RECOMMENDATIONS OF THE JOINT SHA/MDE PANEL OF HYDRAULICS EXPERTS

Changes to the SHH Division Hydraulics Procedures

June 22, 2017

Notice to Potential Users:
Due to the ongoing work of the Hydraulics Panel some parts of this presentation may be modified in a near future.
Eliana Rios Vidal, PE
Water Resources Engineer, RK&K

Kristianne Sandoval
Water Resources Engineer, RK&K

Andrzej (“Andy”) Kosicki, PE
Chief, Structure Hydrology and Hydraulics Division
• Inform SHHD engineers and open end consultants of changes to the hydraulics analysis procedures.

• Review “lessons learned” from pilot project.

• Fully implement revised hydraulics procedures for new OOS SHH Division projects.

• Get participants input (TODAY). Please see handouts.
Executive order 11988 (1977) – FEMA
MDE Regulations concerning flood plain and channel construction (COMAR, Title 26)
FEMA Remapping
Panel: Idea was born in 2007, Funded and started in 2015
- Kaye Brubaker (U. Maryland), Chair
- Will Thomas (Baker), Secretary
- Peggy Johnson (Penn State), Former Chair
- Glenn Moglen (VA Tech, USDA), Former Secretary
- Eric Brown (FHWA)
- Tucker Clevenger (AMEC)
- Dave Guignet (MDE)
- Jon Janowicz (FEMA)
- Andy Kosicki (MDSHA)
- Art Parola (U. of Louisville)
- Bill Seiger (MDE)

Contributors

**Topic: Grouted Culverts**
- David Black (Century Eng.)
- Paul Busam (MDE)

**Topic: Integrated SHA/FEMA Models**
- Eliana Rios Vidal (RK&K)
- Kristianne Sandoval (RK&K)
- Pawel Mizgalewicz (SHA)
- Ben Kaiser (AECOM on FEMA's behalf)
- Bob Pierson (FEMA)
Critically review MDE regulations to identify obsolete parts (e.g. FEMA, fish passage, channel stability, what elevations should be used to define flood plains: WS or EG?) etc.

Draft suggested changes, submit to MDE leadership for consideration.

Develop efficient hydraulics analysis procedures by integrating FEMA and MDE models into one and provide respective guidance. The process will result in cost and time savings, and benefit the communities by yielding improved models and flood plain mapping.

Test the procedures on selected projects (MD Route 144 @ Evitts Creek).

GOALS OF THE PANEL
Initial review issues:
1. Grouted culverts
2. Use of FEMA models
Separate MDE and FEMA models

PAST PROCEDURE

Survey → Hydrology → Stream Morphology

Hydraulics → Bridge Scour → FEMA
PAST PROCEDURE

- MDE Studies – Reviews /Approvals
- FEMA – Model update and LOMR/CLOMR submittal if applicable
- MDE Studies -> Later FEMA model; and oops – we have a problem!
- MDE regs allow increases up to 0.10 ft. on improved properties (a.k.a. Insurable Properties -FEMA)
- Not so for FEMA – must be 0.00 ft. (no increase or “no rise” allowed* – period!)*

* - unless there are no impacted insurable structures, or SHA buys the impacted property
Available Tools and Resources
Improved Procedures
MD FLOOD MAPS

www.mdfloodmaps.net

New data repository for Maryland FEMA models and mapping.
# Maryland Floodplain Mapping

## DFIRM Fact Sheet

(Updated February 2017)

<table>
<thead>
<tr>
<th>County</th>
<th>Preliminary Date</th>
<th>Effective Date</th>
<th>Coastal Preliminary Date</th>
<th>Coastal Effective Date</th>
<th>Notes</th>
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<td>Caroline County, MD**</td>
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<td>Frederick County, MD</td>
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<td>Additional Mapping Updates Planned or Underway</td>
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<td>Montgomery County, MD</td>
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<td>Watershed Basin Study</td>
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<td>Conococheague-Oquequon</td>
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<td>Gunpowder-Patapsco</td>
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<td>Monocacy</td>
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</table>

*Denotes MDE lead through mapping process

**Program status study may not be released and includes community multi-year study

SYNCHRONIZED – The counties where the FEMA studies for Rivers and Coastal DFIRMs were combined and released in one mapping product. These counties have one Preliminary DFIRM release and effective date.

**Email Questions or Comments to: flood.maps@maryland.gov**

1800 Washington Boulevard | Baltimore, MD 21230-1718 | www.mde.maryland.gov

410-537-3000 | 800-633-6101 | TTY Users: 800-735-2258

Larry Hogan, Governor | Boyd Rutherford, Lt. Governor | Ben Grumbles, Secretary
NEW PROCEDURE

Integrated SHA/FEMA Hydraulic Modeling Process
Table 1 Office of Structure Milestones

<table>
<thead>
<tr>
<th>OFFICE OF STRUCTURES MILESTONES</th>
<th>INVOLVEMENT OF THE STRUCTURES H &amp; H DIVISION IN THE DEVELOPMENT OF DESIGN PROJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-TS&amp;L</strong></td>
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<tr>
<td>1. Establish in writing design objectives and priorities; note any environmental commitments.</td>
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<tr>
<td>2. Determine if project is located in a FEMA floodplain. If so, rerun and evaluate the FEMA model.</td>
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<tr>
<td>3. Hold concept meeting. Determine In-Kind vs. Out-of-Kind design approach, seek preliminary approval from Deputy Director of OOS.</td>
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<tr>
<td>4. Request Mapping and/or Surveys.</td>
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<tr>
<td>5. Conduct hydrologic analyses. Obtain MDE approval of design discharges (1).</td>
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<tr>
<td>6. Update the FEMA hydraulics model to meet SHA standards. (2).</td>
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<tr>
<td>7. Obtain FEMA/MDE concurrence (3); accept updated FEMA model as Existing Conditions model (4).</td>
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<tr>
<td>8. Conduct Stream Morphology Studies: evaluate channel stability, obtain design information for hydraulics and scour studies; Evaluate Aquatic Organism Passage (AOP) constraints.</td>
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<tr>
<td>9. Evaluate the need to redesign the road profile (AASHTO and/or design flow requirements) (1). Alternatively, obtain a design exception approval from the OOS Director.</td>
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<tr>
<td>10. Develop proposed bridge/culvert design options; develop conceptual and subsequently semi-final designs for channel stability and AOP design (if applicable). Enter proposed design into the Existing Conditions model to create the Proposed Conditions model. (1).</td>
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<tr>
<td>11. Develop preliminary scour study.</td>
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<tr>
<td>12. Make presentations/obtain concurrence of environmental and regulatory agencies. (1).</td>
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<tr>
<td>13. Obtain community concurrence for FEMA submission (1).</td>
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<tr>
<td><strong>TS&amp;L</strong></td>
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<tr>
<td>1. Review the approved TS&amp;L to confirm no changes are required in hydraulics model, or update the model as necessary. Discuss the acceptability of changes with FEMA/MDE reviewers; if changes are acceptable this now becomes the new effective FEMA/MDE model. (1).</td>
<td></td>
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<tr>
<td>2. Prepare Hydraulics report and submit to MDE to obtain approvals (3).</td>
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<tr>
<td>3. Prepare FEMA Forms and CLOMR Application and submit to FEMA to obtain CLOMR (1).</td>
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<tr>
<td>5. Develop maintenance of flow sequence during construction.</td>
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<tr>
<td><strong>FOUNDATION REPORT</strong></td>
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<tr>
<td>1. Complete scour studies, prepare Final Scour Report (1).</td>
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<tr>
<td>2. Prepare recommendations for design of scour countermeasures as needed.</td>
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<tr>
<td>3. Provide information for Joint Permit Application to OED.</td>
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<tr>
<td><strong>STRUCTURAL REVIEW</strong></td>
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<tr>
<td>1. Resolve any outstanding issues pertaining to scour and scour countermeasures design.</td>
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<tr>
<td><strong>FINAL REVIEW AND PS&amp;E (Design Plans)</strong></td>
<td></td>
</tr>
<tr>
<td>1. Review design plans for consistency with MDE approved hydraulics model including temporary measures during construction. Prepare H/H Data Sheet.</td>
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<tr>
<td><strong>ADVERTISE AND AWARD PROJECT</strong></td>
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<tr>
<td>1. Confirm receipt of FEMA approval and MDE/COE permit (1).</td>
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<tr>
<td><strong>CONSTRUCT PROJECT</strong></td>
<td></td>
</tr>
<tr>
<td>1. Obtain as built plans.</td>
<td></td>
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<tr>
<td>2. Submit LOMR to FEMA (1).</td>
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</tr>
</tbody>
</table>

Involvement of the Structures H&H Division in the Development of Design Projects

Chapter 5: Project Development
PILOT PROJECT

MD Route 144 over Evitts Creek
OVERVIEW

Location: Allegany County
Watershed size: 79.4 mi²
FEMA model to be effective Fall 2017 – Letter of Final Determination (LFD) has been issued
PROCEDURE

1. Determine if project is in a FEMA mapped floodplain/floodway
2. Obtain and Review FEMA's best available data
3. Evaluate SHA data needed to model the subject crossing
4. Prepare FEMA model for use in SHA hydraulic analysis of existing conditions
5. Prepare Corrected Effective Model for use in SHA hydraulic analysis
6. Evaluate existing conditions results (include MDE FEMA coordinator review)
7. Prepare Revised or Post-Project Conditions model
8. Evaluate proposed conditions results (include MDE FEMA coordinator review)
9. Obtain LOMR and/or CLOMR
10. Modify Corrected Effective Model and Revised Conditions Model for use in MDE hydraulics analysis
11. Submit to MDE for approval
12. Prepare Revised or Post-Project Conditions model
13. Evaluate proposed conditions results (include MDE FEMA coordinator review)
FEMA’S EIVHSS CREEK MAP

Original Model Extent
EVITTS CREEK MAP
Extended Limits and SHA's incorporated Cross Sections
Evitts Creek Floodway
SHA vs FEMA’s Floodway
LATEST UPDATES
Integrated SHA/FEMA Hydraulics Modeling Process. OOS H&H Design Manual to incorporate the following:

- FEMA Report Outline.
- FEMA/MDE CLOMR Process Flow Chart.
- Table 1 Updates. OOS H&H Design Manual revisions – Chapter 5, table 1 (2016; based on Panel discussions, subject to further revisions by the SHA/MDE Hydraulics Panel).
FEMA/MDE FLOW CHART

FEMA/MDE CLOMR Process
* For projects encroaching on a detailed floodplain (Zone AE)

- FEMA Model Acquisition
  - *Acquire Effective or Preliminary Model
    - Contact MDE regarding Prince Georges, Montgomery, St. Mary’s, Baltimore City/County, Frederick, Allegany

- Update Existing Conditions Hydraulic Model
- Engage MDE to Evaluate Existing Conditions Model Updates
- Evaluate Existing vs. Effective/ Preliminary WSELs and Consult MDE. Increases in WSELs and/or floodway revisions?
  - YES: Engage Community
  - NO

- Proposed Conditions Hydraulic Model Development
- Does Respective Community Require FEMA CLOMR Per Floodplain Ordinance?
  - YES
  - Construction Bid Advertisement
  - Proceed with Project Construction
  - Comparison of Post-Construction vs Preliminary/ Effective WSELs and Floodplains. Consult MDE to Determine if LOMR Required.
  - NO

- Zone AE with Floodway
  - YES
  - Does Project Encroach on Floodway?
    - YES: FEMA Pre-submission Meeting
    - NO
  - NO

- Existing vs. Proposed WSEL increases > 100ft?
  - YES
  - FEMA Pre-submission Meeting
  - FEMA CLOMR Submission/ Approval +65.12 Compliance
  - * MDE Waterways Permit Submission/ Approval

- Engage MDE Liaison
- Proceed with FEMA LOMR Submission Process
- Submit Final Hydraulic Models and Mapping to mdffloodmaps.com
- FEMA Pre-submission Meeting
- FEMA CLOMR Community Concurrence
- * MDE Waterways Permit Submission/ Approval

* Ultimate development conditions hydrology utilized for MDE waterways permit
Based on FEMA's Best Available Data
Use Truncated Model

Engage Community if Effective
vs. Corrected Effective
(Existing) vs. Proposed WSELs
and/or Floodway changes.

Table 1 Office of Structure Milestones

| OFFICE OF STRUCTURES MILESTONES |
| INVOLVEMENT OF THE STRUCTURES II & II DIVISION |
| IN THE DEVELOPMENT OF DESIGN PROJECTS |

**Pre-TS&L:**
1. Establish in writing design objectives and priorities; note any environmental commitments.
2. Determine if project is located in a FEMA floodplain. If so, return and evaluate the FEMA model.
3. Hold concept meeting. Determine In-Kind vs. Out-of-Kind design approach, seek preliminary approval from Deputy Director of OOS.
4. Request Mapping and/or Surveys.
5. Conduct hydrologic analyses. Obtain MDE approval of design discharges.
6. Update the FEMA hydraulics model to meet SHA standards.
7. Obtain FEMA/MDE concurrence, accept updated FEMA model as Existing Conditions model.
9. Evaluate the need to redesign the road profile (AASHTO and/or design flow requirements). Alternatively, obtain a design exception approval from the OOS Director.
10. Develop proposed bridge/curt design options, develop conceptual and subsequently semi-final designs for channel stability and AOP design (if applicable). Enter proposed design into the Existing Conditions model to create the Proposed Conditions model.
11. Develop preliminary scour study.
12. Make presentations/obtain concurrence of environmental and regulatory agencies.
13. Obtain community concurrence for FEMA submission.

**TS&L:**
1. Review the approved TS&L to confirm no changes are required in hydraulics model, or update the model as necessary. Discuss the acceptability of changes with FEMA/MDE reviewers; if changes are acceptable this now becomes the new effective FEMA/MDE model.
2. Prepare Hydraulics report and submit to MDE to obtain approvals.
3. Prepare FEMA Forms and CLOMR Application and submit to FEMA to obtain CLOMR.
5. Develop maintenance of flow sequence during construction.

UPDATES TO TABLE 1
FEMA REPORT OUTLINE

Introduction
• Objective
• Project Description
• Previous Studies
• Reference Datum

Hydraulic Analysis
• Methodology
• Duplicate Effective model
• Corrected Effective Model
• Existing or Pre-Project Conditions Model
• Revised or Post-Project Conditions Model

Results and Discussion
• Duplicate Effective Model
• Corrected Effective Model
• Existing or Pre-Project Conditions Model
• Revised or Post-Project Conditions Model

Appendices and Documentation
• Digital Copy of Model
• Response to cHECk-RAS messages
• Floodplain Map
• GIS Shapefiles and/or CADD files
LESSONS LEARNED
- Obtain the latest ("best available data") FEMA model.
- Make sure we compare “apples to apples” (same datum, same cross section location).
- Survey request- consider FEMA’s XS location (easier to compare if same alignment) but only if meets SHA analysis requirements – “within the bounds of sound engineering judgement.”
- Keep FEMA model stationing / cross section numbering.
- Be conservative in estimating the length of the study reach.
- Can truncate the FEMA model for analysis, but ultimately the full model must be submitted to FEMA and mdfloodmaps.
- Expect to run the integrated SHA/FEMA model twice:
  A) with FEMA Qs (usually based on existing land use)
  B) with SHA/MDE approved Qs (ultimate land use)
- Prepare two separate but similar reports.
DISCUSSION
- Audience input.

- Past experiences with FEMA.

- What do you think of table 1 in chapter 5?

- What do you think of the report checklists?

- FEMA/MDE flow chart and Table 1’s flow chart (see handouts for charts)
- Dave Guignet
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- Eliana Rios
erios@rkk.com

- Kristianne Sandoval
ksandoval@rkk.com