Working with Wetlands in Altered Landscapes - Hydrology

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Objectives

- Define Alterations in Terms of HGM Classes
- Present the Pertinent Water Budget Inputs for Each Class
- Show how These Inputs are Removed under Alteration
- Show how These Inputs can be Restored under Restoration
- Define Hydrologic Restoration vs. Creation and Enhancement According to NRCS Practice Standards

The Water Budget Equation -

(P + Ri + Gi) – (Ro + Go + E + T) = ΔS

The good news is –

If you know your HGM type, you may be able to ignore several factors

The bad news is –

Some factors you DO need are hard to come by!

Water Budget Paramenters

- Precipitation – P
- Evaporation – E
- Transpiration – T
  - E and T MAY be considered together as ET
- Groundwater out – Go
- Groundwater in – Gi
- Surface Runoff in – Ri
- Surface Runoff out – Ro

Three Factors that Define Wetland Classes in the HGM System

Landscape Position
(i.e. Headwaters)

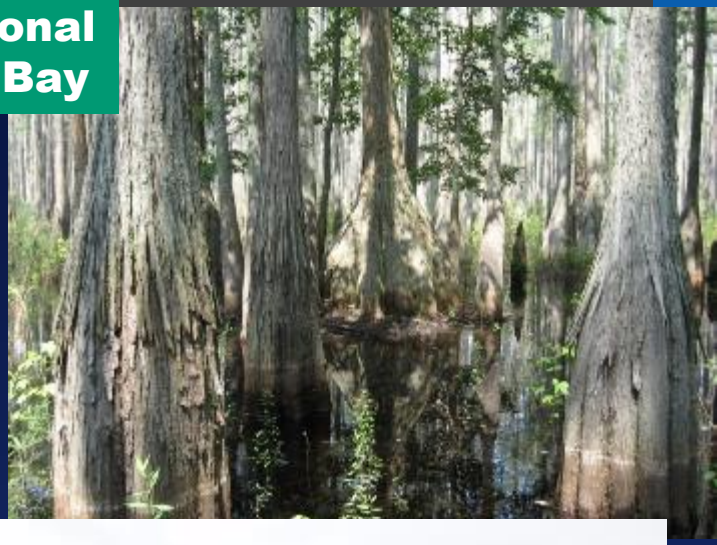
Hydrodynamics
(i.e. vertical lake Fluctuations)

Dominant Water Source
(i.e. Groundwater)

The Seven HGM Classes

- **RIVERINE**
- **SLOPE**
- **MINERAL SOIL FLAT**
- **ORGANIC SOIL FLAT**
- **ESTUARINE FRINGE**
- **LACUSTRINE FRINGE**
- **DEPRESSION**

Depressional
Carolina Bay



Estuarine Fringe
Oregon

Mineral Flats
Indiana Flatwoods

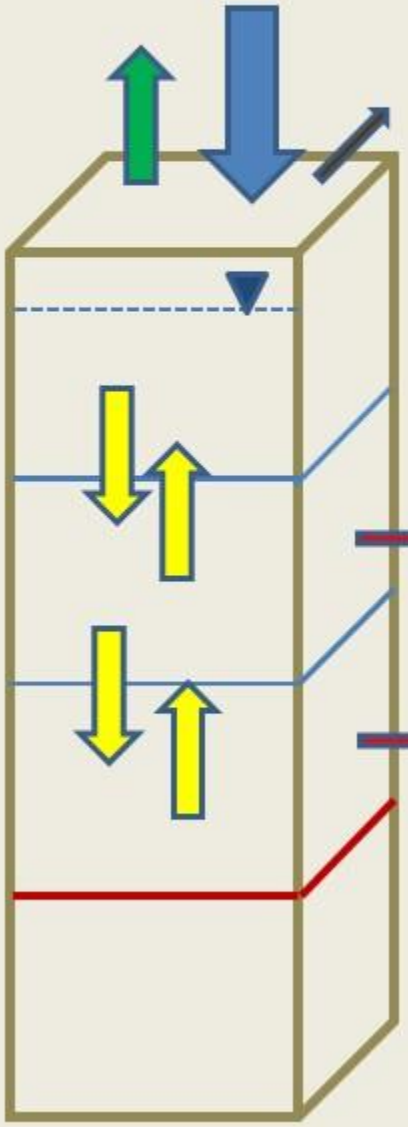
Slope
Puerto Rico

Mineral Flats

- Slopes 0% to 2%
- Little to No Drainage Area
- Rain Fed

Flatwoods in Indiana

Runoff - Recharge Hydrologic Class



Wet Interfluves
No Flow Accumulation
MINERAL FLATS

To Discharge Site

To Discharge Site

P – ET = ΔS

S in Soil and on Surface

MINERAL FLAT Wetlands

Surface Storage (S) Created by Vegetation – Microtopography

Willamette Valley, OR
Wet Prairie

Flatwoods – KY Stream Terrace

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Internal Drainage – Surface and Subsurface Reduces Soil Storage (S)

Subsurface drainage removes water from within the soil. This can be accomplished using:

Ditches

Tile

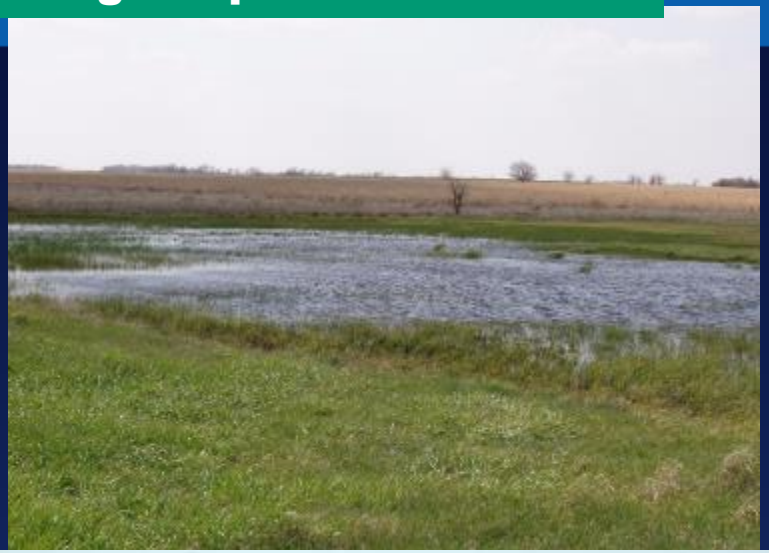
ORGANIC SOIL FLAT
Dominant Water Source – Longer Hydroperiod than Mineral Flats

- Organic Soils
- Often Support Nearby Discharge Wetlands

DEPRESSIONAL

Wyoming – Recharge Depression, Gillette

Nebraska Rainwater Basin – Recharge Depression



South Carolina – Carolina Bay

South Dakota Prairie Pothole

DEPRESSIONAL

Dominant Water Source

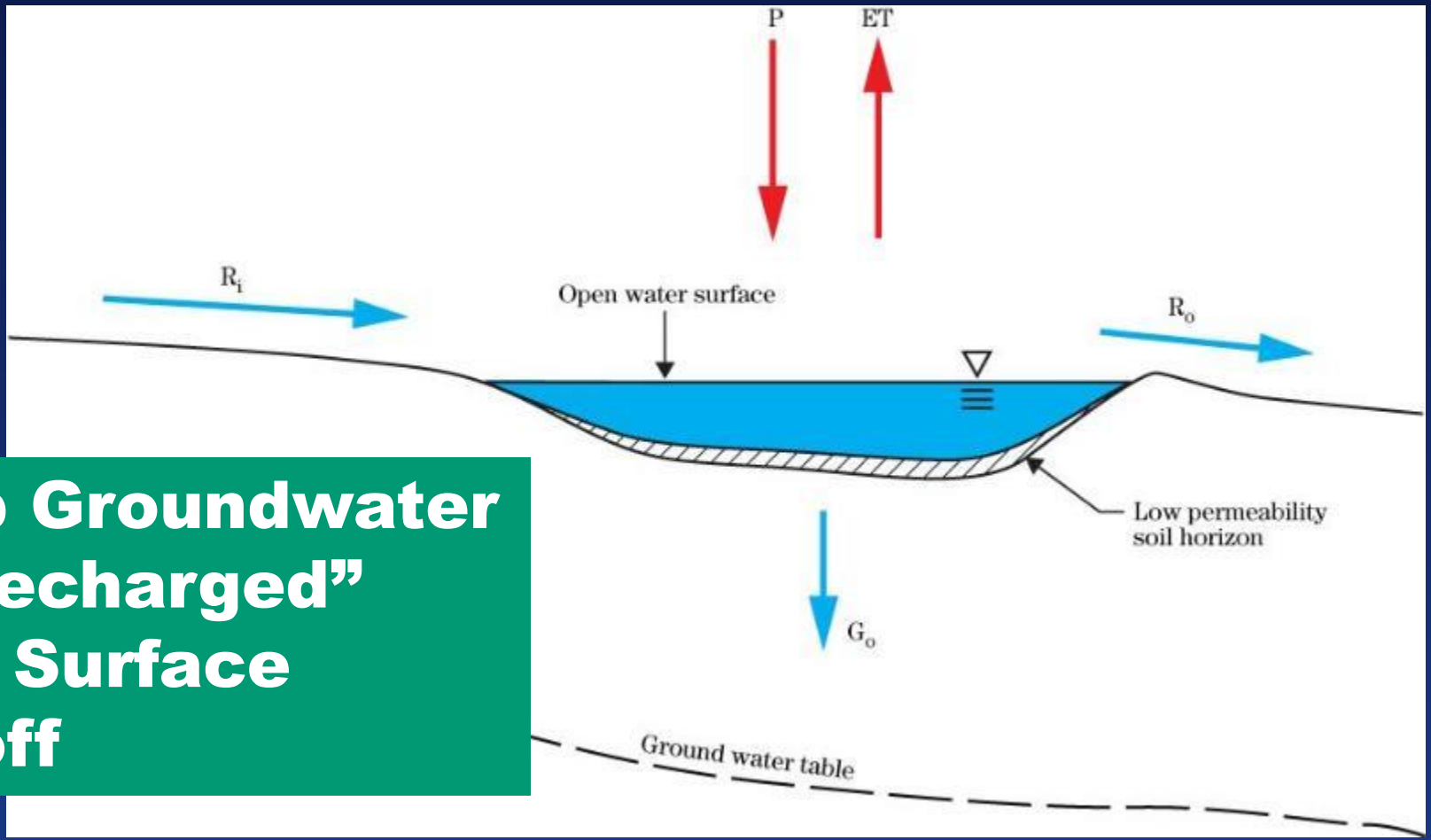
- **Surface Runoff**

OR

- **Groundwater Discharge**

Depressional - Recharge

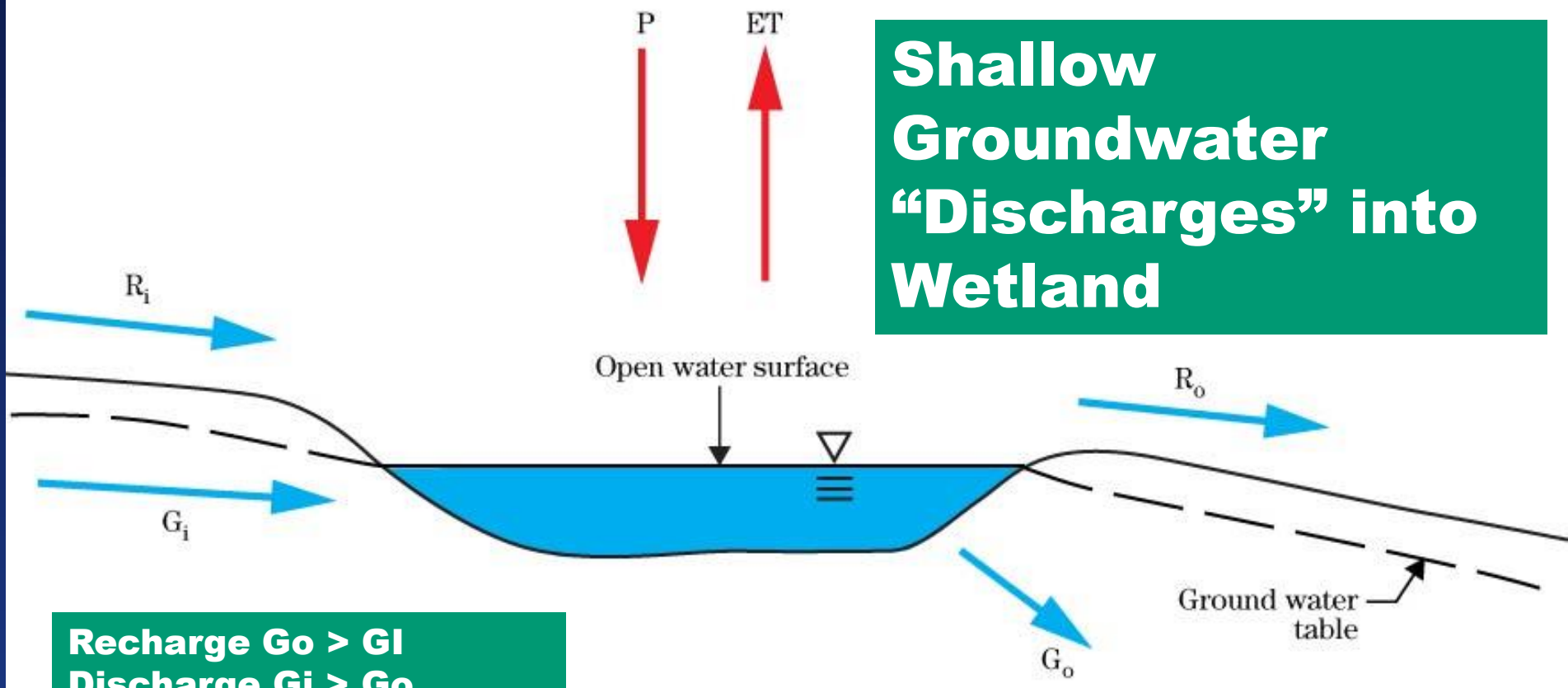
- Restore Watershed Area
- Restore Storage
  - Sediment Removal
  - Plug Outlet Ditch
  - Restore Perching Layer



Deep Groundwater is "Recharged" from Surface Runoff

Depressional – Discharge

- **Plug Interception Ditch**
- **Restore Storage**
  - **Sediment Removal**
  - **Plug Outlet Ditch**



Shallow Groundwater "Discharges" into Wetland

Recharge Go > GI
Discharge Gi > Go
Flow Through Gi = Go

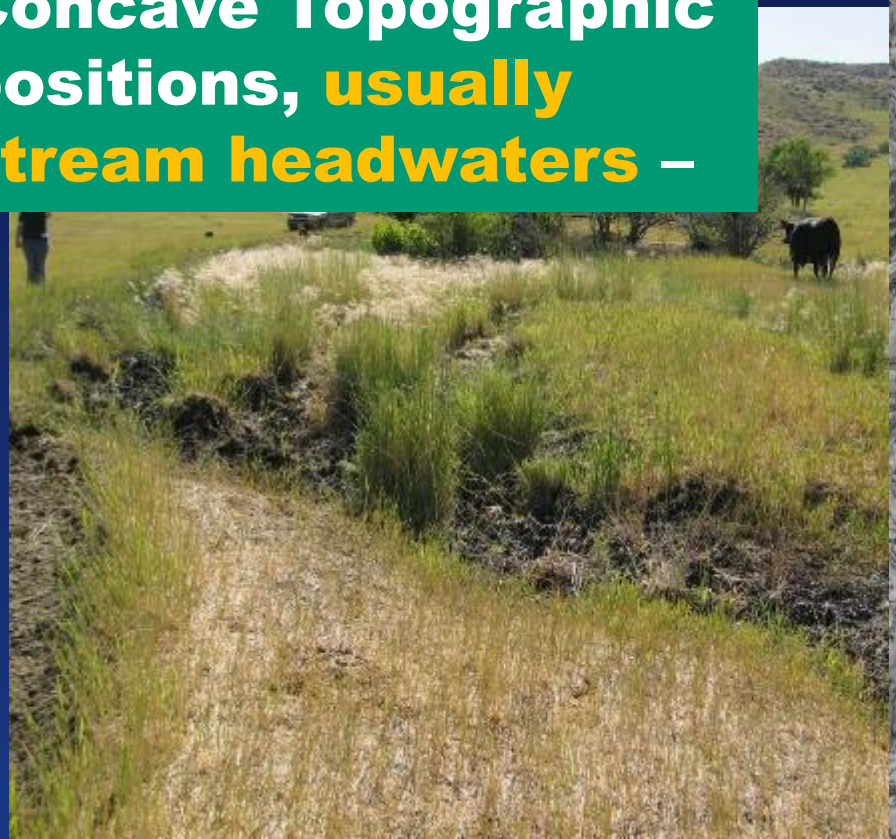
SLOPE Wetlands

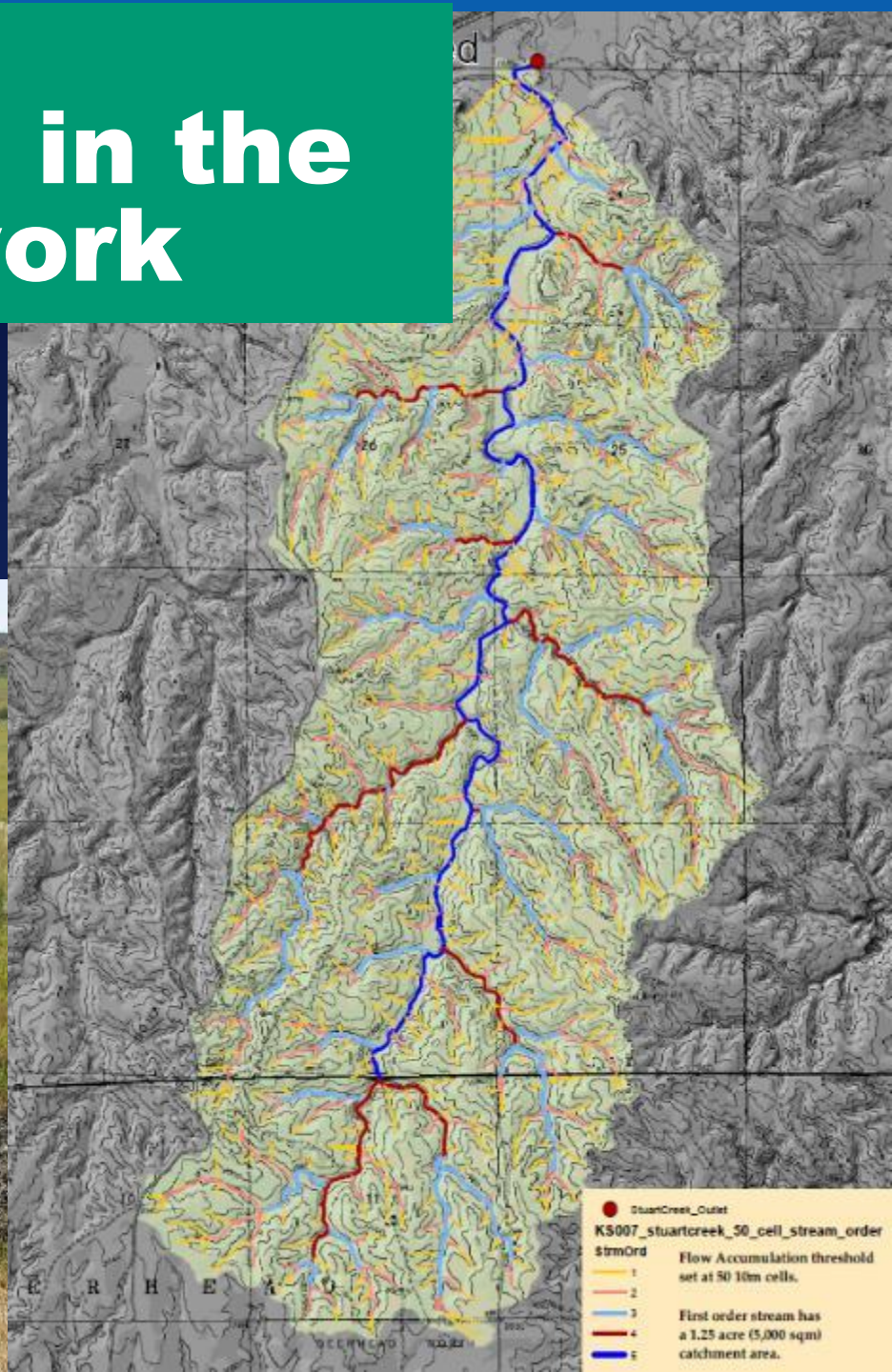
Dominant Water Source – *Groundwater Discharge*

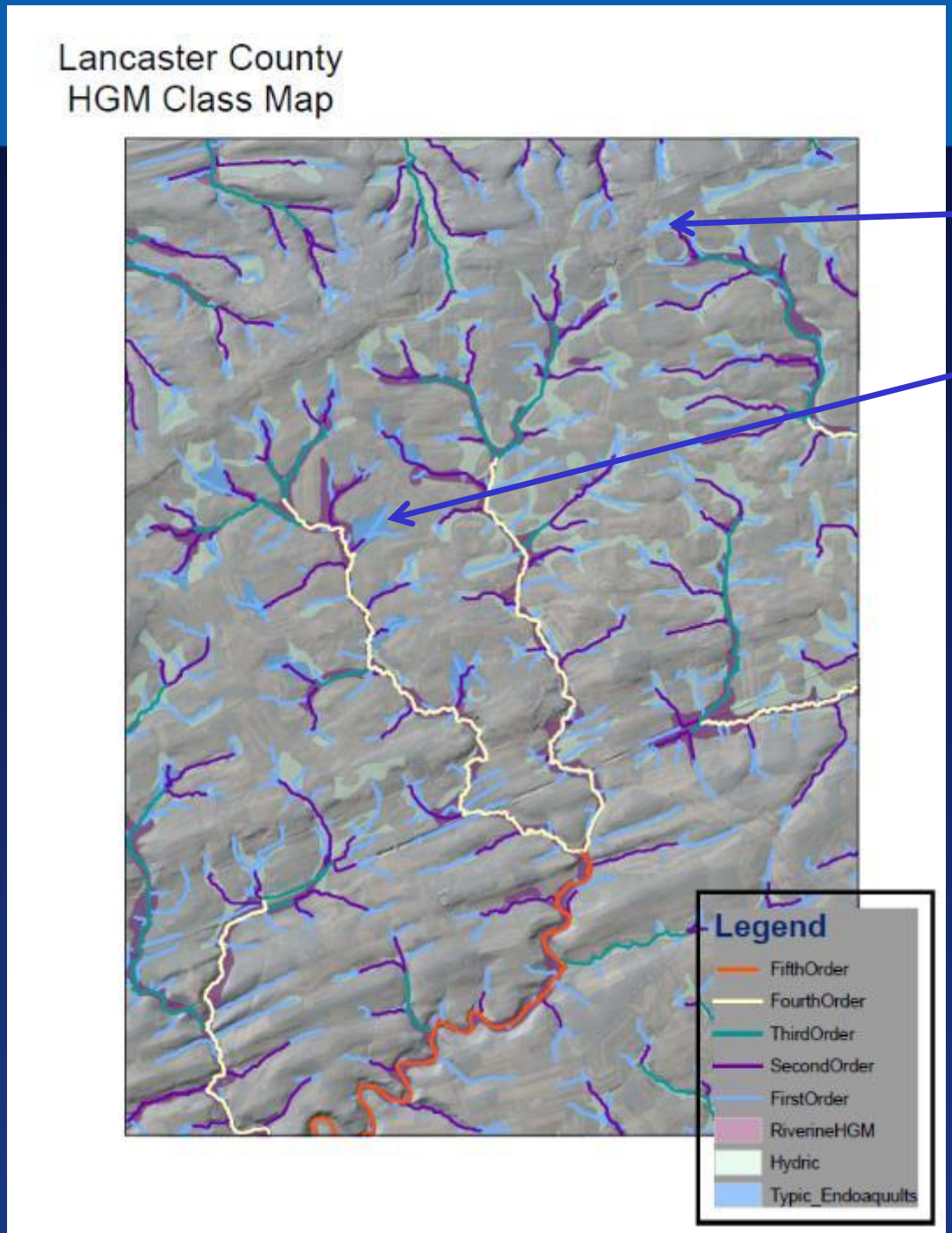
SLOPE Wetlands in the Watershed Network

Landscape Position –

Concave Topographic positions, usually stream headwaters –





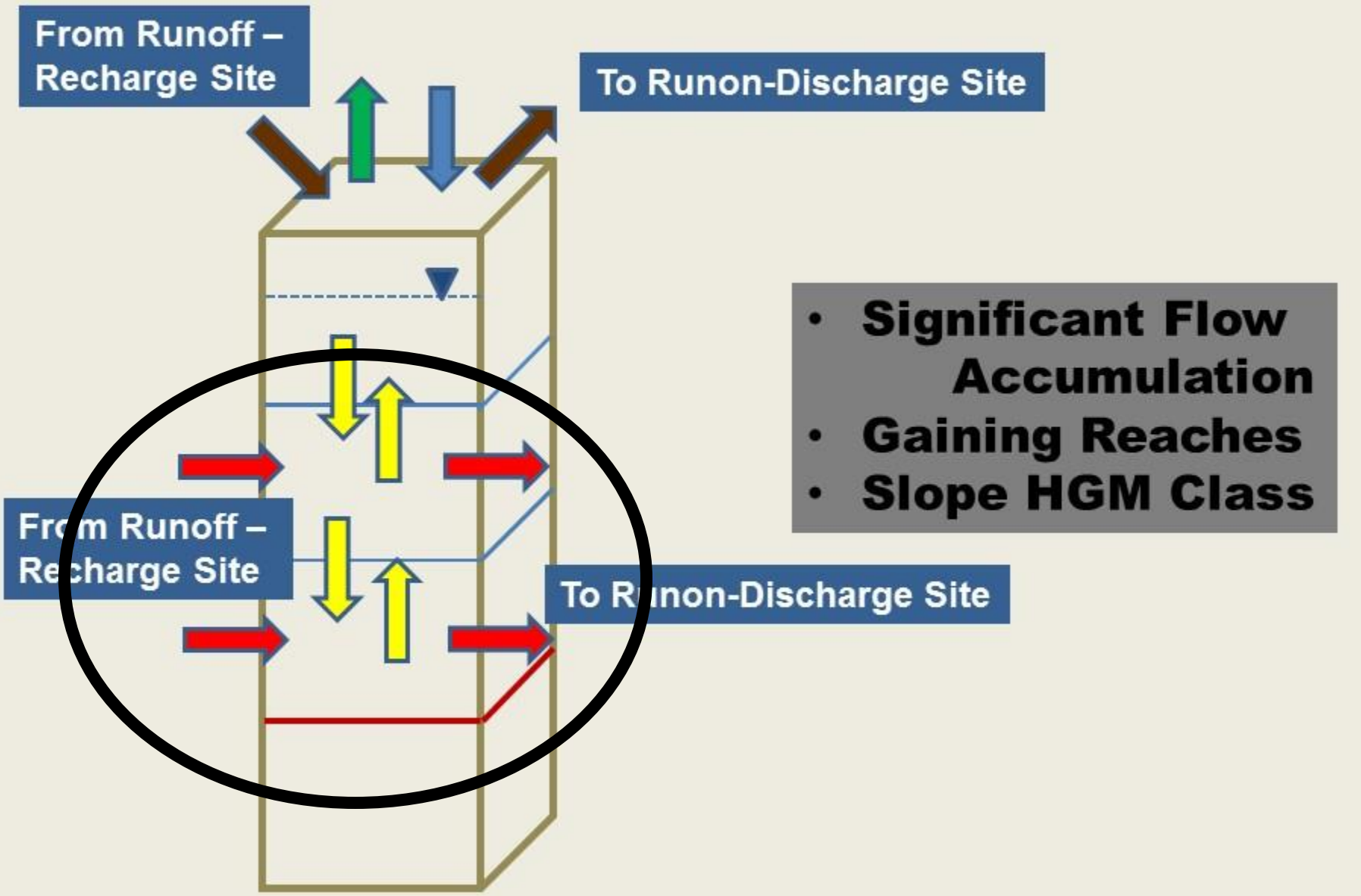


Potential Bog Turtle Habitat

“Typic Endoaquults”

Groundwater Dominated Soils In Low Stream Order Landscapes

Runon-Runoff-Discharge-Recharge Hydrologic Class



- Significant Flow Accumulation
- Gaining Reaches
- Slope HGM Class

SLOPE Wetland – Box Elder Co., Utah

SLOPE Wetland – NY Finger Lakes Region

No Need to Fill Ditch!

- Restored GW Source
- Resaturated Wetland

RIVERINE Wetlands

Landscape Position
Floodplains
Dominant Water Source
Stream Hydrographs (Surface and Groundwater)
Hydrodynamics
Horizontal, Bi-Directional

Floodplain Oxbow -Wyoming

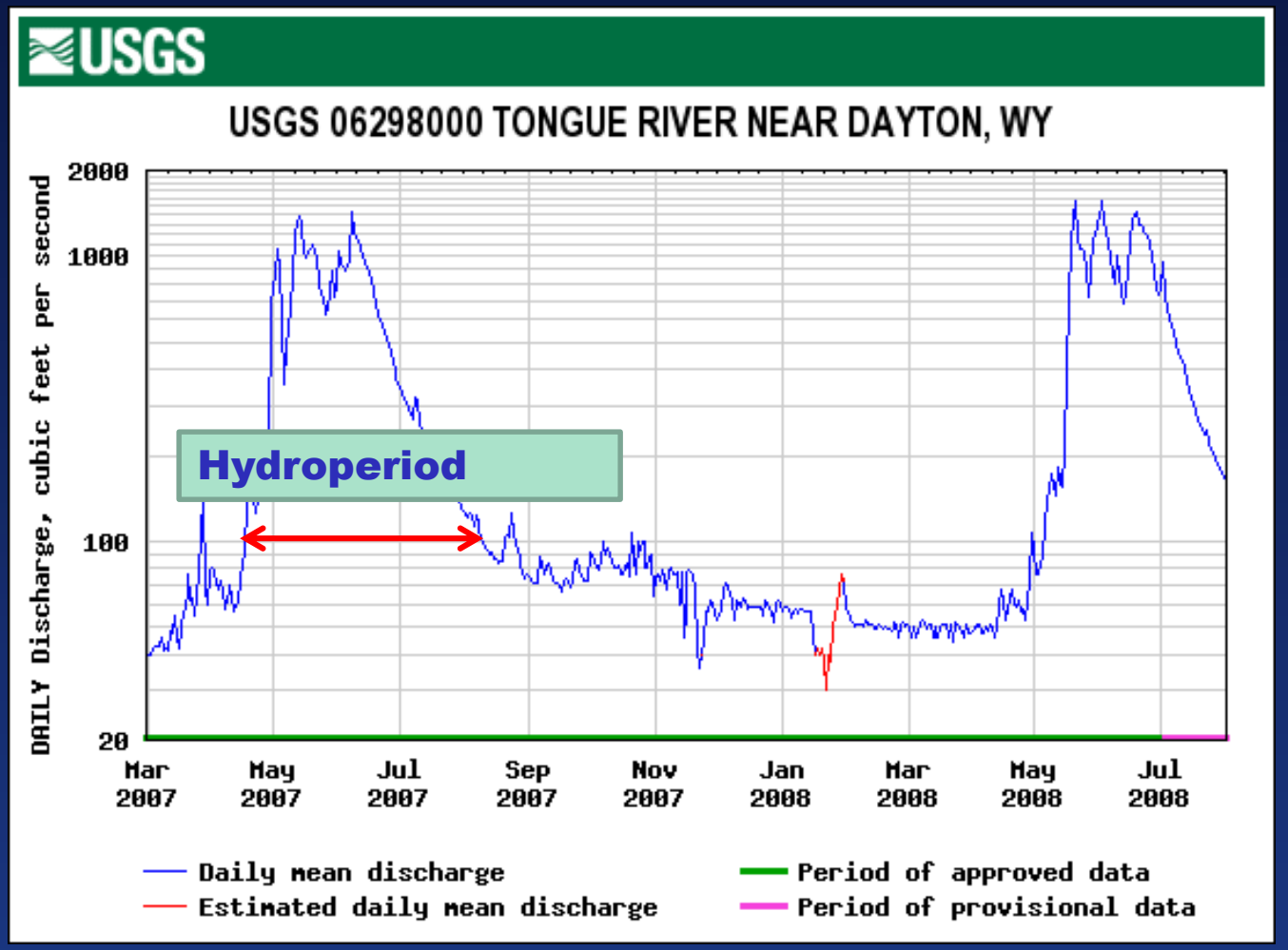
RIVERINE Wetlands

Landscape Position - Floodplains

RIVERINE – Dominant Water Source – Stream Hydrograph

Primary Data Source – Stream Gage

Soil Survey Water Features
- **Flooding**
- **Ponding**
- **Groundwater**



RIVERINE – Lateral Connectivity of Surface Flooding

- Remove Dikes and Levees

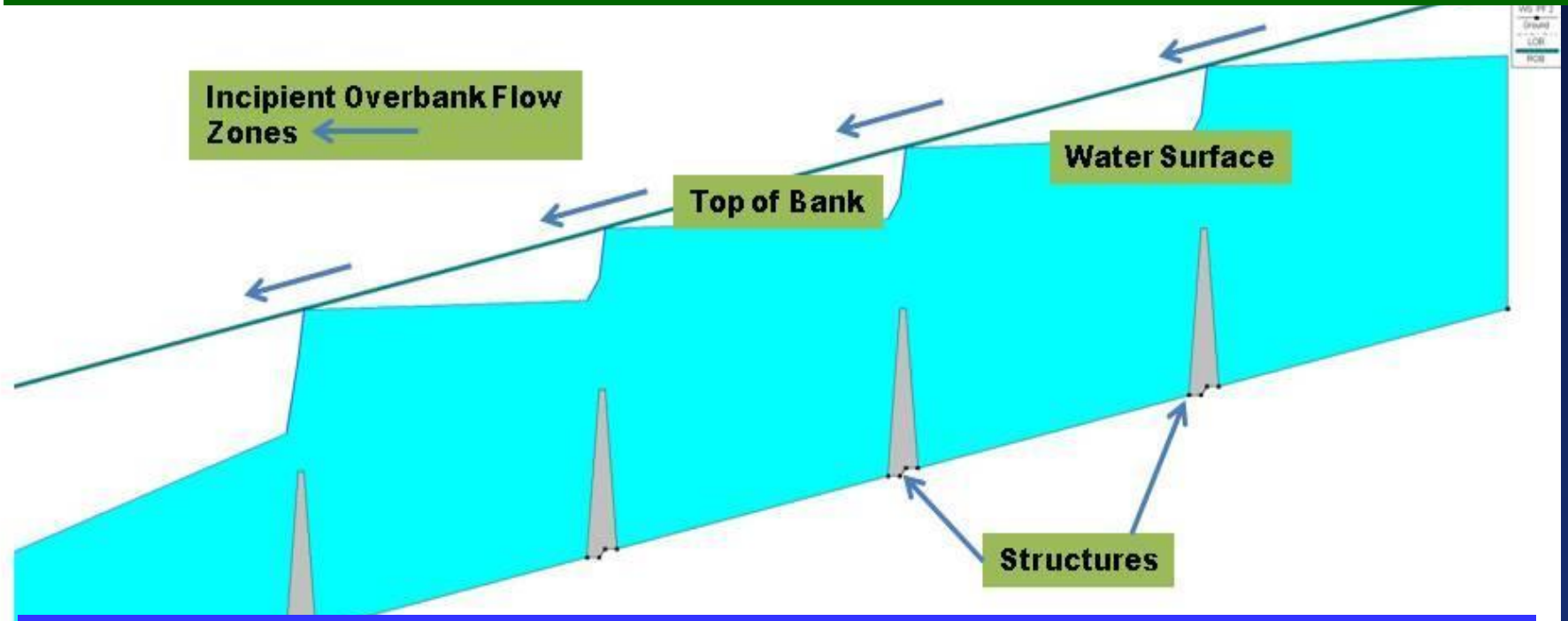
RIVERINE – Maintain Surface Storage (Ponding)

Backswamp - Virginia

RIVERINE – Lateral Connectivity of Floodplain Groundwater

Endosaturated Floodplain

In-Series WCS, Critical Flow – Reduce Channel Capacity, Increase Lateral Connectivity

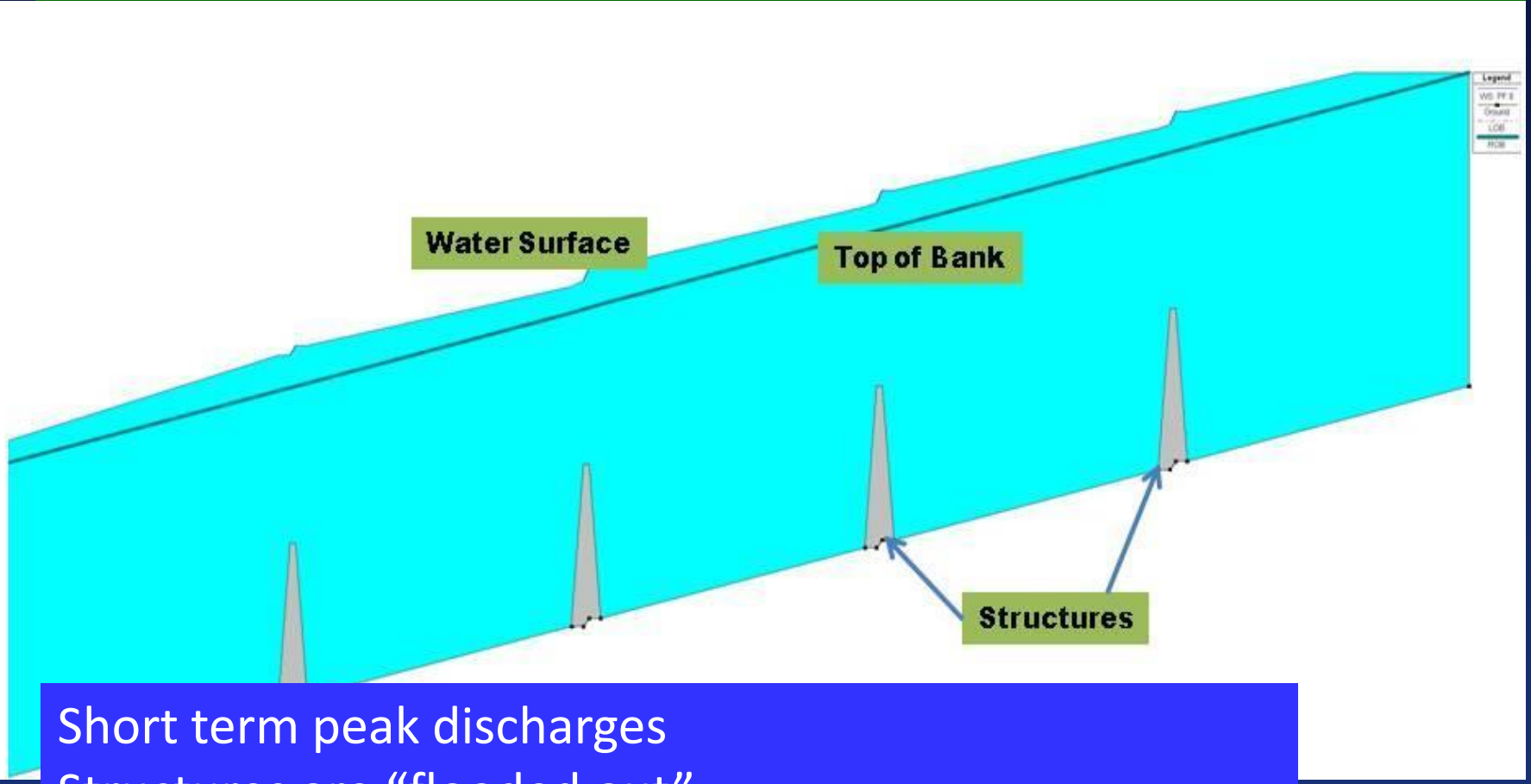


Flow needed to maintain wetland

Head drop across structures is the concern – flanking

Long duration flow – we set the crests at that height on purpose

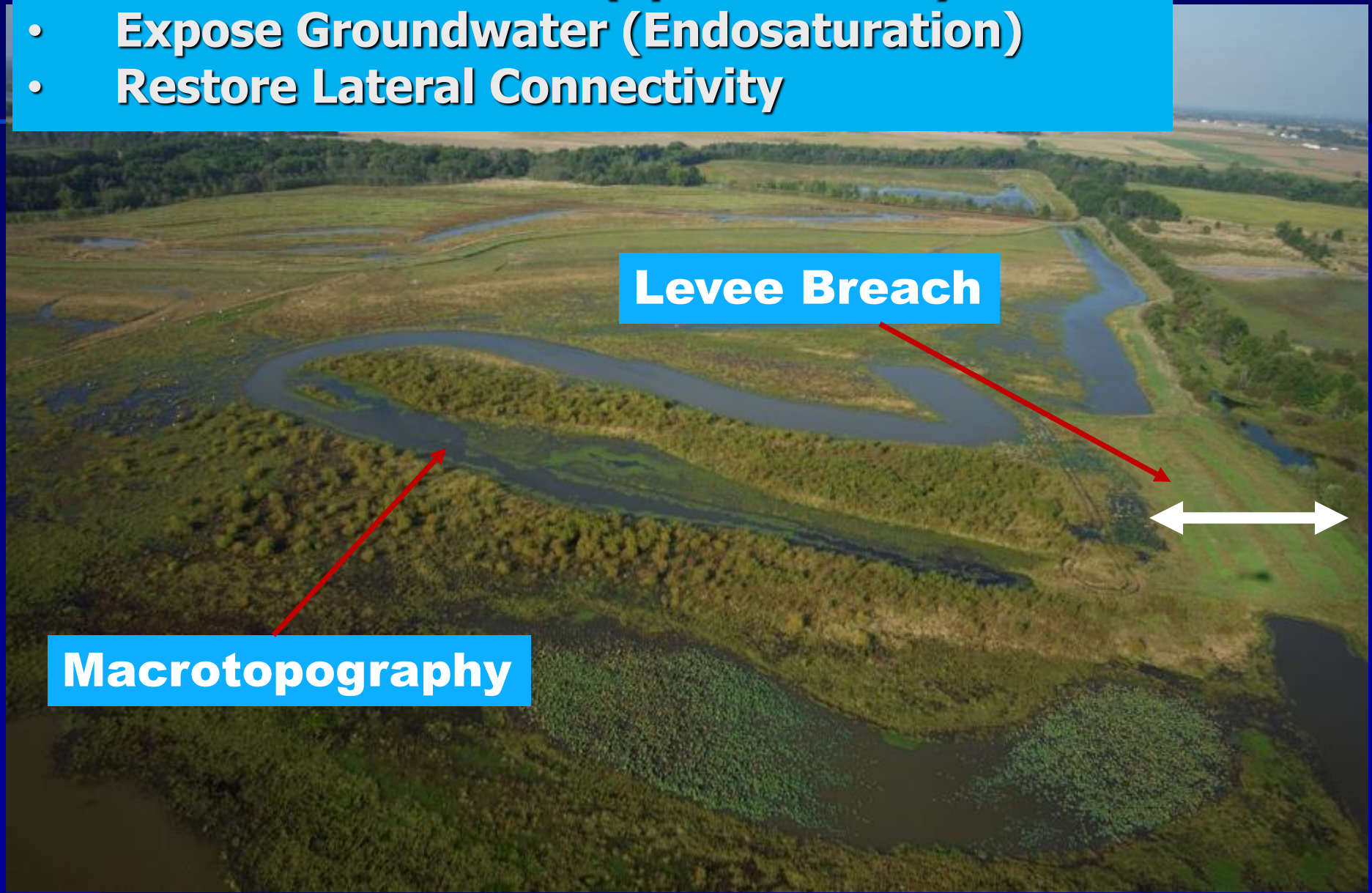
In-Series WCS, Flood Flow



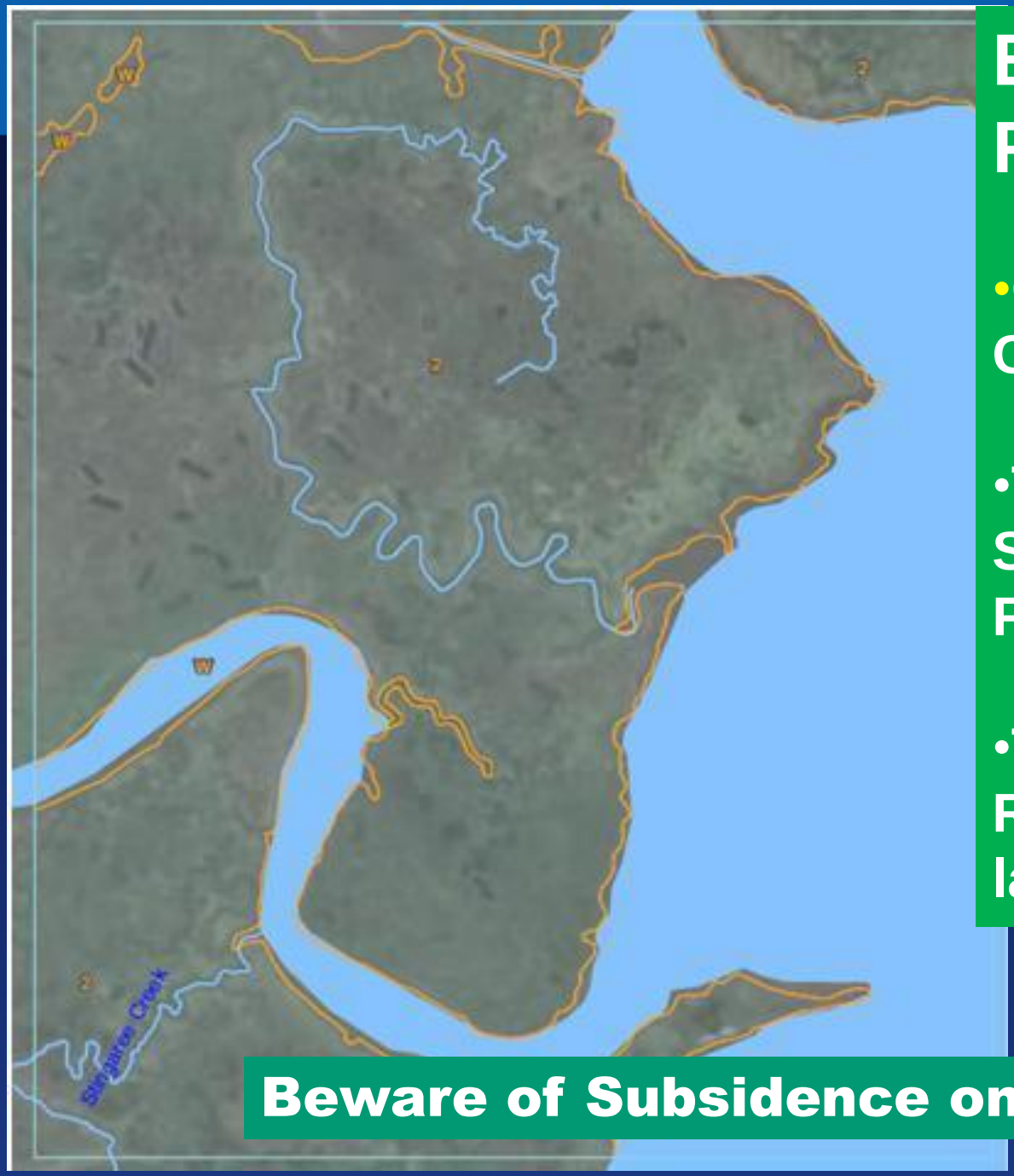
Short term peak discharges
Structures are “flooded out”
Very low head drop across structures, no flanking flow

Levee Removal Macrotopography

- Pond Surface Water (Episaturation)
- Expose Groundwater (Endosaturation)
- Restore Lateral Connectivity



ESTUARINE FRINGE
Dominant Water Source - Tides



Estuarine Fringe

- **Organic Soils** are Common
- Tidally Influenced Salt, Brackish, or Freshwater
- Transitions Into Riverine landscapes

Beware of Subsidence on Organic Soils!

ESTUARINE FRINGE – Tidal Inlet Channels

LACUSTRINE FRINGE
Dominant Water Source-
Lake Fluctuations

Yellowstone Lake

Jenny Lake - Tetons

Conservation Practice Standards In Terms of Hydrology

- **Restoration**
  - **Restoring the original Groundwater, Flooding, and Ponding *Duration* and *Frequency* for the Wetland Soil**
- **Creation**
  - **Choosing to Provide Groundwater, Flooding, and/or ponding on a site that did not have any previously (or enough to be a wetland).**
- **Enhancement**
  - **Increasing (or Decreasing) one of the previous three parameters to meet a specific goal. Limited to 30% of the original wetland acres on a site.**

Thank You!

Wet Headwater – Kansas Flint Hills

photo: Jon Fripp