

REPORT OF THE
MARYLAND HYDRAULICS PANEL

Recommendations
for Hydraulic Analyses in
FEMA Special Flood Hazard Areas
in Maryland

OCTOBER 2018

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October 2018

Subject: ***Report of the Maryland Hydraulics Panel, October 2018***

Users of this Report:

On behalf of the Maryland Department of Transportation State Highway Administration (MDOT SHA) and the Maryland Department of the Environment (MDE), we are pleased to endorse and recommend the use of this report, ***Recommendations for Hydraulic Analyses in FEMA Special Flood Hazard Areas in Maryland*** as it applies to State of Maryland projects. It is important to note that these recommendations will be the required criteria for all hydraulic analyses related to MDOT SHA design in Special Flood Hazard Areas and it is recommended for use by other state and local agencies.

This report is intended to aid the practitioner in hydraulic modeling, permit applications, and communication with affected communities. The integrated MDE/FEMA submittal process outlined in this report guides the user toward the development of consistent models and designs that address both state and federal requirements for construction in Maryland floodplains. This report is to be used in conjunction with state and federal technical manuals, computer program user manuals, and technical papers.

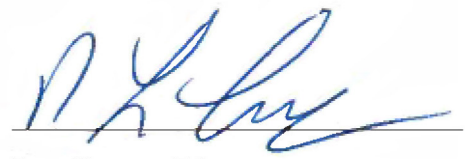
We recognize that hydraulic computer programs and data collection technology are continually being advanced. Although parts of this report will be updated periodically to reflect current technology, data, and methods, it contains guidelines, recommendations, procedures, and analysis methodologies that will be valuable for the practitioner even as the science progresses.

We appreciate the effort of all who participated in the preparation and review of this report and pledge our commitment to the continual improvement of the science and applications of hydraulics in Maryland.

Very truly yours,



Gregory Slater, Administrator
State Highway Administration
Department of Transportation



Lee Currey, Director
Water and Science Administration
Department of the Environment

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TABLE OF CONTENTS

LIST OF FIGURES	iii
ACRONYMS AND ABBREVIATIONS	iv
EXECUTIVE SUMMARY	v
THE MARYLAND HYDRAULICS PANEL	vi
1. INTRODUCTION	1
1.1. RATIONALE.....	2
1.2. NATIONAL FLOOD INSURANCE PROGRAM OVERVIEW	2
1.2.1. The Community’s Role	4
1.2.2. The State’s Role	4
1.2.3. The Federal Role	5
1.2.4. Requirements for Revising Flood Insurance Rate Maps based on Proposed Development	6
1.2.5. Requirements for Revising Flood Insurance Rate Maps based on Completed Development	7
1.3. MARYLAND DEPARTMENT OF THE ENVIRONMENT: NFIP ROLE AND PERMITTING OVERVIEW	7
1.3.1. MDE’s NFIP Role.....	7
1.3.2. Permitting Overview	7
1.3.3. Operational Policy.....	8
1.4. FHWA REQUIREMENTS FOR FLOODPLAIN ENCROACHMENTS AND COORDINATION WITH FEMA	9
1.5. INTEGRATED APPROACH.....	10
1.6. AVAILABLE DATA.....	10
2. RECOMMENDED METHODS FOR DEVELOPING HYDRAULICS MODELS IN FEMA SPECIAL FLOOD HAZARD AREAS IN MARYLAND	13
2.1. FEMA EFFECTIVE MODEL AVAILABILITY AND ACQUISITION	13
2.2. HYDROLOGIC ANALYSES NEEDED FOR DEVELOPMENT OF HYDRAULICS MODELS	14
2.3. EXISTING CONDITIONS MODEL DEVELOPMENT	15
2.4. PROPOSED CONDITIONS MODEL.....	16
2.4.1. Proposed Conditions Model Development	16
2.4.2. Water Surface Elevation Comparison	16

2.4.3. Floodways and No-Rise Analysis	16
2.4.4. Analysis Requirements for MDE Waterways Permitting.....	16
2.5. As-Built Conditions Model Development (LOMR).....	17
2.6. Submission to <i>mdfloodmaps</i>	17
3. RECOMMENDED PROCESS FOR HYDRAULIC MODELING SUBMITTALS AND APPROVALS	19
3.1. COMPARE EFFECTIVE AND EXISTING CONDITIONS MODELS – DETAILED (ZONE AE) FLOODPLAIN	19
3.2. MDE WATERWAY CONSTRUCTION APPROVAL.....	19
3.3. FEMA CONDITIONAL LETTER OF MAP REVISION	20
3.3.1. Approximate Floodplain	20
3.3.2. Detailed Floodplain.....	20
3.4. FEMA LETTER OF MAP REVISION	21
3.5. COMMUNITY APPROVAL OF CLOMR/LOMR	21
REFERENCES	23
APPENDIX A: DEFINITIONS.....	25
APPENDIX B: MAP REVISION REQUIREMENTS.....	29
B.1. NARRATIVE	29
B.2. MT-2 FORMS.....	29
B.2.1. Hydrologic Analysis	30
B.2.2. Hydraulic Analysis.....	30
B.2.3. Certified Topographic Work Map	31
B.2.4. Annotated FIRM	32
B.2.5. Proposed/As-Built Plans	32
B.2.6. Property Owner Notification.....	32
B.2.7. cHECK-RAS Validation.....	32
B.2.8. Conditional Letter of Map Revision Specific Requirements	33
B.2.8.1 Endangered Species Act Compliance	33
B.2.8.2 Section 65.12 Regulatory Requirements.....	34
APPENDIX C: MEMORANDUM OF UNDERSTANDING BETWEEN FHWA AND FEMA (1982).....	35

LIST OF FIGURES

Figure 1.1. Flow chart of the recommended process for projects encroaching on a detailed floodplain (Zone AE).10

Figure 1.2. Flow chart of the recommended process for projects encroaching on an approximate floodplain (Zone A).11

ACRONYMS AND ABBREVIATIONS

BFE	Base Flood Elevation
CFR	Code of Federal Regulations
CLOMR	Conditional Letter of Map Revision
COMAR	Code of Maryland Regulations
DFIRM	Digital Flood Insurance Rate Map
DHS	Department of Homeland Security
DNR	(Maryland) Department of Natural Resources
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
GIS	Geographic Information System
LiDAR	Light Detection and Ranging
LOMR	Letter of Map Revision
MDE	Maryland Department of the Environment
MDOT SHA	Maryland Department of Transportation State Highway Administration
MSC	(FEMA) Map Service Center
NFHL	National Flood Hazard Layer
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
SFHA	Special Flood Hazard Area
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WOTUS	Waters of the United States
WSEL	Water Surface Elevation

EXECUTIVE SUMMARY

This document reports on the work of the Maryland Hydraulics Panel (“the Panel”) since its formation in July 2015. The Maryland Department of Transportation State Highway Administration (MDOT SHA) and the Maryland Department of the Environment (MDE) appointed the Panel to explore the development of improved procedures to ensure that Maryland policies and processes leading to construction in floodplains are efficient, while also providing accurate assessments of hydraulic performance of highway waterway crossings. The Panel has worked closely with the staff of MDOT SHA and MDE; reviewed MDE regulations, policies and design approaches; and provided input on a variety of issues.


The Panel has studied a number of issues surrounding the hydraulics of non-tidal channels (both natural and constructed), including: construction in floodplains, repair of deteriorating culverts, channel stability, and aquatic organism passage. By means of this document, the Panel formally presents recommendations on the first topic only (construction in floodplains).

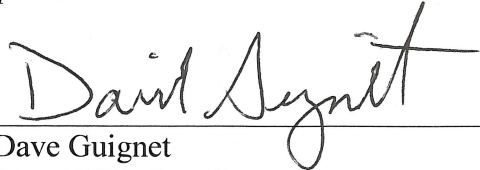
This report presents the Panel’s recommendations for an integrated approach to obtaining MDE approvals while complying with Federal Emergency Management Agency (FEMA) regulations for construction in FEMA-designated Special Flood Hazard Areas. The recommendations address hydraulic modeling/analysis, permit application procedures, and communication among analysts, communities, and regulators. The procedure is summarized in the form of flow charts: Figure 1.1 for projects encroaching on a detailed floodplain (FEMA Zone AE), and Figure 1.2 for projects encroaching on an approximate floodplain (FEMA Zone A). The recommended procedure has the following benefits:

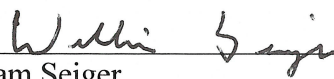
1. It enables applicants/stakeholders to work from a common hydraulic modeling platform to promote consistency and efficiency in updated flood study development.
2. It promotes continuity and improved coordination across both the MDE Waterways Construction and FEMA review processes.
3. It maximizes efficiencies in review and permit approval processes.
4. It enables maintenance of improved digital flood risk data to support sound floodplain management and future flood hazard mapping updates.

THE MARYLAND HYDRAULICS PANEL

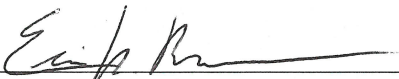
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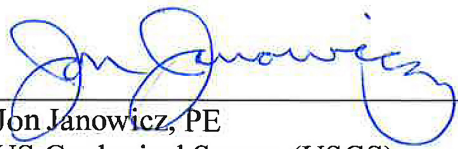

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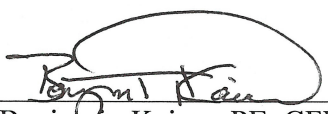

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1. INTRODUCTION

In July, 2015, the Maryland Department of Transportation State Highway Administration (MDOT SHA) and the Maryland Department of Environment (MDE) appointed the Hydraulics Panel to explore the development of improved procedures to ensure that Maryland policies and processes leading to construction in floodplains are efficient, while also providing accurate assessments of hydraulic performance of highway waterway crossings. The Hydraulics Panel has worked closely with the staff of MDOT SHA and MDE; reviewed MDE regulations, policies and design approaches; and provided input on a variety of issues.

This report presents the recommendations of the Maryland Hydraulics Panel (“the Panel”) for a coordinated approach that satisfies both federal and state requirements for projects in Maryland locations that have been identified as FEMA Special Flood Hazard Areas (SFHAs), areas inundated by the 1-percent annual chance flood. The intent is to provide guidance to engineers working on MDOT SHA projects or other projects in SFHAs. Such projects must comply with

- Federal Emergency Management Agency (FEMA) floodplain regulations
 - 44 CFR Parts 59, 60, 65, 70, and 72 [US GPO 2017(b)-(f)]
- Maryland Department of the Environment (MDE) waterway construction regulations
 - COMAR 26.17.04
- Federal Highway Administration (FHWA) regulations
 - 23 CFR Part 650 Subpart A [US GPO, 2017(a)]
 - June 1982 Memorandum of Understanding supporting coordination with FEMA (Appendix C)

This report consists of three chapters. This introductory chapter includes the Panel’s rationale and motivation; an overview of the National Flood Insurance Program (NFIP), including community, state, and federal responsibilities; an overview of Maryland channel and floodplain construction regulations; presentations of the recommended procedures in flow-chart format; and a summary of data available to communities and engineers working on projects that impact floodplains in Maryland. Chapter 2 provides the Panel’s recommendations on hydraulic modeling procedures. Chapter 3 provides the Panel’s recommendations on coordination of floodplain requirements and the submittal process, specifically for projects in a FEMA Special Flood Hazard Area (SFHA).

1.1. RATIONALE

Although very similar analyses are required for compliance with both MDE and FEMA regulations, these processes have historically been completed on separate/parallel tracks, often leading to duplicative work, inconsistent results, confusion, and/or conflict. In working with communities, MDE and MDOT SHA have observed a lack of clarity about best available hydraulic models and the appropriate use of FEMA models. In some cases, a project that was acceptable to MDE was rejected later at the FEMA approval stage. In other cases, communities erroneously believed that by obtaining the MDE waterways permit, they had implicitly satisfied FEMA requirements. The process of design, modeling, and/or obtaining better data (e.g., field surveys) may reveal a need to obtain a FEMA Letter of Map Revision (LOMR); it is important that engineers/designers and communities are aware of what may trigger a need for floodplain map revision and, if so, how to proceed.

The Panel has identified the following primary potential benefits associated with the implementation of the proposed guidance:

1. Enables applicants/stakeholders to work from a common hydraulic modeling platform to promote consistency and efficiency in updated flood study development
2. Promotes continuity and improved coordination across both the MDE Waterways Construction and FEMA review processes
3. Maximizes efficiencies in review and permit approval processes
4. Enables maintenance of improved digital flood risk data to support sound floodplain management and future flood hazard mapping updates

The recommended sequence is presented in Chapters 2 and 3 of this report.

1.2. NATIONAL FLOOD INSURANCE PROGRAM OVERVIEW

The original authorizing legislation for the NFIP was passed in 1968. Congress expressly found that “a program of flood insurance can promote the public interest by encouraging sound land use by minimizing exposure of property to flood losses....”

The NFIP is intended to encourage states and local governments to recognize and incorporate flood hazards in their land use and development decisions. In some communities, this is achieved by guiding development to areas with lower risk. When a proposal is made to develop within a flood hazard area, application of the criteria set forth in federal regulation (Title 44 Code of Federal Regulations [CFR] Section 60.3) [US GPO, 2017(c)] is intended to minimize exposure and flood-related damage.

The NFIP is administered by FEMA, which is part of the Department of Homeland Security (DHS). The NFIP has three main elements:

1. Hazard identification and mapping, in which engineering studies are conducted and flood maps are prepared to delineate areas that are predicted to be subject to flooding under certain conditions;
2. Floodplain management criteria, which establish the minimum requirements for communities to adopt and apply to development within mapped flood hazard areas; and
3. Flood insurance, which provides financial protection for property owners to cover flood related damage to buildings and contents.

Federal flood insurance is designed to provide an alternative to disaster assistance and disaster loans for home and business owners. Disaster assistance rarely comes close to covering all of the costs to repair and clean up. While available to qualified victims, disaster loans do not significantly ease the financial burden due to repayment terms. It is important to remember that disaster assistance is available only after floods have been declared major disasters by the President of the United States. In contrast, flood insurance claims will be paid any time damage from a qualifying flood event occurs.

Another important objective of the NFIP is to break the cycle of flood damage. Many buildings have been flooded, repaired or rebuilt, and flooded again. In some parts of the country, this cycle occurs every couple of years. Before communities adopted floodplain management regulations, people tended to rebuild in the same flood-prone areas using the same construction techniques that did not adequately protect the structure when the first event occurred. On the other hand, structures built to NFIP floodplain management requirements experience, on average, 80 percent less damage through reduced frequency of inundation and severity of losses.

By encouraging communities to guide development to lower risk areas, and to enforce 1-percent annual chance or Base Flood Elevation (BFE) requirements for new buildings and certain existing buildings, one of the long-term objectives of the NFIP can be achieved: reducing flood damage and losses. Older buildings may be removed or replaced, or they may be upgraded or modified with techniques that lead to little or no flood damage.

The NFIP establishes distinct responsibilities for the federal, state, and local levels of government. For local officials who must administer the requirements of their regulations and codes, it is important to recognize how these established roles affect responsibilities. As outlined in the NFIP regulations:

- Communities are responsible for regulating all development in mapped flood hazard areas, issuing permits, and enforcing the requirements.
- States generally are responsible for providing technical assistance to communities, monitoring community programs, and coordinating between communities and the NFIP. Some states also administer regulatory programs and many are engaged in flood hazard mapping initiatives.

- FEMA, through administration of the NFIP, promulgates the minimum regulatory requirements, supports state programs, provides technical assistance, monitors community programs, and produces flood hazard maps.

1.2.1. The Community's Role

A community is a governmental body with the statutory authority to enact and enforce development regulations. These governmental bodies include cities, towns, and counties within Maryland. The community enacts and implements the floodplain regulations required for participation in the NFIP. The community's measures must meet regulations set by its state and NFIP criteria. The NFIP regulations contained in 44 CFR 59.22 [US GPO 2017(b)] and 60.3 [US GPO 2017(c)] outline the responsibilities that communities must accept to become and remain eligible to participate in the NFIP. The key responsibilities include:

1. Designate an agency that is charged with the responsibility to administer floodplain management requirements
2. Determine whether proposed development activities are located in SFHAs
3. Review development proposals to ensure compliance with the requirements of applicable floodplain management regulations and building codes
4. Require that new subdivisions and development proposals with more than 50 lots or larger than five acres include BFEs
5. Issue or deny permits for floodplain development
6. Inspect all development in SFHAs to ensure compliance and maintain records of issued permits, elevation data, inspections, and enforcement actions
7. Support or inform the preparation and revision of floodplain maps. Flood hazard map updates and revisions may be performed by a number of different entities (i.e. FEMA contractors, cooperating technical partners, other federal agencies), but ultimately must be reviewed and approved by both the community and FEMA.
8. Help residents obtain information on flood hazards, floodplain map data, and compliant construction measures

1.2.2. The State's Role

Each state's governor has designated an NFIP State Coordinating Agency. This agency, often referred to as the State NFIP Coordinator's Office, is specifically charged with being a link between federal, state, and local governments. In Maryland, MDE assumes this role. The State NFIP Coordinator stays current on NFIP issues and can advise communities on specific provisions and any state requirements. While the explicit role of the State NFIP Coordinator may vary among states, the NFIP regulations 44 CFR 60.25 [US GPO, 2017(c)] outline the following key responsibilities:

1. Encourage and provide assistance for communities to qualify for participation in the NFIP
2. Guide and assist communities to develop, implement, and maintain floodplain management regulations
3. Provide technical assistance to communities
4. Participate in training opportunities
5. Assist or coordinate the delineation of flood-prone areas
6. Notify FEMA of problems with community programs, if such problems cannot be resolved through technical assistance

1.2.3. The Federal Role

FEMA develops publications to help states and participating communities fulfill their responsibilities and to provide guidance to property owners, architects, engineers, and others proposing to develop in the floodplain. FEMA's responsibilities include:

1. Assist the NFIP State Coordinating Agencies
2. Advise local officials responsible for administering floodplain management regulations
3. Assess community compliance with the minimum NFIP criteria
4. Answer questions from design professionals, builders, and the public
5. Provide information about flood insurance and respond to questions from citizens
6. Maintain and revise flood hazard maps and data
7. Develop technical guidance and standards for floodplain mapping and update NFIP regulations
8. Provide information and training on many aspects of the NFIP, including administration of the requirements
9. Work with states and communities to resolve identified problems with community programs.

FEMA has mapped flood hazards for nearly 20,000 communities in the United States, most commonly on Flood Insurance Rate Maps (FIRMs). Most of the nation's FIRMs were converted during the past five years through the Map Modernization Program into a digital product that depicts flood-prone areas for a community. These are known as Digital Flood Insurance Rate Maps (DFIRMS). Effective October 1, 2009, FEMA discontinued the distribution of paper maps. Paper FIRMs were replaced with DFIRMS.

FEMA maintains a geospatial database of flood hazard information, the National Flood Hazard Layer (NFHL) [FEMA, date unknown (a)]. FEMA's online Map Service Center (MSC) [FEMA, date unknown (b)]. is the official public source for flood hazard information produced in support of the NFIP.

FEMA implements its program responsibilities through 10 Regional Offices. Each Regional Office has a Mitigation Division that works with states and communities on matters related to the NFIP. Maryland is a part of FEMA Region III.

1.2.4. Requirements for Revising Flood Insurance Rate Maps based on Proposed Development

Participating NFIP communities are required to enforce the minimum NFIP program regulations in order to maintain program eligibility. According to these minimum NFIP regulations set forth in FEMA 44 CFR 65.12 [US GPO, 2017(d)], communities are required to receive conditional approval from the NFIP Administrator via a Conditional Letter of Map Revision (CLOMR) in the following scenarios:

- When a regulatory floodway has been adopted and proposed encroachments within the floodway boundary result in any increase (proposed versus existing conditions)
- When BFEs have been established, but a regulatory floodway has not been adopted, and proposed encroachments within the floodplain boundary result in increases above 1.00 feet (proposed versus existing conditions). Communities can enforce more restrictive standards and may require conditional approval for standards beyond FEMA's (see the following bullet).
- The following counties within the State of Maryland currently enforce a standard of no increase to the 1% annual chance water surface elevation (proposed versus existing conditions) for all encroachments within the floodplain boundary: Carroll County, Howard County, Montgomery County and Prince George's County. These more restrictive local standards must be achieved and may require more than this recommended coordinated approach to satisfy federal and state requirements.

Communities must evaluate the cumulative flood risk impacts of all projects or hydraulic conditions in the areas of influence for the proposed project. Multiple proposed projects in a given location will have combined impacts on the waterway; these impacts are not necessarily additive. In evaluating changes to floodplains and floodways, communities must consider the cumulative effects of multiple projects, not evaluating each project individually.

1.2.5. Requirements for Revising Flood Insurance Rate Maps based on Completed Development

Minimum NFIP regulations stipulate that participating communities must require a LOMR following physical changes within the designated SFHA. This requirement is set forth in FEMA 44 CFR 65.3 [US GPO, 2017(d)] as follows:

A community's base flood elevations may increase or decrease resulting from physical changes affecting flooding conditions. As soon as practicable, but not later than six months after the date such information becomes available, a community shall notify the Administrator of the changes by submitting technical or scientific data in accordance with this part. Such a submission is necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and floodplain management requirements will be based upon current data.

LOMRs provide smaller scale DFIRM updates, which are meant to better reflect current flood risk conditions. These mapping updates replace the SFHA represented on the DFIRM through incorporation into the NFHL and are used for more accurate and up-to-date floodplain management and insurance ratings. LOMRs are also required following the completion of projects approved through the CLOMR process. As-built plans and models are required for LOMRs.

1.3. MARYLAND DEPARTMENT OF THE ENVIRONMENT: NFIP ROLE AND PERMITTING OVERVIEW

1.3.1. MDE's NFIP Role

MDE is the designated NFIP State Coordinating Agency, responsible for the items enumerated in Section 1.2.2. As a result of the Maryland Statewide Mapping Program — initiated by MDE in 2006 and endorsed by FEMA — Maryland is in a very unique position in maintaining GIS-based hydraulics models for the majority of FEMA identified floodplains across the state (mdfloodmaps.com). This program addresses Items 3 and 5 in Section 1.2.2, The State's Role. These hydraulics models were utilized as the foundation for updated DFIRM production and serve as the FEMA effective hydraulics models, contributing to Item 6 in Section 1.2.3, The Federal Role. In FEMA terminology, “effective” is used to refer to a published, regulatory, and “in effect” flood insurance rate map (FIRM) or flood insurance study (FIS). “Effective” is also used to refer to the associated models and data used to produce the effective FIRM and FIS.

1.3.2. Permitting Overview

Construction activities in waters of Maryland are guided by both statute and regulation. Title 5, Subtitle 5 of the Environment Article, Annotated Code of Maryland, establishes an

administrative procedure that promotes public safety and welfare. This administrative procedure is further described in the Code of Maryland Regulations (COMAR) 26.17.04. These regulations govern “construction, reconstruction, repair, or alteration of a dam, reservoir, or waterway obstruction or any change of the course, current, or cross section of a stream or body of water within the State including any changes to the 100-year frequency floodplain of free-flowing waters.”

According to COMAR 26.17.04.03, “a person who proposes to construct, reconstruct, repair, or alter a dam, reservoir, or waterway obstruction, or change in any manner the course, current, or cross section of a stream or body of water within the State except tidal waters, including any changes to the 100-year frequency floodplain of free-flowing streams shall obtain a permit from the [Water and Science] Administration before commencing any work.”

The requirements of both statute and regulation are combined in the permit application review process. During the evaluation of an application, The Administration may require an applicant to address issues relating to:

- Safety, operation and maintenance of the structure;
- Ability of all on-site construction to withstand the impacts of the 100-year flood event;
- Flooding on adjacent properties;
- Erosion of the construction site or stream bank; and
- Environmental effects, such as the project's impacts on existing in-stream fisheries; wildlife habitat; or rare, threatened or endangered species.

The issuance of a permit at the conclusion of the permit application review process indicates that the project adequately preserves the public safety, promotes the general public welfare, and protects in-stream resources.

According to COMAR 26.17.04.04, the hydrologic calculations used in preparing the application “shall be based on the *ultimate* development of the watershed, assuming existing zoning” [emphasis added]. Additionally, COMAR 26.17.04.11 B(6) states “Proposed projects which increase the risk of flooding to other property owners are prohibited, unless that area subject to additional risk of flooding is purchased, placed in designated flood easement, or addressed by other means acceptable to the Administration.” This means in Maryland any project that proposes a flooding increase to another’s property must meet the above criteria before state authorization can be granted.

1.3.3. Operational Policy

Since 1993 MDE has recognized an In-Kind Replacement Policy of Bridges and Culverts (Operational Policy 93-1, 1993) (MDOT SHA 2015, Chapter 5). The purpose of the policy was to provide guidance on the replacement of existing bridges and culverts without the need for detailed hydraulic analysis. The policy includes several scenarios including: exact replacement, structurally in-kind replacement, hydraulically in-kind replacement and

structurally or hydraulically out-of-kind replacement. Each scenario has its own specific list of criteria that must be met in order for the project to qualify as an In-Kind Replacement.

The policy recognizes that in specific circumstances certain “changes” to a new structure can be permitted with minimal to no hydrologic or hydraulic modeling. This policy may be in conflict with FEMA requirements, particularly in FEMA floodway areas, and permit applicants need to be aware that detailed modeling may still be required by FEMA.

1.4. FHWA REQUIREMENTS FOR FLOODPLAIN ENCROACHMENTS AND COORDINATION WITH FEMA

In 1979, the United States Department of Transportation (USDOT) issued DOT Order 5650.2 “Floodplain Management and Protection.” Following the issue of this order, FHWA updated the CFR, namely, 23 CFR Part 650 Subpart A [US GPO, 2017(a)], codifying its policies and procedures for the location and hydraulic design of highway encroachments in base (i.e., 100-year) floodplains. The FHWA regulations, policies, and procedures apply to encroachments in all base floodplains and not just those floodplains regulated by FEMA in the NFIP. MDOT SHA projects built with FHWA Federal Aid Funds shall comply with 23 CFR 650 A.

Some key aspects of 23 CFR 650 A include:

- Avoiding longitudinal encroachments and significant encroachments, where practicable, minimizing impacts on base floodplains, and preserving and restoring base floodplain values
- Requiring a location hydraulic study, during NEPA associated compliance, to identify the potential impacts of the highway alternatives on the base floodplain
- Citing (when necessary) in the NEPA documents reasons why an encroachment cannot avoid significant impacts to the base floodplain and requiring approval from the FHWA Maryland Division Office
- Requiring project-by-project risk analyses or assessments

FHWA policy includes requirements for activities in floodplains to be consistent with the standards and criteria in the NFIP, where appropriate. To assist State DOTs to comply with this policy, FHWA developed coordination procedures for Federal-aid highway projects with encroachments in NFIP regulated floodplains. The procedures address scenarios for encroachments in floodways, regulated floodplains that have a detailed design study, and regulated floodplains with approximate zones. FEMA agreed to these procedures by signing a Memorandum of Understanding with FHWA in 1982 (Appendix C).

Chapter 2 of Hydraulic Engineering Circular 17 (HEC-17) (US DOT FHWA, 2016) provides additional background and context for FHWA regulation, policy, and guidance related to floodplain development. Additional FHWA guidance on meeting 23 CFR 650A [US GPO,

2017(a)] requirements and FEMA NFIP coordination procedures are posted on the FHWA Hydraulic Engineering Website (US DOT FHWA, date unknown).

1.5. INTEGRATED APPROACH

The development of statewide GIS-based flood studies has provided a unique opportunity to integrate FEMA's floodplain management requirements with MDE's Waterways Construction Permitting Process. Although very similar floodplain analyses are required for both MDE permitting and FEMA requirements, these processes have historically run on separate/parallel tracks.

In order to promote consistency in modeling and permitting procedures as well as efficiency in processing, the Panel recommends that MDE Waterways Construction Permitting Process incorporate the effective FEMA floodplain modeling. This integrated process will ideally eliminate the preparation of two separate floodplain models (although separate approvals by MDE and FEMA will still be required) and will also enable more detailed and up-to-date information to be leveraged to the benefit of both FEMA and MDE flood risk identification initiatives. FEMA effective floodplain models and supporting data, hosted on *mdfloodmaps*, should be downloaded and utilized as baseline models to support both FEMA CLOMR or LOMR submissions and MDE Waterways Construction Permitting applications. Once the baseline models are updated and approved, the final models should be provided back to *mdfloodmaps* for maintenance and to support future updates. The alignment of these two processes will benefit both the applicant (review consistency and efficiency) and FEMA and MDE (flood map maintenance and future updates). The recommended process is presented in flow chart form: Figure 1.1 for projects encroaching on a detailed floodplain (Zone AE) and Figure 1.2 for projects encroaching on an approximate floodplain (Zone A). Detailed information on this process is contained in Chapters 2 and 3.

1.6. AVAILABLE DATA

Through its *mdfloodmaps* program, MDE has been creating new FEMA floodplain models in both detailed and approximate areas across Maryland since 2006. To date, more than 2300 georeferenced HEC-RAS (USACE, 2018) models have been produced and are available for download at <http://www.mdfloodmaps.com>. In addition, funding for the remaining portions of the state has been secured and floodplain modeling and mapping are underway in these areas. These newly created FEMA models facilitate the process of combining the two required floodplain studies (FEMA and MDE) into one analysis. The FEMA models can now be used as the basis for existing (pre-construction) conditions for both the MDE Waterway Construction Permit and the FEMA LOMR or CLOMR process. FEMA effective models can also be accessed via the FEMA Engineering Library (<https://www.fema.gov/engineering-library>). More detail is provided in Chapter 2.

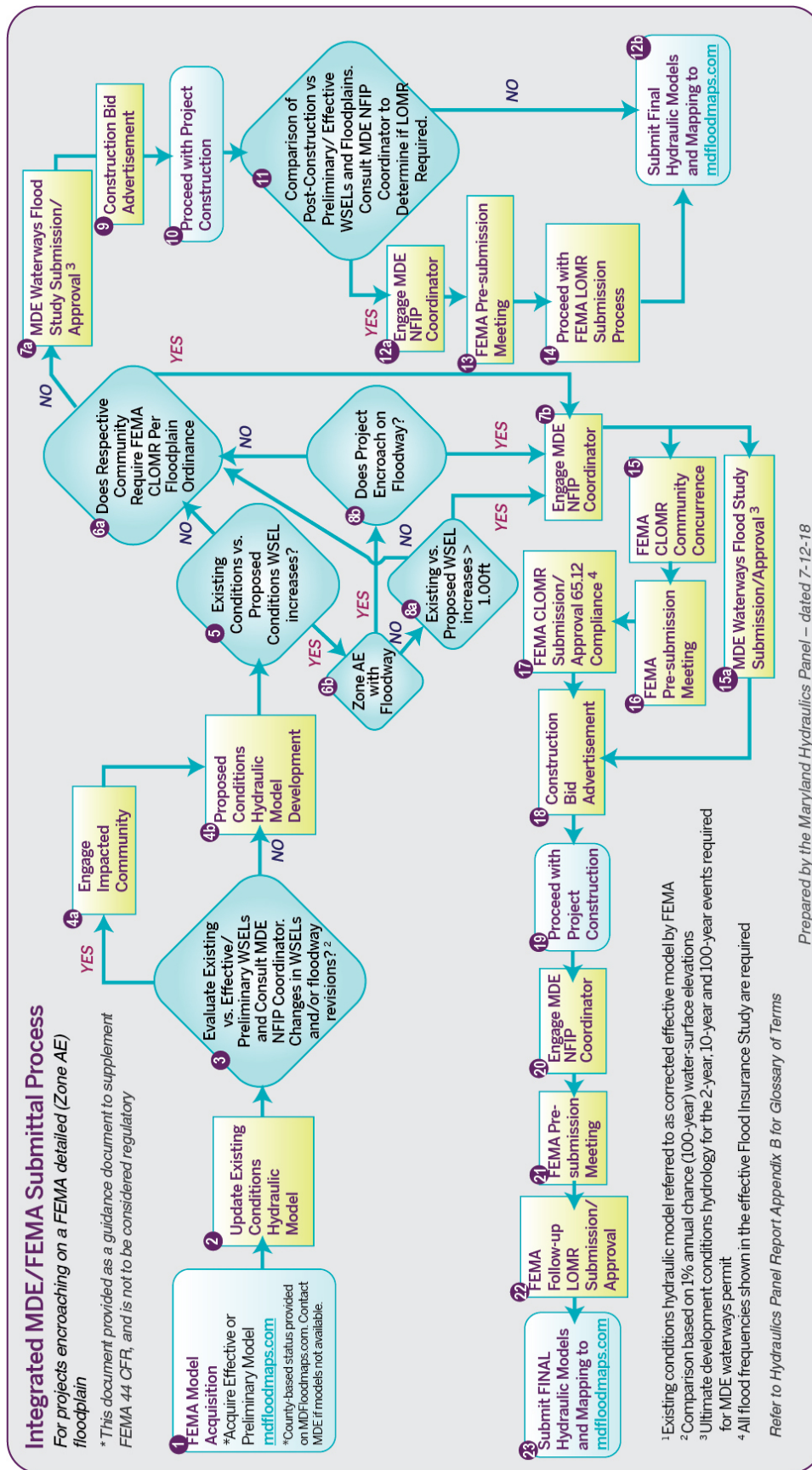


Figure 1.1. Flow chart of the recommended process for projects encroaching on a detailed floodplain (Zone AE).

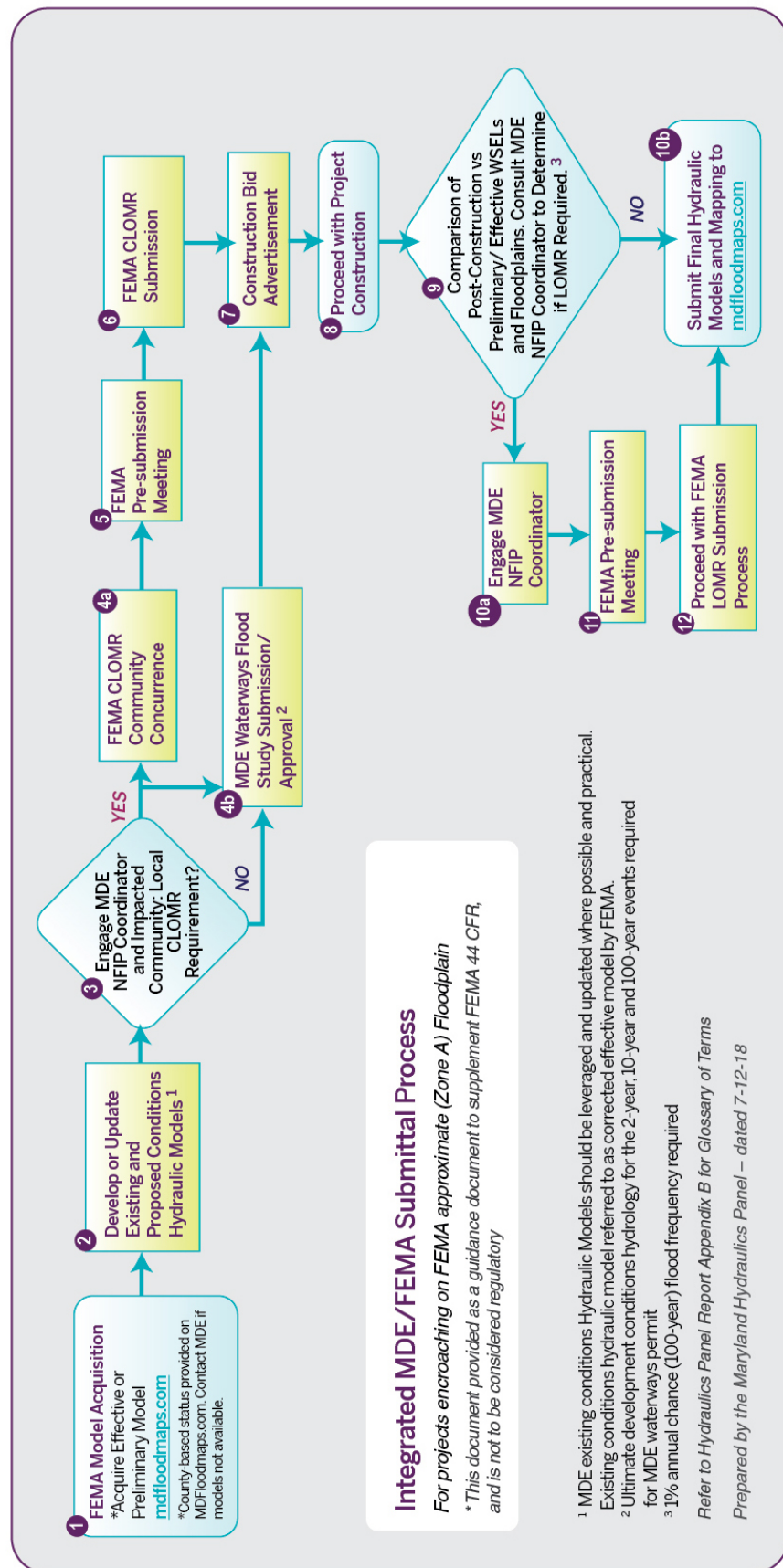


Figure 1.2. Flow chart of the recommended process for projects encroaching on an approximate floodplain (Zone A).

2. RECOMMENDED METHODS FOR DEVELOPING HYDRAULICS MODELS IN FEMA SPECIAL FLOOD HAZARD AREAS IN MARYLAND

This chapter describes the Maryland Hydraulics Panel’s recommendations for developing riverine flood studies to comply with both MDE and FEMA requirements. The intent is to eliminate the preparation, review and approval of two separate floodplain models. The recommended process will ideally result in a more streamlined process and enable the opportunity to maintain and improve upon the up-to-date FEMA modeling now available throughout most of Maryland. Reference is made to the integrated MDE/FEMA review process flow charts, Figures 1.1 and 1.2. In the flow charts, a rectangular shape indicates action to be taken (a “Step”), and a diamond shape indicates a “Decision” point where analysis results determine different requirements and actions.

2.1. FEMA EFFECTIVE MODEL AVAILABILITY AND ACQUISITION

The first step in the modeling process is to obtain the effective FEMA floodplain model for the study location, if available (Step 1 in Figs 1.1 and 1.2).

MDE’s *mdfloodmaps* initiative has supported the development of georeferenced HEC-RAS hydraulics models for the majority of FEMA identified flooding sources — both detailed (Zone AE) and approximate (Zone A) — throughout the state. Following approval through FEMA’s statutory adoption process, these digital models and supporting Geographic Information Systems (GIS) datasets are made available for immediate download via *mdfloodmaps*. The digital models hosted on *mdfloodmaps* should be the same as those used to generate the FEMA flood hazards depicted on the effective DFIRMs. The outputs from the detailed (Zone AE) models should be validated against the applicable effective FEMA FIS. For streams with designated regulatory floodways, model output WSELs should be compared to WSELs provided in the FIS Floodway Data Table. For streams without regulatory floodways, model output WSELs should be validated against FIS Flood Profile elevations.

FEMA effective models can also be accessed via the FEMA Engineering Library (<http://www.fema.gov/engineering-library>). It is important to note that both detailed (Zone AE) and approximate (Zone A) floodplains are supported by georeferenced hydraulics models.

The ultimate goal of MDE's statewide floodplain program is that all FEMA published floodplains throughout Maryland will be supported by GIS-based hydraulics models. In the interim, the *mdfloodmaps* provides a county-based status of available hydraulics models and supporting GIS data. Users should contact MDE directly for flood hazard modeling information related to the counties identified as "in development" on *mdfloodmaps*. As these counties reach their Letter of Final Determination dates (6 months prior to the effective date), the hydraulics models and GIS information will be made available on *mdfloodmaps*.

The information (flood discharge data, hydraulics models, GIS and bridge/culvert data) currently maintained on *mdfloodmaps* and through FEMA's Engineering Library were developed under Maryland's statewide floodplain mapping initiative to support the update of FEMA's DFIRMs. For the majority of flooding sources throughout Maryland, flood studies were developed using HEC-RAS, the U.S. Army Corps of Engineers' (USACE's) hydraulic analysis model and the following datasets/parameters:

- Maryland Regression Equation Discharges (multiple years) [All historical regression equations are documented in Appendix 8 of Maryland Hydrology Panel (2016).]
- Light Detection and Ranging (LiDAR) Aerial Topography (varying vendors and years) (MD iMap, date unknown)
- Field verified (measured) location and geometry of bridges and culverts. Available on *mdfloodmaps* (<http://mdfloodmaps.com/dfirmimap>).

2.2. HYDROLOGIC ANALYSES NEEDED FOR DEVELOPMENT OF HYDRAULICS MODELS

FEMA FISs are based on flood discharges such as the 1-percent annual change discharge that utilize existing land use conditions. In Maryland, most FISs performed by MDE for FEMA utilize the Fixed Region regression equations documented in Appendix 3 of the Maryland Hydrology Panel report (2016). For a few studies, hydrologic models such as WinTR-20 or HEC-HMS are used to estimate the x-percent annual chance discharges based on historical precipitation data from *NOAA Atlas 14, Volume 2* (Bonnin *et al.* 2006). NOAA Atlas 14 that includes Maryland was updated in 2006 and represents reasonably current estimates of the x-percent annual chance precipitation. The National Weather Service plans to update NOAA Atlas 14 in the future for all regions to achieve updated precipitation depths, consistent estimates across regional boundaries and consistent data analyses and methodologies for all regions.

For analyses related to FEMA submittals, MDOT SHA uses the effective flood discharges as determined in the approved FEMA studies (based on existing land use conditions). For bridge and culvert design by MDOT SHA, flood discharges are estimated based on ultimate development conditions to meet MDE regulations. MDOT SHA uses WinTR-20 to estimate flood discharges for existing land use conditions with historical precipitation data from NOAA Atlas 14 and quasi calibration to the Fixed Region regression equations. For

estimation of ultimate development flood discharges, MDOT SHA uses the existing condition WinTR-20 model and revised runoff curve numbers consistent with ultimate development conditions.

Future or projected precipitation data available from Global and Regional Climate Models are not currently used for floodplain mapping by FEMA, for bridge/culvert design by SHA or waterway projects by MDE. The primary reason is that methodologies for incorporating future precipitation data are not well-tested and documented for operational use. However, research sponsored by MDOT SHA and performed by the University of Maryland (Brubaker *et al.* 2017) developed procedures for estimating future precipitation frequency estimates that will be incorporated in designs by MDOT SHA in the future.

2.3. EXISTING CONDITIONS MODEL DEVELOPMENT

In many cases, the effective flood studies may provide an accurate representation of the current flood risk according to FEMA standards, but the models should be validated prior to use. There are often opportunities to update/enhance FEMA FISs based on more detailed, up-to-date, and/or site-specific data/knowledge that provide a more accurate representation of current conditions (Step 2 in Figs. 1.1 and 1.2). FEMA refers to these improved existing conditions models as either “corrected effective” or “existing (pre-project) conditions” models (see Appendix B, Section B.2.2. for detailed description of each model type). For both detailed and approximate flooding sources, the effective models available on *mdfloodmaps* should be used as a baseline for updates/enhancements if appropriate.

Using these effective models will support consistency within data integration/tie-ins and should also help maximize efficiency through the FEMA and MDE waterways review processes. For both approximate and detailed flooding sources, all water-surface elevation profiles represented in the effective model should be updated. Updated floodway analyses should also be performed for detailed flooding sources that include mapped regulatory floodways. The FEMA models generally do not include field surveyed channel cross-sections; therefore, the study engineer should update the existing conditions model with field collected survey data where possible and practical.

Discharges used for the MDE approval process will be based on ultimate-development land use in the watershed. Discharges used for the FEMA hydraulic analysis should be based on effective or updated existing conditions, representing current-development land use. Running the model with the current-development discharge enables a comparison of the effective hydraulic model and the existing conditions model, to assess differences between the effective model and updated existing conditions model.

2.4. PROPOSED CONDITIONS MODEL

For proposed development within the FEMA designated 1% annual chance floodplain, MDE waterway construction approval is required and FEMA approval may be required. The MDE/FEMA review and approval process requires a hydraulics model that reflects the proposed development conditions (addition/removal of structures, and changes within the channel and/or floodplain).

2.4.1. Proposed Conditions Model Development

A proposed conditions hydraulics model must be developed (Step 4 in Fig. 1.1, Step 2, in Fig. 1.2), in order to determine the impacts of a proposed project to 1% annual chance water-surface elevations, flood hazards and stream stability. The proposed conditions model should be created from the updated existing conditions model (Section 2.2), by incorporating all proposed changes to structures (addition and/or removal) and to the geometry and/or parameters of the channel and floodplain.

2.4.2. Water Surface Elevation Comparison

Following the completion of the proposed conditions model, a comparison of the existing and proposed 1% annual chance water surface elevations (WSELs) is required to evaluate the impacts of the proposed project (Step 5 in Fig. 1.1). This comparison is a critical factor in determining both FEMA compliance and MDE permitting requirements.

2.4.3. Floodways and No-Rise Analysis

For detailed studied streams, revised 1% annual chance floodway analyses are required to reflect the impacts of the proposed project on the delineation of the FEMA regulatory floodway (Step 8a in Fig. 1.1). Projects that are physically located within the FEMA regulatory floodway require that no-rise (no increase) in 1% annual chance WSELs (existing versus proposed) be demonstrated or that a FEMA CLOMR be submitted. The minimum NFIP regulations allow for encroachment within the regulatory floodway if “no-rise” in water-surface elevations can be demonstrated. This no-rise analysis must include a direct comparison of updated existing hydraulic conditions versus proposed (encroachment included) hydraulic conditions. This analysis must demonstrate that WSELs do not increase. NFIP participating communities reserve the right to require FEMA approval through a CLOMR for any proposed development within the 1% annual chance floodplain, even if no-rise can be demonstrated.

2.4.4. Analysis Requirements for MDE Waterways Permitting

For proposed development within the Waters of the State (which includes the 1% annual chance floodplain of non-tidal waters, whether or not they are FEMA-mapped), MDE requires that project impacts to both 1% annual chance WSELs and stream stability be evaluated. The

existing and proposed conditions models developed to support FEMA compliance can also be leveraged for MDE Waterways permitting.

According to MDE Waterway Construction regulations (COMAR 26.17.04.04), hydrologic calculations should be based on the ultimate development of the watershed, assuming existing zoning, whereas FEMA models typically employ current land use hydrology. In the integrated MDE/FEMA submittal process, all hydraulics models employ the same geometric and topographic information, but the discharges used to run the models are derived from different hydrologic conditions, as specified by the different agencies.

In addition to the proposed versus existing 1% annual chance WSEL and floodplain delineation comparison, MDE also requires quantifying impacts to channel stability for the 2- and 10-year frequency events (COMAR 26.17.04.07). The study engineer should ensure that the required information can be obtained from the hydraulics model. The reader is referred to COMAR 26.17.04 (Maryland Division of State Documents, 2018) for additional details on the MDE Waterways Permitting process.

2.5. As-Built Conditions Model Development (LOMR)

Per FEMA 44 CFR Part 65.3 [US GPO, 2017(d)], updated flood risk information must be submitted to FEMA within 6 months of project completion. In addition, if a CLOMR was required and processed, a follow-up LOMR must be submitted to ensure that the impacts of the completed project are reflected in FEMA's regulatory DFIRM layer; this submittal must include the as-built conditions hydraulics model. If a project was built as proposed, the proposed conditions hydraulics model should align with the as-built hydraulics model. Follow-up LOMR submissions also need to be supported by certified (stamped) as-built plans.

2.6. Submission to *mdfloodmaps*

A goal of the MDE floodplain program is to acquire all more detailed and up-to-date floodplain modeling and mapping information, regardless of whether submission to FEMA is required. All digital models and data generated in the process described in Chapters 2 and 3 should be submitted to *mdfloodmaps* (Step 23 in Fig. 1.1, Step 10b in Fig. 1.2); the analyst should communicate by email with MDE personnel (flood.maps@maryland.gov) to arrange for submission of digital materials. This information will be maintained on *mdfloodmaps* and used to support floodplain management decisions as well as future FEMA mapping updates.

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3. RECOMMENDED PROCESS FOR HYDRAULIC MODELING SUBMITTALS AND APPROVALS

This chapter describes the Panel’s recommendations for coordination and submission of information for both MDE and FEMA review using the integrated approach. Reference is made to the integrated MDE/FEMA submittal process flow charts, Figures 1.1 and 1.2. In the flow charts, a rectangular shape indicates action to be taken (a “Step”), and a diamond shape indicates a “Decision” point where analysis results determine different requirements and actions.

Coordination with the State NFIP Coordinator begins immediately after model acquisition and update steps (Step 3 in Figs. 1.1 and 1.2). The result of this coordination will be determinations about FEMA and community requirements. MDE Waterway Construction permit submissions are assumed to be required in all cases.

3.1. COMPARE EFFECTIVE AND EXISTING CONDITIONS MODELS – DETAILED (ZONE AE) FLOODPLAIN

For proposed development in a Detailed (Zone AE) floodplain, if model analysis identifies differences (for example, in topography or geometry) between the current effective model and the updated existing conditions model (Fig 1.1, Decision 3), the analyst/engineer and State NFIP Coordinator will consult with the community (Fig 1.1, Step 4a) before proceeding with proposed conditions model development (Fig 1.1, Step 4b). If no differences are identified, then proposed conditions model development proceeds directly (Fig 1.1, Step 4b).

3.2. MDE WATERWAY CONSTRUCTION APPROVAL

The state’s Waterway Construction Process will now incorporate the community’s FEMA floodplain modeling, as described in Chapter 2. This is a significant advantage over the previous process, which rarely aligned with FEMA’s hydraulic floodplain models.

The newly updated existing conditions model (Section 2.2) should be included in the MDE application process. SHA, MDE, FEMA and the community will be looking at the same set of geometric and topographic conditions when evaluating the community floodplain elevations and mapping. However, MDE will continue to require ultimate-development land use discharges, while FEMA and the community will require existing land use discharges.

Study information submitted to MDE for waterway construction authorization will include:

1. the current effective FEMA HEC-RAS analysis obtained from *mdfloodmaps.com* (Section 2.1),
2. an updated existing conditions model that incorporates field-generated cross-sections, if collected (Section 2.2), and
3. a proposed conditions model (Section 2.3).

After MDE approval, improved models should be submitted to *mdfloodmaps* for archive and future use.

3.3. FEMA CONDITIONAL LETTER OF MAP REVISION

As described in Section 1.2.4, communities are required to receive conditional approval from FEMA via a CLOMR under the following conditions.

3.3.1. Approximate Floodplain

FEMA does not require a CLOMR in an approximate (Zone A) floodplain. However, the community may require a CLOMR (Fig. 1.2, Decision 3). If so, the Community concurrence, FEMA Pre-submission meeting, and CLOMR submission must be performed (Fig. 1.2, Steps 4a, 5, and 6). If the community does not require a CLOMR, the process advances to the MDE Waterway flood study (Fig 1.2, Step 4b) and the actions that follow it.

3.3.2. Detailed Floodplain

In a detailed (Zone AE) floodplain, a multistep decision process must be followed. First, model results must be checked to determine whether the proposed conditions model predicts a WSEL rise compared to existing conditions (Section 2.3.4) (Fig. 1.1, Decision 5). Whether or not WSEL rise is predicted, the participating community is required to review and acknowledge this analysis under NFIP regulations, however, a FEMA CLOMR is not required if “no-rise” can be demonstrated.

If there is no rise, then the community’s requirements dictate the next step (Fig 1.1, Decision 6a): If the community does not require a CLOMR, then the process advances to the MDE Waterway submission/approval (Fig. 1.1, Step 7a). If the community does require a CLOMR, then the State NFIP Coordinator must be engaged for the next steps (Fig 1.1, Step 7b).

If analysis (Section 2.3.4) shows a rise in WSEL, the analyst must check for existence of a floodway (Fig 1.1, Decision 6b). If there is no floodway, and the WSEL rise is greater than 1.00 ft (Fig 1.1, Decision 8a), then the State NFIP Coordinator must be engaged for the next steps (Fig 1.1, Step 7b). If there is a floodway, and the project encroaches on the floodway (Fig. 1.1, Decision 8b), then the State NFIP Coordinator must be engaged for the next steps (Fig 1.1, Step 7b). In either of the following cases, the decision path returns to checking the community’s CLOMR requirements (Fig 1.1, Decision 6a): (a) There is no floodway (Fig 1.1, Decision 6b) and WSEL does not rise more than 1.00 ft (Fig. 1.1, Decision 8a), or (b) there is

a floodway (Fig 1.1, Decision 6b) and the project does not encroach on the floodway (Fig 1.1, Decision 8b).

Study information to be submitted to FEMA for a CLOMR is described in Appendix B. NFIP compliance requirements include community review and concurrence along with engagement with the State NFIP Coordinator.

After FEMA approval, improved models should be submitted to *mdfloodmaps* for archive and future use.

3.4. FEMA LETTER OF MAP REVISION

As described in Section 1.2.5, LOMRs are required following completion of projects approved through the CLOMR process (As-built LOMRs) (Fig. 1.1, Step 22). Additionally, for projects in either Zone AE or Zone A, when a CLOMR was not required, the post-construction WSELs and floodplains must still be compared to pre-construction conditions and submitted to FEMA so revisions to DFIRMs can be made to reflect current data (Fig 1.1, Decision 11; Fig 1.2, Decision 9).

Study information to be submitted to FEMA for a LOMR is described in Appendix B. This will include community review and concurrence along with engagement with the State NFIP Coordinator and with FEMA (Fig 1.1, Steps 12a–14; Fig. 1.2, Steps 10a–12).

After FEMA approval, improved models should be submitted to *mdfloodmaps* for archive and future use.

3.5. COMMUNITY APPROVAL OF CLOMR/LOMR

As a participating member of the NFIP, a community is required to enforce the minimum regulations of the program as designated in 44 CFR (US GPO, 2017(b)-(f)]. As a result, all CLOMRs and LOMRs must be reviewed and approved by the impacted participating community prior to submission to FEMA. It is recommended that impacted participating communities be engaged at project inception to better facilitate review and approval. Participating communities can require FEMA review of any development within the SFHA through the LOMR process.

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APPENDIX A: DEFINITIONS

Base Flood – The flood having a one percent chance of being equaled or exceeded in any given year. This is the regulatory standard also referred to as the "100-year flood." The base flood is the national standard used by the National Flood Insurance Program (NFIP) and all federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development. Base Flood Elevations (BFEs) are typically shown on Flood Insurance Rate Maps (FIRMs).

Base Flood Elevation (BFE) – The elevation of surface water resulting from a flood that has a 1% chance of being equaled or exceeded in any given year.

Code of Maryland Regulations (COMAR) – The official compilation of all administrative regulations issued by agencies of the state of Maryland.

Conditional Letter of Map Amendment (CLOMA) – A letter from FEMA stating that a proposed structure or parcel of land that has not been elevated by fill (natural ground) would not be inundated by the base flood if built as proposed.

Conditional Letter of Map Revision (CLOMR) – A letter from FEMA commenting on whether a proposed project, if built as proposed, would meet minimum National Flood Insurance Program standards. The letter does not revise an effective NFIP map and once a project has been completed, the community must request a revision to the National Flood Insurance Program map through a Letter of Map Revision to officially reflect the project.

Conditional Letter of Map Revision Based on Fill (CLOMR-F) – A letter from FEMA stating that a parcel of land or proposed structure that will be elevated by fill would not be inundated by the base flood if fill is placed on the parcel as proposed or the structure is built as proposed.

Community – A political entity that has the authority to adopt and enforce floodplain ordinances for the area under its jurisdiction.

Digital Flood Insurance Rate Map (DFIRM) – A flood insurance rate map (FIRM) in a digital form that can be used in Geographic Information Systems for automated analysis and map updates.

Effective Models - the hydrologic and hydraulic models used to develop the information shown on the FIRM.

Flood Insurance Rate Map (FIRM) – The official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) – A compilation and presentation of flood risk data for specific watercourses, lakes and coastal flood hazard areas within a community. The FIS report

provides a detailed written account of a flood hazard mapping study and its findings. The FIS report usually includes flood profile charts that with detailed base flood elevation information.

Federal Emergency Management Agency (FEMA) – The federal agency under which the NFIP is administered. In March 2003, FEMA became part of the newly created U.S. Department of Homeland Security.

Flood Zone – A geographical area shown on a Flood Hazard Boundary Map (FHBM) or a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

Floodplain – Any land area susceptible to being inundated by floodwaters from any source.

Floodway – A "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height (one foot in Maryland).

Letter of Map Amendment (LOMA) – A letter from FEMA stating that an existing structure or parcel of land that has not been elevated by fill (natural ground) would not be inundated by the base flood.

Letter of Map Change (LOMC) – a general term used to refer to the several types of revisions and amendments to FEMA maps that can be accomplished by letter. They include Letter of Map Amendment (LOMA), Letter of Map Revision (LOMR), and Letter of Map Revision based on Fill (LOMR-F).

Letter of Map Revision (LOMR) – A letter from FEMA officially revising the current National Flood Insurance Program map to show changes to floodplains, floodways, or flood elevations.

Letter of Map Revision Based on Fill (LOMR-F) – A letter from FEMA stating that an existing structure or parcel of land that has been elevated by fill would not be inundated by the base flood.

Maryland Department of Transportation State Highway Administration (MDOT SHA) — A business unit of the Maryland Department of Transportation, responsible for planning, design, engineering, maintenance and operation of state-owned roads and bridges.

Maryland Department of the Environment (MDE) — Created in 1987 to protect and preserve the state's air, water and land resources and safeguard the environmental health of Maryland's citizens. MDE's duties also encompass enforcement of environmental laws and regulations, long-term planning and research. MDE provides technical assistance to Maryland industry and communities for pollution and growth issues and environmental emergencies.

Maryland Department of the Environment Wetland and Waterways Program – Maryland's regulatory agency for the protection of the draining, dredging and filling of tidal

and nontidal wetlands, the nontidal wetland buffer and waterways, including the nontidal 100-year floodplain.

mdfloodmaps – Online resource for flood risk management in the state of Maryland including a repository of DFIRM mapping, effective hydraulic models, and other floodplain information (<http://mdfloodmaps.com>)

National Flood Hazard Layer (NFHL) – a geospatial database that contains current effective flood hazard data. FEMA provides the flood hazard data to support the National Flood Insurance Program (<https://www.fema.gov/national-flood-hazard-layer-nfhl>)

National Flood Insurance Program (NFIP) – The program of flood insurance coverage and floodplain management administered under the Act and applicable federal regulations promulgated in Title 44 of the Code of Federal Regulations, Subchapter B.

Preliminary Model – Hydraulic model used to develop a preliminary Digital Flood Insurance Rate Map for a Community undergoing a FIRM update that is not yet effective.

Special Flood Hazard Area (SFHA) – An area having special flood, mudflow or flood-related erosion hazards and shown on a Flood Insurance Rate Map (FIRM). Included are:

Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.

Zone AO: Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone.

Zone AE: Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown.

Zone AH: Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.

Zone V: Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.

State Highway Administration (SHA) – See Maryland Department of Transportation State Highway Administration (MDOT SHA).

State NFIP Coordinator – The individual who is specifically charged with being a link between federal, state, and local governments. The State NFIP Coordinator stays current on NFIP issues and can advise communities on specific provisions and any state requirements.

United States Army Corps of Engineers (USACE) — a U.S. federal agency under the Department of Defense and a major Army command made up of some 37,000 civilian and military personnel. USACE permits are necessary for any work, including construction and dredging, in the Nation's navigable waters.

United States Fish and Wildlife Service (USFWS) — a U.S. federal agency within the Department of the Interior dedicated to the management of fish, wildlife, and natural habitats. Among its responsibilities are enforcing federal wildlife laws, protecting endangered species, managing migratory birds, restoring nationally significant fisheries, and conserving and restoring wildlife habitat, such as wetlands.

APPENDIX B: MAP REVISION REQUIREMENTS

Requirements for map revision request submittals are noted in FEMA's MT-2 Forms and are summarized below. MT-2 forms include detailed instructions for completing the forms, descriptions of when each form is required, guidance on preparing the required documentation for each form, and a checklist of general requirements for a map revision request submittal. This Appendix summarizes FEMA's map revision request requirements.

B.1. NARRATIVE

A written description of the project is required to describe the purpose of the map revision request, the scope of the proposed/as-built project, and the methodology used to analyze the project effects. In many cases a design report has been prepared for a project for some other submittal, such as to the state or community review agencies, but the report should be updated to ensure that FEMA's requirements are met and the map revision request is well documented.

MDOT SHA is in the process of developing a report outline and checklist for map revision requests. Interested persons can obtain the report outline and checklist from MDOT SHA, Office of Structures, Structure Hydrology & Hydraulics Division..

B.2. MT-2 FORMS

FEMA's MT-2 Forms include MT-2 Instructions, Payment Form, and the following forms to be completed based on site-specific project needs:

- Form 1 – Overview and Concurrence
- Form 2 – Riverine Hydrology and Hydraulics
- Form 3 – Riverine Structures
- Form 4 – Coastal Analysis
- Form 5 – Coastal Structures
- Form 6 – Alluvial Fan Flooding

Form 1 is required for all map revision requests and is signed by the requester, certifying engineer, and each community affected by the revision. The MT-2 form instructions provide the requirements for authority to sign the appropriate sections of Form 1. The preparer of the forms should determine which forms, and which sections of each form, are applicable to the project.

B.2.1. Hydrologic Analysis

If applicable, a FEMA acceptable hydrologic analysis should be provided in digital format and all calculations of hydrologic parameters should be included. If a new or revised hydrologic analysis is prepared, the reason for the new analysis and an explanation as to why the alternative methodology or improved data provides better results over the effective discharges must be included in the MT-2.

For SHA projects, it is generally recommended that FEMA's effective discharges be used for the FEMA map revision request submittal and that a site specific detailed hydrologic study be performed for the design and MDE Wetlands and Waterways submittal following the guidance in the latest version of the *Application of Hydrologic Methods in Maryland* report by the Maryland Hydrology Panel. While the Maryland Hydrology Panel methodology to evaluate ultimate development condition discharges and project impacts is required to comply with COMAR, ultimate development discharges should not be used to delineate Special Flood Hazard Areas for map revision requests.

B.2.2. Hydraulic Analysis

A hydraulic analysis using a FEMA-approved hydraulic model [FEMA, date unknown (c)] should be submitted digitally to FEMA to support a map revision request that involves a hydraulic analysis for riverine flooding that differs from that used to develop the FIRM. The FEMA Accepted Models List (including hydraulic, hydrologic, coastal, and statistical models) can be found on FEMA's website.

The following series of models are used to demonstrate cumulative project impacts:

- Duplicate Effective Model – The duplicate effective model is a copy of the hydraulic analysis used in the effective FIS, referred to as the effective model. The effective model should be obtained and then reproduced on the requester's equipment to produce the duplicate effective model. This is required to ensure that the effective model's input data has been transferred correctly to the requester's equipment and to ensure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.
- Corrected Effective Model – The Corrected Effective Model is the model that corrects any errors that occur in the Duplicate Effective Model, adds any additional cross sections to the Duplicate Effective Model, or incorporates more detailed topographic information than that used in the current effective model. The Corrected Effective Model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.
- Existing (Pre-Project) Conditions Model – The Duplicate Effective Model or Corrected Effective Model is modified to produce the Existing or Pre-Project

Conditions Model to reflect any modifications that have occurred within the floodplain since the date of the Effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective Model or Duplicate Effective Model. The existing or pre-project model may be required to support conclusions about the actual impacts of the project associated with the revised or post-project model or to establish more up-to-date models on which to base the revised or post-project conditions model.

- Revised (Post-Project) Conditions Model – The Existing or Pre-Project Conditions Model (or Duplicate Effective Model or Corrected Effective Model, as appropriate) is modified to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for a proposed project, this model must reflect proposed conditions.

All changes to the duplicate and subsequent models must be supported by certified topographic information, bridge plans, construction plans, survey notes, etc. Changes to the hydraulic models should be limited to the stream reach for which the revision is being requested with cross sections upstream and downstream of the revised reach being identical to the Effective Model.

Due to the series of models required by FEMA to document project impacts, the Panel recommends that the Effective Model be obtained from *mdfloodmaps* or FEMA prior to developing Existing (Pre-Project) Conditions and Revised (Post-Project) Conditions to ensure proper sequencing of models and appropriate tie-in to effective boundary condition data.

B.2.3. Certified Topographic Work Map

A certified Topographic Work Map must be submitted showing the following information (where applicable):

- Boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions);
- Logical tie-ins between the effective and revised flood hazard delineations;
- Topographic contours used to delineate the revised floodplain boundary delineations;
- Location and alignment of all cross sections with stationing control indicated;
- Stream, road, and other alignments (e.g., dams, levees, etc.);
- Current community easements and boundaries;
- Boundaries of the requester's property;

- Certification of a registered professional engineer registered in the subject state;
- Location and description of reference marks; and
- The referenced vertical datum.

B.2.4. Annotated FIRM

The requester must submit a revised FIRM, at the scale of the effective FIRM, which shows the revised boundary delineation of the base floodplain, and the 0.2%-annual-chance floodplain and regulatory floodway if applicable, and how it ties into the boundary delineation shown on the effective FIRM at the downstream and upstream limits of the revised reach. The annotated FIRM ensures that FEMA is aware of how the requester anticipates the FIRM will be revised.

B.2.5. Proposed/As-Built Plans

Design plans (for CLOMRs) or as-built plans or survey (for LOMRs) are required for all hydraulic structures or grading and other improvements within the floodplain along the revised reach. All plans must be certified by a registered Professional Engineer.

B.2.6. Property Owner Notification

Property owner notification is required if the map revision causes increases in the flood hazards. However, unlike property notifications required for MDE to comply with COMAR requirements, acceptance of the changes is not required by FEMA. It is important to note that the NFIP map revision notification process is independent of the MDE notification process.

Two different methods of property owner notification are identified in the MT-2 forms: public notifications, published in the community's local newspaper, or individual letters sent to the impacted property owners. For LOMRs, the revision requestor may choose which method to use. For CLOMRs, the revision requestor may also choose which method to use, unless NFIP Regulation 44 CFR Ch. 1, Part 65.12 [US GPO, 2017(c)] is triggered as described in Section B.2.8.2. If 65.12 regulatory requirements are applicable, then notification must be done via individual letters to the impacted property owners.

NFIP property owner notification methods should follow the guidelines set forth in the MT-2 forms. The MT-2 instructions contain sample public notification and individual letters for both CLOMR and LOMR requests. The applicant should select the appropriate template and use it to prepare a draft notice to be included with the initial application. Once the draft has been reviewed and approved by the FEMA reviewer, the notice may be published/distributed.

B.2.7. cHECK-RAS Validation

cHECK-RAS is a computer program developed by FEMA to verify the validity of an assortment of parameters in the HEC-RAS hydraulic modeling program. cHECK-RAS is a review tool that identifies areas of potential error or concern of the assumptions and

limitations of HEC-RAS. The use of the program is listed as optional in the MT-2 forms, but the Panel highly recommends its use when preparing a map revision request. The program should not replace engineering judgment. If cHECK-RAS produces a comment message that is not applicable to the site or model input, an explanation of why each comment is not valid should be provided with the map revision request. Additionally, resolving valid modeling discrepancies, before submitting it to FEMA for review, will serve to avoid unnecessary review comments and reduce the submittal processing time.

B.2.8. Conditional Letter of Map Revision Specific Requirements

B.2.8.1 Endangered Species Act Compliance

CLOMR applicants are responsible for documenting to FEMA that Endangered Species Act (ESA) compliance has been achieved prior to FEMA's review of a CLOMR request.

For requests without a federal action (construction, funding, or permitting), compliance with Sections 9 and 10 of the ESA must be achieved independently of FEMA's process. Section 9 of the ESA prohibits anyone from "taking" or harming an endangered species. If an action might harm an endangered species, a permit is required from the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS) under Section 10 of the ESA. For these projects the requestor must document that:

1. No potential for "Take" exists to threatened and endangered species. The requestor will be responsible for the potential for take determination and the determination is not required to come from, or be concurred by, the Service (USFWS or NMFS).
2. If the requestor determines a "Take" will or has potential to occur, they can consider contacting the Service to discuss potential project revisions to eliminate the "Take".
3. If neither 1 or 2 are possible and the project has a potential to "Take" listed species, an Incidental Take Permit may be submitted showing that the project is the subject, or is covered by the subject, of the permit.

For actions authorized, funded, or being carried out by federal or state agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA must be submitted. The ESA documentation may include a "No Effect" determination made by an appropriate source; a "Not Likely to Adversely Affect" determination from the Services; a "No Jeopardy Opinion"; or a copy of a federally issued permit with justification that the subject of the CLOMR is part of the area investigated.

Note that for LOMR requests involving floodplain activities that have occurred already, private individuals and local and state jurisdictions are required to comply with the ESA independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under 44 CFR 60.3(a)(2) [US GPO, 2017(c)]. These requests do not provide the same opportunity as CLOMRs for identifying whether threatened or endangered species may be affected by the project because map changes are issued only after the physical action has been undertaken in the floodplain.

B.2.8.2 Section 65.12 Regulatory Requirements

Projects meeting either of the following conditions require that the conditions of NFIP Regulations in 44 CFR Ch. 1, Section 65.12 [US GPO, 2017(c)] must be met:

1. Projects that will have construction within the floodway, which cause the BFEs to increase (any increase), or
2. Projects that will have construction within the floodplain of streams that have a detailed effective study, but for which a floodway has not been established, which cause the BFE's to increase more than 1.0 foot (or any other more stringent requirement set by the community).

The conditions of Section 65.12 include:

- Certification that no structures are located in areas that would be impacted by the increased BFE;
- Documentation of individual legal notice to all affected property owners, explaining the impact of the proposed action on their property;
- Concurrence of the Chief Executive Officer (CEO) of the community, and any other communities affected by the proposed actions; and
- An evaluation of alternatives that would not result in a BFE increase demonstrating why the alternatives are not feasible.

**APPENDIX C:
MEMORANDUM OF UNDERSTANDING
BETWEEN FHWA AND FEMA (1982)**



U.S. Department
of Transportation

**Federal Highway
Administration**

Memorandum

Subject: Procedures for Coordinating Highway
Encroachments on Floodplains with the
Federal Emergency Management Agency (FEMA)

Date: JUN 25 1982

From: Associate Administrator for
Engineering and Operations
Washington, D.C. 20590

Reply to HNG-31
Attn. of:

To: Regional Federal Highway Administrators
Regions 1-10
Direct Federal Division Engineers

Attached are copies of the subject procedures and a letter from Mr. Richard W. Krimm of FEMA dated June 7, 1982. Mr. Krimm has endorsed the procedures and has distributed them to the field offices of FEMA. Please send copies of these procedures to the FHWA Divisions Offices and the States in your Region.

We believe these procedures provide excellent guidance in regard to meeting our responsibility to be consistent with the standards of the National Flood Insurance Program (NFIP) as set forth in the Federal-Aid Highway Program Manual (FHPM) 6-7-3-2, Location and Hydraulic Design of Encroachments on Flood Plains. The procedures establish some flexibility for achieving cost-effective encroachments on floodplains within communities that are in the NFIP. If an encroachment is proposed within an NFIP community, the economic consequences of alternatives can be assessed using the analysis procedures in Hydraulic Engineering Circular No. 17 (HEC 17), the Design of Encroachments on Floodplains Using Risk Analysis. This assessment/analysis can then be used, if needed, to support the community's application to FEMA for approval of an alternate floodway or a floodway revision. For all locations outside of NFIP communities or NFIP identified flood hazard areas, FHPM 6-7-3-2 shall be followed for encroachment design. This policy requires that encroachment designs be supported, as appropriate, by a risk assessment or risk analysis. Economic (risk) analysis, if appropriate, can be accomplished using the guidelines in HEC 17.

We encourage you to work with the States to implement these procedures as a part of Program Emphasis Area Number 2, Cost Effective Design and Construction. We are aware that some State environmental agencies have adopted strict requirements for encroachments on all floodplains, whether rural or urban in nature. These requirements allow the highway designer little discretion to achieve cost-effective designs. In such cases, this subject should be discussed with appropriate State personnel so that practicable State floodplain encroachment requirements can be developed. Implementation of these procedures, along with the economic (risk) assessment/analysis design process required by FHPM 6-7-3-2, has a high potential for achieving significant cost savings in the Federal-aid Highway Program.



R. D. Morgan

Attachments



Federal Emergency Management Agency

Washington, D.C. 20472

7 JUN 1982

Mr. R. D. Morgan
Associate Administrator for Engineering
and Traffic Operations
Federal Highway Administration
Department of Transportation
Washington, D. C. 20590

Dear Mr. Morgan:

This is in response to your letter of May 3 1982, seeking our endorsement of the procedure paper entitled "Procedures for Coordinating Highway Encroachments on Floodplains with FEMA." This paper expands upon my internal policy memorandum of December 29, 1981, concerning the Federal Emergency Management Agency's (FEMA's) handling of highway encroachments within regulatory floodways. Your expansion addresses highway agency responsibilities for coordination with FEMA under various situations in which FEMA has identified flood plains, floodways and base flood elevations.

We have reviewed your procedure paper and believe that it provides an excellent guideline for coordination between highway agencies, communities participating in the National Flood Insurance Program (NFIP) and FEMA, when flood plain encroachments involving highway construction are proposed. In accordance with Executive Order 11988, the procedures require compliance with NFIP standards and regulations, where practicable, but also provide for responsible actions where no practicable alternative can be identified. These actions include appropriate compensation to affected property owners, assurance that the NFIP will not incur additional liability due to increased flood hazards, and the provision of appropriate technical data to FEMA so that flood insurance maps and studies can be revised as necessary.

We compliment you on your efforts to establish workable operating procedures which incorporate coordination with FEMA on site specific projects. We believe that this procedure paper will facilitate the attainment of our mutual objective of future flood loss reduction. We will provide copies of the paper, with our endorsement, to our Regional Offices.

Sincerely,

Richard W. Krimm
Assistant Associate Director
Office of Natural and Technological
Hazards Programs

Procedures for Coordinating Highway Encroachments on Floodplains with Federal Emergency Management Agency (FEMA)

The local community with land use jurisdiction, whether it is a city, county, or State, has the responsibility for enforcing National Flood Insurance Program (NFIP) regulations in that community if the community is participating in the NFIP. Most NFIP communities have established a permit requirement for all development within the base (100 year) floodplain. Consistency with NFIP standards is a requirement for Federal-aid highway actions involving regulatory floodways. The community, by necessity, is the one who must submit proposals to FEMA for amendments to NFIP ordinances and maps in that community should it be necessary. Determination of the status of a community's participation in the NFIP and review of applicable NFIP maps and ordinances are, therefore, essential first steps in conducting location hydraulic studies and preparing environmental documents.

Where NFIP maps are available, their use is mandatory in determining whether a highway location alternative will include an encroachment on the base floodplain. Three types of NFIP maps are published: (1) a Flood Hazard Boundary Map (FHBM), (2) a Flood Boundary and Floodway Map (FBFM), and a Flood Insurance Rate Map (FIRM). A FHBM is generally not based on a detailed hydraulic study and, therefore, the floodplain boundaries shown are approximate. A FBFM, on the other hand, is generally derived from a detailed hydraulic study and should provide reasonably accurate information. The hydraulic data from which the FBFM was derived is available through the regional office of FEMA. This is normally in the form of computer input data cards for calculating water surface profiles. The FIRM is generally produced at the same time using the same hydraulic model and has appropriate rate zones and base flood elevations added.

Communities in the regular program of the NFIP generally have had detailed flood insurance studies performed. In these communities the NFIP map will be a FIRM and in the majority of cases, a regulatory floodway is in effect.

Communities in the emergency program of the NFIP usually have not had a detailed flood insurance study completed and, usually, only limited floodplain data is available. In this case the community NFIP map will be a FHBM and there will not be a regulatory floodway.

Other possibilities are: (1) the community is not in a FEMA identified flood hazard area and thus there is no NFIP map, (2) a FHBM, FIRM, or FBFM is available but the community is not participating in the NFIP, (3) a community is in the process of converting from the emergency program to the regular program and a detailed flood insurance study is underway, or (4) a community is participating in the regular program, the NFIP map is a FIRM, but no regulatory floodway has been established. Information on community participation in the NFIP is provided in the "National Flood Insurance Program Community Status Book" which is published bi-monthly for each State and is available through the Headquarters of FEMA.

Coordination With FEMA

It is intended that there should be highway agency coordination with FEMA in situations where administrative determinations are needed involving a regulatory floodway or where flood risks in NFIP communities are significantly impacted. The circumstances which would ordinarily require coordination with FEMA are:

1. a proposed crossing encroaches on a regulatory floodway and, as such, would require an amendment to the floodway map,
2. a proposed crossing encroaches on a floodplain where a detailed study has been performed but no floodway designated and the maximum 1 foot increase in the base flood elevation would be exceeded,
3. a local community is expected to enter into the regular program within a reasonable period and detailed floodplain studies are underway,
4. a local community is participating in the emergency program and base flood elevation in the vicinity of insurable buildings is increased by more than 1 foot. (Where insurable buildings are not affected, it is sufficient to notify FEMA of changes to base flood elevations as a result of highway construction.)

The draft EIS/EA should indicate the NFIP status of affected communities, the encroachments anticipated and the need for floodway or floodplain ordinance amendments. Coordination means furnishing to FEMA the draft EIS/EA and, upon selection of an alternative, furnishing to FEMA through the community a preliminary site plan and water surface elevation information and technical data in support of a floodway revision request as required. If a determination by FEMA would influence the selection of an alternative, a commitment from FEMA should be obtained prior to the FEIS or FONSI. Otherwise this later coordination may be postponed until the design phase.

For projects that will be processed with a categorical exclusion, coordination may be carried out during design. However, the outcome of the coordination at this time could change the class of environmental processing.

Highway Encroachments Which Are Consistent With Regulatory Floodways In Effect

In many situations it is possible to design and construct highways in a cost-effective manner such that their components are excluded from the floodway. This is the simplest way to be consistent with the standards and should be the initial alternative evaluated. If a project element encroaches on the floodway but has a very minor effect on the floodway water surface elevation (such as piers in the floodway), the project may normally be considered as being consistent with the standards if hydraulic conditions can be improved so that no water surface elevation increase is reflected in the computer printout for the new conditions.

Revision of Regulatory Floodway So That Highway Encroachment Would Be Consistent

Where it is not cost-effective to design a highway crossing to avoid encroachment on an established floodway, a second alternative would be a modification of the floodway itself. Often, the community will be willing to accept an alternative floodway configuration to accommodate a proposed crossing provided NFIP limitations on increases in the base flood elevation are not exceeded. This approach is useful where the highway crossing does not cause more than a 1 foot rise in the base flood elevation. In some cases, it may be possible to enlarge the floodway or otherwise increase conveyance in the floodway above and below the crossing in order to allow greater encroachment. Such planning is best accomplished when the floodway is first established. However, where the community is willing to amend an established floodway to support this option, the floodway may be revised.

The responsibility for demonstrating that an alternative floodway configuration meets NFIP requirements rests with the community. However, this responsibility may be borne by the agency proposing to construct the highway crossing. Floodway revisions must be based on the hydraulic model which was used to develop the currently effective floodway but updated to reflect existing encroachment conditions. This will allow determination of the increase in the base flood elevation that has been caused by encroachments since the original floodway was established. Alternate floodway configurations may then be analyzed.

Base flood elevation increases are referenced to the profile obtained for existing conditions when the floodway was first established.

Data submitted to FEMA in support of a floodway revision request should include:

1. Copy of current regulatory Flood Boundary Floodway Map, showing existing conditions, proposed highway crossing and revised floodway limits.
2. Copy of computer printouts (input, computation, and output) for the current 100-year model and current 100-year floodway model.
3. Copy of computer printouts (input, computation, and output) for the revised 100-year floodway model. Any fill or development that has occurred in the existing flood fringe area must be incorporated into the revised 100-year floodway model.
4. Copy of engineering certification is required for work performed by private subcontractors.

The revised and current computer data required above should extend far enough upstream and downstream of the floodway revision area in order to tie back into the original floodway and profiles using sound hydraulic engineering practices. This distance will vary depending on the magnitude of the requested floodway revision and the hydraulic characteristics of the stream.

A floodway revision will not be acceptable if development that has occurred in the existing flood fringe area since the adoption of the community's floodway ordinance will now be located within the revised floodway area unless adversely affected adjacent property owners are compensated for the loss.

If the input data representing the original hydraulic model is unavailable, an approximation should be developed. A new model should be established using the original cross-section topographic information, where possible, and the discharges contained in the Flood Insurance Study which establish the original floodway. The model should then be run confining the effective flow area to the currently established floodway and calibrate to reproduce within 0.10 foot, the "With Floodway" elevations provided in the Floodway Data Table for the current floodway. Floodway revisions may then be evaluated using the procedures outlined above.

Floodway Encroachment Where Demonstrably Appropriate

When it would be demonstrably inappropriate to design a highway crossing to avoid encroachment on the floodway and where the floodway cannot be modified such that the structure could be excluded, FEMA will approve an alternate floodway with backwater in excess of the 1 foot maximum only when the following conditions have been met:

1. A location hydraulic study has been performed in accordance with Federal-Aid Highway Program Manual (FHPM) 6-7-3-2 "Location and Hydraulic Design of Encroachments on Floodplains" (23 CFR 650, Subpart A) and FHWA finds the encroachment is the only practicable alternative.
2. The constructing agency has made appropriate arrangements with affected property owners and the community to obtain flooding easements or otherwise compensate them for future flood losses due to the effects of the structure.
3. The constructing agency has made appropriate arrangements to assure that the National Flood Insurance Program and Flood Insurance Fund do not incur any liability for additional future flood losses to existing structures which are insured under the Program and grandfathered in under the risk status existing prior to the construction of the structure.
4. Prior to initiating construction, the constructing agency provides FEMA with revised flood profiles, floodway and floodplain mapping, and background technical data necessary for FEMA to issue revised Flood Insurance Rate Maps and Flood Boundary and Floodway Maps for the affected area upon completion of the structure.

Highway Encroachment On A Floodplain With A Detailed Study (FIRM)

In communities where a detailed flood insurance study has been performed but no regulatory floodway designated, the highway crossing should be designed to allow no more than a 1 foot increase in the base flood elevation based on technical data from the flood insurance study. Technical data supporting the increased flood elevation should be submitted to the local community and FEMA for their files. Where it is demonstrably inappropriate to design the highway crossing and meet backwater limitations the procedures outlined under

Floodway Encroachment Where Demonstrably Appropriate should be followed in requesting a revision of base floodplain reference elevations.

Highway Encroachment On A Floodplain Indicated On An FHBM

In communities where detailed flood insurance studies have not been performed, the highway agency must generate its own technical data to determine the base floodplain elevation and design encroachments in accordance with FHPM 6-7-3-2. Base floodplain elevations should be furnished to the community, and coordination carried out with FEMA as outlined previously where the increase in base flood elevations in the vicinity of insurable buildings exceeds 1 foot.

Highway Encroachment On Unidentified Floodplains

Encroachments which are outside of NFIP communities or NFIP identified flood hazard areas should be designed in accordance with FHPM 6-7-3-2 of the Federal Highway Administration. The NFIP identified flood hazard areas are those delineated on an FHBM, FBFM or FIRM.

To Obtain FEMA Publications

1. National Flood Insurance Program Community Status Book

Write to FEMA, 500 "C" Street, SW., Room 431, Insurance Operations, Washington, D.C. 20472 and request to be placed on the appropriate State mailing list.

2. Flood Insurance Study Report and/or FBFM

Write to FEMA, 500 "C" Street, SW., State and Local Programs Room 418, Washington, D.C. 20472 request:

(a) For future studies,

To be placed on mailing list to receive all studies and maps as they are completed for a State.

(b) For completed studies,

(1) The study for a particular community (provide number).

(2) All the studies for a particular State. You will received about 50 percent of the completed studies to date.

3. FHBM or FIRM for a particular community with ID number,

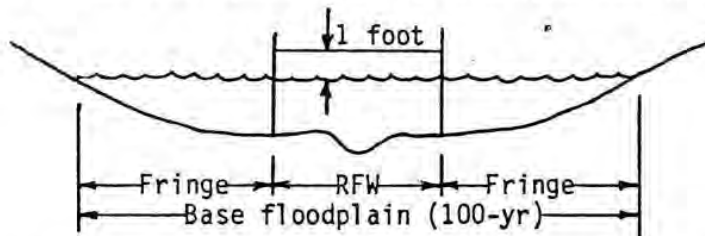
(a) call NFIP contractor (800)638-6620, (800)492-6605(MD), 897-5900 in D.C., or

(b) write NFIP, P.O. Box 34604, Bethesda, Maryland 20034

Briefing FHWA/FEMA Coordination Procedures

The procedures divide highway encroachments on floodplains into six categories:

1. Consistent with a Regulatory Floodway (RFW)
 - a. applicable to 5000 communities (county or city) which are in the FEMA regular flood insurance program.
 - b. community prohibits development in RFW, but allows development that is flood proofed in fringe



- c. highways are consistent by not increasing backwater:
 - (1) bridging RFW and
 - (2) excluding fill from RFW
2. Consistent by Revision of RFW
 - a. same as 1
 - b. same as 1
 - c. same as 1
 - d. if community and FEMA agree, RFW can be shifted
3. On RFW Where Demonstrably Appropriate
 - a. same as 1
 - b. same as 1
 - c. highways can increase backwater if:
 - (1) little or no risk to development can be demonstrated and
 - (2) community and FEMA concur
4. On Floodplain Shown on Flood Insurance Rate Map (FIRM)
 - a. applicable to 2000 communities in regular insurance program,
 - b. no RFW has been developed, but flood elevations have
 - c. community controls development within FIRM
 - d. highway encroachment should cause less than 1 foot of backwater
5. On Floodplain Shown on Flood Hazard Boundary Map (FHBM)
 - a. applicable to 13000 communities, 10000 in emergency insurance program
 - b. no RFW or flood elevations have been developed
 - c. community controls development within FHBM
 - d. highway encroachment should cause less than 1 foot of backwater if insurable buildings are present
6. On unidentified floodplains
 - a. floodplain is not shown on FIRM or FHBM
 - b. floodplain is therefore outside of the 20000 flood prone areas in the US that are of concern of FEMA
 - c. apply FHPM 6-7-3-2, Location and Hydraulic Design of Encroachments on Flood Plains