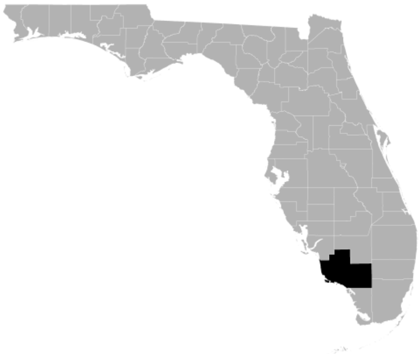
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 6



COLLIER COUNTY, FLORIDA

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
COLLIER COUNTY, UNINCORPORATED AREAS	120067
EVERGLADES CITY, CITY OF	125104
MARCO ISLAND, CITY OF	120426
NAPLES, CITY OF	125130
SEMINOLE TRIBE OF FLORIDA	120685

REVISED:

February 8, 2024

FLOOD INSURANCE STUDY NUMBER
12021CV001C
Version Number 2.5.3.5

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Transect 2	003-004 T
Transect 3	005-006 T
Transect 4	007-008 T
Transect 5	009-010 T
Transect 6	011-012 T
Transect 7	013-014 T
Transect 8	015-016 T
Transect 9	017-018 T
Transect 10	019-020 T
Transect 11	021-023 T
Transect 12	024-026 T
Transect 13	027-028 T
Transect 14	029-030 T
Transect 15	031-032 T
Transect 16	033-034 T
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Transect 18	037-038 T
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Transect 24	049-050 T
Transect 25	051-052 T
Transect 26	053-054 T
Transect 27	055-056 T
Transect 28	057-058 T
Transect 29	059-060 T
Transect 30	061-062 T
Transect 31	063-064 T
Transect 32	065-066 T
Transect 33	067-068 T
Transect 34	069-070 T
Transect 35	071-072 T
Transect 36	073-074 T
Transect 37	075-076 T
Transect 38	077-078 T
Transect 39	079-080 T
Transect 40	081-082 T
Transect 41	083-084 T
Transect 42	085-086 T
Transect 43	087-088 T
Transect 44	089-090 T

Volume 4

Exhibit 1

Transect Profiles	Panel
Transect 45	091-092 T
Transect 46	093-094 T
Transect 47	095-096 T
Transect 48	097-098 T
Transect 49	099-100 T
Transect 50	101-102 T
Transect 51	103-104 T
Transect 52	105-106 T
Transect 53	107-108 T
Transect 54	109-110 T
Transect 55	111-112 T
Transect 56	113-114 T
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Transect 58	118-119 T
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Transect 75	161-163 T
Transect 76	164-166 T
Transect 77	167-169 T
Transect 78	170-172 T
Transect 79	173-174 T
Transect 80	175-176 T
Transect 81	177-178 T

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Exhibit 1

Transect Profiles	Panel
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Transect 83	182-183 T
Transect 84	184-185 T
Transect 85	186-186 T
Transect 86	187-189 T
Transect 87	190-192 T
Transect 88	193-195 T
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Transect 102	240-241 T
Transect 103	242-243 T
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Transect 106	248-249 T
Transect 107	250-252 T
Transect 108	253-255 T
Transect 109	256-258 T
Transect 110	259-261 T
Transect 111	262-267 T

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Exhibit 1

Transect Profiles	Panel
Transect 112	268-269 T
Transect 113	270-271 T
Transect 114	272-273 T
Transect 115	274-275 T
Transect 116	276-277 T
Transect 117	278-279 T
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Transect 129	315-319 T
Transect 130	320-324 T
Transect 131	325-329 T
Transect 132	330-333 T
Transect 133	334-337 T
Transect 134	338-341 T
Transect 135	342-346 T
Transect 136	347-351 T
Transect 137	352-355 T
Transect 138	356-360 T

Published Separately

Flood Insurance Rate Map (FIRM)

FLOOD INSURANCE STUDY REPORT
COLLIER COUNTY, FLORIDA

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 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, *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 Collier County, Florida.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the United States Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC-8) sub-basins affecting each, are shown in Table 1. The 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.

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
Collier County, Unincorporated Areas	120067	03090202 03090204 03090205	12021C0025H 12021C0050H 12021C0075H 12021C0095H 12021C0105H 12021C0110H 12021C0115H 12021C0120H 12021C0130H 12021C0135H 12021C0140H 12021C0145H 12021C0155H 12021C0165H 12021C0175H[1]	

Table 1: Listing of NFIP Jurisdictions (continued)

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Collier County, Unincorporated Areas (continued)	120067	03090202 03090204 03090205	12021C0178J 12021C0179J 12021C0183J 12021C0184H 12021C0187J 12021C0189J 12021C0190H[1] 12021C0191J 12021C0192J 12021C0193J 12021C0194J 12021C0205H 12021C0210H 12021C0211H 12021C0212H 12021C0213H 12021C0214H 12021C0216H 12021C0217H 12021C0218H 12021C0219H 12021C0230H 12021C0235H 12021C0240H 12021C0245H 12021C0255H 12021C0260H 12021C0265H 12021C0270H 12021C0280H 12021C0290H 12021C0300H[1] 12021C0325H[1] 12021C0350H[1] 12021C0375H[1] 12021C0377J 12021C0379J 12021C0381J 12021C0382J 12021C0383J 12021C0384J 12021C0391J 12021C0392J 12021C0393J 12021C0394J 12021C0401H 12021C0402H 12021C0403J 12021C0404J	

Table 1: Listing of NFIP Jurisdictions (continued)

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Collier County, Unincorporated Areas (continued)	120067	03090202 03090204 03090205	12021C0410H 12021C0411J 12021C0412J 12021C0413J 12021C0414J 12021C0416J 12021C0418J 12021C0420H 12021C0430H 12021C0435H 12021C0440H 12021C0445H 12021C0455H 12021C0460H 12021C0465H 12021C0470H 12021C0500H 12021C0525H[1] 12021C0550H[1] 12021C0575H[1] 12021C0581J 12021C0582J 12021C0583J 12021C0584J 12021C0595J 12021C0601J 12021C0602J 12021C0603J 12021C0604J 12021C0606J 12021C0608J 12021C0610J 12021C0612J 12021C0615J 12021C0616J 12021C0620J 12021C0630J 12021C0640J 12021C0650J 12021C0675J 12021C0700J 12021C0725H 12021C0750H[1] 12021C0775H[1] 12021C0800H[1] 12021C0810J 12021C0826J 12021C0827J 12021C0829J	

Table 1: Listing of NFIP Jurisdictions (continued)

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Collier County, Unincorporated Areas (continued)	120067	03090202 03090204 03090205	12021C0835J 12021C0840J 12021C0842J 12021C0845J 12021C0855J 12021C0860J 12021C0875J 12021C0880J 12021C0885J 12021C0890J 12021C0895J 12021C0905J 12021C0910J 12021C0915J 12021C0920J 12021C0950J 12021C0975H[1] 12021C1000H[1] 12021C1025H[1] 12021C1030J 12021C1035J 12021C1075J 12021C1085J 12021C1100J 12021C1105J 12021C1125J 12021C1150J 12021C1175J 12021C1200H[1] 12021C1225H[1]	
Everglades City, City of	125104	03090204	12021C1085J	
Marco Island, City of	120426	03090204	12021C0810J 12021C0826J 12021C0827J 12021C0828J 12021C0829J 12021C0835J 12021C0836J 12021C0837J 12021C0840J 12021C0841J 12021C0842J 12021C0845J	

Table 1: Listing of NFIP Jurisdictions (continued)

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Naples, City of	125130	03090204	12021C0379J 12021C0383J 12021C0384J 12021C0387J 12021C0390H[1] 12021C0391J 12021C0392J 12021C0393J 12021C0394J 12021C0581J 12021C0583J	
Seminole Tribe of Florida	120685	03090204	12021C0145H	

[1] Panel Not Printed

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-percent-annual-chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1-percent-annual-chance and 0.2-percent-annual-chance floodplains; and 1-percent-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 30, "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 Collier County became effective on November 17, 2005. Refer to Table 27 for information about subsequent revisions to the FIRMs.

- 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 www.fema.gov/national-flood-insurance-program-community-rating-system or contact your appropriate FEMA Regional Office for more information about this program.

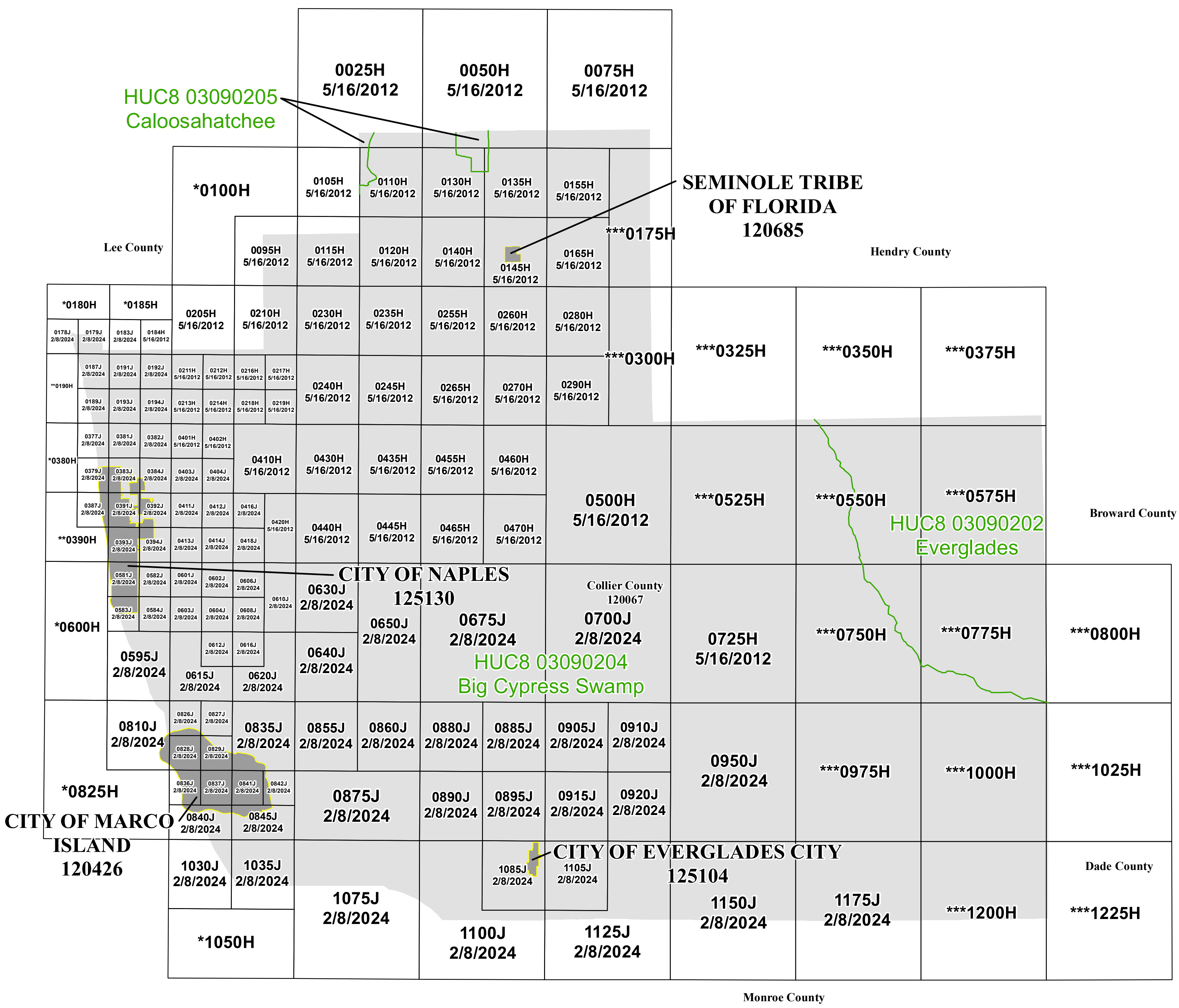
  Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 8 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE National Levee Database (nld.usace.army.mil). For all other levees, the user is encouraged to contact the appropriate local community.

  Please also note that FEMA has identified one or more levees in this jurisdiction that have not been demonstrated by the community or levee owner to meet the requirements of 44 CFR 65.10, of the NFIP regulations as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection.

- 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 www.fema.gov/online-tutorials.

The FIRM Index in Figure 1 shows the overall FIRM panel layout within Collier County, and also displays the panel number and effective date for each FIRM panel in the county. Other information shown on the FIRM Index includes community boundaries, watershed boundaries, and USGS HUC-8 codes.

Figure 1: FIRM Index



ATTENTION: The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before FEBRUARY 8, 2024

1 inch = 40,699 feet 1:488,387

0 11,500 23,000 46,000 69,000 92,000 feet

NAD 1983 State Plane Florida East FIPS 0901 Feet; North American Datum 1983

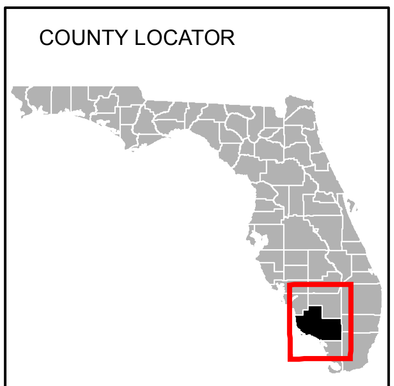
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

*PANEL NOT PRINTED - AREA OUTSIDE COUNTY BOUNDARY
**PANEL NOT PRINTED - OPEN WATER AREA
***PANEL NOT PRINTED - AREA ALL WITHIN ZONE A

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

COLLIER COUNTY, FLORIDA and Incorporated Areas

PANELS PRINTED:

0025, 0050, 0075, 0095, 0105, 0110, 0115, 0120, 0130, 0135, 0140, 0145, 0155, 0165, 0178, 0179, 0183, 0184, 0187, 0189, 0191, 0192, 0193, 0194, 0205, 0210, 0211, 0212, 0213, 0214, 0216, 0217, 0218, 0219, 0230, 0235, 0240, 0245, 0255, 0260, 0265, 0270, 0280, 0290, 0377, 0379, 0381, 0382, 0383, 0384, 0387, 0391, 0392, 0393, 0394, 0401, 0402, 0403, 0404, 0410, 0411, 0412, 0413, 0414, 0416, 0418, 0420, 0430, 0435, 0440, 0445, 0455, 0460, 0465, 0470, 0500, 0581, 0582, 0583, 0584, 0595, 0601, 0602, 0603, 0604, 0606, 0608, 0610, 0612, 0615, 0616, 0620, 0630, 0640, 0650, 0675, 0700, 0725, 0810, 0826, 0827, 0828, 0829, 0835, 0836, 0837, 0840, 0841, 0842, 0845, 0855, 0860, 0875, 0880, 0885, 0890, 0895, 0905, 0910, 0915, 0920, 0950, 1030, 1035, 1075, 1085, 1100, 1105, 1125, 1150, 1175

MAP NUMBER
12021CINDOC

MAP REVISED
FEBRUARY 8, 2024

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on that map. However, the FIRM panel does not contain enough space to show all the notes that may be relevant in helping to better understand the information on the panel. Figure 2 contains the full list of these notes.

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 Flood Map Service Center website at 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 Flood 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 Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 27 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.

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 Non-Coastal 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 (NAVD88). Coastal flood elevations are also provided in the Coastal Transect Parameters table in the FIS Report for this jurisdiction. Elevations shown in the Coastal Transect Parameters table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

Figure 2: FIRM Notes to Users

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.

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 State Plane Transverse Mercator, Florida Zone 0901. The horizontal datum was the North American Datum 1983; Western Hemisphere. 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 www.ngs.noaa.gov.

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 30 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on this FIRM was provided in digital format by the Collier County GIS Services, United States Bureau of Land Management, and Federal Emergency Management Agency. Ortho imagery was produced by the National Agricultural Imagery Program in 2017 and has a 1 meter ground sample distance.

BASE MAP INFORMATION (05/16/2012): Base map information shown on this FIRM was derived from multiple source. This information was compiled from Collier County Government (2003, 2008, 2009), U.S. Bureau of Land Management (2005), 3001, Inc. (2004), NOAA-National Geodetic Survey (2008), and U.S. Geological Survey (2009) at a scale of 1:24,000.

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 Collier County, Florida, 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 27 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.

ATTENTION: The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on the FIRM panels issued before February 8, 2024.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Collier County, Florida, effective February 8, 2024.

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.

NON-ACCREDITED LEVEE SYSTEM: This panel contains a levee system that has not been accredited and is therefore not recognized as reducing the 1-percent-annual-chance flood hazard.

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.

Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in Collier County.

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.
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

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.
	Area with Flood Risk due to Levee: Areas where a non-accredited levee, dike, or other flood control structure is shown as providing protection to less than the 1% annual chance flood.
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.
NO SCREEN	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
(ortho) (vector)	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	
Aqueduct Channel Culvert Storm Sewer	Channel, Culvert, Aqueduct, or Storm Sewer
Dam Jetty Weir	Dam, Jetty, Weir
	Levee, Dike, or Floodwall
Bridge	Bridge

Figure 3: Map Legend for FIRM

REFERENCE MARKERS	
22.0	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
B 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
5280 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
8	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.
513	Base Flood Elevation Line
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

Figure 3: Map Legend for FIRM

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-percent-annual-chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-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 Collier 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-percent-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 22), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1-percent and 0.2-percent-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-percent-annual-chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1-percent and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-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 Collier County, 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 12. 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-percent-annual-chance floodplain corresponds to the SFHAs. The 0.2-percent-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.

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
Airport Road Canal	Collier County, Unincorporated Areas	Confluence with Golden Gate Main Canal	At the intersection of Immokalee Road / County Road 846 and Airport-Pulling Road	03090204	6.8	N/A	N	AE	06/01/2009
Alligator Alley Canal	Collier County, Unincorporated Areas	At Beck Boulevard	At the intersection of State Road 29 and Alligator Alley / Interstate Highway 75 / Everglades Parkway	03090204	23.4	N/A	N	AE	06/01/2009
Ava Maria Basin	Collier County, Unincorporated Areas; Seminole Tribe of Florida	Within Collier County	Within Collier County	03090204	N/A	141.1	N	AE, AH	06/01/2009
Cocohatchee A Basin	Collier County, Unincorporated Areas	Within Collier County	Within Collier County	03090204 03090205	N/A	245.7	N	A, AE, AH	06/01/2009
Cocohatchee B Basin	Collier County, Unincorporated Areas	Within Collier County	Within Collier County	03090204	N/A	54.8	N	AE, AH, VE	06/01/2009
Cocohatchee C Basin	Collier County, Unincorporated Areas	Within Collier County	Within Collier County	03090204	N/A	105.1	N	AE, AH	06/01/2009
951 Canal	Collier County, Unincorporated Areas	Confluence with Golden Gate Main Canal	East side of the intersection of Immokalee Road / County Road 846 and Collier Boulevard / County Road 951	03090204	6.9	N/A	N	AE, AH	06/01/2009
Cocohatchee Canal	Collier County, Unincorporated Areas	At U.S. Highway 41 / Tamiami Trail North	North side of the intersection of Immokalee Road / County Road 846 and Maverick Lane	03090204	11.8	N/A	N	AE	06/01/2009

Table 2: Flooding Sources Included in this FIS Report (continued)

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
Cypress Canal	Collier County, Unincorporated Areas	Confluence with Golden Gate Main Canal	Approximately 600 feet east of 8th Street Northeast bridge	03090204	8.2	N/A	N	AE	06/01/2009
District 6 Basin	Collier County, Unincorporated Areas; Marco Island, City of; Naples, City of	Within Collier County	Within Collier County	03090204	N/A	74.1	N	AE, AH, AO, VE	06/01/2009
Faka Union Canal	Collier County, Unincorporated Areas	Approximately 3.85 miles downstream of U.S. Highway 41 / Tamiami Trail East	At Immokalee Road / County Road 846	03090204	33.2	N/A	N	AE	06/01/2009
Faka Union / Fakahatchee Strand Basin	Collier County, Unincorporated Areas; Everglades City, City of	Within Collier County	Within Collier County	03090204	N/A	449.8	N	A, AE, AH, VE	06/01/2009
Faka Union / Miller Canal Basin	Collier County, Unincorporated Areas	Within Collier County	Within Collier County	03090204	N/A	95.0	N	A, AE, AH	06/01/2009
Golden Gate Estates Basin	Collier County, Unincorporated Areas	Within Collier County	Within Collier County	03090204	N/A	74.9	N	AE, AH	07/01/2011
Golden Gate Main Canal	Collier County, Unincorporated Areas; Naples, City of	Approximately 2,350 feet west of Airport Pulling Road North	Just west of 72nd Avenue Northeast	03090204	26.7	N/A	N	AE	06/01/2009
Golden Gate Main West Basin	Collier County, Unincorporated Areas; Naples, City of	Within Collier County	Within Collier County	03090204	N/A	58.9	N	AE, AH, VE	07/01/2011
Gulf of Mexico	Collier County, Unincorporated Areas; Everglades City, City of; Marco Island, City of	Entire Shoreline of Collier County	Entire Shoreline of Collier County	03090204	62.4	N/A	N	AE, VE	09/11/2019

Table 2: Flooding Sources Included in this FIS Report (continued)

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
Harvey Canal	Collier County, Unincorporated Areas	At the Green Boulevard bridge	At Vanderbilt Beach Road bridge	03090204	3.0	N/A	N	AE	06/01/2009
Henderson Canal	Collier County, Unincorporated Areas	At U.S. Highway 41 / Tamiami Trail North	At Beck Boulevard	03090204	8.6	N/A	N	AE	06/01/2009
Henderson Creek Basin	Collier County, Unincorporated Areas	Within Collier County	Within Collier County	03090204	N/A	47.3	N	AE, AH	06/01/2009
I-75 Canal	Collier County, Unincorporated Areas	Confluence with Golden Gate Main Canal	South side of the intersection of Immokalee Road / County Road 846 and Tarpon Bay Boulevard	03090204	7.3	N/A	N	AE	06/01/2009
Merritt Canal	Collier County, Unincorporated Areas	Confluence with Faka Union Canal	At Interstate Highway 75	03090204	12.1	N/A	N	A, AE	06/01/2009
Miller Canal	Collier County, Unincorporated Areas	Confluence with Faka Union Canal	Approximately 720 feet north of 8th Avenue North	03090204	19.2	N/A	N	AE	06/01/2009
Prairie Canal	Collier County, Unincorporated Areas	Confluence with Merritt Canal	Just east of 118th Avenue Southeast	03090204	3.0	N/A	N	AE	06/01/2009
Southern Coastal Basin	Collier County, Unincorporated Areas; Marco Island, City of	Within Collier County	Within Collier County	03090204	N/A	194.6	N	AE, AH, VE	06/01/2009
SR 29 Canal	Collier County, Unincorporated Areas	Just to the east of the intersection of State Road 29 and U.S. Highway 41 / Tamiami Trail East	Just north of the intersection of Seminole Crossing Trail and State Road 29 / New Harvest Road / East Main Street	03090204	37.9	N/A	N	A, AE	06/01/2009

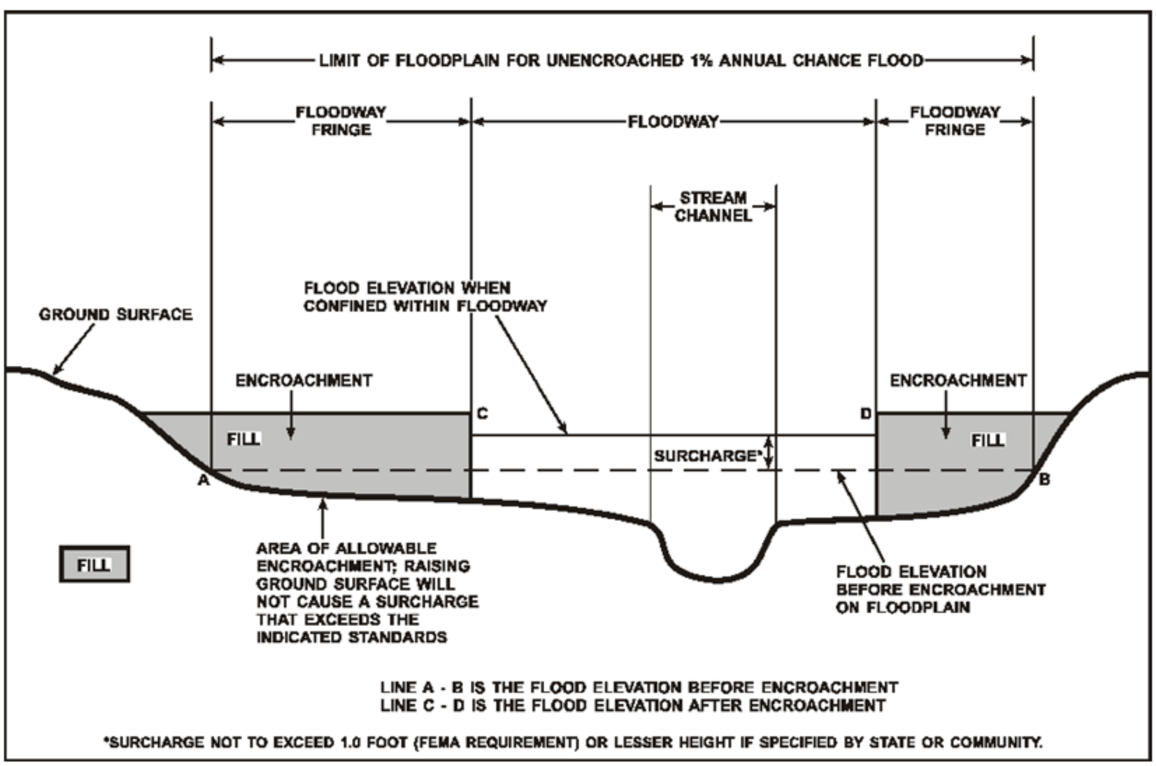
2.2 Floodways

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-percent-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-percent-annual-chance flood. The floodway fringe is the area between the floodway and the 1-percent-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-percent-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. 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



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 BFE is the elevation of the 1-percent-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.

BFEs are primarily intended for flood insurance rating purposes. 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. 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. For example, the user may use the FIRM to determine the stream station of a location of interest and then use the profile to determine the 1-percent annual chance elevation at that location. Because only selected cross sections may be shown on the FIRM for riverine areas, the profile should be used to obtain the flood elevation between mapped cross sections. Additionally, for riverine areas, whole-foot elevations shown on the FIRM may not exactly reflect the elevations derived from the hydraulic analyses; therefore, elevations obtained from the profile may more accurately reflect the results of the hydraulic analysis.

2.4 Non-Encroachment Zones

This section is not applicable to this Flood Risk Project.

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-percent-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.

Coastal flooding sources that are included in this Flood Risk 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-percent-annual-chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1-percent-annual-chance storm. The 1-percent-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.

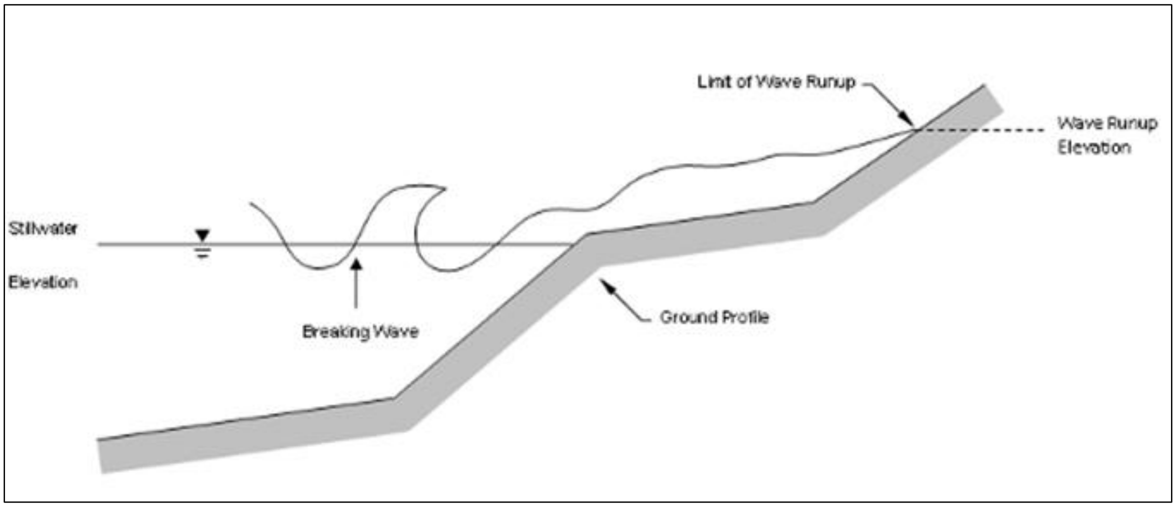
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1-percent-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-percent-annual-chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1-percent-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-percent-annual-chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1-percent-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 25 presents the types of coastal analyses that were used in mapping the 1-percent-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-percent-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 16, "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-percent-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-percent-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.

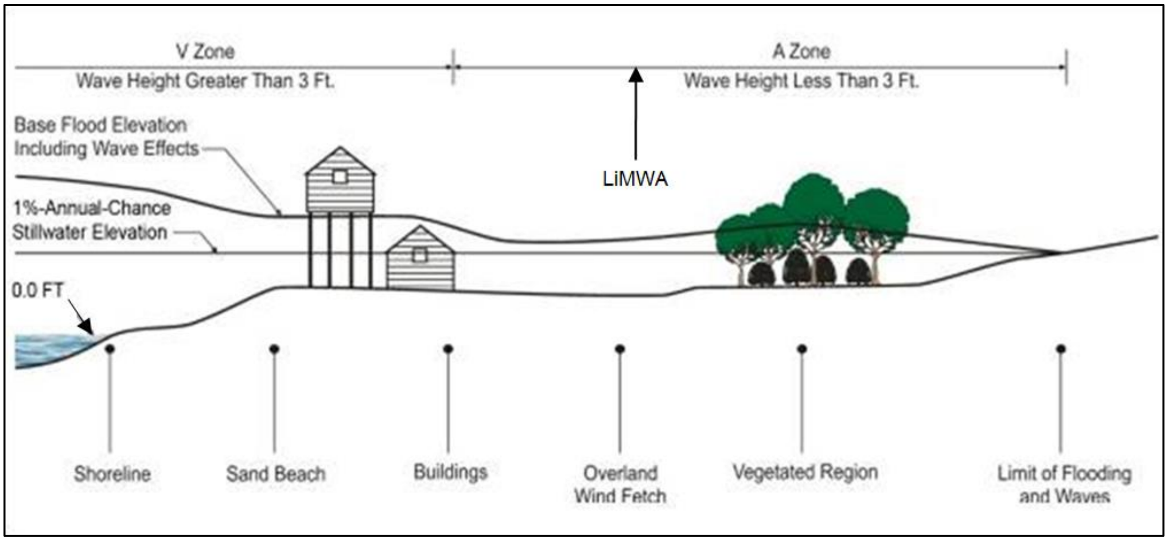
CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the 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-percent-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 Flood Risk 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 16 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-percent-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.

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-percent-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-percent-annual-chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in Collier County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Collier County, Unincorporated Areas	A, AE, AH, AO, VE, X
Everglades City, City of	AE, VE
Marco Island, City of	AE, VE, X
Naples, City of	AE, AH, AO, VE, X
Seminole Tribe of Florida	AE, AH, X

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 4 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 4: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)[1]
Everglades	03090202	Everglades	Located on the western corner of the county	181.9
Big Cypress Swamp	03090204	Big Cypress Swamp	Encompasses almost the entire county	1,840.5
Caloosahatchee	03090205	Caloosahatchee River	Located in two small sections on the north side of the county	6.4

[1] Total drain area of watershed inside the county

4.2 Principal Flood Problems

Table 5 contains a description of the principal flood problems that have been noted for Collier County by flooding source.

Table 5: Principal Flood Problems

Flooding Source	Description of Flood Problems
Various	Flooding results from two major sources in Collier County. Coastal areas are subject to inundation from ocean surges, whereas inland areas become flooded when rainfall accumulates in low, flat areas. Rainfall occurs primarily during thunderstorms in the summer months, with additional rainfall resulting from the passage of hurricanes. A transition region near the coast is vulnerable to both rainfall and ocean surge flooding. Coastal lands typically lie below an elevation of 9 feet, North American Vertical Datum of 1988 (NAVD88), and are subject to flooding from hurricanes and tropical storms. Surges of over 12.7 feet NAVD88 were reported just north of Collier County when the most severe historic storm hit in 1873. Floodwaters progressed as far as 10 miles inland in 1960 (FIS 1986; FIS 2012).
Various	The Labor Day Hurricane, August 31-September 8, 1935, was a severe tropical disturbance. Winds reached 65 miles per hour (mph) in the City of Everglades City and 70 mph in Naples as the storm passed northward approximately 50 miles offshore (FIS 1986).
Various	The storm of October 13-21, 1944 is among the most destructive recorded for the State of Florida, with damages estimated at $63 million. Flooding depths of up to 6 feet NAVD88 were reported in the City of Everglades City and in the low-lying areas of Naples. Severe beach erosion occurred along Naples Beach, where approximately 4 miles of bulkhead were destroyed (FIS 1986).
Various	Hurricane Donna, August 29-September 13, 1960, ranks as one of the great storms of the 20th century. Its center traveled north, paralleling the Gulf Coast west of Collier County. At the City of Everglades City, the tide ranged from a low of -2.1 feet NAVD88 to a high exceeding 8 feet NAVD88 some 5 hours later. Flooding extended from 6 to 10 miles inland. U.S. Highway 41, between the Cities of Everglades and Naples, was covered with tidal debris. As the center moved northward, southwesterly winds generated high tides that flooded most of Goodland, Marco, and Naples. In Collier County, over 300 homes and trailers suffered major damage. Reported high-water elevations are list in NAVD88 and are as follows: Everglades 8.4 ft., Goodland 10.4 ft., Marco 8.9 ft., Naples 10.3 ft., Fort Myers Beach 9.1 ft. (FIS 1986).
Various	Hurricane Isabel, October 8-15, 1964, entered the west coast of Florida near City of Everglades City as it traveled from its origin in the western Caribbean. At the City of Everglades City, the minimum pressure was 973.6 millibars (mb), with winds reaching 80 knots (FIS 1986).
Various	Hurricane Dennis, August 17-21, 1981, began as a tropical storm, striking the Gulf of Mexico coastline in southwest Florida with winds of more than 55 mph. Just after Dennis made landfall, it became stationary between Fort Myers and Lake Okeechobee, producing about 10 inches of rain in southeast Florida, with Homestead receiving almost 20 inches. After passing through central Florida and exiting by the Atlantic Coast, Dennis became a hurricane on August 20, just east of Cape Hatteras, North Carolina (FSGP 1997; FIS 2005).
Various	Hurricane Bob, July 21-25, 1985, made landfall near Fort Myers as a tropical storm on July 23, with winds between 50 and 70 mph. It passed through central Florida and exited into the Atlantic Ocean near Daytona Beach on July 24, becoming a hurricane in the open ocean (FSGP 1997; FIS 2005).

Table 5: Principal Flood Problems (continued)

Flooding Source	Description of Flood Problems
Various	Hurricane Floyd, October 9-13, 1987, made landfall in the northern Keys of Florida Bay, near Key Largo. Along with numerous tornadoes in the southwest Florida coastal areas, the central pressure was measured at 29.32 inches of mercury (or 993mb) with winds of 75 mph (FSGP 1997; FIS 2005).
Various	Hurricane Andrew, August 16-27, 1992. On the morning of August 24, Andrew cut a path of destruction across south Florida from its Atlantic Ocean landfall location south of Miami through Homestead and the Everglades. Andrew finally exited into the Gulf of Mexico in southern Collier County near Marco Island before heading north in the Gulf of Mexico to make landfall again in Louisiana. Andrew became a hurricane when it exited south of Marco Island and produced a storm tide elevation of 6 feet above mean low water, recorded at the City of Everglades City, and 2 feet above mean sea level, National Geodetic Vertical Datum of 1929 (NGVD29), recorded at Fort Myers Beach. The peak gust recorded on August 24 at Collier County Emergency Operations Center was 87 mph. Only 30 million dollars in damages were incurred in Collier County due to Andrew, not nearly as severe as the estimated damages of 20 to 25 billion dollars in the major landfall area of Dade County, Florida. The Dade County damages were due to the 145-mph sustained winds and partly to the 17-foot peak storm surge in Biscayne Bay (SU 1968; FIS 2005).
Various	Hurricane Gordon, November 8-21, 1994, was a hurricane while out at sea in the Florida Straits between Key West and Cuba, but made landfall near Fort Myers on November 16 as a tropical storm with sustained winds of 45 mph and heavy rainfall. Naples Airport recorded peak gusts of 29 mph, and the Naples Conservatory measured a total 2.43 inches of rainfall (FSGP 1997; FIS 2005).
Various	Hurricane Mitch, October 22-November 5, 1998, was responsible for over 9,000 deaths, predominately from rain-induced flooding, in portions of Central America, mainly in Honduras and Nicaragua. This makes Mitch one of the deadliest Atlantic tropical cyclones in history, ranking only below the 1780 “Great Hurricane” in the Lesser Antilles, and comparable to the Galveston hurricane of 1900 and Hurricane Fifi of 1974, which primarily affected Honduras. The 905mb minimum central pressure and estimated maximum sustained wind speed of 155 knots over the western Caribbean make Mitch the strongest October hurricane (records began in 1886). Mitch moved across the Yucatan Peninsula and southern Florida as a tropical storm. Hurricane Mitch made landfall near Naples as a tropical storm on November 5, with a wind speed of 64 mph and a pressure of 989mb (FIS 2012).
Various	Tropical Storm Harvey, September 19-22, 1999, which formed in the eastern Gulf of Mexico and moved across southern Florida, produced heavy rainfall over portions of southwest Florida. Tropical Storm Harvey made landfall near Everglades City, Florida as a tropical storm on September 21, with a wind speed of 58 mph and a pressure of 999mb (FIS 2012).
Various	Hurricane Charley, August 9-14, 2004, strengthened rapidly just before striking the southwestern coast of Florida as a Category 4 hurricane on the Saffir-Simpson Hurricane Scale. Charley was the strongest hurricane to hit the United States since Andrew in 1992 and, although small in size, it caused catastrophic wind damage in Charlotte County, Florida. Serious damage occurred well inland over the Florida peninsula. Hurricane Charley made landfall near Cayo Costa, Florida and reached minimal pressure as a hurricane on August 13, with a wind speed of 150 mph and a pressure of 941mb. It also made landfall near Punta Gorda, Florida as a hurricane on August 13, with a wind speed of 144 mph and a pressure of 942mb (FIS 2012).

Table 5: Principal Flood Problems (continued)

Flooding Source	Description of Flood Problems
Various	Hurricane Wilma, October 15-25, 2005, formed and became an extremely intense hurricane over the northwestern Caribbean Sea. It had the all-time lowest central pressure for an Atlantic basin hurricane, and it devastated the northeastern Yucatan Peninsula. Wilma also inflicted extensive damage over southern Florida. Hurricane Wilma made landfall near Cape Romano, Florida as a hurricane on October 24, with a wind speed of 121 mph and a pressure of 950mb (FIS 2012).
Various	Tropical Storm Isaac, August 27, 2012, moved west-northwest across the Florida Straits south of the Florida Keys on August 26. The northern edge of the wind and rain area associated with Isaac affected the South Florida peninsula throughout the day on the 26th. Isaac continued on a west-northwest track into the Gulf of Mexico on the 27th with winds, rain and flooding continuing over parts of South Florida. Severe beach erosion and coastal flooding occurred on Monday, August 27th as the center of Tropical Storm Isaac moved into the Gulf of Mexico. A storm surge of 2.05 feet was measured at the Naples pier. Farther east along the coast, inundation depths as high as 3 feet were reported in Goodland and Everglades City. Inundation in the Naples area was about 1 foot. Most damage from coastal flooding was to infrastructure in the Goodland and Everglades City areas and was estimated at $400,000. Severe beach erosion in the Naples and Marco Island areas led to damage estimated at $5.6 million (CC 2015).

Table 6 contains information about historic flood elevations in the communities within Collier County.

Table 6: Historic Flooding Elevations

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Various	Along the shoreline	12.7	1873	N/A	FIS 1986
Various	City of Everglades City	6.0	10/13/1960-10/21/1960	N/A	FIS 1986
Various	Everglades City	8.4	08/29/1960-09/13/1960	N/A	FIS 1986
Various	Goodland	10.4	08/29/1960-09/13/1960	N/A	FIS 1986
Various	Marco	8.6	08/29/1960-09/13/1960	N/A	FIS 1986
Various	Naples	10.3	08/29/1960-09/13/1960	N/A	FIS 1986
Various	Fort Myers Beach	9.1	08/29/1960-09/13/1960	N/A	FIS 1986

4.3 Non-Levee Flood Protection Measures

Table 7 contains information about non-levee flood protection measures within Collier County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 7: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Various	N/A	Canals	Various	Canals have been constructed to remove excess rainfall from inland regions. Water may be ponded for several months in areas that do not drain readily. The canals serve as a path for flow and have increased the fraction of rainfall that runs off the land. They also tend to shorten the time required for water to travel from interior regions to the ocean. The major canal systems include the Cocohatchee River Canal, Golden Gate Canal, Henderson Creek Canal, and Faka Union Canal. The Barron River Canal parallels State Highway 29 and drains from the north to south, ending near the City of Everglades City. Some levees have been constructed to control the spread of water in sloughs draining swampy areas (FIS 1986).
Cocohatchee River	State Road 846 Land Trust IMP	Dam	Along the river	The State Road 846 Land Trust earthen dam is located on private property and a current aerial image identifies there is no water present. The earthen dam is agricultural in nature and there are no residential properties within a mile (CC 2015).

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-percent-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-percent-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 8. If the required information for a PAL is not submitted within the required timeframe, or if information indicates that a levee system no 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 Collier County. Table 8, "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 8 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 30.

Table 8: Levees

Community	Flooding Source	System Name	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)
Collier County, Unincorporated Areas	Everglades	Picayune Strand	USACE–Jacksonville, District USACE Federally constructed, turned over to public sponsor operations and maintenance	Yes	3405000123[1]	No	12012C0465H 12012C0630J 12012C0650J 12012C0675J

[1] Levee system has not been accredited and is therefore not recognized as reducing the 1-percent-annual-chance flood hazard

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-percent-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.

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 12. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 9. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 16.)

Table 9: Summary of Discharges

Flooding Source	Location[1]	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
951 Canal	At CR951 #1 (ARS)	2.7	422	*	463	473	440
Cocohatchee Canal	At CC-1 (Coco-1)	214.1	684	*	827	881	1,114
Cocohatchee Canal	At CC-2 (Coco-2)	212.4	615	*	751	784	966
Cocohatchee Canal	At CC-3 (Coco-3)	204.0	194	*	274	302	400
Cypress Canal	CYP 1 (Cypress 1)	40.0	242	*	258	262	294
Faka Union Canal	At FU-1	210.4	3140	*	4,119	4,347	5,238
Faka Union Canal	At FU-2	48.8	1239	*	2,112	2,276	2,778
Faka Union Canal	At FU-3	31.3	948	*	1,593	1,683	2,266
Faka Union Canal	At FU-4	23.1	522	*	1,218	1,223	2,208
Faka Union Canal	At FU-5	12.5	552	*	912	1,039	1,465
Faka Union Canal	At FU-6	7.7	383	*	685	838	1,229
Faka Union Canal	At FU-7	3.9	362	*	577	686	989
Golden Gate Main Canal	GG-1	115.7	2702	*	3,145	3,272	3,706
Golden Gate Main Canal	GG-2	98.5	2408	*	2,700	2,795	3,065
Golden Gate Main Canal	GG-3	61.5	1262	*	1,290	1,309	1,384
Golden Gate Main Canal	GG-4	25.7	815	*	950	1,001	1,128
Golden Gate Main Canal	GG-5	15.2	606	*	788	870	1,079
Golden Gate Main Canal	GG-6	4.2	256	*	317	346	426
Golden Gate Main Canal	GG-7	4.6	91	*	112	120	145
Harvey Canal[2]	Harvey 1	8.3	600	*	777	779	781
Henderson Canal	At HEN CR-1	47.2	434	*	614	692	894
I-75 Canal	I-75-1	25.0	862	*	1,105	1,199	1,436
I-75 Canal	I-75-2	9.2	271	*	369	404	525

Table 9: Summary of Discharges (continued)

Flooding Source	Location[1]	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
I-75 Canal	I-75-3	4.3	167	*	230	250	312
Merritt Canal	At MER-1 (Merrit-1)	93.5	909	*	918	923	933
Merritt Canal	At Lucky Lakes	86.1	651	*	702	729	828
Miller Canal	At MIL-1 (Miller #1)	25.4	1,033	*	1,102	1,140	1,194
Miller Canal	At MIL-2 (Miller #2)	11.6	547	*	629	686	730
Miller Canal	At MIL-3 (Miller #3)	N/A	245	*	288	305	327
Prairie Canal	At PRA-1 (Prairie-1)	8.0	22	*	27	30	63
SR 29 Canal	At SR29-1	255.6	94	*	93	93	94
SR 29 Canal	At SR29-2	237.6	271	*	274	274	348
SR 29 Canal	At SR29-3	236.7	361	*	365	367	556
SR 29 Canal	At SR29-4	234.3	143	*	167	184	386
SR 29 Canal	At SR29-5	232.4	153	*	151	149	650
SR 29 Canal	At SR29-6a	231	63	*	82	93	128
SR 29 Canal	At SR29-7	223.2	206	*	230	240	268
SR 29 Canal	At SR29-8	216.1	318	*	346	362	469

* Not calculated for this Flood Risk Project

[1] These discharges are at control structures along canals. Locations and descriptions of the structures can be found in SFWMD 2003, except for CR951, which is described in reference SFWMD 2006.

[2] The flow for the Harvey Canal is from the Green Canal at the Harvey 1 location.

Figure 7: Frequency Discharge-Drainage Area Curves

[Not Applicable to this Flood Risk Project]

Table 10: Summary of Non-Coastal Stillwater Elevations

[Not Applicable to this Flood Risk Project]

Table 11: Stream Gage Information used to Determine Discharges

[Not Applicable to this Flood Risk Project]

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.

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 12. Roughness coefficients are provided in Table 13. 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 12: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Airport Road Canal	Confluence with Golden Gate Main Canal	At the intersection of Immokalee Road / County Road 846 and Airport-Pulling Road	Other	Other	06/01/2009	AE	Detailed information about Airport Road Canal (ARN-00; ARS-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, "Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas" (TCE 2010). This canal is located in Cocohatchee B and Golden Gate Main West Subbasin. It is also referred to as Airport Road North Canal (ARN-00) and Airport Road South Canal (ARS-00).
Alligator Alley Canal	At Beck Boulevard	At the intersection of State Road 29 and Alligator Alley / Interstate Highway 75 / Everglades Parkway	Other	Other	06/01/2009	AE	Detailed information about Alligator Alley Canal (BRC-01–BRC-04; EMC-02–EMC-13; FKC-01–FKC-02; MLC-02; HEC-06) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, "Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas" (TCE 2010). This canal is located in Faka Union/Fakahatchee Strand Basin, Faka Union/Miller Canal Basin, and Henderson Creek Subbasins. It is also referred to as the I-75 Canal.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Ava Maria Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	AE, AH	The Ave Maria Model covers much of the Collier County Rural Land Stewartship Area (RLSA) which includes approximately 300 square miles around the Seminole Tribe of Florida, Immokalee Reservation. The modeled area extends north to the Collier County line and south to near I-75, east to the north-south alignment of the SR 29 (State Road 29), and west to the Cocohatchee and Faka Union/Miller Basins. The Ave Maria Basin lies within the larger Fakahatchee Strand Basin. The Faka Union/Fakahatchee Strand Basin model was used to determine boundary conditions for the Ave Maria model. Stage hydrographs along the southern boundary of the Ave Maria model were read in from the larger FU-FHS basin model. There are several major canals serving the Faka Union/Fakahatchee Strand basin, but only one within the Ave Maria basin. Only a portion of the SR 29 Canal (BRN-00) lies within the Ave Maria basin and is modeled as offset specific grids. There are no major water control structures within this portion of the SR 29 canal.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Cocohatchee A Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	A, AE, AH	The Cocohatchee A Basin model includes the upper end of the Estero River, Imperial River, and Cocohatchee basins including the Corkscrew Swamp that extend into Lee and Hendry County. This model is setup to simulate the sheetflow movements from the upper end of the basins to the channel flows at the lower end. The Coco A model is used to generate time varying flow hydrographs that are used as upstream boundary conditions for the Coco B model and stage hydrographs that are used for downstream boundary conditions for the Coco C model. The downstream end of the Coco A model is the stage hydrograph representing the water levels in the Cocohatchee Canal upstream of the COCO 3 water control structure. There are no major structures affecting flow in the Cocohatchee A Basin. The Cocohatchee Canal, the Kehl Canal (in the headwaters of the Imperial River), and the Upper reaches of the Estero River are represented in the Coco A model. Each of these outfalls are represented by stage boundary conditions in the Coco A model. This area of poorly defined drainage boundaries includes Corkscrew Swamp, Corkscrew Marsh, and Flint Pen Slough. The results of this model are used to define the contributions of runoff to the lower Cocohatchee basin.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Cocohatchee B Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	AE, AH, VE	The Cocohatchee B Basin model includes the lower portions of the Cocohatchee Basin. This model receives the rainfall as defined in the raingages within the basin and the inflow hydrographs defined by modeled flows in the Coco A model for the boundary at the north east corner of the Coco B basin. The downstream end of the Coco B model is defined by a stage hydrograph representing the tidal conditions at the Cocohatchee's outfall to the estuarine areas of the Gulf Coast. The Cocohatchee Canal (CRB-00) and northern end of Airport Road North Canal (ARN-00) are represented by specific grid inputs that represent these channels as imbedded conveyances. The model cells also include offset channels representing the ditches and canals within the Coco B basin including the 951 Canal (9CN-00).

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Cocohatchee C Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	AE, AH	The Cocohatchee C basin model includes the upper end of the Cocohatchee Basin. The model receives the rainfall as defined in the raingages within the basin and the stage hydrographs at the west end of model grid as defined by the Coco A Model. The Coco C model provides the model results to the resolution needed for floodplain mapping. The model cells primarily represent natural uplands and wetlands which convey runoff overland toward lower ground elevations. There are no major structures affecting flow in the Cocohatchee C Basin. Also, there are no channels associated with this model. Coco C simulates the sheetflows of the Corkscrew Swamp area.
951 Canal	Confluence with Golden Gate Main Canal	East side of the intersection of Immokalee Road / County Road 846 and Collier Boulevard / County Road 951	Other	Other	06/01/2009	AE, AH	Detailed information about 951 Canal (9CC-00; 9CN-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, “Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas” (TCE 2010). This canal is located in Cocohatchee B, Golden Gate Estates, and Golden Gate Main West Subbasins. It is also referred to as 951 Canal (9CC-00) 951 Canal North (9CN-00), and CR 951 Canal.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Cocohatchee Canal	At U.S. Highway 41 / Tamiami Trail North	North side of the intersection of Immokalee Road / County Road 846 and Maverick Lane	Other	Other	06/01/2009	AE	Detailed information about Cocohatchee Canal (CRB-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, “Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas” (TCE 2010). This canal is located in Cocohatchee B Subbasin. It is also referred to as Cocohatchee River (CRB-00; MCB-00).
Cypress Canal	Confluence with Golden Gate Main Canal	Approximately 600 feet east of 8th Street Northeast bridge	Other	Other	06/01/2009	AE	Detailed information about Cypress Canal (CYC-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, “Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas” (TCE 2010). This canal is located in Golden Gate Estates Subbasin.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
District 6 Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	AE, AH, AO, VE	The District 6 Basin includes the areas south of the Golden Gate Main Canal, west of the CR 951 Canal, extending south and west to the tidal waters extending from the Gordon River south to Marco Island. The model cells include numerous offset channels representing the ditches and canals within the District 6 basin including the Lely Canal, Haldeman Canal and Rock Creek. There are no major canals serving the District 6 Basin. Nor are there any major water control structures. There are, however, numerous small canals and ditches with associated water control structures. The main canals modeled are Rock Creek (RCB-00), Lely Main Canal (LCB-00), Lely Manor Canal (LMB-00), and Haldeman Creek (HCB-00).
Faka Union Canal	Approximately 3.85 miles downstream of U.S. Highway 41 / Tamiami Trail East	At Immokalee Road / County Road 846	Other	Other	06/01/2009	AE	Detailed information about Faka Union Canal (FKC-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, “Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas” (TCE 2010). This canal is located in Faka Union/Fakahatchee Strand Basin and Faka Union/Miller Canal Basin Subbasins.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Faka Union / Fakahatchee Strand Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	A, AE, AH, VE	The Faka Union/Fakahatchee Basin includes the areas northeast and east of Immokalee, west of the Okaloacoochee Slough. The Barron River (SR 29 Canal) and the Faka Union System, which includes the Faka Union Canal, Miller Canal, Merritt Canal, and Prairie Canal are included in this basin model. The southern terminus of this basin model is the Gulf of Mexico from the southern end of the Faka Union Canal to the southern end of the SR 29 Canal near Everglades City. Between the latter two canals the Fakahatchee Strand carries sheet flows to the Gulf as well. The model cells include numerous offset channels representing the ditches and canals within the basin including the Faka Union Canal (FKC-00), Miller Canal (MJC-00), Merritt Canal (EMC-00), Prairie Canal (FPC-00), and SR 29 Canal (BRC-00; BRN-00). The latter four canals are part of the Faka Union outfall system which also receives runoff from the Golden Gate Estates Basin.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Faka Union / Miller Canal Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	A, AE, AH	The Faka Union/Miller Basin includes the Faka Union Canal and Miller Canals both north and south of I-75. These canals continue south of I-75 until the Miller discharges into the Faka Union Canal at the same point where the Merritt and Prairie Canals also discharge to the Faka Union Canal. The model cells include numerous offset channels representing the canals within the Faka Union/Miller basin including the Miller Canal and the Faka Union Canal. Inflow hydrographs to the Faka Union from the Merritt and Prairie Canals are used in the Faka Union/Miller Canal Basin Model to account for these flows. These latter flows are computed by the Faka Union/Fakahatchee Model. The major canals in the Faka Union/Miller Basin are the Miller Canal (MJC-00) and the Faka Union Canal (FKC-00). Theses canals are part of the Faka Union outfall system. This system receives runoff from the Golden Gate Estates Basin.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Golden Gate Estates Basin	Within Collier County	Within Collier County	Other	Other	07/01/2011	AE, AH	The Golden Gate Estates Basin Model includes the areas drained by the Golden Gate Main Canal which receives flow from the Cypress Canal, Orange Canal, Corkscrew Canal, and Curry Canal basins. The Golden Gate Estates drainage system includes roadside swales that drain the uplands to several of the latter canals. Other water management systems for smaller developments also drain to these canals. The Golden Gate Main Canal and its tributary canals (described above) are all represented by specific grid inputs that represent these channels as imbedded conveyances. The model cells also include numerous channels representing the ditches and swales within the Golden Gate Estates basin. The major canals in the Golden Gate Estates North Basin are the Golden Gate Main Canal (MGG-00), Miller Canal (MJC-00), C-1 Canal (MJC-03), Orangetree Canal (OTC-00), Corkscrew Canal (CCB-00), Curry Canal (CYC-01), and Cypress Canal (CYC-00).
Golden Gate Main Canal	Approximately 2,350 feet west of Airport Pulling Road North	Just west of 72^{nd} Avenue Northeast	Other	Other	06/01/2009	AE	Detailed information about Golden Gate Main Canal (MGG-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, “Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas” (TCE 2010). This canal is located in Golden Gate Estates and Golden Gate Main West Subbasins.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Golden Gate Main West Basin	Within Collier County	Within Collier County	Other	Other	07/01/2011	AE, AH, VE	The Golden Gate Main West Basin model includes all of the areas draining to the Golden Gate Main Canal west of the 951 Canal. These areas include the drainage subbasins of the Harvey Canal, Green Canal, Airport Road South Canal, I-75 Canal, and the Gordon River Extension. The Golden Gate Main Canal receives runoff directly from areas adjacent to it as well as from tributary basins of these other canals. The Harvey Canal, Green Canal, Golden Gate Main Canal, Airport Road Canal, and I-75 Canal are all represented by specific grid inputs that represent these channels as imbedded conveyances. The Gordon River Extension is represented by embedded swales. The model cells also include numerous other channels representing the ditches and swales serving urban areas within the Golden Gate Main Canal West basin. The major canals in the Golden Gate Main West Basin are the Golden Gate Main Canal (MGG-00), Airport Road South Canal (ARS-00), I-75 Canal (D2D-00), Harvey Canal (D1C-00), and Green Canal (GCB-00).
Harvey Canal	At the Green Boulevard bridge	At Vanderbilt Beach Road bridge	Other	Other	06/01/2009	AE	Detailed information about Harvey Canal (D1C-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, "Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas" (TCE 2010). This canal is located in Golden Gate Estates Subbasin.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Henderson Canal	At U.S. Highway 41 / Tamiami Trail North	At Beck Boulevard	Other	Other	06/01/2009	AE	Detailed information about Henderson Canal (HEC-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, "Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas" (TCE 2010). This canal is located in District 6 and Henderson Creek Subbasins. It is also referred to as Henderson Creek (HEC-00), Henderson Creek Canal, 951 Canal as it aligns with SR 951.
Henderson Creek Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	AE, AH	The Henderson Creek Basin Model is located in the south central portion of Collier County and is bound by the CR-951 (County Road 951) to the west, the Miller Canal Basin (Faka Union/Miller Basin Model), the Southern Coastal Basin to the south, and the Golden Gate Estates Basin Model to the north. The I-75 drainage ditches along both sides of the highway convey water east toward the upper end of the 951 Canal. These canals collect sheetflows from the north and deliver sheetflows to the south to continue the natural flows. The Henderson Creek Canal (951 Canal) is represented by specific cells embedded into the model grid. The model cells also include offset channels representing the I-75 canals within the Henderson Creek basin. The major canal in the Henderson Creek Basin is the Henderson Creek Canal (HEC-00), also known as the 951 Canal as it aligns with State Road 951 and Alligator Alley Canal, also known as I-75 Canal.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
I-75 Canal	Confluence with Golden Gate Main Canal	South side of the intersection of Immokalee Road / County Road 846 and Tarpon Bay Boulevard	Other	Other	06/01/2009	AE	Detailed information about I-75 Canal (D2D-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, "Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas" (TCE 2010). This canal is located in Golden Gate Main West Subbasin.
Merritt Canal	Confluence with Faka Union Canal	At Interstate Highway 75	Other	Other	06/01/2009	A, AE	Detailed information about Merritt Canal (EMC-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, "Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas" (TCE 2010). This canal is located in Faka Union/Fakahatchee Strand Subbasin.
Miller Canal	Confluence with Faka Union Canal	Approximately 720 feet north of 8th Avenue North	Other	Other	06/01/2009	AE	Detailed information about Miller Canal (MJC-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, "Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas" (TCE 2010). This canal is located in Faka Union/Miller Canal and Golden Gate Estates Subbasins.
Prairie Canal	Confluence with Merritt Canal	Just east of 118th Avenue Southeast	Other	Other	06/01/2009	AE	Detailed information about Prairie Canal (FPC-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, "Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas" (TCE 2010). This canal is located in Faka Union/Fakahatchee Strand Subbasin.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Southern Coastal Basin	Within Collier County	Within Collier County	Other	Other	06/01/2009	AE, AH, VE	The Southern Coastal Basin is a mostly undeveloped drainage area in the southern portion of Collier County, bounded on the east by the Faka Union System, on the north by the Henderson Creek Basin and on the west by the District 6 Basin. U.S. Highway 41 crosses the Southern Coastal Basin interrupting the otherwise natural south to southwest sheetflow. There are several culverts that carry the runoff under U.S. Highway 41 toward the tidal waters of the Gulf Coast. These culverts flows are redistributed as sheetflow or, in the western portion of the basin, connect to swales carrying the flow through developed areas. The U.S. Highway 41 roadway is represented by a barrier with culverts conveying water to the south. The swales are represented by embedded channels. There are no major canals serving the Southern Coastal basin. Nor are there any major water control structures. There are, however, numerous small canals and ditches with associated water control structures that are part of a secondary drainage system and overland flow and sloughs in the primarily undeveloped southeastern part of the Basin. The main canal modeled is the Tamiami Canal, which runs parallel to and on the north side of U.S. Highway 41, also known as Tamiami Trail.

Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
SR 29 Canal	Just to the east of the intersection of State Road 29 and U.S. Highway 41 / Tamiami Trail East	Just north of the intersection of Seminole Crossing Trail and State Road 29 / New Harvest Road / East Main Street	Other	Other	06/01/2009	A, AE	Detailed information about SR 29 Canal (BRC-00; BRN-00) is provided in the narrative below. A more complete description of the hydraulic and hydrologic methods used is given in, “Hydrologic/Hydraulic Analysis and Engineering Report, Collier County and Incorporated Areas” (TCE 2010). This canal is located in Ava Maria and Faka Union/Fakahatchee Strand Subbasins. It is also referred to as Barron River and Barron River Canal, SR 29 Canal.

Riverine Analysis

The riverine analysis was conducted using two-dimensional hydrologic/hydrodynamic modeling. At the beginning of the project, the seven major basins that cover the middle and western portions of Collier County were defined based on topography and on the basin delineations provided by the SFWMD. Each basin was then modeled using the S2DMM program (TCE 2008), which is a two-dimensional, grid-based hydrologic/hydrodynamic model. The grid sizes for each basin varied between 500 feet by 500 feet to 1,000 feet by 1,000 feet, depending on the size of the basin, level of development, and resolution needed. The grid size of each basin is summarized in the following table.

Basin	Grid Size (ft.)	Calibration Period	Verification Period
Ava Maria	1000 x 1000	05/2005-09/2005	05/2006-09/2006
Cocohatchee A	2640 x 2640	05/2006-09/2006	05/2005-09/2005
Cocohatchee B/C	1000 x 1000	05/2006-09/2006	05/2005-09/2005
Golden Gate Estates	660 x 660	08/1995	09/1999[1]
Golden Gate Main West	500 x 500	08/1995	09/1999
Henderson	1000 x 1000	08/1995	09/1999
District 6	500 x 500	08/1995	09/1999
Southern Coastal	1000 x 1000	07/2001	09/1999
Faka Union/Miller Canal	660 x 660	05/2005-07/2005	06/2006-09/2006
Faka Union/Fakahatchee Strand	2640 x 2640	05/2005-09/2005	05/2006-09/2006
Copeland	1000 x 1000	No observed data available for calibration	

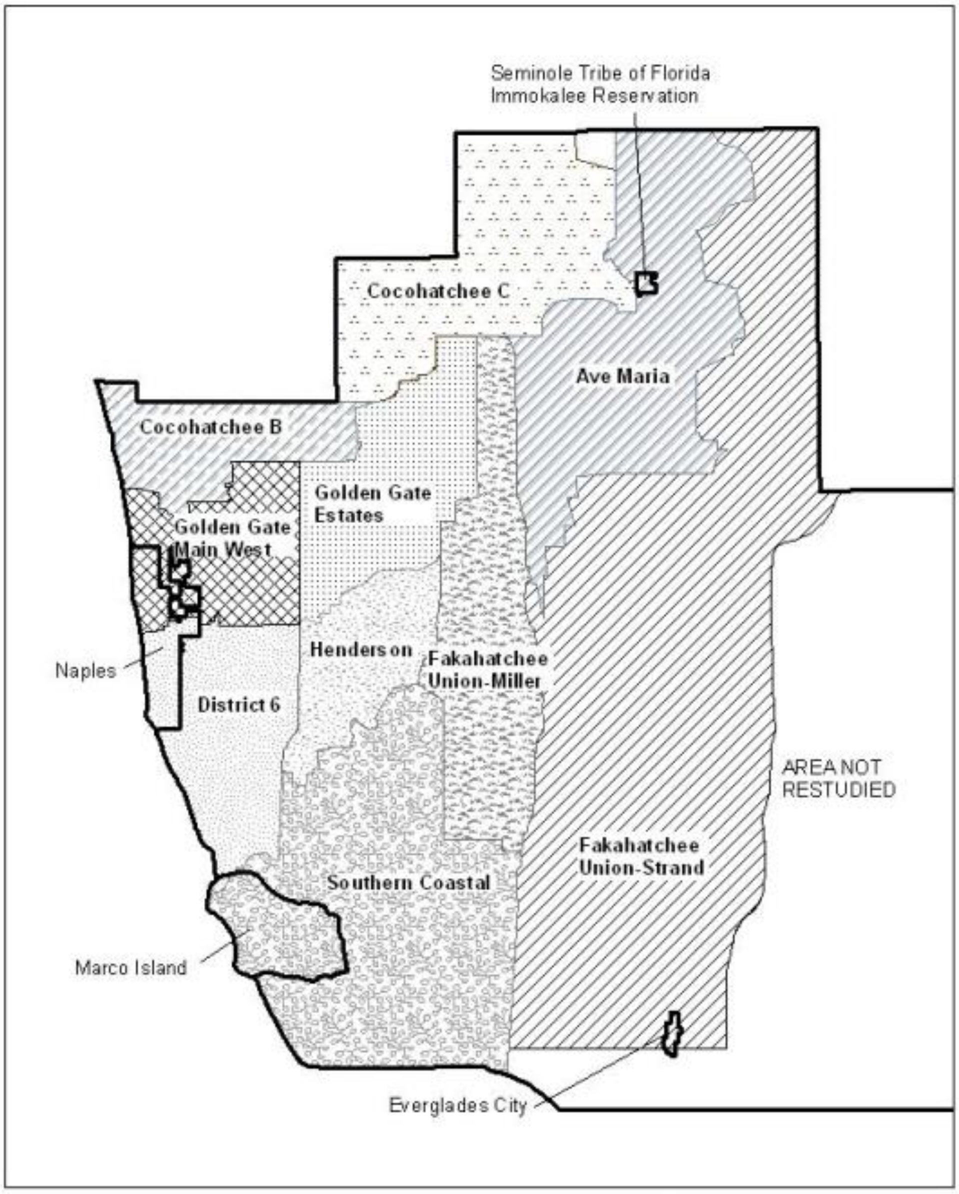
[1] August 1995 rainfall data are from Tropical Storm Jerry; September 1999 data are from Tropical Storm Harvey

The less-developed area of eastern Collier County was modeled by two larger-sized grid models (2,640 feet by 2,640 feet); output from these models was used to provide input values to the smaller-sized grids for populated areas within the basins. Results from the larger grid models were not used to establish flood elevations. Twelve basin models were developed in the following figure.

Each model was calibrated and validated by comparing the modeled stages and discharge hydrographs to recorded stages, high water marks, and discharges where available. Observed well elevations were also used to calibrate rainfall loss to groundwater. Calibration and verification used rainfall data for major storms during the wet season to best represent basin behavior in flood events. The periods of data used in the calibration and validation for each model are summarized in the table above.

The calibrated watershed model was used to simulate the 10-percent, 2-percent, 1-percent, and 0.2-percent-annual-chance floods. The starting conditions for each basin model were established by running the models for 14 days with the average daily rainfall for the months of August and September (wet season). The resulting water levels throughout the basins were used as the antecedent condition.

Major Basin Location Map



FEDERAL EMERGENCY MANAGEMENT AGENCY

COLLIER COUNTY, FL
AND INCORPORATED AREAS

MAJOR BASIN LOCATION MAP

The WSELs were estimated using rainfall data from the SFWMD, which provide rainfall isohytes for 10-percent, 25-percent and 1-percent-annual-chance events. Depths for the 2-percent and 0.2-percent-annual-chance storms were derived graphically from log-log relationship of depth and frequency. Depths varied from basin to basin as defined in the SFWMD's Environmental Resource Permit Information Manual (SFWMD 2000) and rainfall was distributed temporally according to the SFWMD 3-day temporal distribution. Table 9 lists the calculated discharges.

The peak stage was calculated for each grid cell. The grid cells represented uplands as well as water bodies, including lakes, canals, rivers and bays. In basin models, canals were typically represented as "offset channels" that allowed the hydrodynamics to be computed separately from the upland runoff dynamics. The offset channels were connected to the upland runoff areas via actual structures such as pipes and weirs or effective structures to represent bank overtoppings.

Combined Coastal/Riverine Analyses

For the areas of the county that would be impacted by both coastal surge/hurricane flooding events and large rainfall flooding, a combined effects analysis was conducted. The 1-percent-annual-chance riverine flood elevations were compared to the 1-percent-annual-chance coastal flood elevation in each riverine grid cell along this transition zone. If one flood elevation statistically dominated, it became the recorded 1-percent-annual-chance elevation. For most of these transitional grids, it was necessary to estimate the combined effects to determine the correct BFE. The methods specified in Appendix D of FEMA's Guidelines and Specifications (FEMA 2003) were applied to estimate the combined effects from coastal and riverine flooding. The following equation was used:

$$R_{P,T}(Z) = R_{P,R}(Z) + R_{P,S}(Z)$$

Where,

- Z – flood level at point P
- $R_{P,T}(Z)$ – total rate (occurrences per year) that Z is exceeded, irrespective of flood source
- $R_{P,R}(Z)$ – rate that Z is exceeded for rainfall events (riverine impact)
- $R_{P,S}(Z)$ – rate that Z is exceeded for surge events (coastal impact)

After the flood elevations in the transition zone were adjusted, it was decided that those areas would be mapped in the riverine portion of the watershed. The coastal portion of each watershed was mapped with whole-foot BFEs, while the riverine portion was mapped with half-foot BFEs. Including the transition zone areas with the riverine portion provides those areas with more detailed BFE information.

Table 13: Roughness Coefficients

[Not Applicable to this Flood Risk Project]

5.3 Coastal Analyses

For the areas of Collier 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 14 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 14: Summary of Coastal Analyses

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Gulf of Mexico	Entire coastline of Collier County	Entire coastline of Collier County	Storm Climatology Statistical Analyses	JPM-OS	01/22/2017
Gulf of Mexico	Entire coastline of Collier County	Entire coastline of Collier County	Storm Surge Including Regional Wave Setup	ADCIRC + SWAN	03/06/2018
Gulf of Mexico	Entire coastline of Collier County	Entire coastline of Collier County	Stillwater Frequency Analysis	SURGESTAT (low and high frequency)	03/06/2018
Gulf of Mexico	Entire coastline of Collier County	Entire coastline of Collier County	Wave Generation	SWAN	03/05/2019
Gulf of Mexico	Entire coastline of Collier County	Entire coastline of Collier County	Erosion	FEMA's Erosion Assessment	03/05/2019
Gulf of Mexico	Entire coastline of Collier County	Entire coastline of Collier County	Overland Wave Propagation	WHAFIS 4.0	03/05/2019
Gulf of Mexico	Entire coastline of Collier County	Entire coastline of Collier County	Wave Runup	RUNUP2.0	03/05/2019

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1-percent-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 14. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 16, "Coastal Transect Parameters." Figure 8 shows the total stillwater elevations for the 1-percent-annual-chance flood that was determined for this coastal analysis.

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

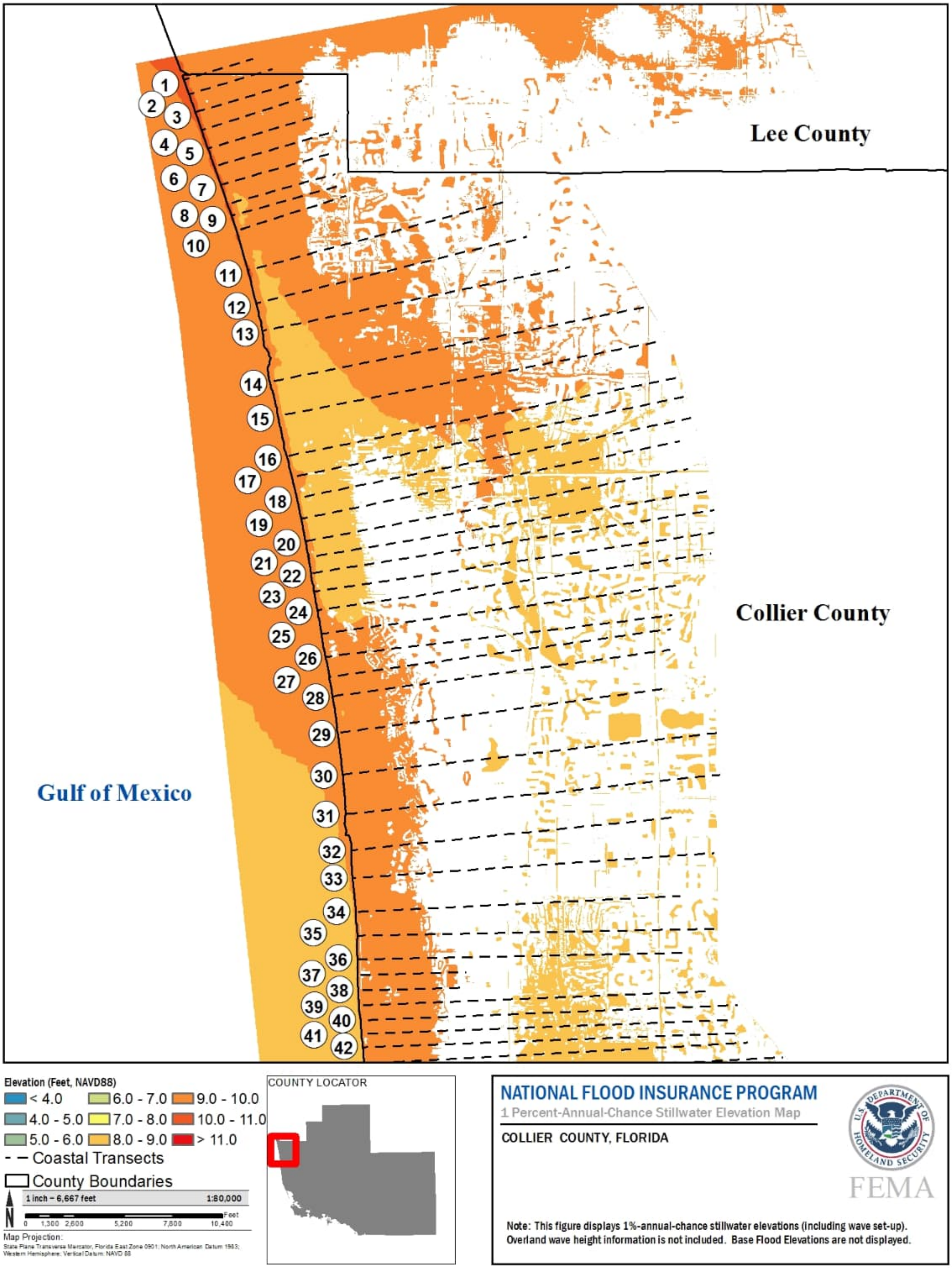


Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas

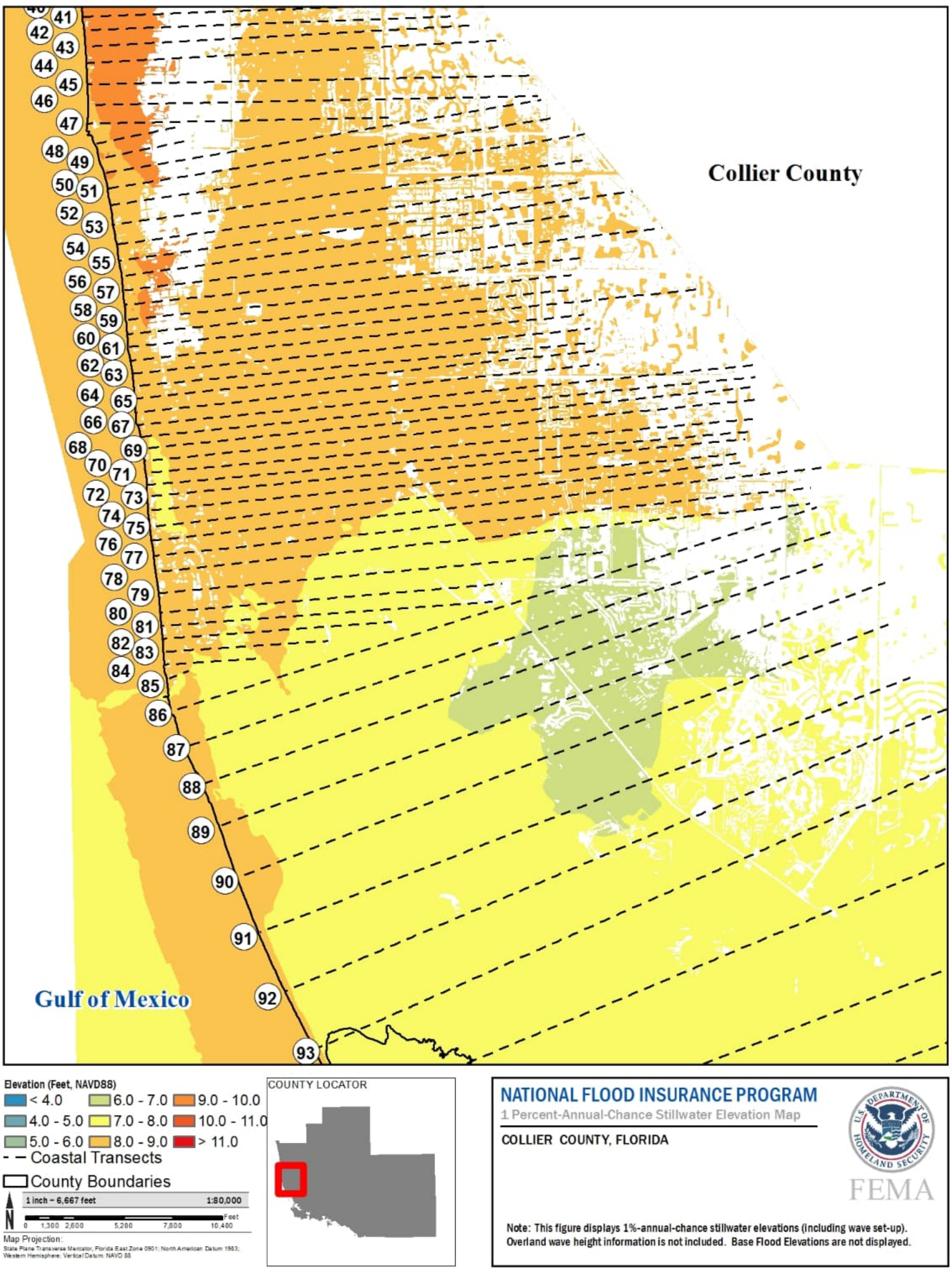
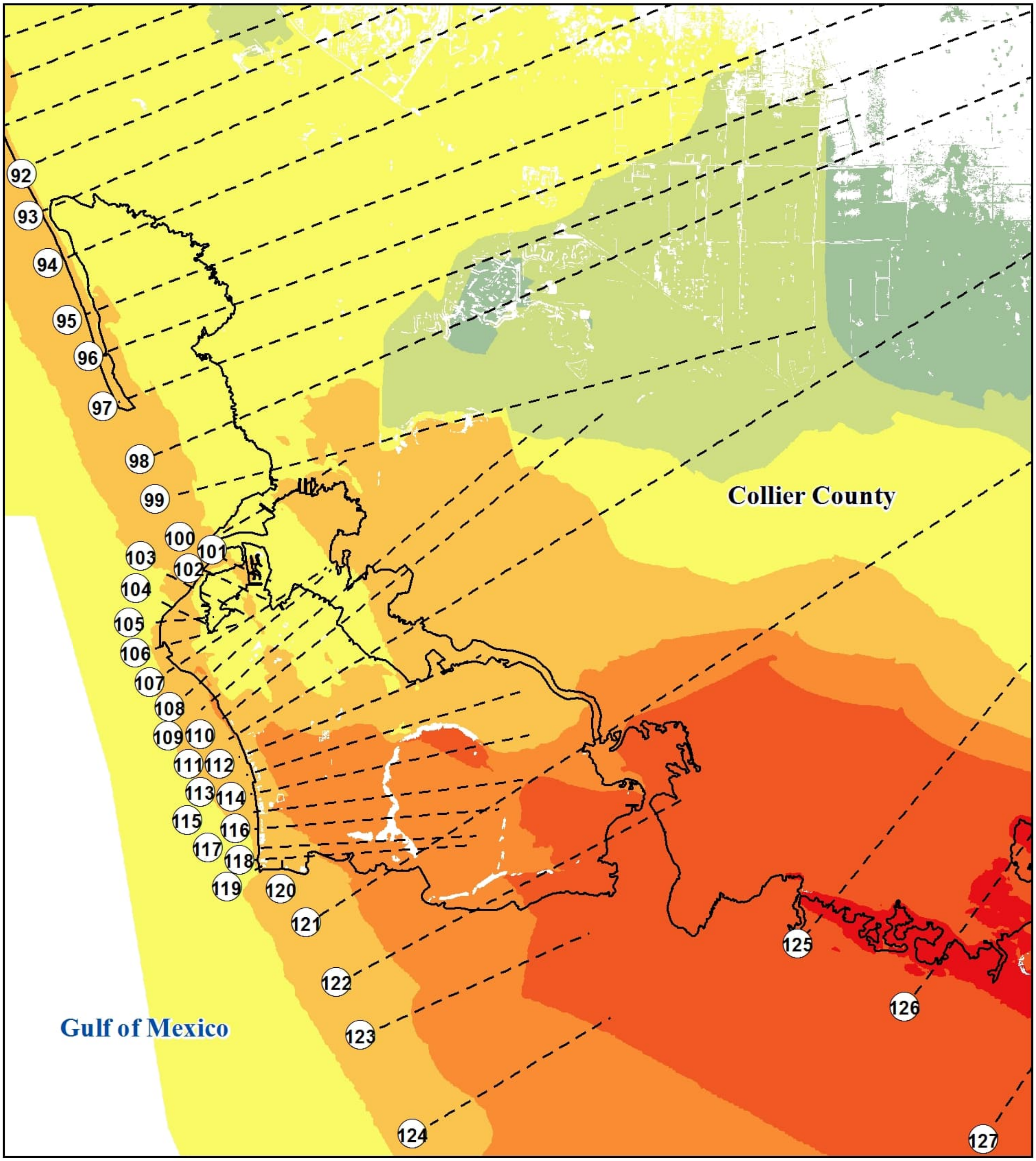
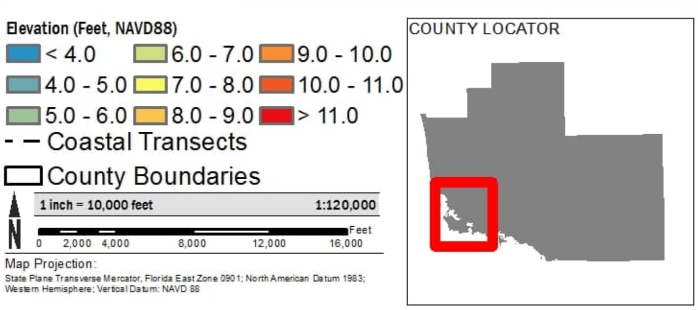


Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas





NATIONAL FLOOD INSURANCE PROGRAM

1 Percent-Annual-Chance Stillwater Elevation Map

COLLIER COUNTY, FLORIDA

FEMA

Note: This figure displays 1%-annual-chance stillwater elevations (including wave set-up). Overland wave height information is not included. Base Flood Elevations are not displayed.

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

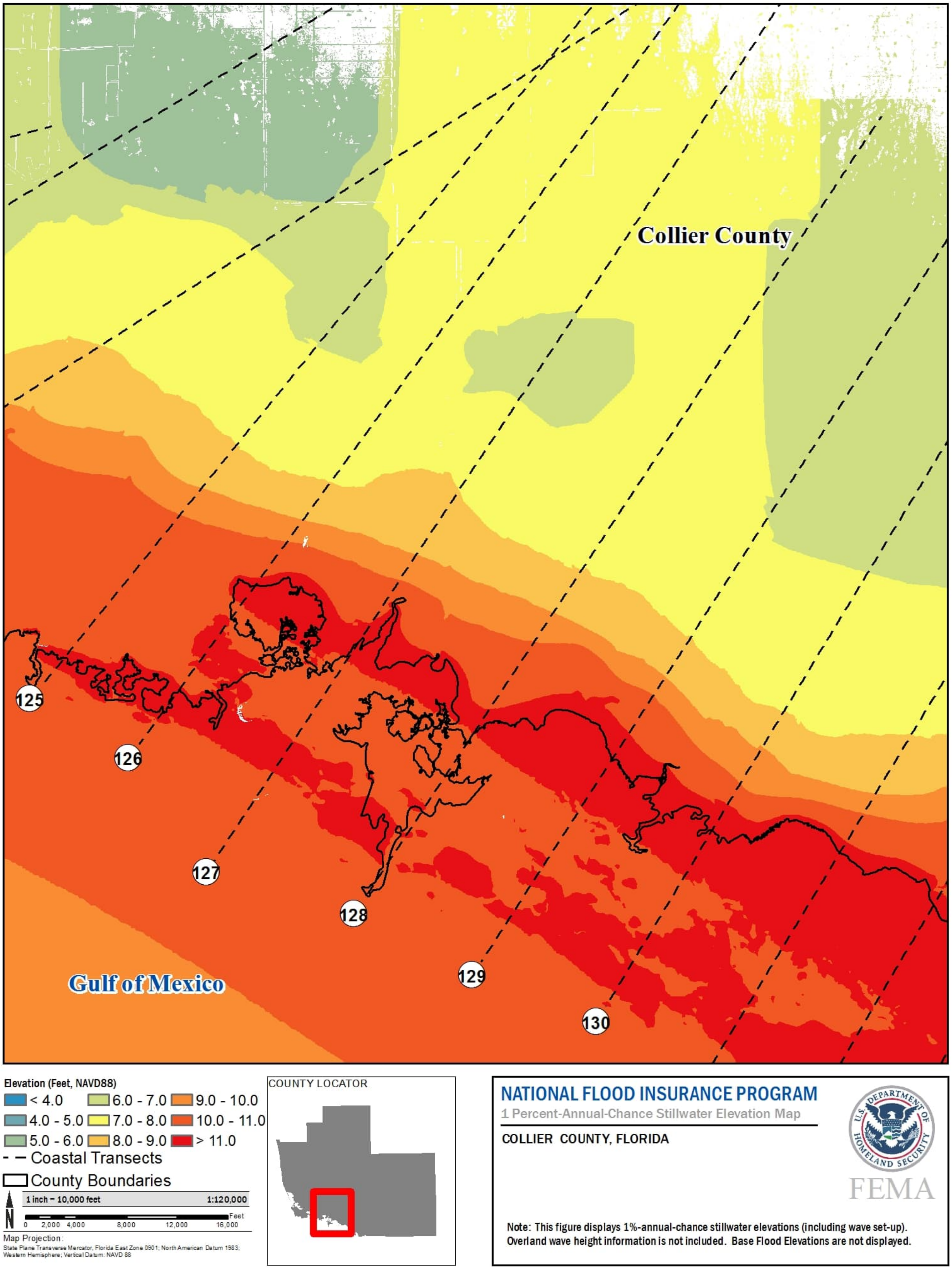
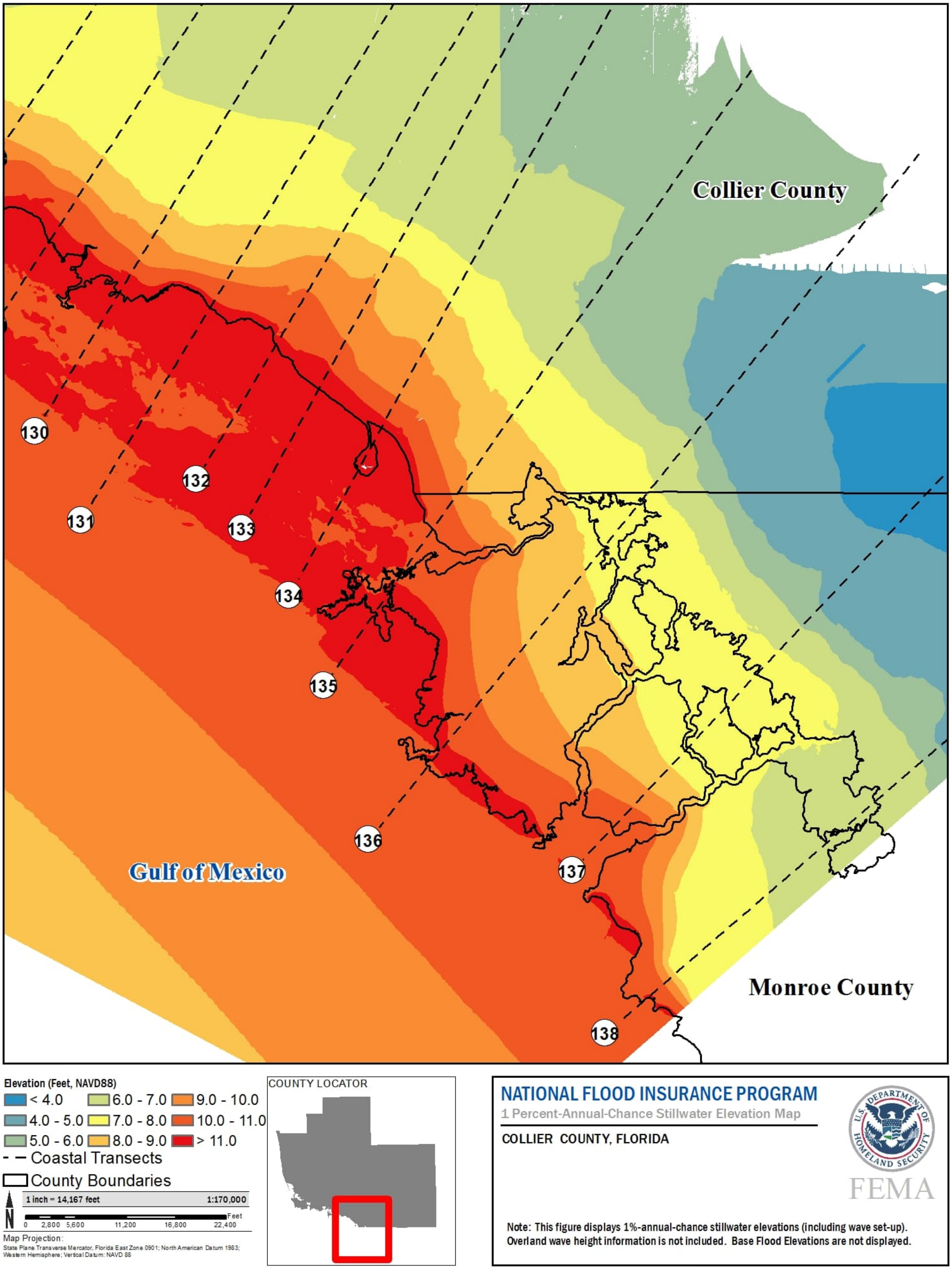


Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas



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.

Characteristics such as the strength, size, and track were used in the Joint Probability Method (JPM) to define tropical storm behavior for the Southwest Florida Study Region. 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-percent-annual chance flood.

Table 15: Tide Gage Analysis Specifics

[Not Applicable to this Flood Risk Project]

Combined Riverine and Tidal Effects

A combined rate of occurrence analysis was conducted to compute a 1-percent-annual-chance BFE for areas subject to flooding by both coastal and riverine flooding mechanisms. Since riverine and coastal analyses were based on independent events, the resulting combined BFE would be higher than that of their individual occurrence. In other words, at the location where the computed 1-percent-annual-chance coastal flood level equals the computed 1-percent-annual-chance riverine flood level, there was a greater than 1-percent-annual-chance of this flood level being equaled or exceeded.

In Collier County, combined rate of occurrence calculations were performed.

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 14 and included in the frequency analysis for the determination of the total stillwater elevations.

5.3.2 Waves

Offshore wave conditions were modeled as part of the regional hydrodynamic and wave modeling (ADCIRC + SWAN). The regional model results provided valuable information on the wave conditions that could be expected to occur during the types of extreme storm events that would produce storm surge elevations with 1- and 0.2-percent-annual-chance probabilities of occurrence. Wave heights and periods derived from the SWAN model results were used as inputs to the wave hazard analyses described in Section 5.3.4.

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 14. 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-percent-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 16 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 14, "Summary of Coastal Analyses". For the 0.2-percent-annual-chance event, wave profiles were created to indicate the results of the wave height analysis at each transect (Exhibit 1). Such wave profiles may show greater detail than the mapping product, due to limitations of the map scale and smoothing tolerances applied during boundary cleanup.

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-percent-annual-chance flood. Wave runup elevations were modeled using the methods and models listed in Table 14. Wave runup is defined as the maximum vertical extent of wave uprush on a beach or structure. FEMA's 2018 Guidelines and Specifications require the 2-percent wave runup level be computed for the coastal feature being evaluated (cliff, coastal bluff, dune, or structure) (FEMA 2018). The 2-percent-exceedence runup is the runup exceeded by 2-percent of the runup values calculated at the shoreline/structure face. Each transect defined within the study area was evaluated for the applicability of wave runup, and if necessary, the appropriate runup methodology was selected and applied to each transect. Runup elevations were then compared to WHAFIS results to determine the dominant process affecting BFEs and associated flood hazard levels. Based on wave runup rates, wave overtopping was computed following the FEMA 2018 Guidelines and Specifications. Wave runup analysis for the 0.2-percent-annual-chance event was not performed for this study and is not included in the profiles.