

## Water Control in Wetlands



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## Objectives

- Discuss when water control is needed
- Understand water level control and flow rate control
- Understand the advantages and disadvantages with different structures

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## Water Control Structures Function:

- Management
  - Restore, Create, or Enhance Hydrology Function
  - Water Control is control of OUTFLOW, Ro
  - An attempt to re-create natural function by manipulating hydroperiod and regime or:
  - An attempt to enhance hydroperiod and/or regime
  - Pass fish and other aquatic organisms
- Concerns – Integrity of Structure
  - Pass Surface Runoff Discharges
  - Reservoir Route Hydrographs through Principal and/or Auxiliary Spillway
  - Survive Inundation in Riverine Wetland Type

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## Outflow

- Water Level Control
  - Maintaining same level of water throughout hydroperiod does not mimic natural dynamic wetting and drying cycles
- Flow Rate Control
  - Attempt to use water control structure to mimic natural wetland losses due to outflow, flood recession, and evapotranspiration.

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## Management



Drawdown to To Control Vegetation

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## Management



Maintenance Drawdown

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## Management

Create shore  
bird habitat



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## Management – Aquatic Organism Passage

To Maintain Aquatic Organism Passage  
-Off channel rearing, feeding, refugia



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## Fish Passage



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## Safety of Embankment



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## Types of Structures

- Weirs
  - Sharp Crested
  - Broad Crested (Auxiliary Spillways)
- Pipes
- Orifices

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## Sharp Crested Weir



- Pros-
- High capacity at low heads.
  - Easy to clean, maintain
  - Creates problems for aquatic organism passage
- Cons-
- Expensive- May require specialized equipment

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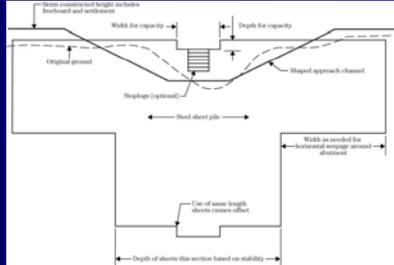
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## Steel Sheet Pile Weir

Good option for peat and muck soils IF mineral layer exists within a few feet of the surface



Just like an iceberg, most of it is below the surface!

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## Open Stoplog Riser



- Pros-**
- Can use in deep pools
  - Can maintain access across dike
  - Excellent Water Level Control
- Cons-**
- Easy for beavers to plug
  - Hard to clean out
  - Prevents aquatic organism passage
  - Moderate Flow Rate Control

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## Agri-Drain Open Stoplog



- Pros-**
- Inexpensive
  - Easy to Install
  - Good Water Level Control
- Cons-**
- Low Capacity
  - Bouyancy Issues
  - Moderate Flow Rate Control
  - Beaver problems
  - Passage barrier

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## Closed Stoplog



- Pros-
  - Inexpensive
  - Minimize Beaver Problems
  - Moderate flow rate control
- Cons-
  - Low capacity
  - Bouyancy issues
  - Passage barrier

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## Full Round CSP Stop Log



- Pros-
  - Virtually no problems with beaver.
  - Good water control
- Cons-
  - Low capacity
  - Passage barrier

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## Stoplog in Culvert



- Pros-
  - Medium capacity.
  - Good water level control
  - Maintains access.
- Cons-
  - Potential for beaver problems.
  - More expensive.
  - Passage barrier.
  - Poor flow rate control

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## Pre-Cast Concrete Riser Full Round with Stoplogs



Pros-  
Medium capacity.  
Quick Install.  
Moderate maintenance.  
Moderate beaver issues.  
Minimize buoyancy problems

Cons-  
Capacity.  
Weight.  
Moderate Expense.

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## Downstream Flap Gates with Dikes



Appropriate in-Riverine systems where it is not feasible to allow flood flows to access their original floodplain.

Restoration is done to mimic original flooding by controlling runoff from uplands or other portions of the floodplain.

ONLY do when allowing flooding will affect currently protected off-project areas.

These are severe aquatic organism passage barriers.

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## On-Channel Cross Vanes



Appropriate for riverine applications as grade stab. and water surface profile modification. Must be installed in series.

Expensive, requires hydraulic modeling of channel system.

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## "Cut-Pipe" Culvert



**Pros-**

Maximum capacity for low heads.  
Fish passable.  
Inexpensive.  
Excellent water level control

**Cons-**

Limited to low pool depths.  
Bouyancy Issues.  
No flow rate control

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## Riser with Orifices



**Pros-**

Inexpensive.  
Low maintenance.  
Good flow rate control.

**Cons-**

Low capacity.  
Passage barrier.  
Difficult to access.  
Poor water level control.  
High management.

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## Gates



**Pros-**

Good incremental flow rate control  
Submerged Inlet (beaver)

**Cons-**

Must re-set after drawdown.  
Poor water level control  
High management

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## Structure Hydraulics

- Sharp-Crested Weir
  - Capacity governed by weir length
  - $Q = CLH^{3/2}$ 
    - C = Weir coefficient 2.6 to 3.3
    - L = Weir Length
    - H = Flow Depth (Head)
- Orifices
  - Capacity governed by orifice size
  - $Q = CA(2hg)^{1/2}$ 
    - C = Orifice Coefficient (0.6 to 0.71)
    - A = Area of Orifice
    - h = Water Depth above center of orifice
    - g = 32.2 ft/sec<sup>2</sup>

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## NRCS NHCP -Criteria

- Structure for Water Control
  - NHCP Practice Standard 587
- Grade Stabilization Structure
  - NHCP Practice Standard 410
- Dike
  - NHCP Practice Standard 356
- Wetland Restoration, Creation, Enhancement
  - NHCP Practice Standards 657, 658, 659

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## Return Period Storm Criteria

- Wetland Standards
  - 10-yr., 24-hr.
- Grade Stabilization
  - 25-yr., 24-hr. when embankment pond
  - 2 to 25 year for other types depending on rainfall zone, and structure height.
- Structure for Water Control
  - No specific criteria
- Dike
  - Class III is 10-yr, 24-hr. below 6 feet high.

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### On-Channel "Island Structures"

- Ref. NHCP 410 – Grade Stabilization Structure
- During storm flow, structure is "flooded out" from downstream
- Examples –
  - On-channel
  - In Flood Plain

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### On Channel Island Structures

- Structure capacity is at least as great as downstream channel
- Water Surface Profile drop less than 1 foot across structure
- Requires hydraulic analysis
  - HEC-RAS

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### Adjacent to Channel "Island Structure"

- Stream "floods out" structure during high flow event
- Out of Bank Flows must be allowed to access areas downstream of structure
- Use extreme care – must carefully analyze timing of peak flows

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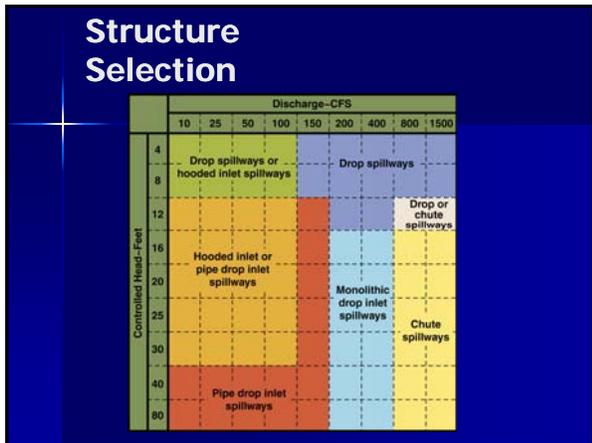
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- ### Considerations
- Water control structures only let out water, not sediment.
  - Nature's drawdowns are usually slower than man's
  - Nature's drawdowns have more diversity than man's

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- ### Permits
- Water Rights
  - Floodplain
  - Dam Safety
  - NPDES (Section 401)
  - Section 404
  - Easements
    - Flowage
    - Utility
    - Roads

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