LOWER CLEAR CREEK & DICKINSON BAYOU WATERSHED STUDY

H-GAC Briefing

October 20, 2021

The Planning Partners

League City TEXAS

HARRIS COUNTY FLOOD CONTROL DISTRICT

THE STATE OF TEXAS COUNTY OF GALVESTON

US Army Corps of Engineers ®
Galveston District

BRAZORIA DRAINAGE DISTRICT NO. 4 PEARLAND TEXAS

Dickinson

FRIENDSWOOD TEXAS FOUNDED 1895

Webster TEXAS

NASSAU BAY Charting New Horizons

CITY OF PEARLAND PEARLAND TEXAS EST. 1894

Project Purpose

Develop a comprehensive flood mitigation plan for the Lower Clear Creek and Dickinson Bayou Watersheds, including *identification of vulnerabilities* in the watersheds and *development and refinement of concepts* to reduce flooding

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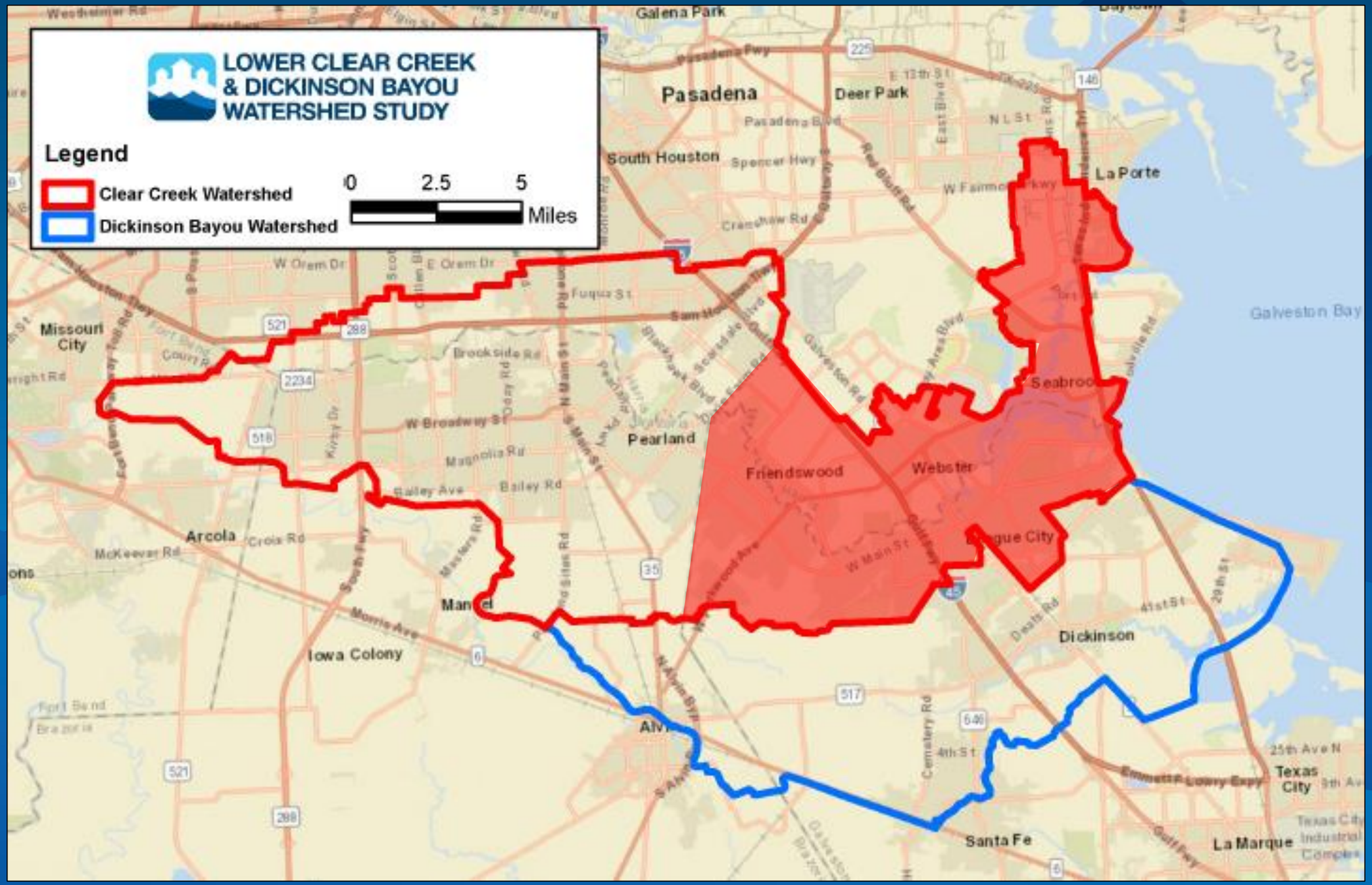
Project Area



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Project Focus

- This is a riverine study of regional magnitude.
- Storm analysis based on 24-hour duration, Atlas 14 intensity.
    - 2-, 5-, 10-, 50-, 100-, and 500-year events analyzed
- Models calibrated to Tax Day 2015, Hurricane Harvey 2017

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Existing Flooding Risk

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Important Note…

- The flood risk analysis shows inundation directly caused along the creeks, but not by localized storm drain capacity constraints.
  - **Damages and flooding instances are likely higher than what is presented.**
  - **The benefits provided by riverine alternatives will also be higher than what is presented as all storm drainage systems eventually outfall to the creeks, so lowering the flood elevation on the creeks will benefit local drainage system performance.**

CC Damage Centers - High Flooding Instances

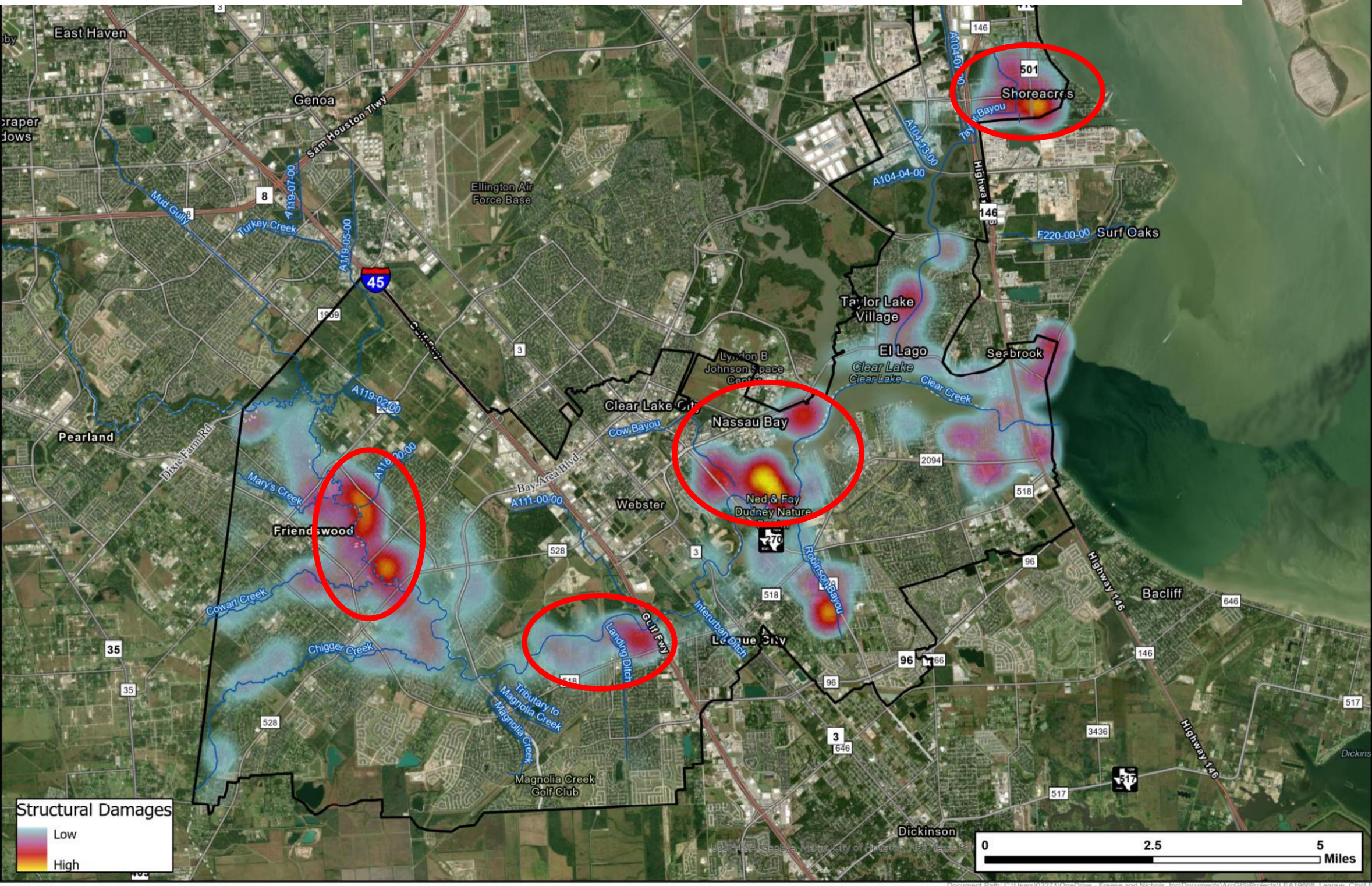


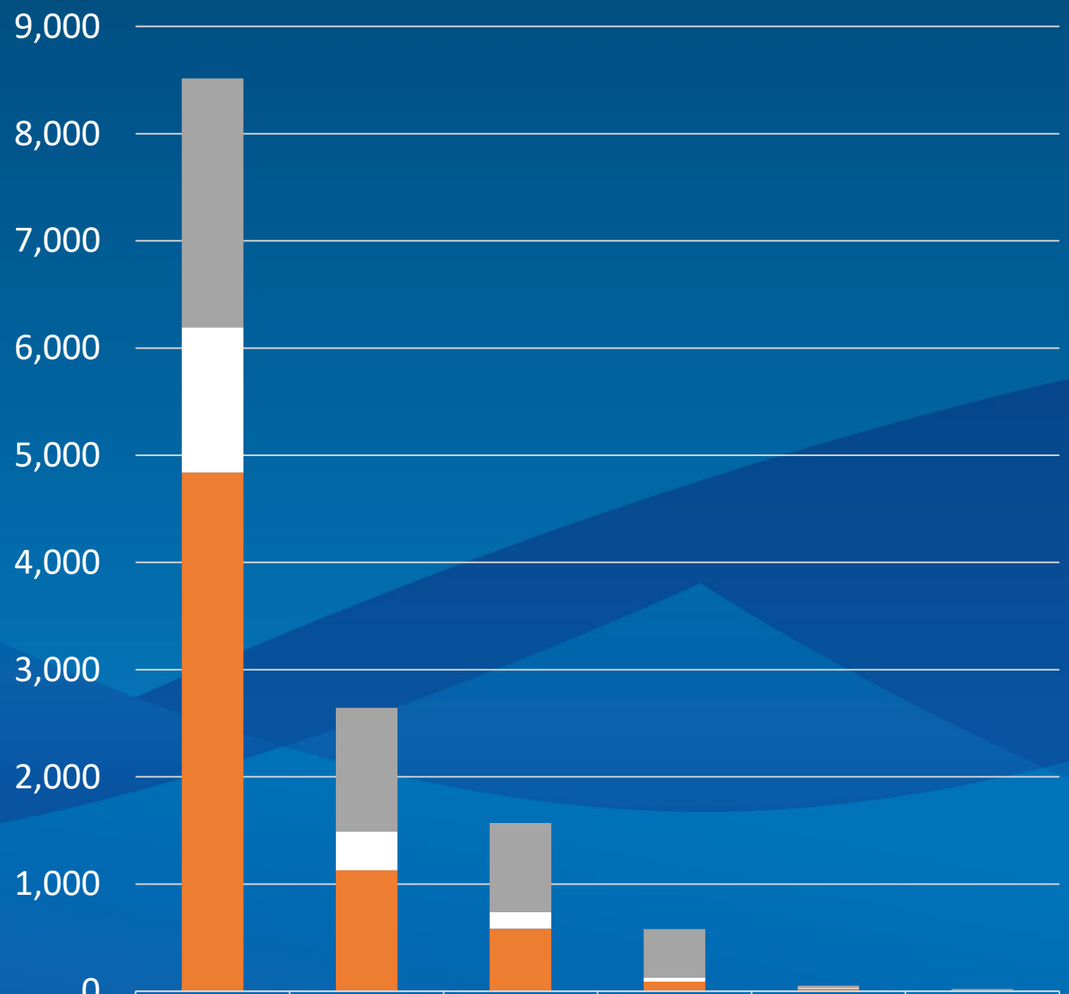
FIGURE Y

AOB Instances of flooding

FN JOB NO	LEA19668
FILE	LEA19668 League City
DATE	2/24/2021
SCALE	1:87,000
DRAFTED	02271

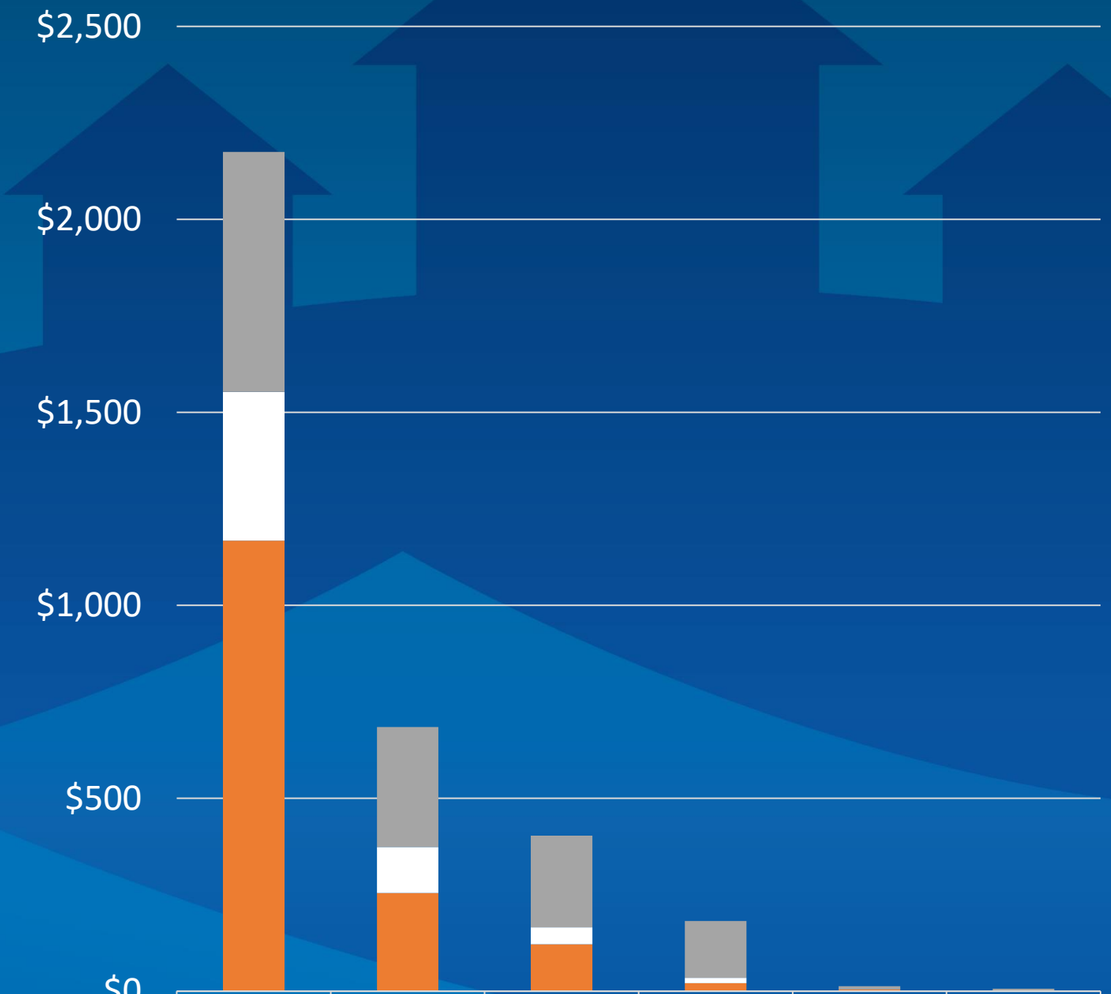
FREESE NICHOLS
2711 North Haskell Ave.
Suite 3300
Dallas, Texas 75204
P: 214-217-2200

Clear Creek Flooding Instances (Future)



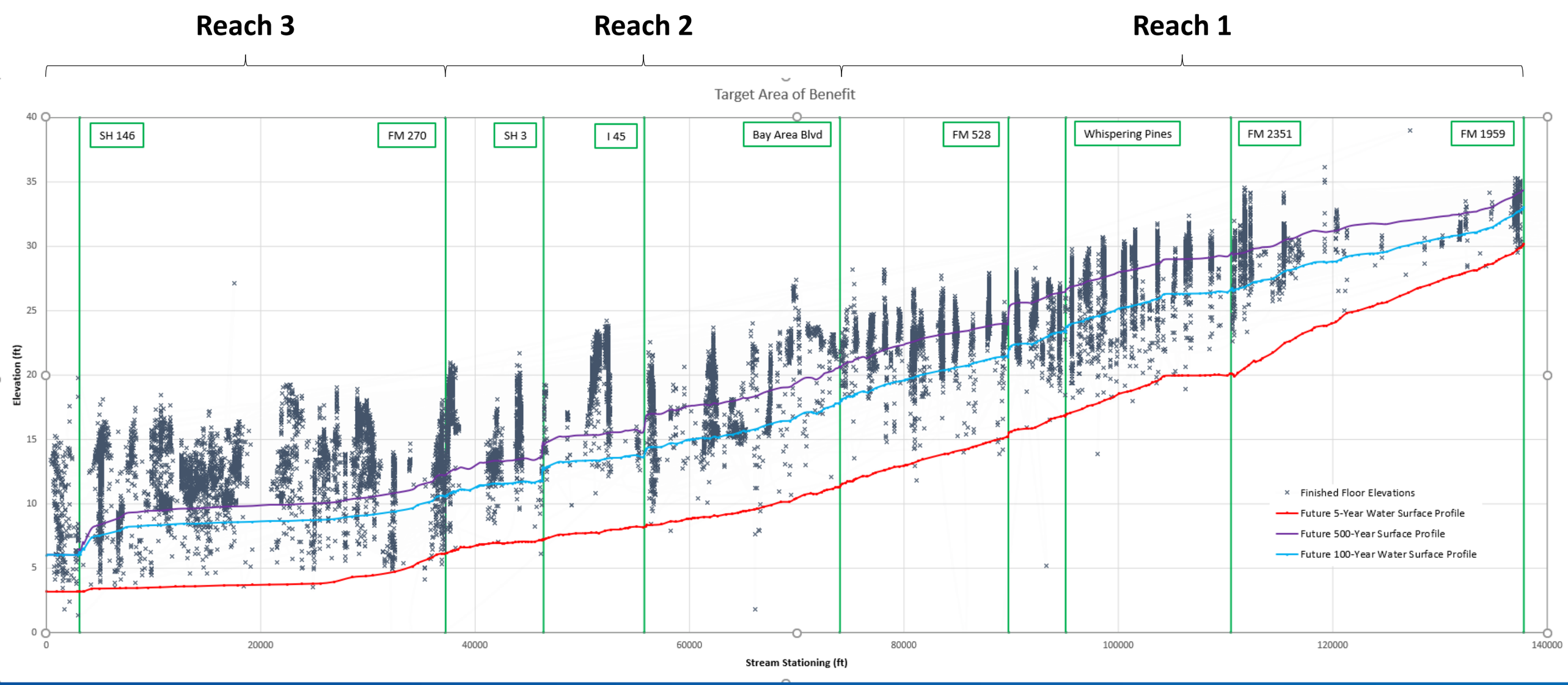
	500-year	100-year	50-year	10-year	5-year	2-year
Reach 3	2322	1153	832	452	21	12
Reach 2	1353	364	154	37	6	2
Reach 1	4840	1128	584	90	25	7

Clear Creek Value of Flooded Structures $M (Future)



	500-year	100-year	50-year	10-year	5-year	2-year
Reach 3	$622	$311	$237	$147	$8	$6
Reach 2	$385	$119	$44	$14	$0	$0
Reach 1	$1,168	$255	$122	$21	$5	$1

Clear Creek Finished Floor Elevations



DB Damage Centers - High Flooding Instances

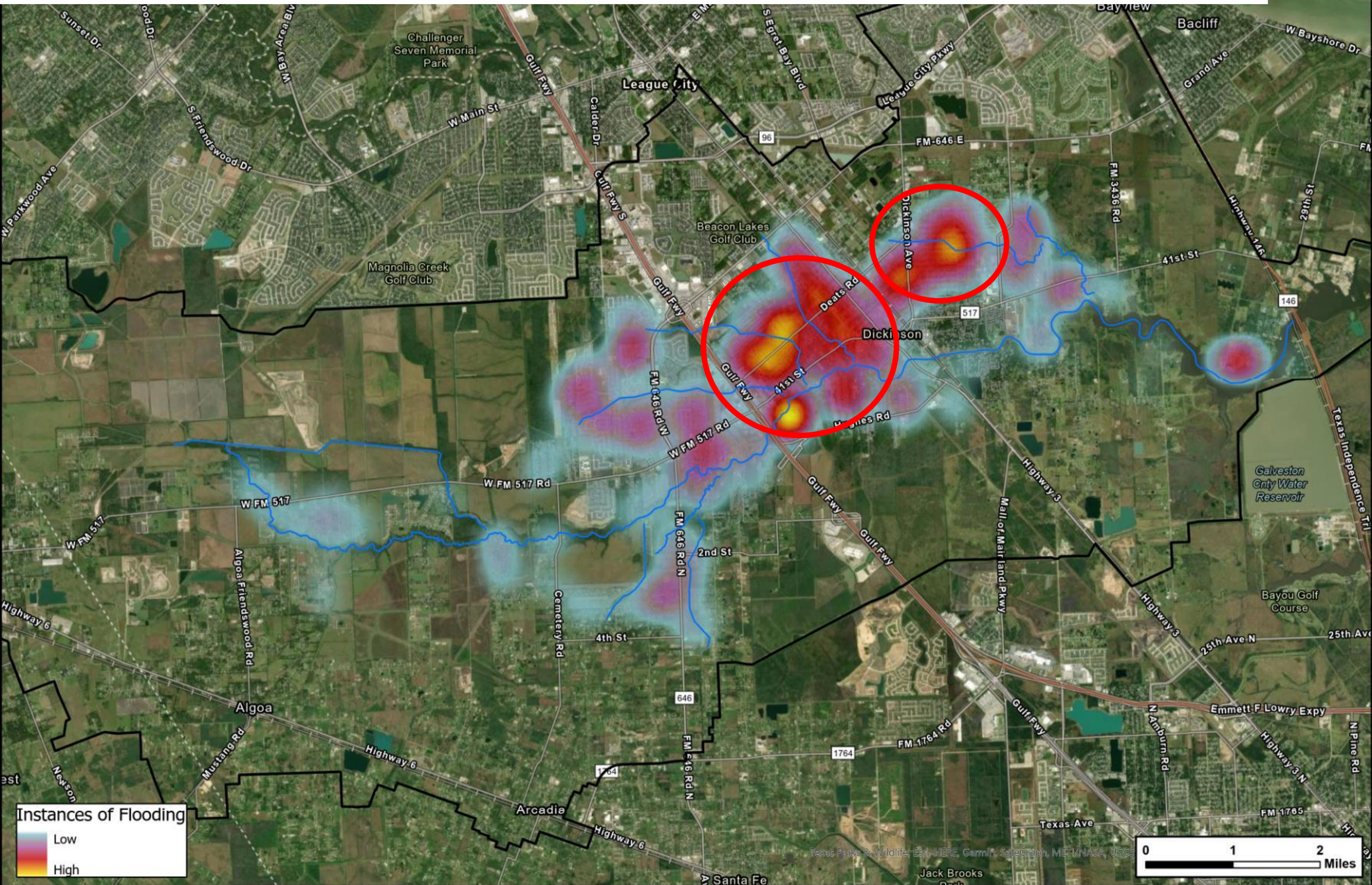


FIGURE X

AOB Instances of flooding

FN JOB NO	LEA19668
FILE	LEA19668 League City
DATE	2/24/2021
SCALE	1:66,929
DRAFTED	02271

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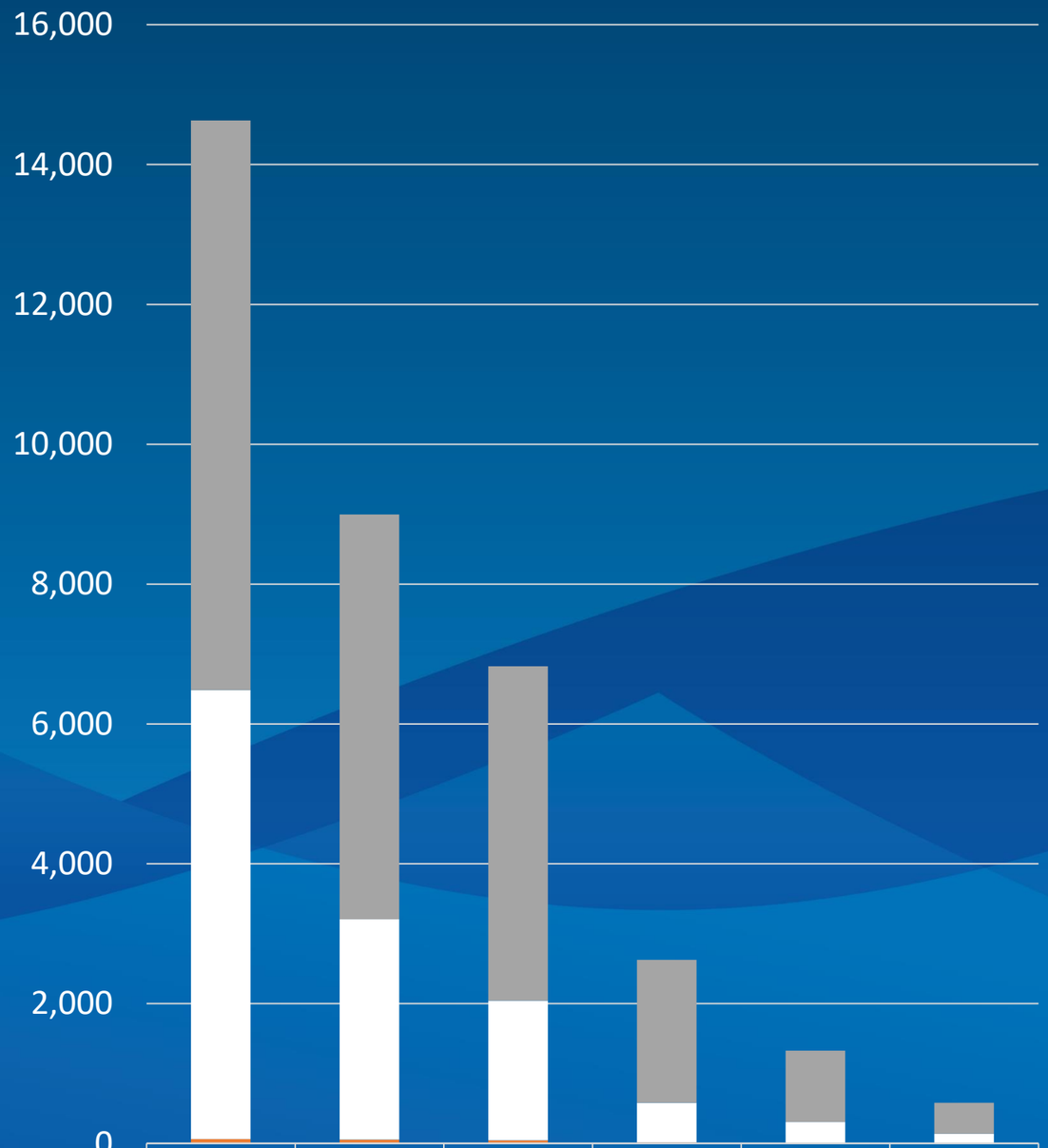
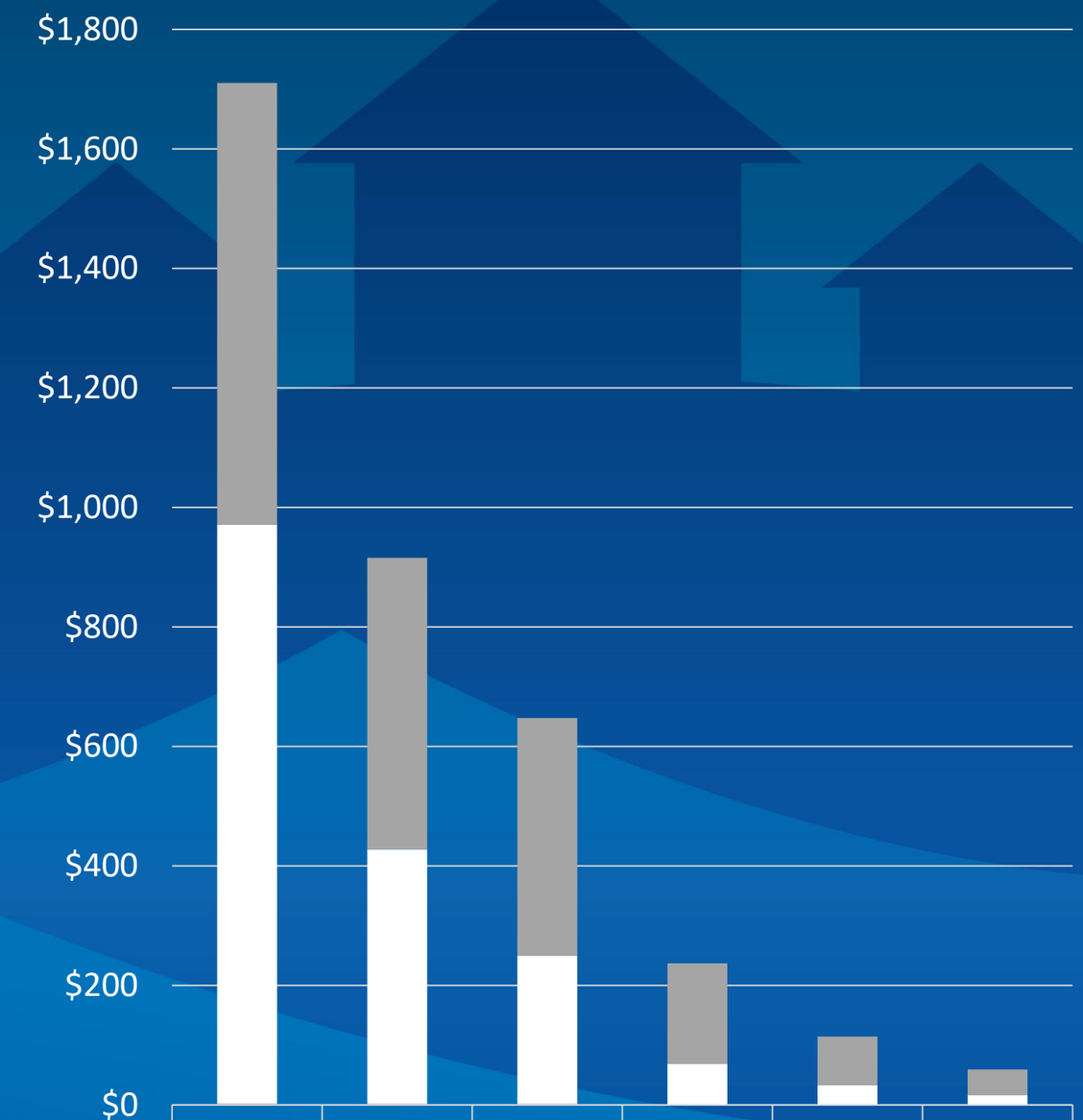
Dickinson Bayou Flooding Instances (Future)



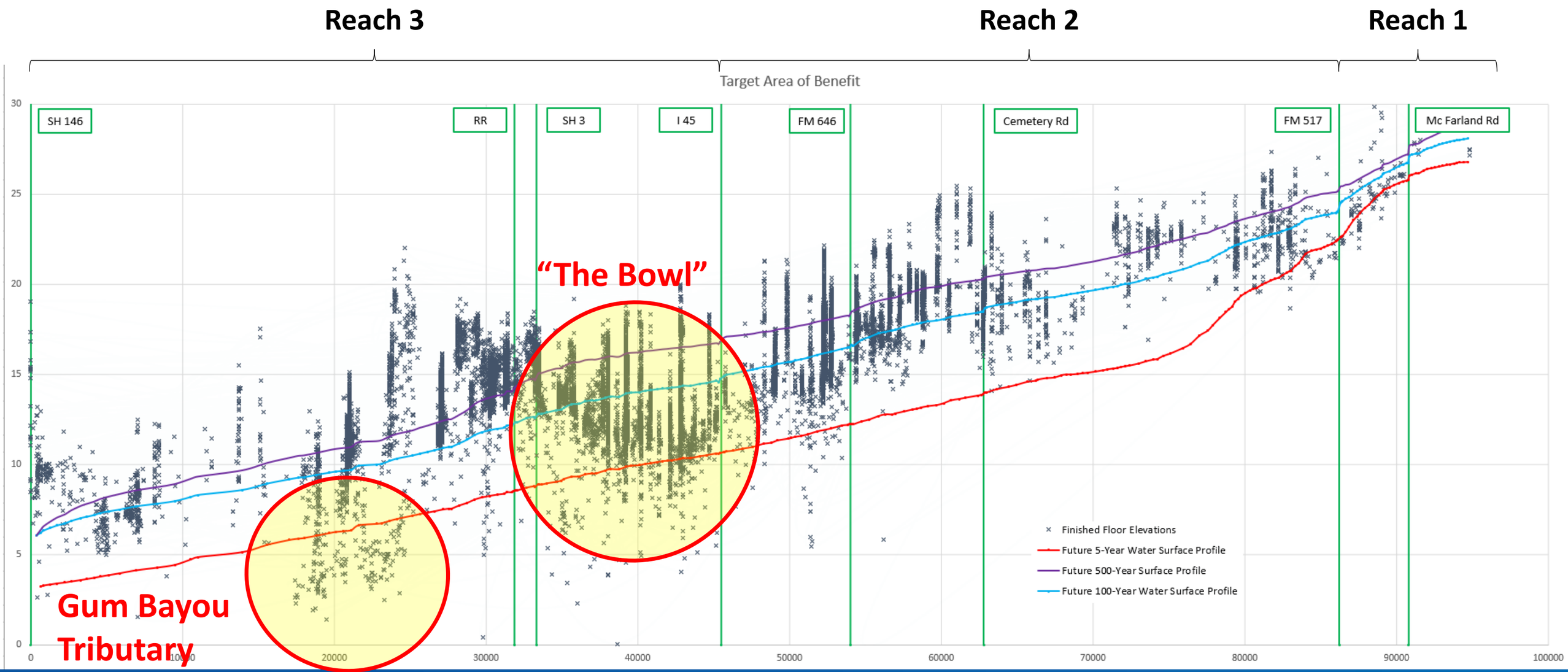
	500-year	100-year	50-year	10-year	5-year	2-year
Reach 3	8147	5789	4784	2044	1018	444
Reach 2	6421	3153	1995	566	304	136
Reach 1	62	54	45	15	3	2

Dickinson Bayou Value of Flooded Structures $M (Future)



	500-year	100-year	50-year	10-year	5-year	2-year
Reach 3	$739	$488	$398	$168	$81	$43
Reach 2	$969	$426	$248	$68	$33	$16
Reach 1	$2	$2	$1	$1	$0	$0

Dickinson Bayou Finished Floor Elevations



Mitigation Alternatives

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Historic Project Recommendations

USACE 1982 Preconstruction Authorization Planning Report

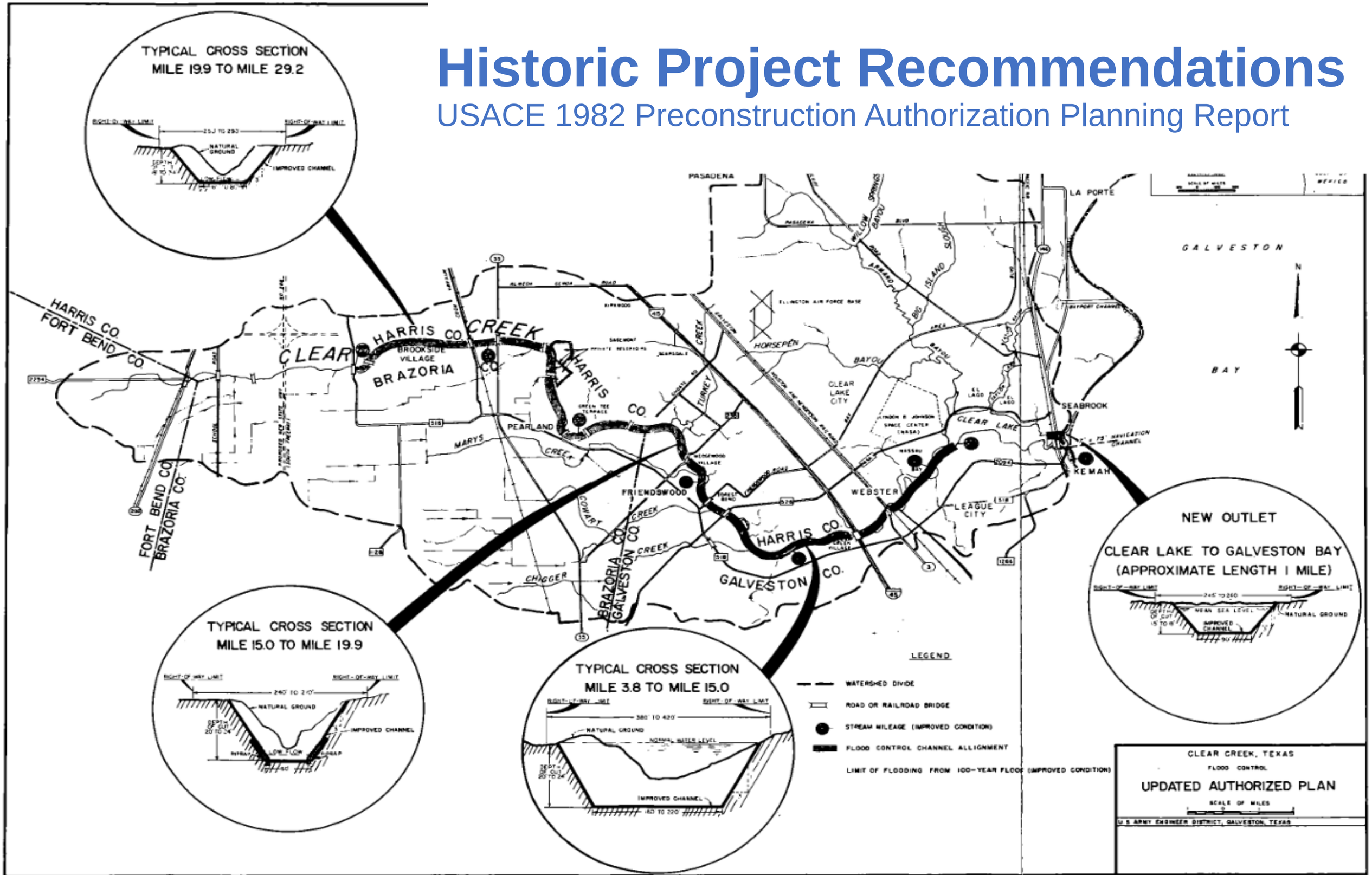


FIGURE 6

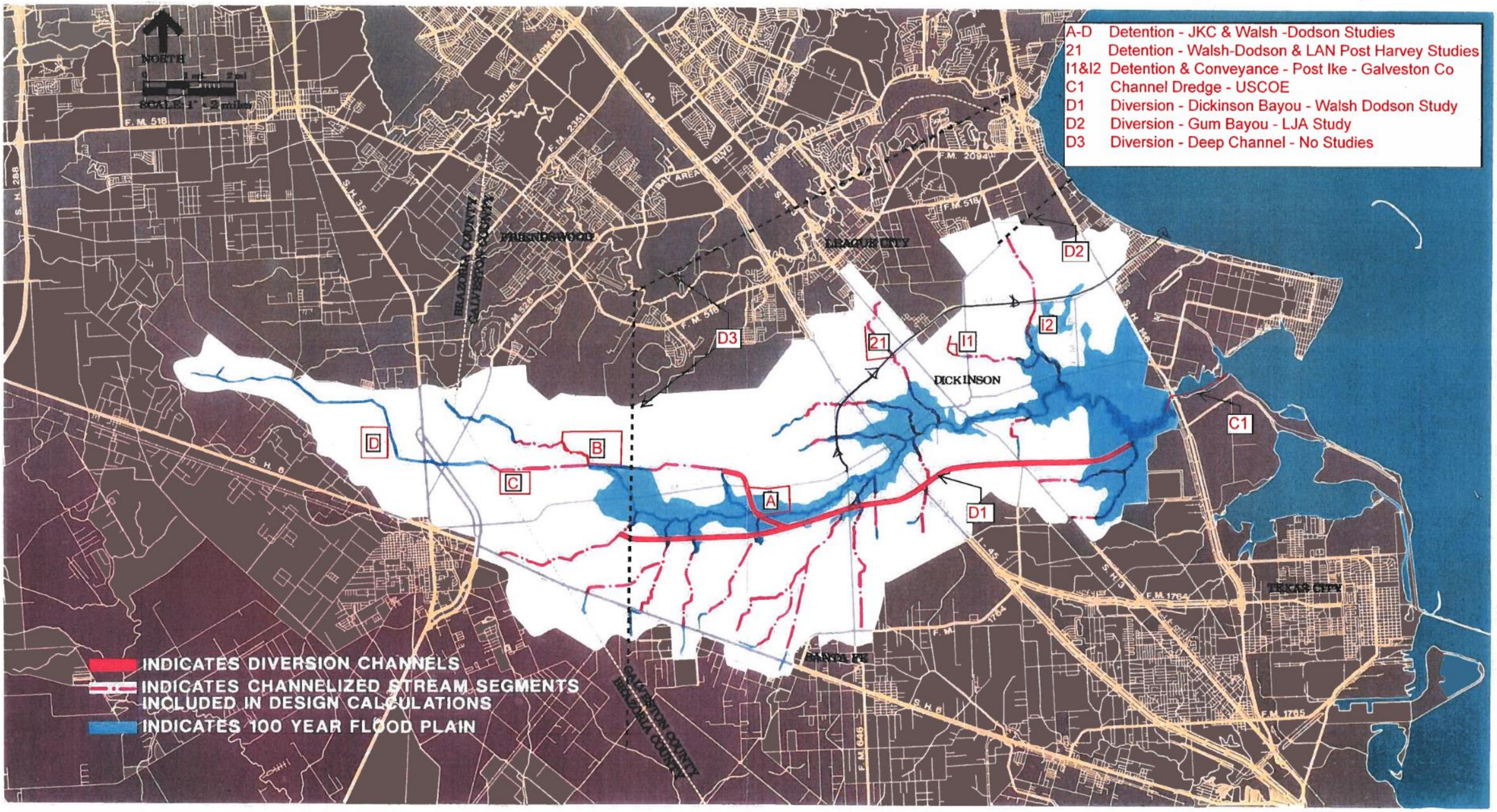
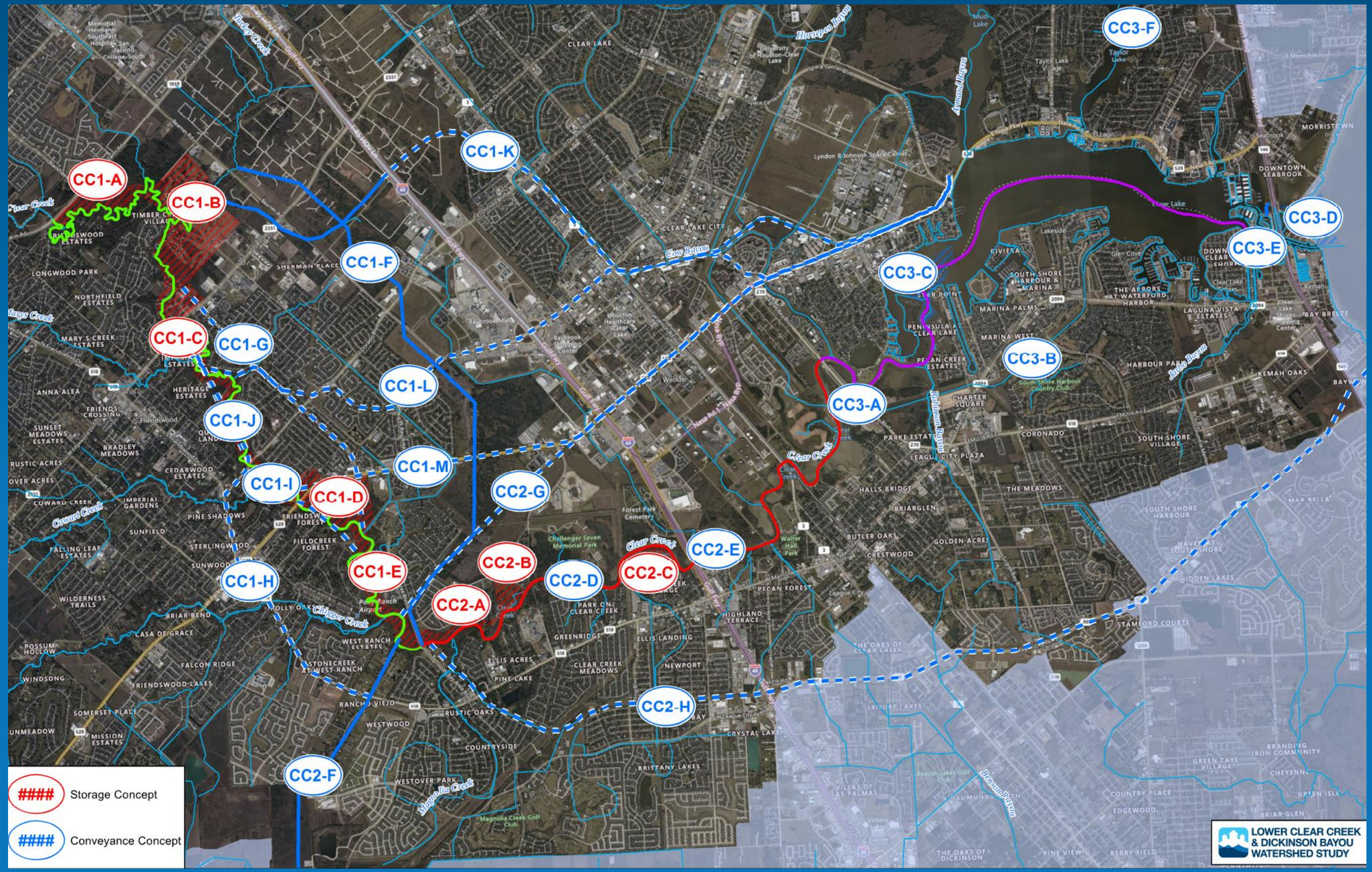


EXHIBIT 10: Channelization/Diversion Alternative

1994

WALSH ENGINEERING, INC.
in association with
DODSON & ASSOCIATES, INC.
Vernon G. Henry & Associates, Inc.
Vazquez Environmental Services, Inc.

CC Individual Concepts Evaluated



DB Individual Concepts Evaluated

Clear Creek Individual Mitigation Effectiveness

Concept	Flooding Instances Eliminated	Flooding Instances Reduced per $M	Flooding Instances Caused	Flood Damage Reduction (100 year event)	Flood Damage/Capital Cost	Flood Damage Caused (100 year event)	Capital Cost Estimate $M	Non Cost Factor Weighted Score
Clearing and Desnagging - FM 1959 - Bay Area Blvd	182	12.13	168	22	1.467	15	15	**3.8**
FM 270 Bypass	59	11.80	0	5	1.000	0	5	**4.1**
Clear Lake Outlet Expansion	220	8.80	0	25	1.000	0	25	**4.5**
Replace SH-3 and UPRR Bridge	127	2.54	36	11	0.220	4.5	50	**3.7**
OHWM Channel Bench - FM 1959 - Bay Area Blvd	247	2.06	262	33	0.275	22	120	**3.1**
Timber Creek Golf Course Basin	267	2.05	0	29	0.223	0	130	**3.1**
Channel Improvement I - FM 1959 to Bay Area	386	1.93	406	44	0.220	36	200	**2.3**
Friendswood Basin	40	1.33	0	5	0.167	0	30	**4.8**
FM2351 to Clear Lake Tunnel - 40 FT	1065	1.12	0	111	0.117	0	950	**4.0**
FM528 to Clear Lake Tunnel - 40 FT	875	1.09	0	96	0.120	0	800	**4.0**
FM1959 to Clear Lake Tunnel - 40 FT	925	0.93	0	100	0.100	0	1000	**4.0**
Bay Area Blvd to Clear Lake Tunnel - 40 FT	660	0.85	0	75	0.097	0	775	**4.0**
I-45 to Galveston Bay Tunnel - 40 FT	591	0.74	0	74	0.093	0	800	**3.9**

100-year event analysis

Dickinson Bayou Individual Mitigation Effectiveness

Concept	Flooding Instances Eliminated	Flooding Instances Reduced per $M	Flooding Instances Caused	Flood Damage Reduction (100 year event)	Flood Damage/Capital Cost	Flood Damage Caused (100 year event)	Capital Cost Estimate $M	Non Cost Factor Weighted Score
Bowl Bypass Channel 11000 cfs	1843	7.37	60	126	0.504	1	250	**2.6**
Bowl Bypass Channel 7500 cfs	1265	6.84	53	95	0.514	1	185	**2.6**
Bowl Bypass Channel 8500 cfs	1403	6.68	55	104	0.495	1	210	**2.6**
Magnolia Bayou & Benson Bayou Detention	30	3.75	0	3	0.375	0	8	**3.9**
McFarland Detention	250	2.50	0	18	0.180	0	100	**3.9**
Golf Course Detention Basin (Hilton)	33	2.20	0	4	0.267	0	15	**4.4**
West Cemetary Road Detention Basin	172	1.91	0	15	0.167	0	90	**3.9**
East Cemetary Road Detention Basin	166	1.28	0	16	0.123	0	130	**3.2**

100-year event analysis

Overall Individual Mitigation Conclusions

1. There is more flow draining to these waterways than can be accommodated.
2. There is not a “single solution” that will adequately address flood risk. Combination Solutions are necessary to maximize impact.
3. A balanced mitigation plan of additional conveyance and storage benefits the entire study reach and minimizes adverse impacts.

Clear Creek Combination Mitigation Options

Detention/Conveyance Improvements	+ FM 2351 Diversion (Tunnel)	+ I-45 Diversion (Tunnel)
1. Friendswood Basin 2. Timber Creek Basin 3. Clearing & De-Snagging FM 1959 to Bay Area Blvd 4. Replace SH-3 and UPRR 5. FM 270 Bypass 6. Clear Lake Outlet Expansion 7. Voluntary Buyouts	Conveyance Improvements Plus: 1. FM 2351 Tunnel - 40 ft diameter to Clear Lake	Conveyance Improvements Plus: 1. Above OHWM Benching FM 1959 to Bay Area Blvd 2. I-45 Tunnel - 40 ft diameter to Galveston Bay 3. No Clear Lake Outlet Expansion Required

Conveyance Improvements

1. Friendswood Basin
2. Timber Creek Basin
3. Clearing & De-Snagging FM 1959 to Bay Area Blvd
4. Replace SH-3 and UPRR
5. FM 270 Bypass
6. Clear Lake Outlet Expansion
7. Voluntary Buyouts

Estimated Construction Cost $275M

Factor	Score
Land Acquisition	4
Community Impact/Aesthetics	5
O&M/Resiliency	5
Other Agency Coordination	3
Speed of Implementation	4
Non-Cost Factor Weighted Score	4.4

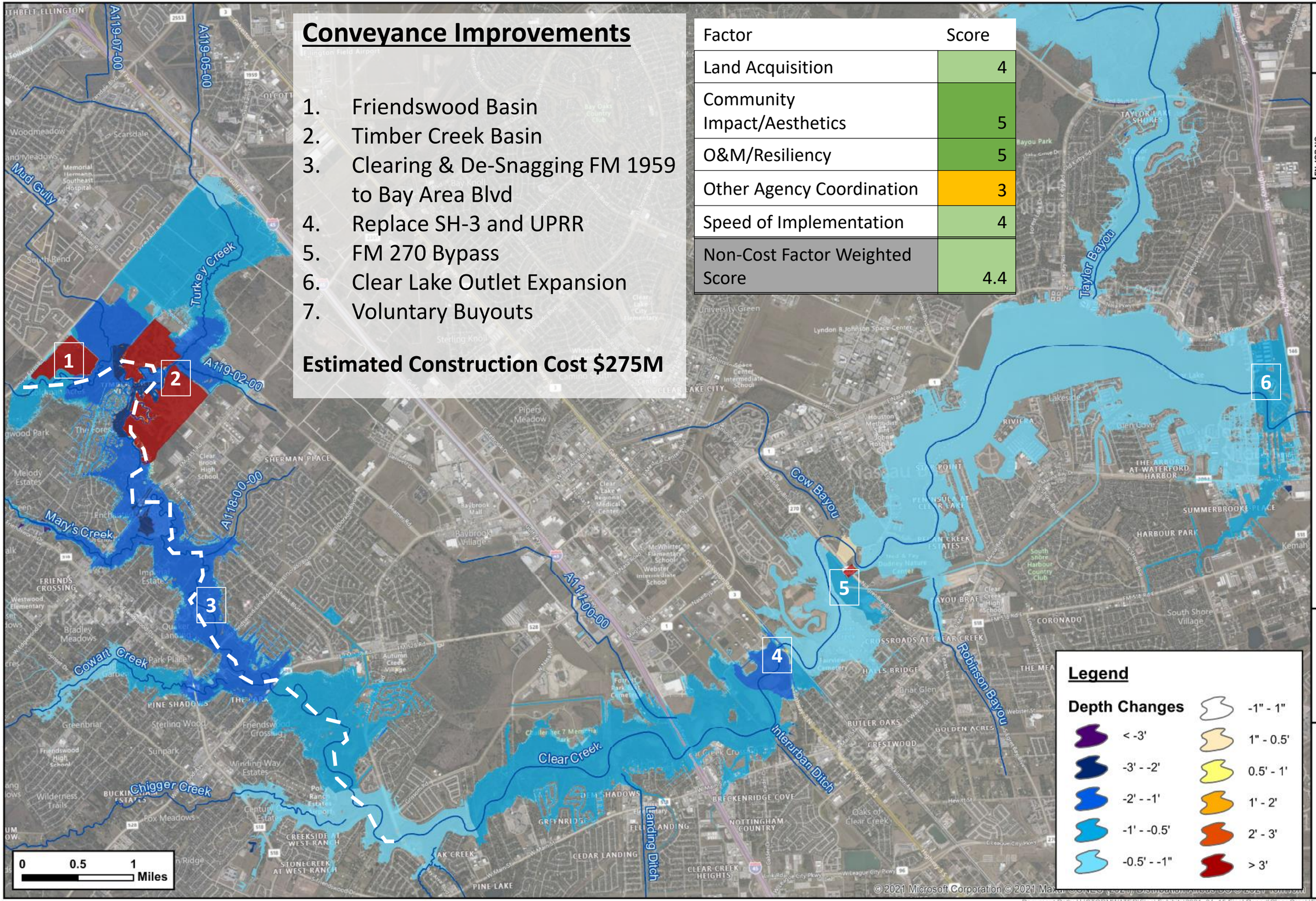


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FIGURE 1

FN JOB NO	LEA19688
FILE	Fig1.Combined_Small
DATE	3/18/2021
SCALE	1:50,000
DRAFTED	90206

Combined Small

100-yr Inundation Depth Changes Map

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CI + FM 2351 Tunnel

1. Friendswood Basin
2. Timber Creek Basin
3. Clearing & De-Snagging FM 1959 to Bay Area Blvd
4. **FM 2351 Tunnel - 40 ft DIA to Clear Lake**
5. Replace SH-3 and UPRR
6. FM 270 Bypass
7. Clear Lake Outlet Expansion
8. Voluntary Buyouts

Estimated Construction Cost
$1,250M

Factor	Score
Land Acquisition	4
Community Impact/Aesthetics	4
O&M/Resiliency	3
Other Agency Coordination	2
Speed of Implementation	4
Non-Cost Factor Weighted Score	3.6

1
2
3
4
5
6
7

A119-07-00
A119-05-00
A119-02-00
A118-00-00
A117-00-00
Mud Gully
Turkey Creek
Mary's Creek
Cowart Creek
Chigger Creek
Clear Creek
Taylor Bayou
Cow Bayou
Robinson Bayou
Interurban Ditch
Landing Ditch

0 0.5 1 Miles

Legend

Depth Changes

- < -3'
- -3' - -2'
- -2' - -1'
- -1' - -0.5'
- -0.5' - -1'
- -1" - 1"
- 1" - 0.5'
- 0.5' - 1'
- 1' - 2'
- 2' - 3'
- > 3'

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FIGURE 3

Combined Large V2

100-yr Inundation Depth Changes Map

FN JOB NO	LEA19688
FILE	Fig3.Combined_LargeV2
DATE	3/23/2021
SCALE	1:50,000
DRAFTED	WJ

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CI + I-45 Tunnel

1. Friendswood Basin
2. Timber Creek Basin
3. **Above OHWM Benching FM 1959 to Bay Area Blvd**
4. **I-45 Tunnel - 40 ft DIA to Galveston Bay**
5. Replace SH-3 and UPRR
6. FM 270 Bypass
7. ~~Clear Lake Outlet Expansion~~
8. Voluntary Buyouts

Estimated Construction Cost $1,150M

Factor	Score
Land Acquisition	3
Community Impact/Aesthetics	4
O&M/Resiliency	3
Other Agency Coordination	2
Speed of Implementation	4
Non-Cost Factor Weighted Score	3.3

FIGURE 2

FN JOB NO LEA19688
FILE Fig2.Combined_LargeV1
DATE 3/23/2021
SCALE 1:50,000
DRAFTED 90206

Combined Large V1

100-yr Inundation Depth Changes Map

Legend

Depth Changes

- < -3'
- -3' - -2'
- -2' - -1'
- -1' - -0.5'
- -0.5' - -1'
- -1" - 1"
- 1" - 0.5'
- 0.5' - 1'
- 1' - 2'
- 2' - 3'
- > 3'

0 0.5 1 Miles

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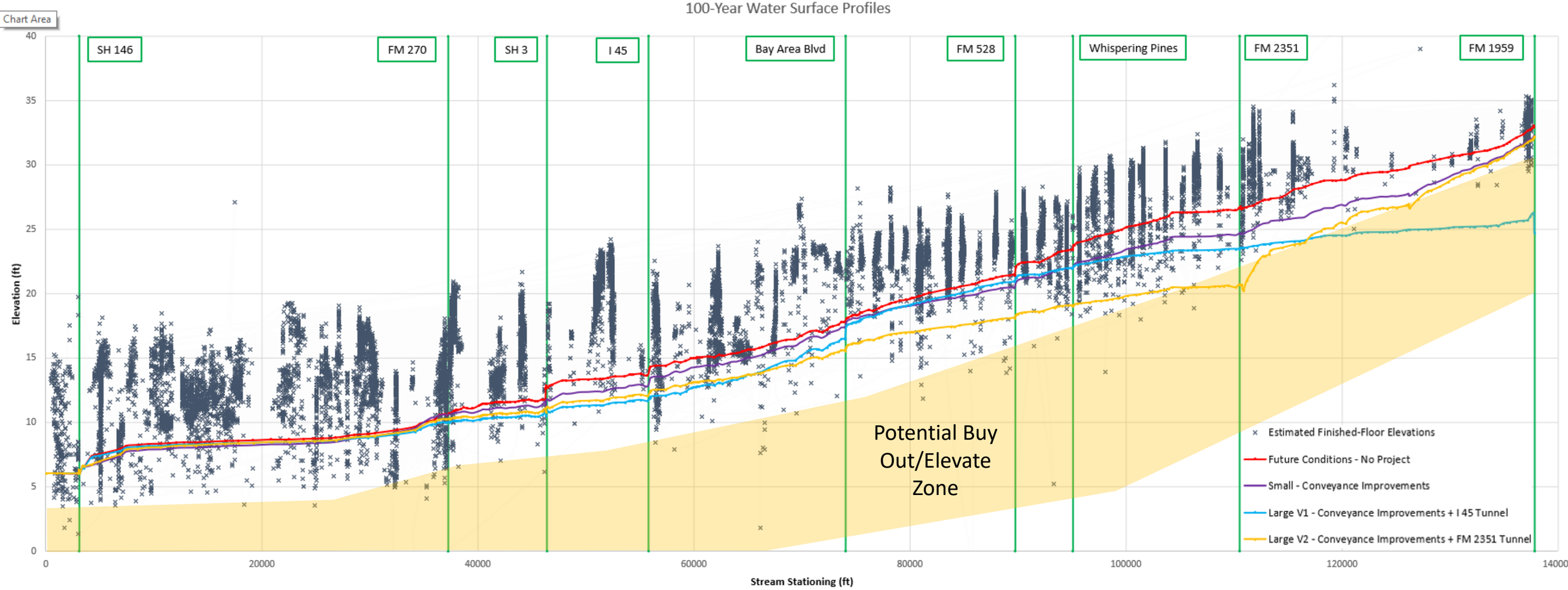
Clear Creek Combination Mitigation WSEL Profile

Reach 3 **Reach 2** **Reach 1**



Dickinson Bayou Combination Mitigation Option

Detention	Detention + Diversion Channel
1. McFarland Rd Detention 2. Cemetery Rd West Detention 3. Golf Course (Hilton Ln) Detention 4. Magnolia & Borden Detention 5. Voluntary Buyouts	Detention plus: 1. “Bowl” 11,000 cfs Diversion Channel

Detention + Channel

1. McFarland Rd Detention
2. Cemetery Rd West Detention
3. Golf Course (Hilton Ln) Detention
4. Magnolia & Borden Detention
5. Voluntary Buyouts
6. **"Bowl" 11,000 cfs Diversion Channel**

Estimated Capital Cost $500M

Factor	Score
Land Acquisition	1
Community Impact/Aesthetics	2
O&M/Resiliency	5
Other Agency Coordination	3
Speed of Implementation	3
Non-Cost Factor Weighted Score	2.9

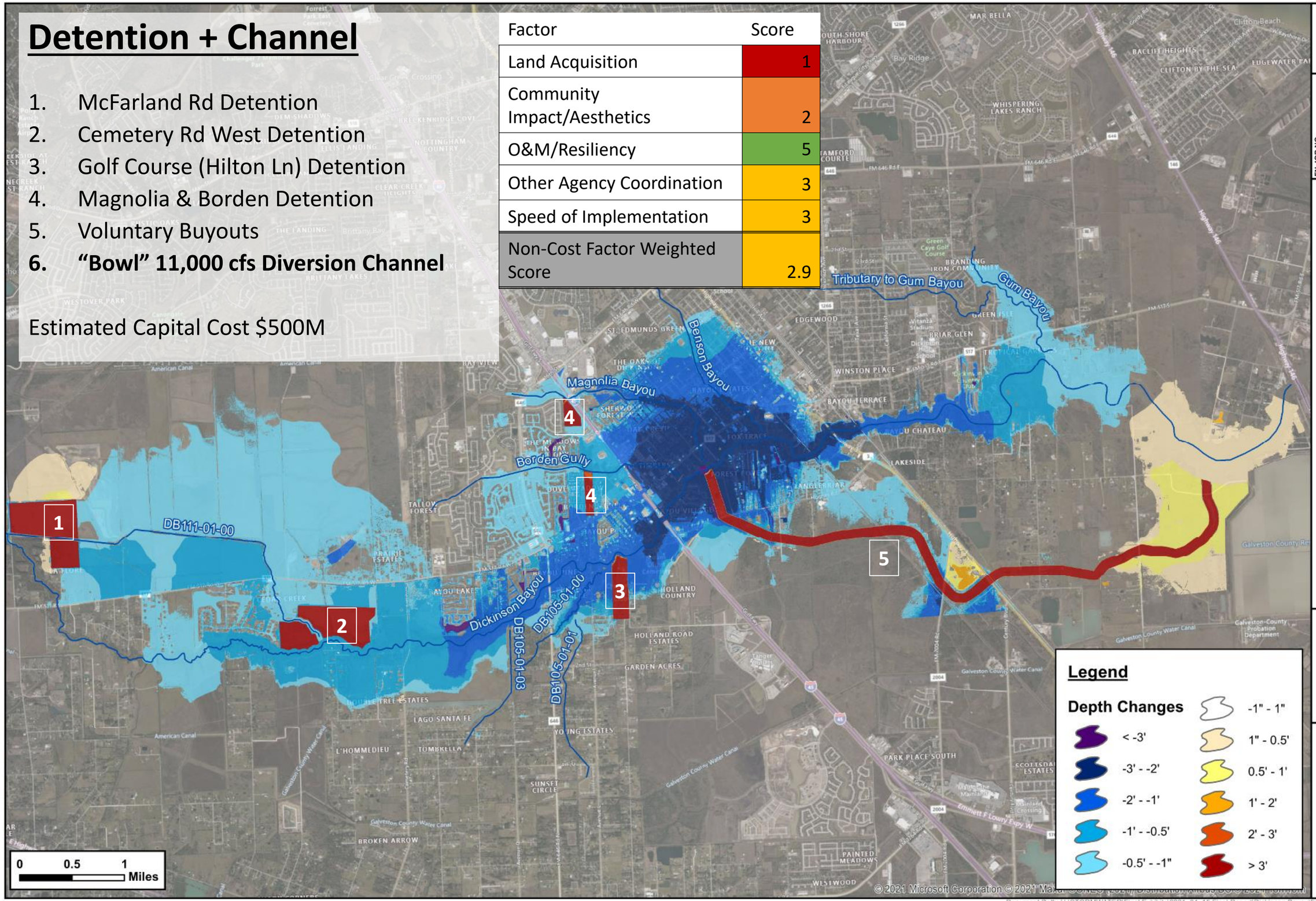


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FIGURE 2

FN JOB NO	LEA19688
FILE	Fig2.Combined_Large
DATE	3/22/2021
SCALE	1:53,000
DRAFTED	WJ

Combined Large

100-yr Inundation Depth Changes Map

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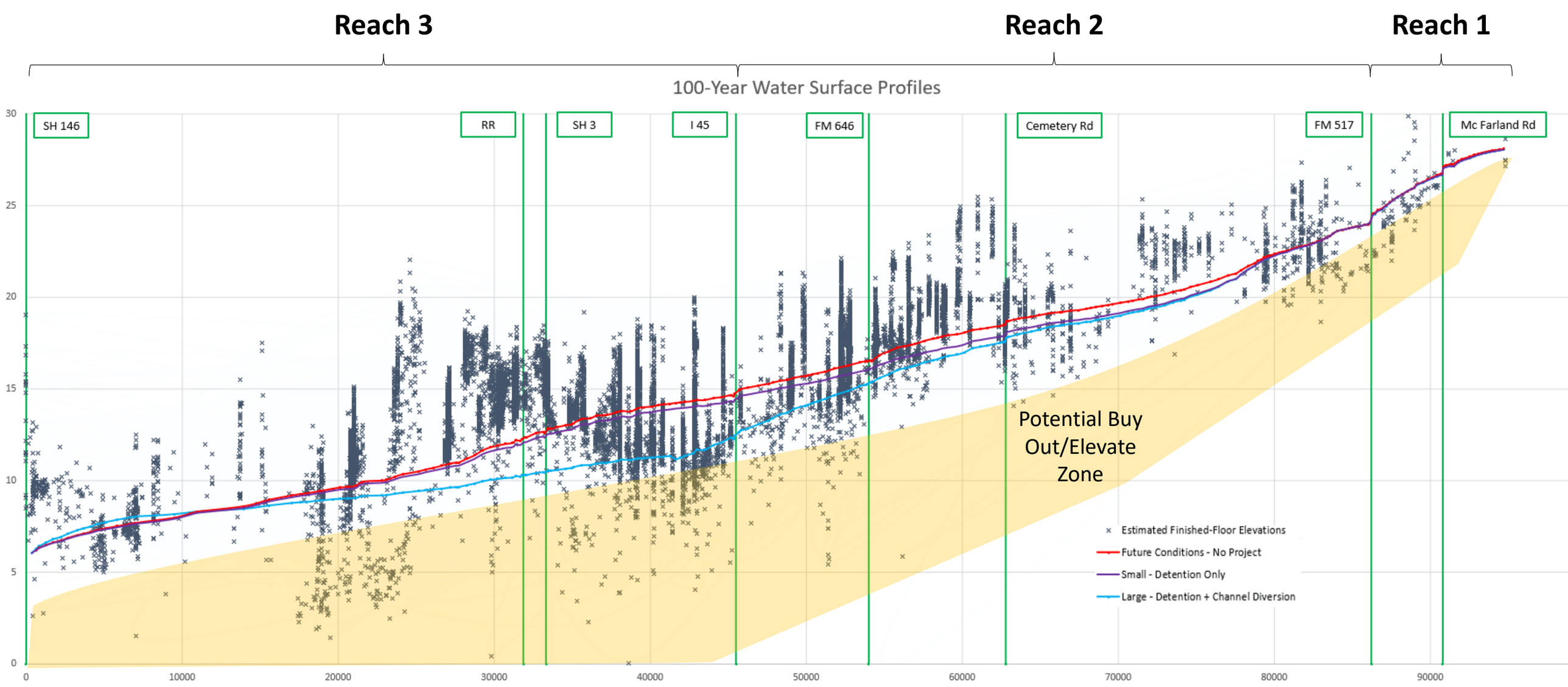
Dickinson Bayou Combination Mitigation WSEL Profile



Combination Mitigation Conclusions

1. Significant residual risk exists east of I-45 in both watersheds due to low lying structures, rising sea levels and storm surge.
2. Diversion solutions provide greater protection for large storms (100-yr and 500-yr).
   a) Tunnels are possibly the only diversion option for Clear Creek.
   b) Open channel diversion is an option for Dickinson Bayou.
3. Benefits indicated do not fully account for local drainage benefits which could be significant.
4. Due to cost, non-diversion options are the most cost efficient, but provide limited flood risk reduction benefit.

Study Recommendations and Path Forward

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Recommendations

1. Conveyance improvements upstream cannot be constructed without additional improvements downstream to Galveston Bay.
2. **Certain improvements (i.e. regional detention ponds) can be constructed now in advance of large flow diversion improvements.**
3. Feasibility phase is needed and should include understanding of:
   a) How local drainage system benefits from riverine water surface reduction increase total project flood risk reduction benefits.
   b) The impact of Galveston Bay surge improvements on final riverine solutions.
4. Regardless of the improvements, residual risk will remain. Elevating structures and buy outs will need to be considered as a part of all solutions.
5. All viable solutions are expensive. Local partners will need state and federal level support to implement a long-term solution.

Path Forward

1. Move forward with design/implementation of regional detention ponds with local/regional funding – “Quick Win” opportunity for H-GAC
2. Conduct a deeper review of highest impact alternatives to refine cost and impact
    a) Assess impact of riverine water surface reduction on local drainage systems
    b) Assess impact of coastal barrier improvements on riverine solutions
    c) Refine size and cost of measures
    d) Assess environmental requirements and develop potential implementation schedule
3. Continue advocacy for state and federal support

Discussion

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Thank You