

Appendix 6-D

MDOT Guidelines for Evaluating Scour at Structures and Scour Analysis Worksheets

Updated September 2026

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GUIDELINES FOR EVALUATING SCOUR AT STRUCTURES

INTRODUCTION

These guidelines are proposed for the evaluation of scour at existing and proposed (new) bridge structures for the MDOT and local agencies. It supplements the following FHWA publications and directives on scour:

1. [Evaluating Scour at Bridges](#), FHWA HEC-18 (2012)
2. [Evaluating Scour at Bridges](#), FHWA Technical Advisory T 5140.23 (1991)
3. [Stream Stability at Highway Structures](#), FHWA HEC-20 (2012)
4. [Bridge Scour and Stream Instability Countermeasures Experience, Selection, and Design Guidance, Vol. 1](#), FHWA HEC-23 (2009)
5. [Bridge Scour and Stream Instability Countermeasures Experience, Selection, and Design Guidance, Vol. 2](#), FHWA HEC-23 (2009)
6. [Hydraulic Considerations for Shallow Abutment Foundations](#), FHWA TechBrief FHWA-HIF-19-007 (2018)
7. [Hydraulic Considerations for Abutments on Deep Foundations](#), FHWA TechBrief FHWA-HIF-23-048 (2023)
8. [Scour Considerations within AASHTO LRFD Design Specifications](#), FHWA Tech Brief FHWA-HIF-19-060 (2021)
9. [Guidance on Applying Risk Based, Data Driven Decision-Making Process to the FHWA Scour Program](#), FHWA Memorandum HIBT-20 (2012)
10. [Specification for National Bridge Inventory](#) (SNBI), FHWA (2022)
11. [National Bridge Inspection Standards](#) (NBIS), FHWA (2022)

The MDOT [Michigan Structure Inspection Manual](#) (MiSIM) supplements the Federal Highway Administration (FHWA) publications and directives on scour.

This appendix presents the importance of evaluation, three levels of scour analysis, National Bridge Inspection Standards (NBIS), Plan of Action, and design of scour countermeasures for scour-critical bridges. Include hydraulic, geotechnical, and structural engineers in all levels of scour analysis and the evaluation process.

Chapter 10 of FHWA HEC-18 (2012) outlines a scour evaluation process for bridges. FHWA HEC-18 (2012) requires documentation of each level of scour analysis. Documentation for Michigan includes updating the scour vulnerability rating within the National Bridge Inventory (NBI) at each level of scour analysis and action (refer to the scour evaluation process). The Level 1 and Level 2 Worksheets are updated during this

process. The Level 2 Worksheet includes recommended scour countermeasures and a “Plan of Action,” if needed. The Plan of Action, discussed in a subsequent section, includes a timetable to implement the design and construction of accepted scour countermeasures.

IMPORTANCE OF EVALUATION

Ensure all inventoried structures over 20 feet in length crossing a waterway have a channel cross section and a Level 1, 2, or 3 scour analysis in the bridge file. Evaluate all new construction for the potential for scour prior to final design. The Bridge Owner must ensure that these documents are reviewed and updated as necessary (i.e. structure replacement, installation of countermeasures, severe flood event, etc.).

NATIONAL BRIDGE INVENTORY STANDARDS (NBIS)

The NBIS, CFR 650.313 (o) requires all bridges over water to have a current scour appraisal on file to determine the bridge’s scour vulnerability. For bridges that are determined to be scour critical or have unknown foundations, a scour Plan of Action (POA) is required to provide guidance for mitigating the potential foundation instability due to scour conditions. The Bridge Owner must complete the scour appraisal and properly code the structure’s scour vulnerability.

Determination of the scour vulnerability is based on a collaborative effort between a multi-disciplinary team of hydraulic, structural, and geotechnical engineers. Additional information is found in the MiSIM.

For MDOT-owned bridges, the Bureau of Development-Hydraulic Unit determines the initial vulnerability coding based on the design of new construction, bridge replacements, or scour countermeasures added to existing bridges with input from the multi-disciplinary team specialty areas as needed. When an actual or potential scour problem is identified by the Region Bridge Engineer, Bridge Inspector, or Bureau of Bridges and Structures (BOBS)-Scour Specialist, the bridge is further evaluated by the multi-disciplinary team specialty areas.

LEVEL 1 - QUALITATIVE ANALYSIS

A Level 1 scour analysis is an information gathering effort consisting of office and field reviews of the structure. Obtain, review, and comment on the following information:

- Bridge Safety Inspection Reports
- Streambed Cross-Sections
- Underwater Inspection Reports (if available)
- Items from the FHWA Specifications for the National Bridge Inventory
 - B.C.03 - Substructure Condition Rating
 - B.C.04 - Culvert Condition Rating
 - B.C.09 - Channel Condition Rating
 - B.C.10 - Channel Protection Condition Rating

- B.C.11 - Scour Condition Rating
- B.AP.02 - Overtopping Likelihood
- B.AP.03 - Scour Vulnerability
- B.IR.03 - Underwater Inspection Required
- B.C.15 - Underwater Inspection Condition
- Construction, design, and maintenance files for repair and maintenance work done on the structure
- Hydraulic Data (Flood Insurance Study or original design analysis)

A worksheet for a Level 1 scour analysis is included in this document. The Level 1 scour analysis procedure is outlined in Chapter 4 of FHWA HEC-20 (2012). The six-step process covers stream characteristics, land use, stream stability, lateral stability, vertical stream stability, and channel response to change. Items used in the initial screening procedure should be verified, corrections to the screening database made, and the priority list updated accordingly.

A field investigation is required to obtain the stream characteristics and confirm the minimum hydraulic parameters, i.e., channel slope, channel and overbank roughness coefficients, plan elevations and dimension of structure, and foundation conditions, etc.

Structures with unknown foundations have an Item B.AP.03 code of "U". MDOT requires structures with unknown foundations to be screened and categorized for further action based on risk of failure and impact to user.

LEVEL 2 - BASIC ENGINEERING ANALYSIS

The Level 2 scour analysis defines stream stability and scour problems in an eight-step process:

1. Hydrology or flood history
2. Hydraulic conditions
3. Geotechnical - bed and bank material evaluation
4. Watershed sediment yield
5. Incipient motion analysis
6. Armoring potential
7. Rating curve shifts
8. Scour calculations

A worksheet for a Level 2 scour analysis is included in this document. Each step of the process is discussed as follows.

HYDROLOGY

Flood discharges for a Level 2 scour analysis are developed independently or as part of a flood flow discharge request from the Michigan Department of Environment, Great Lakes, and Energy (EGLE). The range of peak discharges used include the 2% AEP (50-year), 1% AEP (100-year), 0.5% AEP (200-year), 0.2% AEP (500-year) chance, and the overtopping if less than the 0.2% AEP (500-year). EGLE requires using one of the following methods for estimating flood discharges as part of an independent analysis:

- Drainage areas less than 20 square miles:
Use Natural Resource Conservation Service's (NRCS) WinTR-55. See Chapter 3, Hydrology, Section 3.5 for additional information.
- Drainage areas greater than 20 square miles:
Use regression equations in *Michigan Hydrologic Calculation Procedures* (Watkins et al., 2026).
- The drainage area ratio method on gaged streams can be used where USGS gages exist, or recent EGLE discharge estimates at or near the bridge may be used. The ratio of the drainage areas is raised to the 0.89 power when estimating the discharge. This method is only used if the hydrologic characteristics of the two drainage basins are similar.

Estimated discharges are for scour evaluation purposes only. Design and construction of structure repair, replacement, or scour countermeasures requires a discharge estimate from EGLE with a permit application for the proposed work. Compare the EGLE discharge estimate with the range of discharges used in the scour evaluation. Engineering judgement is used to determine if the scour evaluation is adequate.

For a Level 3 scour analysis, a flood hydrograph may be necessary.

HYDRAULIC CONDITIONS

Chapter 2 of FHWA HEC-18 (2012) recommends utilizing existing hydraulic studies. If these studies are not available, a new hydraulic survey, hydraulic analysis, and scour analysis is completed following guidance from Chapters 4 and 6.

MDOT requires using the U.S. Army Corps of Engineers Hydrologic Engineering Center's River Analysis System (HEC-RAS) computer program or a 2D computer program to calculate the water surface profiles and hydraulic parameters needed in the scour calculations, per Section 6.4.3.

GEOTECHNICAL

A soil gradation curve of streambed and overbank material is needed to determine the D₅₀ and D₈₄ particle sizes for use in the respective contraction scour and pier scour equations. Gradation curves or soil boring information in the original plans of the structure can be used for scour evaluation at existing bridges. Obtain soil borings and sieve analysis for all new structures. Consult a geotechnical engineer to estimate the

D50 and D84. If existing plans or soil information are not available to analyze the existing structures, then contraction scour is analyzed based on the worst-case scenario.

If rock is encountered within the anticipated scour depth, the rock is cored and the Rock Quality Designation (RQD) is determined. A minimum core length of 5 feet is required. Consider coring deeper if competent rock (50% or greater RQD) is not encountered. Perform slake durability testing for pier foundations to determine the Geotechnical Scour Number (GSN) used in Equation 7.41 in HEC-18.

For cohesive soils within the anticipated scour depth, the critical shear stress, as determined by Erosion Function Apparatus (EFA) testing, is determined from Shelby tube samples. Erosion testing is not common and is only done in concurrence with the interdisciplinary team of hydraulic, geotechnical, and structural engineers.

WATERSHED SEDIMENT YIELD

The availability of watershed yield is imprecise. Information on Michigan streams is limited and, therefore, not typically used in the overall evaluation of a Level 2 scour analysis.

INCIPIENT MOTION ANALYSIS

Using the Shields relation (Chapter 6 of FHWA HEC-20 (2012)) for the range of discharges may provide information on stream channel stability and what flood causes stream channel instability. This relation is only recommended for gravel and cobble stream systems.

ARMORING POTENTIAL

Determining the potential for natural armoring of a streambed is discussed in Chapter 6 of FHWA HEC-20 (2012). This process sorts the larger and heavier particles forming a natural stream bottom armoring. Armoring is uncommon in Michigan.

RATING CURVE SHIFTS

USGS stream gage data is limited to a few locations on Michigan streams. Analyses of rating curve shifts have not been completed in Michigan. Therefore, this portion of a Level 2 scour analysis is typically unnecessary.

SCOUR CALCULATIONS

Scour has three additive components: local scour at abutments and piers, contraction scour, and aggradation/degradation of the streambed. FHWA HEC-18 (2012) provides detailed computational procedures. Geotechnical and structural engineers are required to review the total scour depth to evaluate the structure's stability.

LEVEL 3 - COMPUTATIONAL FLUID DYNAMICS (CFD) AND PHYSICAL MODEL STUDIES

A detailed evaluation and assessment of stream stability is completed by CFD or physical model studies. These studies are significantly more expensive and time consuming than typical hydraulic design and may only be reasonable for exceptionally large or complex structures. A Level 3 scour analysis is considered in complex situations where Level 2 scour analysis techniques have proven inadequate. A Level 3 scour analysis can illustrate the time and duration that hydraulic forces are present to transport bed material.

SCOUR COUNTERMEASURES

Scour countermeasures are recommended at a bridge to make it less vulnerable to either damage or failure from scour. For existing bridges, recommended countermeasures are selected following guidance in FHWA HEC-23 (2009).

LEVEL 1 WORKSHEET

Rev: April 2026

MICHIGAN DEPARTMENT OF TRANSPORTATION LEVEL 1 SCOUR ANALYSIS WORKSHEET

Date: _____ By: _____ Structure No: _____ Control Section: _____

Job No.: _____ Route: _____ Watercourse: _____

All references are to HEC-20, Fourth Edition.

Data Collection

- ☐ Plans
- ☐ Bridge Safety Inspection Reports
- ☐ Underwater Inspection Reports
- ☐ Review existing items B.C.03, B.C.04, B.C.09, B.C.10, B.C.11, B.AP.02, B.AP.03, B.IR.03, and B.C.15 of the Specifications for the National Bridge Inventory (SNBI)
- ☐ Review available construction, design, and maintenance files for repair and maintenance work done on the structure
- ☐ Current Scour Condition Rating at Time of Evaluation (Item B.AP.03)

Field Investigation**Date:** _____

- ☐ Channel bottom width approximately one bridge span upstream = _____ feet
- ☐ Overbank and channel Manning's roughness coefficients
Left: _____ Channel: _____ Right: _____
- ☐ Is there sufficient riprap (size, gradation, quality, depth, filter, and covers entire substructure)? Proper design of riprap must follow HEC-23 guidance.
Abutments: _____ Piers: _____
- ☐ Photographs
- ☐ Cross sections at upstream and downstream faces of bridge
- ☐ Designed information available

Comments:

Stream Characteristics

- ☐ Complete and attach Figure 2.6 from HEC-20

Comments:

Land Use: Identify the existing and past land uses of the upstream watershed:

Urban Area ☐ Yes ☐ No Comments: _____

Sand and Gravel Mining ☐ Yes ☐ No Comments: _____

Undeveloped Land ☐ Yes ☐ No Comments: _____

Lateral Stability: Refer to HEC-20, Section 2.3.9 on Channel Boundaries and Vegetation for channel bank stability.

Comments: _____

Vertical Stability:

Streambed elevation change from as-built plans? ☐ Yes ☐ No

Exposed pier footings (degradation)? ☐ Yes ☐ No ☐ N/A

Exposed abutment footings (degradation)? ☐ Yes ☐ No

Channel bank caving in (degradation)? ☐ Yes ☐ No

Eroding floodplain (aggradation)? ☐ Yes ☐ No

Crossing at confluence or tributaries? ☐ Yes ☐ No

Bridge sites upstream and downstream? ☐ Yes ☐ No

Grade or hydraulic controls, i.e., dams, weirs, diversions? ☐ Yes ☐ No

Foundation on rock ☐ Yes ☐ No

Channel armoring potential ☐ Yes ☐ No

Comments: _____

Stream Stability: Make a qualitative assessment of the overall stream stability by referring to the information documented on this worksheet and Figure 2.6 and Table 4.2 from HEC-20. Attach copies of figures.

☐ Stable ☐ Unstable ☐ Degrading ☐ Aggrading

Comments: _____

RECOMMENDED SNBI ITEM B.AP.03 (SCOUR VULNERABILITY) CODE: _____

LEVEL 2 ANALYSIS NEEDED: ☐ YES ☐ NO

Worksheet approved by: _____ P.E. License #: _____ Date: _____

LEVEL 2 WORKSHEET

Rev: April 2026

MICHIGAN DEPARTMENT OF TRANSPORTATION LEVEL 2 SCOUR ANALYSIS WORKSHEET

Date: _____ By: _____ Structure No.: _____ Control Section: _____

Job No.: _____ Route: _____ Watercourse: _____

Page numbers refer to HEC-20, Fourth Edition, and HEC-18, Fifth Edition. Attach water surface profile modeling printouts with pertinent variables highlighted. Scour calculations automated by HEC-RAS are not acceptable. All calculations must be attached or on the back of their respective pages.

1. HYDROLOGY:Method of Analysis: ☐ EGLE estimate ☐ SCS ☐ Regression ☐ DAR to gage ☐ other

Drainage Area: _____ square miles

Q₁₀ = _____ cfsQ₅₀₀ = _____ cfsQ₅₀ = _____ cfsQ_{overtopping} = _____ cfsQ₁₀₀ = _____ cfsQ₂₀₀ = _____ cfs**2. HYDRAULICS:** Water surface profiles by SRH-2D _____ HEC-RAS _____

Other _____

3. GEOTECHNICAL: Bed and overbank material valuesD₅₀: _____ D₈₄: _____ (ft) Left OverbankD₅₀: _____ D₈₄: _____ (ft) Right OverbankD₅₀: _____ D₈₄: _____ (ft) Main Channel

Critical shear stress (cohesive soils): _____

Geotechnical Scour Number (GSN): _____

Source of information: _____

4. INCIPIENT MOTION ANALYSIS: For gravel and cobble streams only. Refer to page 6.26 of HEC-20.**5. ARMORING POTENTIAL:** Refer to page 6.28 of HEC-20.

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

6. SCOUR CALCULATIONS

LONG-TERM BED ELEVATION CHANGES - AGGRADATION/DEGRADATION

- ☐ Use information from **Level 1** Analysis
- ☐ Use information from bridge inspection reports
- ☐ Estimate change during the next 100 years if enough information exists

Estimated aggradation/degradation = _____ feet

Note: Do not adjust fixed bed hydraulics for contraction scour and local scour. If channel has aggraded, do not adjust the estimated scour depth.

CONTRACTION SCOUR (Section 6.2, HEC-18)

Bridge Site Condition:

CASE: ☐ 1a ☐ 1b ☐ 1c ☐ 2 ☐ 3 ☐ 4

Compare critical velocity V_c to mean velocity V :

$$V_c = 11.17 y^{1/6} D^{1/3} \quad (\text{page 6.2, HEC-18})$$

	Design Flood	Check Flood	
y	= _____ ft	_____ ft	
D_{50}	= _____ ft	_____ ft	
V_c	= _____ fps	_____ fps	
V	= _____ fps	_____ fps	

If $V_c < V$, use Laursen's Live-Bed contraction scour (page 6.2, HEC-18).

If $V_c > V$, use Laursen's Clear-Water contraction scour (page 6.2, HEC-18).

If coarse sediments in bed material, refer to page 6.11, HEC-18.

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

Laursen's live-bed scour equation (page 6.10, HEC-18)

$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{6/7} \left(\frac{W_1}{W_2}\right)^{k_1} \text{ and}$$

 $y_s = y_2 - y_0 =$ average contraction scour depth (feet)

Design Flood

Check Flood

$y_1 =$ _____ ft	_____ ft
$y_2 =$ _____ ft	_____ ft
$y_0 =$ _____ ft	_____ ft
$W_1 =$ _____ ft	_____ ft
$W_2 =$ _____ ft	_____ ft
$Q_1 =$ _____ cfs	_____ cfs
$Q_2 =$ _____ cfs	_____ cfs
$V^* =$ _____ fps	_____ fps
$\omega =$ _____ t/s	_____ t/s
$S_1 =$ _____ ft/ft	_____ ft/ft
$V^*/\omega =$ _____	_____
$k_1 =$ _____	_____
$y_s =$ _____ ft	_____ ft

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

Laursen's Clear-Water Contraction Scour (page 6.12, HEC-18)

$$y_2 = \left[\frac{K_u Q^2}{D_m^{2/3} W^2} \right]^{3/7}$$

 $y_s = y_2 - y_0 =$ average scour depth (feet)

Design Flood

Check Flood

 $y_0 =$ _____ ft

_____ ft

 $y_2 =$ _____ ft

_____ ft

 $Q =$ _____ cfs

_____ cfs

 $W =$ _____ ft

_____ ft

 $D_m =$ _____ ft

_____ ft

 $D_{50} =$ _____ ft

_____ ft

 $y_s =$ _____ ft

_____ ft

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

PRESSURE FLOW CONTRACTION SCOUR (page 6.25, HEC-18):

$$y_s = y_2 + t - h_b$$

$$\frac{t}{h_b} = 0.5 \left(\frac{h_b \cdot h_t}{h_u^2} \right)^{0.2} \left(1 - \frac{h_w}{h_t} \right)^{-0.1}$$

Design Flood

Check Flood

y_s =	_____ ft	_____ ft
y_2 =	_____ ft	_____ ft
t =	_____ ft	_____ ft
h_b =	_____ ft	_____ ft
h_t =	_____ ft	_____ ft
D_{50} =	_____ ft	_____ ft
h_u =	_____ ft	_____ ft

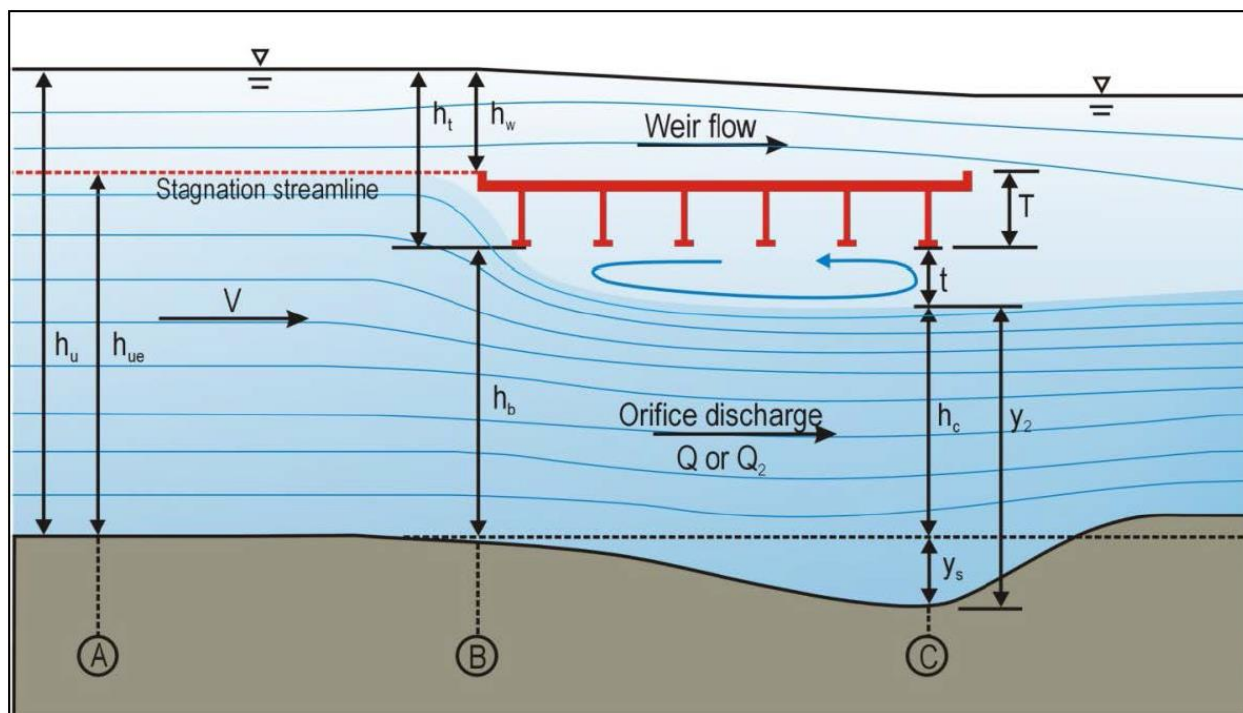


Figure 6.18. Vertical contraction and definition for geometric parameters.

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

LOCAL SCOUR**ABUTMENTS****Froehlich's live-bed scour equation.**

$$\text{Froehlich's equation: } \frac{y_s}{y_a} = 2.27 K_1 K_2 \left(\frac{L'}{y_a} \right)^{0.43} Fr^{0.61} + 1 \quad (\text{page 8.7, HEC-18})$$

Left Abutment**Right Abutment**

	Design Flood	Check Flood	Design Flood	Check Flood
$K_1 =$	_____	_____	_____	_____
$K_2 =$	_____	_____	_____	_____
$L' =$	_____ ft	_____	_____	_____
$A_e =$	_____ sf	_____ sf	_____ sf	_____ sf
$Q_e =$	_____ cfs	_____ cfs	_____ cfs	_____ cfs
$V_e =$	_____ fps	_____ fps	_____ fps	_____ fps
$Fr =$	_____	_____	_____	_____
$y_a =$	_____ ft	_____ ft	_____ ft	_____ ft
$y_s =$	_____ ft	_____ ft	_____ ft	_____ ft

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

NCHRP 24-20 Method:Live Bed: $y_{max} = \alpha_A y_c$ (page 8.8, HEC-18)Clear Water: $y_{max} = \alpha_B y_c$ (page 8.8, HEC-18) $y_s = y_{max} - y_0$ (page 8.8, HEC-18)**Left Abutment****Right Abutment**

	Design Flood	Check Flood	Design Flood	Check Flood
Method _____	_____	_____	_____	_____
$q_1 =$ _____ cfs	_____ cfs	_____ cfs	_____ cfs	_____ cfs
$q_2 =$ _____ cfs	_____ cfs	_____ cfs	_____ cfs	_____ cfs
$y_c =$ _____ ft	_____ ft	_____ ft	_____ ft	_____ ft
$\alpha =$ _____	_____	_____	_____	_____
$y_{max} =$ _____ ft	_____ ft	_____ ft	_____ ft	_____ ft
$y_s =$ _____ ft	_____ ft	_____ ft	_____ ft	_____ ft

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

PIER(S)

Colorado State University equation (page 7.3, HEC-18):

$$\frac{y_s}{y_1} = 2.0K_1K_2K_3 \left(\frac{a}{y_1} \right)^{0.65} Fr_1^{0.43}$$

	Pier # _____		Pier # _____	
	Design Flood	Check Flood	Design Flood	Check Flood
y_1	_____ ft	_____ ft	_____ ft	_____ ft
$K_1 =$	_____ cfs	_____ cfs	_____ cfs	_____ cfs
$K_2 =$	_____ cfs	_____ cfs	_____ cfs	_____ cfs
$K_3 =$	_____ 1.1	_____ 1.1	_____ 1.1	_____ 1.1
$a =$	_____ ft	_____ ft	_____ ft	_____ ft
$V_1 =$	_____ fps	_____ fps	_____ fps	_____ fps
$Fr_1 =$	_____	_____	_____	_____
$y_s =$	_____ ft	_____ ft	_____ ft	_____ ft

	Pier # _____		Pier # _____	
	Design Flood	Check Flood	Design Flood	Check Flood
y_1	_____ ft	_____ ft	_____ ft	_____ ft
$K_1 =$	_____ cfs	_____ cfs	_____ cfs	_____ cfs
$K_2 =$	_____ cfs	_____ cfs	_____ cfs	_____ cfs
$K_3 =$	_____ 1.1	_____ 1.1	_____ 1.1	_____ 1.1
$a =$	_____ ft	_____ ft	_____ ft	_____ ft
$V_1 =$	_____ fps	_____ fps	_____ fps	_____ fps
$Fr_1 =$	_____	_____	_____	_____
$y_s =$	_____ ft	_____ ft	_____ ft	_____ ft

Note: If there is a possibility of channel migration, use the worst-case condition for all piers. For complex pier foundations, refer to Section 7.5, HEC-18. For cohesive soils, refer to Section 7.12, HEC-18.

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

SUMMARY**SCOUR DESIGN FLOOD:** _____ % AEP (____ - year)

Element	Long-term (ft)	Contraction (ft)	Local (ft)	Total (ft)
Left Abutment	XXX	XXX	XXX	XXX
Right Abutment	XXX	XXX	XXX	XXX
Pier #	XXX	XXX	XXX	XXX
Pier #	XXX	XXX	XXX	XXX
Pier #	XXX	XXX	XXX	XXX
Pier #	XXX	XXX	XXX	XXX

Adjust total scour depth as needed if scour holes overlap

***SCOUR CHECK SCOUR:** _____ % AEP (____ -year)

Element	Long-term (ft)	Contraction (ft)	Local (ft)	Total (ft)
Left Abutment	XXX	XXX	XXX	XXX
Right Abutment	XXX	XXX	XXX	XXX
Pier #	XXX	XXX	XXX	XXX
Pier #	XXX	XXX	XXX	XXX
Pier #	XXX	XXX	XXX	XXX
Pier #	XXX	XXX	XXX	XXX

* Use overtopping discharge for scour check if overtopping flow is less than the 0.2% AEP (500-year) peak discharge

☐ Attach sketch or marked copy of existing design plan showing design event and check event total scour depths in relation to foundation. Foundation elevations must be shown.

Geotechnical Evaluation of scour results by: _____

Structural Evaluation of scour results by: _____

LEVEL 2 SCOUR ANALYSIS WORKSHEET

Str. No. _____ C.S. _____ Job No. _____ By: _____ Date: _____

Is the structure stable under the estimated scour depth presented in this scour evaluation? ☐ Yes ☐ No

Is the structure the structure dependent on designed countermeasures?
 ☐ Yes ☐ No

RECOMMENDED NBIS ITEM B.AP.03 CODE: _____**ATTACHMENTS:**

- A. Calculations
- B. Water surface profile computer output with pertinent values highlighted
- C. Sketch of bridge with scour depths in relation to foundation
- D. Scour countermeasure calculations with plans showing limits of countermeasures
- E. Recommended plan of action

Worksheet approved by: _____ Date: _____

P.E. License #: _____

Additional comments:

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