

GENERAL GUIDELINES FOR THE HYDROLOGIC-HYDRAULIC ASSESSMENT OF FLOODPLAINS IN INDIANA

Comments or questions regarding these guidelines are always welcome. The Department of Natural Resources intends to update this document on a regular basis as changes and improvements warrant. You can contact the Division of Water by the following means:

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- Send questions or comments to:
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Main office - (317) 232-4160 or toll free 1-877-928-3755
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In order to help us track and compile comments regarding these guidelines, e-mail is the preferred option for your general comments. If using the e-mail portion of our website, enter "guideline comment" in the field labeled "Staff Name".

Indiana Department of Natural Resources
Division of Water
Indianapolis, Indiana
December 5, 2002

PREFACE

General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana was created to assist the floodplain management community in establishing base flood elevations and floodway limits and in evaluating projects in accordance with the Indiana Flood Control Act and the National Flood Insurance Program. The guidelines detail methods acceptable to both the Indiana Department of Natural Resources (IDNR) and the Federal Emergency Management Agency (FEMA) with respect to hydrologic and hydraulic modeling and floodplain mapping. Also included in this guide are recommendations on presenting results of a floodplain study and other useful reference material.

As noted above, these guidelines are intended to assist the floodplain management community. They are geared to a knowledgeable audience and are not meant to be a self contained document.

This guide was authored by a team of water resource professionals representing the IDNR - Division of Water and engineering consulting firms active in the area of water resources in the state of Indiana. The team members are:

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CONTENTS

PREFACE	i
LIST OF ABBREVIATIONS.....	vi
LINKS	viii
EXECUTIVE SUMMARY	x
CHAPTER 1: INTRODUCTION	1-1
1.1 HISTORIC OVERVIEW	1-1
1.2 TERMINOLOGY	1-2
1.3 PURPOSE OF GUIDELINES	1-4
CHAPTER 2: OBTAINING A FLOODPLAIN DETERMINATION FOR A MINOR SITE ASSESSMENT.....	2-1
2.1 PURPOSE	2-1
2.2 OVERVIEW	2-1
2.3 IDNR ASSISTANCE	2-1
2.4 HYDROLOGIC-HYDRAULIC APPROACH USED BY THE IDNR	2-3
CHAPTER 3: OVERVIEW OF THE PROCESS FOR PERFORMING A DETAILED FLOODPLAIN ANALYSIS	3-1
3.1 PURPOSE	3-1
3.2 GATHERING DATA AND INFORMATION	3-1
3.3 SUBMITTING DETAILED FLOODPLAIN ANALYSIS TO THE IDNR	3-2
3.4 POSSIBLE REVISIONS TO EXISTING BASE FLOOD ELEVATION AND FLOODWAY LIMITS	3-3
3.5 MODELS REQUIRED FOR IDNR APPROVAL OF A PERMIT OR MAP REVISION REQUEST	3-4
3.6 APPLICATIONS FOR PROPOSED CONSTRUCTION IN A FLOODWAY	3-8

3.7 APPLICATIONS FOR FEMA LETTERS OF MAP REVISION	3-10
3.8 FLOOD CONTROL PROJECTS.....	3-11
3.9 LEVEES.....	3-12
CHAPTER 4: MAPPING STANDARDS AND METHODS	4-1
4.1 PURPOSE	4-1
4.2 SOURCES OF EXISTING MAPPING.....	4-1
4.3 SITE SPECIFIC TOPOGRAPHIC MAPPING	4-4
CHAPTER 5: SURVEYING STANDARDS AND METHODS.....	5-1
5.1 PURPOSE	5-1
5.2 PLANS TO BE SUBMITTED WITH CROSS-SECTION DATA	5-1
5.3 GUIDELINES FOR LOCATION AND ORIENTATION OF CROSS-SECTIONS	5-2
5.4 GUIDELINES FOR SURVEY BENCHMARKS	5-5
5.5 GUIDELINES FOR BRIDGE AND CULVERT INFORMATION	5-5
CHAPTER 6: RESEARCHING AND EVALUATING EXISTING MODELS	6-1
6.1 PURPOSE	6-1
6.2 SEARCHING FOR EXISTING MODELS.....	6-1
6.3 EVALUATING EXISTING MODELS	6-1
6.4 SOURCES OF MODELS.....	6-2
CHAPTER 7: GUIDELINES FOR DETERMINING PEAK DISCHARGES.....	7-1
7.1 PURPOSE	7-1
7.2 COORDINATED DISCHARGES	7-1
7.3 DISCHARGES DETERMINED BY IDNR.....	7-2

7.4 DISCHARGES DETERMINED BY OTHERS AND SUBMITTED TO THE IDNR FOR APPROVAL.....	7-2
7.5 HISTORIC FLOOD PROFILES AND DISCHARGES	7-4
CHAPTER 8: GUIDELINES FOR HYDRAULIC MODELING USING HEC-RAS	8-1
8.1 PURPOSE	8-1
8.2 PROGRAM DEFAULTS	8-1
8.3 DISCHARGES.....	8-2
8.4 STARTING WATER SURFACE ELEVATIONS	8-2
8.5 MANNING'S ROUGHNESS COEFFICIENTS	8-3
8.6 FLOOD MODEL CALIBRATION.....	8-4
8.7 CROSS-SECTIONS	8-4
8.8 INEFFECTIVE FLOW AREAS AND BLOCKED OBSTRUCTIONS.....	8-5
8.9 BRIDGES	8-5
8.10 CULVERTS	8-8
8.11 CRITICAL DEPTHS.....	8-8
8.12 FLOODWAYS.....	8-9
8.13 CHECK RAS.....	8-11
CHAPTER 9: GUIDELINES FOR ALTERNATIVE HYDRAULIC MODELS	9-1
9.1 PURPOSE	9-1
9.2 HEC-2.....	9-1
9.3 REVISIONS TO HEC-2 MODELS USING HEC-RAS	9-2
9.4 OTHER ONE DIMENSIONAL, STEADY STATE MODELS.....	9-2
CHAPTER 10: PRESENTATION OF MODELING RESULTS.....	10-1
10.1 PURPOSE	10-1

10.2 HYDRAULIC MODELING CHECKLIST..... 10-1
10.3 HYDRAULIC MODELING DOCUMENTATION 10-2

BIBLIOGRAPHY

APPENDIX

FLOW CHART: OVERVIEW FOR PERFORMING A DETAILED FLOODPLAIN
ANALYSIS

HYDRAULIC MODELING CHECKLIST

LIST OF ABBREVIATIONS

BFE	Base Flood Elevation
CAD	Computer Aided Drafting
CFR	Code of Federal Regulations
CLOMR	Conditional Letter of Map Revision
CR	Contraction Ratio
DEM	Digital Elevation Model
DOQ	Digital Orthophoto Quadrangle
DOW	Division of Water (within IDNR)
ER	Expansion Ratio
ESC	Engineering Services Center (part of Division of Water)
FARA	Floodplain Analysis Regulatory Assessment
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study (used by FEMA)
FW	Floodway
GIS	Geographic Information System
HD	Hydraulic Depth (average)
HEC	Hydrologic Engineering Center
HEC-HMS	Hydrologic Engineering Center – Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center – River Analysis System
IAC	Indiana Administrative Code

IC	Indiana Code
ICPR	Interconnected Pond Routing Model
IDNR	Indiana Department of Natural Resources
INDOT	Indiana Department of Transportation
L	Reach Length
LOMA	Letter of Map Amendment
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision – Based on Fill
LPA	Local Public Agency
n	Roughness Coefficient Used in the Manning Equation
NAVD-1988	North American Vertical Datum of 1988
NFIP	National Flood Insurance Program
NGVD-1929	National Geodetic Vertical Datum of 1929
NRC	Natural Resources Commission
NRCS	Natural Resources Conservation Service
PMR	Physical Map Revision
S	Average Reach Slope in Percent
TIN	Triangulated Integrated Network
TR-20	Technical Release 20 (used by NRCS)
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WSP2	Water Surface Profiles 2 (used by NRCS)
WSPRO	Water Surface Profiles (used by FHWA)

LINKS

Indiana Flood Control Act: <http://www.in.gov/legislative/ic/code/title14/ar28/ch1.html>

Indiana Floodplain Management Act:

<http://www.in.gov/legislative/ic/code/title14/ar28/ch3.html>

312 IAC 10 Floodplain Management Rule: <http://www.in.gov/legislative/iac/title312.html>

Request for Floodplain Information: <http://www.in.gov/icpr/webfile/formsdiv/50356.pdf>

44 CFR

http://www.access.gpo.gov/nara/cfr/waisidx_99/44cfr59_99.html

http://www.access.gpo.gov/nara/cfr/waisidx_99/44cfr60_99.html

http://www.access.gpo.gov/nara/cfr/waisidx_99/44cfr65_99.html

http://www.access.gpo.gov/nara/cfr/waisidx_99/44cfr67_99.html

http://www.access.gpo.gov/nara/cfr/waisidx_99/44cfr70_99.html

FEMA Guidelines (Feb 2002)

http://www.fema.gov/mit/tsd/dl_cgs.htm

MT-2 Forms

http://www.fema.gov/mit/tsd/dl_mt-2.htm

Division of Water links

Floodplain Mapping:

<http://www.in.gov/dnr/water/publications/index.html>

County / City Mapping: [_<under construction>](#)

FEMA workmaps: [<under construction>](#)

Benchmarks: http://www.in.gov/dnr/water/comm_assistance/benchmarks/index.html

H & H Modeling: http://www.in.gov/dnr/water/surface_water/hydro_hydraulic/index.html

Coordinated Discharges:

http://www.in.gov/dnr/water/surface_water/coordinated_discharges/index.html

Rainfall Frequency:

http://www.in.gov/dnr/water/surface_water/rainfallfrequency/index.html

Drainage Areas of Indiana Streams:

http://www.in.gov/dnr/water/surface_water/drainage_area/index.html

Modeling Checklist:

http://www.in.gov/dnr/water/surface_water/pdf/fp_guidelines_checklist.pdf

USGS Mapping links

DOQ: <http://www-wmc.wr.usgs.gov/doq/>

Quads: <http://mcmcweb.er.usgs.gov/topomaps/>

30 Meter DEM: http://mcmcweb.er.usgs.gov/status/dem_stat.html

Drainage Areas of Indiana Streams: <http://in.water.usgs.gov/cdfactsheet/arcinfo.html>

HEC-RAS: <http://www.hec.usace.army.mil/>

CheckRAS: http://www.fema.gov/mit/tsd/frm_crdr.htm

WSPRO: <http://water.usgs.gov/software/wspro.html>

E431: <http://water.usgs.gov/software/e431.html>

ICPR: <http://www.streamnologies.com/icpr.htm>

WRAS: <http://www.wcc.nrcs.usda.gov/water/quality/common/hec-ras/hecraspg.html>

EXECUTIVE SUMMARY

General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana was created to assist the floodplain management community in establishing base flood elevations (BFEs) and floodway limits and in evaluating projects in accordance with the Indiana Flood Control Act and the National Flood Insurance Program. Members of the floodplain community and, therefore, the intended audience of these guidelines includes individual property owners, developers, engineers, surveyors, elected and appointed officials and interested citizens.

The guidelines were authored by a team of water resource professionals representing the Indiana Department of Natural Resources (IDNR) – Division of Water and engineering consulting firms active in the area of water resources in the state of Indiana. The current version of these guidelines is available at the IDNR website (<http://www.in.gov/dnr/water>).

Chapter 1 reviews federal and state floodplain acts and codes, defines some key terms and expands on the purpose of the guidelines. The process of obtaining BFEs and floodway limits for projects consisting of a single lot and/or structure is explained in Chapter 2. In these cases, the IDNR may provide or calculate the BFE.

Chapter 3 provides an overview of detailed floodplain analyses. Historically, the IDNR has provided BFEs and floodway limits for proposed developments in unstudied areas, assuming the area of contributing watershed at the development is greater than one square mile. As of July 1, 2002, the Department required that these hydrologic-hydraulic assessments be performed by the requester and submitted to the IDNR for review and approval. Overview topics discussed in Chapter 3 include gathering data and information, submitting analyses to IDNR, revising existing BFEs and/or floodway limits, and computer model requirements. Subsequent chapters elaborate on the overview topics.

Suggestions for selecting or creating a map suitable for plotting floodplain and floodway limits are offered in Chapter 4. Chapter 5 prescribes surveying standards and suggests surveying methods likely to lead to determination of BFEs and plotting of floodplain and floodway limits acceptable to the IDNR.

Computer modeling is discussed in Chapter 6. This chapter provides guidance on potential model sources and offers suggestions on how to evaluate the suitability of a model. The overall thrust of this chapter is to facilitate optimum use of existing modeling. Chapter 7 temporarily shifts the guideline's emphasis from hydraulics, to hydrology, that is, from BFE's and floodplain and floodway limits to flood flows. Described are three options for determining peak discharges acceptable to IDNR.

Returning to hydraulics, Chapter 8 offers suggestions for more effectively creating and using a HEC-RAS model. HEC-RAS, a widely used hydraulic model developed by the U.S. Army Corps of Engineers, is preferred by the IDNR for floodplain analyses. Chapter 9 recognizes that other hydraulic models may occasionally be used. Accordingly, this chapter discusses issues that should be considered when using such models. Finally, Chapter 10 provides suggestions on how to effectively present to the IDNR the modeling that supports a floodplain hydrologic-hydraulic assessment. Included is a discussion of a modeling checklist.

General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana, is a living document whose content will be continuously refined in response to improvements in the art and science of floodplain analyses as the IDNR interacts with the floodplain community. In the spirit of continuous improvement, the IDNR welcomes questions and suggestions. Refer to the title page for contact information.

Keywords: base flood elevation, cumulative effects, Federal Emergency Management Agency (FEMA), flood hazard, floodplain, floodway, hydraulics, hydrology, Indiana Department of Natural Resources (IDNR), modeling, regulation