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CE 249

December 8th, 2017

Matagorda County: Approximate and Detailed Coastal Flood Mapping

Matagorda county was established in 1836 and is situated in the middle of the Texas coastline on the Gulf of Mexico. The county contains 1,100 square miles of land and 512 square miles of water and it is home to roughly 37,000 people, according to 2016 Census estimates. Matagorda Bay and East Matagorda Bay are split by the Colorado River and sheltered somewhat on the seaward edge by a vast stretch of coastal dunes. The county seat is Bay city, which is located approximately 20 miles inland from the protected shoreline and sits on the eastern bank of the Colorado River. Roughly half of the county's population live in Bay City and just over 20% of the city and county live below the poverty line. The City of Palacios, nestled between Turtles Bay and Tres Palacios Bay on the coast, is home to only 5,000 residents but is the second-largest city in the county (U.S. Census Bureau, 2014).

The Matagorda chamber of commerce boasts that the county receives 350,000 visitors annually, yet this volume is very low considering the proximity to neighboring Texas gulf vacation spots. Just down the coast, Port Aransas is only home to 4,000 residents but serves five million annual visitors, and South Padre is also home to 5,000 but serves one million tourists every year. Tourism is not a major industry for the county, instead agricultural production of turf grass and rice is an economic driver as well as a varied energy generation portfolio. This portfolio consists of petrochemical refineries, natural gas extraction, offshore oil production and most importantly one of the state's two nuclear power plants. Matagorda at a glance appears to be a quiet agrarian county with more wildlife than people but the large amounts of energy activity combined with the coastal location creates a heightened vulnerability to natural hazards such as hurricanes, tropical storms and especially coastal flooding.

Coastal and riverine flood hazard mapping is developed by FEMA, and outside consultants, under a federal program called the National Flood Insurance Program (NFIP). The NFIP was established under the Federal Emergency Management Agency (FEMA) in 1968 as a result of a piece of legislation called the National Flood Insurance Act of 1968 (National Research Council, 2015). The program allowed property owners to buy insurance against flood damages from the government, and made flood insurance mandatory for any loans or lines of credit that used existing structures as collateral. Prior to the NFIP, flood insurance was available from private insurers but most homeowners did not consider the policies to be essential. In 2012 additional legislation called the Biggert-Waters Flood Insurance Reform Act was passed that added risk-based premiums to NFIP participant policies. This was an effort to adjust NFIP premiums from flat rates to a cost structure that more closely represented the actual risk and expected losses from flooding. The act was passed largely because the National Flood Insurance Program’s cumulative debt at that point was in excess of $17 billion. A budgetary committee analysis of the program concluded that the largest contributor to the program’s snowballing debt was the artificially lowered pricing of the program’s policies due to historically exempt properties or structures. Basically, as long as a house or the ownership of a given property pre-dated NFIP price increases, the associated policy was grandfathered in to a lower pricing tier in perpetuity. Additionally, since in most cases the policy prices had to be subsidized by the government due to adjacent homeownership legislation, prices were well below actuarial rates from private insurers (National Research Council, 2015). After the passage of Biggert-Waters many lawmakers experienced severe backlash from their constituents due to large increases in individual flood insurance policies, as NFIP rates were allowed to rise for the first time in decades. This public outcry resulted in the subsequent passage of the Homeowner Flood Insurance Affordability Act of 2013 (HFIAA), which modified the Biggert-Waters plan to increase premiums by deferring the rate increases and distributing the net loss from the lower premiums across all policy holders after reinstatement of the historically exempt rates. The goal of the deferment scheme is outlined in the following excerpt from the Congressional Budget Office:

> CBO estimates that the surcharges collected under the bill would exceed the costs of reduced premiums over the 2015-2019 period, resulting in a decrease in direct spending of $165 million over that time. Over the subsequent five-year period, additional borrowing (made possible by lower borrowing during the first five years), as well as reduced net income to the program, would increase direct spending by $165 million, resulting in no net effect over the 2015-2024 period.

While FEMA is waiting for the fiscal response from this legislation, the Risk Mapping Assessment and Planning Program (Risk MAP), which was established in 2009 by the Appropriations Committee (FEMA, 2010), is the program responsible for the maintenance of the flood hazard data that drives the NFIP rates. The 2010 Department of Homeland Security Appropriates Act established the Flood Map Modernization Fund, which guaranteed $220,000,000 for the purpose of upgrading the NFIP's nationwide flood mapping to account for more precise hazard boundaries so that policies could be accurately purchased and regulated under the HFIAA. Risk MAP is the institutional mechanism by which FEMA employees and outside consultants (often referred to as Mapping Partners) develop and improve the National

Flood Hazard Layer (NFHL). The NFHL is available to the public in digital form and as displayed in Flood Insurance Rate Maps (FIRMs), and it is the database that contains the flood risk boundaries in effect as of the date shown on the associated FIRM (Oregon Risk MAP, 2014). The process by which new NFHL data and mapping is developed and instituted can be broken in to two parts, Preliminary and Final. The preliminary stage includes several rounds of internal and external review, called the Qualitative Review Process and both the final and preliminary stages involve public comment and appeal periods where the study products are available to members of the public for the purposes of review and comment.

The two primary categories of flood studies are approximate and detailed. Approximate studies used to be the “best practices” approach for FEMA flood studies, but as technology and data progressed over time, new methods were developed that allowed engineers and GIS Specialists to incorporate more accuracy and complexity into flood models and mapping. all that we had for floodplain mapping due to technology and data limitations (FEMA, 2010). Detailed approaches have not yet completely supplanted approximate studies. There are still new approximate studies every year, mostly due to time and cost constraints, and in areas where the hazard risk is considered to be low because there are so few people or historic flood events. The majority of new approximate studies are re-delineations of old studies on new topographic data where the Base Flood Elevations (BFEs) do not need to be replaced by a new study, but more accurate terrain data allows the same BFEs to be expressed as more precise hazard boundary inundation extents. Approximate studies area more tied to ground elevations and only incorporate a basic level of water height, whereas detailed studies include not only the Stillwater elevations but also account for wave height, vegetation, coastal structures and other variables in order to calculate a “detailed” base flooding elevation. To demonstrate the differences between mapping and modeling approaches I created mock approximate modelling and FIRM panels for four panels in Matagorda county. I chose Matagorda county it is located on the coast and because the effective flood hazard mapping for the county went effective in 1992 and 1985 (FEMA, 1992). A new study was created in the late 2000's and preliminary flood risk products were completed as preliminary in September of 2012 but since then it does not appear that those materials have replaced the older products as the new effectives for the county.

Approximate studies do not take as long to complete as detailed studies, mainly due to the lack of complexity and limited inputs. For this project I wanted to find out if a possible solution to Matagorda's missing mapping might be an interim approximate study. I decided to select four FIRM panels (500, 575, 600, and 625; all in a row along a portion of the coast) from Matagorda county's existing DFIRM database and create approximate mapping to fill the panels. To do this I use the 2012 preliminary detailed study and created a mock approximate study in order to compare the results. In theory, if the approximate study is within a reasonable degree of accuracy as contrasted with the detailed study, this might be a workable solution for areas of the country with very outdated flood mapping that are waiting for new effective studies to complete. I chose a hybrid model approach between two common types of approximate studies, contour interpolation and historical high water mark methods. Technically approximate studies do not require base flood elevations, but since I had access to this data (and the work product is academic in nature) I ended up incorporating BFEs to lend a degree of difficulty and a bit of legitimacy to the project's results.

To begin the project, I developed BFEs in HEC-RAS, which is a piece of modeling software developed by the Army Corps of Engineers, borrowing from both the preliminary detailed data and historical high water marks. HEC-RAS is usually only used for riverine flood studies, but since the process was largely experimental and not meant for regulatory purposes, it suited the need of the project to have manually-placed flood elevations to project across a terrain surface. Since the results are Zone A approximate (see table 1 for flood zone designations), the software is largely irrelevant to the final product. Once the BFEs were established in RAS, I exported them to an .sdf file and use an ArcGIS extension called Geo-RAS to convert the .sdf into first an XML file and then a geodatabase using a terrain surface. My initial intention for the terrain surface was to use 140cm coastal LiDAR tiles, released by NOAA in 2006, but after several attempts it became clear that the output data from the LiDAR surface was too dense to be workable. For the final product I opted to create a surface from StratMap Hypso elevation data, provided by the Texas Natural Resources Information System (TNRIS). To do this I started with the stratmap tiles and used the mosaic to new raster tool to develop a surface that was of a size sufficient for the selected FIRM panel footprint, then extracted the BFEs from the .sdf file across the surface. The output was a rough inundation extent for the flood heights along the surface. From that rough output I used stratmap contours and the smooth polygon tool in the ArcGIS cartography toolbox to clean up any noise left over from the terrain surface and manipulate the data into a more refined flood plain. Once the approximate flood extents were completed I made two sets of FIRM panel maps. For both sets I created a modified FEMA FIRM template MXD (ArcMap document format) in the 2013 style format and created a DFIRM geodatabase using the 2013 FIRM XML schema (FEMA, 2017). In order to create the mock FIRMs I loaded one geodatabase with the 2012 preliminary NFHL data and made another geodatabase with the same schema, loaded with the approximate study results, using the simple data loader from ArcCatalog for both. Using the geodatabases and the template map document I set up the annotation layers and symbologies for all of the data, as well as the title block and panel locators, according to the

2016 FIRM technical reference (FEMA, 2017). Lastly, I set up data driven pages for the four selected panels and used page definition queries to ensure that the data and labels shown on each page matched only the target display page and then exported the panels to PDF files (see figures at the end of report). Even before the mock FIRMs and preliminary FIRMs were complete it was clear that the approximate study data was not going to be sufficient to supplant the detailed preliminary mapping. Approximate mapping was not able to account for velocity calculations so I decided to retain the VE zones on both FIRMs to increase the hazard boundary accuracy along the immediate coastline, mostly to compensate for inaccuracies in the terrain data. The most important takeaway from this work is that if a homeowner had to use either the detailed or the approximate study results to determine their flood hazard risk, even though both studies used almost exactly the same BFEs as inputs, the accuracy and consistency is greatly lacking in the approximate FIRM panels. The approximate approach requires several assumptions on the part of the modeler, but also because the coastal velocity zones simply cannot be captured by approximate methods.

In conclusion, although it is unfortunate that there are so many sections of the country that are still without current effective flood hazard coverage, approximate methods cannot replace a detailed study. The ongoing struggle of the NFIP and the Risk MAP program is to strike a balance between outdated flood mapping and potentially inaccurate new studies. Neither are helpful to the communities served by the program, which means that for most cases it is worth the wait for detailed studies to go through the proper channels for completion, despite the delay. Some might see aspects of the Risk MAP process, such as the Qualitative Review process or the several appeal periods and meetings as unnecessary bureaucracy. Over 5,000,000 American homes are insured through the NFIP (Witkowski, 2017) which means that at the very least it is important to have accurate flood hazard mapping for financial reasons, and in more extreme cases the accuracy of a flood map could make a very significant difference in times of catastrophic loss.

Works Cited

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Federal Emergency Management Agency. "Risk Mapping, Assessment and Planning (Risk MAP)." Risk Mapping, Assessment and Planning (Risk MAP) | FEMA.Gov, Federal Emergency Management Agency, www.fema.gov/risk-mapping-assessment-and-planning-risk-map.

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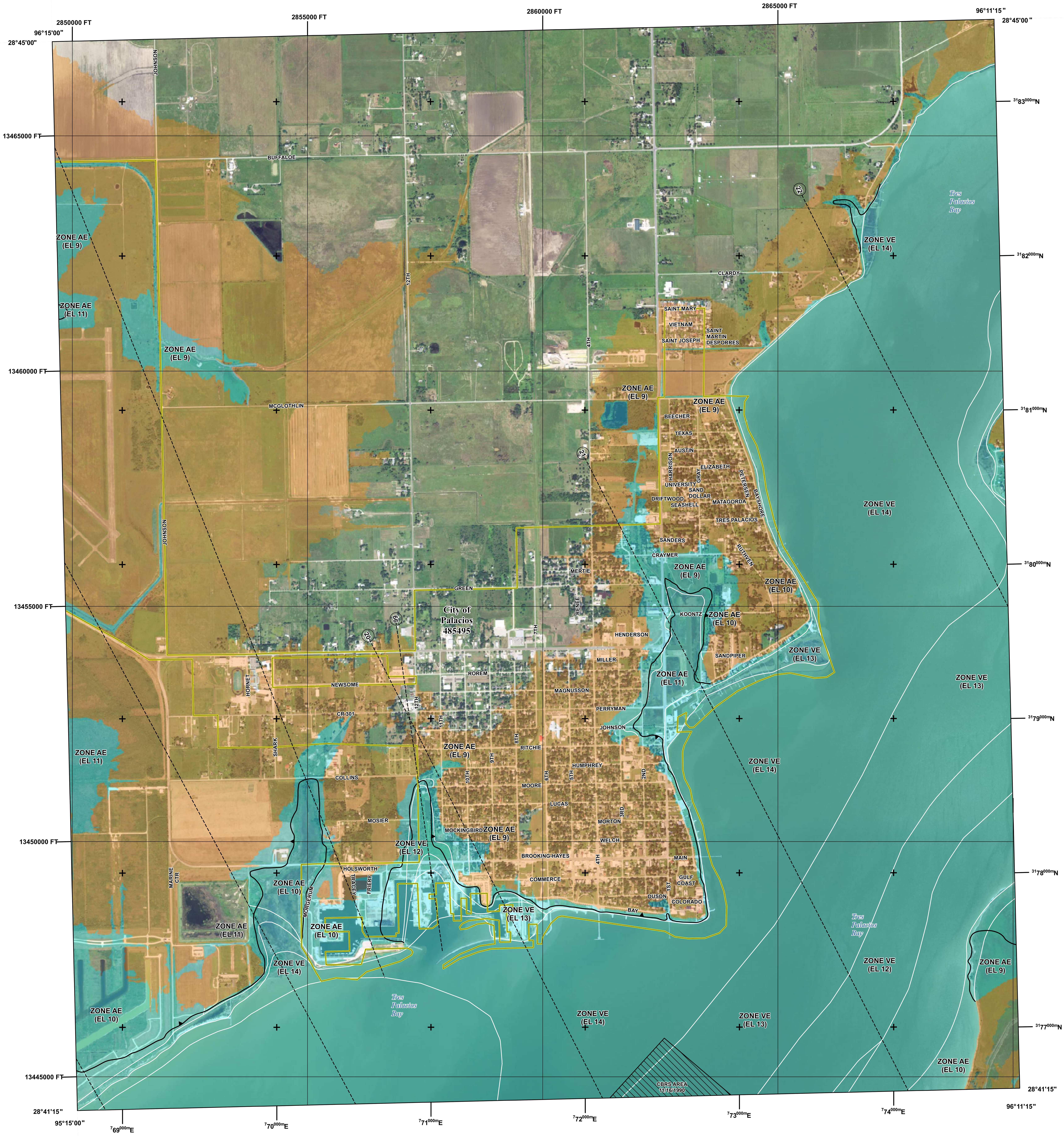
Witkowski, Rachel, and Leslie Scism. "Hurricane Harvey Threatens Largest Flood Insurer: The Government." *The Wall Street Journal*, Dow Jones & Company, 26 Aug. 2017, www.wsj.com/articles/hurricane-harvey-threatens-largest-flood-insurer-1503771686.

Data Sources

Terrain: https://tnris.org/, https://coast.noaa.gov/dataviewer/

Preliminary DFIRM: https://msc.fema.gov/portal/

THE FOLLOWING PAGES CONTAIN PDF EXPORTS OF DRAFT FIRM PANELS DISPLAYING THE 2012 PRELIMINARY FLOOD STUDY NFHL DATA FOR PANELS 48321C0555F, 48321C0575F, 48321C0600F AND 48321C0625F



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

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

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	E 18.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

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Basemap information shown on this FIRM UPDATE.

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

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Limit of Moderate Wave Action (LiMWA)

COASTAL BARRIER RESOURCES SYSTEM (CBRS)

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CBRS Area

Otherwise Protected Area

SCALE

N

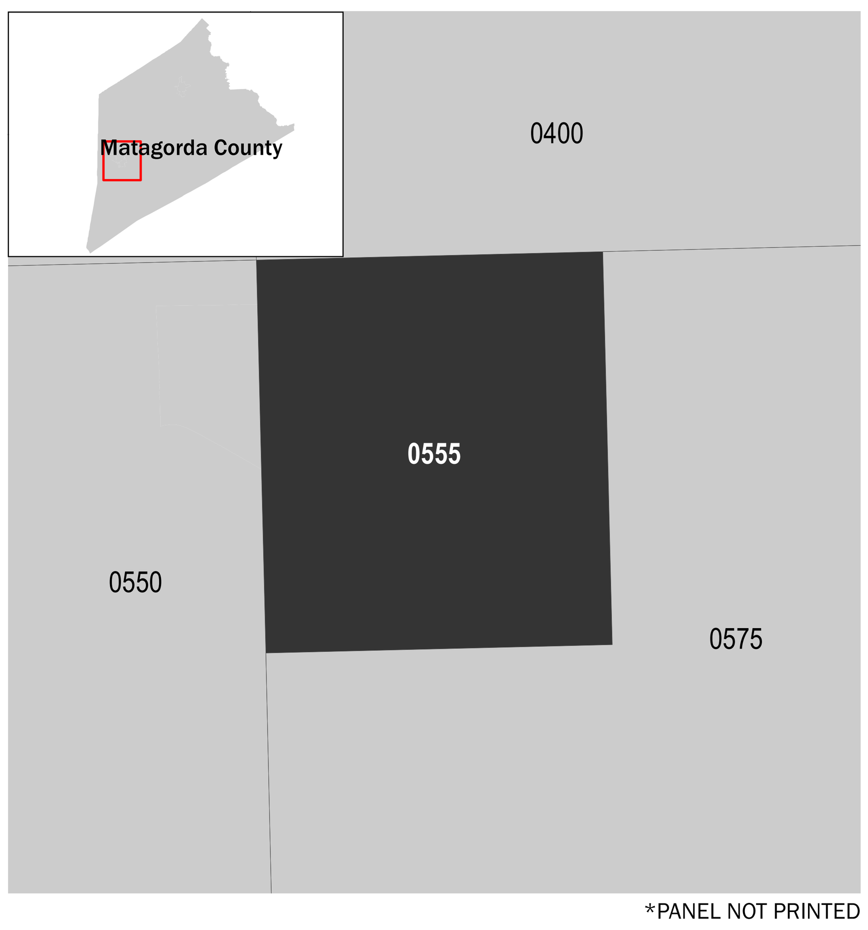
Map Projection:
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet;
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 1,000 feet **1:12,000**

0 1,000 2,000 4,000 Feet

0 250 500 1,000 Meters

PANEL LOCATOR



*PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MATAGORDA COUNTY, TEXAS
0

PANEL **555** OF **850**

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
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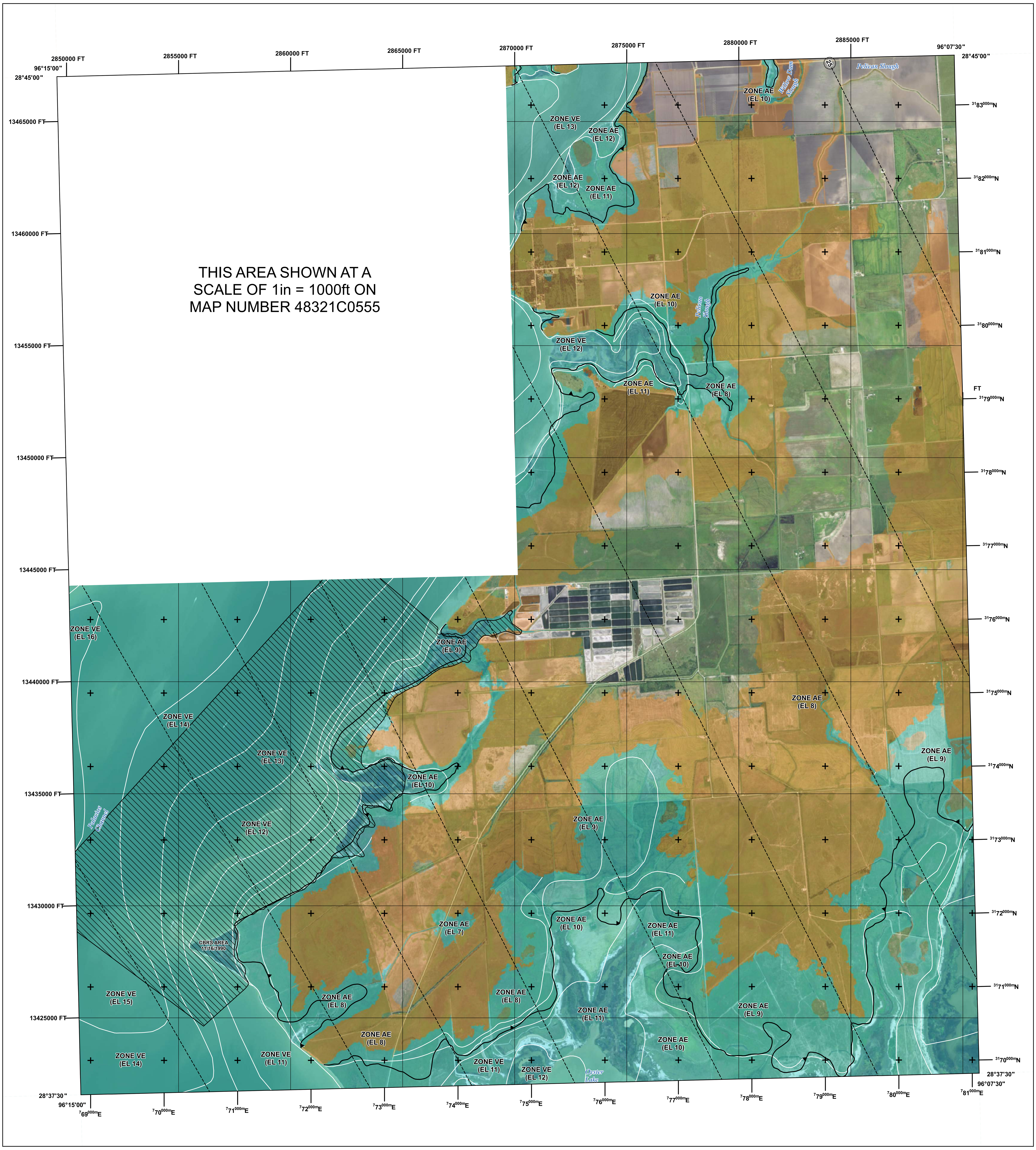
VERSION NUMBER
2.3.3.2

MAP NUMBER
48321C0555F

MAP REVISED
9/9/9999



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GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
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	E 18.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	Coastal Transect Baseline
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	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
OTHER FEATURES	Limit of Study
	Jurisdiction Boundary

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CBRS Area

Otherwise Protected Area

SCALE

N

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0 2,050 4,100 8,200 Feet

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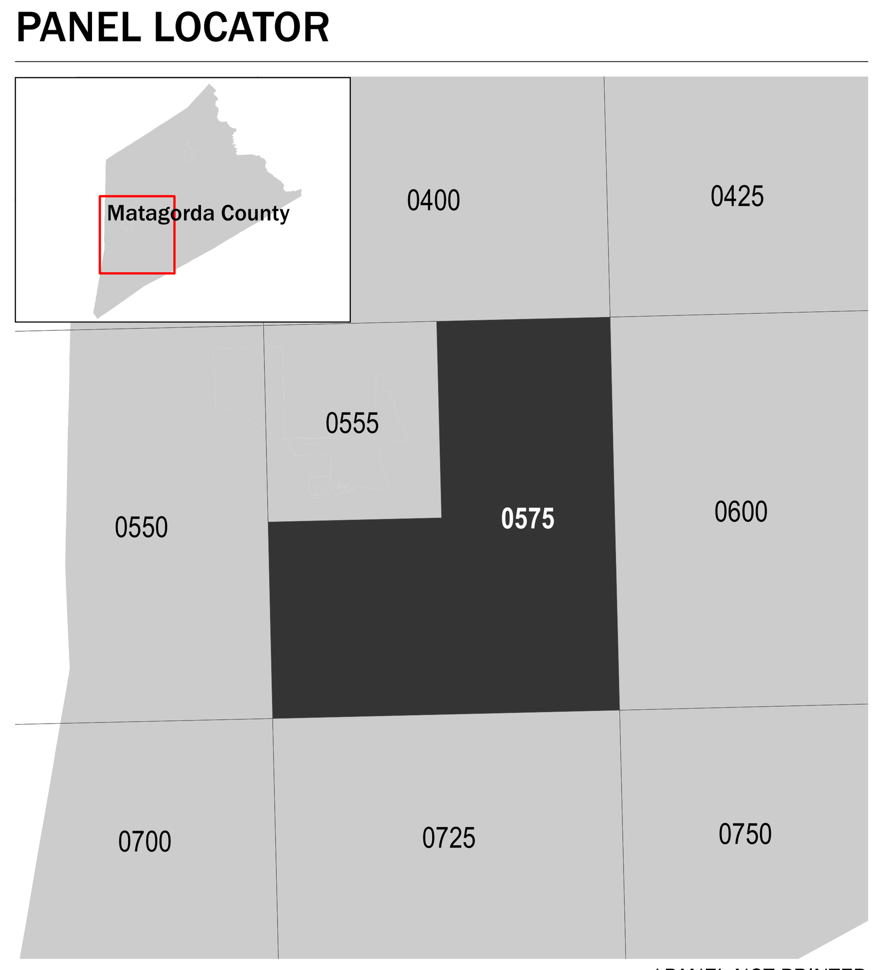
PANEL LOCATOR



*PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MATAGORDA COUNTY, TEXAS

O

PANEL **575** OF **850**

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
Community	Number	0575	F
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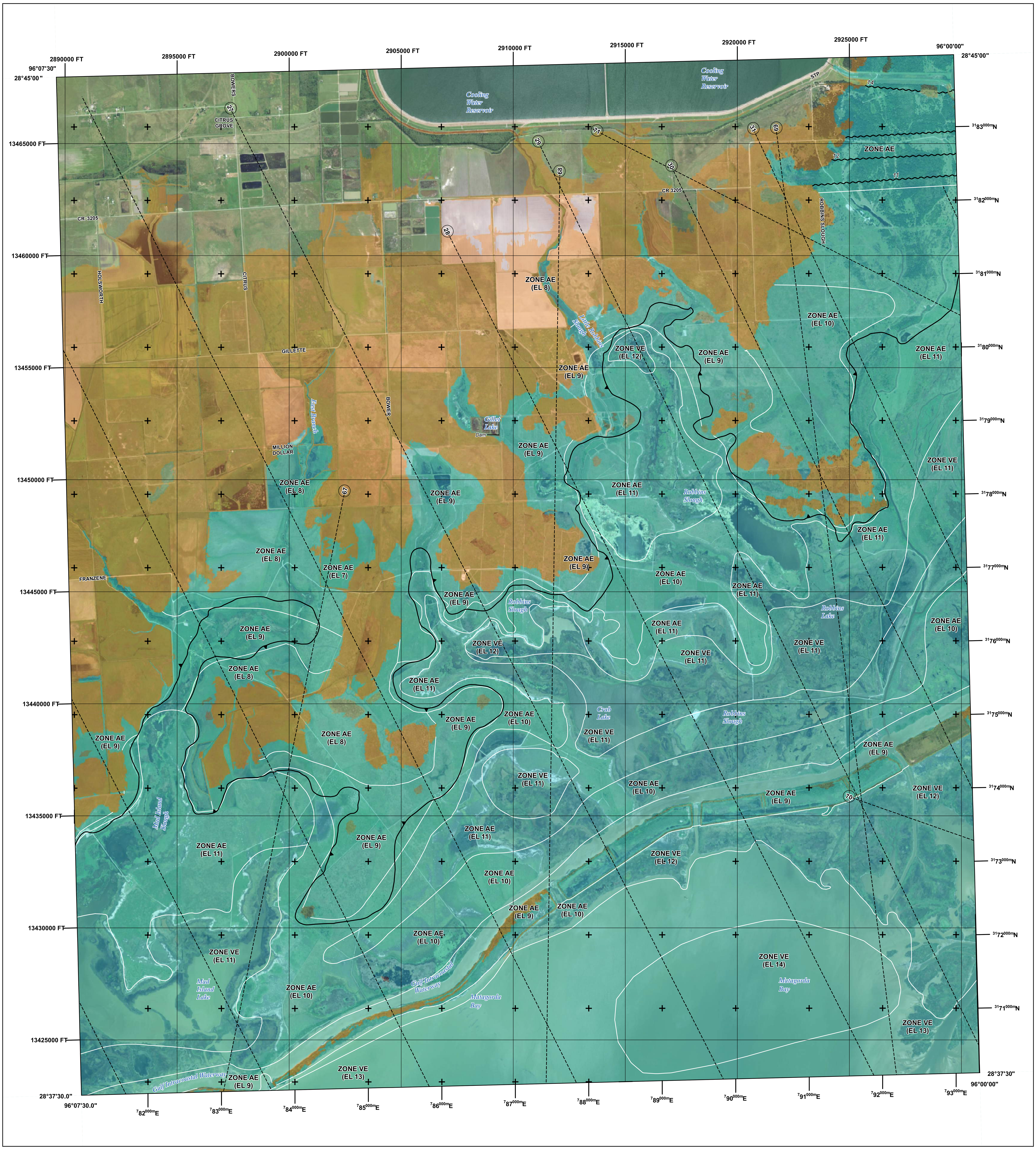

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SCALE

N

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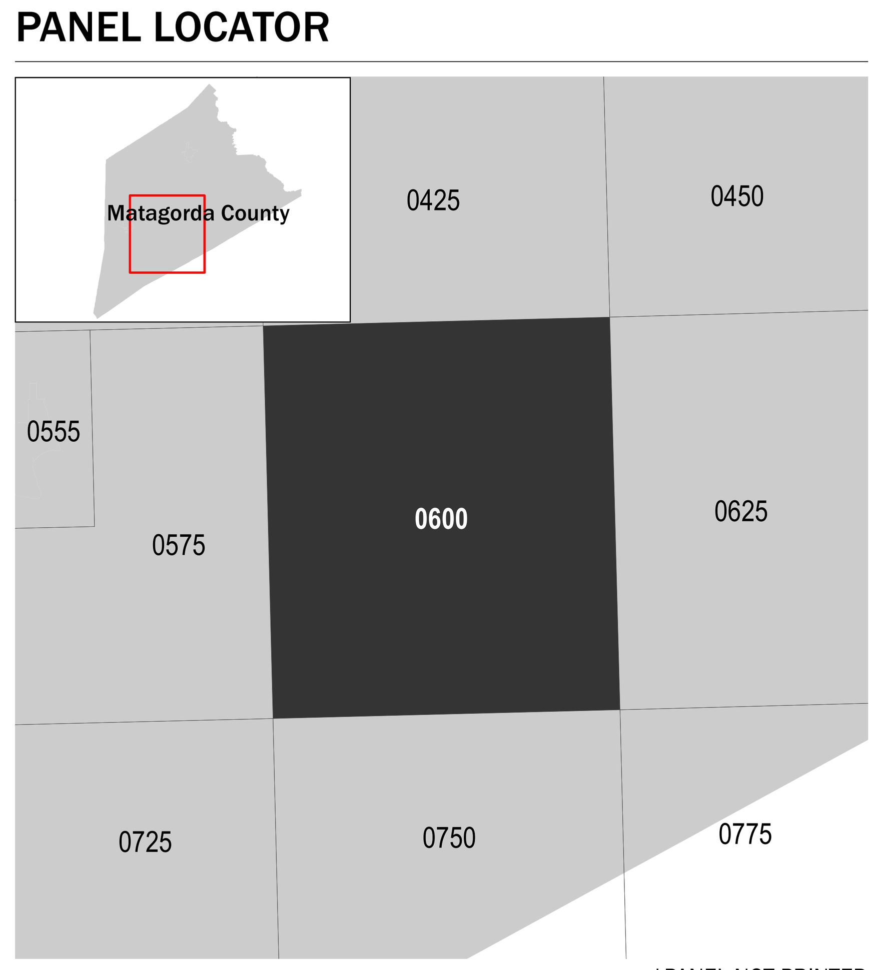
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet;
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 2,000 feet   1:24,000

0 2,050 4,100 8,200 Feet

0 500 1,000 2,000 Meters

PANEL LOCATOR



*PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MATAGORDA COUNTY, TEXAS

0

PANEL 600 OF 850

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
Community	Number	0600	F
Community	Number	0600	F
Community	Number	0600	F
Community	Number	0600	F
Community	Number	0600	F
Community	Number	0600	F
Community	Number	0600	F
Community	Number	0600	F

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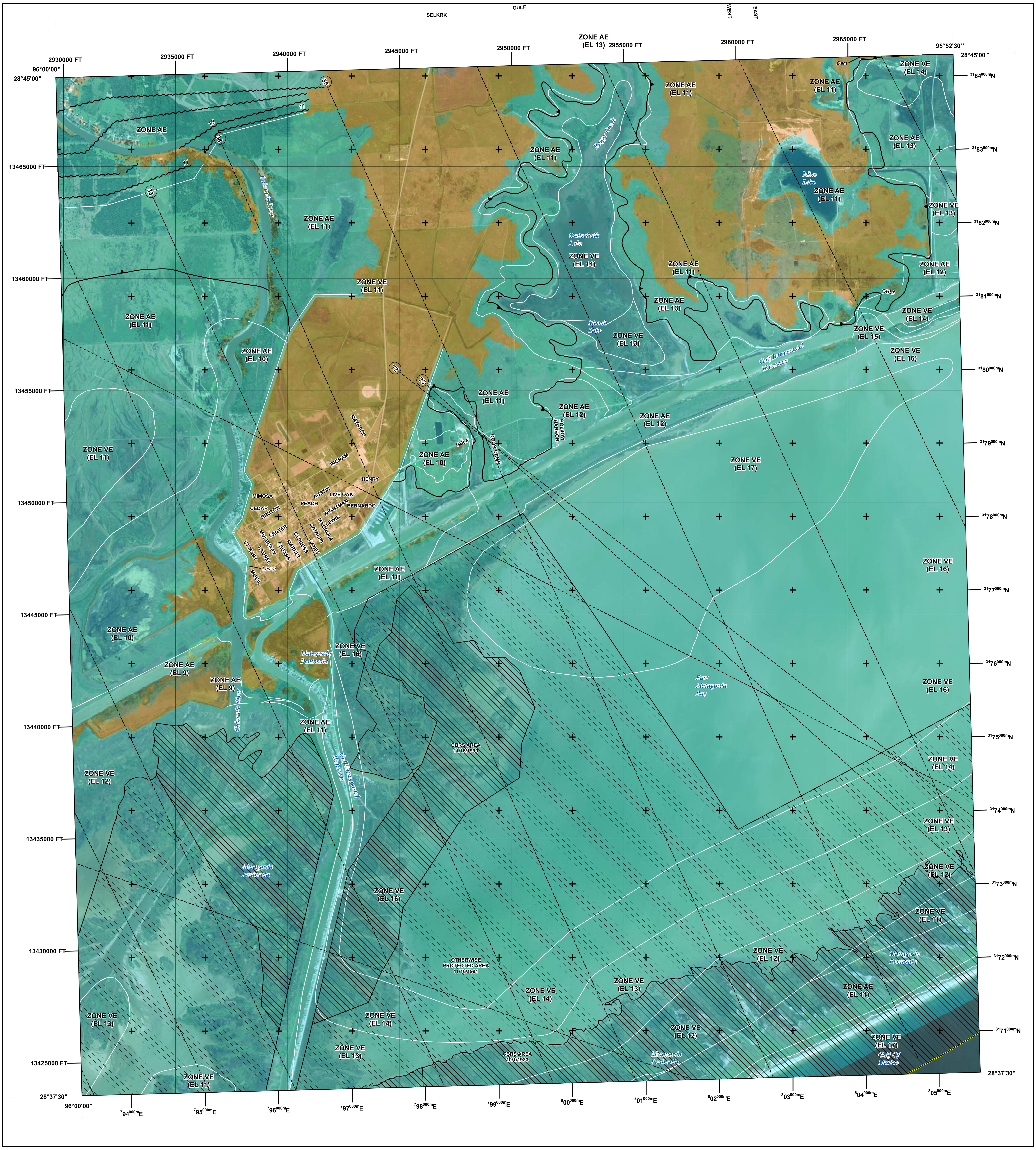
VERSION NUMBER
2.3.3.2

MAP NUMBER
48321C0600F

MAP REVISED
9/9/9999



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

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

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99*
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	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
OTHER FEATURES	Limit of Study
	Jurisdiction Boundary

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CBRS Area

Otherwise Protected Area

SCALE

N

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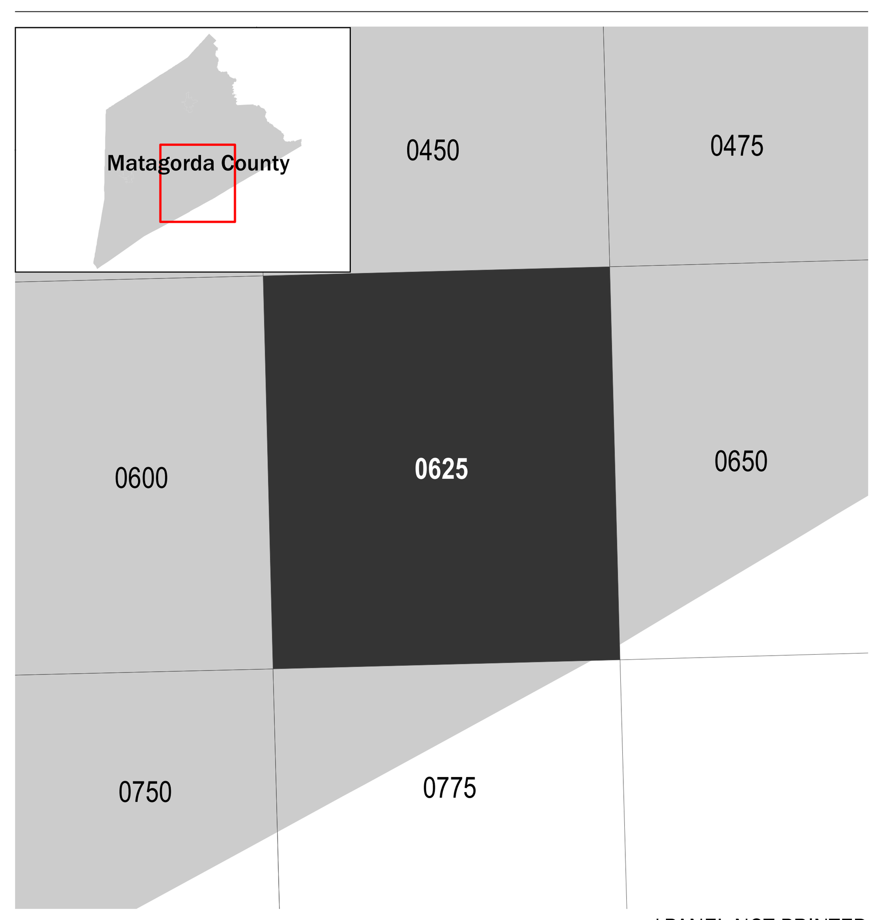

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FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MATAGORDA COUNTY, TEXAS

0

PANEL 625 OF 850

FEMA

Panel Contains:

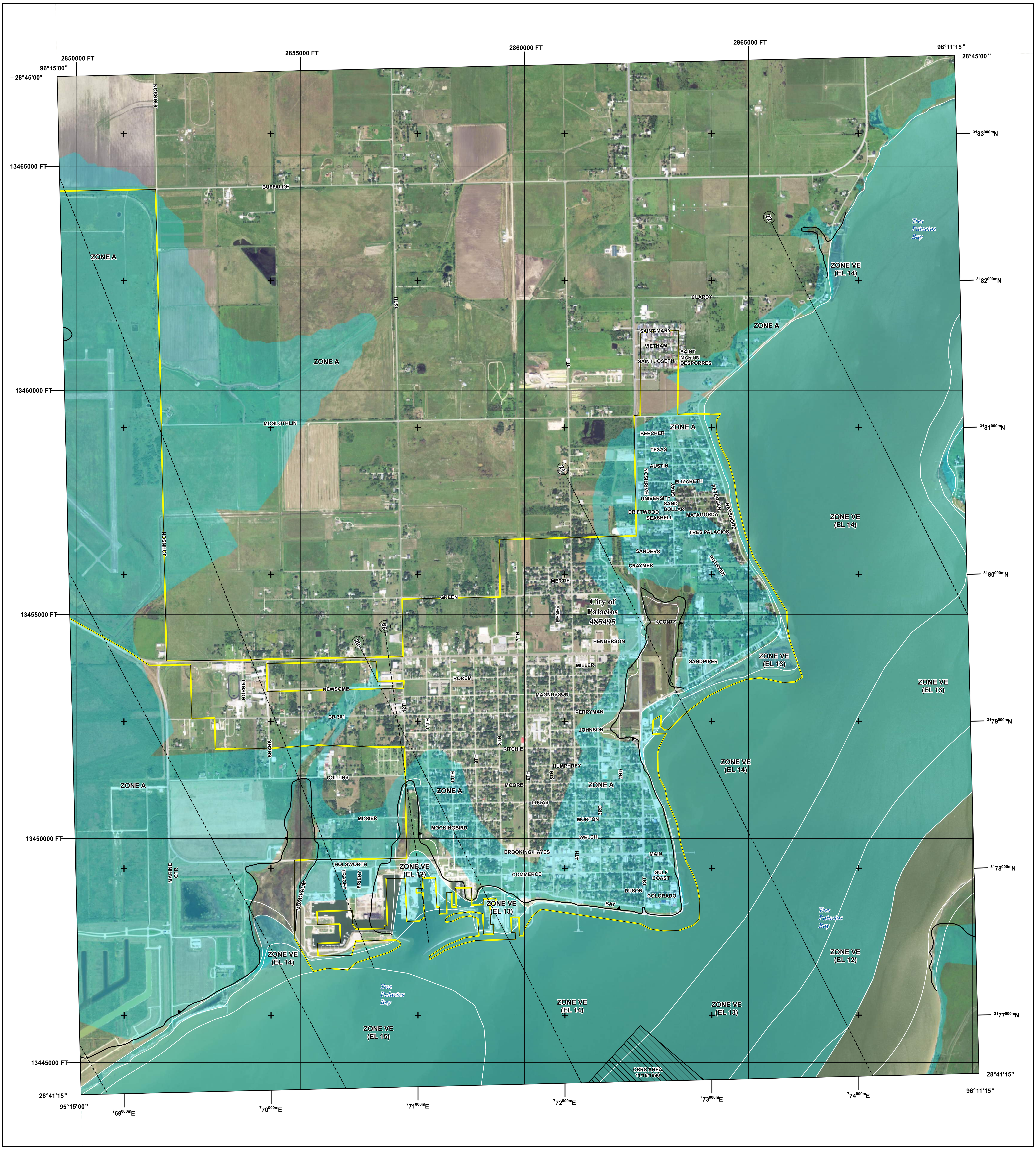
COMMUNITY	NUMBER	PANEL	SUFFIX
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F

VERSION NUMBER
2.3.3.2

MAP NUMBER
48321C0625F

MAP REVISED
9/9/9999

THE FOLLOWING PAGES CONTAIN PDF EXPORTS OF DRAFT FIRM PANELS DISPLAYING THE MOCK APPROXIMATE FLOOD STUDY RESULTS FOR PANELS 48321C0555F, 48321C0575F, 48321C0600F AND 48321C0625F



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	Limit of Study
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CBRS Area

Otherwise Protected Area

SCALE

N

Map Projection:
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Western Hemisphere; Vertical Datum: NAVD 88

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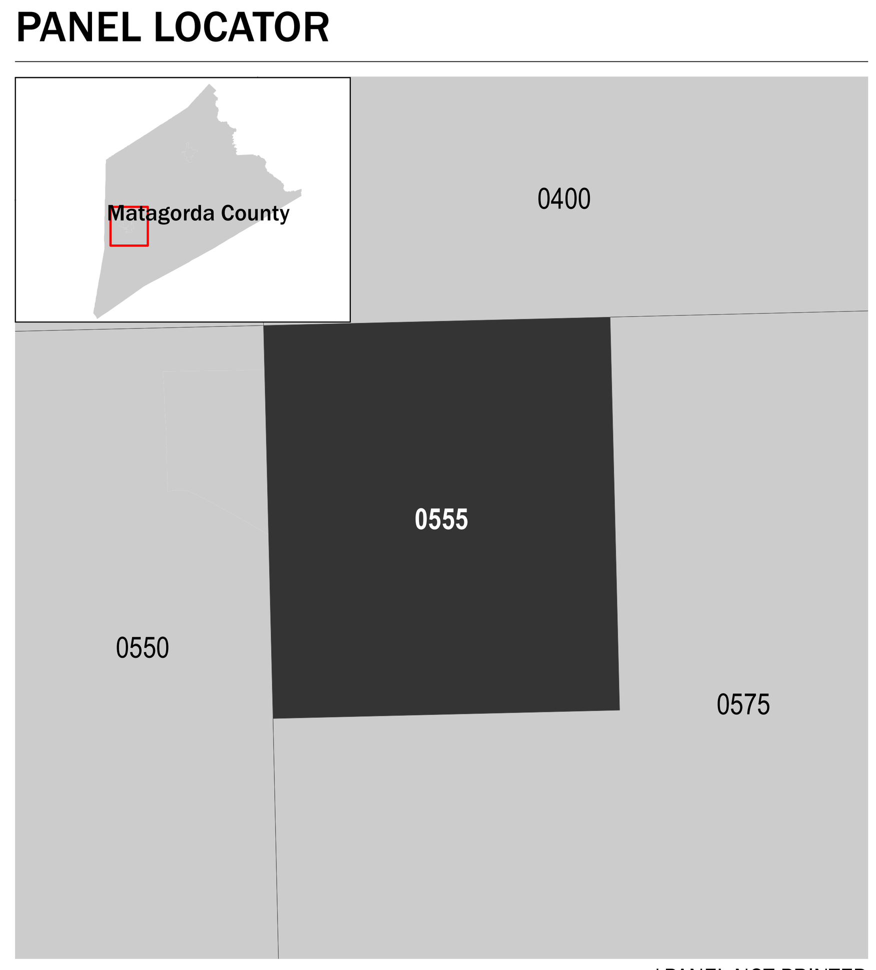
0 1,000 2,000 4,000 Feet

0 250 500 1,000 Meters

PANEL LOCATOR



*PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MATAGORDA COUNTY, TEXAS

O

PANEL **555** OF **850**

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F
Community	Number	0555	F

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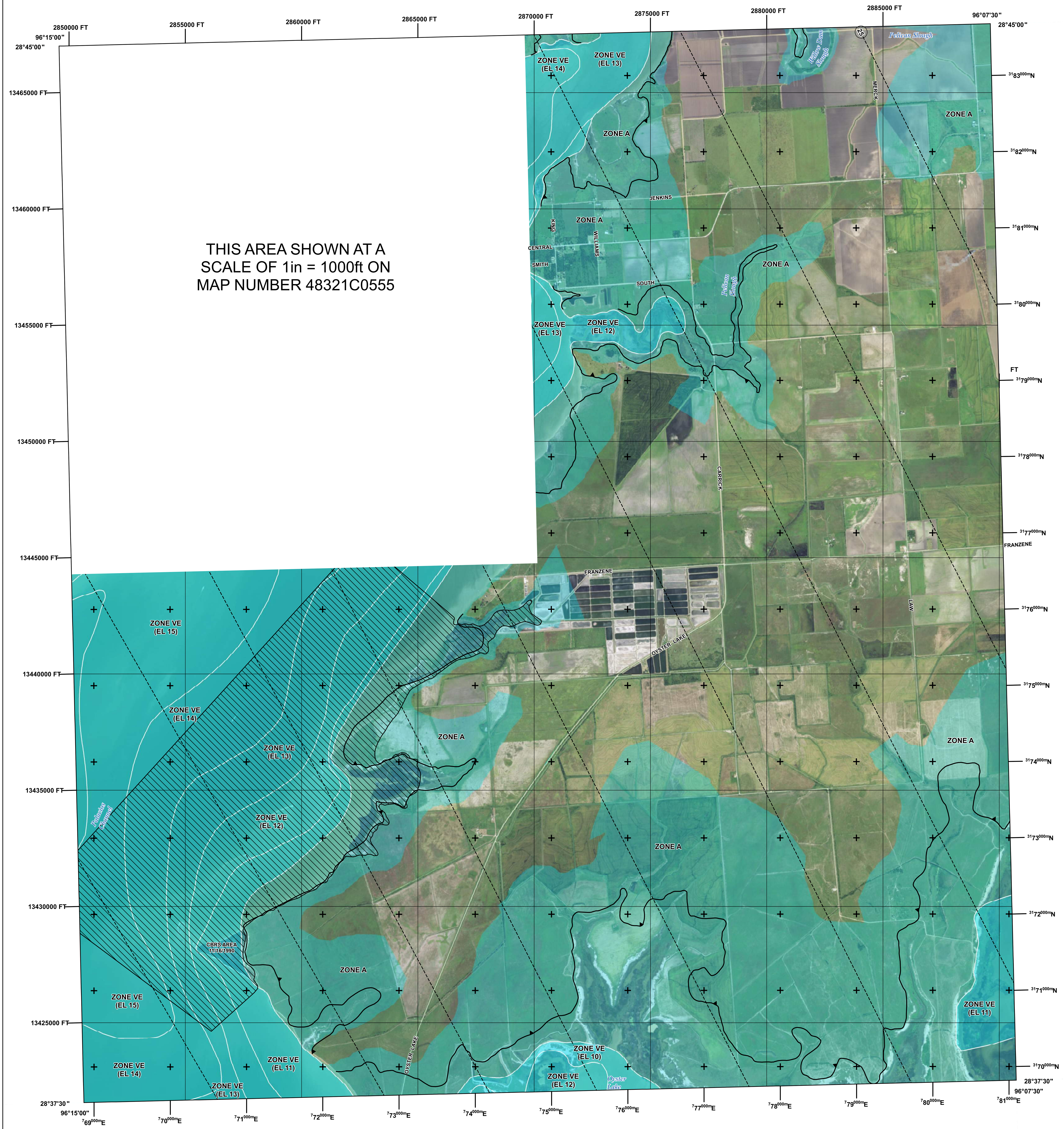
MAP NUMBER
48321C0555F

MAP REVISED
9/9/9999



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	Limit of Study
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CBRS Area

Otherwise Protected Area

SCALE

N

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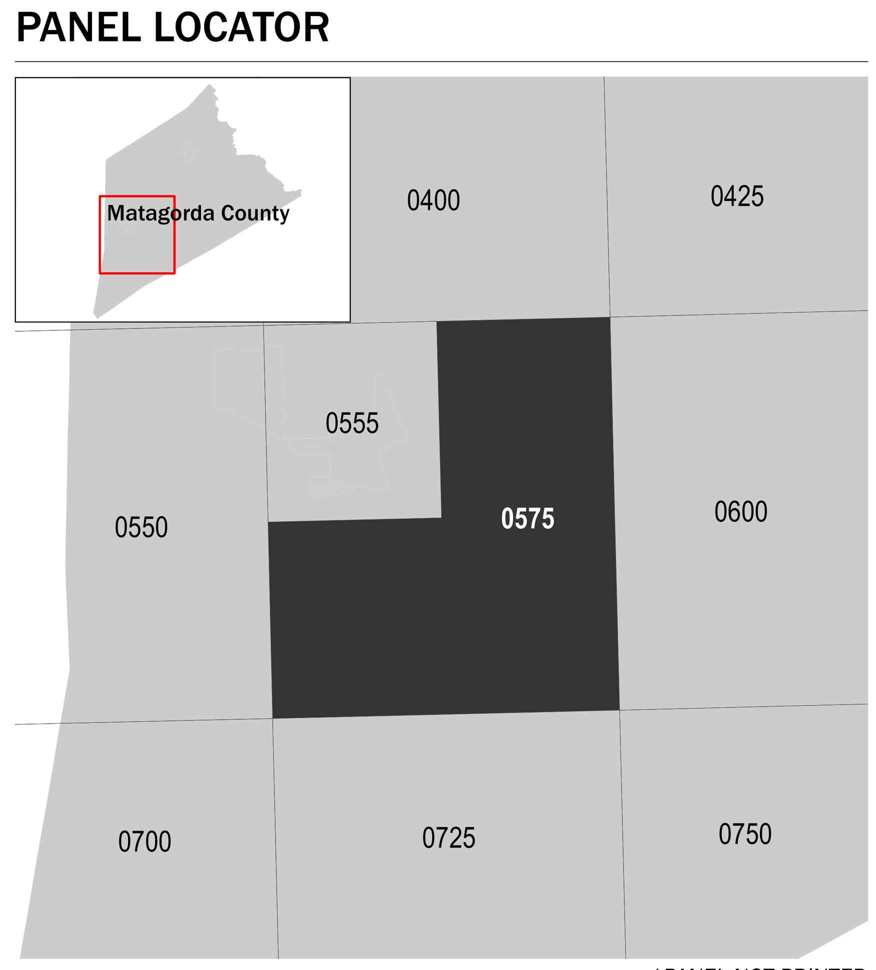
PANEL LOCATOR



*PANEL NOT PRINTED

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MATAGORDA COUNTY, TEXAS

0

PANEL **575** OF **850**

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
Community	Number	0575	F
Community	Number	0575	F
Community	Number	0575	F
Community	Number	0575	F
Community	Number	0575	F
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VERSION NUMBER
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MAP NUMBER
48321C0575F

MAP REVISED
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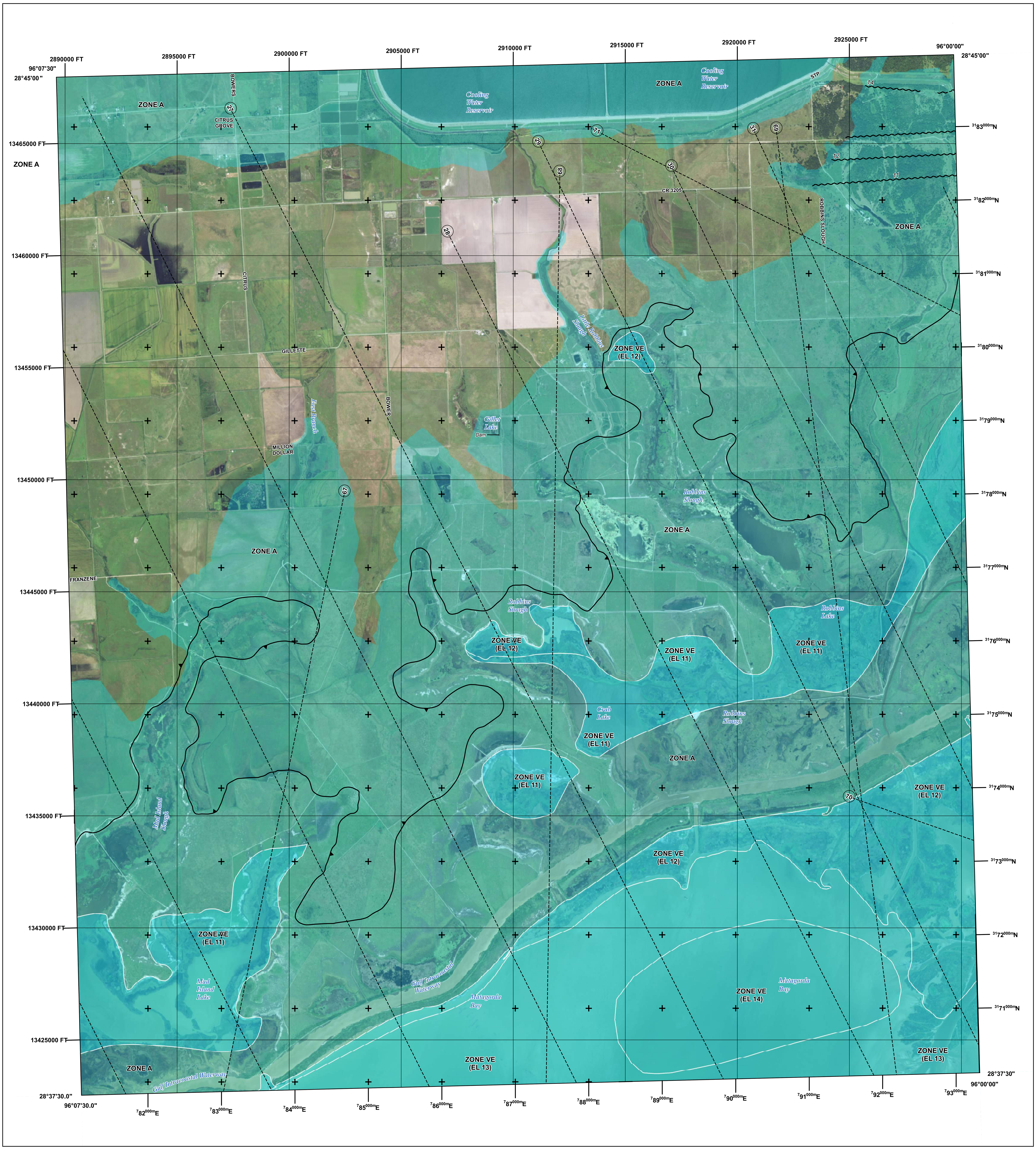

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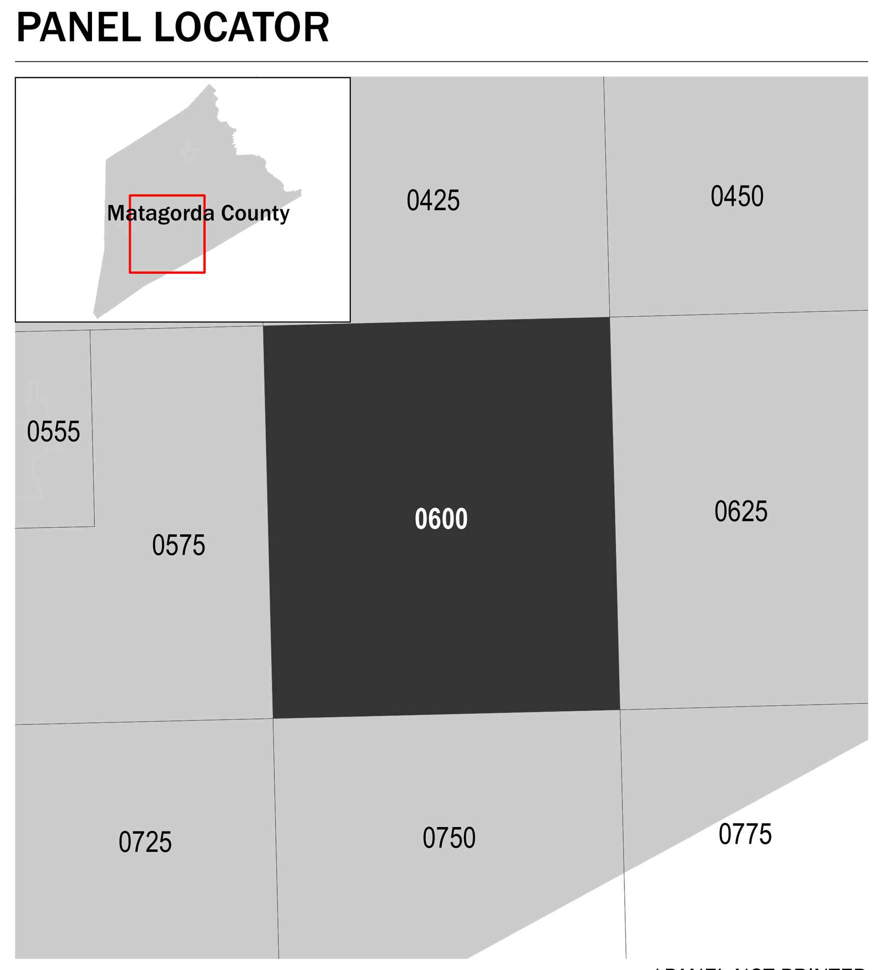

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National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MATAGORDA COUNTY, TEXAS
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PANEL **600** OF **850**

FEMA

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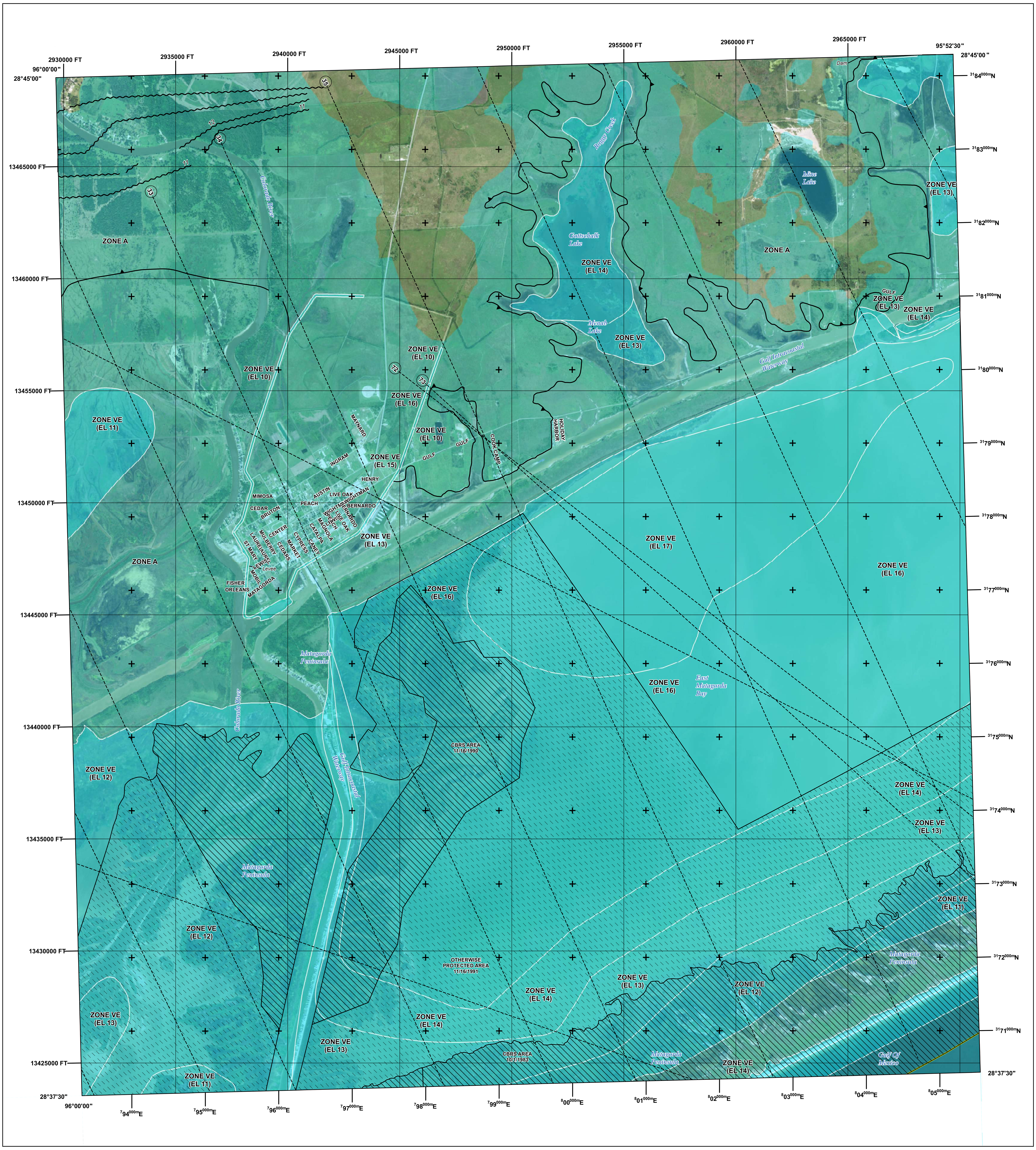

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NOTES TO USERS

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

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

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

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

Basemap information shown on this FIRM UPDATE.

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

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

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

Limit of Moderate Wave Action (LiMWA)

COASTAL BARRIER RESOURCES SYSTEM (CBRS)

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

CBRS Area

Otherwise Protected Area

SCALE

N

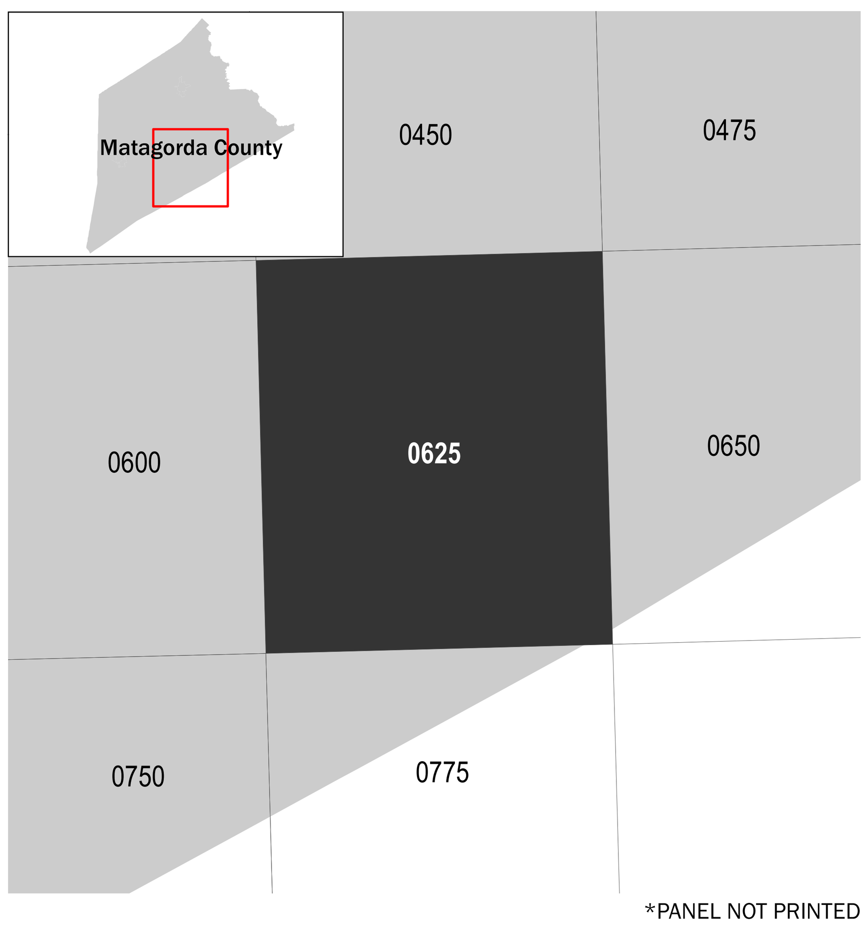
Map Projection:
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet;
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 2,000 feet — 1:24,000

0 — 2,050 — 4,100 — 8,200 Feet

0 — 500 — 1,000 — 2,000 Meters

PANEL LOCATOR



FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MATAGORDA COUNTY, TEXAS

O

PANEL **625** OF **850**

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F
Community	Number	0625	F

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NOT FOR REPRODUCTION

VERSION NUMBER
2.3.3.2

MAP NUMBER
48321C0625F

MAP REVISED
9/9/9999

Additional References:

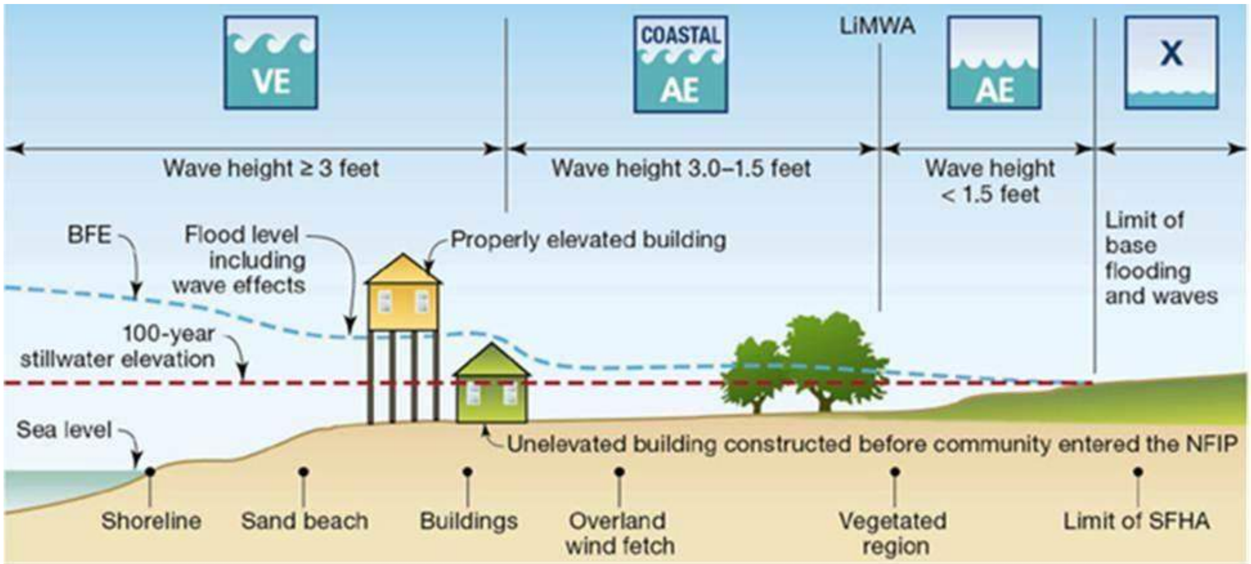

Figure 1 Coastal detailed flood study example cross section graphic, taken from https://gopremierone.com/flood-zone-designations/

Table 1: Flood Zone Designations

Table 1 Source: http://www.floodadvocate.com/fema-zone-definitions/

ZONE	DESCRIPTION
	Special Flood Hazard Areas – High Risk
A	Areas subject to inundation by the 1-percent-annual-chance flood event. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.
AE, A1-A30	Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. BFEs are shown within these zones. (Zone AE is used on new and revised maps in place of Zones A1–A30.)
AH	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are 1–3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone.
AO	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are 1–3 feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone.
AR	Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection.

A99	Areas subject to inundation by the 1-percent-annual-chance flood event, but which will ultimately be protected upon completion of an under-construction Federal flood protection system. These are areas of special flood hazard where enough progress has been made on the construction of a protection system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes. Zone A99 may be used only when the flood protection system has reached specified statutory progress toward completion. No BFEs or flood depths are shown.

Coastal High Hazard Risk Zones

V	Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves. Because detailed coastal analyses have not been performed, no BFEs or flood depths are shown.
VE, V1-V30	Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. BFEs derived from detailed hydraulic coastal analyses are shown within these zones. (Zone VE is used on new and revised maps in place of Zones V1–V30.)