



Hydraulic Updates and Typical Issues

Road Design Conference
May 2026



INDIANA DEPARTMENT OF TRANSPORTATION



Alex Schwinghamer, PE

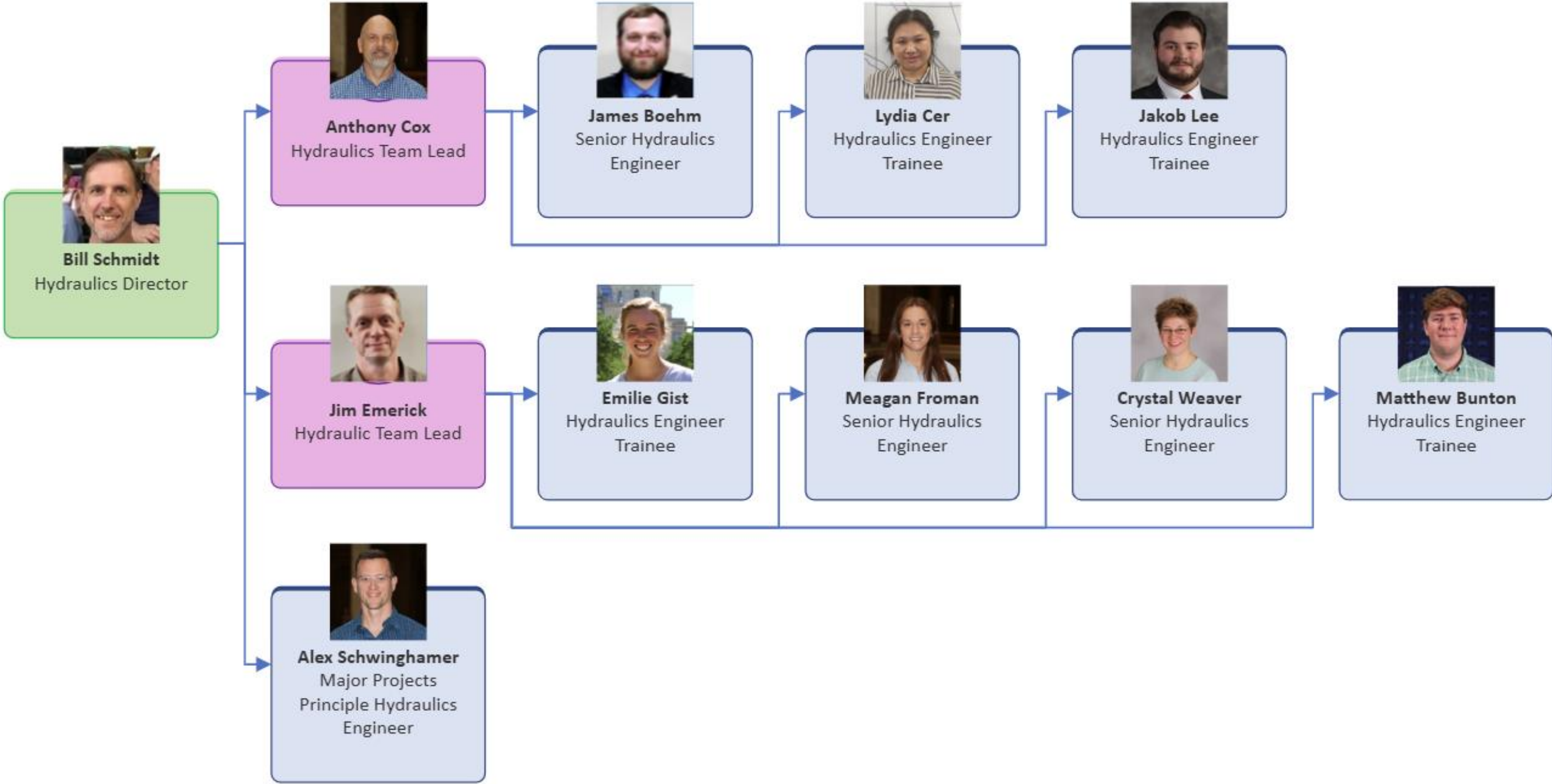
Aschwinghamer@indot.in.gov



INDIANA DEPARTMENT OF TRANSPORTATION



INDOT Hydraulics Staff





Small Structures



INDIANA DEPARTMENT OF TRANSPORTATION



...

Small Structure Memos

- Memo Structural Elevations
 - Low Structure
 - Flowline
 - Invert

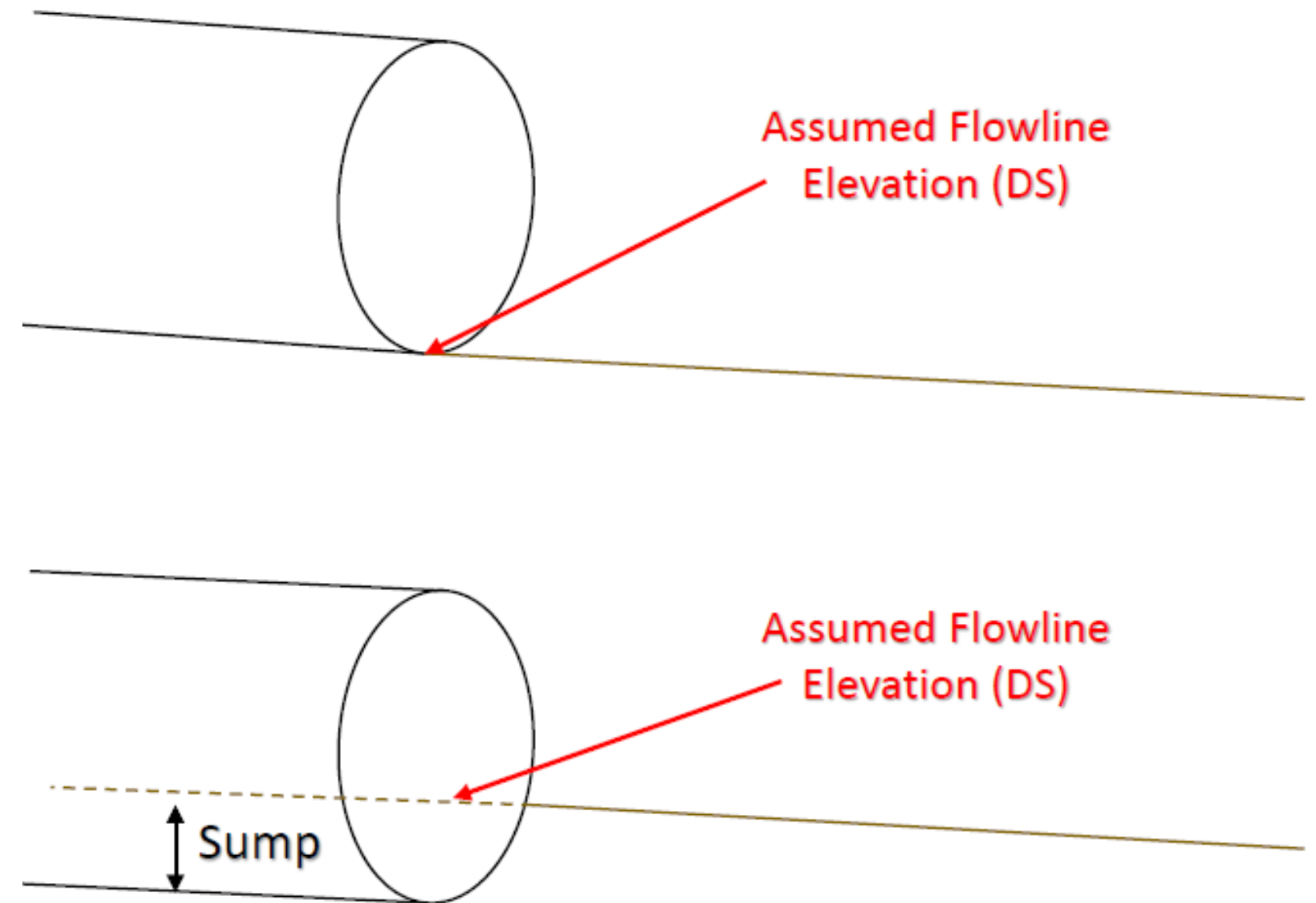
Parameter	Existing		Proposal 1	
Structure Size & Type	36" ID CMP w/Grated Box End Section		53" x 34" HECP w/Pipe End Sections	
Q ₁₀₀ Headwater Elevation	520.54	ft.	517.33	ft.
Meets Roadway Serviceability @ Q ₁₀₀ (AEP 1%)	No		Yes	
Backwater	5.36	ft.	2.15	ft.
Minimal Low Structure Elevation (DS)	515.80	ft.	515.62	ft.
Assumed Flowline Elevation (DS)	512.80	ft.	512.79	ft.
Sump Depth	N/A	in.	0	in.



Small Structure Memos

- Flowline vs Invert

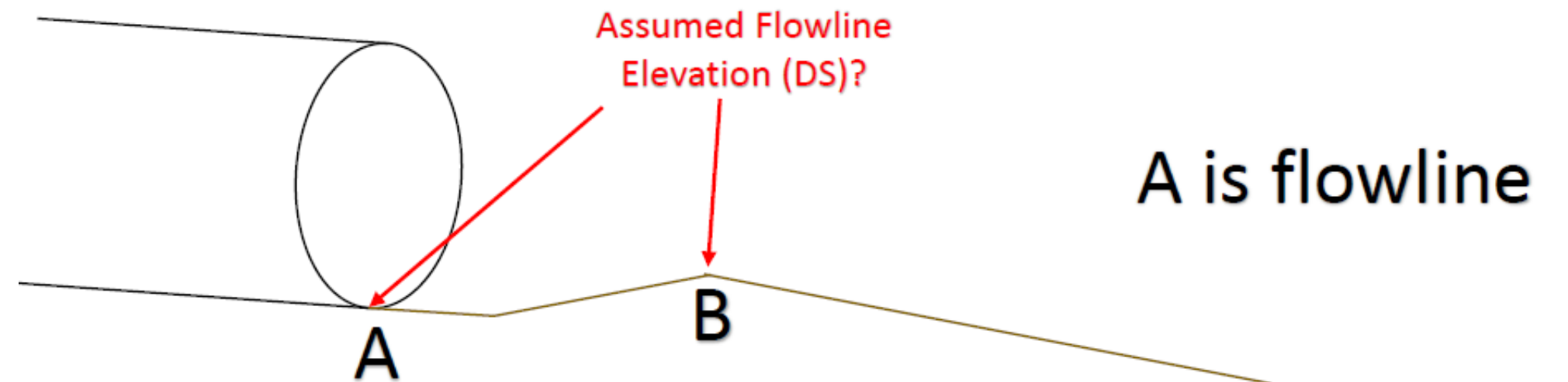
- Flow line is the elevation of the flowline above the outlet invert



Small Structure Memos

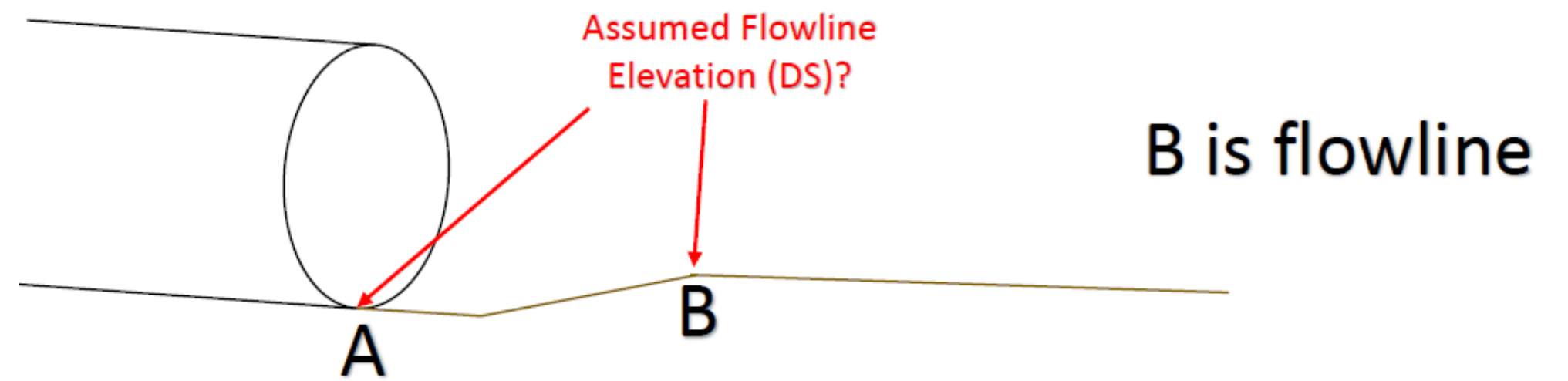
- Flowline vs Invert

- DS channel is higher than the invert
- Common scenario
 - B has sediment buildup and not representative of the natural channel



- Uncommon Scenario

- Downstream Ditch is actually higher than pipe invert. Most likely seen in farm fields that have high sedimentation

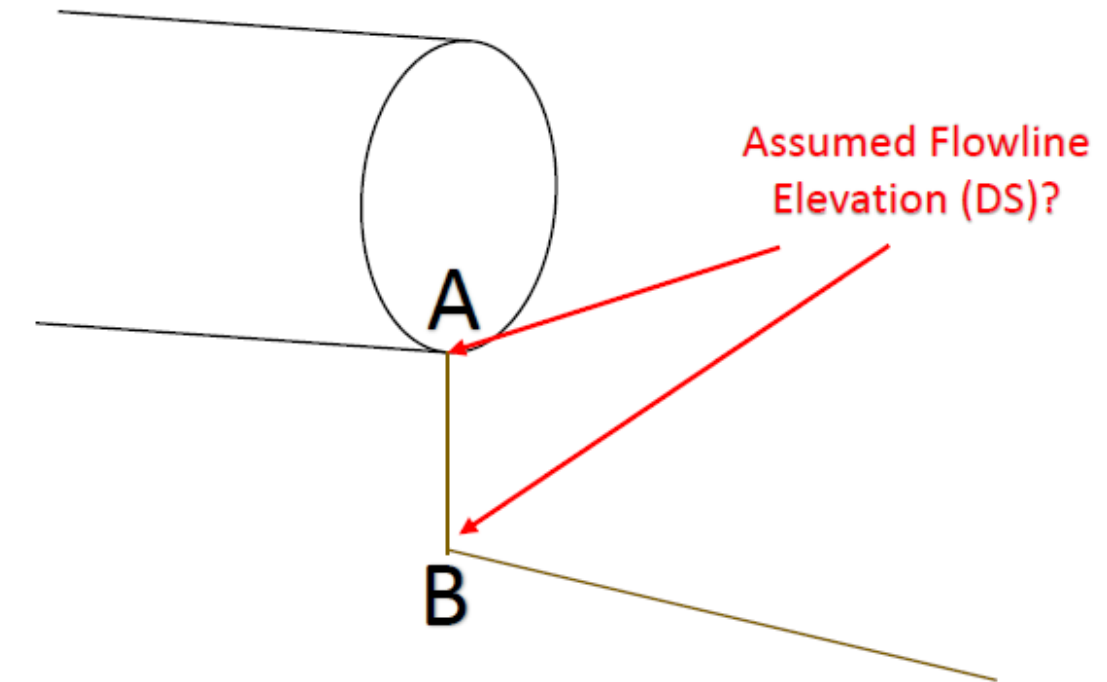


Small Structure Memos

- Flowline vs Invert

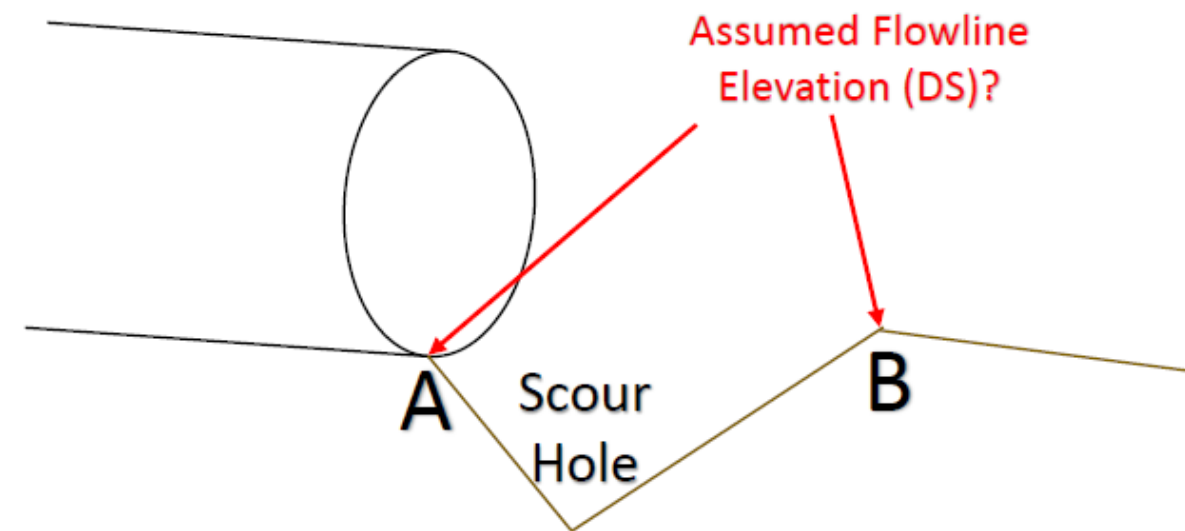
- Drop at outlet of the pipe

- Channel degradation or original design has an actual drop after the outlet to the natural flowline of the channel.
 - Point B is the flow line



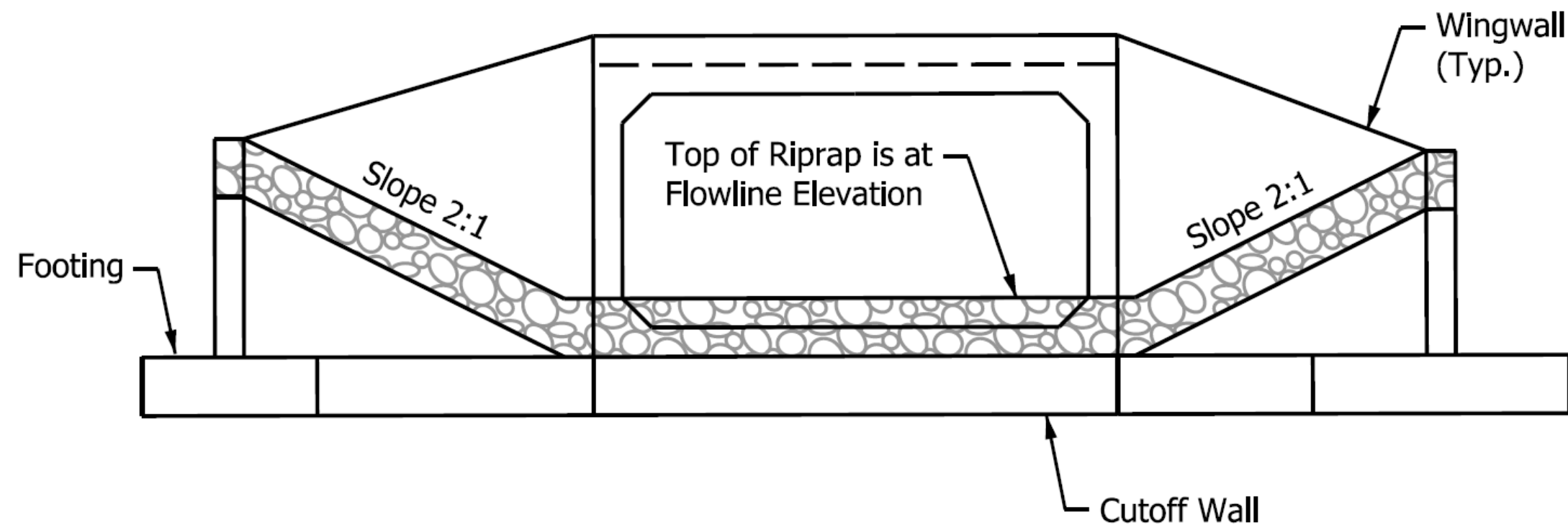
- A scour hole has formed and there is simply a hole or bowl at the outlet that then goes back to a natural channel formation.

- Scour hole and sedimentation are not representative of the natural channel
 - Point A is the Flowline



Small Structure Memos

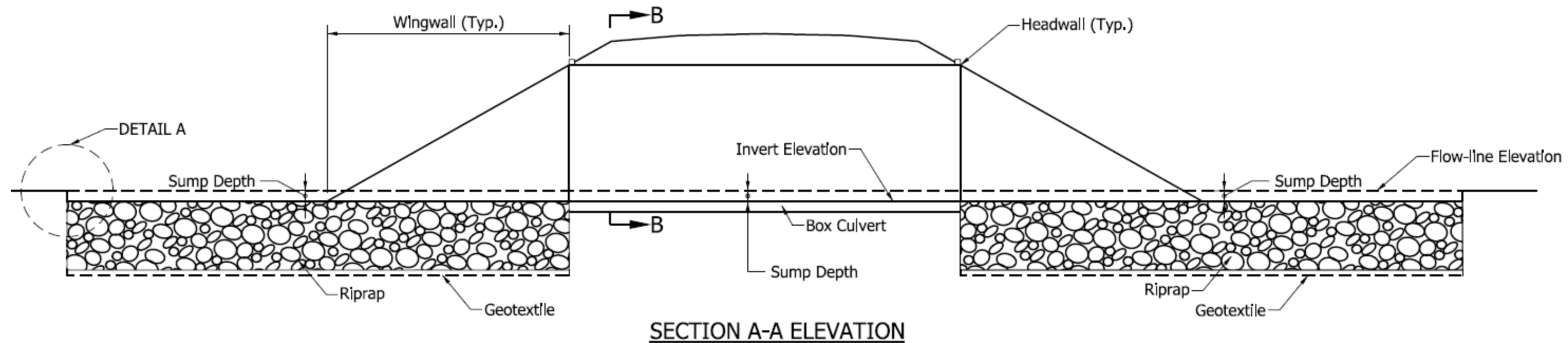
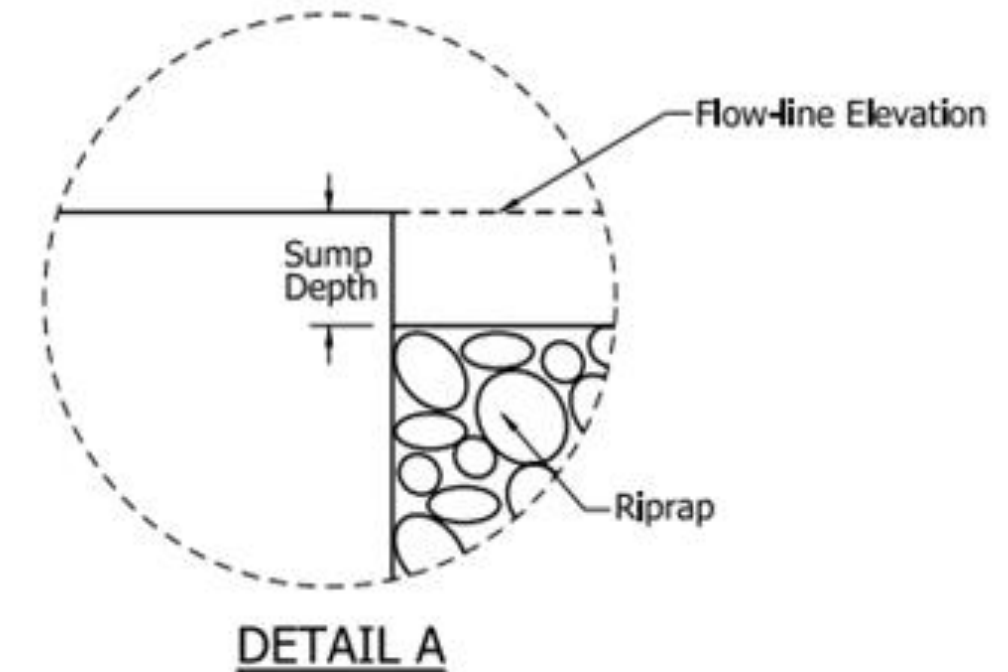
- Reinforced Concrete Boxes (RCB's)
 - Sample Plans – Riprap at Flowline elevation
 - Standard Drawing E714-BCSP-01 – Riprap at invert elevation



ELEVATION

Small Structure Memos

- Reinforced Concrete Boxes (RCB's)
 - Sample Plans – Riprap at Flowline elevation
 - Standard Drawing E714-BCSP-01 – Riprap at invert elevation





Median Drains

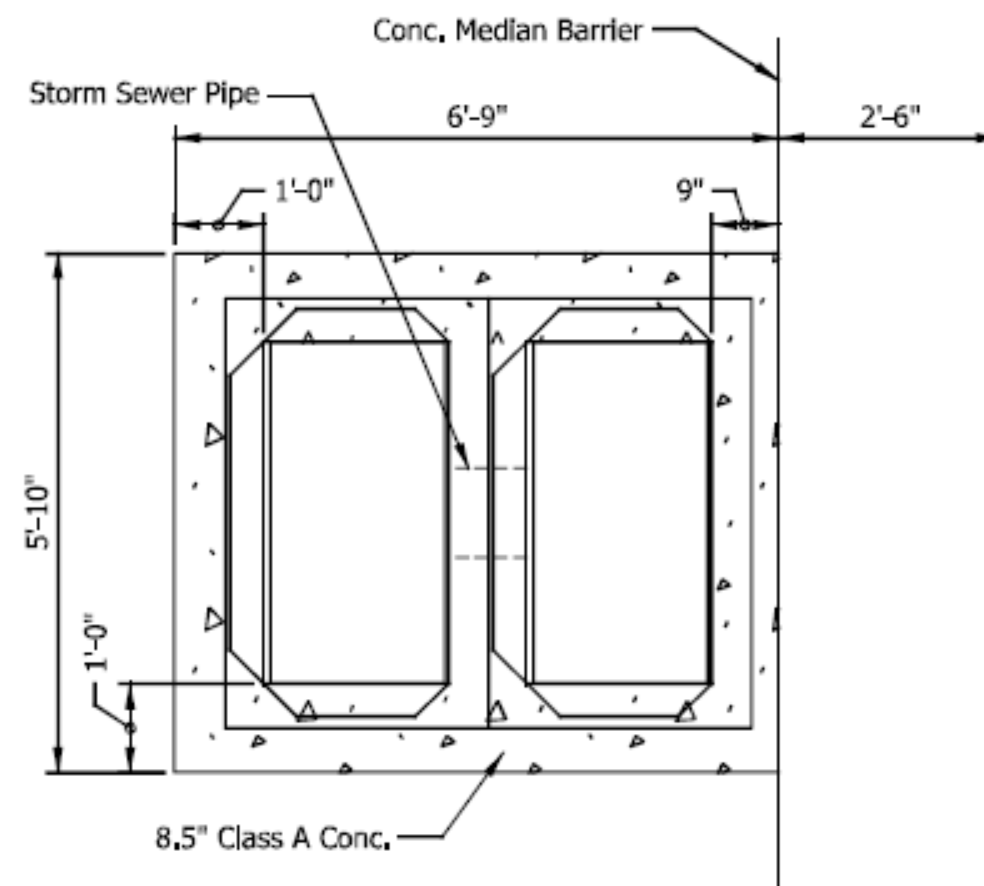


INDIANA DEPARTMENT OF TRANSPORTATION

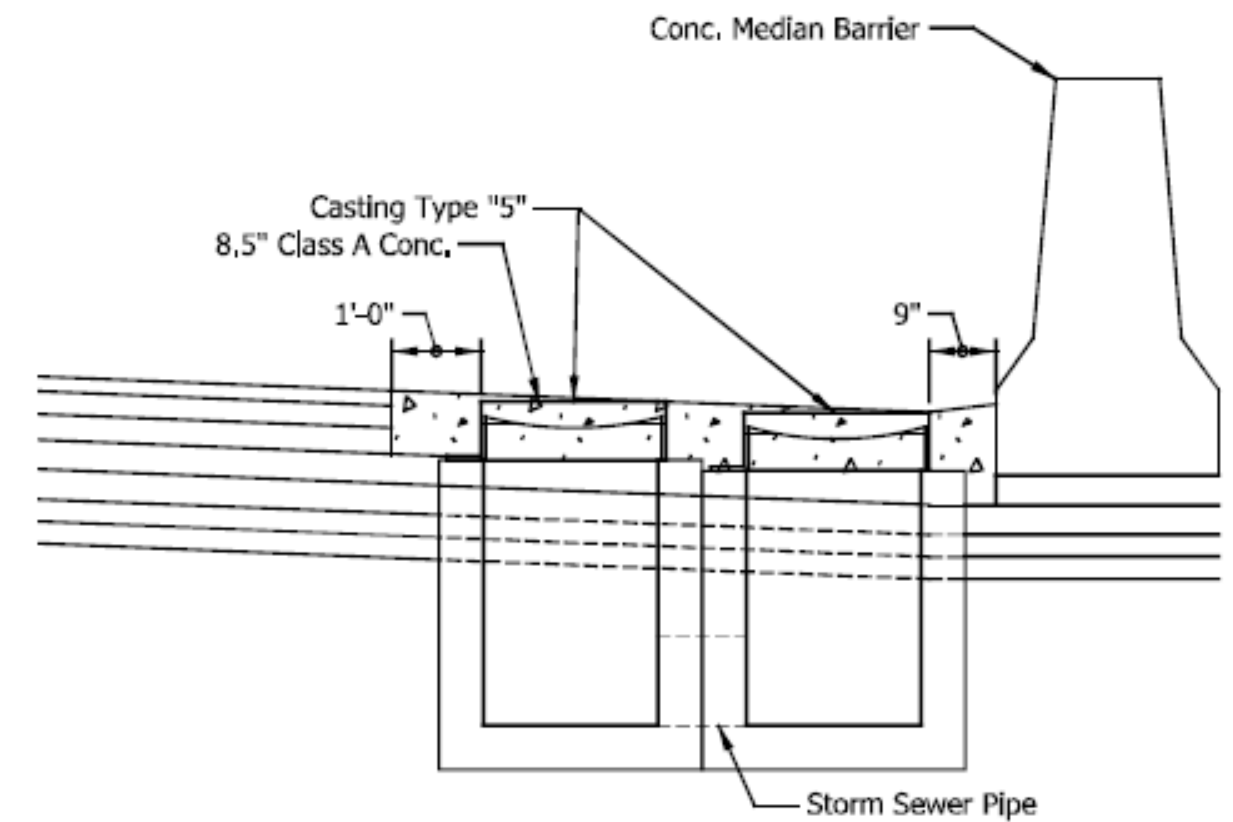


Median Drains

- Double H5
 - Substitute for slotted drain formation
 - More Maintainable



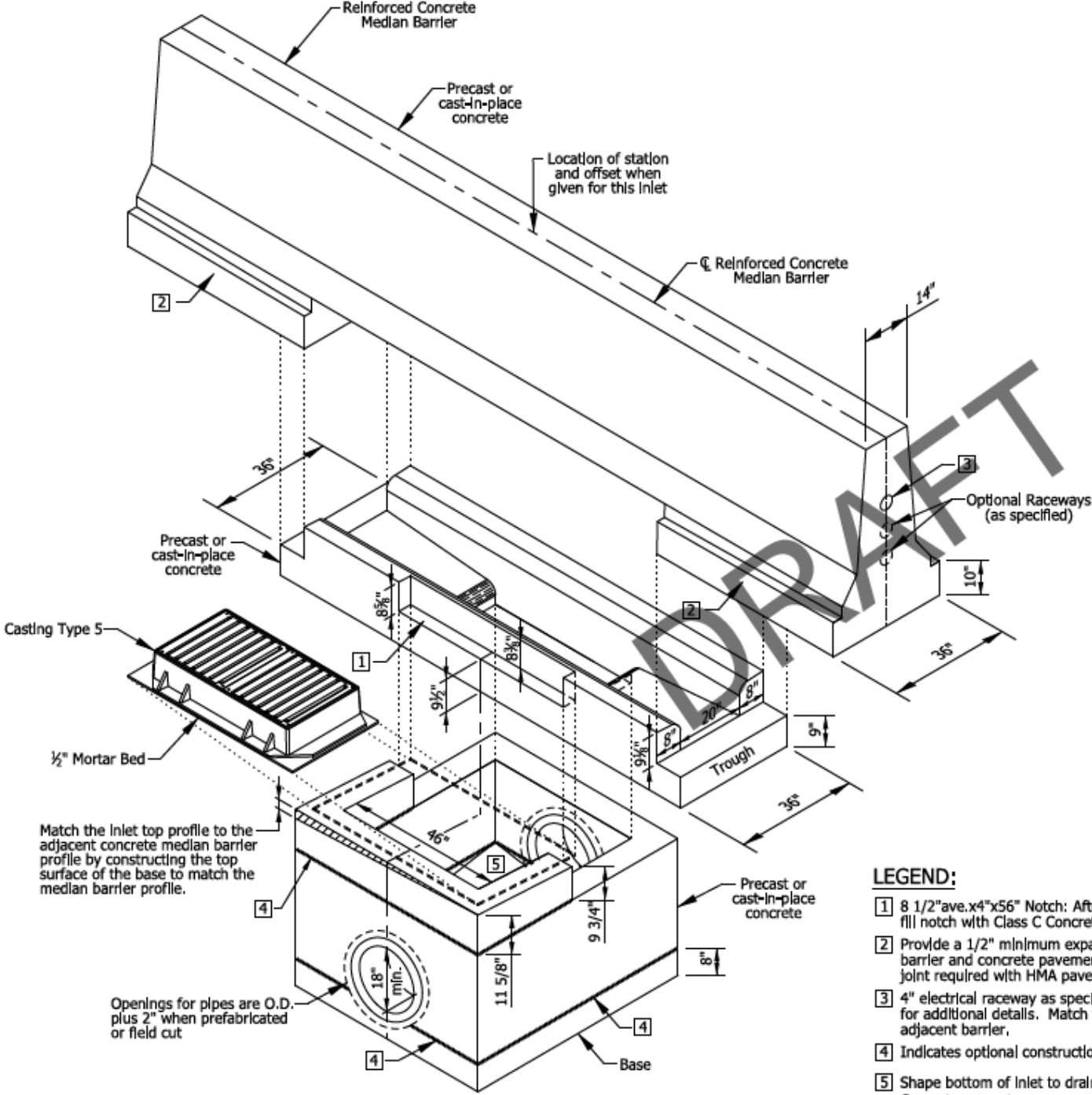
Dual HA-5 Concrete Apron Detail
Plan View



Dual HA-5 Concrete Apron Detail
Section View

Median Drains

- HB-5
 - No clogging factor for spread
 - Minimum 18-inch outlet pipe due to larger debris
 - H-5 access grate



- NOTES:**
1. For additional details of Reinforced Concrete Median Barriers, see sheets 7 and 8.
 2. The walls between the bottom slab and the upper permissible construction joint may be built of brick, concrete block or cast-in-place concrete, 8" nominal thickness for depths of 12' or less. Precast walls have a minimum thickness of 6" and are reinforced sufficiently to permit shipping and handling without damage.
 3. Cast-in-place concrete shall be Class A or higher. When precast, provide concrete that meets the requirements of 702. Seal the exposed concrete surfaces of the barrier when specified in the plans.
 4. Precast or cast-in-place Inlets over 12 feet in depth, reinforce with #5 bars on 12" centers both vertically and horizontally, with 2" clearance from face.
 5. Minimum inside pipe diameter to be 18". Ensure pipe openings are the outside diameter of the pipe being supplied plus 2" when fabricated or field cut. Fill all voids.
 6. Slope the aprons on both sides of the casting toward the inlet windows and fill with Class C concrete or HMA pavement as specified. On superelevated sections, slope the aprons as shown in Section C-C.
 7. PCJ Indicates optional construction joint.

INDIANA DEPARTMENT OF TRANSPORTATION	
REINFORCED CONCRETE MEDIAN BARRIER WITH INLET TYPE HB INSTALLATION	
SEPTEMBER 2026	
STANDARD DRAWING NO. E 602-CCMB-06	
DESIGN STANDARDS ENGINEER	DATE
CHIEF ENGINEER	DATE



...

Median Drains

- HB-5



...

INDIANA DEPARTMENT OF TRANSPORTATION



Median Drains

- HB-5



Median Drains

- HB-5



...

Median Drains

- HB-5



...

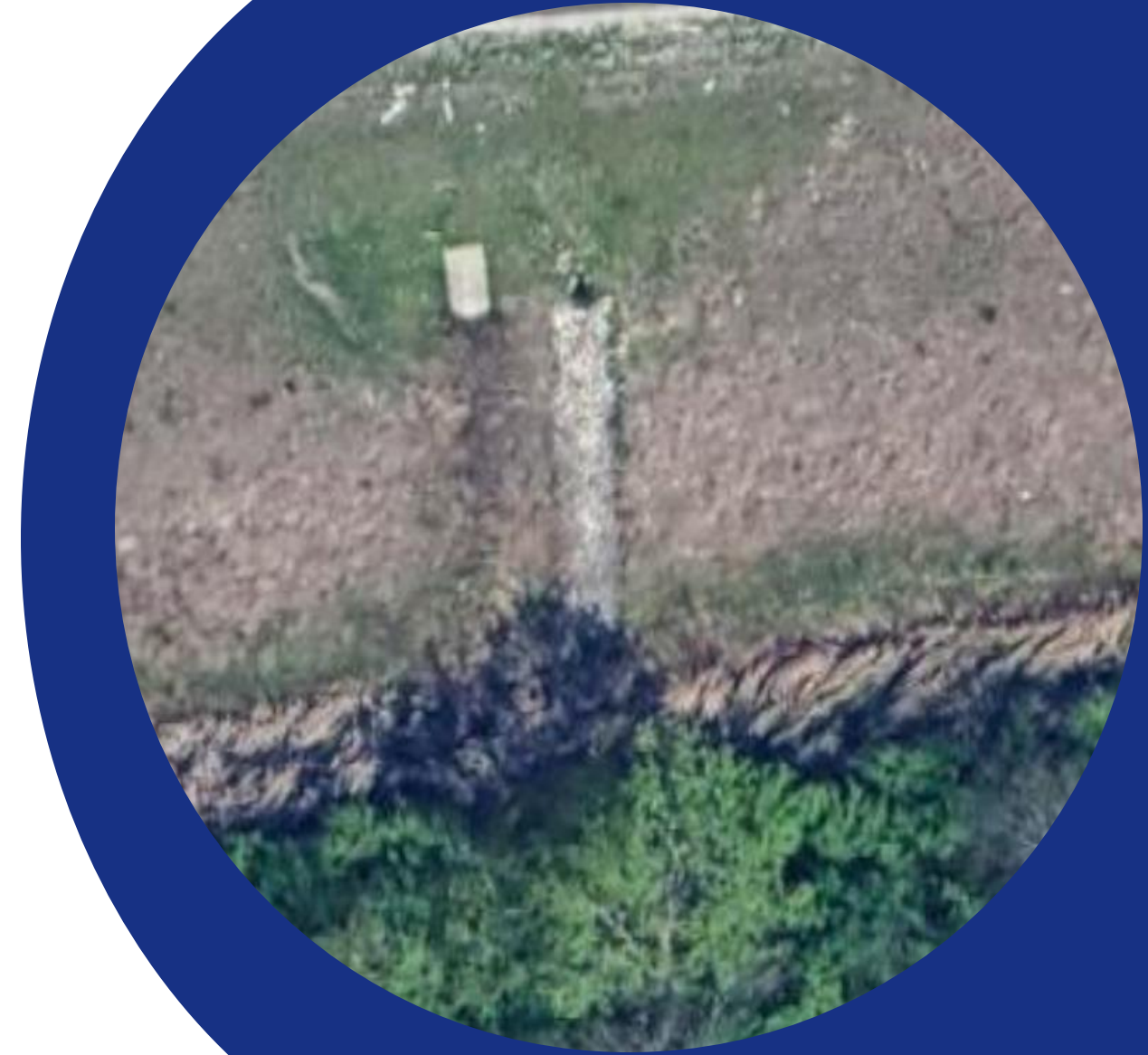
INDIANA DEPARTMENT OF TRANSPORTATION



...

Median Drain Erosion Control

- Riprap to extend from outlet to ditch line
- History of eroding out the embankment
- Embankment loss can lead to road failure



...

... Median Drain Erosion Control



...
INDIANA DEPARTMENT OF TRANSPORTATION





Level Spreaders



INDIANA DEPARTMENT OF TRANSPORTATION



Level Spreaders

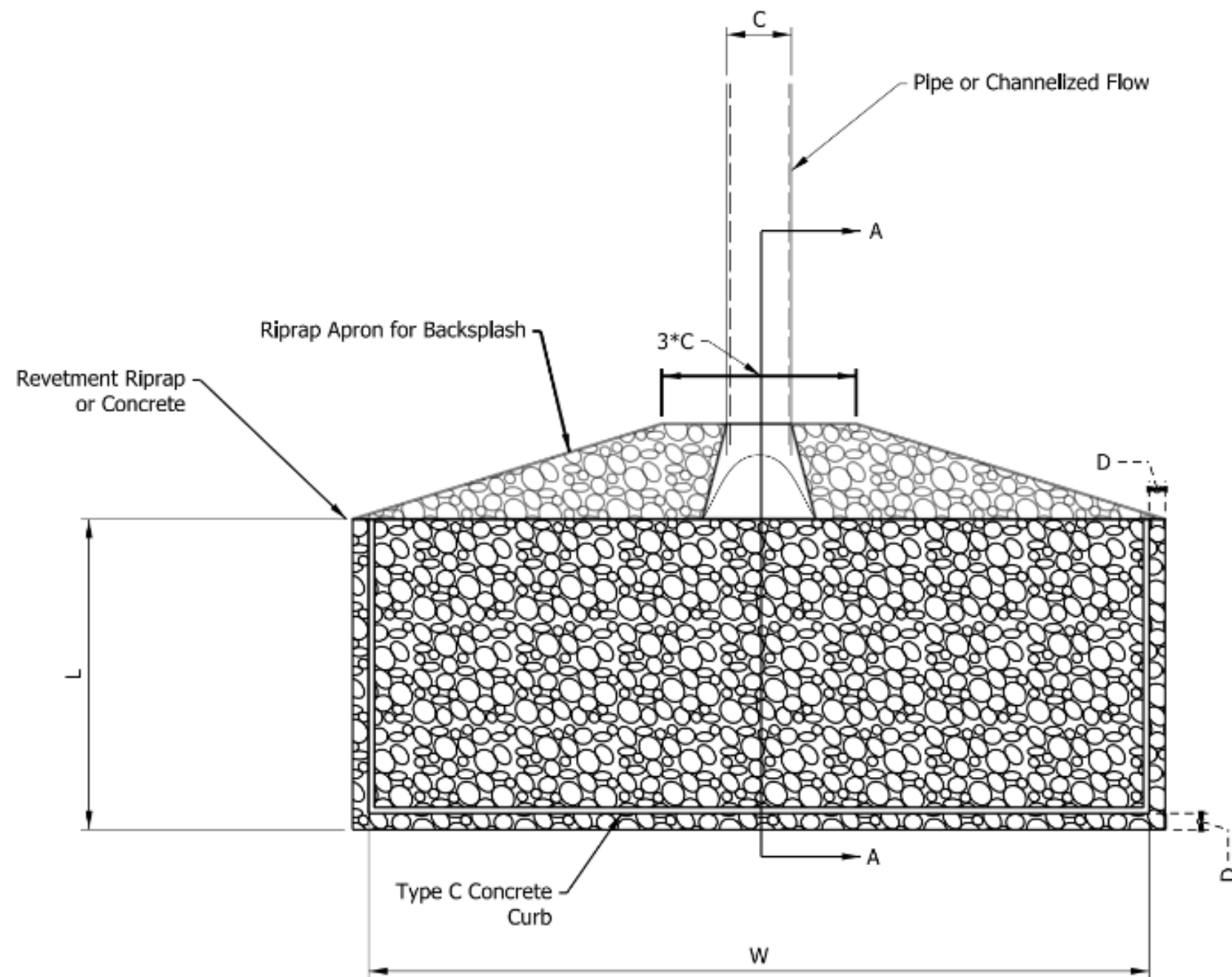
...

- Spreads concentrated water to sheet flow
- Dissipates energy
- Erosion protection needed on both sides
- Width = 10*Pipe diameter
- Sitting water drains through riprap into ground

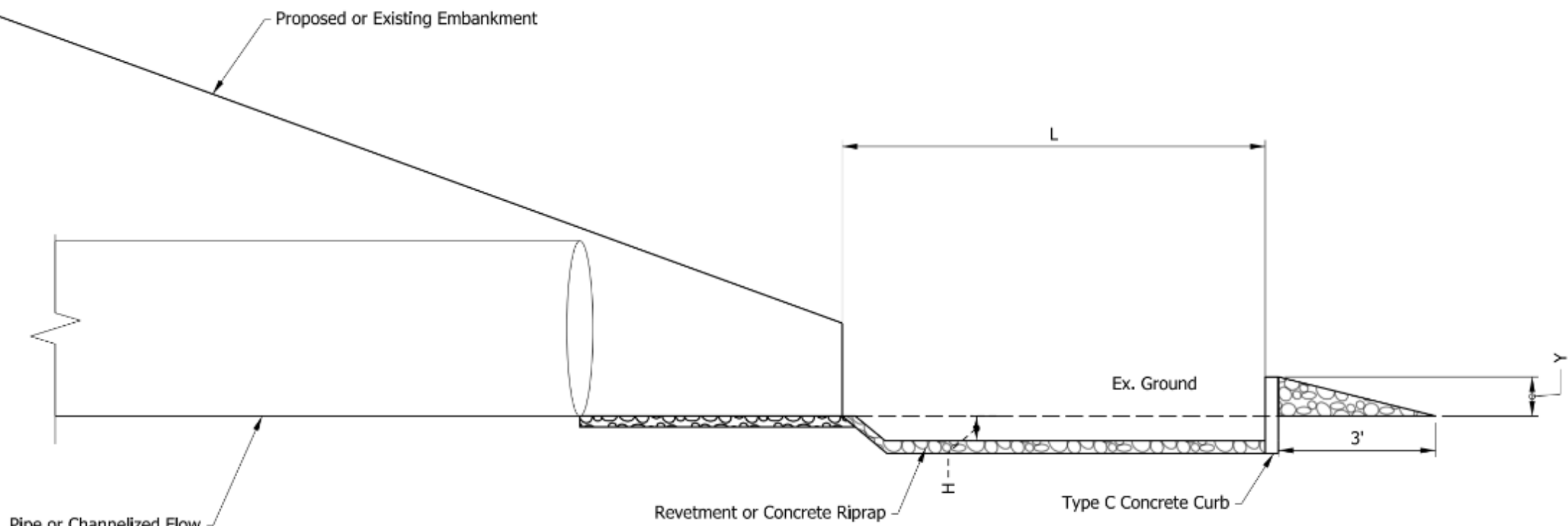


...

Level Spreaders



Level Spreaders



...

Level Spreaders

L and D Design Criteria

Water Quality Treatment Rate (cfs)	Minimum Depth, D (ft)	Minimum Length, L (ft)
0-10	0.5	10
10-20	0.6	20

H and Y Design Criteria

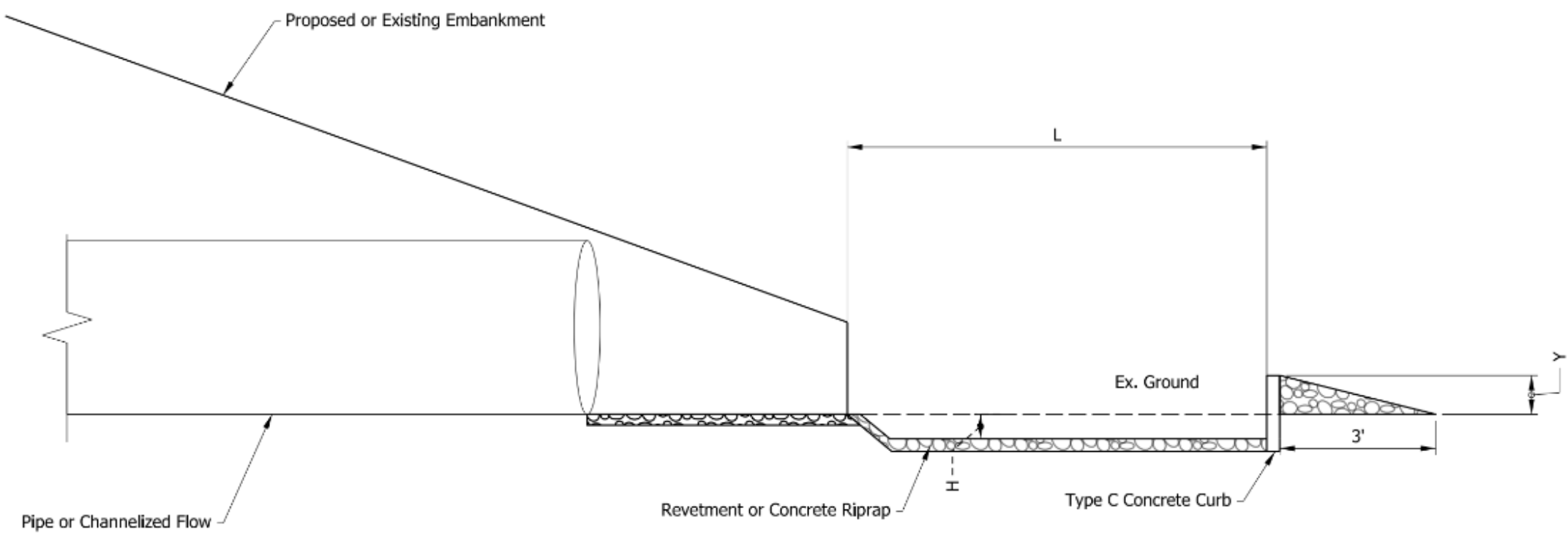
Depth from pipe or channel invert to bottom of plunge pool (h)	0.6*D
Depth from pipe invert to top of weir (y)	0.4*D

W Design Criteria

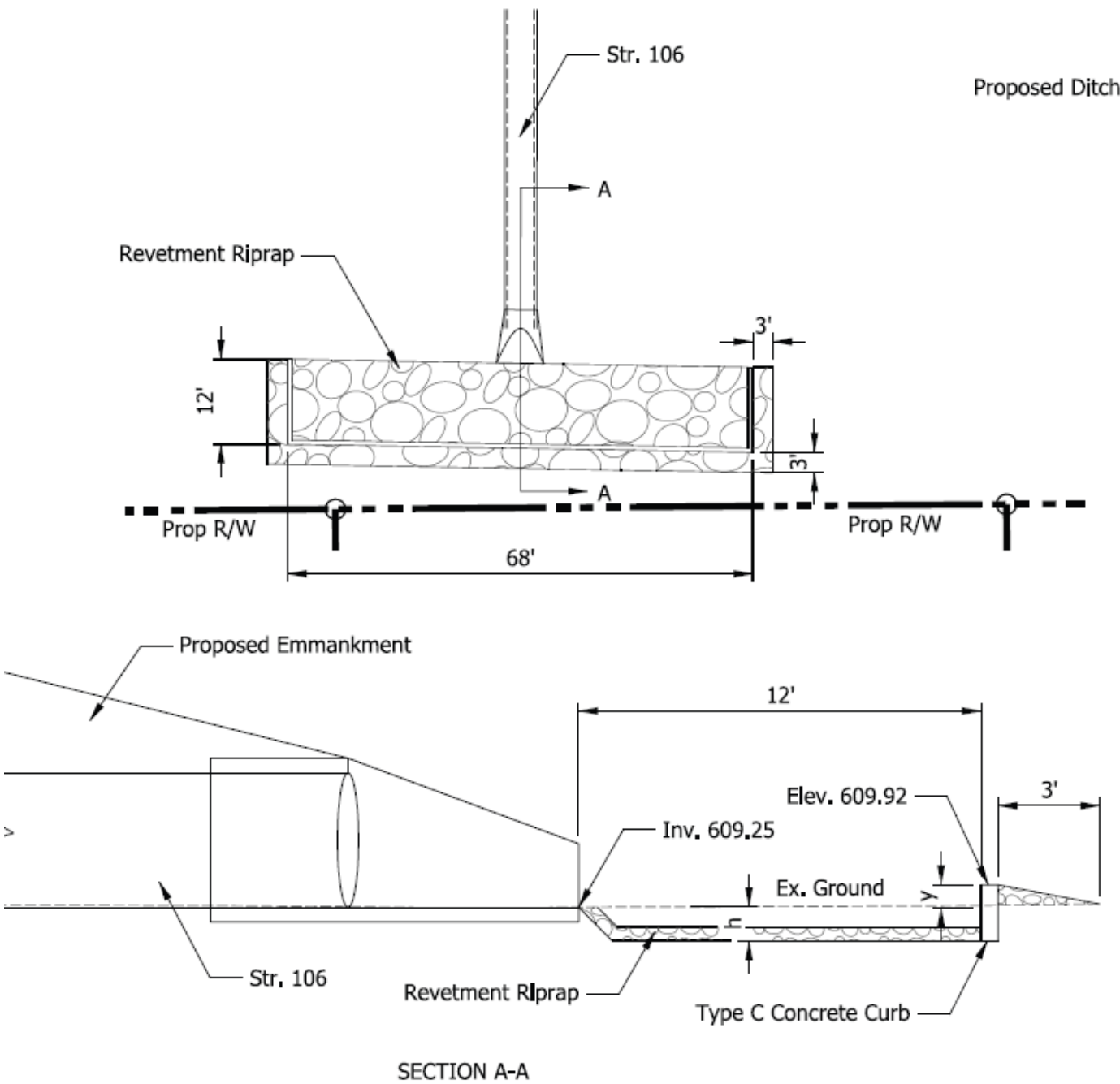
W shall be at least ten times wider than the diameter of the inlet pipe or channel



Level Spreaders



Level Spreaders



Level Spreaders

- CLV-99231 – intersection of SR11 and SR46





Water Retaining Systems



INDIANA DEPARTMENT OF TRANSPORTATION



Water Retaining Systems

- Detention Pond
 - Holds water in a pond and will outlet through an orifice style structure
 - Normally requires more ROW
- Detention Ditch
- Inline Detention
- Retention Pond
- Infiltration Pond



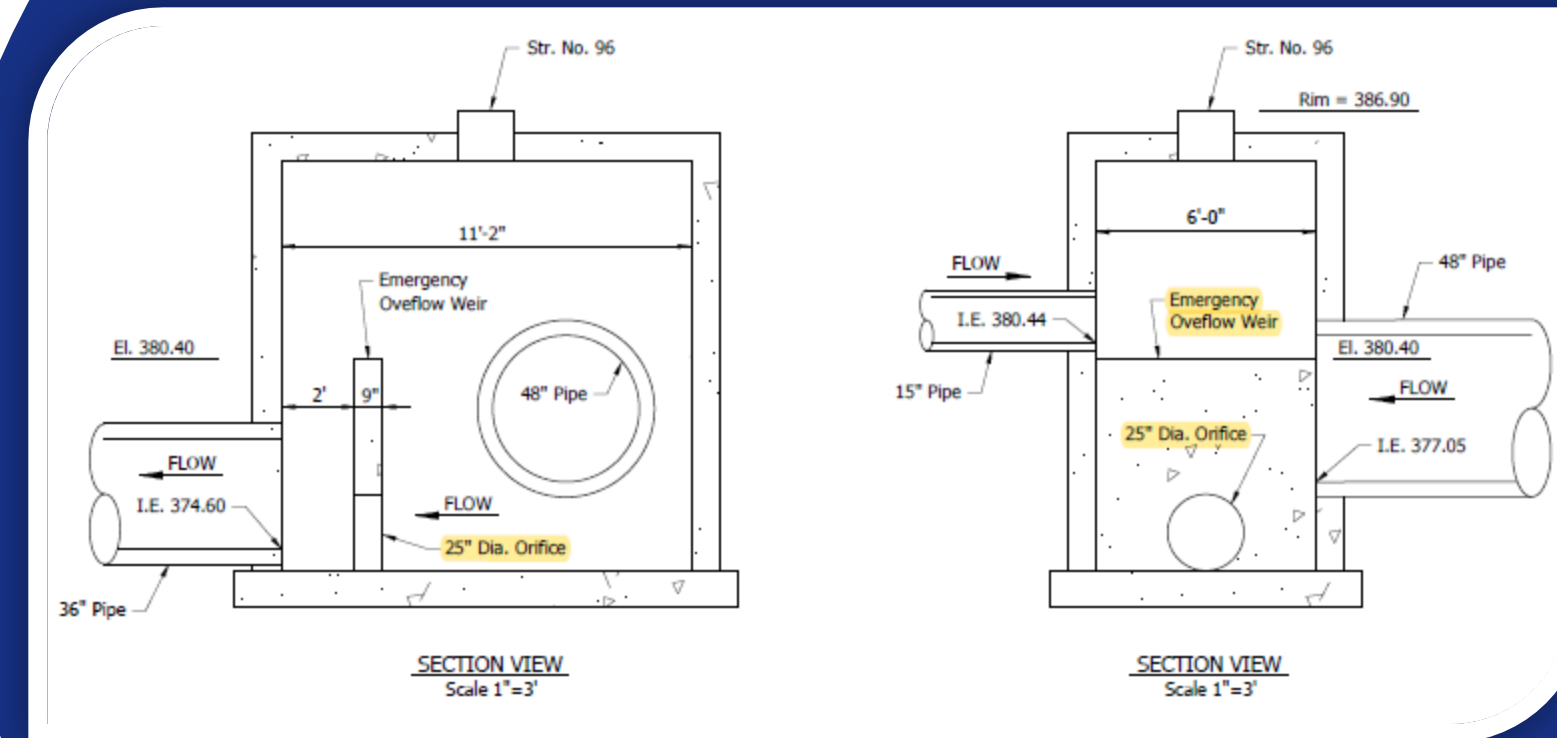
Water Retaining Systems

- Detention Pond
- Detention Ditch
 - Holds water within the side ditch and will outlet through an orifice style structure
 - Normally requires less ROW
 - Preferred
- Inline Detention
- Retention Pond
- Infiltration Pond



Water Retaining Systems

- Detention Pond
- Detention Ditch
- **Inline Detention**
 - Detention in oversized Storm Sewer Pipes
 - Preferred normally in urban environments
 - ROW acquisition limited
- Retention Pond
- Infiltration Pond



Water Retaining Systems

- Detention Pond
- Detention Ditch
- Inline Detention
- Retention Pond
 - Holds water and is consistently wet. No outlet structure but may have an overflow
 - Not preferred
- Infiltration Pond



Water Retaining Systems

- Detention Pond
- Detention Ditch
- Inline Detention
- Retention Pond
- Infiltration Pond
 - Water's primary outfall is the soil itself
 - Only to be used in sandy soils with maximum water table over 2 ft below Pond bottom



Detention Structures

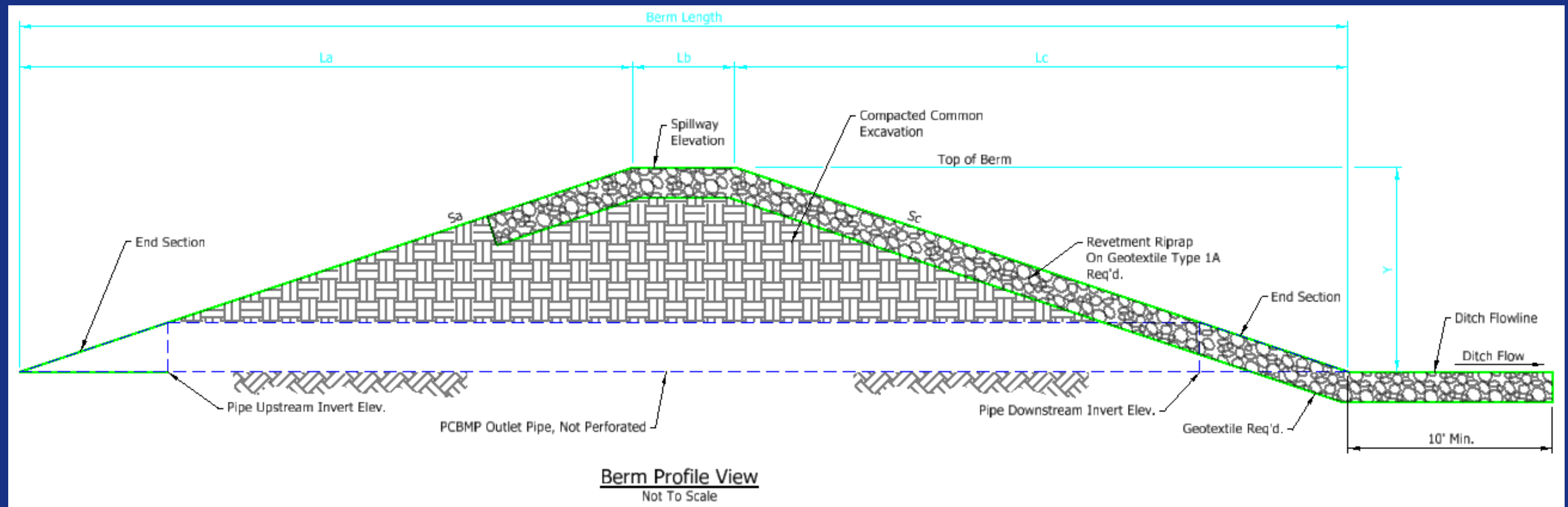


- PCSM Templates
- 5 styles of berms and outlet styles
- Can be used for detention ponds or ditches
- [INDOT PCSM Website](#)



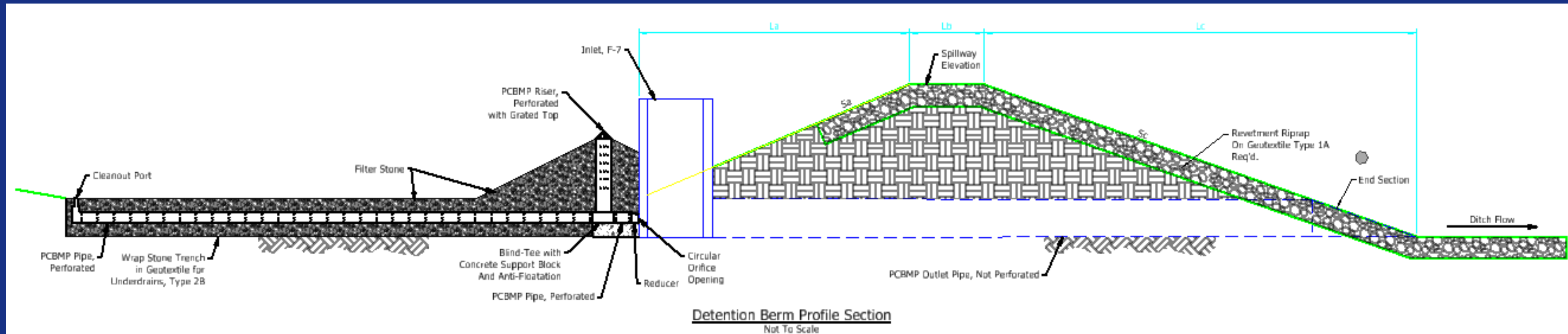
Detention Structures

- Overflow Berm with Pipe $D \geq 12''$



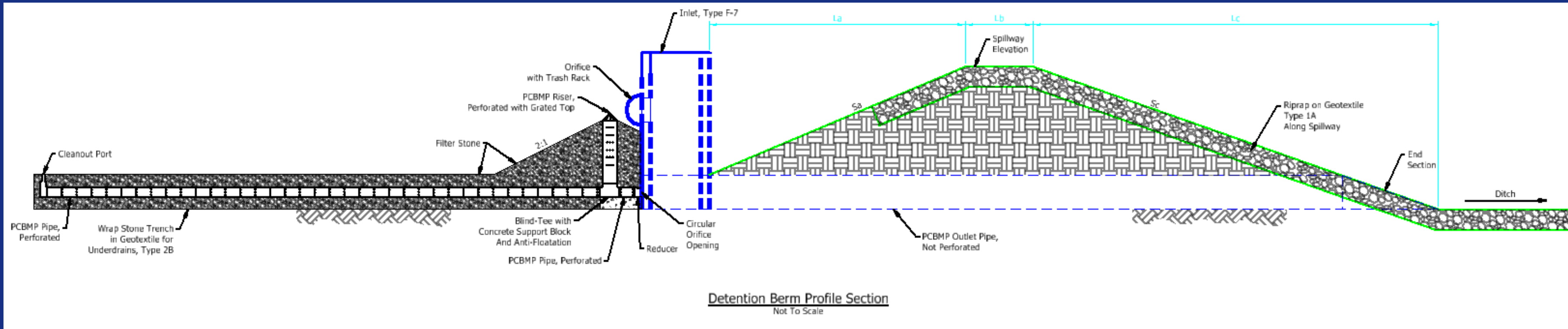
Detention Structures

- Single Orifice $4'' \leq D < 6''$



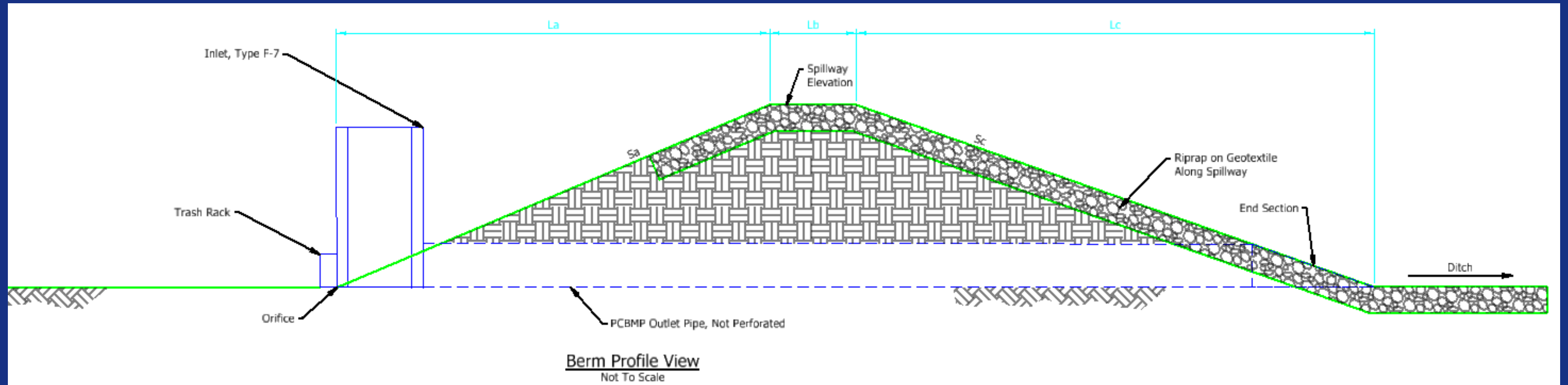
Detention Structures

- Double Orifice: Main Orifice $4" \leq D < 6"$



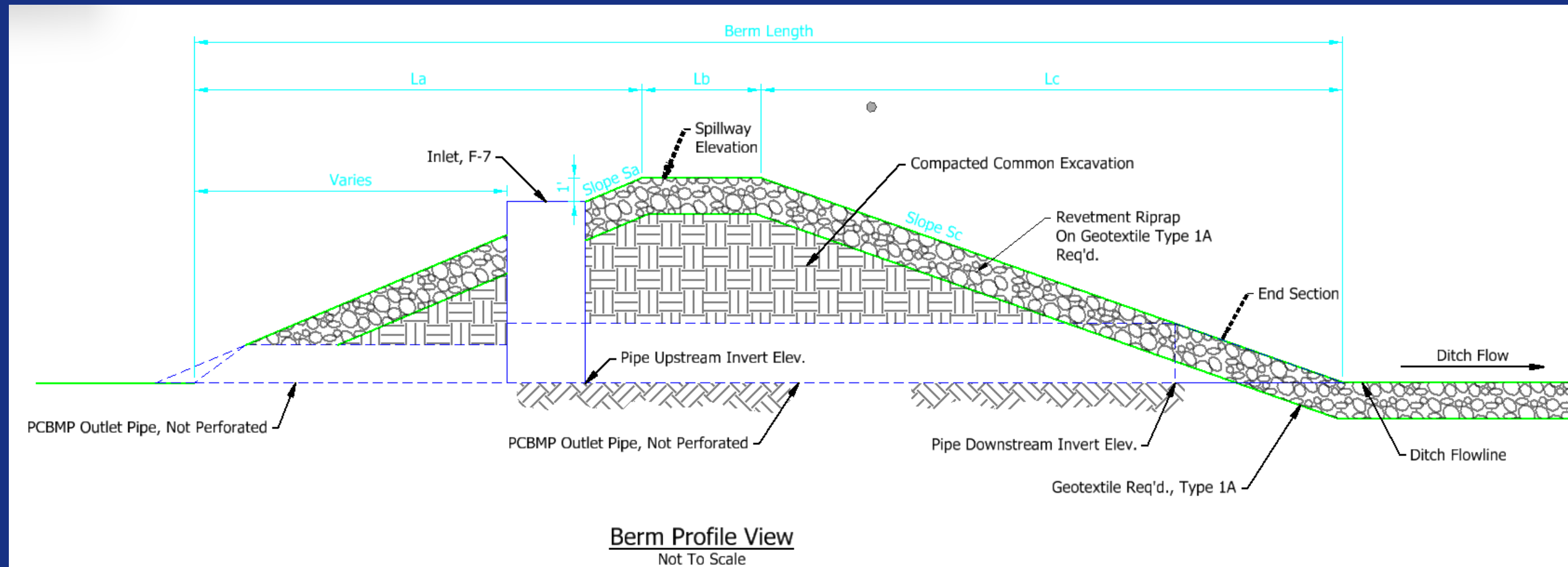
Detention Structures

- Orifice $6'' \leq D < 12''$



Detention Structures

- Orifice Pipe $6'' \leq D < 12''$ to F7





Questions



INDIANA DEPARTMENT OF TRANSPORTATION

