FLOOD INSURANCE STUDY

JEFFERSON PARISH, LOUISIANA

AND INCORPORATED AREAS

Community Name	Community Number
GRAND ISLE, TOWN OF	225197
GRETNA, CITY OF	225198
HARAHAN, CITY OF	225200
JEAN LAFITTE, TOWN OF	220371
JEFFERSON PARISH (UNINCORPORATED AREAS)	225199
KENNER, CITY OF	225201
WESTWEGO, CITY OF	220094

Revised: February 2, 2018

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
22051CV000A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this Flood Insurance Study may be revised and republished at any time. In addition, part of this Flood Insurance Study may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the Flood Insurance Study. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current Flood Insurance Study components. A listing of the community Map Repositories can be found on the Index Map.

Initial Parishwide FIS Effective Date: March 23, 1995

First Revised Parishwide FIS Revision Date: February 2, 2018

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FLOOD INSURANCE STUDY
JEFFERSON PARISH, LOUISIANA AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This parishwide Flood Insurance Study (FIS) investigates the existence and severity of flood hazards, or revises and updates information on the existence and severity of flood hazards, in the geographic area of Jefferson Parish, including the Cities of Gretna, Harahan, Kenner and Westwego; the Towns of Grand Isle and Jean Lafitte; and the unincorporated areas of Jefferson Parish (referred to collectively herein as Jefferson Parish).

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this FIS report are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The initial parishwide (March 23, 1995) FIS was prepared to include communities within Jefferson Parish into a parishwide format FIS. Information on the authority and acknowledgments for each jurisdiction with a previously printed FIS report included in the parishwide FIS is shown below.

Town of Grand Isle: Wave height analysis for the FIS report dated September 2, 1982, was prepared for the Federal Emergency Management Agency (FEMA) from information collected from various Federal agencies in order to include the wave action from the Gulf of Mexico and Caminada Bay (FEMA, September 1982 and October 1983).

City of Gretna: The hydrologic and hydraulic analyses for the FIRM dated February 13, 1976, were prepared by New Orleans District of the U.S. Army Corps of Engineers (USACE-MVN) under Inter-Agency Agreement No. 21, and Inter-Agency Agreement No. IAA-H-8-71, Project Order No. 2. The analyses for the FIS report dated November 1, 1985, were also prepared by USACE-MVN, under Inter-Agency Agreement No. EMW-E-0105, Project Order No. 7. That work was completed in September 1982. A reanalysis of the pumping stations in City of Gretna was performed by the USACE-MVN.

The revised analysis was completed in 1984.

City of Harahan: The hydrologic and hydraulic analyses for the FIRM dated July 11, 1975, were prepared by the USACE-MVN, under Inter-Agency Agreement No. IAA-H-8-70, Project Order No. 2. The analyses for the FIRM dated July 5, 1984, were prepared by the USACE-MVN, under Inter-Agency Agreement No. EMW-E-0105, Project Order No. 7. That work was completed in September 1982.

City of Kenner: The hydrologic and hydraulic analyses for the FIRM dated August 22, 1975, were prepared by the USACE-MVN for FEMA under Inter-Agency Agreement No. IAA-H-8-70, Project Order No. 21, and Inter-Agency Agreement No. IAA-H-8-71, Project Order No. 2. The analyses for the FIS report dated November 1, 1985, were prepared by the USACE-MVN for FEMA, under Inter-Agency Agreement No. EMW-E-0105, Project Order No. 7. That work was completed in September 1982. A reanalysis of the pumping stations in City of Gretna was performed by the USACE-MVN. The wave height analysis was revised by Bernard Johnson, Inc., to include the effect of muddy bottoms. The revised analysis was completed in 1984.

City of Westwego: The hydrologic and hydraulic analyses for the FIRM dated March 11, 1977, were prepared by the USACE-MVN for FEMA, under Inter-Agency Agreement No. IAA-H-8-70, Project Order No. 21, and Inter-Agency Agreement No. IAA-H-8-71, Project Order No. 2. The analyses for the FIRM dated June 15, 1984, were prepared by the USACE-MVN, under Inter-Agency Agreement No. EMW-E-0105, Project Order No. 7. That work was completed in September 1982.

FIS reports were previously not produced for Jefferson Parish Unincorporated Areas or the Town of Jean Lafitte.

In the initial parishwide FIS (March 23, 1995) for Jefferson Parish, the interior drainage analysis for Ponding Areas 1-54 were prepared by the USACE-MVN under Inter-Agency Agreement No. 88-E-2730, Project Order No. 7. This work was completed in November 1991. In addition, a wave height analysis for the Gulf of Mexico was prepared by Dewberry & Davis. This work was completed in August 1991. Base Flood Elevations (BFEs) within Drainage District No. 9 were taken from the Jefferson Parish Flood Insurance Rate Map (FIRM) dated October

1, 1983, except for the area north of U.S. Route 90, which were taken from the City of Gretna FIRM dated November 1, 1985 (FEMA, October 1983; FEMA, November 1985).

This parishwide FIS (February 2, 2018) includes new detailed coastal analyses which were performed by the USACE-MVN, for FEMA under Interagency Agreement No. EMT-2003-IA-0141. This study was completed by Michael Baker Jr., Inc. as the FEMA Region VI Regional Management Center (RMC) in June 2008.

This study also incorporates the Hurricane Storm Damage Risk Reduction System (HSDRRS) completed by the USACE. Revised hydrologic and hydraulic analyses inside of the HSDRRS were prepared for FEMA by Risk Assessment Mapping Partners (RAMPP) under contract number HSFEHQ-09-D-0369. This work was completed in March 2015.

Base map information shown on this FIRM was derived from multiple sources. This information was compiled and provided in digital format by the USACE, New Orleans District; FEMA; Interagency Performance Evaluation Task Force (IPET); United States Fish and Wildlife Service; Jefferson Parish GIS Department; and the Louisiana Department of Transportation. This information was developed at scales of 1”=2000’ and 1”=1000’.

The projection used in the preparation of this map is Louisiana State Plane South Federal Information Processing Standard (FIPS) 1702 and North American Datum of 1983 (NAD83) horizontal datum.

1.3 Coordination

The dates of the initial and final Consultation Coordination Officer (CCO) meetings held for the incorporated communities within Jefferson Parish, as part of the previous studies, are listed in the following table:

Community Name	Initial CCO Date	Final CCO Date
City of Gretna	January 1979	*
City of Harahan	January 1979	August 2, 1983
City of Kenner	January 1979	August 2, 1983
City of Westwego	January 1979	August 1, 1983

* Data not available

The final CCO meeting for the original parishwide study was held on June 24, 1992.

The initial CCO meeting was held on September 20, 2011, and attended by representatives of FEMA, the communities, and study contractors to explain the nature and purpose of Flood Insurance Studies and to identify the flooding sources to be studied by detailed methods.

The results of this study were reviewed at the final CCO meeting held on December 5, 2012, and attended by representatives of FEMA, the communities, and the study contractor. All issues identified at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Jefferson Parish, Louisiana, including the incorporated communities listed in Section 1.1.

In the October 30, 2008 revision, tidal flooding from the Gulf of Mexico and Lake Pontchartrain, including wave action, was studied by detailed methods. This revision was carried out to incorporate an updated coastal surge analysis, implement coastal erosion regulations for frontal dunes, and incorporate an analysis of the effects of marsh grass on wave dissipation. Other detailed study streams that were not studied during the 2008 revision in the FIS have been redelineated.

As part of this parishwide FIS, updated analyses were included for the areas of revision as described below:

The area of revision is within the limits of the HSDRRS situated in the Greater New Orleans metropolitan area, which includes portions of Jefferson Parish. HSDRRS consists of a complex perimeter that includes levees (segments of Lake Pontchartrain & Vicinity levees, and Mississippi River levees), floodwalls, drainage structures, locks, sector gates, and pumping stations all designed for elevation and stability to withstand a 1% probabilistic flooding event originating from river flow or hurricane surge. HSDRRS also includes a complex network of interior drainage features consisting of interior pump stations, box culverts, open channels, subsurface drainage systems, and interior floodwall/levee alignments.

All or portions of the flooding sources listed in Table 1, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 3).

Table 1 – Flooding Sources Studied by Detailed Methods

Ames Westwego Polder	
Ames Outer Canal	Grand Cross Canal Tributary 3
Ames Outer Canal Tributary 1_2	Grand Cross Canal Tributary 4
Ames Outer Canal Tributary 2	Gullizo Canal
Ames Outer Canal Tributary 3	Gullizo Canal Tributary 2
Ames Outer Canal Tributary 4	Kenta Canal
Ames Outer Canal Tributary 5	Keyhole Canal
Brickwall Canal	Keyhole Canal Tributary 1_4
Canal A	Mayronne Canal Tributary 2
Canal C	Mayronne Canal Tributary 3
Canal D	Mayronne Canal Tributary 4
Dugues Canal	W.P.A. Canal

Table 1 - Flooding Sources Studied by Detailed Methods (continued)

Ames Westwego Polder (continued)

Giaise Canal	West Wego Outer Canal Tributary 1
Grand Cross Canal Tributary 1	West Wego Outer Canal Tributary 2
Grand Cross Canal Tributary 2	West Wego Outer Canal Tributary 4

Cataouatche Polder

Avon Garden Canal	Main Canal East
Avon Home 2 Canal	Main Canal East Tributary 1
Avon Homes North Canal	Main Canal South
Avon Homes South Canal	Main Canal Southeast
Avondale Canal	Main Canal Southwest
Bayou Outer Canal	Main Canal Southwest Tributary 1
Bridge City Number 3 East Canal	Main Canal Southwest Tributary 2
Canal C	Marsh Canal
Crawfish Ditch	Modern Farms Canal
Dandelion Ditch	North Railroad Ditch East Tributary 1
Glen Della Canal	North Railroad Ditch East Tributary 2
Hooters Canal South	North Railroad Ditch West
Inner Cataouatche Canal Northwest	North Railroad Ditch West Tributary b
Inner Cataouatche Canal South	North Sauls Canal
Inner Cataouatche Canal Southeast	North South Kenner Ditch
Inner Cataouatche Canal Southeast Tributary 1	Railroad Canal
Inner Cataouatche Canal Southwest	Railroad Ditch 2 East
Jefferson Ditch East	Railroad Ditch 2 West
Jefferson Ditch South	South Railroad Ditch East
Jefferson Ditch South Tributary 2	South Railroad Ditch West
Kelly Canal	South Kenner Ditch
Labranch Canal	South Kenner Canal
Lake Cataouatche Outer Canal	West Tish Ditch
Lateral Number 1 Canal	Waggaman Canal
Lateral Number 3 Canal	Whiskey Bayou
LPL 1	Whiskey Branch
LPL 2	Winn Dixie Ditch

East of Harvey Polder

Barataria Canal Tributary 1-7	Hebee Canal Tributary 2-2
Barataria Canal Tributary 2-7	Hero Pump To Canal
Barataria Canal Tributary 4-7	Huber Canal
Barataria Canal Tributary 5-7	Industry Canal Tributary 1-5
Barataria Canal Tributary 6-7	Industry Canal Tributary 2-5
Barataria Canal Tributary 7-7	Industry Canal Tributary 3-5
Brown Canal	Industry Canal Tributary 4-5
Carol Sue	Industry Canal Tributary 5-5
Convent Canal Tributary 1-3	Murphy Canal 23
Convent Canal Tributary 3-3	Oakwood Canal 1-3

Table 1 - Flooding Sources Studied by Detailed Methods (continued)

East of Harvey Polder (continued)

Coolie Canal
Donner Canal Outfall Tributary 1-3
Engineer Planters Canal
Engineers Canal
Fatma Canal Tributary 1-6
Fatma Canal Tributary 2-6
Fatma Canal Tributary 3-6
Fatma Canal Tributary 4-6
Fatma Canal Tributary 5-6
Fatma Canal Tributary 6-6
Fortado Canal
Gardere Canal Tributary 1-2
Gardere Canal Tributary 2-2
Governor Hall Canal Tributary 1-2
Governor Hall Canal Tributary 2-2
Hancock Virgil Canal
Hebee Canal Tributary 1-2
Oakwood Canal 2-3
Oakwood Canal 3-3
Outfall 1-3
Outfall 2-3
Planters Canal
Reach 24
STUMPF
Terry Parkway Canal
Trapp Canal
Verret Canal 1-2
Verret Canal 2-2
Weyerauch Canal 1-2
Whitney Canal 1-4
Whitney Canal 2-4
Whitney Canal 3-4
Whitney Canal 4-4
Wright Avenue

Harvey Estelle Cousins Polder

Avenue D Canal
B-C Canal
Bayou Des Famill Canal
Bent Tree Canal
Breaux Ditch
California Canal
Canal B
Canal C
Canal D
Canal F
Canal F South
Canal G
Canal G East West
Canal H
Cousins Canal
Deer Run Ditch
Emily Ditch
First Avenue Canal
Gulizo Canal
Harvey C Canal
Harvey C Pump
Justice Canal
Oil Company Ditch
Pipeline Canal
Pipeline Canal North
Powerline Canal
Powerline Canal East
Pritchard Ditch
Swift Canal
Two Mile Canal
V-Line Canal
Woodmere Canal

Hoey's Polder (East Bank Metro)

Geisenheimer Canal
Hoey Drain Canal
Hoey's Canal
L and A Ditch
Metairie CC West Canal
Old Metarie Place Canal

Table 1 - Flooding Sources Studied by Detailed Methods (continued)

Jefferson East Bank Polder

Ad Circ Canal	Canal Number 6 East
Arnoult Canal Number 5	Canal Number 6 West
Bonnabel North Canal 1	Canal Number 7
Bonnabel South Canal	Canal Number 7_17
Brown Miller Ditch	Crochet Powerline Canal
Butler Canal	Crochet Canal
Cains Ditch	Cross Canal
Canal Street Canal Number 3	Cross St. Peters Canal
Canal Number 1	Duncan Canal
Canal Number 10	Elmwood Canal
Canal Number 10 12	Harahan Ditch
Canal Number 11	Mazoue Ditch
Canal Number 13	Plauche Canal Number 6
Canal Number 14	Soniat Canal
Canal Number 19	St. Peters Ditch
Canal Number 2	Suburban Canal
Canal Number 3	Suburban Canal Number 5
Canal Number 4	Taca Canal
Canal Number 5	

Western Closure Complex (WCC)

Algiers Canal	Hero Cutoff Canal
Harvey Canal	

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

2.2 Community Description

Jefferson Parish lies in southeastern Louisiana and is bordered by Lake Pontchartrain to the north, Orleans and Plaquemines Parishes to the east, the Gulf of Mexico to the south, and Lafourche and St. Charles Parishes to the west. The Cities of Gretna, Harahan, Kenner, and Westwego; and the towns of Grand Isle and Jean Lafitte are located within Jefferson Parish. The total land area contained within the Jefferson Parish limits is 306.5 square miles (U.S. Census Bureau, 2008). According to U.S. Census Bureau figures, the parish population decreased from 455,466 in 2000 to 431,361 in 2006 (U.S. Census Bureau, 2008).

Major transportation routes that traverse the parish include State Routes 18, 23, 45 and 48, the Lake Pontchartrain Causeway, U.S. Routs 61 and 90, and Interstate 10. The parish is also traversed by the Mississippi River, the Gulf Intercoastal Waterway, and the Illinois Central Gulf, Kansas City Southern, Texas and Pacific, and Southern Pacific railroads. Air transportation in Jefferson Parish is provided by the New Orleans International Airport located in the City of Kenner.

Jefferson Parish is located in a part of the Mississippi River deltaic plain now occupied by the present course of the river. Principal physiographic features of the area are the river channel, natural levee ridges along its banks and along the banks of abandoned distributary channels, and low marshlands situated between and bordering the channels. Land elevations vary in Jefferson Parish from about 10.0 feet North American Vertical Datum of 1988 (NAVD88) near the Mississippi River to less than 0.0 feet NAVD88 in the coastal marsh area. The crest of the natural levee is the highest ground in the region. The coastal marsh area contains numerous bodies of shallow water.

Jefferson Parish is located in a subtropical latitude. The climate is characterized by mild winters and hot, humid summers. During the summer, prevailing southerly winds produce conditions favorable for thunder showers. During hurricane season, the area experiences frontal passages which produce squalls and sudden temperature drops. The mean annual temperature is about 70 degrees Fahrenheit (ºF). The average temperatures in the summer and winter are 82ºF and 56 ºF, respectively. The average annual rainfall is 63 inches (Louisiana Department of Health and Hospitals, 2005).

The Mississippi River divides the parish into two distinctly different communities. Development on the east bank of the Mississippi River consists mainly of residential and commercial improvements. Although some industrial development is located on the east bank of the river, most of the heavy industrial concentration is found on the west bank. In recent years, the west bank area has also experienced rapid residential development.

2.3 Principal Flood Problems

The history of flooding within Jefferson Parish indicates that flooding may occur during any season of the year. In the cooler months, the area is subject to heavy rainfalls resulting from frontal passages; in the summer months, heavy rainfalls result from convective thundershowers. In the later summer, hurricanes accompanied by rainfall and super-elevated water surface elevations pose the largest threat of flooding to the area.

The principal sources of flooding are rainfall ponding, levee overtopping and hurricane or tropical storm surges originating in the Gulf of Mexico from Lake Pontchartrain on the east bank and Lakes Salvador and Cataouatche on the west bank. According to the original parishwide FIS, the largest 24-hour rainfall amount during a 107-year period of record at a nearby gage in Audobon Park in Orleans Parish was 14 inches, on April 15 and 16, 1927. Continuous gage records of water surface are available in many nearby lakes and bays. Among tidal gages, the longest period of record is at the West End gage in Lake Pontchartrain. During its 50-year period of operation, the highest stage of 5.37 feet occurred on September 9, 1965, during the passage of Hurricane Betsy.

The most severe flood in the study area occurred in August 2005 when Hurricane Katrina passed through the area. A mandatory evacuation order was issued by the Jefferson Parish President on August 26, 2005, for Hurricane Katrina. Three days later, the storm crossed southeastern Louisiana, approximately 20 miles east of Jefferson Parish, with wind gusts reaching 100 to 125 mph. Storm surges of up to 15 feet severely flooded areas in the southern part of the parish. Heavy rains and overtopping of the Lake Pontchartrain levees resulted in flooding in the northernmost sections of the parish, and sections of "Old Metairie" remained flooded for weeks (Jefferson Parish – Disaster Impact and Needs Assessment, 2008).

On September 27, 2005, Hurricane Rita hit the western part of the state, bringing sustained winds of 45 mph to Jefferson Parish. Storm surges again flooded areas of southern Jefferson Parish, particularly around the Town of Jean Lafitte. Utilities were disrupted throughout the parish and most commerce was halted for several weeks. High winds damaged more than 26,700 residential roofs throughout the parish. Jefferson Parish, although suffering significant damage, fared better than its neighbors Orleans, Plaquemines, and St. Bernard Parishes (Jefferson Parish – Disaster Impact and Needs Assessment, 2008).

Other significant floods in Jefferson Parish occurred in 1909, 1915, 1947, 1956, 1965, 1969, 1978, 1980, and 1992. Severe flood in the parish also occurred in September 1965 when Hurricane Betsy crossed the Louisiana coastline.

2.4 Flood Protection Measures

The most densely populated areas of Jefferson Parish are protected from flooding by levees, drainage canals, and storm water pumps. The City of Gretna is served by the Hero and Planters pumping stations, which are located in Jefferson Parish along Barataria. The major canal within City of Gretna is Verret Canal. The City of Harahan is served by Pump Station No. 3, which is located in Jefferson Parish along Elmwood Canal. The major canal in the City of Harahan is Soniat Canal. The City of Kenner is served by Pumping Station No. 4, which is located in the city along Duncan Canal, Pumping Station No. 3, and Kenner Relief Pumping Station, which is located in the Parish Line Canal approximately 3.9 miles below Lake Pontchartrain. The major canals in the City of Kenner are Duncan Canal, Canal No. 1, Canal No. 2, and Canal No. 13. The City of Westwego is served by the Westwego and Bayou Segnette pumping stations, which are located in the southwestern portion of the city along Bayou Segnette. The City of Westwego is partially protected from hurricane surges from Lake Salvador and Lake Cataouatche by parish-built levees.

The federally-constructed Mississippi River and Tributaries Levee protects Jefferson Parish from flooding due to high stages in the Mississippi River. On the east bank of the parish, the Lake Pontchartrain and Hurricane Protection Levee affords protection from hurricane surges from Lake Pontchartrain. The west bank area is partially protected from hurricane surge from the Gulf of Mexico by parish-built levees.

Levees exist in Jefferson Parish that provides protection against flooding. However, it has been ascertained that some of these levees may not protect the parish from rare events such as the 1-percent-annual-chance flood. Levees that do not protect against the 1-percent-annual-chance flood were not considered in the hydraulic analysis for the Jefferson Parish FIS.

The flood control facilities experienced damage of varying degrees throughout southeastern Louisiana as a result of Hurricanes Katrina and Rita, and the USACE-MVN is on an aggressive path to repair and improve the flood control system (Jefferson Parish – Disaster Impact and Needs Assessment, 2008).

After Hurricane Katrina hit, USACE repaired and restored the HSDRRS. The protection system consists of levees, floodwalls, floodgates, outfall canals, locks, surge barriers, and pump stations in the five-parish Greater New Orleans area. A perimeter levee system protects the area from the coastal surge and the Mississippi River flooding. Pump stations are located along the perimeter levee to discharge local runoff into the exterior lakes or the Mississippi River. Local pump stations perform the same function along interior levees and discharge to marshy areas designated to collected flood water from developed areas. Two major closure complexes, the West Closure Structure Complex and the Inner Harbor Navigation Canal Complex keep the surge from entering the major canals and navigation channels within the New Orleans area. The HSDRRS is designed to protect the Greater New Orleans area from 1-percent-annual-chance flood.

FEMA specifies that all levees must have a minimum of 3-feet of freeboard against 1-percent-annual-chance flooding to be considered a safe flood protection structure. The HSDRRS meets the FEMA freeboard requirement.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods 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 is expected to be equaled or exceeded once on the average during any 10-, 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-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent 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 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 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.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source as well as direct runoff inflow hydrographs from the associated contributing areas for each flooding source studied by detailed methods affecting the community.

Initial Parishwide Analyses (March 23, 1995)

The hydrologic analyses that were originally performed for the communities and the unincorporated areas of Jefferson Parish were incorporated in a parishwide format study. The same analyses were used to perform the internal draining analysis for 53 ponding areas.

Although rainfall records are available in Jefferson Parish, their periods of record are not long enough to allow development of particular frequencies and distributions with an adequate degree of confidence. Therefore, rainfall frequency and duration data were derived from the Rainfall Frequency Atlas of the United States (U. S. Department of Commerce, 1963). A synthetic 24-hour storm distribution was computed utilizing the rainfall frequency and distribution data. No rainfall runoff monitoring was performed; therefore, rainfall runoff hydrographs were developed for individual drainage areas from the synthetic rainfall distributions and synthetic unit hydrographs.

All hydrologic data for the Mississippi River were obtained from prior studies for the unincorporated areas of Jefferson Parish, Cities of Gretna, Harahan, Kenner, and Westwego (FEMA, September 1982 and October 1983; FEMA, October 1983; FEMA, July 1984; FEMA, November 1985; FEMA, June 1984).

This Parishwide Revision (February 2, 2018)

Storage areas were modeled as sub-basins in the HEC-HMS version 3.5 (USACE, 2010), and the 10-, 2-, 1-, and 0.2-percent-annual-chance event discharges for these recurrence intervals were directly input as flow hydrographs at corresponding locations in the hydraulic models.

Frequency based synthetic rainfall was used for each sub-basin within a polder. In this parishwide analysis, the precipitation depths for 10-, 2-, 1-, and 0.2-percent-annual-chance storm events were estimated using information obtained from the National Weather Service's (NWS) Technical Memorandum HYDRO-35 (NOAA, 1977), and the Southeastern Region Climatic Center (SRCC) Technical Report 97-1 (University of Pittsburg at Johnstown, PA, 1997).

No routing was used within the HEC-HMS model and the storage areas included within the HEC-HMS model were not connected to each other. Routing was accomplished through the HEC-RAS model where connections between storage areas and canals were taken into consideration.

The hydrologic analyses for this project used rainfall runoff modeling using HEC-HMS to develop flow hydrographs which were used in unsteady HEC-RAS models. The final hydrologic output was a flow hydrograph as opposed to a single flow value. Therefore, rather than provide a number of tables with the flow hydrograph information at various locations, the user is referred to the digital HMS model output that contains all the flow hydrograph discharges.

The storage area boundaries and identification numbers are shown in Figures 1 through 6.

The stillwater elevations have been determined for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods for the flooding sources studied by detailed methods and are summarized in Table 2, "Summary of Stillwater Elevations."

The 0.2-percent-annual-chance (500-year) flood elevations shown for storage areas listed in Table 2 represent the highest flood elevation based on the following: 1) interior drainage calculation of 0.2-percent-annual-chance precipitation only and interior pump station capacity; or 2) the flood elevations provided by the USACE which represent the 0.2-percent-annual-chance water surface elevation that could occur from hurricanes, as applied to the HSDRRS system with no armoring in place, including potential overtopping or breaching of the HSDRRS and Mississippi River levees.

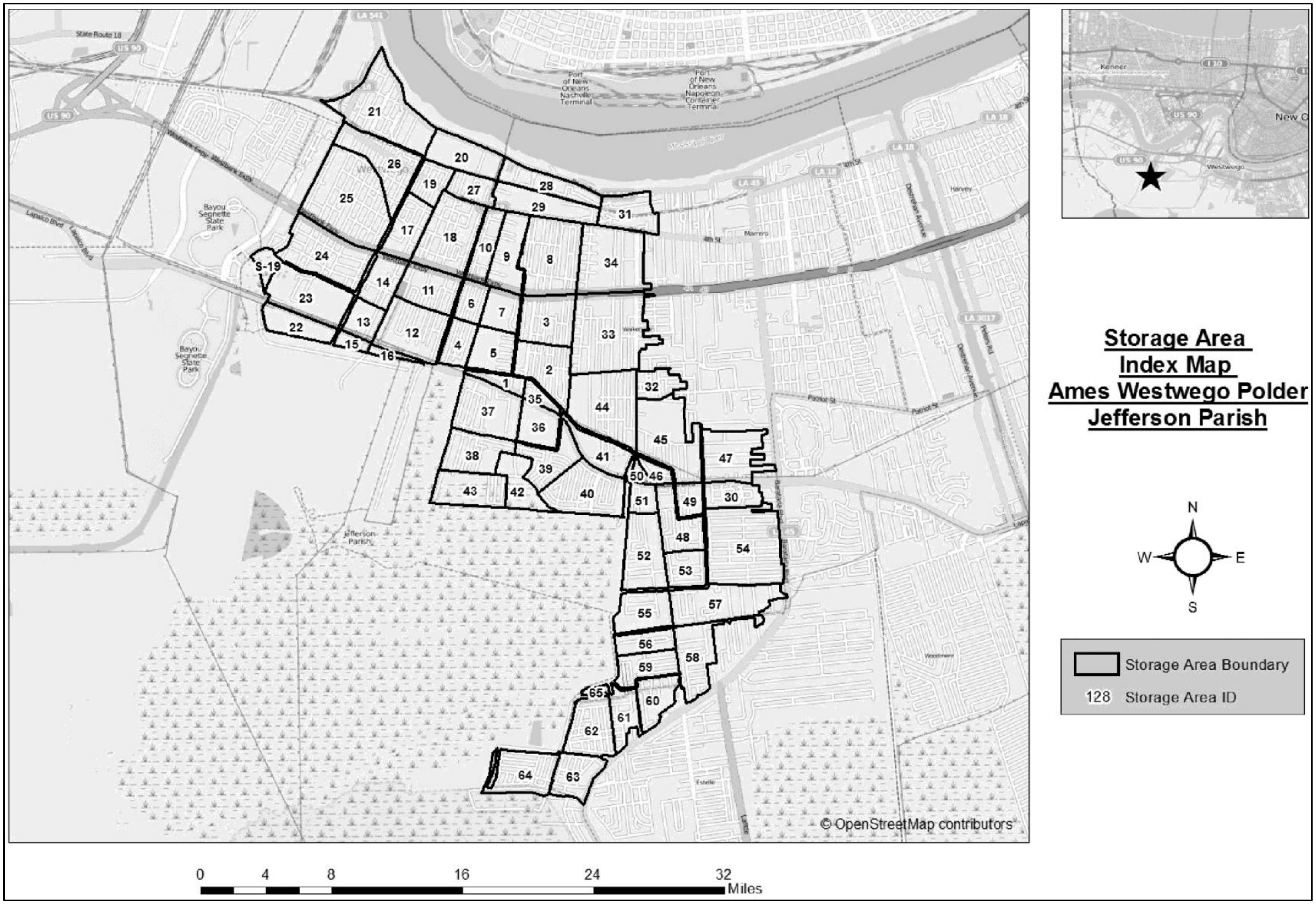

Figure 1: Storage Area Index Map, Ames Westwego Polder

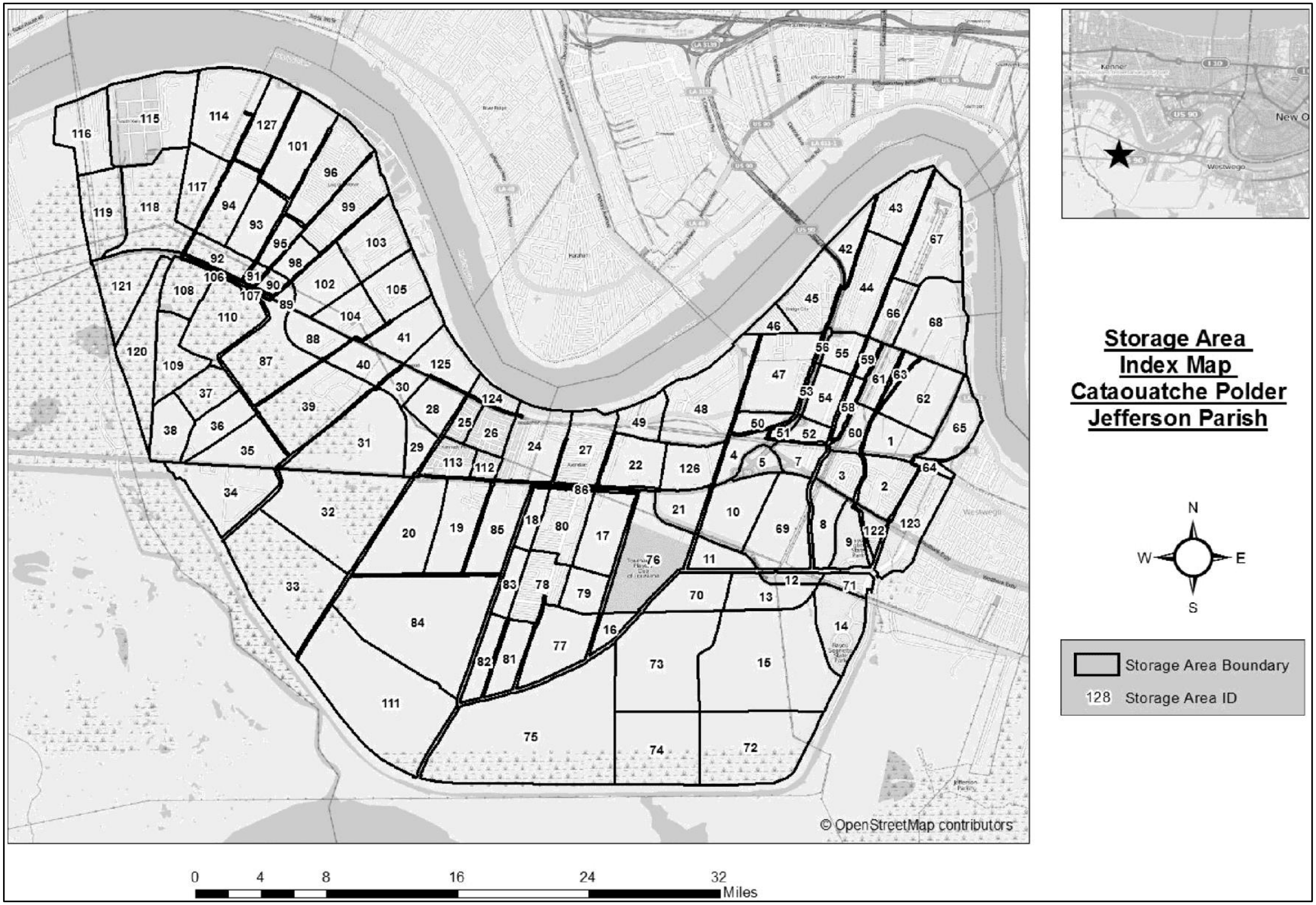

Figure 2: Storage Area Index Map, Cataouatche Polder

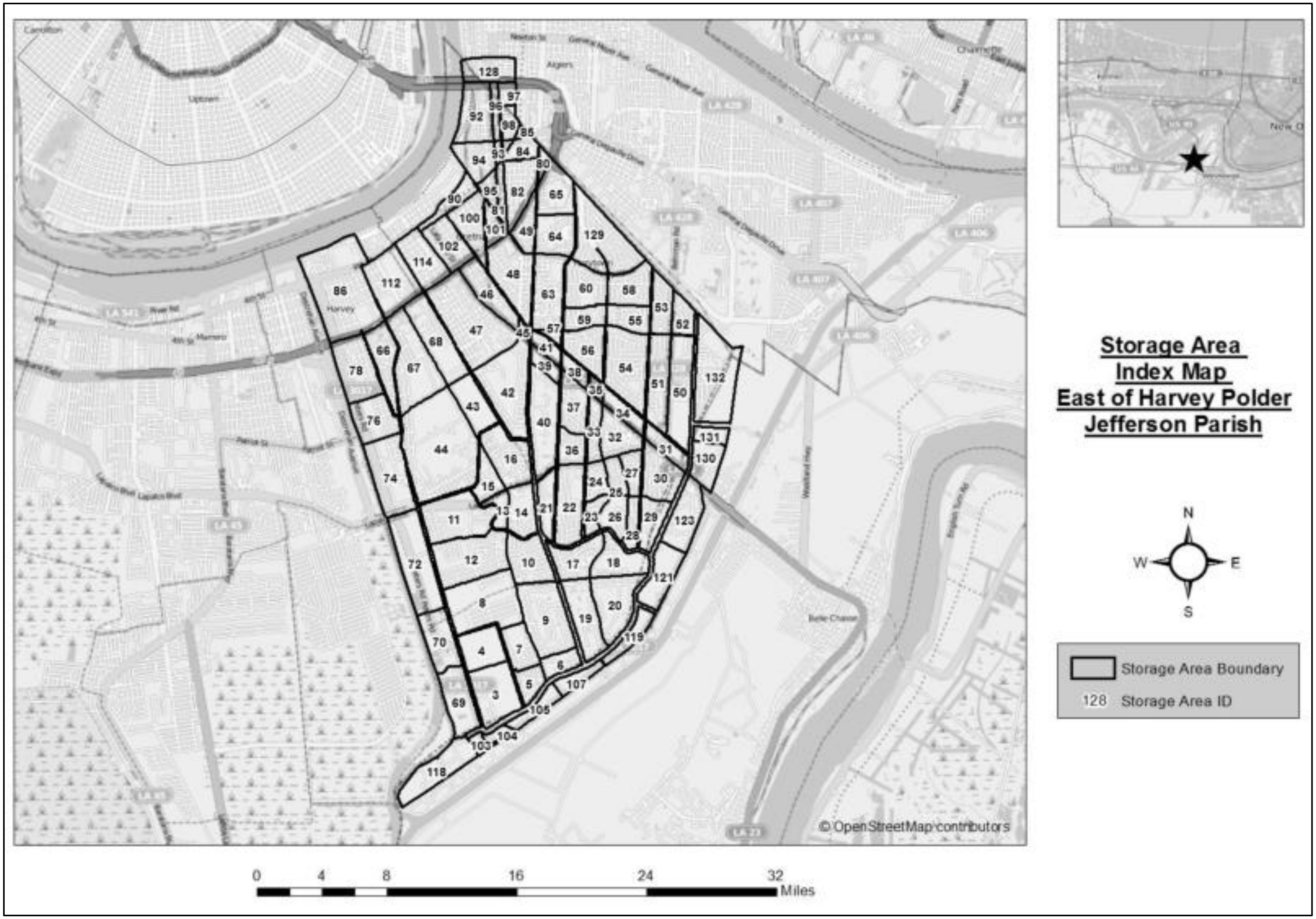

Figure 3: Storage Area Index Map, East of Harvey Polder

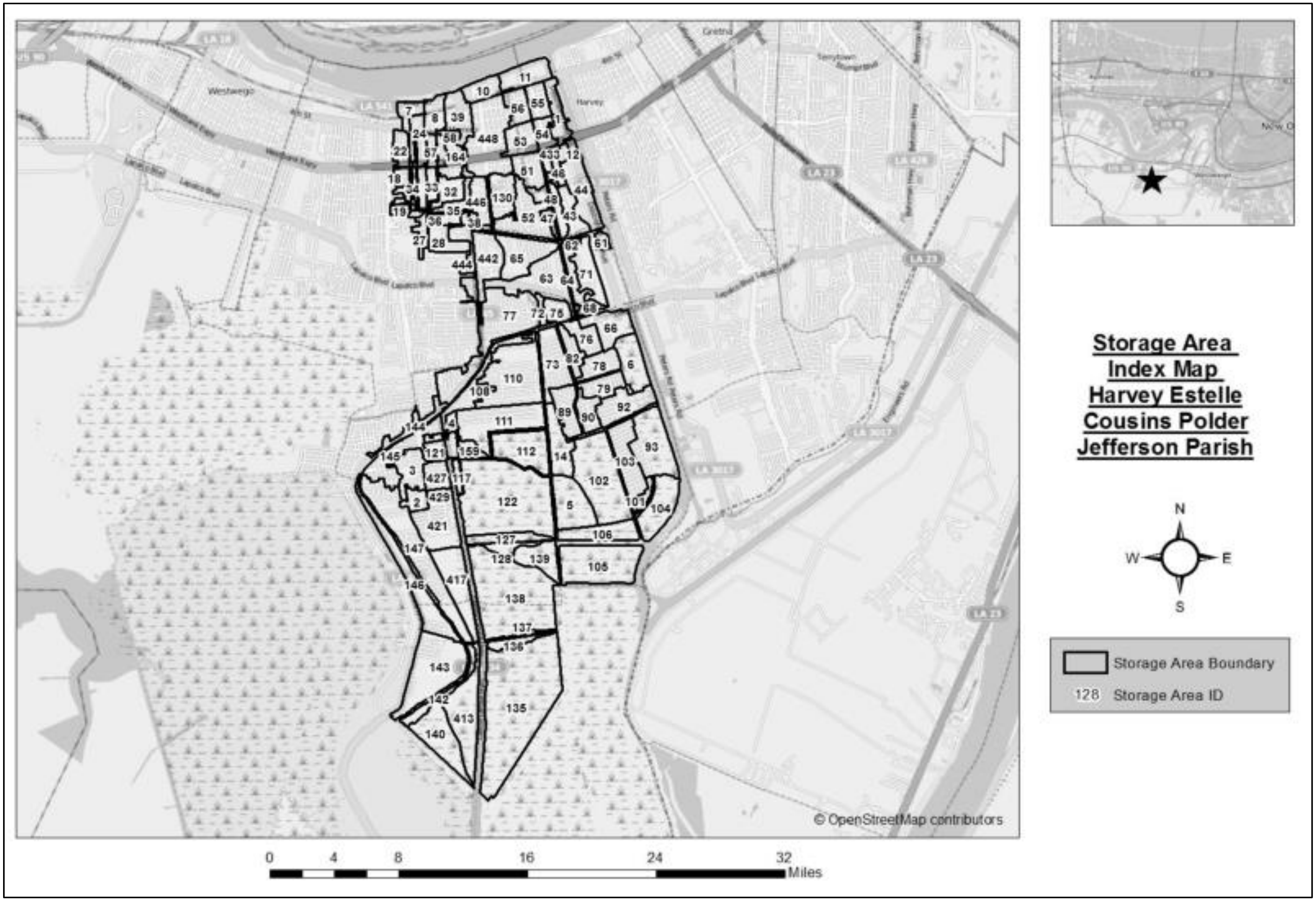

Figure 4: Storage Area Index Map, Harvey Estelle Cousins Polder

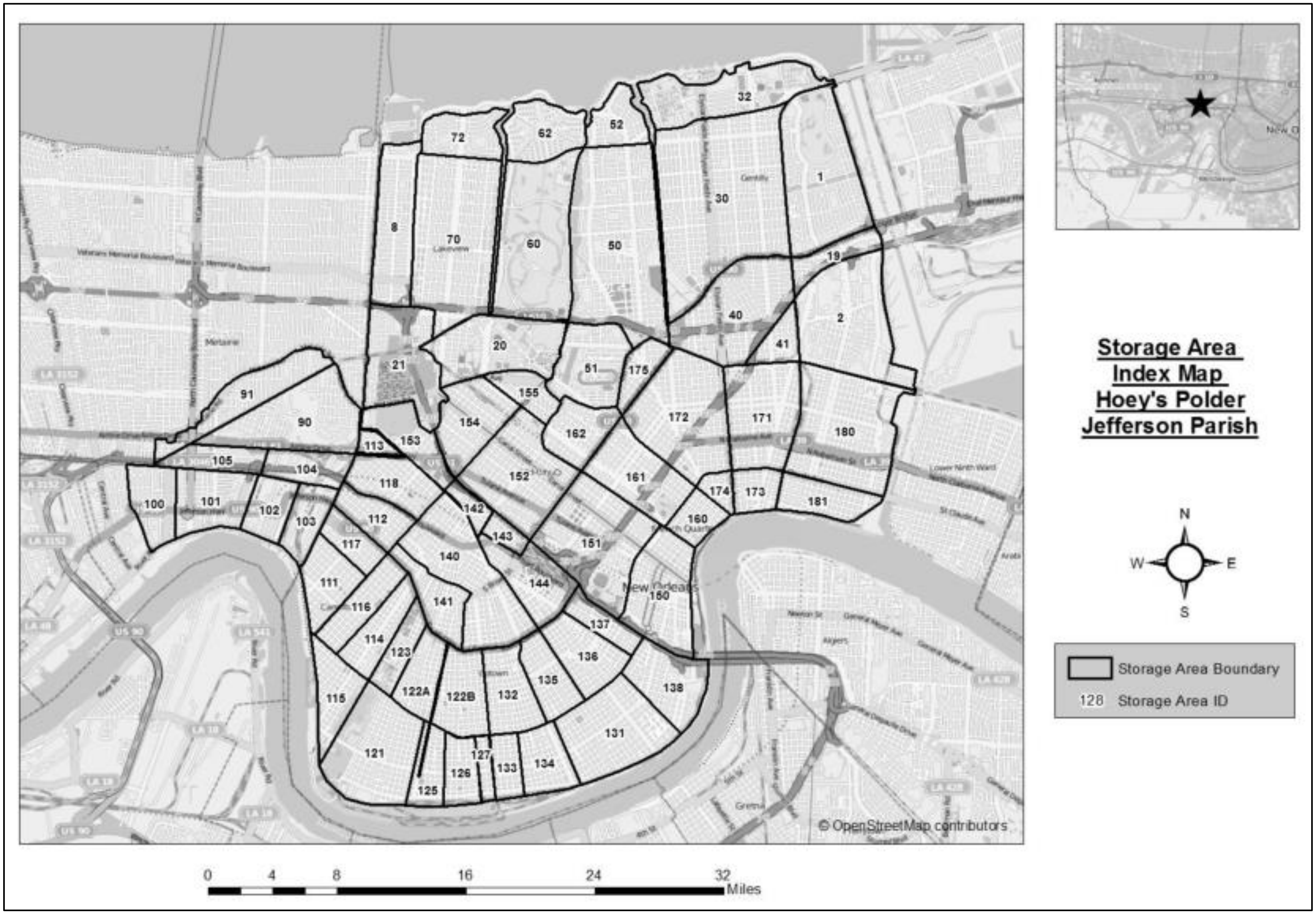

Figure 5: Storage Area Index Map, Hoey's Polder

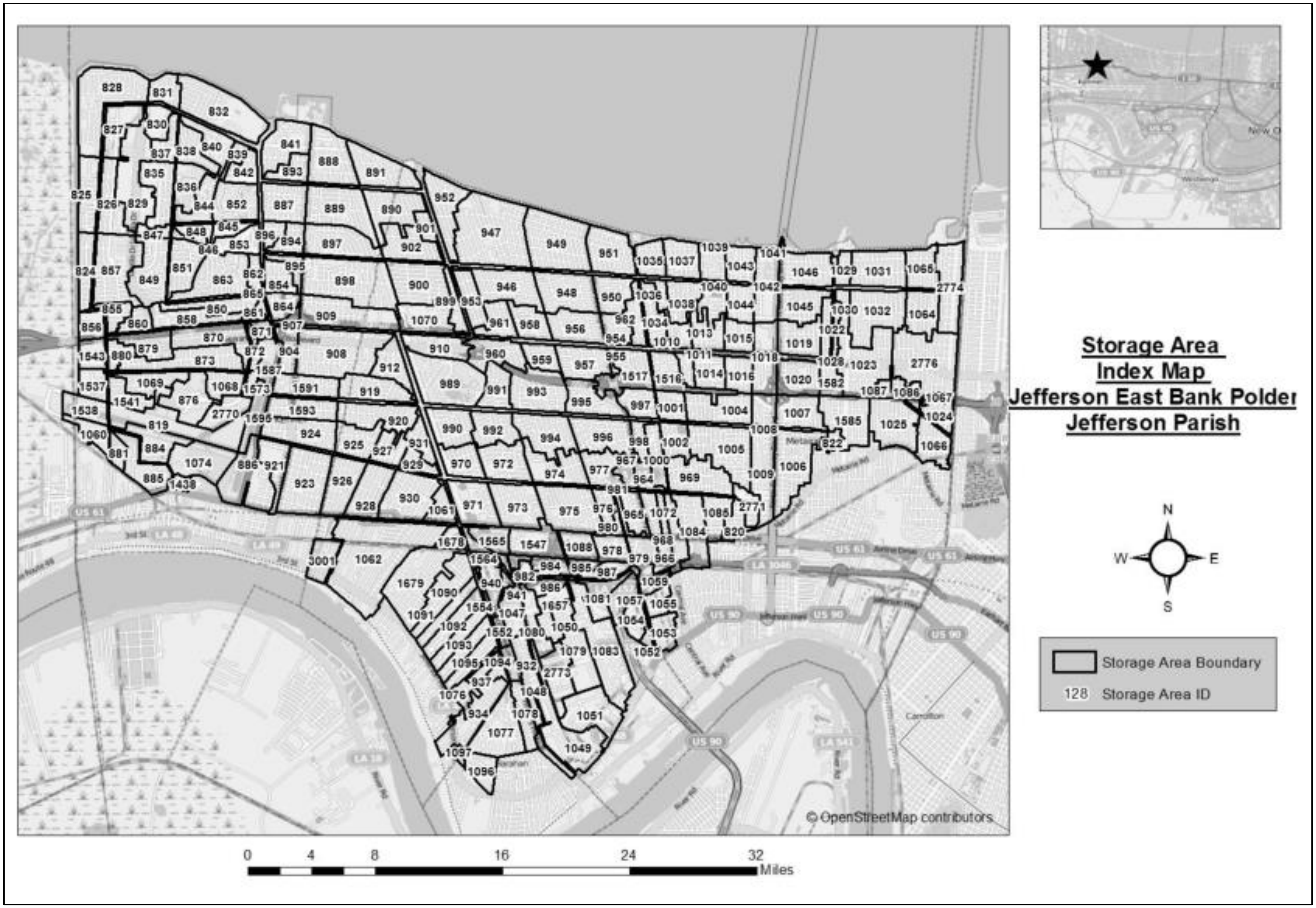

Figure 6: Storage Area Index Map, Jefferson East Bank Polder

Table 2 – Summary of Stillwater Elevations

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE
AMES WESTWEGO POLDER (list of storage areas below)				
1	-0.6	0.5	1	5.0
10	1.6	2.0	2	5.0
11	-2.0	-2.0	-2	5.0
12	-3.0	-2.5	-2	5.0
13	-2.5	-2.0	-2	5.0
14	-2.0	-1.7	-1	5.0
15	-3.0	-2.3	-2	5.0
16	-3.0	-2.3	-2	5.0
17	-0.3	0.1	0	5.0
18	1.1	1.2	1	5.0
19	-0.1	0.3	1	5.0
2	0.0	0.0	0	5.0
20	-3.0	-3.0	-3	5.0
21	1.3	1.9	2	5.0
22	-3.0	-2.3	-2	5.0
23	-2.6	-2.0	-2	5.0
24	-2.4	-2.0	-2	5.0
25	-2.3	-1.6	-1	5.0
26	-1.8	-0.2	0	5.0
27	2.9	3.0	3	5.0
28	4.0	4.0	4	5.0
29	3.0	3.0	3	5.0
3	0.0	0.9	2	5.0
30	2.1	2.4	3	5.0
31	2.0	2.0	2	5.0
32	2.0	2.0	2	5.0
33	-1.0	-1.0	-1	5.0
34	-0.8	-0.8	-1	5.0
35	0.5	0.8	1	5.0
36	0.0	0.2	0	5.0
37	-2.3	-0.9	0	5.0
38	-1.4	-0.9	0	5.0
39	-0.4	-0.1	0	5.0
4	0.3	0.6	1	5.0
40	-1.5	-0.9	0	5.0
41	-2.5	-2.5	-1	5.0
42	-1.7	-1.0	0	5.0
43	-1.9	-1.1	-1	5.0
44	-0.1	0.3	1	5.0
45	1.5	2.0	2	5.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE
46	1.5	2.0	2	5.0
47	3.8	4.1	4	5.0
49	1.4	1.9	2	5.0
5	1.4	1.9	2	5.0
50	-0.6	0.5	1	5.0
51	-1.2	0.5	1	5.0
52	-0.9	0.1	0	5.0
53	-3.0	-1.0	0	5.0
54	0.2	0.7	1	5.0
55	0.3	0.8	1	5.0
56	-1.6	-0.9	0	5.0
57	-4.0	-2.6	0	5.0
58	0.2	0.7	1	5.0
59	0.5	0.5	0	5.0
6	-0.1	0.1	0	5.0
60	-2.0	0.5	1	5.0
61	2.0	2.1	2	5.0
62	-2.0	-1.1	-1	5.0
63	-1.5	-0.8	0	5.0
64	-1.0	-1.0	0	5.0
7	-1.0	0.6	1	5.0
8	0.9	1.3	2	5.0
9	3.1	3.2	3	5.0
S-19	2.5	3.1	3	5.0
CATAOUATCHE POLDER (list of storage areas below)				
1	-0.6	-0.1	1	5.0
10	-2.9	-2.6	-2	5.0
101	5.1	5.7	6	6.5
102	-4.7	1.0	3	5.0
103	-6.0	-6.0	-6	5.0
104	3.8	4.1	5	5.0
105	3.7	3.7	4	5.0
106	-0.3	-0.3	0	5.0
107	1.5	1.9	3	5.0
108	-1.3	-0.7	0	5.0
109	-1.7	-1.0	0	5.0
11	-5.5	-5.1	-4	5.0
110	-2.4	-2.2	-2	5.0
111	-7.5	-6.7	-5	5.0
112	0.1	0.3	1	5.0
113	-0.8	-0.3	0	5.0
114	7.2	7.3	8	7.7

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE
115	3.4	3.4	3	5.0
116	1.0	1.0	1	5.0
117	2.3	2.5	3	5.0
118	1.7	2.2	3	5.0
119	1.4	1.9	2	5.0
12	-5.1	-5.1	-5	5.0
120	2.4	2.8	3	5.0
121	2.3	2.7	3	5.0
122	-7.0	-6.3	-5	5.0
123	-10.0	-10.0	-5	5.0
124	5.9	6.0	6	6.1
125	4.2	4.4	5	5.0
126	-0.6	-0.2	1	5.0
127	7.0	7.2	7	7.6
13	-3.0	-2.7	-2	5.0
14	-4.7	-4.6	-4	5.0
15	-4.6	-4.4	-4	5.0
16	-5.4	-5.1	-4	5.0
17	-4.0	-3.9	-4	5.0
18	-3.7	-3.6	-3	5.0
19	-3.6	-3.4	-3	5.0
2	-5.5	-5.5	-2	5.0
20	-3.7	-3.6	-3	5.0
21	-1.7	-1.5	-1	5.0
22	0.0	0.2	0	5.0
24	1.1	1.4	2	5.0
25	-1.0	-1.0	-1	5.0
26	1.0	1.0	1	5.0
27	1.2	1.3	2	5.0
28	0.0	0.0	0	5.0
29	-4.0	-4.0	-4	5.0
3	-2.0	-1.8	-1	5.0
30	1.4	1.7	2	5.0
31	-5.2	-4.8	-3	5.0
32	-4.5	-4.1	-4	5.0
33	-5.2	-4.7	-4	5.0
34	-4.6	-4.1	-4	5.0
35	-2.9	-2.8	-3	5.0
36	-2.1	-1.9	-2	5.0
37	-1.0	-0.9	-1	5.0
38	-0.6	-0.4	0	5.0
39	-21.7	-9.4	-3	5.0
4	-0.6	-0.2	1	5.0
40	1.4	1.7	2	5.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE
41	3.8	4.1	5	5.0
42	4.5	4.6	5	5.0
43	7.5	7.6	8	7.8
44	3.0	3.2	4	5.0
45	3.1	3.2	3	5.0
46	3.0	3.0	3	5.0
47	2.3	2.6	3	5.0
48	2.4	2.5	3	5.0
49	1.6	1.6	2	5.0
5	0.0	0.0	0	5.0
50	1.7	2.1	3	5.0
51	1.8	2.1	2	5.0
52	-0.8	-0.4	0	5.0
53	2.3	2.5	3	5.0
54	-0.4	-0.1	1	5.0
55	0.1	0.9	1	5.0
56	2.7	2.8	3	5.0
58	-0.6	-0.2	0	5.0
59	0.1	0.3	1	5.0
60	-0.7	-0.2	1	5.0
61	0.4	0.5	1	5.0
62	0.2	0.5	1	5.0
63	0.3	0.5	1	5.0
64	-0.2	-0.2	0	5.0
65	2.5	2.7	3	5.0
66	3.0	3.2	4	5.0
67	5.8	6.0	6	6.4
68	2.0	2.0	2	5.0
69	-4.6	-4.5	-4	5.0
7	-1.8	-1.6	-1	5.0
70	-2.0	-1.9	-2	5.0
71	-7.2	-6.4	-5	5.0
72	-5.8	-5.1	-5	5.0
73	-6.6	-5.8	-5	5.0
74	-6.1	-5.3	-5	5.0
75	-7.1	-5.8	-5	5.0
76	-4.5	-4.1	-4	5.0
77	-5.5	-5.1	-4	5.0
78	-3.6	-3.5	-3	5.0
79	-6.4	-5.9	-4	5.0
8	-4.5	-4.2	-4	5.0
80	-1.9	-1.9	-2	5.0
81	-6.0	-5.2	-4	5.0
82	-6.0	-5.1	-4	5.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE
83	-5.0	-4.8	-4	5.0
84	-4.5	-4.4	-4	5.0
85	-3.6	-3.4	-3	5.0
86	-1.0	-1.0	-1	5.0
87	-2.8	-2.7	-2	5.0
88	-0.1	0.1	0	5.0
89	1.7	2.1	3	5.0
9	-9.9	-7.6	-5	5.0
90	1.7	2.1	3	5.0
91	1.6	2.0	3	5.0
92	1.7	2.1	3	5.0
93	1.5	2.4	3	5.0
94	2.3	2.5	3	5.0
95	2.3	2.7	3	5.0
96	5.3	5.4	5	5.5
98	2.4	2.8	3	5.0
99	4.7	5.0	5	5.2
WT-1	1.6	2.1	3	5.0
WT-2	2.4	2.8	3	5.0
EAST OF HARVEY POLDER (list of storage areas below)				
10	-5.9	-5.1	-5	1.0
100	-0.9	-0.6	0	1.0
101	-0.7	-0.6	0	1.0
102	-1.2	-1.0	-1	1.0
103	-11.0	-11.0	-11	1.0
104	-10.5	-10.5	-10	1.0
105	-8.0	-5.6	-5	1.0
107	-7.0	-7.0	-7	1.0
11	-5.1	-4.7	-4	1.0
112	-0.9	-5.0	-3	1.0
114	-1.6	-1.3	-1	1.0
118	-11.0	-11.0	-11	1.0
119	-7.8	-5.6	-5	1.0
12	-5.2	-4.8	-4	1.0
121	-6.4	-5.6	-5	1.0
123	-6.5	-5.6	-5	1.0
128	1.5	1.7	2	2.1
129	-3.8	-3.6	-3	1.0
13	-5.2	-4.8	-4	1.0
130	-5.0	-5.0	-5	1.0
131	-5.0	-5.0	-5	1.0
132	-9.6	-9.6	-10	1.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
14	-5.7	-5.0	-5	1.0
15	-5.0	-4.6	-4	1.0
16	-5.7	-4.4	-4	1.0
17	-5.8	-5.1	-5	1.0
18	-8.0	-6.0	-5	1.0
19	-10.8	-9.5	-5	1.0
20	-7.4	-7.1	-6	1.0
21	-5.7	-5.1	-5	1.0
22	-5.8	-5.1	-5	1.0
23	-7.8	-5.1	-5	1.0
24	-8.8	-8.8	-6	1.0
25	-5.0	-5.0	-5	1.0
26	-6.1	-5.4	-5	1.0
27	-6.5	-6.5	-5	1.0
28	-6.3	-5.5	-5	1.0
29	-6.3	-5.5	-5	1.0
3	-8.6	-7.8	-6	1.0
30	-8.6	-5.2	-5	1.0
31	-5.0	-5.0	-5	1.0
32	-5.0	-5.0	-5	1.0
33	-8.1	-6.6	-4	1.0
34	-3.9	-3.9	-4	1.0
35	-5.0	-5.0	-5	1.0
36	-5.1	-4.9	-4	1.0
37	-4.9	-4.6	-4	1.0
38	-5.1	-3.9	-4	1.0
39	-5.0	-4.9	-3	1.0
4	-8.4	-5.9	-5	1.0
40	-5.1	-4.6	-4	1.0
41	-5.0	-3.6	-3	1.0
42	-4.7	-4.2	-4	1.0
43	-4.5	-4.2	-4	1.0
44	-4.9	-4.6	-4	1.0
45	-3.2	-2.9	-3	1.0
46	-2.6	-2.2	-2	1.0
47	-3.4	-3.1	-3	1.0
48	-2.7	-2.5	-2	1.0
49	-1.6	-1.4	-1	1.0
5	-6.2	-6.2	-6	1.0
50	-10.1	-7.6	-5	1.0
51	-4.8	-4.5	-4	1.0
52	-7.3	-5.5	-5	1.0
53	-4.5	-4.1	-4	1.0
54	-4.2	-3.8	-4	1.0
55	-3.9	-3.8	-4	1.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
56	-3.7	-3.6	-3	1.0
57	-5.0	-3.8	-3	1.0
58	-4.5	-4.0	-4	1.0
59	-4.0	-3.9	-4	1.0
6	-6.2	-6.2	-6	1.0
60	-4.0	-3.9	-4	1.0
63	-3.8	-2.9	-2	1.0
64	-2.7	-2.6	-2	1.0
65	-2.8	-2.6	-2	1.0
66	-3.9	-3.6	-3	1.0
67	-4.9	-4.4	-4	1.0
68	-3.4	-3.1	-3	1.0
69	-10.3	-6.0	-5	1.0
7	-6.4	-5.3	-5	1.0
70	-5.5	-5.1	-5	1.0
72	-5.2	-4.8	-4	1.0
74	-4.2	-4.0	-4	1.0
76	-4.0	-3.6	-3	1.0
78	-2.8	-2.6	-2	1.0
8	-6.1	-5.0	-5	1.0
80	-2.8	-2.0	-1	1.0
81	-0.7	-0.7	-1	1.0
82	-0.5	-0.2	0	1.0
83	2.1	2.2	2	2.4
84	0.1	0.2	0	1.0
85	-0.5	-0.5	-1	1.0
86	0.3	0.4	1	1.2
9	-6.4	-6.0	-5	1.0
90	2.0	2.0	2	2.0
92	1.3	1.5	2	2.1
93	1.7	1.9	2	2.3
94	1.0	1.0	1	1.2
95	1.0	1.1	1	1.2
96	2.0	2.2	2	2.5
97	1.5	1.7	2	2.2
98	0.9	1.5	2	2.1
HARVEY ESTELLE COUSINS POLDER (list of storage areas below)				
1	0.0	1.0	1	5.0
10	1.4	1.4	1	5.0
101	-3.2	-3.2	-3	5.0
102	-3.6	-3.5	-3	5.0
103	-3.6	-3.6	-4	5.0
104	-2.9	-2.7	-3	5.0
105	-2.0	-1.8	-2	5.0
106	-3.0	-2.9	-3	5.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
108	0.9	1.1	1	5.0
11	5.1	5.5	6	5.9
110	-4.0	-1.9	-1	5.0
111	-2.8	-2.5	-2	5.0
112	-3.5	-2.7	-2	5.0
115	-0.1	0.9	1	5.0
116	-1.4	-0.8	-1	5.0
117	-1.8	-1.3	-1	5.0
12	-1.3	-1.3	-1	5.0
121	1.0	1.3	2	5.0
122	-2.9	-2.7	-2	5.0
127	-3.2	-2.9	-3	5.0
128	-3.0	-2.7	-2	5.0
130	-0.5	0.0	0	5.0
135	-2.5	-2.3	-2	5.0
136	-2.7	-2.4	-2	5.0
137	-2.6	-2.4	-2	5.0
138	-2.8	-2.5	-2	5.0
139	-3.0	-2.7	-2	5.0
14	-3.5	-2.7	-2	5.0
140	-1.9	-1.4	-1	5.0
142	-0.7	-0.1	0	5.0
143	-1.4	-0.6	0	5.0
144	1.4	2.1	2	5.0
145	1.4	2.1	2	5.0
146	-2.5	0.3	1	5.0
147	0.1	0.7	1	5.0
159	-1.4	-1.2	-1	5.0
16	2.0	2.0	2	5.0
164	-1.6	-0.3	1	5.0
17	2.3	2.8	3	5.0
18	2.1	2.6	3	5.0
19	1.2	1.2	1	5.0
2	2.1	2.4	3	5.0
20	2.2	2.2	2	5.0
21	2.2	2.8	3	5.0
22	-3.0	-3.0	0	5.0
23	1.1	1.2	2	5.0
24	0.4	0.4	0	5.0
26	0.1	0.2	1	5.0
27	0.9	2.1	2	5.0
28	-0.4	-0.4	0	5.0
3	0.5	1.1	2	5.0
31	1.5	1.5	2	5.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
32	0.5	1.0	1	5.0
33	0.5	1.0	1	5.0
34	0.4	1.0	1	5.0
35	0.0	0.7	1	5.0
36	0.4	0.9	1	5.0
37	0.3	0.8	1	5.0
38	-1.5	-1.5	-1	5.0
39	0.6	0.6	1	5.0
4	1.6	1.9	2	5.0
413	-1.9	-1.4	-1	5.0
417	-1.8	-0.5	0	5.0
421	1.2	1.4	2	5.0
427	1.0	1.2	1	5.0
429	-1.0	-0.3	0	5.0
43	-5.8	-3.5	-3	5.0
433	-1.9	-1.5	-1	5.0
439	1.7	1.7	2	5.0
44	-4.3	-3.2	-3	5.0
440	0.0	0.7	2	5.0
441	1.1	1.3	2	5.0
442	-0.9	-0.3	0	5.0
444	-0.4	-0.4	0	5.0
446	-0.6	0.0	0	5.0
448	1.0	1.3	2	5.0
46	-1.5	-0.9	-1	5.0
47	-2.9	-1.9	-2	5.0
48	-2.7	-1.8	-2	5.0
49	-2.6	-2.5	-2	5.0
5	-3.2	-2.7	-2	5.0
50	-1.2	-1.2	-1	5.0
51	-2.1	-1.5	-1	5.0
52	-3.0	-1.9	-2	5.0
53	-0.4	1.1	1	5.0
54	0.5	1.2	1	5.0
55	2.7	3.1	3	5.0
56	2.0	2.3	2	5.0
57	-1.0	0.1	1	5.0
58	0.7	2.1	2	5.0
6	-3.9	-3.1	-2	5.0
61	-3.1	-3.1	-3	5.0
62	-2.3	-2.3	-2	5.0
63	-2.1	-1.5	-1	5.0
64	-2.6	-2.6	-3	5.0
65	-5.7	-4.6	-2	5.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
66	-2.9	-2.9	-3	5.0
68	-4.4	-3.7	-3	5.0
7	1.0	1.0	1	5.0
71	-4.0	-4.0	-3	5.0
72	-0.4	-0.4	0	5.0
73	-7.0	-1.9	-1	5.0
75	-0.1	0.1	0	5.0
76	-0.5	-0.3	0	5.0
77	-0.8	0.5	1	5.0
78	-3.8	-1.7	-1	5.0
79	-5.0	-2.3	-1	5.0
8	2.1	3.0	3	5.0
82	-1.4	-1.1	-1	5.0
89	-2.5	-1.8	-1	5.0
90	-1.7	-1.3	-1	5.0
92	-3.2	-2.8	-2	5.0
93	-3.2	-2.8	-2	5.0
HOEY'S POLDER (list of storage areas below)				
100	2.3	2.5	3	3.0
101	0.3	0.7	1	1.1
102	0.3	0.7	1	1.1
103	0.1	0.7	1	1.1
104	-0.6	-0.1	0	0.3
105	0.3	0.7	1	1.0
90	-2.1	-0.7	-1	0.3
91	-0.8	-0.2	0	0.5
Causeway Pond	3.4	3.8	4	4.0
Pontiff Playground	-0.3	0.3	0	0.8
JEFFERSON EAST BANK POLDER (list of storage areas below)				
1000	-4.0	-3.7	-3	12.0
1001	-5.0	-4.7	-4	12.0
1002	-4.1	-3.9	-4	12.0
1004	-4.8	-4.3	-4	12.0
1005	-4.3	-3.9	-4	12.0
1006	-3.4	-3.3	-3	12.0
1007	-3.6	-3.4	-3	12.0
1008	-4.5	-4.1	-4	12.0
1009	-4.3	-4.0	-4	12.0
1010	-5.9	-5.8	-5	12.0
1011	-5.0	-5.0	-5	12.0
1013	-5.4	-5.1	-5	12.0
1014	-5.0	-4.9	-5	12.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
1015	-5.3	-5.1	-5	12.0
1016	-4.8	-4.7	-5	12.0
1017	-4.9	-4.8	-5	12.0
1018	-4.8	-4.7	-5	12.0
1019	-4.9	-4.8	-5	12.0
1020	-4.2	-4.1	-4	12.0
1022	-5.0	-5.0	-5	12.0
1023	-4.3	-4.2	-4	12.0
1024	-2.2	-2.0	-2	12.0
1025	-1.1	-1.1	-1	12.0
1028	-11.8	-8.0	-7	12.0
1029	-5.2	-5.0	-5	12.0
1030	-6.5	-5.2	-5	12.0
1031	-5.2	-5.0	-5	12.0
1032	-5.0	-4.8	-4	12.0
1034	-6.9	-6.5	-6	12.0
1035	-5.5	-5.3	-5	12.0
1036	-6.1	-6.1	-6	12.0
1037	-5.4	-5.3	-5	12.0
1038	-5.8	-5.7	-5	12.0
1039	-5.2	-5.1	-5	12.0
1040	-5.4	-5.3	-5	12.0
1041	-6.1	-5.5	-5	12.0
1042	-5.7	-5.6	-5	12.0
1043	-5.4	-5.3	-5	12.0
1044	-5.6	-5.5	-5	12.0
1045	-5.2	-5.1	-5	12.0
1046	-5.2	-5.2	-5	12.0
1047	2.2	2.6	3	12.0
1048	2.2	2.8	4	12.0
1049	6.1	6.1	6	12.0
1050	2.1	2.3	3	12.0
1051	6.3	6.4	6	12.0
1052	5.5	5.5	6	12.0
1053	3.9	4.1	4	12.0
1054	3.1	3.2	3	12.0
1055	3.9	4.0	4	12.0
1057	1.7	2.2	3	12.0
1058	3.2	3.3	4	12.0
1059	3.6	3.8	4	12.0
1060	-1.5	-1.2	-1	12.0
1061	-3.5	-3.2	-3	12.0
1062	0.8	1.2	2	12.0
1064	-4.9	-4.7	-4	12.0
1065	-4.9	-4.7	-4	12.0
1066	-1.8	-1.8	-2	12.0
1067	-2.9	-2.9	-3	12.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
1068	-5.5	-5.1	-5	12.0
1069	-5.4	-5.1	-5	12.0
1070	-5.7	-5.2	-5	12.0
1072	-2.9	-2.7	-2	12.0
1074	-0.7	-0.5	0	12.0
1076	2.5	2.7	3	12.0
1077	3.6	3.7	4	12.0
1078	2.6	2.9	3	12.0
1079	2.2	2.4	3	12.0
1080	1.5	2.0	3	12.0
1081	1.4	1.8	3	12.0
1083	1.9	2.2	3	12.0
1084	-2.8	-2.6	-2	12.0
1085	-2.5	-2.3	-2	12.0
1086	-3.7	-3.6	-3	12.0
1087	-3.8	-3.8	-4	12.0
1088	-0.8	-0.8	0	12.0
1090	1.4	1.8	2	12.0
1091	2.3	2.5	3	12.0
1092	2.0	2.4	3	12.0
1093	2.0	2.4	3	12.0
1094	2.1	2.5	3	12.0
1095	2.0	2.5	3	12.0
1096	7.1	7.2	7	12.0
1097	7.1	7.1	7	12.0
1438	0.2	0.3	1	12.0
1516	-6.0	-5.5	-5	12.0
1517	-6.0	-5.5	-5	12.0
1537	-4.7	-4.6	-5	12.0
1538	-4.7	-4.3	-4	12.0
1541	-5.2	-5.0	-5	12.0
1543	-5.8	-5.5	-5	12.0
1547	-1.5	-0.7	0	12.0
1550	2.1	2.6	3	12.0
1552	2.1	2.5	3	12.0
1554	1.7	2.1	3	12.0
1556	2.8	2.8	3	12.0
1558	4.0	4.0	4	12.0
1559	-0.4	-0.4	1	12.0
1560	1.2	1.2	1	12.0
1564	-3.0	-2.8	1	12.0
1565	-0.6	-0.1	0	12.0
1573	-5.5	-5.1	-5	12.0
1582	-4.4	-4.3	-4	12.0
1585	-3.2	-3.0	-3	12.0
1587	-5.5	-5.1	-5	12.0
1591	-4.3	-4.2	-4	12.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
1593	-3.7	-3.6	-3	12.0
1595	-3.0	-2.9	-3	12.0
1657	1.8	2.1	3	12.0
1678	-0.4	0.1	1	12.0
1679	1.9	2.1	2	12.0
2770	-4.6	-4.6	-4	12.0
2771	-2.9	-2.9	-3	12.0
2773	2.3	2.4	3	12.0
2774	-4.8	-4.7	-4	12.0
2776	-4.4	-4.2	-4	12.0
3001	3.1	3.3	4	12.0
819	-4.7	-4.3	-4	12.0
820	-2.7	-2.6	-2	12.0
822	-2.0	-2.0	-2	12.0
824	-7.4	-6.0	-6	12.0
825	-6.3	-6.0	-6	12.0
826	-6.7	-6.1	-6	12.0
827	-6.5	-6.1	-6	12.0
828	-6.4	-6.0	-6	12.0
829	-6.6	-6.1	-6	12.0
830	-6.7	-6.2	-6	12.0
831	-6.7	-6.2	-6	12.0
832	-5.8	-5.7	-6	12.0
835	-6.6	-6.2	-6	12.0
836	-6.6	-6.2	-6	12.0
837	-6.8	-6.3	-6	12.0
838	-7.9	-6.3	-6	12.0
839	-6.2	-6.1	-6	12.0
840	-6.9	-6.4	-6	12.0
841	-6.4	-6.3	-6	12.0
842	-5.4	-5.4	-5	12.0
844	-6.5	-6.2	-6	12.0
845	-6.7	-6.3	-6	12.0
846	-7.8	-6.2	-6	12.0
847	-6.6	-6.2	-6	12.0
848	-6.6	-6.2	-6	12.0
849	-6.4	-6.0	-6	12.0
850	-6.3	-5.8	-5	12.0
851	-6.1	-6.0	-6	12.0
852	-6.7	-6.3	-6	12.0
853	-7.9	-6.1	-6	12.0
854	-6.4	-6.0	-6	12.0
855	-6.6	-5.9	-5	12.0
856	-6.1	-5.9	-5	12.0
857	-6.5	-6.0	-6	12.0
858	-6.0	-5.6	-5	12.0
860	-6.1	-5.8	-5	12.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
861	-5.7	-5.4	-5	12.0
862	-6.4	-6.0	-6	12.0
863	-6.3	-5.9	-5	12.0
864	-6.2	-5.8	-5	12.0
865	-6.2	-5.8	-5	12.0
870	-5.5	-5.2	-5	12.0
871	-5.7	-5.4	-5	12.0
872	-5.5	-5.2	-5	12.0
873	-5.4	-5.1	-5	12.0
876	-5.4	-5.1	-5	12.0
879	-6.1	-5.8	-5	12.0
880	-5.8	-5.5	-5	12.0
881	-1.5	-1.1	-1	12.0
884	-1.6	-1.0	-1	12.0
885	-1.1	-0.8	0	12.0
886	-1.6	-1.2	-1	12.0
887	-6.0	-6.0	-6	12.0
888	-5.4	-5.4	-5	12.0
889	-5.6	-5.5	-5	12.0
890	-6.3	-5.8	-5	12.0
891	-5.5	-5.4	-5	12.0
893	-5.9	-5.9	-6	12.0
894	-6.3	-5.9	-5	12.0
895	-6.3	-5.9	-5	12.0
896	-7.0	-6.1	-6	12.0
897	-5.7	-5.3	-5	12.0
898	-5.3	-5.2	-5	12.0
899	-5.9	-5.5	-5	12.0
900	-5.7	-5.3	-5	12.0
901	-6.2	-5.8	-5	12.0
902	-4.8	-4.8	-5	12.0
904	-5.5	-5.2	-5	12.0
907	-4.9	-4.8	-5	12.0
908	-5.1	-4.8	-4	12.0
909	-4.9	-4.8	-5	12.0
910	-5.3	-4.9	-5	12.0
912	-4.8	-4.5	-4	12.0
919	-4.7	-4.4	-4	12.0
920	-3.9	-3.7	-3	12.0
921	-3.2	-2.7	-2	12.0
923	-2.7	-2.4	-2	12.0
924	-3.1	-3.0	-3	12.0
925	-3.7	-3.5	-3	12.0
926	-3.0	-2.8	-2	12.0
927	-3.6	-3.4	-3	12.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
928	-3.3	-3.1	-3	12.0
929	-3.7	-3.4	-3	12.0
930	-3.6	-3.2	-3	12.0
931	-4.0	-3.7	-3	12.0
932	2.4	2.8	3	12.0
933	2.5	2.9	3	12.0
934	2.9	3.1	4	12.0
936	2.1	2.6	3	12.0
937	2.3	2.7	3	12.0
939	0.8	0.8	1	12.0
940	0.7	0.7	1	12.0
941	2.4	2.4	2	12.0
942	-0.1	1.5	3	12.0
945	1.1	1.6	3	12.0
946	-5.8	-5.4	-5	12.0
947	-5.7	-5.4	-5	12.0
948	-5.6	-5.4	-5	12.0
949	-5.4	-5.4	-5	12.0
950	-5.6	-5.5	-5	12.0
951	-5.6	-5.5	-5	12.0
952	-6.3	-5.8	-5	12.0
953	-5.9	-5.4	-5	12.0
954	-5.3	-5.2	-5	12.0
955	-5.9	-5.5	-5	12.0
956	-5.5	-5.2	-5	12.0
957	-5.8	-5.3	-5	12.0
958	-5.7	-5.3	-5	12.0
959	-5.6	-5.2	-5	12.0
960	-5.5	-5.1	-5	12.0
961	-5.6	-5.2	-5	12.0
962	-7.1	-6.5	-6	12.0
964	-6.0	-4.9	-4	12.0
965	-2.8	-2.6	-2	12.0
966	-2.9	-2.7	-2	12.0
967	-4.7	-4.0	-4	12.0
968	-2.9	-2.8	-2	12.0
969	-3.6	-3.5	-3	12.0
970	-4.2	-4.0	-4	12.0
971	-3.8	-3.6	-3	12.0
972	-4.2	-4.0	-4	12.0
973	-3.8	-3.6	-3	12.0
974	-4.0	-3.9	-4	12.0
975	-3.1	-3.0	-3	12.0
976	-2.8	-2.6	-2	12.0
977	-4.0	-4.0	-4	12.0

Table 2 - Summary of Stillwater Elevations (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
978	-0.3	0.0	2	12.0
979	-1.3	-0.8	2	12.0
980	-2.4	-1.9	-1	12.0
981	-2.4	-1.9	-1	12.0
982	0.6	0.7	2	12.0
984	-0.3	-0.3	2	12.0
985	0.0	0.0	2	12.0
986	-1.3	1.2	2	12.0
987	0.1	0.1	0	12.0
989	-5.0	-4.5	-4	12.0
990	-4.3	-4.0	-4	12.0
991	-5.1	-4.6	-4	12.0
992	-4.4	-4.1	-4	12.0
993	-5.0	-4.6	-4	12.0
994	-4.4	-4.2	-4	12.0
995	-4.9	-4.8	-5	12.0
996	-4.2	-4.0	-4	12.0
997	-4.7	-4.6	-4	12.0
998	-4.1	-4.0	-4	12.0

3.2 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. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. 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 in conjunction with the data shown on the FIRM.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Please note that for this parishwide analyses, flood profiles were not developed for the channels inside the HSDRRS levee system as no structures are built in the channels. Due to the lack of structures in the channels, flood profiles for the channels would serve no purpose for floodplain management.

Initial Parishwide Analyses (March 23, 1995)

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

The effective hydraulic analyses that were performed for the communities and the unincorporated areas of Jefferson Parish were incorporated into a parishwide format study. The same analyses were used to perform the internal drainage analyses for the 54 ponding areas.

Storage-elevation curves for Jefferson Parish including the Cities of Harahan and Kenner were established from one-foot contour topographic maps developed by the USACE-MVN for the study on the East Bank titled "Lake Pontchartrain and Vicinity Hurricane Protection Program Restudy" (USACE, 1979). For the West Bank, the one-foot contour topographic maps utilized were developed by URS/Forrest-Cotton, Inc., for Jefferson Parish (including the Cities of Gretna and Westwego) in the study entitled "West Bank Master Drainage District No. 1" and by Barnard & Thomas, Consulting Engineers, Inc., in the study entitled "Jefferson Parish Master Drainage Plan for Drainage District No. 9" (URS/Forrest and Cotton, Inc., 1981; Barnard & Thomas Consulting Engineers, 1982). Flood elevations for Ponding Areas 1 through 54 were established by computing peak water storage volumes resulting from rainfall runoff and hurricane surge overtopping, where appropriate. Storage volumes for rainfall runoff were computed by routing flood hydrographs through drainage structures and over roadways into the individual drainage units. Flood hydrographs were routed to outfall canal pumping stations, and floodwaters were relieved by pumping.

Federally built levees were considered to remain intact during the 1-percent-annual-chance storm event. The stability of non-federal levees were evaluated individually based upon observation of similar levees which have been overtopped and upon engineering judgment. Proper maintenance of the levees is essential in maintaining the level of protection and the flood hazards shown on the FIRM. As the levees consolidate and/or subside, the frequency and severity of surge overtopping could increase and create higher hazards in the areas protected by the levees. The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the maps are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

This Parishwide Revision (February 2, 2018)

For streams, as well as ponding areas, water surface elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed using the USACE's HEC-RAS version 4.0, and 4.1 (USACE, March 2008 and USACE, January 2010) for all polders within Jefferson Parish. All hydraulic models were performed using unsteady-state condition simulation.

Stage-storage relationship curves were established from 2-foot contour topographic maps (The Louisiana Statewide GIS website). These stage-storage relationship curves were subsequently updated based on 2012 Light Detention and Ranging (LiDAR) data from the USACE (USACE, 2012). Storage volumes for rainfall runoff were computed by routing flood hydrographs through drainage structures and over roadways into the individual drainage units. Flood hydrographs were routed to outfall canals and drainage ditches. It should be noted that a pumping capacity of 90% was assumed at each pump station for this study, except West Closure Complex, which is 95%.

Roughness coefficients (Manning's "n") were estimated based on field inspection of stream channels and floodplain areas. Table 3, "Summary of Roughness Coefficients", shows the Manning's "n" ranges for the streams studied by detailed methods in this study:

Table 3 – Summary of Roughness Coefficients

Stream	Channel "n"	Overbank "n"
All channels in Jefferson Parish	0.011-0.150	0.012-0.150

3.3 Coastal Analyses

The hydraulic characteristics of flooding from possible sources were analyzed to provide estimates of flood elevations for selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown in the coastal data tables and flood profiles in the FIS report.

3.3.1 Storm Surge Analysis and Modeling

For areas subject to tidal inundation, the 10-, 2-, 1-, and 0.2-percent-annual-chance stillwater elevations and delineations were taken directly from a detailed storm surge study documented in the TSDN for this Louisiana coastal flood hazard study.

The Advanced Circulation model for Coastal Ocean Hydrodynamics (ADCIRC) developed by the USACE-MVN, was applied to predict the stillwater elevations or storm surge levels for coastal Louisiana. The ADCIRC model uses an unstructured grid and is a finite-element long wave model. It has the capability to simulate tidal circulation and storm surge propagation over large areas and is able to provide highly detailed resolution in the areas of interest including shorelines, open coasts and inland bays. It solves the three dimensional equations of motion, including tidal potential, Coriolis acceleration, and nonlinear terms of the governing equations. The model is formulated from the depth averaged shallow water equations for conservation of mass and momentum which result in the generalized wave continuity equation.

Nearshore waves are required to calculate wave runup and overtopping on structures, and the wave momentum (radiation stress) contribution to elevated water levels (wave setup). The numerical model STWAVE was used to generate and transform waves to the shore. STWAVE is a finite-difference model that calculates wave spectra on a rectangular grid. The model outputs zero-moment wave height, peak wave period (Tp), and mean wave direction at all grid points and two-dimensional spectra at selected grid points. STWAVE includes an option to input spatially variable wind and surge field. The surge significantly alters the wave transformation and generation for the hurricane simulations in shallow areas flooded.

The STWAVE model was applied on several grids for the southern Louisiana area. The input for each grid includes the bathymetry (interpolated from the ADCIRC domain), surge fields (interpolated from ADCIRC surge fields), and wind (interpolated from the ADCIRC wind fields, which apply land effects to the wind fields input to the surge model). The wind applied in the STWAVE is spatially and temporally variable for all domains. The STWAVE model was run at 30-minute intervals.

An existing ADCIRC grid mesh developed by the USACE-MVN was refined along the shoreline of Louisiana and surrounding areas using bathymetric and topographic data from various sources. Bathymetric data consisted of ETOPO5 and Digital Nautical chart databases in the offshore regions. In the nearshore areas, bathymetric data came from regional bathymetric surveys conducted by the USACE-MVN. The topographic portion of the ADCIRC mesh was populated with topographic LiDAR from several sources. In addition, subgrid sized features such as roads and levees were captured in the grid and modeled as weirs. Further details about the terrain data and how it was processed can be found in the TSDN.

The completed ADCIRC grid mesh forming the finite element model has over 2,200,000 grid nodes. The National Oceanic and Atmospheric Administration (NOAA) high definition vector shoreline was used to define the change between water and land elements. The grid includes other features, such as islands, roads, bridges, open water, bays, and rivers. Field reconnaissance detailed the significant drainage and road features, and documentation of coastal structures in the form of seawalls, bulkheads, and harbors. The National Land Cover Dataset was used to define Manning’s n values for bottom roughness coefficients input at each node to the mesh. A directional surface wind roughness value was also applied. Further details about the ADCIRC mesh creation and grid development process can be found in the TSDN.

Predicted tidal cycles were used to calibrate the ADCIRC model and refine the grid. Tidal boundary conditions were obtained from a total of 40 NOAA tide gauges. Seven tidal constituents were used (K1, O1, Q1, M2, S2, N2, and K2). The simulated water-surface elevation time series was compared to measured tides from tide gauge stations for over a 30-day period. Model validation, which tests its ability to reproduce historical events, was performed against Hurricanes Katrina (2005), Rita (2005), and Andrew (1992). Simulated water levels for each event were compared to observed water levels from NOAA tidal gauges, as well as available high water marks. Further details about the model calibration and validation can be found in the TSDN.

Production runs were carried out with STWAVE and ADCIRC on a set of hypothetical storm tracks and storm parameters in order to obtain the maximum water levels for input to the statistical analysis. The hypothetical (synthetic) population of storms was divided into two groups, one for hurricanes of Saffir-Simpson scale Category 3 and 4 strength or "greater storms" and another set for hurricanes of Category 2 strength or "lesser storms." A total of 304 individual storms with different tracks and various combinations of the storm parameters were chosen for the production runs of synthetic hurricane simulations. Each storm was run for at least 3 days of simulation and did not include tidal forcing. Wind and pressure fields obtained from the Planetary Boundary Layer model and wave radiation stress from the STWAVE model were input into the ADCIRC model for each production storm. All stillwater results for this study include the effects of wave setup. The maximum water-surface elevation was output at every wetted ADCIRC grid point in a specific storm. This resulted in more than 1,000,000 locations where statistical methods were applied to obtain return periods of the stillwater elevation. A Triangular Irregular Network (TIN) was created to represent the stillwater surface based on the density of the output points from the ADCIRC. Further details about the production run process can be found in the TSDN.

3.3.2 Statistical Analysis

The Joint Probability Method (JPM) was used to develop the stillwater frequency curves for the 10-, 2-, 1-, and 0.2-percent-annual-chance stillwater elevations. The JPM approach is a simulation methodology that relies on the development of statistical distributions of key hurricane input variables such as central pressure, radius to maximum wind speed, maximum wind speed, translation speed, track heading, etc., and sampling from these distributions to develop model hurricanes. The resulting simulation results in a family of modeled storms that preserve the relationships between the various input model components, but provides a means to model the effects and probabilities of storms that historically have not occurred. The JPM approach was modified for this coastal study based on updated statistical methods developed by FEMA and the USACE-MVN for Mississippi and Louisiana.

Due to the excessive number of simulations required for the traditional JPM method, the Joint Probability Method-Optimum Sampling (JPM-OS) was utilized to determine the stillwater elevations associated with tropical events. JPM-OS is a modification of the JPM method developed cooperatively by FEMA and the USACE-MVN for Mississippi and Louisiana coastal flood studies that were being performed simultaneously, and is intended to minimize the number of synthetic storms that are needed as input to the ADCIRC model. The methodology entails sampling from a distribution of model storm parameters (e.g., central pressure, radius to maximum wind speed, maximum wind speed, translation speed, and track heading) whose statistical properties are consistent with historical storms impacting the region, but whose detailed tracks differ. The methodology inherently assumes that the hurricane climatology dating as far back as 1940 is representative of the past and future hurricanes likely to occur along the Louisiana coast.

3.3.3 Stillwater Elevation

The results of the ADCIRC model, as described above, provided Stillwater elevations, including wave setup effects that are statistically analyzed to produce probability curves. The JPM-OS is applied to obtain the return periods associated with tropical storm events. The approach involves assigning statistical weights to each of the simulated storms and generating the flood hazard curves using these statistical weights. The statistical weights are chosen so that the effective probability distributions associated with the selected greater and lesser storm populations reproduced the modeled statistical distributions derived from all historical storms.

Stillwater elevations for each Louisiana coastal parish, obtained using the ADCIRC and JPM-OS models, are provided for JPM and ADCIRC grid node locations for the 10-, 2-, 1-, and 0.2-percent-annual-chance return period stillwater elevations in the TSDN.

3.3.4 Wave Height Analysis

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The USACE-MVN has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (USACE, 1978). The 3-foot wave has been established as the minimum size wave capable of causing major damage to conventional wood frame and brick veneer structures.

Figure 7 shows a profile for a typical transect that illustrates the effects of energy dissipation and regeneration of wave as it moves inland. This figure shows the wave crest elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations, and being increased by open, unobstructed wind fetches. Figure 7 also illustrates the relationship between the local stillwater elevations, the ground profile, and the location of the VE/AE boundary. This inland limit of the coastal high hazard area is delineated to ensure that adequate insurance rates apply and appropriate construction standards are imposed, should local agencies permit building in this coastal high hazard area.

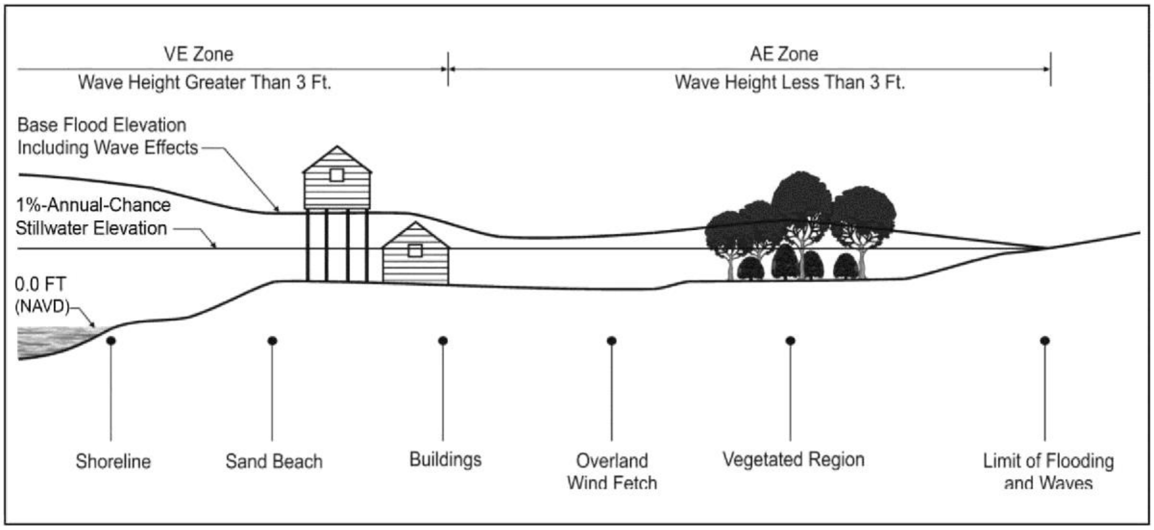

Figure 7: Transect Schematic

For Jefferson Parish, the only coastal flood source is the Gulf of Mexico. Transects (shown in Figure 8) are oriented from south to north, starting in the gulf coastline, and ending at the Mississippi River south levee. The initial wave heights representing 1- and 0.2-percent-annual-chance flood events were determined based on depth-limited breaker heights, which is 78% of the stillwater depth under the corresponding surge conditions. Wave periods were extracted from STWAVE modeling results.

The wave transects listed in Table 4, "Summary of Coastal Data", for this study were developed considering the physical and cultural characteristics of the land so that they would closely represent physical conditions in their locality. Transects were spaced dense enough to represent the hydraulic conditions and to capture hydraulic changes. In areas having more uniform characteristics, transects were spaced at relatively larger intervals. Transects are also located in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects. Transects are shown on the respective FIRM panels for the parish.

The topographic information applied to transect profiles was based on ADCIRC grid bathymetry and LiDAR data collected by the State of Louisiana and FEMA between 2003 and 2005. The vertical datum for topographic/bathymetry data is NAVD 88.

The Louisiana Gap Analysis Program (GAP) Analysis, developed by the USGS (USGS, 1998), served as the primary source for the spatial distribution of vegetative cover. Aerial imagery and field reconnaissance were performed to verify the Louisiana GAP Analysis data. Aerial photos and images downloaded from http://atlas.lsu.edu/ were applied to verify features such as buildings, levees, forested vegetation, and marsh grass for input to the wave height models.

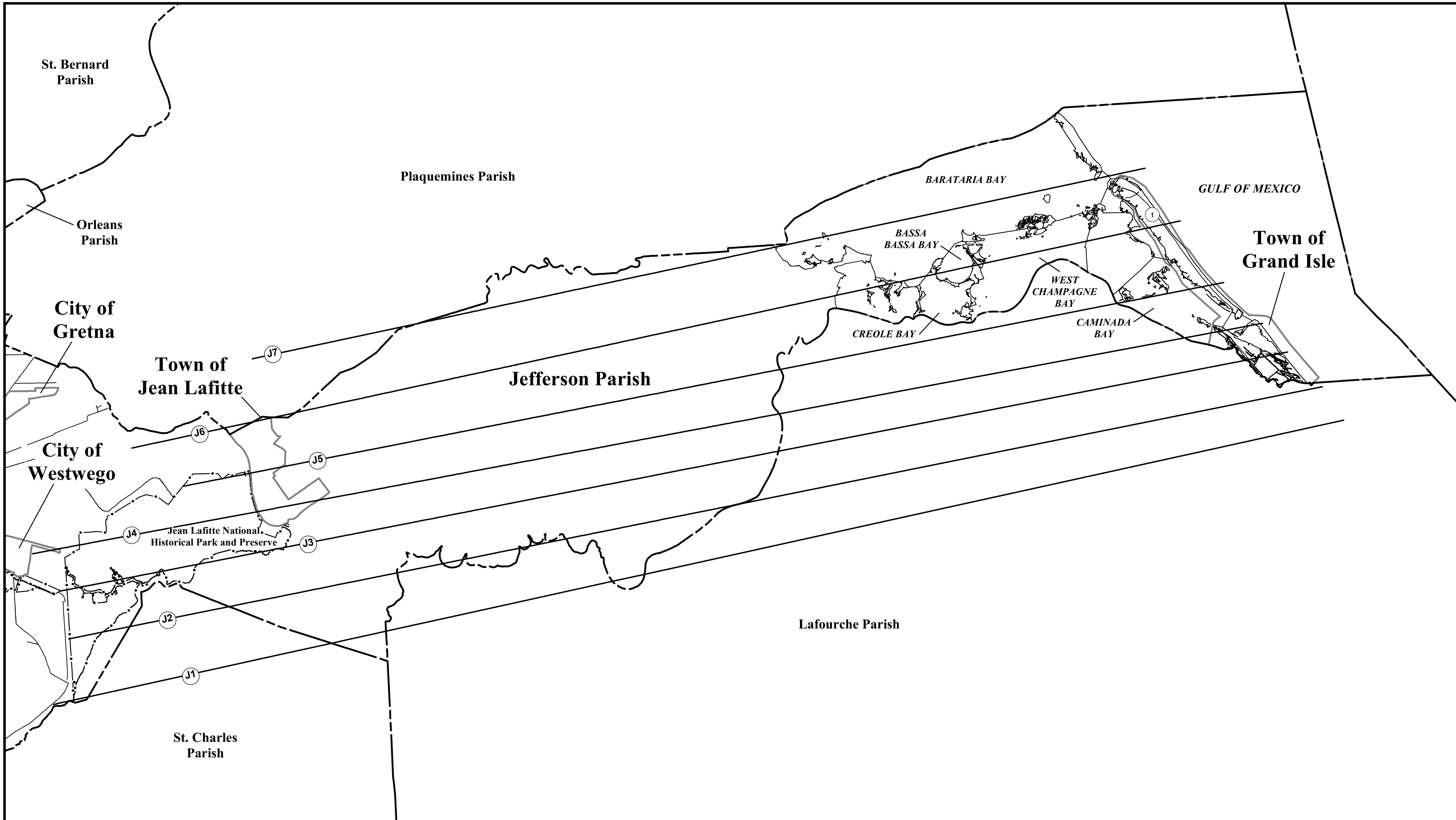

FIGURE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

WILLACY COUNTY, TX

AND INCORPORATED AREAS

N

0 4 8 16 Miles

TRANSECT LOCATION MAP

No storm-induced erosion analysis was performed. Primary frontal dune erosion was not applicable for this parish. Wave height calculation used in this study follows the methodology described in Appendix D of the October 2006 FEMA Guidelines and Specifications for Flood Hazard Mapping Partners (FEMA, 2006). WHAFIS 4.0 was applied to calculate overland wave height propagation and establish base flood elevations. In addition to the 1-percent-annual-chance event, the 0.2 percent-annual-chance event was also modeled with WHAFIS 4.0. The 0.2-percent-annual-chance wave height results are not included on the FIRMs but are provided in wave transect profiles in the FIS.

Stillwater elevations are applied to each ground station along each transect and input to WHAFIS. The stillwater elevations were obtained from the ADCIRC storm surge study, using the stillwater TIN generated by the USACE-MVN. Wave setup was not calculated separately because wave setup was included in the base stillwater elevations from the storm surge analysis. Levees and embankment structures not meeting the freeboard requirements of Title 44 Code of Federal Regulations, 65.10 were removed in the WHAFIS wave height analyses. For the remaining levees, if there is high ground in front of those levees and the surge did not reach those levees, then no wave runup analysis is performed. Otherwise, the van der Meer Method described in the 2003 version of the Coastal Engineering Manual (CEM) (USACE, 2003) was used in calculating wave runup over sloped levees. Wave characteristics were obtained from the WHAFIS wave height analyses. Stillwater elevations were extracted from USACE-MVN’s storm surge analyses with the ADCIRC model, which included the wave setup. The wave setup was deducted from the surge elevations to avoid double counting in the wave runup analyses since the wave runup analysis formulas include the wave runup. The FIRM panel shows a BFE along the levee that includes wave runup.

Table 4 – Summary of Coastal Data

Community Name	Transect	Description	Latitude & Longitude at Start of WHAFIS Transect (NAD83)		Starting Stillwater Elevations (feet NAVD 88) Range of Stillwater Elevations (feet NAVD 88)				Zone Designation and BFE (feet NAVD88)
					10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	
Jefferson Parish	J1	Begins at Gulf shoreline in Jefferson Parish, near western end of the Parish, traversing south to north and ending at the MR Levee	29.1472	90.1144	6.2	9.7	11.3 5.9-11.3	14.4 8.0-14.4	AE 14-23 VE 18-28
Jefferson Parish	J2	Located to the east of transect J1, traversing south to north and ending at the MR Levee	29.1614	90.0926	6.2	9.6	11.3 6.0-11.3	14.4 8.2-14.4	AE 14-23 VE 19-28
Jefferson Parish	J3	Located to the east of transect J2, traversing south to north and ending at the MR Levee	29.1768	90.0684	6.1	9.5	11.1 3.7-11.2	14.2 4.5-14.3	AE14-22 VE 19-27
Jefferson Parish	J4	Located to the east of transect J3, traversing south to north and ending at the MR Levee	29.1884	90.0488	6.1	9.5	11.1 3.6-11.4	14.2 4.8-17.4	AE 15-22 VE 21-28
Jefferson Parish	J5	Located to the east of transect J4, traversing south to north and ending at the MR Levee	29.2130	90.0217	5.4	8.9	11.1 6.0-11.7	14.4 9.3-15.8	AE14-20 VE 21-28
Jefferson Parish	J6	Located to the east of transect J5, traversing south to north and ending at the MR Levee	29.2375	89.9809	5.2	8.5	10.5 5.6-11.2	13.6 8.9-15.1	AE 13-20 VE 21-27
Jefferson Parish	J7	Located to the east of transect J6, near east end of the Parish, traversing south to north and ending at the MR Levee	29.4972	89.9853	5.1	8.2	8.9 7.9-9.3	12.2 11.8-13.5	AE 18-21 VE 23-24

3.4 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD 29). With the completion of the NAVD 88, many FIS reports and FIRMs are now prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD 88. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between communities.

Prior versions of this FIS report and FIRM were referenced to NGVD 29. When a datum conversion is effected for a FIS report and FIRM, the Flood Profiles, base flood elevations (BFEs), and Elevation Reference Marks reflect the new datum values. To compare structure and ground elevations to 1-percent-annual- chance elevations shown in the FIS and FIRM, the subject structure and ground elevations must be referenced to the new datum values.

Some of the data used in this revision were taken from the prior effective FIS reports and FIRMs and adjusted to NAVD 88. Ground, structure, and flood elevations may be compared and/or referenced to NGVD 29 by applying a standard conversion factor. The datum conversion factor to NGVD 29 from NAVD 88 in Jefferson Parish is +0.03 feet.

For additional information regarding conversion between the NGVD 29 and NAVD 88, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

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

3.5 Land Subsidence

The prevalence of land subsidence in the study area complicates the determination of the expected depth of flooding at a property. This information should always be obtained by direct comparison of the current property elevation with the official base flood elevation at the property as shown on the FIRM.

Local officials should be aware of the subsidence problem and should require the use of the most up-to-date and accurate property elevation data in compensating for land subsidence; however, base flood elevations should not be adjusted, but rather obtained directly from the FIRM.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent annual-chance flood data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section.

For this parishwide FIS, flood boundaries between cross sections were interpolated using topographic data derived from LiDAR bare-earth data with an average point spacing less than 0.7 meters. The 1- and 0.2-percent-annual-chance floodplain boundaries were delineated by detailed methods using the LiDAR data obtained from Louisiana State University and the USACE. This LiDAR data was used to create a Digital Elevation Model (DEM) and Digital Terrain Model (DTM) ESRI terrain.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 3). On this map, the 1-percent-annual-chance floodplain boundary correspond to the boundaries of the areas of special flood hazard (Zones AE, V, and VE), and the 0.2-percent-annual-chance floodplain boundaries correspond to the boundaries of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations, but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 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 this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The area between the floodway and 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation (WSEL) of the base 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 8.

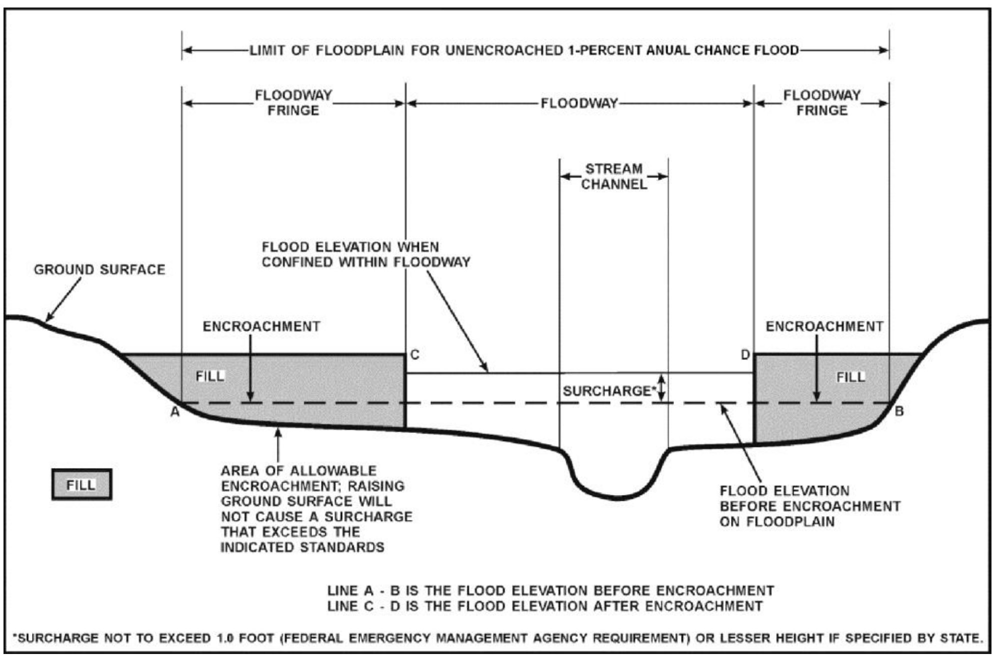

Figure 9: Floodway Schematic

No floodways were computed for Jefferson Parish because no water surface profiles, except the Mississippi River, are provided and all the studied channels are defined by the berms between the storage areas.

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1- percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the base flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

The parishwide FIRM presents flooding information for the entire geographic area of Jefferson Parish. This parishwide FIRM may also include flood hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community, up to and including the initial parishwide FIS are presented in Table 5, "Community Map History."

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FIRM EFFECTIVE DATE	FIRM REVISION DATE(S)
Grand Isle, Town of	August 25, 1970	None	August 28, 1970	October 20, 1970 July 1, 1974 April 18, 1975 March 2, 1983 October 1, 1983
Gretna, City of	August 11, 1970	None	August 14, 1970	July 1, 1974 April 18, 1975 February 13, 1976 November 1, 1985
Harahan, City of	June 15, 1973	None	June 15, 1973	July 1, 1974 July 11, 1975 July 5, 1984
Jean Lafitte, Town of	October 1, 1971	None	October 1, 1971	March 26, 1976
Jefferson Parish (Unincorporated Areas)	March 6, 1970	None	October 1, 1971	July 1, 1974 July 9, 1976 October 1, 1983
Kenner, City of	November 17, 1970	None	June 25, 1971	July 1, 1974 August 22, 1975 November 1, 1985
Westwego, City of	July 16, 1976	None	December 28, 1976	March 11, 1977 June 15, 1984

Table 5

FEDERAL EMERGENCY MANAGEMENT AGENCY
JEFFERSON PARISH, LA
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

FISs are on-going for Lafourche, Orleans, Plaquemines, and St. Charles Parishes. The results of this study are in agreement with those studies.

Information pertaining to revised and unrevised flood hazards for each jurisdiction within the Jefferson Parish has been compiled into this FIS. Therefore, this FIS report supersedes all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA Region VI, Federal Insurance and Mitigation Division, 800 North Loop 288, Denton, Texas 76209.

9.0 BIBLIOGRAPHY AND REFERENCES

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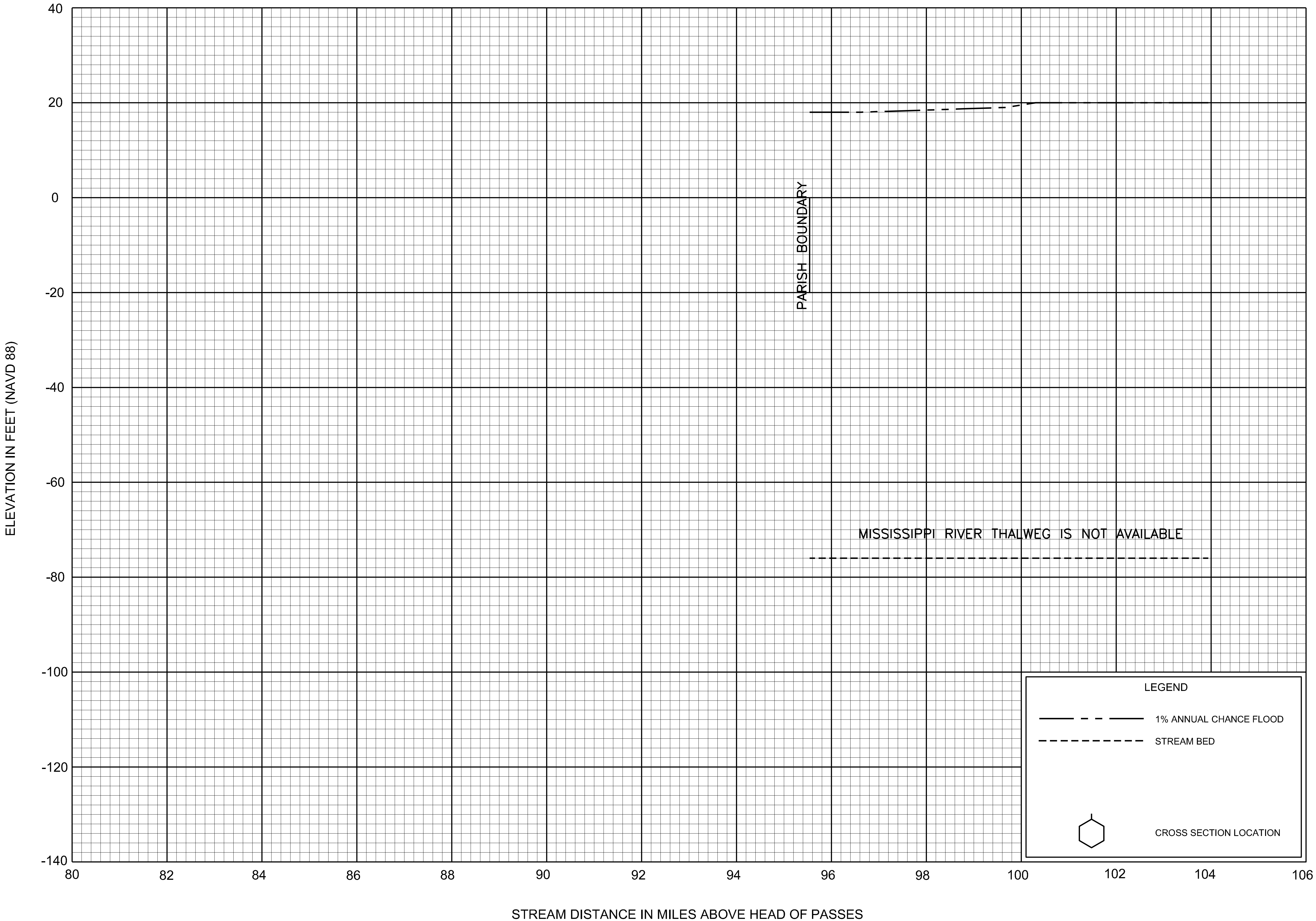


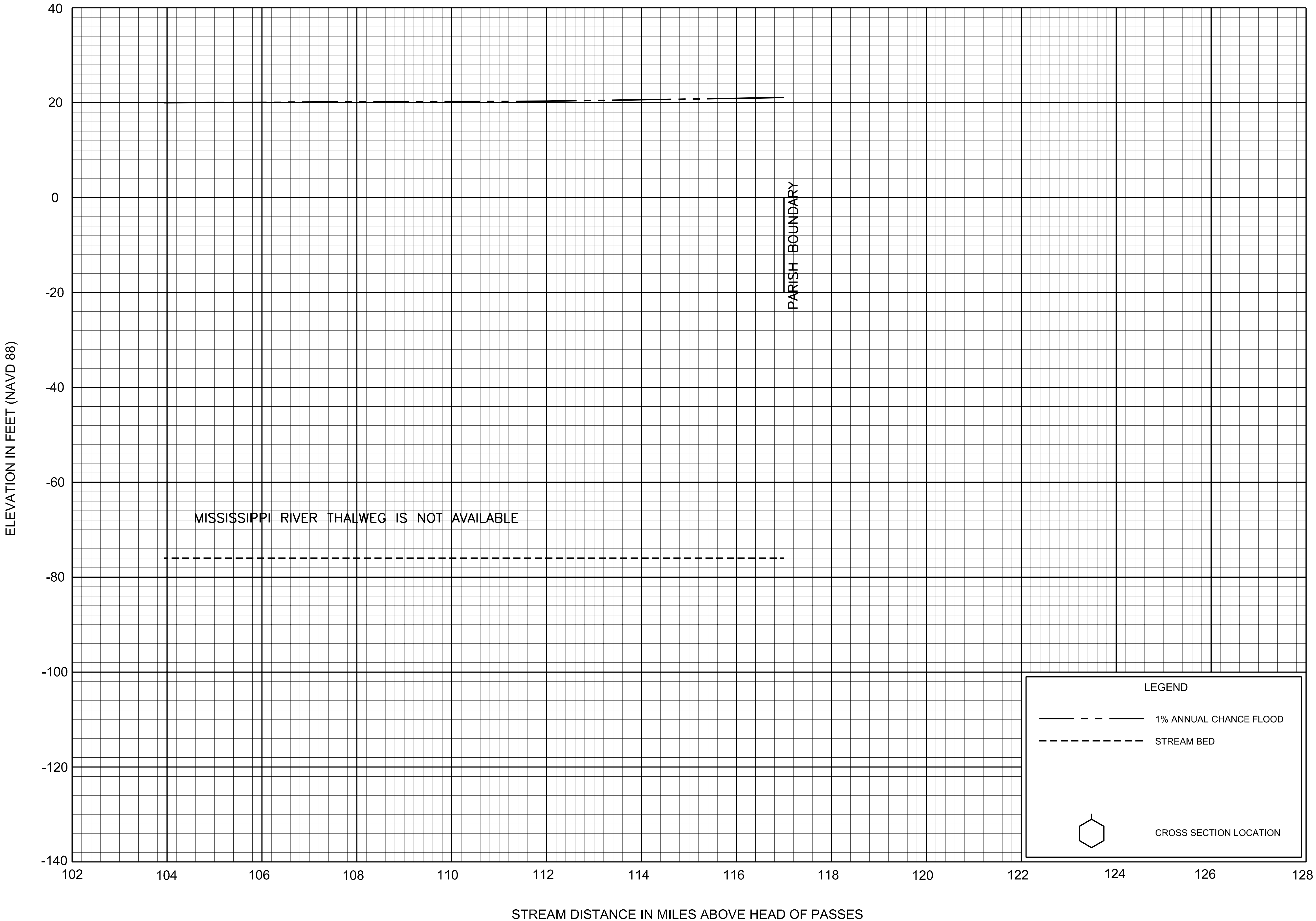
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA
AND INCORPORATED AREAS

01P



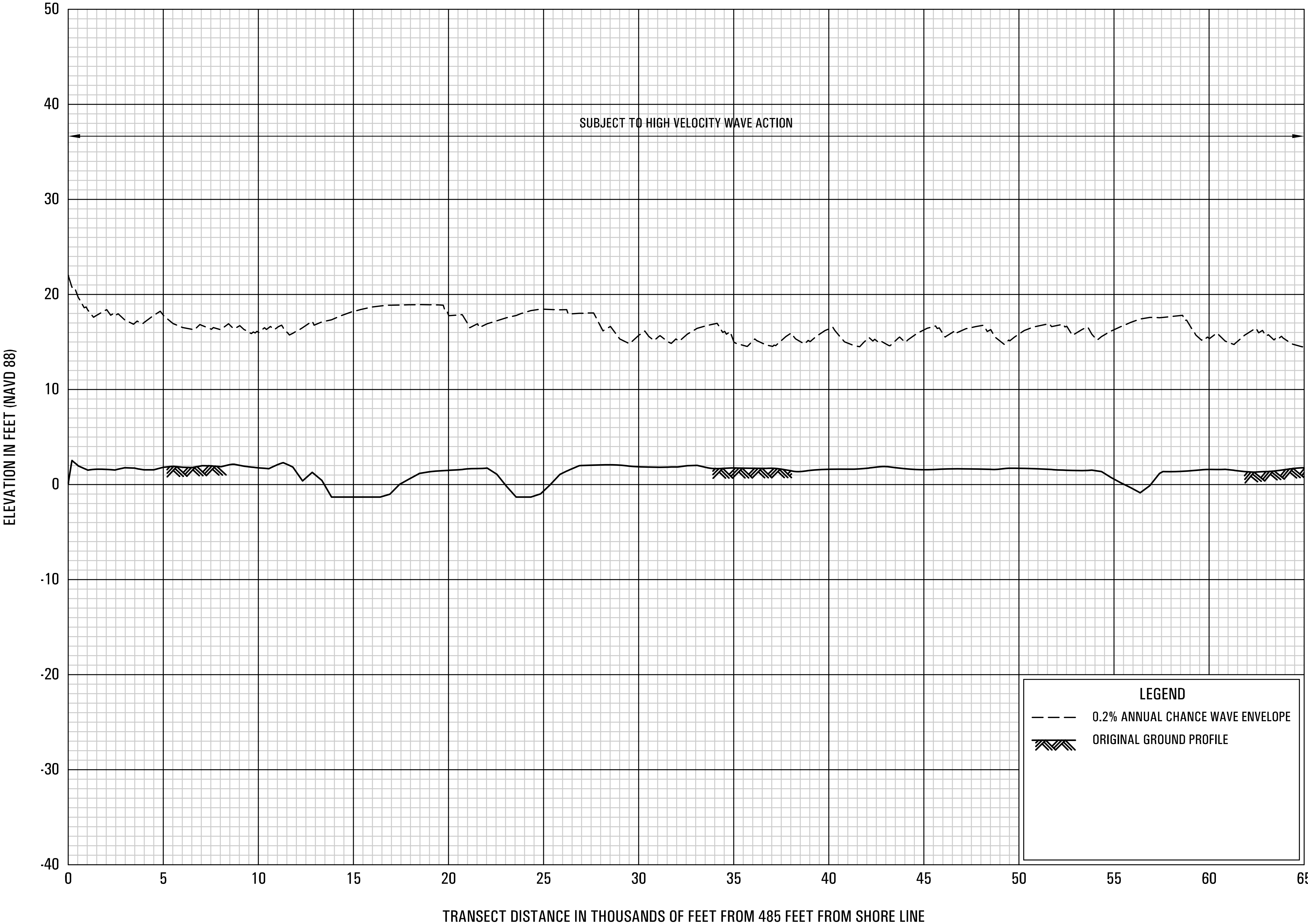
FLOOD PROFILES

MISSISSIPPI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA
AND INCORPORATED AREAS

02P



0.2% ANNUAL CHANCE WAVE ENVELOPE

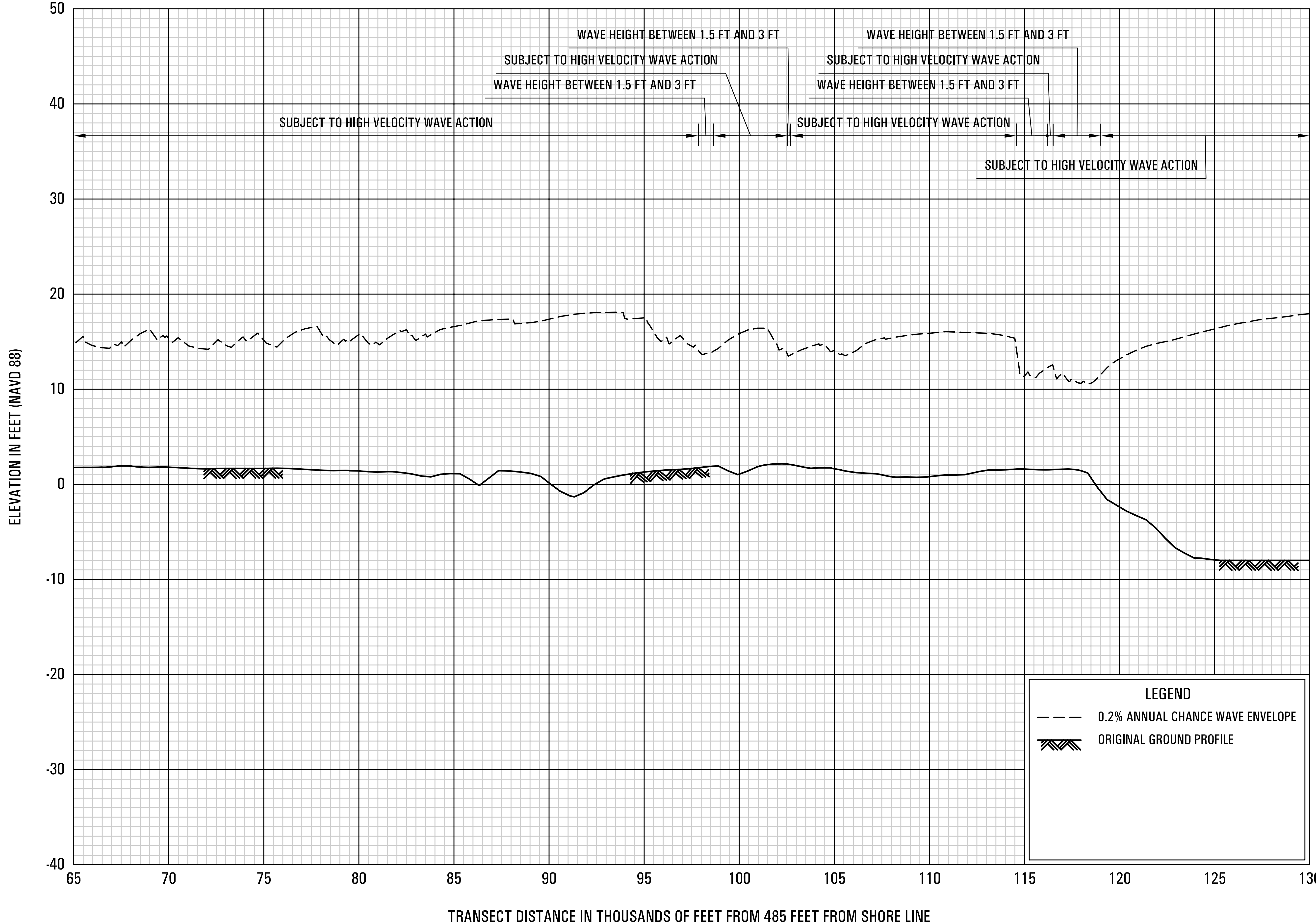
TRANSECT 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

01P



0.2% ANNUAL CHANCE WAVE ENVELOPE

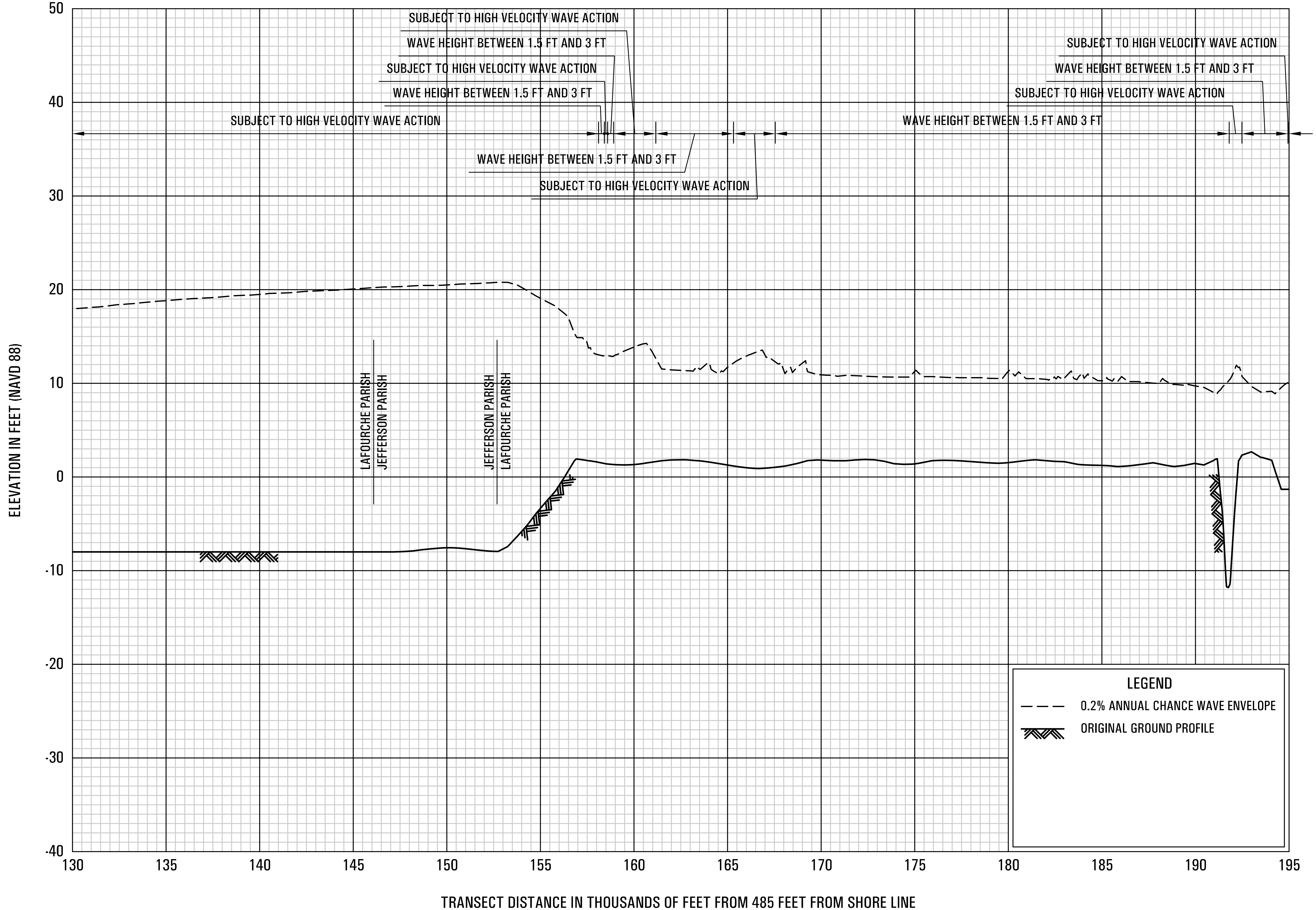
TRANSECT 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

02P



0.2% ANNUAL CHANCE WAVE ENVELOPE

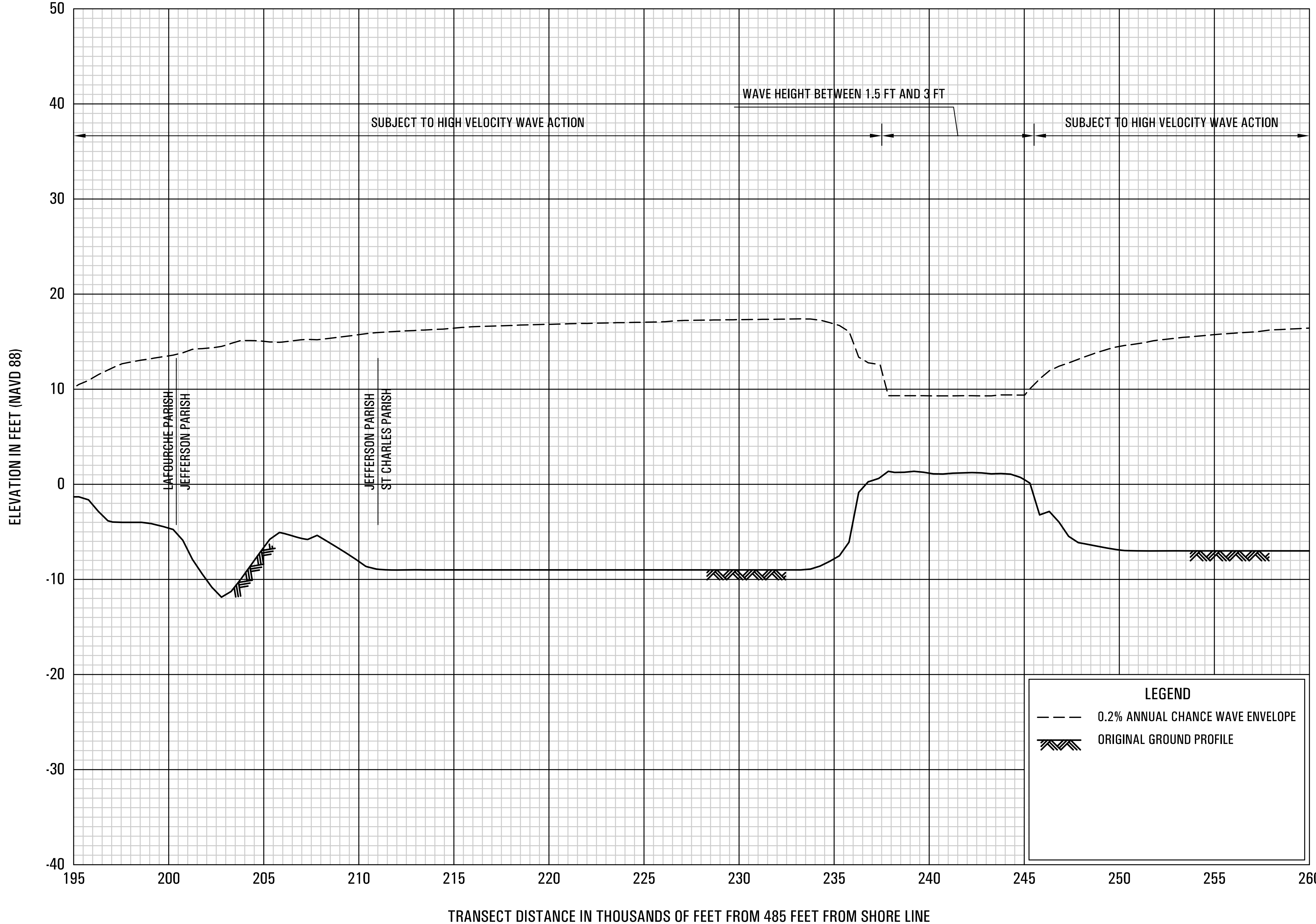
TRANSECT 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

03P



0.2% ANNUAL CHANCE WAVE ENVELOPE

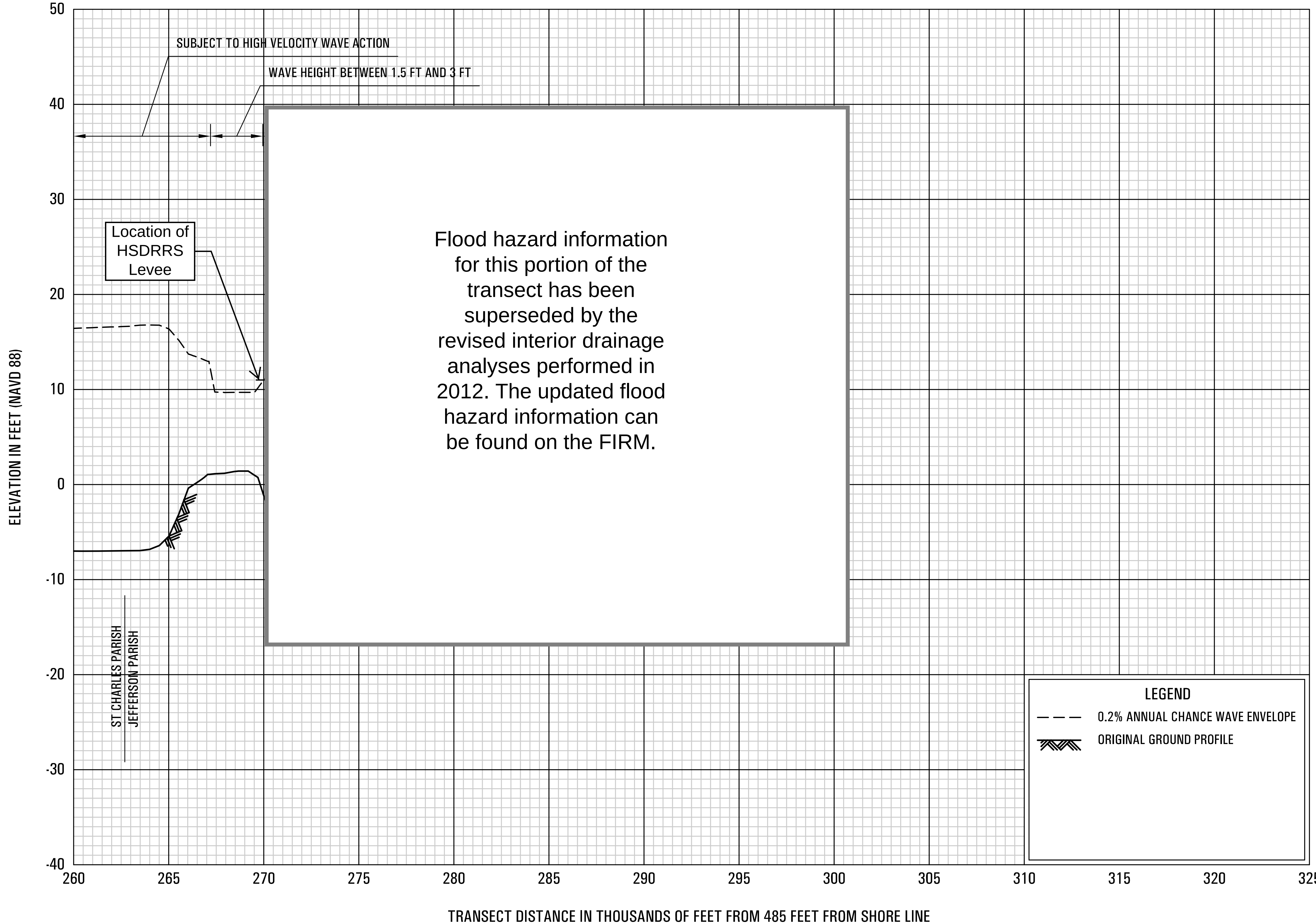
TRANSECT 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

04P



0.2% ANNUAL CHANCE WAVE ENVELOPE

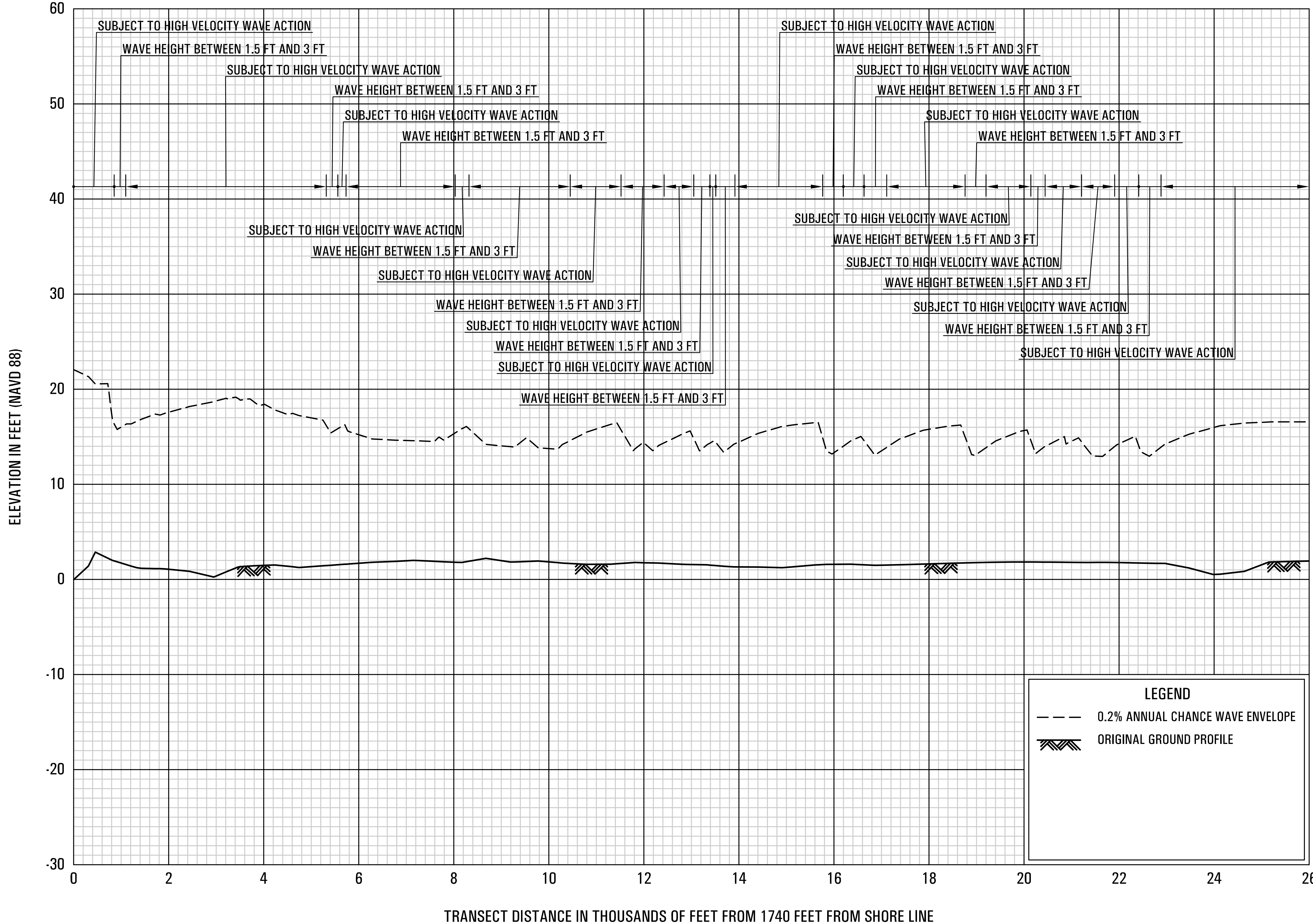
TRANSECT 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

05P



0.2% ANNUAL CHANCE WAVE ENVELOPE

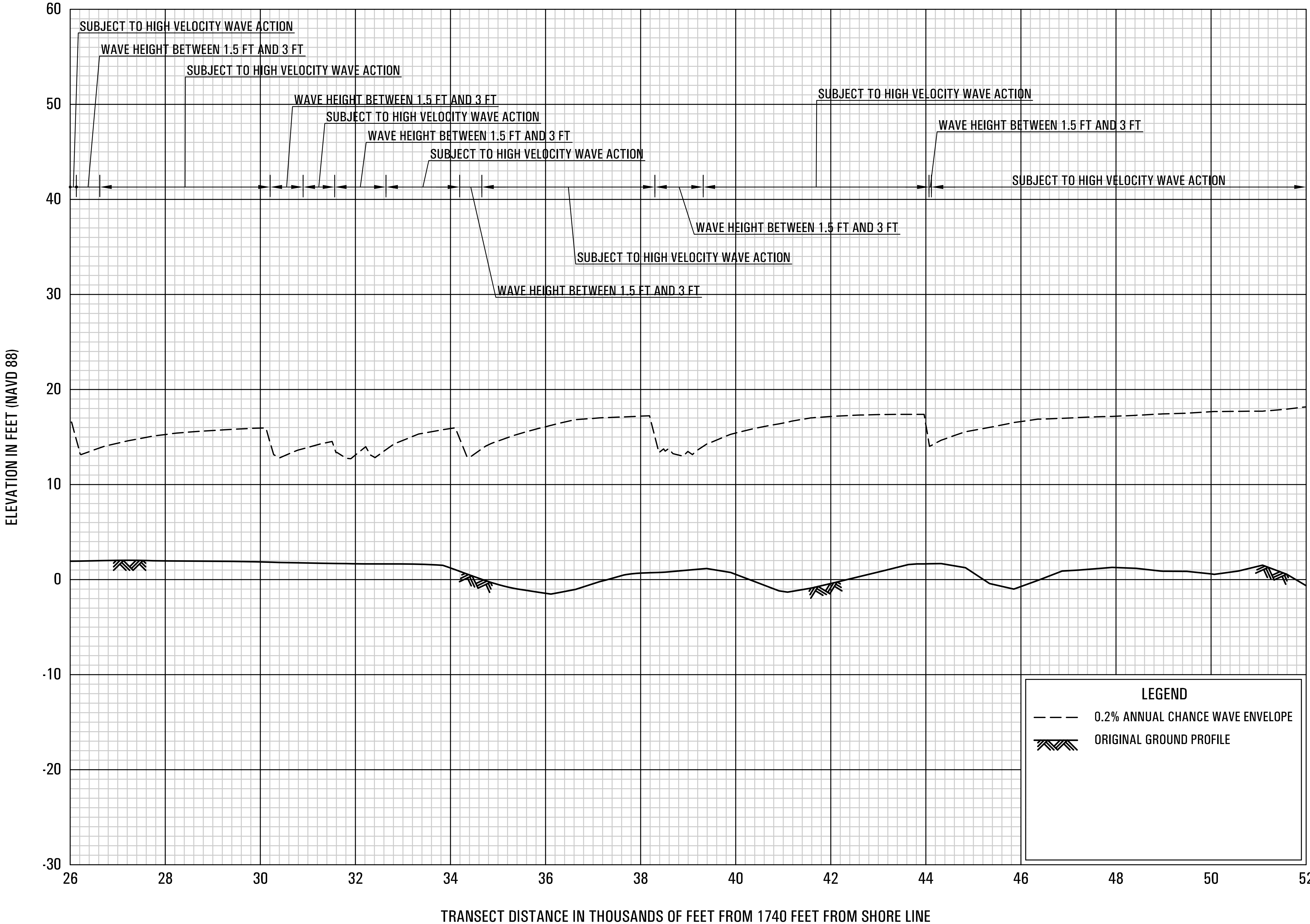
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

06P



0.2% ANNUAL CHANCE WAVE ENVELOPE

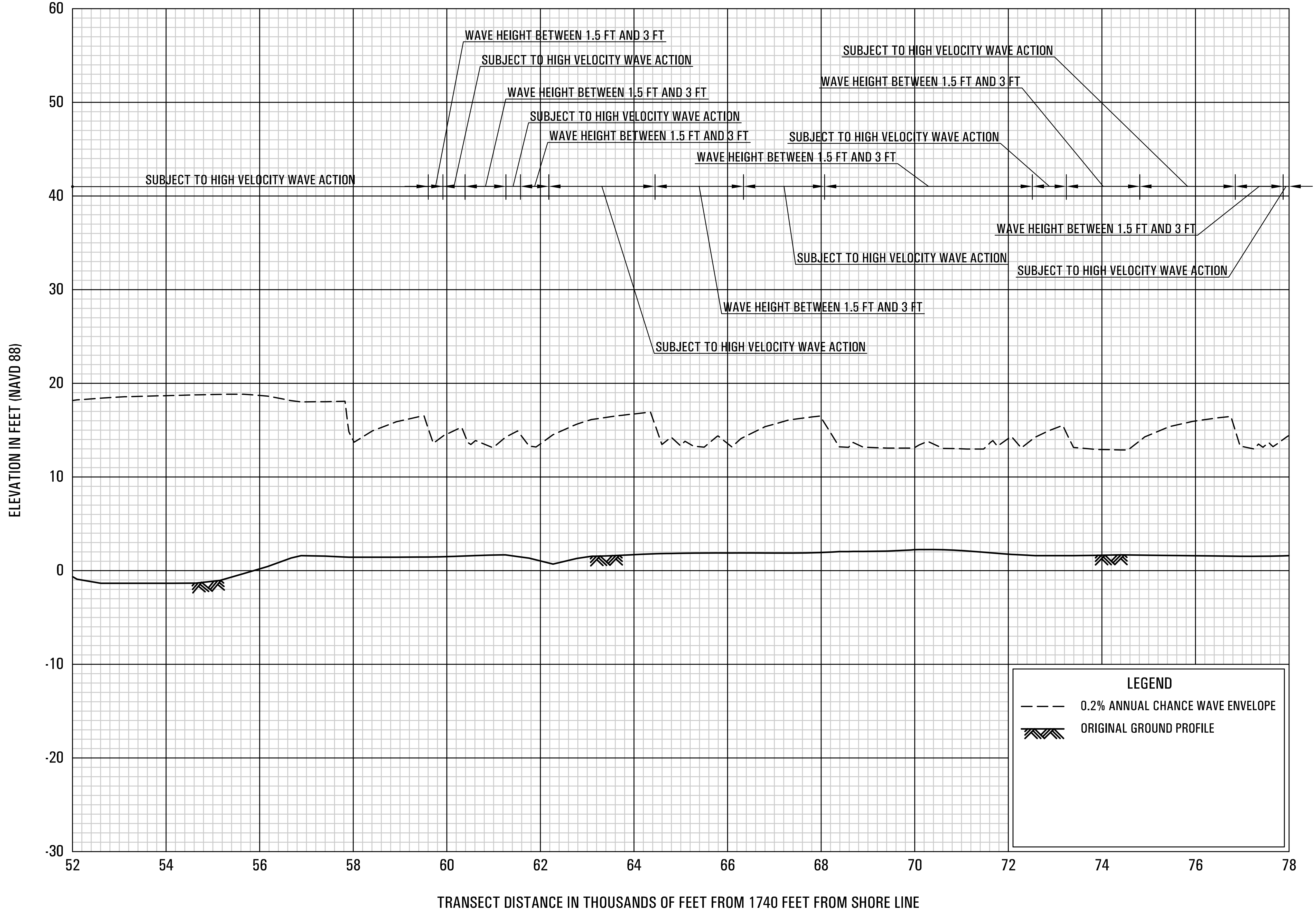
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

07P



0.2% ANNUAL CHANCE WAVE ENVELOPE

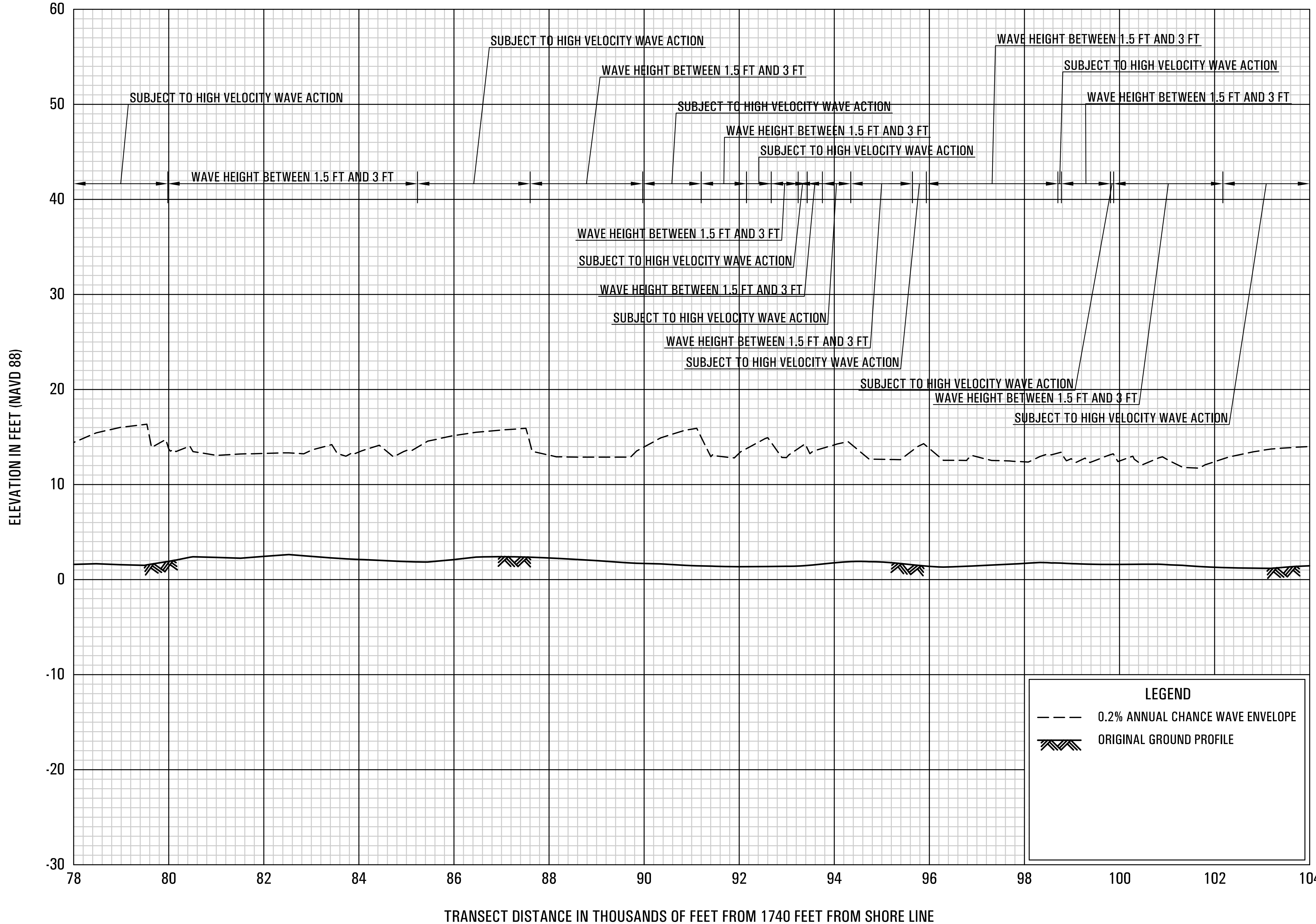
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

08P



0.2% ANNUAL CHANCE WAVE ENVELOPE

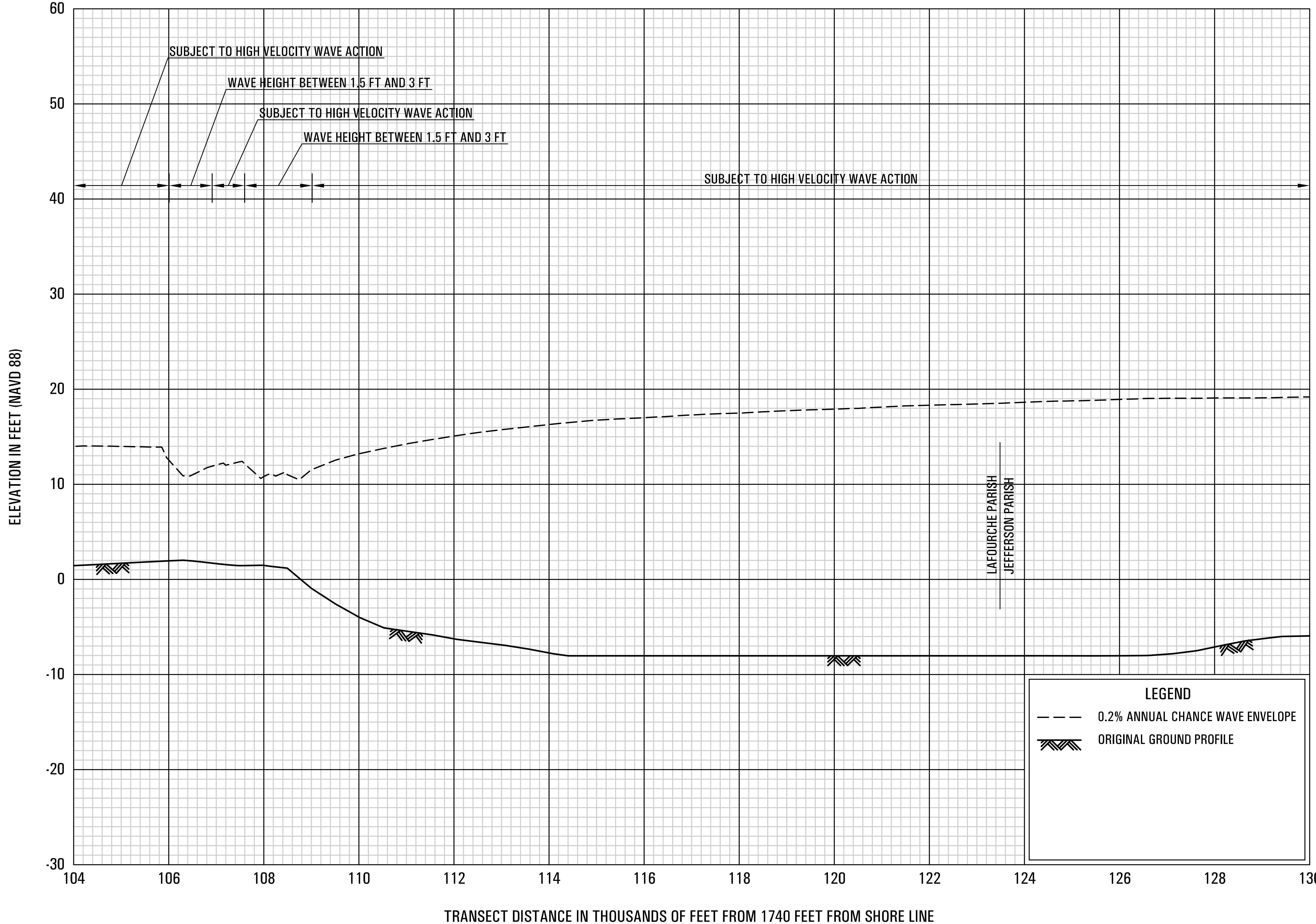
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

09P



0.2% ANNUAL CHANCE WAVE ENVELOPE

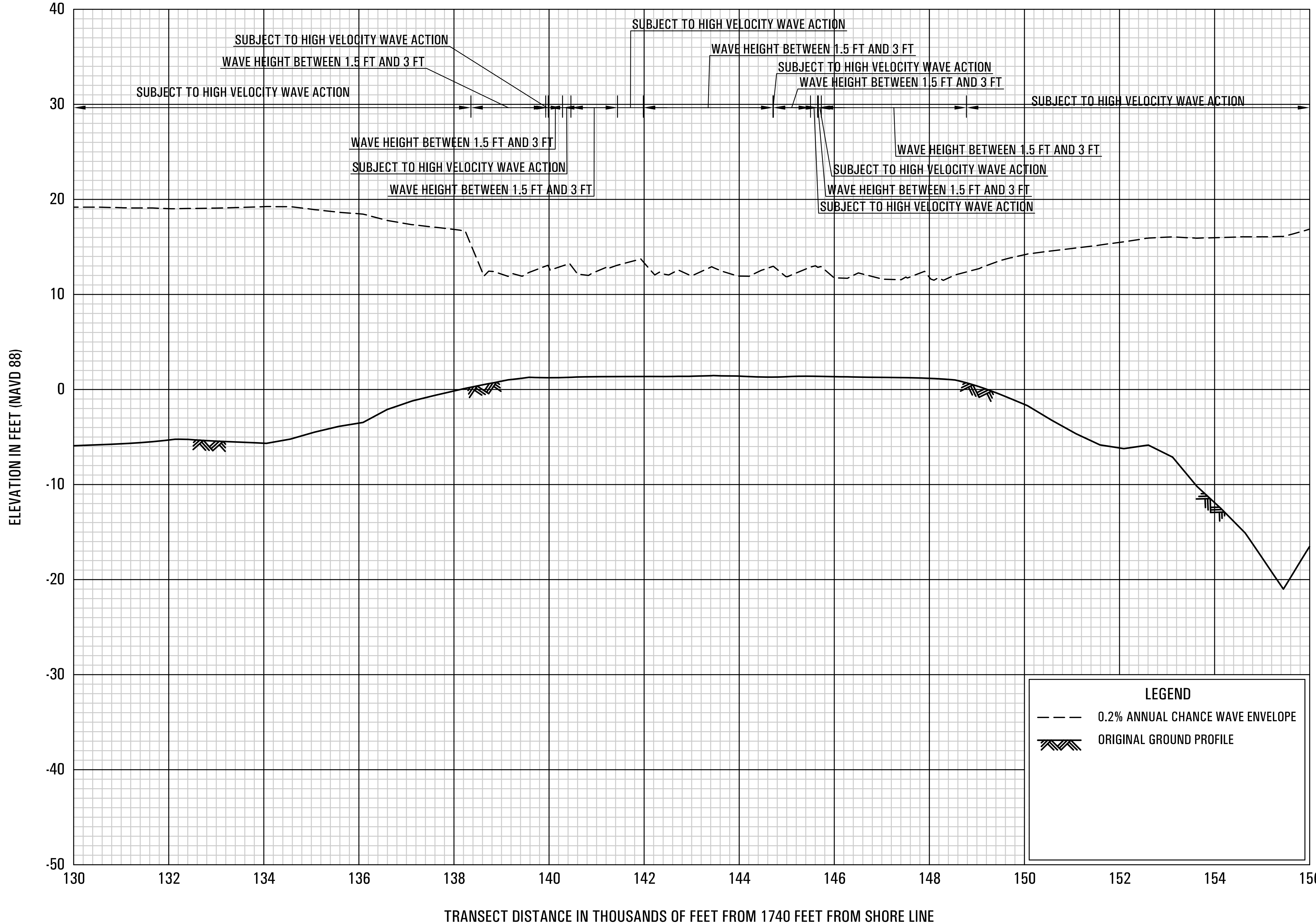
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

10P



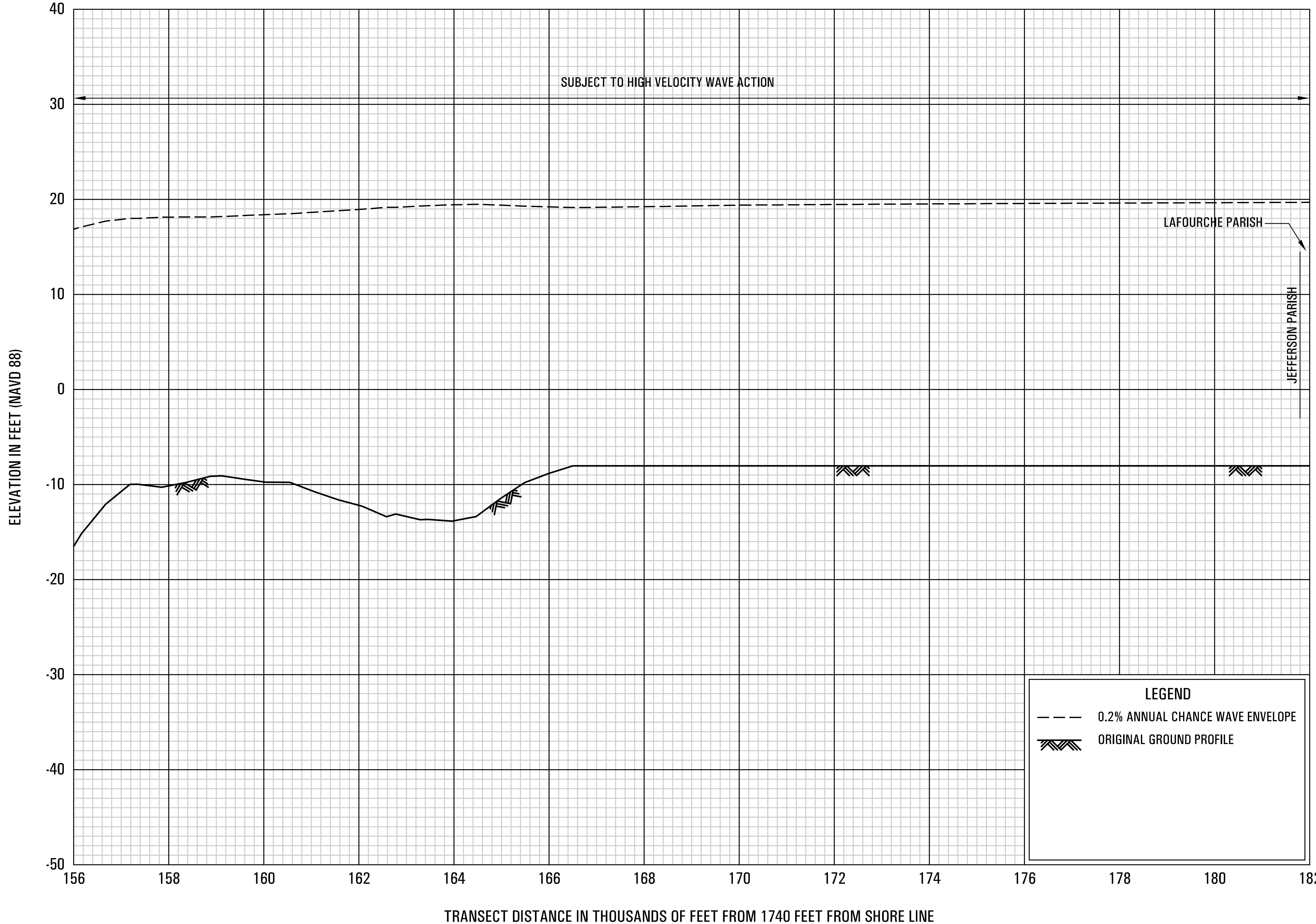
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

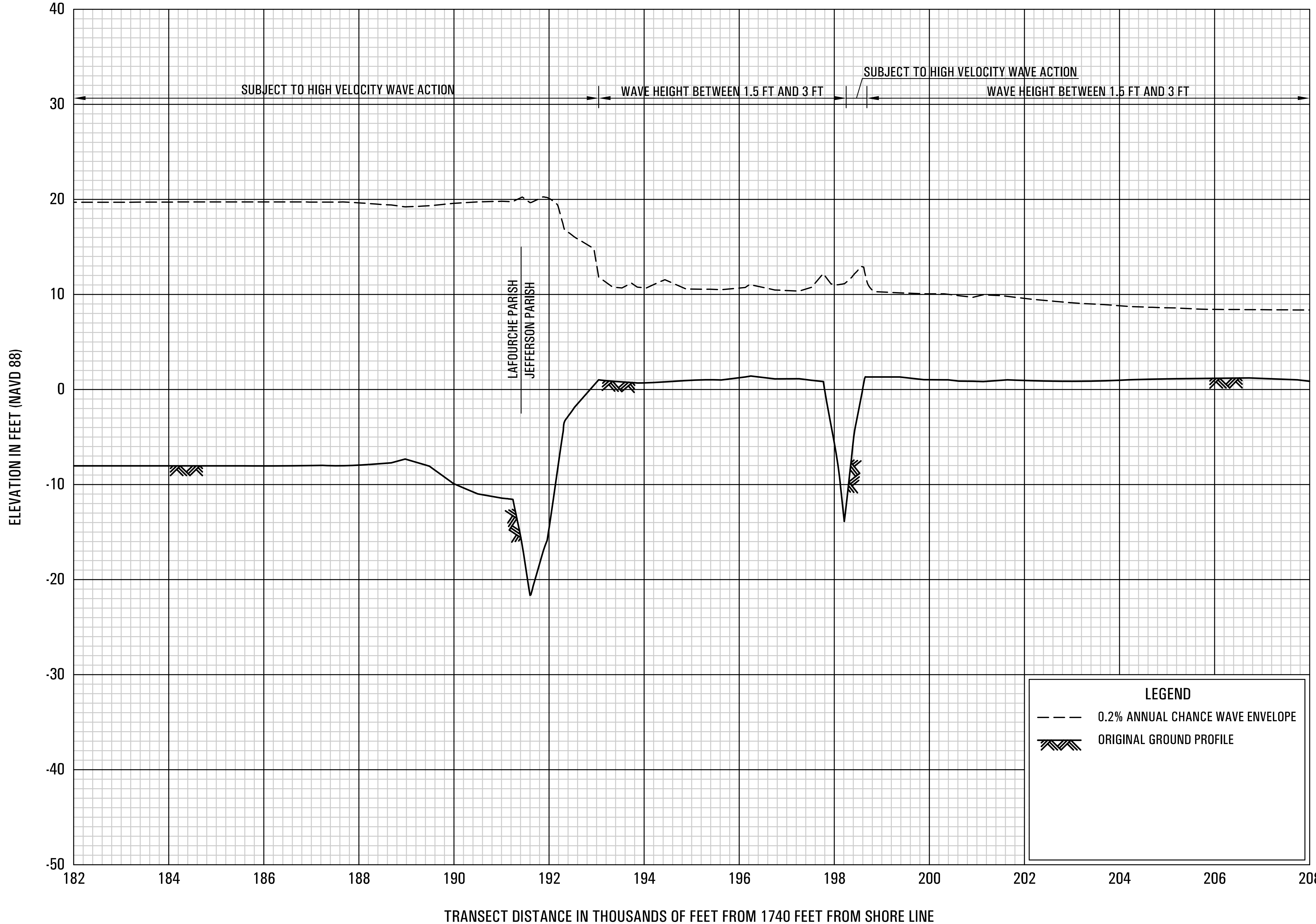
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

12P



0.2% ANNUAL CHANCE WAVE ENVELOPE

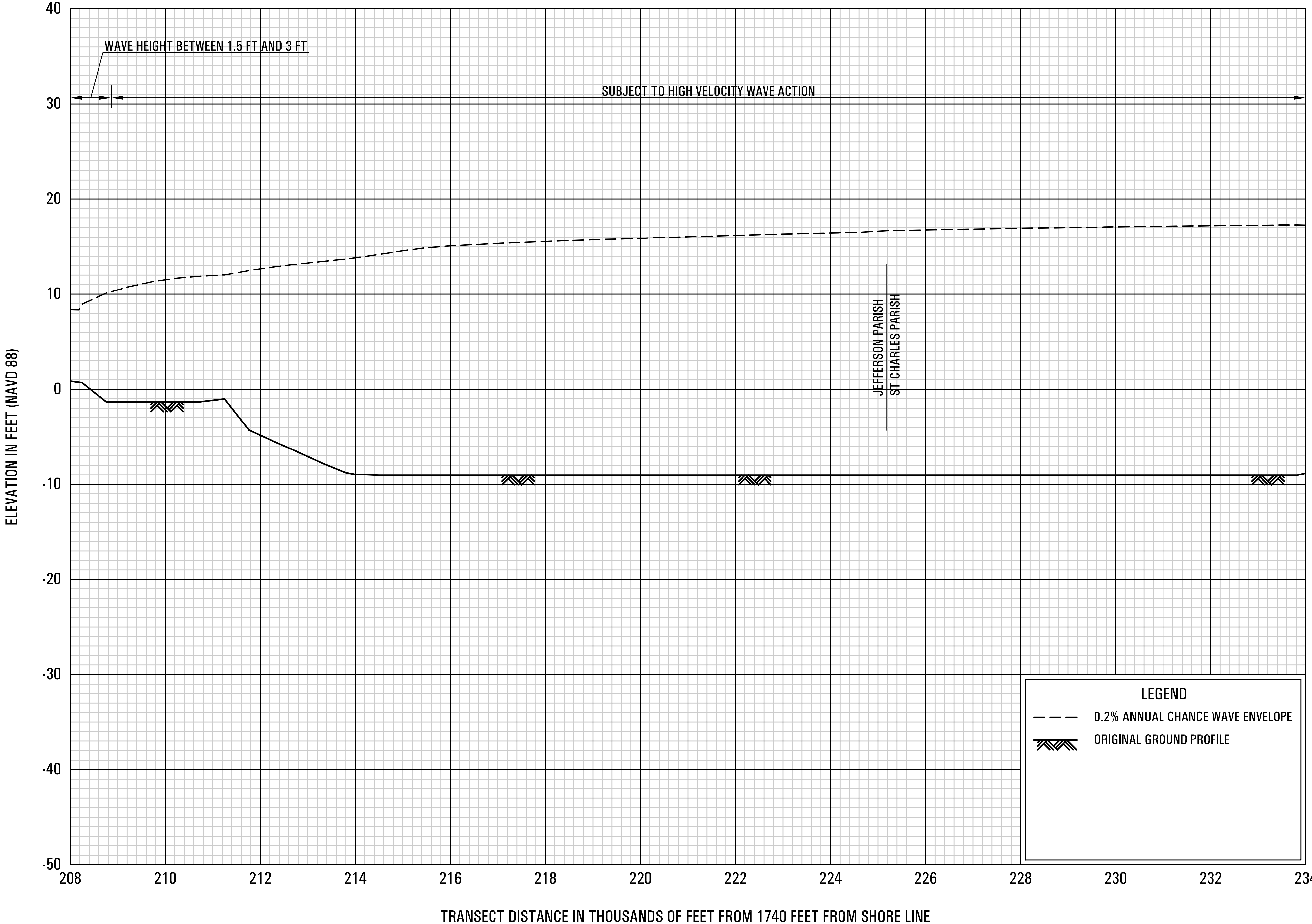
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

13P



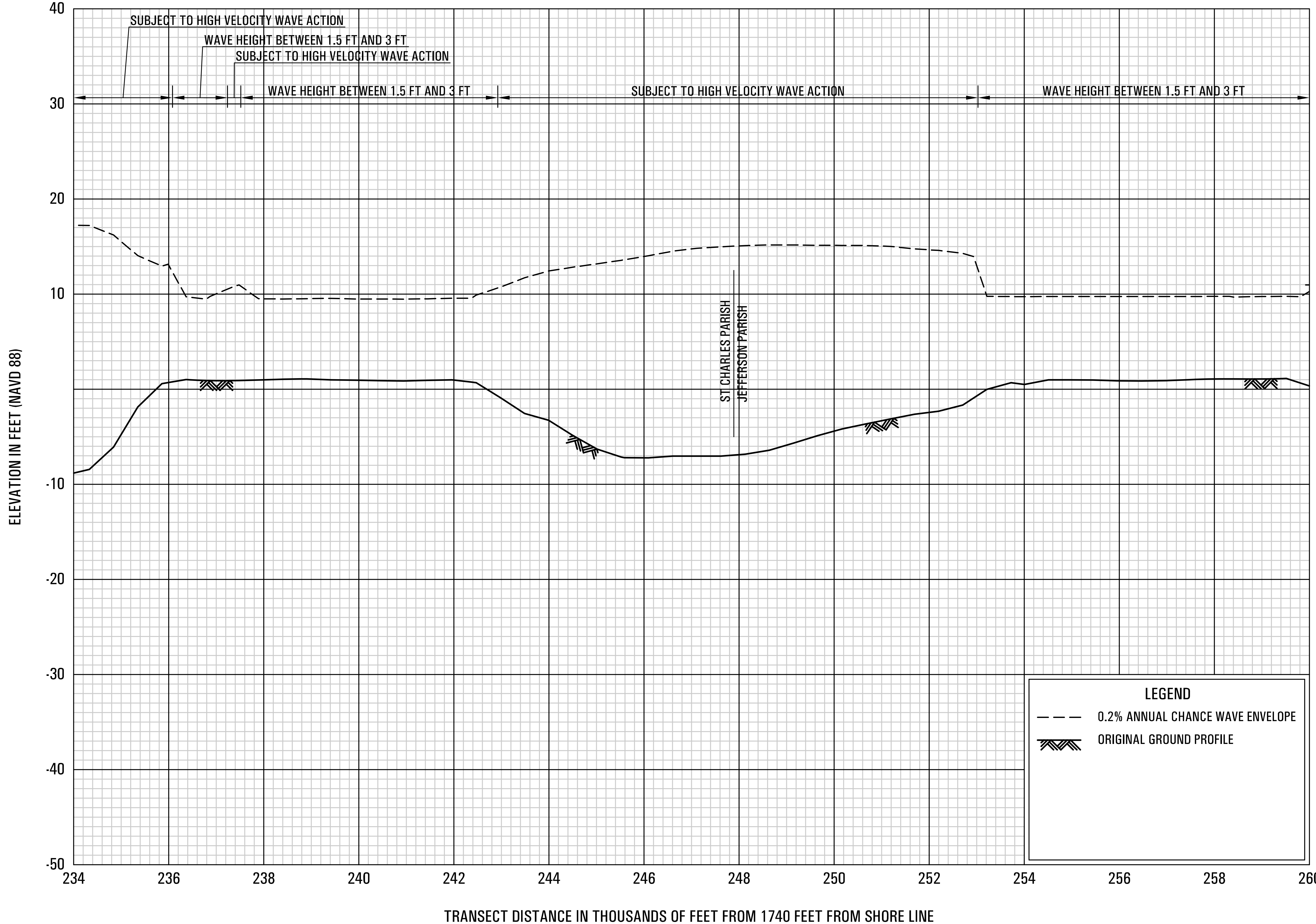
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

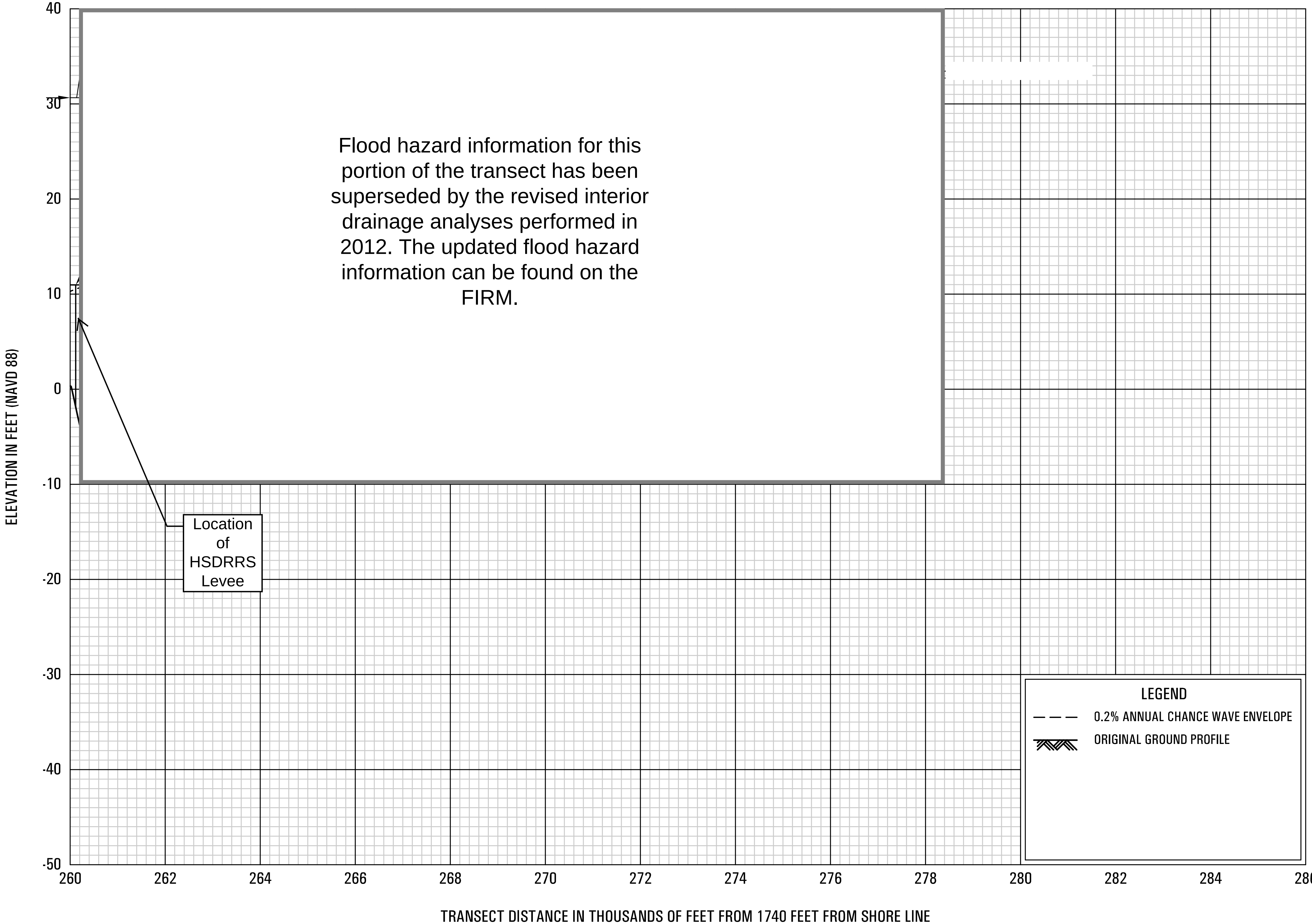
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

15P



0.2% ANNUAL CHANCE WAVE ENVELOPE

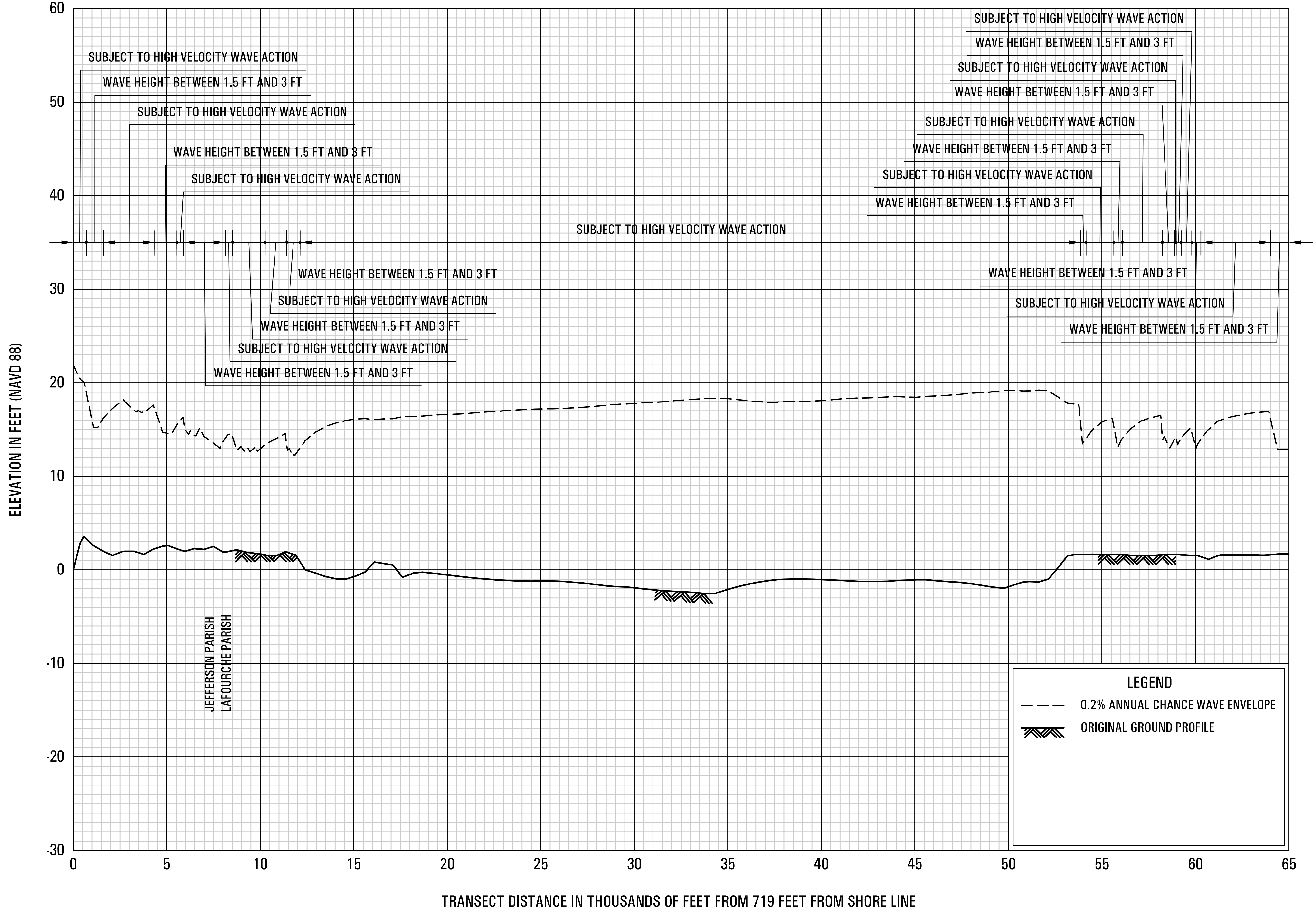
TRANSECT 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

16P



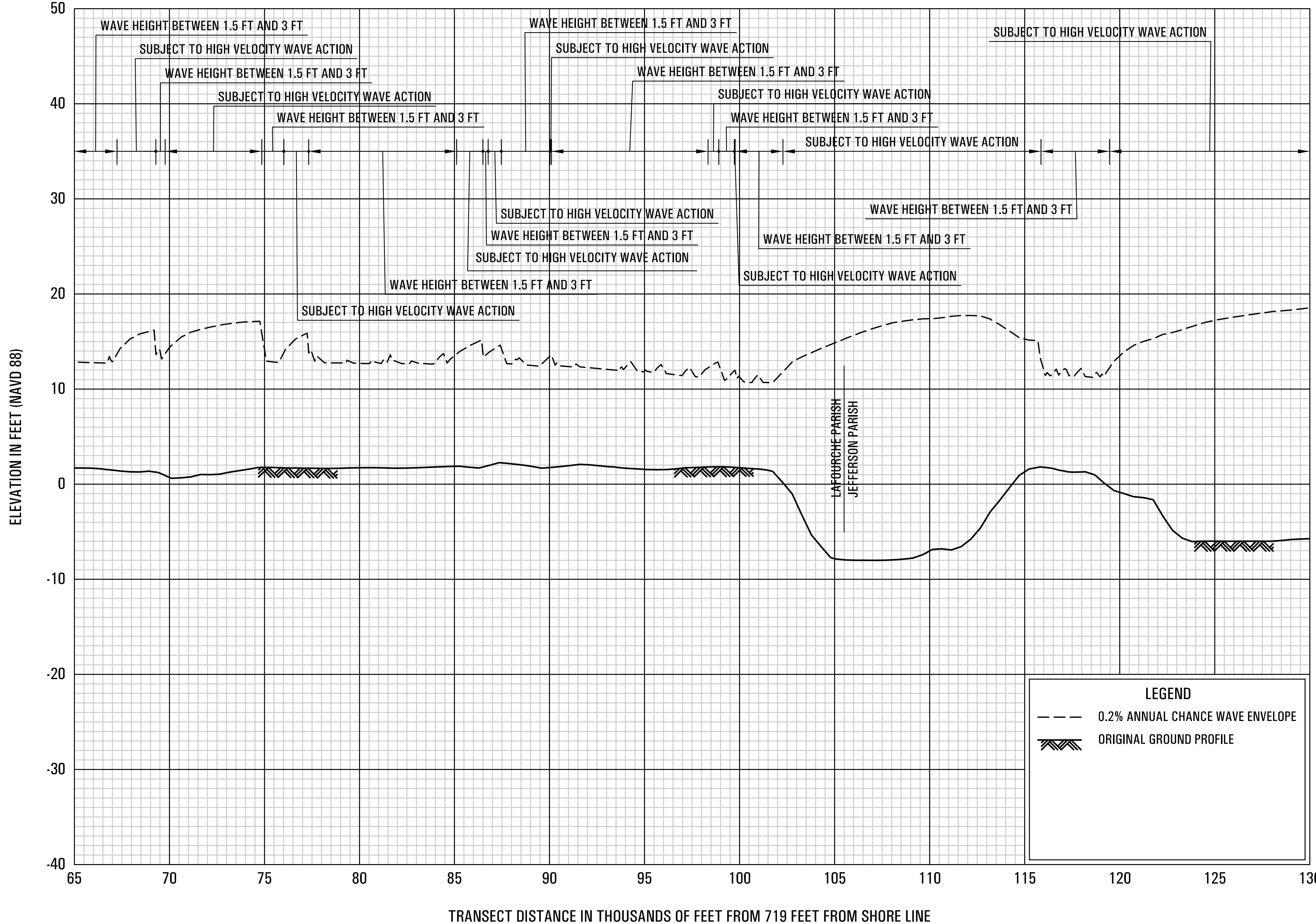
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



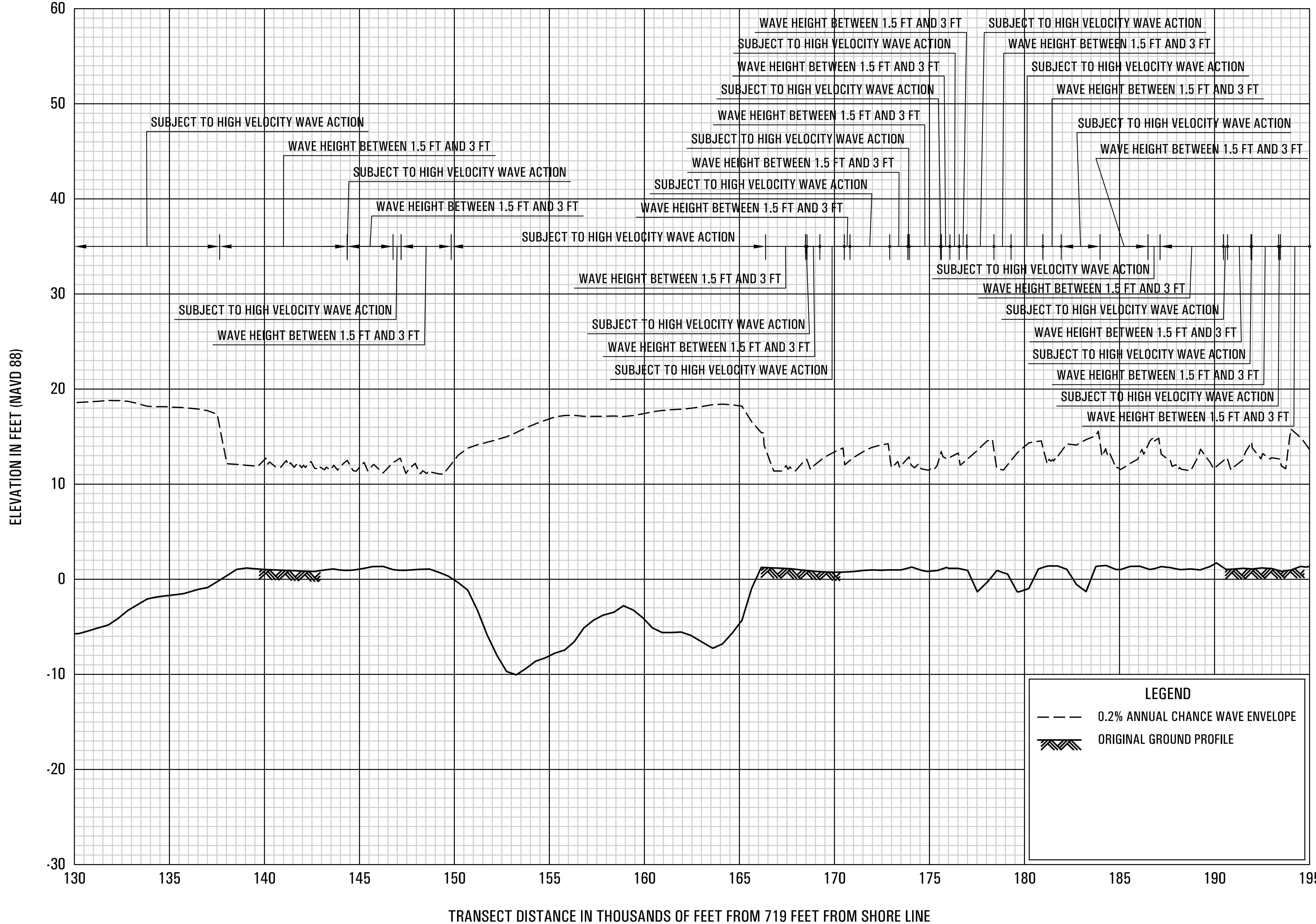
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

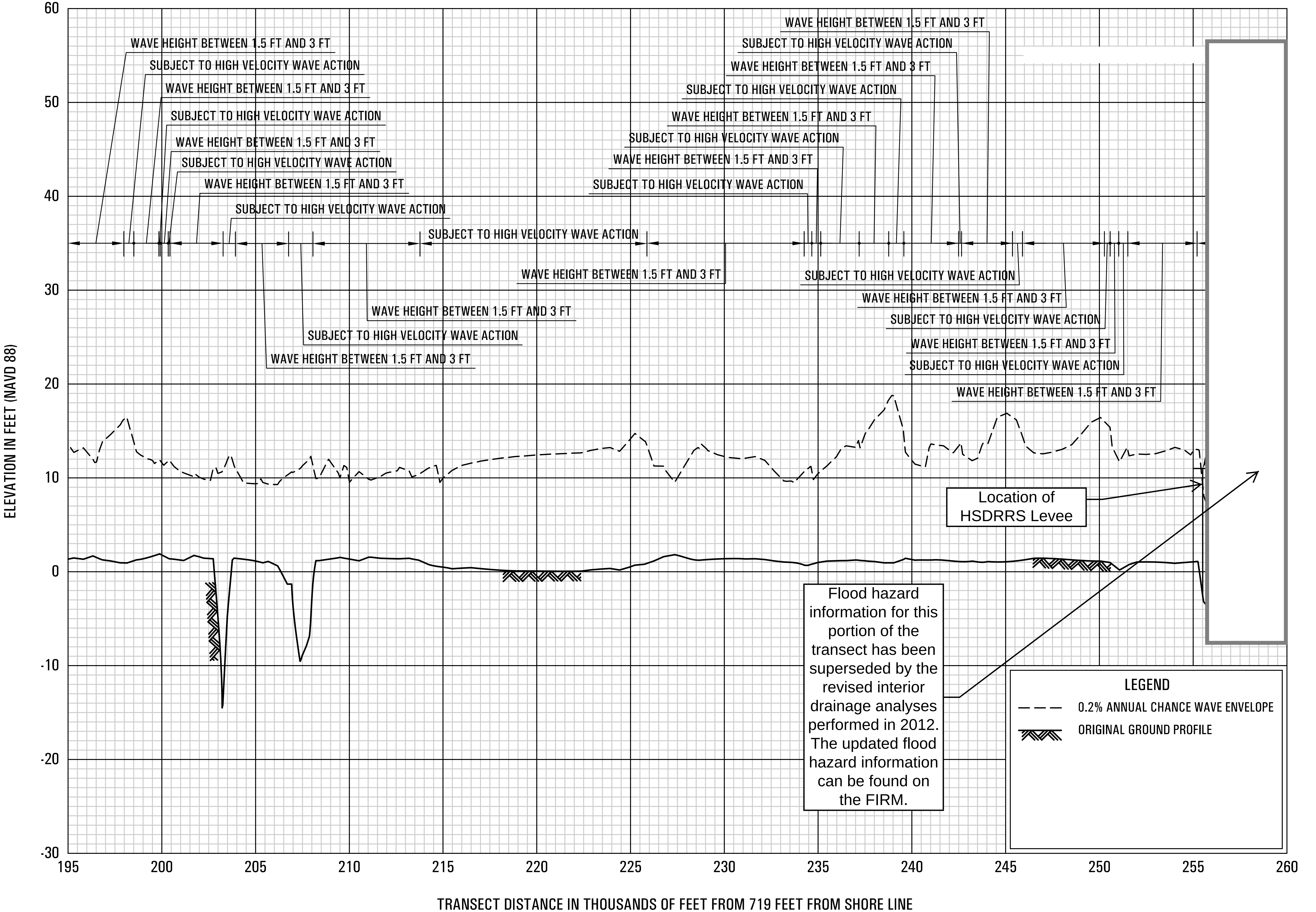
TRANSECT 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

19P



0.2% ANNUAL CHANCE WAVE ENVELOPE

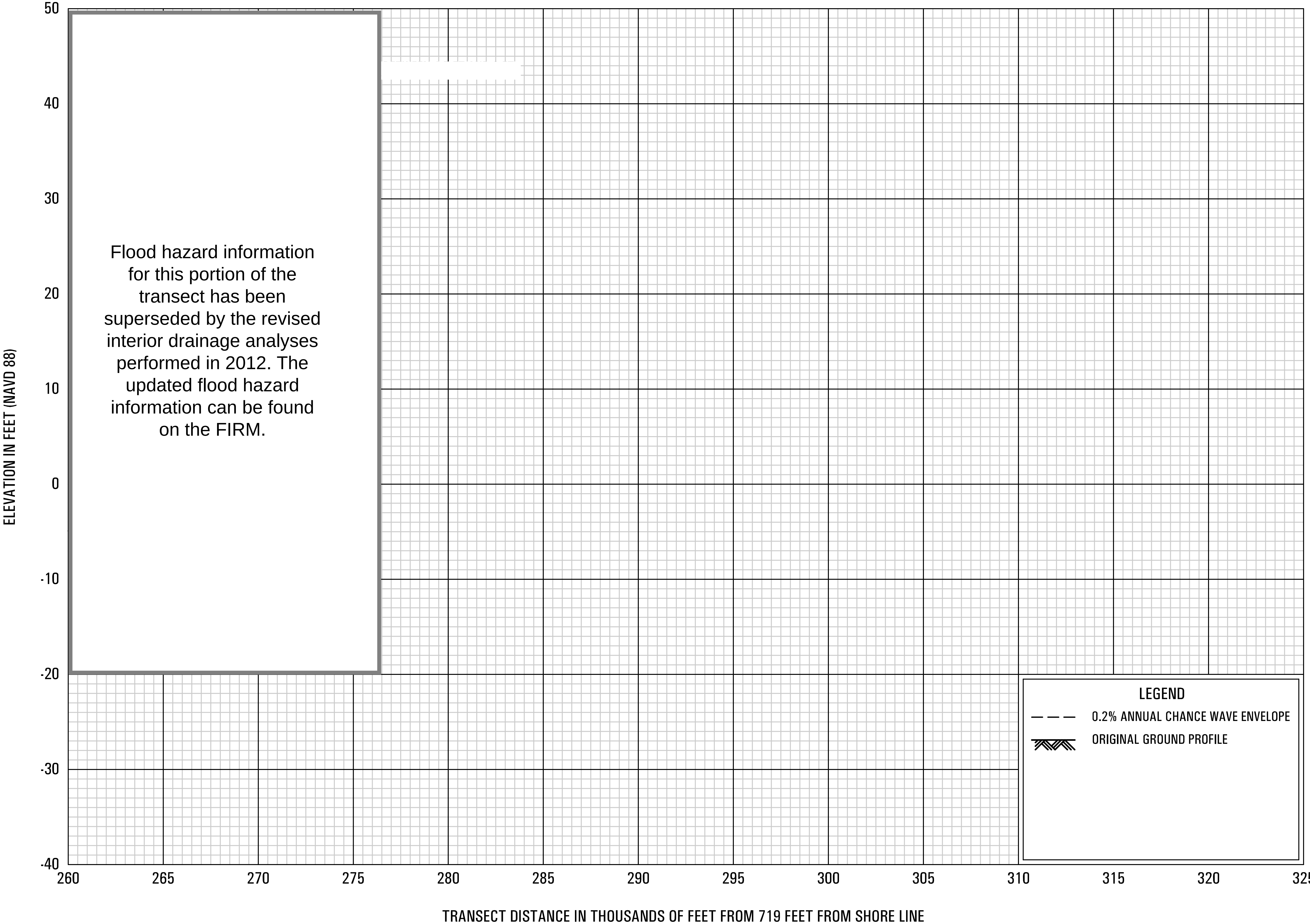
TRANSECT 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

20P



Flood hazard information for this portion of the transect has been superseded by the revised interior drainage analyses performed in 2012. The updated flood hazard information can be found on the FIRM.

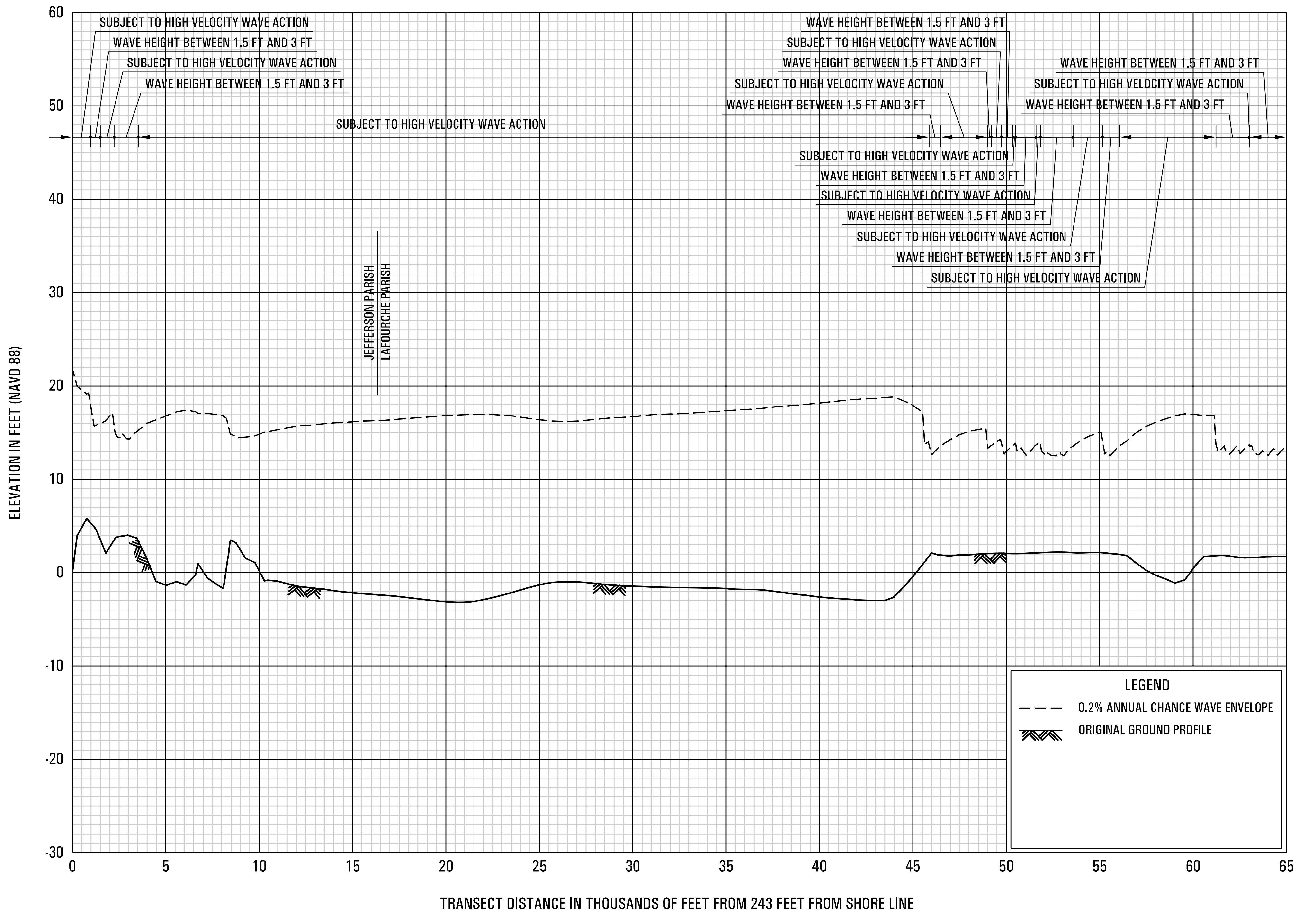
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

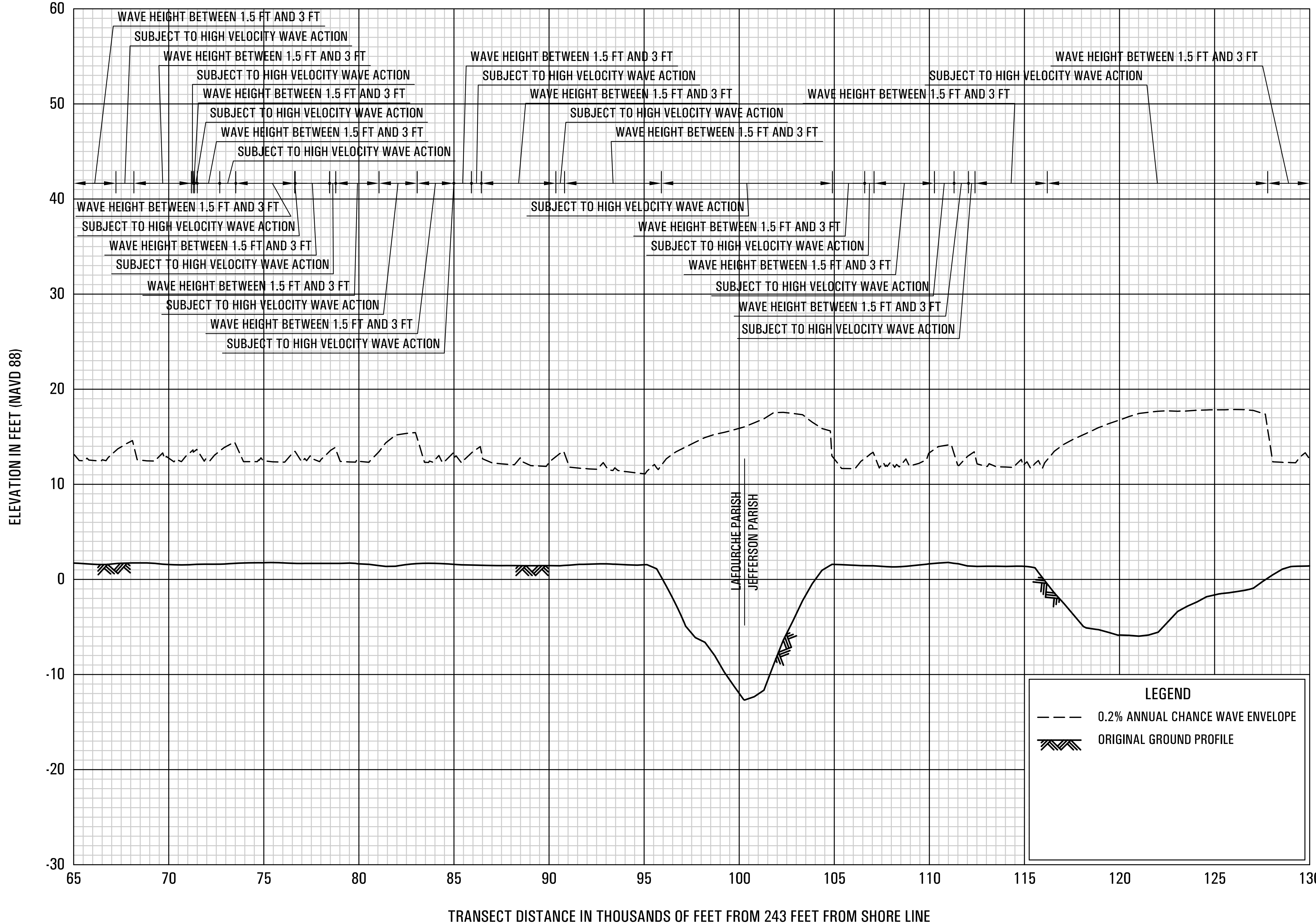
TRANSECT 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

22P



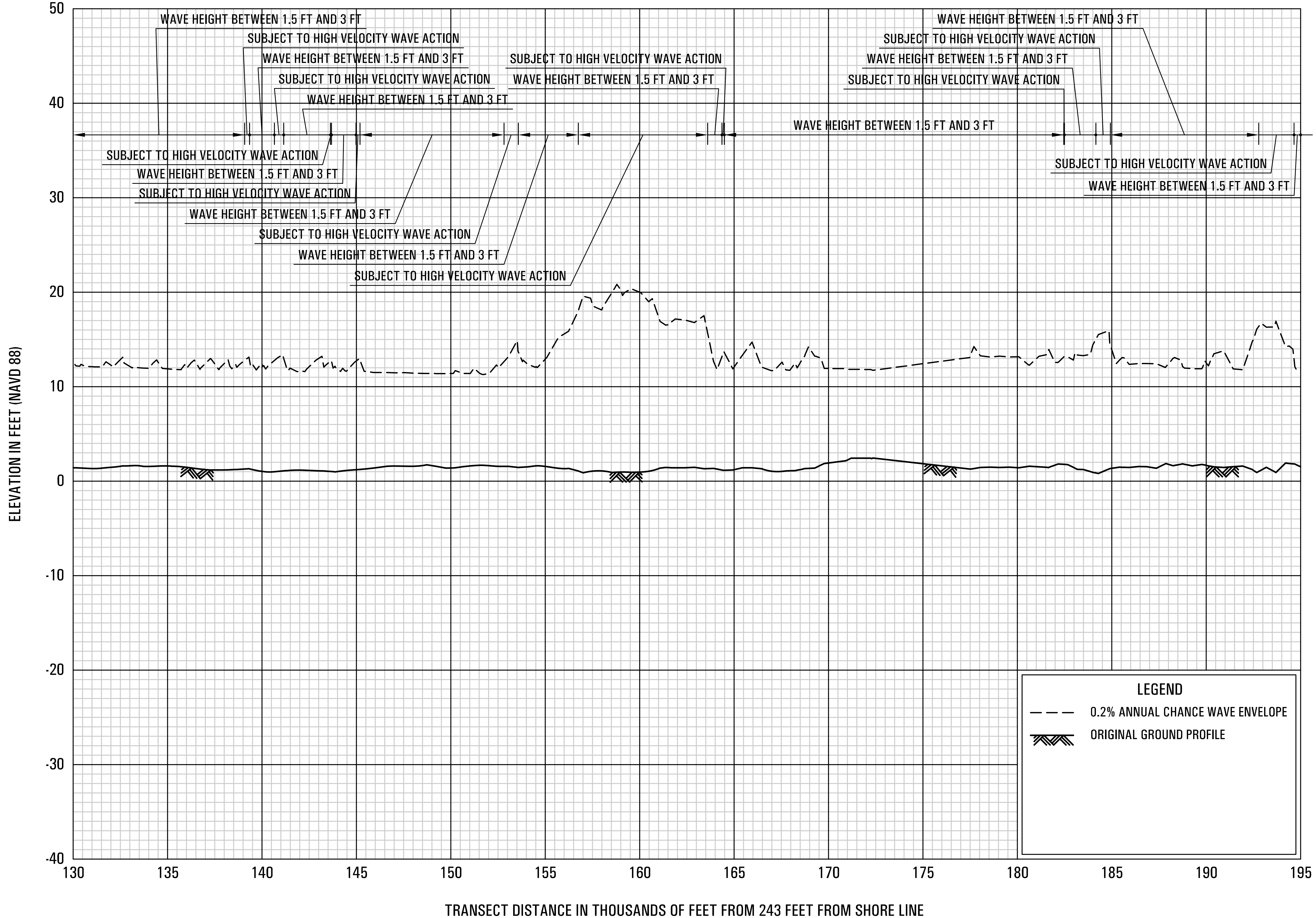
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

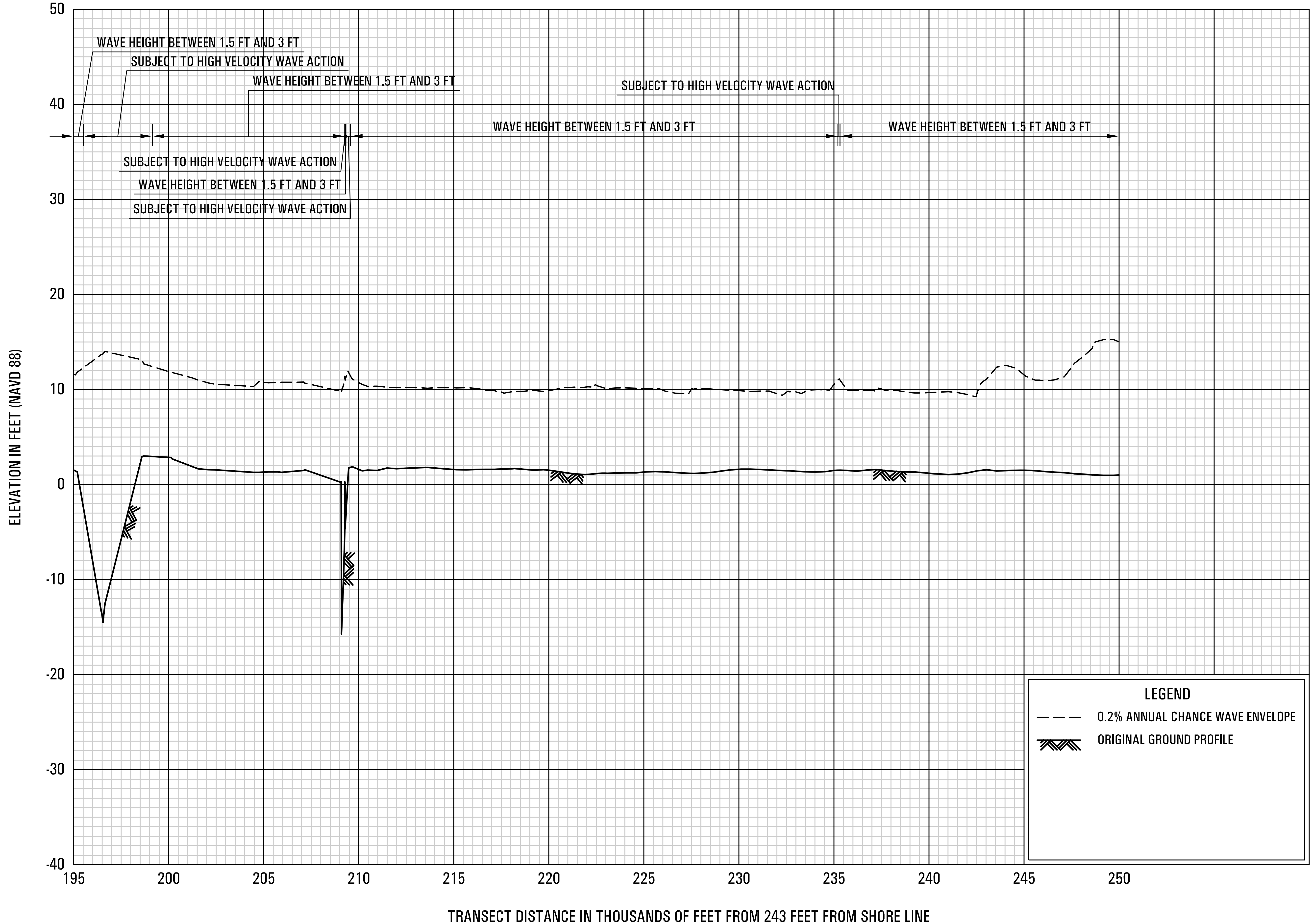
TRANSECT 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

24P



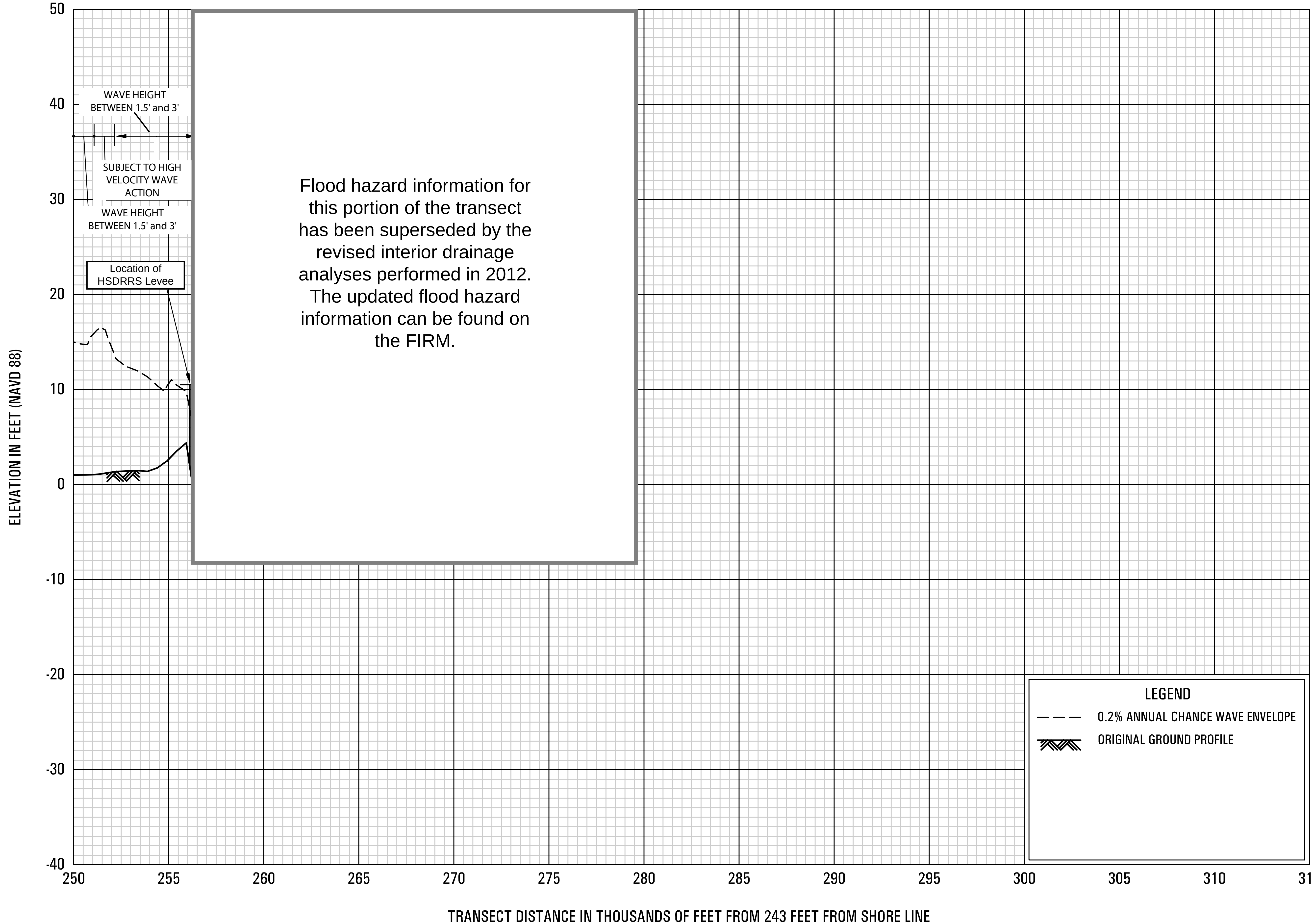
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

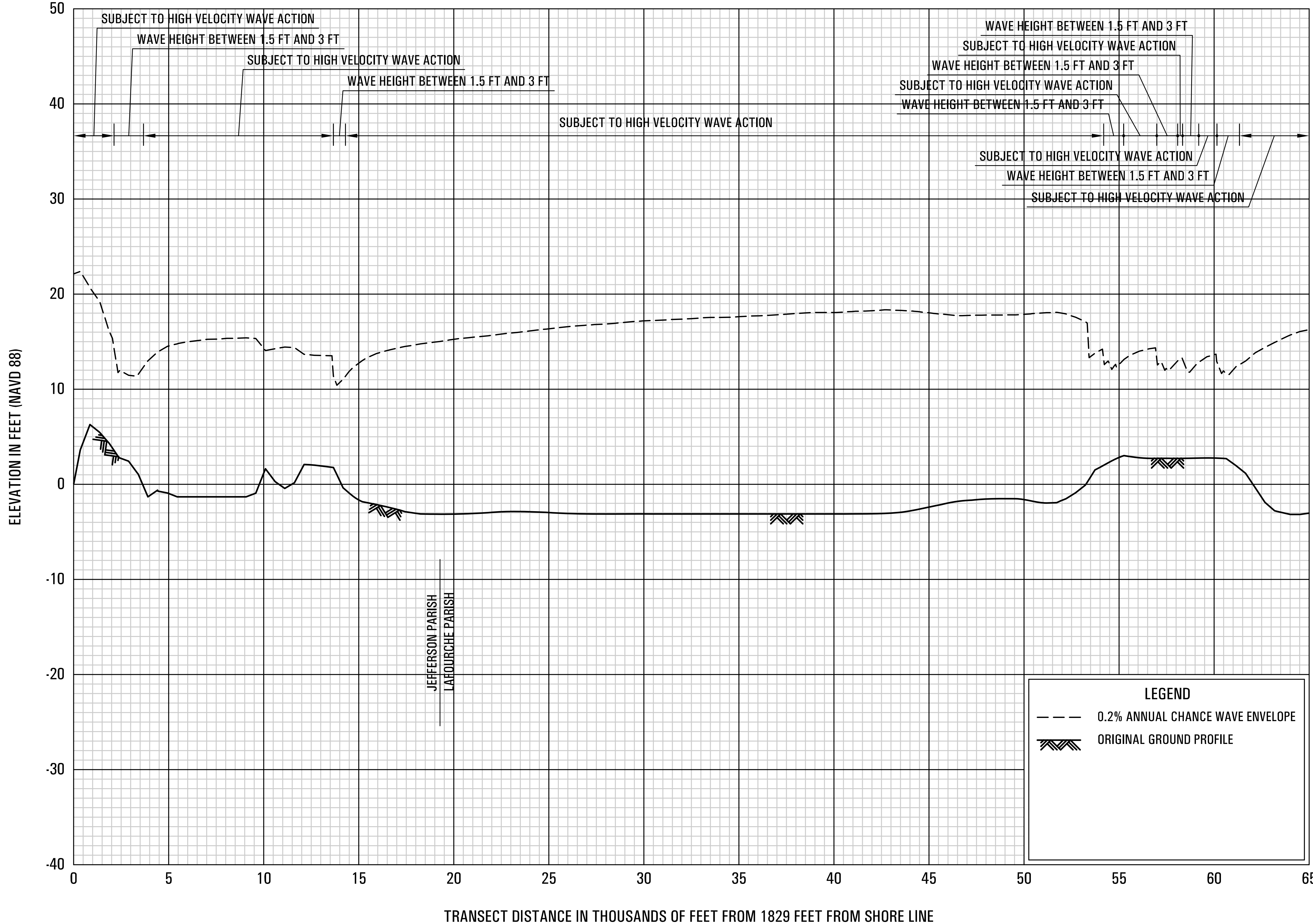
TRANSECT 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

26P



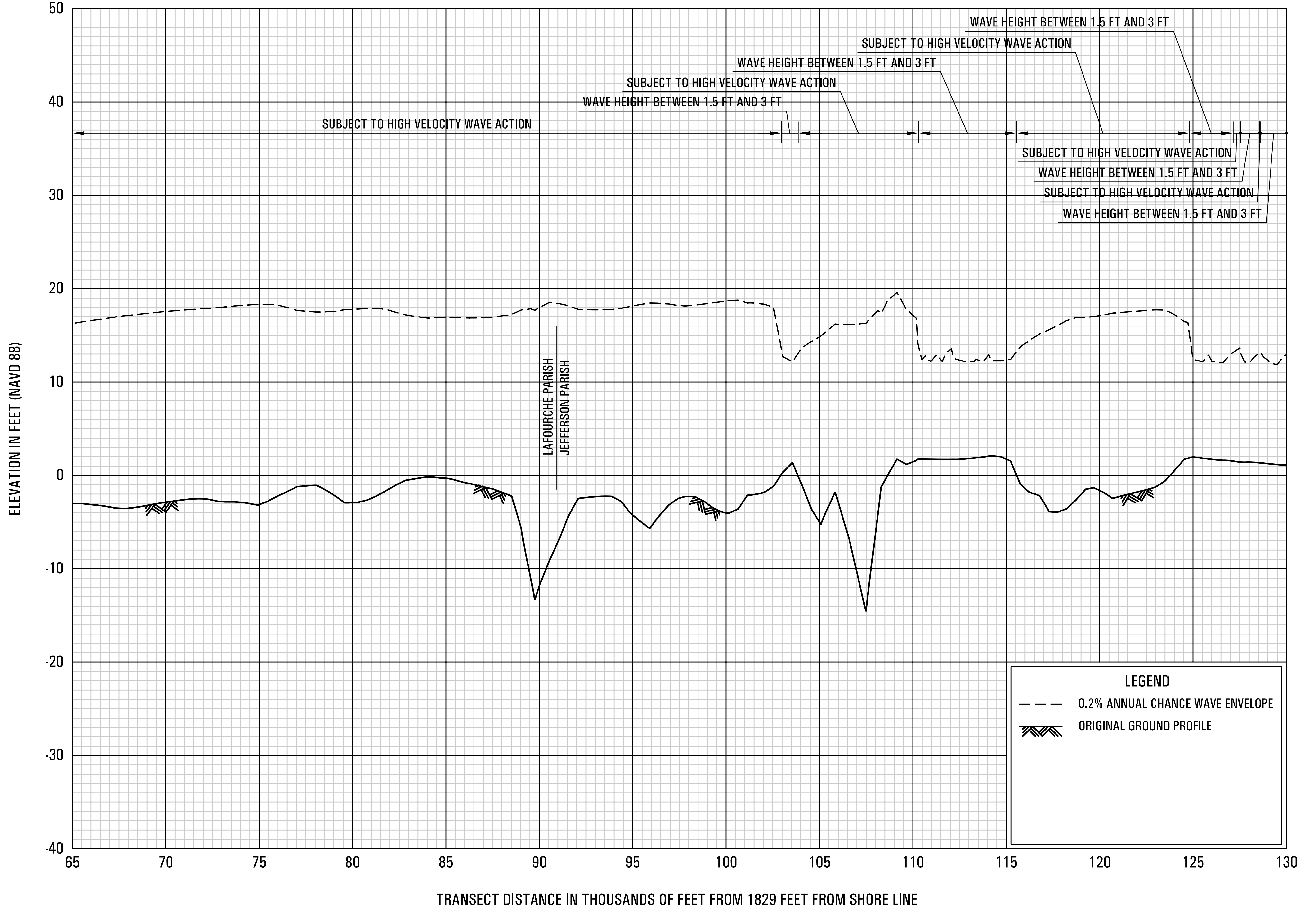
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

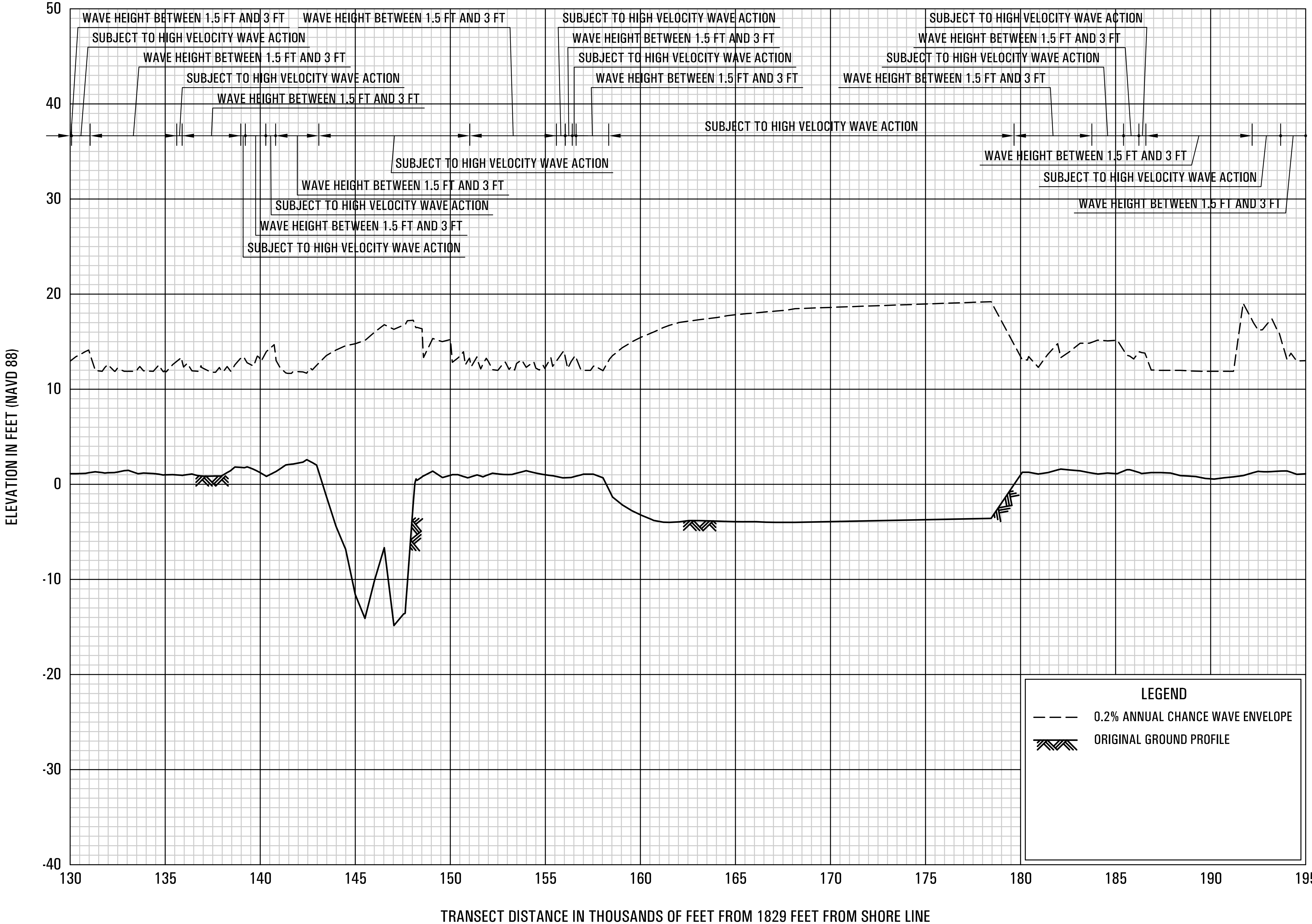
TRANSECT 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

28P



0.2% ANNUAL CHANCE WAVE ENVELOPE

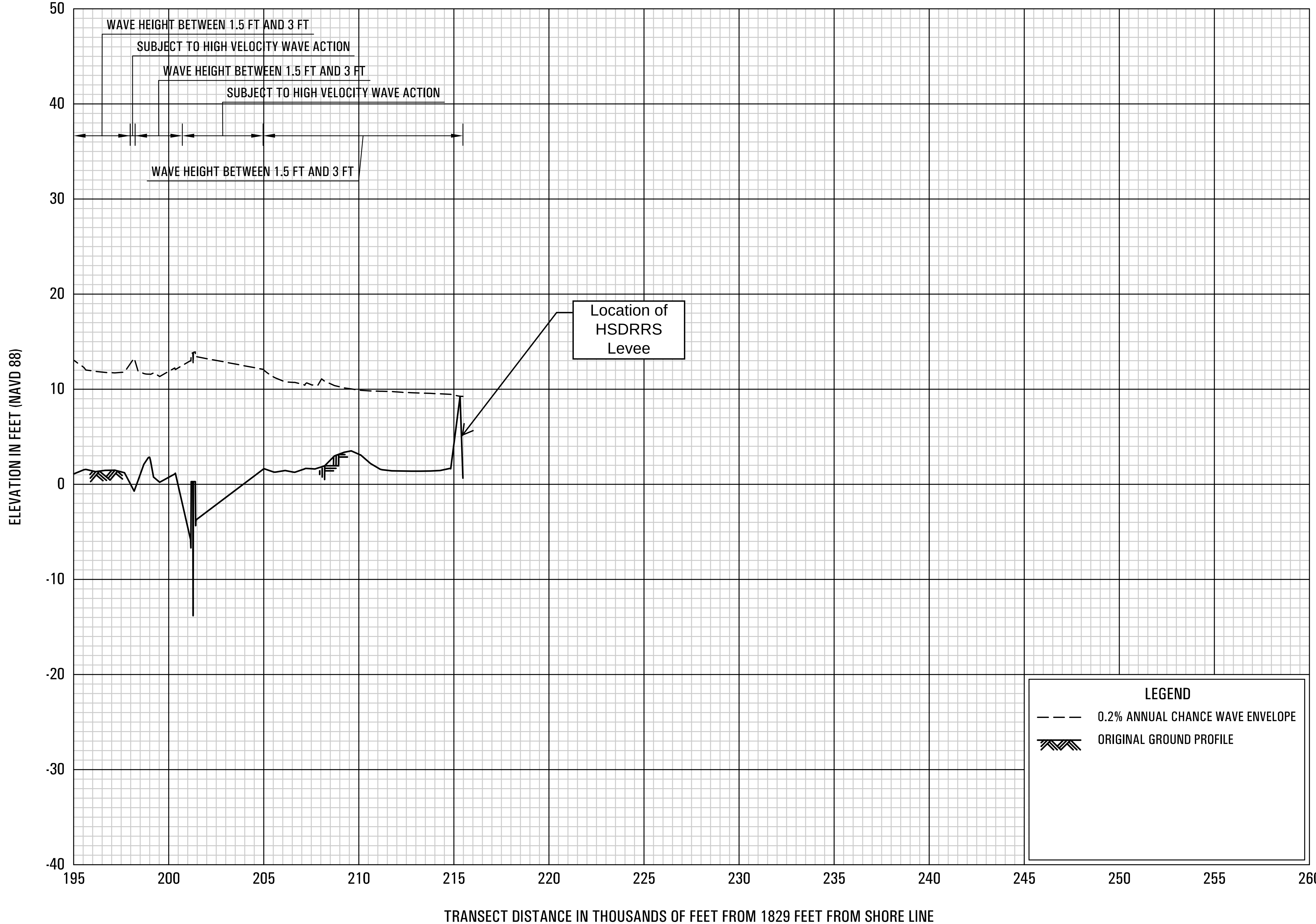
TRANSECT 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

29P



0.2% ANNUAL CHANCE WAVE ENVELOPE

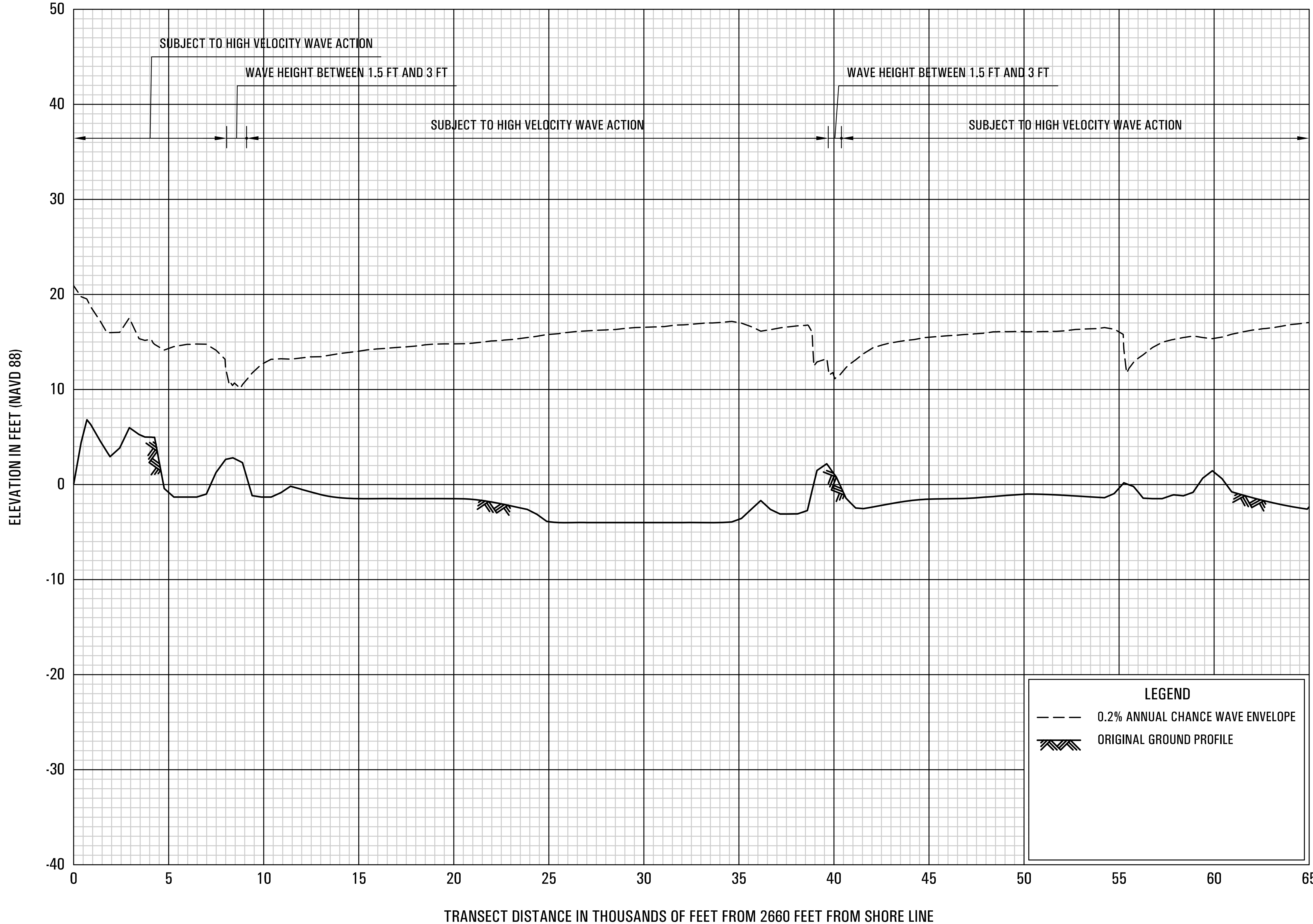
TRANSECT 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS

30P



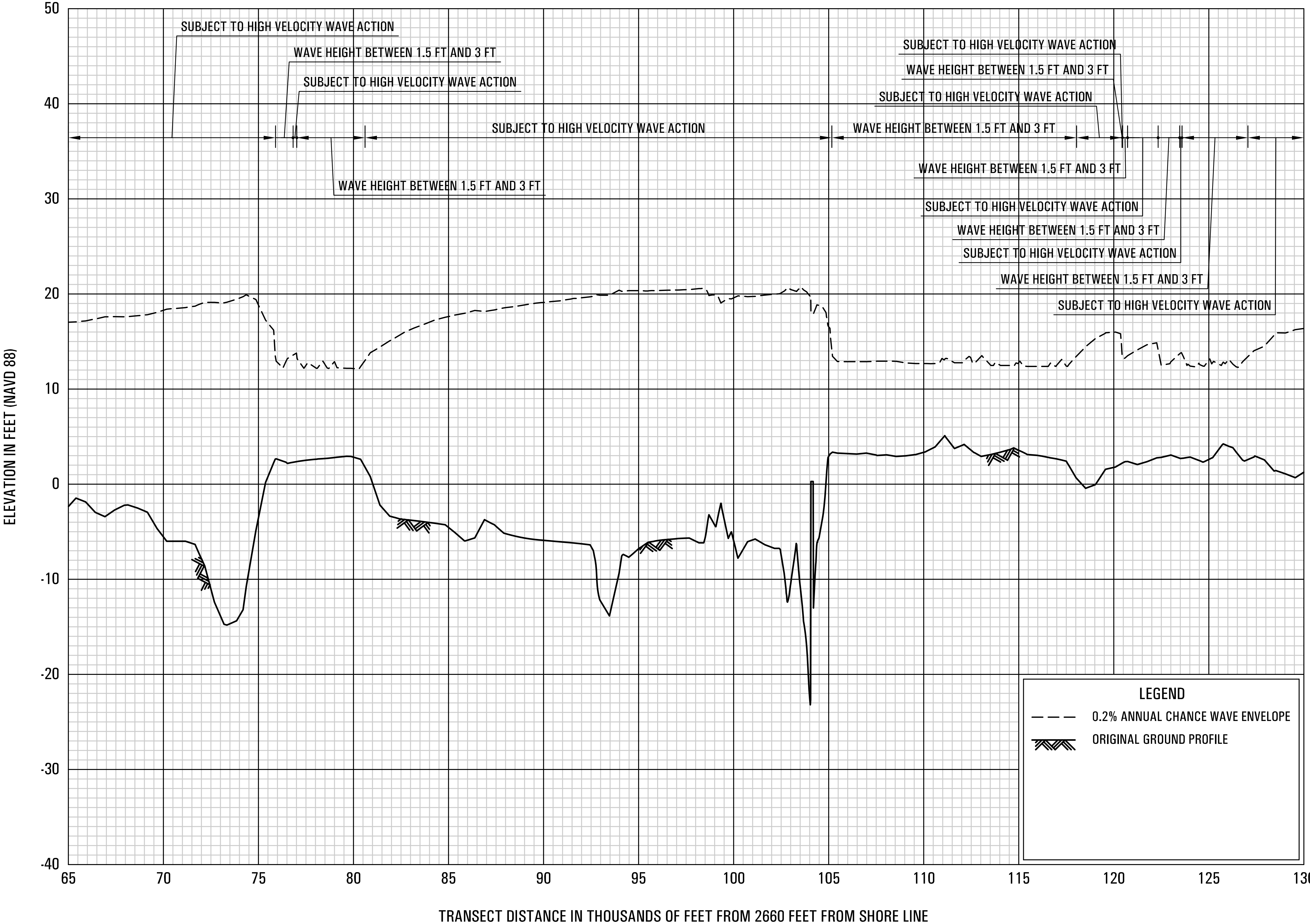
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



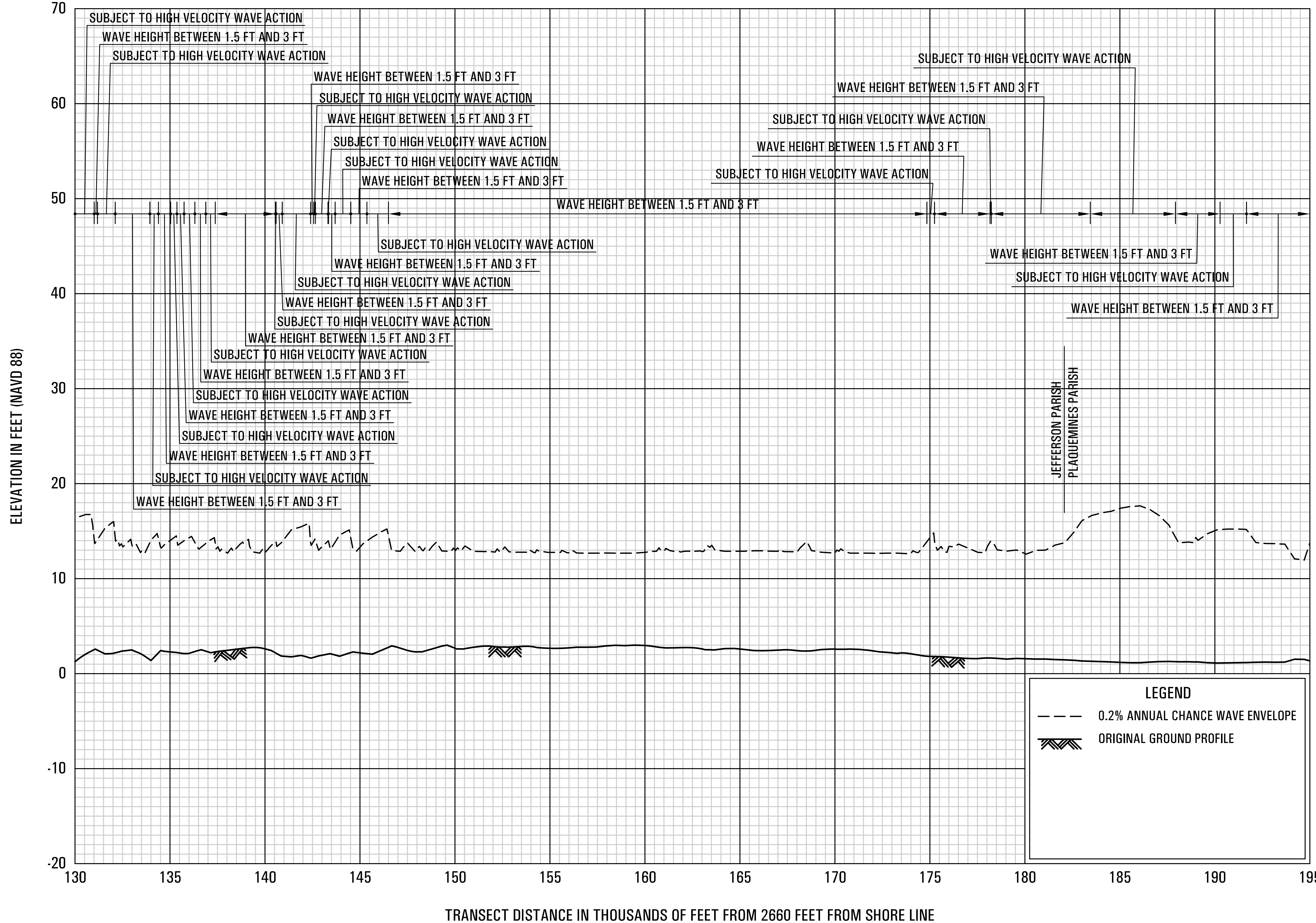
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



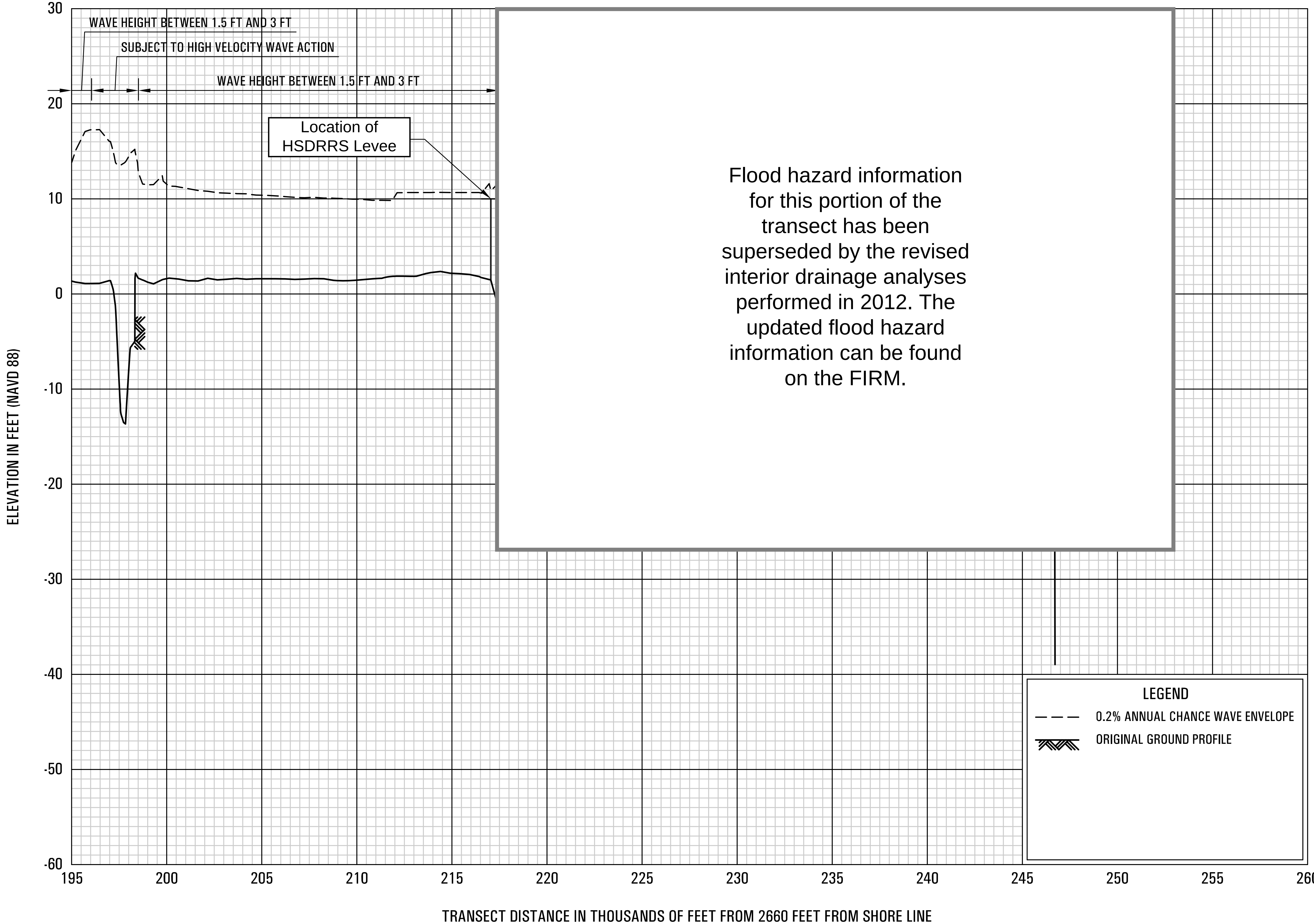
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



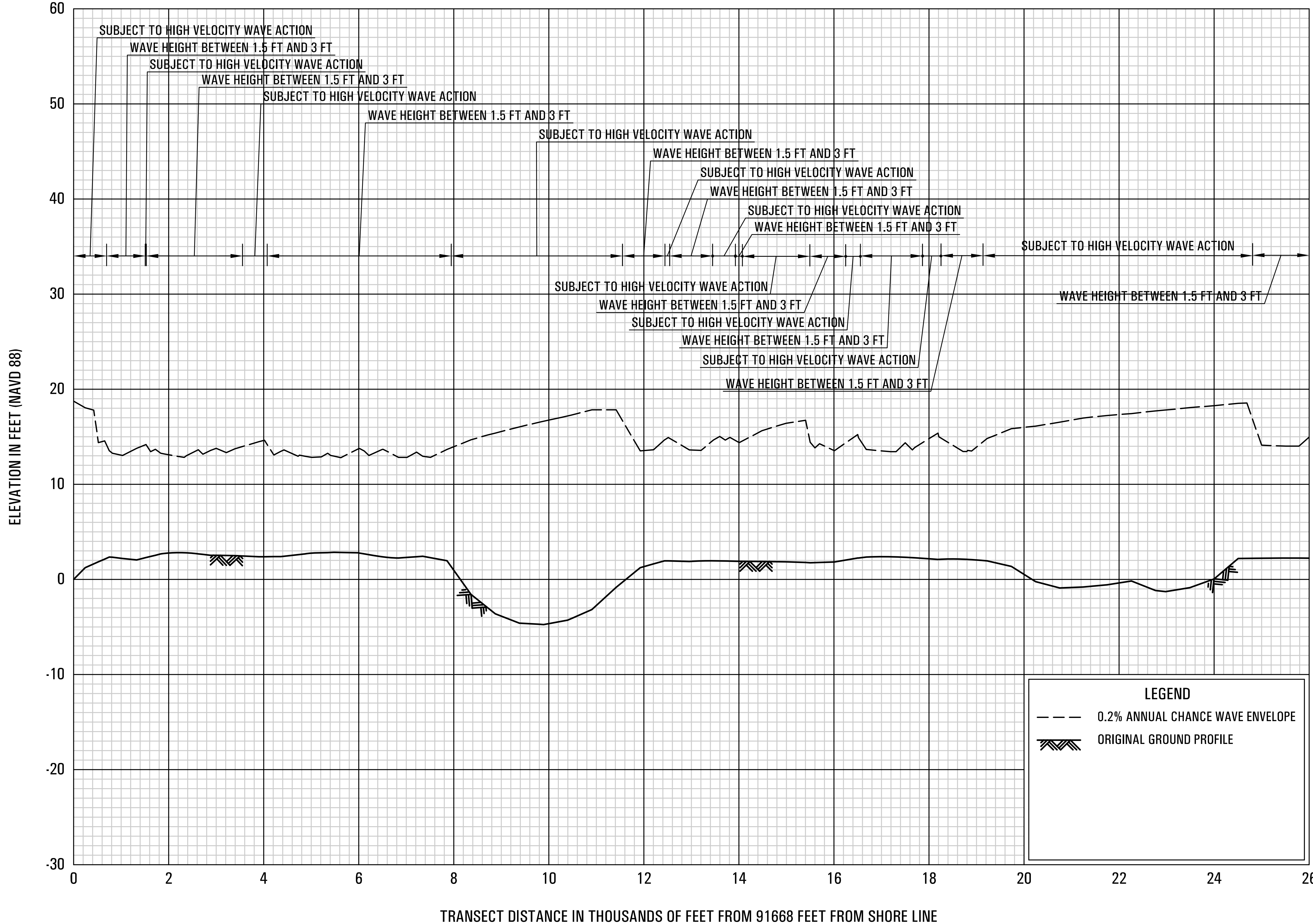
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



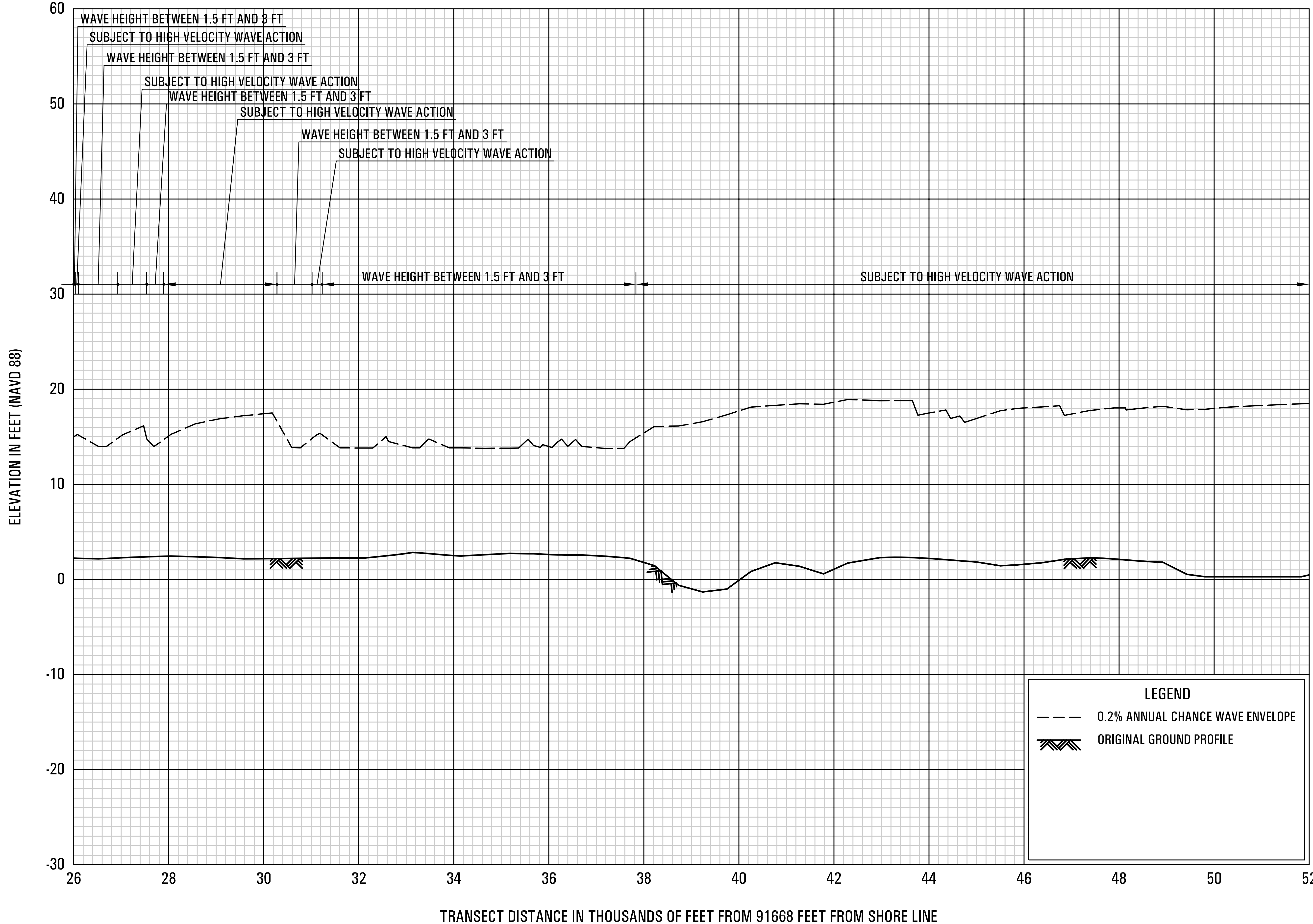
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



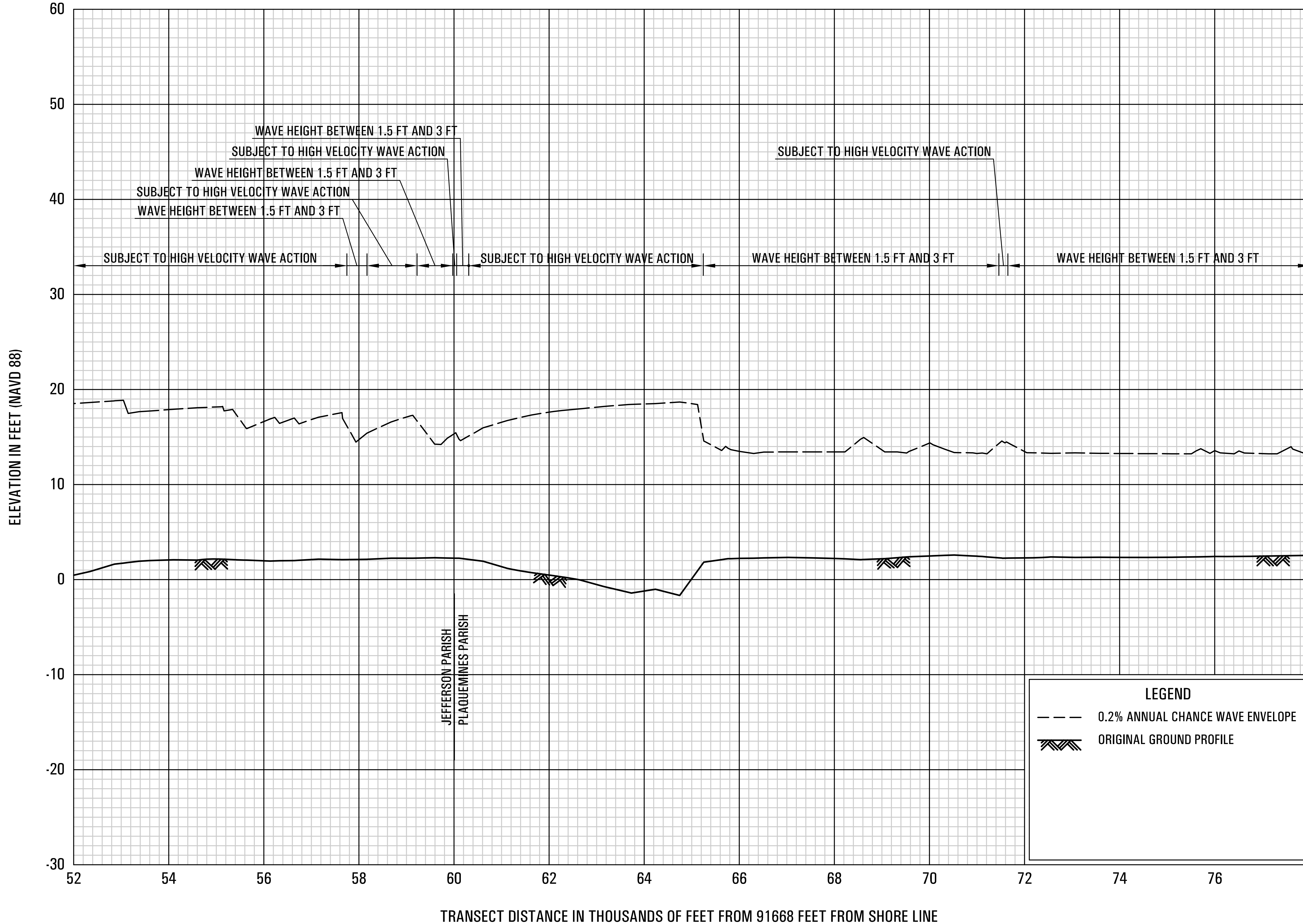
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



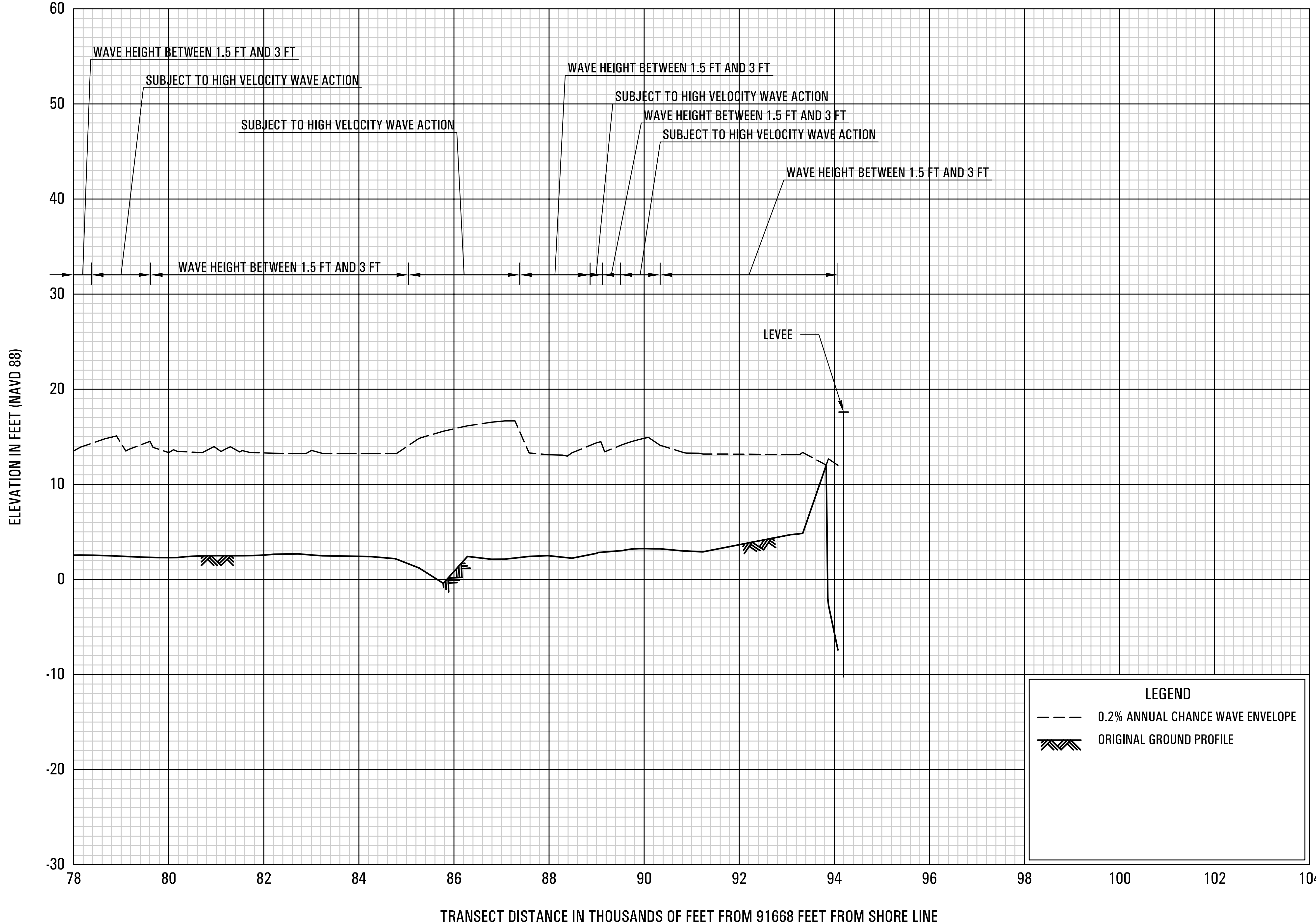
0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS



0.2% ANNUAL CHANCE WAVE ENVELOPE

TRANSECT 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

JEFFERSON PARISH, LA

AND INCORPORATED AREAS