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WATER RESOURCES

Georgia's Unified Stormwater Sizing Criteria
The Old, the New, and the Misunderstood

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WATER RESOURCES

The Old

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Traditional Stormwater Management

– Focused on pre- vs. post-development peak flows

– No consideration of volume or timing of runoff from site

– No consideration of water quality

– No consideration of channel impacts

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The Old New

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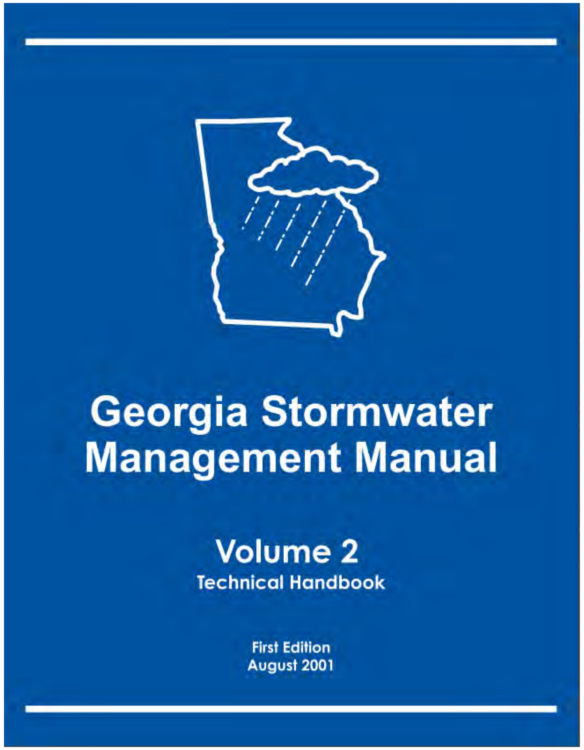
Georgia Stormwater Management Manual 1st Edition (2001)

Purpose:

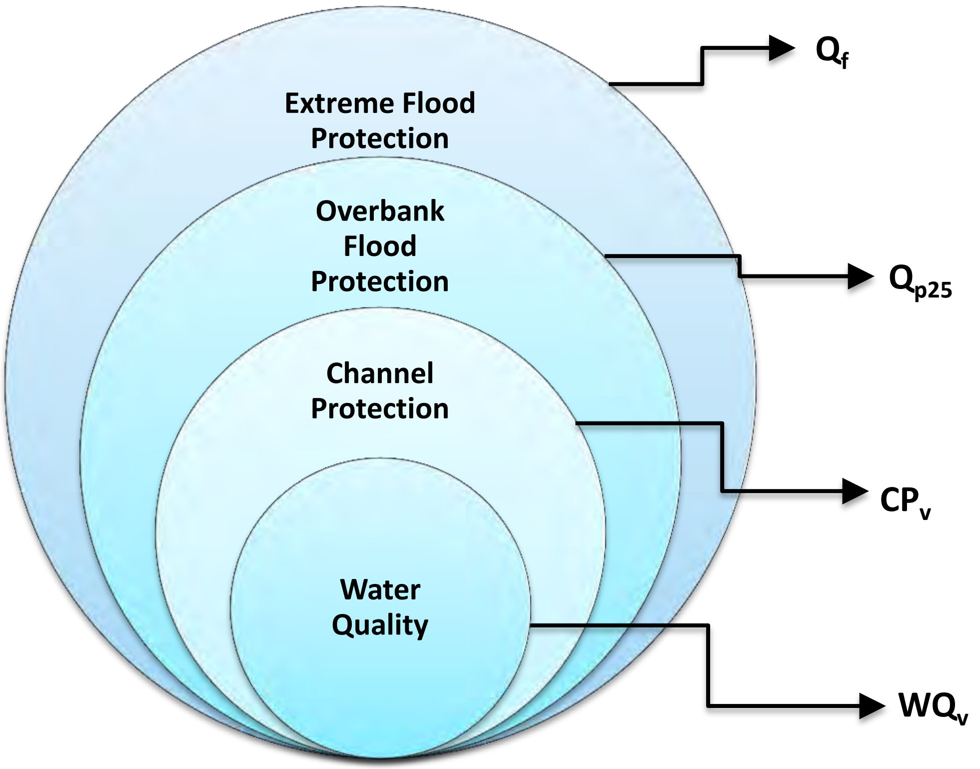
- Provide unified set of design criteria and tools
- Create consistency in design
- Address water quality concerns
- Protect downstream channels
- Address increased runoff quantity from developed areas



Georgia Stormwater Management Manual 1st Edition (2001)

Introduced:

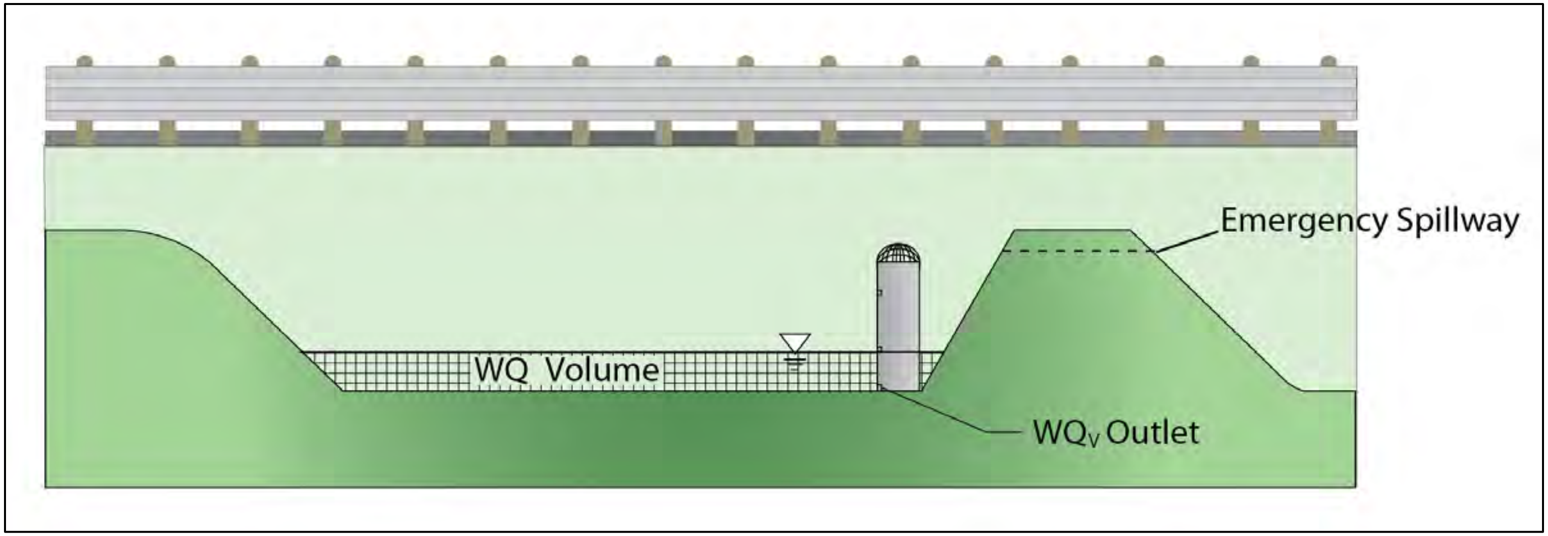
– Unified Sizing Criteria



Unified Sizing Criteria

Water Quality

- Remove 80% of total suspended solids (TSS) from runoff of 1.2” rainfall event
  - 85th percentile storm
  - Treats “first flush”
  - Directly related to impervious cover of basin

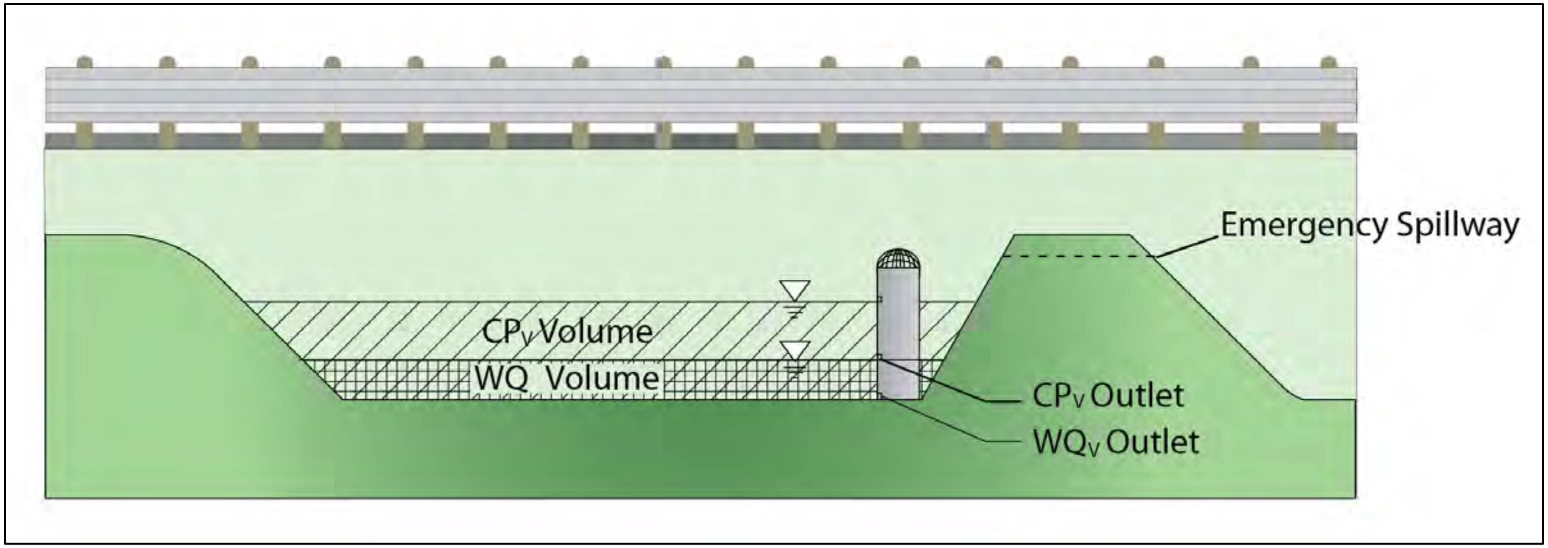


Georgia’s Unified Stormwater Sizing Criteria

Unified Sizing Criteria

Channel Protection

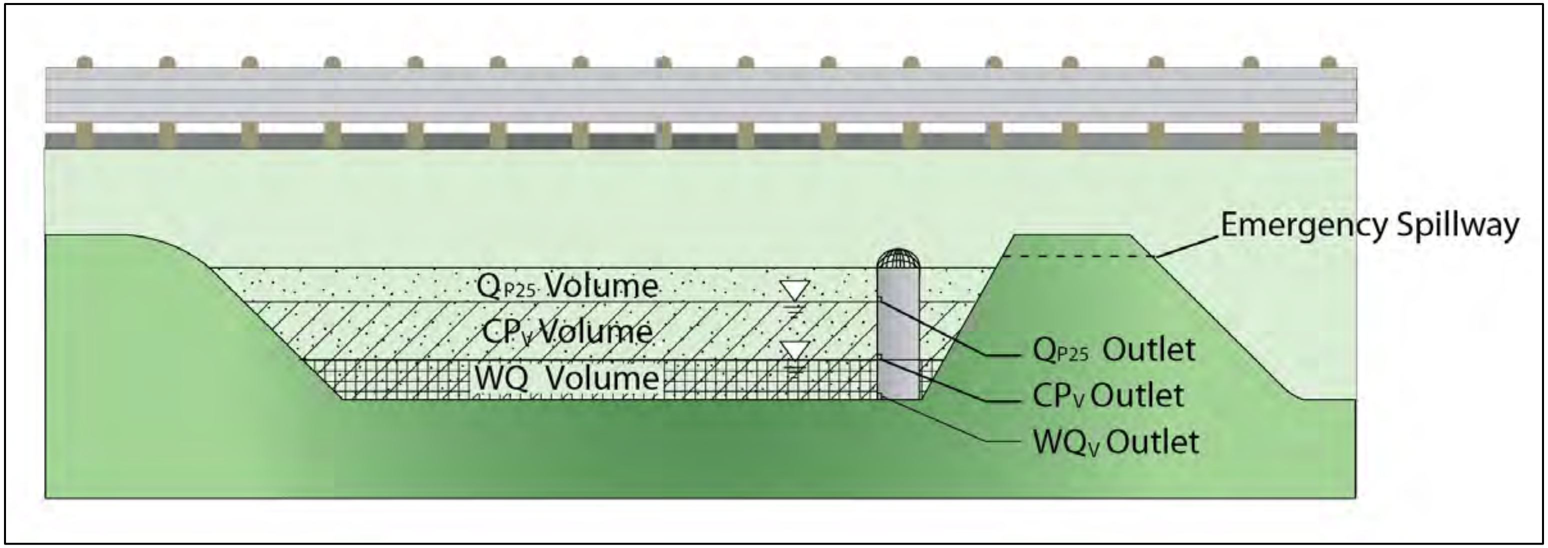
- Detain 1-year 24-hour storm for 24 hours
  - Protects downstream channels
  - Not required for post-development flows <2.0 cfs



Unified Sizing Criteria

Overbank Flood Protection

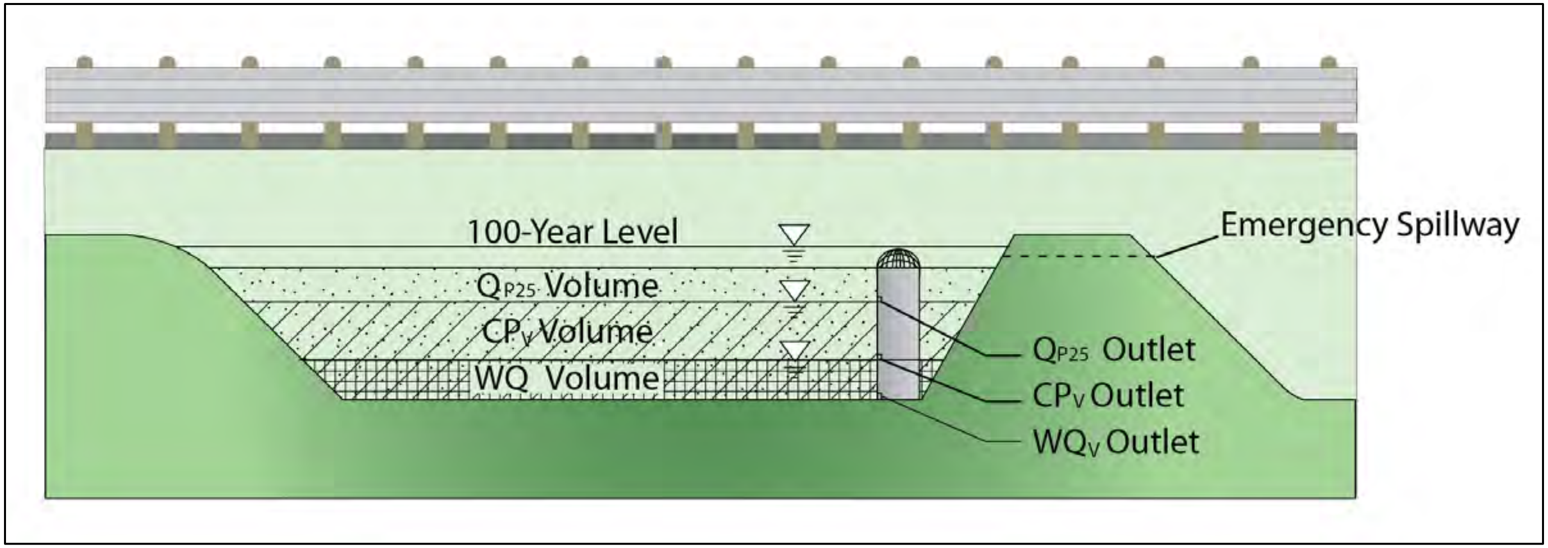
- Detain 25-year 24-hour storm to match pre-developed flow rates
  - Minimizes overbank flooding
  - Larger storms partially controlled through control of Q_{p25} event



Unified Sizing Criteria

Extreme Flood Protection

- Safely convey 100-year storm
- Evaluate the effects on the drainage system and adjacent and downstream property and facilities

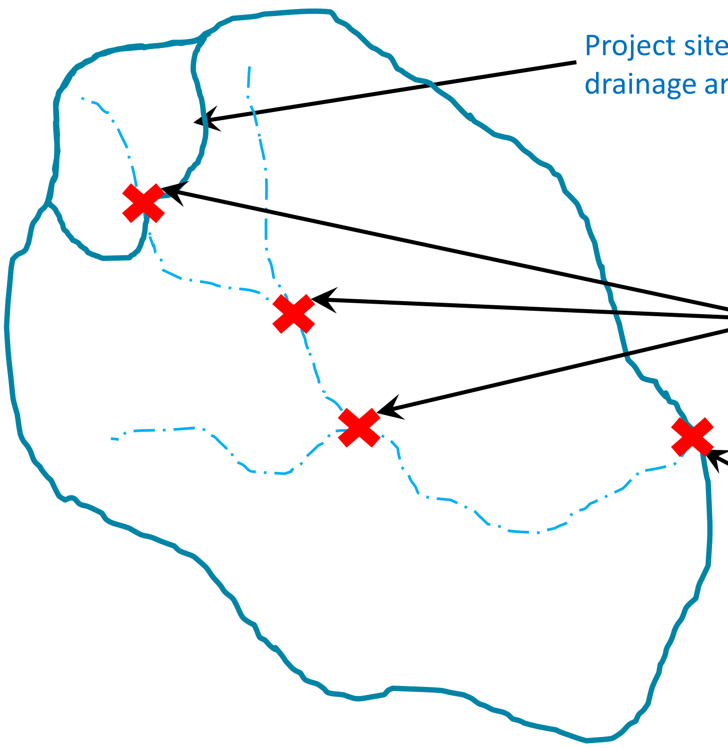


Georgia's Unified Stormwater Sizing Criteria

Georgia Stormwater Management Manual 1st Edition (2001)

Introduced:

– Downstream Analysis



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The New New

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Georgia Stormwater Management Manual 2016 Edition

Purpose:

- Provide comprehensive stormwater management approach
- Revise format for increased ease of use
- Reflect current approaches and technical methods
- Provide additional operations and maintenance information
- Update BMP calculator tool

Georgia Stormwater Management Manual 2016 Edition

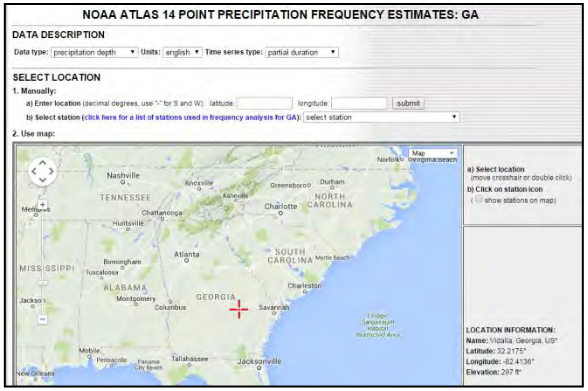
Major Changes:

– Revised Rainfall Reference: NOAA online data

	Rainfall (inches)			
	1-year 24-hour		100-year 24-hour	
City	**GSMM 2001 Static Values**	**GSMM 2016 Dynamic Values**	**GSMM 2001 Static Values**	**GSMM 2016 Dynamic Values**
Rome	3.10	3.31	7.70	7.65
Atlanta	3.30	3.32	7.90	7.75
Macon	3.30	3.27	8.20	8.06
Savannah	3.70	3.71	10.00	10.90

GSMM 2001 data from TP 40 and Hydro-35

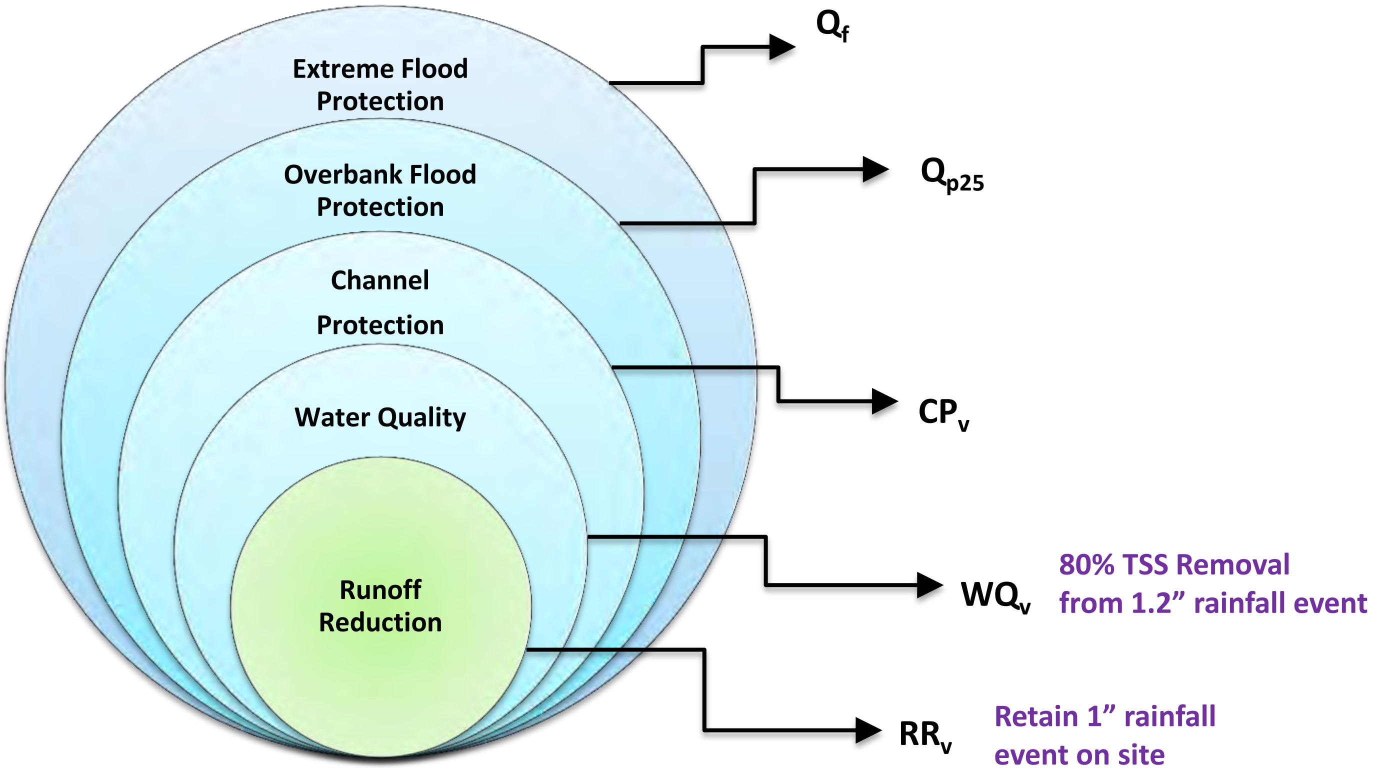
GSMM 2016 data from NOAA Atlas 14



Georgia Stormwater Management Manual 2016 Edition

Major Changes:

– Recommended Runoff Reduction Performance Standard

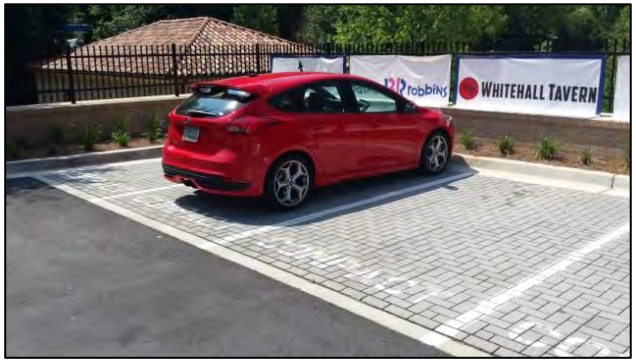


Georgia’s Unified Stormwater Sizing Criteria

Runoff Reduction Methodology

Advantages:

- Reduces post-construction stormwater runoff rates, volumes, and pollutant loads
- Reduces risk of flooding
- Eliminates stormwater runoff (and therefore pollutants contained in it) instead of treating
- Provides economic benefits (jobs, property value increase, etc.)
- Maintains, mimics or replaces landscape hydrologic functions



(Source: City of Atlanta)

Runoff Reduction Methodology

Design Challenges:

– Complex calculations

– Often requires several iterations

– Substantial BMP detailing

– Increased plan review time and resources

$$RR_v = (P)(R_v)(A) / 12$$

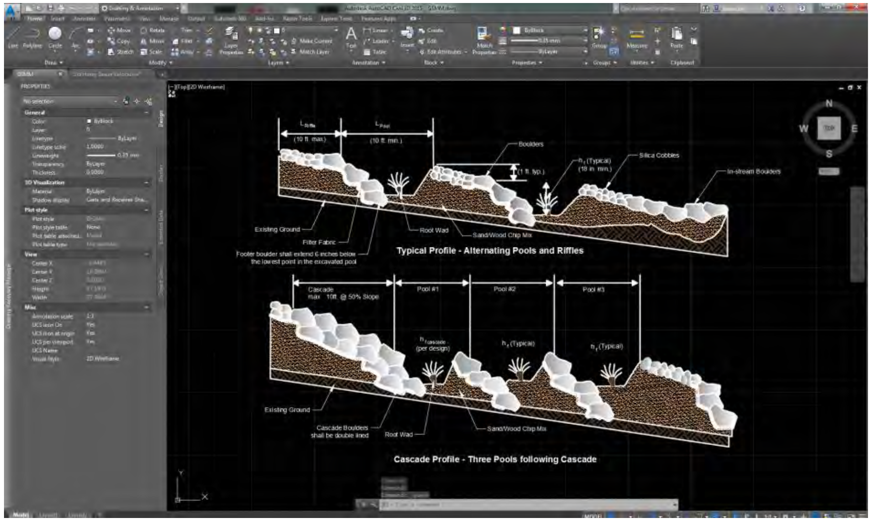
Where:

RR_v = Runoff Reduction Target Volume (ft³)
P = Target runoff reduction rainfall (inches)
R_v = Volumetric runoff coefficient which can be found by:

$$R_v = 0.05 + 0.009(I)$$

Where:

I = new impervious area of the contributing drainage area (%)



Runoff Reduction Methodology

Construction Challenges:

- Limited number of knowledgeable, experienced contractors
- Poor erosion and sediment controls
- Over-compaction of soils
- Incorrect installation of components

Runoff Reduction Methodology

Maintenance Challenges:

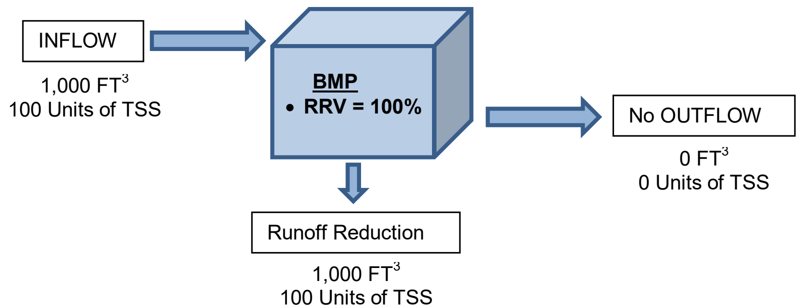
– Most BMPs privately owned

– Complicated maintenance often required

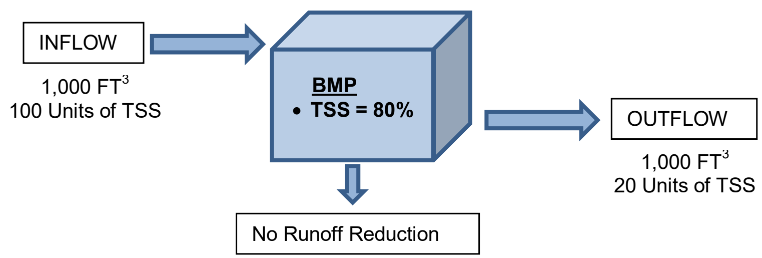
– High maintenance costs

How does Runoff Reduction Differ from Traditional TSS Removal Approach?

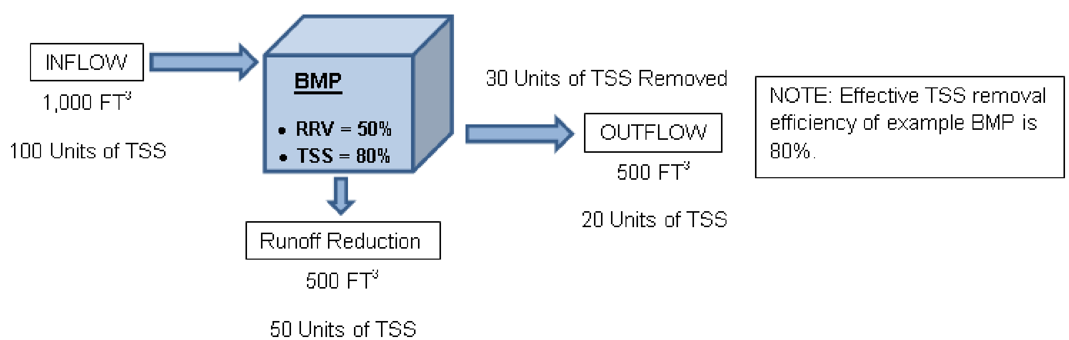
Runoff Reduction Approach



Traditional TSS Removal Approach



Partial Runoff Reduction Approach



Georgia's Unified Stormwater Sizing Criteria

WATER RESOURCES

The Misunderstood

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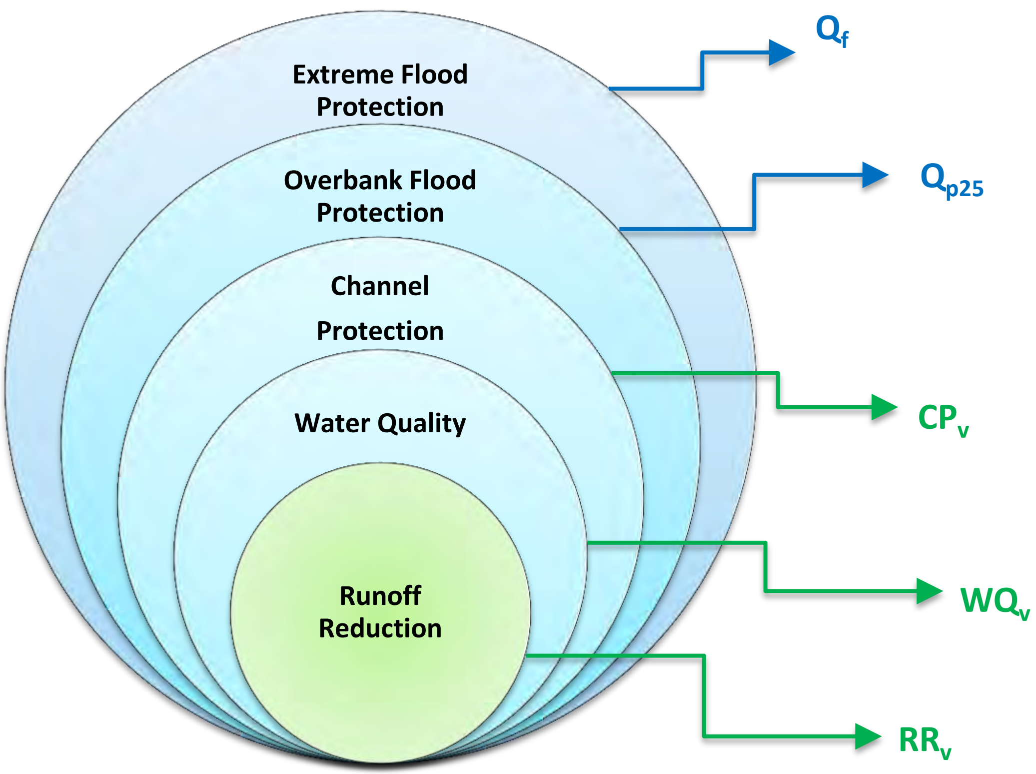
Application of the Criteria

– Three criteria deal with treating a runoff **VOLUME**

– Two criteria deal with reducing **FLOW RATES**



It is Not Pre vs Post for all Criteria!

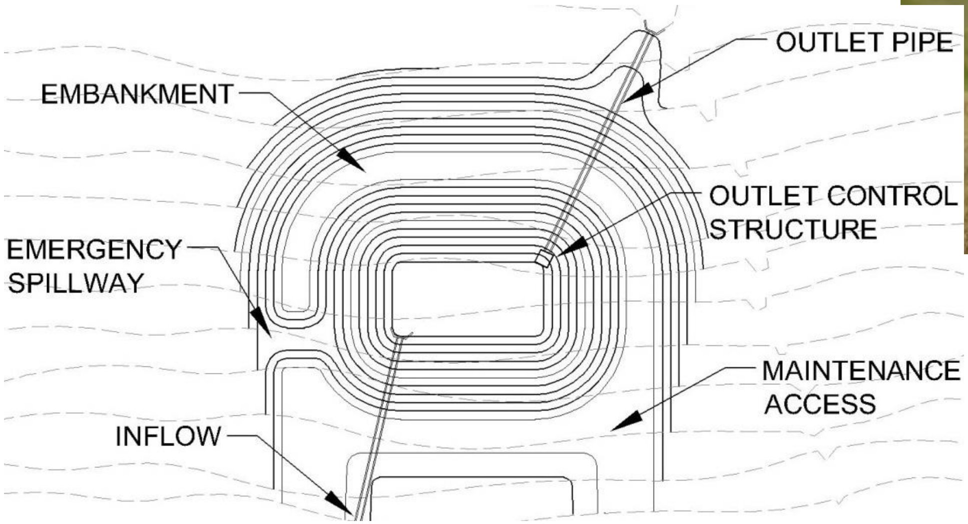
Criteria	Name	Type	Goal
Q_f	extreme flood protection	flow rate	Safely convey the 100-yr storm and evaluate effects on the storm system and downstream areas
Q_{p25}	overbank protection	flow rate	Provide detention for the 25-yr 24-hr storm (Qpost <Qpre)
CP_v	channel protection	volume	Detain runoff from the 1-yr 24-hr storm for 24 hours
W_v	water quality	volume	Detain and remove 80% TSS from the first 1.2” of runoff from impervious area
RR_v	runoff reduction	volume	Retain runoff from first 1.0" rainfall on site (or treat)

Example Scenario for Comparison

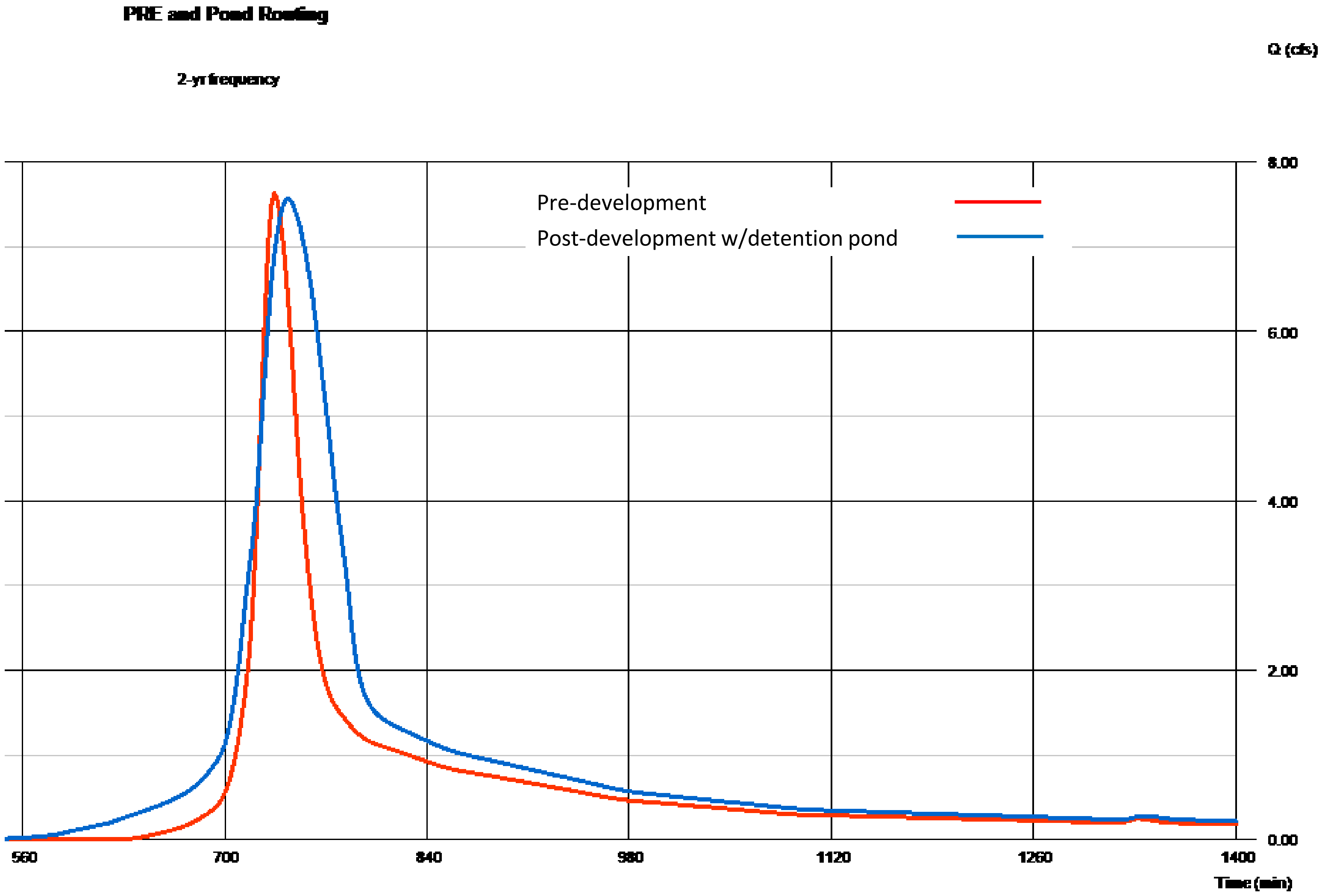
– Site Development

– Post-Construction Stormwater Control: Dry Detention Pond (*approximately 55 ft x 30 ft x 10 ft*)

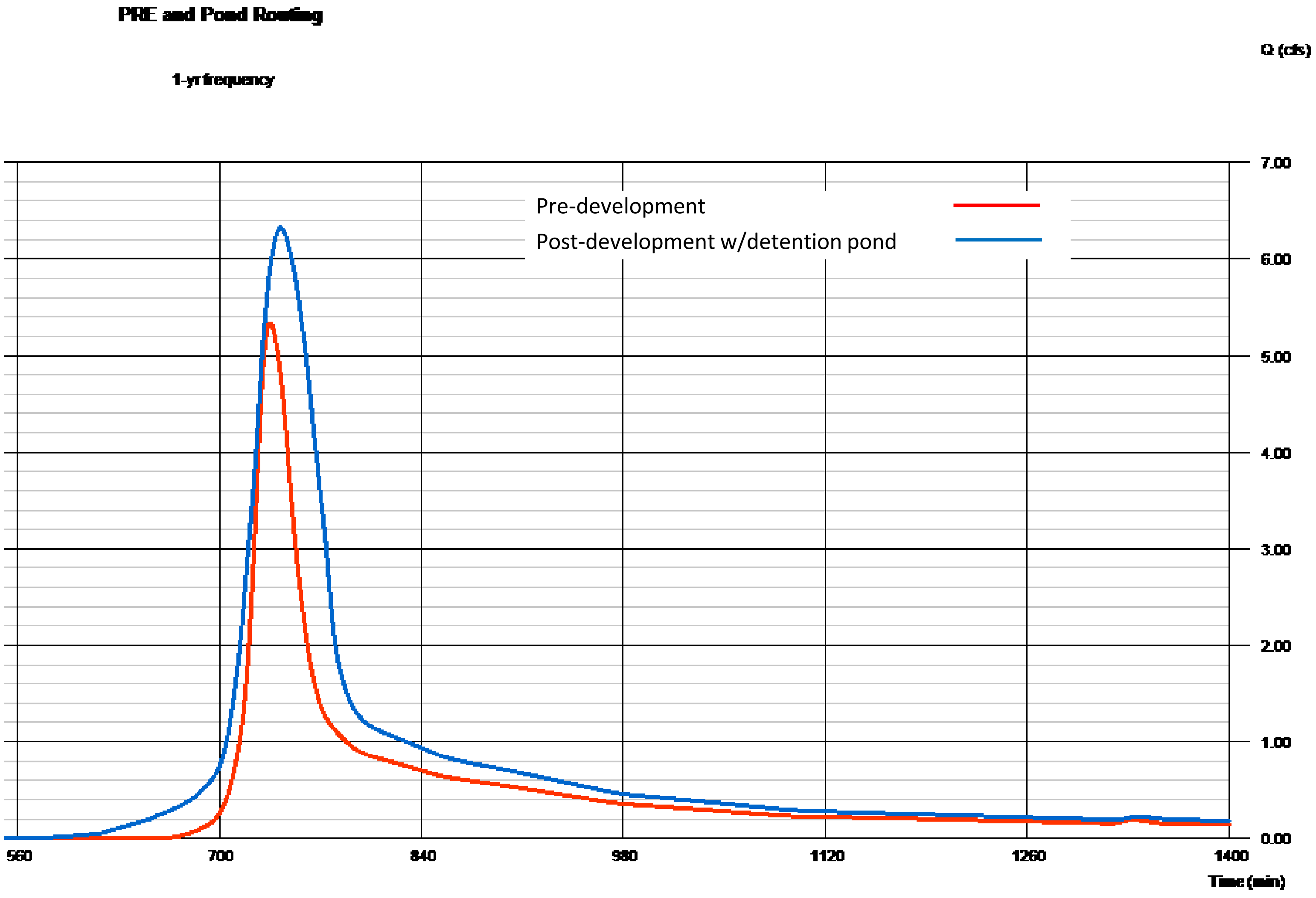
We will compare the two methodologies…



Simplified Peak Flow Comparison Method
2-Year 24-Hour Event Hydrograph

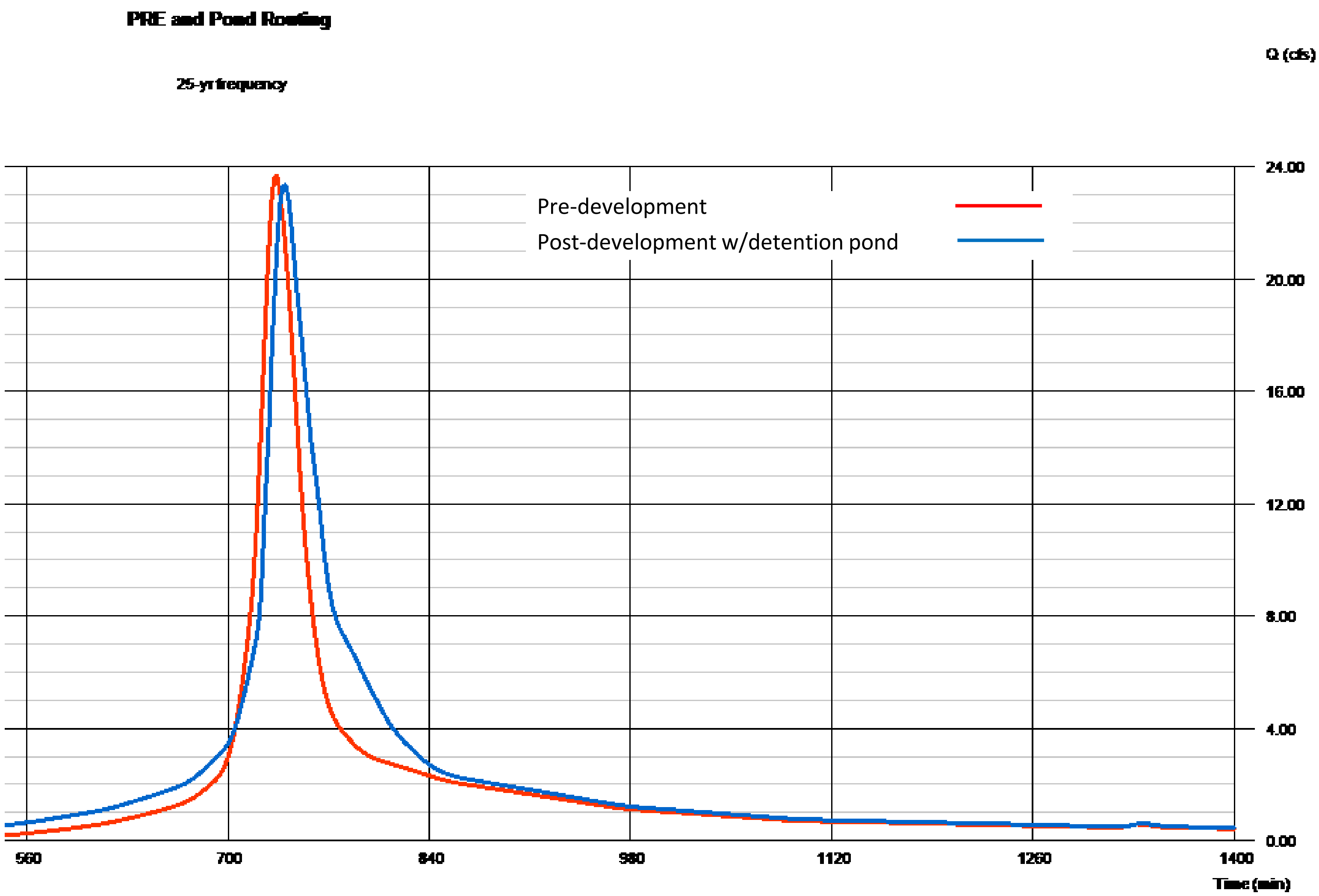


Simplified Peak Flow Comparison Method
1-Year 24-Hour Event Hydrograph



Georgia's Unified Stormwater Sizing Criteria

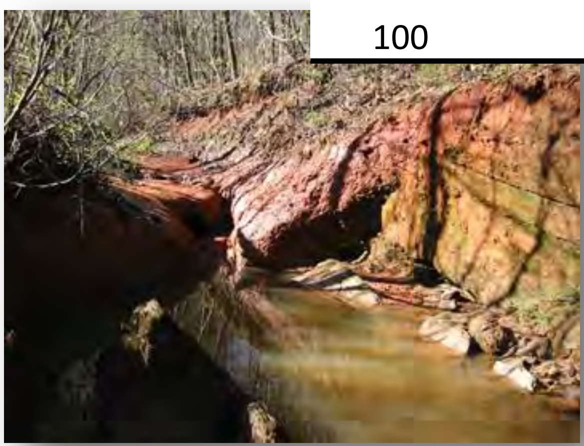
Simplified Peak Flow Comparison Method
25-Year 24-Hour Event Hydrograph



Simplified Peak Flow Comparison Method
Summary Table

– We accomplished the goal (matching/reducing pre-developed peak flows for the 2-, 5-, 10-, 25-, 50- and 100-year events), but...

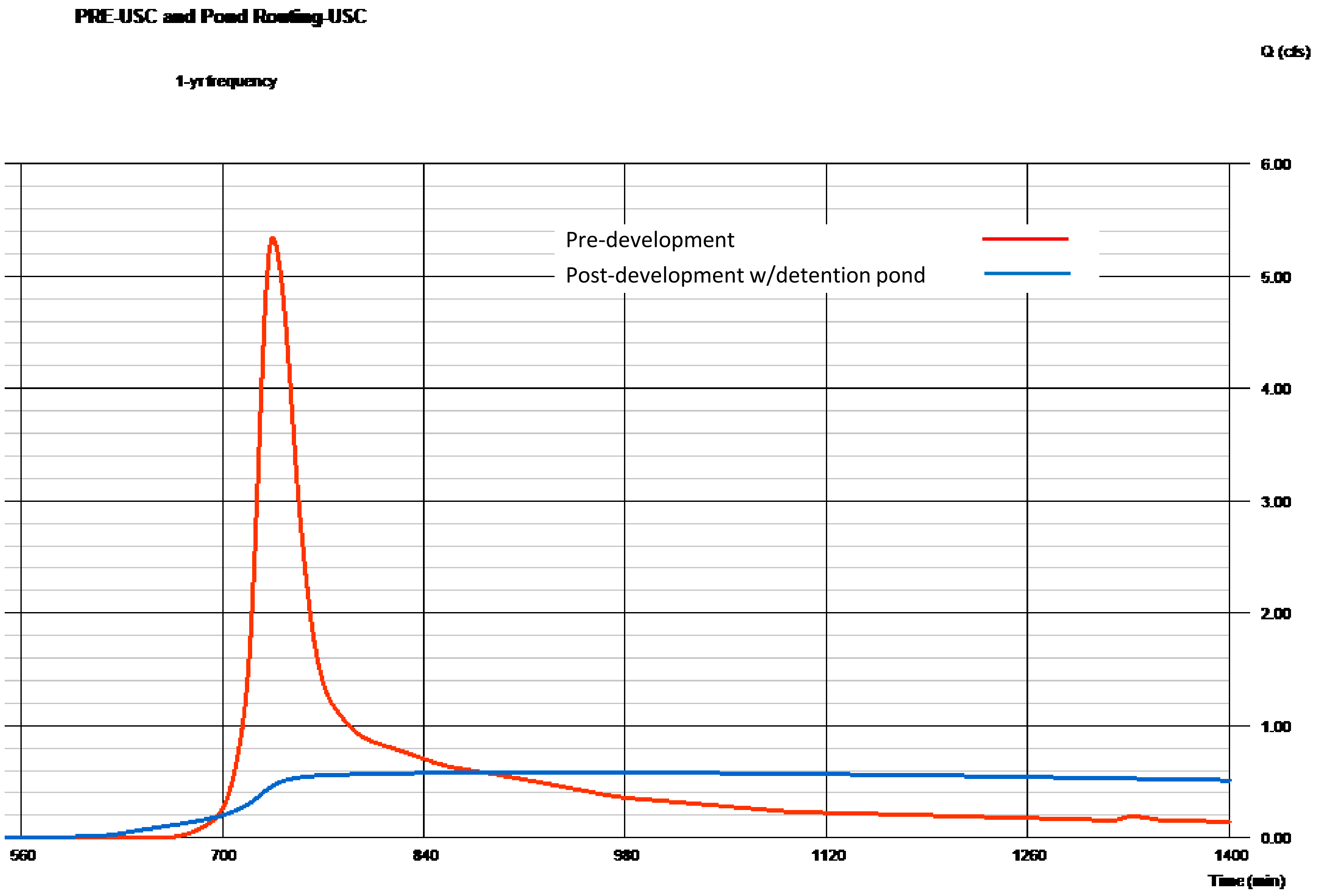
Return Period (Yr)	Pre-Developed Peak Flow Rate (cfs)	Post-Developed Peak Flow Rate (cfs)	Old School Routed Pond Outflows (cfs)
1	5.33	9.27	6.32
2	7.63	12.16	7.57
5	12.14	17.61	12.05
10	16.58	22.76	16.01
25	23.69	30.76	23.34
50	29.85	37.53	29.81
100	36.74	44.91	36.47



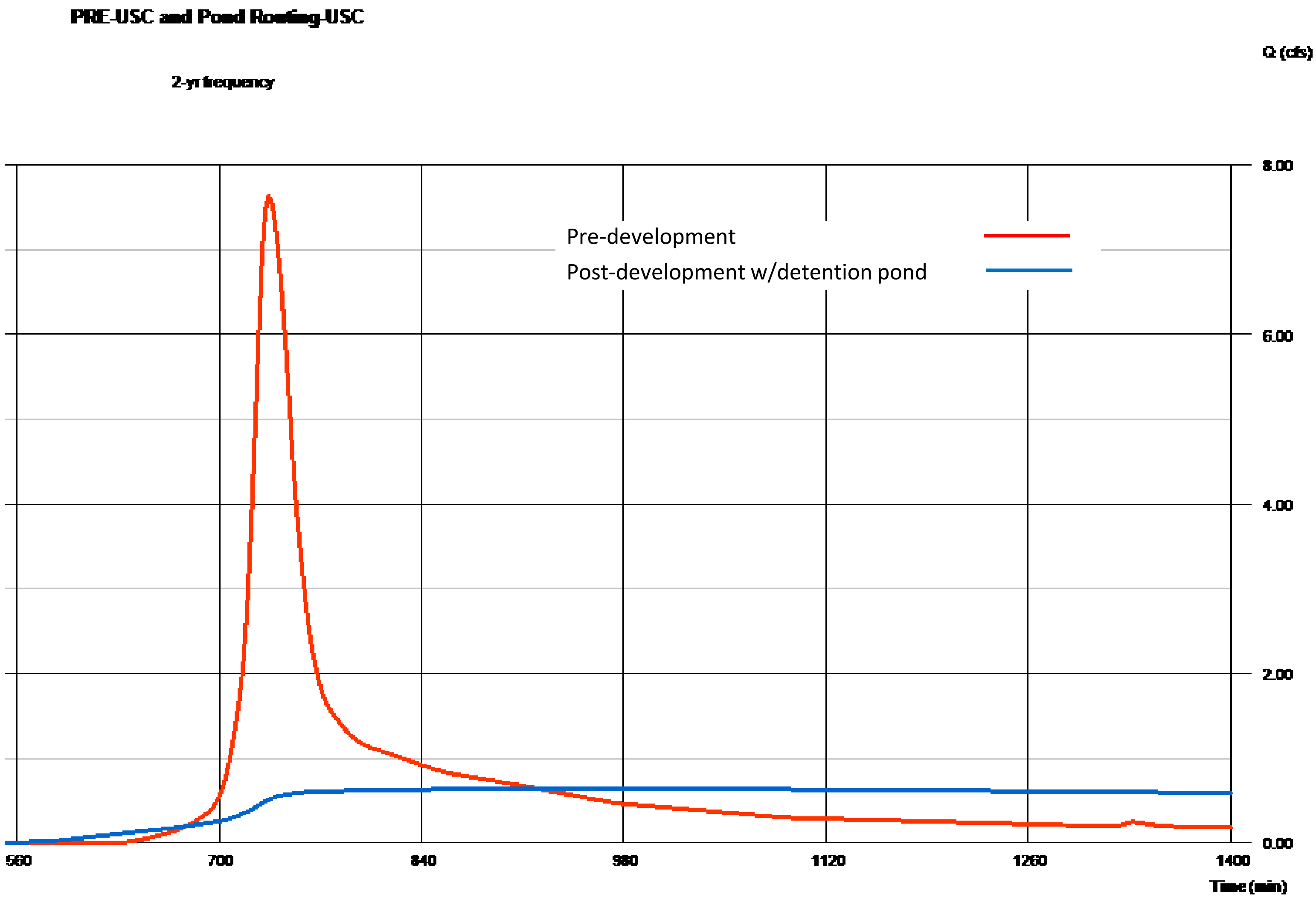
Georgia's Unified Stormwater Sizing Criteria

...we did not consider the "channel-forming" 1-year event

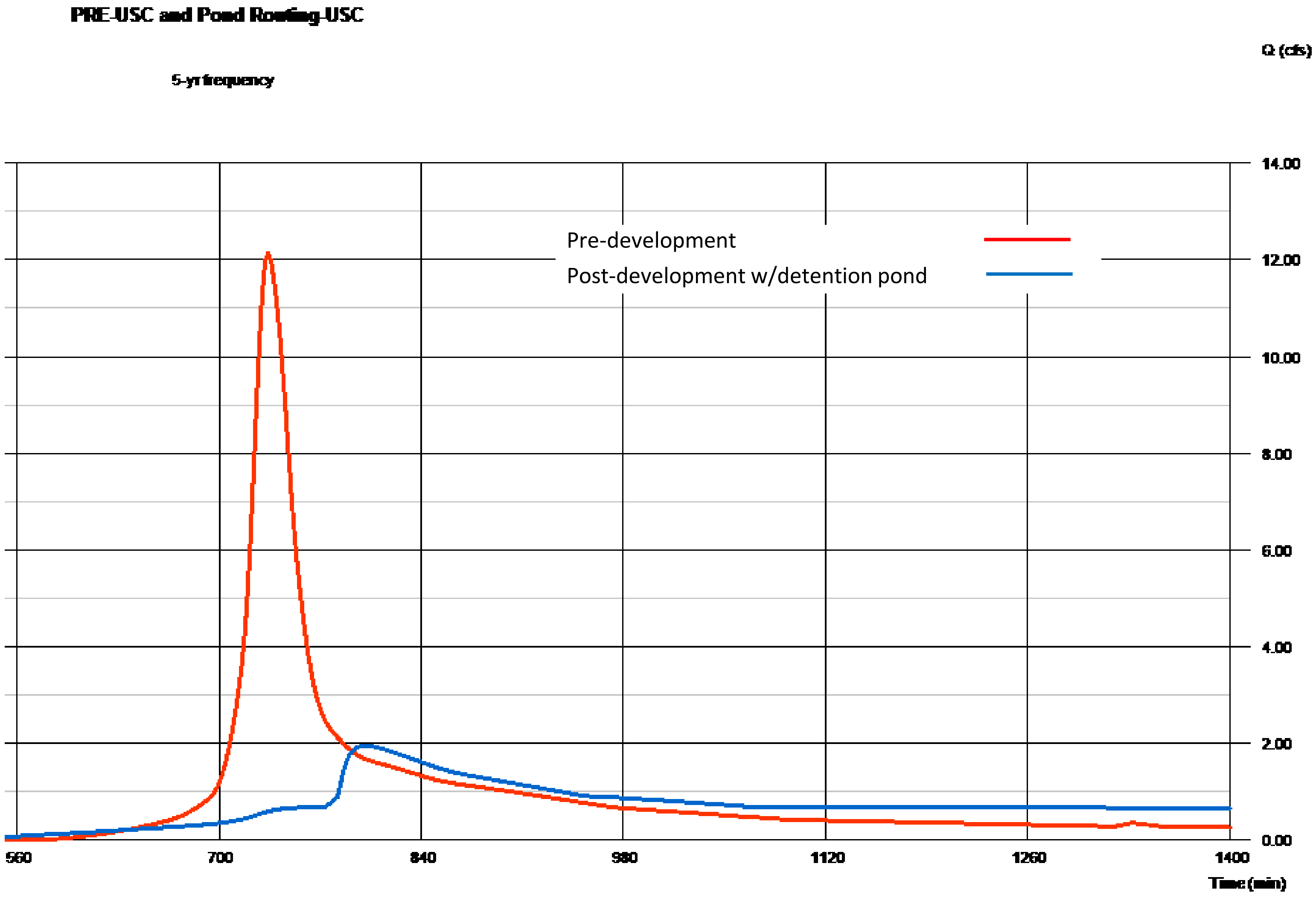
Unified Sizing Criteria Method
1-Year 24-Hour Event Hydrograph



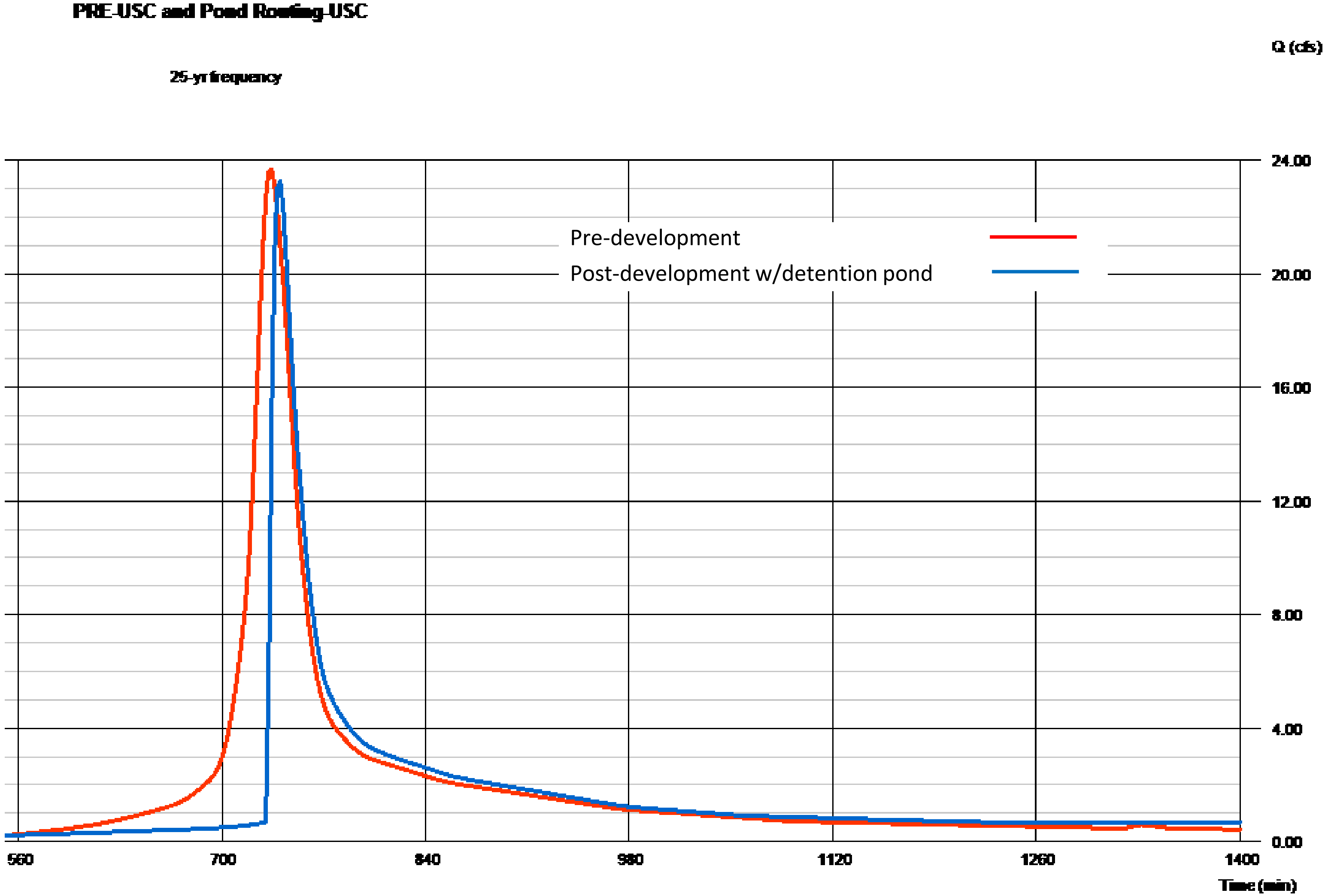
Unified Sizing Criteria Method
2-Year 24-Hour Event Hydrograph



Unified Sizing Criteria Method
5-Year 24-Hour Event Hydrograph



Unified Sizing Criteria Method
25-Year 24-Hour Event Hydrograph



Unified Sizing Criteria Method
Summary Table

– We accomplished the goal (matching/reducing pre-developed peak flows for the 2-, 5-, 10-, 25-, 50- and 100-year events), and this time...

Return Period (Yr)	Pre-Developed Peak Flow Rate (cfs)	Post-Developed Peak Flow Rate (cfs)	USC - Routed Pond Outflows (cfs)
1	5.33	9.27	0.58
2	7.63	12.16	0.64
5	12.14	17.61	1.95
10	16.58	22.76	8.98
25	23.69	30.76	23.27
50	29.85	37.53	31.55
100	36.74	44.91	38.68

...we are protecting the channel from erosion by attenuating the 1-year event

Application of the Downstream Analysis Check

– Compare hydrographs at:

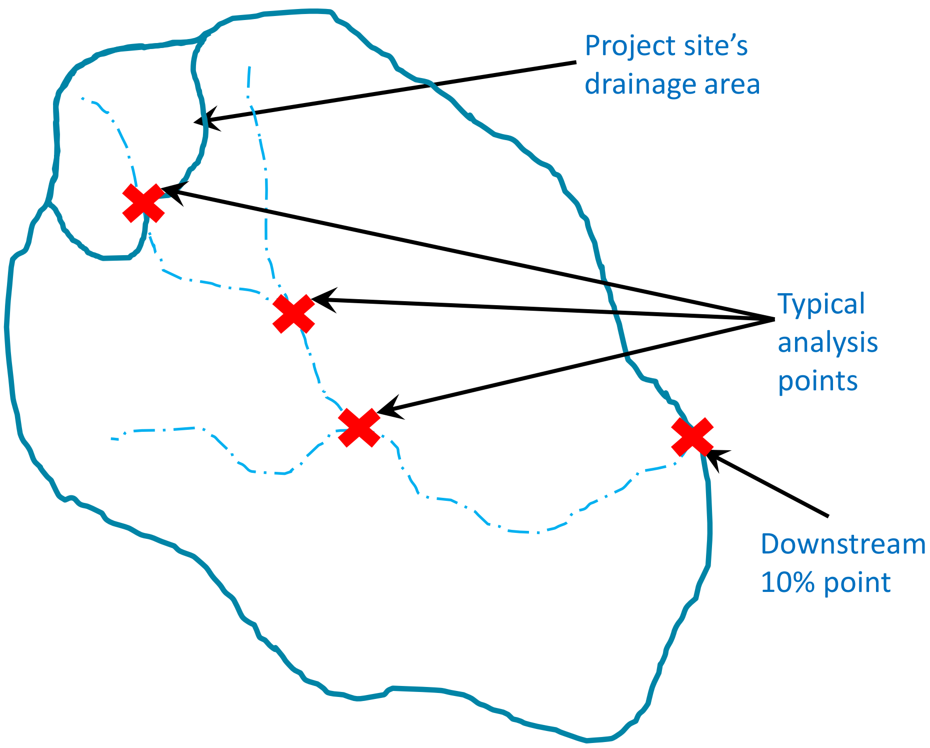
» Pond Outlet

» Intermediate downstream locations of concern:

- Confluence
- Hydraulic Structure
- Conveyance

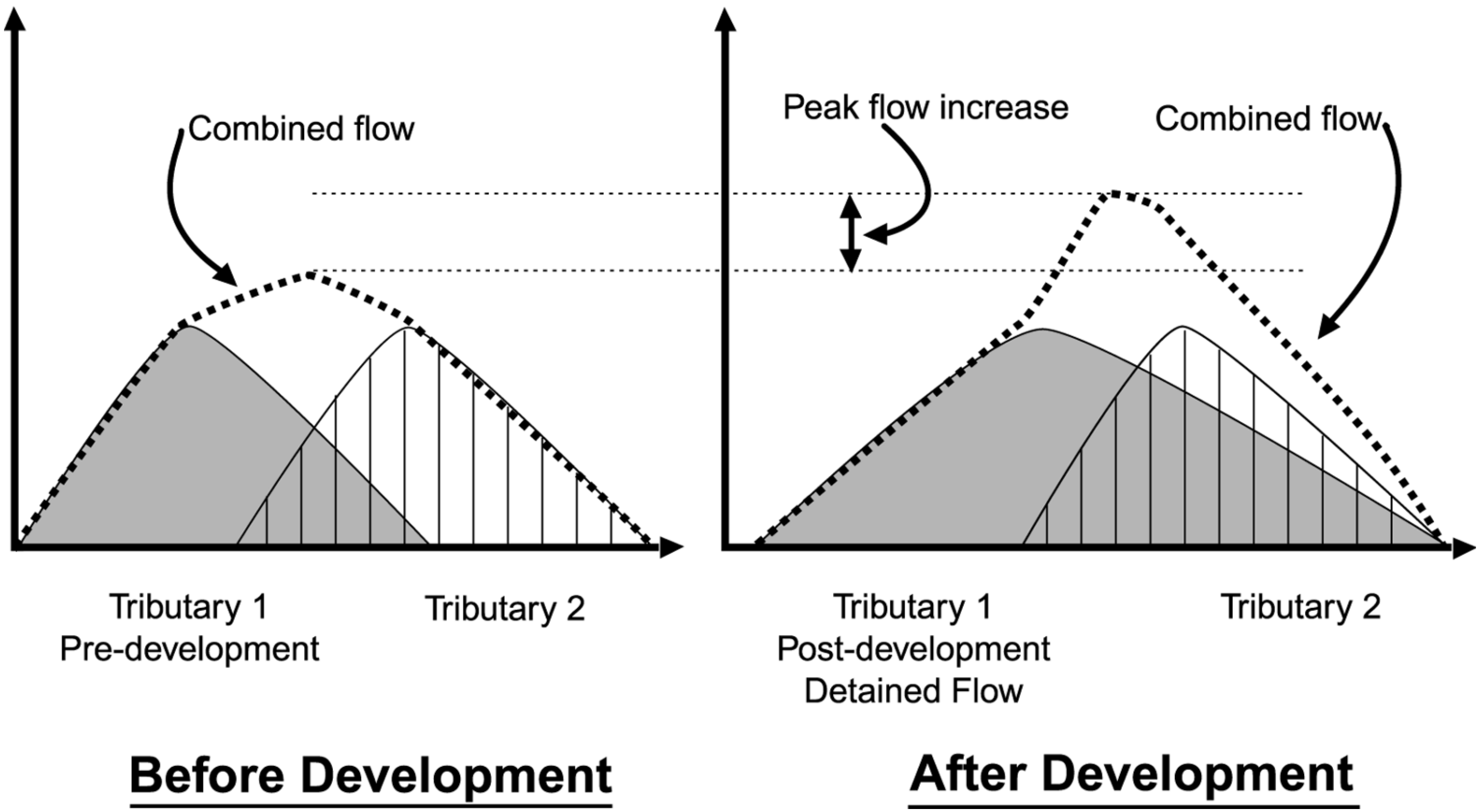
» End of Downstream Zone of Influence:

- Point where drainage area is 10 times the project site drainage area, or
- Large receiving water (lake, river, estuary)



Application of the Downstream Analysis Check

– Check for adverse impacts created by peak timing shift due to detention



So what have we learned?

– Trying to mimic natural hydrologic conditions is complicated!

– Understanding the requirements and using the tools correctly is key!

– Education plays an important role!

It is all worth it!

Old becomes new when the USC is understood!


ANY
QUESTIONS
?

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WATER RESOURCES

Thank You!

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