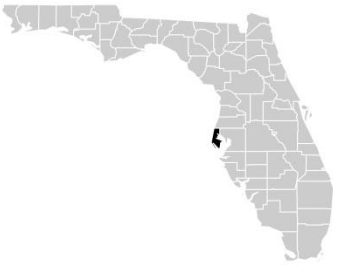
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 8



PINELLAS COUNTY, FLORIDA

AND INCORPORATED AREAS

COMMUNITY NAME	NUMBER	COMMUNITY NAME	NUMBER
BELLEAIR, TOWN OF	125088	REDINGTON SHORES, TOWN OF	125141
BELLEAIR BEACH, CITY OF	125089	SAFETY HARBOR, CITY OF	125143
BELLEAIR BLUFFS, CITY OF	120239	SEMINOLE, CITY OF	120257
BELLEAIR SHORE, TOWN OF	125090	SOUTH PASADENA, CITY OF	125151
CLEARWATER, CITY OF	125096	ST. PETE BEACH, CITY OF	125149
DUNEDIN, CITY OF	125103	ST. PETERSBURG, CITY OF	125148
GULFPORT, CITY OF	125108	TARPON SPRINGS, CITY OF	120259
INDIAN ROCKS BEACH, CITY OF	125117	TREASURE ISLAND, CITY OF	125153
INDIAN SHORES, TOWN OF	125118		
KENNETH CITY, TOWN OF	120245		
LARGO, CITY OF	125122		
MADEIRA BEACH, CITY OF	125127		
NORTH REDINGTON BEACH, TOWN OF	125133		
OLDSMAR, CITY OF	120250		
PINELLAS COUNTY, UNINCORPORATED AREAS	125139		
PINELLAS PARK, CITY OF	120251		
REDINGTON BEACH, TOWN OF	125140		

REVISED:

AUGUST 24, 2021

FLOOD INSURANCE STUDY NUMBER
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Version Number 2.4.3.2

FEMA

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Published Separately

Flood Insurance Rate Map (FIRM)

FLOOD INSURANCE STUDY REPORT
PINELLAS 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 Pinellas 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
Belleair, Town of	125088	03100207	12103C0104H 12103C0108J 12103C0112H 12103C0116J	
Belleair Beach, City of	125089	03100207	12103C0111H 12103C0112H	
Belleair Bluffs, City of	120239	03100207	12103C0112H 12103C0116J	
Belleair Shore, Town of	125090	03100207	12103C0111H 12103C0112H	

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
Clearwater, City of	125096	03100206, 03100207	12103C0064H 12103C0069H 12103C0086G 12103C0087H 12103C0088G 12103C0089H 12103C0102H 12103C0104H 12103C0106J 12103C0107J 12103C0108J 12103C0109J 12103C0112H 12103C0116J 12103C0117J 12103C0126G 12103C0127H 12103C0128H 12103C0129H 12103C0131H 12103C0133H 12103C0134H 12103C0136H	
Dunedin, City of	125103	03100207	12103C0054H 12103C0058H 12103C0062H 12103C0064H 12103C0066H 12103C0067H 12103C0068H 12103C0069H 12103C0086G 12103C0088G 12103C0102H 12103C0106J 12103C0107J	
Gulfport, City of	125108	03100207	12103C0213H 12103C0214H 12103C0276H 12103C0277H	
Indian Rocks Beach, City of	125117	03100207	12103C0111H 12103C0112H 12103C0113H 12103C0114H 12103C0176H	

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
Indian Shores, Town of	125118	03100207	12103C0176H 12103C0177H 12103C0179H	
Kenneth City, Town of	120245	03100207	12103C0203J 12103C0204H 12103C0211H 12103C0212G	
Largo, City of	125122	03100206, 03100207	12103C0108J 12103C0109J 12103C0112H 12103C0113H 12103C0114H 12103C0116J 12103C0117J 12103C0118H 12103C0119H 12103C0128H 12103C0136H 12103C0137H 12103C0138H 12103C0139H 12103C0177H	
Madeira Beach, City of	125127	03100207	12103C0191H 12103C0192H	
North Redington Beach, Town of	125133	03100207	12103C0179H 12103C0183H 12103C0187H	
Oldsmar, City of	120250	03100206	12103C0083H 12103C0084H 12103C0087H 12103C0089H 12103C0091H 12103C0092H 12103C0093H 12103C0094H	
Pinellas County, Unincorporated Areas	125139	03100206, 03100207	12103C0015H 12103C0016H 12103C0017H 12103C0018H 12103C0019H 12103C0036H 12103C0037H 12103C0038H 12103C0039H 12103C0041G 12103C0042G	

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
Pinellas County, Unincorporated Areas (continued)	125139	03100206, 03100207	12103C0043G 12103C0044G 12103C0052H 12103C0054H 12103C0056H 12103C0057H 12103C0058H 12103C0059H 12103C0062H 12103C0066H 12103C0067H 12103C0069H 12103C0076H 12103C0077G 12103C0078G 12103C0079H 12103C0081G 12103C0082G 12103C0083H 12103C0084H 12103C0086G 12103C0087H 12103C0088G 12103C0089H 12103C0091H 12103C0092H 12103C0093H 12103C0094H 12103C0106J 12103C0107J 12103C0108J 12103C0109J 12103C0112H 12103C0113H 12103C0114H 12103C0116J 12103C0117J 12103C0118H 12103C0119H 12103C0126G 12103C0127H 12103C0128H 12103C0129H 12103C0131H 12103C0132G[1] 12103C0133H 12103C0134H 12103C0136H 12103C0137H	

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
Pinellas County, Unincorporated Areas (continued)	125139	03100206, 03100207	12103C0138H 12103C0139H 12103C0141H 12103C0142H 12103C0143H 12103C0144H 12103C0155G[1] 12103C0161H 12103C0162G[1] 12103C0163H 12103C0164H 12103C0176H 12103C0177H 12103C0179H 12103C0181H 12103C0182H 12103C0183H 12103C0184H 12103C0191H 12103C0192H 12103C0193H 12103C0194H 12103C0201J 12103C0202J 12103C0203J 12103C0204H 12103C0206J 12103C0207H 12103C0208J 12103C0211H 12103C0212G 12103C0213H 12103C0214H 12103C0216G 12103C0226H 12103C0227G[1] 12103C0257H 12103C0276H 12103C0277H 12103C0278H 12103C0279H 12103C0283H 12103C0286H 12103C0287H 12103C0288H 12103C0289H 12103C0295H 12103C0326H 12103C0327H	

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
Pinellas Park, City of	120251	03100206, 03100207	12103C0119H 12103C0138H 12103C0139H 12103C0143H 12103C0182H 12103C0201J 12103C0202J 12103C0203J 12103C0204H 12103C0206J 12103C0208J	
Redington Beach, Town of	125140	03100207	12103C0179H 12103C0183H 12103C0187H 12103C0191H	
Redington Shores, Town of	125141	03100207	12103C0179H	
Safety Harbor, City of	125143	03100206	12103C0087H 12103C0089H 12103C0093H 12103C0127H 12103C0131H	
Seminole, City of	120257	03100207	12103C0118H 12103C0177H 12103C0181H 12103C0182H 12103C0183H 12103C0184H 12103C0191H 12103C0192H	
South Pasadena, City of	125151	03100207	12103C0194H 12103C0213H 12103C0257H 12103C0276H	
St. Pete Beach, City of	125149	03100206, 03100207	12103C0194H 12103C0213H 12103C0257H 12103C0276H 12103C0278H 12103C0286H	
St. Petersburg, City of	125148	03100206, 03100207	12103C0141H 12103C0142H 12103C0143H 12103C0144H 12103C0161H 12103C0163H	

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
St. Petersburg, City of (continued)	125148	03100206, 03100207	12103C0192H 12103C0194H 12103C0206J 12103C0207H 12103C0208J 12103C0209H 12103C0211H 12103C0212G 12103C0213H 12103C0214H 12103C0216G 12103C0217H 12103C0218G 12103C0219H 12103C0226H 12103C0227G[1] 12103C0228H 12103C0229H 12103C0236H 12103C0237G[1] 12103C0238H 12103C0239G[1] 12103C0245G[1] 12103C0277H 12103C0278H 12103C0279H 12103C0281H 12103C0282H 12103C0283H 12103C0284H 12103C0287H 12103C0289H 12103C0295H 12103C0301H 12103C0302G[1] 12103C0303G[1] 12103C0304G[1] 12103C0310G[1] 12103C0315G[1]	
Tarpon Springs, City of	120259	03100206, 03100207	12103C0015H 12103C0016H 12103C0017H 12103C0018H 12103C0019H 12103C0036H 12103C0038H 12103C0056H 12103C0057H 12103C0076H	

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
Treasure Island, City of	125153	03100207	12103C0191H 12103C0192H 12103C0193H 12103C0194H 12103C0257H	

[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% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

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

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

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 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 Pinellas County became effective on September 3, 2003. Refer to Table 27 for information about subsequent revisions to the FIRMs.

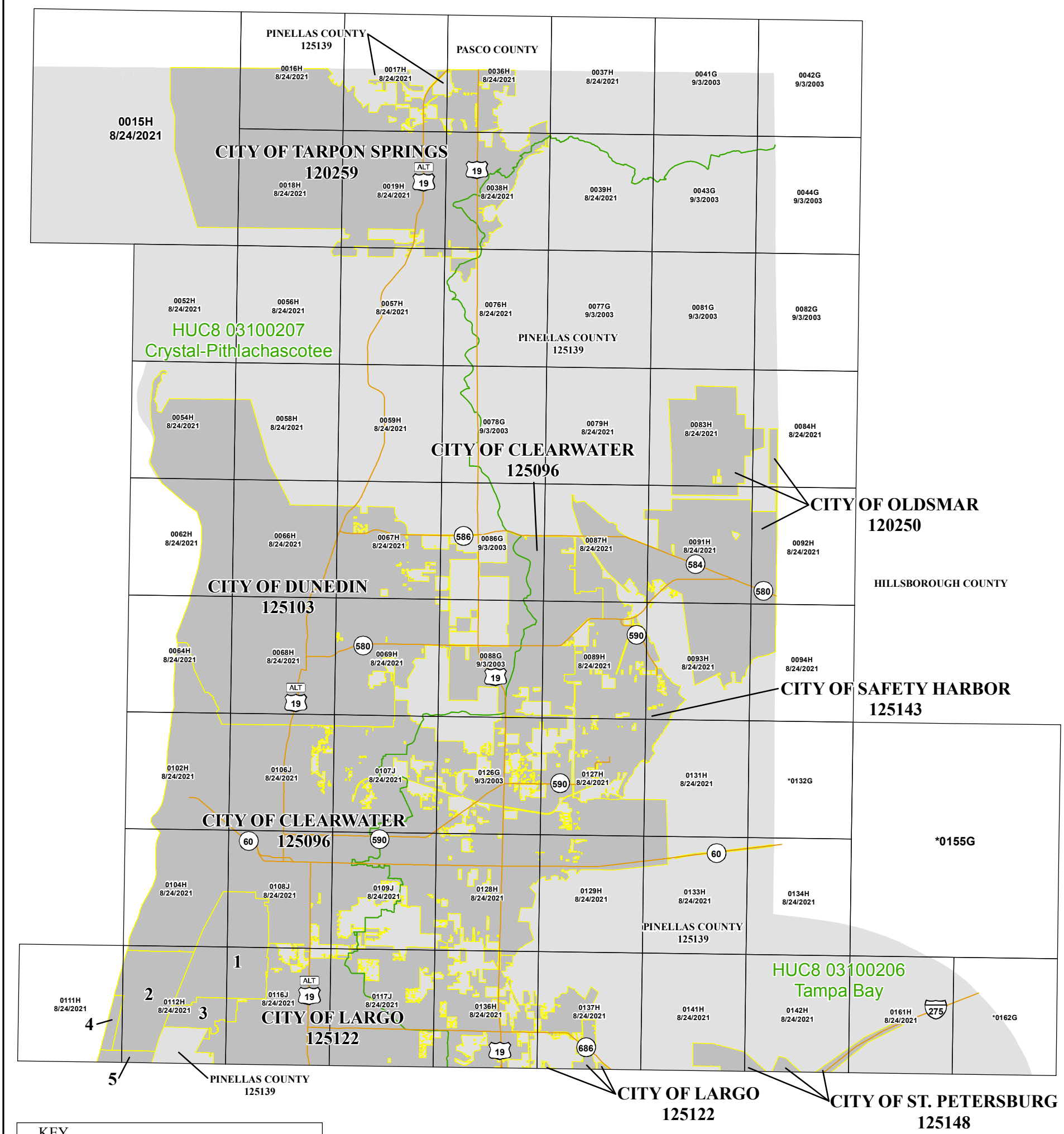
- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by 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/flood-insurance/rules-legislation/community-rating-system or contact your appropriate FEMA Regional Office for more information about this program**.**

- 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/flood-maps/tutorials.

The FIRM Index in Figure 1 shows the overall FIRM panel layout within Pinellas 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, transportation features, flooding sources, watershed boundaries, and USGS HUC-8 codes.

Figure 1: FIRM Panel Index



KEY NUMBER	COMMUNITY	CID
1	Town of Belleair	125088
2	City of Belleair Beach	125089
3	City of Belleair Bluffs	120239
4	Town of Belleair Shore	125090
5	City of Indian Rocks Beach	125117

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 August 24, 2021.

N

1 inch = 10,417 feet 1:125,000

feet
0 2,950 5,900 11,800 17,700 23,600

Map Projection:
Universal Transverse Mercator Zone 17N;
North American Datum 1927

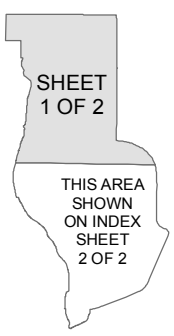
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - OPEN WATER AREA

PINELLAS COUNTY, FL
INDEX LOCATOR DIAGRAM



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

PINELLAS COUNTY, FLORIDA and Incorporated Areas
SHEET 1 OF 2

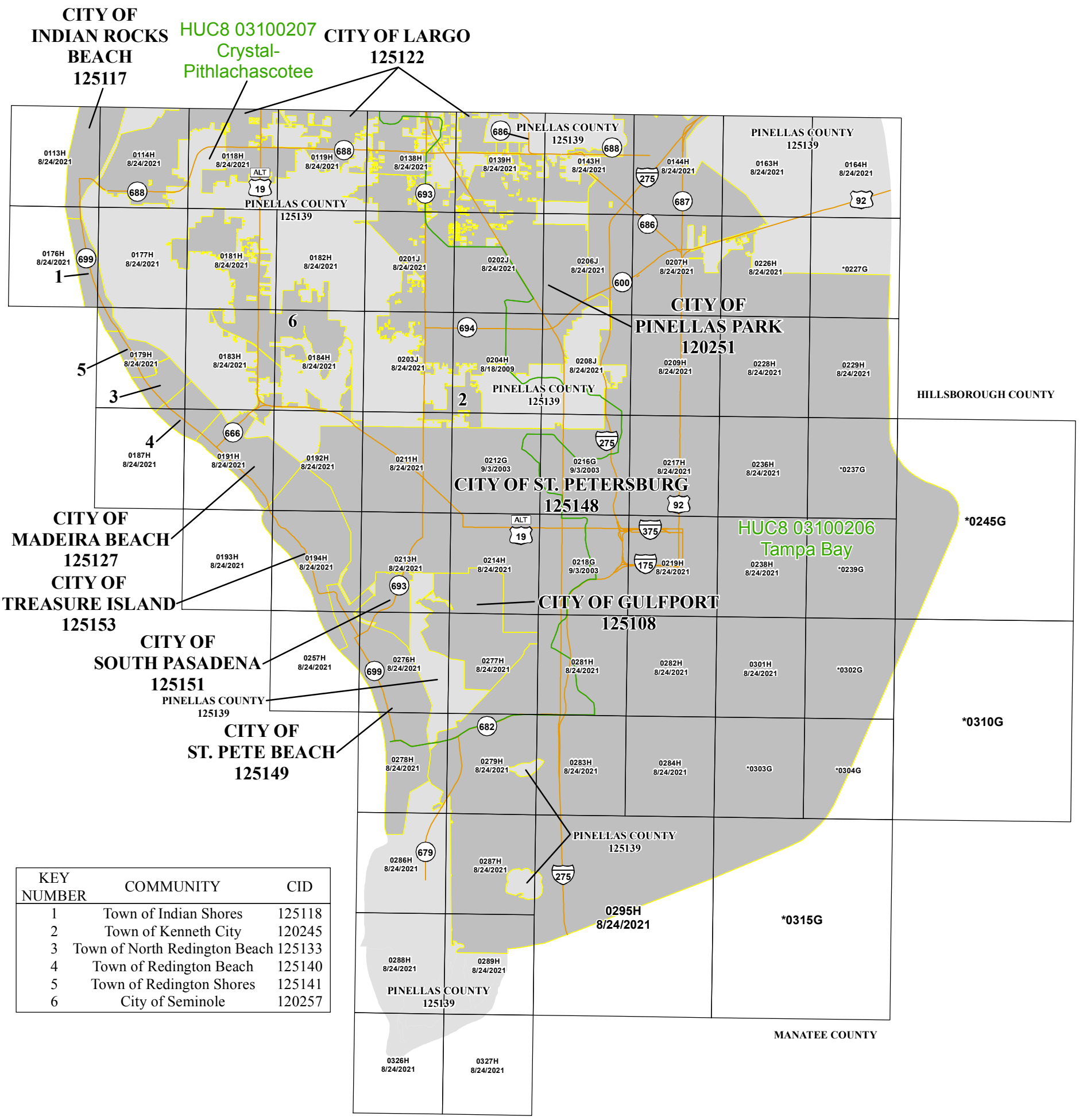
PANELS PRINTED:
0015, 0016, 0017, 0018, 0019, 0036, 0037, 0038, 0039, 0041, 0042, 0043, 0044, 0052, 0054, 0056, 0057, 0058, 0059, 0062, 0064, 0066, 0067, 0068, 0069, 0076, 0077, 0078, 0079, 0081, 0082, 0083, 0084, 0086, 0087, 0088, 0089, 0091, 0092, 0093, 0094, 0102, 0104, 0106, 0107, 0108, 0109, 0111, 0112, 0116, 0117, 0126, 0127, 0128, 0129, 0131, 0133, 0134, 0136, 0137, 0141, 0142, 0161

FEMA

MAP NUMBER
12103CIND1D

MAP REVISED
AUGUST 24, 2021

Figure 1: FIRM Panel Index (continued)



KEY NUMBER	COMMUNITY	CID
1	Town of Indian Shores	125118
2	Town of Kenneth City	120245
3	Town of North Redington Beach	125133
4	Town of Redington Beach	125140
5	Town of Redington Shores	125141
6	City of Seminole	120257

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 August 24, 2021.

N

1 inch = 12,500 feet 1:150,000

feet 0 3,500 7,000 14,000 21,000 28,000

Map Projection:
Universal Transverse Mercator Zone 17N;
North American Datum 1927

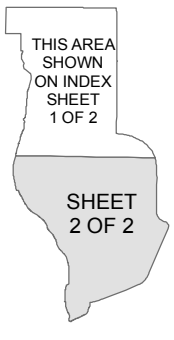
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - OPEN WATER AREA

PINELLAS COUNTY, FL
INDEX LOCATOR DIAGRAM



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

PINELLAS COUNTY, FLORIDA and Incorporated Areas
SHEET 2 OF 2

PANELS PRINTED:
0113, 0114, 0118, 0119, 0138, 0139, 0143, 0144, 0163, 0164, 0176, 0177, 0179, 0181, 0182, 0183, 0184, 0187, 0191, 0192, 0193, 0194, 0201, 0202, 0203, 0204, 0206, 0207, 0208, 0209, 0211, 0212, 0213, 0214, 0216, 0217, 0218, 0219, 0226, 0228, 0229, 0236, 0238, 0257, 0276, 0277, 0278, 0279, 0281, 0282, 0283, 0284, 0286, 0287, 0288, 0289, 0295, 0301, 0326, 0327

FEMA

MAP NUMBER
12103CIND2C

MAP REVISED
AUGUST 24, 2021

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 Mapping and Insurance 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 Mapping and Insurance 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.

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

Figure 2: FIRM Notes to Users

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

PROJECTION INFORMATION: The projection used in the preparation of the map was Universal Transverse Mercator (UTM) Zone 17N. The horizontal datum was the North American Datum of 1927 NAD27, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at 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 the FIRM was provided in digital format by the Federal Emergency Management Agency, dated 2009; the Florida Department of Transportation, dated 2017; the Florida Resources and Environmental Analysis Center, dated 2003; Pinellas County, dated 2017; and the U.S. Department of Agriculture, dated 2016. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

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.

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Pinellas 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 FIRM panels issued before August 24, 2021.

Figure 2: FIRM Notes to Users

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Pinellas County, Florida, effective August 24, 2021.

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.

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 Pinellas 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.

Figure 3: Map Legend for FIRM

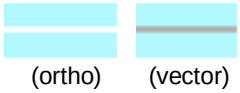
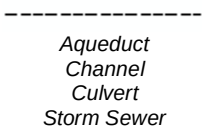
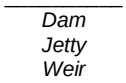
	Regulatory Floodway determined in Zone AE.
OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood 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.
	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
	Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
	Channel, Culvert, Aqueduct, or Storm Sewer
	Dam, Jetty, Weir

Figure 3: Map Legend for FIRM

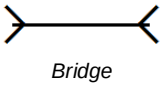
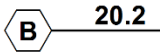
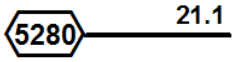
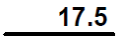
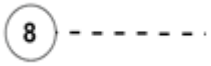
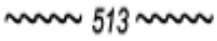
	Levee, Dike, or Floodwall
	Bridge
REFERENCE MARKERS	
	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
	Coastal Transect
	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
	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
BASE MAP FEATURES	
	River, Stream or Other Hydrographic Feature
	Interstate Highway
	U.S. Highway
	State Highway

Figure 3: Map Legend for FIRM

234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}E$	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16' 52.5"	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

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

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

Depending on the accuracy of available topographic data (Table 22), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, "Map Legend for FIRM", describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Pinellas 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% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic

data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

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
Alligator Creek Channel A	Clearwater, City of; Pinellas County, Unincorporated Areas	Confluence with Alligator Lake	Approximately 90 feet upstream of Glen Oak Avenue	03100206	0.7	--	Y	AE	2017
Alligator Creek Channel A[1]	Clearwater, City of; Pinellas County, Unincorporated Areas; Safety Harbor, City of	Approximately 90 feet upstream of Glen Oak Avenue	At Sunset Point Road	03100206, 03100207	4.3	--	Y	AE, A	1988
Alligator Creek Channel B[1]	Clearwater, City of; Pinellas County, Unincorporated Areas	Confluence with Alligator Creek Channel A	At Lake Shore Drive	03100206	2.4	--	Y	AE, A	1988
Alligator Creek Channel C[1]	Clearwater, City of; Pinellas County, Unincorporated Areas	Confluence with Alligator Creek Channel A	Approximately 1,440 feet upstream of Sunset Point Road	03100206	1.1	--	Y	AE, A	1988
Alligator Creek Channel E	Pinellas County, Unincorporated Areas; Safety Harbor, Cicy of	Confluence with Alligator Lake	Approximately 95 feet upstream of Railroad	03100206	0.2	--	Y	AE	2017
Alligator Creek Channel E[1]	Clearwater, City of; Pinellas County, Unincorporated Areas; Safety Harbor, City of	Approximately 95 feet upstream of Railroad	At McMullen Booth Road	03100206	0.6	--	Y	AE, A	1988
Alligator Creek Channel G	Clearwater, City of; Pinellas County, Unincorporated Areas	Confluence with Alligator Creek Channel A	At Drew Street	03100206	0.4	--	Y	AE	1988
Alligator Creek Channel H[1]	Clearwater, City of; Pinellas County, Unincorporated Areas	Confluence with Alligator Creek Channel A	Approximately 1,285 feet upstream of Sharkey Road	03100206	0.7	--	Y	AE, A	1988
Alligator Lake	Clearwater, City of; Safety Harbor, City of	Entire shoreline	Entire shoreline	03100206	--	0.12	N	AE	2017
Anclote River	Pinellas County, Unincorporated Areas; Tarpon Springs, City of	Confluence with Gulf of Mexico	Pinellas/Pasco County boundary	03100207	6.5	--	Y	AE	2017

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
Boca Ciega Bay	Gulfport, City of; Madeira Beach, City of; North Redington Beach, Town of; Seminole, City of; South Pasadena, City of; St. Pete Beach, City of; St. Petersburg, City of; Treasure Island, City of; Pinellas County, Unincorporated Areas; Redington Beach, Town of; Redington Shores, Town of	Entire shoreline of Pinellas County	Entire shoreline of Pinellas County	03100206, 03100207	--	32.7	N	AE, AO, VE	2017
Brooker Creek Tributary A	Pinellas County, Unincorporated Areas	Confluence with Lake Tarpon	Approximately 2,200 feet upstream of Ridgemoor Boulevard	03100206	2.6	--	Y	AE	1996
Brooker Creek Tributary B	Pinellas County, Unincorporated Areas	Confluence with Brooker Creek Tributary A	Approximately 150 feet upstream of East Lake Woodlands Parkway	03100206	1.7	--	Y	AE	1996
Channel 1	Pinellas County, Unincorporated Areas; Pinellas Park, City of	Confluence with Joe's Creek	Approximately 2.5 miles upstream of confluence with Joe's Creek	03100207	2.5	--	N	AE	2017
Channel 1	Pinellas County, Unincorporated Areas; Pinellas Park, City of	Approximately 2.5 miles upstream of confluence with Joe's Creek	3.0 miles upstream of the confluence with Joe's Creek	03100206, 03100207	0.5	--	N	AE	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
Channel 2	Pinellas County, Unincorporated Areas; Pinellas Park, City of	Confluence with Sawgrass Lake	Approximately 10 feet upstream of 76th Terrace North	03100206	1.1	--	N	AE	2017
Channel 2	Pinellas Park, City of	Approximately 10 feet upstream of 76th Terrace North	680 feet upstream of 76th Terrace North	03100206	0.1	--	N	AE	2009
Channel 3	Pinellas County, Unincorporated Areas; Pinellas Park, City of	Confluence with Sawgrass Lake	At 68th Avenue North	03100206	0.7	--	N	AE	2017
Channel 3	Pinellas Park, City of	At 68th Avenue North	0.62 miles upstream of Park Entrance Bridge	03100206	1.4	--	N	AE	2009
Clearwater Harbor	Belleair, Town of; Belleair Beach, City of; Belleair Bluffs, City of; Clearwater, City of; Dunedin, City of; Indian Rocks Beach, City of; Largo, City of; Pinellas County, Unincorporated Areas	Entire shoreline of Pinellas County	Entire shoreline of Pinellas County	03100207	--	17.8	N	AE, VE	2017
Curlew Creek	Dunedin, City of; Pinellas County, Unincorporated Areas	Confluence with St. Joseph Sound/ Intracoastal Waterway	Approximately 1.2 miles upstream of US 19A/Broadway Bayshore Boulevard	03100207	1.3	--	Y	AE	2017
Curlew Creek	Dunedin, City of; Pinellas County, Unincorporated Areas	Approximately 1.2 miles upstream of US 19A/Broadway Bayshore Boulevard	Confluence of Jerry Branch	03100207	1.0	--	Y	AE	1996
Flagler Drive Tributary	Clearwater, City of; Pinellas County, Unincorporated Areas	Confluence with Stevenson Creek	Approximately 1,300 feet upstream of Keene Road	03100207	1.8	--	N	AE	2003

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
Gulf of Mexico	Belleair Beach, City of; Belleair Shore, Town of; Clearwater, City of; Dunedin, City of; Indian Rocks Beach, City of; Indian Shores, Town of; Madeira Beach, City of; North Redington Beach, Town of; Pinellas County, Unincorporated Areas; Redington Beach, Town of; Redington Shores, Town of; St. Pete Beach, City of; Tarpon Springs, City of; Treasure Island, City of	Entire shoreline of Pinellas County	Entire shoreline of Pinellas County	03100206, 03100207	51.6	--	N	AE, AO, VE	2017
Hammond Creek	Clearwater, City of	Confluence with Stevenson Creek	Approximately 415 feet upstream of Kings Highway	03100207	0.3	--	N	AE	2017
Hammond Creek	Clearwater, City of	Approximately 415 feet upstream of Kings Highway	Approximately 375 feet upstream of N Highland Avenue	03100207	0.5	--	N	AE	2003
Hollin Creek Tributary A	Pinellas County, Unincorporated Areas	Confluence with Salt Lake	Approximately 960 feet upstream of East Lake Drive	03100207	1.2	--	Y	AE	2017
Hollin Creek Tributary A	Pinellas County, Unincorporated Areas	Approximately 960 feet upstream of East Lake Drive	Approximately 1,600 feet upstream of Crescent Oaks Boulevard	03100207	2.5	--	Y	AE	1996

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
Hollin Creek Tributary A-2	Pinellas County, Unincorporated Areas	Confluence with Hollin Creek Tributary A	Approximately 3,600 feet upstream of the confluence with Hollin Creek Tributary A (at a Dirt Road)	03100207	0.7	--	Y	AE	1996
Hollin Creek Tributary B	Pinellas County, Unincorporated Areas	Confluence with Hollin Creek Tributary A	Trinity Boulevard	03100207	2.2	--	Y	AE	1996
Jeffords Street Tributary	Clearwater, City of; Pinellas County, Unincorporated Areas	Confluence with Stevenson Creek	End of Lake Aline	03100207	1.1	--	N	AE	2003
Jerry Branch	Dunedin, City of; Pinellas County, Unincorporated Areas	At confluence with Curlew Creek/Oak Creek Drive	Weir at north end of Indigo Drive	03100207	2.3	--	Y	AE	1996
Joe's Creek	Kenneth City, Town of; Pinellas County, Unincorporated Areas	Confluence with Cross Bayou Canal	Approximately 0.4 miles upstream of 66th Street North	03100207	3.1	--	Y	AE	2017
Joe's Creek	Kenneth City, Town of; Pinellas County, Unincorporated Areas; St. Petersburg, City of	Approximately 0.4 miles upstream of 66th Street North	28th Street North	03100207	3.5	--	Y	AE	1996
Joe's Creek Tributary No. 4 (Channel 4)	Kenneth City, Town of; Pinellas County, Unincorporated Areas; Pinellas Park, City of	Confluence with Joe's Creek	Approximately 500 feet upstream of FPL Access Road	03100207	2.8	--	Y	AE	2009
Joe's Creek Tributary No. 5	Pinellas County, Unincorporated Areas; Pinellas Park, City of	Approximately 215 feet downstream of 66th Street North	Approximately 225 feet upstream of 61st Street North	03100207	2.0	--	Y	AE	1996

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
Lake Seminole	Largo, City of; Pinellas County, Unincorporated Areas; Seminole, City of	Entire shoreline of Pinellas County	Entire shoreline of Pinellas County	03100207	--	1.1	N	AE	2017
Lake Tarpon	Pinellas County, Unincorporated Areas; Tarpon Springs, City of	The entire shoreline	The entire shoreline	03100206	--	3.9	N	AE	1974
Long Bayou	Pinellas County, Unincorporated Areas; Seminole, City of; St. Petersburg, City of	Entire shoreline of Pinellas County	Entire shoreline of Pinellas County	03100207	--	1.5	N	AE, VE	2017
Miles Creek	Pinellas County, Unincorporated Areas; St. Petersburg, City of	Confluence with Joe's Creek	Approximately 100 feet upstream of 22nd Avenue North and 58th Street North	03100207	2.2	--	Y	AE	1996
Old Tampa Bay	St. Petersburg, City of	North of 118th Ave. N. between Dr. Martin Luther King Jr. St. N. and 10th Way N.	Approximately 650 feet north of 118th Ave. N. between Dr. Martin Luther King Jr. St. N. and 10th Way N.	03100206	--	0.01	N	AE	2020
Old Tampa Bay	Clearwater, City of; Largo, City of; Oldsmar, City of; Pinellas County, Unincorporated Areas; Safety Harbor, City of; St. Petersburg, City of	Entire shoreline of Pinellas County	Entire shoreline of Pinellas County	03100206	23.3	--	N	AE, VE	2017

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
Safety Harbor	Oldsmar, City of	The shoreline north of Highway 580 and south of Meriden Ave.	Approximately 150 feet southwest of St. Clair Ave. located north of Highway 580 and south of Meriden Ave.	03100206	--	0.03	N	AE, VE	2020
Spring Branch	Clearwater, City of; Pinellas County, Unincorporated Areas	Confluence with Stevenson Creek	Approximately 1,550 feet upstream of Highland Avenue	03100207	1.4	--	N	AE	2003
St. Joseph Sound	Tarpon Springs, City of	Approximately 150 feet east of Riverside Dr. north of Loquat Dr.	Approximately 150 feet west of Eunice Dr. north of Loquat Dr.	03100207	--	0.02	N	AE	2020
St. Joseph Sound	Dunedin, City of; Pinellas County, Unincorporated Areas; Tarpon Springs, City of	Entire shoreline of Pinellas County	Entire shoreline of Pinellas County	03100207	--	33.5	N	AE, VE	2017
Stevenson Creek	Clearwater, City of; Pinellas County, Unincorporated Areas	Clearwater Harbor	Approximately 1.6 miles upstream of confluence with Clearwater Harbor	03100207	1.6	--	N	AE	2017
Stevenson Creek	Clearwater, City of; Largo, City of; Pinellas County, Unincorporated Areas	Approximately 1.6 miles upstream of confluence with Clearwater Harbor	Approximately 400 feet upstream of Southridge Drive	03100207	2.9	--	N	AE	2003
Tampa Bay	Largo, City of; Pinellas County, Unincorporated Areas; St. Petersburg, City of	Entire shoreline of Pinellas County	Entire shoreline of Pinellas County	03100206	132.3	--	N	AE, AO, VE	2017
Zone A ponding areas[1]	Dunedin, City of; Pinellas County, Unincorporated Areas	Various locations	Various locations	03100206, 03100207	--	*	N	A	1979

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
Zone AE ponding areas	Clearwater, City of; Largo, City of; Pinellas County, Unincorporated Areas	Various locations	Various locations	03100207	--	*	N	AE	2003
Zone AH ponding areas	Pinellas Park, City of	Various locations	Various locations	03100207	--	*	N	AH	1996
Zone AO ponding area	Dunedin, City of; Pinellas County, Unincorporated Areas	Just upstream of Virginia Street	Lake Canal	03100207	--	*	N	AO	1979

[1]Source was redelineated in the September 3, 2003 revision using the effective modeling information

*Data not available

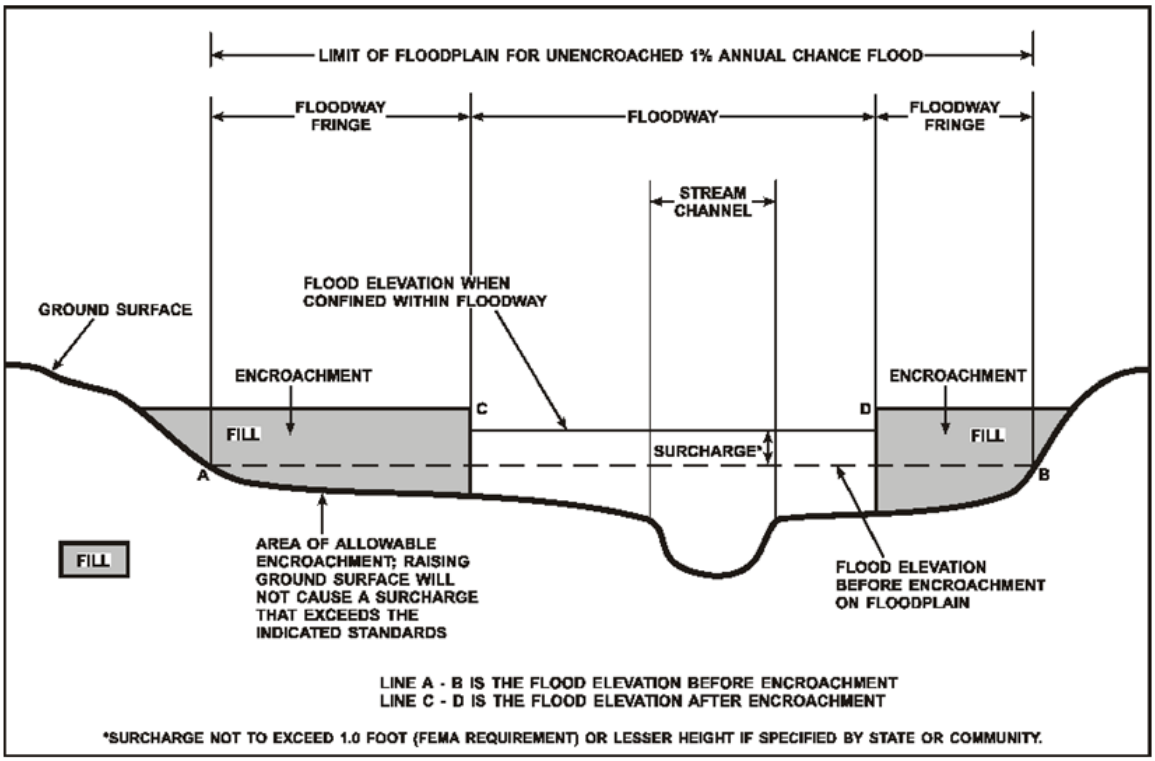
2.2 Floodways

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

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

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

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 23, “Floodway Data.”

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and 1% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

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

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

2.4 Non-Encroachment Zones

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% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

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

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

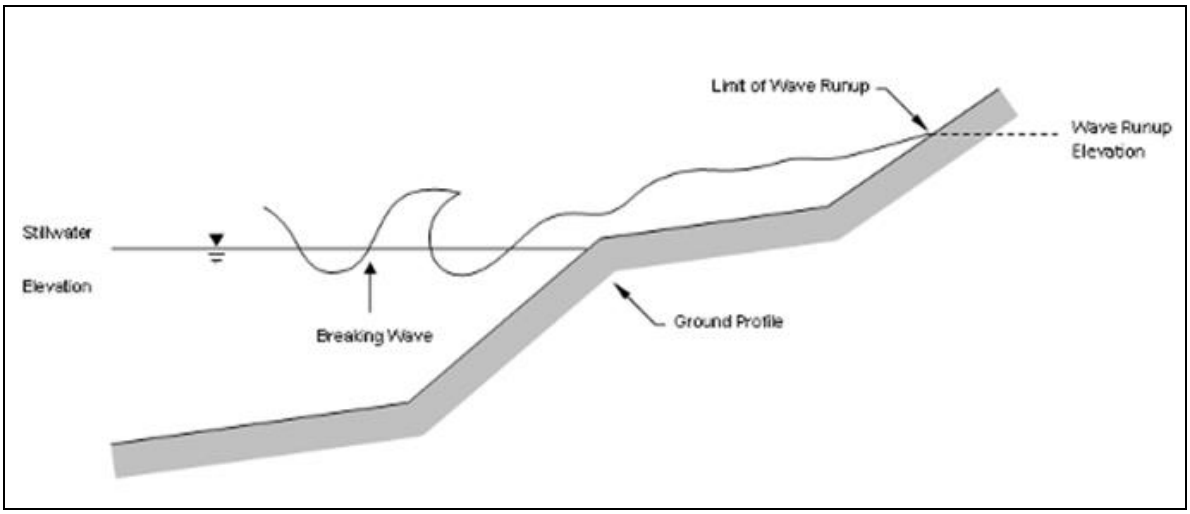
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

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

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

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

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

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

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

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

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

Table 25 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs
Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood

hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

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

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 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% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

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

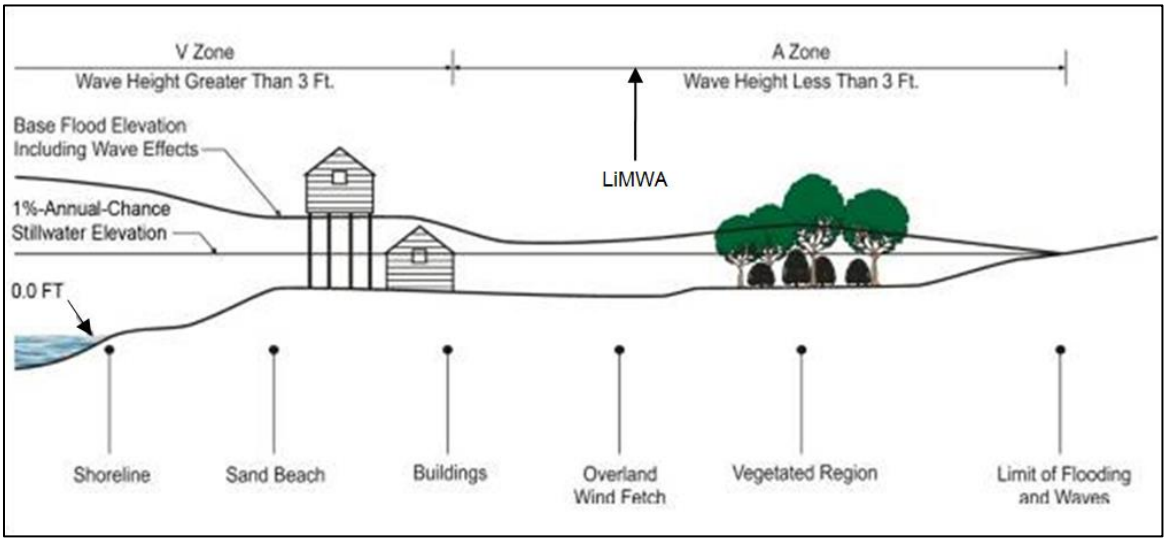
CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the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

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

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

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

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this 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% annual chance flooding event. Communities are therefore encouraged to adopt and enforce more stringent floodplain management requirements than the minimum NFIP requirements in the LiMWA. The NFIP Community Rating System provides credits for these actions.

Where wave runup elevations dominate over wave heights, there is no evidence to date of significant damage to residential structures by runup depths less than 3 feet.

Examples of these areas include areas with steeply sloped beaches, bluffs, or flood protection structures that lie parallel to the shore. In these areas, the FIRM shows the LiMWA immediately landward of the VE/AE boundary. Similarly, in areas where the zone VE designation is based on the presence of a primary frontal dune or wave overtopping, the LiMWA is delineated immediately landward of the Zone VE/AE boundary.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

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

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

Table 3 lists the flood insurance zones in Pinellas County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Belleair, Town of	AE, VE, X
Belleair Beach, City of	AE, VE, X
Belleair Bluffs, City of	AE, VE, X
Belleair Shore, Town of	AE, VE, X
Clearwater, City of	A, AE, AO, VE, X
Dunedin, City of	A, AE, AO, VE, X
Gulfport, City of	AE, VE, X
Indian Rocks Beach, City of	AE, AO, VE, X
Indian Shores, Town of	AE, VE, X
Kenneth City, Town of	A, AE, X
Largo, City of	A, AE, VE, X
Madeira Beach, City of	AE, VE, X
North Redington Beach, Town of	AE, VE
Oldsmar, City of	A, AE, VE, X
Pinellas County, Unincorporated Areas	A, AE, AO, VE, X
Pinellas Park, City of	A, AE, AH, X

Table 3: Flood Zone Designations by Community (continued)

Community	Flood Zone(s)
Redington Beach, Town of	AE, VE
Redington Shores, Town of	AE, VE
Safety Harbor, City of	AE, VE, X
Seminole, City of	AE, VE, X
South Pasadena, City of	AE, VE, X
St. Pete Beach, City of	AE, VE, X
St. Petersburg, City of	A, AE, AO, VE, X
Tarpon Springs, City of	AE, VE, X
Treasure Island, City of	AE, VE, 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)
Crystal-Pithlachascotee	03100207	Gulf of Mexico	Located in Citrus, Hernando, Hillsborough, Pasco, and Pinellas counties.	1,174
Tampa Bay	03100206	Tampa Bay	Located in Manatee, Pasco, Hillsborough, and Pinellas counties.	874

4.2 Principal Flood Problems

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

Table 5: Principal Flood Problems

Flooding Source	Description of Flood Problems
All flooding sources	Flooding in Pinellas County results primarily from two major sources: heavy rainfall, which can affect the many areas in the county that have a high water table and are subject to ponding, and tidal surge caused by tropical storms and hurricanes. Not all storms that pass close to the study area produce extremely high tides. Similarly, storms that produce extreme conditions in one area may not necessarily produce critical conditions in other parts of the study area. However, with the condition of high winds directed onshore, the tides produced can inundate the low coastal islands and flood the coastal areas behind them for some distance inland. Wave action, which accompanies wind-generated tides, can cause floods, erosion, and structural damage, particularly on the offshore islands.
Anclote River	The Anclote River is a broad estuary and, under certain conditions, tides generated at its mouth in the Gulf of Mexico can intrude far upstream. Rainfall, which usually accompanies hurricanes, can aggravate the tidal flood situation.

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

Table 6: Historic Flooding Elevations

[Not Applicable to this Flood Risk Project]

4.3 Non-Levee Flood Protection Measures

Table 7 contains information about non-levee flood protection measures within Pinellas 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
Lake Tarpon	Lake Tarpon Outfall Canal	Canal with gated spillway	From the southern portion of Lake Tarpon to the northern portion of Tampa Bay.	The canal was built in 1969, and is designed to reduce the freshwater flooding of Lake Tarpon. It completely protects Lake Tarpon from storm surges associated with a 1- to 15-year event. It provides partial protection for storm surges associated with events up to the 500-year frequency.

4.4 Levees

This section is not applicable to this Flood Risk Project.

Table 8: Levees

[Not Applicable to this Flood Risk Project]

SECTION 5.0 – ENGINEERING METHODS

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

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

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. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 10. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 16.) Stream gage information is provided in Table 11.

Table 9: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Alligator Creek Channel A	At McMullen Booth Road	7.40	680	*	1,340	1,710	2,820
Alligator Creek Channel A	At U.S. Highway 19	*	*	*	*	*	*
Alligator Creek Channel A	At Old Coachman Road	3.59	500	*	960	1,380	2,300
Alligator Creek Channel A	At Railroad	3.27	460	*	910	1,160	1,950
Alligator Creek Channel A	At Blecher Road	1.43	260	*	510	680	1,150
Alligator Creek Channel A	At Sunshine Drive	0.59	150	*	290	420	680
Alligator Creek Channel A	At Sunset Point Road	0.13	90	*	180	270	400
Alligator Creek Channel B	At mouth	1.72	290	*	570	760	1,300
Alligator Creek Channel B	Approximately 1,600 feet downstream of State Road 590	1.54	280	*	530	700	1,220
Alligator Creek Channel B	At Evans Drive	1.23	230	*	450	620	1,050
Alligator Creek Channel B	At Main Street	1.01	210	*	400	540	920

Table 9: Summary of Discharges (continued)

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Alligator Creek Channel B	Approximately 1,300 feet upstream of Main Street at 4th Avenue South	0.62	160	*	310	430	720
Alligator Creek Channel C	At mouth	0.60	170	*	290	420	690
Alligator Creek Channel C	At Sunset Point Road	0.33	120	*	230	340	530
Alligator Creek Channel C	Approximately 1,300 feet upstream of Sunset Point Road	0.27	110	*	210	320	490
Alligator Creek Channel E	At mouth	0.82	180	*	360	490	820
Alligator Creek Channel E	At State Road 590	0.70	170	*	320	450	750
Alligator Creek Channel E	At McMullen Booth Road	0.34	120	*	230	340	530
Alligator Creek Channel G	At mouth	0.49	140	*	270	380	630
Alligator Creek Channel G	At Drew Street	0.13	90	*	180	280	400
Alligator Creek Channel H	At mouth	0.55	150	*	290	410	670
Alligator Creek Channel H	At Drew Street	0.17	90	*	180	280	430
Anclote River	At U.S. Highway 19	107.0	3,480	*	6,320	7,770	11,800
Brooker Creek Tributary A	At the confluence with Lake Tarpon	33.1	1,921	*	2,678	3,471	4,967

Table 9: Summary of Discharges (continued)

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Brooker Creek Tributary A	At Tarpon Woods Boulevard	28.3	1,432	*	2,056	2,689	3,915
Brooker Creek Tributary A	At Ridgemoor Boulevard	27.5	1,413	*	2,040	2,653	3,864
Brooker Creek Tributary B	At Woodlands Boulevard	4.0	561	*	869	1,053	1,455
Brooker Creek Tributary B	At Golf Course Road	0.8	162	*	209	305	530
Channel 1	At mouth	3.2	340	*	440	480	550
Channel 2	At mouth	2.0	200	*	260	280	320
Channel 3	At mouth	1.6	160	*	205	220	255
Curlew Creek	At mouth	10.6	4,343	*	6,694	7,592	9,848
Curlew Creek	Approximately 1,100 feet downstream of Country Road 1	9.8	4,252	*	6,539	7,379	9,548
Flagler Drive Tributary	Just downstream of Palmetto Street	0.88	215	*	376	455	594
Hammond Creek	At the confluence with Stevenson Creek	0.43	632	*	1,229	1,546	2,113
Hollin Creek Tributary A	Approximately 280 feet downstream of Old East Lake Drive	6.6	921	*	1,497	1,735	2,485
Hollin Creek Tributary A	Approximately 800 feet upstream of the confluence of Hollin Creek Tributary B	4.0	590	*	948	1,084	1,589

Table 9: Summary of Discharges (continued)

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Hollin Creek Tributary A	At East Lake Road	3.5	427	*	794	1,002	1,499
Hollin Creek Tributary A-2	Approximately 750 feet upstream of the confluence with Hollin Creek Tributary A	0.4	132	*	210	237	301
Hollin Creek Tributary B	Approximately 400 feet upstream of the confluence with Hollin Creek Tributary A	3.1	382	*	636	736	962
Hollin Creek Tributary B	At East Lake Road	2.4	359	*	591	688	895
Hollin Creek Tributary B	At Trinity Boulevard	2.1	308	*	507	589	768
Hollin Creek Tributary B	Just north of Kimberly Lake	1.5	192	*	313	361	547
Hollin Creek Tributary B	At Trinity Boulevard	1.2	107	*	262	325	509
Jeffords Street Tributary	At Highland Avenue	0.9	294	*	512	620	891
Jerry Branch	At Oak Creek Drive	3.9	1,373	*	2,408	2,862	3,888
Jerry Branch	At Laurelwood Lane	3.5	1,108	*	2,202	2,611	3,528
Jerry Branch	At Main Street	2.5	676	*	1,176	1,655	2,275
Jerry Branch	Weir at north end of Indigo Drive	2.3	605	*	1,230	1,480	2,035
Joe’s Creek	At mouth	15.1	5,775	*	8,251	8,985	10,622

Table 9: Summary of Discharges (continued)

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Joe's Creek	Upstream of Joe's Creek Tributary No. 4 near 52nd Avenue North	10.4	3,538	*	5,390	5,883	6,815
Joe's Creek	At 66th Street North	4.4	1,842	*	2,517	2,685	3,151
Joe's Creek	At 62nd Street North	4.2	1,689	*	2,315	2,475	2,905
Joe's Creek	At 58th Street North	3.2	1,112	*	1,655	1,859	2,250
Joe's Creek	At 46th Avenue North and 46th Street North	2.6	758	*	1,035	1,156	1,440
Joe's Creek	At Railroad bridge near 40th Street North	1.7	291	*	391	543	917
Joe's Creek	At U.S. Highway 19 (34th Street North)	1.3	697	*	1,035	1,156	1,440
Joe's Creek	At 28th Street North	0.8	360	*	561	608	764
Joe's Creek Tributary No. 4	At mouth	2.9	1,457	*	1,925	2,082	2,447
Joe's Creek Tributary No. 4	At footbridge near Applecross Street	2.0	924	*	1,165	1,272	1,476
Joe's Creek Tributary No. 4	Approximately 1,640 feet upstream of 62nd Avenue North	0.9	417	*	558	584	716
Joe's Creek Tributary No. 4	At 58th Street North	0.5	176	*	312	337	465
Joe's Creek Tributary No. 5	At mouth	1.0	682	*	994	1,103	1,347
Joe's Creek Tributary No. 5	At Park Boulevard	0.5	338	*	460	505	600

Table 9: Summary of Discharges (continued)

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Joe's Creek Tributary No. 5	At 66th Street North	0.2	206	*	263	280	308
Joe's Creek Tributary No. 5	Approximately 430 feet downstream of 63rd Street North	0.1	85	*	86	90	160
Miles Creek	At mouth	5.3	1,823	*	2,801	3,048	3,445
Miles Creek	At 62nd Street North	4.8	1,638	*	2,528	2,746	3,071
Miles Creek	At 58th Street North	3.9	643	*	1,139	1,314	1,703
Miles Creek	At 22nd Street Avenue North and 58th Street North	3.0	317	*	357	395	428
Spring Branch	Just downstream of Overbrook Road	2.19	674	*	827	884	1,010
Spring Branch	Just downstream of King's Highway	1.73	641	*	973	1,105	1,325
Stevenson Creek	At Douglas Avenue	6.35	3,071	*	4,150	4,716	5,841
Stevenson Creek	At Railroad	4.52	2,125	*	2,908	3,260	3,986
Stevenson Creek	At Court Street	3.81	1,647	*	2,289	2,602	3,266
Stevenson Creek	At Belleair Road	0.52	235	*	374	460	612

*Not calculated for this Flood Risk Project

Figure 7: Frequency Discharge-Drainage Area Curves

[Not Applicable to this Flood Risk Project]

Table 10: Summary of Non-Coastal Stillwater Elevations

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Clear View Lake	Clearwater, City of	55.31	*	59.07	56.48	57.28
Crest Lake	Clearwater, City of	67.85	*	68.83	69.03	69.76
Highland Lake	Pinellas County, Unincorporated Areas	46.23	*	46.58	46.61	46.81
Hobart Lake	Clearwater, City of	64.89	*	66.04	66.54	67.32
Jerry Lake	Dunedin, City of; Pinellas County, Unincorporated Areas	*	*	*	47.00	*
Lake Bellevue Area No. 1	Clearwater, City of	33.40	*	38.49	38.91	39.57
Lake Bellevue Area No. 2	Clearwater, City of	37.7	*	39.27	39.85	40.71
Lake Bellevue Area No. 3	Clearwater, City of	39.54	*	40.22	40.50	41.01
Lake Bellevue Area No. 4	Clearwater, City of	41.46	*	42.11	42.36	42.79
Lake Bellevue Area No. 5	Clearwater, City of	41.48	*	42.26	42.60	43.20
Lake Bellevue Area No. 6	Clearwater, City of	42.10	*	43.25	43.71	44.44
Lake Bellevue Area No. 7	Clearwater, City of	42.72	*	44.26	44.82	45.68

Table 10: Summary of Non-Coastal Stillwater Elevations (continued)

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Lake Bellevue Area No. 8	Clearwater, City of	43.34	*	45.25	45.93	46.92
Lake Bellevue Area No. 9	Clearwater, City of	43.97	*	46.25	47.04	48.14
Lake Bellevue Area No. 10	Clearwater, City of	48.45	*	49.41	49.68	50.36
Lake Bellevue Area No. 11	Clearwater, City of	49.66	*	50.68	51.39	52.44
Lake Bellevue Area No. 12	Clearwater, City of	51.70	*	52.45	52.79	53.35
Lake Bellevue Area No. 13	Clearwater, City of	52.25	*	53.45	53.84	54.48
Lake Bellevue Area No. 14	Clearwater, City of	53.39	*	54.45	54.89	55.62
Lake Bellevue Area No. 15	Clearwater, City of	54.24	*	55.46	55.94	56.77
Lake Bellevue Area No. 16	Clearwater, City of; Pinellas County, Unincorporated Areas	55.95	*	56.80	57.12	57.65
Lake Lucille	Clearwater, City of	59.49	*	59.98	60.21	60.59
Lake Rhonda	Pinellas County, Unincorporated Areas	34.08	*	34.95	35.21	36.22
Lake Tarpon	At shoreline	3.3	*	*	6.1	*
Lake Tarpon	At mouth	3.3	*	5.3	6.1	7.1

Table 10: Summary of Non-Coastal Stillwater Elevations (continued)

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Ponding Area No. 1	Clearwater, City of	19.92	*	20.75	21.00	21.39
Ponding Area No. 2	Clearwater, City of	60.91	*	61.21	61.33	61.53
Ponding Area No. 3	Clearwater, City of; Pinellas County, Unincorporated Areas	44.11	*	45.01	45.47	46.28
Ponding Area No. 4	Pinellas County, Unincorporated Areas	40.09	*	41.26	42.63	41.78
Ponding Area No. 5	Pinellas County, Unincorporated Areas	40.52	*	41.78	42.29	43.13
Ponding Area No. 6	Clearwater, City of; Pinellas County, Unincorporated Areas	44.90	*	46.30	46.72	47.54
Ponding Area No. 7	Clearwater, City of	58.99	*	60.23	60.81	61.80
Ponding Area No. 8	Clearwater, City of	34.70	*	35.46	35.78	36.26
Ponding Area No. 9	Clearwater, City of	17.80	*	20.18	20.45	20.29
Ponding Area No. 10	Clearwater, City of	65.66	*	66.19	66.25	66.36
Ponding Area No. 11	Clearwater, City of	63.79	*	63.94	64.00	64.12
Ponding Area No. 12	Clearwater, City of	20.54	*	20.95	21.09	21.29

Table 10: Summary of Non-Coastal Stillwater Elevations (continued)

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Ponding Area No. 13	Clearwater, City of	12.65	*	15.59	15.90	16.39
Ponding Area No. 14	Clearwater, City of	22.32	*	23.32	23.70	24.17
Ponding Area No. 15	Clearwater, City of; Pinellas County, Unincorporated Areas	61.10	*	61.66	61.90	62.32
Ponding Area No. 16	Clearwater, City of	66.29	*	67.17	67.74	68.45
Ponding Area No. 17	Clearwater, City of	68.76	*	68.90	68.95	96.02
Ponding Area No. 18	Clearwater, City of	43.51	*	44.60	44.99	45.69
St. Andrews Lake	Clearwater, City of	66.36	*	67.50	68.06	69.93
Woodside Lake No. 1	Clearwater, City of	47.97	*	48.97	49.43	50.24
Woodside Lake No. 2	Clearwater, City of	53.16	*	54.53	55.22	56.49

*Not calculated for this Flood Risk Project

Table 11: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Alligator Lake	02307696	USGS	Alligator Lake at Safety Harbor, FL	9.0	05/14/1948	08/03/2010

5.2 Hydraulic Analyses

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

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed in Table 23, “Floodway Data.”

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
Alligator Creek Channel A	Confluence with Alligator Lake	Approximately 90 feet upstream of Glen Oak Avenue	*	*	12/2017	AE w/ Floodway	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Alligator Creek Channel A	Approximately 90 feet upstream of Glen Oak Avenue	At Sunset Point Road	Calibrated Rainfall/runoff model	HEC-2	09/1988	AE w/ Floodway	The starting water surface elevations were known. The flood hazard information was redelineated based on newly developed topographic data in the 2003 revision. No new flood hazard analysis was performed.
Alligator Creek Channel B	Confluence with Alligator Creek Channel A	At Lake Shore Drive	Regional Regression Equations	HEC-2	09/1988	AE w/ Floodway	The starting water surface elevations were obtained using the slope/area method. The flood hazard information was redelineated based on newly developed topographic data in the 2003 revision. No new flood hazard analysis was performed.
Alligator Creek Channel C	Confluence with Alligator Creek Channel A	Approximately 1,440 feet upstream of Sunset Point Road	Regional Regression Equations	HEC-2	09/1988	AE w/ Floodway	The starting water surface elevations were obtained using the slope/area method. The flood hazard information was redelineated based on newly developed topographic data in the 2003 revision. No new flood hazard analysis was performed.
Alligator Creek Channel E	Confluence with Alligator Lake	Approximately 95 feet upstream of Railroad	*	*	12/2017	AE w/ Floodway	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Alligator Creek Channel E	Approximately 95 feet upstream of Railroad	At McMullen Booth Road	Regional Regression Equations	HEC-2	09/1988	AE w/ Floodway	The starting water surface elevations were known. The flood hazard information was redelineated based on newly developed topographic data in the 2003 revision. No new flood hazard analysis was performed.

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
Alligator Creek Channel G	Confluence with Alligator Creek Channel A	At Drew Street	Regional Regression Equations	HEC-2	09/1988	AE w/ Floodway	The starting water surface elevations were obtained using the slope/area method.
Alligator Creek Channel H	Confluence with Alligator Creek Channel A	Approximately 1,285 feet upstream of Sharkey Road	Regional Regression Equations	HEC-2	09/1988	AE w/ Floodway	The starting water surface elevations were obtained using the slope/area method. The flood hazard information was redelineated based on newly developed topographic data in the 2003 revision. No new flood hazard analysis was performed.
Anclote River	Confluence with Gulf of Mexico	Pinellas/Pasco County boundary	*	*	12/2017	AE w/ Floodway	Anclote River is completely inundated by coastal flooding effects, and therefore does not have an applicable riverine Flood Profile.
Brooker Creek Tributary A	Confluence with Lake Tarpon	Approximately 2,200 feet upstream of Ridgemoor Boulevard	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Brooker Creek Tributary B	Confluence with Brooker Creek Tributary A	Approximately 150 feet upstream of East Lake Woodlands Parkway	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Channel 1	Confluence with Joe's Creek	Approximately 2.5 miles upstream of confluence with Joe's Creek	*	*	12/2017	AE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Channel 1	Approximately 2.5 miles upstream of confluence with Joe's Creek	3.0 miles upstream of the confluence with Joe's Creek	ICPR	ICPR	09/2009	AE	
Channel 2	Confluence with Sawgrass Lake	Approximately 10 feet upstream of 76th Terrace North	*	*	12/2017	AE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.

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
Channel 2	Approximately 10 feet upstream of 76th Terrace North	680 feet upstream of 76th Terrace North	ICPR	ICPR	09/2009	AE	
Channel 3	Confluence with Sawgrass Lake	At 68th Avenue North	*	*	12/2017	AE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Channel 3	At 68th Avenue North	0.62 miles upstream of Park Entrance Bridge	ICPR	ICPR	09/2009	AE	
Curlew Creek	Confluence with St. Joseph Sound/ Intracoastal Waterway	Approximately 1.2 miles upstream of US 19A/Broadway Bayshore Boulevard	*	*	12/2017	AE w/ Floodway	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Curlew Creek	Approximately 1.2 miles upstream of US 19A/Broadway Bayshore Boulevard	Confluence of Jerry Branch	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Flagler Drive Tributary	Confluence with Stevenson Creek	Approximately 1,300 feet upstream of Keene Road	adICPR Version 2.2	adICPR Version 2.2	09/2003	AE	
Hammond Creek	Confluence with Stevenson Creek	Approximately 415 feet upstream of Kings Highway	*	*	12/2017	AE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Hammond Creek	Approximately 415 feet upstream of Kings Highway	Approximately 375 feet upstream of N Highland Avenue	adICPR Version 2.2	adICPR Version 2.2	09/2003	AE	
Hollin Creek Tributary A	Confluence with Salt Lake	Approximately 960 feet upstream of East Lake Drive	*	*	12/2017	AE w/ Floodway	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.

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
Hollin Creek Tributary A	Approximately 960 feet upstream of East Lake Drive	Approximately 1,600 feet upstream of Crescent Oaks Boulevard	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Hollin Creek Tributary A-2	Confluence with Hollin Creek Tributary A	Approximately 3,600 feet upstream of the confluence with Hollin Creek Tributary A (at a Dirt Road)	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Hollin Creek Tributary B	Confluence with Hollin Creek Tributary A	Trinity Boulevard	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Jeffords Street Tributary	Confluence with Stevenson Creek	End of Lake Aline	adICPR Version 2.2	adICPR Version 2.2	09/2003	AE	
Jerry Branch	At confluence with Curlew Creek/ Oak Creek Drive	Weir at north end of Indigo Drive	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Joe's Creek	Confluence with Cross Bayou Canal	Approximately 0.4 miles upstream of 66th Street North	*	*	12/2017	AE w/ Floodway	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.
Joe's Creek	Approximately 0.4 miles upstream of 66th Street North	28th Street North	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Joe's Creek Tributary No. 4 (Channel 4)	Confluence with Joe's Creek	Approximately 500 feet upstream of FPL Access road	ICPR and HEC-RAS	ICPR and HEC-RAS	09/2009	AE w/ Floodway	
Joe's Creek Tributary No. 5	Approximately 215 feet downstream of 66th Street North	Approximately 225 feet upstream of 61st Street North	HEC-1	HEC-2	09/1996	AE w/ Floodway	

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
Lake Tarpon	The entire shoreline	The entire shoreline	Not provided	Not provided	1974	AE	Lake Tarpon elevations were taken from the 1974 FIS for Lake Tarpon, prepared by the USACE (USACE 1974).
Miles Creek	Confluence with Joe's Creek	Approximately 100 feet upstream of 22nd Avenue North and 58th Street North	HEC-1	HEC-2	09/1996	AE w/ Floodway	
Old Tampa Bay	North of 118th Ave. N. between Dr. Martin Luther King Jr. St. N. and 10th Way N.	Approximately 650 feet north of 118th Ave. N. between Dr. Martin Luther King Jr. St. N. and 10th Way N.	*	WHAFIS	08/30/2020	AE	Per July 30, 2019 submittal, Transect 41 was revised with updated topographic data and WHAFIS modeling, revising the mapping of two developed areas.
Safety Harbor	The shoreline north of Highway 580 and south of Meriden Ave.	Approximately 150 feet southwest of St. Clair Ave. located north of Highway 580 and south of Meriden Ave.	*	WHAFIS	08/30/2020	AE, VE	Per July 30, 2019 submittal, unpublished transects were revised with updated topographic data and WHAFIS modeling, revising the mapping of one developed area.
Spring Branch	Confluence with Stevenson Creek	Approximately 1,550 feet upstream of Highland Avenue	adICPR Version 2.2	adICPR Version 2.2	09/2003	AE	
St. Joseph Sound	Approximately 150 feet east of Riverside Dr. north of Loquat Dr.	Approximately 150 feet west of Eunice Dr. north of Loquat Dr.	*	WHAFIS	08/30/2020	AE	Per July 30, 2019 submittal, Transect 239 was revised with updated topographic data and WHAFIS modeling, revising the mapping of one developed area.
Stevenson Creek	Clearwater Harbor	Approximately 1.6 miles upstream of confluence with Clearwater Harbor	*	*	12/2017	AE	Combined probability analysis was calculated for each riverine cross section that intersected the coastal surge.

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
Stevenson Creek	Approximately 1.6 miles upstream of confluence with Clearwater Harbor	Approximately 400 feet upstream of Southridge Drive	adICPR Version 2.2	adICPR Version 2.2	09/2003	AE	
Zone A ponding areas	Various locations	Various locations	Not provided	Not provided	06/1979	A	
Zone AE ponding areas	Various locations	Various locations	Not provided	Not provided	09/2003	AE	
Zone AH ponding areas	Various locations	Various locations	Not provided	Not provided	09/1996	AH	
Zone AO ponding area	Just upstream of Virginia Street	Lake Canal	Not provided	Not provided	06/1979	AO	

*Data not available

Table 13: Roughness Coefficients

Flooding Source	Channel "n"	Overbank "n"
Alligator Creek Channel A	0.035-0.060	0.050-0.180
Alligator Creek Channel B	0.035-0.080	0.060-0.150
Alligator Creek Channel C	0.035-0.050	0.060-0.100
Alligator Creek Channel E	0.030-0.080	0.070-0.150
Alligator Creek Channel G	0.045-0.055	0.150
Alligator Creek Channel H	0.012-0.060	0.060-0.150
Anclote River	0.050-0.130	0.170-0.500
Brooker Creek Tributary A	0.040-0.120	0.030-0.250
Brooker Creek Tributary B	0.030-0.120	0.030-0.120
Channel 1	0.013-0.050	0.027-0.070
Channel 2	0.013-0.050	0.027-0.070
Channel 3	0.013-0.050	0.027-0.070
Curlew Creek	0.030-0.065	0.100-0.120
Flagler Drive Tributary	0.030-0.100	0.040-0.150
Hammond Creek	0.030-0.100	0.040-0.150
Hollin Creek Tributary A	0.030-0.100	0.10-0.120
Hollin Creek Tributary A-2	0.030-0.060	0.030-0.120
Hollin Creek Tributary B	0.040-0.120	0.030-0.120
Jeffords Street Tributary	0.040-0.090	0.060-0.150
Jerry Branch	0.030-0.060	0.100-0.200
Joe's Creek	0.030-0.035	0.030-0.150
Joe's Creek Tributary No. 4	0.020-0.030	0.040-0.500
Joe's Creek Tributary No. 5	0.020-0.030	0.100-0.150
Miles Creek	0.030-0.035	0.070-0.100
Spring Branch	0.035-0.100	0.070-0.150
Stevenson Creek	0.015-0.080	0.005-0.150