



# Federal Emergency Management Agency

Washington, D.C. 20472

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**MEMORANDUM FOR:** Hazards Study Branch, Washington, DC Office  
Regional Engineers, Regions I-X  
Map Coordination Contractors

[original signed]

**FROM:** Michael K. Buckley, P.E.  
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**SUBJECT:** Policy for Use of HEC-RAS in the NFIP

## **Background:**

The U.S. Army Corps of Engineers (USACE) is a leading Federal agency in the development of hydrologic and hydraulic computer modeling programs. These programs have been used throughout the history of the National Flood Insurance Program (NFIP) for flood hazard mapping and the creation of Flood Insurance Studies (FISs) and Flood Insurance Rate Maps (FIRMs). The HEC-2 computer model is one specific model that has been used extensively throughout the history of the NFIP for hydraulic calculations to determine base (1-percent-annual-chance) flood elevations (BFEs).

The Hydrologic Engineering Center of the USACE released the River Analysis System, HEC-RAS, to replace the HEC-2 hydraulic model. It is a completely new piece of software; in fact, none of the hydraulic routines from HEC-2 were used in the HEC-RAS software. This memorandum addresses the policy for the use of HEC-RAS to replace HEC-2 models for flood hazard mapping in the NFIP.

## **Issues:**

The majority of detailed FISs and FIRMs in existence today have used the HEC-2 model to calculate BFEs. Paragraph 65.6(a)(8) of the NFIP regulations states that computer model used in support of a map revision must use the same computer model as was used in the original study. Since the USACE no longer supports the use of the HEC-2 model, FEMA must determine when it is appropriate to use HEC-RAS when the original study used HEC-2 to determine BFEs.

FEMA issued a policy statement on March 14, 1997, that explained the appropriate uses of HEC-RAS. Briefly, it stated that HEC-RAS could be used for a FIS revision or restudy when one of the following conditions had been met:

- The entire stream was rerun using HEC-RAS; or
- the stream reach remodeled using HEC-RAS was hydraulically independent from the rest of the stream, e.g. the stream was restudied from the downstream confluence with the

receiving stream (or other hydraulic control section) upstream to a dam or other hydraulic control section.

Given that the USACE replaced HEC-2 with HEC-RAS, FEMA is hereby revising its policy statement to encourage the use of HEC-RAS when appropriate, using the following guidance.

**Final Procedure:**

New detailed Flood Insurance Studies:

For FISs that have not yet been started, and for streams for which there is not an effective detailed study, FEMA encourages the use of HEC-RAS rather than HEC-2. Note that other computer models may also be used; FEMA's complete list of acceptable computer models may be viewed on our web site at [http://www.fema.gov/fhm/en\\_modl.shtm](http://www.fema.gov/fhm/en_modl.shtm). HEC-2 is still considered an acceptable hydraulic model; however the use of HEC-RAS instead of HEC-2 is strongly encouraged.

Revisions to Effective Flood Insurance Studies:

For revisions or restudies of detailed-studied streams, where the effective model is HEC-2, the conversion to HEC-RAS is encouraged. The following guidelines must be followed to convert an effective HEC-2 model to HEC-RAS.

- The effective HEC-2 model should be rerun on the requestor's computer in HEC-RAS to create the duplicate effective model. The differences in water-surface elevation between the effective model and the duplicate effective model must be fully documented and thoroughly explained. Most differences in water-surface elevation can be attributed to the (1) differences in bridge/culvert modeling routines, (2) method of conveyance calculations, (3) critical depth default, and (4) floodway computations. The *HEC-RAS User's Manual* and the *HEC-RAS Hydraulics Reference Manual* provide details on computational differences between the two models and guidance on simulating HEC-2 results; these manuals should be consulted to explain the differences between the effective and duplicate effective models.
- Once the duplicate effective model has been established, the corrected effective, existing conditions, and post-project conditions models can be created in HEC-RAS, using the duplicate effective HEC-RAS model as the basis.
- The HEC-RAS models must tie in to the effective water-surface profile within 0.5 foot at the upstream and downstream ends of the revised reach, in compliance with Subparagraph 65.6(a)(2) of the NFIP regulations.

Because the USACE has replaced the HEC-2 model with HEC-RAS, we support the use of HEC-RAS wherever practicable. I trust that this adequately explains the procedures to convert HEC-2 models to HEC-RAS for flood hazard mapping purposes in the NFIP. If you have any comments or questions, please do not hesitate to contact Ms. Sally P. Magee of our Headquarters staff in Washington, D.C. at (202) 646-8242, or by e-mail at [sally.magee@fema.gov](mailto:sally.magee@fema.gov).