

-
- The diagram shows a box titled 'Structure design steps' containing a bulleted list of design considerations.
- Structure design steps**
- Choose a structure width based on:
 - Bankfull width
 - Minimum bank width
 - Floodplain requirements
 - Other passage requirements
 - Add LVAP & road surface to:
 - Cross-section graph
 - Profile graph
 - Select an initial structure:
 - Type and size
 - Id min & max cover requirements

Structure design steps

- Select an elevation for the invert or bottom of footer
- Verify cover requirements & embedment depth
- Determine structure length taking into account:
 - side-slope
 - end treatments
- Check
 - hydraulic capacity ($HW/D < 0.8$ for Q_{100}),
 - bed mobility
 - key piece stability
- Repeat as needed

Structure type and size



Culvert size & type factors based on project objectives

- Bankfull width minimum
- Capacity for the Q_{100} with $HW/D < 0.8$ plus debris
- Self-sustaining bed with stable key pieces
- Minimize maintenance needs
- Passage of non-aquatic species
- Maintain floodplain processes



Culvert size & type factors based on site conditions and engineering constraints

- Alignment of channel to road
- Ice plugging in severe cold climate
- Large bed material relative to culvert width
- High water level stage during floods
- Soft foundations or shallow bedrock
- High conveyance across flood plain
- Height of road and load requirements
- Access for equipment and materials
- Utilities



Stream simulation culvert width

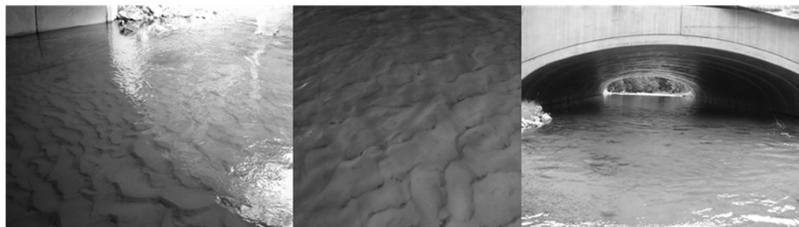
Benefits of structures wider than bankfull width:

- Banks match reference channel
- Minimize inlet contraction during high flow events
- Can create dry habitat conditions for passage of additional organisms—increases “openness”
- More important on high volume traffic roads

Is wider always better?

Very low gradient stream simulation design

- **Maybe not - in sand bed streams with low flows**
- **Without structure to create banks or a thalweg**
- **Sand spreads out to create a flat, uniform bed**
- **Shallow water may impede passage of some sp.**



Example of an open-bottom arch in Michigan.

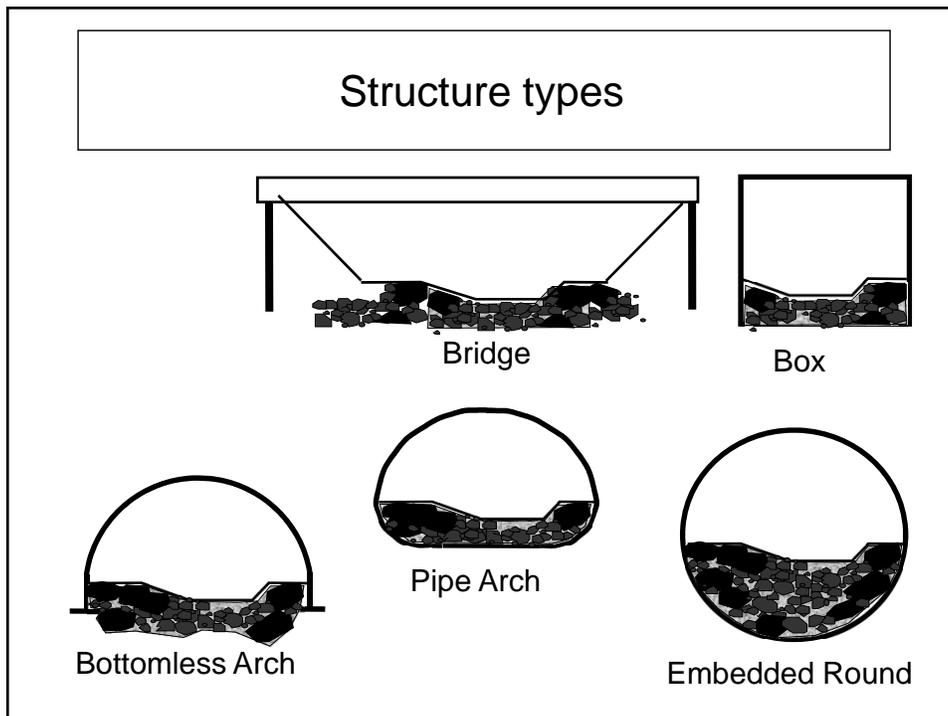
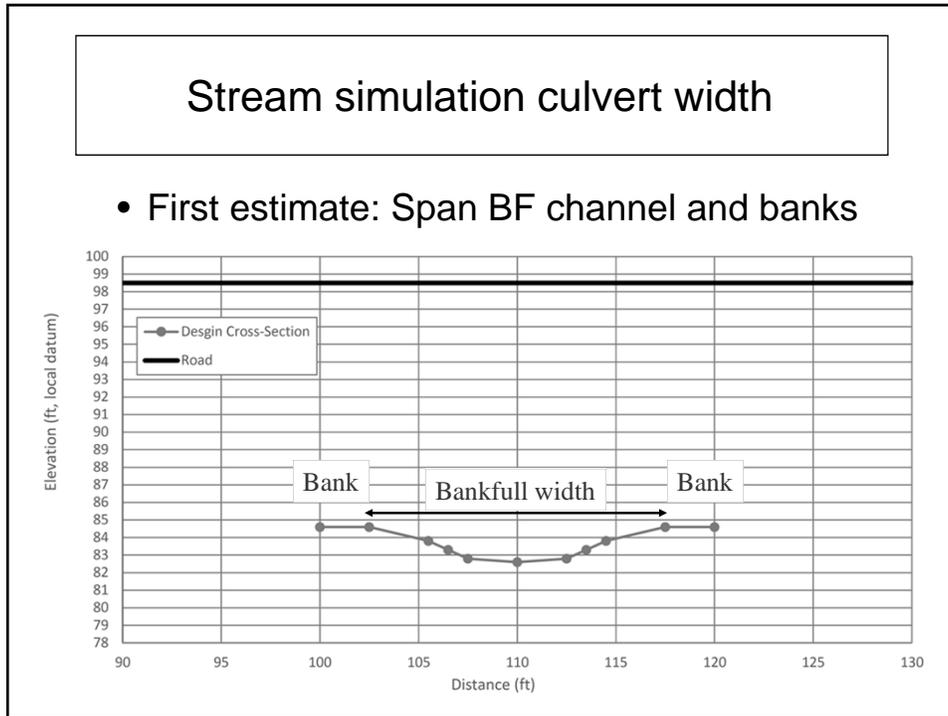
>Bankfull width and sand beds
Very low gradient stream simulation design

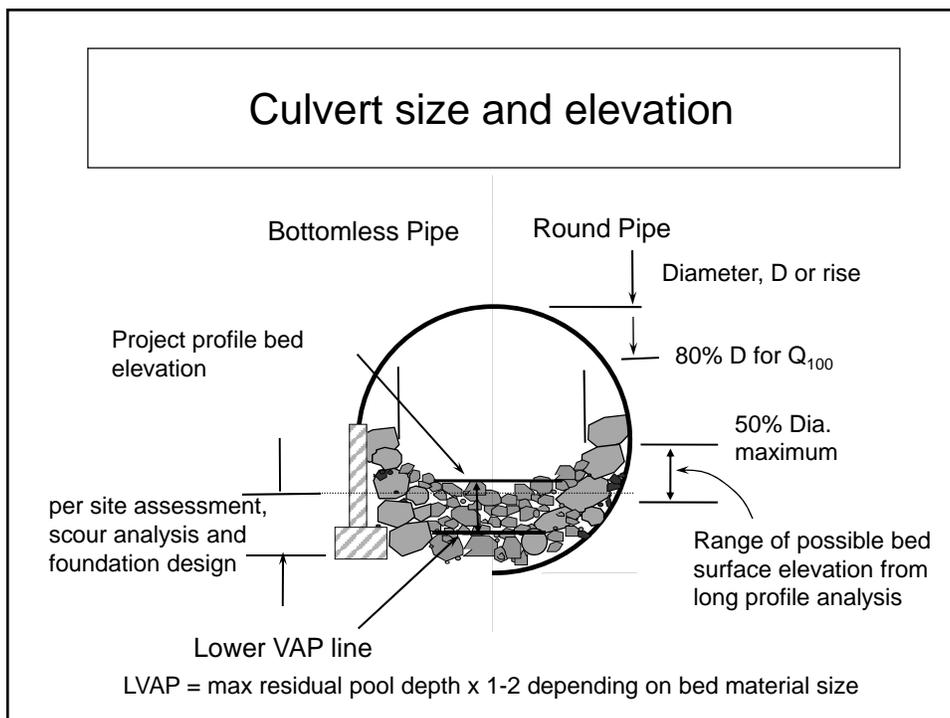
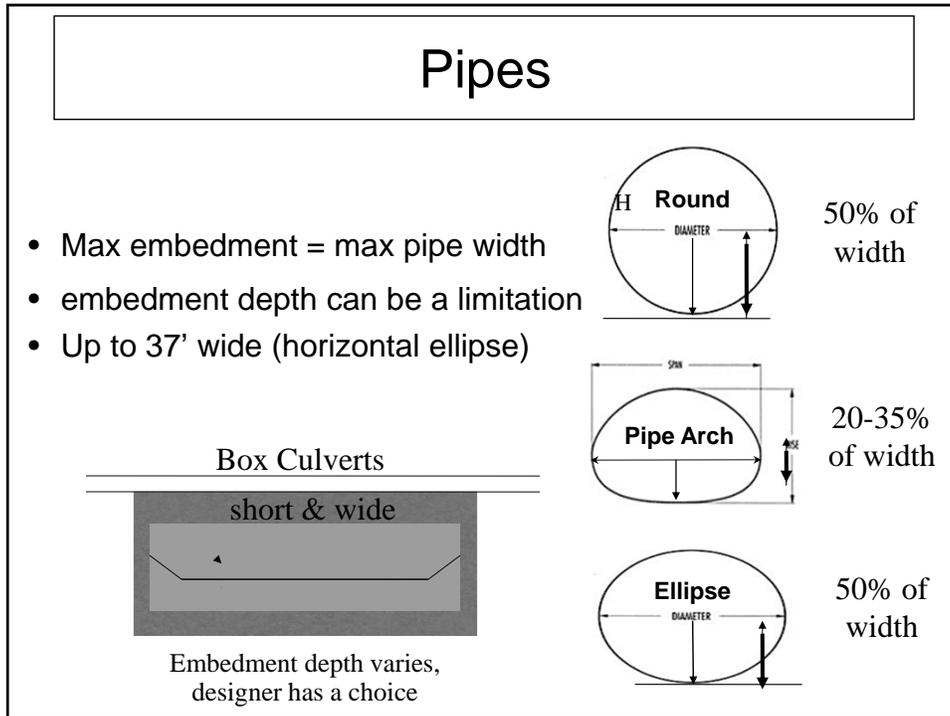
Example of bridge on Spring Cr near Durango in SW WI.

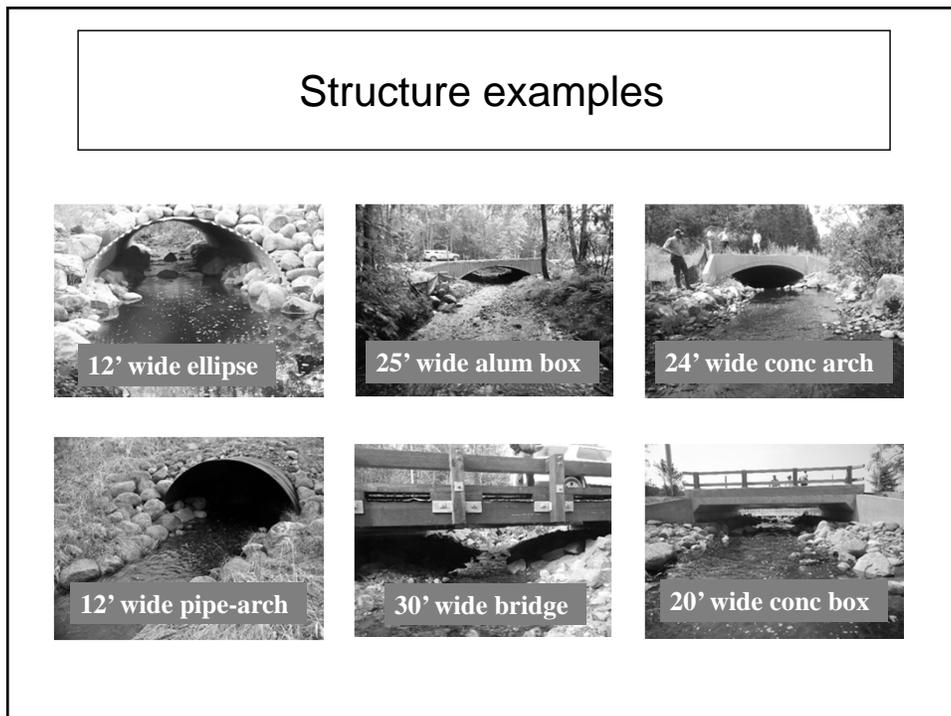
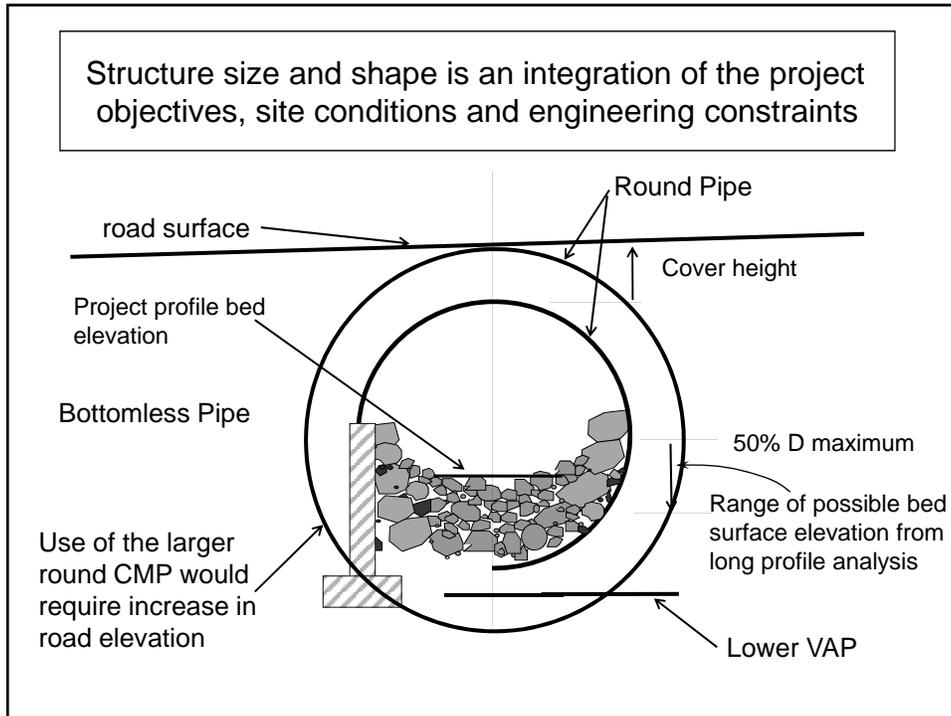
Rock bars for thalweg development
NB Oconto Middle Trib at Hwy 64

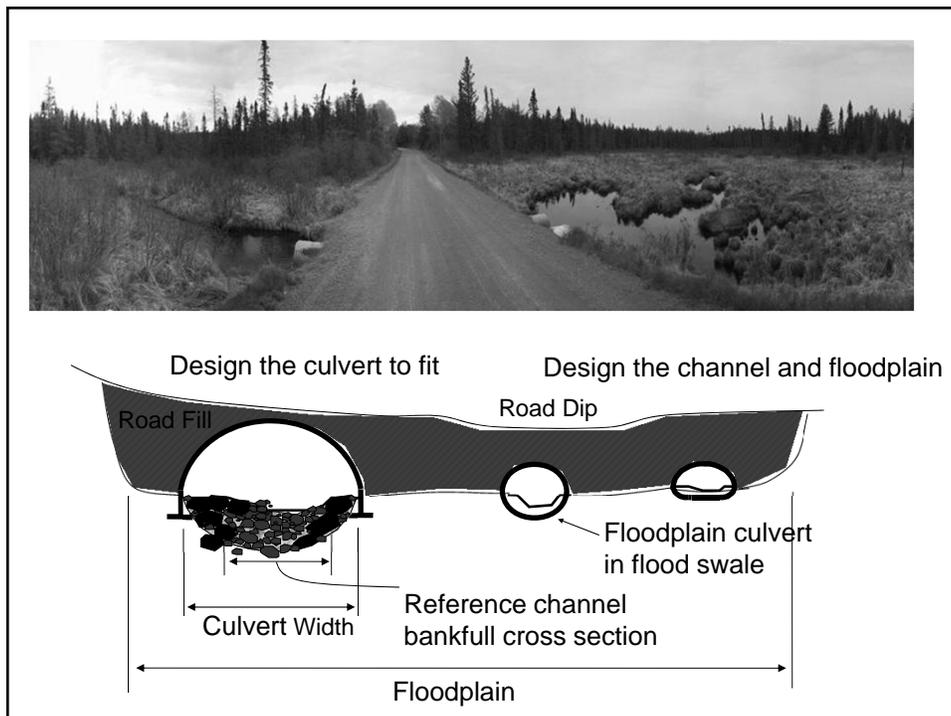
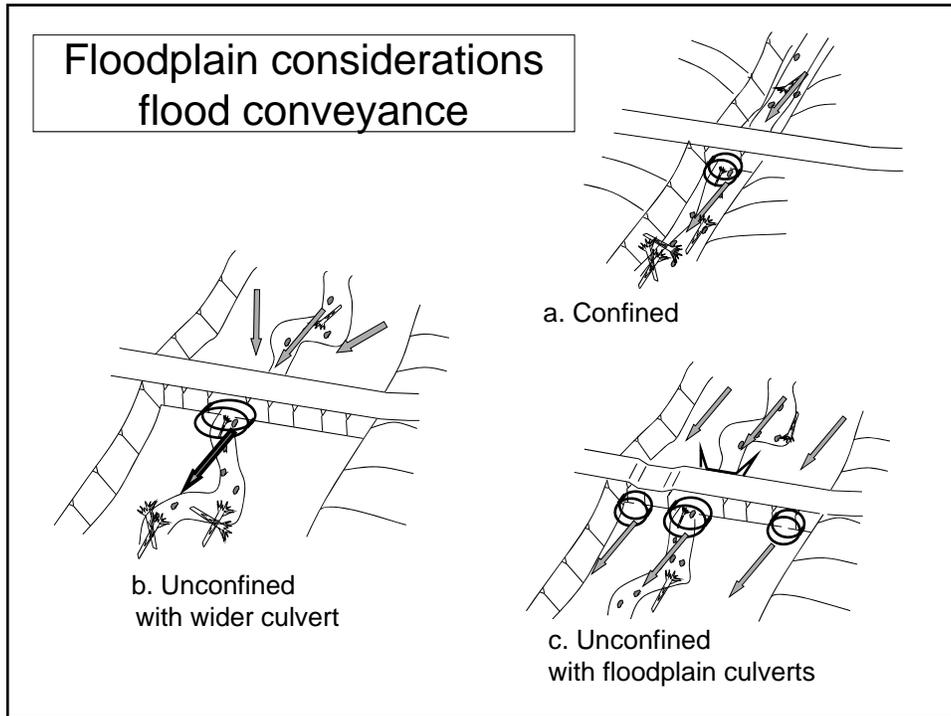
Bankfull

Rock bars extend up to bankfull, cause differential scour and deposition of sand

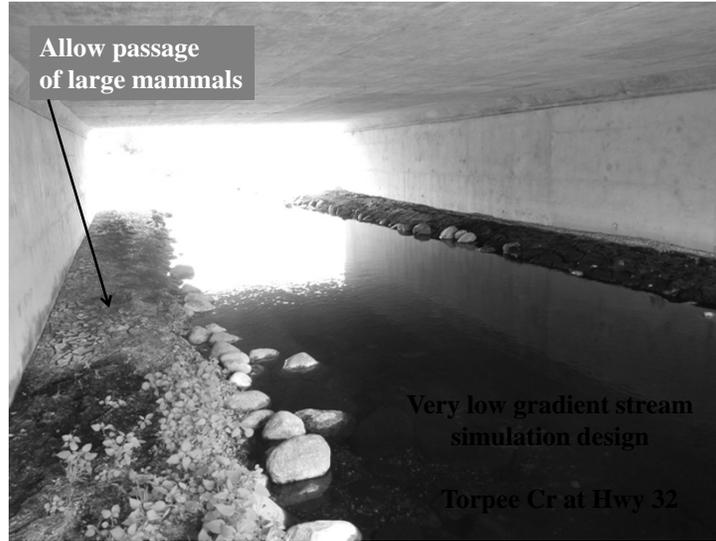




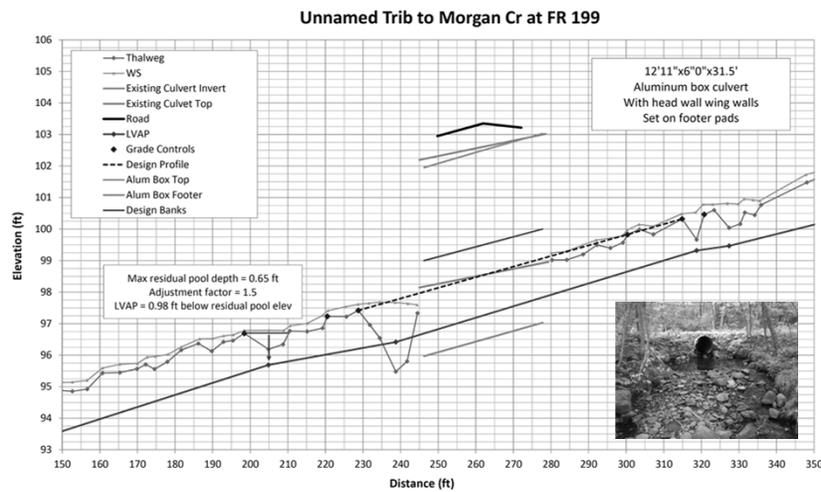




Floodplain considerations animal passage



Structure elevation and length



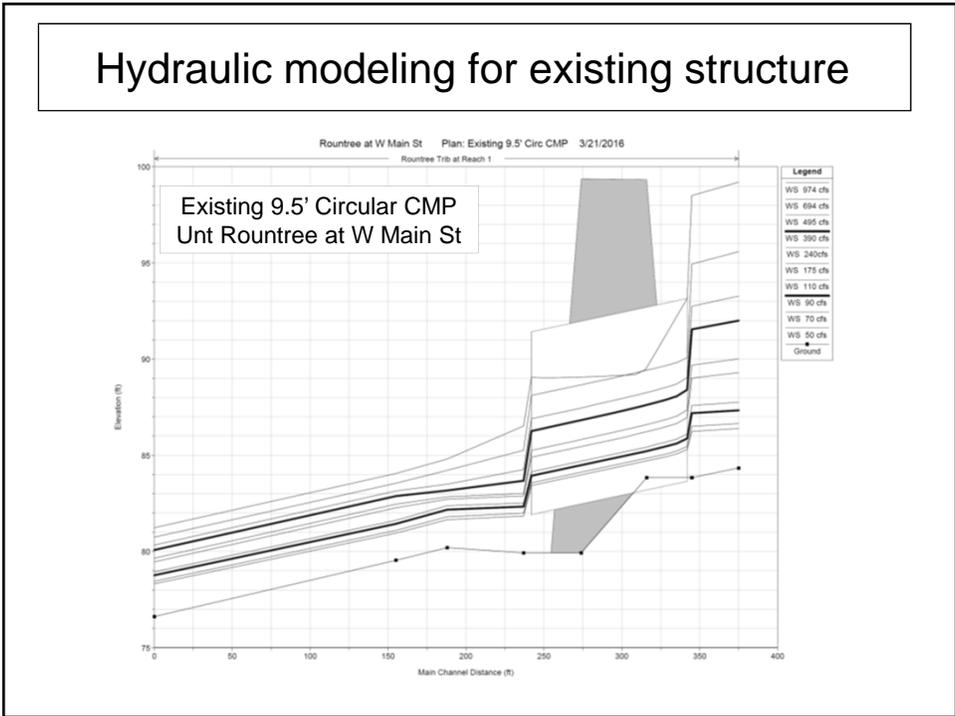
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Structure design steps

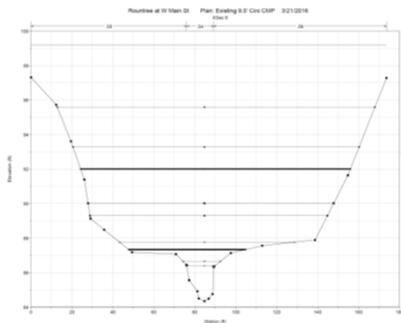
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Stream simulation structure shape and size exercise

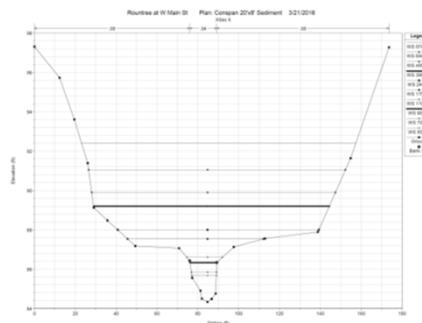


Hydraulic modeling for existing and proposed structure

Cross-section 6 located 33 ft upstream from culvert inlet

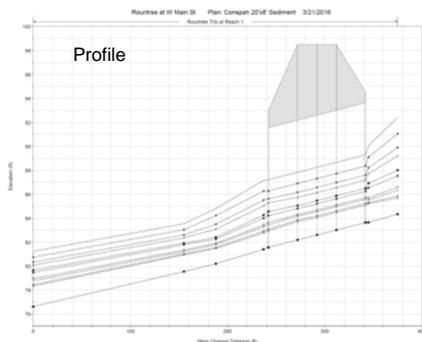
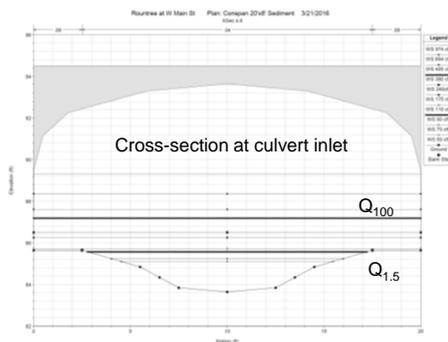


Existing 9.5' Circular CMP
Unt Rountree at W Main St



Proposed 20' Arch
Unt Rountree at W Main St

Hydraulic modelling for proposed structure



Proposed 20'x8' Arch Unnamed Tributary to Rountree at W Main St

Questions?

