**ORDINANCE NO. 2022-O-31**

**AN ORDINANCE OF THE CITY OF MANVEL, TEXAS, AMENDING CHAPTER 50. *PLANNING AND DEVELOPMENT*, ARTICLE III. *COMPREHENSIVE PLAN*, BY AMENDING SECTION 50-53. *MASTER DRAINAGE PLAN* APPROVING THE UPDATE TO THE CITY'S MASTER DRAINAGE PLAN; PROVIDING FOR CONFORMITY OF ALL DRAINAGE REGULATIONS TO THE 2022 MASTER DRAINAGE PLAN; PROVIDING A PENALTY IN AN AMOUNT NOT TO EXCEED $2,000.00 PER DAY FOR EACH DAY OF VIOLATION OF ANY PROVISION HEREOF; AND PROVIDING FOR SEVERABILITY; AND PROVIDING A SEVERANCE CLAUSE AND EFFECTIVE DATE.**

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**WHEREAS**, the City of Manvel commissioned Lentz Engineering with the task of updating the 2015 Master Drainage Plan for the city; and

**WHEREAS**, the new update to the Master Drainage Plan prepared by Lentz is now in final format and has been presented to the City for adoption; and

**WHEREAS**, the 2015 Master Drainage Plan, as updated by the 2022 Master Drainage Plan Update (dated July 29, 2022), shall be known as the 2022 Master Drainage Plan; and

**WHEREAS**, the City Council hereby adopts the new updated 2022 Master Drainage Plan into Chapter 50 of The City Code as a plan and policy for the city; **now, therefore,**

**BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MANVEL, TEXAS:**

**Section 1.** The 2022 Master Drainage Plan Update (dated July 29, 2022), is hereby approved. The 2015 Master Drainage Plan, as updated by the 2022 Master Drainage Plan Update (dated July 29, 2022), shall be known as the "2022 Master Drainage Plan."

**Section 2.** Chapter 50 of the Code of Ordinances of the City of Manvel is hereby amended by amending section 50-53 in Article III to read and provide as follows:

"**CHAPTER 50. PLANNING AND DEVELOPMENT**

. . .

**ARTICLE III. COMPREHENSIVE PLAN**

. . .

**Sec. 50-53. Master drainage plan.**

(a) Pursuant to the authority contained in section 213.004 of the Texas Local Government Code, the city council hereby adopts the [~~2015~~] 2022 Master Drainage Plan ("Master Drainage Plan"), a true and correct copy of which shall remain on file in the office of the city secretary. The Master Drainage Plan shall be the plan and policy for drainage matters within the city and, to the extent permitted by law, the extra-territorial jurisdiction of the City of Manvel.

(b) All drainage and related regulations and requirements of The City Code, including, but not limited to, Chapter 32. *Flood Damage Prevention* and Chapter 62. *Subdivisions* shall conform to the Master Drainage Plan. If there is any conflict between an ordinance, rule or regulation of The City Code and the Master Drainage Plan, the Master Drainage Plan shall control."

**Section 3.** **Penalty**. Any person who shall intentionally, knowingly, recklessly, or with criminal negligence violate any provision of this chapter shall be deemed guilty of a misdemeanor and, upon conviction, shall be fined in an amount not to exceed $2,000.00. Each day of violation shall constitute a separate offense.

**Section 4.** **Repealer**. All ordinances or parts of ordinances inconsistent or in conflict herewith, are, to the extent of such inconsistency or conflict, hereby repealed.

**Section 5.** **Severability**. In the event any clause, phrase, provision, sentence, or part of this Ordinance or the application of the same to any person or circumstance shall for any

reason be adjudged invalid or held unconstitutional by a court of competent jurisdiction, it shall not affect, impair, or invalidate this Ordinance as a whole or any part or provision hereof other than the part declared to be invalid or unconstitutional; and the City Council of the City of Manvel, Texas, declares that it would have passed each and every part of the same notwithstanding the omission of any such part thus declared to be invalid or unconstitutional, whether there be one or more parts.

PASSED AND APPROVED on first reading this 7 day of November, 2022.

PASSED, APPROVED, AND ADOPTED on second and final reading this November 21, 2022.

CITY OF MANVEL CORPORATE SEAL

Debra Davison, Mayor

Attest:

Tammy Bell, City Secretary

APPROVED AS TO FORM:

Robert Gervais, City Attorney

# *Brazoria County Conservation and Reclamation District No. Three*

**P.O. Box 789**
**ALVIN, TEXAS 77512-0789**

**BOARD OF COMMISSIONERS**
**RICKY KUBECZKA, Place #1**
**ALFRED FROBERG, Place #2**
**JODY SCHIBI, Place #3**

**FAX 281-331-6761**
**TELEPHONE 281-331-3433**
**1318 ROSHARON ROAD**

To: City Of Manvel
From: Richard Mclaren
Date: September 7, 2022
Subject: (LONO) Updated Master Drainage Plan (July 29, 2022)

The Brazoria County Conservation Reclamation District # 3 (BCCRD#3) has reviewed the updated Master Drainage Plan of the City Of Manvel, prepared by Lentz Engineering. This drainage report is served as an update of the 2014 Klotz MDP to reflect changes of drainage, new floodplain data, and developments within the City Of Manvel.

BCCRD#3 does not have any objections to the Drainage Plan update of The City Of Manvel.

Please note that any changes made within BCCRD#3 facilities or drainage easements will need to be reviewed by our District Engineer and approved by our board of commissioners before the work takes place.

Richard McLaren

Thank You,
Richard Mclaren
General Manager
Brazoria County Conservation & Reclamation District #3

# MASTER DRAINAGE PLAN UPDATE

**City of Manvel, Texas**

July 29, 2022


**Prepared by:**

**Lentz Engineering, LLC**
**11511 N. Garden**
**Houston, Texas 77071**
**(713) 839-8900**
**Firm # F-001378**


STATE OF TEXAS
JARROD D. ADEN
92955
LICENSED
PROFESSIONAL ENGINEER
7/29/22

## Executive Summary

Lentz Engineering, LLC (Lentz) was retained by the City of Manvel (Manvel) to provide an update to the City of Manvel's Master Drainage Plan (MDP) prepared by Klotz Associates (Klotz) in 2014. Unlike the Klotz MDP the scope of our services did not include hydrologic and hydraulic modeling and a high level of analysis. The purpose of this MDP addendum is to document changes of drainage significance which have occurred in the last several years and to identify some possible additional projects which provide opportunities for the City of Manvel to further improve drainage within their jurisdiction.

This update will make various references to the previous Klotz MDP which may include specific page numbers, exhibits, etc used in that previous report. For this reason, reviewers of this MDP update are encouraged to have a copy of the previous Klotz MDP available for reference.

# Section 1 Introduction

## Authorization

The City of Manvel (Manvel) authorized Lentz Engineering, LLC (Lentz) to complete this Master Drainage Plan (MDP) addendum in a professional services agreement between Manvel and Lentz.

## Purpose

This high level study is intended to provide the City of Manvel with information regarding drainage changes of significance within Manvel, overview of new floodplain data, opportunities for improving drainage, and examples of possible projects. Based upon the relatively short length of time since the 2014 Klotz MDP was completed, only a broad, high level of analysis was deemed necessary for this effort.

The description of drainage changes within Manvel are meant to be general nature for the purpose of documenting the major areas of development within Manvel. Because all of the major areas of development were designed and built to be in strict conformance with City of Manvel Design Criteria Manual requirements, it is unnecessary to provide a detailed level of analysis here.

On December 30, 2020, new Flood Insurance Rate Maps (FIRMs) became effective for the City of Manvel. Those new maps will be provided and discussed here for the purpose of identifying the City's most flood prone areas and in the hopes of providing insight for future drainage improvement and flood reduction projects.

In addition to reviewing the previous 2014 Klotz MDP and the list of potential drainage improvement and flood reduction projects identified in that report, Our team has obtained feedback and first hand accounts from City Staff and Manvel citizens for the purpose of getting further insight into drainage pain points and possible projects within Manvel.

## Location

As stated in Section 1.4 and shown in Figure 1 of the Klotz MDP, the City of Manvel's ETJ is positioned as the north end of Brazoria County. Although the City's ETJ may have changed and may continue to change in the future, these changes do not generally introduce new watersheds and waterways into the City's jurisdiction.

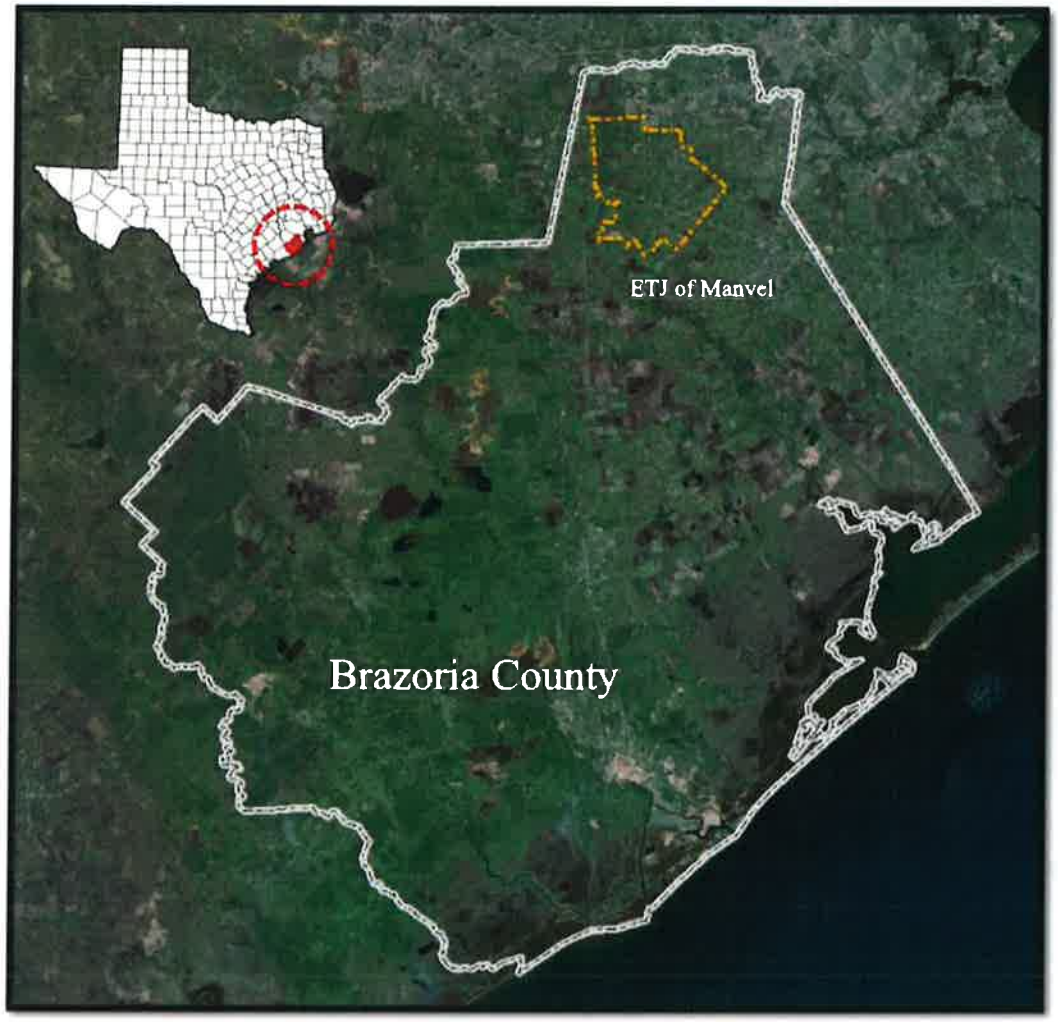



**Figure 1: Vicinity Map**



11511 N. Garden • Houston, Texas 77071 • Phone: (713) 839-8900 • Fax (713) 839-9020 • .www.lentzengineering.net
TBPE Registration No. F-1378

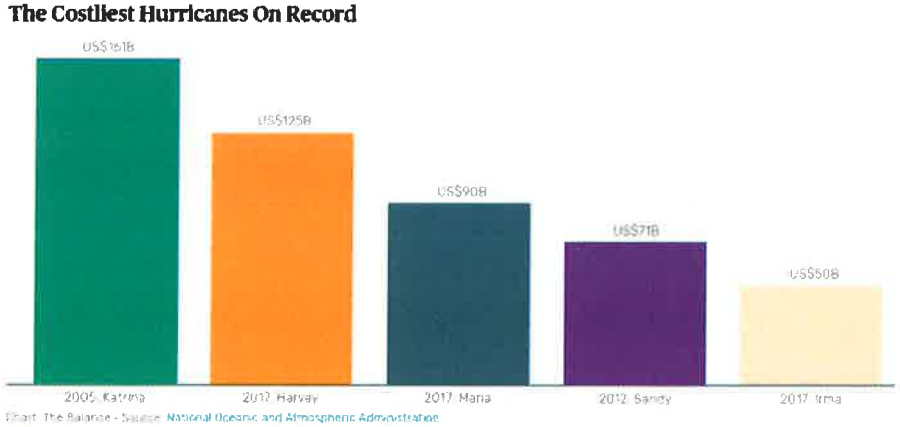
## Section 2 City of Manvel

### Drainage Overview

Section 2.1 of the Klotz MDP provides an overview of drainage within the City which includes discussions about the clayey and loamy soils throughout the City which generally have low infiltration or more plainly low capacity for absorption of rainfall into the ground. Additionally, Klotz mentions the high humidity, subtropical climate, and the annual average rainfall of 48 inches per year.

Based upon our review of data available online, the latest information shows that the City of Manvel has an average annual rainfall of 54 inches annually compared to the national average of 38 inches per year. Our research further found that the City of Manvel experiences some degree of rain, snow, sleet, or hail on an average of 102 days per year.

Klotz further mentions in the 2014 MDP that Manvel like many other areas in the Gulf Coast region is prone to experiencing Hurricanes. In August of 2017, the City of Manvel and the majority of the Gulf Coast region was impacted by Hurricane Harvey. According to the National Weather Service, this hurricane produced over 60 inches of rainfall with the highest reported rainfall being in Nederland, Texas just 120 miles east of the City of Manvel. According to the National Oceanic and Atmospheric Administration, damages from Hurricane Harvey are estimated to be $125 billion dollars making is the second most costly hurricane on record.



In addition to the extreme flooding and damage caused by Hurricane Harvey, there has been extensive analysis and discussion regarding rainfall quantities to be used in 100-year rainfall analysis. These rainfall amounts are developed based upon statistical analysis of prior storm events. Post Hurricane Harvey, experts began to question if we were under-estimating the correct amount of rainfall to be used for these analyses.

Prior to Hurricane Harvey, many agencies in the area used approximately 13 inches to represent the 100-year event. Post Harvey, many agencies have already made changes or are considering changes to increase the 100-year rainfall amount. While opinions vary, the consensus seems to point toward a range of 16 to 17.5 inches. This would be roughly a 20 – 35% increase.

Experts are still in the early stages of considering or making changes and while it is too early to tell exactly what the implications are for cities and municipalities might be, the discussions and analysis seem to suggest that future modeling and analysis will further increase floodplains, require larger detention ponds, and show that drainage channels and infrastructure will need to be further upsized.

**Regional Relationships**

In Section 2.2 of the 2014 MDP, Klotz mentions Brazoria Drainage District No. 4, Brazoria County Drainage District No. 5, and Brazoria County Conservation and Reclamation District No. 3, entities charged with the task of maintaining drainage related infrastructure within the City of Manvel. We mention those again here primarily for the purpose of restating the potential opportunity to team with those overlapping jurisdictions for the purpose of further improving drainage and reducing flooding within the City. The percentage of overlap of these entities onto the City of Manvel was provided in Table 2 of the Klotz MDP but is shown again below for reference.

| Drainage Authority | Percentage overlap onto City of Manvel |
|---|---|
| Brazoria Drainage District No. 4 | 27% |
| Conservation and Reclamation District 3 | 55% |
| Brazoria County Drainage District No. 5 | 15% |
| No Drainage District | 3% |

Similarly, there are neighboring cities such as the City of Iowa Colony and the City of Alvin who face drainage and flooding issues and share Manvel's common goal of resolving those issues.

As a final point in this section, we draw attention to other agencies with overlapping authority which include TxDOT, Railroad entities, and the Gulf Coast Water Authority. Although these agencies may not primarily serve the purpose of improving drainage and reducing flooding, these agencies do have highways, canals, and railroad within the City of Manvel which currently restrict or inhibit the movement of stormwater runoff downstream to the Gulf of Mexico. With this in mind, these are important partners to work with going forward.

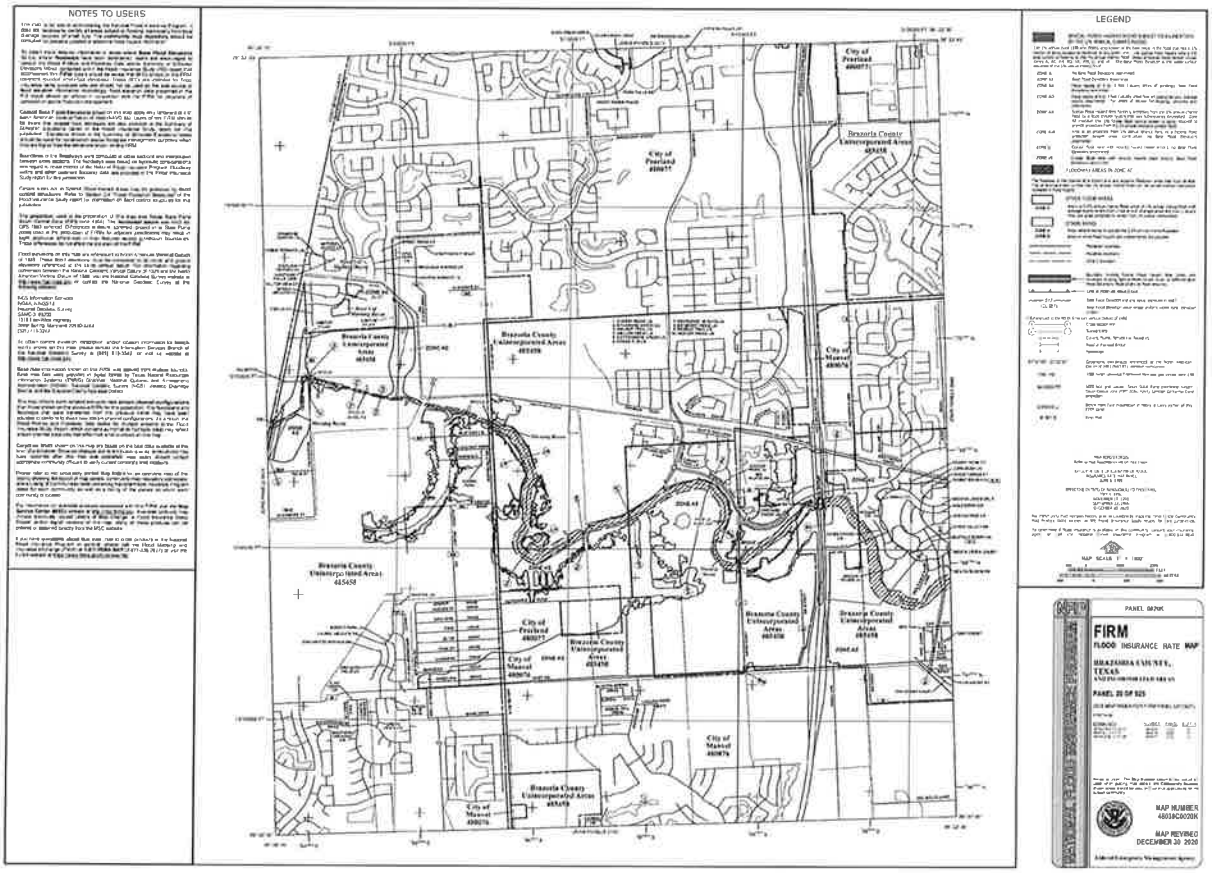
**Floodplain**

Prior to December 30, 2020, the Federal Emergency Management Agency (FEMA) had not adopted new Flood Insurance Rate Maps (FIRMs) for the City of Manvel since around 1983. The adoption of these new flood maps is arguably one of the most significant developments within the City of Manvel since Klotz issued the 2014 MDP.

It should be noted here that FEMA FIRM updates in some cases take years and years to develop and issue. As a result, these maps even immediately after release may not be representative of the latest and most up to date information. Furthermore, there may be current modeling for new development which propose projects that will remove areas from the floodplain. One such example is mentioned in the notes for the first panel provided below but it is not within the scope of this MDP update to present those findings in greater detail.

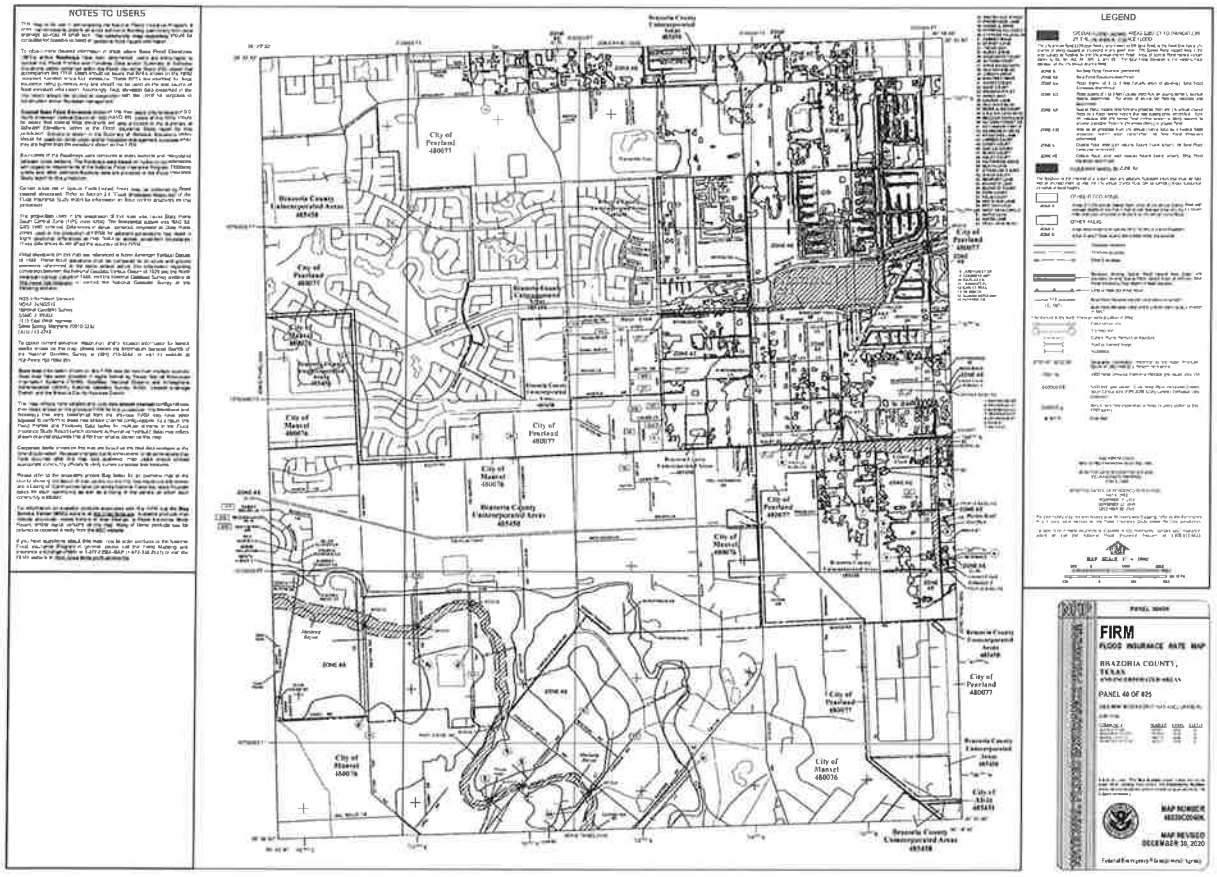
Where Manvel's City limits or ETJ are mentioned in this section it is based upon those jurisdictional lines as shown on the FEMA FIRMs and not necessarily the latest and most up to date locations of those boundaries.

A thumbnail view of these maps and a broad description of each is provided as follows:



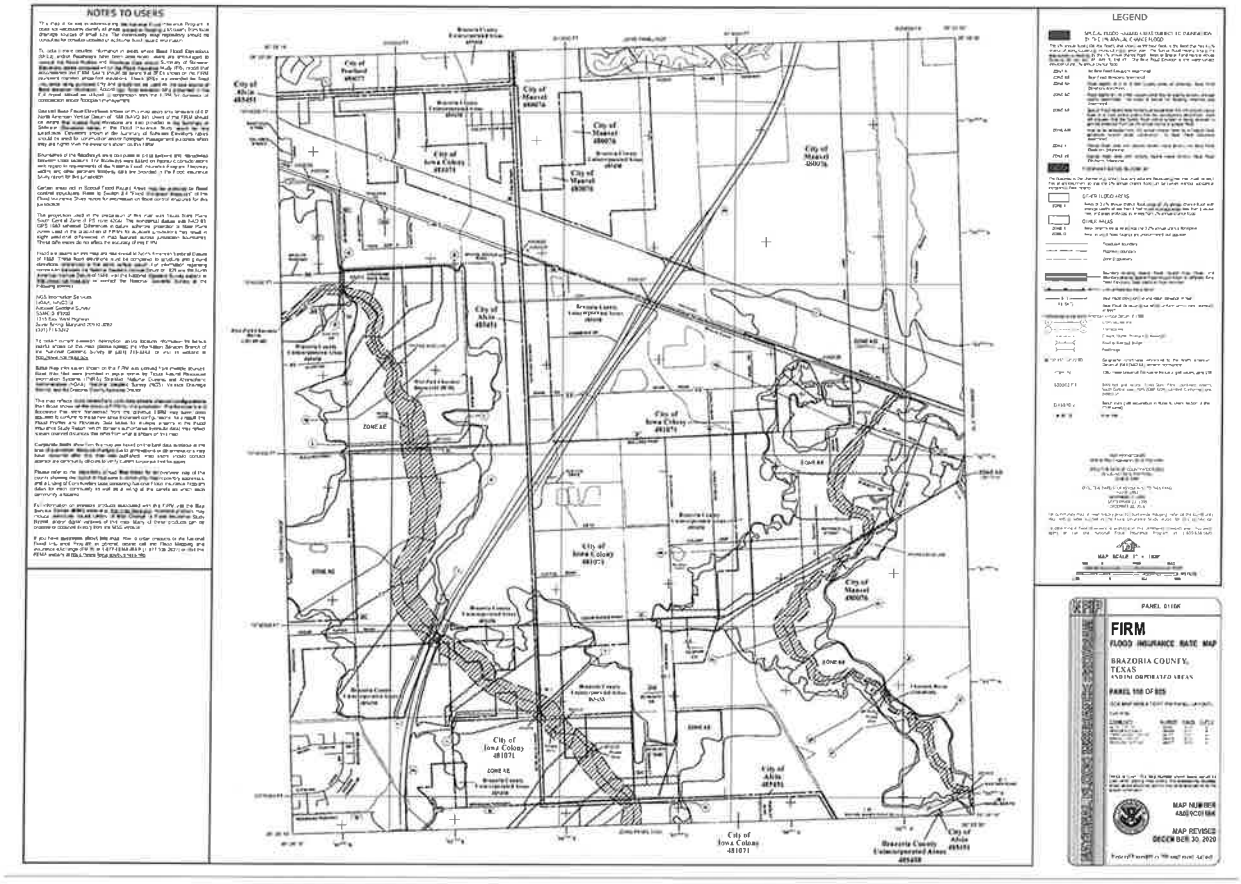

Panel 0020K – December 30, 2020

This panel shows the portion of Mustang Bayou predominantly on the west side of SH-288 and a small portion on the east side of SH-288 in the vicinity of the Sedona Lakes development. Of additional note is the fact that Post Road (Croix Road, CR-58) appears to effectively act as a barrier for flood water along it's north side. A significant portion of the floodplain on the West side of SH-288 is expected to be removed from the floodplain by the Pomona Development which proposes to confine floodwaters to their oversized detention facilities effectively the reducing the footprint of floodplain within their deep detention ponds. The same is expected to be true for the Sedona Lakes development north of Mustang Bayou and east of SH-288.



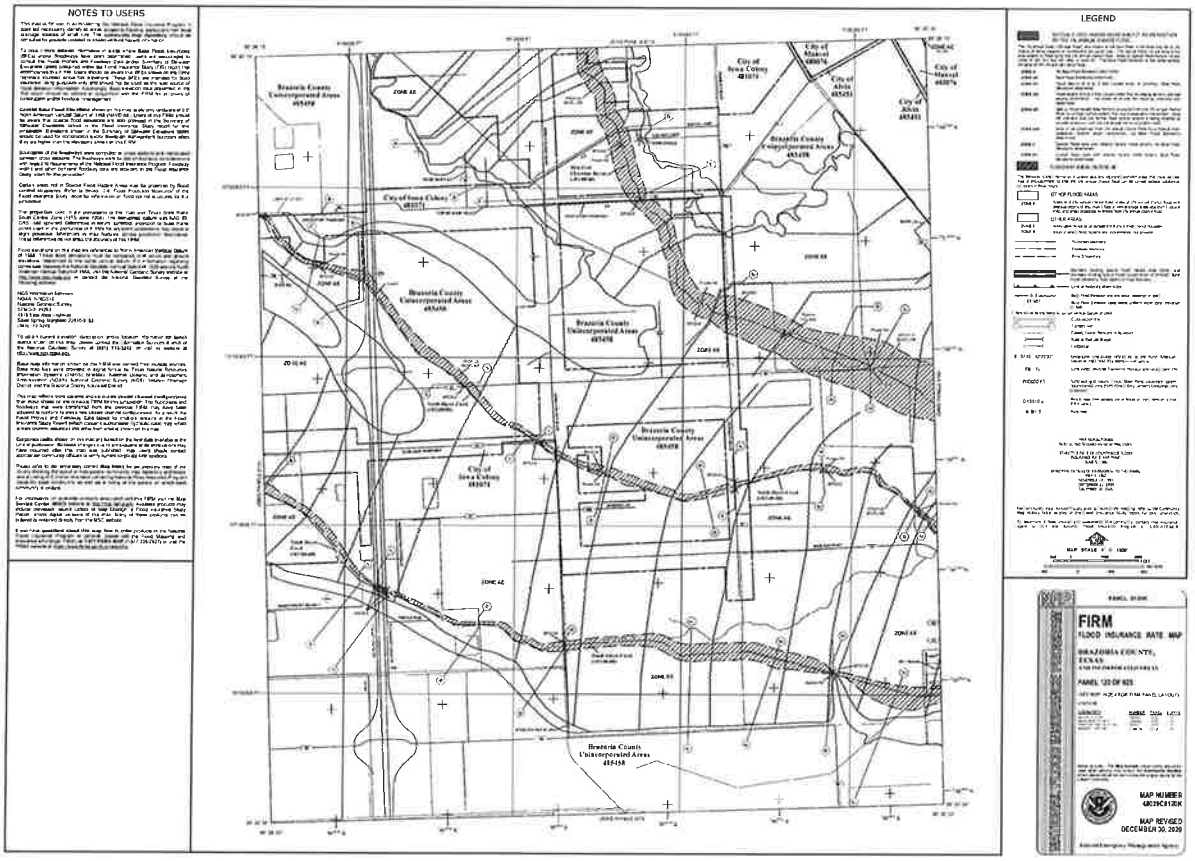

Panel 0040K – December 30, 2020

The portion of floodplain shown in the top right corner of the panel is the City of Pearland. The floodplain shown in the lower left corner shows the northeast part of the City of Manvel along Mustang Bayou. There is a significant amount of floodplain on this portion of the map.



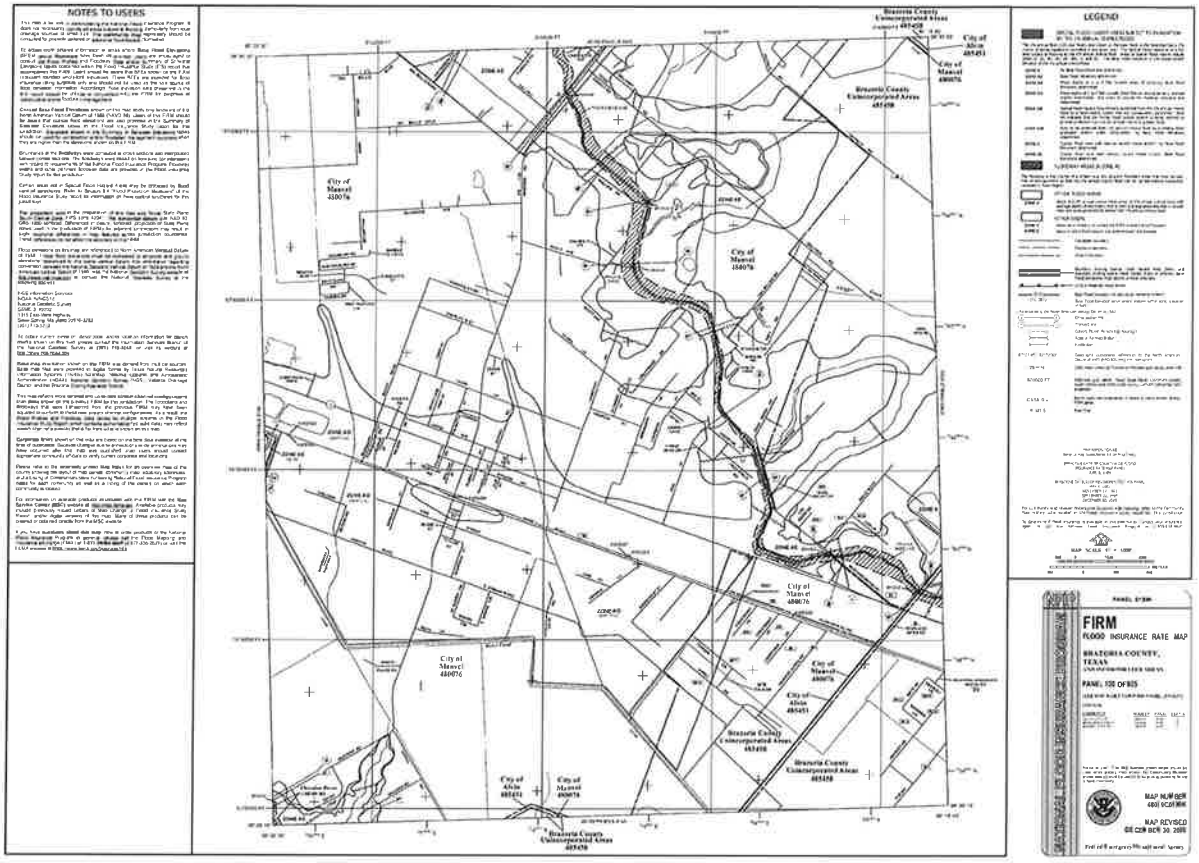

Panel 0110K – December 30, 2020

The left portion of this map shows portions of Iowa Colony, Alvin, and unincorporated areas within the West Fork of Chocolate Bayou watershed. The right portion of the maps includes areas north and south of Highway 6 on the east side of SH-288. Of additional note, the top portion of the floodplain is potentially held back by bridges or siphons at the Railroad and / or Bricoe Canal.



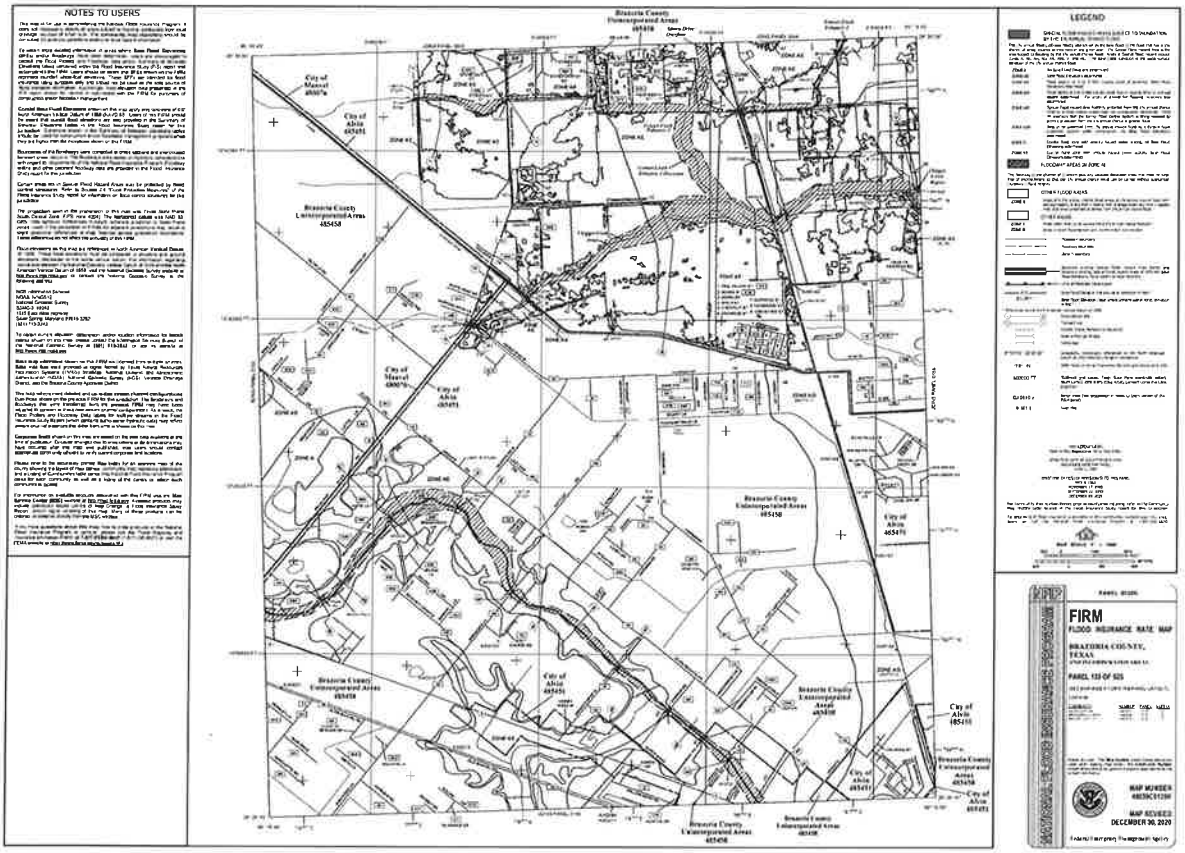

Panel 0120K – December 30, 2020

The City of Manvel jurisdiction is limited to a tiny portion in the top right corner of the map. The panel shows significant inundation areas along the West Fork, North Hayes, and South Hayes which are all tributaries of Chocolate Bayou.



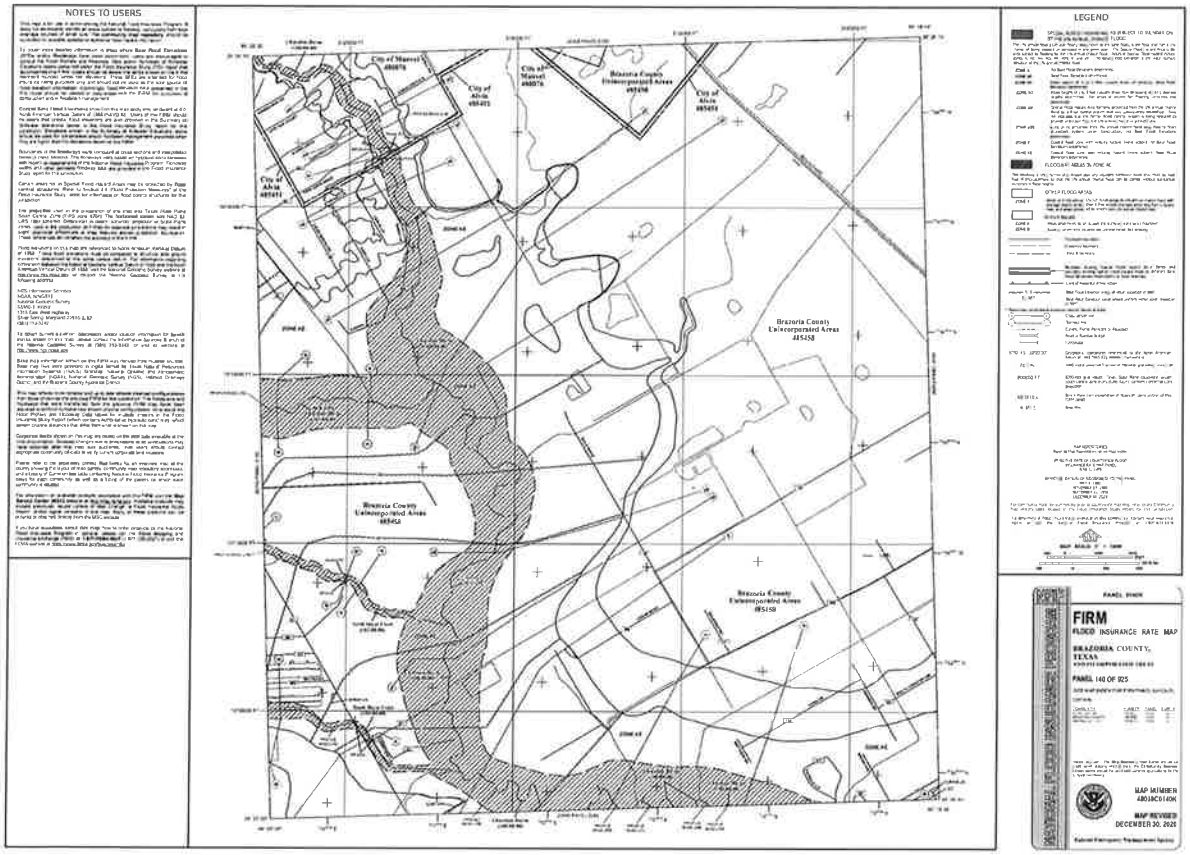

Panel 0130K – December 30, 2020

This panel shows the more central portion of Manvel on the north and south sides of Highway 6. A significant amount of floodplain appears along Mustang Bayou. Of additional note are the apparent restriction or blocking of water created by the Briscoe Canal in the lower left part of the map and Highway 6 in the lower right portion of the map.




Panel 0135K – December 30, 2020

This panel shows predominantly the City of Alvin, City of Pearland and unincorporated parts of the County. A small portion of Manvel is shown along the left edge and has a similarly small inundation area within the Mustang Bayou watershed.




Panel 0140K – December 30, 2020

A small portion of the City of Manvel within the Chocolate Bayou floodplain appears in the top left portion of this panel. The majority of this panel shows other cities or unincorporated parts of Brazoria County.

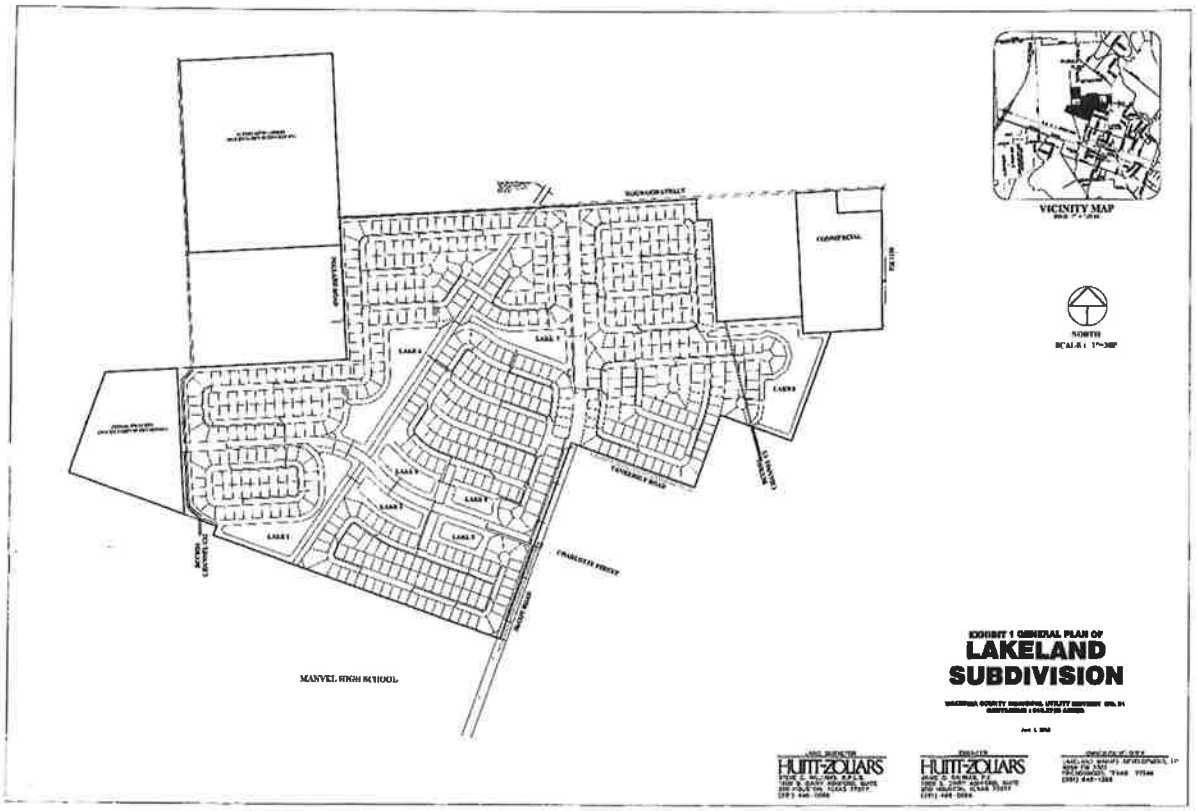
**Recent and Proposed Development**

Since the 2014 Klotz MDP was issued, there has and will continue to be significant development within the City of Manvel. For the purposes of this Master Drainage Plan addendum, our primary goal is to mention most of the major recent and proposed development to document the significant changes to drainage within the City.

Because all new developments are subject the requirements in the City of Manvel's Design Criteria Manual we can make the following statements about these recent and proposed developments:

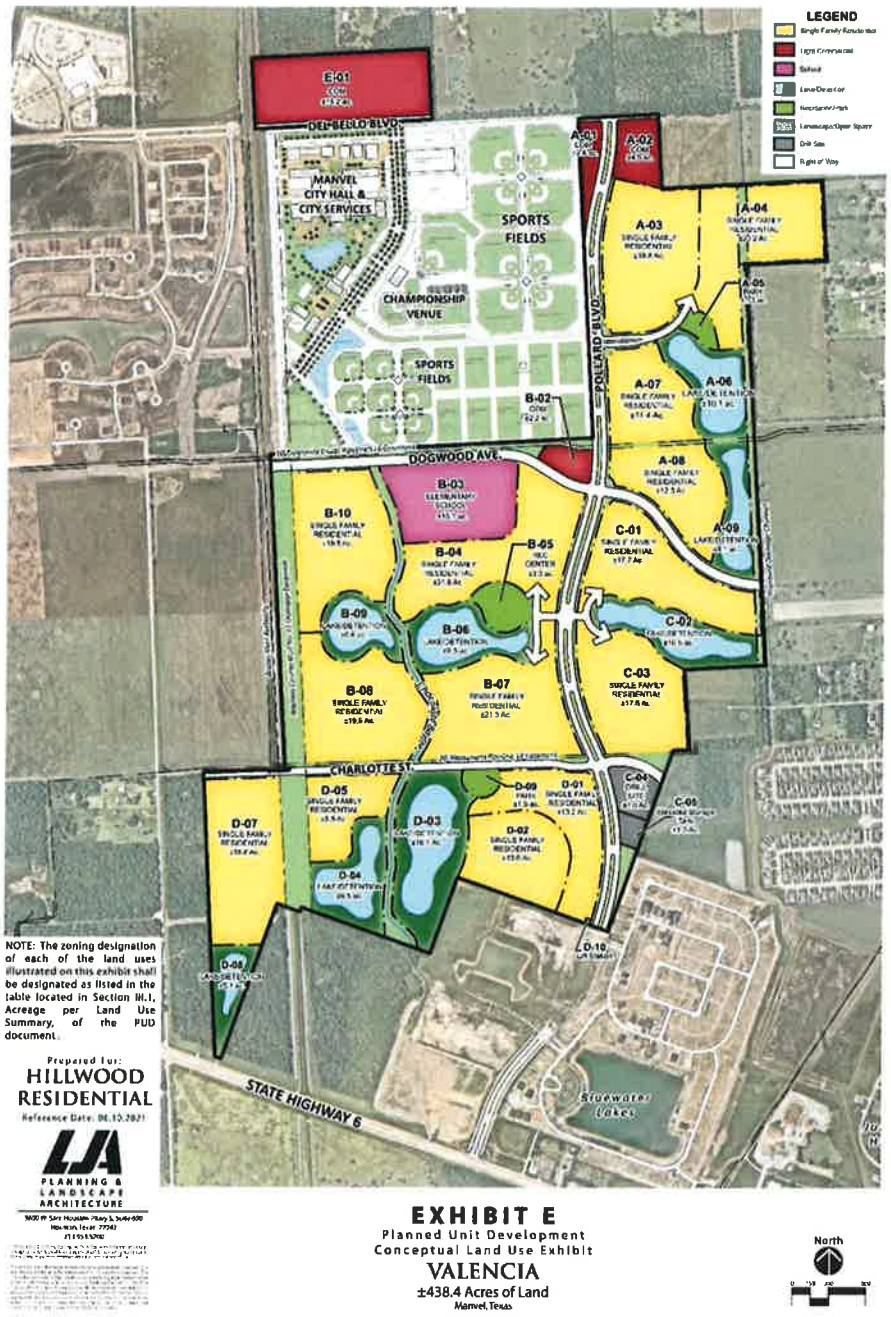
1) Development has / will provide the requisite amount of detention to ensure that all increased stormwater runoff will be adequately mitigated on site. As a result, existing (pre-development) runoff will remain the same or in some cases be reduced.
2) Development within the floodplain has / will be required to provide compensatory cut (additional mitigation above and beyond detention) for any fill placed within the floodplain. As a result, existing floodplain will typically be reduced as it relocated to the mitigation ponds within the development. In other words, the footprint is reduced as the equal volume is placed in a deeper pond with a smaller footprint than before.
3) Development has / will dedicate the requisite ultimate drainage easement for the major drainage channels within the City of Manvel per the Master Drainage Plan as these developments are platted.

Some examples of recent and proposed major developments within the City of Manvel are as follows:




LakeLand

A 310 acre development north of the Manvel High School which is predominantly single family residential development but also includes a small amount of commercial development.




Valencia

A 438 acre development east and south of the Del Bello development which includes single family residential lots, the City Center project, and elementary school, and commercial development.


Presidio

A 394 acre development east of SH-288 and north of Highway 6 which includes commercial, retail, hotel, and single family development. The contemplated project appeared to be idle at the time of this report.


Bluewater Lakes

A predominantly single family development north of Highway 6 and west of the Manvel High School.

**Reports of Flooding**

In the early stages of developing this amendment to the MDP, Our team met with City Staff for the purposes of identifying flood prone areas based upon their own first hand information or the feedback from citizens.

Two areas were the focus of our meeting with Staff.

CR 89 West of Patterson Road

Staff reported incidents of flooding and high water along CR 89 between Old Chocolate Bayou Road and Patterson Road. CR-89 is an asphalt road with one lane in each direction. Shallow roadside ditches with minimal fall, nearby heavy vegetation, and standing water were observed during a site visit. The potential project for this area will be further discussed later in this MDP addendum.

FM 1128 at Scott Street

Staff reported incidents of flooding and high water in the vicinity of FM-1128 at Scott Street. FM-1128 is an asphalt road with one lane and a full shoulder in each direction. Shallow roadside ditches were observed during a site visit. Scott Street is drained by shallow roadside ditches with nearby vegetation based upon the same site visit. The potential project for this area will be further discussed later in this MDP addendum.

Repetitive Loss Data

In discussions with City Staff, it was determined that there were relatively few cases of significant repetitive loss. Further review of the repetitive loss date did not provide any clearly defined areas with dense groups of flooding occurrence.

**Drainage Obstructions**

In Section 2.6.3 of the 2014 MDP, Klotz discussed the presence of drainage obstructions and impediments within the City of Manvel. The list of obstructions within the City of Manvel include Highway 6, the railroad south and parallel to Highway 6, and the GCWA and Briscoe Canals. A review of the 2020 FEMA FIRM panels further illustrates this.

As a result of these impediments, it is difficult to get stormwater runoff downstream to the Gulf of Mexico. Although the solution to these issues seems to be as simple as removing the obstructions or increasing the opening to allow more water through, it is not that easy. Watersheds downstream of these pinch points are extremely sensitive to increased stormwater flows. As a result, any project proposing to widen or open up these crossings must also typically include compensatory detention mitigation potentially in very significant quantity.

## Section 3 Drainage Projects

### Klotz Scenario 1

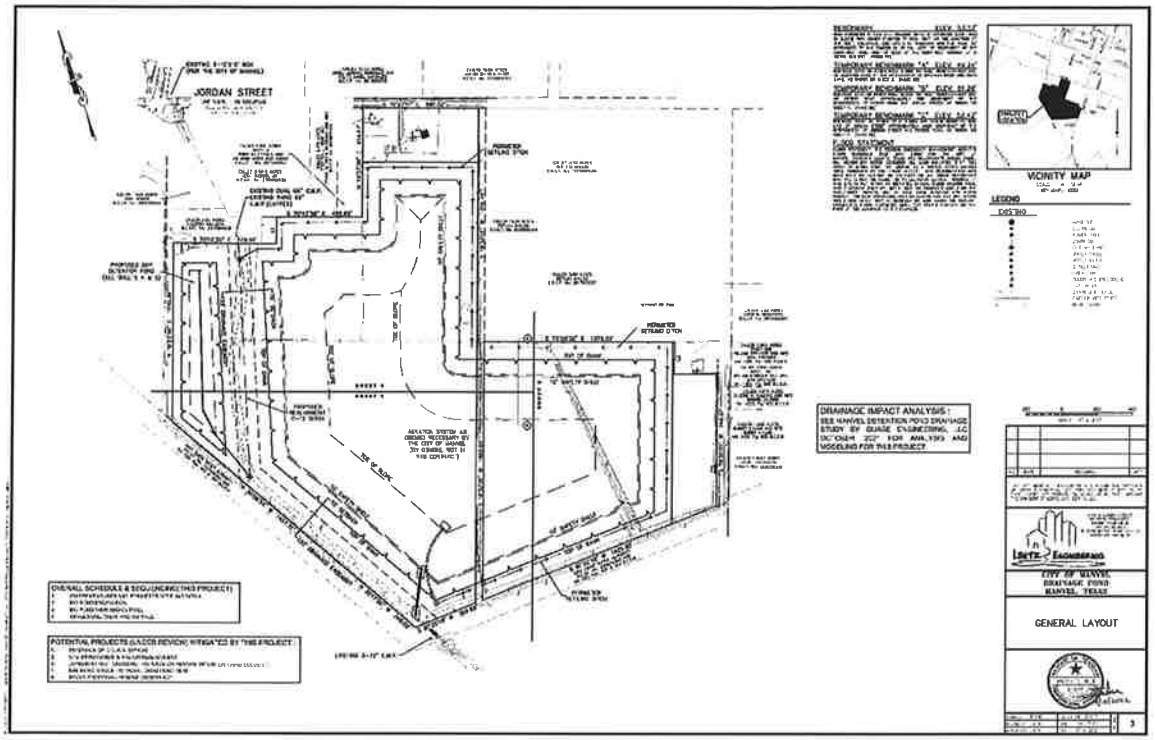
Section 3.7.1 of the Klotz MDP provides discussion regarding their analysis of the City of Manvel's major drainage ways and promotion of channel improvements that would convey the 100 year pre-developed (existing) flows within the banks of it's creeks. Additionally, a determination has been made regarding the minimum total width drainage easements needed to construct these channels to their 100-year capacity. Our scope did not include any updated modeling however We agree that obtaining these ultimate width drainage easements needs to be an on-going priority for the City of Manvel.

### Klotz Scenario 2

Section 3.7.2 of the Klotz MDP provides discussion regarding their analysis of the City of Manvel's major drainage ways and promotion of channel improvements that would convey the 100 year post-developed (proposed) flows within the banks of it's creeks. In anticipation of other future development, this scenario would include detention mitigation to offset those future developments.

This scenario calls for additional right-of-way and additional land for detention mitigation on top of considerable construction costs to complete the work. Based upon the rate at which development continues to come into the City of Manvel, it seems a more reasonable approach would be for development to provide any required ultimate width drainage easements based upon pre-developed (existing) flows and to provide detention on site to mitigate for their developments.

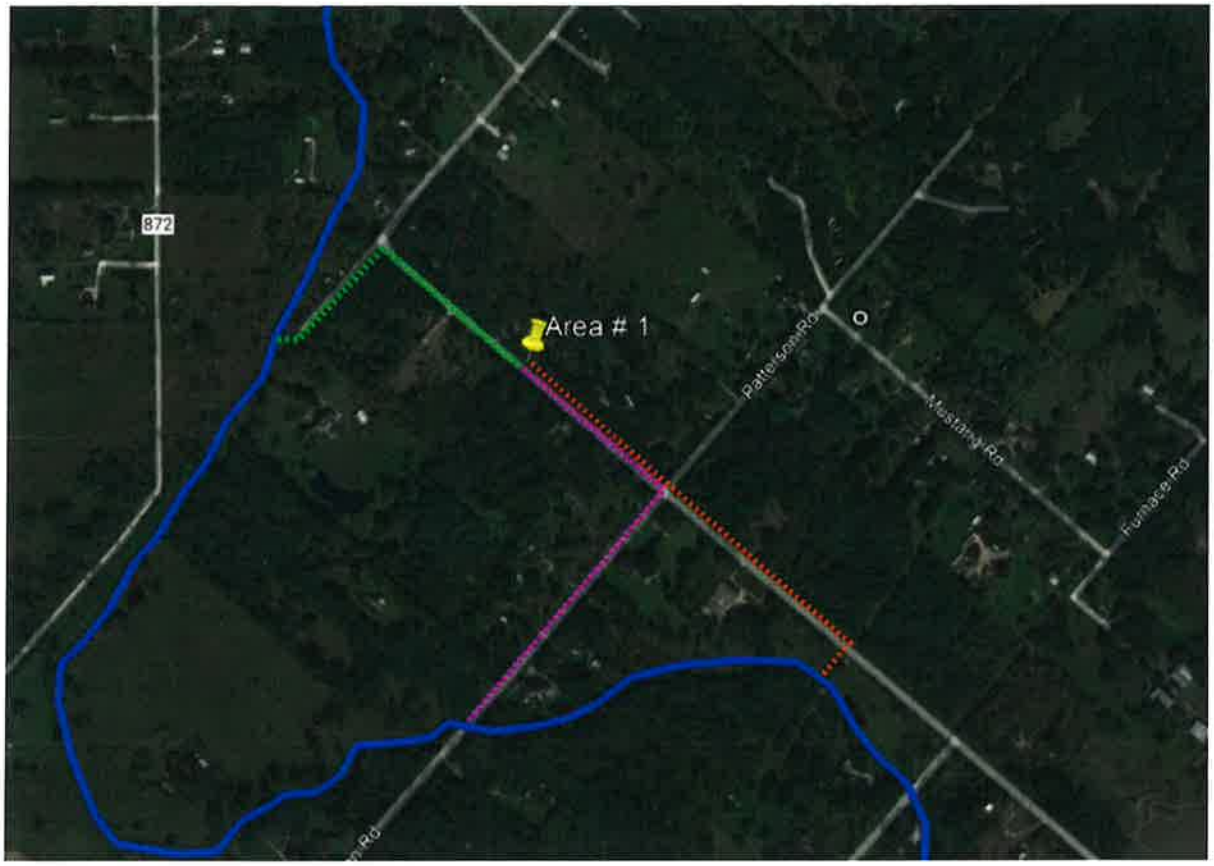
## 117 Acre Master Road Detention Project




The City of Manvel has approved the construction plans prepared by Lentz Engineering, LLC for the 117 acre detention pond at Masters Road. This project is covered in detail in the Manvel Detention Pond Drainage Study prepared by Gauge Engineering, LLC but the key points made in that study are as follows:

1) The project would create over 1,000 acre feet of detention storage.
2) The project would dedicate the required ultimate drainage easement for the C-12 ditch and realign that ditch's configuration to be straighter and maximize detention on site.
3) The project creates the opportunity to improve drainage and flooding upstream of the GCWA freshwater canal.
4) The project creates the opportunity to remove the Bissel Road culvert.
5) The project creates the opportunity to reconfigure the existing railroad bridge.
6) The project creates the opportunity to reduce flooding up to and north of Highway 6.

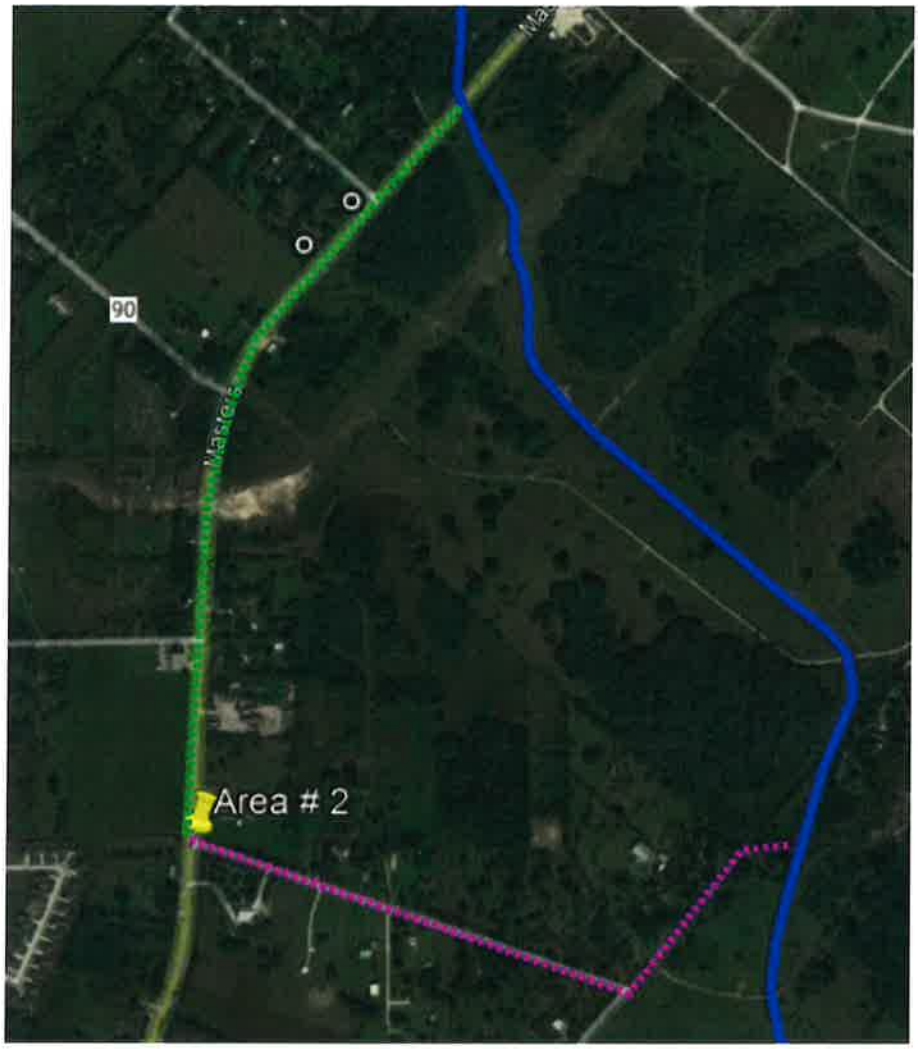
**Area # 1 – CR-89 between Old Chocolate Bayou Road and Patterson Road**




The CR-89 project was identified by Manvel Staff during one of Our meetings to discuss flood prone areas within the City. The City identified the area of concern (Area # 1 marker) and three potential alternative drainage improvement project as shown in green, pink, and orange above.

Although a complete design and analysis was not within the scope of this effort, we preliminarily estimate easement acquisition costs between $130,000.00 and $180,000.00 and storm sewer construction costs between $215,000.00 and $300,000.00 for a total estimated construction cost between $345,000.00 and $480,000.00.

**Area # 2 – FM-1128 at Scott Street**




This additional flood prone area was identified by City Staff in our meetings. The City identified the area of concern (Area # 2 marker) and Our team identified two potential alternative drainage improvement projects as shown in green, and pink above.

Although a complete design and analysis was also not within the scope of this effort, we preliminarily estimate easement acquisition costs between $345,000.00 and $410,000.00 and storm sewer construction costs between $575,000.00 and $700,000.00 for a total estimated construction cost between $920,000.00 and $1,110,000.00. Our team would further offer that the FM-1128 alignment is undesirable unless there might be an opportunity to partner with TxDOT.

**Mustang Bayou Regional Detention Pond**


The exhibit above shows an existing sand pit site which the City of Manvel owns. The site is located on the south side of Mustang Bayou just east of Sedona Lakes and the Oak Crest modular home park.

Our team identified this project based upon prior experience in repurposing old sand pits as regional detention ponds. One such successful project is at the east end of My Road in Alvin, Texas. These projects have proven to be cost effective ways to create detention due to the significant reduction in hauling costs.

We would further add that there is an apparent need for available sites to dispose of clean spoils as evidenced by the existing fill site directly across CR-90 from this location. There appears to be an opportunity to modify this sand pit into a detention pond at relatively low cost as compared to traditional detention pond construction. Detailed design of this facility and preliminary estimates of costs are not within the scope of this effort. Costs could vary significantly based upon the actual approach to constructing this facility.

Our team reviewed aerial topography for this site and We estimate that existing side slopes of this sand pit are between 1.5:1 and 2:1. We further estimate that 15,000 – 25,000 cubic yards of clean fill material would be needed to restore these slopes to a stable 4:1 slope.

Based upon preliminary analysis, Our team determined that no less than 400 acre-feet of detention could be created for the purposes of reducing water surface elevations along Mustang Bayou in the vicinity of portions of the City of Manvel which are within the mapped floodplain. The project conceived above is based upon an assumed gravity drain, permanent wet lake design. The completed project might additionally create a nice park amenity for the City of Manvel.

**Cherry Sand Pit Alternative**

A similar sand pit rehabilitation project was identified in Section 5.1.3 of the 2014 Klotz MDP. The location is south of Highway 6 and east of SH-288. Based upon our review of the updated FEMA FIRM panel 0110K provided above, this area does not appear to be particularly inundated by floodplain. Additionally, the eminent or proposed Manvel Town Center projects appear to be moving forward without delay. Although the detention rates required for some of these projects are far more than typical projects, that fact does not appear to be discouraging or restricting development within the area.

## Section 4 Funding

### Estimated Costs

Section 5.2 of the Klotz MDP provides cost estimates for the Scenario 1 and Scenario 2 projects outlined in their report. In round figures, both scenarios were estimated to cost $125 million. To the extent that this MDP addendum did not further analyze those two scenarios, there is no reason to perform an updated cost estimate on either scenario.

For the other projects that Our team introduces to the City of Manvel for consideration above, we have provided some estimates of construction costs and other pertinent information for the purposes of assisting Manvel in identifying potential drainage improvement projects to further analyze and evaluate to a greater degree. For the smaller projects identified above, preliminary ranges of cost estimates are provided to assist the City in eliminating them as possibility or designing and analyzing them to a greater degree.

### Funding Sources

Section 4 of the Klotz MDP provides an extremely thorough discussion about a wide variety of grant and funding which may be available through a wide variety of sources. Our scope of work did not include research of new grant or funding opportunities and this is admittedly outside Our area of expertise.

Instead of offering further input on how the City might fund drainage projects, we would like to point out again the potential opportunity for partnering with any one of three drainage districts with overlapping authority. Although these districts generally have modest annual budgets, they have the equipment and manpower required to complete in whole or in part any number of the projects outlined above.

Additionally, we have identified some possible drainage projects above which involve County or TxDOT roadways. As a result, Brazoria County or the Texas Department of Transportation are potential partners for some of these projects.

## Section 5 Final Recommendations

In conclusion, the 2014 Klotz MDP and this addendum show that there are a wide variety of potential projects within the City of Manvel which would further improve drainage and reduce flooding. These projects vary greatly in size and cost. Additionally, as the leadership of the City of Manvel continues to evaluate and act on these opportunities, development seems to be thriving under the close and watchful eye of City Staff. With this in mind, we offer the following final recommendations to the City of Manvel:

1) Continue to observe and record the effects of heavy rainfall events for the purpose of mapping the most significantly affected areas and potential future drainage improvement or flood reduction projects.
2) Continue to watch and regulate development within the City of Manvel to ensure strict conformance with the City's Design Criteria Manual and the City's Master Drainage Plan. As additional development occurs, new and improved drainage infrastructure will be constructed in addition those developments providing the requisite mitigation quantities to maintain or reduce existing (pre-development) runoff amounts.
3) Continue to require drainage easement dedications from new development at the time of platting in strict conformance with the City's Master Drainage Plan. These ultimate width drainage easements will be essential at such time that the City and / or other drainage partners have the necessary resources to further improve the channels and creeks within the City.
4) Continue to evaluate available budget money and potential grant or funding sources for the purpose of determining which drainage improvement and flood reduction projects are too expensive to be considered in the near to short term.
5) Continue to work with partner agencies to pool funding and resources to complete projects which benefit all of the agencies involved.