



Permitting Bridges & Stream Crossings

INAFSM September 7, 2017

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Introduction

- Do I need a permit for this stream crossing?
- How does the Division of Water review a Construction in the Floodway Permit Application?
 - When you need a permit
 - Permit as replacement in kind
 - Permit with hydraulic modeling
 - Other bridge work



When you need a permit

- Construction in the floodway permit required:
 - New bridge or culvert
 - Replacement of a bridge or culvert
 - Widening a bridge
 - Extending a culvert
 - Scour repair
 - Pier repair
- Exemptions
 - Drainage area less than 1 sq mile
 - Rural bridge exemption: construction or reconstruction project on a state or county highway bridge in a rural (outside incorporated and planning area) over a stream with an upstream drainage area of 50 sq miles or less



Engineering submittal for Bridges/Culverts

- A permit submittal can be supported with 2 kinds of engineering analysis:
 - Bridge Non modeling worksheet
 - Hydraulic modeling



Bridge Non-Modeling Assessment

Appropriate to use for-

- bridge replacement structure such as a roadway, pedestrian, golf cart, or private access bridge
- Pier wrapping
- Bridge widening, culvert extension
- Scour repair at stream or river crossing



Bridge Non-Modeling Assessment

Replacement

- Bridge to Bridge replacement
- Culvert to Bridge replacement
- Culvert to Culvert replacement
 - If the length of the culvert is essentially the same
 - And if the proposed culvert is of essentially the same material (roughness coefficient)
 - http://www.hec.usace.army.mil/software/hec-ras/documents/HEC-RAS_4.0_Reference_Manual.pdf (page 6-24)
 - Concrete is typically smoother than corrugated metal, smaller “n”, less loss, lower surcharge



Bridge Non-Modeling Assessment

Replacement

When to Not Use the Worksheet

- The waterway opening decreases
- The existing structure remains in place
- Bridge to Culvert replacement
- If the New bridge is more than 500 ft from the existing bridge



Where are these worksheets located?



REGULATORY PERMIT PROGRAMS AND RELATED INFORMATION

The DNR Division of Water regulatory webpage provide a comprehensive one-stop site for permitting information. Simply click on a particular category below for links to forms, instructions, and informational resources. Several instructional videos are now available that provides important information to assist you in completing a permit application, fulfilling the public notice requirements, and providing the supporting technical documentation that is necessary in the application review process. In addition, technical worksheets have been developed for the agents who are submitting Construction in a Floodway applications.

If your corporate firewall restricts access to YouTube, your systems administrator may allow exceptions to certain publishers. All DNR videos are published by Indiana DNR Videos for the purposes of such exceptions.

[Use a Permit Application Form or File an Application Online](#)

[Technical Requirements: Minimum Application Submittal for Construction in a Floodway](#)

[GIS Resources](#)

[Floodway Habitat Mitigation Guidelines](#)

[Public Notice Requirements](#)

[Other Permit-Related Resources and Information](#)

[Regulatory Permit Statutes, Rules and Related Information Links](#)

<http://www.in.gov/dnr/water/2455.htm>



Where are these worksheets located?

All Non-modeling Worksheets



Instructional videos have been developed to assist agents in preparing the technical information that is needed in a permit application for construction in a floodway. These videos are broken down into specific non-modeling assessment approaches. A link to the corresponding worksheets can be found to the right of the video link in the table below. Also refer to Construction in a Floodway User Guide for a quick reference of various project types and the appropriate worksheet. To watch an instructional video or access a worksheet, click the link in the table below. If you have problems viewing the videos, please contact us at water_inquiry@dnr.in.gov or at (317) 232-4160, toll free at 1-877-928-3755.

Instruction Info		Video
Introduction and general overview of Non-Modeling Worksheets		Video
Bridges & Culverts		Worksheets
Bridge Replacement in Kind Worksheet B	Video	Worksheet (fillable PDF) Worksheet (Word Format) Companion B
-DR-		INDOT-DNR Worksheet
INDOT-DNR Bridge Replacement Assessment		
All Other Construction		Worksheets
No Change in Effective Cross Sectional Flow Area	Video	Worksheet (PDF format) Worksheet (Word format)
Change in Effective Cross Sectional Flow Area Companion Worksheet A	Video	Worksheet (fillable PDF) Worksheet (Word format) Companion worksheet A (fillable PDF) Companion worksheet A (Word format)
Ineffective Area of Contraction or Expansion Reach of a Stream Crossing	Video	Worksheet (fillable PDF) Worksheet (Word format)

GIS Resources
[Floodway Habitat Mitigation Guidelines](#)
[Bridle State Determinants](#)

<http://www.in.gov/dnr/water/2455.htm>



Bridge Non-Modeling Assessment

How to Use the Worksheet

- The worksheet was intended to streamline the majority of replacement in kind projects
- BUT, it does not capture *every* possibility
 - 1) It works for my bridge: submit worksheet
 - 2) It does not work for my bridge: modeling
 - 3) It does not work for my bridge, BUT maybe it should: submit worksheet with additional documentation



Minimum Requirements

- Plan view of construction components
- Aerial of disturbed area
- Delineated Floodway through the project
- Plan views with calculations of waterway opening, top of road profile, and low structure
- Cross section location map
- Project location map
- Site photos

Why is it important to consider if it's a bridge or culvert?

- When modeling in HEC-RAS, bridges and culverts are modeled differently which can give drastically different results
- Bridges are modeled using the methods selected in the bridge modeling approach editor (Energy, Momentum, Pressure and/or Weir, ...)

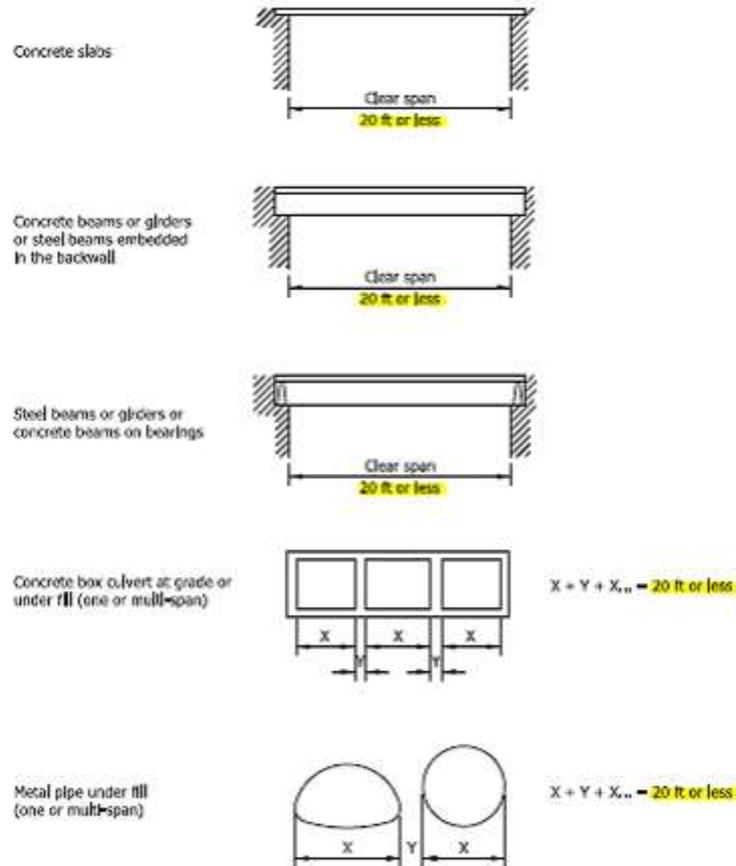
Why is it important to consider if it's a bridge or culvert?

- Culverts also come in many different shapes (box, arch, circular, ellipse, ...)
- Culverts can be made of different materials which have different roughness coefficient
- Culverts are modeled using inlet or outlet control culvert equations and when applicable weir equations

When is it a bridge and not a culvert?

- Conceptual consideration:
 - bridge methods when the structure has a very large opening relative to the deck thickness
 - culvert methods when the structure has a very deep deck and small relative opening
- FHWA defines a culvert as a structure with a total span of 20 ft. or less (measured along centerline of roadway)

FHWA defines a culvert as a structure with a span of 20 ft. or less (measured along centerline)



MAXIMUM SPAN LENGTHS FOR CULVERTS

Figure 203-2A



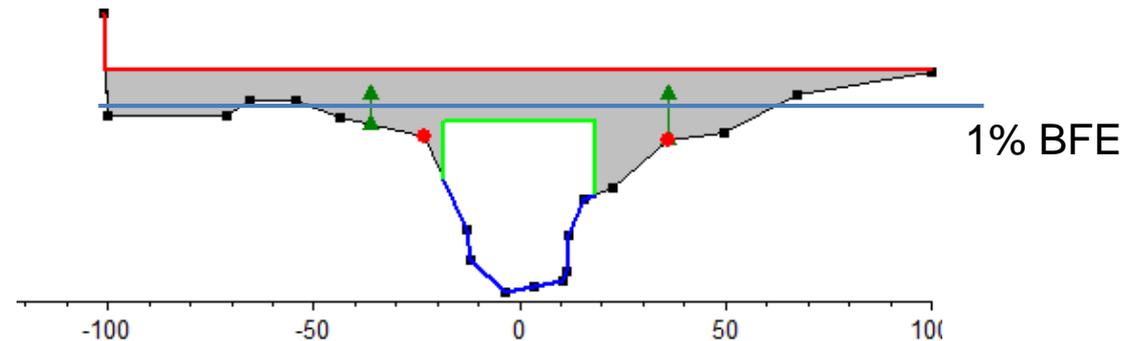
Bridge Non-Modeling Assessment

How does the worksheet evaluate replacement?

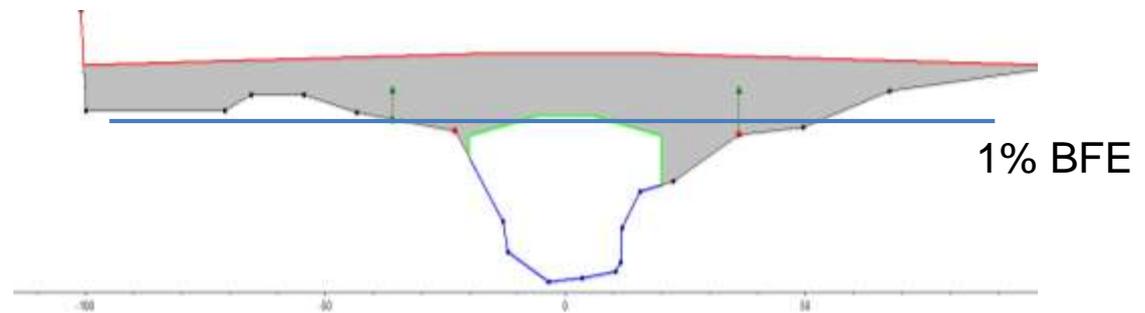
- Theory behind logic is to approve *in-kind*
- Would the same modeling equations be used to model both structures?

- The BFE hits the deck of the existing bridge, while the proposed bridge deck is raised. The BFE now flows under a portion.

Existing

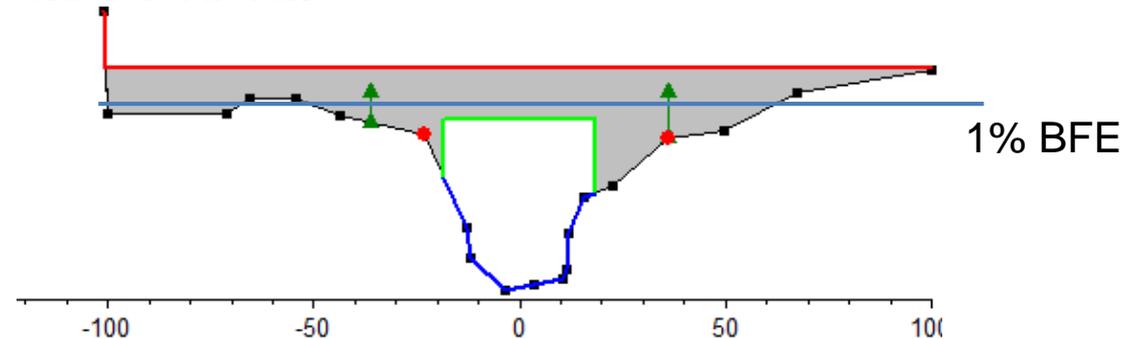


Proposed

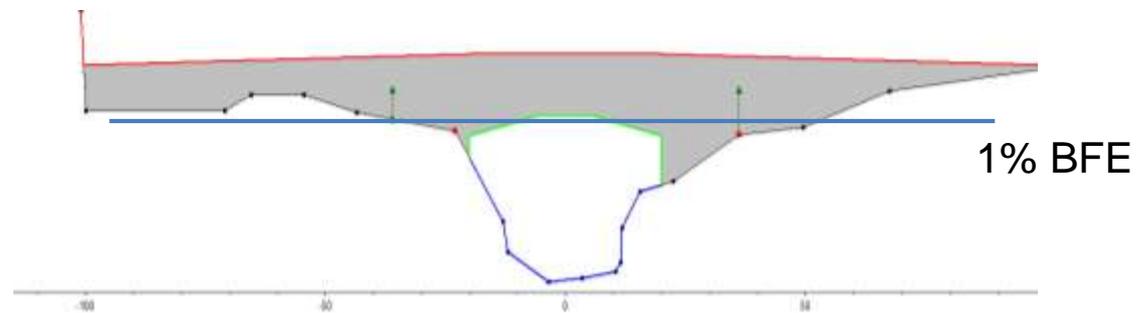


- The modeled bridge solution may change. The worksheet logic will identify this change. However, this scenario has been evaluated and approved as in-kind.

Existing



Proposed





Modeling Assessment

- Support permit submittal with hydraulic modeling
 - HEC-RAS versions 4.xx
 - HEC-RAS versions 5.xx
 - HY-8 version 7.2
 - Other FEMA supported



Modeling Guidelines

- Modeling Guidelines
 - Officially: General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana
 - First published on December 5, 2002



Modeling Guidelines

- Available at www.floodmaps.IN.gov

DNR: Indiana Floodplain M... x +

www.in.gov/dnr/water/5647.htm 90% Search

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Indiana Floodplain Mapping Quick Links

Floodplain Management Links

- [The Indiana Floodplain Information Portal](#)**
Launch INFIP, an interactive floodplain mapping tool, which includes address searching and eFARA, the Division of Water's on-line floodplain analysis submittal tools. INFIP also now includes the "Best Available Data" layer, showing up to date floodplain mapping information.
- [FEMA Map Service Center](#)**
View and download official FEMA floodplain mapping products, including Flood Insurance Rate Maps, Flood Insurance Studies, Letters of Map Change (LOMA, LOMR-F, LOMR) FIRM database information, and preliminary and historic mapping products.
- [The General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana](#)**
Technical guidance documents for developing floodplain modeling for submittal to the Division of Water. Also includes external links to other modeling information.
- [USGS Flood Inundation Mapper](#)**
The Flood Inundation Mapper shows estimates of flood inundation areas based on USGS stream gage information. Areas are shown based on gage height, allowing users to view the approximate limits of a flood based on a reported gage reading.
- [Floodplain Management & Homeowner Information](#)**
More information regarding floodplain management with respect to both insurance and construction.
- [Interim Digital FIRMs](#)**
Digital versions of historic Flood Insurance Rate Maps from 2004.

www.in.gov/dnr/



Modeling Guidelines

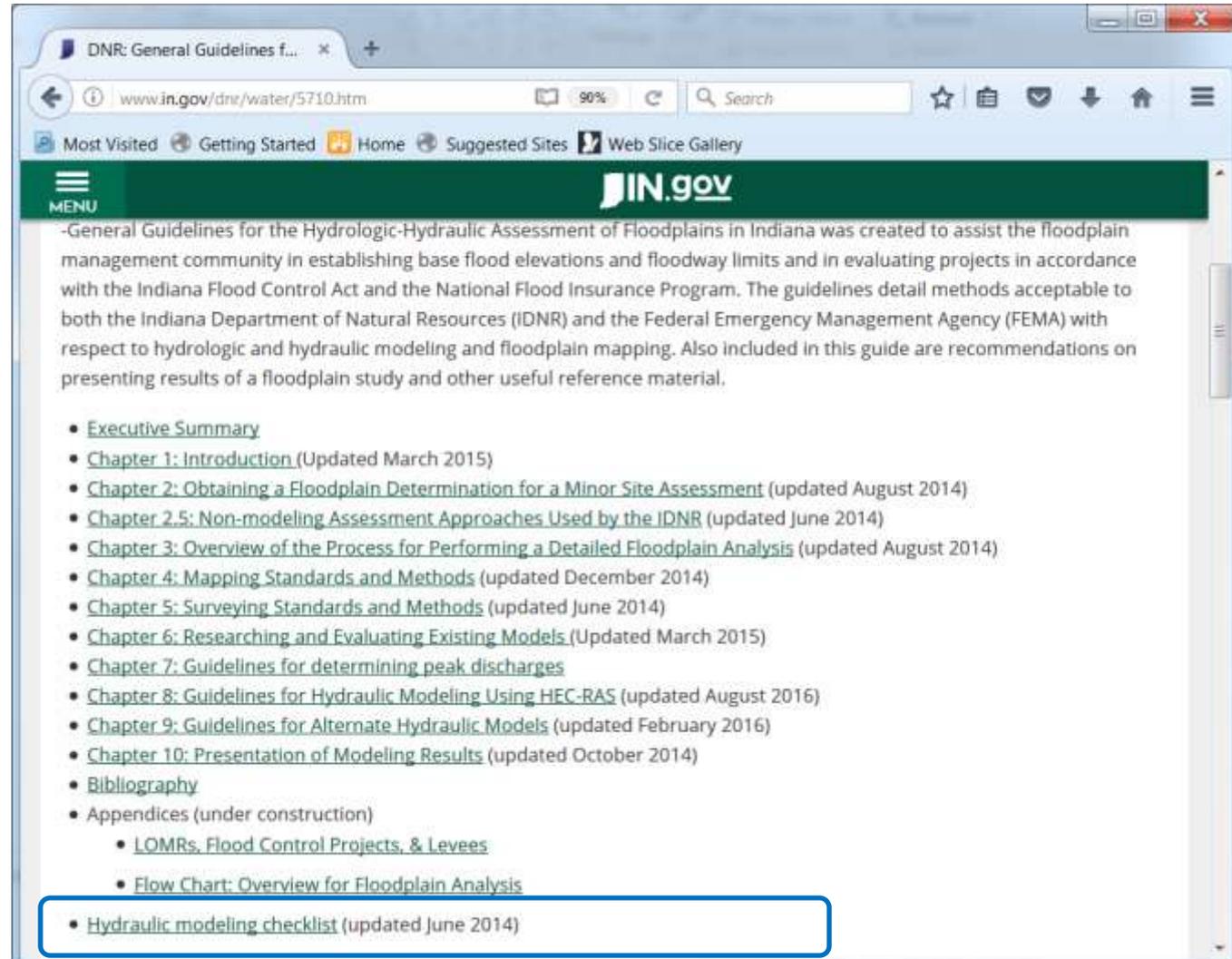
- www.floodmaps.IN.gov

The screenshot shows a web browser window with the address bar displaying www.in.gov/dnr/water/5710.htm. The page title is "DNR: General Guidelines f...". The browser interface includes navigation buttons, a search bar, and a menu icon. The website header features the "IN.gov" logo and a "MENU" button. The main content area is titled "GENERAL GUIDELINES FOR THE HYDROLOGIC-HYDRAULIC ASSESSMENT".

-General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana was created to assist the floodplain management community in establishing base flood elevations and floodway limits and in evaluating projects in accordance with the Indiana Flood Control Act and the National Flood Insurance Program. The guidelines detail methods acceptable to both the Indiana Department of Natural Resources (IDNR) and the Federal Emergency Management Agency (FEMA) with respect to hydrologic and hydraulic modeling and floodplain mapping. Also included in this guide are recommendations on presenting results of a floodplain study and other useful reference material.

- [Executive Summary](#)
- [Chapter 1: Introduction](#) (Updated March 2015)
- [Chapter 2: Obtaining a Floodplain Determination for a Minor Site Assessment](#) (updated August 2014)
- [Chapter 2.5: Non-modeling Assessment Approaches Used by the IDNR](#) (updated June 2014)
- [Chapter 3: Overview of the Process for Performing a Detailed Floodplain Analysis](#) (updated August 2014)
- [Chapter 4: Mapping Standards and Methods](#) (updated December 2014)
- [Chapter 5: Surveying Standards and Methods](#) (updated June 2014)
- [Chapter 6: Researching and Evaluating Existing Models](#) (Updated March 2015)
- [Chapter 7: Guidelines for determining peak discharges](#)
- [Chapter 8: Guidelines for Hydraulic Modeling Using HEC-RAS](#) (updated August 2016)
- [Chapter 9: Guidelines for Alternate Hydraulic Models](#) (updated February 2016)
- [Chapter 10: Presentation of Modeling Results](#) (updated October 2014)
- [Bibliography](#)
- [Appendices](#) (under construction)

- Hydraulic Modeling Checklist



DNR: General Guidelines f... x +

www.in.gov/dnr/water/5710.htm 90% Search

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- [Bibliography](#)
- [Appendices \(under construction\)](#)
 - [LOMRs, Flood Control Projects, & Levees](#)
 - [Flow Chart: Overview for Floodplain Analysis](#)
- [Hydraulic modeling checklist](#) (updated June 2014)



Modeling Checklist

- 2014 Revised Checklist Updates
 - Savable PDF format
 - Title block automatically copied to pages
 - Example text in entry boxes
 - Study Reach
 - H&H Model Library Stream reference
 - Table format: Previous FARA/ Permits
 - Table format: Discharge
 - Table format: bridges & culverts
 - Model Plans submitted

- 2014 Checklist Updates

 <p>HYDRAULIC Modeling Checklist State Form 52882 (5-14) DEPARTMENT OF NATURAL RESOURCES DIVISION OF WATER</p>	
<p>This checklist will assist the staff at the Division of Water in the review of modeling for the definition of the floodway, for evaluation of a Construction in a Floodway permit application, for state concurrence of a Letter of Map Revision or a Flood Insurance Study or any other modeling that is submitted for review. The checklist items are based on the document "General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana." The modeler should be familiar with this document and any discrepancies between the general guidelines and the submitted modeling should be discussed with the Division of Water Engineering Services staff prior to submittal.</p> <p>This completed checklist must be submitted to the Division of Water along with your models. The Division of Water <u>will not</u> review any modeling submittal that is not accompanied by a completed checklist.</p> <p>Please keep in mind that these questions were written primarily for the application of HEC-RAS computer models. HEC-RAS is preferred by the Division of Water, however, other modeling programs may be used provided their use has been discussed previously with Division of Water Staff. Should you have any questions, please contact Division of Water staff at (317) 232-4160 or toll free at (877) 928-3755.</p>	
<p>1. General Information</p> <p>a. Preparer Name: <input type="text"/></p> <p>b. Preparer Firm: <input type="text"/></p> <p>c. Date: (mm/dd/yy) <input type="text"/></p> <p>2. Project Location and Background Information</p> <p>a. Waterbody Name: <input type="text"/></p> <p>b. Location Description: <input type="text"/> <input type="text"/> <input type="text"/></p> <p>c. Nearest Town/City: <input type="text"/></p> <p>d. County: <input type="text"/></p>	
<p>Page 1 of 12</p>	



Bridge Non-Modeling Assessment

Other Bridge projects:

- Pier wrapping
- Bridge widening, culvert extension
- Scour repair at stream or river crossing

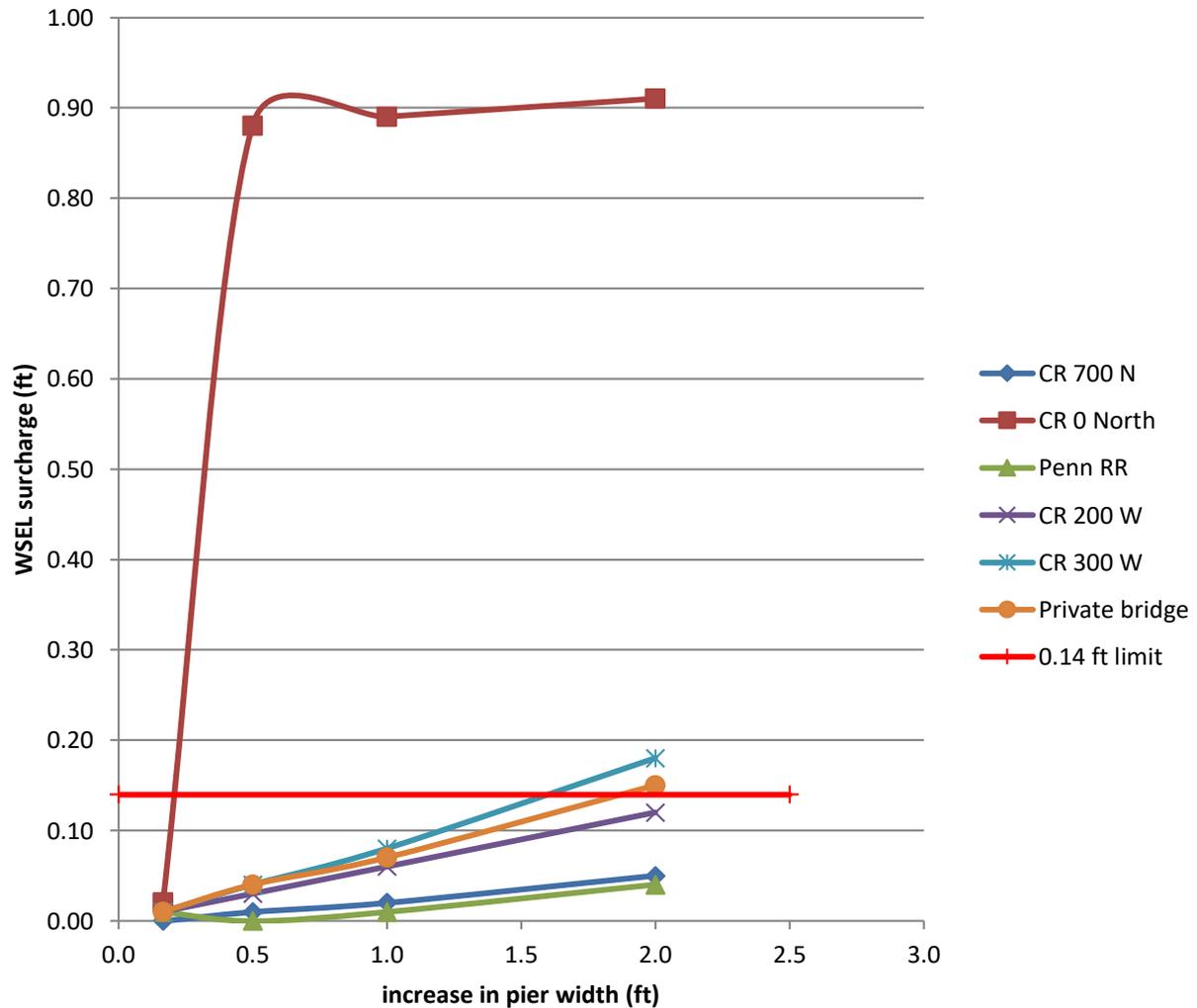
Pier Wrap Width and Number of Piers	Pier Wrap Thickness		Number of Piers	
	<input type="text"/>	in	<input type="text"/>	
Increase in Structure Width (Along stream profile)	Upstream Extension		Downstream Extension	
	<input type="text"/>	ft	<input type="text"/>	ft
Scour Section	Pre-Eroded Cross Sectional Area		Proposed Cross Sectional Area	
	<input type="text"/>	sq ft	<input type="text"/>	sq ft
Low Structure Elevation and datum	Existing Structure		Proposed Structure	
	<input type="text"/>	ft, <input type="text"/> datum	<input type="text"/>	ft, <input type="text"/> datum
High Structure Elevation and datum	Existing Structure		Proposed Structure	
	<input type="text"/>	ft, <input type="text"/> datum	<input type="text"/>	ft, <input type="text"/> datum
Minimum top of road elevation across entire floodplain	Existing		Proposed	
	<input type="text"/>	ft, <input type="text"/> datum	<input type="text"/>	ft, <input type="text"/> datum



Bridge Non-Modeling Assessment

- Pier Wrap
 - 1.0 ft or less total pier width increase
 - Limitation scenarios:
 - No overtopping, Pressure /weir flow

- example stream model

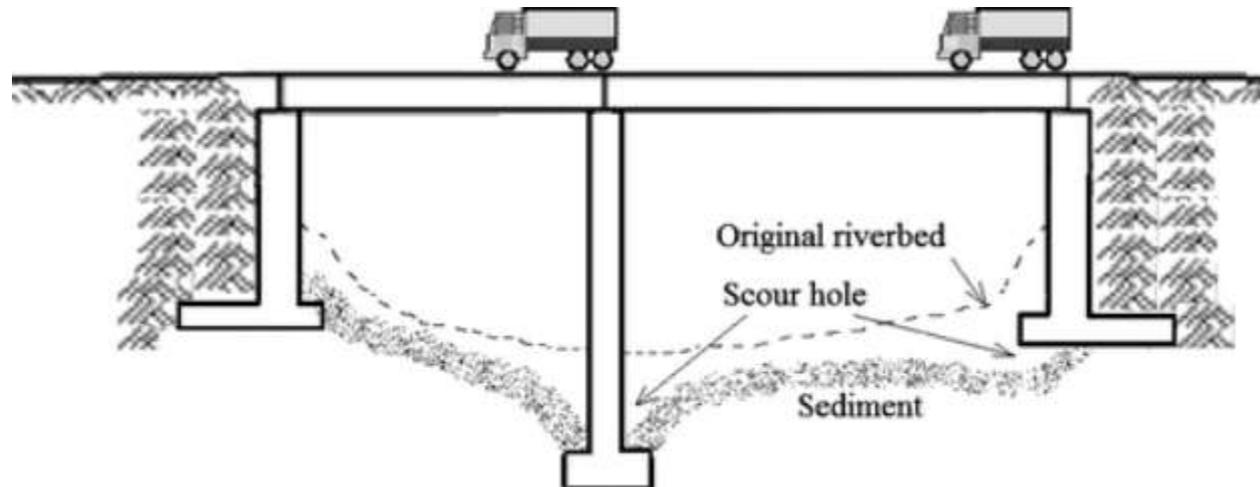




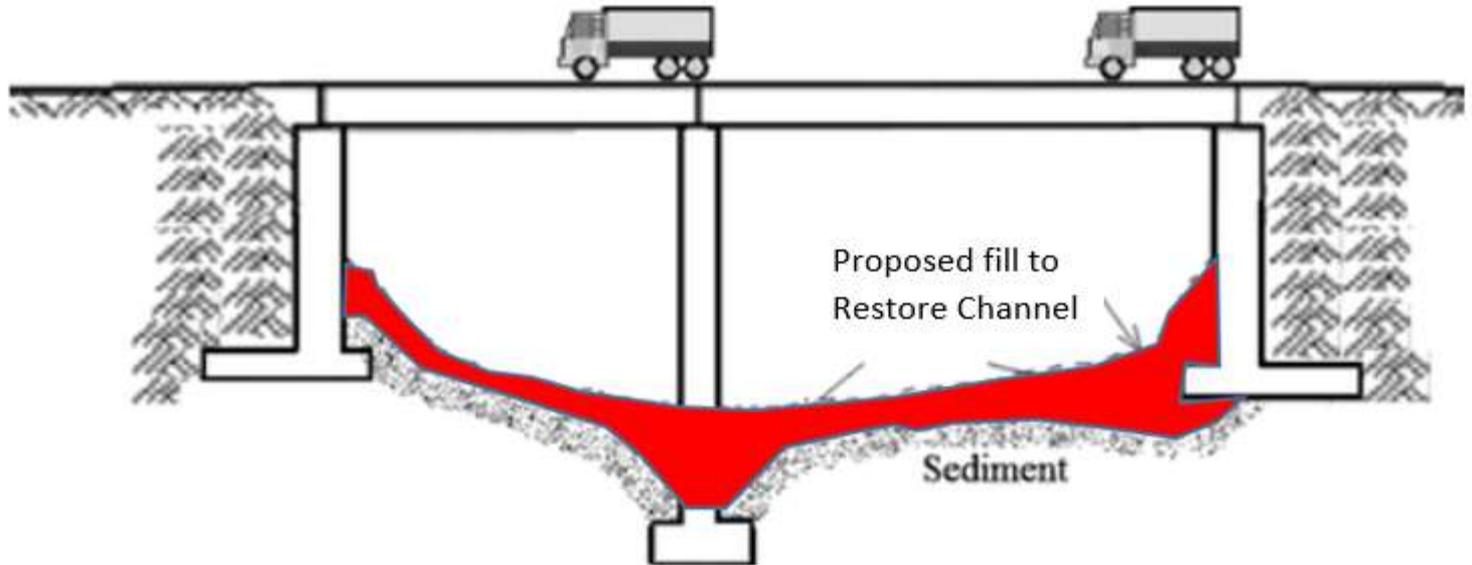
Bridge Non-Modeling Assessment

- Scour
 - Restoration of scour within bridge extents
 - Form requests the Pre-eroded cross sectional area and the Proposed cross sectional area
 - Limitation
 - Modeling will be required if the Proposed cross sectional area is less than the Pre-eroded cross sectional area

- Calculate the cross sectional area for the Pre-eroded (original riverbed) cross sectional area.



- Only place enough fill to return the area back to Pre-eroded conditions.





Bridge Non-Modeling Assessment

- Widening & Extension
 - Bridge widening
 - Form requests increase in structure width
 - Culvert
 - Limited to extension downstream
 - Extension upstream –modeling (HEC-RAS or HY-8)
 - Upstream raises the invert and therefore potentially the headwater elevation



Permit Life Limitation & Renewal

- Effective July 1, 2014, the Flood Control Act was amended to:
 - Limit the number of years construction in a floodway is authorized to 2 years
 - Bring an end to permits remaining valid indefinitely
 - Allow the Department to issue a one time, 2 year permit renewal
 - Renewal request must be received prior to the permit expiration date



Permit Life Limitation & Renewal

- Permit issued after July 1, 2014
 - A permit is valid for 2 years from the date of issuance.
 - For an INDOT or a county highway department project associated with federal funding.
 - Permit is valid for 5 years from the date of issuance



Sample Problems

- R - I - K

- Step 1

- New crossing with existing structure being removed
 - The replacement is not a culvert
 - The location will not change

- Step 2

- Existing Low Structure: 430', NAVD88
 - Proposed Low Structure: 432', NAVD88
 - Existing High Structure: 436', NAVD88
 - Proposed High Structure: 439', NAVD88





Sample Problems



- R - I - K (continued)
 - Step 2
 - Existing Minimum Top of Road: 433', NAVD88
 - Proposed Minimum Top of Road: 433', NAVD88
 - Step 3
 - Existing waterway opening: 940 sq ft
 - Proposed waterway opening: 964 sq ft
 - There is variation with guardrails (higher)
 - Proposed approach roads are being raised
 - BFE: 431', NAVD88 Source: FIS



Sample Problems



- Pier Wrap

- Step 1

- Nothing else is asked

- Step 2

- Total Width of Pier Wrap: 10''
 - Number of Piers 3
 - Existing Low Structure: 430', NAVD88
 - Existing High Structure: 436', NAVD88
 - Existing Top of Road: 433', NAVD88



Sample Problems



- Pier Wrap (continued)
 - Step 3
 - (Pressure/Weir example)
 - BFE: 431', NAVD88 Source: FIS
 - (energy example)
 - BFE: 428;, NAVD88 Source: FIS



Sample Problems



- Widening
 - Step 1
 - Nothing else is asked

 - Step 2
 - Report upstream extension length: 0'
 - Report downstream extension length: 15'
 - Existing Low Structure: 430', NAVD88
 - Proposed Low Structure: 430', NAVD88
 - Existing Minimum Top of Road: 433', NAVD88
 - Proposed Minimum Top of Road: 433', NAVD88



Sample Problems



- Widening(continued)
 - Step 3
 - Proposed waterway opening area: 113 sq ft
 - No variation with guardrails or road profile
 - Approach roads are not being raised
 - BFE: 428;, NAVD88 Source: FIS



Sample Problems



- Scour
 - Step 1
 - Nothing else is asked

 - Step 2
 - Pre-eroded Cross Sectional Area: 940 sq ft
 - Proposed Cross Sectional Area: 940 sq ft
 - Step 3
 - Nothing else asked