U.S. Department of Homeland Security
500 C Street, SW
Washington, DC 20472

FEMA

December 8, 2011

Procedure Memorandum No. 66

Amending the Guidelines and Standards for Flood Hazard Mapping Partners

Title: Flood Insurance Study Report Alignment to Digital Vision

Effective Date: Optional for all studies funded prior to FY2012
Required for all studies funded in FY2012 and beyond

Approval: Doug A. Bellomo
Director, Risk Analysis Division
Federal Insurance and Mitigation Administration

Background: In Fiscal Year (FY) 2010, the Federal Emergency Management Agency (FEMA) initiated the Risk Mapping, Assessment, and Planning (Risk MAP) program. Under Risk MAP, FEMA seeks to:

- Deliver new data and products that expand risk awareness and promote mitigation planning that leads to risk reduction actions;
- Incorporate new efficiencies into flagship products (Flood Insurance Rate Map (FIRM), the FIRM Database, and Flood Insurance Study (FIS) Reports); and
- Deliver data and products in formats that align to FEMA's Digital Vision supporting expanded usage and user benefits.

FEMA's Digital Vision for the future is based on delivery of digital information using geospatial datasets for all National Flood Insurance Program products. For the FIS Report, this will mean that its graphics, maps, text, tables, and profiles are to be generated from project databases associated with each study. The long-term vision is to allow a user to create a database-driven, on-demand FIS Report of an area of interest at the local, jurisdictional, or watershed level. This change provides user-friendly products, a FIS Report based on up-to-date data, and quicker access to FIS Report information via the internet.

Updates to Appendix L (Guidance for Preparing Digital Data and FIRM Databases) and Appendix M (Data Capture Standards) of FEMA's *Guidelines and Standards for Flood Risk Analysis and Mapping* (Previously *Guidelines and Standards for Flood Hazard Mapping*

Partners) provide the framework for easy population of the project information within the FIS Report from the FIRM database.

Issues: Appendices K, L, and M of FEMA's *Guidelines & Standards* have gone through the update process to reflect necessary changes as a result of the Risk MAP vision and to align more closely with FEMA's Digital Vision. However, Appendix J (Format and Specifications for Flood Insurance Study Reports) has not yet been included in the update process. Therefore, short-term guidance is needed for the preparation of FIS Reports during Risk MAP to accommodate these changes until Appendix J is updated. Updates to Appendix K have removed certain items shown on the Map Index, Map Legend and Notes to User on the FIRM. The objective is to place these items within the FIS Report. These changes require new FIS guidance to indicate where and how to incorporate the information.

As outlined in the April 2003 version of Appendix J, much of the content in FIS Reports is currently organized in paragraph format. Searching through paragraphs for specific project information can be cumbersome.

Appendix J currently provides limited guidance on how to organize certain sections of the FIS Report such as sections pertaining to Coastal Barrier Resource System (CBRS) areas, levees, and alluvial fan studies. Appendix J provides limited guidance on how the final PDF document is to be digitally bookmarked so it can be searched more efficiently. Appendix J also lacks typographical specifications such as typeface, size, and weight of text and specifications for the size and layout of tables and figures.

Actions Taken: The requirements outlined in the attached guidance must be used in producing FIS Reports. These requirements will move the FIS Report closer to the long-term digital vision and address the issues referenced above until Appendix J can be updated. The attached guidance provides a template that reorganizes as much flood study information as possible into tabular format. The guidance also resolves the gaps caused by changes to Appendix K and matches data changes described in the new Appendices L and M.

Supersedes/Amends: The sections of Appendix J (April 2003) superseded by this procedure memorandum are identified in Annex A of the attachment.

Attachments:
Guidance for Creation of Flood Insurance Study Reports

Distribution List (electronic distribution only):

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Procedure Memorandum # 66

Flood Insurance Study Report Alignment to Digital Vision

Guidance for Creation of FIS Reports

October 2011

FEMA

Table of Contents

1. Introduction

This guidance document provides instructions and standards for creating Flood Insurance Study (FIS) Reports. The following sections explain specific elements of the FIS Report template that must be used in developing FIS Reports for flood risk projects. Supporting information to the following guidance is provided in Annexes A through D which include:

- Annex A - Sections of Appendix J, Published April 2003, that are Superseded by this Procedure Memorandum
- Annex B – FIS Report Template (Microsoft Word Format)
- Annex C – FIS Report Template (PDF Format, including profiles and bookmarks)
- Annex D – Watershed Project Considerations

Previously effective countywide FIS Reports that are being revised will be required to use the new template. However, special considerations for projects conducted at the watershed level are included in Annex D and should be followed. Any information that was included in Section 10 in the previous effective FIS Report will be incorporated into the text and tables of the new FIS Report.

The tables included within the FIS Report and Appendix L and M have been aligned as far as possible so that population of the appropriate fields in the FIRM Database will allow the respective data in the FIS Report tables to be incorporated more easily. For a Physical Map Revision (PMR) or watershed project, the mapping partner should refer to Annex D for guidance regarding the preparation of the FIS Report.

2. General Guidelines

2.1. General Content

- **IMPORTANT NOTE** – The study-specific content (bold, orange font) provided within the tables in the example template is for illustration only and so may not be completely consistent throughout the report. This example content should not be used to infer standards for data. For example, some tables include more flooding sources listed so that a variety of examples may be shown, whereas other tables do not need lengthy entries to convey the information they are to include. As an additional example, and in order to reduce the overall size of the template, not every Zone AE flooding source listed in Table 2, "Flooding Sources Included in this FIS Report", has a companion Flood Profile at the back of the Report. These variations should not be construed as a change to current guidance or to the expectation that exhaustive quality control checks must be performed to reach agreement between all modeling results, tables, and profiles. Rather, the templates should simply be used as an example of the type of information that is to be included in each FIS Report. Mapping Partners are responsible for making sure that each table in the FIS Report contains the relevant information for each flooding source so that the details and results of the study can effectively be communicated to the end user.

- All numbered sections, tables, and figures in the template are required for every FIS Report and should not be removed. Text shown as optional in the template that does not apply to the specific project should be deleted; if all text under a heading is non-applicable and deleted, insert the statement, "This section is not applicable to this FIS project." under the heading. Tables or figures that do not apply to the specific project should be indicated below the caption by adding "[Not Applicable to this FIS Project]".

Figure 1: Examples of Not Applicable Text, Table, and Figure

Example of not applicable section	**5.3 Coastal Flood Hazard Areas** **5.3.1 Total Stillwater Elevations** This section is not applicable to this FIS project.
Example of not applicable table	**Table 16: Summary of Coastal Analyses** **[Not Applicable to this FIS Project]**
Example of not applicable figure	**Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas** **[Not Applicable to this FIS Project]**

- Text that is not to be edited is shown in black, regular (non-bold-faced) type in the template.
- Text that is required for specific types of data in the FIS Report is indicated in **blue, bold-faced type**. This text can be deleted if it does not apply to the FIS project and replaced by the statement, "This section is not applicable to this FIS project." An example of non-applicable text that can be deleted is coastal data for an inland county. If the optional text is left in the report because it is applicable, be sure to change the font to black, non-bold-faced for final publication.
- Text for a few sections (such as those describing hydrologic, hydraulic, coastal, and alluvial analyses) may require manual editing for the specific project area. Descriptions of additional information such as specific methodology with references will need to be added manually. Variable text and study-specific table entries that must be edited are shown in **orange, bold-faced type**. Be sure to change the type to black, non-bold-faced for final publication.
- Hyperlink text should be shown in black print with no underlining; however, active links may be retained so that they will be carried over when creating the PDF.

- Avoid using “detailed,” “limited detailed,” or “approximate” to describe flooding sources or the methodologies used to analyze them. Specify the flood zone or actual methodology instead.
- Use “FIS project” or “project” to refer to the entire project. Components of the project include compilation of flooding data, hydrologic and hydraulic analyses, base map preparation, mapping boundaries and elevations, and publishing the FIRM and FIS Report. Refer to the document as “Flood Insurance Study Report” or “FIS Report” to clearly identify the published report that accompanies the FIRM. Use “study” to refer to specific engineering analyses.
- References to tables or figures in the one section or subsection can omit the title of the table or figure if it is obvious from the context.
- Use an (Author Year) format rather than consecutive numbering to cite references within the text. The references should match the citation listed in the Bibliography and References table.
- If a future conditions analysis has been performed, the data should be reported in the FIS Report. The mapping partner should edit the Summary of Discharges and Floodway Data tables, as in the following illustration, and the text referring to floods wherever it occurs in the report as appropriate.

Figure 2: Example of Future Conditions column

Elevations (feet NAVD88)				
10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	
			Existing	Future
13.8	*	15.6	16.9	*
41.4	*	50.6	54.2	*

2.2. Type Specifications for Text

These specifications generally follow *House Style Guidelines* for Homeland Security, October 2003.

- The text in the body of the FIS Report is Times New Roman, 11 point; justified (left and right side); single space with one line between paragraphs. One space is inserted after a period (.) at the end of a sentence.
- Heading 1 is Arial, 12 point, Bold, All Caps; left aligned; with 24 point spacing before.
- Heading 2 is Arial, 11 point, Bold; left aligned; with 18 point spacing before and 6 point spacing after.
- Heading 3 is Arial, 11 point, Bold; left aligned; with 12 point spacing before and 6 point spacing after.
- Heading 4 is unnumbered, Arial, 11 point, Bold; left aligned; with 0 point spacing before and 0 point spacing after.

- Text in the body of the report is aligned under the words of the heading rather than the number for Headings 1 and 2. Text is aligned under the number for Headings 3 and 4.

3. Guidelines for Cover and Table of Contents

3.1. Cover

- Communities and CIDs are shown in Arial, 12 point. The date is shown in Arial, 14 point, bold. The FIS project number is shown in Arial, 12 point, bold.
- Choose the appropriate cover template depending on the number of communities included in the report. Delete the cover from the template that is not being used.
- Use "EFFECTIVE" for the first version of a countywide FIS project; use "REVISED" for subsequent versions of a countywide FIS project.
- If the FIS Report is one volume, use "V000" with the FIPS code preceding this part of the number. If there are multiple volumes, use "V001" on the cover of Volume 1, "V002" on the cover of Volume 2, etc. For a first-time countywide FIS project, the suffix "A" is to be used as it indicates that this is the first countywide study. For each subsequent revision of the FIS Report, the suffix will advance in alphabetical order (excluding the use of the letter I – "eye" or the letter O – "oh"). If there is a revision to an existing countywide that does not already have a suffix on the FIS project number, the first revision would use the suffix "B".
- The Specification Version number corresponds to the version of the Guidelines and Standards used to produce the FIS Report as described in the Risk MAP Version Guide available from FEMA.

3.2. Notice to Flood Insurance Study Users

The Notice to FIS Users that appeared after the cover page and before the Table of Contents in previous FIS Reports is now included in the content of Section 1.4 of the FIS Report.

3.3. Table of Contents, Lists of Tables and Figures, and Exhibits

All Table of Contents items are shown in Arial, 11 point.

4. Guidelines for Tables in the Body of the FIS Report

4.1. General Guidelines

- Tables should be sized to the width of the preceding text block. If a table needs to be wider than the previous text block to be readable, insert section breaks before and after the table and change the page orientation to landscape. Centered page numbers must be included at

the bottom of tables in landscape orientation. Column width can be adjusted as needed to accommodate data.

- If a table is split between two pages, consider adding a header for each page with "(continued)" next to the title. In general, rows should not be allowed to split between pages unless this causes too many page breaks and large areas of white space. For example, the Principal Flood Problems table may contain rows with long descriptive passages, so the rows are permitted to split between pages.
- Table and figure captions are Arial, 11 point, bold; centered; with 12 point spacing before and 6 point spacing after the caption.
- Text in tables is Arial, 10 point, single spaced with 3 point before and after (row height not specified) except for the Floodway Data table (FDT). The FDT is 0 point before and after each row – row height is governed by paragraph spacing rather than specifying row height. Text may be reduced to 9 point to accommodate data as long as readability is not reduced.
- Text or dates in tables should be left aligned (for running text or longer content that wraps in the cell) or centered. Headings in tables should be centered at the bottom of the cell.
- Numeric data in tables should be aligned on decimal points or right aligned (if no decimals are present in the entire column). Numbers greater than 999 should include a comma appropriately placed.
- All cells in tables should be populated with data, an explanatory entry or a footnote giving more explanation of why they are blank. You may need to edit the FIS Report to replace default output for missing values that have been exported from the FIRM database.
- As outlined in Annex D, depending on decisions made for updating to the new format, the information requested for certain table fields in the FIS Report may be unknown, or simply may not be scoped to be populated. In these cases, it may be necessary to manually populate those table entries with a value of "Unknown" or "Not Provided".

4.2. Derivation of Data from Appendix L

Most of the data shown in tables in the FIS Report can be derived from tables of the FIRM database as specified in Appendix L. Table 1 provides guidance for the tables and fields that can be used to help accomplish this.

Table 1: Derivation of FIS Report Template Tables from Data in Appendix L Tables

FIS Report Template Table Column Name Cover	Appendix L Table Name	Appendix L Table Field
Study Name	Study_Info	STUDY_PRE + STUDY_NM + STATE_NM + JURIS_TYP
Community Name	S_Pol_Ar	POL_NAME1
Community Number	S_Pol_Ar	CID
Effective Date	Study_Info	INDX_EFFDT
FIS Project Number	Study_Info	FIS_NM

Table 1: Listing of NFIP Jurisdictions

This table can be created by a spatial overlay of S_Pol_Ar joined to L_Comm_Info, S_FIRM_Pan, and S_Subbasins, summarized on POL_NAME1 (one record per community).

FIS Report Template Table Column Name	Appendix L Table Name	Appendix L Table Field
Community	S_Pol_Ar	POL_NAME1
CID	S_Pol_Ar	CID
HUC-8 Sub-basin(s)	S_Subbasins	HUC8
Located on FIRM Panels(s)	S_FIRM_Pan	FIRM_PAN
Included in this FIS Project	S_Pol_Ar	ANI_TF
If Not Included, Location of Flood Hazard Data	S_Pol_Ar	ANI_FIRM
No SFHA identified footnote	L_Comm_Info	FLOODPRONE

Section 1.4

Initial Countywide FIS Report	L_Comm_Info	FST_CW_FIS

Figure 1. FIRM Panel Index

	S_FIRM_Pan	FIRM_PAN or PANEL + SUFFIX
	S_FIRM_Pan	EFF_DATE
	S_FIRM_Pan	PNP_REASON
	S_Pol_Ar	POL_NAME1
	S_Subbasins	HUC8
	S_Subbasins	SUBBAS_NM
	S_Wtr_Ln and/or S_Wtr_Ar	WTR_NM
	S_Trnsport_Ln	ROUTENUM
	Study_Info	STUDY_PRE + STUDY_NM + STATE_NM + JURIS_TYP
	Study_Info	INDX_EFFDT

Figure 2. FIRM Notes to Users

Coastal Base Flood Elevation limits – landward value	Study_Info	LANDWD_VAL
Coastal Base Flood Elevation limits	Study_Info	V_DATUM
Projection	Study_Info	PROJECTION + PROJ_ZONE
Horizontal Datum	Study_Info	H_DATUM

FIS Report Template Table Column Name	Appendix L Table Name	Appendix L Table Field
Vertical Datum	Study_Info	V_DATUM
Base Map Information: source, scale	L_Source_Cit	TITLE + PUBLISHER + SRC_SCALE + PUB_DATE
Revisions to Index: Effective Date	Study_Info	INDX_EFFDT

Special Notes for Specific FIRM Panels: The CBRS notes could be triggered by the S_CBRS feature class not being empty; the LiMWA note could be triggered by the S_LiMWA feature class not being empty; and the levee notes could be triggered from S_Levee.

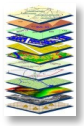
Study Name	Study_Info	STUDY_PRE + STUDY_NM
Effective Date	Study_Info	INDX_EFFDT

Table 2: Flooding Sources Included in this FIS Report

This table can be created by a spatial overlay of S_Pol_Ar, S_Profil_Basln and/or S_Tsct_Basln, S_Fld_Haz_Ar, and S_Submittal_Info, summarized on WTR_NM (one record per Flooding Source).

Flooding Source	S_Profil_Basln and/or S_Tsct_Basln	WTR_NM
Community	S_Pol_Ar	POL_NAME1
Downstream Limit	S_Profil_Basln and/or S_Tsct_Basln	R_ST_DESC
Upstream Limit	S_Profil_Basln and/or S_Tsct_Basln	R_END_DESC
HUC-8 Sub-Basin	S_Subbasins	HUC8
Length (mi) (streams or coastlines)	S_Profil_Basln and/or S_Tsct_Basln	Read from GIS data
Area (mi^2) (estuaries or ponding)	S_Profil_Basln and/or S_Tsct_Basln	Read from GIS data
Floodway (Y/N)	S_Profil_Basln	True where STUDY_TYP = SFHAs WITH HIGH FLOOD RISK
Zone Shown on FIRM	S_Fld_Haz_Ar	FLD_ZONE
Date of Analysis	S_Submittal_Info	COMP_DATE

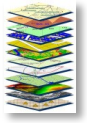
Table 3: Flood Zone Designations by Community



This table can be created by a spatial overlay of S_Pol_Ar and S_Fld_Haz_Ar (one record per community).

Community	S_Pol_Ar	POL_NAME1
Flood Zone(s)	S_Fld_Haz_Ar	FLD_ZONE

Table 4: Coastal Barrier Resources System Information



This table can be created by a spatial overlay of S_CBRS and S_FIRM_Pan (one record per Primary Flooding Source).

FIS Report Template Table Column Name	Appendix L	Appendix L Table Field
Primary Flooding Source	S_CBRS	WTR_NM
CBRS/OPA Type	S_CBRS	CBRS_TYP
Date CBRS area established	S_CBRS	CBRS_DATE
FIRM Panel Number(s)	S_FIRM_Pan	FIRM_PAN

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	S_Subbasins	SUBBAS_NM
HUC-8 Sub-Basin Number	S_Subbasins	HUC8
Primary Flooding Source	S_Subbasins	WTR_NM
Description of Affected Area	S_Subbasins	BASIN_DESC
Drainage Area (units)	S_Subbasins S_Subbasins	SUB_AREA AREA_UNIT

Table 6: Principal Flood Problems

Flooding Source	S_Profil_Basln	WTR_NM
Description of Flood Problems	S_Profil_Basln	FLD_PROB1 + FLD_PROB2 + FLD_PROB3 or separate text file if more characters are needed

Table 7: Historic Flooding Elevations

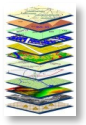
Flooding Source	S_HWM	WTR_NM
Location	S_HWM	LOC_DESC
Historic Peak (vertical datum)	S_HWM S_HWM S_HWM	ELEV LEN_UNIT V_DATUM
Event Date	S_HWM	EVENT_DT
Approximate Recurrence Interval (years)	S_HWM	APX_FREQ
Source of Data	S_HWM	HWM_SOURCE

Table 8: Non-Levee Flood Protection Measures

Flooding Source	S_Gen_Struct	WTR_NM
Structure Name	S_Gen_Struct	STRUCT_NM
Type of Measure	S_Gen_Struct	STRUCT_TYP

FIS Report Template Table Column Name	Appendix L Table	Appendix L Table Field
Location	S_Gen_Struct	LOC_DESC
Description of Measure	S_Gen_Struct	STRUC_DESC

Table 9: Levees



This table can be created by a spatial overlay of S_Pol_Ar, S_Levee, and S_FIRM_Pan (one record per Levee Segment defined by the same flooding source, owner, and contiguous bank location).

Community	S_Pol_Ar	POL_NAME1
Flooding Source	S_Levee	WTR_NM
Levee Location	S_Levee	BANK_LOC
Levee Owner	S_Levee	OWNER
USACE Levee	S_Levee	USACE_LEV
Levee ID	S_Levee	LVDBASE_ID
Covered Under PL84-99 Program?	S_Levee	PL84_99TF
FIRM Panel(s)	S_FIRM_Pan	FIRM_PAN
Levee Status	S_Levee	LEVEE_STAT

Table 10: Summary of Discharges

Flooding Source	S_Nodes	WTR_NM via L_Summary_Discharges NODE_ID field
Location	L_Summary_Discharges	NODE_DESC
Drainage Area (units)	L_Summary_Discharges	DRAIN_AREA
	L_Summary_Discharges	AREA_UNIT
Discharge (units)	L_Summary_Discharges	DISCH_UNIT
Discharge (units) 10% Annual Chance	L_Summary_Discharges	DISCH where EVENT_TYP = 10 PERCENT CHANCE EVENT
Discharge (units) 4% Annual Chance	L_Summary_Discharges	DISCH where EVENT_TYP = 4 PERCENT CHANCE EVENT
Discharge (un its) 2% Annual Chance	L_Summary_Discharges	DISCH where EVENT_TYP = 2 PERCENT CHANCE EVENT
Discharge (units) 1% Annual Chance Existing	L_Summary_Discharges	DISCH where EVENT_TYP = 1 PERCENT CHANCE EVENT
Discharge (units) 1% Annual Chance Future	L_Summary_Discharges	DISCH where EVENT_TYP = 1 PERCENT CHANCE FUTURE EVENT

FIS Report Template Table Column Name	Appendix L Table	Appendix L Table Field
Discharge (cfs) 0.2% Annual Chance	L_Summary_Discharges	DISCH where EVENT_TYP = 0.2 PERCENT CHANCE EVENT

Figure 7: Frequency Discharge - Drainage Area Curves
– Provide per Appendix M only if needed –

Table 11: Summary of Non-Coastal Stillwater Elevations

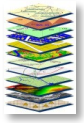
Flooding Source	S_Nodes	WTR_NM via L_Summary_Elevations NODE_ID field
Location	S_Nodes	NODE_DESC via L_Summary_Elevations NODE ID field
Elevations (Vertical Datum)	L_Summary_Elevations	V_DATUM
Elevations (unit)	L_Summary_Elevations	WSEL_UNIT
Elevation 10% Annual Chance	L_Summary_Elevations	WSEL where EVENT_TYP = 10 PERCENT CHANCE EVENT
Elevation 4% Annual Chance	L_Summary_Elevations	WSEL where EVENT_TYP = 4 PERCENT CHANCE EVENT
Elevation 2% Annual Chance	L_Summary_Elevations	WSEL where EVENT_TYP = 2 PERCENT CHANCE EVENT
Elevation 1% Annual Chance	L_Summary_Elevations	WSEL where EVENT_TYP = 1 PERCENT CHANCE EVENT
Elevation 1% Annual Chance Future*	L_Summary_Elevations	WSEL where EVENT_TYP = 1 PERCENT CHANCE FUTURE EVENT
Elevation 0.2% Annual Chance	L_Summary_Elevations	WSEL where EVENT_TYP = 0.2 PERCENT CHANCE EVENT

Table 12: Stream Gage Information Used to Determine Discharges

Flooding Source	S_Gage	WTR_NM
Gage Identifier	S_Gage	GAGE_OWNID
Agency that Maintains Gage	S_Gage	AGENCY
Site Name	S_Gage	GAGE_DESC
Drainage Area (Square Miles)	S_Gage S_Gage	DRAIN_AREA AREA_UNIT
Period of Record From	S_Gage	START_PD
Period of Record To	S_Gage	END_PD

FIS Report Template Table Column Name	Appendix L Table Name	Appendix L Table Field

Table 13: Summary of Hydrologic and Hydraulic Analyses



This table can be created by a spatial overlay of S_Profil_Basln and S_Submittal_Info (one record per studied profile baseline where the S_Submittal_Info information is consistent across the entire profile).

Flooding Source	S_Profil_Basln	WTR_NM
Downstream Limit	S_Profil_Basln	R_ST_DESC
Upstream Limit	S_Profil_Basln	R_END_DESC
Hydrologic Model or Method Used	S_Submittal_Info	HYDRO_MDL
Hydraulic Model or Method Used	S_Submittal_Info	HYDRA_MDL
Date Analyses Completed	S_Submittal_Info	COMP_DATE
Flood Zone on FIRM	S_Profil_Basln	INTER_ZONE + query for AO, AH, and AE on non-profile flooding sources and add manually
Special Considerations	S_Profil_Basln	SPEC_CONS1 + SPEC_CONS2 or separate text file if more characters are needed

Table 14: Roughness Coefficients

Flooding Source	L_ManningsN	WTR_NM
Channel “n”	L_ManningsN	CHANNEL_N
Overbank “n”	L_ManningsN	OVERBANK_N

Table 15: Summary of Coastal Analyses

Flooding Source	L_Cst_Model	WTR_NM
From	L_Cst_Model	LIMIT_FROM
To	L_Cst_Model	LIMIT_TO
Hazard Evaluated	L_Cst_Model	HAZARDEVAL
Model or Method Used	L_Cst_Model	SURGE_MDL, STRM_PRM, TDESTAT_MT, WAVEHT_MDL, RUNUP_MDL, SETUP_METH, R_FETCH_MT, and/or EROS_METH

FIS Report Template Table Column Name	Appendix L Table	Appendix L Table Field
Date Analysis was Completed	L_Cst_Model	SURGE_DATE, STM_PRM_DT, TDESTAT_DT, WAVEHT_DT, RUNUP_DATE, SETUP_DATE, R_FETCH_DT, WAVE_EFFDT, and/or EROS_DATE

Section 5.3 Variable Text – provide per Appendix M as needed to summarize methodology

Figure 8: 1% Annual Chance Total Stillwater Elevation for Coastal Areas

– Provide per Appendix M –

Table 16: Tide Gage Analysis Specifics

Gage Name	S_Cst_Gage	GAGE_NM
Managing Agency of Tide Gage Record	S_Cst_Gage	AGENCY
Gage Type	S_Cst_Gage	GAGE_TYPE
Start Date	S_Cst_Gage	START_PD
End Date	S_Cst_Gage	END_PD
Statistical Methodology	L_Cst_Model	TDESTAT_MT via CST_MDL_ID

Table 17: Coastal Transect Parameters

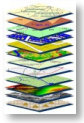
Flood Source	S_Cst_Tsct_Ln	WTR_NM
Coastal Transect	S_Cst_Tsct_Ln	TRAN_NO
Significant Wave Height H_s (ft)	S_Cst_Tsct_Ln S_Cst_Tsct_Ln	SIG_HT ELEV_UNIT
Peak Wave Period T_p (sec)	S_Cst_Tsct_Ln S_Cst_Tsct_Ln	SIG_PD TIME_UNIT
Starting Stillwater Elevations (Vertical Datum)	S_Cst_Tsct_Ln	V_DATUM
Stillwater (SWEL) Elevation Unit	S_Cst_Tsct_Ln	ELEV_UNIT
Starting Stillwater Elevation - 10% Annual Chance	L_Cst_Tsct_Elev	WSEL_START where EVENT_TYP = 10 PERCENT CHANCE EVENT
Range of Stillwater Elevations - 10% Annual Chance	L_Cst_Tsct_Elev	WSEL_MIN + WSEL_MAX where EVENT_TYP = 10 PERCENT CHANCE EVENT
Starting Stillwater Elevation - 4% Annual Chance	L_Cst_Tsct_Elev	WSEL_START where EVENT_TYP = 4 PERCENT CHANCE EVENT

FIS Report Template Table Column Name	Appendix L Table Name	Appendix L Table Field
Range of Stillwater Elevations - 4% Annual Chance	L_Cst_Tsct_Elev	WSEL_MIN + WSEL_MAX where EVENT_TYP = 4 PERCENT CHANCE EVENT
Starting Stillwater Elevation - 2% Annual Chance	L_Cst_Tsct_Elev	WSEL_START where EVENT_TYP = 2 PERCENT CHANCE EVENT
Range of Stillwater Elevations - 2% Annual Chance	L_Cst_Tsct_Elev	WSEL_MIN + WSEL_MAX where EVENT_TYP = 2 PERCENT CHANCE EVENT
Starting Stillwater Elevation - 1% Annual Chance	L_Cst_Tsct_Elev	WSEL_START where EVENT_TYP = 1 PERCENT CHANCE EVENT
Range of Stillwater Elevations - 1% Annual Chance	L_Cst_Tsct_Elev	WSEL_MIN + WSEL_MAX where EVENT_TYP = 1 PERCENT CHANCE EVENT
Starting Stillwater Elevation 0.2% Annual Chance	L_Cst_Tsct_Elev	WSEL_START where EVENT_TYP = 0.2 PERCENT CHANCE EVENT
Range of Stillwater Elevations (ft) 0.2% Annual Chance	L_Cst_Tsct_Elev	WSEL_MIN + WSEL_MAX where EVENT_TYP = 0.2 PERCENT CHANCE EVENT

Figure 7: Transect Locator Map

	S_Cst_Tsct_Ln	TRAN_NO
	S_Tsct_Basln and/or S_Wtr_Ln and/or S_Wtr_Ar	WTR_NM
	S_Pol_Ar	POL_NAME1
	S_Trnsport_Ln	FULLNAME

Table 18: Summary of Alluvial Fan Analyses

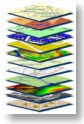


This table can be created by a spatial overlay of S_Alluvial_Fan, S_Profil_Basln, and S_Submittal_Info (one record per studied alluvial fan where the S_Submittal_Info information is consistent across the entire fan).

Flooding Source	S_Alluvial_Fan	ACTIVE_FAN
Location From (apex)	S_Profil_Basln	R_ST_DESC
Location To (toe)	S_Profil_Basln	R_END_DESC
Drainage Area above Apex (sq mi)	S_Alluvial_Fan S_Alluvial_Fan	FANAPEX_DA AREA_UNITS
Model(s) Used	S_Submittal_Info	HYDRA_MDL
Date Analysis was Completed	S_Submittal_Info	COMP_DATE

FIS Report Template Table Column Name	Appendix L Table Name	Appendix L Table Field
Method Description	S_Alluvial_Fan	METH_DESC

Table 19: Results of Alluvial Fan Analyses



This table can be created by a spatial overlay of S_Alluvial_Fan and S_Profil_Basln (one record per studied alluvial fan).

Flooding Source	S_Alluvial_Fan	ACTIVE_FAN
From (apex)	S_Profil_Basln	R_ST_DESC
To (toe)	S_Profil_Basln	R_END_DESC
1% Annual Chance Peak Flow at Fan Apex (unit)	S_Alluvial_Fan	FANAPEX_Q
	S_Alluvial_Fan	DISCH_UNIT
Flood Zones and Depths	If multiple zones and depths, manual from spatial overlay with S_Alluvial_Fan and S_Fld_Haz_Ar	if only one flood zone and depth exist for the alluvial fan, S_Alluvial_Fan FLD_ZONE + DEPTH
Depth (unit)	S_Alluvial_Fan	DEPTH_UNIT
Maximum Velocity	S_Alluvial_Fan	FAN_VEL_MN
Minimum Velocity	S_Alluvial_Fan	FAN_VEL_MX
Velocity (unit)	S_Alluvial_Fan	VEL_UNIT

Table 20: Countywide Vertical Datum Conversion

Quadrangle Name	S_Datum_Conv_Pt	QUAD_NM
Quadrangle Corner	S_Datum_Conv_Pt	QUAD_COR
Latitude	S_Datum_Conv_Pt	Read from GIS data
Longitude	S_Datum_Conv_Pt	Read from GIS data
Conversion from (feet)	S_Datum_Conv_Pt	CONVFACTOR
	S_Datum_Conv_Pt	FROM_DATUM + TO_DATUM
	S_Datum_Conv_Pt	LEN_UNIT
Conversion from	S_Datum_Conv_Pt	FROM_DATUM
Conversion to	S_Datum_Conv_Pt	TO_DATUM
Average Conversion	S_Datum_Conv_Pt	Calculated based on CONVFACTOR for all points
Average Conversion (units)	S_Datum_Conv_Pt	LEN_UNIT

Table 21: Stream-by-Stream Vertical Datum Conversion Calculate variance for each point from CONV_FACTOR to determine if Table 20 needs to be populated (> 0.25 ft)

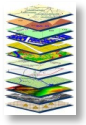
Flooding Source	S_Datum_Conv_Pt	WTR_NM
Average Vertical Datum Conversion Factor (feet)	S_Datum_Conv_Pt	Calculated based on average CONVFACTOR for each WTR_NM

FIS Report Template Table Column Name	Appendix L Table Name	Appendix L Table Field
	S_Datum_Conv_Pt	LEN_UNIT

Table 22: Base Map Sources

Data Type	L_Source_Cit	TITLE for all entries where SOURCE_CIT = “BASE” type
Data Provider	L_Source_Cit	PUBLISHER
Data Date	L_Source_Cit	PUB_DATE
Data Scale	L_Source_Cit	SRC_SCALE
Data Description	– FIRM database metadata –	Source_Contribution keyword

Table 23: Summary of Topographic Elevation Data Used in Mapping



This table can be created by a spatial overlay of S_Pol_Ar, S_Profil_Basln and/or S_Tsct_Basln and S_Submittal_Info (one record per topographic data source).

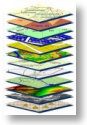
Community	S_Pol_Ar	POL_NAME1
Flooding Source	S_Profil_Basln and/or S_Tsct_Basln	WTR_NM
Source for Topographic Elevation Data: Description	S_Submittal_Info	TOPO_SRC
Source for Topographic Elevation Data: Scale	S_Submittal_Info	TOPO_SCALE
Source for Topographic Elevation Data: Contour Interval	S_Submittal_Info	CONT_INTVL
Source for Topographic Elevation Data: Citation	L_Source_Cit	CITATION

Table 24: Floodway Data

Flooding Source	S_XS	WTR_NM
Cross Section	S_XS	XS_LTR where XS_LN_TYP = “LETTERED”.
Distance	S_XS	STREAM_STN
Floodway: Width (feet)	L_XS_ELEV	FW_WIDTH
	L_XS_ELEV	LEN_UNIT
Floodway: Section Area (sq feet)	L_XS_ELEV	XS_AREA
	L_XS_ELEV	AREA_UNIT
Floodway: Mean Velocity (feet/sec)	L_XS_ELEV	VELOCITY
	L_XS_ELEV	VEL_UNIT
1% Annual Chance Flood Water Surface Elevation: Existing Conditions	L_XS_ELEV	WSEL where EVENT_TYP = 1 PERCENT CHANCE EVENT

FIS Report Template Table Column Name	Appendix L Table	Appendix L Table Field
1% Annual Chance Flood Water Surface Elevation: Existing Conditions: Left Levee	L_XS_ELEV	WSELREG_LL via XS_LN_ID
1% Annual Chance Flood Water Surface Elevation: Existing Conditions: Right Levee	L_XS_ELEV	WSELREG_RL via XS_LN_ID
1% Annual Chance Flood Water Surface Elevation: Future Conditions	L_XS_ELEV	WSEL where EVENT_TYP = 1 PERCENT CHANCE FUTURE EVENT
1% Annual Chance Flood Water Surface Elevation: Existing Conditions without Floodway	L_XS_ELEV	WSEL_WOFWY
1% Annual Chance Flood Water Surface Elevation: Existing Conditions with Floodway	L_XS_ELEV	WSEL_FLDWY
1% Annual Chance Flood Water Surface Elevation: Increase	L_XS_ELEV	WSEL_INCRS
Footnote for Station Start Description	S_Stn_Start	START_DESC via S_XS START_ID
Footnote for elevations computed w/o backwater	L_XS_ELEV	If CALC_WO_BW equals T, add stock text “Computed without consideration of backwater effects”

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams



Most of this table can be created from S_XS joined to L_XS_Elev on the 1% Annual Chance event. The Flood Discharge Field can be obtained via a spatial over using S_XS, L_XS_Elev, L_Summary_Discharges_S_Nodes and S_Subbasins (one record per SELECTED cross section).

Flooding Source	S_XS	WTR_NM
Cross Section	S_XS	XS_LTR
Stream Station	S_XS	STREAM_STN
Flood Discharge (cfs)	L_Summary_Discharges	DISCH where EVENT_TYP = 1 PERCENT ANNUAL CHANCE

FIS Report Template Table Column Name	Appendix L Table	Appendix L Table Field
1% Annual Chance Water Surface Elevation (vertical datum)	L_XS_ELEV	V_DATUM
1% Annual Chance Water Surface Elevation	L_XS_ELEV	WSEL where EVENT_TYP = 1 PERCENT ANNUAL CHANCE
Non-Encroachment Width/ left	L_XS_ELEV	NE_WIDTH_L
Non-Encroachment Width/ right	L_XS_ELEV	NE_WIDTH_R
Footnote for Station Start Description	S_Stn_Start	START_DESC via S_XS START_ID

Table 26: Summary of Coastal Transect Mapping Considerations – provide per Appendix M –

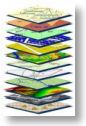
Table 27: Incorporated Letters of Map Change

Case Number	L_MT2_LOMR	CASE_NO
Effective Date	L_MT2_LOMR	EFF_DATE
Flooding Source	L_MT2_LOMR	WTR_NM
FIRM Panel(s)	L_MT2_LOMR	FIRM_PAN

Table 28: Community Map History

Community Name	S_Pol_Ar	POL_NAME1 via L_Comm_Info COM_NFO_ID
Initial Identification Date (First NFIP Map Published)	L_Comm_Info	IN_NFIP_DT
Initial FHBM Effective Date	L_Comm_Info	IN_FHBM_DT
FHBM Revision Date(s)	L_Pol_FHBM	FHBM_DATE via S_Pol_Ar CID via S_Pol_Ar COM_NFO_ID
Initial FIRM Effective Date	L_Comm_Info	IN_FRM_DAT
FIRM Revision Date(s)	L_Comm_Revis	REVIS_DATE via L_Comm_Info COM_NFO_ID

Table 29: Summary of Contracted Studies Included in this FIS Report



This table can be created by a spatial overlay of S_Pol_Ar, S_Profil_Basln and/or S_Tsct_Basln and S_Submittal_Info (one record per flooding source).

Flooding Source	S_Profil_Basln and/or S_Tsct_Basln	WTR_NM
FIS Report Dated	S_Submittal_Info	EFF_DATE
Contractor	S_Submittal_Info	SUBMIT_BY
Number	S_Submittal_Info	CONTRCT_NO

FIS Report Template Table Column Name	Appendix L Table Name	Appendix L Table Field
Work Completed Date	S_Submittal_Info	COMP_DATE
Affected Communities	S_Pol_Ar	POL_NAME1

Table 30: Community Meetings

Community	S_Pol_Ar	POL_NAME1 via L_Comm_Info COM_NFO_ID
FIS Report Dated	L_Meetings	FIS_EFF_DT
Date of Meeting	L_Meetings	MTG_DATE
Meeting Type	L_Meetings	MTG_TYP
Attended By	L_Mtg_POC	AGENCY via MTG_ID

Table 31: Map Repositories

Community	S_Pol_Ar	POL_NAME1 via L_Comm_Info COM_NFO_ID
Address	L_Comm_Info	REPOS_ADR1 + REPOS_ADR2 + REPOS_ADR3
City	L_Comm_Info	REPOS_CITY
State	L_Comm_Info	REPOS_ST
Zip Code	L_Comm_Info	REPOS_ZIP

Table 32: Additional Information

FEMA and the NFIP: FEMA website	Boilerplate (verify that the link works)	
FEMA and the NFIP: NFIP website	Boilerplate (verify that the link works)	
FEMA and the NFIP: NFHL Dataset	Boilerplate (verify that the link works)	
FEMA and the NFIP: FEMA Region	https://hazards.fema.gov and search for Geospatial Data Coordination Contacts by State	
Other Federal Agencies: USGS website	Boilerplate (verify the link works)	
Other Federal Agencies: Hydraulic Engineering Center website	Boilerplate (verify the link works)	
State Agencies and Organizations: State NFIP Coordinator	https://hazards.fema.gov and search for Geospatial Data Coordination Contacts by State	
State Agencies and Organizations: State GIS Coordinator	https://hazards.fema.gov and search for Geospatial Data Coordination Contacts by State	

Column Name	Appendix L Table Name	Appendix L Table Field

Table 33: Bibliography and References

Citation in this FIS Report	L_Source_Cit	CITATION
Publisher/Issuer	L_Source_Cit	PUBLISHER
Publication Title, "Article", Volume, Number, etc	L_Source_Cit	TITLE
Author/Editor	L_Source_Cit	AUTHOR
Place of Publication	L_Source_Cit	PUB_PLACE
Publication Date/Date of Issuance	L_Source_Cit	PUB_DATE
Link	L_Source_Cit	WEBLINK

Not included in template; add column in table when data is developed in studies, per this Guidance

4.3. Guidelines for Specific Tables

4.3.1. Table 1, Listing of NFIP Jurisdictions

- Include all communities that fall within the geographic area of the county in this table, including communities that fall on the boundary line, nonparticipating communities, Areas Not Included, and multi-jurisdictional communities.
- Indicate communities that have no identified Special Flood Hazard Areas (SFHAs) with a footnote.
- In the template, the Village of Summer Beaches illustrates a community for which panels are not printed.

4.3.2. Table 2, Flooding Sources Included in this FIS Report

- Alphabetize the rows by flooding source first; if multiple entries exist for the same flooding source (such as to account where the methodology and/or mapped zone change along the same stream), list in reverse chronological order (newest study first).
- If more than 20 Zone A streams are included, consider listing only large named streams and group other Zone A streams.

4.3.3. Table 6, Principal Flood Problems

The Descriptions of Flood Problems column is populated by combining three fields from the database. If a longer description is needed for a specific flooding source, a tab separated value text file may be submitted instead. After populating this table from the database, check the Descriptions to determine if you need to find and manually copy the text file into this table. Also check that the three fields have been combined correctly and no additional punctuation or spacing is needed.

4.3.4. Table 9, Levees

All accredited levees, PALs, and de-accredited levees should be shown in this table. The decision on whether to include other levees should be made in consultation with FEMA Regional staff and the local communities.

4.3.5. Table 13, Summary of Hydrologic and Hydraulic Analyses

- Query the database and manually populate the "Zone shown on the FIRM" column for non-profile ponding sources (examples include Zones AO and AH and AE associated with ponding).
- If more than 20 Zone A streams are included, consider listing only large named streams and group other Zone A streams.
- The Special Considerations column is populated by combining two fields from the database. If a longer description is needed for a specific flooding source, a tab separated value text file may be submitted instead. After populating this table from the database, check the Special Considerations to determine if you need to find and manually copy the text file into this table. Also check that the two fields have been combined correctly and no additional punctuation or spacing is needed.

4.3.6. Table 18, Summary of Alluvial Fan Analyses

- For an alluvial fan analysis, the "start" is the apex of the study; the "end" is the toe of the study area. The drainage area is the area above the apex.
- Manually edit the "Models Used" output to include multiple models if needed, because the FIRM database will only store a single domain value for model.

4.3.7. Table 24, Floodway Data

If unlettered cross sections have been displayed on the FIRM panels, these are not to be included in the Floodway Data Table. Only lettered or numbered cross sections are displayed in the Floodway Data Tables.

4.3.8. Table 25, Flood Hazard and Non-Encroachment Data for Selected Streams

This table should only be populated if flooding sources were studied that (1) do not have published BFEs on the FIRMs, or (2) do not have a profile in the FIS Report, but there is a project, FEMA Regional, or CTP requirement to report the 1% annual chance flood elevations at selected cross sections for these streams. Widths for non-encroachment zones should be provided in this table if these have been determined rather than floodways. Consult with the FEMA Regional Project Officer if questions remain about whether this table needs to be populated.

4.3.9. Table 28, Community Map History

- The format of the Community Map History table may have changed slightly from previous versions that Mapping Partners are accustomed to seeing.

- Include all communities that fall within the geographic area of the project, including dual-county communities, nonparticipating communities, and communities with some (but not all) maps that have been rescinded. (The unincorporated area and incorporated areas used for a countywide study are not considered a community and should not be included in this table.)
- List the dates for the FHBM and FIRM Revision Date(s) columns in reverse chronological order (most recent date first).
- Indicate communities without SFHAs (No identified Special Flood Hazard Areas) with a footnote.
- As PMRs are completed, include the effective date of the PMR in the "FIRM Revisions Date(s)" column for the communities that received updated FIRMs, even if the PMR did not revise all the panels within that community. Users should, therefore, be aware that the "FIRM Revision Date(s)" column includes all the effective dates of FIRMs for that community, whether the date corresponds to a community-based update, first-time or subsequent countywide revision, or PMR of individual panels.

4.3.10. Table 30, Community Meetings

The final CCO meeting is now referred to as the "CCO Open House."

5. Guidelines for Figures

5.1. General Guidelines

- The FIS Report now includes the FIRM Panel Index as Figure 1. The FIRM Notes to Users that were previously printed on the FIRM Index and individual panels are now included in the FIS Report as Figure 1. The Legend that was printed on individual FIRM panels is included as Figure 3. Refer to Appendix K [July 2011] for Notes to Users and Legend elements that are still shown on the FIRM.
- Figures should be the width of the preceding text block. If they need to be wider than the previous text block to be readable, insert section breaks before and after and change the orientation to landscape. Include centered page numbers at the bottom of figures in landscape orientation.
- Captions are Arial, 11 point, **bold**; centered; with 12 point spacing before and 6 point spacing after.
- Text in figures should be at least the size of body text. Sans serif type is preferred for labeling.

5.2. Guidelines for Specific Figures

5.2.1. Figure 1, FIRM Panel Index

The assigned Mapping Partner shall produce a FIRM Panel Index for every community or county that requires more than one printed map panel. Panel Indexes are prepared in an11" x 17" format to facilitate inclusion in the FIS Report text. Countywide FIRMs may require more than one Panel Index page. In this case, the page number should be indicated in the title block in the following

manner: PANEL INDEX (Sheet 1 of 2). A county locator map shall be added with a rectangle showing the extent of the current index panel. The county locator map is optional for studies with a single page index.

The following base map features shall be shown on the Panel Index: HUC-8 boundaries and political entities. The HUC-8 boundaries should at a minimum cover the entire county and shall be clipped to the county boundary. Each HUC-8 area shall be labeled as detailed in Table 2. All base map features including HUC-8 data should be shown only within the county boundary. Political entities will include CID labels. State parks and national parks do not need to be labeled. If there is not enough space to label them within the map, a numbered key may be used for the congested area. The example index map in Annex C includes only the required features.

Optional features are: Interstate Highways, U.S. Highways, State Highways, County Highways, and railroads as well as major studied streams. The optional features are a subset of the vector data in the FIRM database. Major roads and streams may be shown and labeled, where appropriate, in order to facilitate ease of geographic location by the user.

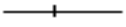
FIRM panels shown on the index should only be labeled with the four-digit panel number and suffix. The effective date is to be placed directly beneath the four-digit FIRM panel number in dd/mm/yyyy format. A 0.75-point white halo is required for all panel labels and optional for any other annotation that may overprint features.

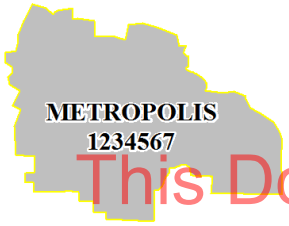
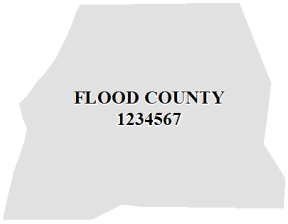
The Panel Index shall identify unprinted panels with asterisks and footnotes that define the reason(s) for the panel not being printed. The appropriate reason(s) for the panel not being printed shall appear as a footnote(s) below the lower left-hand corner of the grid layout. A listing of appropriate footnotes is provided in Table 2.

The Panel Index layout is customizable to a certain degree based upon space requirements for certain features. The Panel Index shall always reside at the top of the page, while the PNP Notes, North Arrow, MSC Note and other notes shall reside at the bottom left, followed by the County Locator (where applicable) and Title Block to the bottom right. In cases where the list of printed panels does not fit in the title block due to the number of panels, the size of the title block may be increased. If more than one Panel Index page is included, only the panels shown on the page should be listed in the Title Block for that page.

Table 2: FIRM Panel Index Elements

Example (not shown to scale)	Feature/Usage	Optional or Required	Specification [Hatch Pattern] (RGB Values) (Font specifications that cannot be matched may be approximated.)
 MAIN STREET	Road Line Road Name	Optional	Line weight 0.72 pt., Orange (230, 152, 0) 6 pt. Arial CAPS, Black

Example (not shown to scale)	Feature/Usage	Optional or Required	Specification [Hatch Pattern] (RGB Values) (Font specifications that cannot be matched may be approximated.)
	Interstate Highway Symbol	Required when roads shown	Standard Interstate Route Shield Line weight 0.72 pt. Size .200" x .200" to .400" x .480", White Fill 6 pt. Arial CLC
	U.S. Highway Symbol	Required when roads shown	Standard U.S. Route Shield Line weight 0.72 pt. Size .200" x .200" to .400" x .480", White Fill 6 pt. Arial CLC
	State Highway Symbol	Required when roads shown	Circle Line weight 0.72 pt. Diameter .200" to .280", White Fill 6 pt. Arial CLC
	County Highway Symbol	Required when roads shown	Rectangle Line weight 0.72 pt Size .150" x .250" to .300" x .400", White Fill 6 pt. Arial CLC
	Railroad Railroad Label	Optional	Vertical hash symbol offset at 90 degrees from main line; Line weight 4 Pt., Black, Hash spacing [7pt - 1pt - 7pt] Line weight 0.72 Pt., Black 6 pt. Arial CAPS, Black
	River or other Hydrographic Feature	Optional	Line weight 0.72 pt., Blue (158, 187, 215) 8 pt. Times New Roman Italic, CLC, Blue (68, 101, 137)
	Lake or other Hydrographic Feature	Optional	Blue Fill (158, 187, 215) 8 pt. Times New Roman Italic, CLC, Blue (68, 101, 137)

Example (not shown to scale)	Feature/Usage	Optional or Required	Specification [Hatch Pattern] (RGB Values) (Font specifications that cannot be matched may be approximated.)
	HUC-8 Boundary	Required	Line weight 0.70 pt., Green (56, 168, 0)
HUC8 17100303 North Watershed	HUC-8 Label	Required	12 pt. Arial, Green (56, 168, 0)
	Incorporated Area, Extraterritorial Jurisdiction and label	Required	Gray Fill (191, 191, 191) Yellow Border (255, 255, 0) 0.50 pt. Width 12 pt. Times New Roman, Bold, CAPS, 0.75 White Halo
	Unincorporated Area and Label	Required	Gray Fill (225, 225, 225) No border 7 pt. Times New Roman, Bold, CAPS
0488B 12/21/9999 **0235X** **12/21/9999** **0625A** **12/21/9999**	FIRM Panel Number and Effective Dates	Required	1:6000 – 5 pt. Arial, Black, Bold, CAPS, 0.75 White Halo 1:12000 – 8 pt. Arial, Black, Bold, CAPS, 0.75 White Halo 1:24000 – 10 pt. Arial, Black, Bold, CAPS, 0.75 White Halo
	FIRM Panel Boundary	Required	Line weight 0.58 pt., Black
	North arrow; can be ESRI standard or equivalent	Required	Line weight .72 pt. Width 0.0755” Height 0.0755”

Example (not shown to scale)	Feature/Usage	Optional or Required	Specification [Hatch Pattern] (RGB Values) (Font specifications that cannot be matched may be approximated.)
Map Projection: Universal Transverse Mercator Zone 10 North; North American Datum 1983	This note identifies the projection of the primary horizontal reference grid shown on the FIRM, as well as identifies the horizontal datum of the geographic (latitude and longitude) coordinates shown at the four corners of each map panel.	Required	8 pt. Arial, Black, CLC
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://MSC.FEMA.GOV	This note refers users to the Map Service Center	Required	7 pt. (255,0,0), Franklin Gothic Medium Cond, CAPS 12 pt. (255,0,0), Franklin Gothic Medium, CAPS
SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION	This note is placed below the red MSC note	Required	7 pt. Franklin Gothic Book, Black, CAPS
	The FIRM scale bar includes reference to feet and emulates the scale bar used by USGS on topographic quadrangles. Note that this scale bar is not shown to actual size; can be ESRI standard or equivalent	Required	Line weight . 72 pts. **(Scale Bar [Feet]) =**Length: 5” **(Scale Bar [Meters]) =** Length: 4.5” **(Map Scale Note) =** 15 pt. Arial CAPS **(Scale Bar Labels) =** 12 pt. Arial CAPS

Example (not shown to scale)	Feature/Usage	Optional or Required	Specification [Hatch Pattern] (RGB Values) (Font specifications that cannot be matched may be approximated.)
	County Locator (within State)	Required when more than one panel index page; optional for index on one page	8 pt. Arial, Black, CAPS Line: Black, 1.25 pt. County of Interest: Black Other Counties: Gray (178, 178, 178) Boundary: White, width 0.40 pt. Rectangle: Red (255, 0, 0), width 2.0 pt.
NATIONAL FLOOD INSURANCE PROGRAM	National Flood Insurance Program Header	Required	12 pt. Franklin Gothic Medium, (0, 82, 171), CAPS
FLOOD INSURANCE RATE MAP PANEL INDEX	Flood Insurance Rate Map Header	Required	11 pt. Franklin Gothic Medium, (156, 156, 156), CAPS
FLOOD INSURANCE RATE MAP PANEL INDEX (1 of 2)	Panel Index for multiple index pages	Required when applies	11 pt. Franklin Gothic Medium, (156, 156, 156), CAPS
	County dividing line	Required	Width 1 pt., Black
FLOOD COUNTY, USA and Incorporated Areas	County Name	Required	10 pt. Franklin Gothic Medium Cond, Black, CAPS 8 pt. Franklin Gothic Book, Black, CAPS
PANELS PRINTED:	Panels Printed	Required	8 pt. Franklin Gothic Medium Cond, Black, CAPS
0025, 0150, 0235	Printed Panel Numbers	Required	8 pt. Franklin Gothic Book, Black, CAPS

Example (not shown to scale)	Feature/Usage	Optional or Required	Specification [Hatch Pattern] (RGB Values) (Font specifications that cannot be matched may be approximated.)
MAP NUMBER 12345CIND0X MAP REVISED DECEMBER 31, 2011	Map Number and Map Revised (or Effective Date)	Required	8 pt. Franklin Gothic Medium Cond, Blue (0, 82, 171), CAPS 8 pt. Franklin Gothic Medium, Black, CAPS
	Department of Homeland Security seal	Required	Width: 1” Height: 1.4”
PANEL NOT PRINTED – NO SPECIAL FLOOD HAZARD AREAS	This note is used to designate panels not printed because the entire panel area does not contain floodplain areas.	Required when applies	7 pt. Arial, Black, CAPS
PANEL NOT PRINTED – NO SPECIAL FLOOD HAZARD AREAS; ALL AREAS WITHIN 0.2% ANNUAL CHANCE FLOODPLAIN	This note is used to indicate panels not printed because the panel area is entirely contained within the 0.2% annual chance floodplain. This note shall be used on a discretionary basis for undeveloped areas of the community. If this area is behind a levee or at least moderately developed (>25000 people per square mile), it shall be a printed panel.	Required when applies	7 pt. Arial, Black, CAPS

Example (not shown to scale)	Feature/Usage	Optional or Required	Specification [Hatch Pattern] (RGB Values) (Font specifications that cannot be matched may be approximated.)
PANEL NOT PRINTED – AREA IN ZONE D	This note is used to indicate panels not printed because the panel area is entirely Zone D.	Required when applies	7 pt. Arial, Black, CAPS
PANEL NOT PRINTED – AREA NOT INCLUDED	This note is used when the area of an entire panel is contained in an Area Not Included.	Required when applies	7 pt. Arial, Black, CAPS
PANEL NOT PRINTED – OPEN WATER AREA	This note is used when an area of all water and no land is contained within the panel area.	Required when applies	7 pt. Arial, Black, CAPS
PANEL NOT PRINTED – AREA ALL WITHIN ZONE AE (EL x)	This note is used when the area of the panel falls within one flood hazard zone (either Zone AE or VE with one flood elevation or A or V). If the panel contains any land area, this procedure shall only be used with the approval of a FEMA Project Officer, as normally any lands areas with flood hazards should be printed. The elevation value is shown here as "x."	Required when applies	7 pt. Arial, Black, CAPS

5.2.2. Figure 2, FIRM Notes to Users

- Every note that is shown on the Notes to Users on one or more of the county's FIRM panels must be included once in the Notes to Users section in the FIS Report.
- If specific panels need to be referenced in the notes, add this information manually.

5.2.3. Figure 3, Map Legend for FIRM

- Refer to Appendix K [July 2011] for the specifications for the Map Legend.
- The special double cross-hatching used to indicate the Colorado River Floodway in the template should only be used in special situations and removed whenever it is not used on the FIRM. This pattern is used to indicate any Area of Special Consideration, the Colorado River Floodway, or a Density Fringe Area.
- With the exception of the elements for Non-Encroachment Zone and Area of Special Consideration, all other elements of the Map Legend should be included in each FIS Report.

5.2.4. Figure 7, Frequency Discharge – Drainage Area Curves

Frequency discharge – drainage area curves for selected flooding sources may be added under this caption if they are needed to explain the methodology for hydraulic analysis, but they are not required. The decision to include these figures should be made on a case-by-case basis.

5.2.5. Figure 9, Transect Location Map

The transect location map should use the same specifications as the Map Legend. Refer to Appendix K [July 2011] for the specifications for the Map Legend.

6. Bibliography and References

- Citations (references within the body of the report) should follow the (Author Year) format in the text to eliminate the need to renumber citations. These can be populated from Appendix L but may require some manual editing for clarity in the FIS report. The U.S. Government Printing Office Style Manual (2008 online) notes that "Consistency is more important than the style itself…." The following references provide additional guidance on the use of citations:
    - Better Report Writing, by Willis H. Waldo Reinhold Publishing Corp., New York,1965.
    - Macmillan Handbook of English, by Robert F. Wilson. Macmillan Co., New York, 1982.
    - Chicago Manual of Style, University of Chicago Press, Chicago, 2003.
    - Words Into Type, Prentice-Hall, New York, 1974."

- Information obtained from web pages should cite the link to the top web page (such as www.fema.gov) at the very least and the date accessed.
- This table should be arranged alphabetically by "Citation in this FIS Report."

7. Profiles

- Profiles should be developed to match the example shown in Annex C (FIS Report Template in PDF format) as closely as possible. Details such as fonts or symbols that cannot be matched should be approximated.

- If the 4% annual chance data was calculated for a flooding source, this data should be included in the profile.
- If unlettered cross sections have been displayed on the FIRM panels, these are not to be included on the flood profile. Only lettered or numbered cross sections are displayed on the flood profiles.
- 3 Tables have been added into Appendix L to accommodate creation of the Flood Profiles from the FIRM Database:
    - **L_Profil_Bkwtr_El** – stores the backwater elevation for each event
    - **L_Profil_Label** – stores the labels (roads, confluences, etc.) used on the profiles
    - **L_XS_Struct** – stores the type of structure, high/low chord, etc. for display on the profiles

8. Preparation of the FIS Report in PDF Format

- A bookmark to the first page of the Table of Contents should be added.
- In addition to bookmarks at the start of each flooding source's Flood Profile (as specified in Appendix J), bookmarks should be added for the first and second heading levels (Heading 1 and Heading 2) and for all tables and figures. PDFs should include active links for all URLs cited in the FIS Report. Bookmarks for tables and for figures should be grouped under their own bookmarks under the TOC bookmark instead of scattered through the other sections.
- In addition to bookmarks for profiles, a hypertext link to each profile name listed in the Exhibits in the Table of Contents should be added.
- The source Word document should be provided with the PDF to assist in preparing future updates to the FIS Report.
- If software that allows individual layers to be saved is used to generate PDFs of flood profiles, remove any "layer" information.

ANNEX A -
Sections of Appendix J, Published April 2003, that are Superseded by this Procedure Memorandum

Table 3 itemizes the sections of Appendix J, published April 2003, that are superseded by guidance in this Procedure Memorandum. These changes represent new or updated guidance for mapping partners.

Table 3: Sections in Appendix J Superseded by this Procedure Memorandum

Date	Affected Section	Revision Description
July 2011	All	Subsections of FIS Report reorganized and renumbered (see next table)
July 2011	J.1.2	"Detailed, " "limited detailed," and "approximate" removed
July 2011	J.1.2	Community description no longer required
July 2011	J.1.3	4-percent-annual-chance added to Table of Discharges and Stillwater Elevations
July 2011	J.2.1	Guidance on determining correct orientation of tables added
July 2011	J.2.1	Guidance on format for citations and Bibliography and References added
July 2011	J.2.1.6	Revisions by Addendum not allowed; revisions require reformatting of FIS and populating FIRM database for restudied areas
July 2011	J.2.1.7	Include outline of subject county and State on cover
July 2011	J.2.1.9	Transect Location map prepared in digital form, not contact negative film
July 2011	J.2.2.1	Flood Profile requirements added
July 2011	J.2.2.2	No manual profiles permitted; digital is required
July 2011	J.5.2.2	No manual document; digital is required
July 2011	J.5.2.1	Bookmarks for all tables and figures also required in PDF
July 2011	J.6	Updated sample FIS Report (see next table for changes to the template)
July 2011	Figures J-1 through J-10	Figures updated in new FIS template
July 2011	Figure J-11 Stream Name Changes Table	Not updated; add this table manually if needed
July 2011	Figures J-12 through J-16	Figures updated in new FIS template

Date	Affected Section	Revision Description
July 2011	Figure J-17 Coastal Flood Insurance Zone Table	No longer used

The following Summary of Changes to the FIS Template table details revisions to the FIS template (Section J.6 of Appendix J) subsequent to the previous publication of that template in April 2003.

Table 4: Summary of Changes to the FIS Template

Date	Old Section Number (2003)	New Section Number	Summary of Change
July 2011	Cover	Cover	Graphic removed and cover redesigned with DHS logo
July 2011	Notice to Flood Insurance Study Users	1.4	Notices to users moved into new section, "Guidance for using this Flood Insurance Study Report"
July 2011	1.1	1.1 and 1.2	Section split into two sections "The National Flood Insurance Program" and "Purpose of this Flood Insurance Study Report"
July 2011	1.1	1.3, Table 1	Communities moved to "Jurisdictions included in the Flood Insurance Study Report" and provided as table with CID, FIRM panels, and location of flood data
July 2011	1.1	1.1	Background on NFIP expanded
July 2011	1.1	1.2	Statement on regulations by states or communities moved
July 2011	1.2	1.3	Content moved and section deleted
July 2011	1.2	7.1, Table 29	Contracted studies moved into new section "Contracted Studies and Community Coordination" and provided in table
July 2011	1.2	6.2, Table 22	Base map information moved into new section "Mapping Methods" and provided in table
July 2011	1.3	1.3	Section renamed "Jurisdictions included in this Flood Insurance Study Project"
July 2011	1.3	7.2, Table 30	Community meetings moved into new section "Community Meetings" and provided in table
July 2011	2.0	4.0	Section moved after new sections

Date	Old Section Number (2003)	New Section Number	Summary of Change
July 2011	2.1	Table 2	Flooding sources moved and provided as table with methods
July 2011	2.2	-	Community descriptions removed
July 2011	2.3	4.2	Section moved
July 2011	2.4	4.3, Table 8 and 9	Section moved and information provided in tables
July 2011	3.0	5.0	Section moved after new sections
July 2011	3.0	5.0	Information presented in tables wherever possible
July 2011	3.0	5.0	Statement and cross reference to table of incorporated LOMRs added
July 2011	3.1	Table 10	Methods for hydrologic analyses moved and summarized in table
July 2011	3.2	5.3	Coastal information moved to new section "Coastal Analyses"
July 2011	3.2	Table 2	Methods for hydraulic analyses moved and summarized in table
July 2011	3.2	5.3	Coastal information moved to new section 5.3 Coastal Analyses
July 2011	3.3	6.1, Tables 22 and 23	Section moved to new section "Mapping Methods" and presented as tables
July 2011	4.0	2.0	Section moved and expanded
July 2011	4.1	6.3, Table 23 and 24	Information on specific mapping practices for floodplain boundaries moved
July 2011	4.2	6.3, Table 23	Information on specific mapping practices for floodways moved
July 2011	4.2	2.2, Figure 4	"Floodway Schematic" moved to new section "Floodways"
July 2011	Floodway Data Table	6.3, Table 23	Moved to new section "Floodplain and Floodway Delineation"
July 2011	5.0	3.0	Section moved and expanded
July 2011	5.0	3.0	Zone descriptions moved into Figure 3 "Map Legend"
July 2011	6.0	2.0 and 3.0	Content moved and section removed
July 2011	7.0	Table 33	"Other Studies" content also incorporated into table "Bibliography and References"
July 2011	8.0	8 and Table 32	FEMA contacts updated and contacts expanded in text and new table "Additional Information"
July 2011	8.0	Table 31	New table "Map Repositories" added

Date	Old Section Number (2003)	New Section Number	Summary of Change
July 2011	9.0	Table 32	Content presented as table with repository location added
July 2011	Citations	Citations	(Author Year) citations used to eliminate need for renumbering
July 2011	10.0	-	No longer used
July 2011	-	1.4	New section “Guidance for using this Flood Insurance Study Report” added
July 2011	-	Figure 1	FIRM Index that was previously published separately now only in FIS
July 2011	-	Figure 2	Notes to users that appeared on FIRM now only in FIS
July 2011	-	Figure 3	Complete Map Legend for FIRM added
July 2011	-	4.1	New section “Basin Description” added with table
July 2011	-	4.4	New section “Levees” added with table
July 2011	-	5.3	New section “Coastal Analyses” added
July 2011	-	5.4	New section “Alluvial Fan Analyses” added
July 2011	-	6.0	New section “Mapping Methods” added
July 2011	-	6.2	New section “Base Map” added
July 2011	-	6.3	New section “Floodplain and Floodway Delineation” added
July 2011	-	6.4	New section “Coastal Flood Hazard Mapping” added
July 2011	-	6.5	New section “FIRM Revision” added

ANNEX B –
FIS Report Template (Microsoft Word Format)

A Microsoft Word 2007 (.docx) version of the FIS Report template
can be downloaded from the MIP

ANNEX C –
FIS Report Template (PDF Format, including profiles and bookmarks)

A PDF version of the FIS Report template
can be downloaded from the MIP

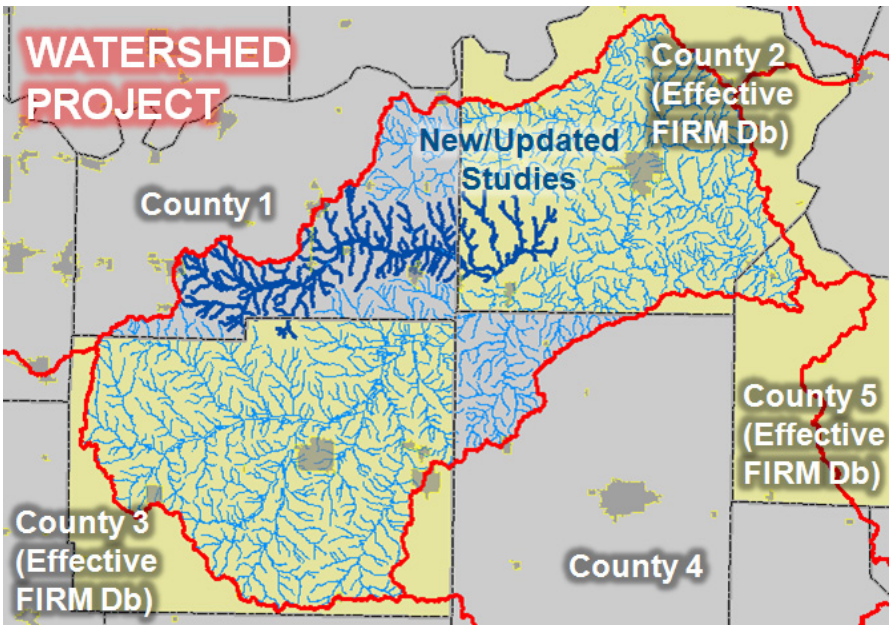
ANNEX D –
Watershed Project Considerations

D.1. Introduction

The FIS Report will continue to be produced at a countywide level. When performing Watershed studies, several scenarios will come into play that will influence production and distribution decisions for the FIS Report. Because the geographic extents of each watershed may vary substantially, along with the availability and format of the previously effective FIS Report(s) within the counties that are affected by the watershed study, Regions and Mapping Partners will need to take several items into consideration as they choose the appropriate way to update the FIS Report with the results from the watershed study. In considering these factors, Regions and Mapping Partners are strongly encouraged to convert to the new FIS Report format whenever possible, as doing so will provide a more useful product to communities, will allow future updates to be made in a more efficient and cost-effective manner, and will lead to greater consistency from study to study.

Figure 3 shows an example of possible scenarios that may occur, as they relate to the decision to update the existing FIS Report(s) to the new format. In the example below, it is assumed that counties 2, 3, and 5 have an effective FIS Report in countywide format, whereas counties 1 and 4 do not. However, only counties 1, 2, and 3 are affected by the new studies conducted within the watershed.

Figure 3. Possible Scenarios Associated with Watershed Projects



D.2. Considerations

The examples that follow refer back to Figure 3 as they relate to the scenarios posed by Counties 1-5 and the decision to update to the new FIS format. While it is recognized that flexibility in the application of these guidelines must be granted, based on unique circumstances or budget constraints, it is strongly encouraged that every effort be made to transition FIS Reports to this new format.

D.2.1. Counties Partially Affected by New Studies

Most watershed studies will affect multiple counties. At the same time, most counties are covered by multiple watersheds, and as such, only a portion of the flooding sources within a particular county may be studied as part of the watershed project. Whenever possible, it is advisable to update the FIS Report to the new format for each county that is affected by the new studies (Counties 1, 2, and 3 in Figure 3). However, in cases where only a small portion of a county is affected by the new studies (County 3), the discretion is left to the Regional Project Officer to decide whether to update the FIS Report in that county to the new format as part of the watershed project, or to amend the information for those flooding sources in the format of the previous countywide FIS Report.

D.2.1.1. FIS Reports that are Updated to the New Format

Because the new FIS Report format provides tables for including additional information that may not have been captured in previous FIS Reports (such as that for levees, coastal areas, and other general study information), if the decision is made to update the county's FIS Report to the new format, the following items should be addressed for flooding sources within the county that were not studied as part of the watershed project.

- **TABLES**: Whether the additional table information should be collected and populated, or listed as "Unknown" or "Not Provided"
- **PROFILES**: Whether the flood profiles be updated graphically to match the examples included within Annex C to this Procedure Memo

In making these decisions, Regions have the flexibility to dictate that all tables be updated or only selected ones. For example, a Region may feel it is necessary or desirable to include all the information in Table 9, "Levees" (owner, FIRM panels affected, status, etc.), even for those levees in other portions of the county not updated as part of the watershed study. However, they may choose not to document the dates that the effective studies were completed within Table 13, "Summary of Hydrologic and Hydraulic Analyses" if those dates are not readily available within the effective FIS Report. This decision should be based upon available budget, anticipated benefit to the reader, and the opportunity to defer the format update until it can be undertaken as adjacent watersheds affecting the county are completed.

D.2.1.2. FIS Reports that are Not Updated to the New Format

If after consultation between the Regional Project Officer and Mapping Partner it is determined not to update the FIS Report to the new format, then the effective FIS Report must be amended for the studied flooding sources.

D.2.2. Format and Availability of Effective FIS Report

Counties that have an effective countywide FIS Report must remain countywide, regardless of whether they are updated to the new FIS Report format or not. In these cases, one and only one FIS Report should be available for the county. For example, this means that it would not be permissible to produce a new FIS Report for the studied flooding sources in County 2 and distribute that to the communities affected by those flooding sources, but keep the effective countywide FIS Report for the communities in the county outside of that area. Unlike the PMR process where panels within a county may have differing effective dates, this does not hold true for a countywide FIS Report.

Counties that do not have an effective FIS Report in countywide format but are affected by new studies within the watershed project, such as the example shown by County 1 in Figure 3, must either have their FIS Report produced in countywide format using the new FIS Report template outlined in this Procedure Memo, or follow the guidance outlined in PM 46 – *Partial Countywide Mapping Evaluation*.

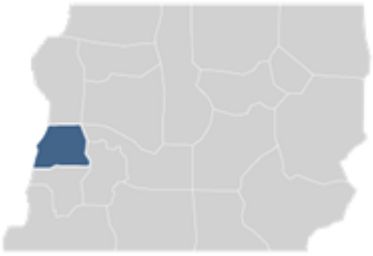
D.2.3. FIS Report Distribution

All communities within a county whose FIS Report is being updated to the new format shall receive a copy of the new FIS Report, regardless of whether they are affected by the new studies or are outside the project watershed altogether.

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 2



FLOOD COUNTY, STATE

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
CITY OF COASTLAND	123456
FLOOD COUNTY UNINCORPORATED AREAS	123457
TOWN OF FLOODVILLE	123458
CITY OF METROPOLIS	123459
VILLAGE OF UPLAND*	123460

*No Special Flood Hazard Areas Identified

FEMA

EFFECTIVE:

DECEMBER 31, 2011

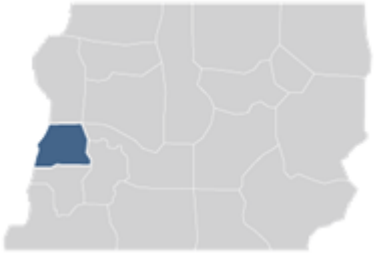
FLOOD INSURANCE STUDY NUMBER
12345CV000X

Version Number 1.0.0.0

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 2



FLOOD COUNTY, STATE

AND INCORPORATED AREAS

COMMUNITY NAME	NUMBER
FLOOD COUNTY UNINCORPORATED AREAS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF COASTLAND	123456

COMMUNITY NAME	NUMBER
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
CITY OF METROPOLIS	123456
TOWN OF FLOODVILLE	123456

EFFECTIVE:

DECEMBER 31, 2011

FLOOD INSURANCE STUDY NUMBER

12345CV001A

Version Number 1.0.0.0

FEMA

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Published Separately

Flood Insurance Rate Map (FIRM)

FLOOD INSURANCE STUDY REPORT
FLOOD COUNTY, STATE

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60.3, *Criteria for land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after

the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as "Post-FIRM" buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) report **revises and updates** information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community's regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of **Flood County, State**.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 1. The Flood Insurance Rate Map (FIRM) panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
City of Coastland	123457	99999998	12345C0234X	
Village of Summer Beaches	123470	99999996	N/A	
Flood County, Unincorporated Areas	123456	99999996, 99999997, 99999998	12345C0234X 12345C0235X	
Town of Floodville	123458	99999998	12345C0200X	
City of Metropolis	123459	99999997, 99999998	12345C0200X	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
City of New Metropolis	123480	99999995, 99999996	N/A	Dry County FIS Report, 2006
Village of Upland[1]	123460	99999997	12345C0100X	

[1] No Special Flood Hazard Areas Identified

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 31, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

  The initial Countywide FIS Report for **Flood County** became effective on **December 31, 9999**. Refer to Table 28 for information about subsequent revisions to the FIRMs.

- **Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels. In addition, former flood hazard zone designations have been changed as follows:**

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X (shaded)
C	X (unshaded)

- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

  The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at http://www.fema.gov or contact your appropriate FEMA Regional Office for more information about this program.

- Previous FIS Reports and FIRMs may have included levees that were accredited as reducing the risk associated with the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems."

  Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database. For all other levees, the user is encouraged to contact the appropriate local community.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at http://www.fema.gov.

Figure 1: FIRM Panel Index

[insert 11x17 of FIRM Panel Index into PDF]

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 28 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the FIS Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

Figure 2. FIRM Notes to Users

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was **Universal Transverse Mercator (UTM) Zone 10.** The horizontal datum was **NAD83, GRS1980 spheroid.** Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the **North American Vertical Datum of 1988.** These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the **North American Vertical Datum of 1988,** visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was provided by **Flood County GIS Department at a scale of 1:5,000. The following panels used base map information provided by the U.S. Geological Survey at a scale of 1:12,000: 125, 130, and 140.** For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Figure 2. FIRM Notes to Users

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within **Flood County, USA**, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 28 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for **Flood County, USA**, effective **December 31, 9999**.

COASTAL BARRIER RESOURCES (CBRS) NOTE: This map includes approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see http://www.fws.gov/habitatconservation/coastal_barrier.html, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

LIMIT OF MODERATE WAVE ACTION: Zone AE has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between Zone VE and the LiMWA (or between the shoreline and the LiMWA for areas where Zone VE is not identified) will be similar to, but less severe than, those in Zone VE.

ACCREDITED LEVEE NOTES TO USERS: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by December 31, 2011. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

Figure 2. FIRM Notes to Users

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone, either at cross section locations or as static whole-foot elevations that apply throughout the zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.
	Regulatory Floodway determined in Zone AE.

Figure 3: Map Legend for FIRM

Non-encroachment zone (see Section 2.4 of this FIS Report for more information)

FLOOD INSURANCE IS NOT AVAILABLE FOR STRUCTURES NEWLY BUILT OR SUBSTANTIALLY IMPROVED ON OR AFTER APRIL 8, 1987, IN THE DESIGNATED COLORADO RIVER FLOODWAY

The Colorado River Floodway was established by Congress in the Colorado River Floodway Protection Act of 1986, Public Law 99-450 (100 Statute 1129). The Act imposes certain restrictions within the Floodway.

OTHER AREAS OF FLOOD HAZARD

Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.

Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.

Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood. See Notes to Users for important information.

OTHER AREAS

Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible

Unshaded Zone X: Areas determined to be outside the 0.2% annual chance flood hazard

FLOOD HAZARD AND OTHER BOUNDARY LINES

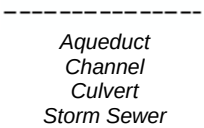
Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)

Limit of Study

Jurisdiction Boundary

Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet

GENERAL STRUCTURES



Channel, Culvert, Aqueduct, or Storm Sewer

Figure 3: Map Legend for FIRM

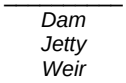
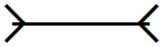
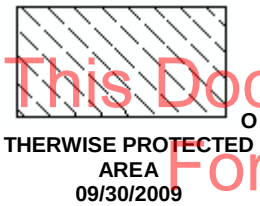
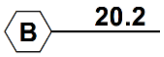
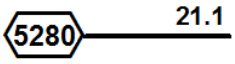
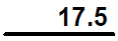
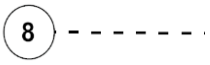
	Dam, Jetty, Weir
	Levee, Dike, or Floodwall accredited or provisionally accredited to reduce the flood risk from the 1% annual chance flood.
	Levee, Dike or Floodwall not accredited to reduce the flood risk from the 1% annual chance flood.
	Bridge
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas. See Notes to Users for important information.*	
	Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.
	Otherwise Protected Area
REFERENCE MARKERS	
	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Coastal Transect
	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.

Figure 3: Map Legend for FIRM

513	Base Flood Elevation Line (shown for flooding sources for which no cross sections or profile are available)
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity
BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}$**E**	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16' 52.5"	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and **Flood County** as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 23), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, "Map Legend for FIRM", describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within **Flood County, USA**, respectively.

Table 2, "Flooding Sources Included in this FIS Report," lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 13. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

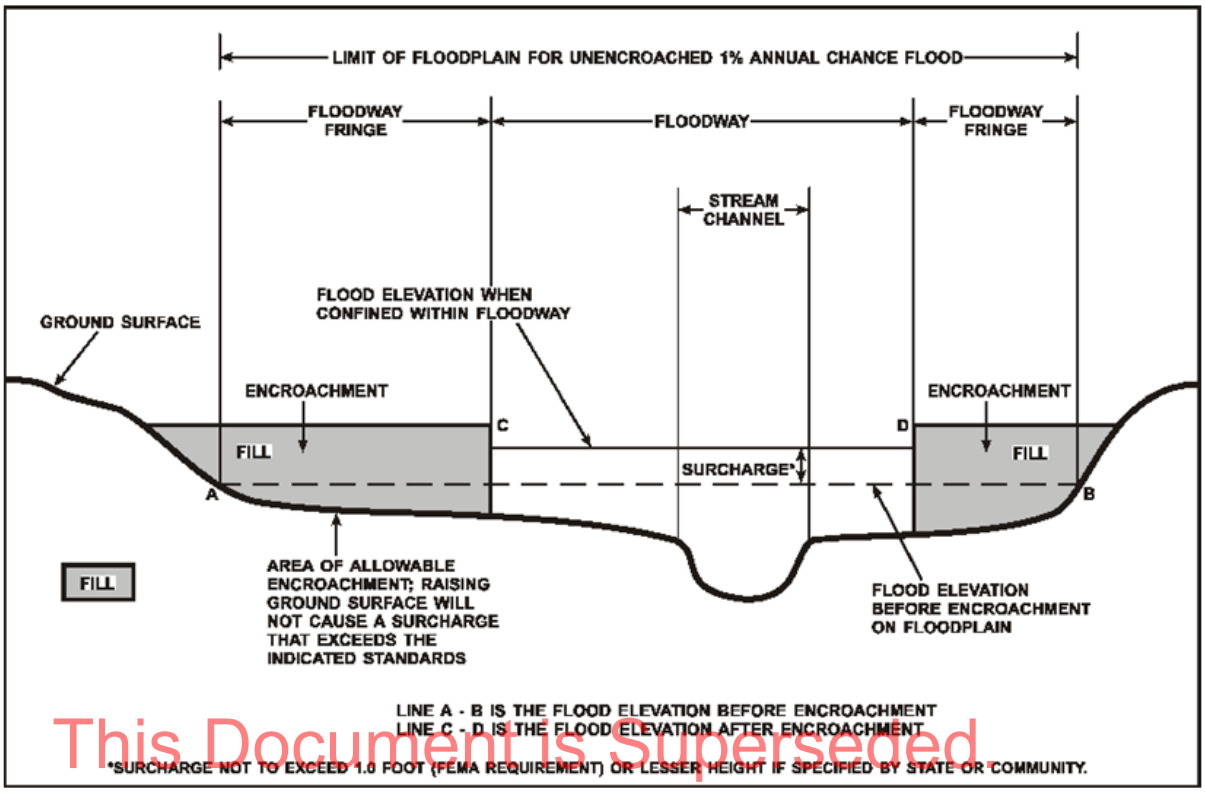
2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. **Regulations for State require communities in Flood County to limit increases caused by encroachment to 0.5 foot and several communities have** adopted **additional restrictions.** The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Big Ocean	City of Coastland, Flood County	Entire Coastline	Entire Coastline	N/A	16.3		N	VE, AE, AO	1989
Culvert Creek	Flood County	Confluence with South Fork Inundation River	2.3 miles upstream of confluence of Ripple Creek	99999998	0.7		N	AE	1997
Inundation River	City of Metropolis	Confluence with Big Ocean	Approximately 500 feet upstream of State Highway 999	99999998	12.5		Y	AE	2007
Inundation River	City of Metropolis	Approximately 500 feet upstream of State Highway 999	Confluence of North Fork Inundation River and South Fork Inundation River	99999998	3.8		N	A	1997
Lily Pond	City of Metropolis	Pear Tree Circle	Westwood Lane	99999997		1.6	N	AE	2002
North Fork Inundation River	City of Coastland, Flood County	Confluence with Inundation River	0.7 miles upstream of Lilac Stream	99999998	4.2		Y	AE	2010
South Fork Inundation River	Flood County	Confluence with Inundation River	3.2 miles upstream of confluence of Culvert Creek	99999998	3.8		Y	AE	2010

All floodways that were developed for this FIS project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

2.4 Non-Encroachment Zones

Some States and communities use non-encroachment zones to manage floodplain development. **For flooding sources with medium flood risk, field surveys are often not collected and surveyed bridge and culvert geometry is not developed. Standard hydrologic and hydraulic analyses are still performed to determine BFEs in these areas. However, floodways are not typically determined, since specific channel profiles are not developed. To assist communities with managing floodplain development in these areas, a "non-encroachment zone" may be provided.** While not a FEMA designated floodway, the non-encroachment zone represents that area around the stream that should be reserved to convey the 1% annual chance flood event. **As with a floodway, all surcharges must fall within the acceptable range in the non-encroachment zone.**

General setbacks can be used in areas of lower risk (e.g. unnumbered Zone A), but these are not considered sufficient where unnumbered Zone A is replaced by Zone AE. The NFIP requires communities to ensure that any development in a non-encroachment area causes no increase in BFEs. Communities must generally prohibit development within the area defined by the non-encroachment width to meet the NFIP requirement. Regulations for State require communities in Flood County to limit increases caused by encroachment to 0.5 foot and several communities have adopted additional restrictions for non-encroachment areas.

Non-encroachment determinations may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this FIS project have been tabulated for selected cross sections and are shown in Table 25, "Flood Hazard and Non-Encroachment Data for Selected Streams." **Areas for which non-encroachment zones are provided show BFEs**

and the 1% annual chance floodplain boundaries mapped as zone AE on the FIRM but no floodways.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this FIS project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

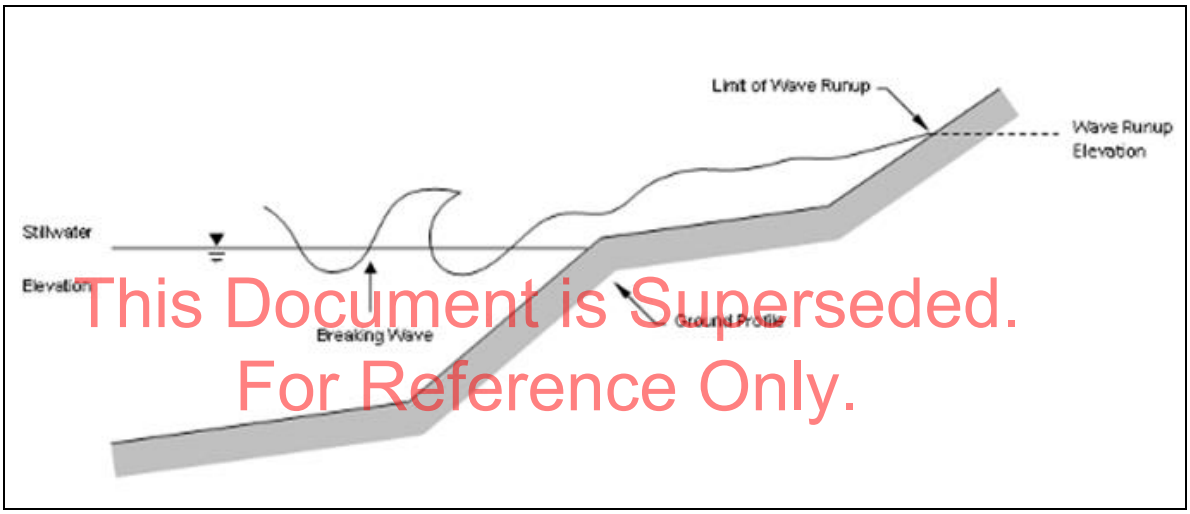
Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced

erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 8, "1% Annual Chance Total Stillwater Levels for Coastal Areas."

In some areas, the 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1% annual chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 26 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 17, "Coastal Transect Parameters." The locations of transects are shown in Figure 9, "Transect Location Map." More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.
- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

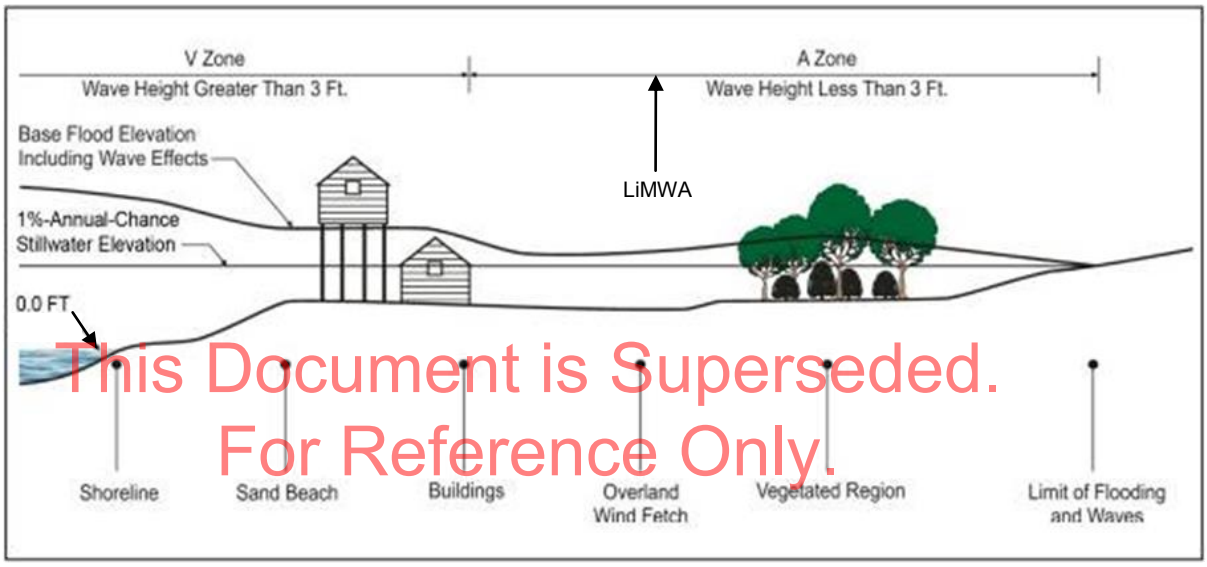
The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented

in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as "A" zones on the FIRM.

Figure 6, "Coastal Transect Schematic," illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this FIS project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM." In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

Laboratory tests and field investigations have shown that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE building construction. Wood-frame, light gage steel, or masonry walls on shallow footings or slabs are subject to damage when exposed to waves less than 3 feet in height. Other flood hazards associated with coastal waves (floating debris, high velocity flow, erosion, and scour) can also damage Zone AE construction.

Therefore, a LiMWA boundary may be shown on the FIRM as an informational layer to assist coastal communities in safe rebuilding practices. The LiMWA represents the

approximate landward limit of the 1.5-foot breaking wave. The location of the LiMWA relative to Zone VE and Zone AE is shown in Figure 6.

The effects of wave hazards in Zone AE between Zone VE (or the shoreline where Zone VE is not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot or greater breaking waves are projected to occur during the 1% annual chance flooding event. Communities are therefore encouraged to adopt and enforce more stringent floodplain management requirements than the minimum NFIP requirements in the LiMWA. The NFIP Community Rating System provides credits for these actions.

Where wave runup elevations dominate over wave heights, there is no evidence to date of significant damage to residential structures by runup depths less than 3 feet. Examples of these areas include areas with steeply sloped beaches, bluffs, or flood protection structures that lie parallel to the shore. In these areas, the FIRM shows the LiMWA immediately landward of the VE/AE boundary. Similarly, in areas where the zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA is delineated immediately landward of the Zone VE/AE boundary.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in the unincorporated and incorporated areas of **Flood County**.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Flood County, Unincorporated Areas	**A, AE, AO, AH, V, VE, X**
City of Coastland	**A, AE, AO, VE, X**
Town of Floodville	**A, X**
City of Metropolis	**A, AE, X**

3.2 Coastal Barrier Resources System

The Coastal Barrier Resources Act (CBRA) of 1982 was established by Congress to create areas

along the Atlantic and Gulf coasts and the Great Lakes, where restrictions for Federal financial assistance including flood insurance are prohibited. In 1990, Congress passed the Coastal Barrier Improvement Act (CBIA), which increased the extent of areas established by the CBRA and added "Otherwise Protected Areas" (OPA) to the system. These areas are collectively referred to as the John. H Chafee Coastal Barrier Resources System (CBRS). The CBRS boundaries that have been identified in the project area are in Table 4, "Coastal Barrier Resource System Information."

Table 4: Coastal Barrier Resources System Information

Primary Flooding Source	CBRS/OPA Type	Date CBRS Area Established	FIRM Panel Number(s)
Big Ocean	**CBRS**	**1/1/1999**	**12345C0235X**

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (**square miles**)
Great-Red River	**99999997**	**Great River**	**Begins at confluence with Inundation River, extends northwest, affecting one third of Flood County**	**598**
Inundation River	**99999998**	**Inundation River**	**Largest watershed within Flood County, encompassing the southeastern half of the county**	**1,058**
Whitewater River	**99999996**	**Whitewater River**	**Begins in Coast Range Mountains and flows through central portion of the county to Inundation River near Coastland**	**789**

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for **Flood County** by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
All sources	Most flooding in Flood County occurs on the Inundation River and its tributaries. Most other rivers and streams in the county flood less frequently. Riverine flooding usually occurs from November through February when storms moving inland off the Big Ocean cause heavy rainfall.
Inundation River	The Inundation River at Metropolis typically exceeds flood stage at least once each winter. In the lower reaches of the Inundation River, higher than normal tides combining with high runoff can cause extensive flooding. Storm runoff is high because of moderately steep to steep terrain and the characteristic low soil permeability in the upper Inundation River valley. A natural constriction in the Inundation River valley downstream of Coastland and tidal influences control the flood elevations at the City of Metropolis. The river valley at Metropolis is flooded an average of 3 months each year. The worst flooding occurs when high tides combine with high runoff and onshore winds during major winter storms.
South Fork Inundation River	The South Fork Inundation River at Floodville typically exceeds flood stage at least once each winter. Flood stage in the Coastland area is higher than in the areas downstream because of a natural constriction in the flood plain immediately downstream of the confluence of the North and South Forks of the Inundation River. In December 1964, the Spruce Street Bridge staff gage at Coastland, indicated that the South Fork Inundation River crested at approximately 11 feet above flood stage (bankfull discharge) with an estimated discharge of 100,000 cfs. This flow has a return period greater than 500 years. Stream gage No. 19999999 on the South Fork Inundation River at Floodville recorded a peak flow of 48,900 cfs . This flow has a return period of about 500 years.
North Fork Inundation River	Flood stage in the Coastland area is higher than in the areas downstream because of a natural constriction in the flood plain immediately downstream of the confluence of the North and South Forks of the Inundation River. Flooding on the North Fork Inundation River is often affected by backwater from the South Fork Inundation River. However, a localized storm system could cause flooding on the North Fork with resulting water surface elevations that are not significantly affected by South Fork flows. During the December 1964 flood, the North Fork Inundation River near Coastland (stream gage No. 19999998) peaked at 38,400 cfs. This flow has a return interval of 55 years.
Big Ocean	Storms during the months of November through February produce the storm surge and wind generated waves which combine with the astronomical tide to cause the most frequent and serious flooding. Seismic sea waves or tsunamis, which can occur at any time during the year, are the most destructive type of ocean flooding. In March 1964, a tsunami generated by an earthquake reached the coast during the high spring tides. Wave heights were about 10 feet above the prevailing mean high water along the Flood County coastline.

Flooding Source	Description of Flood Problems
	In September 2009, Hurricane Amy caused widespread flooding and property damage. Wave heights reached approximately 3 feet above mean high water along the coastline and additional flooding was caused when 6 inches of rain fell during a 24-hour period.

Table 7 contains information about historic flood elevations in the communities within **Flood County**.

Table 7: Historic Flooding Elevations

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Inundation River	Outlet of Inundation River at Big Ocean	19.8	1986	80	USGS gage
South Fork Inundation River	700 feet upstream of Fulton Road	18.8	2007	50	NRCS high water marks

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within **Flood County** such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 8: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Big Ocean	A.B. Smith Jetty	Jetties	At entrance channel	Constructed by USACE in 1929
Big Ocean	N/A	Tidal flooding warnings	Low-lying coastal areas	Flood Weather Forecast Office issues storm tide warnings
Big Ocean	N/A	Berms and riprap	Floodville, along the coast of the Big Ocean	Several property owners in this city have placed berms and riprap to protect homes
Inundation River	N/A	Dam	1.5 miles upstream of Rockhampton Circle	Maintained by Floodville Waterworks
Inundation River	N/A	Dike	Various locations	Not high enough to completely prevent flooding

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
South Fork Inundation River	N/A	navigation channel	Is maintained at 5 feet to RM 8.8; Is maintained at 3 feet from RM 8.8 to RM 9.2	Maintained by USACE

4.4 Levees

For purposes of the NFIP, FEMA only recognizes levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with comprehensive floodplain management criteria. The Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) describes the information needed for FEMA to determine if a levee system reduces the risk from the 1% annual chance flood. This information must be supplied to FEMA by the community or other party when a flood risk study or restudy is conducted, when FIRMs are revised, or upon FEMA request. FEMA reviews the information for the purpose of establishing the appropriate FIRM flood zone.

Levee systems that are determined to reduce the risk from the 1% annual chance flood are accredited by FEMA. FEMA can also grant provisional accreditation to a levee system that was previously accredited on an effective FIRM and for which FEMA is awaiting data and/or documentation to demonstrate compliance with Section 65.10. These levee systems are referred to as Provisionally Accredited Levees, or PALs. Provisional accreditation provides communities and levee owners with a specified timeframe to obtain the necessary data to confirm the levee's certification status. Accredited levee systems and PALs are shown on the FIRM using the symbology shown in Figure 3 and in Table 9. If the required information for a PAL is not submitted within the required timeframe, or if information indicates that a levee system not longer meets Section 65.10, FEMA will de-accredit the levee system and issue an effective FIRM showing the levee-impacted area as a SFHA.

FEMA coordinates its programs with USACE, who may inspect, maintain, and repair levee systems. The USACE has authority under Public Law 84-99 to supplement local efforts to repair flood control projects that are damaged by floods. Like FEMA, the USACE provides a program to allow public sponsors or operators to address levee system maintenance deficiencies. Failure to do so within the required timeframe results in the levee system being placed in an inactive status in the USACE Rehabilitation and Inspection Program. Levee systems in an inactive status are ineligible for rehabilitation assistance under Public Law 84-99.

FEMA coordinated with the USACE, the local communities, and other organizations to compile a list of levees that exist within Flood County. Table 9, "Levees," lists all accredited levees, PALs, and de-accredited levees shown on the FIRM for this FIS Report. Other categories of levees may also be included in the table. The Levee ID shown in this table may not match numbers based on other identification systems that were listed in previous FIS Reports. Levees identified as PALs in the table are labeled on the FIRM to indicate their provisional status.

Please note that the information presented in Table 9 is subject to change at any time. For

that reason, the latest information regarding any USACE structure presented in the table should be obtained by contacting USACE and accessing the USACE national levee database. For levees owned and/or operated by someone other than the USACE, contact the local community shown in Table 31.

Table 9: Levees

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
Flood County, Unincorporated Areas	Inundation River	Right Bank	Flood County Water Supply	Yes	1354212346	Yes	123450C234X	Accredited
Flood County, Unincorporated Areas	Inundation River	Left Bank	Flood County Water Supply	Yes	1234545362	Yes	12345C0234X	Provisionally Accredited
Town of Floodville	Inundation River	Left Bank	Floodville Waterworks	No	1901990990	No	12345C0245X	De-Accredited

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 27, "Incorporated Letters of Map Change", which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, "FIRM Revisions."

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 10. Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 11. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 17.) Stream gage information is provided in Table 12.

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Culvert Creek	Downstream side of Smith Lane	1.0	130	*	170	190	*	240
Inundation River	Confluence with Big Ocean	1,058	77,200	*	107,000	122,000	132,000	143,000
Inundation River	At Coastland	980	73,100	86,800	101,000	116,000	119,000	136,000
Inundation River	At Floodville	930	70,500	82,360	97,100	111,000	115,000	130,000
Inundation River	At Metropolis	902	69,000	81,100	95,000	109,000	113,000	128,000
Inundation River	Confluence with North Fork Inundation River and South Fork Inundation River	879	67,700	*	93,200	107,000	114,00	125,000
North Fork Inundation River	Above State Highway 42	137	18,100	*	24,000	27,000	*	31,600
South Fork Inundation River	Confluence with North Fork	598	51,100	*	69,700	79,600	*	93,300

*Not calculated for this FIS project

Figure 7: Frequency Discharge-Drainage Area Curves

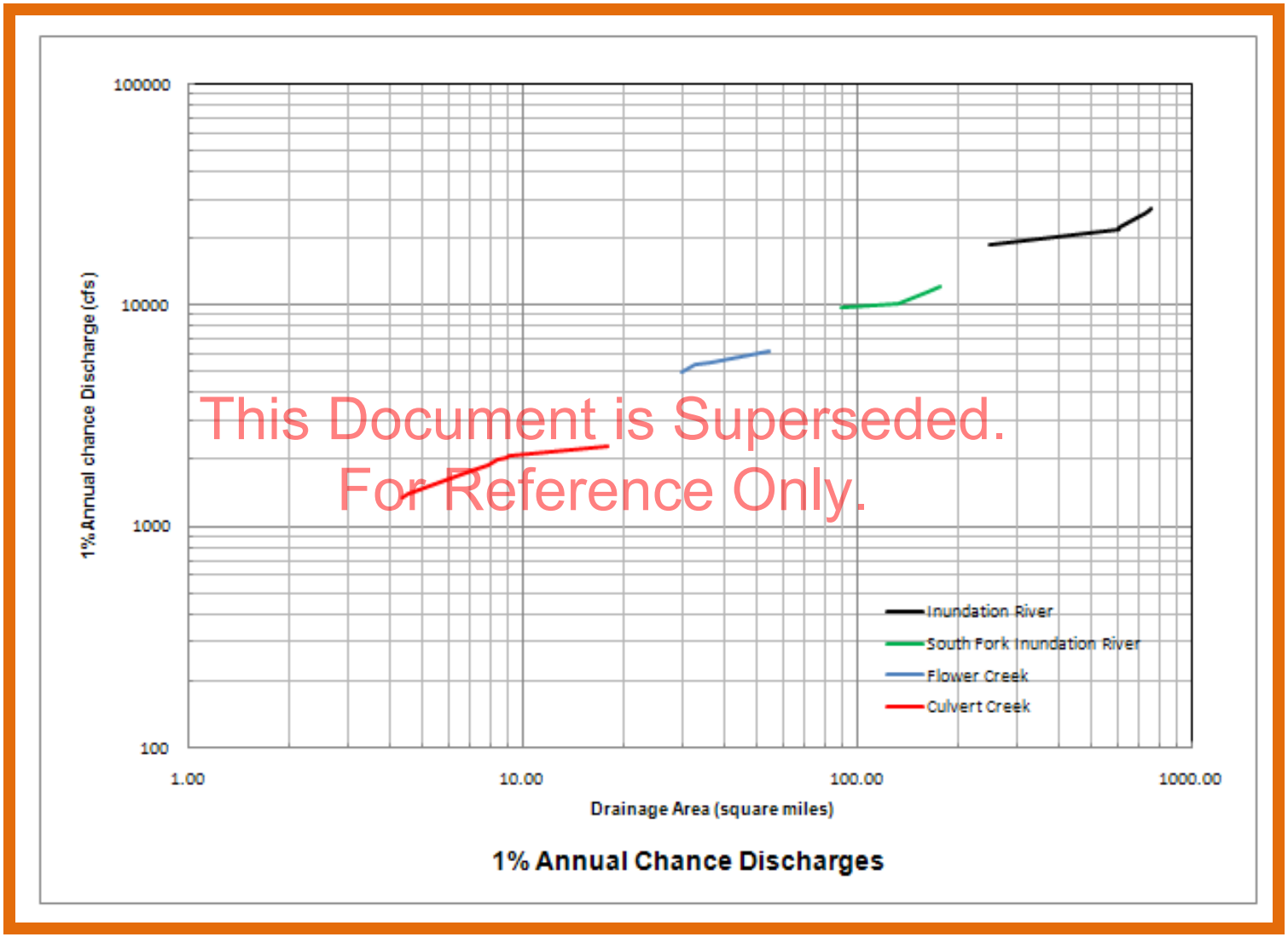


Table 11: Summary of Non-Coastal Stillwater Elevations

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Lily Pond	Metropolis	8.6	*	11.6	12.6	13.3
Central Reservoir	Flood County Unincorporated Areas	12.6	*	14.5	15.2	17.0

*Not calculated for this FIS project

Table 12: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
North Fork Inundation River	19999998	USGS	North Fork Inundation River near Floodville	161	01/14/1915	01/08/2009

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed on Table 24, "Floodway Data."

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Culvert Creek	Confluence with South Fork Inundation River	2.3 miles upstream of confluence of Ripple Creek	1994 State Regression Equations – Region 3	HEC-2 4.6	03/22/1997	AE	Ice jam analysis evaluated by Modified Indirect Method (CRREL 2004). Flood Profile reflects results of ice jam analysis.
Inundation River	Confluence with Big Ocean	Approximately 500 feet upstream of State Highway 999	2004 State Regression Equations – Region 3	HEC-RAS 3.1	06/30/2007	AE w/ Floodway	With and without levee analyses were performed for the reach affected by Levee IDs 1354212346 and 1234545362.
Inundation River	Approximately 500 feet upstream of State Highway 999	Confluence of N. Fork Inundation River and S. Fork Inundation River	2004 State Regression Equations – Region 3	HEC-RAS 3.1	06/30/2007	A	Effects of hydraulic structures were not considered in the model.
Lily Pond	Pear Tree Circle	Westwood Lane	ICPR 2.20	ICPR 2.20	05/28/2002	AE	Elevations determined using ICPR. Survey data utilized in model was based on county information collected in 2008.
North Fork Inundation River	Confluence with Inundation River	0.7 miles upstream of confluence of Lilac Stream	Log Pearson Type III Frequency Analysis	HEC-RAS 4.0	12/12/2010	AE	Gage No. 19999998 was used in hydrologic analysis. Hydraulic models incorporated field measured bridge and culvert data.
South Fork Inundation River	Confluence with Inundation River	3.2 miles upstream of confluence of Culvert Creek	HEC-HMS 3.4	Unsteady HEC-RAS 4.0	12/12/2010	AE w/ Floodway	Hydraulic model was calibrated to high water marks collected for flood of 2007, which was estimated to be the 2% annual chance flood.

Table 14: Roughness Coefficients

Flooding Source	Channel "n"	Overbank "n"
Culvert Creek	0.040-0.060	0.040-0.080
Inundation River	0.040-0.060	0.040-0.080
North Fork Inundation River	0.080-0.100	0.040-0.080
South Fork Inundation River	0.030	0.030-0.035

5.3 Coastal Analyses

For the areas of Flood County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 15 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

Table 15: Summary of Coastal Analyses

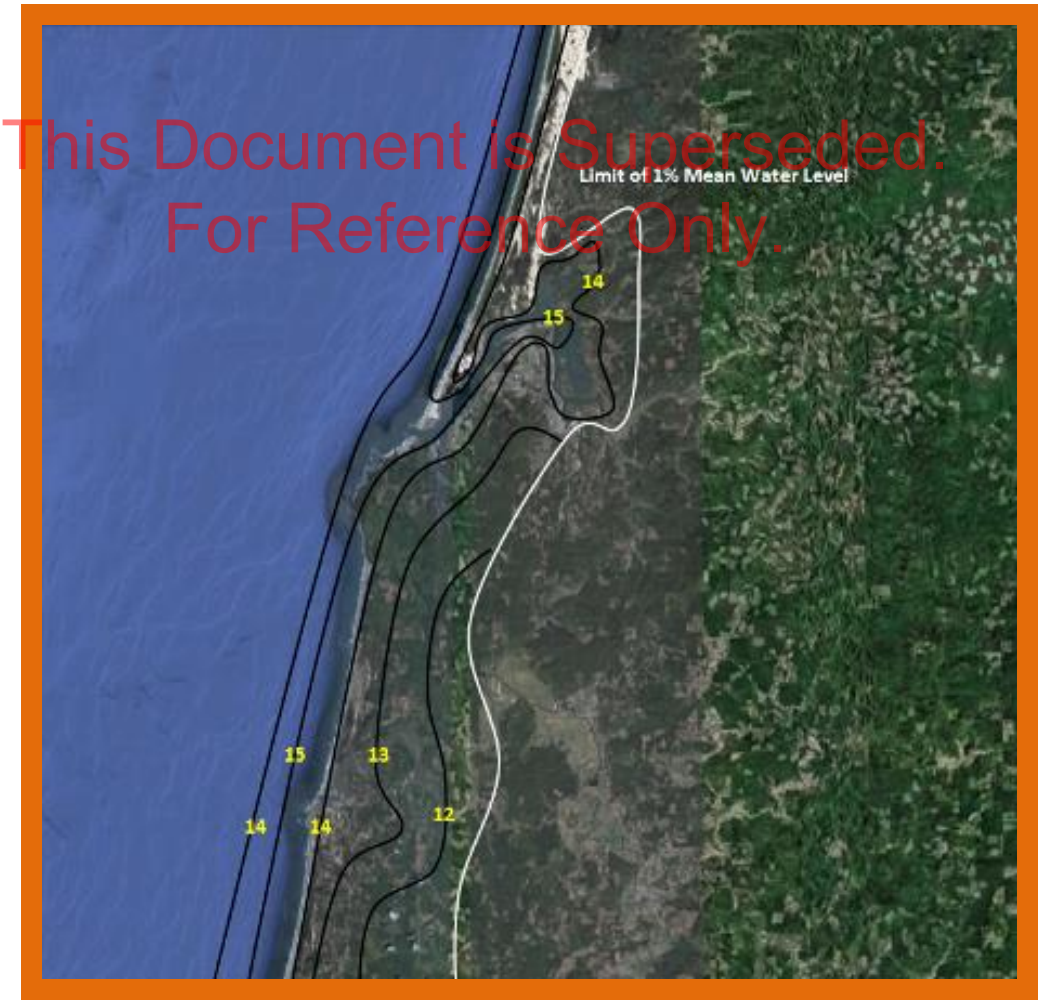
Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Storm Surge	ADCIRC	99/99/9999
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Wave setup	Direct Integration Method (DIM)	99/99/9999
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Statistical Analyses	JPM	99/99/9999
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Wave Runup	TAW	99/99/9999
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Wave Generation	ACES	99/99/9999

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Overland Wave Propagation	WHAFIS	99/99/9999

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1% annual chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 15. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 17, "Coastal Transect Parameters." Figure 8 shows the total stillwater elevations for the 1% annual chance flood that was determined for this coastal analysis.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas



Astronomical Tide

Astronomical tidal statistics were generated directly from local tidal constituents by sampling the predicted tide at random times throughout the tidal epoch.

Storm Surge Statistics

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms or by statistical study of tidal gages.

When historic records are used to calculate storm surge, characteristics such as the strength, size, track, etc., of storms are identified by site. Storm data was used in conjunction with numerical hydrodynamic models to determine the corresponding storm surge levels. An extreme value analysis was performed on the storm surge modeling results to determine a stillwater elevation for the 1% annual chance event.

Tidal gages can be used instead of historic records of storms when the available tidal gage record for the area represents both the astronomical tide component and the storm surge component. Table 16 provides the gage name, managing agency, gage type, gage identifier, start date, end date, and statistical methodology applied to each gage used to determine the stillwater elevations. For areas between gages, peak stillwater elevations for selected recurrence intervals were estimated by combining interpolation between gages and observed high water marks during major storms. A regionalized statistical approach was applied to the gage data so that stillwater elevations in areas between gages could be identified.

Table 16: Tide Gage Analysis Specifics

Gage Name	Managing Agency of Tide Gage Record	Gage Type	Start Date	End Date	Statistical Methodology
N-408	NOAA	Tide	1968	2003	GEV
N-422	NOAA	Tide	1985	2010	GEV

Combined Riverine and Tidal Effects

Riverine and surge rates for the lower reaches of the Inundation River were combined by developing curves for rate of occurrence vs. flood level for each flood source.

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the total stillwater elevations. The oscillating component of wave setup, *dynamic wave setup*, was calculated for areas subject to wave runup hazards.

5.3.2 Waves

A coastal wave model (Coastal State University 2007) was used to calculate the nearshore wave fields required for the addition of wave setup effects. Three nested grids were used to

obtain sufficient nearshore resolution to represent the radiation stress gradients required as ADCIRC inputs. Radiation stress fields output from the inner grids are used by ADCIRC to estimate the contribution of breaking waves (wave setup effects) to the total stillwater elevation.

5.3.3 Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated to determine the modification to existing topography that is expected to be associated with flooding events. Erosion was evaluated using the methods listed in Table 15. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.

5.3.4 Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation and wave runup. These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1% annual chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, "Transect Location Map," are also depicted on the FIRM. Table 17 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, "starting" indicates the parameter value at the beginning of the transect.

Wave Height Analysis

Wave height analyses were performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 6 for a schematic of a coastal transect evaluated for overland wave propagation hazards.

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 15, "Summary of Coastal Analyses".

Wave Runup Analysis

Wave runup analyses were performed to determine the height and extent of runup beyond the limit of stillwater inundation for the 1% annual chance flood. Wave runup elevations were modeled using the methods and models listed in Table 15.

Table 17: Coastal Transect Parameters

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Big Ocean	1	27.2	13	5.6 5.6-5.6	* *	10.6 10.1-10.9	15.7 15.2-15.8	19.6 18.6-19.8

*Not calculated for this FIS project

Figure 9: Transect Location Map

[insert 11x17 inch transect location map in PDF]

5.4 Alluvial Fan Analyses

Alluvial fan flooding can pose significant risk to communities due to uncertain flow paths and the potential for mud and debris flows. Alluvial fans and flooding on alluvial fans show great diversity because of variations in climate, fan history, rates and styles of tectonism, source area lithology, vegetation, and land use. Acknowledging this diversity, FEMA developed an approach that considers site-specific conditions in the identification and mapping of flood hazards on alluvial fans. The FEMA alluvial fan methodology was used to determine the flood depths and velocities on the alluvial fans described in Table 18.

A summary of the peak discharge at the fan apex and results for the 1% annual chance determinations for all the streams studied by alluvial fan analyses is shown in Table 19, "Results of Alluvial Fan Analyses."

Table 18: Summary of Alluvial Fan Analyses

Flooding Source	Location From (apex)	Location To (toe)	Drainage Area above Apex (sq mi)	Model(s) Used	Date Analysis was Completed	Method Description
Culvert Creek Fan	From apex of fan	Highway I-10	24.2	N/A	2005	Geomorphic Data, Post Flood Hazard Verification, and Historical Information
Mountain Wash Fan	Apex of fan	Stan Rd	54.5	FLO-2D, version 2006.07	2006	Risk-Based Analysis
Petal Creek fan	From apex of fan	Tangerine Road	15.8	FLO-2D version 2007.06	2009	Composite Methods
Valley Creek Fan	Apex of N. Fork Inundation River Fan	Maple Ln	44.7	FAN Computer Program	1993	Areas identified with historical aerial photos. FAN analysis used for 1% annual chance flood in active areas. HEC-2 4.6 was used in inactive areas, where incised networks and little risk of avulsion observed.

Table 19: Results of Alluvial Fan Analyses

Flooding Source	Location From (apex)	Location To (toe)	1% Annual Chance Peak Flow at Fan Apex (cfs)	Flood Zones and Depths (ft)	Maximum Velocity (fps)	Minimum Velocity (fps)
Culvert Creek Fan	From apex of fan	Highway I-10	1,750	AO 1-2', AE	1	6
Mountain Wash Fan	From apex of fan	Stan Rd	2,140	AO 1-3'	2	6
Petal Creek Fan	From apex of Petal Creek fan	Tangerine Rd	880	AO 1-3', A	1	7
Valley Creek Fan	From apex of N. Fork Inundation River Fan	Maple Ln	1,500	AO	N/A	N/A

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to **NAVD88**. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please contact information services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for **Flood County** are provided in Table 20.

Table 20: Countywide Vertical Datum Conversion

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Flood SW	**SW**	**44.250**	**-83.625**	**-0.682**
Flood SE	**SE**	**44.250**	**-83.750**	**-0.647**
Flood City	**SE**	**44.250**	**-83.875**	**-0.654**

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Flood Town	SE	44.375	-83.375	-0.708
Coastland	SE	44.375	-83.500	-0.722
Flooding	SE	44.375	-83.625	-0.646
Floodopolis	SE	44.375	-83.750	-0.600
Metropolis SE	SE	44.375	-83.875	-0.554
Metropolis SW	SW	44.500	-83.375	-0.722
Flood Lake	SE	44.500	-83.500	-0.666
Flood Forest	SE	44.500	-83.625	-0.620
Flood Pond	SE	44.500	-83.750	-0.594
Flood Point	SE	44.500	-83.875	-0.658
Floodland	SE	44.250	-83.500	-0.705
Average Conversion from NGVD29 to NAVD88 = -0.640 feet				

A countywide conversion factor could not be generated for Flood County because the maximum variance from average exceeds 0.25 feet. Calculations for the vertical offsets on a stream by stream basis are depicted in Table 21.

Table 21: Stream-by-Stream Vertical Datum Conversion

Flooding Source	Average Vertical Datum Conversion Factor (feet)
Culvert Creek	-0.457
Flower Creek	-0.604
Inundation River	-0.681
Little Creek	-0.545
North Fork Inundation River	-0.627
Petal Creek	-0.513
Small Creek	-0.350
South Fork Inundation River	-0.592
Spring Creek	-0.447
Summer Creek	-0.463

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM database specifications and geographic information standards. This information is

provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Mapping Partners*, Appendix L.

Base map information shown on the FIRM was derived from the sources described in Table 22.

Table 22: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
Digital Orthophoto	Flood County & USGS	2005	1 foot GSD	Color orthoimagery was provided for urban areas of the county
Digital Orthophoto	USGS	1998	1:12,000	Digital Orthophoto Quadrangles were used in rural areas of the county
Political boundaries	Flood County	2005	1:5,000	Municipal and county boundaries
Transportation Features	State Center for Geographic Information	2003	1:10,000	Roads and railroads, were delineated from 2005 orthoimagery
Surface Water Features	State Center for Geographic Information	2003	1:5,000	Streams, rivers, and lakes were derived from NHD data
Public Land Survey System (PLSS)	State Center for Geographic Information	2005	1:24,000	PLSS data were digitized from USGS quadrangles
Benchmarks	NGS	2005	1:24,000	Benchmarks located using NGS data sheets
Airports	State Center for Geographic Information	2003	1:10,000	Airport locations were derived from data provided by the metro transportation authority

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the

boundaries were interpolated using the topographic elevation data described in Table 23. **For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 23, and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 23.**

In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

Certain flooding sources may have been studied that do not have published BFEs on the FIRMs, or for which there is a need to report the 1% annual chance flood elevations at selected cross sections because a published Flood Profile does not exist in this FIS Report. These streams may have also been studied using methods to determine non-encroachment zones rather than floodways. For these flooding sources, the 1% annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. All topographic data used for modeling or mapping has been converted as necessary to NAVD 88. The 1% annual chance elevations for selected cross sections along these flooding sources, along with their non-encroachment widths, if calculated, are shown in Table 25, "Flood Hazard and Non-Encroachment Data for Selected Streams."

Table 23: Summary of Topographic Elevation Data used in Mapping

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Scale	Contour Interval	Citation
Flood County	**All within HUC 99999998**	**LiDAR**	**1:4,800**	**2 ft**	**USGS 2008**
City of Metropolis	**Lily Pond**	**Topographic maps**	**1:24,000**	**10 ft**	**USGS 1988**

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. **Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations.**

Table 24: Floodway Data

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	60	46	262	5.8	20.1	20.1	20.2	0.1
B	160	51	353	4.3	21.5	21.5	22.5	1.0
C	680	170	1,253	1.2	22.0	22.0	22.9	0.9

[1]Feet above mouth

TABLE 24	FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD COUNTY, STATE AND INCORPORATED AREAS	FLOODWAY DATA FLOODING SOURCE: CULVERT CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
009	920	34	219	4.4	22.0	14.2[2]	15.2	1.0
026	2,560	38	188	4.6	22.0	18.0[2]	18.1	0.1
036	3,560	34	187	4.7	22.0	20.0[2]	20.1	0.1
043	4,280	38	169	2.5	22.0	20.1[2]	20.2	0.1
044	4,390	38	169	2.5	22.1	20.1[2]	20.2	0.1
048	4,830	26	102	4.2	22.3	20.6[2]	20.7	0.1
053	5,270	26	109	3.9	22.6	21.5[2]	21.7	0.2
054	5,360	26	109	3.9	22.7	21.5[2]	21.7	0.2
055	5,530	36	167	2.6	22.8	22.0[2]	23.0	1.0

[1]Feet above mouth
[2]Computed without consideration of backwater effects

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: FLOWER CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	82,440	1,395	23,879	4.9	22.2	22.2	23.2	1.0
B	84,620	2,208	42,275	2.7	22.8	22.8	23.8	1.0
C	86,800	2,500	45,371	2.6	23.1	23.1	24.1	1.0
D	89,600	3,921	72,926	1.6	23.3	23.3	24.3	1.0
E	121,600	5,548	88,146	1.3	24.0	24.0	25.0	1.0
F	123,550	6,965	129,249	0.9	24.0	24.0	25.0	1.0
G	126,250	7,598	138,886	0.8	24.0	24.0	25.0	1.0
H	128,400	6,440	125,613	0.9	24.1	24.1	25.1	1.0
I	130,300	7,170	133,927	0.8	24.1	24.1[2]/ 21.3[3]/ 22.1[4]	25.1	1.0
J	132,250	6,701	128,508	0.9	24.1	24.1	25.1	1.0
K	133,050	7,198	131,137	0.8	24.1	24.1	25.1	1.0
L	135,700	6,116	118,706	1.0	24.1	24.1	25.1	1.0
M	137,800	5,938	103,284	1.1	24.1	24.1	25.1	1.0
N	139,600	6,274	115,736	1.0	24.2	24.2	25.2	1.0
O	141,500	6,398	111,041	1.0	24.2	24.2	25.2	1.0
P	143,150	6,551	101,204	1.1	24.2	24.2	25.2	1.0
Q	145,200	5,993	88,563	1.2	24.3	24.3	25.3	1.0
R	168,350	5,616	49,712	2.2	30.4	30.4	31.4	1.0
S	171,350	5,868	47,885	2.3	31.2	31.2	32.2	1.0
T	174,250	7,466	62,370	1.7	31.9	31.9	32.8	0.9
U	191,520	1,091	16,630	6.4	38.0	38.0	39.0	1.0

[1]Feet above mouth
[2]With both levees holding
[3]Without right levee
[4]Without left levee

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: INUNDATION RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	39,950	611	16,224	1.7	36.7	36.7	37.7	1.0
B	43,630	284	7,306	3.7	36.7	36.7	37.7	1.0
C	45,630	282	7,335	3.7	37.0	37.0	38.0	1.0
D	46,590	431	7,137	2.5	37.2	37.2	38.2	1.0
E	48,910	332	6,198	2.9	37.5	37.5	38.5	1.0
F	50,070	439	6,885	2.6	37.7	37.7	38.7	1.0
G	50,670	297	5,233	3.2	37.8	37.8	38.8	1.0
H	50,760	297	5,330	3.2	38.1	38.1	39.1	1.0
I	50,860	297	5,335	3.1	38.2	38.2	39.2	1.0
J	52,260	247	4,812	3.5	38.4	38.4	39.3	0.9
K	53,700	251	4,275	3.9	38.7	38.7	39.6	0.9
L	54,080	175	3,835	4.4	38.8	38.8	39.7	0.9
M	54,130	175	3,835	4.4	38.8	38.8	39.7	0.9
N	54,350	173	3,784	4.4	39.0	39.0	39.8	0.8
O	55,190	173	3,605	4.7	39.2	39.2	40.1	0.9
P	57,150	139	3,352	5.0	39.9	39.9	40.9	1.0

[1]Feet above mouth

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[2]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A[1]	12,930	*	*	*	11.4	11.4	*	*
B	13,165	25	98	4.5	12.2	12.2	13.2	1.0
C	13,315	47	210	2.1	12.8	12.8	13.5	0.7
D	13,835	71	279	1.6	12.9	12.9	13.7	0.8
E	14,345	29	85	4.7	14.1	14.1	14.4	0.3
F	14,425	30	95	4.2	14.6	14.6	14.9	0.3
G	14,695	31	91	4.4	15.5	15.5	15.6	0.1
H	14,985	53	144	2.8	16.2	16.2	16.3	0.1
I	15,785	28	98	2.2	17.2	17.2	17.4	0.2
J	16,465	22	80	2.7	18.4	18.4	19.3	0.9
K	17,965	19	69	3.2	19.8	19.8	20.3	0.5

[1]Floodway not shown for this cross section
[2]Feet above Ocean Bay

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: PETAL CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	17,700	90	1,273	3.1	21.5	21.5	22.5	1.0
B	19,180	339	3,260	1.2	22.3	22.3	23.3	1.0
C	21,380	237	2,389	1.6	22.9	22.9	23.9	1.0
D	22,900	809	7,235	0.5	23.1	23.1	24.1	1.0
E	24,680	973	6,866	0.6	23.2	23.2	24.2	1.0
F	26,200	107	1,577	2.5	23.4	23.4	24.4	1.0
G	26,570	107	1,602	2.4	23.6	23.6	24.6	1.0
H	26,597	107	1,602	2.4	23.7	23.7	24.7	1.0
I	26,807	114	1,680	2.3	23.8	23.8	24.8	1.0

[1]Feet above mouth

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: WINTER CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)				
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY (EXISTING CONDITIONS)	FUTURE CONDITIONS	EXISTING CONDITIONS WITHOUT FLOODWAY	EXISTING CONDITIONS WITH FLOODWAY	INCREASE
A	500	350	7,466	1.8	37.2	37.7	37.2	38.2	1.0
B	620	350	7,221	1.8	37.2	37.7	37.2	38.2	1.0
C	1,020	350	7,632	1.8	37.3	37.8	37.3	38.3	1.0
D	2,620	404	9,307	1.5	37.4	37.9	37.4	38.4	1.0
E	4,580	321	6,278	2.2	37.4	37.9	37.4	38.4	1.0
F	7,020	347	6,501	2.1	37.6	38.1	37.6	38.6	1.0
G	7,940	223	3,395	4.0	37.6	38.1	37.6	38.6	1.0
H	8,140	219	3,346	4.1	37.7	38.2	37.7	38.7	1.0
I	8,190	219	3,337	4.1	37.7	38.2	37.7	38.7	1.0
J	8,420	201	3,175	4.3	37.8	38.3	37.8	38.8	1.0
K	10,700	194	3,745	3.7	38.6	38.4	38.6	39.6	1.0

[1]Feet above mouth

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: WOOD BRANCH

Non-encroachment areas may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this FIS project have been tabulated for selected cross sections and are shown in Table 25. The non-encroachment width indicates the measured distance left and right (looking downstream) from the mapped center of the stream to the non-encroachment boundary based on a surcharge of 1.0 foot or less.

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams

Flooding Source	Cross Section	Stream Station[1]	1% Annual Chance Flood Discharge (cfs)	1% Annual Chance Water Surface Elevation (feet NAVD88)	Non-Encroachment Width (feet)	
					Left	Right
Culvert Creek	179	17,857	850	22.3	50	60
Culvert Creek	195	19,499	780	23.6	60	80
Culvert Creek	210	20,993	780	24.3	20	200
Spring Branch	025	2,487	1,230	32.4	N/A	N/A
Spring Branch	056	5,612	1,090	37.5	N/A	N/A
Spring Branch	077	7,659	860	40.1	N/A	N/A

[1] Feet above mouth

6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Table 23.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1% annual chance flood condition):

- The *primary frontal dune zone* is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

- The *wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

- The *wave overtopping splash zone* is the area landward of the crest of an overtopped

barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.

- The *breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).

- The *high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv^2) is greater than or equal to 200 ft^3/sec^2. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either "V" zones or "A" zones.

Table 26 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 26: Summary of Coastal Transect Mapping Considerations

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis: Zone Designation and BFE (ft NAVD 88)	Wave Height Analysis: Zone Designation and BFE (ft NAVD 88)	Zone VE Limit	SFHA Boundary
1	✓	VE 12	VE 14-16	PFD	PFD
2		N/A	VE 14-16 AE 9-12	Wave Height	SWEL
3		VE 16	N/A	Runup	Overtopping

A LiMWA boundary has also been added in coastal areas subject to wave action for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. To simplify representation, the LiMWA was continued immediately landward of the VE/AE boundary in areas where wave runup elevations dominate. Similarly, in areas where the Zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA was delineated immediately landward of the Zone VE/AE boundary.

6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions to FIS projects may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies.

These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 31, "Map Repositories").

6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA. A LOMA cannot be issued for properties located on the PFD (primary frontal dune).

To obtain an application for a LOMA, visit http://www.fema.gov and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at http://www.fema.gov/plan/prevent/fhm/ot_lmreq.shtm.

For more information about how to apply for a LOMA, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting http://www.fema.gov for the "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Map Information eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at http://www.fema.gov/plan/prevent/fhm/ot_lmreq.shtm.

6.5.4 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If the request for a LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit http://www.fema.gov and download the form "MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision". Visit the "Flood Map-Related Fees" section to determine the cost of applying for a

LOMR. For more information about how to apply for a LOMR, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the **Flood County** FIRM are listed in Table 27.

Table 27: Incorporated Letters of Map Change

Case Number	Effective Date	Flooding Source	FIRM Panel(s)
10-10-0012P	01-01-2010	Inundation River	1234C0234X
10-10-0014P	01-01-2005	North Fork Inundation River	1234C0234X

6.5.3 Physical Map Revisions

PMRs are an official republication of a community's NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community's chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period. When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit http://www.fema.gov and visit the "Flood Map Revision Processes" section.

6.5.4 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

6.5.5 Community Map History

The current FIRM presents flooding information for the entire geographic area of **Flood County**. Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 28, "Community Map History." A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or "pending" (for Preliminary FIS Reports) is shown. If the community is listed in Table 28 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first Flood Hazard Boundary Map (FHBM). This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community. This is the first effective date that is shown on the FIRM panel.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as Physical Map Revisions (PMR) of FIRM panels within the county are completed, the FIRM Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

The initial effective date for the Flood County FIRMs in countywide format was 07/23/2008.

Table 28: Community Map History

Community Name	Initial Identification Date (First NFIP Map Published)	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Coastland, City of	02/15/1973	02/15/1973	10/10/1980 06/23/1975	09/28/1984	12/31/2011 07/23/2008 02/14/2005 09/02/1998
Flood County Unincorporated Areas	11/01/1974	11/01/1974	09/06/1977	08/15/1984	12/31/2011 07/23/2008 10/26/2002 02/18/1998

Community Name	Initial Identification Date (First NFIP Map Published)	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Floodville, Town of	11/01/1974	04/15/1975	N/A	12/15/1984	07/23/2008 01/05/2003 05/26/1998
Metropolis, City of	11/01/1974	12/21/1974	03/04/1983 10/17/1978	06/19/1986	12/31/2011 07/23/2008 09/31/2002 03/22/1999 10/04/1995
Upland, Village of[1]	08/15/1984	N/A	N/A	09/24/1984	07/23/2008 02/18/1992

[1] No Special Flood Hazard Areas Identified

SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

7.1 Contracted Studies

Table 29 provides a summary of the contracted studies, by flooding source, that are included in this FIS Report.

Table 29: Summary of Contracted Studies Included in this FIS Report

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Culvert Creek	12/31/2011	ABC Engineers, Inc.	EMW-C-9999	April 2011	Flood County Uninc. Areas, Metropolis
Inundation River	12/31/2011	ABC Engineers, Inc.	EMW-C-9999	April 2011	Flood County Uninc. Areas, Metropolis
North Fork Inundation River	12/31/2011	ABC Engineers, Inc.	EMW-C-9999	April 2011	City of Coastland, Flood County Uninc. Areas
South Fork Inundation River	12/31/2011	ABC Engineers, Inc.	EMW-C-9999	April 2011	Flood County Uninc. Areas
Big Ocean	2/18/1998	DEF Engineers, Inc.	EMW-C-0000	September 1995	All communities

7.2 Community Meetings

The dates of the community meetings held for this FIS project and any previous FIS projects are shown in Table 30. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

Table 30: Community Meetings

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Flood County and Incorporated Areas	12/31/2011	03/16/2008	Discovery	FEMA, City of Coastland, Town of Floodville, City of Metropolis, the State Department of Land and Development and the State Department of Geology and Mineral Industries
		02/08/2010	Resilience	FEMA, City of Coastland, Town of Floodville, City of Metropolis
		11/30/2010	CCO Open House	FEMA, City of Coastland, Town of Floodville, City of Metropolis, the State Department of Land and Development and the State Department of Geology and Mineral Industries
Town of Coastland	07/28/2008	05/01/2005	Scoping	FEMA, this community and the study contractor
		06/30/2007	Final CCO	FEMA, this community and the study contractor
City of Metropolis	01/08/2006	05/01/2003	Scoping	FEMA, this community and the study contractor
		01/20/2005	Final CCO	FEMA, this community and the study contractor
Town of Floodville	10/26/2002	01/07/1999	Initial CCO	FEMA, this community and the study contractor
		08/15/2001	Final CCO	FEMA, this community and the study contractor
Flood County, Unincorporated Areas	10/1/1974	11/27/1970	Initial CCO	FEMA, City of Coastland, Town of Floodville, City of Metropolis, county, State Department of Land and Development, and the study contractor
		08/30/1973	Final CCO	FEMA, City of Coastland, Town of Floodville, City of Metropolis, county and the study contractor

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see http://www.fema.gov.

The additional data that was used for this project includes the FIS Report and FIRM that were previously prepared for Dry County and the City of New Metropolis, (FEMA 2006). In addition, the USACE prepared a Tsunami Prediction Study for Flood County in 1967 in response to the destruction caused by the March 1964 tsunami (USACE 1964).

Table 31 is a list of the locations where FIRMs for **Flood County** can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 31: Map Repositories

Community	Address	City	State	Zip Code
Flood County, Unincorporated Areas	123 Noah's Ark Drive	Floodville	USA	99999
City of Coastland	456 Sump Pump Boulevard	Coastland	USA	99999
Town of Floodville	789 Highwaters Street	Floodville	USA	99999
City of Metropolis	1234 Stilts Avenue	Metropolis	USA	99999

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 32.

Table 32 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the state NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of state and local GIS data in their state.

Table 32: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	http://www.fema.gov
NFIP website	http://www.fema.gov/business/nfip

NFHL Dataset	http://msc.fema.gov
FEMA Region X	**Federal Regional Center, 130 228th Street SW, Bothell, WA 98021-9796** **(425) 487-4657**
Other Federal Agencies	
USGS website	http://www.usgs.gov
Hydraulic Engineering Center website	http://www.hec.usace.army.mil
State Agencies and Organizations	
State NFIP Coordinator	**Chris Harris, CFM** **Dept. of Land Conservation & Development** **1234 Stilts Avenue** **Metropolis, State 99999** **111-999-0050 x111** **chris.harris@state.gov.us**
State GIS Coordinator	**Julio Gonzales, GISP** **Statewide GIS Coordinator** **1234 Stilts Avenue** **Metropolis, State 99999** **Phone: 111-999-6066** **julie.gonzales@state.gov.us**
Statewide Regulatory Coordinator	**Beth Smith** **Statewide Regulatory Coordinator** **1234 Stilts Avenue** **Metropolis, State 99999** **Phone: 111-999-6032** **beth.smith@state.gov.us**

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 33 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 33: Bibliography and References

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
ABC Eng, 1978	ABC Engineers, Inc.	*Flower Creek Water Supply, Coastland Water Board, City of Coastland, State,* C10933.00		City of Coastland, State	April 1978	City of Coastland Water Board
Coastland 1977	City of Coastland	*Inventory of Coastal Resources for the 1990 Comprehensive Plan*			December 1977	City of Coastland library
Coastland 1978	City of Coastland	*1990 Comprehensive Plan*			September 1978	City of Coastland library
Johnes 1975	A. Johnes and Associates	*A Report on an Engineering Study to Prepare a Master Plan of Storm Sewers for the City of Coastland, State*	Housing and Home Finance Agency Project No. P-ORE-3191	City of Coastland, State	January 1966, reprinted November 1975	http://www.usa.gov
FEMA 1989	Federal Emergency Management Agency	*Flood Insurance Study, Flood County, State, and Unincorporated Areas*		Washington, D.C.	1989	FEMA Map Service Center http://msc.fema.gov
FEMA 1996	Federal Emergency Management Agency	*Flood Insurance Study, City of Floodville, Flood County, State*		Washington, D.C.	1996	FEMA Map Service Center http://msc.fema.gov

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FIA 1977	**U.S. Department of Housing and Urban Development, Federal Insurance Administration**	***Flood Hazard Boundary Map, Flood County, USA, Community-Panel Numbers 410042 0001 through 0021***	**Sidney McFlood**	**Washington, D.C.**	**September 1977**	**FEMA Express Document Delivery (EDDie) http://edd.msc.fema.gov/edd/**
State CES 1967	**State University, Resource Development Section, Cooperative Extension Service**	***Resources Analysis, Flood County, State***	**Dave Waters and Gary Mapper**	**City of Coastland, State**	**December 1967**	**http://extension.state.edu/catalog/**
State Geology and Mineral Industries 1975	**State Department of Geology and Mineral Industries**	***Bulletin 87: Environmental Geology of Flood County, State***	**Tim Flow**	**City of Coastland, State**	**1975**	**State University library http://university.lib.state.edu**
State Sea Grant 1974	**State University, Sea Grant College**	***Descriptions and Information Sources for State Estuaries***	**H. Toow**	**City of Coastland, State**	**May 1974**	**http://seagrant.state.edu**
NWRBC 1968	**Northwest River Basins Commission, Hydraulics and Hydrology Committee**	***River Mile Index, Coastal Tributaries for Inundation River Basin, State***		**City of Coastland, State**	**June 1968**	**State University http://university.lib.state.edu**

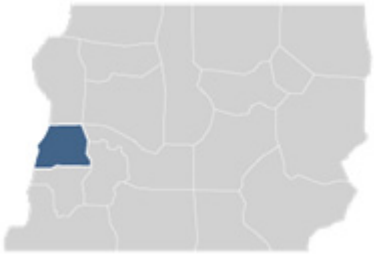
Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
City of Coastland Population Research 1981	State University, Center for Population Research and Census	***Population Estimates, Flood County and Incorporated Cities, July 1, 1980***		City of Coastland, State	March 1981	http://www.pdx.edu/prc/publications-list
SCS 1975	U.S. Department of Agriculture, Soil Conservation Service	***General Soil Map, Flood County, State, Scale 1:126,700***			April 1975	http://www.usa.gov
U.S. Census 2007	U.S. Department of Commerce, Bureau of the Census	"State & County Quickfacts"		Website. accessed October 12, 2010	2007	http://www.census.gov/
USGS 2008	U.S. Department of Interior, Geological Survey	***LiDAR Data, Scale 1:4,800, Contour Interval 2 Feet.***		Washington, D.C.	2008	http://lidar.cr.usgs.gov/
USGS 1988	U.S. Department of Interior, Geological Survey	***7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 Feet.*** Coastland, ST (1984, revised 1988)		Washington, D.C.	Various	http://topomaps.usgs.gov
CRREL 2004	ERDC CRREL	***ERDC_CRREL Technical Note 04-3: Method to Estimate River Ice Thickness Based on Meteorological Data***	K.D. White	Hanover, NH	2004	http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TN04-3.pdf

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
-	**U.S. Department of Agriculture, Soil Conservation Service**	***National Engineering Handbook, Section 4 Hydrology***		**Washington, D.C.**	**August 1972**	**out of print**

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 2



FLOOD COUNTY, STATE

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
CITY OF COASTLAND	123456
FLOOD COUNTY UNINCORPORATED AREAS	123457
TOWN OF FLOODVILLE	123458
CITY OF METROPOLIS	123459
VILLAGE OF UPLAND*	123460

*No Special Flood Hazard Areas Identified

FEMA

EFFECTIVE:

DECEMBER 31, 2011

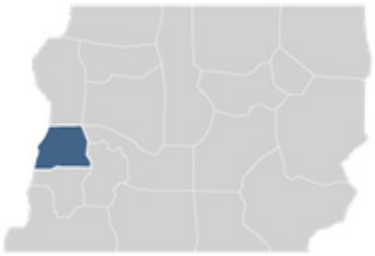
FLOOD INSURANCE STUDY NUMBER
12345CV000X

Version Number 1.0.0.0

FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 2



FLOOD COUNTY, STATE

AND INCORPORATED AREAS

COMMUNITY NAME	NUMBER
FLOOD COUNTY UNINCORPORATED AREAS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
TOWN OF FLOODVILLE	123456
CITY OF COASTLAND	123456

COMMUNITY NAME	NUMBER
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
TOWN OF FLOODVILLE	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF METROPOLIS	123456
CITY OF COASTLAND	123456
CITY OF METROPOLIS	123456
TOWN OF FLOODVILLE	123456

EFFECTIVE:

DECEMBER 31, 2011

FLOOD INSURANCE STUDY NUMBER
12345CV001A

Version Number 1.0.0.0

FEMA

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FLOOD INSURANCE STUDY REPORT
FLOOD COUNTY, STATE

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60.3, *Criteria for land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after

the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as "Post-FIRM" buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) report **revises and updates** information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community's regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of **Flood County, State**.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 1. The Flood Insurance Rate Map (FIRM) panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
City of Coastland	123457	99999998	12345C0234X	
Village of Summer Beaches	123470	99999996	N/A	
Flood County, Unincorporated Areas	123456	99999996, 99999997, 99999998	12345C0234X 12345C0235X	
Town of Floodville	123458	99999998	12345C0200X	
City of Metropolis	123459	99999997, 99999998	12345C0200X	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
City of New Metropolis	123480	99999995, 99999996	N/A	Dry County FIS Report, 2006
Village of Upland[1]	123460	99999997	12345C0100X	

[1] No Special Flood Hazard Areas Identified

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 31, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

  The initial Countywide FIS Report for **Flood County** became effective on **December 31, 9999**. Refer to Table 28 for information about subsequent revisions to the FIRMs.

- **Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels. In addition, former flood hazard zone designations have been changed as follows:**

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X (shaded)
C	X (unshaded)

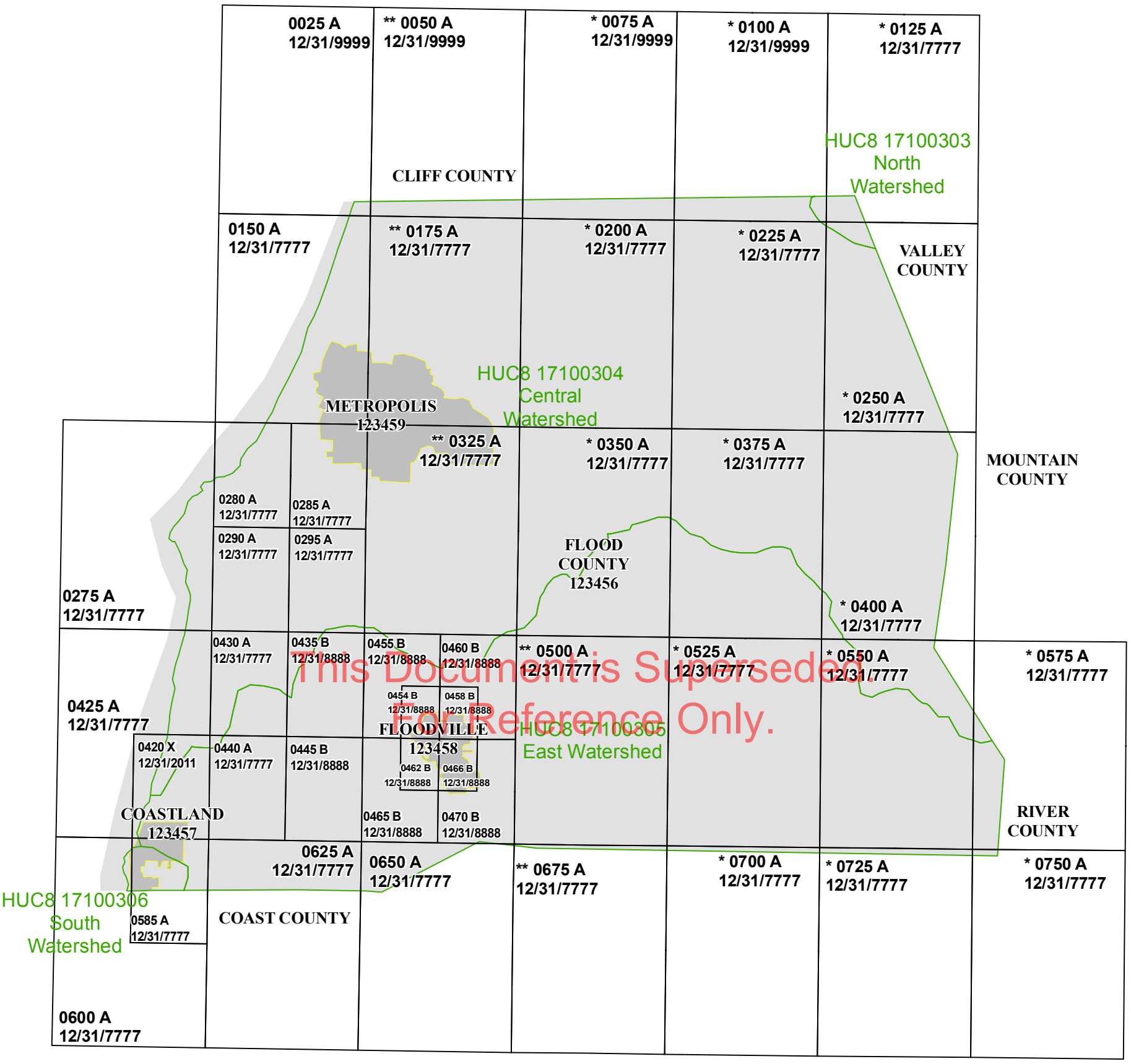
- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

  The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at http://www.fema.gov or contact your appropriate FEMA Regional Office for more information about this program.

- Previous FIS Reports and FIRMs may have included levees that were accredited as reducing the risk associated with the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems."

  Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database. For all other levees, the user is encouraged to contact the appropriate local community.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at http://www.fema.gov.



N

1 inch = 5 miles

0 2.5 5 10 Miles

Map Projection:
Universal Transverse Mercator Zone 10 North;
North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FIS REPORT FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - AREA ALL IN ZONE D
** PANEL NOT PRINTED - AREA ALL IN ZONE X AND ZONE D

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

FLOOD COUNTY, USA and Incorporated Areas

PANELS PRINTED:

0025, 0150, 0275, 0280, 0285, 0290, 0295, 0420, 0425, 0430, 0435, 0440, 0445, 0454, 0455, 0458, 0460, 0462, 0465, 0466, 0470, 0585, 0600, 0625, 0650

FEMA

MAP NUMBER
12345CIND0X

MAP REVISED
DECEMBER 31, 2011

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 28 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the FIS Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

Figure 2. FIRM Notes to Users

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was **Universal Transverse Mercator (UTM) Zone 10.** The horizontal datum was **NAD83, GRS1980 spheroid.** Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the **North American Vertical Datum of 1988.** These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the **North American Vertical Datum of 1988,** visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was provided by **Flood County GIS Department at a scale of 1:5,000. The following panels used base map information provided by the U.S. Geological Survey at a scale of 1:12,000: 125, 130, and 140.** For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Figure 2. FIRM Notes to Users

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within **Flood County, USA**, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 28 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for **Flood County, USA**, effective **December 31, 9999**.

COASTAL BARRIER RESOURCES (CBRS) NOTE: This map includes approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see http://www.fws.gov/habitatconservation/coastal_barrier.html, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

LIMIT OF MODERATE WAVE ACTION: Zone AE has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between Zone VE and the LiMWA (or between the shoreline and the LiMWA for areas where Zone VE is not identified) will be similar to, but less severe than, those in Zone VE.

ACCREDITED LEVEE NOTES TO USERS: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by December 31, 2011. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

Figure 2. FIRM Notes to Users

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone, either at cross section locations or as static whole-foot elevations that apply throughout the zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.
	Regulatory Floodway determined in Zone AE.

Figure 3: Map Legend for FIRM

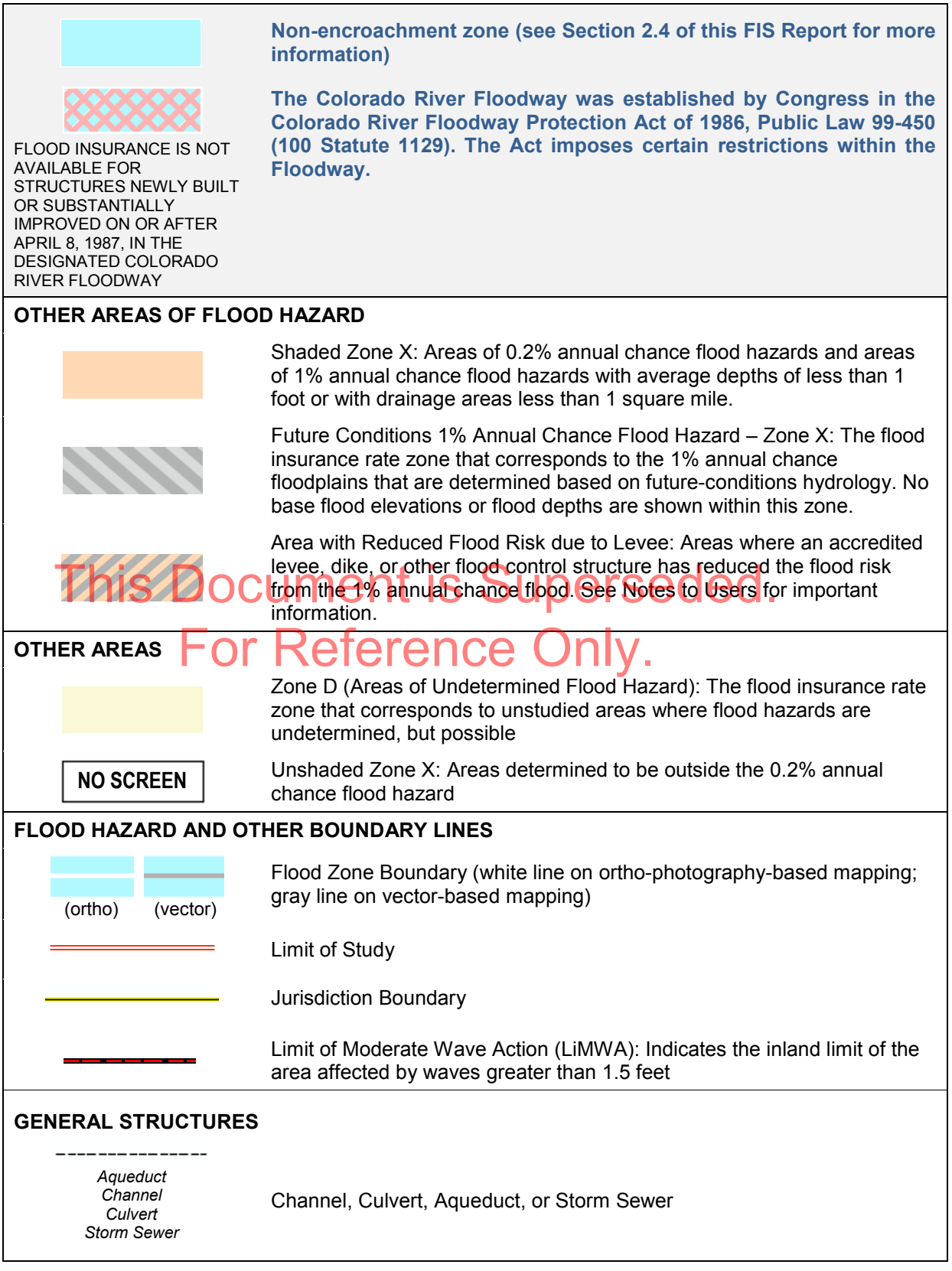
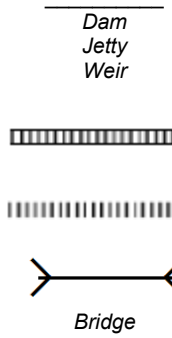


Figure 3: Map Legend for FIRM



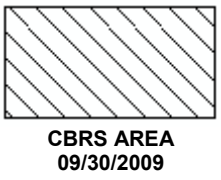
Dam, Jetty, Weir

Levee, Dike, or Floodwall accredited or provisionally accredited to reduce the flood risk from the 1% annual chance flood.

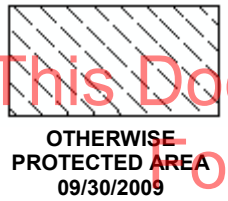
Levee, Dike or Floodwall not accredited to reduce the flood risk from the 1% annual chance flood.

Bridge

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas. See Notes to Users for important information.*



Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.

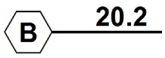


Otherwise Protected Area

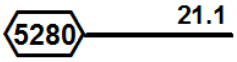
REFERENCE MARKERS

River mile Markers

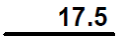
CROSS SECTION & TRANSECT INFORMATION



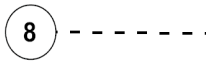
Lettered Cross Section with Regulatory Water Surface Elevation (BFE)



Numbered Cross Section with Regulatory Water Surface Elevation (BFE)



Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)



Coastal Transect

Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.

Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.

Figure 3: Map Legend for FIRM

513	Base Flood Elevation Line (shown for flooding sources for which no cross sections or profile are available)
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity
BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}E$	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16' 52.5"	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and **Flood County** as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 23), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, "Map Legend for FIRM", describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within **Flood County, USA**, respectively.

Table 2, "Flooding Sources Included in this FIS Report," lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 13. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

2.2 Floodways

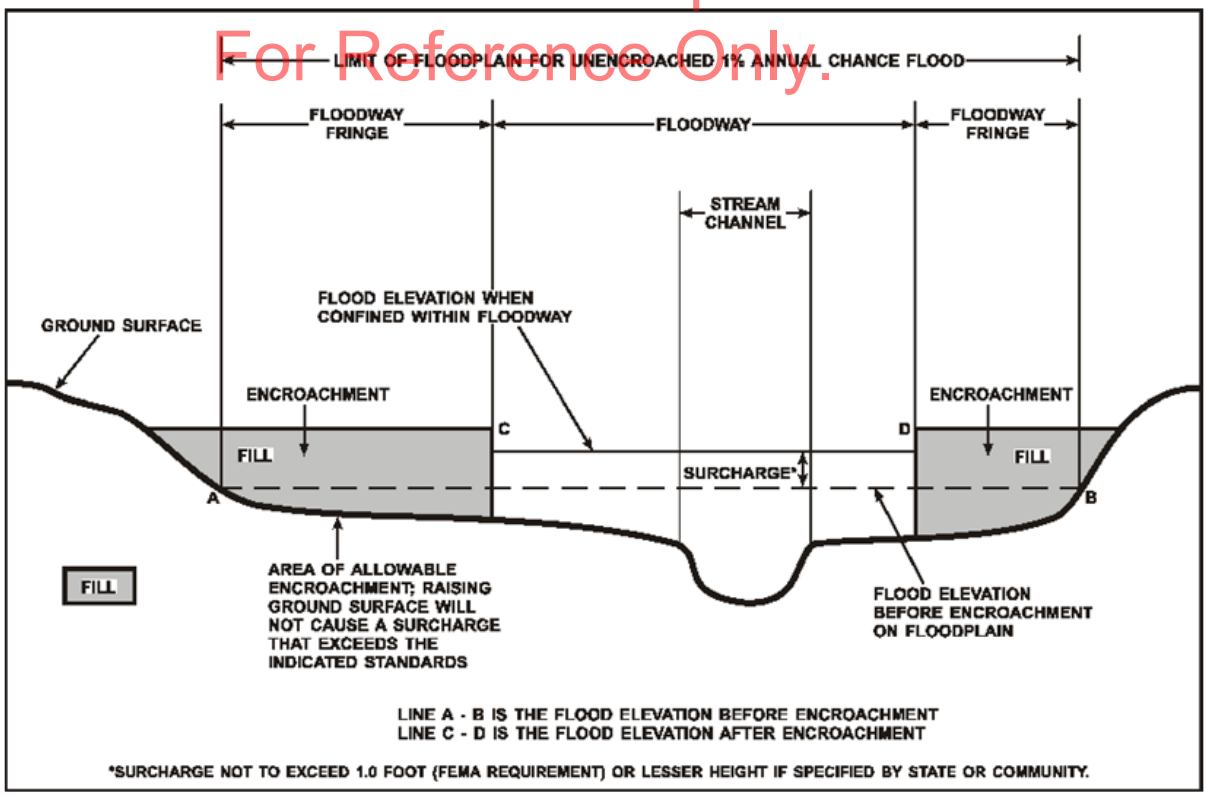
Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the

encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. **Regulations for State require communities in Flood County to limit increases caused by encroachment to 0.5 foot and several communities have** adopted **additional restrictions.** The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections.

Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 24, “Floodway Data.”

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Big Ocean	City of Coastland, Flood County	Entire Coastline	Entire Coastline	N/A	16.3		N	VE, AE, AO	1989
Culvert Creek	Flood County	Confluence with South Fork Inundation River	2.3 miles upstream of confluence of Ripple Creek	99999998	0.7		N	AE	1997
Inundation River	City of Metropolis	Confluence with Big Ocean	Approximately 500 feet upstream of State Highway 999	99999998	12.5		Y	AE	2007
Inundation River	City of Metropolis	Approximately 500 feet upstream of State Highway 999	Confluence of North Fork Inundation River and South Fork Inundation River	99999998	3.8		N	A	1997
Lily Pond	City of Metropolis	Pear Tree Circle	Westwood Lane	99999997		1.6	N	AE	2002
North Fork Inundation River	City of Coastland, Flood County	Confluence with Inundation River	0.7 miles upstream of Lilac Stream	99999998	4.2		Y	AE	2010
South Fork Inundation River	Flood County	Confluence with Inundation River	3.2 miles upstream of confluence of Culvert Creek	99999998	3.8		Y	AE	2010

All floodways that were developed for this FIS project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

2.4 Non-Encroachment Zones

Some States and communities use non-encroachment zones to manage floodplain development. **For flooding sources with medium flood risk, field surveys are often not collected and surveyed bridge and culvert geometry is not developed. Standard hydrologic and hydraulic analyses are still performed to determine BFEs in these areas. However, floodways are not typically determined, since specific channel profiles are not developed. To assist communities with managing floodplain development in these areas, a "non-encroachment zone" may be provided.** While not a FEMA designated floodway, the non-encroachment zone represents that area around the stream that should be reserved to convey the 1% annual chance flood event. **As with a floodway, all surcharges must fall within the acceptable range in the non-encroachment zone.**

General setbacks can be used in areas of lower risk (e.g. unnumbered Zone A), but these are not considered sufficient where unnumbered Zone A is replaced by Zone AE. The NFIP requires communities to ensure that any development in a non-encroachment area causes no increase in BFEs. Communities must generally prohibit development within the area defined by the non-encroachment width to meet the NFIP requirement. Regulations for State require communities in Flood County to limit increases caused by encroachment to 0.5 foot and several communities have adopted additional restrictions for non-encroachment areas.

Non-encroachment determinations may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this FIS project have been tabulated for selected cross sections and are shown in Table 25, "Flood Hazard and Non-Encroachment Data for Selected Streams." **Areas for which non-encroachment zones are provided show BFEs**

and the 1% annual chance floodplain boundaries mapped as zone AE on the FIRM but no floodways.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this FIS project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

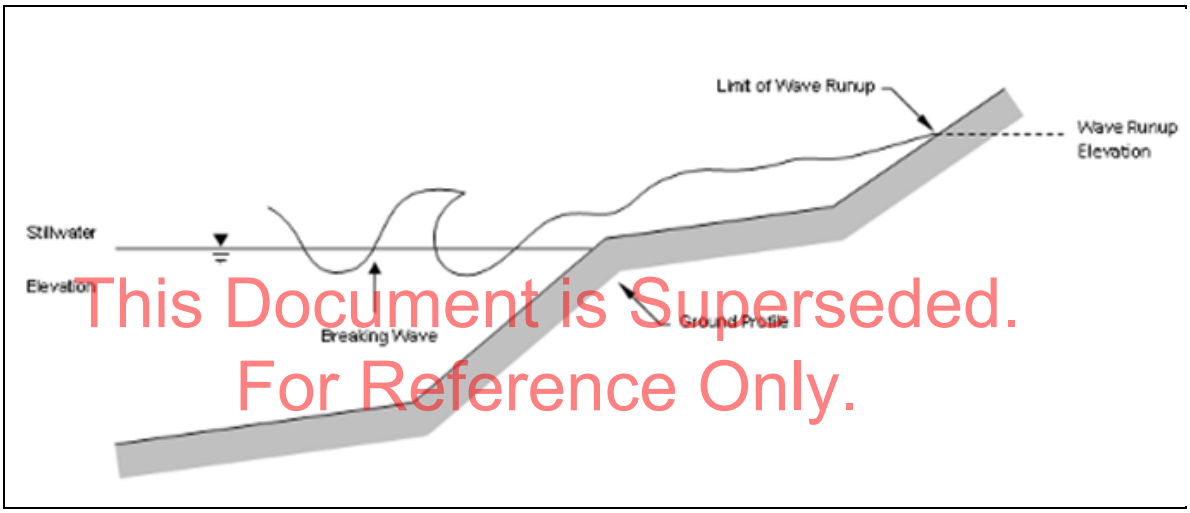
Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced

erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 8, "1% Annual Chance Total Stillwater Levels for Coastal Areas."

In some areas, the 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1% annual chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 26 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 17, "Coastal Transect Parameters." The locations of transects are shown in Figure 9, "Transect Location Map." More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.
- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

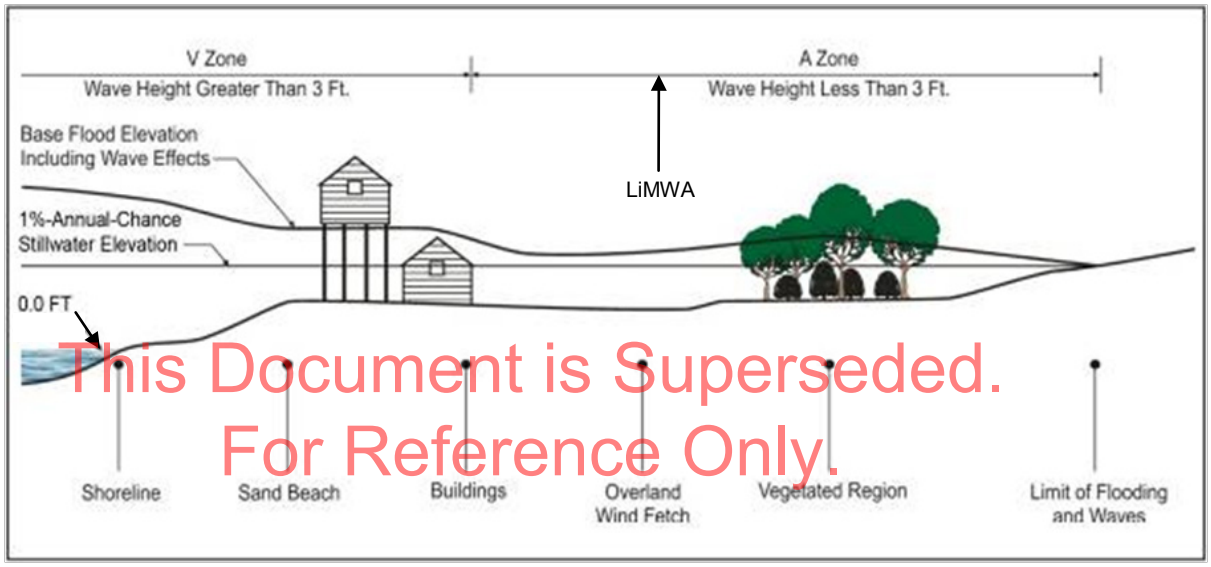
The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented

in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as "A" zones on the FIRM.

Figure 6, "Coastal Transect Schematic," illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this FIS project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM." In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

Laboratory tests and field investigations have shown that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE building construction. Wood-frame, light gage steel, or masonry walls on shallow footings or slabs are subject to damage when exposed to waves less than 3 feet in height. Other flood hazards associated with coastal waves (floating debris, high velocity flow, erosion, and scour) can also damage Zone AE construction.

Therefore, a LiMWA boundary may be shown on the FIRM as an informational layer to assist coastal communities in safe rebuilding practices. The LiMWA represents the

approximate landward limit of the 1.5-foot breaking wave. The location of the LiMWA relative to Zone VE and Zone AE is shown in Figure 6.

The effects of wave hazards in Zone AE between Zone VE (or the shoreline where Zone VE is not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot or greater breaking waves are projected to occur during the 1% annual chance flooding event. Communities are therefore encouraged to adopt and enforce more stringent floodplain management requirements than the minimum NFIP requirements in the LiMWA. The NFIP Community Rating System provides credits for these actions.

Where wave runup elevations dominate over wave heights, there is no evidence to date of significant damage to residential structures by runup depths less than 3 feet. Examples of these areas include areas with steeply sloped beaches, bluffs, or flood protection structures that lie parallel to the shore. In these areas, the FIRM shows the LiMWA immediately landward of the VE/AE boundary. Similarly, in areas where the zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA is delineated immediately landward of the Zone VE/AE boundary.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in the unincorporated and incorporated areas of **Flood County**.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Flood County, Unincorporated Areas	**A, AE, AO, AH, V, VE, X**
City of Coastland	**A, AE, AO, VE, X**
Town of Floodville	**A, X**
City of Metropolis	**A, AE, X**

3.2 Coastal Barrier Resources System

The Coastal Barrier Resources Act (CBRA) of 1982 was established by Congress to create areas

along the Atlantic and Gulf coasts and the Great Lakes, where restrictions for Federal financial assistance including flood insurance are prohibited. In 1990, Congress passed the Coastal Barrier Improvement Act (CBIA), which increased the extent of areas established by the CBRA and added "Otherwise Protected Areas" (OPA) to the system. These areas are collectively referred to as the John. H Chafee Coastal Barrier Resources System (CBRS). The CBRS boundaries that have been identified in the project area are in Table 4, "Coastal Barrier Resource System Information."

Table 4: Coastal Barrier Resources System Information

Primary Flooding Source	CBRS/OPA Type	Date CBRS Area Established	FIRM Panel Number(s)
Big Ocean	CBRS	1/1/1999	12345C0235X

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Great-Red River	99999997	Great River	Begins at confluence with Inundation River, extends northwest, affecting one third of Flood County	598
Inundation River	99999998	Inundation River	Largest watershed within Flood County, encompassing the southeastern half of the county	1,058
Whitewater River	99999996	Whitewater River	Begins in Coast Range Mountains and flows through central portion of the county to Inundation River near Coastland	789

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for Flood County by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
All sources	**Most flooding in Flood County occurs on the Inundation River and its tributaries. Most other rivers and streams in the county flood less frequently. Riverine flooding usually occurs from November through February when storms moving inland off the Big Ocean cause heavy rainfall.**
Inundation River	**The Inundation River at Metropolis typically exceeds flood stage at least once each winter. In the lower reaches of the Inundation River, higher than normal tides combining with high runoff can cause extensive flooding. Storm runoff is high because of moderately steep to steep terrain and the characteristic low soil permeability in the upper Inundation River valley. A natural constriction in the Inundation River valley downstream of Coastland and tidal influences control the flood elevations at the City of Metropolis. The river valley at Metropolis is flooded an average of 3 months each year. The worst flooding occurs when high tides combine with high runoff and onshore winds during major winter storms.**
South Fork Inundation River	**The South Fork Inundation River at Floodville typically exceeds flood stage at least once each winter.** **Flood stage in the Coastland area is higher than in the areas downstream because of a natural constriction in the flood plain immediately downstream of the confluence of the North and South Forks of the Inundation River. In December 1964, the Spruce Street Bridge staff gage at Coastland, indicated that the South Fork Inundation River crested at approximately 11 feet above flood stage (bankfull discharge) with an estimated discharge of 100,000 cfs. This flow has a return period greater than 500 years. Stream gage No. 19999999 on the South Fork Inundation River at Floodville recorded a peak flow of 48,900 cfs . This flow has a return period of about 500 years.**
North Fork Inundation River	**Flood stage in the Coastland area is higher than in the areas downstream because of a natural constriction in the flood plain immediately downstream of the confluence of the North and South Forks of the Inundation River.** **Flooding on the North Fork Inundation River is often affected by backwater from the South Fork Inundation River. However, a localized storm system could cause flooding on the North Fork with resulting water surface elevations that are not significantly affected by South Fork flows. During the December 1964 flood, the North Fork Inundation River near Coastland (stream gage No. 19999998) peaked at 38,400 cfs. This flow has a return interval of 55 years.**
Big Ocean	**Storms during the months of November through February produce the storm surge and wind generated waves which combine with the astronomical tide to cause the most frequent and serious flooding. Seismic sea waves or tsunamis, which can occur at any time during the year, are the most destructive type of ocean flooding.** **In March 1964, a tsunami generated by an earthquake reached the coast during the high spring tides. Wave heights were about 10 feet above the prevailing mean high water along the Flood County coastline.**

Flooding Source	Description of Flood Problems
	In September 2009, Hurricane Amy caused widespread flooding and property damage. Wave heights reached approximately 3 feet above mean high water along the coastline and additional flooding was caused when 6 inches of rain fell during a 24-hour period.

Table 7 contains information about historic flood elevations in the communities within Flood County.

Table 7: Historic Flooding Elevations

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Inundation River	Outlet of Inundation River at Big Ocean	19.8	1986	80	USGS gage
South Fork Inundation River	700 feet upstream of Fulton Road	18.8	2007	50	NRCS high water marks

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within Flood County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 8: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Big Ocean	A.B. Smith Jetty	Jetties	At entrance channel	Constructed by USACE in 1929
Big Ocean	N/A	Tidal flooding warnings	Low-lying coastal areas	Flood Weather Forecast Office issues storm tide warnings
Big Ocean	N/A	Berms and riprap	Floodville, along the coast of the Big Ocean	Several property owners in this city have placed berms and riprap to protect homes
Inundation River	N/A	Dam	1.5 miles upstream of Rockhampton Circle	Maintained by Floodville Waterworks
Inundation River	N/A	Dike	Various locations	Not high enough to completely prevent flooding

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
South Fork Inundation River	N/A	navigation channel	Is maintained at 5 feet to RM 8.8; Is maintained at 3 feet from RM 8.8 to RM 9.2	Maintained by USACE

4.4 Levees

For purposes of the NFIP, FEMA only recognizes levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with comprehensive floodplain management criteria. The Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) describes the information needed for FEMA to determine if a levee system reduces the risk from the 1% annual chance flood. This information must be supplied to FEMA by the community or other party when a flood risk study or restudy is conducted, when FIRMs are revised, or upon FEMA request. FEMA reviews the information for the purpose of establishing the appropriate FIRM flood zone.

Levee systems that are determined to reduce the risk from the 1% annual chance flood are accredited by FEMA. FEMA can also grant provisional accreditation to a levee system that was previously accredited on an effective FIRM and for which FEMA is awaiting data and/or documentation to demonstrate compliance with Section 65.10. These levee systems are referred to as Provisionally Accredited Levees, or PALs. Provisional accreditation provides communities and levee owners with a specified timeframe to obtain the necessary data to confirm the levee's certification status. Accredited levee systems and PALs are shown on the FIRM using the symbology shown in Figure 3 and in Table 9. If the required information for a PAL is not submitted within the required timeframe, or if information indicates that a levee system not longer meets Section 65.10, FEMA will de-accredit the levee system and issue an effective FIRM showing the levee-impacted area as a SFHA.

FEMA coordinates its programs with USACE, who may inspect, maintain, and repair levee systems. The USACE has authority under Public Law 84-99 to supplement local efforts to repair flood control projects that are damaged by floods. Like FEMA, the USACE provides a program to allow public sponsors or operators to address levee system maintenance deficiencies. Failure to do so within the required timeframe results in the levee system being placed in an inactive status in the USACE Rehabilitation and Inspection Program. Levee systems in an inactive status are ineligible for rehabilitation assistance under Public Law 84-99.

FEMA coordinated with the USACE, the local communities, and other organizations to compile a list of levees that exist within Flood County. Table 9, "Levees," lists all accredited levees, PALs, and de-accredited levees shown on the FIRM for this FIS Report. Other categories of levees may also be included in the table. The Levee ID shown in this table may not match numbers based on other identification systems that were listed in previous FIS Reports. Levees identified as PALs in the table are labeled on the FIRM to indicate their provisional status.

Please note that the information presented in Table 9 is subject to change at any time. For

that reason, the latest information regarding any USACE structure presented in the table should be obtained by contacting USACE and accessing the USACE national levee database. For levees owned and/or operated by someone other than the USACE, contact the local community shown in Table 31.

Table 9: Levees

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
Flood County, Unincorporated Areas	Inundation River	Right Bank	Flood County Water Supply	Yes	1354212346	Yes	123450C234X	Accredited
Flood County, Unincorporated Areas	Inundation River	Left Bank	Flood County Water Supply	Yes	1234545362	Yes	12345C0234X	Provisionally Accredited
Town of Floodville	Inundation River	Left Bank	Floodville Waterworks	No	1901990990	No	12345C0245X	De-Accredited

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 27, "Incorporated Letters of Map Change", which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, "FIRM Revisions."

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 10. Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 11. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 17.) Stream gage information is provided in Table 12.

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Culvert Creek	Downstream side of Smith Lane	1.0	130	*	170	190	*	240
Inundation River	Confluence with Big Ocean	1,058	77,200	*	107,000	122,000	132,000	143,000
Inundation River	At Coastland	980	73,100	86,800	101,000	116,000	119,000	136,000
Inundation River	At Floodville	930	70,500	82,360	97,100	111,000	115,000	130,000
Inundation River	At Metropolis	902	69,000	81,100	95,000	109,000	113,000	128,000
Inundation River	Confluence with North Fork Inundation River and South Fork Inundation River	879	67,700	*	93,200	107,000	114,00	125,000
North Fork Inundation River	Above State Highway 42	137	18,100	*	24,000	27,000	*	31,600
South Fork Inundation River	Confluence with North Fork	598	51,100	*	69,700	79,600	*	93,300

*Not calculated for this FIS project

Figure 7: Frequency Discharge-Drainage Area Curves

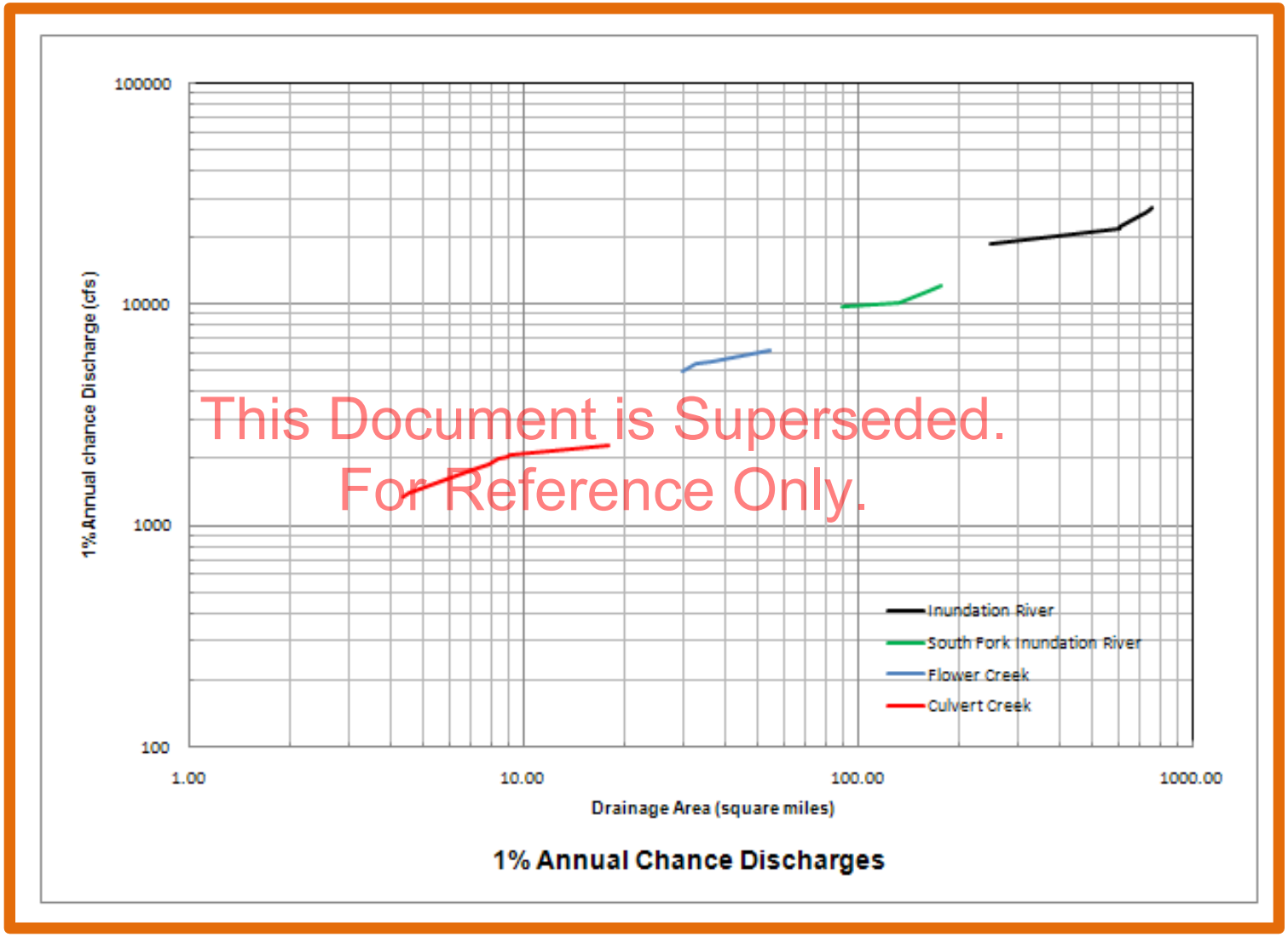


Table 11: Summary of Non-Coastal Stillwater Elevations

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Lily Pond	Metropolis	8.6	*	11.6	12.6	13.3
Central Reservoir	Flood County Unincorporated Areas	12.6	*	14.5	15.2	17.0

*Not calculated for this FIS project

Table 12: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
North Fork Inundation River	19999998	USGS	North Fork Inundation River near Floodville	161	01/14/1915	01/08/2009

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed on Table 24, “Floodway Data.”

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits		Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
	Downstream Limit	Upstream Limit					
Culvert Creek	Confluence with South Fork Inundation River	2.3 miles upstream of confluence of Ripple Creek	1994 State Regression Equations – Region 3	HEC-2 4.6	03/22/1997	AE	Ice jam analysis evaluated by Modified Indirect Method (CRREL 2004). Flood Profile reflects results of ice jam analysis.
Inundation River	Confluence with Big Ocean	Approximately 500 feet upstream of State Highway 999	2004 State Regression Equations – Region 3	HEC-RAS 3.1	06/30/2007	AE w/ Floodway	With and without levee analyses were performed for the reach affected by Levee IDs 1354212346 and 1234545362.
Inundation River	Approximately 500 feet upstream of State Highway 999	Confluence of N. Fork Inundation River and S. Fork Inundation River	2004 State Regression Equations – Region 3	HEC-RAS 3.1	06/30/2007	A	Effects of hydraulic structures were not considered in the model.
Lily Pond	Pear Tree Circle	Westwood Lane	ICPR 2.20	ICPR 2.20	05/28/2002	AE	Elevations determined using ICPR. Survey data utilized in model was based on county information collected in 2008.
North Fork Inundation River	Confluence with Inundation River	0.7 miles upstream of confluence of Lilac Stream	Log Pearson Type III Frequency Analysis	HEC-RAS 4.0	12/12/2010	AE	Gage No. 19999998 was used in hydrologic analysis. Hydraulic models incorporated field measured bridge and culvert data.
South Fork Inundation River	Confluence with Inundation River	3.2 miles upstream of confluence of Culvert Creek	HEC-HMS 3.4	Unsteady HEC-RAS 4.0	12/12/2010	AE w/ Floodway	Hydraulic model was calibrated to high water marks collected for flood of 2007, which was estimated to be the 2% annual chance flood.

Table 14: Roughness Coefficients

Flooding Source	Channel "n"	Overbank "n"
Culvert Creek	0.040-0.060	0.040-0.080
Inundation River	0.040-0.060	0.040-0.080
North Fork Inundation River	0.080-0.100	0.040-0.080
South Fork Inundation River	0.030	0.030-0.035

5.3 Coastal Analyses

For the areas of Flood County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 15 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

Table 15: Summary of Coastal Analyses

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Storm Surge	ADCIRC	99/99/9999
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Wave setup	Direct Integration Method (DIM)	99/99/9999
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Statistical Analyses	JPM	99/99/9999
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Wave Runup	TAW	99/99/9999
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Wave Generation	ACES	99/99/9999

Flooding Source	Study Limits From	To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Big Ocean	Entire coastline of Flood County	Entire coastline of Flood County	Overland Wave Propagation	WHAFIS	99/99/9999

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1% annual chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 15. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 17, "Coastal Transect Parameters." Figure 8 shows the total stillwater elevations for the 1% annual chance flood that was determined for this coastal analysis.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas

Astronomical Tide

Astronomical tidal statistics were generated directly from local tidal constituents by sampling the predicted tide at random times throughout the tidal epoch.

Storm Surge Statistics

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms or by statistical study of tidal gages.

When historic records are used to calculate storm surge, characteristics such as the strength, size, track, etc., of storms are identified by site. Storm data was used in conjunction with numerical hydrodynamic models to determine the corresponding storm surge levels. An extreme value analysis was performed on the storm surge modeling results to determine a stillwater elevation for the 1% annual chance event.

Tidal gages can be used instead of historic records of storms when the available tidal gage record for the area represents both the astronomical tide component and the storm surge component. Table 16 provides the gage name, managing agency, gage type, gage identifier, start date, end date, and statistical methodology applied to each gage used to determine the stillwater elevations. For areas between gages, peak stillwater elevations for selected recurrence intervals were estimated by combining interpolation between gages and observed high water marks during major storms. A regionalized statistical approach was applied to the gage data so that stillwater elevations in areas between gages could be identified.

Table 16: Tide Gage Analysis Specifics

Gage Name	Managing Agency of Tide Gage Record	Gage Type	Start Date	End Date	Statistical Methodology
N-408	NOAA	Tide	1968	2003	GEV
N-422	NOAA	Tide	1985	2010	GEV

Combined Riverine and Tidal Effects

Riverine and surge rates for the lower reaches of the Inundation River were combined by developing curves for rate of occurrence vs. flood level for each flood source.

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the total stillwater elevations. The oscillating component of wave setup, *dynamic wave setup*, was calculated for areas subject to wave runup hazards.

5.3.2 Waves

A coastal wave model (Coastal State University 2007) was used to calculate the nearshore wave fields required for the addition of wave setup effects. Three nested grids were used to

obtain sufficient nearshore resolution to represent the radiation stress gradients required as ADCIRC inputs. Radiation stress fields output from the inner grids are used by ADCIRC to estimate the contribution of breaking waves (wave setup effects) to the total stillwater elevation.

5.3.3 Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated to determine the modification to existing topography that is expected to be associated with flooding events. Erosion was evaluated using the methods listed in Table 15. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.

5.3.4 Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation and wave runup. These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1% annual chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, "Transect Location Map," are also depicted on the FIRM. Table 17 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, "starting" indicates the parameter value at the beginning of the transect.

Wave Height Analysis

Wave height analyses were performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 6 for a schematic of a coastal transect evaluated for overland wave propagation hazards.

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 15, "Summary of Coastal Analyses".

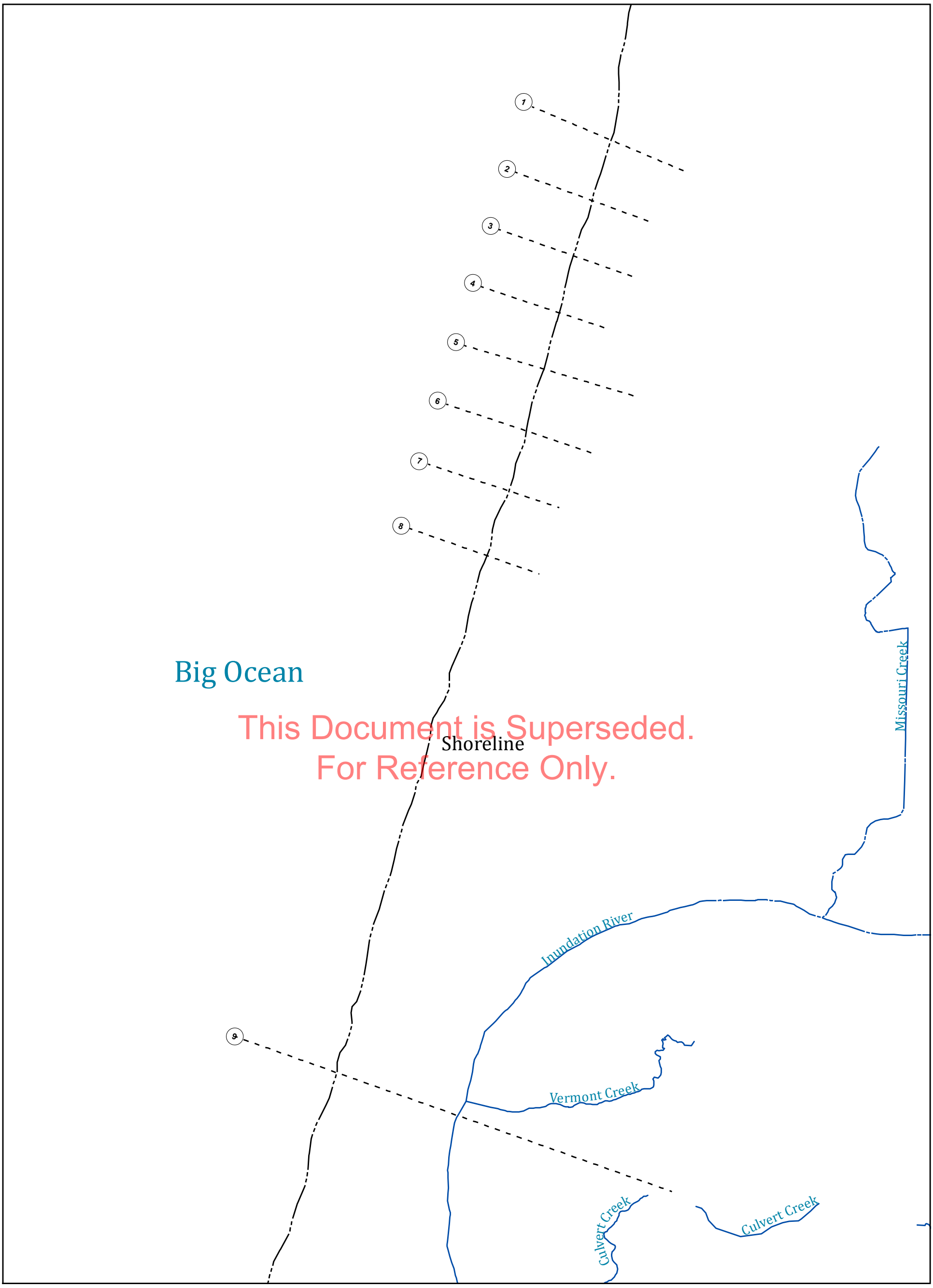
Wave Runup Analysis

Wave runup analyses were performed to determine the height and extent of runup beyond the limit of stillwater inundation for the 1% annual chance flood. Wave runup elevations were modeled using the methods and models listed in Table 15.

Table 17: Coastal Transect Parameters

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Big Ocean	1	27.2	13	5.6 5.6-5.6	* *	10.6 10.1-10.9	15.7 15.2-15.8	19.6 18.6-19.8

*Not calculated for this FIS project



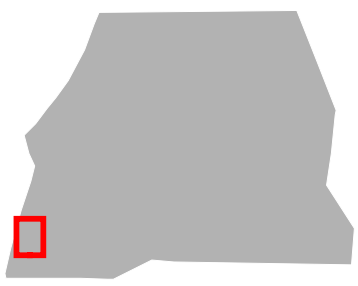
1 inch = 1,500 feet 1:18,000

N

0 455 910 1,820 2,730 3,640 Feet

Map Projection:
Universal Transverse Mercator Zone 10 North;
North American Datum 1983

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Transect Locator Map

PANELS WITH TRANSECTS:

0235X

FEMA

5.4 Alluvial Fan Analyses

Alluvial fan flooding can pose significant risk to communities due to uncertain flow paths and the potential for mud and debris flows. Alluvial fans and flooding on alluvial fans show great diversity because of variations in climate, fan history, rates and styles of tectonism, source area lithology, vegetation, and land use. Acknowledging this diversity, FEMA developed an approach that considers site-specific conditions in the identification and mapping of flood hazards on alluvial fans. The FEMA alluvial fan methodology was used to determine the flood depths and velocities on the alluvial fans described in Table 18.

A summary of the peak discharge at the fan apex and results for the 1% annual chance determinations for all the streams studied by alluvial fan analyses is shown in Table 19, "Results of Alluvial Fan Analyses."

Table 18: Summary of Alluvial Fan Analyses

Flooding Source	Location From (apex)	Location To (toe)	Drainage Area above Apex (sq mi)	Model(s) Used	Date Analysis was Completed	Method Description
Culvert Creek Fan	From apex of fan	Highway I-10	24.2	N/A	2005	Geomorphic Data, Post Flood Hazard Verification, and Historical Information
Mountain Wash Fan	Apex of fan	Stan Rd	54.5	FLO-2D, version 2006.07	2006	Risk-Based Analysis
Petal Creek fan	From apex of fan	Tangerine Road	15.8	FLO-2D version 2007.06	2009	Composite Methods
Valley Creek Fan	Apex of N. Fork Inundation River Fan	Maple Ln	44.7	FAN Computer Program	1993	Areas identified with historical aerial photos. FAN analysis used for 1% annual chance flood in active areas. HEC-2 4.6 was used in inactive areas, where incised networks and little risk of avulsion observed.

Table 19: Results of Alluvial Fan Analyses

Flooding Source	Location		1% Annual Chance Peak Flow at Fan Apex (cfs)	Flood Zones and Depths (ft)	Maximum Velocity (fps)	Minimum Velocity (fps)
	From (apex)	To (toe)				
Culvert Creek Fan	From apex of fan	Highway I-10	1,750	AO 1-2', AE	1	6
Mountain Wash Fan	From apex of fan	Stan Rd	2,140	AO 1-3'	2	6
Petal Creek Fan	From apex of Petal Creek fan	Tangerine Rd	880	AO 1-3', A	1	7
Valley Creek Fan	From apex of N. Fork Inundation River Fan	Maple Ln	1,500	AO	N/A	N/A

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to **NAVD88**. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please contact information services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for **Flood County** are provided in Table 20.

Table 20: Countywide Vertical Datum Conversion

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Flood SW	**SW**	**44.250**	**-83.625**	**-0.682**
Flood SE	**SE**	**44.250**	**-83.750**	**-0.647**
Flood City	**SE**	**44.250**	**-83.875**	**-0.654**

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Flood Town	SE	44.375	-83.375	-0.708
Coastland	SE	44.375	-83.500	-0.722
Flooding	SE	44.375	-83.625	-0.646
Floodopolis	SE	44.375	-83.750	-0.600
Metropolis SE	SE	44.375	-83.875	-0.554
Metropolis SW	SW	44.500	-83.375	-0.722
Flood Lake	SE	44.500	-83.500	-0.666
Flood Forest	SE	44.500	-83.625	-0.620
Flood Pond	SE	44.500	-83.750	-0.594
Flood Point	SE	44.500	-83.875	-0.658
Floodland	SE	44.250	-83.500	-0.705
Average Conversion from NGVD29 to NAVD88 = -0.640 feet				

A countywide conversion factor could not be generated for Flood County because the maximum variance from average exceeds 0.25 feet. Calculations for the vertical offsets on a stream by stream basis are depicted in Table 21.

Table 21: Stream-by-Stream Vertical Datum Conversion

Flooding Source	Average Vertical Datum Conversion Factor (feet)
Culvert Creek	-0.457
Flower Creek	-0.604
Inundation River	-0.681
Little Creek	-0.545
North Fork Inundation River	-0.627
Petal Creek	-0.513
Small Creek	-0.350
South Fork Inundation River	-0.592
Spring Creek	-0.447
Summer Creek	-0.463

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM database specifications and geographic information standards. This information is

provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Mapping Partners*, Appendix L.

Base map information shown on the FIRM was derived from the sources described in Table 22.

Table 22: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
Digital Orthophoto	Flood County & USGS	2005	1 foot GSD	Color orthoimagery was provided for urban areas of the county
Digital Orthophoto	USGS	1998	1:12,000	Digital Orthophoto Quadrangles were used in rural areas of the county
Political boundaries	Flood County	2005	1:5,000	Municipal and county boundaries
Transportation Features	State Center for Geographic Information	2003	1:10,000	Roads and railroads, were delineated from 2005 orthoimagery
Surface Water Features	State Center for Geographic Information	2003	1:5,000	Streams, rivers, and lakes were derived from NHD data
Public Land Survey System (PLSS)	State Center for Geographic Information	2005	1:24,000	PLSS data were digitized from USGS quadrangles
Benchmarks	NGS	2005	1:24,000	Benchmarks located using NGS data sheets
Airports	State Center for Geographic Information	2003	1:10,000	Airport locations were derived from data provided by the metro transportation authority

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the

boundaries were interpolated using the topographic elevation data described in Table 23. **For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 23, and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 23.**

In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

Certain flooding sources may have been studied that do not have published BFEs on the FIRMs, or for which there is a need to report the 1% annual chance flood elevations at selected cross sections because a published Flood Profile does not exist in this FIS Report. These streams may have also been studied using methods to determine non-encroachment zones rather than floodways. For these flooding sources, the 1% annual chance floodplain boundaries have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. All topographic data used for modeling or mapping has been converted as necessary to NAVD 88. The 1% annual chance elevations for selected cross sections along these flooding sources, along with their non-encroachment widths, if calculated, are shown in Table 25, "Flood Hazard and Non-Encroachment Data for Selected Streams."

Table 23: Summary of Topographic Elevation Data used in Mapping

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Scale	Contour Interval	Citation
Flood County	All within HUC 99999998	LiDAR	1:4,800	2 ft	USGS 2008
City of Metropolis	Lily Pond	Topographic maps	1:24,000	10 ft	USGS 1988

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. **Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations.**

Table 24: Floodway Data

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	60	46	262	5.8	20.1	20.1	20.2	0.1
B	160	51	353	4.3	21.5	21.5	22.5	1.0
C	680	170	1,253	1.2	22.0	22.0	22.9	0.9

[1]Feet above mouth

TABLE 24	FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD COUNTY, STATE AND INCORPORATED AREAS	FLOODWAY DATA FLOODING SOURCE: CULVERT CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
009	920	34	219	4.4	22.0	14.2[2]	15.2	1.0
026	2,560	38	188	4.6	22.0	18.0[2]	18.1	0.1
036	3,560	34	187	4.7	22.0	20.0[2]	20.1	0.1
043	4,280	38	169	2.5	22.0	20.1[2]	20.2	0.1
044	4,390	38	169	2.5	22.1	20.1[2]	20.2	0.1
048	4,830	26	102	4.2	22.3	20.6[2]	20.7	0.1
053	5,270	26	109	3.9	22.6	21.5[2]	21.7	0.2
054	5,360	26	109	3.9	22.7	21.5[2]	21.7	0.2
055	5,530	36	167	2.6	22.8	22.0[2]	23.0	1.0

[1]Feet above mouth
[2]Computed without consideration of backwater effects

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	82,440	1,395	23,879	4.9	22.2	22.2	23.2	1.0
B	84,620	2,208	42,275	2.7	22.8	22.8	23.8	1.0
C	86,800	2,500	45,371	2.6	23.1	23.1	24.1	1.0
D	89,600	3,921	72,926	1.6	23.3	23.3	24.3	1.0
E	121,600	5,548	88,146	1.3	24.0	24.0	25.0	1.0
F	123,550	6,965	129,249	0.9	24.0	24.0	25.0	1.0
G	126,250	7,598	138,886	0.8	24.0	24.0	25.0	1.0
H	128,400	6,440	125,613	0.9	24.1	24.1	25.1	1.0
I	130,300	7,170	133,927	0.8	24.1	24.1[2]/ 21.3[3]/ 22.1[4]	25.1	1.0
J	132,250	6,701	128,508	0.9	24.1	24.1	25.1	1.0
K	133,050	7,198	131,137	0.8	24.1	24.1	25.1	1.0
L	135,700	6,116	118,706	1.0	24.1	24.1	25.1	1.0
M	137,800	5,938	103,284	1.1	24.1	24.1	25.1	1.0
N	139,600	6,274	115,736	1.0	24.2	24.2	25.2	1.0
O	141,500	6,398	111,041	1.0	24.2	24.2	25.2	1.0
P	143,150	6,551	101,204	1.1	24.2	24.2	25.2	1.0
Q	145,200	5,993	88,563	1.2	24.3	24.3	25.3	1.0
R	168,350	5,616	49,712	2.2	30.4	30.4	31.4	1.0
S	171,350	5,868	47,885	2.3	31.2	31.2	32.2	1.0
T	174,250	7,466	62,370	1.7	31.9	31.9	32.8	0.9
U	191,520	1,091	16,630	6.4	38.0	38.0	39.0	1.0

[1]Feet above mouth
[2]With both levees holding
[3]Without right levee
[4]Without left levee

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: INUNDATION RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	39,950	611	16,224	1.7	36.7	36.7	37.7	1.0
B	43,630	284	7,306	3.7	36.7	36.7	37.7	1.0
C	45,630	282	7,335	3.7	37.0	37.0	38.0	1.0
D	46,590	431	7,137	2.5	37.2	37.2	38.2	1.0
E	48,910	332	6,198	2.9	37.5	37.5	38.5	1.0
F	50,070	439	6,885	2.6	37.7	37.7	38.7	1.0
G	50,670	297	5,233	3.2	37.8	37.8	38.8	1.0
H	50,760	297	5,330	3.2	38.1	38.1	39.1	1.0
I	50,860	297	5,335	3.1	38.2	38.2	39.2	1.0
J	52,260	247	4,812	3.5	38.4	38.4	39.3	0.9
K	53,700	251	4,275	3.9	38.7	38.7	39.6	0.9
L	54,080	175	3,835	4.4	38.8	38.8	39.7	0.9
M	54,130	175	3,835	4.4	38.8	38.8	39.7	0.9
N	54,350	173	3,784	4.4	39.0	39.0	39.8	0.8
O	55,190	173	3,605	4.7	39.2	39.2	40.1	0.9
P	57,150	139	3,352	5.0	39.9	39.9	40.9	1.0

[1]Feet above mouth

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[2]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A[1]	12,930	*	*	*	11.4	11.4	*	*
B	13,165	25	98	4.5	12.2	12.2	13.2	1.0
C	13,315	47	210	2.1	12.8	12.8	13.5	0.7
D	13,835	71	279	1.6	12.9	12.9	13.7	0.8
E	14,345	29	85	4.7	14.1	14.1	14.4	0.3
F	14,425	30	95	4.2	14.6	14.6	14.9	0.3
G	14,695	31	91	4.4	15.5	15.5	15.6	0.1
H	14,985	53	144	2.8	16.2	16.2	16.3	0.1
I	15,785	28	98	2.2	17.2	17.2	17.4	0.2
J	16,465	22	80	2.7	18.4	18.4	19.3	0.9
K	17,965	19	69	3.2	19.8	19.8	20.3	0.5

[1]Floodway not shown for this cross section
[2]Feet above Ocean Bay

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: PETAL CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	17,700	90	1,273	3.1	21.5	21.5	22.5	1.0
B	19,180	339	3,260	1.2	22.3	22.3	23.3	1.0
C	21,380	237	2,389	1.6	22.9	22.9	23.9	1.0
D	22,900	809	7,235	0.5	23.1	23.1	24.1	1.0
E	24,680	973	6,866	0.6	23.2	23.2	24.2	1.0
F	26,200	107	1,577	2.5	23.4	23.4	24.4	1.0
G	26,570	107	1,602	2.4	23.6	23.6	24.6	1.0
H	26,597	107	1,602	2.4	23.7	23.7	24.7	1.0
I	26,807	114	1,680	2.3	23.8	23.8	24.8	1.0

[1]Feet above mouth

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: WINTER CREEK

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)				
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/ SEC)	REGULATORY (EXISTING CONDITIONS)	FUTURE CONDITIONS	EXISTING CONDITIONS WITHOUT FLOODWAY	EXISTING CONDITIONS WITH FLOODWAY	INCREASE
A	500	350	7,466	1.8	37.2	37.7	37.2	38.2	1.0
B	620	350	7,221	1.8	37.2	37.7	37.2	38.2	1.0
C	1,020	350	7,632	1.8	37.3	37.8	37.3	38.3	1.0
D	2,620	404	9,307	1.5	37.4	37.9	37.4	38.4	1.0
E	4,580	321	6,278	2.2	37.4	37.9	37.4	38.4	1.0
F	7,020	347	6,501	2.1	37.6	38.1	37.6	38.6	1.0
G	7,940	223	3,395	4.0	37.6	38.1	37.6	38.6	1.0
H	8,140	219	3,346	4.1	37.7	38.2	37.7	38.7	1.0
I	8,190	219	3,337	4.1	37.7	38.2	37.7	38.7	1.0
J	8,420	201	3,175	4.3	37.8	38.3	37.8	38.8	1.0
K	10,700	194	3,745	3.7	38.6	38.4	38.6	39.6	1.0

[1]Feet above mouth

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, STATE

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: WOOD BRANCH

Non-encroachment areas may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this FIS project have been tabulated for selected cross sections and are shown in Table 25. The non-encroachment width indicates the measured distance left and right (looking downstream) from the mapped center of the stream to the non-encroachment boundary based on a surcharge of 1.0 foot or less.

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams

Flooding Source	Cross Section	Stream Station[1]	1% Annual Chance Flood Discharge (cfs)	1% Annual Chance Water Surface Elevation (feet NAVD88)	Non-Encroachment Width (feet)	
					Left	Right
Culvert Creek	179	17,857	850	22.3	50	60
Culvert Creek	195	19,499	780	23.6	60	80
Culvert Creek	210	20,993	780	24.3	20	200
Spring Branch	025	2,487	1,230	32.4	N/A	N/A
Spring Branch	056	5,612	1,090	37.5	N/A	N/A
Spring Branch	077	7,659	860	40.1	N/A	N/A

[1] Feet above mouth

6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Table 23.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1% annual chance flood condition):

- The *primary frontal dune zone* is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

- The *wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

- The *wave overtopping splash zone* is the area landward of the crest of an overtopped

barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.

- The *breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).

- The *high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv^2) is greater than or equal to 200 ft^3/sec^2. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either "V" zones or "A" zones.

Table 26 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 26: Summary of Coastal Transect Mapping Considerations

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis: Zone Designation and BFE (ft NAVD 88)	Wave Height Analysis: Zone Designation and BFE (ft NAVD 88)	Zone VE Limit	SFHA Boundary
1	✓	VE 12	VE 14-16	PFD	PFD
2		N/A	VE 14-16 AE 9-12	Wave Height	SWEL
3		VE 16	N/A	Runup	Overtopping

A LiMWA boundary has also been added in coastal areas subject to wave action for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. To simplify representation, the LiMWA was continued immediately landward of the VE/AE boundary in areas where wave runup elevations dominate. Similarly, in areas where the Zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA was delineated immediately landward of the Zone VE/AE boundary.

6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions to FIS projects may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies.

These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 31, "Map Repositories").

6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA. A LOMA cannot be issued for properties located on the PFD (primary frontal dune).

To obtain an application for a LOMA, visit http://www.fema.gov and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at http://www.fema.gov/plan/prevent/fhm/ot_lmreq.shtm.

For more information about how to apply for a LOMA, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting http://www.fema.gov for the "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Map Information eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at http://www.fema.gov/plan/prevent/fhm/ot_lmreq.shtm.

6.5.4 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If the request for a LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit http://www.fema.gov and download the form "MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision". Visit the "Flood Map-Related Fees" section to determine the cost of applying for a

LOMR. For more information about how to apply for a LOMR, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the **Flood County** FIRM are listed in Table 27.

Table 27: Incorporated Letters of Map Change

Case Number	Effective Date	Flooding Source	FIRM Panel(s)
10-10-0012P	01-01-2010	Inundation River	1234C0234X
10-10-0014P	01-01-2005	North Fork Inundation River	1234C0234X

6.5.3 Physical Map Revisions

PMRs are an official republication of a community's NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community's chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period. When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit http://www.fema.gov and visit the "Flood Map Revision Processes" section.

6.5.4 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

6.5.5 Community Map History

The current FIRM presents flooding information for the entire geographic area of **Flood County**. Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 28, "Community Map History." A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or "pending" (for Preliminary FIS Reports) is shown. If the community is listed in Table 28 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first Flood Hazard Boundary Map (FHBM). This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community. This is the first effective date that is shown on the FIRM panel.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as Physical Map Revisions (PMR) of FIRM panels within the county are completed, the FIRM Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

The initial effective date for the Flood County FIRMs in countywide format was 07/23/2008.

Table 28: Community Map History

Community Name	Initial Identification Date (First NFIP Map Published)	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Coastland, City of	02/15/1973	02/15/1973	10/10/1980 06/23/1975	09/28/1984	12/31/2011 07/23/2008 02/14/2005 09/02/1998
Flood County Unincorporated Areas	11/01/1974	11/01/1974	09/06/1977	08/15/1984	12/31/2011 07/23/2008 10/26/2002 02/18/1998

Community Name	Initial Identification Date (First NFIP Map Published)	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
Floodville, Town of	11/01/1974	04/15/1975	N/A	12/15/1984	07/23/2008 01/05/2003 05/26/1998
Metropolis, City of	11/01/1974	12/21/1974	03/04/1983 10/17/1978	06/19/1986	12/31/2011 07/23/2008 09/31/2002 03/22/1999 10/04/1995
Upland, Village of[1]	08/15/1984	N/A	N/A	09/24/1984	07/23/2008 02/18/1992

[1] No Special Flood Hazard Areas Identified

SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

7.1 Contracted Studies

Table 29 provides a summary of the contracted studies, by flooding source, that are included in this FIS Report.

Table 29: Summary of Contracted Studies Included in this FIS Report

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Culvert Creek	12/31/2011	ABC Engineers, Inc.	EMW-C-9999	April 2011	Flood County Uninc. Areas, Metropolis
Inundation River	12/31/2011	ABC Engineers, Inc.	EMW-C-9999	April 2011	Flood County Uninc. Areas, Metropolis
North Fork Inundation River	12/31/2011	ABC Engineers, Inc.	EMW-C-9999	April 2011	City of Coastland, Flood County Uninc. Areas
South Fork Inundation River	12/31/2011	ABC Engineers, Inc.	EMW-C-9999	April 2011	Flood County Uninc. Areas
Big Ocean	2/18/1998	DEF Engineers, Inc.	EMW-C-0000	September 1995	All communities

7.2 Community Meetings

The dates of the community meetings held for this FIS project and any previous FIS projects are shown in Table 30. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

Table 30: Community Meetings

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Flood County and Incorporated Areas	12/31/2011	03/16/2008	Discovery	FEMA, City of Coastland, Town of Floodville, City of Metropolis, the State Department of Land and Development and the State Department of Geology and Mineral Industries
		02/08/2010	Resilience	FEMA, City of Coastland, Town of Floodville, City of Metropolis
		11/30/2010	CCO Open House	FEMA, City of Coastland, Town of Floodville, City of Metropolis, the State Department of Land and Development and the State Department of Geology and Mineral Industries
Town of Coastland	07/28/2008	05/01/2005	Scoping	FEMA, this community and the study contractor
		06/30/2007	Final CCO	FEMA, this community and the study contractor
City of Metropolis	01/08/2006	05/01/2003	Scoping	FEMA, this community and the study contractor
		01/20/2005	Final CCO	FEMA, this community and the study contractor
Town of Floodville	10/26/2002	01/07/1999	Initial CCO	FEMA, this community and the study contractor
		08/15/2001	Final CCO	FEMA, this community and the study contractor
Flood County, Unincorporated Areas	10/1/1974	11/27/1970	Initial CCO	FEMA, City of Coastland, Town of Floodville, City of Metropolis, county, State Department of Land and Development, and the study contractor
		08/30/1973	Final CCO	FEMA, City of Coastland, Town of Floodville, City of Metropolis, county and the study contractor

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see http://www.fema.gov.

The additional data that was used for this project includes the FIS Report and FIRM that were previously prepared for Dry County and the City of New Metropolis, (FEMA 2006). In addition, the USACE prepared a Tsunami Prediction Study for Flood County in 1967 in response to the destruction caused by the March 1964 tsunami (USACE 1964).

Table 31 is a list of the locations where FIRMs for **Flood County** can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 31: Map Repositories

Community	Address	City	State	Zip Code
Flood County, Unincorporated Areas	123 Noah's Ark Drive	Floodville	USA	99999
City of Coastland	456 Sump Pump Boulevard	Coastland	USA	99999
Town of Floodville	789 Highwaters Street	Floodville	USA	99999
City of Metropolis	1234 Stilts Avenue	Metropolis	USA	99999

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 32.

Table 32 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the state NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of state and local GIS data in their state.

Table 32: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	http://www.fema.gov
NFIP website	http://www.fema.gov/business/nfip

NFHL Dataset	http://msc.fema.gov
FEMA Region X	**Federal Regional Center, 130 228th Street SW, Bothell, WA 98021-9796** **(425) 487-4657**
Other Federal Agencies	
USGS website	http://www.usgs.gov
Hydraulic Engineering Center website	http://www.hec.usace.army.mil
State Agencies and Organizations	
State NFIP Coordinator	**Chris Harris, CFM** **Dept. of Land Conservation & Development** **1234 Stilts Avenue** **Metropolis, State 99999** **111-999-0050 x111** **chris.harris@state.gov.us**
State GIS Coordinator	**Julio Gonzales, GISP** **Statewide GIS Coordinator** **1234 Stilts Avenue** **Metropolis, State 99999** **Phone: 111-999-6066** **julie.gonzales@state.gov.us**
Statewide Regulatory Coordinator	**Beth Smith** **Statewide Regulatory Coordinator** **1234 Stilts Avenue** **Metropolis, State 99999** **Phone: 111-999-6032** **beth.smith@state.gov.us**

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 33 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 33: Bibliography and References

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
ABC Eng, 1978	ABC Engineers, Inc.	*Flower Creek Water Supply, Coastland Water Board, City of Coastland, State,* C10933.00		City of Coastland, State	April 1978	City of Coastland Water Board
Coastland 1977	City of Coastland	*Inventory of Coastal Resources for the 1990 Comprehensive Plan*			December 1977	City of Coastland library
Coastland 1978	City of Coastland	*1990 Comprehensive Plan*			September 1978	City of Coastland library
Johnes 1975	A. Johnes and Associates	*A Report on an Engineering Study to Prepare a Master Plan of Storm Sewers for the City of Coastland, State*	Housing and Home Finance Agency Project No. P-ORE-3191	City of Coastland, State	January 1966, reprinted November 1975	http://www.usa.gov
FEMA 1989	Federal Emergency Management Agency	*Flood Insurance Study, Flood County, State, and Unincorporated Areas*		Washington, D.C.	1989	FEMA Map Service Center http://msc.fema.gov
FEMA 1996	Federal Emergency Management Agency	*Flood Insurance Study, City of Floodville, Flood County, State*		Washington, D.C.	1996	FEMA Map Service Center http://msc.fema.gov

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
FIA 1977	**U.S. Department of Housing and Urban Development, Federal Insurance Administration**	***Flood Hazard Boundary Map, Flood County, USA, Community-Panel Numbers 410042 0001 through 0021***	**Sidney McFlood**	**Washington, D.C.**	**September 1977**	**FEMA Express Document Delivery (EDDie) http://edd.msc.fema.gov/edd/**
State CES 1967	**State University, Resource Development Section, Cooperative Extension Service**	***Resources Analysis, Flood County, State***	**Dave Waters and Gary Mapper**	**City of Coastland, State**	**December 1967**	**http://extension.state.edu/catalog/**
State Geology and Mineral Industries 1975	**State Department of Geology and Mineral Industries**	***Bulletin 87: Environmental Geology of Flood County, State***	**Tim Row**	**City of Coastland, State**	**1975**	**State University library http://university.lib.state.edu**
State Sea Grant 1974	**State University, Sea Grant College**	***Descriptions and Information Sources for State Estuaries***	**H. Toow**	**City of Coastland, State**	**May 1974**	**http://seagrant.state.edu**
NWRBC 1968	**Northwest River Basins Commission, Hydraulics and Hydrology Committee**	***River Mile Index, Coastal Tributaries for Inundation River Basin, State***		**City of Coastland, State**	**June 1968**	**State University http://university.lib.state.edu**

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
City of Coastland Population Research 1981	State University, Center for Population Research and Census	*Population Estimates, Flood County and Incorporated Cities, July 1, 1980*		City of Coastland, State	March 1981	http://www.pdx.edu/prc/publications-list
SCS 1975	U.S. Department of Agriculture, Soil Conservation Service	*General Soil Map, Flood County, State, Scale 1:126,700*			April 1975	http://www.usa.gov
U.S. Census 2007	U.S. Department of Commerce, Bureau of the Census	"State & County Quickfacts"		Website. accessed October 12, 2010	2007	http://www.census.gov/
USGS 2008	U.S. Department of Interior, Geological Survey	*LiDAR Data, Scale 1:4,800, Contour Interval 2 Feet.*		Washington, D.C.	2008	http://lidar.cr.usgs.gov/
USGS 1988	U.S. Department of Interior, Geological Survey	*7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 Feet.* Coastland, ST (1984, revised 1988)		Washington, D.C.	Various	http://topomaps.usgs.gov
CRREL 2004	ERDC CRREL	*ERDC_CRREL Technical Note 04-3: Method to Estimate River Ice Thickness Based on Meteorological Data*	K.D. White	Hanover, NH	2004	http://www.crrel.usace.army.mil/techpub/CRREL_Reports/reports/TN04-3.pdf

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
-	**U.S. Department of Agriculture, Soil Conservation Service**	***National Engineering Handbook, Section 4 Hydrology***		**Washington, D.C.**	**August 1972**	**out of print**

1% ANNUAL CHANCE BACKWATER EFFECTS FROM CULVERT CREEK

CONFLUENCE WITH CULVERT CREEK

W MOUNT DR

BEECHWOOD DR

ELEVATION IN FEET (NAVD)

150
140
130
120
110
100
90
80
70
60

0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500

STREAM DISTANCE IN FEET ABOVE MOUTH

A
B
C
D
E
F

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 4% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- A — CROSS SECTION LOCATION

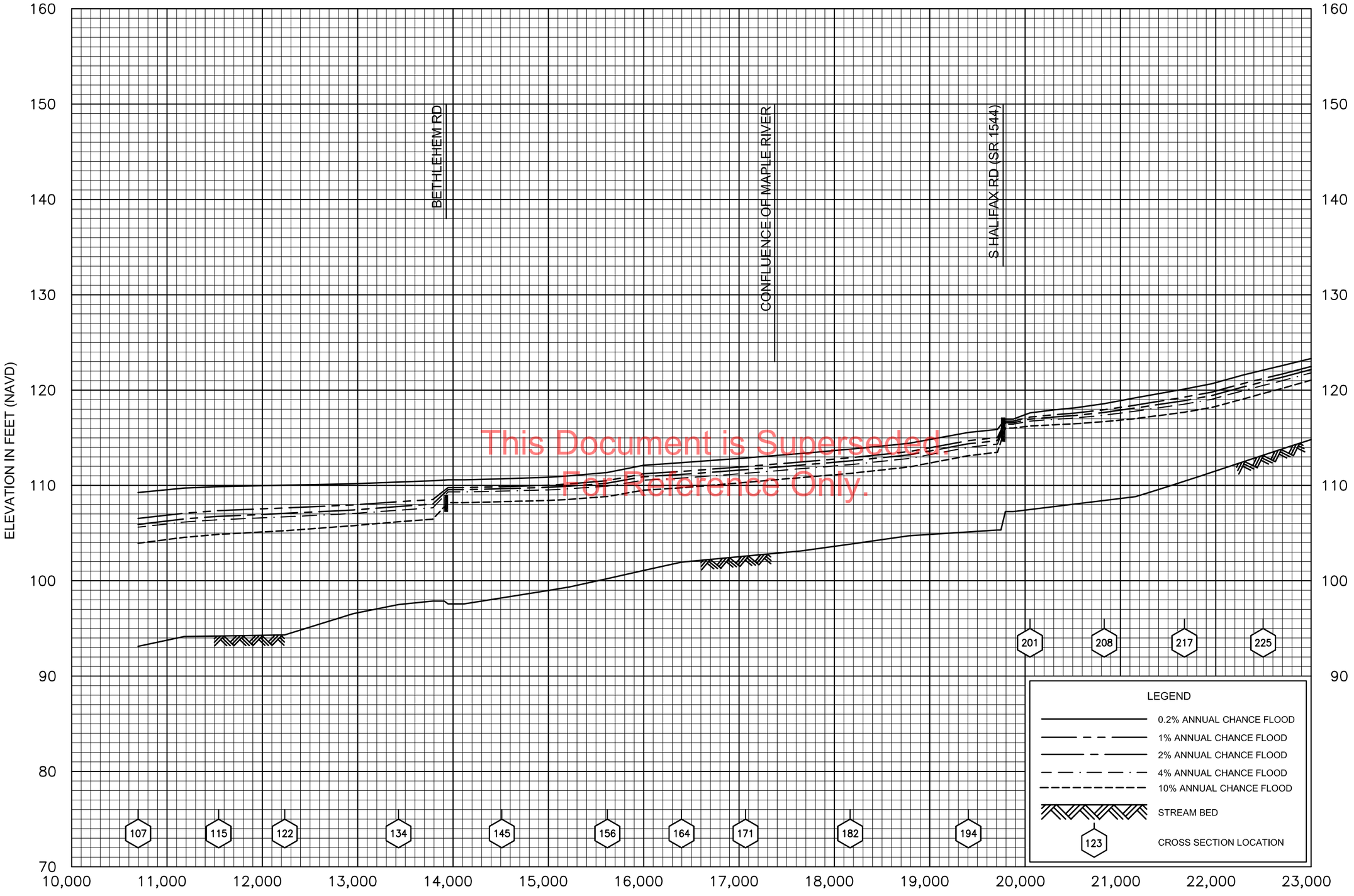
FLOOD PROFILES

FLOWER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, USA
AND INCORPORATED AREAS

01P



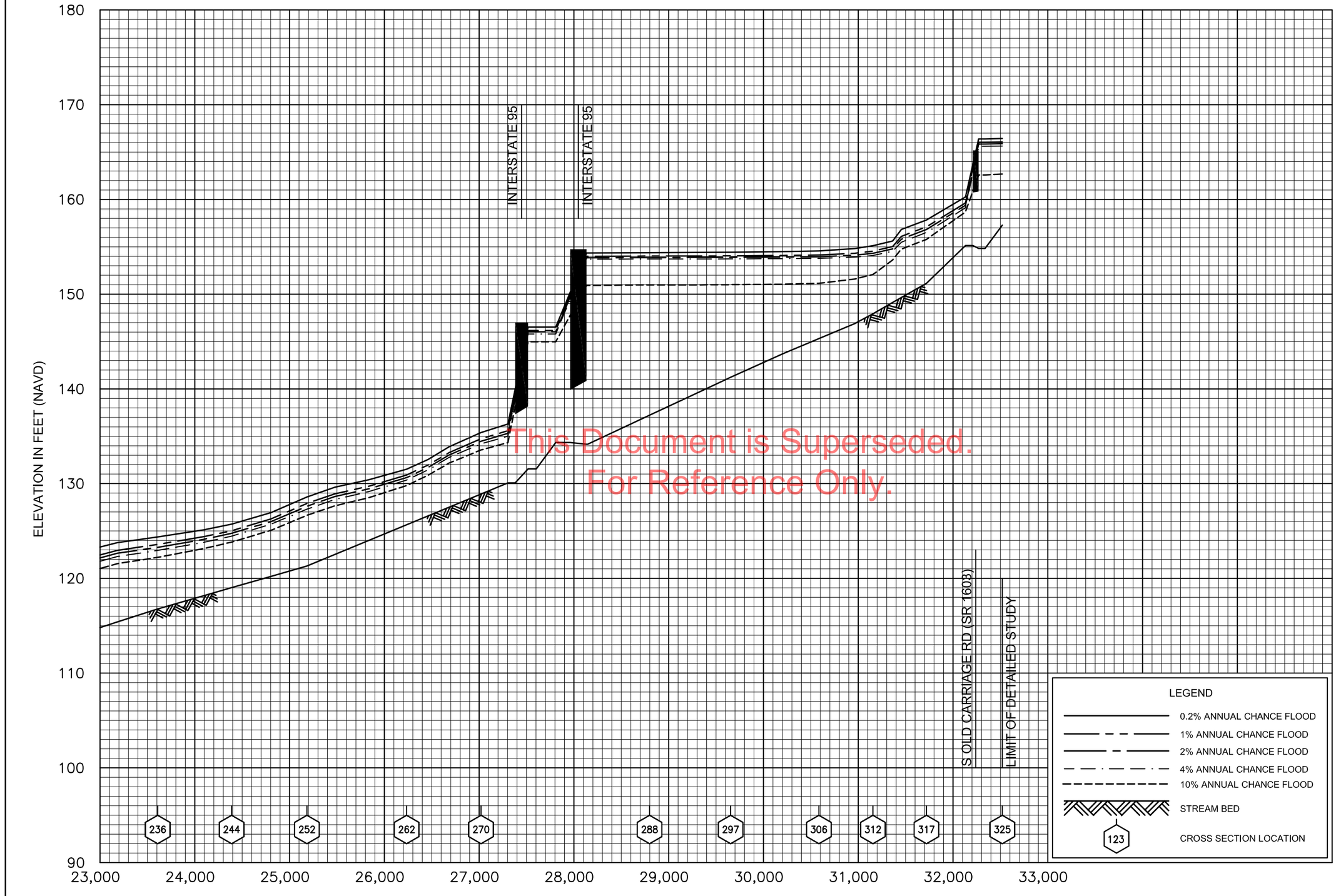
FLOOD PROFILES

INUNDATION RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, USA
AND INCORPORATED AREAS

02P



FLOOD PROFILES

INUNDATION RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, USA

AND INCORPORATED AREAS

03P

ELEVATION IN FEET (NAVD)

130
120
110
100
90
80
70
60
50
40

RAILROAD

2197
2215
2227
2240
2286
2335
2362

LEGEND
- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 4% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- 123 CROSS SECTION LOCATION

215,000 217,000 219,000 221,000 223,000 225,000 227,000 229,000 231,000 233,000 235,000 237,000

STREAM DISTANCE IN FEET ABOVE MOUTH

FLOOD PROFILES

PETAL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, USA
AND INCORPORATED AREAS

04P

ELEVATION IN FEET (NAVD)

140
130
120
110
100
90
80
70
60
50

BELLAMY MILL RD (SR 1518)
MASONRY DAM
CONFLUENCE OF OAK RIVER
CONFLUENCE OF ROSE RIVER
INTERSTATE 95
INTERSTATE 95

2402
2427
2441
2453
2472
2483
2515
2541
2570
2605
2629

LEGEND
0.2% ANNUAL CHANCE FLOOD
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD
4% ANNUAL CHANCE FLOOD
10% ANNUAL CHANCE FLOOD
STREAM BED
123 CROSS SECTION LOCATION

237,000 239,000 241,000 243,000 245,000 247,000 249,000 251,000 253,000 255,000 257,000 259,000 261,000 263,000

STREAM DISTANCE IN FEET ABOVE MOUTH

FLOOD PROFILES

PETAL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, USA
AND INCORPORATED AREAS

05P

ELEVATION IN FEET (NAVD)

150
140
130
120
110
100
90
80
70
60

HIGHWAY 48

OBRYAN RD (SR 1513)

2638 2657 2681 2701 2725 2739 2756 2772 2792 2810 2828 2841 2856 2872 2886

263,000 265,000 267,000 269,000 271,000 273,000 275,000 277,000 279,000 281,000 283,000 285,000 287,000 289,000

STREAM DISTANCE IN FEET ABOVE MOUTH

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 4% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- 123 CROSS SECTION LOCATION

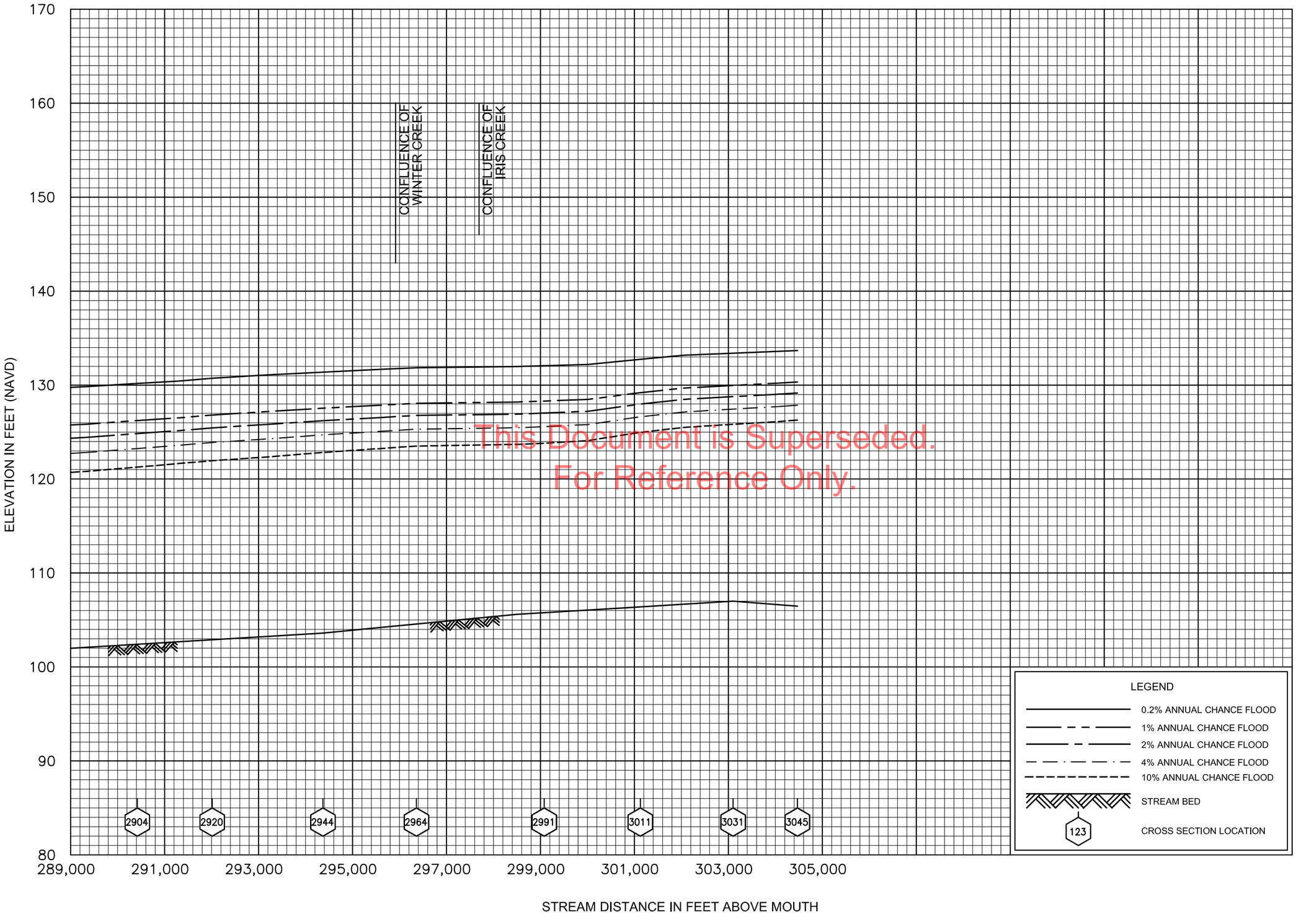
FLOOD PROFILES

PETAL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, USA
AND INCORPORATED AREAS

06P



FLOOD PROFILES

PETAL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD COUNTY, USA
AND INCORPORATED AREAS

07P