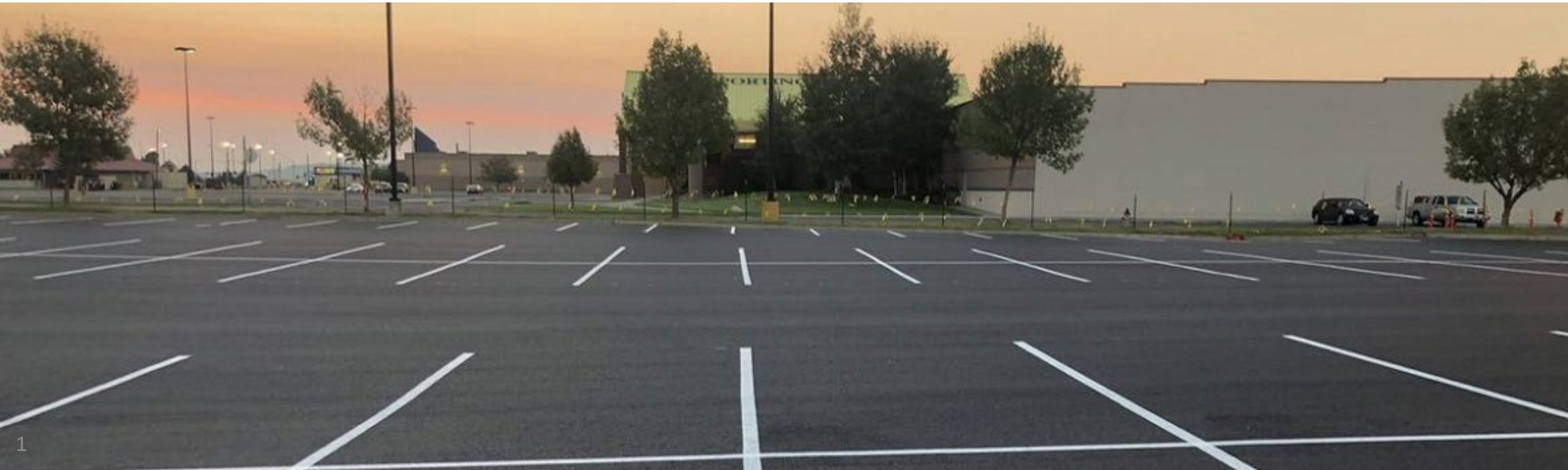
It's All Impervious to Me!

Redevelopment and Green Infrastructure Modeling Guidance

Dane County Land & Water Resources Department
Water Resource Engineering Division
September 15, 2022



Presenters

Theresa Nelson, PE
Stormwater Engineer

Elliott Mergen, PE
Conservation Engineer

AND

Jeremy Balousek, PE
WRE Division Manager

DANE COUNTY LAND&WATER RESOURCES DEPARTMENT

Webinar Information

All Participants Muted

Use Q&A for Questions

PDH Certificates Emailed

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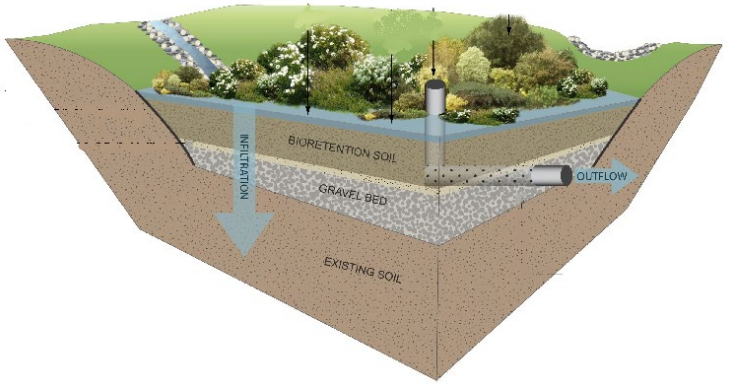
Presentation Outline

Redevelopment

- Definition
- Scenarios

Green Infrastructure

- New Standard
- Benefits
- Practices



Modeling

- Half-inch Requirement
- Peak Rate

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Poll #1

Redevelopment

What is Redevelopment?

- Replaces existing impervious surfaces

- Results in the cumulative increase of less than 20,000 square feet of impervious surface to a site since August 21, 2001 on sites predominately developed as commercial, industrial, institutional or multifamily.

Sites may be required to meet a

combination

of new development and redevelopment standards

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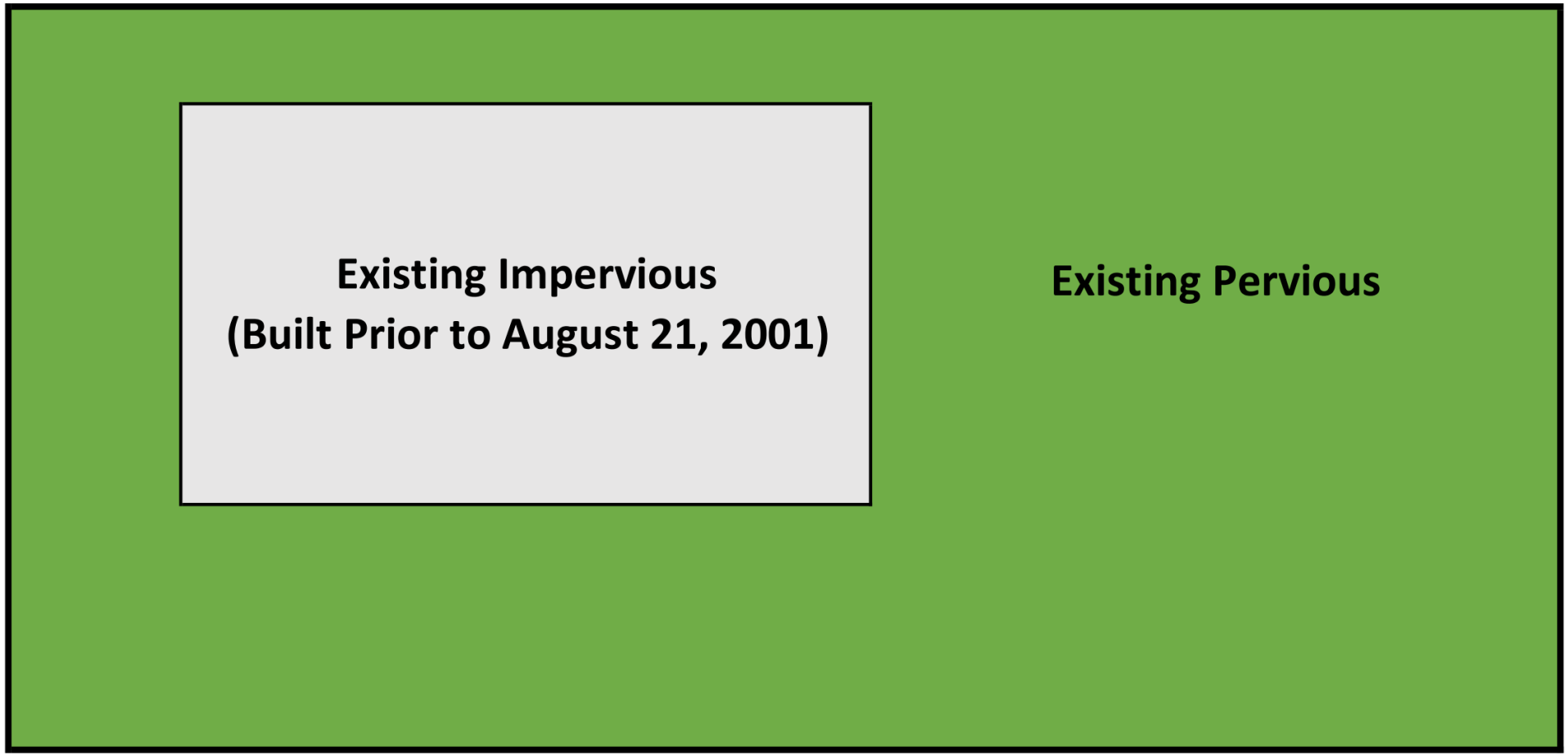
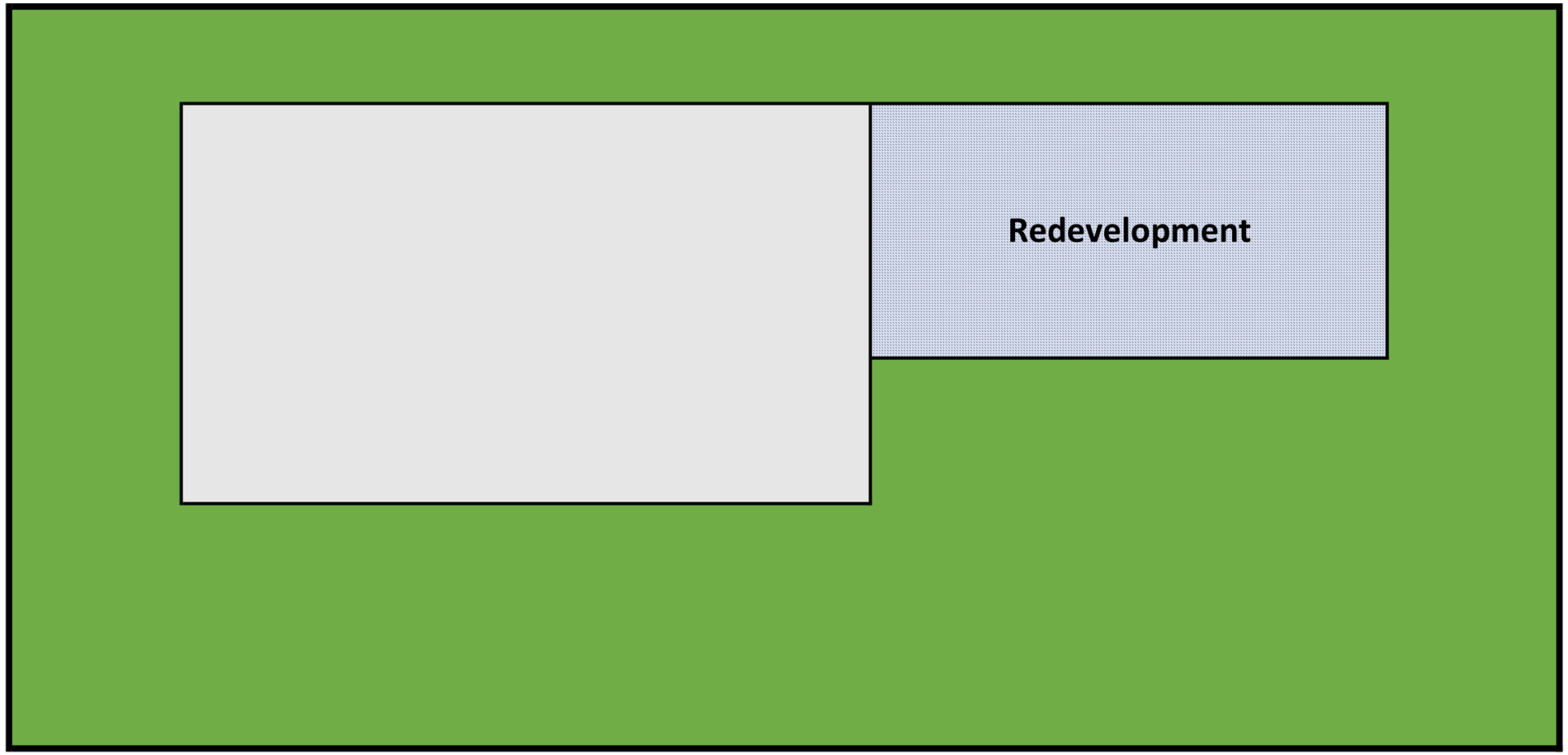
Existing Conditions



Scenario 1

New impervious is less than 20,000 ft^2.



Scenario 2

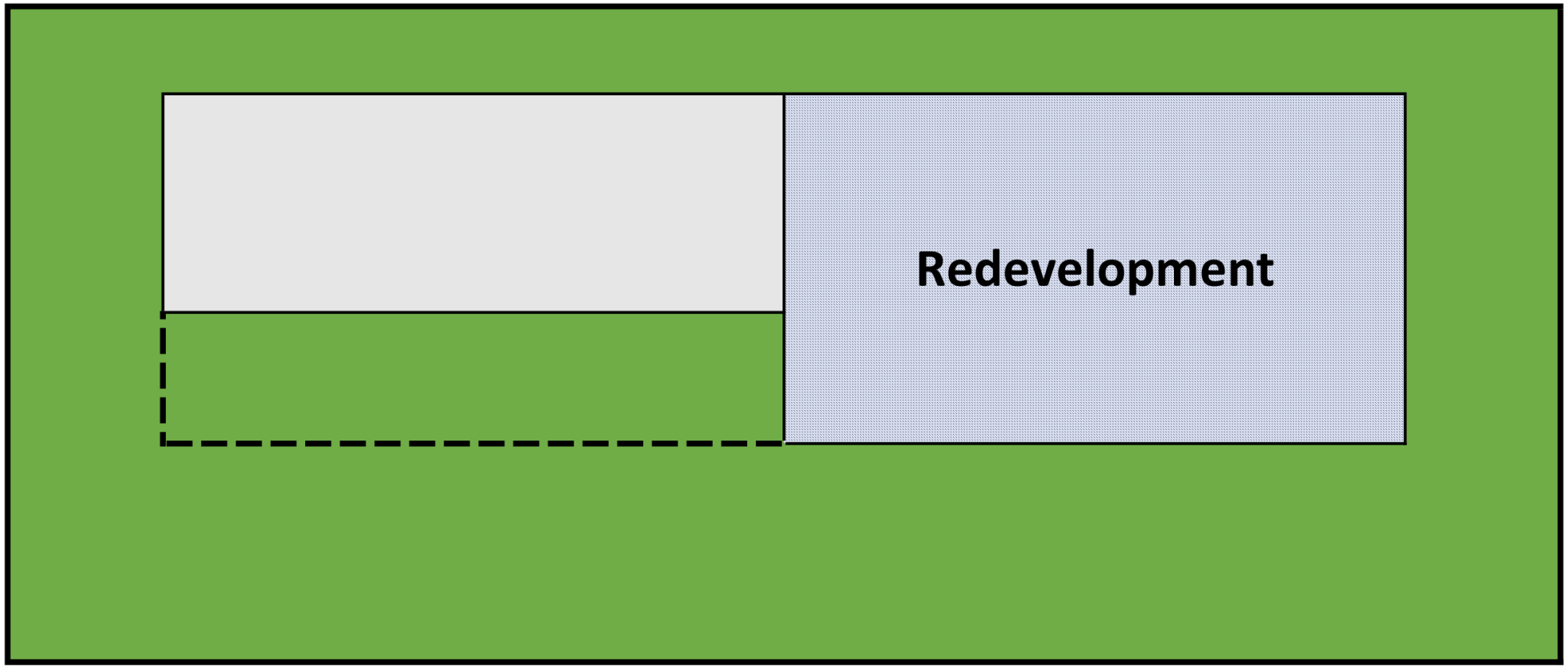
Proposed impervious area is greater than 20,000 ft².

Scenario 3

New impervious is greater than 20,000 ft^2,
a portion of existing impervious is replaced.

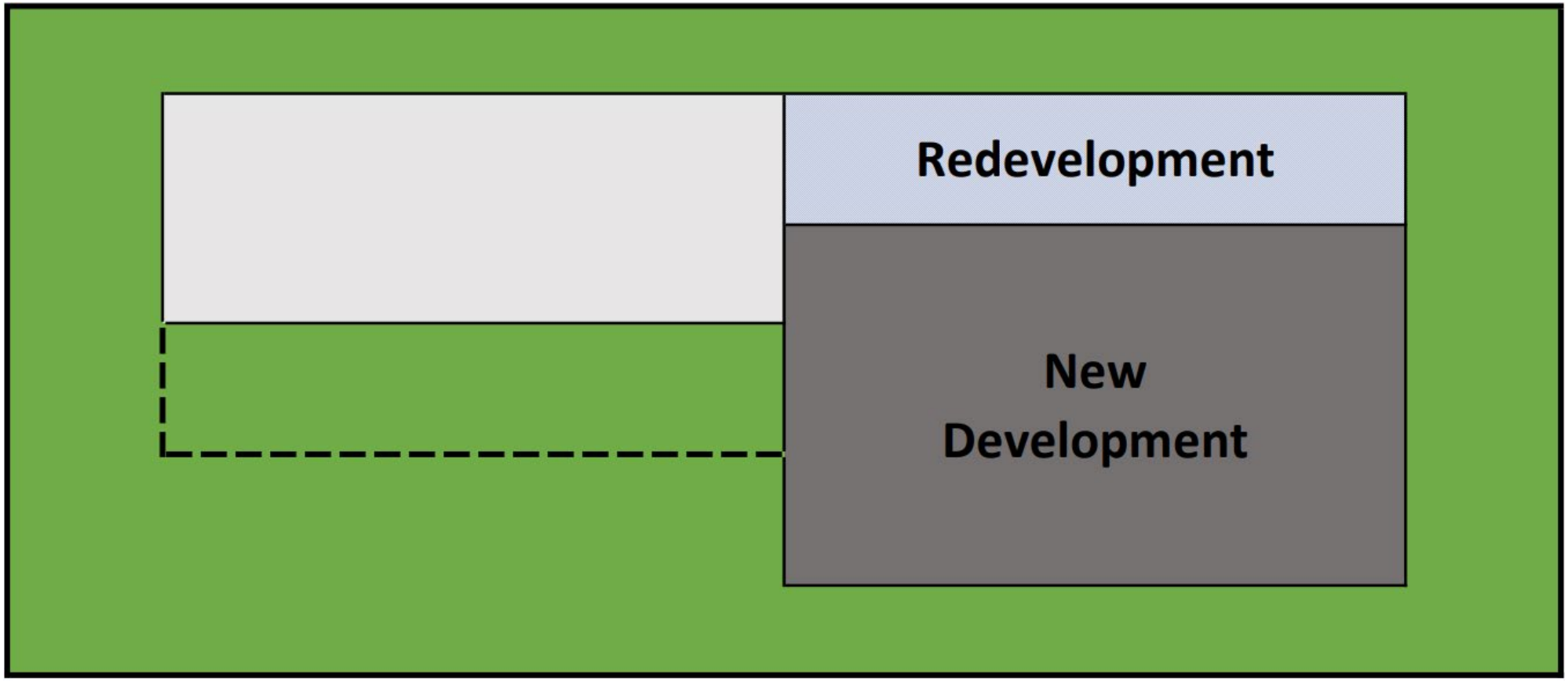
Scenario 4

A portion of existing impervious is converted to pervious.
The cumulative addition of new impervious is less than 20,000 ft².



Scenario 5

A portion of existing impervious is converted to pervious.
The cumulative addition of new impervious is greater than 20,000 ft².



Look Back to 2000!

2000

2005

Looking back to 2000

2014

2020

Cumulative addition of >40,000 SF impervious since 2000

Poll #2

Green Infrastructure

New Regulatory Requirement!

For redevelopment with proposed impervious surface area greater than **80% of existing**, the first 0.5 inches of runoff from redeveloped impervious surfaces must be captured using green infrastructure.

danecountystormwatermanual.com

LAND&WATER RESOURCES DEPARTMENT

What is Green Infrastructure?

Plant or Soil Systems

Runoff Volume Reduction

Remove Sediment

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Types of Green Infrastucture

Rainwater Harvesting

Infiltration Basin, Rain Garden, and Bioretention

Vegetated Swale

Green Roof

Permeable Pavement

UW Hospital Green Roof

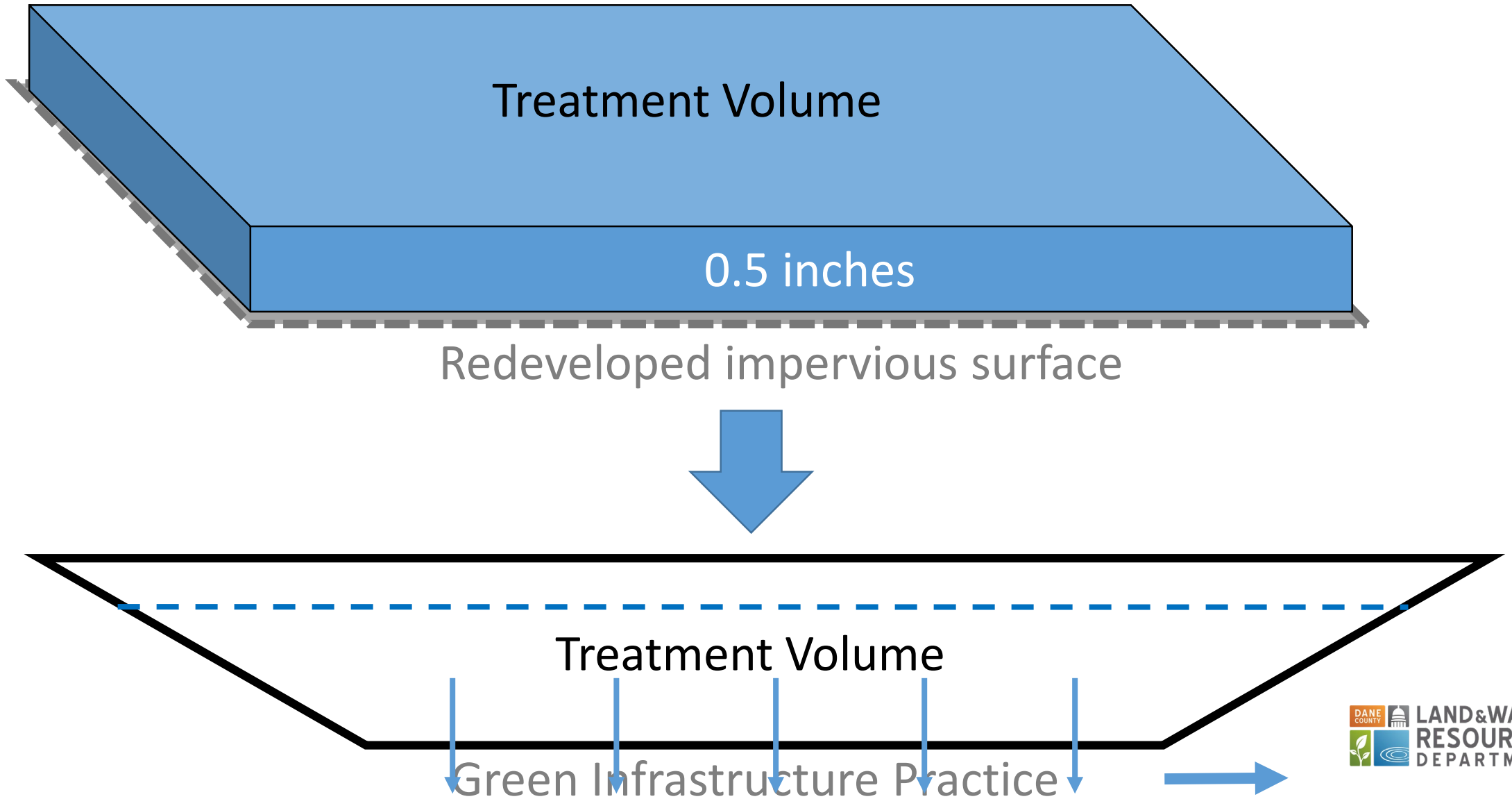
Updated Website

https://lwrd.countyofdane.com/

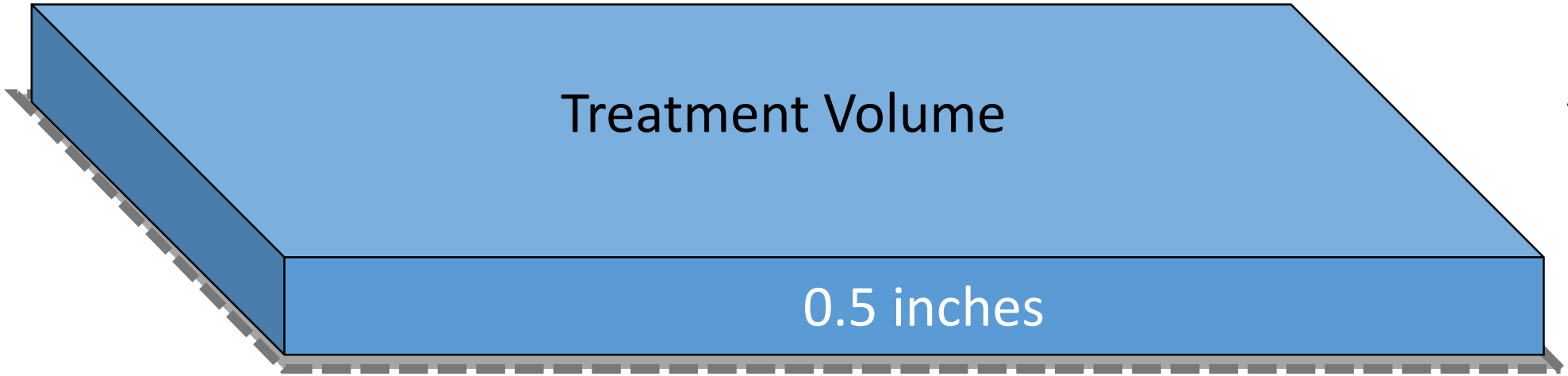
Poll #3

Modeling

How to Demonstrate ½-inch Requirement



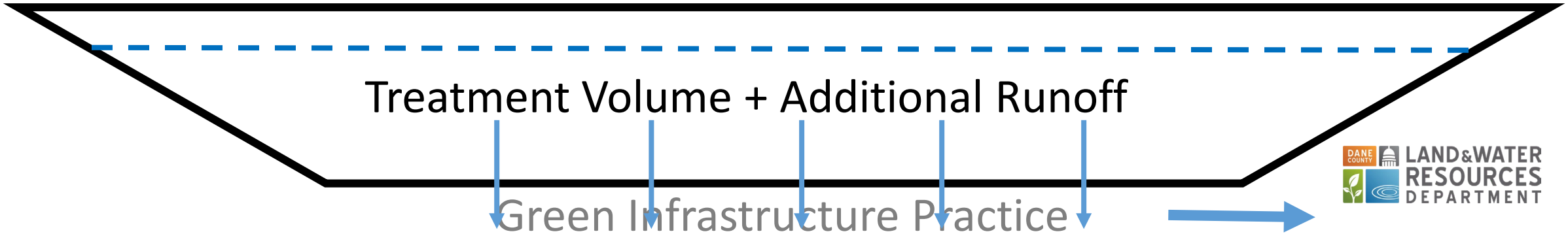
How to Demonstrate ½-inch Requirement



Redeveloped impervious surface

Additional Runoff

Other surfaces



How to Demonstrate ½-inch Requirement

Practice	Method	Details
Cistern, Rain Barrel	Storage Volume Calculation	• Volume of container must be equal to or greater than treatment volume required
Bioretention Basin, Infiltration Basin, Rain Garden, Infiltration Trench	Model in WinSLAMM, HydroCAD, or similar	• WinSLAMM: model 4/7/81 event • HydroCAD: model 0.7 inch MSE4 storm
Permeable Pavement, Green Roof	Follow technical standards and/or guidance	• Show void space is equal to or greater than treatment volume

Cisterns & Rain Barrels

Size

Size to temporarily store the treatment volume

Release Rate

Must have plan for release within 72hrs of storm

Pervious Surface

Must release to a pervious surface

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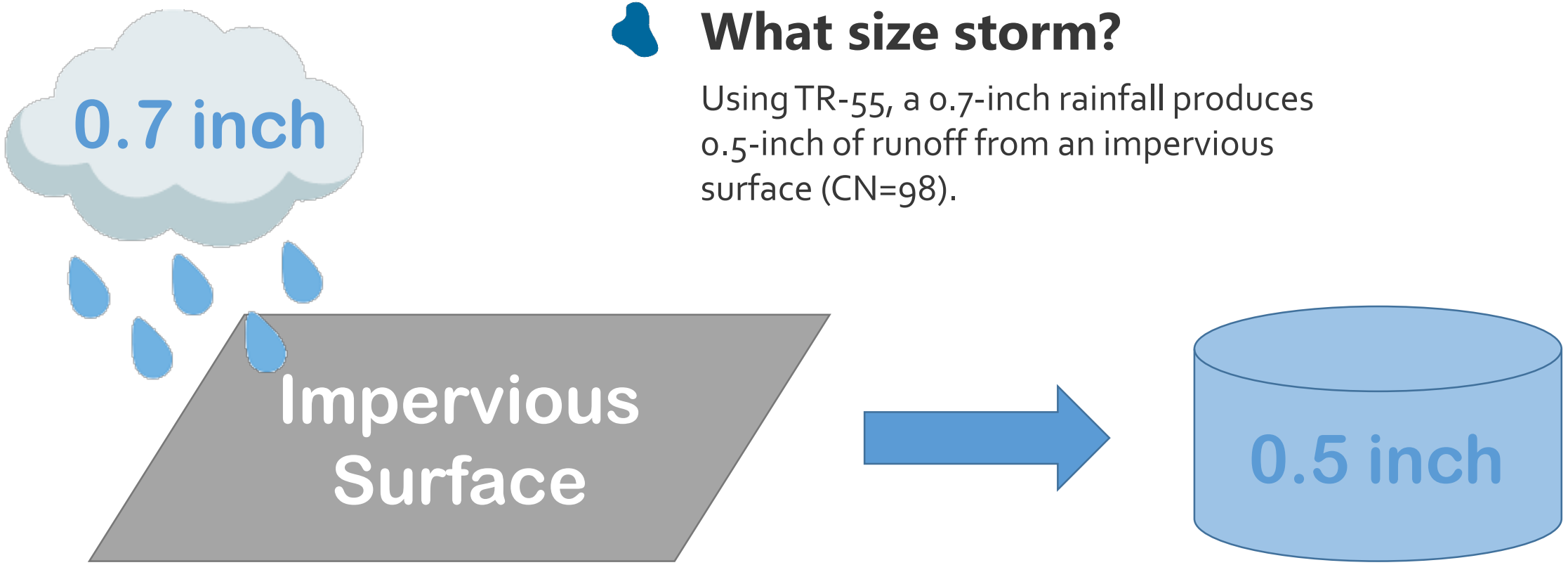
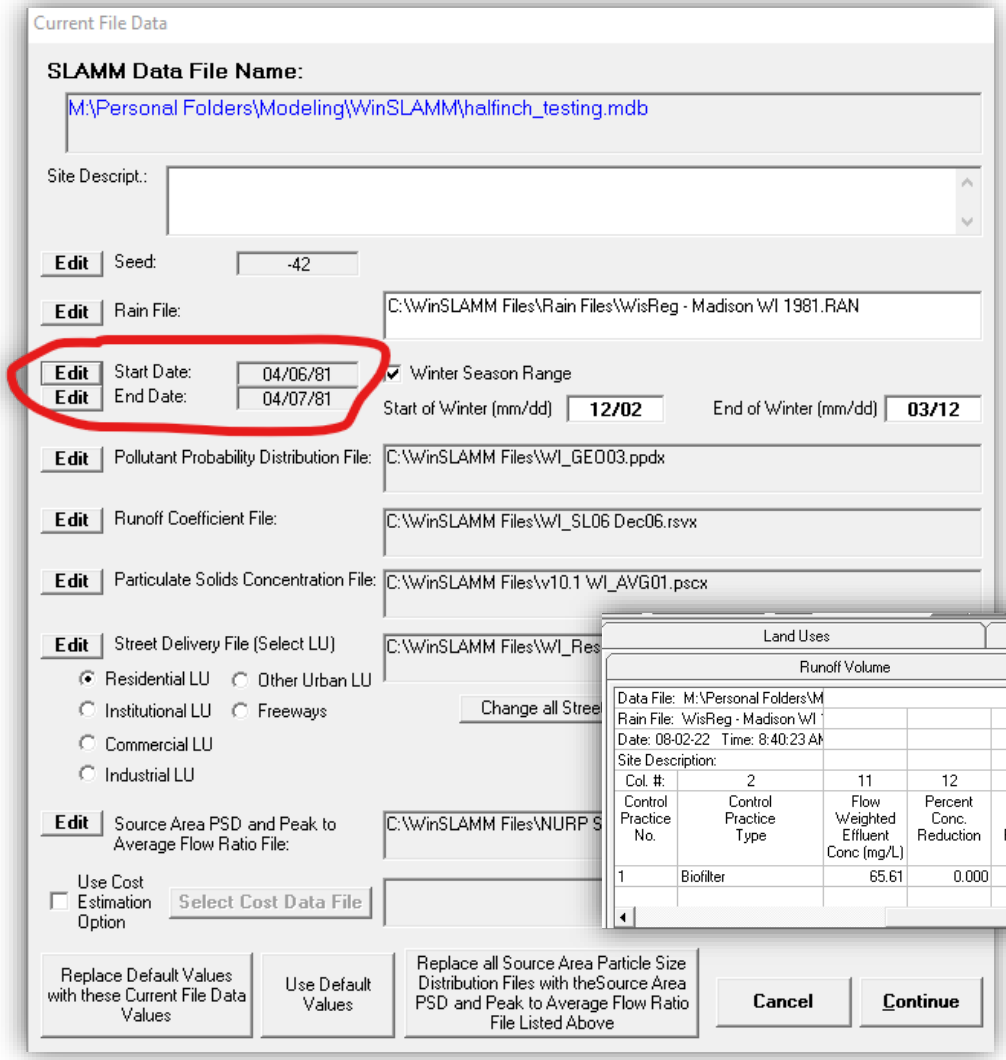
Modeling the ½-inch Requirement

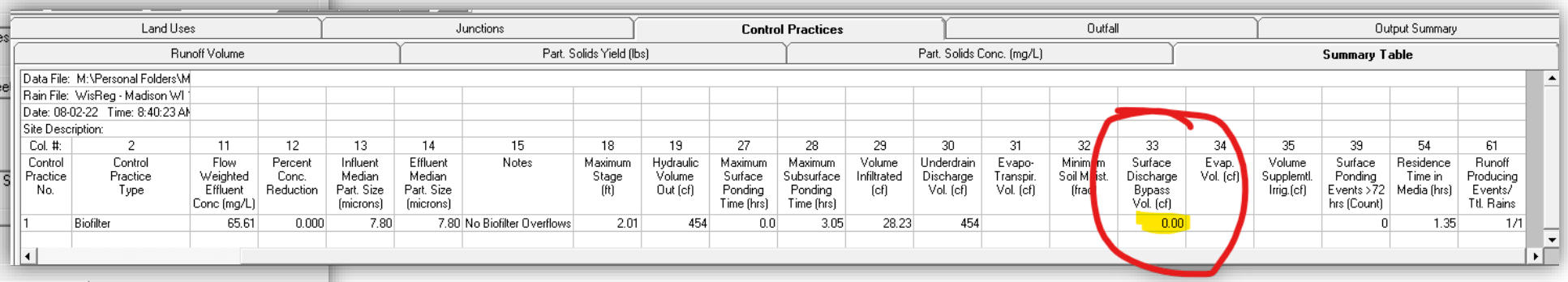
What size storm?

Using TR-55, a 0.7-inch rainfall produces 0.5-inch of runoff from an impervious surface (CN=98).



Modeling the ½-inch Requirement

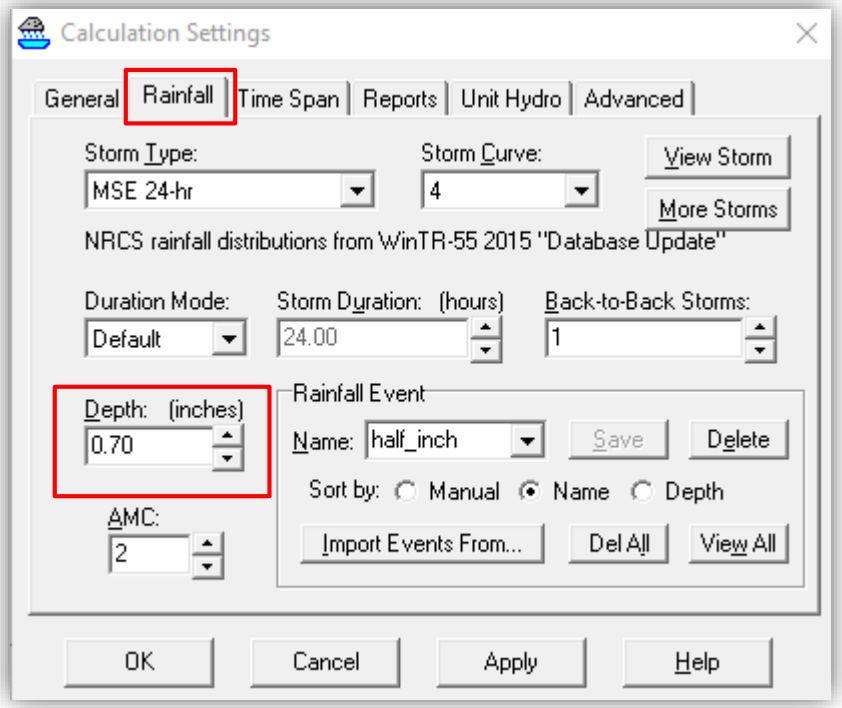




WinSLAMM

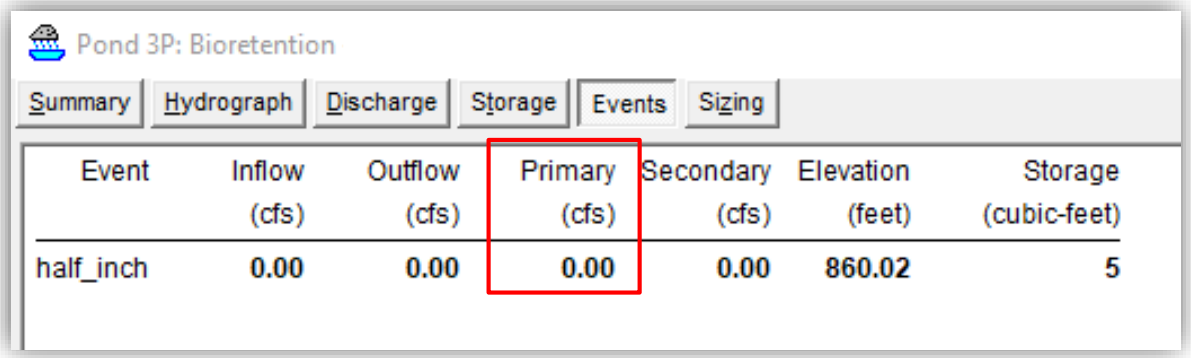
- Run model with start date 4/6/81 and end date 4/7/81.
- Show no surface outlet discharge

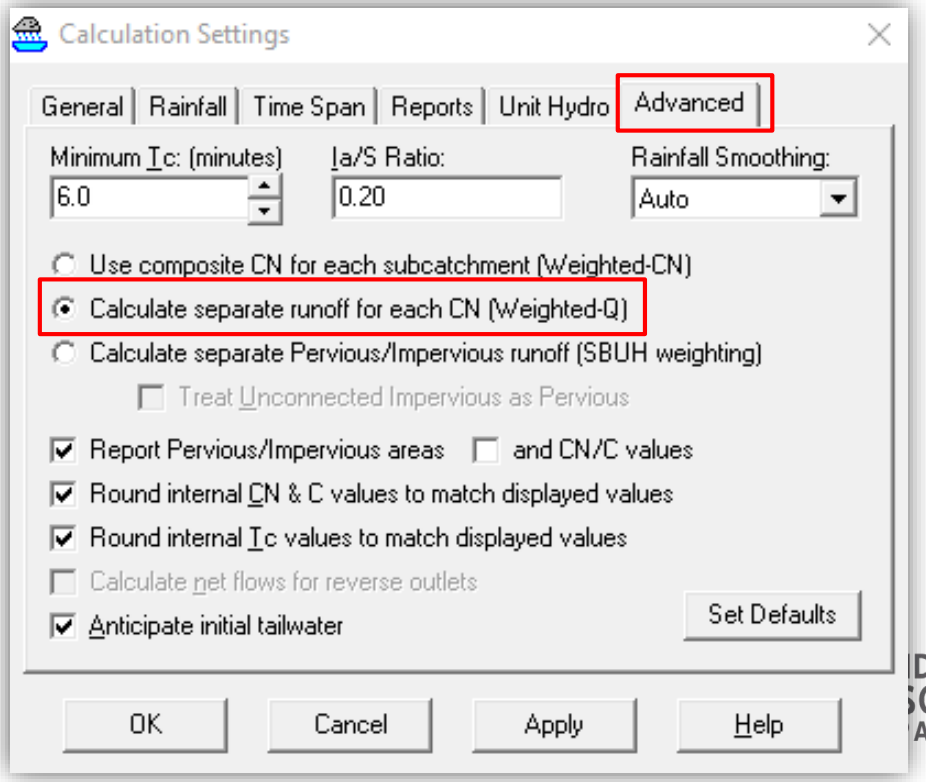
Modeling the ½-inch Requirement



HydroCAD

- Run model with 0.7-inch 24-hr MSE4 storm.
- No weighted curve number
- Show no surface outlet discharge





Modeling the ½-inch Requirement

Trading/Treatment options

Capture runoff from other surfaces in lieu of redeveloped impervious surface or treat to more restrictive standards

Trade "Like" Existing Impervious NOT Being Redeveloped

If site has other existing impervious surfaces (constructed prior to 2001), then an equivalent "like" area can be captured

Treat Redeveloped Impervious to New Development Standards

Assume redeveloped impervious areas are "new development" and model as such to meet new development standards – including infiltration

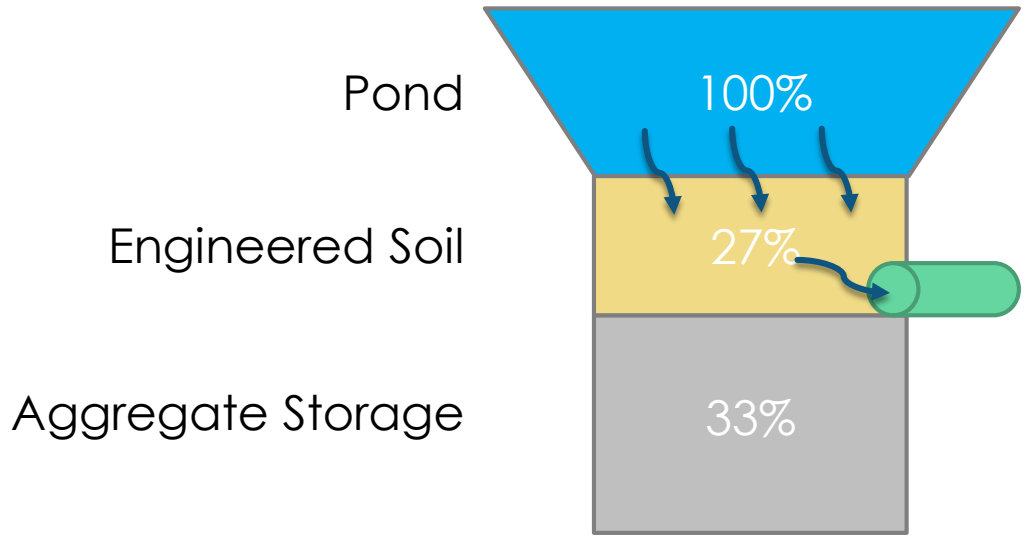
Other Methods That Meet Intent of the Ordinance

Discuss with WRE staff

Modeling Peak Rate Control in HydroCAD

How to properly model facilities with underground storage zones?

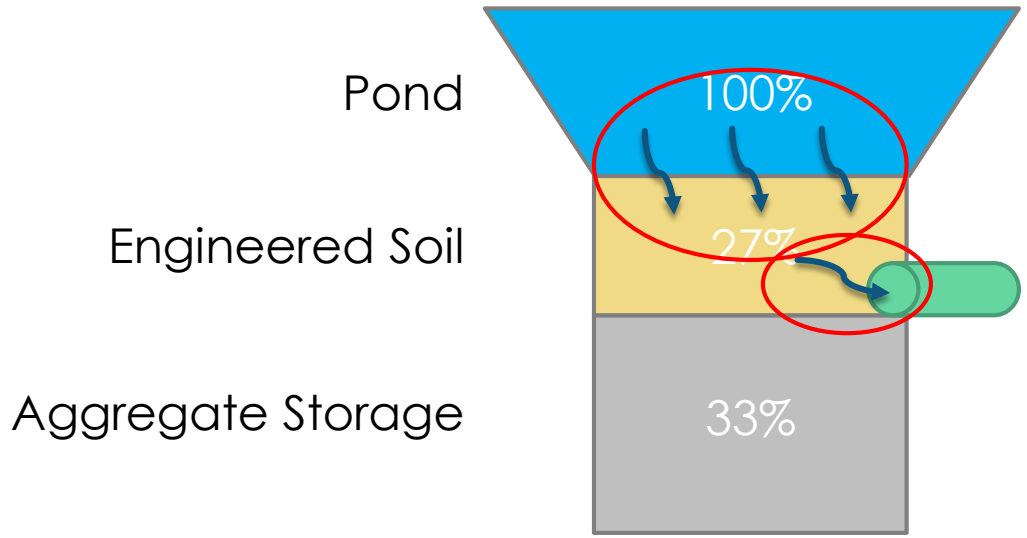
- Following HydroCAD developers guidance:
  - https://www.hydrocad.net/raingarden.htm



Modeling Peak Rate Control in HydroCAD

Identify most restrictive outflow control

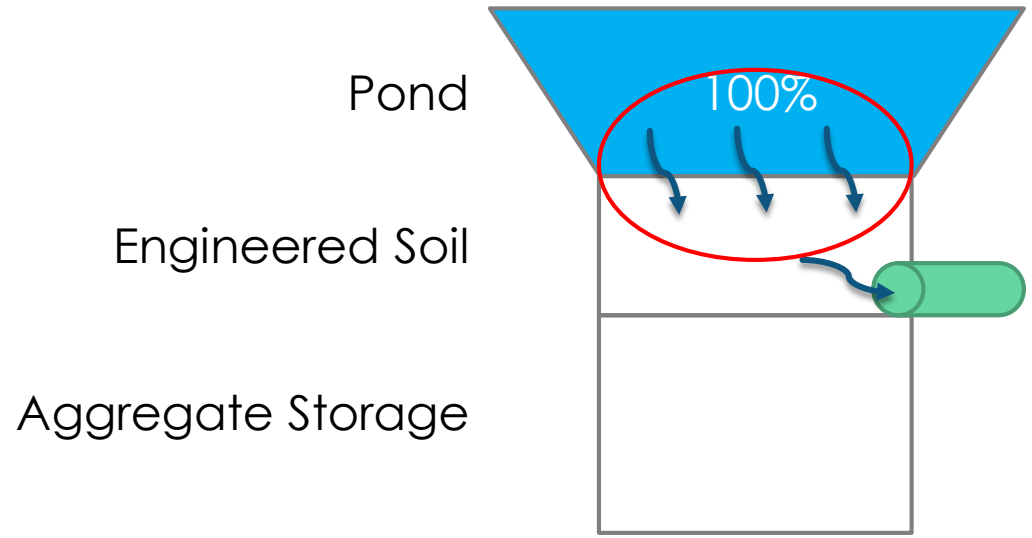
- Compare underdrain outflow to flow through engineered soil



Modeling Peak Rate Control in HydroCAD

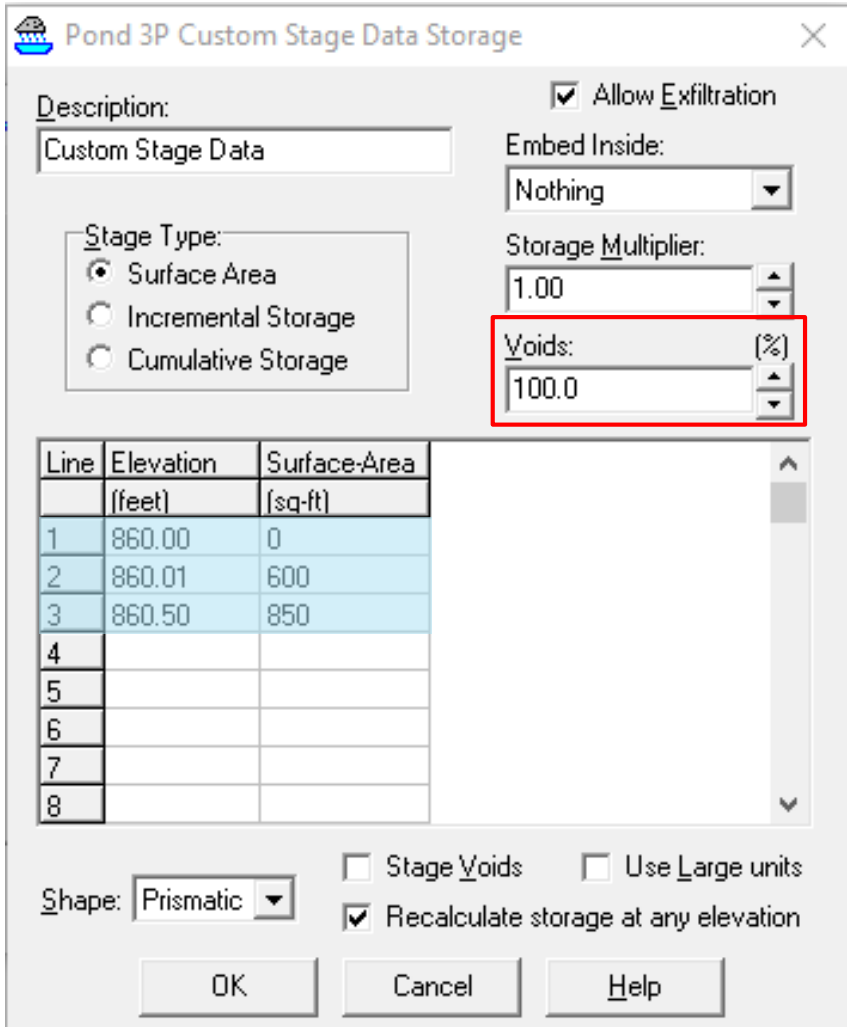
Case 1 – Engineered soil is more restrictive

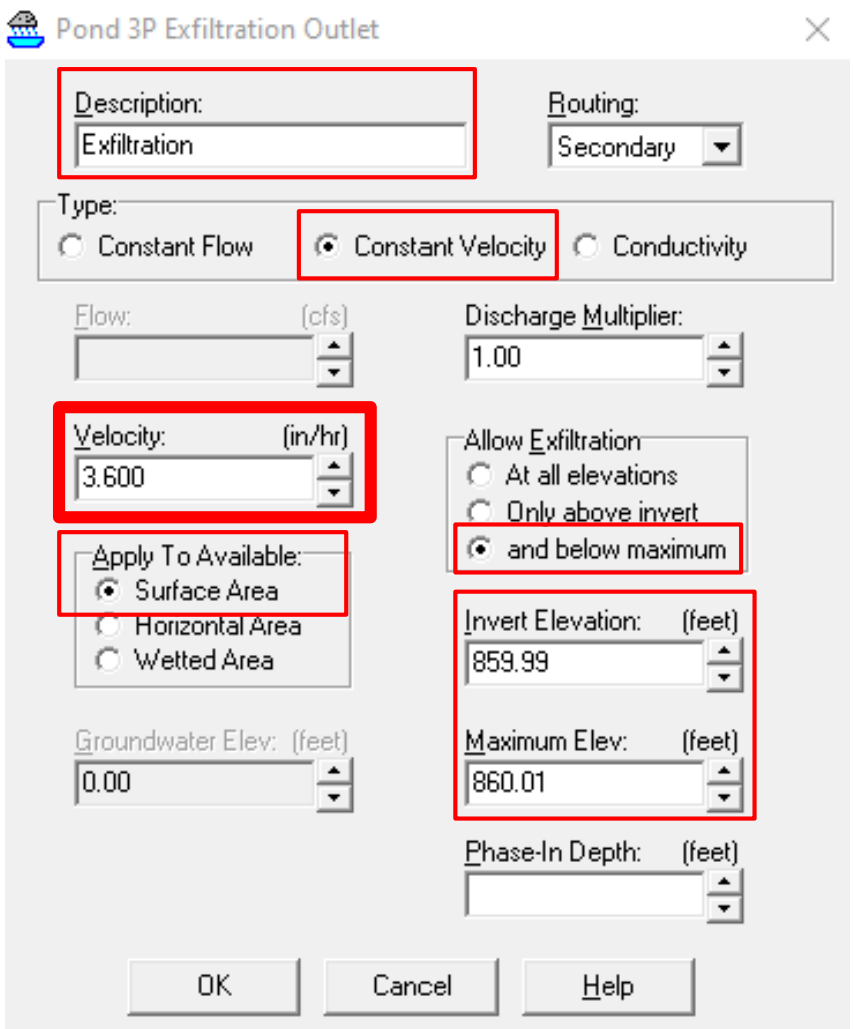
- Most common
- Do not include void space storage
- Model outflow as "exfiltration" (3.6 in/hr for engineered soil) and route to underdrain outlet (optional)



Modeling Peak Rate Control in HydroCAD

Pond

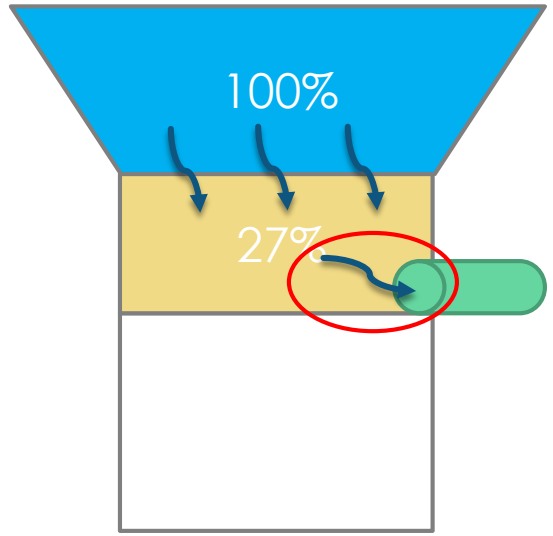




Modeling Peak Rate Control in HydroCAD

Case 2 – Underdrain is more restrictive

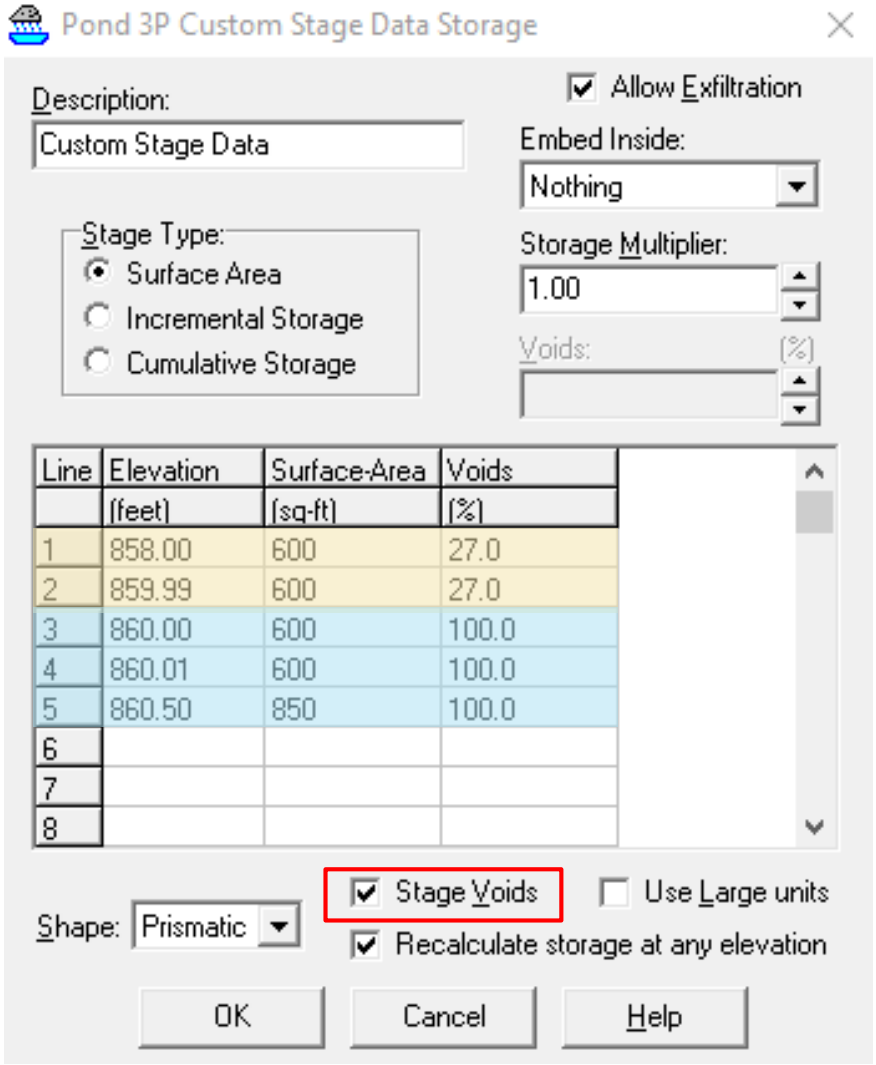
- May apply to large bioretention with extensive underdrain systems or those with restricted underdrain
- Model engineered soil void storage as part of pond storage
- Include underdrain outlet as orifice



Modeling Peak Rate Control in HydroCAD

Engineered Soil

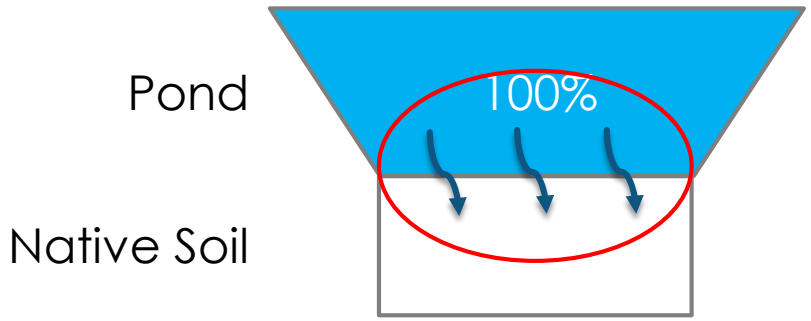
Pond



Modeling Peak Rate Control in HydroCAD

Case 3 – No Underdrain

- Infiltration basins
- Do not include void space storage
- Model outflow as "exfiltration" with infiltration rate equal to that of native soil



Modeling Peak Rate Control in HydroCAD

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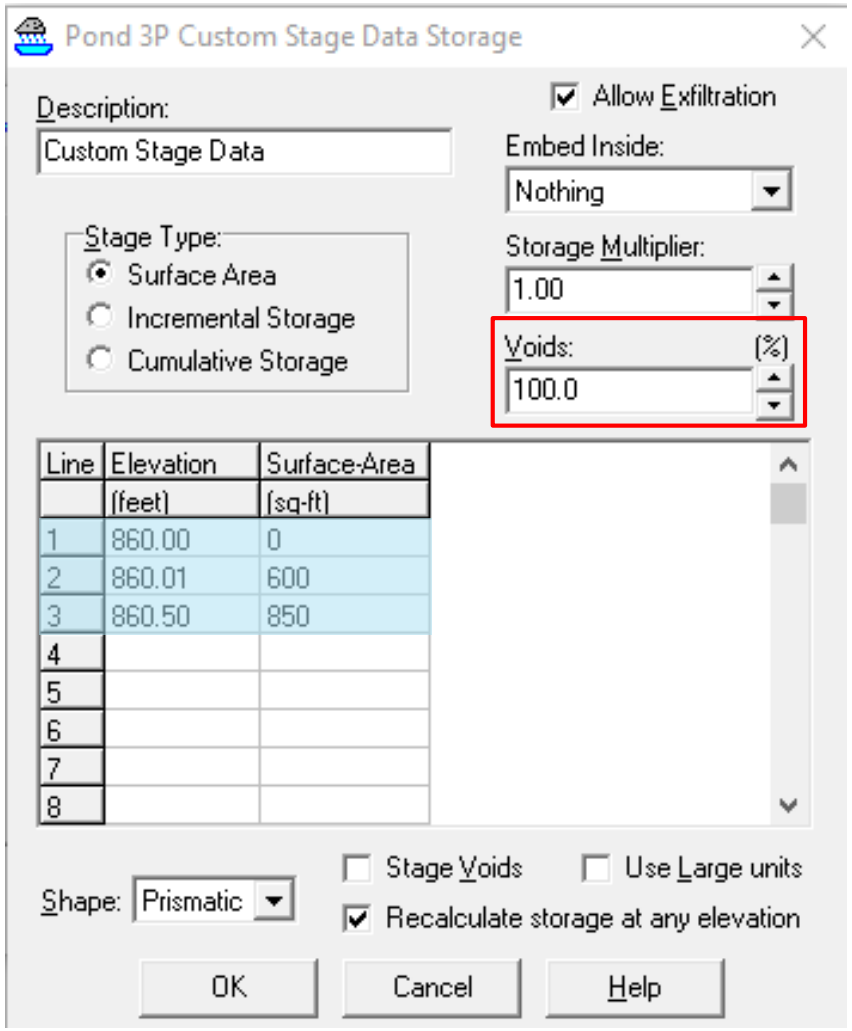

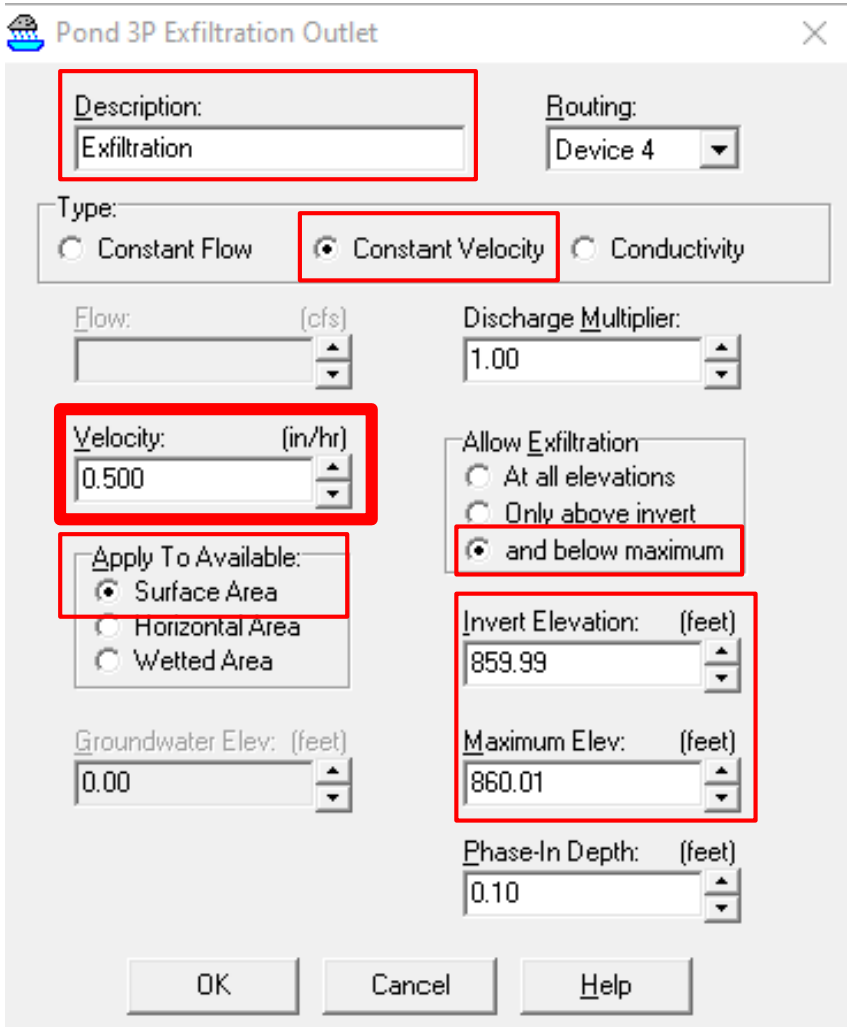

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LAND&WATER RESOURCES DEPARTMENT

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WEBSITE:
https://lwrd.countyofdane.com/tools/ecsm-manual

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