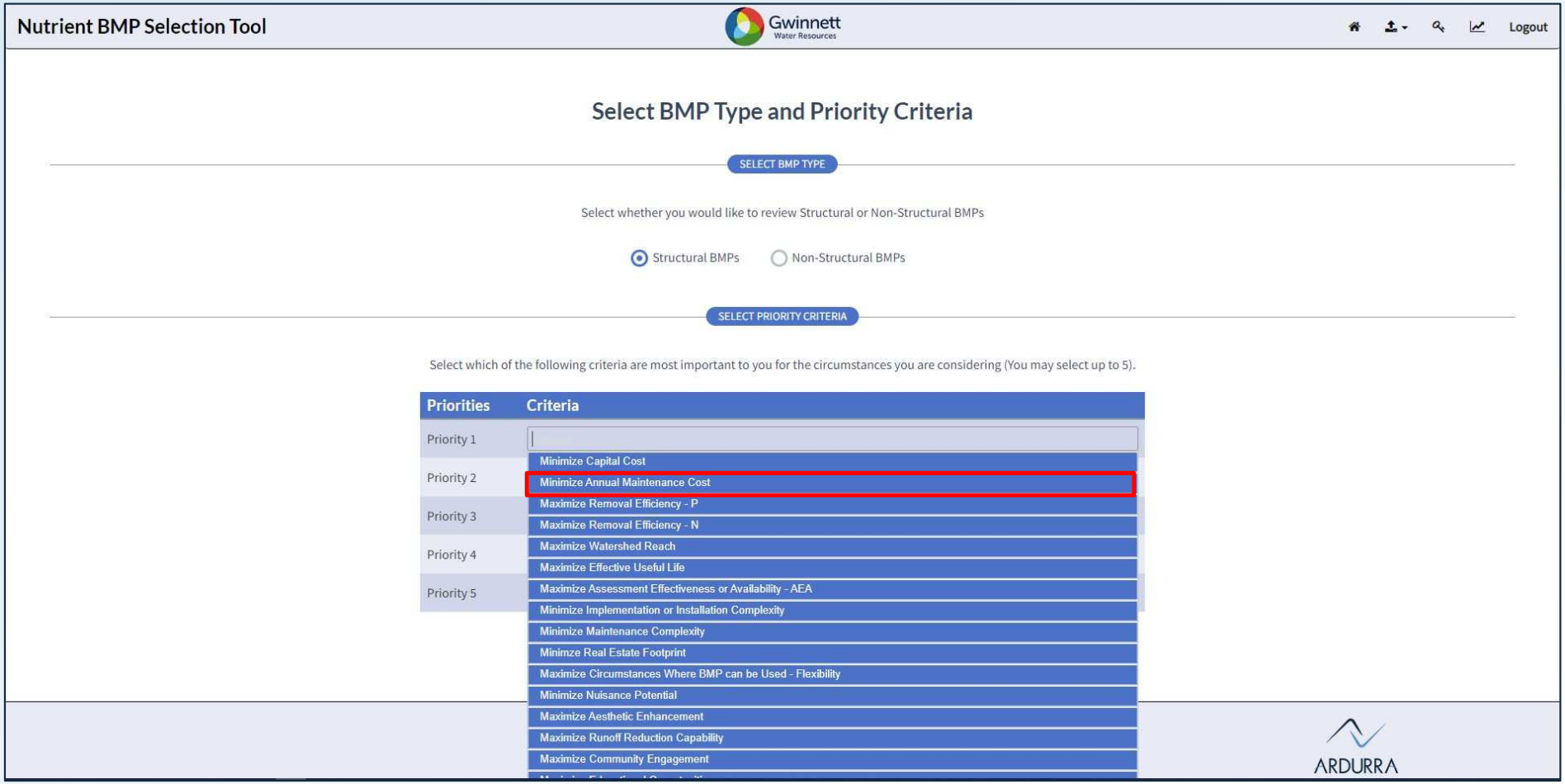

Nutrient BMP Selection Tool
Gwinnett
Water Resources
Logout
Select BMP Type and Priority Criteria
SELECT BMP TYPE
Select whether you would like to review Structural or Non-Structural BMPs
Structural BMPs
Non-Structural BMPs
SELECT PRIORITY CRITERIA
Select which of the following criteria are most important to you for the circumstances you are considering (You may select up to 5).
Priorities
Criteria
Priority 1
Criteria...
Priority 2
Criteria...
Priority 3
Criteria...
Priority 4
Criteria...
Priority 5
Criteria...
Calculate
Reset
ARDURRA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Minimize Annual Maintenance Cost
Maximize Removal Efficiency - P
Maximize Removal Efficiency - N
Maximize Watershed Reach
Maximize Effective Useful Life
Maximize Assessment Effectiveness or Availability - AEA
Minimize Implementation or Installation Complexity
Minimize Maintenance Complexity
Minimze Real Estate Footprint
Maximize Circumstances Where BMP can be Used - Flexibility
Minimize Nuisance Potential
Maximize Aesthetic Enhancement
Maximize Runoff Reduction Capability
Maximize Community Engagement
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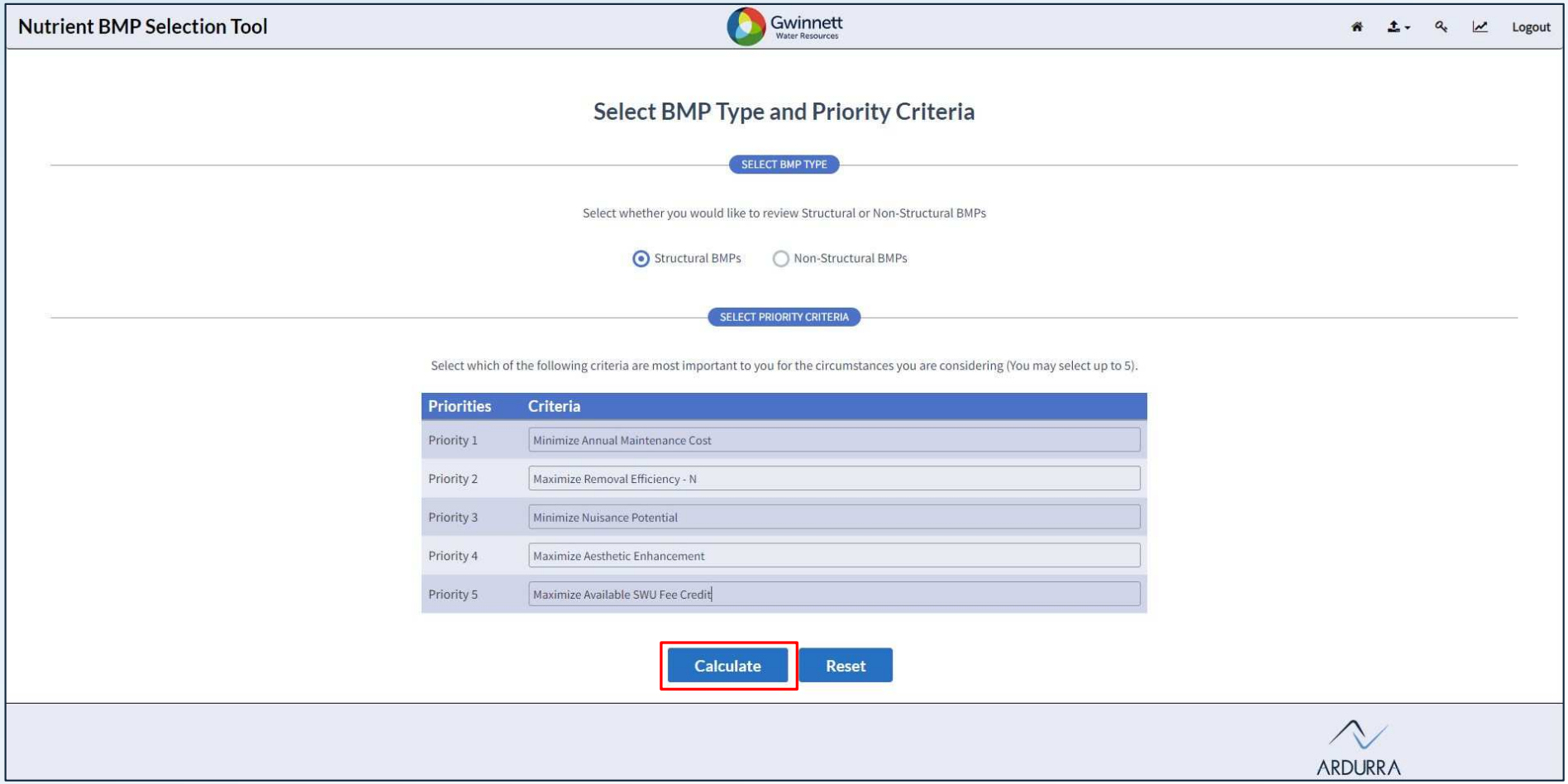
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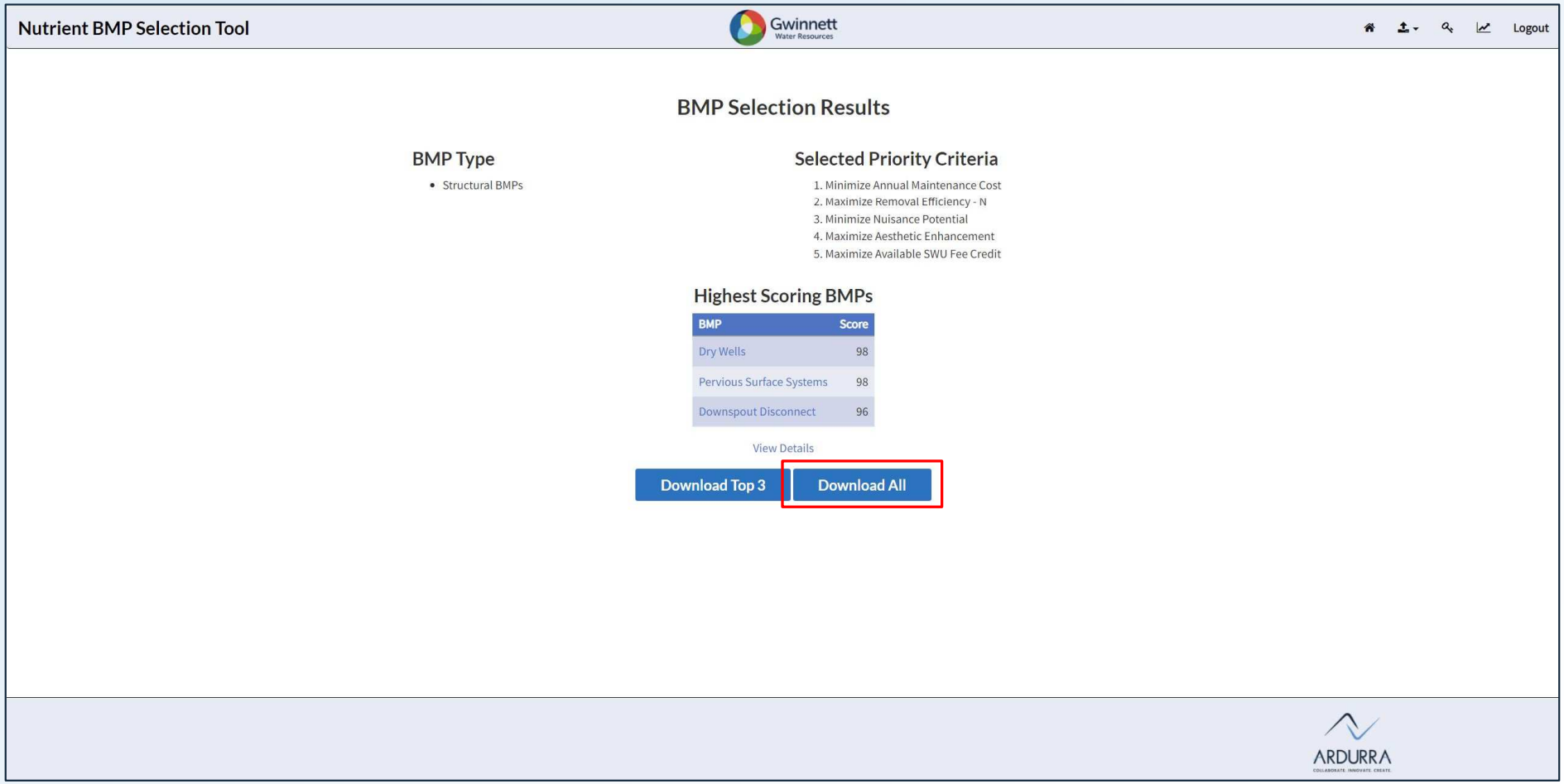
Nutrient BMP Selection Tool
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BMP Selection Results
BMP Type
Structural BMPs
Selected Priority Criteria
1. Minimize Annual Maintenance Cost
2. Maximize Removal Efficiency - N
3. Minimize Nuisance Potential
4. Maximize Aesthetic Enhancement
5. Maximize Available SWU Fee Credit
Highest Scoring BMPs
BMP
Score
Dry Wells
98
Pervious Surface Systems
98
Downspout Disconnect
96
View Details
Download Top 3
Download All
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BMP Selection Results

BMP Type

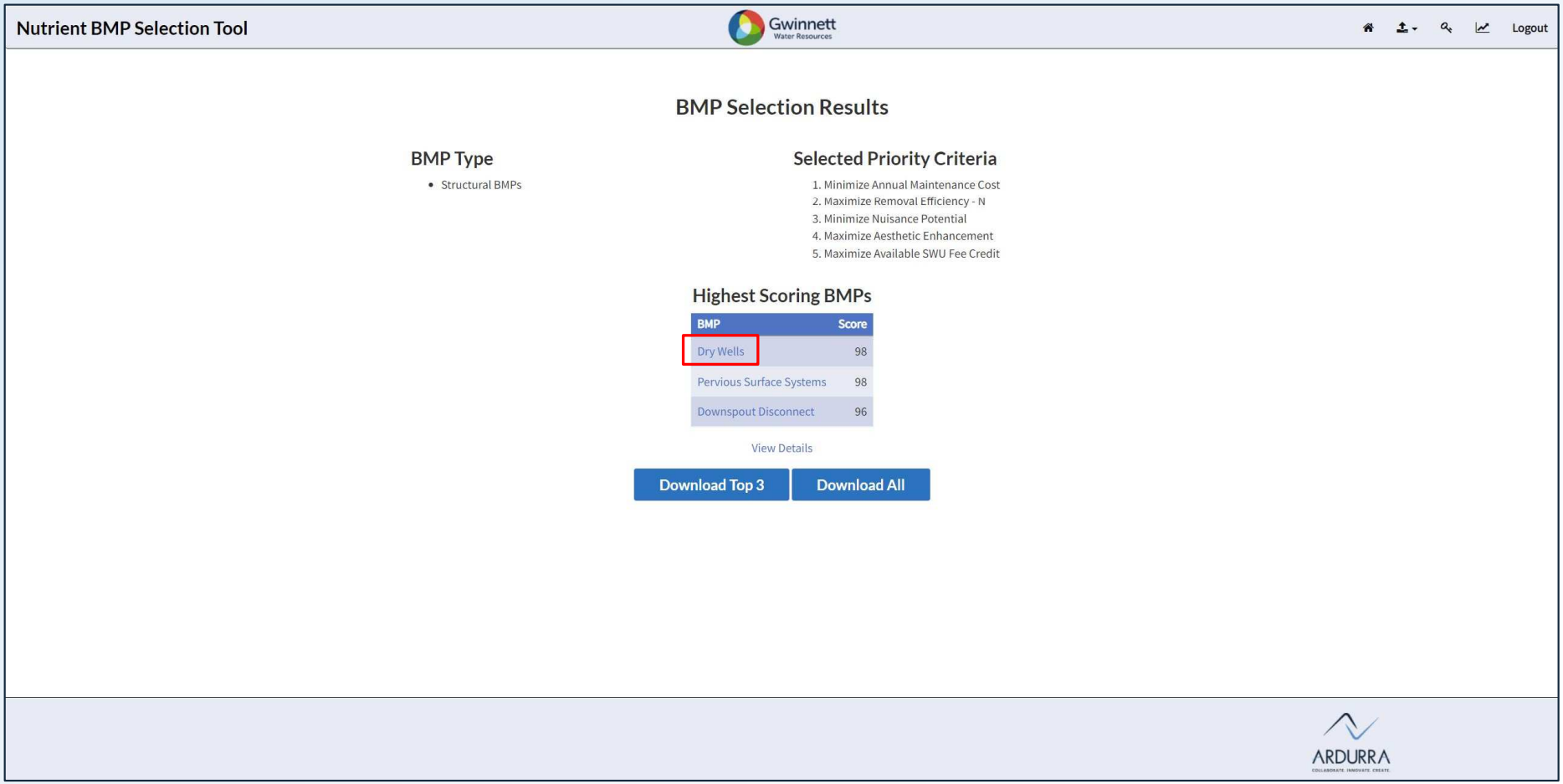
- Structural BMPs

Selected Priority Criteria

1. Minimize Annual Maintenance Cost
2. Maximize Removal Efficiency - N
3. Minimize Nuisance Potential
4. Maximize Aesthetic Enhancement
5. Maximize Available SWU Fee Credit

Highest Scoring BMPs

BMP	Score
Dry Wells	98
Pervious Surface Systems	98
Downspout Disconnect	96
Bioslopes	92
Gravity Oil-Grit Separator	82
Bioretention	79
Stormwater Ponds	79
Stormwater Wetlands	76
Dry-Wet Enhanced Swales	73
Infiltration Trench	73
Grass Channels	69
Dry-Extended Detention Basins	61
Vegetated Filter Strip	60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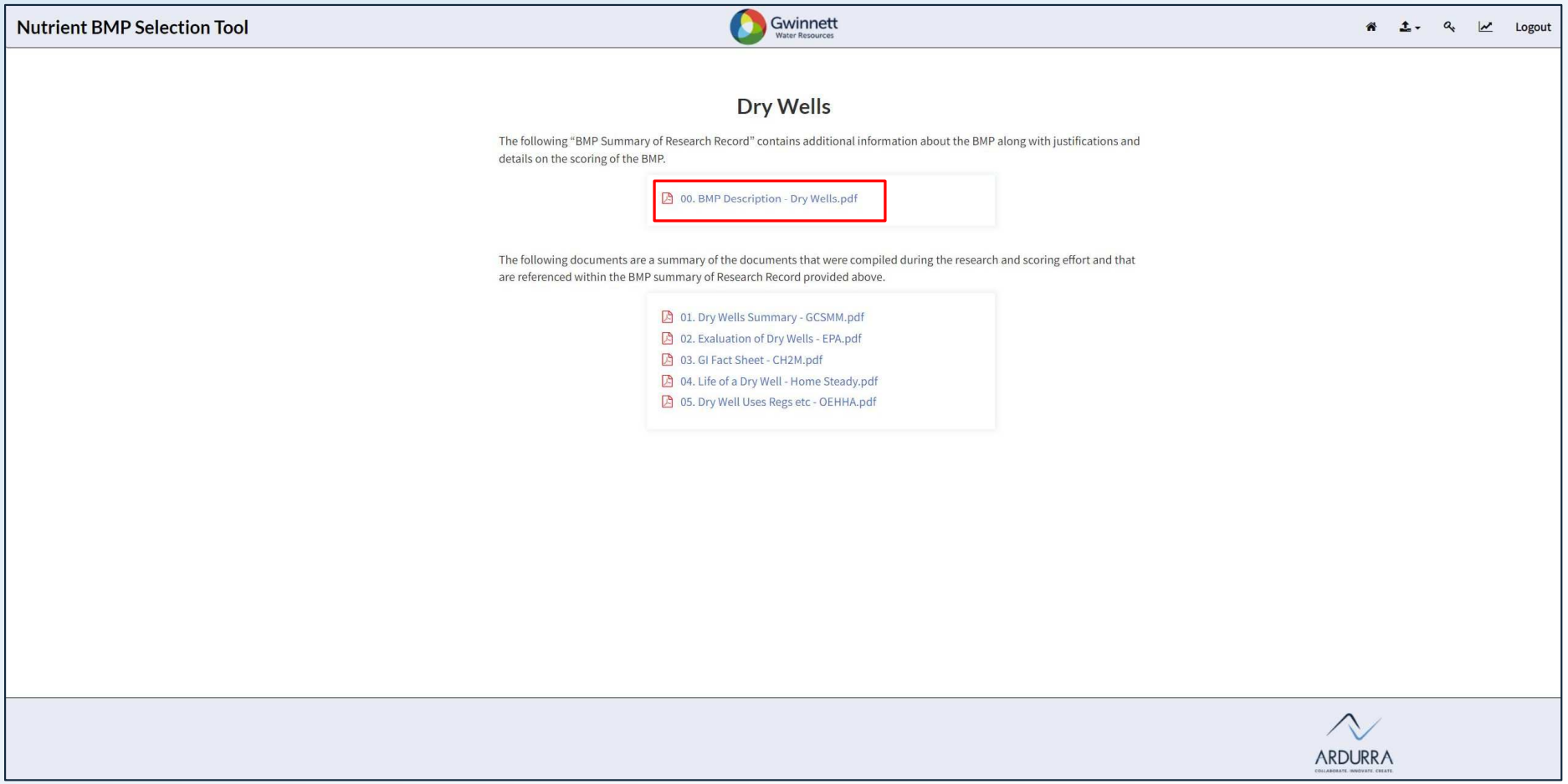
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Dry Wells
The following "BMP Summary of Research Record" contains additional information about the BMP along with justifications and details on the scoring of the BMP.
00. BMP Description - Dry Wells.pdf
The following documents are a summary of the documents that were compiled during the research and scoring effort and that are referenced within the BMP summary of Research Record provided above.
01. Dry Wells Summary - GCSMM.pdf
02. Exaluation of Dry Wells - EPA.pdf
03. GI Fact Sheet - CH2M.pdf
04. Life of a Dry Well - Home Steady.pdf
05. Dry Well Uses Regs etc - OEHHA.pdf
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BMP Summary of Research Record

BMP Name: Dry Wells

BMP Type: Structural

BMP Description: Dry wells (also known as seepage pits and French drains) are low impact development practices that are located below the surface of development sites. They consist of shallow excavations, typically filled with stone, that are designed to intercept and temporarily store post-construction stormwater runoff until it infiltrates into the underlying and surrounding soils. If properly designed, they can provide significant reductions in post-construction stormwater runoff rates, volumes, and pollutant loads on development sites.

General Advantages/Benefits:

- Helps restore pre-development hydrology on development sites
- Reduces post-construction stormwater runoff rates, volumes, and pollutant loads
- Well-suited for use on urban development sites"

Source: 1; vol 2, page 207, section "Advantages/Benefits"; "Gwinnett County Stormwater Management Manual", Gwinnett County

General Disadvantages/Limitations:

- Can only be used to "receive" runoff from small drainage areas of 2,500 square feet or less
- Should not be used on development sites that have soils with infiltration rates of less than 0.5 inches per hour"

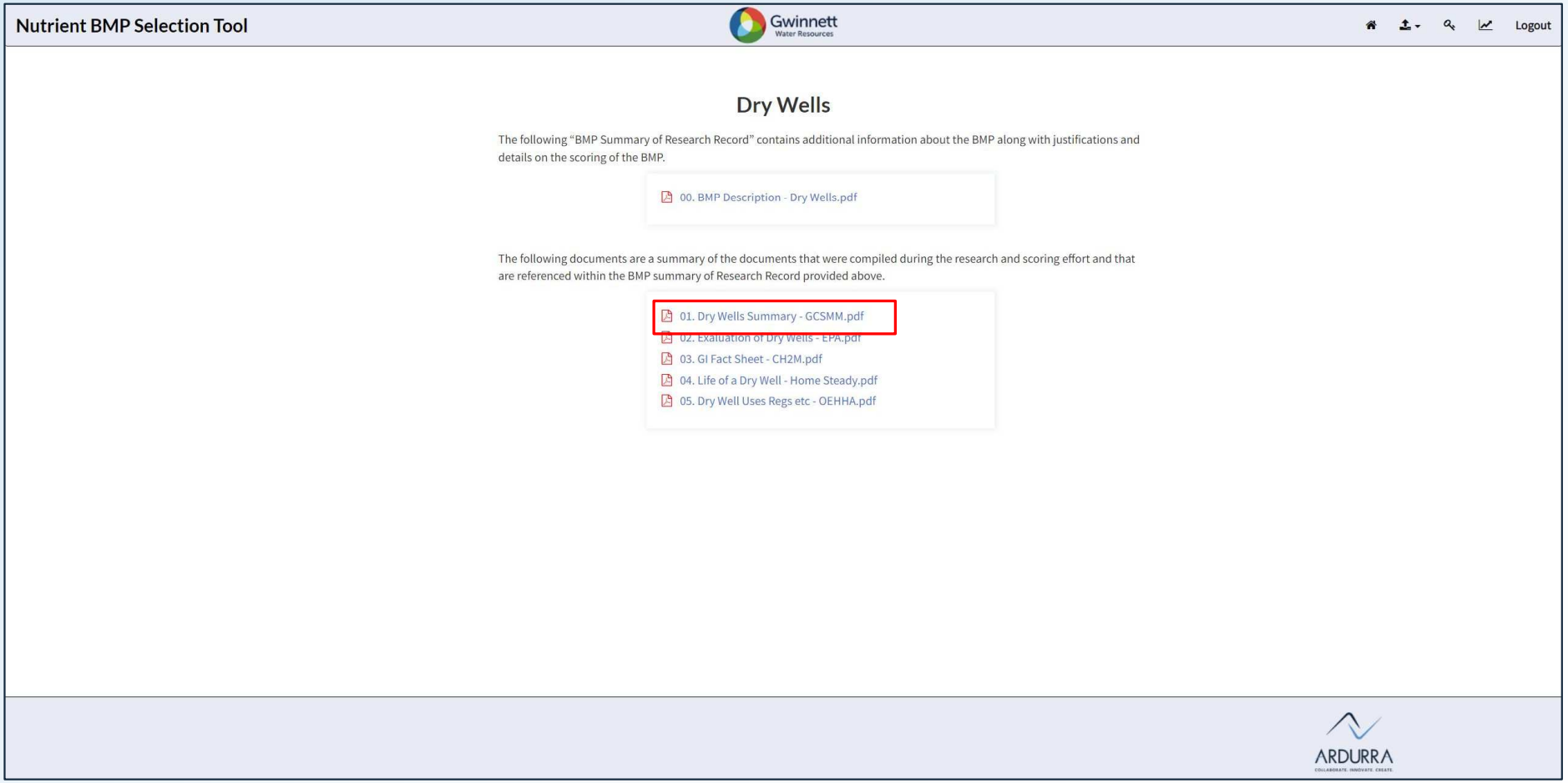
Source: 1; vol 2, page 207, section "Disadvantages/Limitations"; "Gwinnett County Stormwater Management Manual", Gwinnett County

Capital Cost:

The GCSMM assess the capital cost of a Dry Well as Medium.

Other Information:

The below references indicate that costs for a dry well range from $1,350 to $16,900 depending on size. These costs are not referenced in terms of contributing impervious surface.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4.7 Dry Wells

(Source: City of Portland, OR, 2008)

Description: Dry wells are low impact development practices that are located below the surface of development sites. They consist of shallow excavations, typically filled with stone, that are designed to intercept and temporarily store post-construction stormwater runoff until it infiltrates into the underlying and surrounding soils.

LID/GI Considerations: Use of a dry well decreases the post construction runoff volume from a site, decreasing the pollutant load as well as thermal and erosive impacts to receiving waters. Dry wells are installed underground, which allows for multiple uses of development space.

KEY CONSIDERATIONS

DESIGN CRITERIA

- Dry wells should be designed to completely drain within 24 hours of the end of a rainfall event.
- There should be at least 2 feet of separation distance between the bottom of a dry well and the top of the water table.
- Dry wells should be designed with slopes that are as close to flat as possible to help ensure that stormwater runoff is evenly distributed throughout the stone reservoir.

ADVANTAGES / BENEFITS

- Helps restore pre-development hydrology on development sites
- Reduces post-construction stormwater runoff rates, volumes, and pollutant loads
- Well-suited for use on urban development sites

DISADVANTAGES / LIMITATIONS

- Can only be used to "receive" runoff from small drainage areas of 2,500 square feet or less
- Should not be used on development sites that have soils with infiltration rates of less than 0.5 inches per hour

ROUTINE MAINTENANCE REQUIREMENTS

- A dry well and its components shown in Figure 4.7-1 must be inspected and maintained at least annually.
- Replace gravel when more than 6 inches of sediment has accumulated.
- Inspect after major storm events to ensure water does not pond for more than 48 hours. If extended ponding occurs, the gravel may need to be replaced.

POLLUTANT REMOVAL

- 100% Total Suspended Solids
- 100% Metals - Cadmium, Copper, Lead, and Zinc removal
- 100/100% Nutrients - Total Phosphorus / Total Nitrogen removal
- 100% Pathogens – Fecal Coliform

STORMWATER MANAGEMENT SUITABILITY

- ✓ Runoff Reduction
- ✓ Water Quality
- ★ Channel Protection
- Overbank Flood Protection
- Extreme Flood Protection

✓ suitable for this practice
★ may provide partial benefits

IMPLEMENTATION CONSIDERATIONS

- (L) Land Requirement
- (M) Capital Cost
- (M) Maintenance Burden

Residential Subdivision Use: *Yes*
High Density/Ultra-Urban: *Yes*
Roadway Projects: *Not recommended*

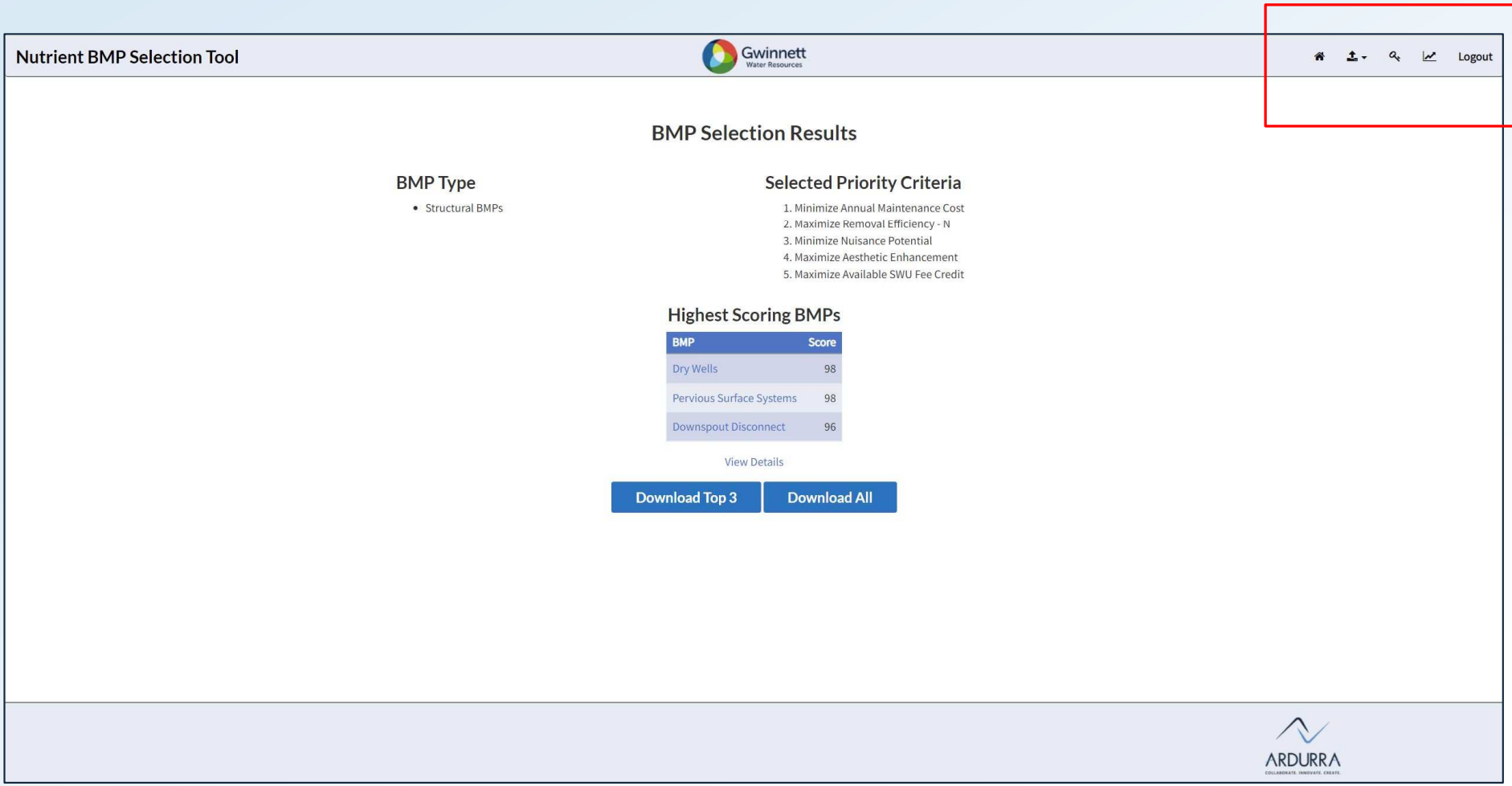
Soils: *Dry wells should be considered for use on development sites where fine sediment (e.g., clay, silt) loads will be relatively low, as high sediment loads will cause them to clog and fail. Permeable soils with a water table low enough to provide for the infiltration of stormwater runoff are recommended.*

Other Considerations: *Dry wells should not be located beneath a driveway, parking lot or other impervious surface.*

L=Low M=Moderate H=High

RUNOFF REDUCTION CREDIT

- 100% runoff reduction volume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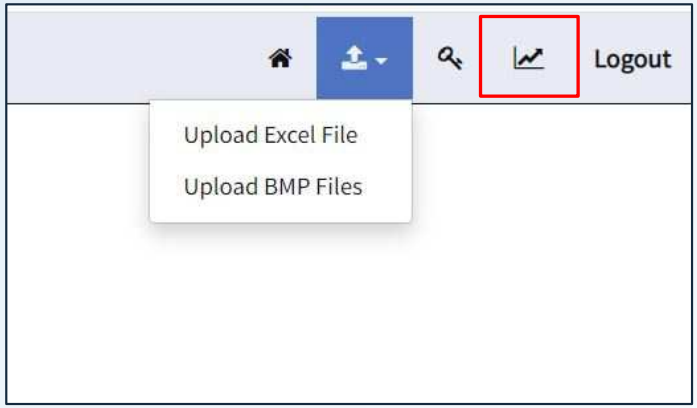
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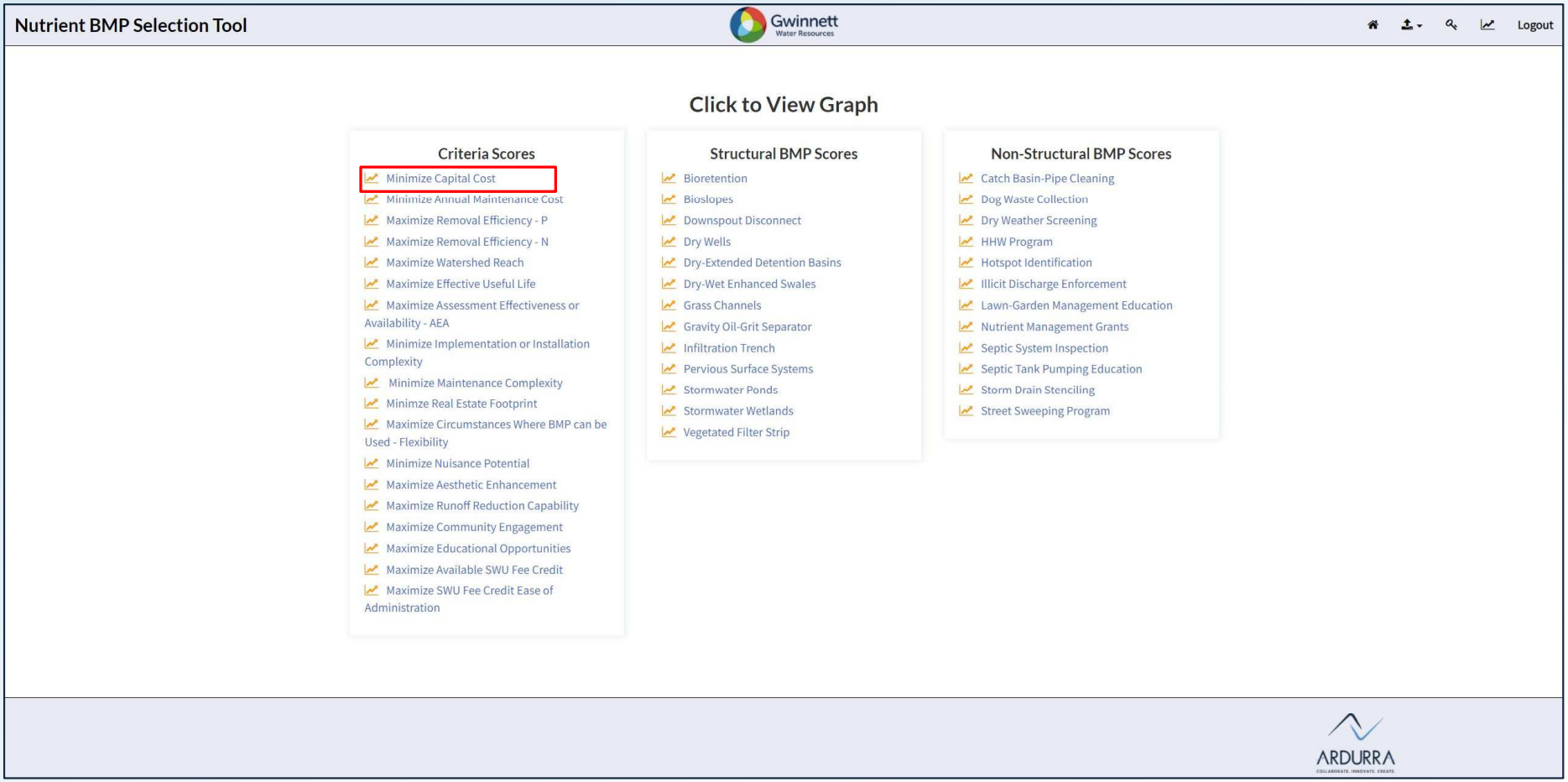
Upload Excel File
Upload BMP Files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Criteria Scores
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Stormwater Wetlands
Vegetated Filter Strip
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Catch Basin-Pipe Cleaning
Dog Waste Collection
Dry Weather Screening
HHW Program
Hotspot Identification
Illicit Discharge Enforcement
Lawn-Garden Management Education
Nutrient Management Grants
Septic System Inspection
Septic Tank Pumping Education
Storm Drain Stenciling
Street Sweeping Program
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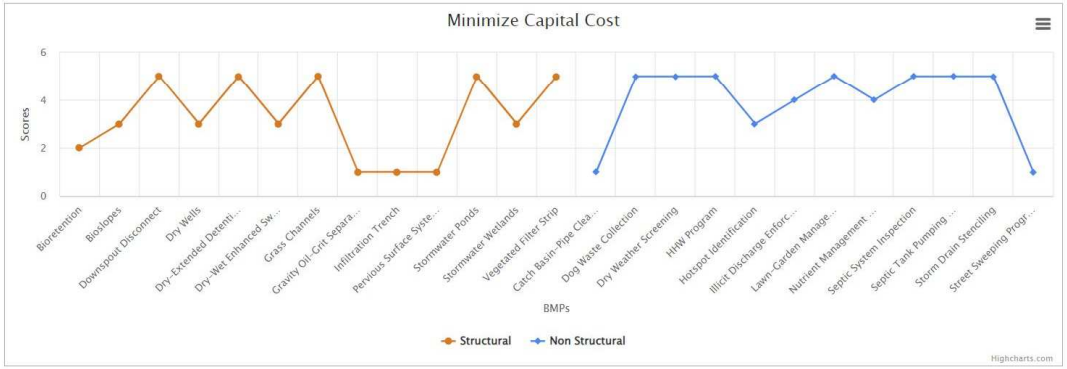
Nutrient BMP Selection Tool

Gwinnett Water Resources

Logout

Capital Cost Scores for All BMPs



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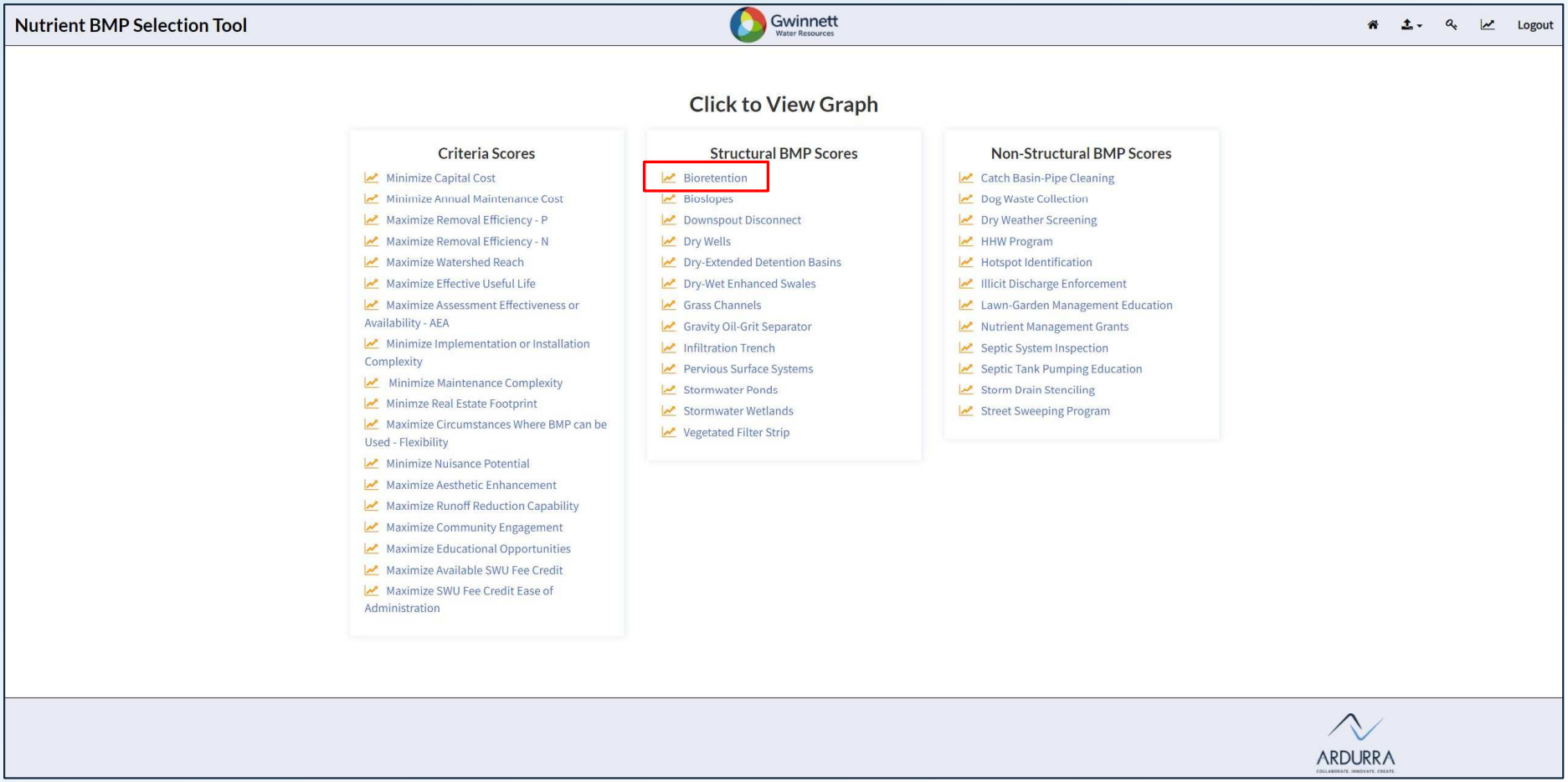
COLLABORATE. INNOVATE. CREATE.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Nutrient BMP Selection Tool

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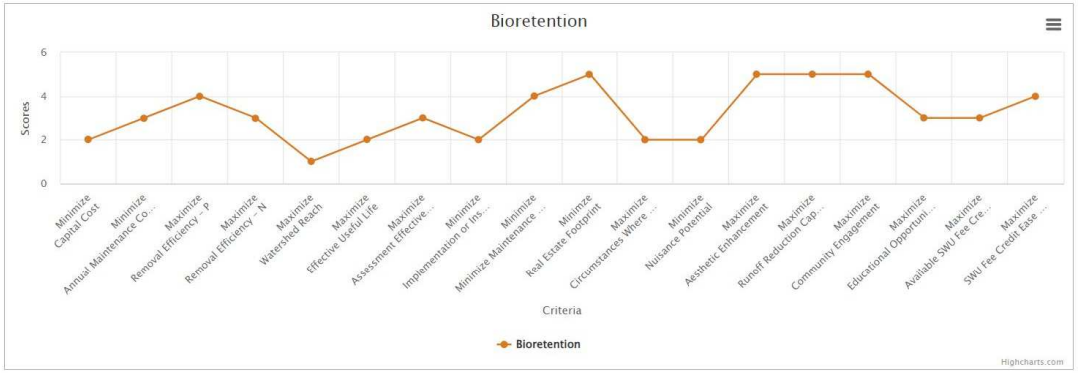
Logout

Structural BMPs

Bioretention Scores for All Criteria



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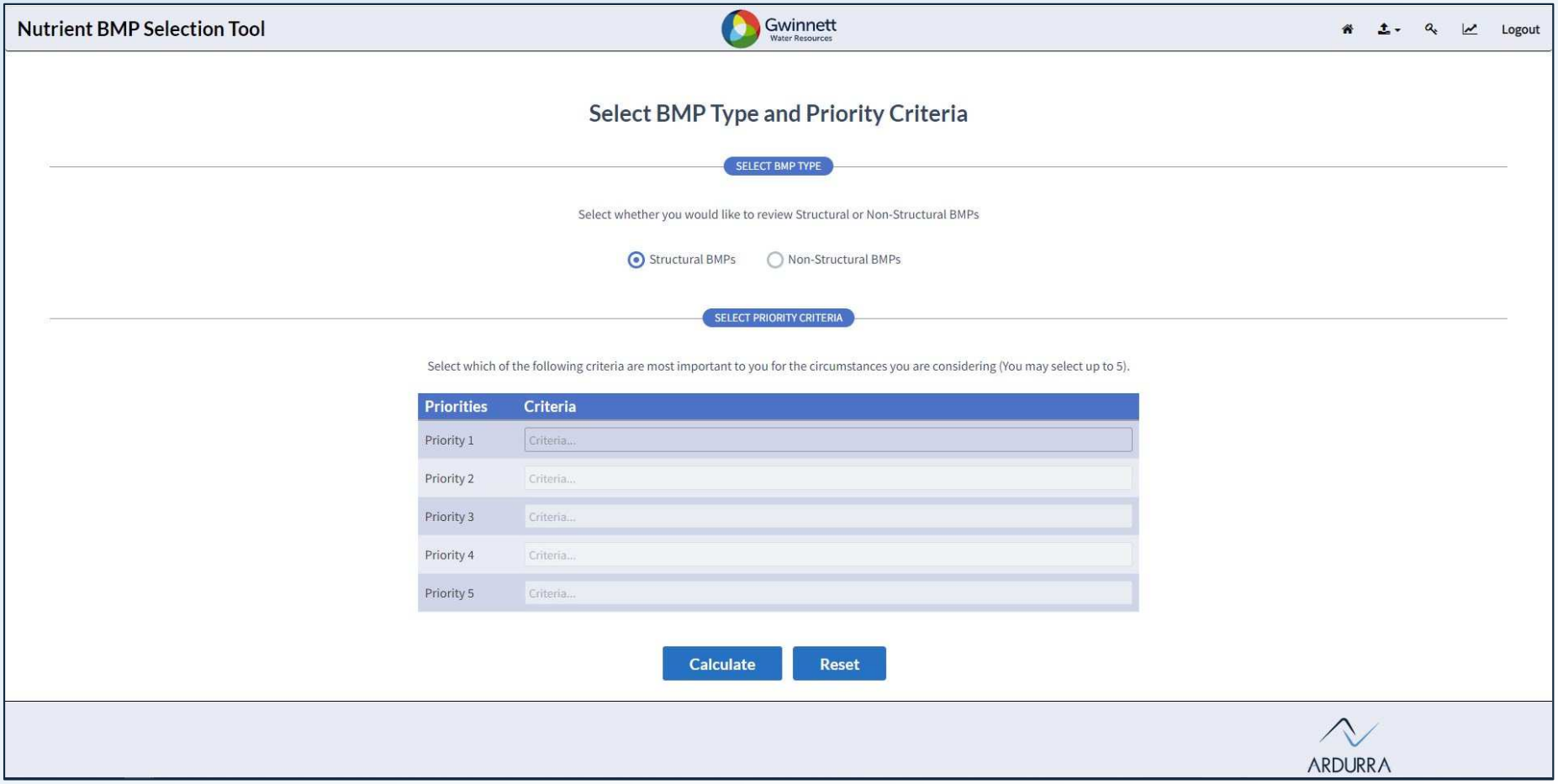
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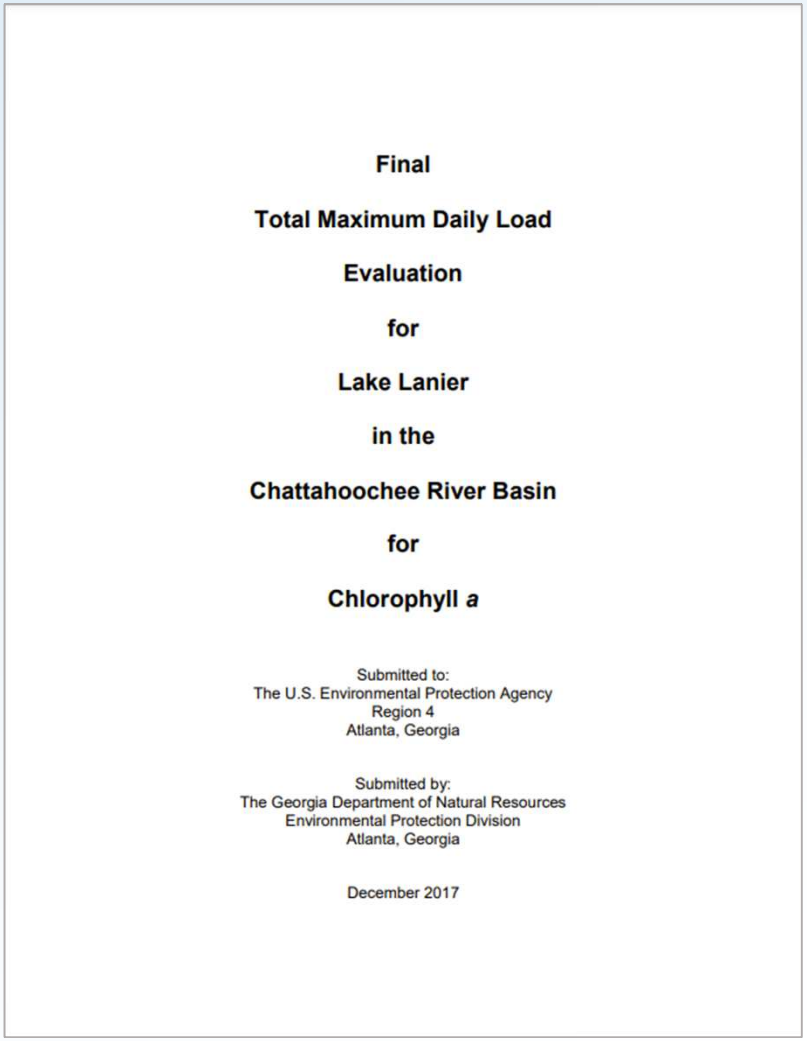
PROJECT BACKGROUND & DESCRIPTION

- Project Drivers
  - *Regulatory Requirement – MS4 Permit and TMDL*
    - Section 3.3.7 of MS4 Permit
    - 303d Listings trigger IWP (Impaired Waters Plan) Development
    - IWP: Identify and assess feasibility of BMPs to address POC
  - *Capture Institutional knowledge*
  - *User friendly access to BMP information*
  - *ID BMPs based on management objectives*
  - *Identify previously unused/unknown BMPs*
  - *Enhance Water Quality*



Final

Total Maximum Daily Load

Evaluation

for

Lake Lanier

in the

Chattahoochee River Basin

for

Chlorophyll *a*

Submitted to:
The U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

Submitted by:
The Georgia Department of Natural Resources
Environmental Protection Division
Atlanta, Georgia

December 2017

PROJECT BACKGROUND & DESCRIPTION

- Project Goals and Objectives
  - ***Goal:*** *Develop a better understanding of Nutrient Reduction BMPs so that the most effective BMP can be selected for a defined set of circumstances*
  - ***Objectives:***
    - Develop an inventory of available BMPs
    - Research and Document attributes of these BMPs
    - Develop BMP Characterization Criteria: facilitate differentiation
    - Assess BMP effectiveness
    - Develop a user-friendly decision support tool – easy to update
    - Assess BMP options for Lake Lanier Watershed in Gwinnett

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PROJECT APPROACH

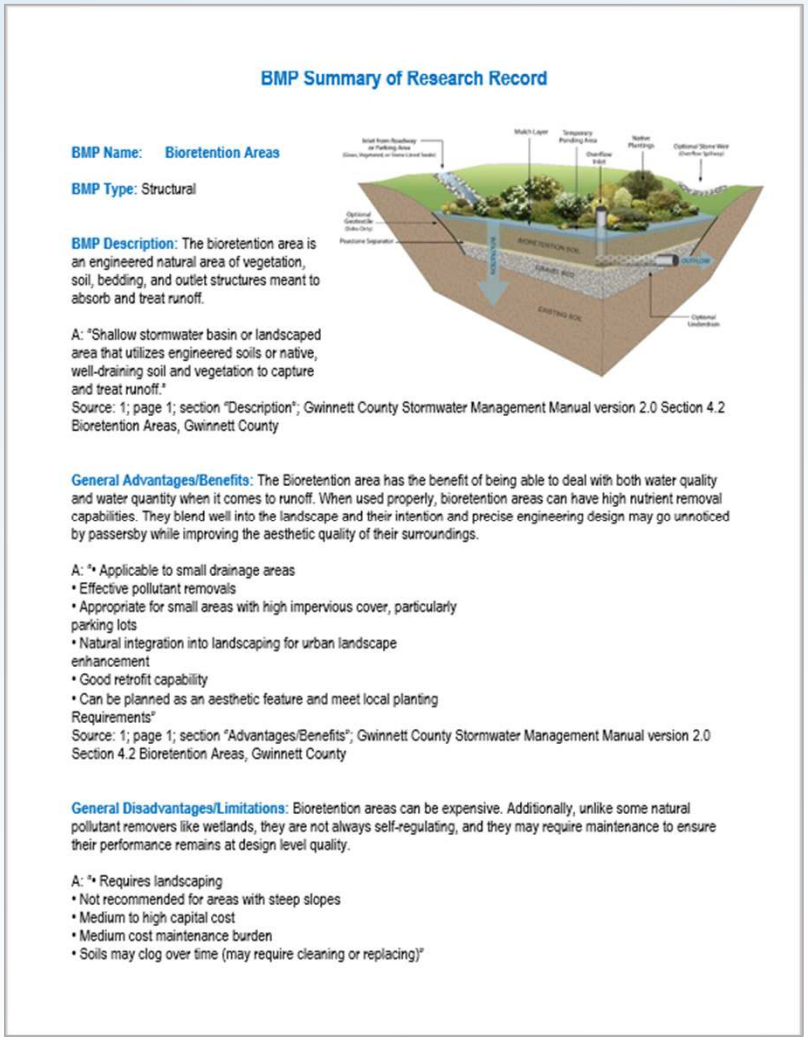
- Review availability of similar tools
- Identify/Inventory Nutrient Management BMPs
- Identify and Define BMP Characterization Criteria
  - *Brainstorming sessions*
  - *Identify differentiating BMP Criteria*
  - *Criteria must reflect desirable management outcomes or priorities*
  - *Clearly define Criteria*
  - *Developed 18 Structural and 13 Non-Structural Criteria*

CHARACTERIZATION CRITERIA
Minimize Capital Cost
Minimize Annual Maintenance Cost
*Maximize Removal Efficiency – P**
*Maximize Removal Efficiency – N**
*Maximize Watershed Reach**
Maximize Effective Useful Life
Maximize Assessment Effectiveness/Availability (AEA)
Minimize Implementation/Installation Complexity
Minimize Maintenance Complexity
*Minimize Real Estate Footprint**
Maximize Circumstances Where BMP can be Used (Flexibility)
Minimize Nuisance Potential
Maximize Aesthetic Enhancement
*Maximize Runoff Reduction Capability**
Maximize Community Engagement
Maximize Educational Opportunities
Maximize Available SWU Fee Credit
Maximize SWU Fee Credit Ease of Administration

**Excluded from Non-Structural BMP assessments*

PROJECT APPROACH

- Literature Review: Document and Summarize available research
  - *Summary of Research Record Template*
  - *Documented research results*
  - *Indexed source material*
  - *Scoring justification*



BMP Summary of Research Record

BMP Name: **Bioretention Areas**

BMP Type: Structural

BMP Description: The bioretention area is an engineered natural area of vegetation, soil, bedding, and outlet structures meant to absorb and treat runoff.

A: "Shallow stormwater basin or landscaped area that utilizes engineered soils or native, well-draining soil and vegetation to capture and treat runoff."
Source: 1; page 1; section "Description"; Gwinnett County Stormwater Management Manual version 2.0 Section 4.2 Bioretention Areas, Gwinnett County

General Advantages/Benefits: The Bioretention area has the benefit of being able to deal with both water quality and water quantity when it comes to runoff. When used properly, bioretention areas can have high nutrient removal capabilities. They blend well into the landscape and their intention and precise engineering design may go unnoticed by passersby while improving the aesthetic quality of their surroundings.

A: "• Applicable to small drainage areas
• Effective pollutant removals
• Appropriate for small areas with high impervious cover, particularly parking lots
• Natural integration into landscaping for urban landscape enhancement
• Good retrofit capability
• Can be planned as an aesthetic feature and meet local planting Requirements"
Source: 1; page 1; section "Advantages/Benefits"; Gwinnett County Stormwater Management Manual version 2.0 Section 4.2 Bioretention Areas, Gwinnett County

General Disadvantages/Limitations: Bioretention areas can be expensive. Additionally, unlike some natural pollutant removers like wetlands, they are not always self-regulating, and they may require maintenance to ensure their performance remains at design level quality.

A: "• Requires landscaping
• Not recommended for areas with steep slopes
• Medium to high capital cost
• Medium cost maintenance burden
• Soils may clog over time (may require cleaning or replacing)"

Gwinnett Water Resources

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PROJECT APPROACH

- Literature Review: Document and Summarize available research
  - *To manage budget we developed Tier 1 and 2 BMP's*
  - *Researched 13 Structural and 12 Non-Structural BMPs*

Structural BMP Scores

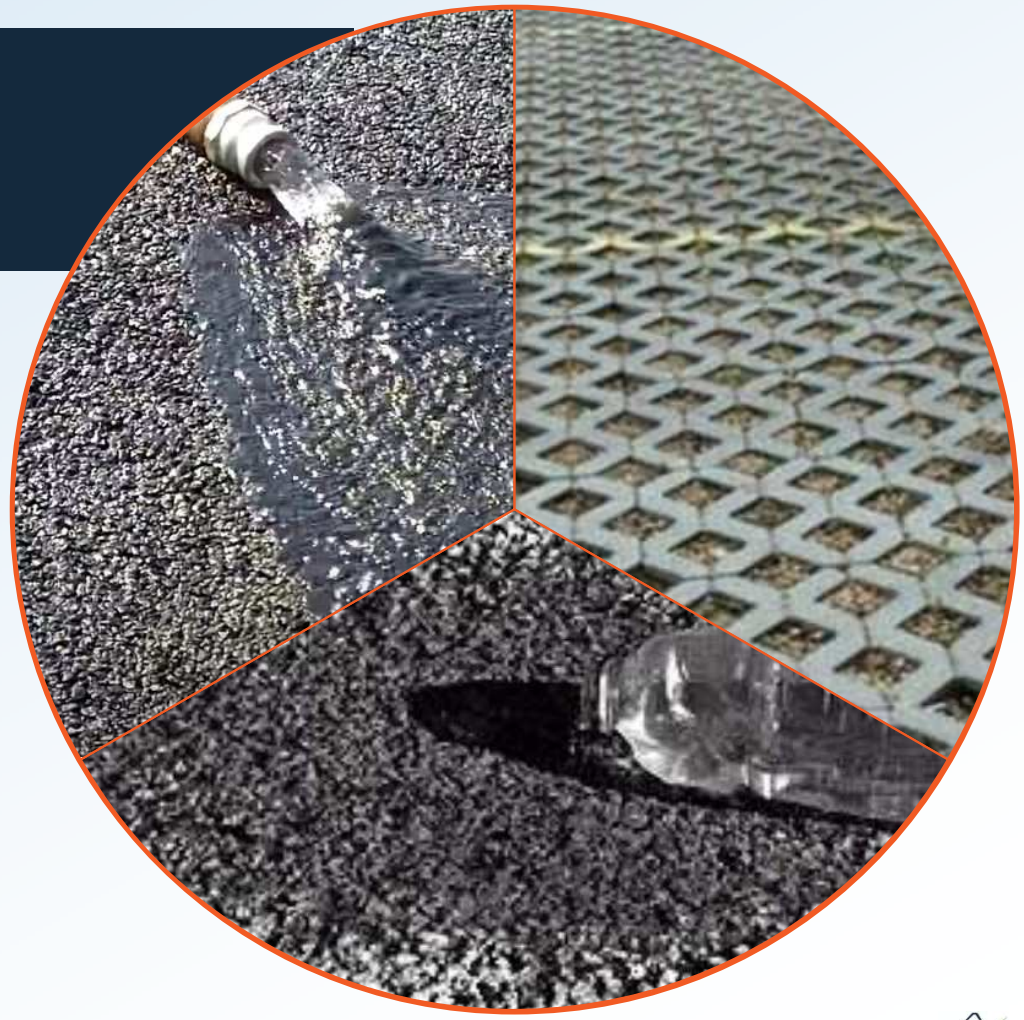
- Bioretention
- Bioslopes
- Downspout Disconnect
- Dry Wells
- Dry-Extended Detention Basins
- Dry-Wet Enhanced Swales
- Grass Channels
- Gravity Oil-Grit Separator
- Infiltration Trench
- Pervious Surface Systems
- Stormwater Ponds
- Stormwater Wetlands
- Vegetated Filter Strip

Non-Structural BMP Scores

- Catch Basin-Pipe Cleaning
- Dog Waste Collection
- Dry Weather Screening
- HHW Program
- Hotspot Identification
- Illicit Discharge Enforcement
- Lawn-Garden Management Education
- Nutrient Management Grants
- Septic System Inspection
- Septic Tank Pumping Education
- Storm Drain Stenciling
- Street Sweeping Program

PROJECT APPROACH

- Literature Review: Document and Summarize available research
  - *Focused on post-construction practices*
  - *Some structural BMP types were combined to simplify*
  - *Source data: journal articles, reports, and other online materials*
  - *Each BMP was researched and scored*
  - *Researched 2 BMPs, refined methods, then extended to others*



Gwinnett Water Resources

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PROJECT APPROACH

- Develop Scoring, Weighting, and Ranking Methodology
  - *Scoring:*
    - Standardized 1-5 scoring for each criteria
    - Higher score = more desirable
    - Aligned Upper and Lower Limits of Scores to data ranges

Annual Maintenance Cost

Definition:
Annual maintenance cost expressed as a percentage of construction cost.

Approach:
Literature was reviewed and sources were identified that had assessed the maintenance cost of BMPs as a percent of construction cost. This is a relatively common way to express these costs.

Assumptions:
1 Low annual maintenance cost is more desirable than high annual maintenance cost

Scoring
1 12-14% of construction cost
2 9-11% of construction cost
3 6-8% of construction cost
4 3-5% of construction cost
5 0-2% of construction cost

PROJECT APPROACH

- Develop Scoring, Weighting, and Ranking Methodology
  - *Scoring:*
    - Some scoring: hard researched numbers
    - Other scoring: Professional Judgement - Judgement Based Criteria

Implementation/Installation Complexity (Bioretention):

Installation/Implementation Complexity Criteria	Points	Justification
1) Is specialized knowledge required;	1	Understanding of filter media and construction practices to avoid site compaction.
2) Do different conditions require adjustments to implementation/installation approach that could only be obtained through experience;	1	Different soils and other site conditions may dictate how this BMP is used.
3) Is cost a significantly limiting factor?	1	"Medium-High" in the GCSMM
4) Is the approach likely to receive resistance from citizen/business/political representatives?		People like to see Bioretention Cells.
Total Points	3	

PROJECT APPROACH

- Develop Scoring, Weighting, and Ranking Methodology
  - *Scoring:*
    - Performed diversity analysis to recalibrate score ranges
      - *Removed questions that did not contribute to diversification*

Installation/Implementation Complexity Criteria	Points	Justification
1) Is specialized equipment required;		
2) Is specialized knowledge required;		
3) Do different conditions require adjustments to implementation/installation approach that could only be obtained through experience;		
4) is specialized licensing or permitting required;		
5) Are there difficult administrative barriers to overcome;		
6) Are there difficult institutional/jurisdictional barriers to overcome;		
7) Is cost a significantly limiting factor?		
8) Is the approach likely to receive resistance from citizen/business/political representatives?		
9) Does the practice have "difficult to overcome" regulatory restrictions?		
10) Does the practice create significant liability for the County?		
Total Points		

Before

Implementation/Installation Complexity (Bioretention):

Installation/Implementation Complexity Criteria	Points	Justification
1) Is specialized knowledge required;	1	Understanding of filter media and construction practices to avoid site compaction.
2) Do different conditions require adjustments to implementation/installation approach that could only be obtained through experience;	1	Different soils and other site conditions may dictate how this BMP is used.
3) Is cost a significantly limiting factor?	1	"Medium-High" in the GCSMM
4) Is the approach likely to receive resistance from citizen/business/political representatives?		People like to see Bioretention Cells.
Total Points	3	

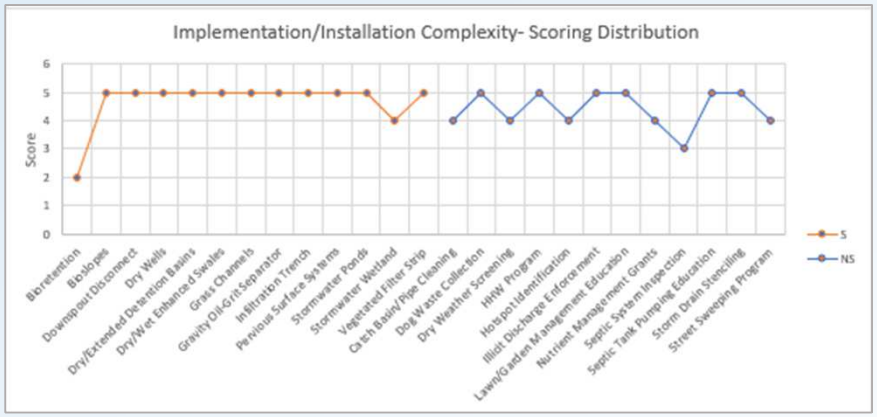
After

Gwinnett Water Resources

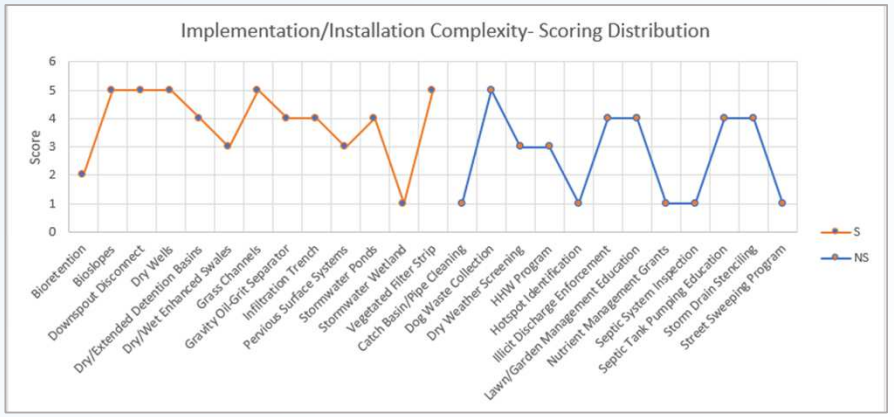
ARDURRA

PROJECT APPROACH

- Develop Scoring, Weighting, and Ranking Methodology
  - *Scoring:*
    - Compare before and after



Before

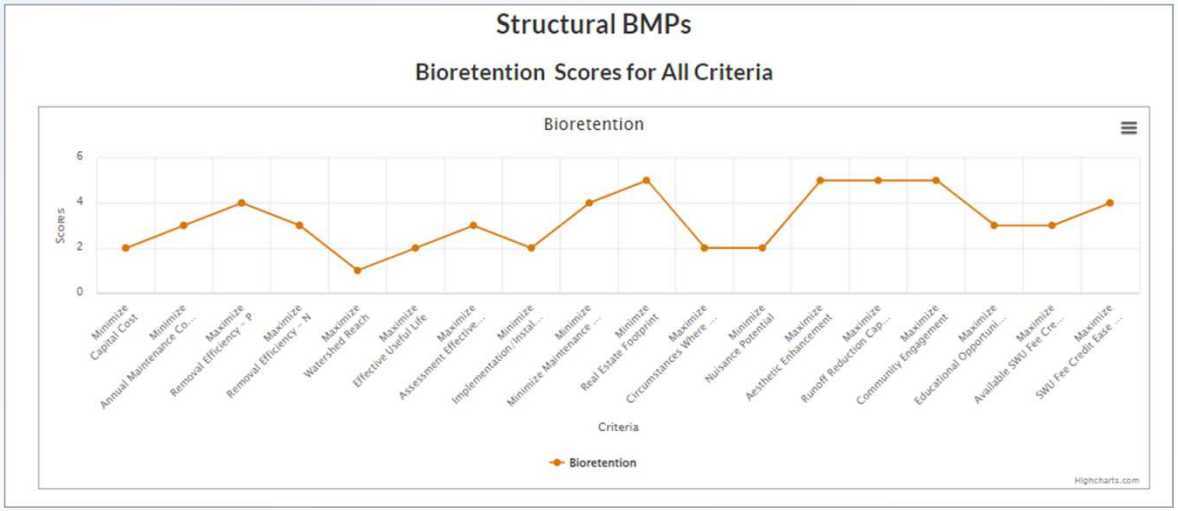


After

PROJECT APPROACH

Characterization Criteria	Scoring Guide	Bioretention	Bioslopes
Minimize Capital Cost	1(High), 2(Med-High), 3 (Med), 4 (Med-Low), 5 (Low)	2	3
Minimize Annual Maintenance Cost	1 (12-14), 2(9-11), 3 (6-8), 4 (3-5), 5 (0-2)	3	5
Maximize Removal Efficiency - P	1 (<20), 2 (21-40), 3(41-60), 4 (61-80), 5 (>81)	4	4
Maximize Removal Efficiency - N	1 (<20), 2 (21-40), 3(41-60), 4 (61-80), 5 (>81)	3	2
Maximize Watershed Reach	1 (<20), 2 (21-40), 3(41-60), 4 (61-80), 5 (>81)	1	1
Maximize Effective Useful Life	1 (10-18), 2 (19-26), 3(27-34), 4 (35-42), 5 (43-50)	2	2
Maximize Assessment Effectiveness/Availability (AEA)	1 (4-6), 2 (7-9), 3(10-12), 4 (13-15), 5 (16-18)	3	3
Minimize Implementation/Installation Complexity	1 (4), 2 (3), 3(2), 4 (1), 5 (0)	2	5
Minimize Maintenance Complexity	1 (N/A), 2 (3), 3(2), 4 (1), 5 (0)	4	5
Minimze Real Estate Footprint	1 (45-55), 2 (34-44), 3(23-33), 4 (12-22), 5 (0-11)	5	5
Maximize Circumstances Where BMP can be Used (Flexibility)	1 (1-2), 2 (3), 3(4), 4 (5), 5 (6)	2	2
Minimize Nuisance Potential	1 (8), 2 (6-7), 3(4-5), 4 (2-3), 5 (0-1)	2	4
Maximize Aesthetic Enhancement	1 (N/A) 2 (0), 3(1), 4 (2), 5 (3)	5	2
Maximize Runoff Reduction Capability	1 (0-19), 2 (20-39), 3(40-59), 4 (60-79), 5 (80-100)	5	2
Maximize Community Engagement	1 (0), 2 (1), 3(2), 4 (3), 5 (4)	5	2
Maximize Educational Opportunities	1 (not intrinsic) , 3 (can be), 5 (intrinsic)	3	1
Maximize Available SWU Fee Credit	1 (5-11), 2 (12-18), 3(19-25), 4 (26-32), 5 (33-40)	3	2
Maximize SWU Fee Credit Ease of Administration	1 (3), 2 (4-5), 3(6-7), 4 (8-9), 5 (10)	4	4

- Develop Scoring, Weighting, and Ranking Methodology
  - *Scoring:*
    - Criteria were scored for each BMP type
    - Outcome: Unique BMP "fingerprint"



Gwinnett Water Resources

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PROJECT APPROACH

- Develop Scoring, Weighting, and Ranking Methodology
  - *Weighting:*
    - 5 Priority weightings were assigned
      - *Priority 1: 10*
      - *Priority 2: 7*
      - *Priority 3: 5*
      - *Priority 4: 3*
      - *Priority 5: 1*
    - BMP Score:
      - *BMP Criteria Score x Priority Weighting*

	Bioretention				
Criteria	Priority 1	Priority 2	Priority 3	Priority 4	Priority 5
Minimize Capital Cost	20	14	10	6	2
Minimize Annual Maintenance Cost	30	21	15	9	3
Maximize Removal Efficiency - P	40	28	20	12	4
Maximize Removal Efficiency - N	30	21	15	9	3
Maximize Watershed Reach	10	7	5	3	1
Maximize Effective Useful Life	20	14	10	6	2
Maximize Assessment Effectiveness/Availability (AEA)	30	21	15	9	3
Minimize Implementation/Installation Complexity	20	14	10	6	2
Minimize Maintenance Complexity	40	28	20	12	4
Minimze Real Estate Footprint	50	35	25	15	5
Maximize Circumstances Where BMP can be Used (Flexibility)	20	14	10	6	2
Minimize Nuisance Potential	20	14	10	6	2
Maximize Aesthetic Enhancement	50	35	25	15	5
Maximize Runoff Reduction Capability	50	35	25	15	5
Maximize Community Engagement	50	35	25	15	5
Maximize Educational Opportunities	30	21	15	9	3
Maximize Available SWU Fee Credit	30	21	15	9	3
Maximize SWU Fee Credit Ease of Administration	40	28	20	12	4
Score	74				

PROJECT APPROACH

- Develop Scoring, Weighting, and Ranking Methodology
  - *Ranking:*
    - For the selected array of Priority Criteria:
      - *Scores for each BMP are Summed*
      - *Rank scores*
      - *Tool presents highest ranking BMPs for selected priority criteria*

BMP Selection Results

BMP Type

- Structural BMPs

Selected Priority Criteria

1. Minimize Capital Cost
2. Maximize Community Engagement
3. Maximize Watershed Reach
4. Minimize Maintenance Complexity
5. Maximize Effective Useful Life

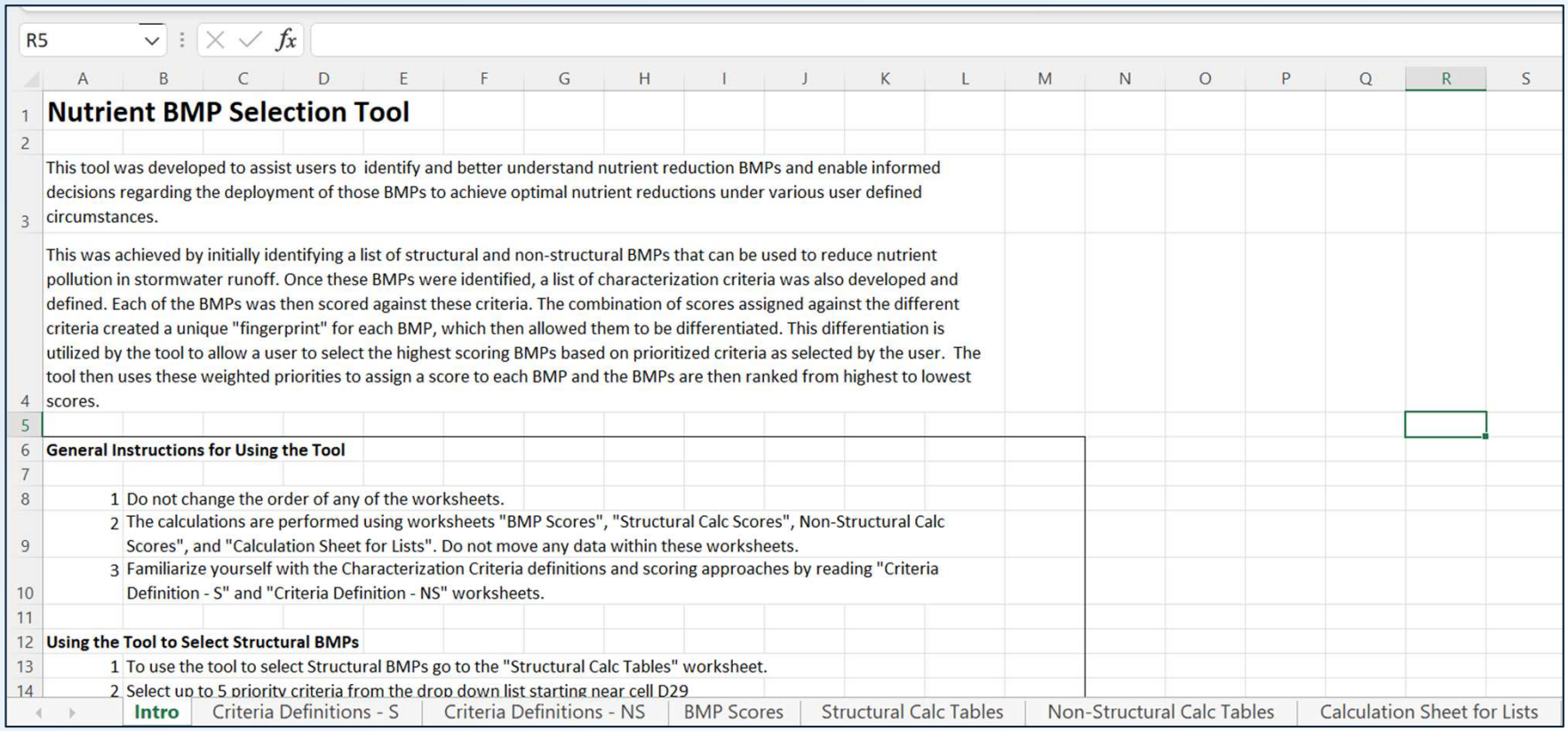
Highest Scoring BMPs

BMP	Score
Stormwater Ponds	104
Dry-Extended Detention Basins	100
Stormwater Wetlands	98
Grass Channels	89
Dry-Wet Enhanced Swales	87
Vegetated Filter Strip	85
Downspout Disconnect	79
Bioretention	74
Bioslopes	66
Dry Wells	60
Pervious Surface Systems	43
Gravity Oil-Grit Separator	40
Infiltration Trench	39

PROJECT APPROACH

- Under the Hood: A look at the tool
  - *Excel Format*
    - Instructions
    - Criteria Definitions
    - Recorded BMP Scores
    - Calculation Tables
  - *Web Based Format*
    - More user friendly
    - Same results as Excel Spreadsheet tool
    - Additional functionality:
      - *Supporting documents*
      - *Printable Reports*
      - *Fingerprint Graphs*

ARDURRA Gwinnett Water Resources



Nutrient BMP Selection Tool

This tool was developed to assist users to identify and better understand nutrient reduction BMPs and enable informed decisions regarding the deployment of those BMPs to achieve optimal nutrient reductions under various user defined circumstances.

This was achieved by initially identifying a list of structural and non-structural BMPs that can be used to reduce nutrient pollution in stormwater runoff. Once these BMPs were identified, a list of characterization criteria was also developed and defined. Each of the BMPs was then scored against these criteria. The combination of scores assigned against the different criteria created a unique "fingerprint" for each BMP, which then allowed them to be differentiated. This differentiation is utilized by the tool to allow a user to select the highest scoring BMPs based on prioritized criteria as selected by the user. The tool then uses these weighted priorities to assign a score to each BMP and the BMPs are then ranked from highest to lowest scores.

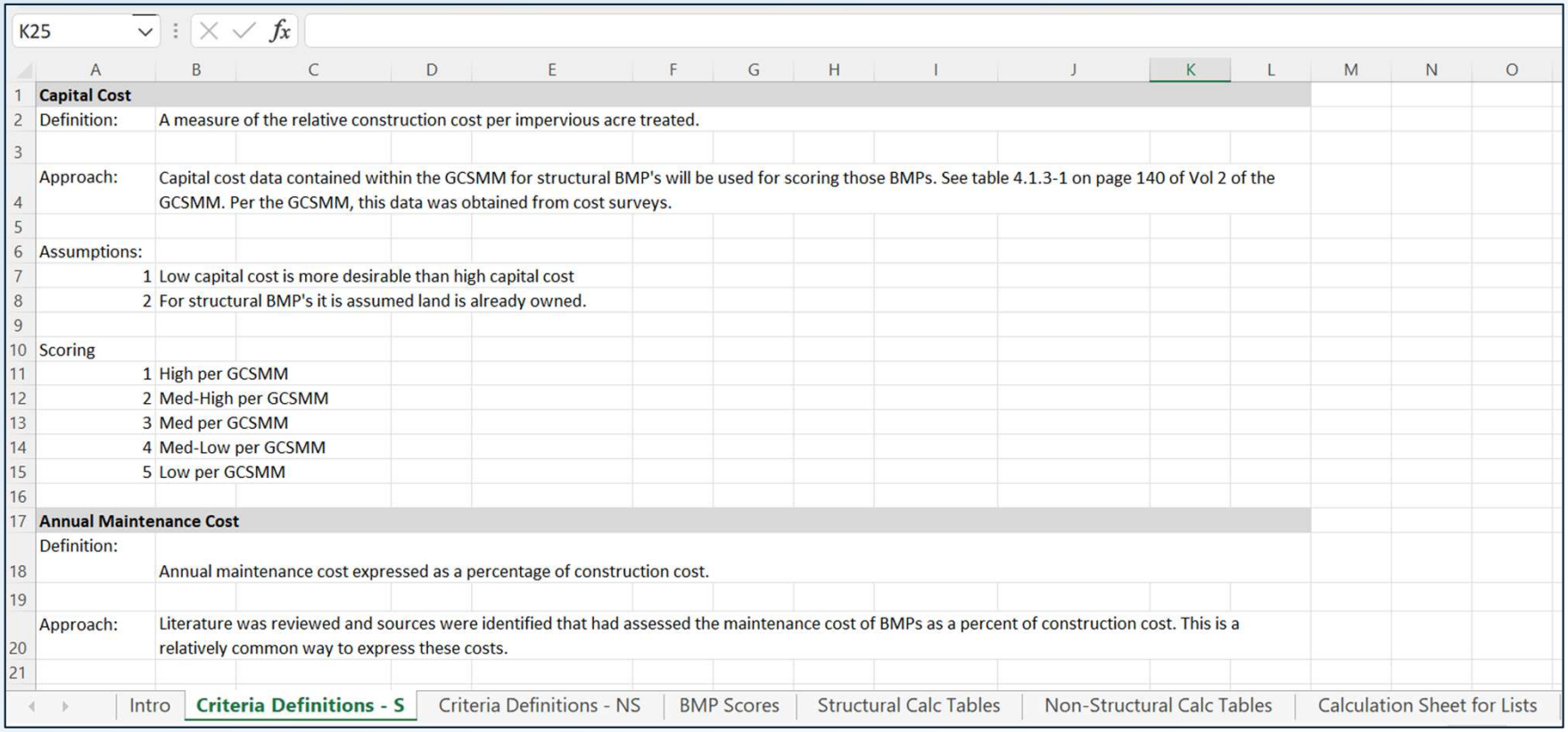
General Instructions for Using the Tool

1. Do not change the order of any of the worksheets.
2. The calculations are performed using worksheets "BMP Scores", "Structural Calc Scores", Non-Structural Calc Scores", and "Calculation Sheet for Lists". Do not move any data within these worksheets.
3. Familiarize yourself with the Characterization Criteria definitions and scoring approaches by reading "Criteria Definition - S" and "Criteria Definition - NS" worksheets.

Using the Tool to Select Structural BMPs

1. To use the tool to select Structural BMPs go to the "Structural Calc Tables" worksheet.
2. Select up to 5 priority criteria from the drop down list starting near cell D29

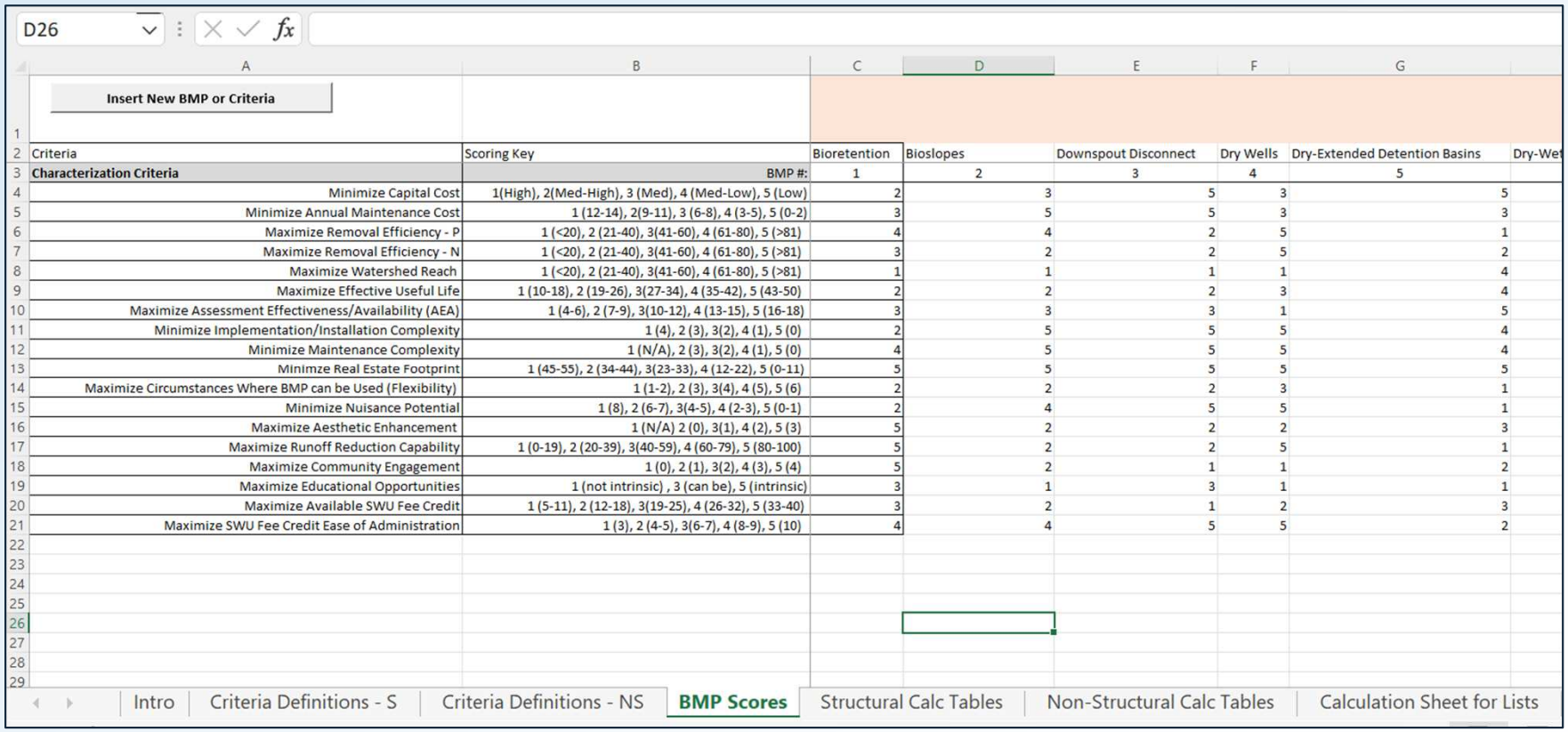
Intro | Criteria Definitions - S | Criteria Definitions - NS | BMP Scores | Structural Calc Tables | Non-Structural Calc Tables | Calculation Sheet for Lists



K25

	A	B	C
1	**Capital Cost**		
2	Definition:	A measure of the relative construction cost per impervious acre treated.	
3			
4	Approach:	Capital cost data contained within the GCSMM for structural BMP's will be used for scoring those BMPs. See table 4.1.3-1 on page 140 of Vol 2 of the GCSMM. Per the GCSMM, this data was obtained from cost surveys.	
5			
6	Assumptions:		
7	1	Low capital cost is more desirable than high capital cost	
8	2	For structural BMP's it is assumed land is already owned.	
9			
10	Scoring		
11	1	High per GCSMM	
12	2	Med-High per GCSMM	
13	3	Med per GCSMM	
14	4	Med-Low per GCSMM	
15	5	Low per GCSMM	
16			
17	**Annual Maintenance Cost**		
18	Definition:	Annual maintenance cost expressed as a percentage of construction cost.	
19			
20	Approach:	Literature was reviewed and sources were identified that had assessed the maintenance cost of BMPs as a percent of construction cost. This is a relatively common way to express these costs.	
21			

Intro | **Criteria Definitions - S** | Criteria Definitions - NS | BMP Scores | Structural Calc Tables | Non-Structural Calc Tables | Calculation Sheet for Lists

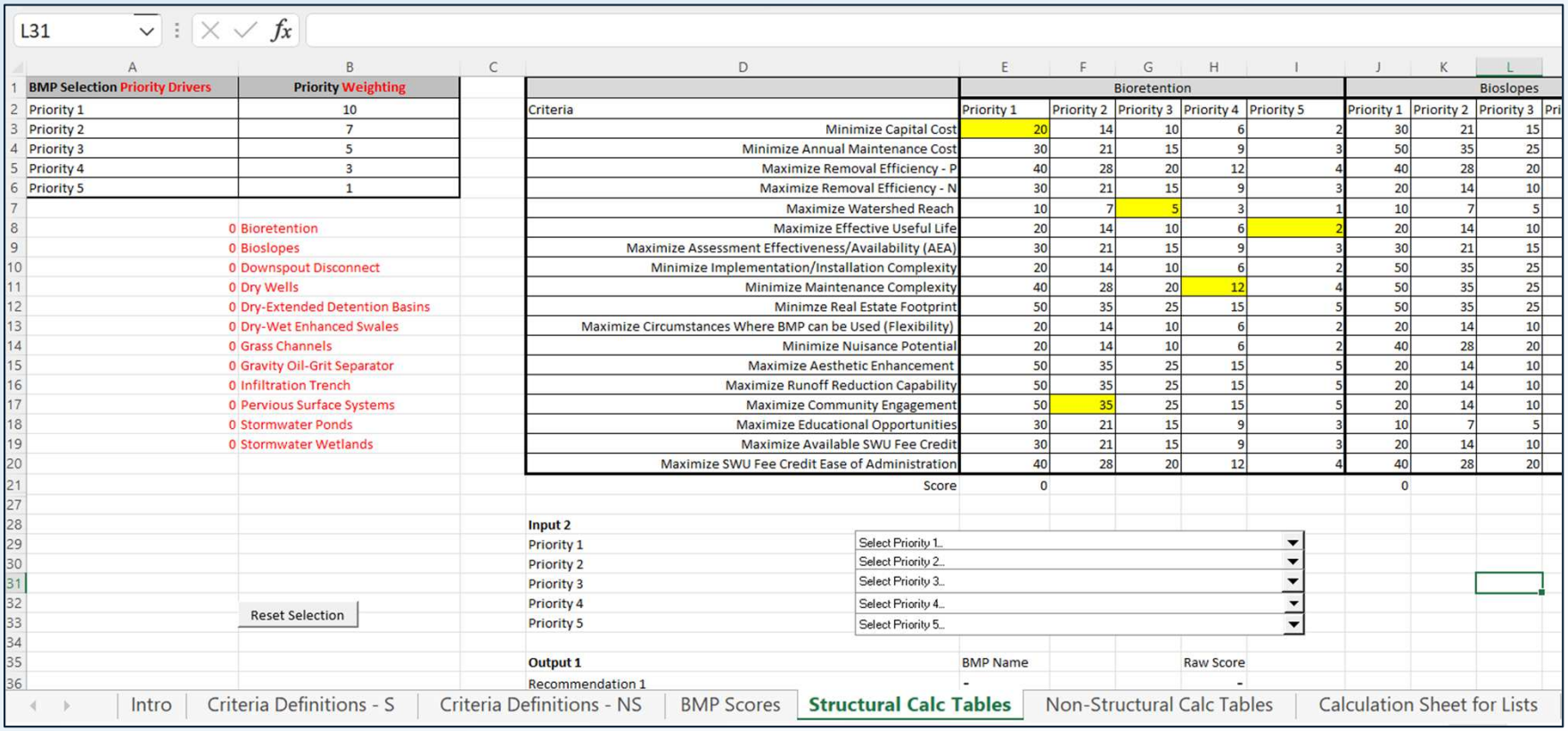


D26

Insert New BMP or Criteria

Criteria	Scoring Key	Bioretention	Bioslopes	Downspout Disconnect	Dry Wells	Dry-Extended Detention Basins	Dry-Wet
Characterization Criteria	BMP #:	1	2	3	4	5	
Minimize Capital Cost	1(High), 2(Med-High), 3 (Med), 4 (Med-Low), 5 (Low)	2	3	5	3	5	
Minimize Annual Maintenance Cost	1 (12-14), 2(9-11), 3 (6-8), 4 (3-5), 5 (0-2)	3	5	5	3	3	
Maximize Removal Efficiency - P	1 (<20), 2 (21-40), 3(41-60), 4 (61-80), 5 (>81)	4	4	2	5	1	
Maximize Removal Efficiency - N	1 (<20), 2 (21-40), 3(41-60), 4 (61-80), 5 (>81)	3	2	2	5	2	
Maximize Watershed Reach	1 (<20), 2 (21-40), 3(41-60), 4 (61-80), 5 (>81)	1	1	1	1	4	
Maximize Effective Useful Life	1 (10-18), 2 (19-26), 3(27-34), 4 (35-42), 5 (43-50)	2	2	2	3	4	
Maximize Assessment Effectiveness/Availability (AEA)	1 (4-6), 2 (7-9), 3(10-12), 4 (13-15), 5 (16-18)	3	3	3	1	5	
Minimize Implementation/Installation Complexity	1 (4), 2 (3), 3(2), 4 (1), 5 (0)	2	5	5	5	4	
Minimize Maintenance Complexity	1 (N/A), 2 (3), 3(2), 4 (1), 5 (0)	4	5	5	5	4	
Minimze Real Estate Footprint	1 (45-55), 2 (34-44), 3(23-33), 4 (12-22), 5 (0-11)	5	5	5	5	5	
Maximize Circumstances Where BMP can be Used (Flexibility)	1 (1-2), 2 (3), 3(4), 4 (5), 5 (6)	2	2	2	3	1	
Minimize Nuisance Potential	1 (8), 2 (6-7), 3(4-5), 4 (2-3), 5 (0-1)	2	4	5	5	1	
Maximize Aesthetic Enhancement	1 (N/A) 2 (0), 3(1), 4 (2), 5 (3)	5	2	2	2	3	
Maximize Runoff Reduction Capability	1 (0-19), 2 (20-39), 3(40-59), 4 (60-79), 5 (80-100)	5	2	2	5	1	
Maximize Community Engagement	1 (0), 2 (1), 3(2), 4 (3), 5 (4)	5	2	1	1	2	
Maximize Educational Opportunities	1 (not intrinsic) , 3 (can be), 5 (intrinsic)	3	1	3	1	1	
Maximize Available SWU Fee Credit	1 (5-11), 2 (12-18), 3(19-25), 4 (26-32), 5 (33-40)	3	2	1	2	3	
Maximize SWU Fee Credit Ease of Administration	1 (3), 2 (4-5), 3(6-7), 4 (8-9), 5 (10)	4	4	5	5	2	

Intro | Criteria Definitions - S | Criteria Definitions - NS | **BMP Scores** | Structural Calc Tables | Non-Structural Calc Tables | Calculation Sheet for Lists



L31

BMP Selection Priority Drivers	Priority Weighting
Priority 1	10
Priority 2	7
Priority 3	5
Priority 4	3
Priority 5	1

0	Bioretention
0	Bioslopes
0	Downspout Disconnect
0	Dry Wells
0	Dry-Extended Detention Basins
0	Dry-Wet Enhanced Swales
0	Grass Channels
0	Gravity Oil-Grit Separator
0	Infiltration Trench
0	Pervious Surface Systems
0	Stormwater Ponds
0	Stormwater Wetlands

Reset Selection

	Bioretention					Bioslopes			
Criteria	Priority 1	Priority 2	Priority 3	Priority 4	Priority 5	Priority 1	Priority 2	Priority 3	Pri
Minimize Capital Cost	20	14	10	6	2	30	21	15	
Minimize Annual Maintenance Cost	30	21	15	9	3	50	35	25	
Maximize Removal Efficiency - P	40	28	20	12	4	40	28	20	
Maximize Removal Efficiency - N	30	21	15	9	3	20	14	10	
Maximize Watershed Reach	10	7	5	3	1	10	7	5	
Maximize Effective Useful Life	20	14	10	6	2	20	14	10	
Maximize Assessment Effectiveness/Availability (AEA)	30	21	15	9	3	30	21	15	
Minimize Implementation/Installation Complexity	20	14	10	6	2	50	35	25	
Minimize Maintenance Complexity	40	28	20	12	4	50	35	25	
Minimze Real Estate Footprint	50	35	25	15	5	50	35	25	
Maximize Circumstances Where BMP can be Used (Flexibility)	20	14	10	6	2	20	14	10	
Minimize Nuisance Potential	20	14	10	6	2	40	28	20	
Maximize Aesthetic Enhancement	50	35	25	15	5	20	14	10	
Maximize Runoff Reduction Capability	50	35	25	15	5	20	14	10	
Maximize Community Engagement	50	35	25	15	5	20	14	10	
Maximize Educational Opportunities	30	21	15	9	3	10	7	5	
Maximize Available SWU Fee Credit	30	21	15	9	3	20	14	10	
Maximize SWU Fee Credit Ease of Administration	40	28	20	12	4	40	28	20	
Score	0					0			

Input 2

Priority 1	Select Priority 1...
Priority 2	Select Priority 2...
Priority 3	Select Priority 3...
Priority 4	Select Priority 4...
Priority 5	Select Priority 5...

Output 1	BMP Name	Raw Score
Recommendation 1	-	-

Intro | Criteria Definitions - S | Criteria Definitions - NS | BMP Scores | **Structural Calc Tables** | Non-Structural Calc Tables | Calculation Sheet for Lists

Gwinnett Water Resources

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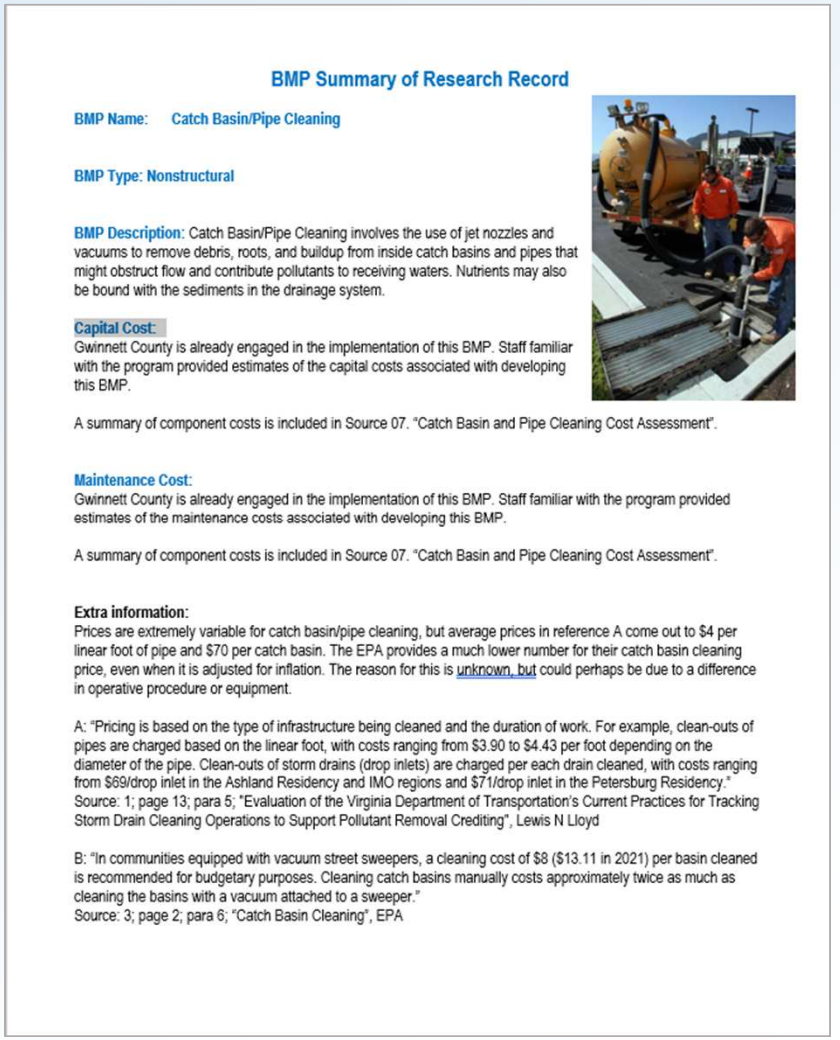
PROJECT DELIVERABLES

- Criteria Definitions
- Nutrient Reduction BMP inventory
- Characterized BMPs
- "Summary of Research" Documents
- Spreadsheet Tool
- Website tool



BMP Summary of Research Record

BMP Name: Catch Basin/Pipe Cleaning

BMP Type: Nonstructural

BMP Description: Catch Basin/Pipe Cleaning involves the use of jet nozzles and vacuums to remove debris, roots, and buildup from inside catch basins and pipes that might obstruct flow and contribute pollutants to receiving waters. Nutrients may also be bound with the sediments in the drainage system.

Capital Cost:
Gwinnett County is already engaged in the implementation of this BMP. Staff familiar with the program provided estimates of the capital costs associated with developing this BMP.

A summary of component costs is included in Source 07. "Catch Basin and Pipe Cleaning Cost Assessment".

Maintenance Cost:
Gwinnett County is already engaged in the implementation of this BMP. Staff familiar with the program provided estimates of the maintenance costs associated with developing this BMP.

A summary of component costs is included in Source 07. "Catch Basin and Pipe Cleaning Cost Assessment".

Extra information:
Prices are extremely variable for catch basin/pipe cleaning, but average prices in reference A come out to $4 per linear foot of pipe and $70 per catch basin. The EPA provides a much lower number for their catch basin cleaning price, even when it is adjusted for inflation. The reason for this is unknown, but could perhaps be due to a difference in operative procedure or equipment.

A: "Pricing is based on the type of infrastructure being cleaned and the duration of work. For example, clean-outs of pipes are charged based on the linear foot, with costs ranging from $3.90 to $4.43 per foot depending on the diameter of the pipe. Clean-outs of storm drains (drop inlets) are charged per each drain cleaned, with costs ranging from $69/drop inlet in the Ashland Residency and IMO regions and $71/drop inlet in the Petersburg Residency."
Source: 1; page 13; para 5; "Evaluation of the Virginia Department of Transportation's Current Practices for Tracking Storm Drain Cleaning Operations to Support Pollutant Removal Crediting", Lewis N Lloyd

B: "In communities equipped with vacuum street sweepers, a cleaning cost of $8 ($13.11 in 2021) per basin cleaned is recommended for budgetary purposes. Cleaning catch basins manually costs approximately twice as much as cleaning the basins with a vacuum attached to a sweeper."
Source: 3; page 2; para 6; "Catch Basin Cleaning", EPA

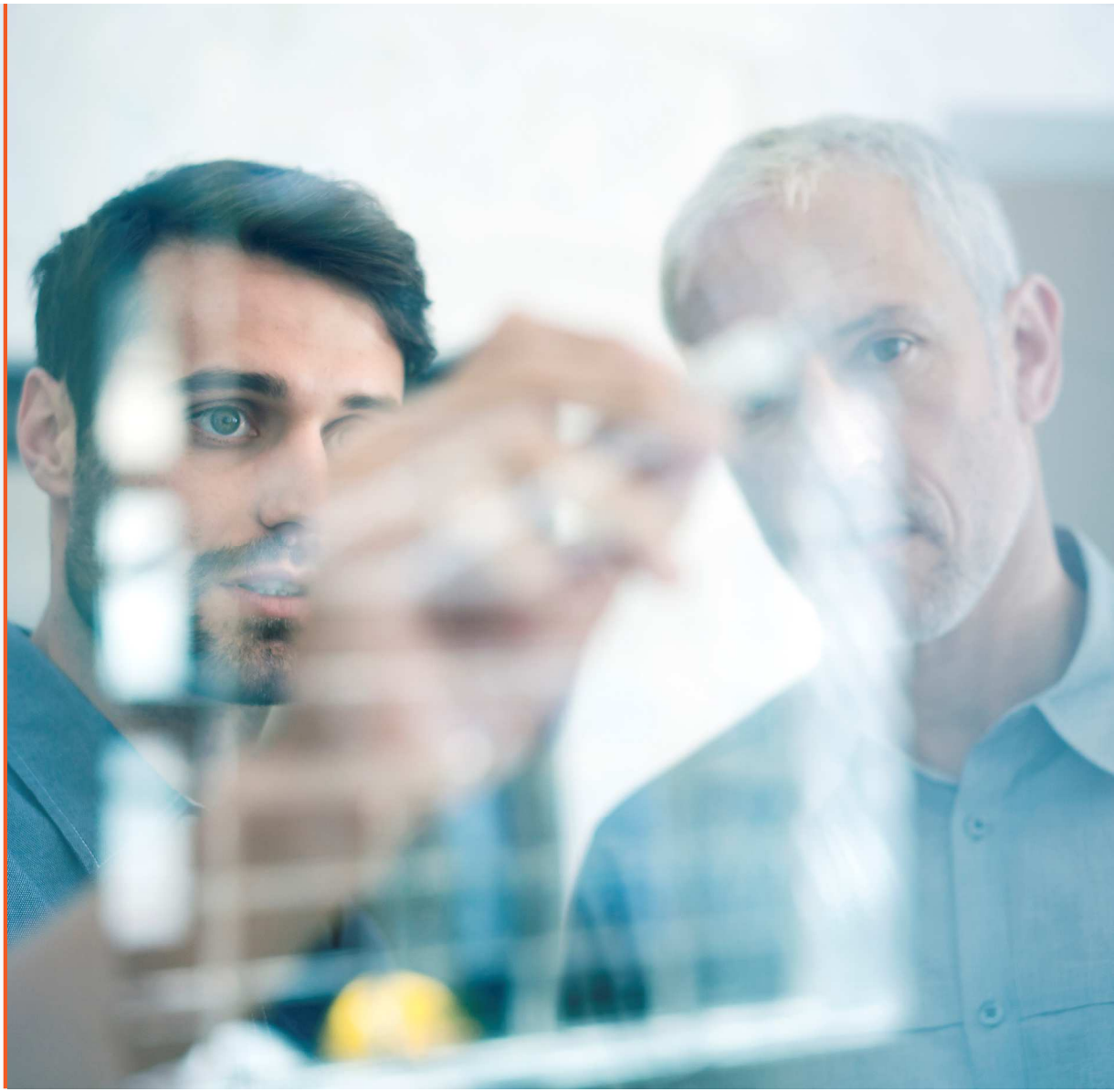
PROJECT CHALLENGES

- Deciding to break up structural v non-structural BMP's within the tool
- Identifying best cost approaches for comparing BMPs
- Finding NS BMP data
- Developing methodologies for scoring some of the criteria
  - *SWU Credit Ease of Administration; when no credit exists*
  - *Assessment of Effectiveness*

ARDURRA Gwinnett Water Resources

LESSONS LEARNED

- Ask for assistance from internal IT early on
- Review IT deliverable requirements with client early on
- Complete scoring of BMPs ASAP after research is completed



ARDURRA Gwinnett Water Resources

TOOL IMPLEMENTATION

Lake Lanier Watershed

- Short list 4 NS BMPs for use in Lake Lanier watershed
- NS BMP Enhancements:
  - *Dog Waste Collection: Develop maintenance program; add dog waste collection stations at veterinary offices*
  - *Lawn and Garden Management: Assess whether soil testing can be provided at no cost to residents to avoid unnecessary fertilization*
- Results will be submitted to GA EPD in response to requirements of the Impaired Water Plan that drove this effort
- Tool has provided simple method to compare BMPs for different management scenarios

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Gwinnett Water Resources

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THANK YOU!

Questions?

BMPSelectionTool.com

User: Guest
Pass: BMP-Tool