

Hydraulic Review *

MT-2 Case Number or Project Name:

Stream Name(s):

Reviewer:

Review Date:

	Review Items	Additional review criteria/explanation (if necessary)	Pass/Fail/NA	Reviewer Comments
General Items				
1	Is the hydraulic modeling computer program approved by FEMA?	Click for a list of FEMA Approved Hydraulic Models		
2	Is the specific model version documented and approved?			
3	Is the model steady state or unsteady state?			
4	Are there any modeled levees that provide protection from flooding?			
5	Is vertical datum used for modeling and mapping documented?			
6	Do all models open without errors or missing files?			
7	Do all models run as submitted?			
8	Are all models and/or plans clearly titled?	It should be obvious that a specific model or plan is either "duplicate effective", "corrected effective", "existing (pre-project) conditions", "proposed (post-project) conditions", "as-built conditions" etc.		
9	Are all applicable models (Duplicate Effective, Corrected Effective, Existing or Pre_Project Conditions, Revised or Post-Project Conditions) provided?	See Instructions for Completing the Riverine Hydrology & Hydraulics Form (Form 2), Section B: Hydraulics, paragraph 4 for specific instructions.		
Flow Items				
1	Are all effective recurrence intervals being modeled for this revisions?			
2	If effective flows are being used, does the steady state flow table match the flow change locations in the effective model for each recurrence interval?	Note: not all flow change locations in the effective model are reported in the FIS. HEC-2 and HEC-RAS apply flow changes in opposite directions. HEC-RAS applies a flow change downstream to the next flow change locations, while HEC-2 applied a flow change upstream to the next flow change location. Make sure effective flow are applied correctly at each reach		
3	If hydrology was revised for the revision, does the steady state flow table match the peak flow output from the hydrologic model at each flow change location for every recurrence interval?	The peak flow output at a hydrologic element should be applied to the hydraulic reach upstream of that hydrologic element in HEC-RAS		
4	Are all discharges increasing in the downstream direction?	If not, please provide an explanation		
5	Are discharges the same upstream and downstream of all structures?	If not, please provide an explanation		
6	Flow regime should be subcritical unless an engineered channel is part of the revised reach, then mixed flow regime can be used.	If flow is supercritical for parts of a non-engineered channel, the model should report critical depth.		
Boundary Conditions/Tie in items				
1	Is normal depth used as the downstream boundary conditions? Is the friction slope used reasonable?	Normal depth is the preferred boundary conditions when no effective profiles exist to tie into.		
2	If a known water surface elevation boundary condition used, is it justified?	A known water surface elevations is justified if the downstream limit ties into an effective profile elevation. Junction or backwater boundary conditions may be used for tributaries at confluences only when it can be shown that a coincident peak occurs with the main stem stream.		
3	If a known water surface elevation is used as the downstream boundary condition, are the correct elevations used for each recurrence interval?			
4	If the known water surface elevation is used as the downstream boundary conditions, the downstream tie-in elevations should match exactly with the effective profile at the d/s limit of revision. The upstream limit of revision should tie-in to the effective profile with in 0.5 feet.			
5	The horizontal delineations of the 0.2 % chance, 1% chance floodplains and floodway delineations should tie-in to with 5% of the map scale at both the upstream and downstream limits of the revision	For 1"=500' map tolerance is 25' For 1" = 1000' map tolerance is 50' For 1" = 2000' map tolerance is 100'		

Geometry Review				
1	Does profile baseline in model agree with topography?			
2	Do modeled reach lengths between cross sections and structures agree with reach lengths on the topographic workmap?			
3	Are downstream reach lengths constant for left overbank, channel, and right overbank?			
4	Does the modeled flow path agree with the topography? Are there alternative flow paths not modeled or considered.	If alternative or overland flow paths have not been modeled there should be documentation explaining why the situation was not modeled.		
5	Are there split flow paths modeled? If so, a separate profile should be produced from the model.			
6	Are all cross sections non-intersecting?			
7	Do all cross section intersect the stream centerline only once?			
8	Do any cross sections intersect the stream centerline at an angle greater than 30 degrees?	If so, is the skew angle correct?		
9	Does the cross section topography reasonably agree with the topography shown on the workmap?			
10	Does cross sectional spacing reasonably represent stream conditions in the longitudinal direction?	Significant changes in topography (constrictions or expansions) should have cross sections placed such that the placement captures the topographic transitions of the channel and floodplain.		
11	Do all cross sections extend beyond the 0.2 % chance annual floodplain, or 1% annual chance floodplain if there is no 0.2% annual chance flood modeled?	This should be confirmed by both the cross sections on the topographic workmap and cross sections in the model		
12	Are ineffective flow areas or blocked obstructions used for non structure cross sections?	The stationing and elevations of non-structure ineffective flow areas or blocked obstructions should be consistent with topography clearly shown on the workmap. Stationing of ineffective flow areas should also be consistent with published recommended flow expansion and contraction ratios		
13	Are bank station locations reasonable?	If the 1% annual chance flow does not reach the bank stations, then the bank station locations should be revised.		
14	Are the manning's "n" values reasonable for both the channel and the overbanks?	If values are outside of recommended range, documentation and justification for their use should be provided		
15	Are channel "n" values higher than overbank "n" values at any cross section.	"n" values should be adjusted, or explained		
16	Are expansion and contraction loss coefficients reasonable at cross sections?	Generally steady flow expansion and contraction loss coefficients should be 0.3 and 0.1 for typical cross sections with gradual transitions.		
Structures Review				
1	Are all existing structures within the revised reach modeled?			
2	Are the 4 bounding cross sections appropriately placed at each structure?	Cross sections 1 should be placed at the location where flow is fully expanded, cross section 4 should be placed at the location right before flow begins to contract. Cross section 3 be placed at the upstream toe of the road embankment and should represent the fully contracted flow just before entering the structure. Cross section 2 should be placed at the downstream toe of the road embankment.		
3	Has ineffective flow been used at cross sections 2 and 3? Has it been applied appropriately?	Ineffective flow should be placed for areas on either side of the structure opening. The ineffective flow area elevations should be consistent with overtopping elevations on either side of the stream.		
4	Are expansion and contraction loss coefficients at the bounding cross sections appropriate?	Generally, for steady flow, cross section 2, 3, and 4 should have expansion and contraction and expansion loss coefficients of 0.5 and 0.3 respectively.		
5	If a new structure is being modeled as part of the revised reach, have bridge plans or survey data been submitted?			
6	Is the structure deck/roadway profile consistent with any survey data/bridge plans/etc?			
7	For new culverts, is the culvert geometry data consistent with survey data?	Culvert shape, diameter/span, # of barrels, upstream/downstream invert elevations, length, distance to upstream XS should be consistent with survey data		
8	For new culverts, are manning's "n" values and loss coefficients appropriate?			
9	For all modeled culverts, is the solution criteria selected "Highest U.S. Energy"			
10	Have appropriate bridge modeling methods been selected for both high and low flows?	Review bridge output results to ensure the method is appropriate for the flow situation		
11	Is the bridge skewed to the normal flow direction? If so, did the modeler account for the skew with the pier and opening dimensions.			
12	Are there any model output warnings at structures that need to be resolved or justified?			

Floodway Items				
1	If floodway is being revised or analyzed for the first time and the stream drains over 1 sq. mile, has an OWR letter of concurrence been received for the floodway?	See IDNR-OWR approval flow chart for more details about situations that require IDNR-OWR approval prior to a FEMA map revision		
2	Do the steady flow discharges for the floodway match the 1% annual chance flow discharges exactly?	If the floodway is included with all profiles this is always the case.		
3	Is the boundary condition for the floodway profile within 0.1 feet of the boundary condition for the 1% annual chance profile?			
4	Do all cross sections within the revised reach contain encroachment stations?			
5	Are all the encroachment stations in Method 1 for HEC-RAS?	Convert alternate methods to Method 1		
6	Are all encroachment stations within the 1% annual chance floodplain?			
7	Are all encroachment stations outside of the bank stations?	If not, a change might be necessary for the bank station locations		
8	Does the flowway at all cross sections meeting the Illinois State Criteria?	Surcharges between 0.0 and 0.1 feet Velocity increase up to 10% Flow area reduction of up to 10%		
9	Are there any negative surcharges?	Negative surcharges need to be eliminated. Some exceptions can be made at structures where negative surcharge rounds to 0.0 feet		
Topographic Workmap - Model Consistency				
1	Does the topographic workmap contain all information required by the MT-2 Forms?	a) Boundaries of effective 1% AC floodplain; 0.2% AC floodplain; and floodway b) Contours with elevation annotation at major intervals c) Location and alignment (and station name) of all modeled cross sections d) Road names, dams, levees, and other structures e) Community boundaries and requestor's property boundary f) Certification of a registered professional engineer g) Referenced vertical datum h) Scale; north arrow; and a legend referencing all linetypes		
2	Has information about the study topography been provided?	Was the data obtained by survey, lidar, etc? What is the contour interval? What is the vertical accuracy? When was the data obtained?		
3	Is scale appropriate for revision area?			
4	Are all modeled cross sections represented on the topographic workmap?	Include structure deck/roadway alignment.		
5	Are all cross section on the topographic workmap represented in the model?			
6	Are all modeled structures shown and properly aligned on the workmap?			
7	Are the model reported topwidths of the 0.2 % annual chance floodplain and 1% annual chance floodplain consistent with the measured topwidths of the floodplains at each cross section on the topographic workmap? Consistency is within map tolerance.	For 1"=500' map tolerance is 25' For 1" = 1000' map tolerance is 50' For 1" = 2000' map tolerance is 100'		
Other Items				
1	Is there any model instability, where unreasonable results are produced for any part of the model?			
2	Has Check-RAS been run? Have the significant issues been addressed?			
3	Does the model output match the model output and/or summary tables provided by the requestor in their report/narrative?			
4	Was the model calibrated to any gage data or historical flood/high water marks? If so, what calibration parameters were adjusted?			

*This checklist provides a generic framework for reviewing hydraulic models. It helps reviewers identify common errors or issues in steady state hydraulic modeling. It is not intended to suffice as a complete review for all hydraulic modeling scenarios. MT-2 (LOMR/CLOMR) reviewers can request changes to the model based on criteria not listed in this checklist. Reviewers can also request additional supporting documentation to verify any model parameters or assumptions.