



**REGIONAL  
WATERSHED  
STUDY**

**JEFFERSON COUNTY, TEXAS**

**DRainage District No. 6**

**Large-Scale Regional Watershed Study on a Short Schedule**

**Jefferson County Drainage District No. 6**

**March 9, 2023**

**FREESE NICHOLS**

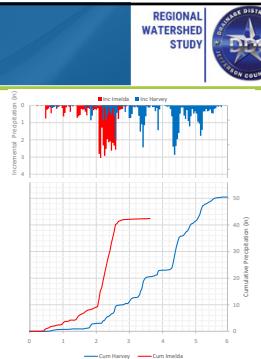
**Project Background**

- Extreme rainfall and flooding in Jefferson County
  - Hurricane Harvey 2017 – 60 in
  - T.S. Imelda 2019 – 40 in
  - May 2021 Storm
- Jefferson County DD6 is leading an effort to evaluate flood risks and find ways to reduce risks.

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**BEAUMONT ENTERPRISE**

**VICTORIA ADVOCATE**

**VALLEY STAR**

**EXTREMES OF HARVEY**

# Project Goals

- Identify areas of high flood risk and the sources of flooding.
- Develop large-scale regional flood reduction solutions to address flood damages.
- Prepare an implementation path for future projects that includes costs, benefits, challenges, and prioritization.

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graph TD
    subgraph ProjectTeam [Project Team]
        subgraph Partners [In partnership with]
            DDD((Jefferson County DDO Logo))
            TWDB[Texas Water Development Board]
        end
        subgraph Consultants [Prime Consultant]
            FN[FREESE AND NICHOLS]
        end
        FN --- PC[Prime Consultant]
        FN --- SubConsultants[Sub-Consultants]
        subgraph SubConsultants
            Gauge[Gauge ENGINEERING]
            HDR[HDR]
        end
    end

```

**Project Team**

In partnership with:

**Jefferson County DDO**

**Texas Water Development Board**

**FREESE AND NICHOLS**  
Prime Consultant

**Gauge ENGINEERING**  
Sub-Consultant

**HDR**  
Sub-Consultant

**REGIONAL  
WATERSHED  
STUDY**

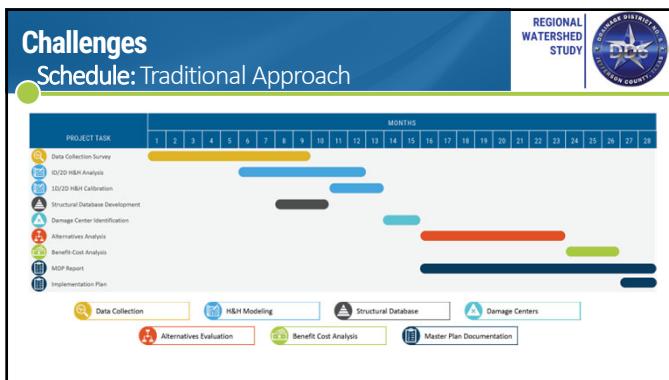
**Jefferson County DDO**

## Study Area

- Drainage Area: 1,500 sq.mi.
- Stream Miles: 1,200 miles
- Topography:
  - Highest: 200 feet
  - Lowest: -25 feet
- Atlas 14 100-yr (24hr): 18.5 inches



Map showing the Neches River Watershed, which spans across four counties: Hardin, Liberty, Jefferson, and Chambers. The map highlights the main river and its major tributaries, including the Trinity River, Neches River, Limestone Bayou, Neches Bayou, Hildebrand Bayou, Taylor Bayou, and Ichne. The map also shows the locations of Hardin, Liberty, Jefferson, and Chambers counties.



## Data Collection Key Structures

REGIONAL  
WATERSHED  
STUDY  
DRAINAGE DISTRICT NO. 5  
HARRIS COUNTY, TEXAS  
DDS



SWB @ Taylors Bayou

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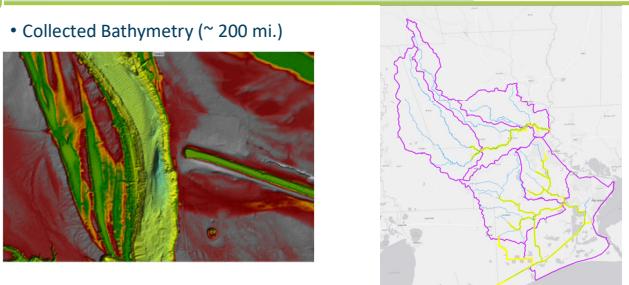
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## Data Collection Bathymetry

REGIONAL  
WATERSHED  
STUDY  
DRAINAGE DISTRICT NO. 5  
HARRIS COUNTY, TEXAS  
DDS

- Collected Bathymetry (~ 200 mi.)



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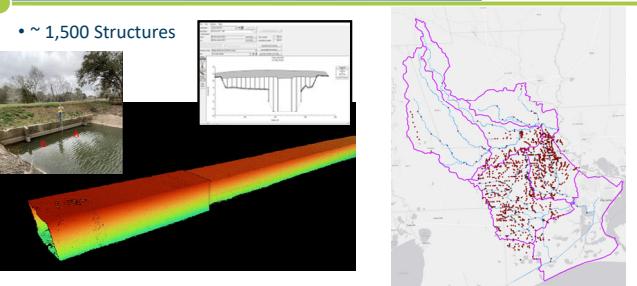
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## Data Collection Drainage Crossings

REGIONAL  
WATERSHED  
STUDY  
DRAINAGE DISTRICT NO. 5  
HARRIS COUNTY, TEXAS  
DDS

- ~ 1,500 Structures



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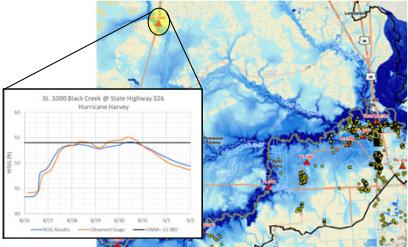
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## Preliminary Analysis Existing Conditions

Survey  Prelim.  Detailed 

REGIONAL WATERSHED STUDY  
DRAINSAGE DISTRICT OF SOUTHERN CALIFORNIA DDS

- Available LiDAR
- Rain-on-mesh
- Validation
  - Flood claims
  - Gage data
- Identify flooding sources



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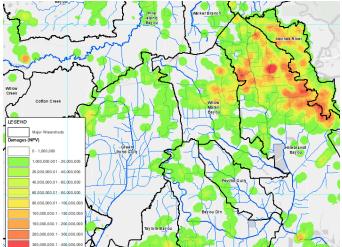


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## Preliminary Analysis Focus Areas

REGIONAL WATERSHED STUDY  
DRAINSAGE DISTRICT OF SOUTHERN CALIFORNIA DDS

- Model Results
- Structure Database
- Based on flood risk (hardest hit areas)



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## Preliminary Analysis Alternatives Analysis

REGIONAL WATERSHED STUDY  
DRAINSAGE DISTRICT OF SOUTHERN CALIFORNIA DDS



Existing      Proposed

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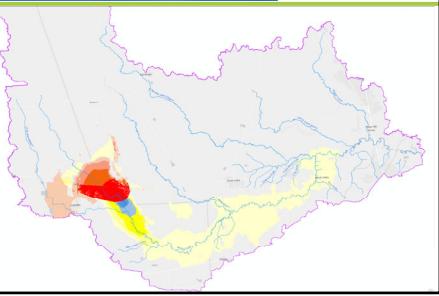
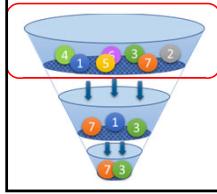


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## Preliminary Analysis Objective

REGIONAL WATERSHED STUDY  
DODGE DISTRICT OF CALIFORNIA COUNTY

Preliminary Evaluation of Concepts



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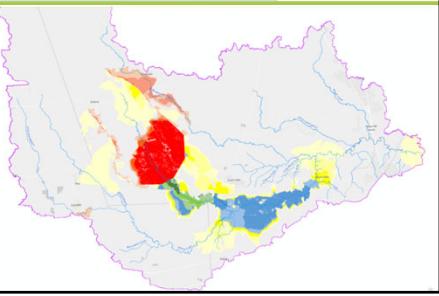
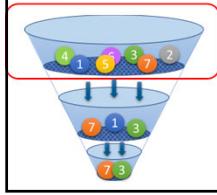
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## Preliminary Analysis Objective

REGIONAL WATERSHED STUDY  
DODGE DISTRICT OF CALIFORNIA COUNTY

Preliminary Evaluation of Concepts



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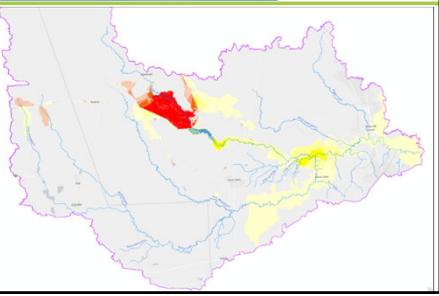
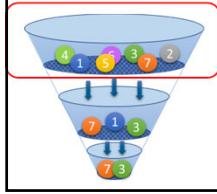
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## Preliminary Analysis Objective

REGIONAL WATERSHED STUDY  
DODGE DISTRICT OF CALIFORNIA COUNTY

Preliminary Evaluation of Concepts



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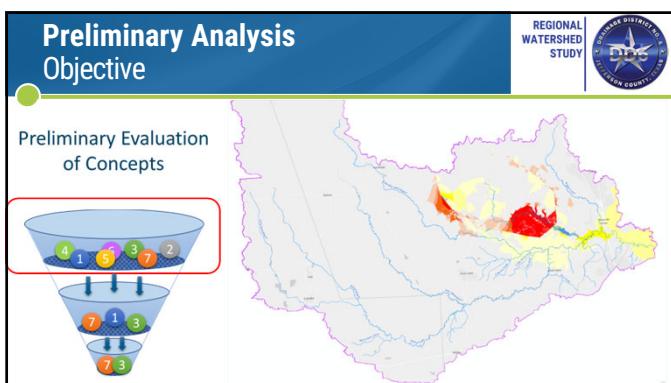
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## Preliminary Analysis Objective

REGIONAL WATERSHED STUDY  
DODGE DISTRICT OF CALIFORNIA COUNTY

Preliminary Evaluation of Concepts



The slide features a blue header with the title 'Preliminary Analysis Objective' and the 'REGIONAL WATERSHED STUDY' logo. Below the header is a section titled 'Preliminary Evaluation of Concepts' with a red-bordered box. To the right is a map of a watershed with various colored areas (yellow, red, green) and a legend. Below the map is a funnel diagram with seven numbered circles (4, 1, 5, 3, 7, 2, 6) in the top circle, which narrows down to three circles (7, 1, 3) in the middle, and finally to three circles (7, 3) at the bottom.

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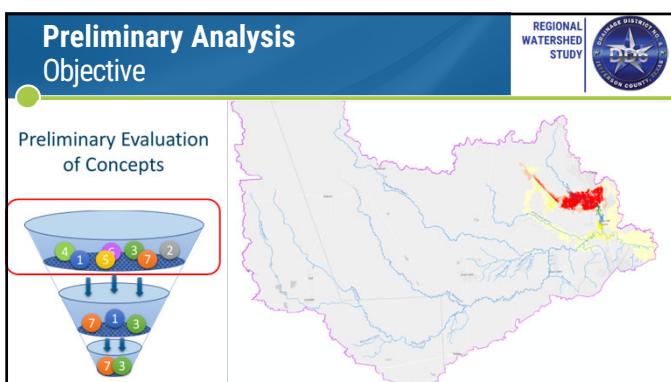
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REGIONAL WATERSHED STUDY  
DODGE DISTRICT OF CALIFORNIA COUNTY

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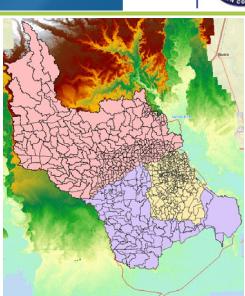
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## Detailed Analysis Hydrologic Models

Survey      Prelim.      Detailed   

REGIONAL WATERSHED STUDY  
DODGE DISTRICT OF CALIFORNIA COUNTY

- HEC-HMS
- Used to generate flows
- Subbasin Delineations
- Generate parameters based on topography



The slide features a blue header with the title 'Detailed Analysis Hydrologic Models' and the 'REGIONAL WATERSHED STUDY' logo. Below the header is a section with three colored bars labeled 'Survey', 'Prelim.', and 'Detailed'. To the right is a map of a watershed showing subbasin delineations and flow accumulation, with colors ranging from green to red.

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Detailed Analysis  
Hydraulic Models

Survey      Prelim.      Detailed

REGIONAL  
WATERSHED  
STUDY

LEAVENWORTH COUNTY, KS  
DNR

Preliminary      Detailed

Leverage Preliminary ROG Models

# Detailed Analysis Calibration

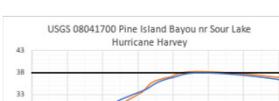
REGIONAL  
WATERSHED  
STUDY

• Calibrate H&H Model to 3 Historical Events:

- Harvey 2017: 60 inches
- Imelda 2019: 40 inches
- May 2021: ~ 10-yr

• Gage elevation adjustments

• Recent Improvements



Date	Observed Stage (ft)	Detailed Model (ft)
8/26	8.0	8.0
8/27	13.0	13.0
8/28	22.0	22.0
8/29	32.0	32.0
8/30	37.88	37.88
8/31	37.88	37.88
9/1	37.88	37.88

# Detailed Analysis

## Gage Elevation Adjustments

- Vast network of gages
  - DD6
  - USGS
- Stages defined based on old benchmarks
- DD6 surveyed gages based on current benchmark
- Elevation Adjustments:
  - Range -2.76 ft to 1.9 ft



The map displays the Milwaukee River and its major tributaries, including the Menomonee, Kinnickinnic, Cudahy, and Whitefish Rivers. Numerous gage stations are marked with red triangles and green circles, representing DD6 and USGS gages respectively. Elevation adjustment markers are indicated by small red and green dots. A legend in the bottom right corner identifies the symbols for DD6 (red triangle), USGS (green circle), and Elevation Adjustment (red dot).

A slide titled 'Detailed Analysis Recent Improvements' featuring a satellite image of a river and agricultural fields on the left, and a map with a red overlay and a blue starburst on the right. The map includes a legend for 'Soil Health Index' and a 'Soil Health Index' logo.

**Detailed Analysis Calibration**

**St. 5600 SH 124 (D-540 N, Fork Taylors Bayou)**  
May 2021

**St. 5600 Labelle Road @ D-500 Taylors Bayou**  
Hurricane Harvey

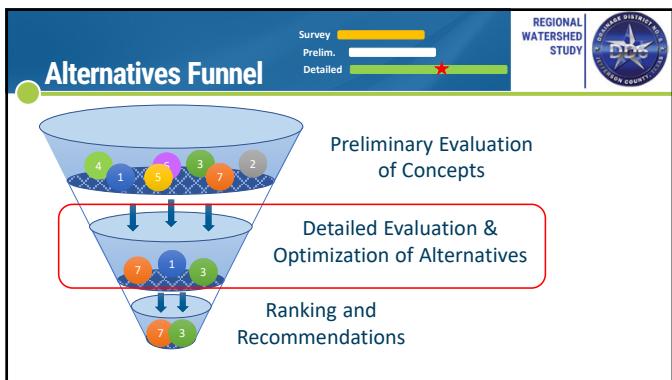
**USGS 08042189 Pine Island Bayou in Seaford Lake**  
Hurricane Harvey

**St. 2800 (Walton Road) (D-128-202)**  
Hurricane Harvey

**St. 2100 Gladys Ave. @ Hildebrand Bayou (D-100)**  
May 2021

**REGIONAL  
WATERSHED  
STUDY**

**WATERSHED DISTRICT NO. 12**  
**WILSON COUNTY, TEXAS**




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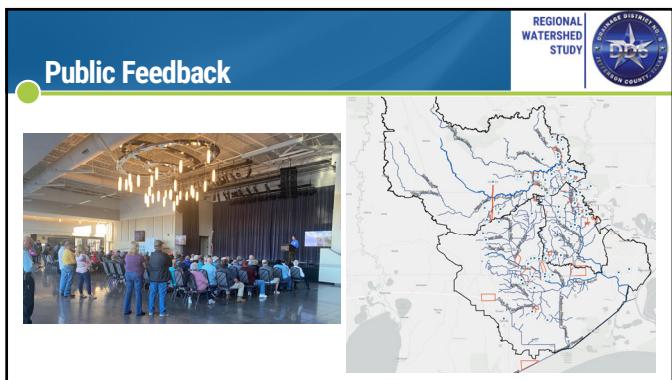
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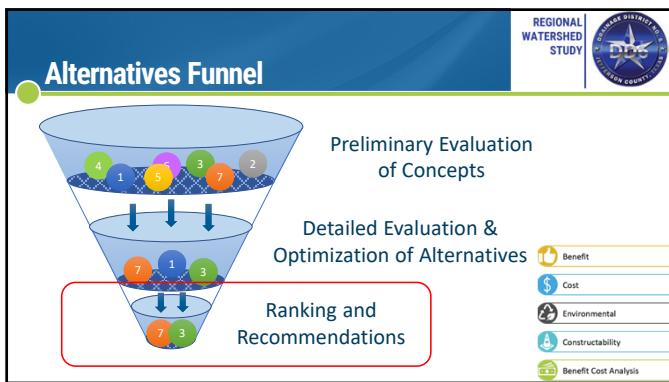
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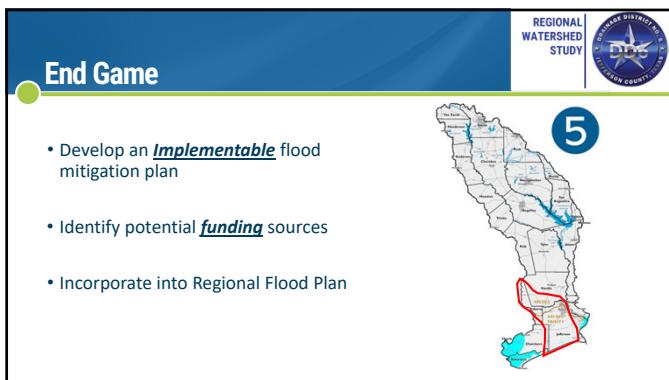
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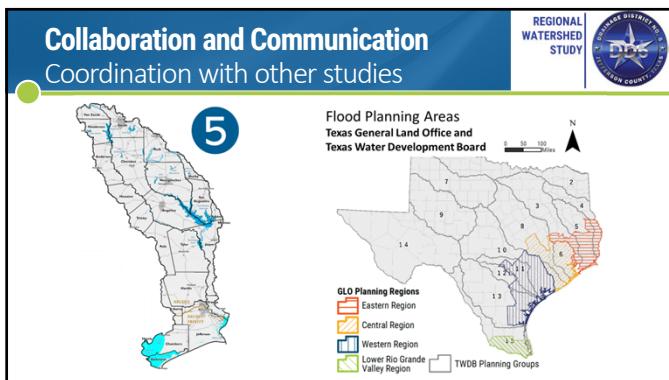
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**Status**

Survey  Prelim.  Detailed 

REGIONAL  
WATERSHED  
STUDY

DIXIEVILLE DISTRICT  
WATER SUPPLY  
DEPARTMENT  
LAWRENCE COUNTY

**DDS**

- ✓ Data Collection
- ✓ Preliminary Existing Conditions
- ✓ Preliminary Alternatives
- Detailed H&H Models (90%)
  - Detailed Alternatives
  - Implementation Plan



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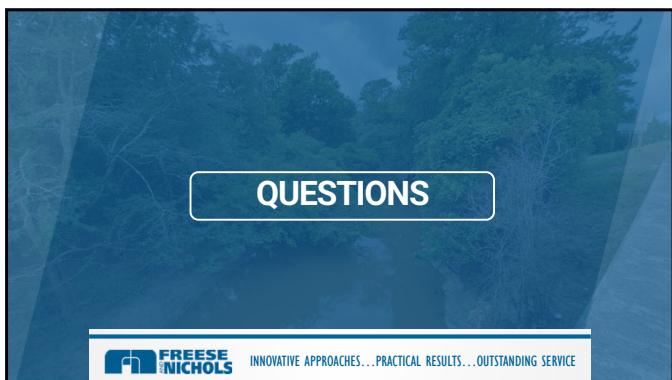
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**QUESTIONS**

 **FREESE  
NICHOLS** INNOVATIVE APPROACHES...PRACTICAL RESULTS...OUTSTANDING SERVICE

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