



**DRAINAGE PRESENTATION**

**MONTROSE BOULEVARD IMPROVEMENTS**

WBS No. N-T27000-0005-7



**MONTROSE**  
TAX INCREMENT REINVESTMENT ZONE 27

May 20, 2024



# Agenda

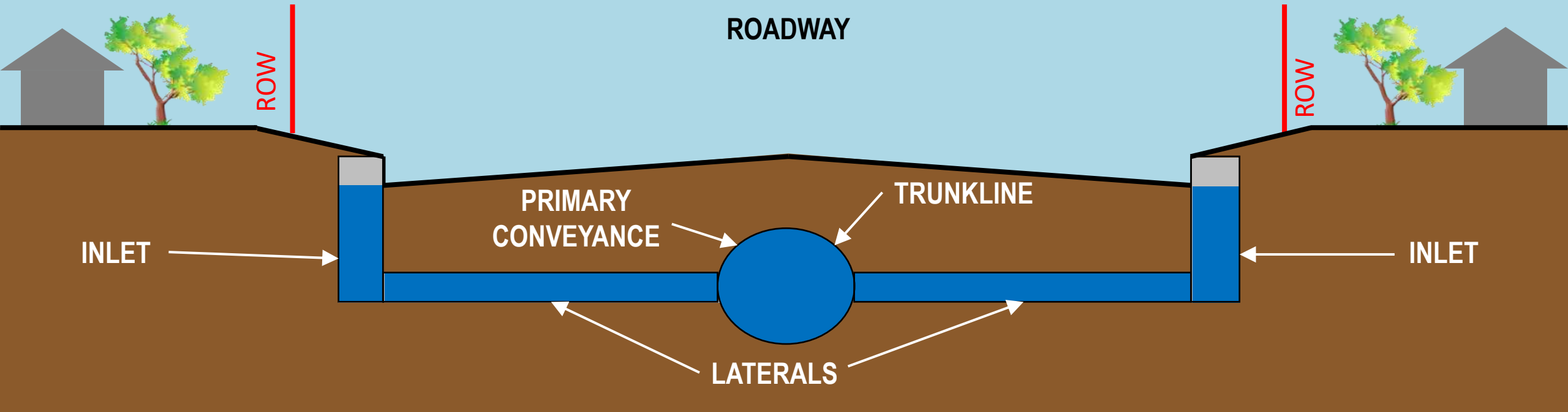
- City of Houston Drainage Criteria
- Montrose Drainage Study
  - Background and Objectives
  - Existing Conditions Results
  - Hurricane Harvey
  - Proposed Improvements
- Montrose Blvd Improvements
  - Montrose Blvd Phase 1



# Drainage Criteria



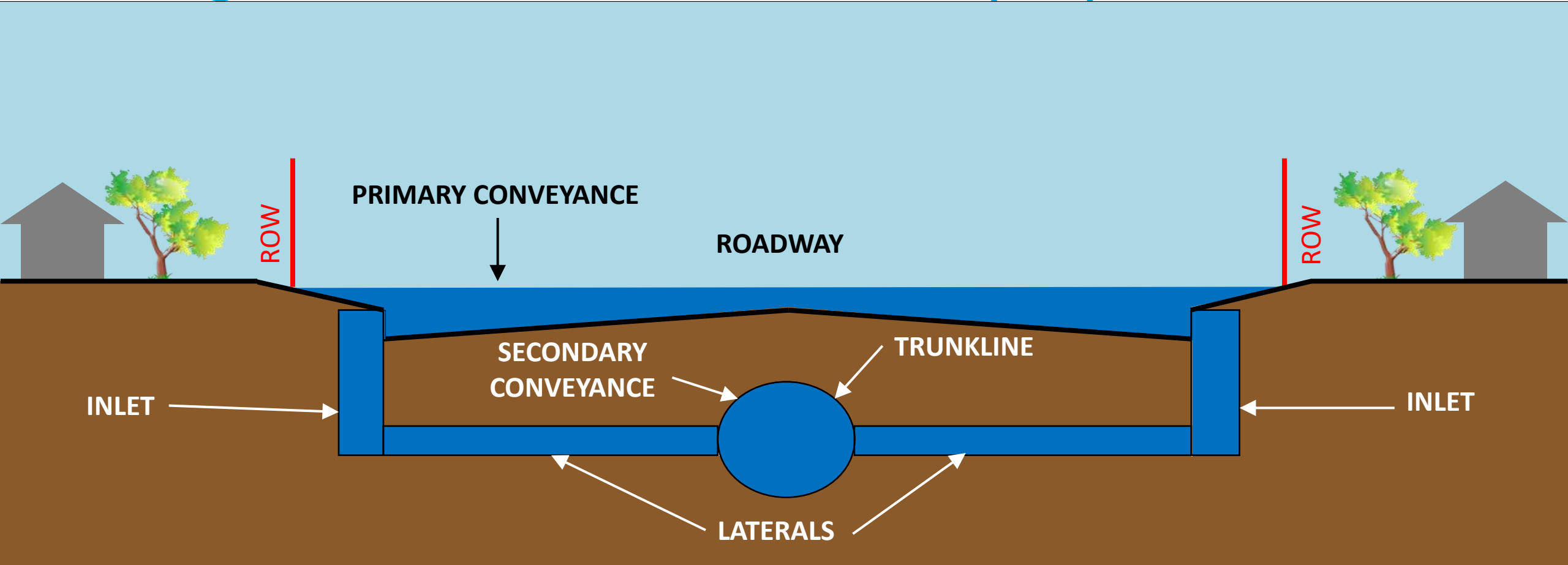
# Current City of Houston Roadway Drainage Criteria – 2-Year Event (50%)



## Development Criteria

- Water Surface not to Exceed Gutter Elevation
- Storm Sewers used as Primary Conveyance System

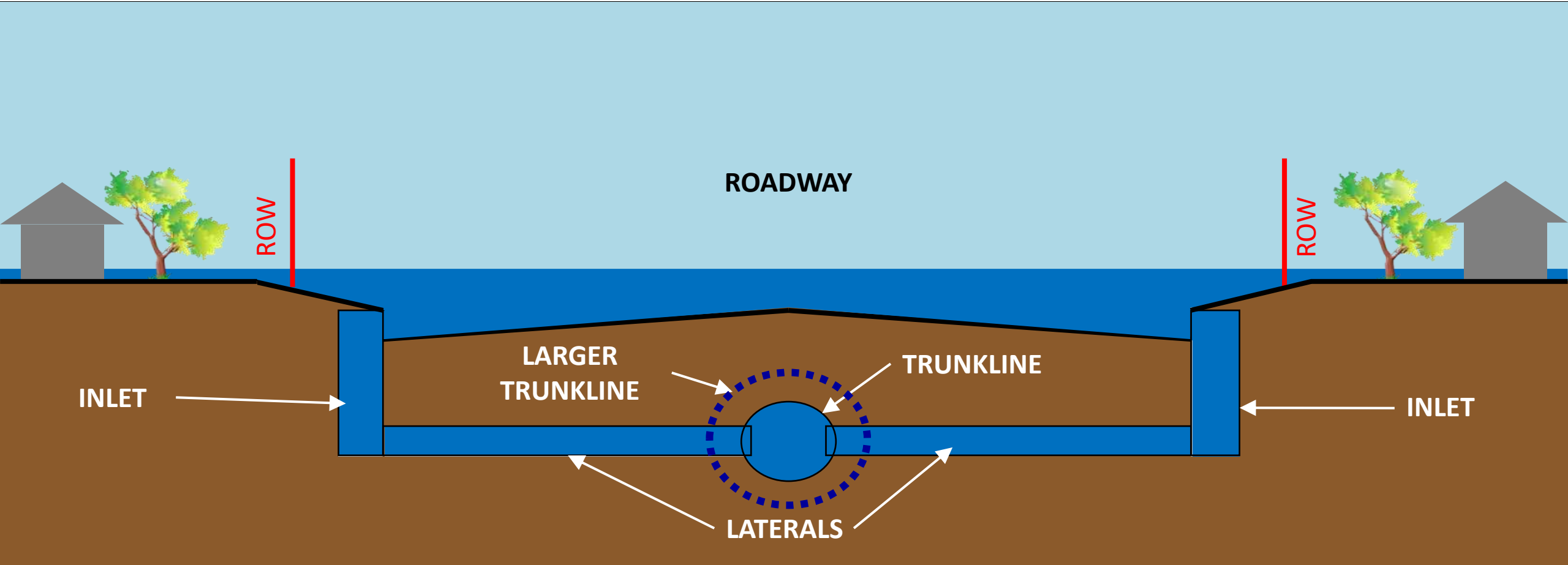
# Current City of Houston Roadway Drainage Criteria– 100-Year Event (1%)



## Development Criteria

- Water Surface not to Exceed Ground Elevation at ROW Line
- Streets used as Primary Conveyance System
- Provide Overland Flow Outfall

# Older/Smaller Storm Sewers

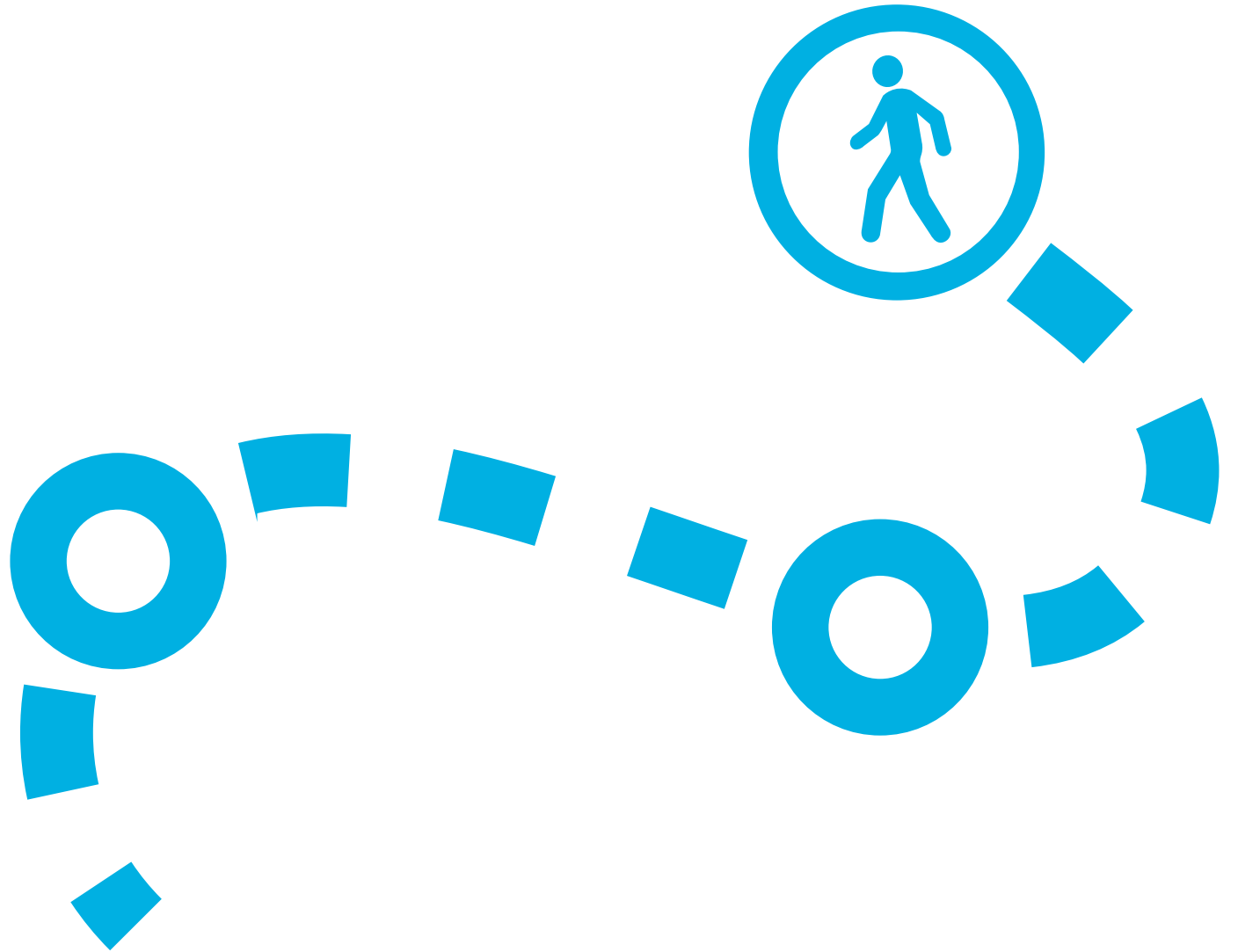


# Montrose Drainage Study



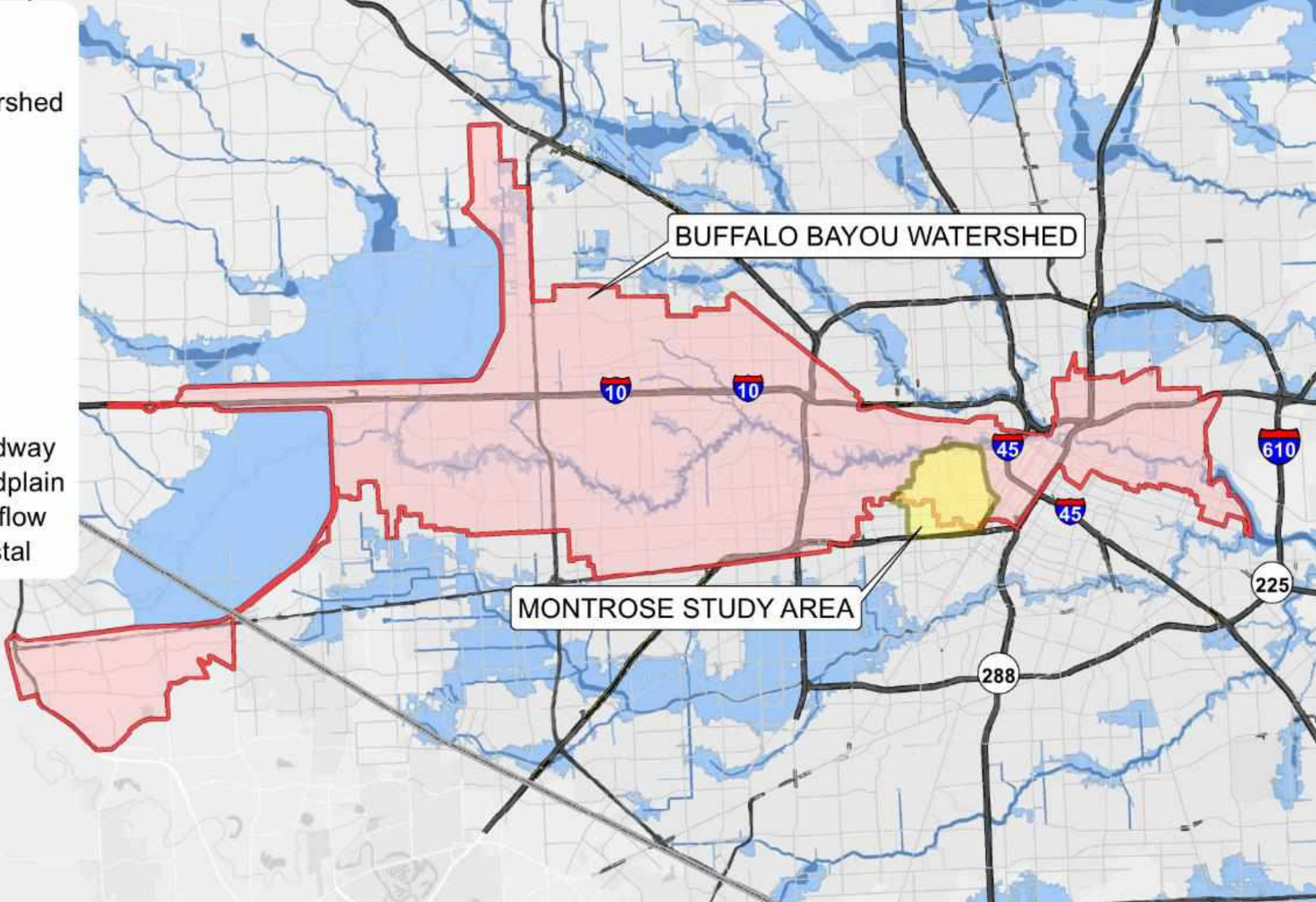
# Montrose Drainage Study Background and Objectives

- **Study Objectives:**
  - Identify and Quantify Flood Risk in the Montrose Community
  - Develop Improvement Plans to Reduce Flooding
- **Consistency with City of Houston Criteria and Modeling Approach**
  - Strong Alignment
  - Atlas 14 Rainfall
  - City of Houston 2D Modeling Guidelines
  - Same Analysis Platform and Approach as the City's new Stormwater Master Plan.
- **Historical Calibration Event**
  - Hurricane Harvey



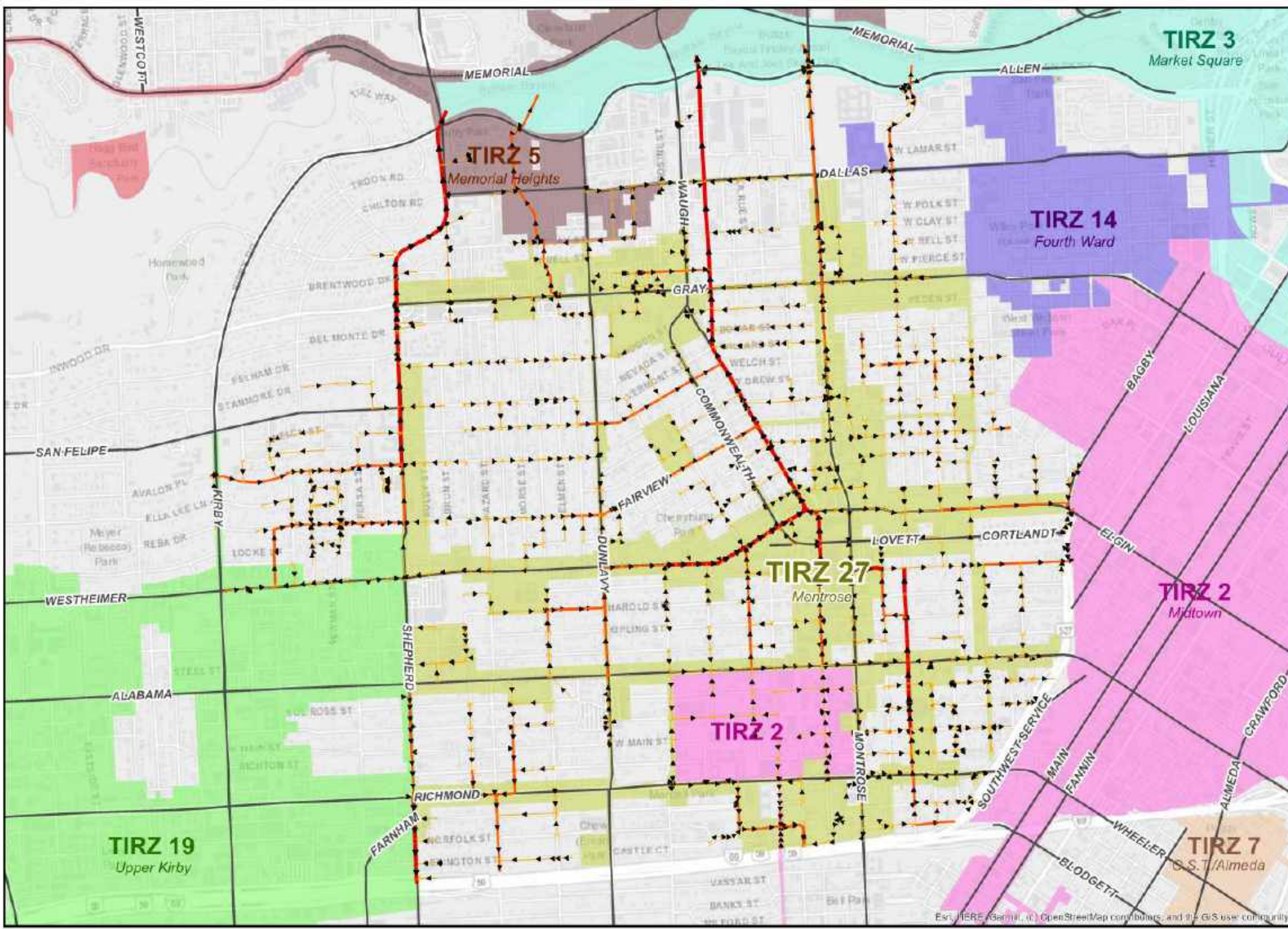


- Legend**
- Study Area
  - Buffalo Bayou Watershed
  - Harris County
- Roads**
- Freeway
  - Frontage
  - Tollway
  - HOV
  - Major
  - Ramp
- FEMA Floodplains**
- 1% (100-year) Floodway
  - 1% (100-year) Floodplain
  - 1% (100-year) Overflow
  - 1% (100-year) Coastal

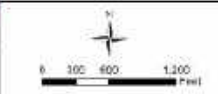


BUFFALO BAYOU WATERSHED

MONTROSE STUDY AREA



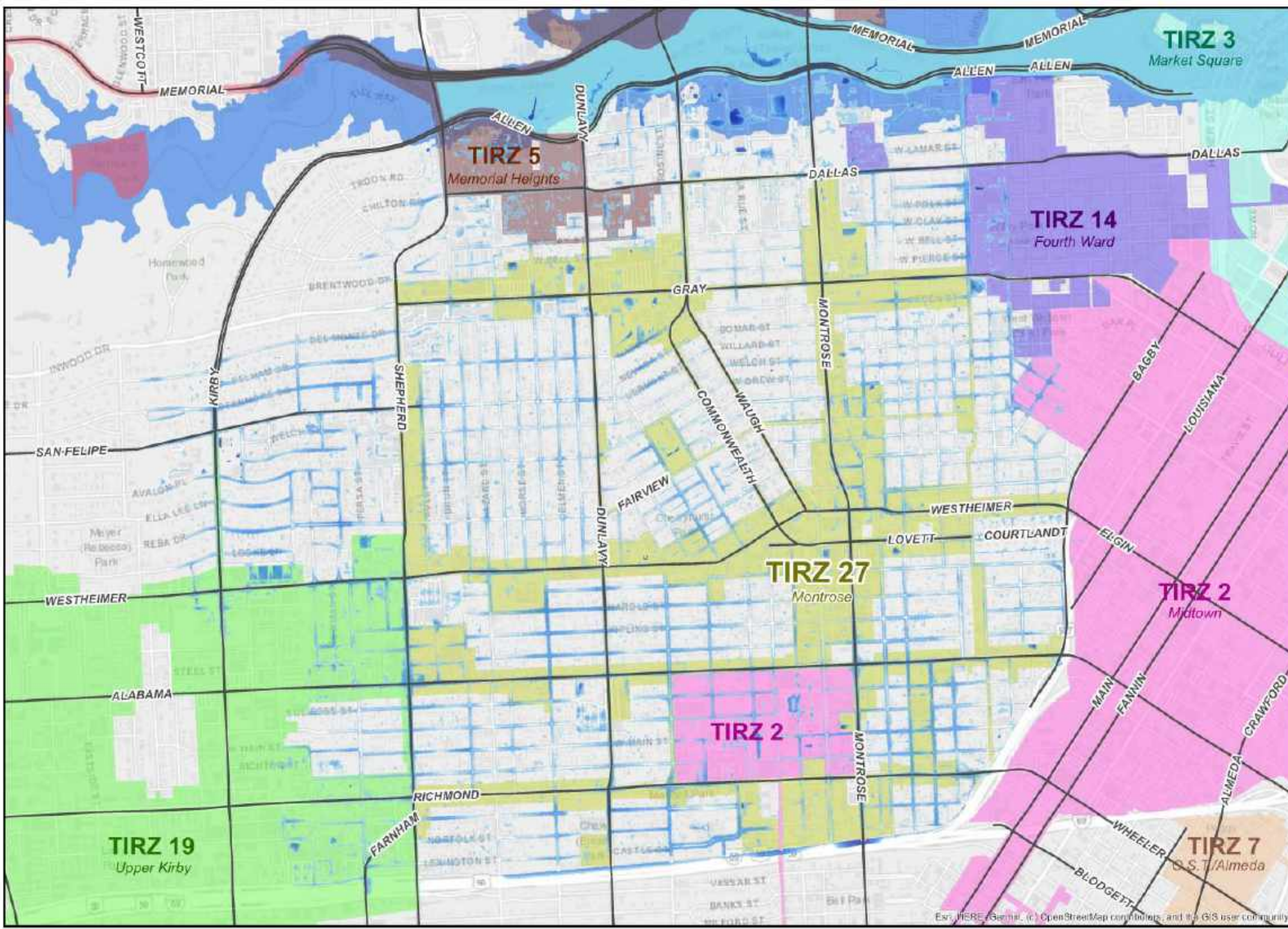
- Legend**
- Major Streets
  - Storm Drain Inlet
  - Storm Drain Pipe Size
    - < 36"
    - 36" - 60"
    - > 60"
  - TIRZ Boundaries
    - TIRZ 13
    - TIRZ 14
    - TIRZ 16
    - TIRZ 19
    - TIRZ 2
    - TIRZ 27
    - TIRZ 3
    - TIRZ 5
    - TIRZ 7



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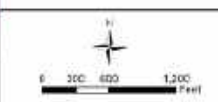
# Montrose Drainage Study Existing Conditions





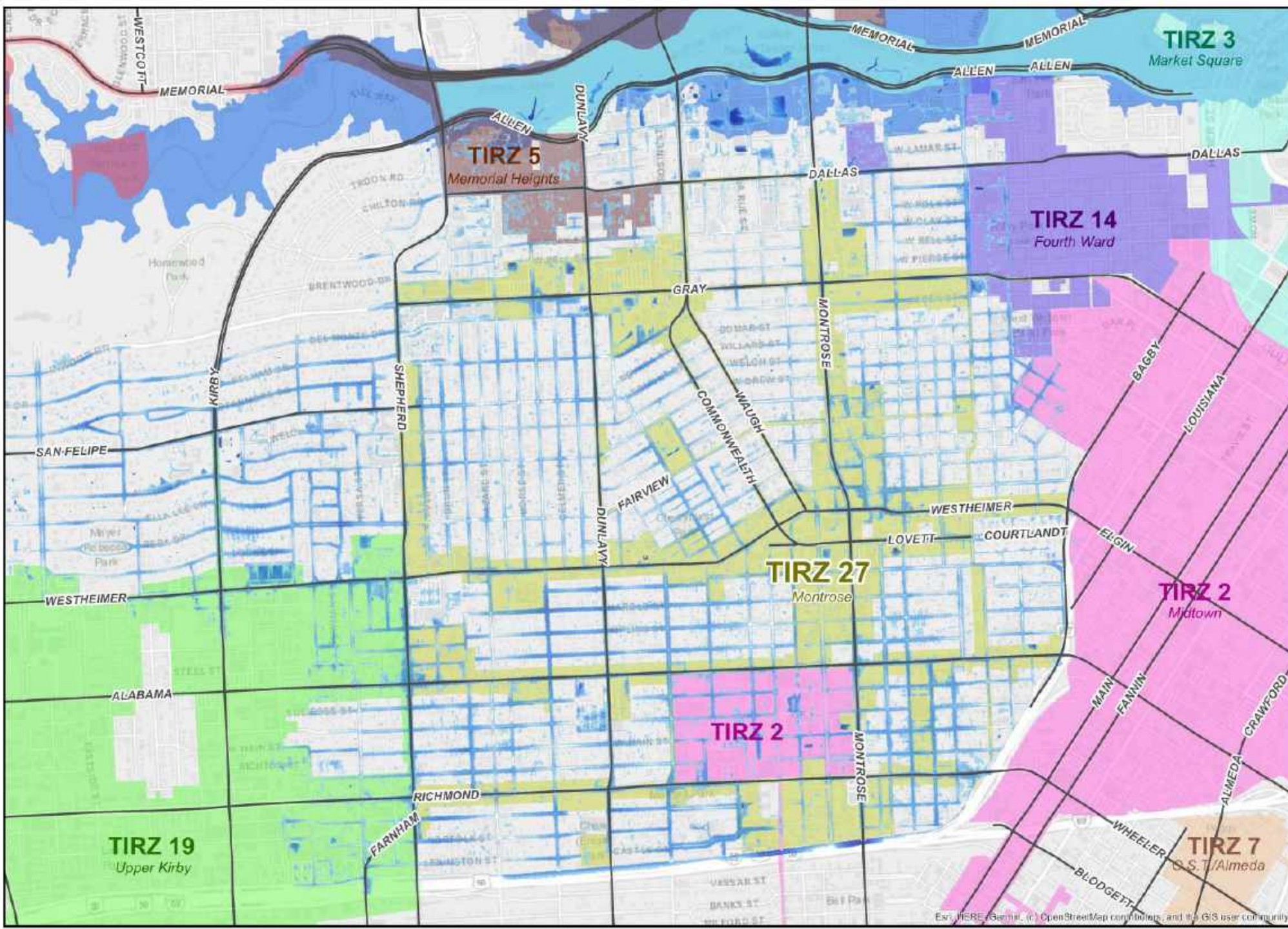
**Existing 2-yr Inundation**

- Legend**
- Major Streets
  - FEMA 500-yr
  - Existing 2-year Depths (ft)**
  - 0.25 - 0.50
  - 0.51 - 0.75
  - 0.76 - 1.00
  - 1.01 - 1.50
  - 1.51 - 2.00
  - 2.01 - 2.50
  - 2.51 - 3.00
  - 3.01 - 5.00
  - < 5.01
  - TIRZ Boundaries**
  - TIRZ 13
  - TIRZ 14
  - TIRZ 16
  - TIRZ 19
  - TIRZ 2
  - TIRZ 27
  - TIRZ 3
  - TIRZ 5
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City of Houston  
Harris County

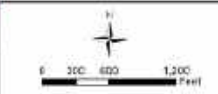
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**Existing 10-yr Inundation**

**Legend**

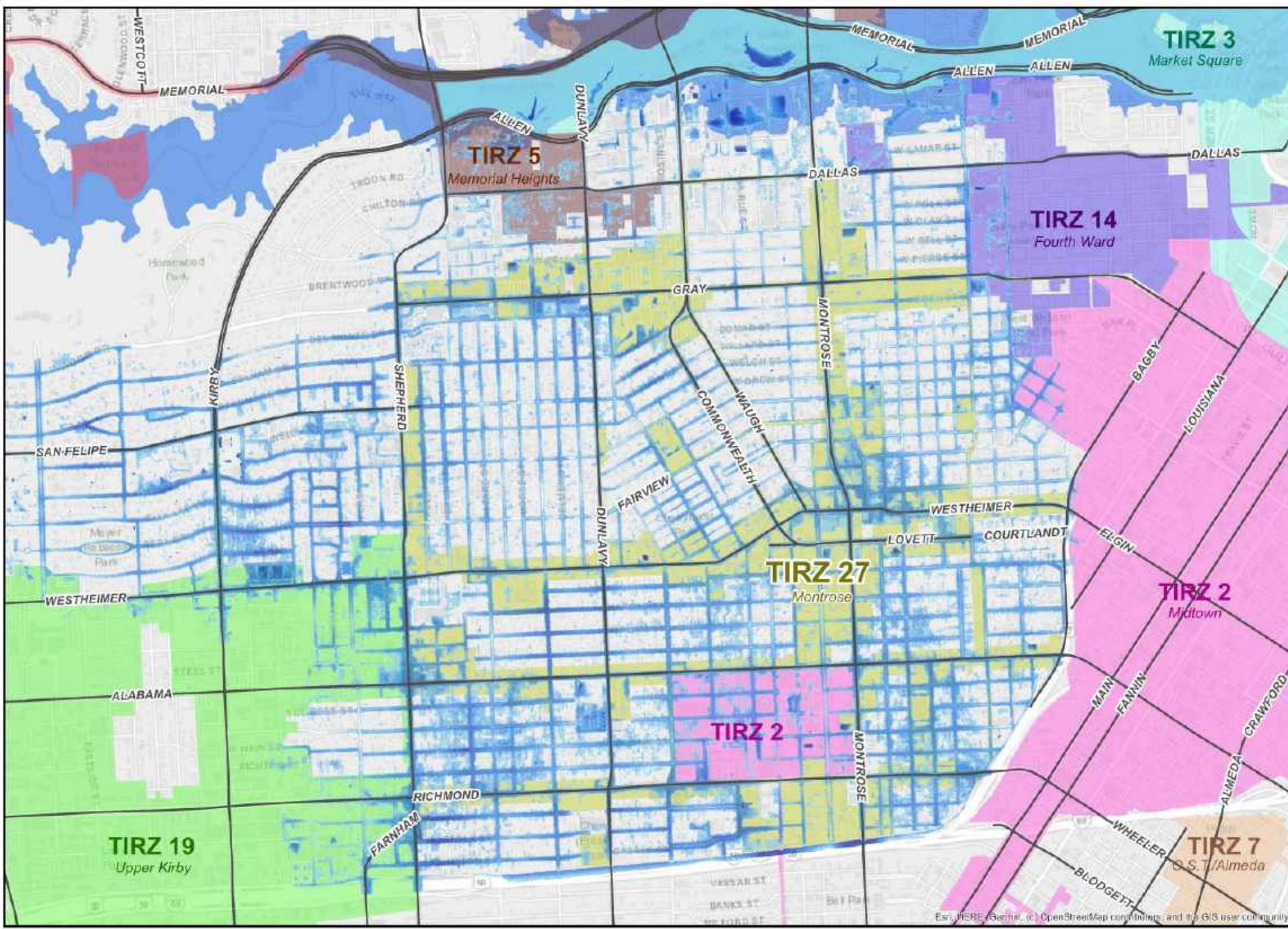
- Major Streets
- FEMA 500-yr
- Existing 10-year Depths (ft)**
- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00
- 2.01 - 2.50
- 2.51 - 3.00
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- TIRZ 3
- TIRZ 5
- TIRZ 7



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**Existing 100-yr Inundation**

**Legend**

- Major Streets
- FEMA 500-yr
- Existing 100-year Depths (ft)**
  - 0.25 - 0.50
  - 0.51 - 0.75
  - 0.76 - 1.00
  - 1.01 - 1.50
  - 1.51 - 2.00
  - 2.01 - 2.50
  - 2.51 - 3.00
  - 3.01 - 5.00
  - < 5.01
- TIRZ Boundaries**
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  - TIRZ 19
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  - TIRZ 27
  - TIRZ 3
  - TIRZ 5
  - TIRZ 7

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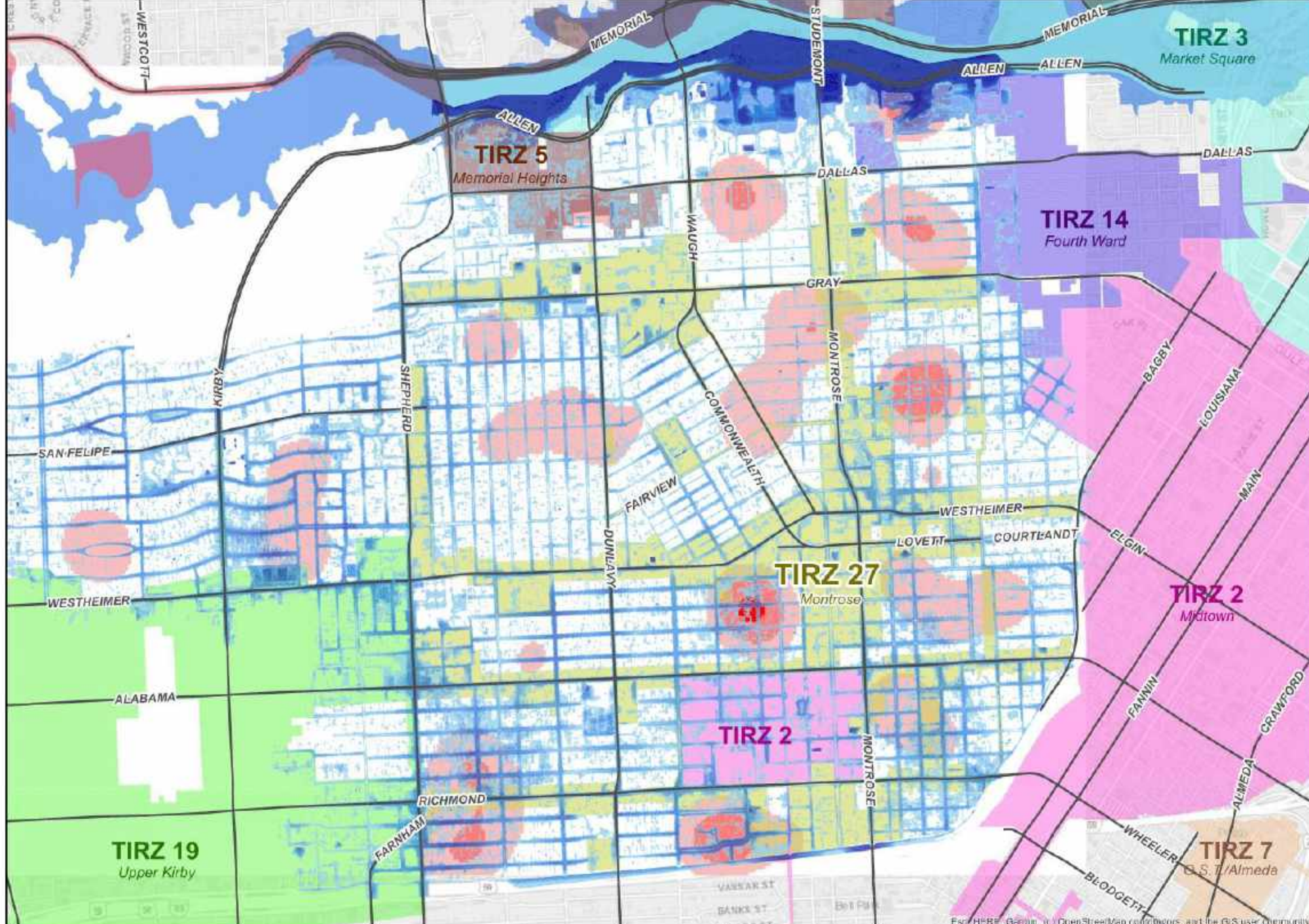
### Hurricane Harvey Inundation

#### Legend

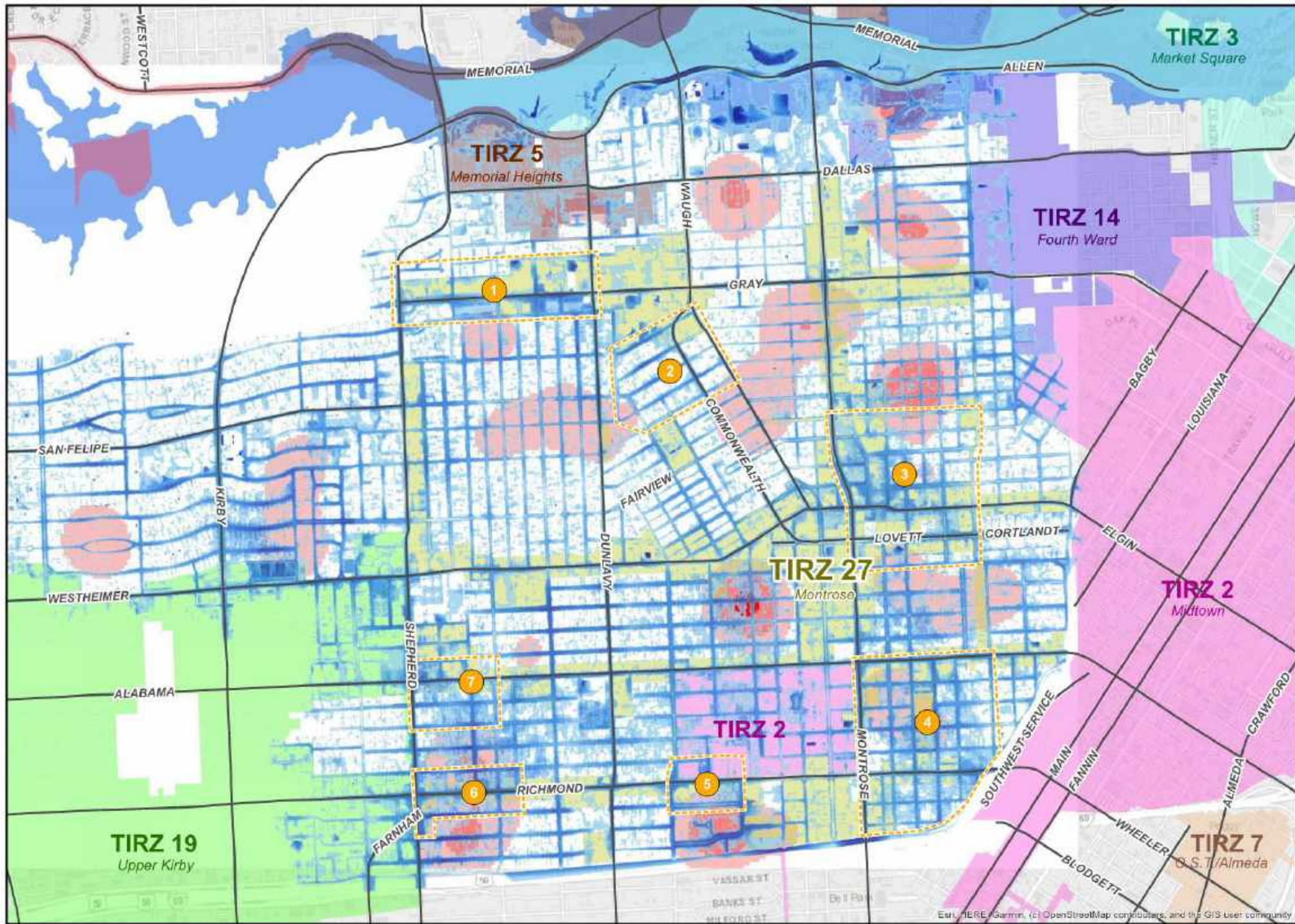
- Major Streets
- FEMA 500-yr
- Hurricane Harvey**
- Depths (ft)**
- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00
- 2.01 - 2.50
- 2.51 - 3.00
- 3.01 - 5.00
- < 5.01
- COHTIRZ2019**
- TIRZ Boundaries**
- TIRZ 13
- TIRZ 14
- TIRZ 16
- TIRZ 19
- TIRZ 2
- TIRZ 27
- TIRZ 3
- TIRZ 5
- TIRZ 7
- Harvey Flooded Structure Hot Spots**
- White
- Light Red
- Red
- Dark Red



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**Existing Problem Areas**

**Legend**

- Major Streets
- ▭ Problem Area
- FEMA 500-yr 100-Year, Atlas 14 Depths (ft)
- 0.25 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00
- 2.01 - 2.50
- 2.51 - 3.00
- 3.01 - 5.00
- < 5.01

**TIRZ Boundaries**

- TIRZ 13
- TIRZ 14
- TIRZ 16
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- TIRZ 3
- TIRZ 5
- TIRZ 7

**Flooded Structure Hot Spots**

- 
- 
- 
- 
- 



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# Historical Flood Photos



Harvey

Hurricane Harvey Flooding on Colquitt Street  
7AM ~ 8/27/2017

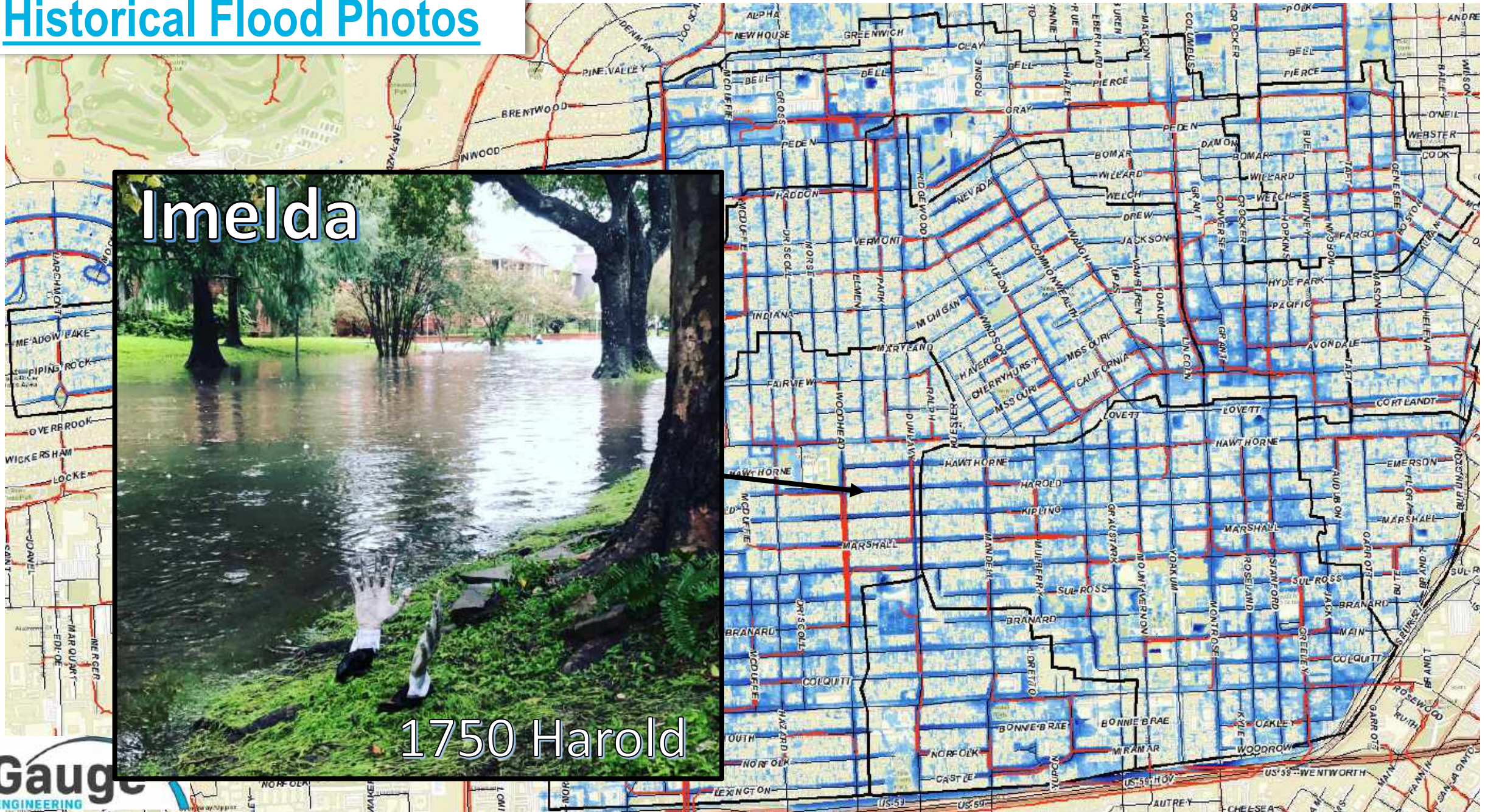
# Historical Flood Photos

Imelda

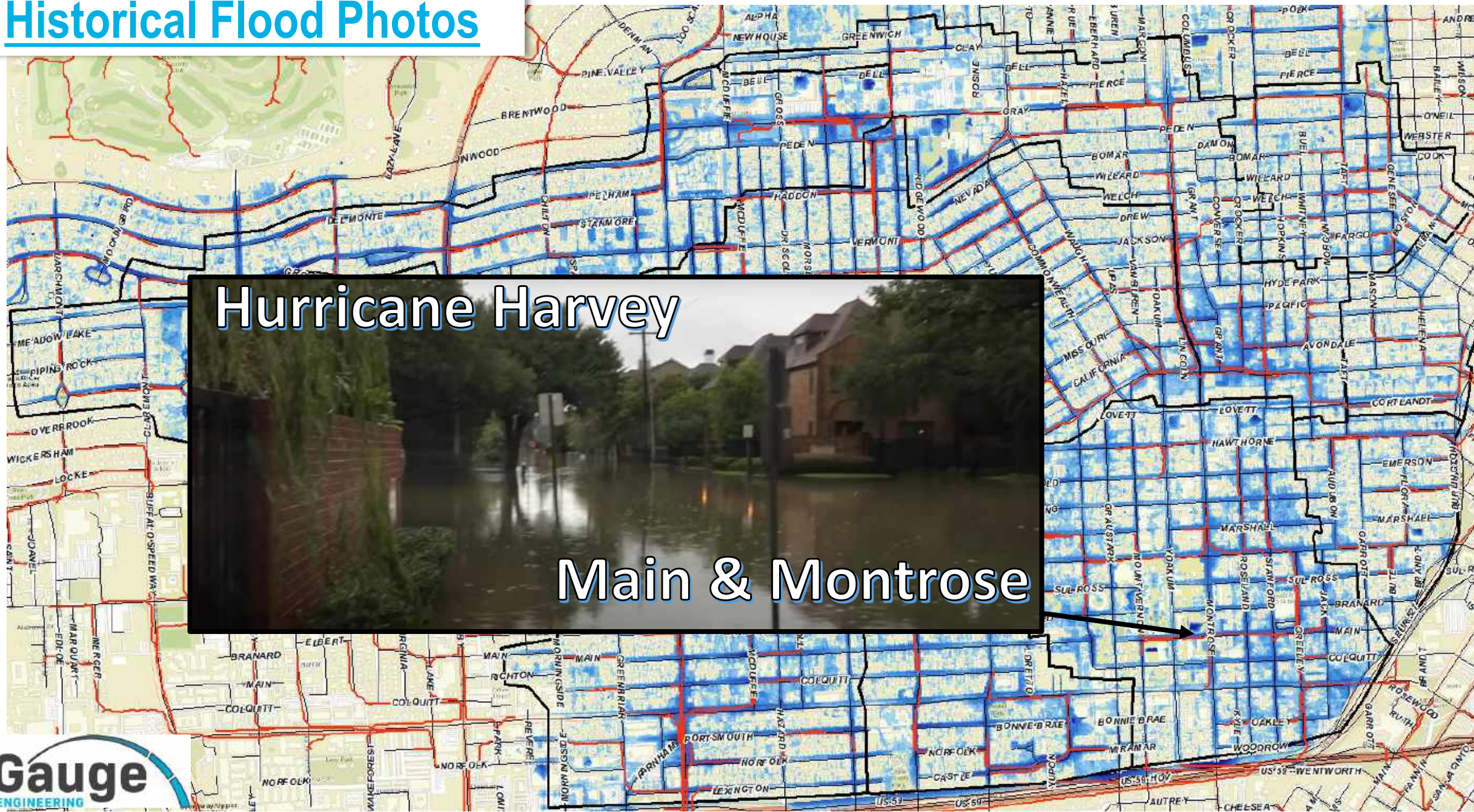


1750 Harold

Gauge  
ENGINEERING



# Historical Flood Photos



Hurricane Harvey

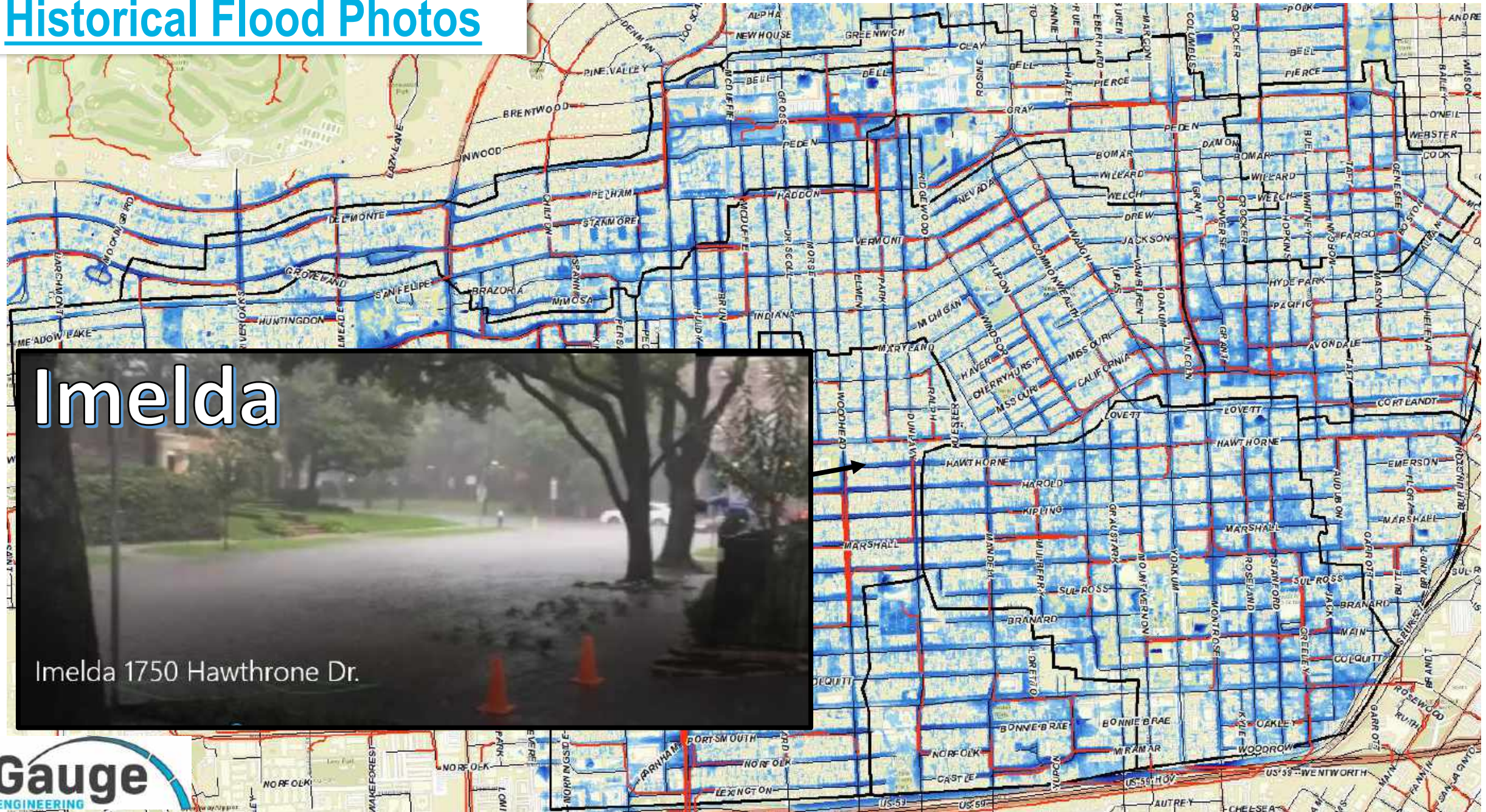
Main & Montrose



**MONTROSE BLVD &  
W MAIN ST**



# Historical Flood Photos

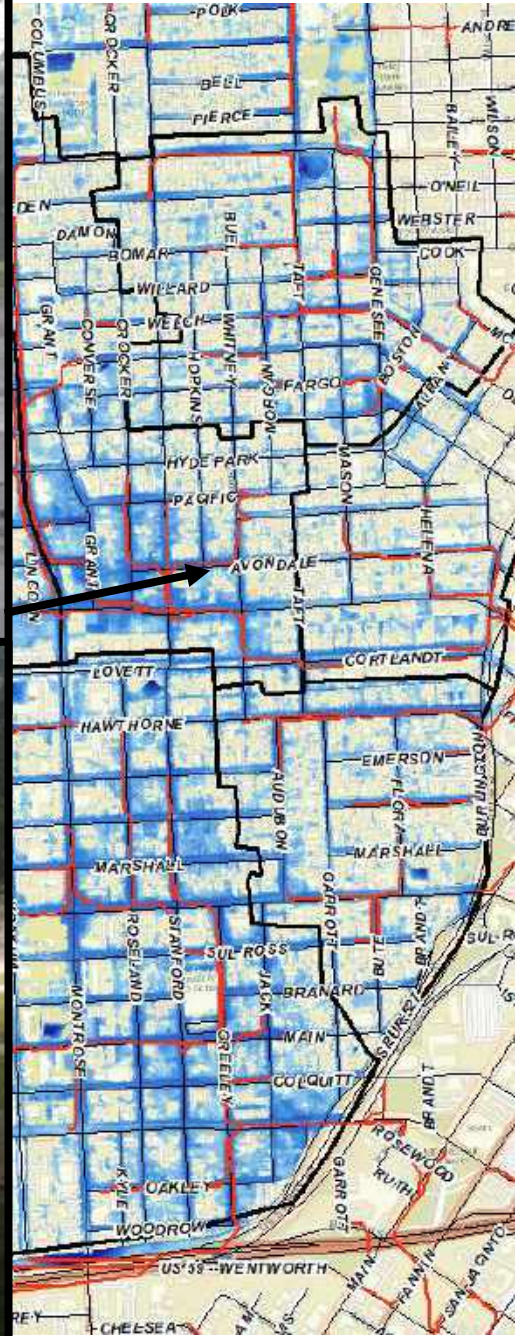


Imelda

Imelda 1750 Hawthorne Dr.

# Historical Flood Photos

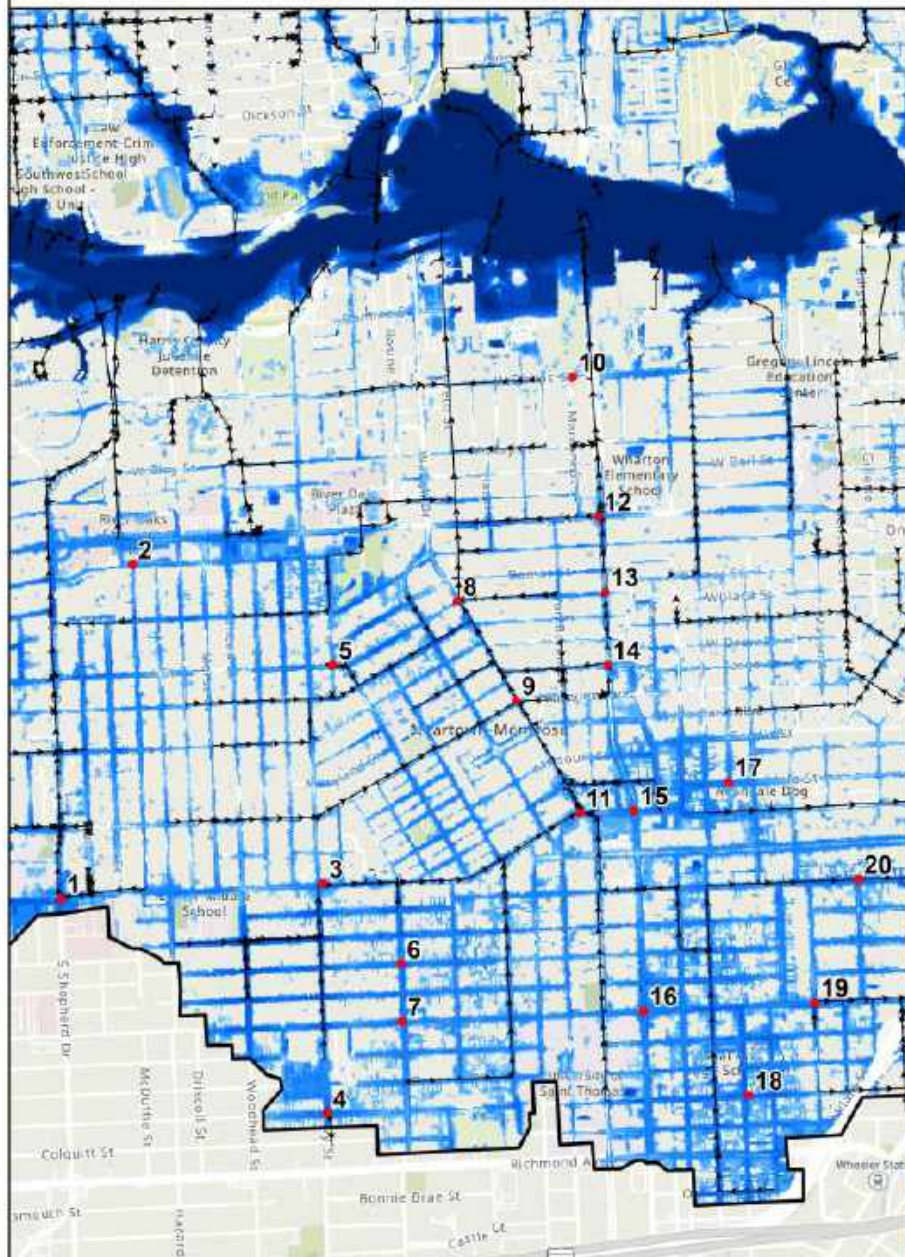
# Halloween 2015



606 Avondale



**City of Houston ICM Model**



**TIRZ 27 ICM Model**

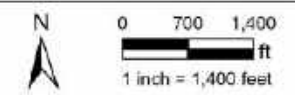


**EXISTING CONDITIONS  
ICM MODEL RESULT  
COMPARISON**



**Legend**

- 2D Model Boundary
- Modeled Conduits
- Comparison Point Locations
- 100-Year Existing Conditions Inundation (ft)**
- < 0.25
- 0.25 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- 2.00 - 3.00
- 3.00 - 5.00
- 5.00 - 10.00
- > 10.00



ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<b>City of Houston ICM Model</b>	1.88	1.06	1.26	1.43	0.55	1.55	1.55	1.33	1.49	0.33	0.79	1.13	0.72	0.72	1.15	1.38	1.17	2.60	1.59	2.22
<b>TIRZ 27 ICM Model</b>	1.26	0.90	1.06	1.13	0.29	1.30	1.36	0.89	1.49	0.58	0.76	1.12	0.65	0.71	1.04	1.08	1.05	2.10	1.08	1.61



# Existing Conditions Summary

- **2-Year Criteria Not Met**
- **100-Year Criteria Not Met**
- **Moderate Historical Structural Flooding**
- **Historical Storm Events Less Intense Relative to Other Options of the City.**



# Montrose Drainage Study Proposed Conditions

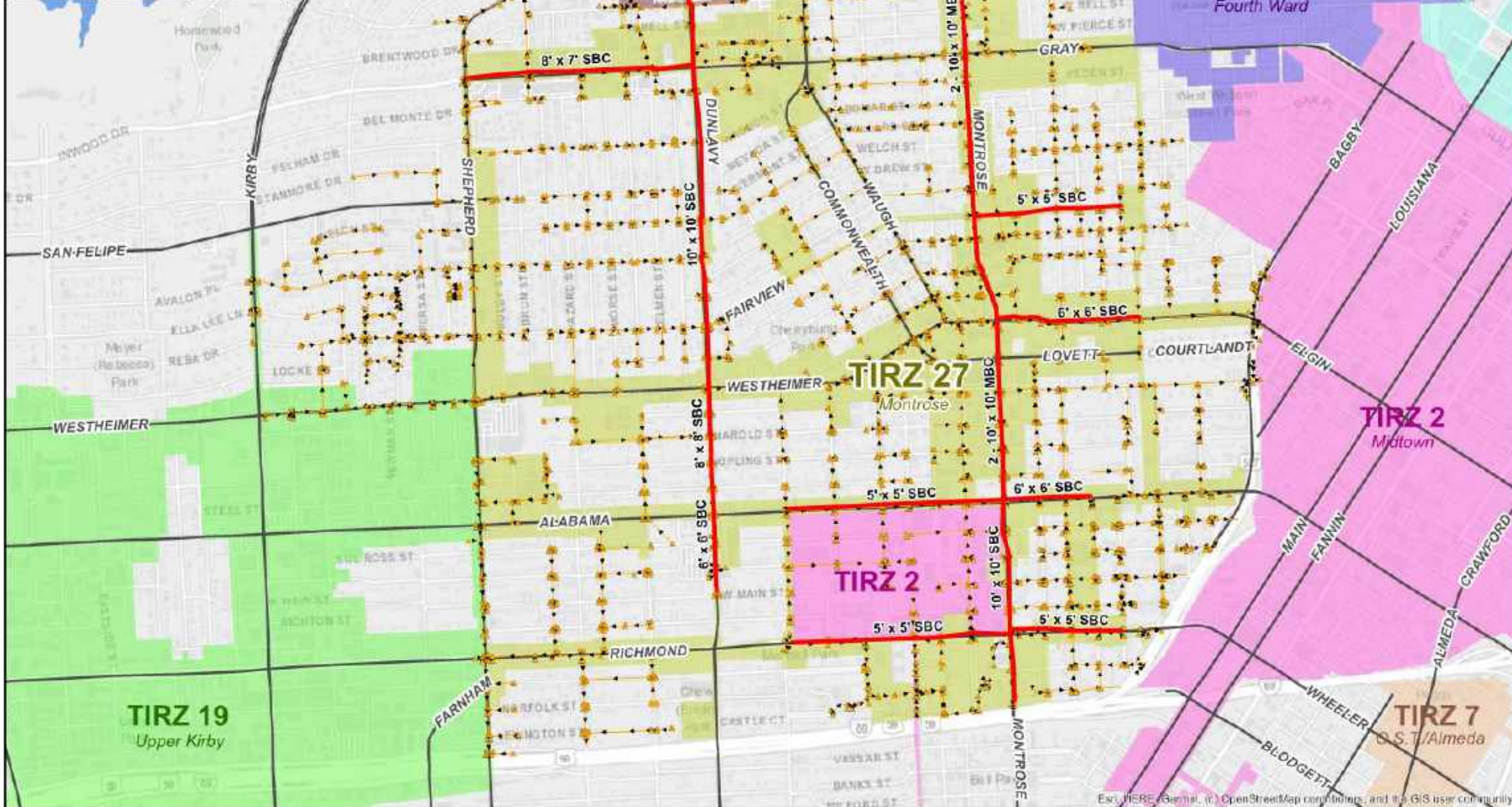


# Proposed Conditions Alternatives

**Alternative 1 – Free Unrestricted Outfall to Buffalo Bayou**

**Alternative 3 – Restricted Outfall to Buffalo Bayou**

Street	Size	Total Length
Gray	8' x 7'	2690
Dunlavy	6' x 6'	1240
	8' x 8'	1170
	10' x 10'	6530
Montrose	10' x 10'	2440
	2 - 10' x 10'	8600
Alabama	5' x 5'	2590
	6' x 6'	1050
Westheimer	6' x 6'	1720
Fainew	5' x 5'	1750
Richmond	5' x 5'	3880



**MONTROSE**  
TIRZ INCREMENT REINVESTMENT ZONE 27

**Alternatives 1 and 2  
Proposed Storm  
Drain Layout**

**Legend**

- Major Streets
- Existing SD Inlet
- Existing SD Pipe
- Proposed SD Trunklines

**TIRZ Boundaries**

- TIRZ 13
- TIRZ 14
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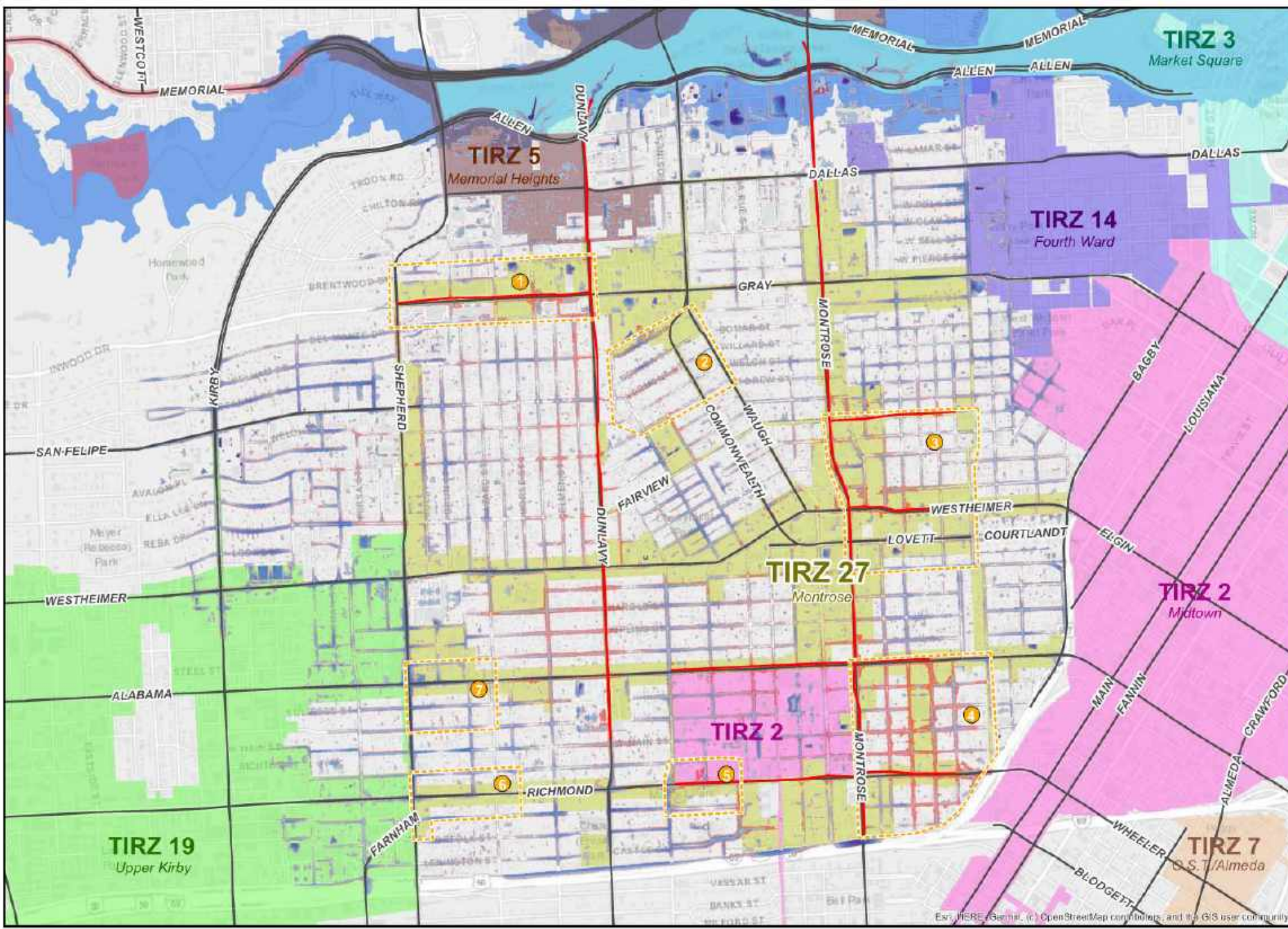
City of Houston  
Harris County

**Gauge**  
ENGINEERING

Scale: 0 300 600 1,200 Feet

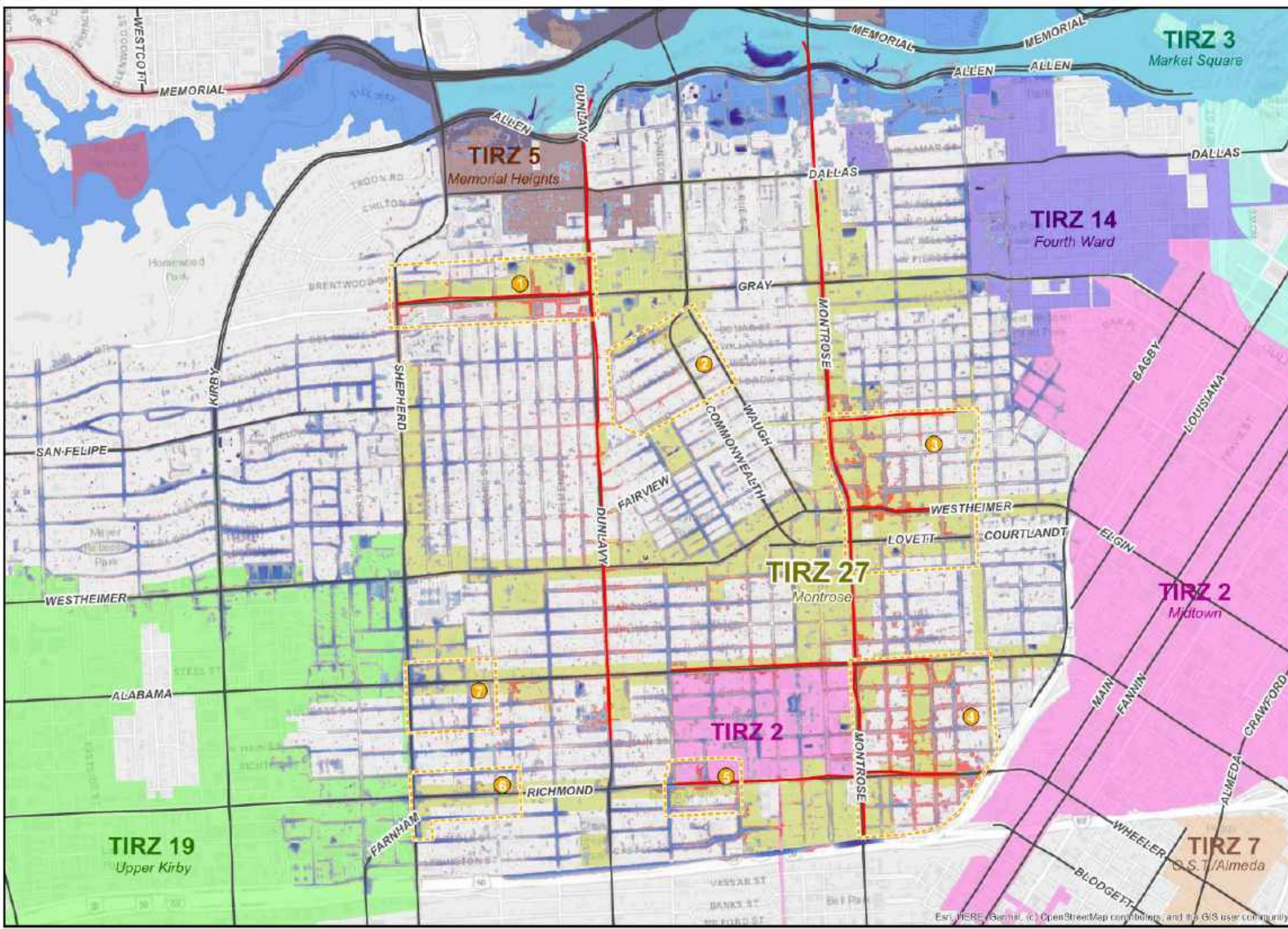
North Arrow

Map Data: Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community



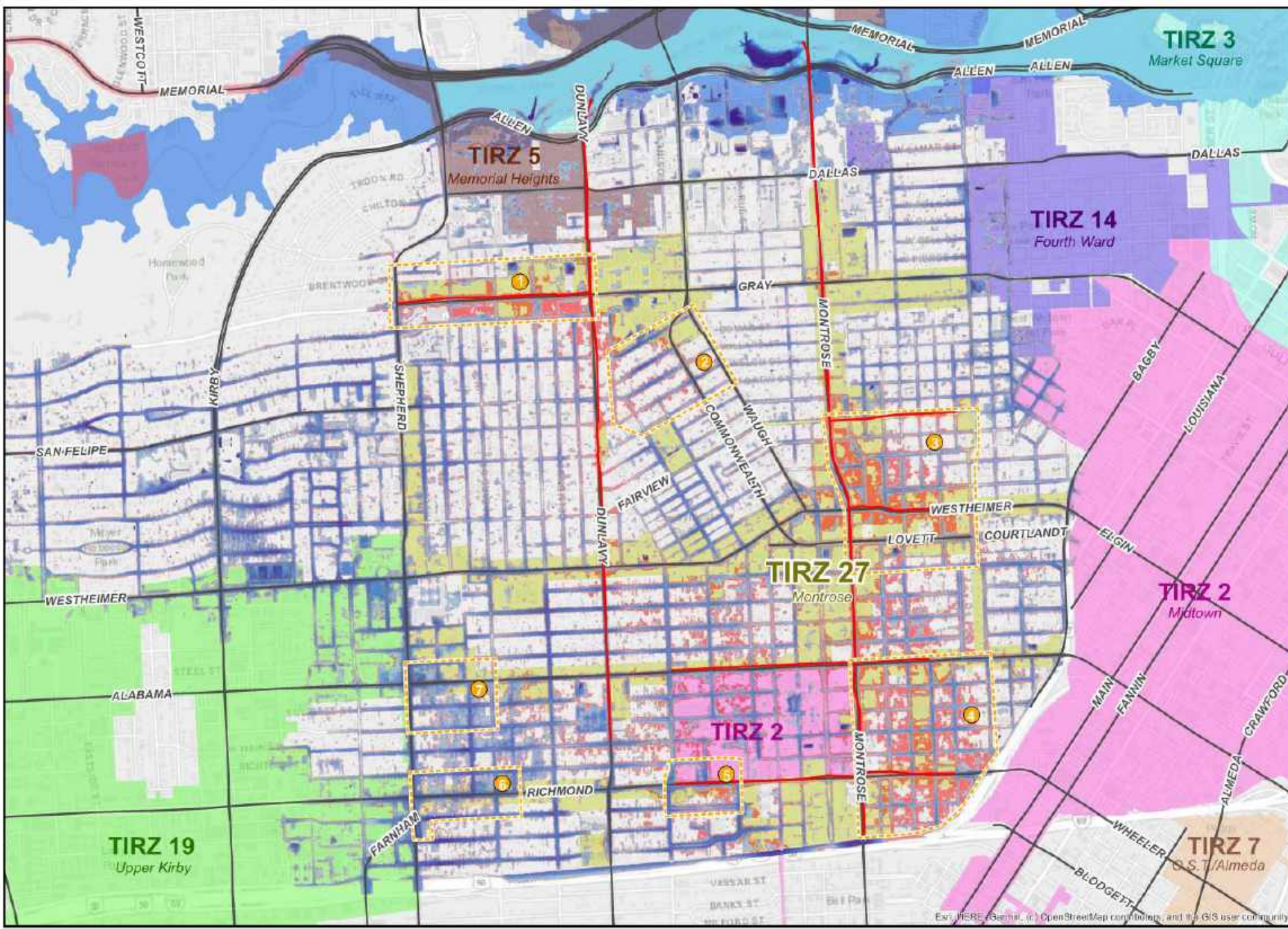
- Legend**
- Major Streets
  - FEMA 500-yr
  - ▭ Problem Area
  - Proposed SD Trunklines
  - Existing 2-yr
- Proposed 2-yr Depths (ft)**
- 0.25 - 0.50
  - 0.51 - 0.75
  - 0.76 - 1.00
  - 1.01 - 1.50
  - 1.51 - 2.00
  - 2.01 - 2.50
  - 2.51 - 3.00
  - 3.01 - 5.00
  - < 5.01
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  - TIRZ 5
  - TIRZ 7

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- Legend**
- Major Streets
  - FEMA 500-yr
  - ▭ Problem Area
  - Proposed SD Trunklines
  - Existing 10-yr
- Proposed 10-yr Depths (ft)**
- 0.25 - 0.50
  - 0.51 - 0.75
  - 0.76 - 1.00
  - 1.01 - 1.50
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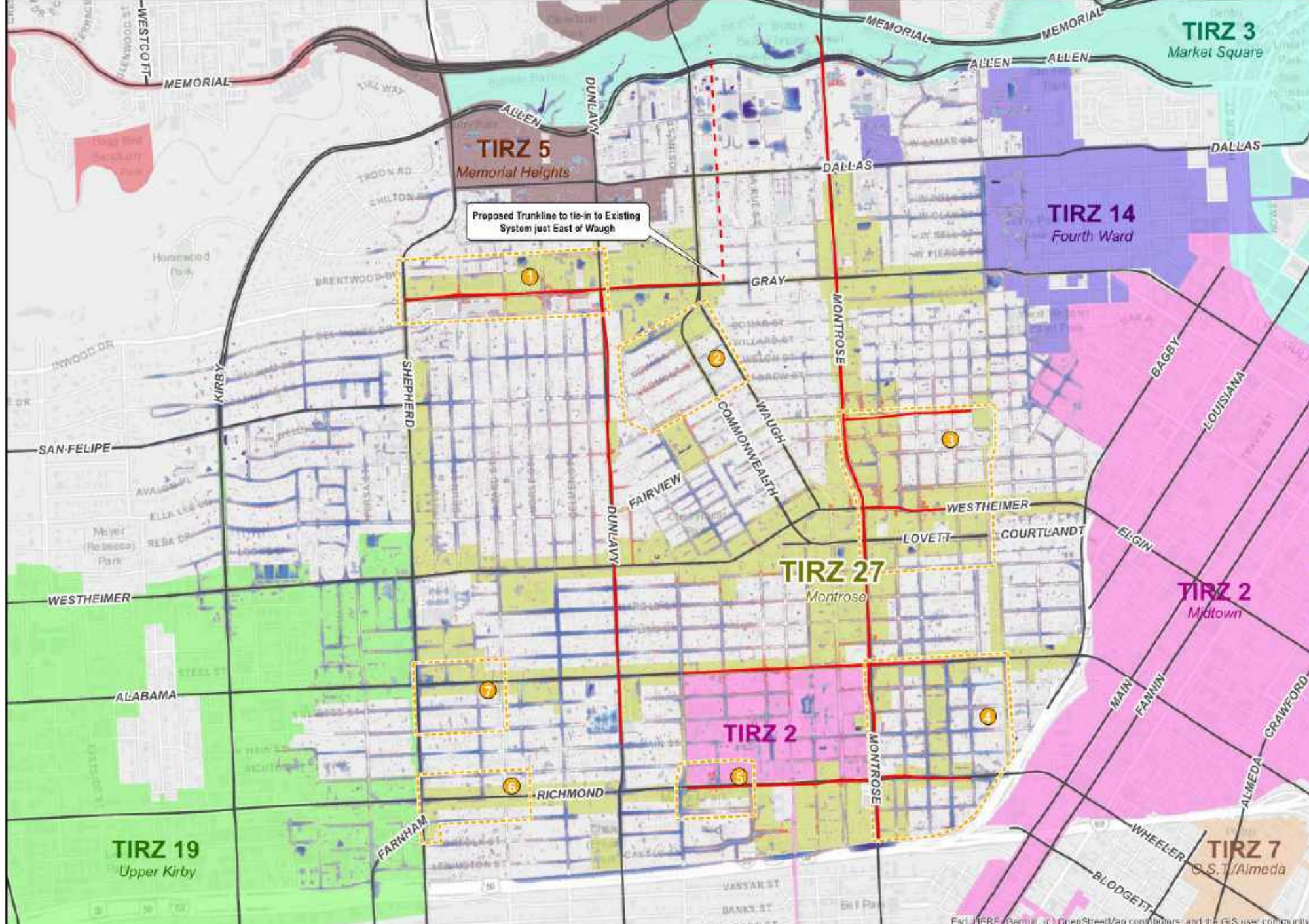
- Legend**
- Major Streets
  - FEMA 500-yr
  - ▭ Problem Area
  - Proposed SD Trunklines
  - ▭ Existing 100-yr
- Proposed 100-yr  
 Depths (ft)**
- 0.25 - 0.50
  - 0.51 - 0.75
  - 0.76 - 1.00
  - 1.01 - 1.50
  - 1.51 - 2.00
  - 2.01 - 2.50
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  - TIRZ 5
  - TIRZ 7

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**Proposed ALT 3  
2-yr Inundation**

**Legend**

- Major Streets
  - - - Existing Storm Drain
  - - - Cutoff at Waugh
  - Proposed SD Trunkline
  - ▭ Problem
  - ▭ Existing 2-yr
- Proposed 2-yr  
Depths (ft)**
- 0.25 - 0.50
  - 0.51 - 0.75
  - 0.76 - 1.00
  - 1.01 - 1.50
  - 1.51 - 2.00
  - 2.01 - 2.50
  - 2.51 - 3.00
  - 3.01 - 5.00
  - < 5.01
- TIRZ Boundaries**
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City of Houston  
Harris County

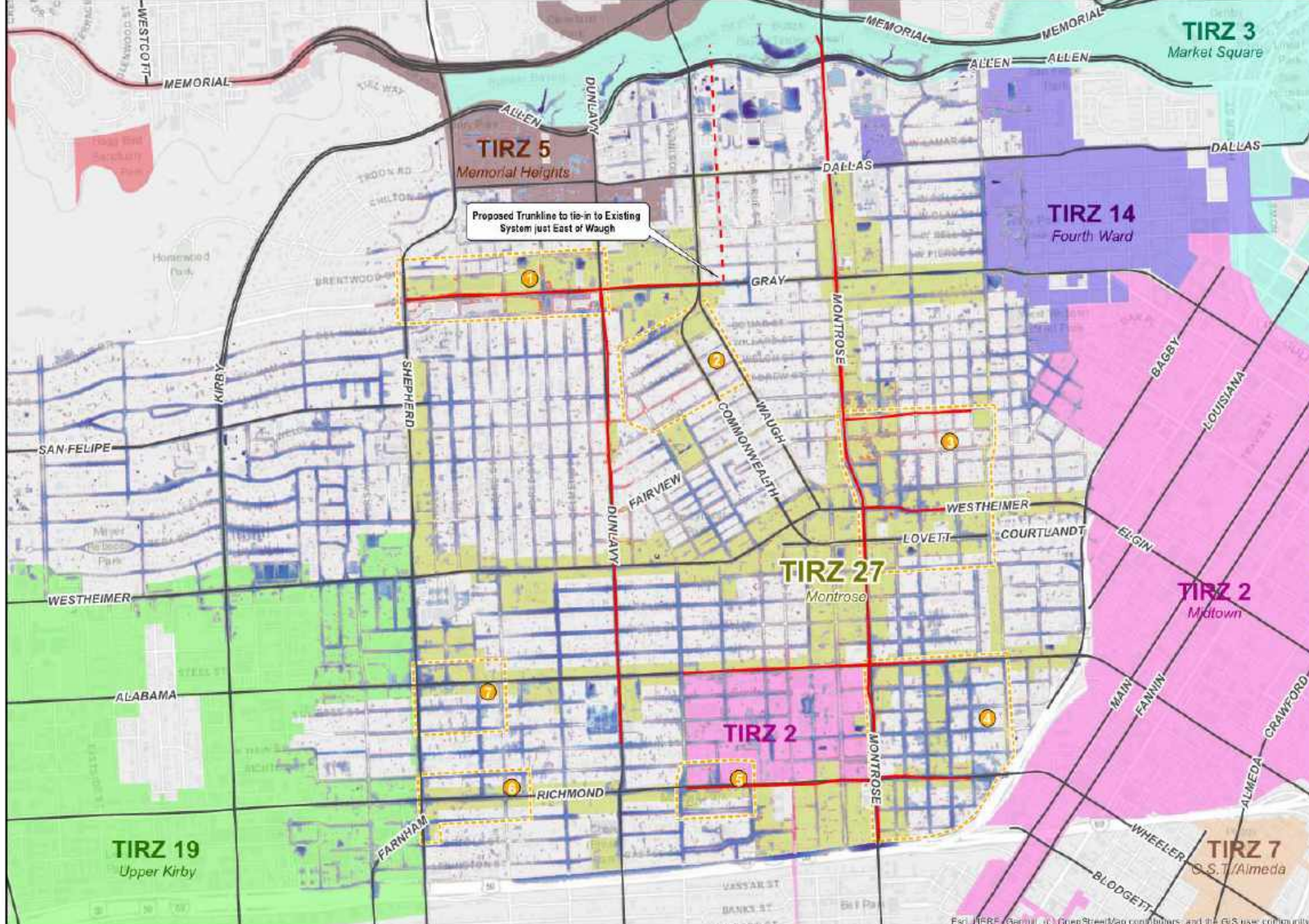


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**Proposed ALT 3  
10-yr inundation**

**Legend**

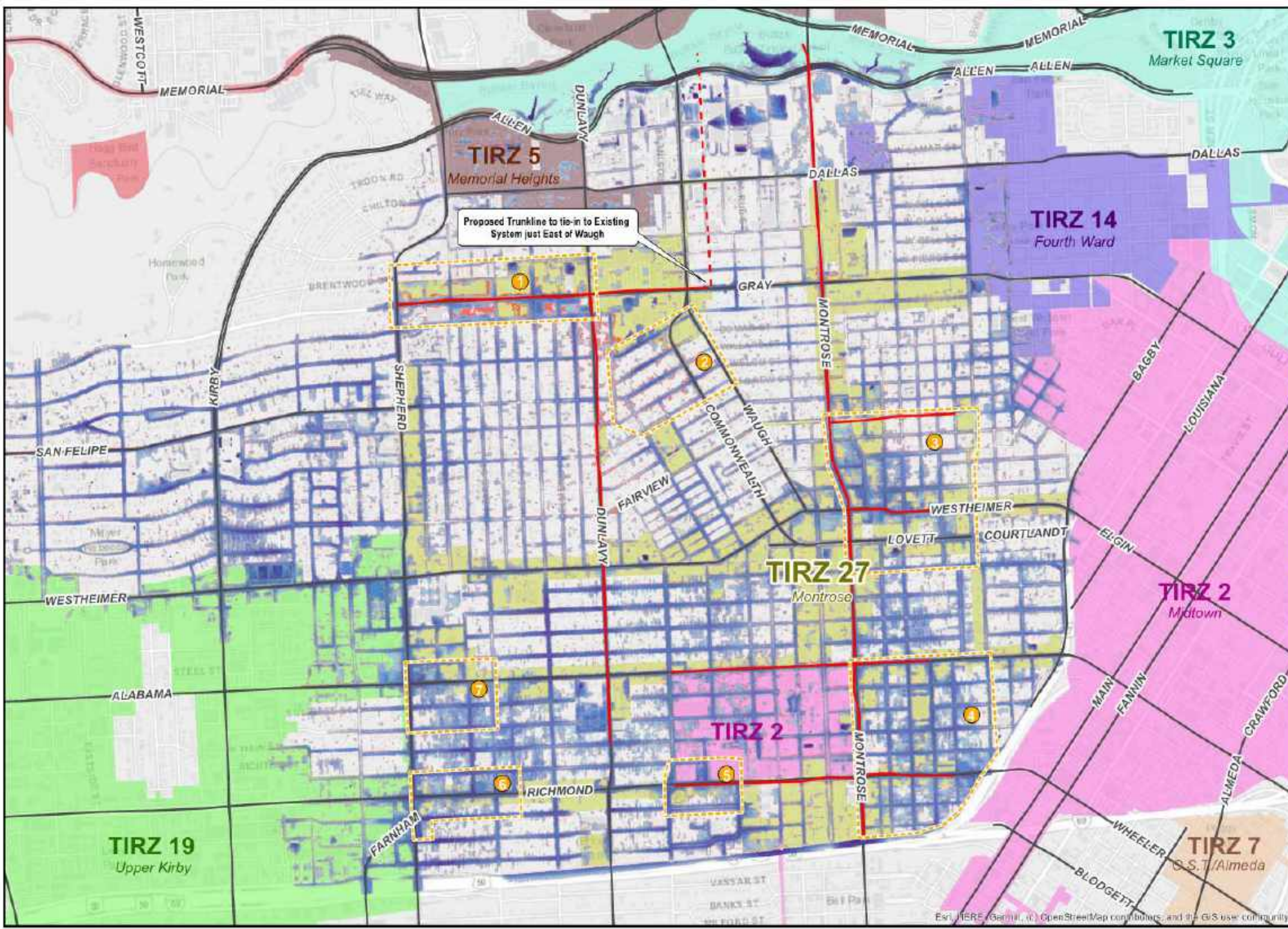
- Major Streets
- - - Existing Storm Drain
- - - Cutoff at Waugh
- Proposed SD Trunkline
- Problem
- Existing 10-yr
- Proposed 10-yr  
Depths (ft)**
- 0.25 - 0.50
- 0.51 - 0.75
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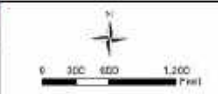
**MONTROSE**  
 TIRZ INCREMENT REINVESTMENT ZONE 27

**Proposed ALT 3**  
**100-yr Inundation**

- Legend**
- Major Streets
  - - - Existing Storm Drain
  - - - Cutoff at Waugh
  - Proposed SD Trunkline
  - Problem
  - Existing 100-yr

- Proposed 100-yr**  
**Depths (ft)**
- 0.25 - 0.50
  - 0.51 - 0.75
  - 0.76 - 1.00
  - 1.01 - 1.50
  - 1.51 - 2.00
  - 2.01 - 2.50
  - 2.51 - 3.00
  - 3.01 - 5.00
  - <math>< 5.01</math>

- TIRZ Boundaries**
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  - TIRZ 3
  - TIRZ 5
  - TIRZ 7



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# Proposed Improvement Options Summary

- **Alternative 1 (Unrestricted) Provides:**
  - **2-Year Criteria**
  - **10-Year Level of Protection**
  - **Close to 100-Year Level of Protection**
- **Alternative 3 (Restricted) Provides:**
  - **2-Year Criteria**
  - **Moderate Improvement for the 10-year**
  - **Limited Improvement for the 100-year**
- **Currently working with the City of Houston and HCFCD on approval of the unrestricted option.**



**Gauge**  
ENGINEERING

**THANK YOU**



**MONTROSE**  
TAX INCREMENT REINVESTMENT ZONE 27

May 20, 2024

