SJRA

SAN JACINTO RIVER AUTHORITY

Upper San Jacinto River Basin Regional Sedimentation Study

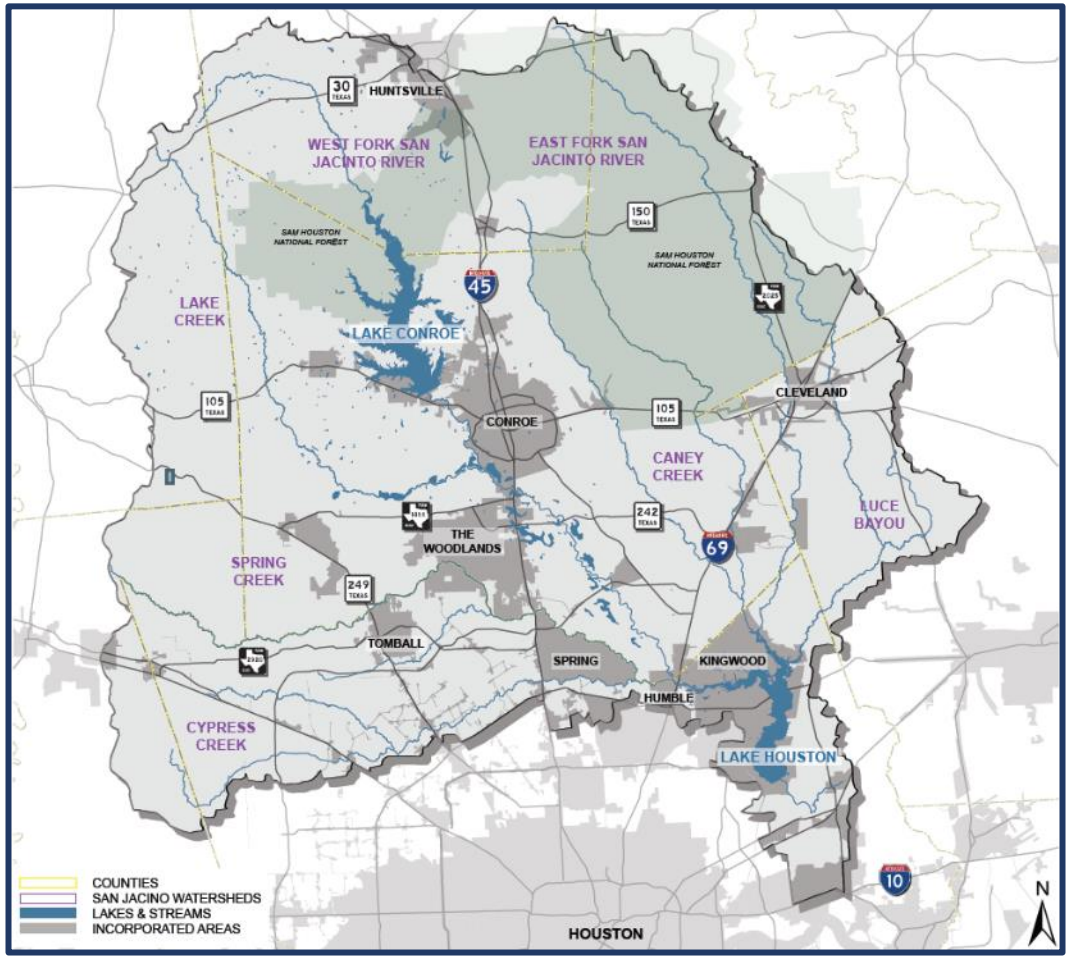
August 30, 2023

Please send questions to:

floodmanagementdivision@sjra.net

San Jacinto Regional Watershed Master Drainage Plan

- The San Jacinto Regional Watershed Master Drainage Plan (SJMDP) was a comprehensive regional study of the Upper San Jacinto River Watershed.
- The SJMDP was led by Harris County Flood Control District (HCFCD) and included the San Jacinto River Authority (SJRA), Montgomery County, and the City of Houston as funding and technical partners.
- One of the recommendations from the SJMDP was the development of a regional sediment management plan.
- SJRA applied for and was awarded grant funding from the Flood Infrastructure Fund (FIF) to perform a project to develop the recommended plan, with local match funding support from multiple regional partners.



Regional Sedimentation Study

- **Study Cost: $750,000**
- **TWDB FIF Grant Funding: $375,000**
- **Maximum Local Partner Contributions: $375,000**
- **SJRA In-Kind Goal: $84,374**
- **Anticipated SJRA In-Kind services include:**
  - Perform Project Management Activities
  - Assist with Public Outreach, Messaging, and Logistics
  - Support Data Analysis and GIS Mapping efforts
  - Assist with Field evaluations
  - Coordinate Property Access for Field Assessments
  - Review Interim Reports and Final Deliverables

STUDY GOAL: *Understand the characteristics of sedimentation in the Upper San Jacinto River Basin to develop feasible and cost-effective conceptual solutions, best management practices, and an overall implementation strategy that can help better manage sediment in the Basin.*

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Upper San Jacinto River Basin Regional Sedimentation Study

Public Engagement Meeting #2

Civitas
Engineering Group

August 30, 2023

Agenda

1

1. Consultant Team
2. Project Approach and Watershed Characterization
3. Site Selection and Field Reconnaissance
4. Field Sampling and Analysis
5. Next Steps
6. Schedule
7. Community Engagement
8. Wrap-up / Q&A

Consultant Team

I

Consultant Team

Civitas
Engineering Group

Watershed Characterization / Sediment Budgets

halff SM

Sediment Mgmt. Solutions / Funding Identification

PARSONS

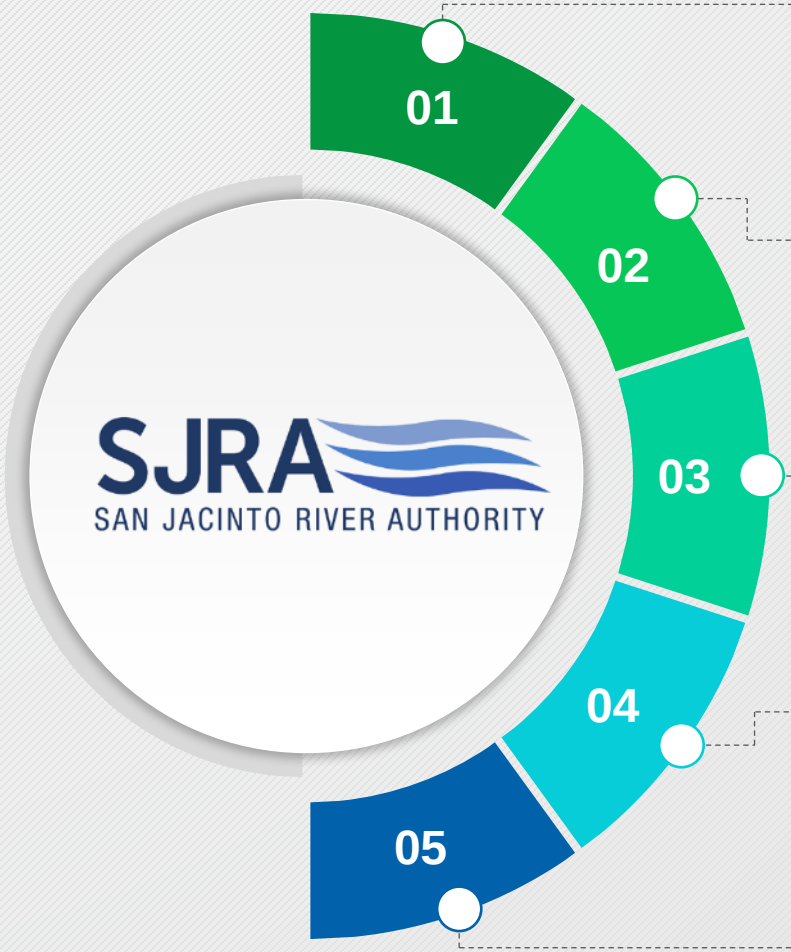
Geomorphology Assessments / Fingerprinting

JMT 50 YEARS

Public Outreach & Communications

HOLLAWAY
ENVIRONMENTAL + COMMUNICATIONS

SJRA Staff are an Extension of Our Team



Provide Input During Progress Meetings & Milestone Workshops

Assist w/ Public Outreach Plan, Messaging & Logistics

Coordination of Property Access for Field Assessments

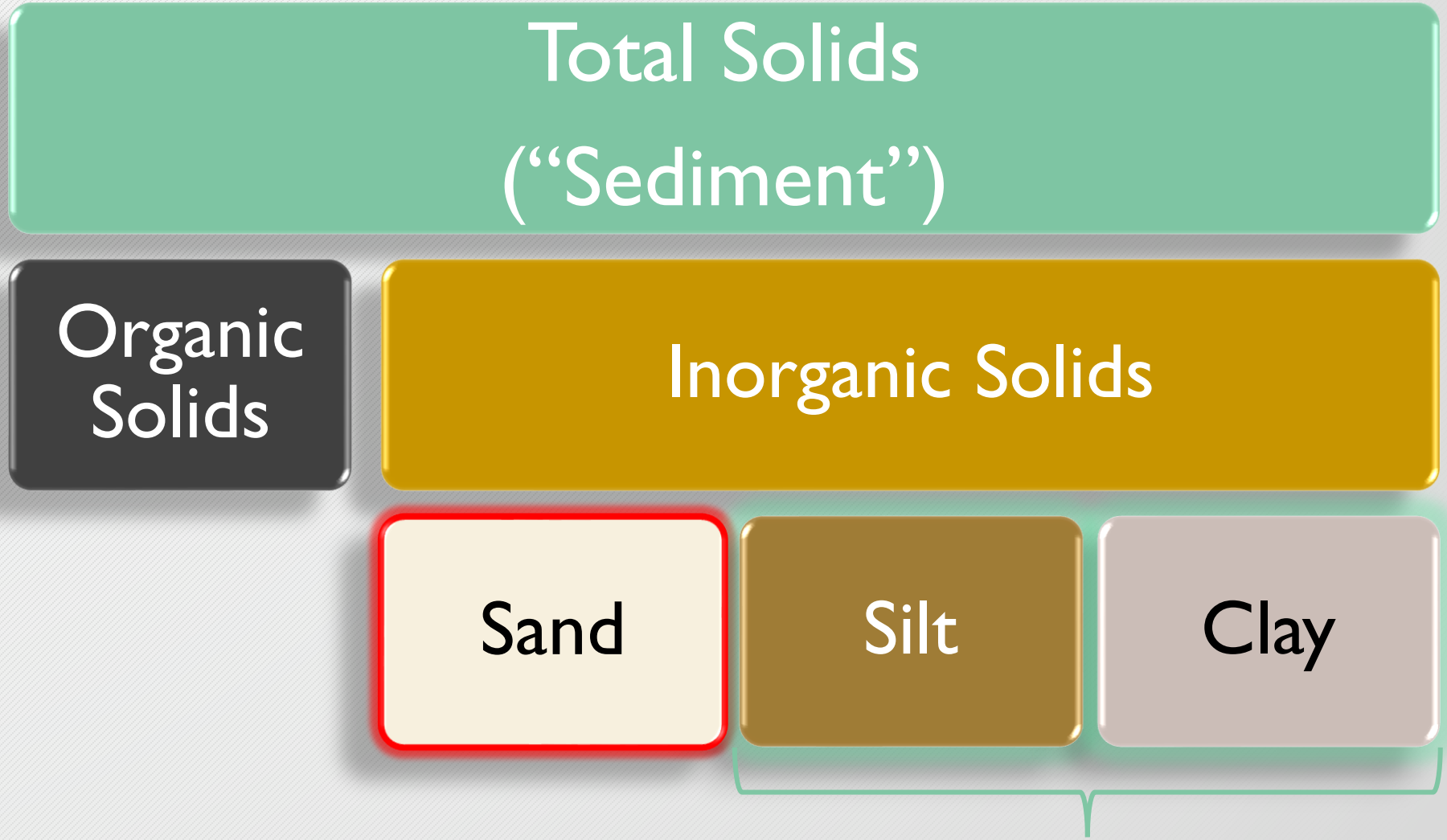
Support w/ Procore Updates, Data Analysis and GIS Mapping

Review Interim Reports & Final Deliverables

Project Approach and Watershed Characterization

2

Key Consideration: A Tale of Two Sediments



Approach Summary – Varying Spatial Scales

Desktop analysis to characterize and prioritize watersheds

Detailed, focused modeling and field investigation

Data extrapolation and solutions development

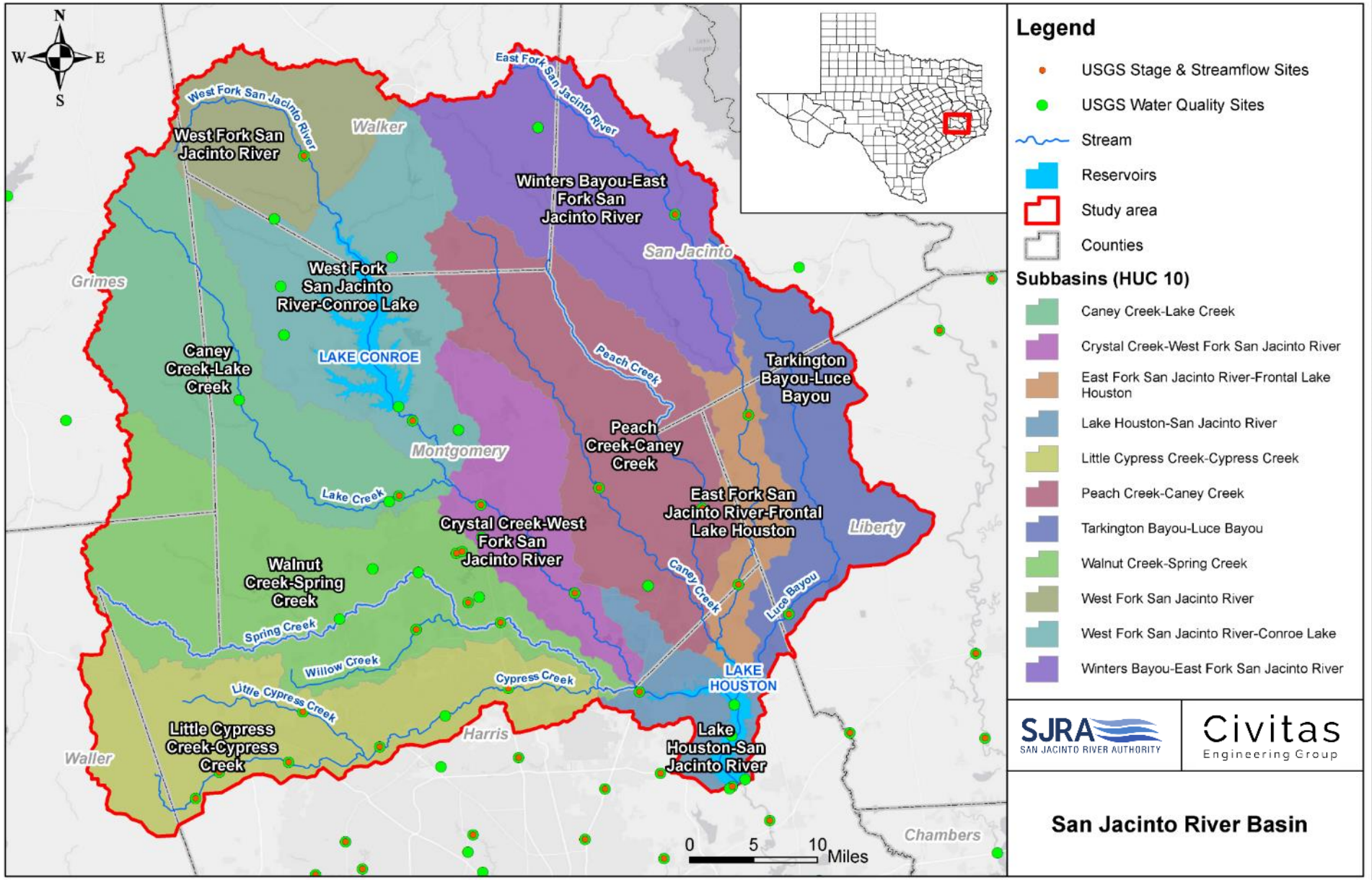
First Phase – Desktop Analysis

Desktop analysis to characterize and prioritize watersheds

Detailed, focused modeling and field investigation

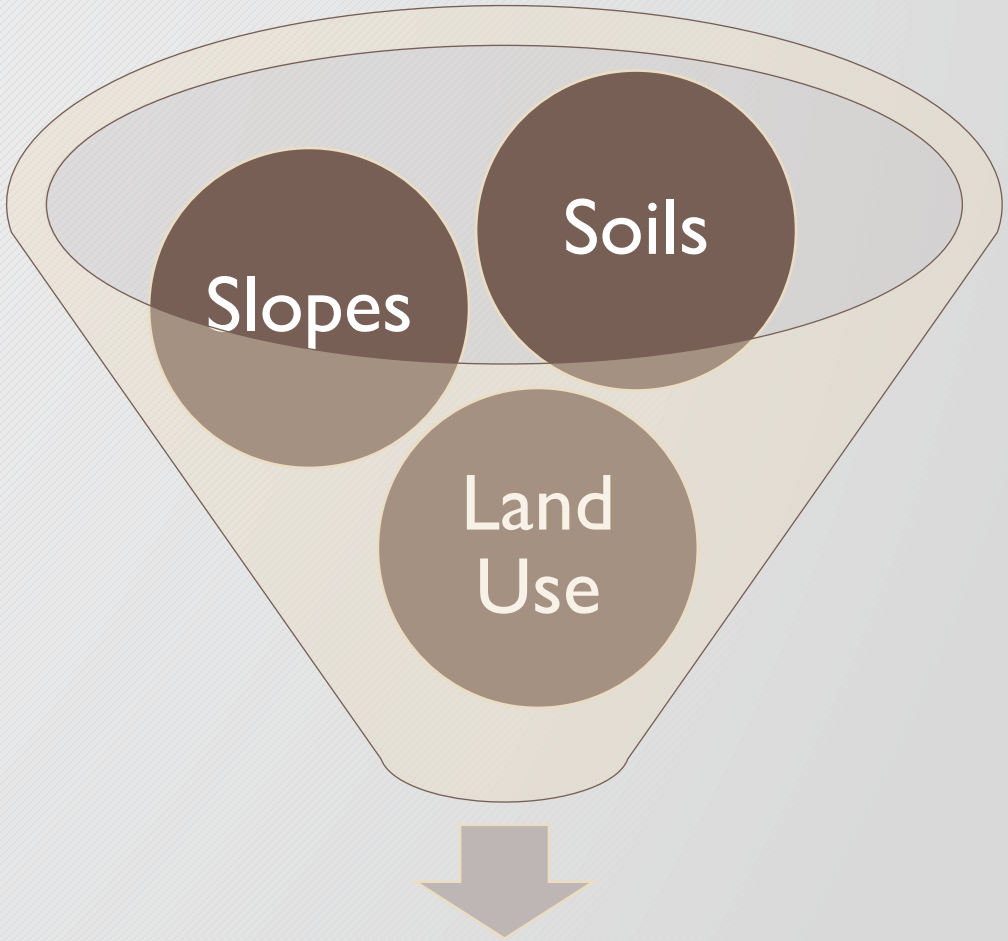
Data extrapolation and solutions development

Upper San Jacinto River Basin Watersheds



Watershed Characterization Approach

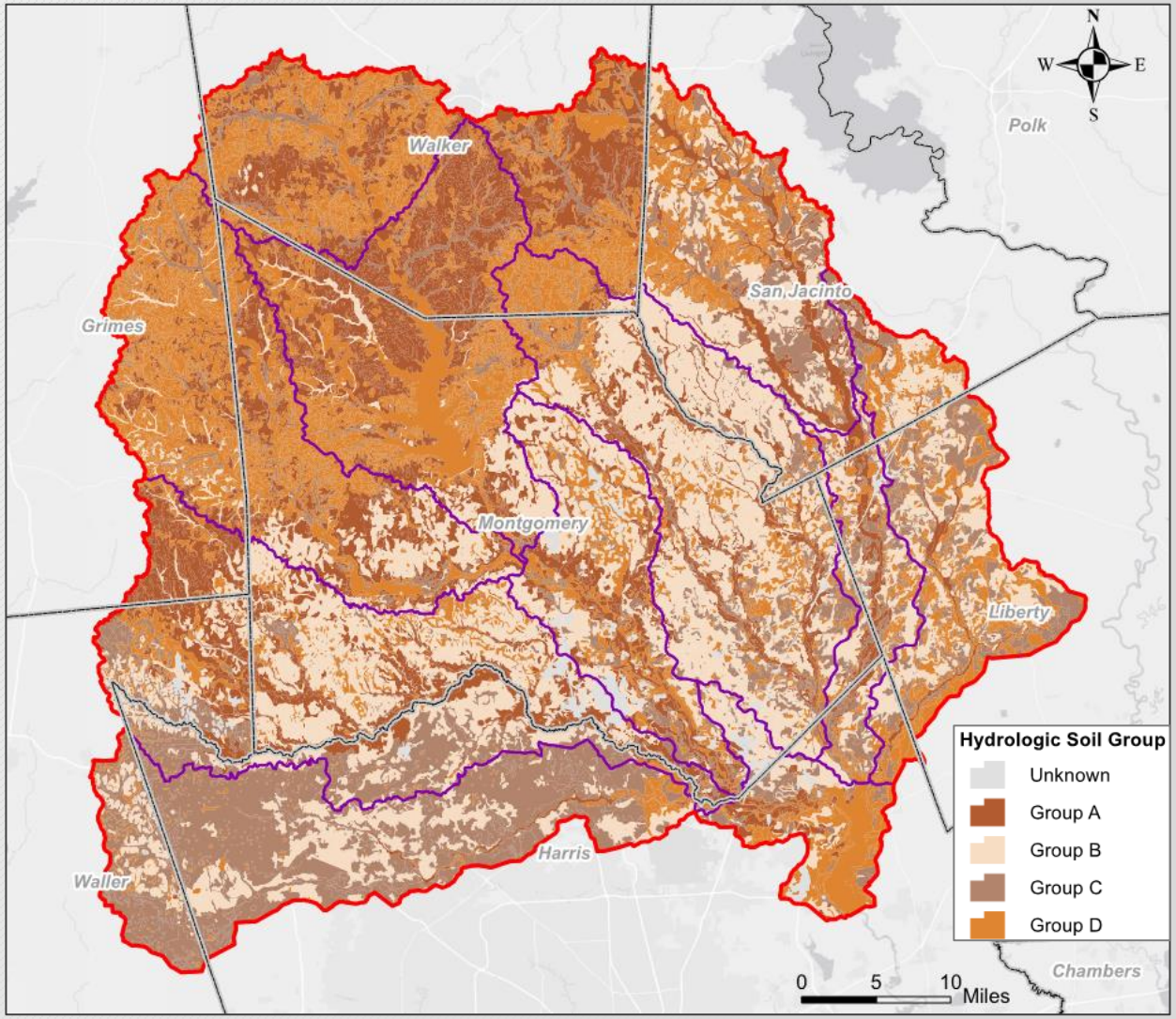
- Desktop (i.e., GIS) analysis of broad spectrum of data and models
  - Soils
  - Land Use
  - Impervious Cover
  - Topography
- Develop watershed "bins," or groups, with shared characteristics
- Select 3 representative subwatersheds for detailed analysis



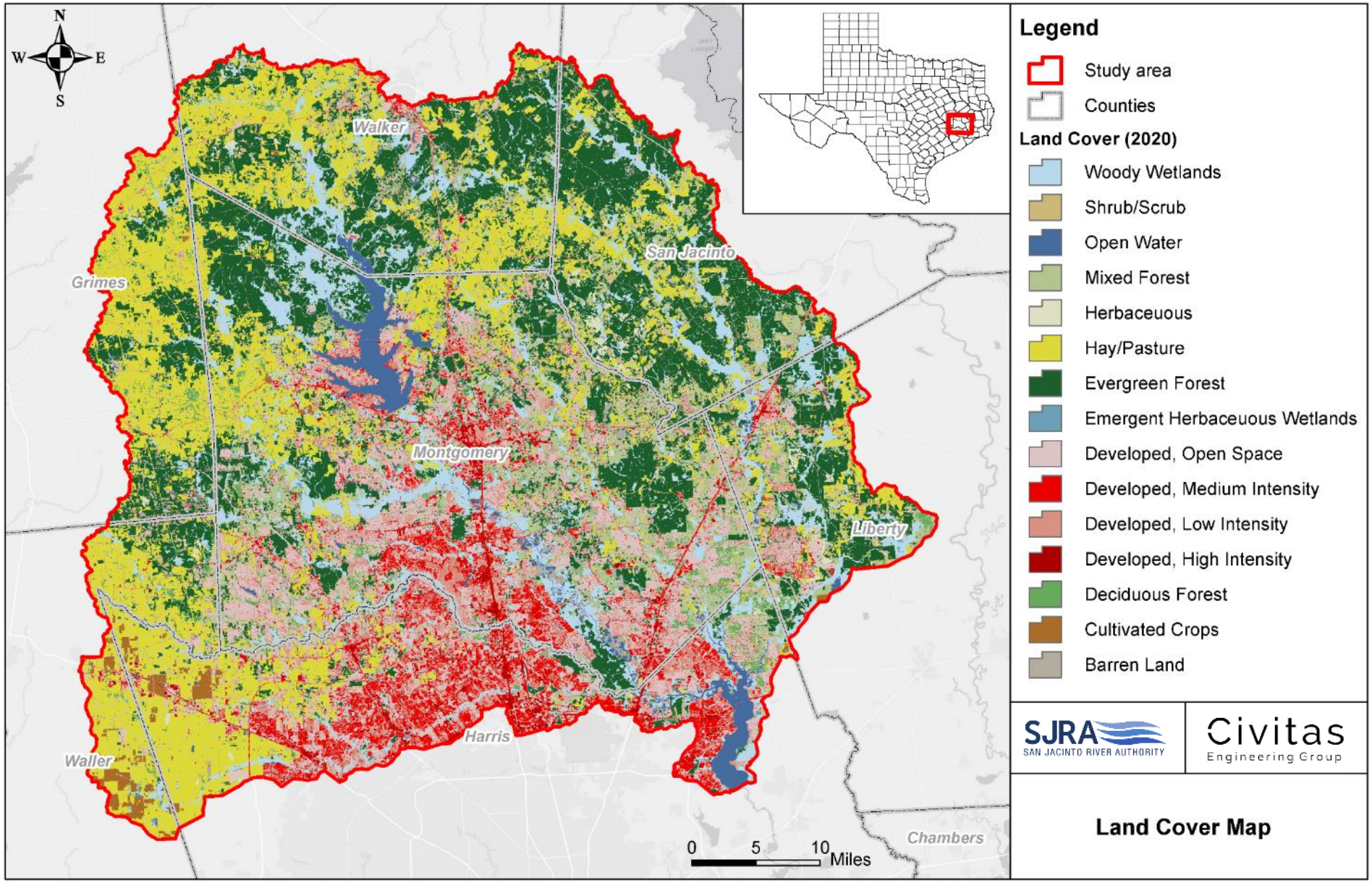
Watershed "Clusters"

Upper San Jacinto River Basin Soils

- Upland soils predominantly fine-grained
- Stream channels have higher proportion of sandy soils

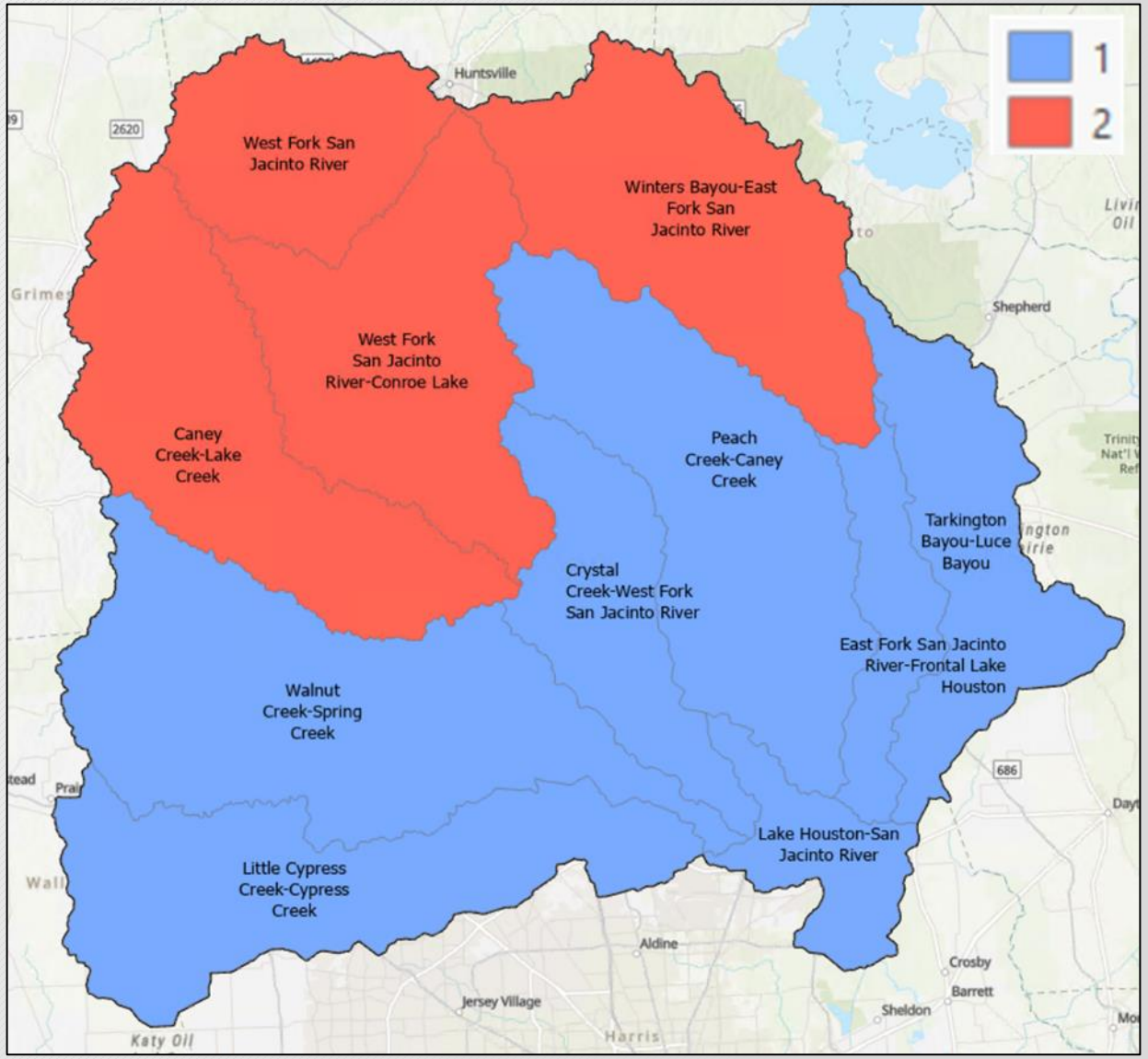


Upper San Jacinto River Basin Land Use



Upper San Jacinto River Basin Watershed Clusters

- Two distinct watershed groups:
  1. More developed, lower slopes, silty soils
  2. Less developed, more forested, clayey soils



Site Selection and Field Reconnaissance

3

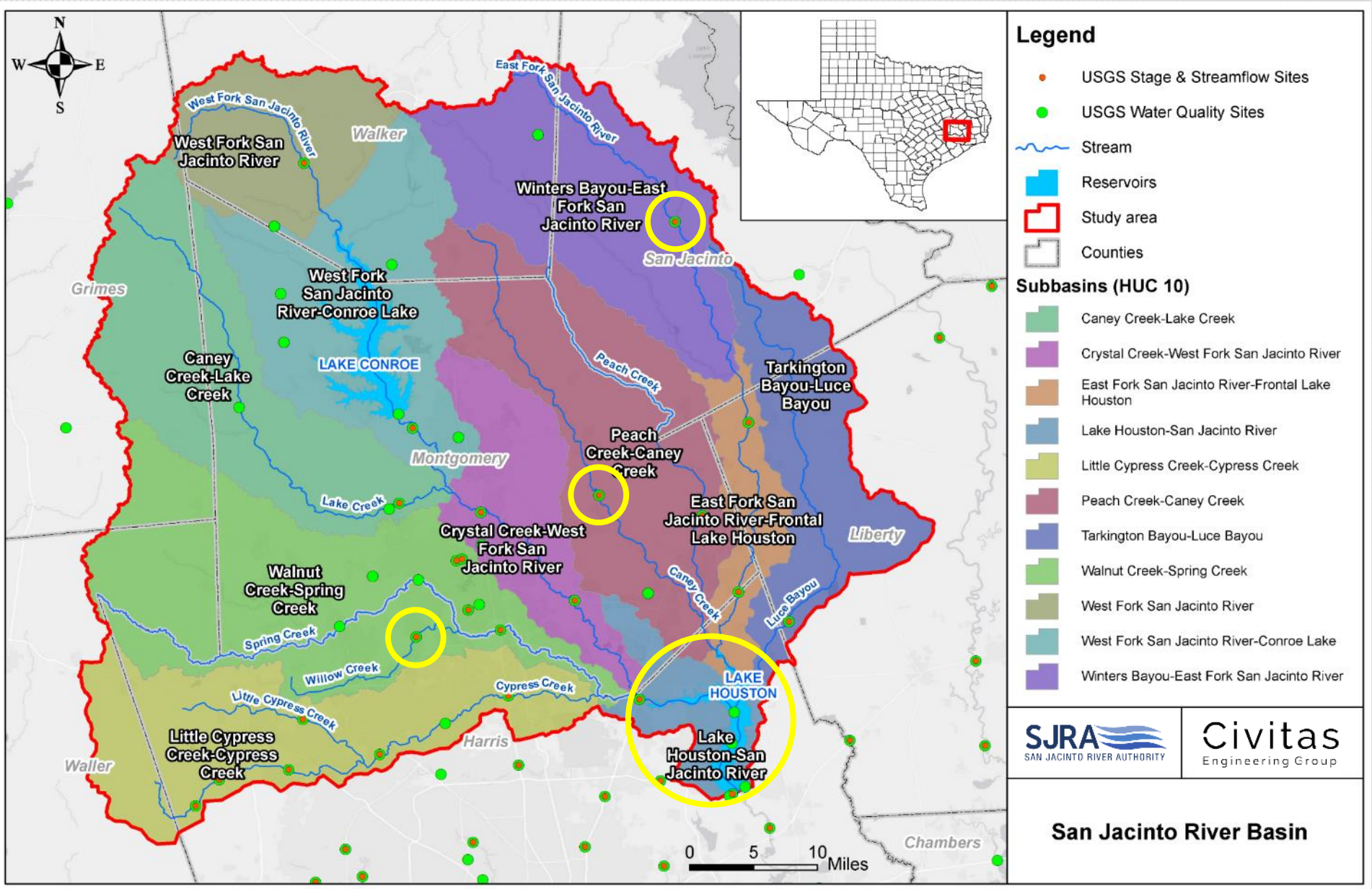
Second Phase – Detailed Field Investigation

Desktop analysis to characterize and prioritize watersheds

Detailed, focused modeling and field investigation

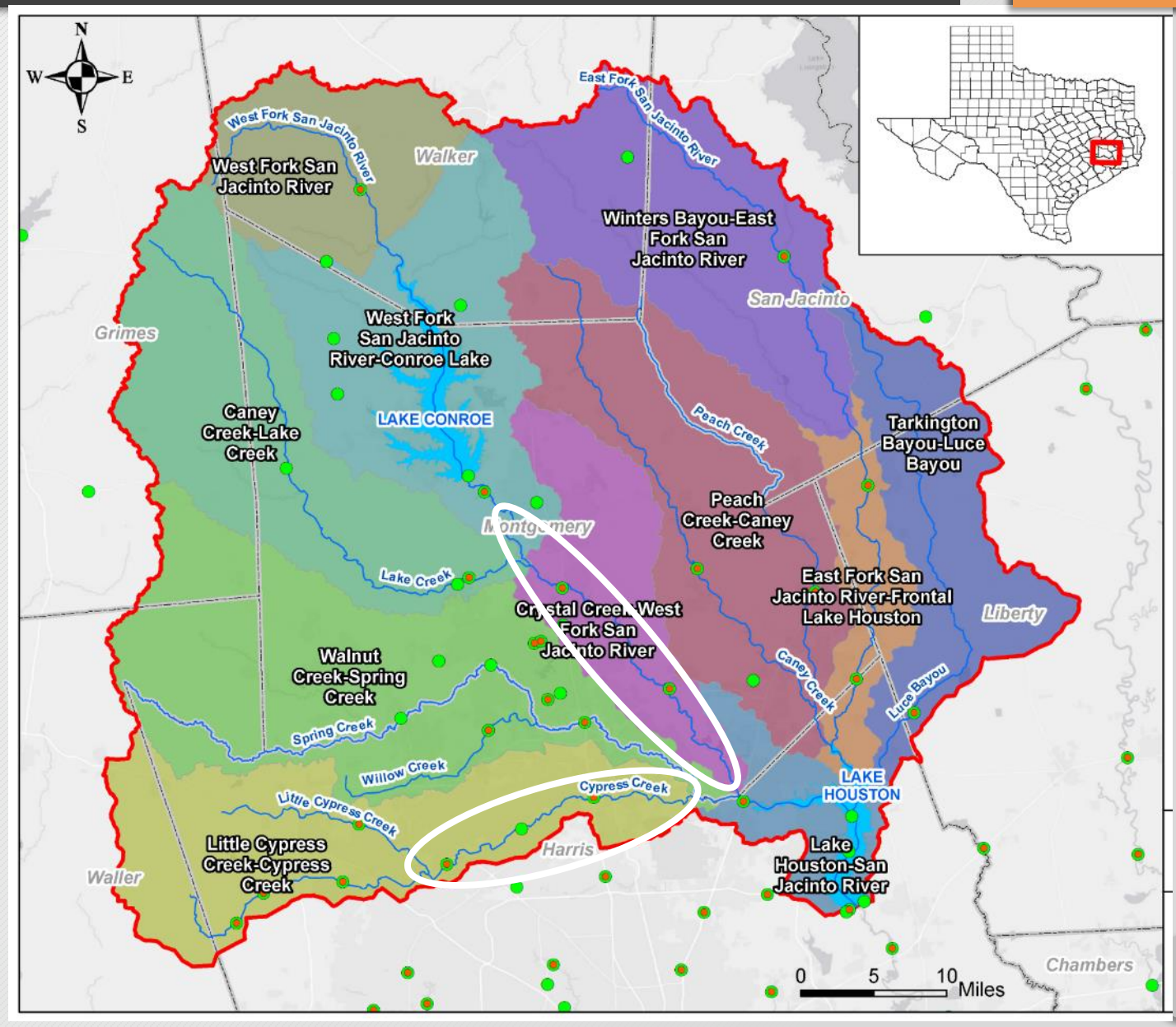
Data extrapolation and solutions development

Site Selections

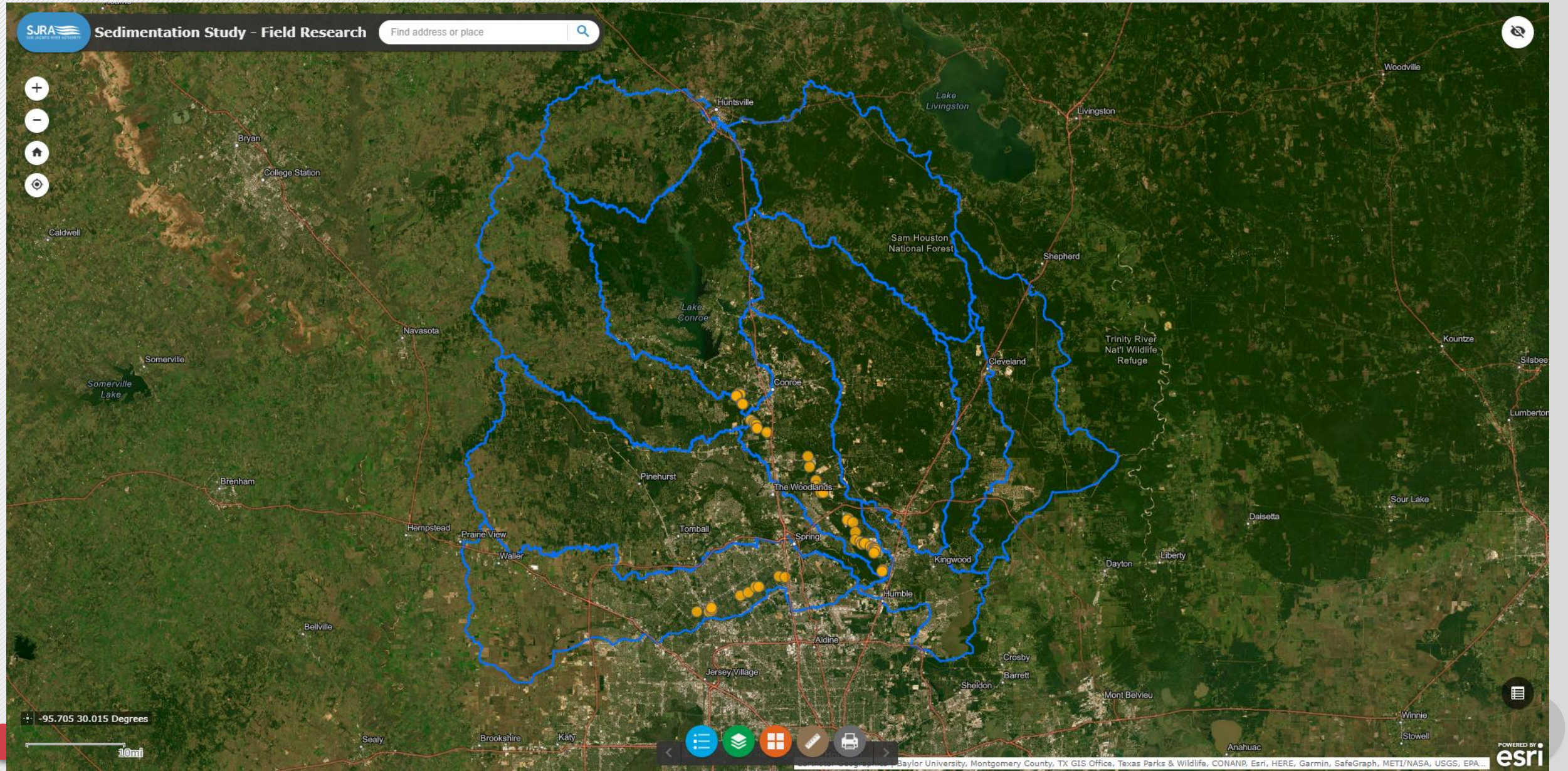


West Fork / Cypress Creek Investigations

- Visual inspection of areas of concern that are not sampleable
  - Kayak for floatable reaches
  - Foot for shallower reaches

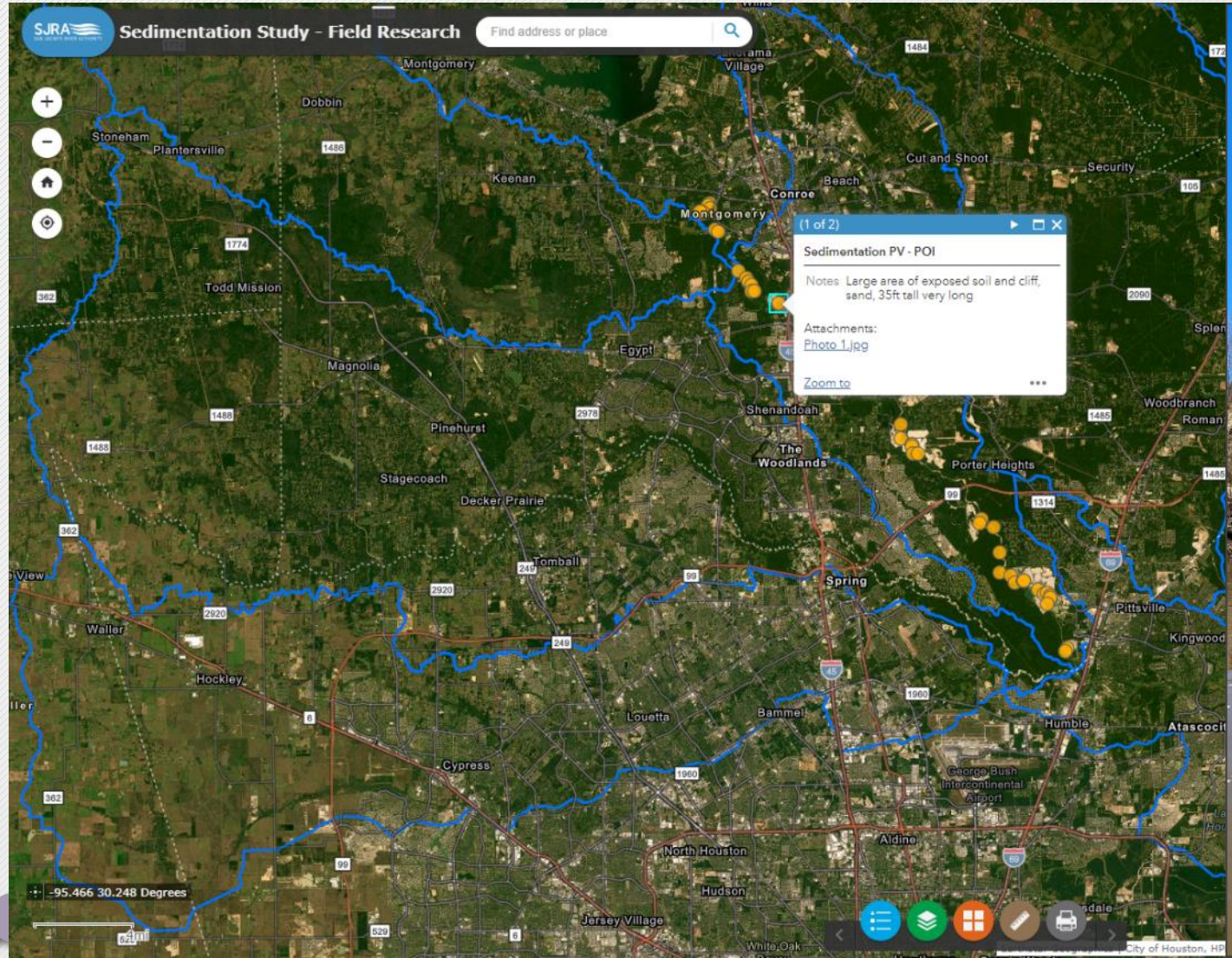


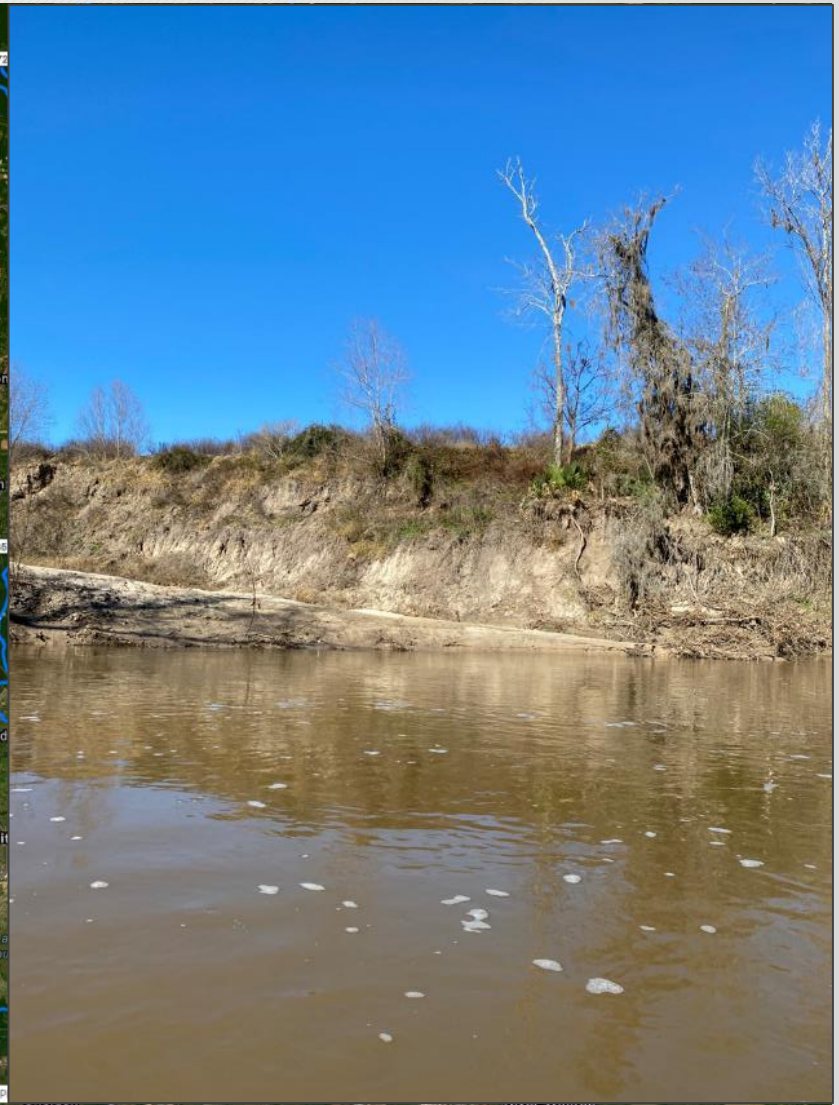
SJRA Field Reconnaissance – West Fork & Cypress Creek



GIS Geodatabase

- SJRA staff developed tool to input and geospatially store imagery and data



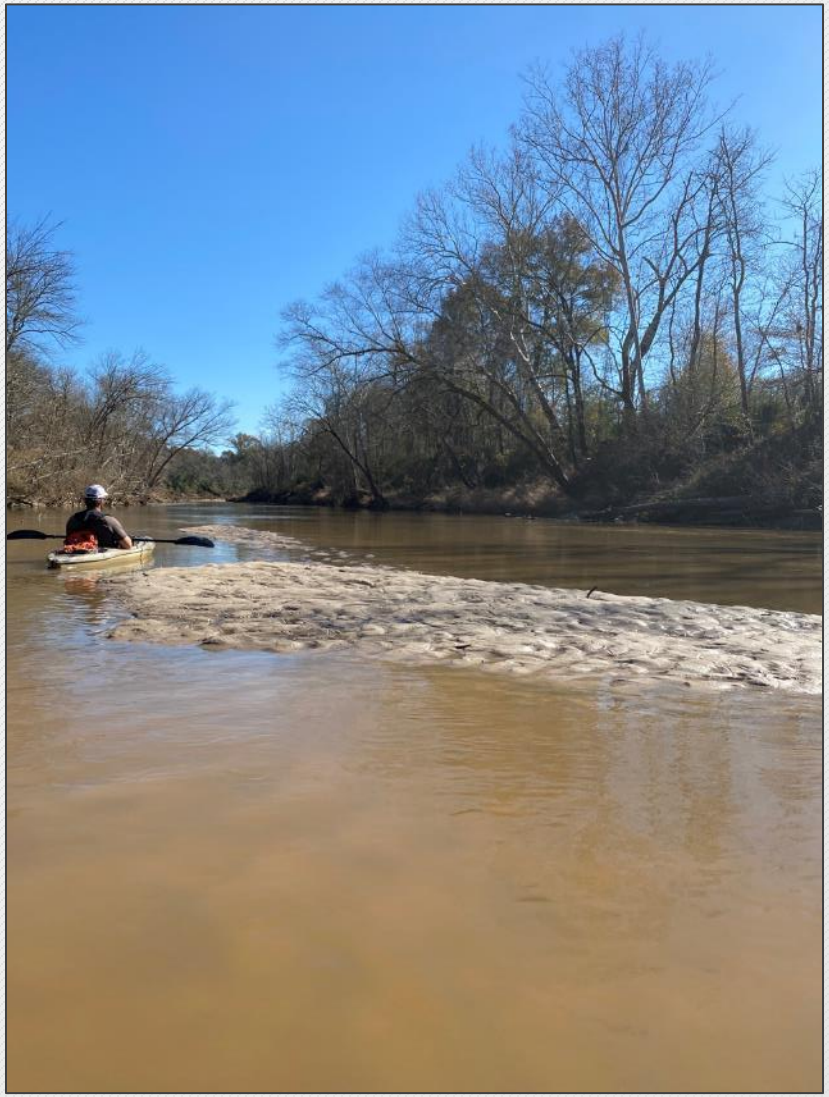


Example Photos – Sandy Banks

3

Sand Bars

3



Cypress Creek Field Reconnaissance

Field Sampling and Analysis

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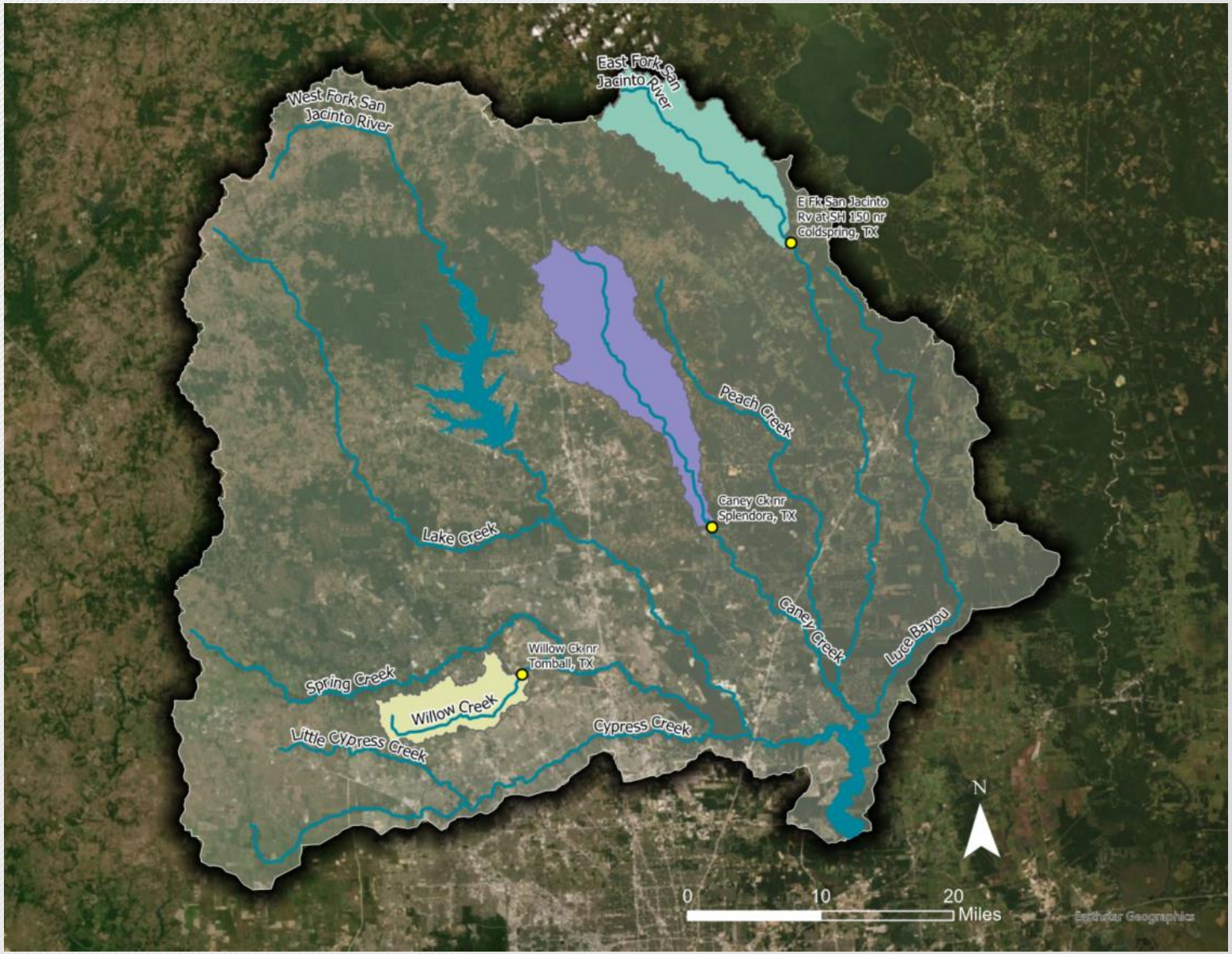
Watershed Sampling Site Delineations



Watershed Sampling Overview

Performed extensive field sampling and analysis:

- BANCS Model
- Dendrogeomorphic Analysis

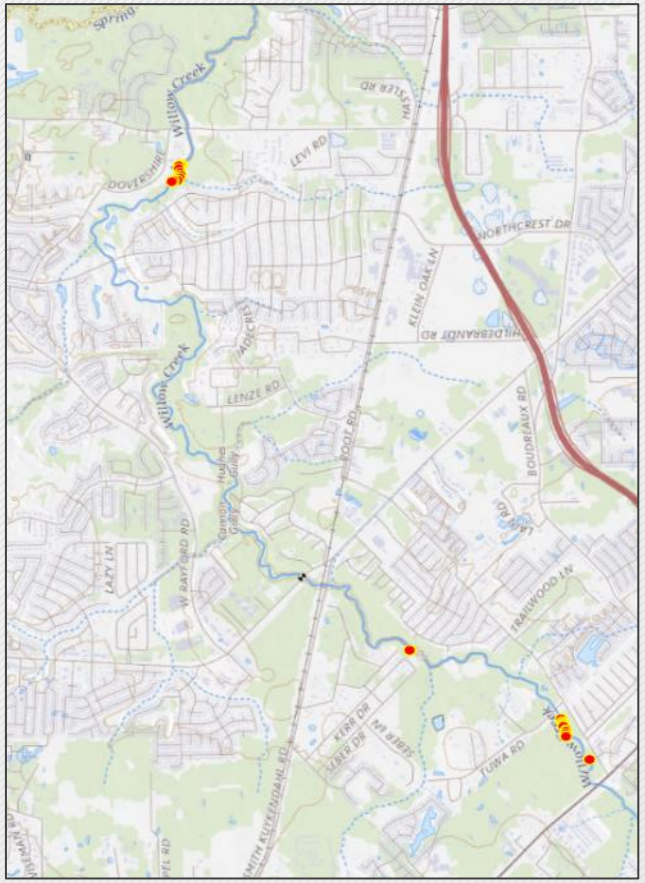
→ Streambank Erosion Rates

- Particle Size Characterization
- Isotope Analysis

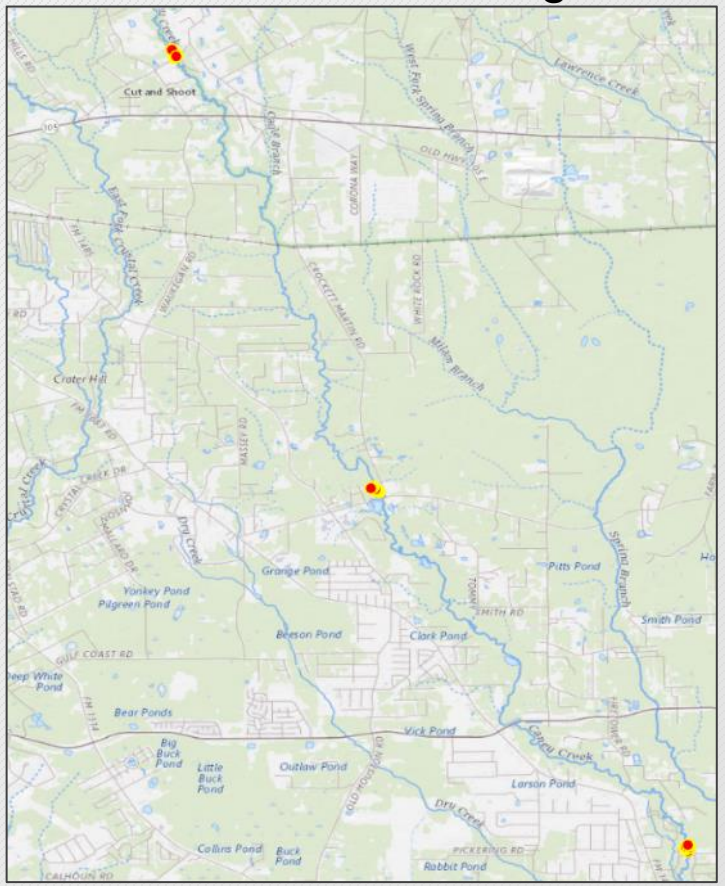
→ Sediment Characterization

BANCS Model Data Collection

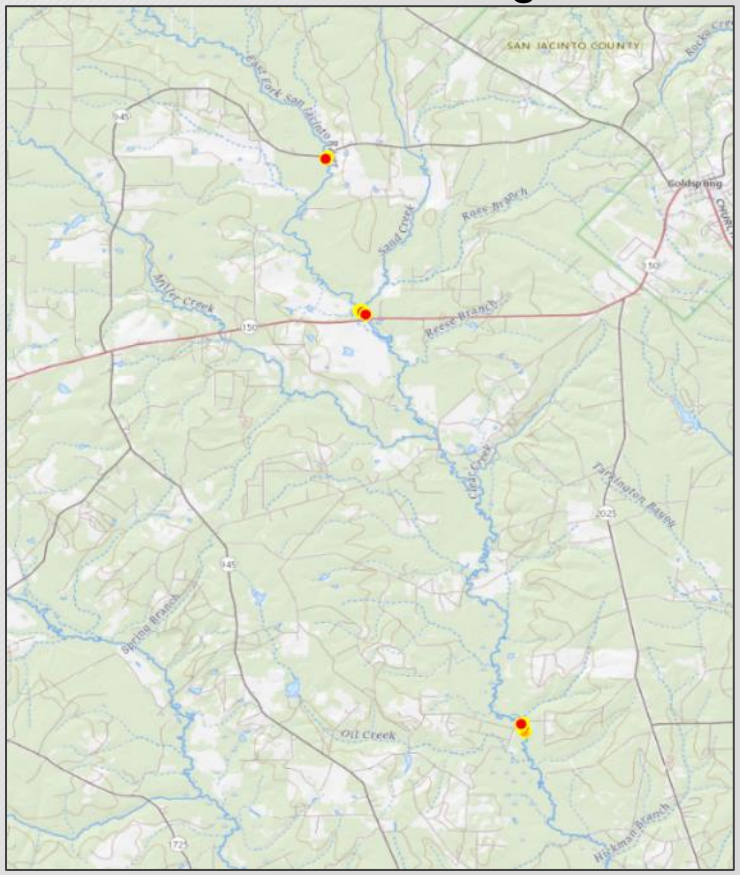
Willow Creek
- 3 Sampling Locations
- 47 Individual Bank Segments



Caney Creek
- 3 Sampling Locations
- 50 Individual Bank Segments



East Fork of San Jacinto
- 3 Sampling Locations
- 32 Individual Bank Segments



- Floodplain & Streambank Sites for Sediment Fingerprinting (Gamma Spectrometry – Cesium-137 / Lead-210) collected

BANCS Model Analysis

BEHI / NBS Data Analysis:

Stream: Location:
Station: Observers:
Date: Stream Type: Valley Type:

Study Bank Height / Bankfull Height (C) — BEHI Score (Fig. 3-7)

Study Bank Height (ft) = (A) | Bankfull Height (ft) = (B) | (A) / (B) = (C)

Root Depth / Study Bank Height (E)

Root Depth (ft) = (D) | Study Bank Height (ft) = (A) | (D) / (A) = (E)

Weighted Root Density (G)

Root Density as % = (F) | (F)×(E) = (G)

Bank Angle (H)

Bank Angle as Degrees = (H)

Surface Protection (I)

Surface Protection as % = (I)

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform med. to large cobble)
- **Gravel or Composite Matrix** (Add 5-10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (No adjustment)

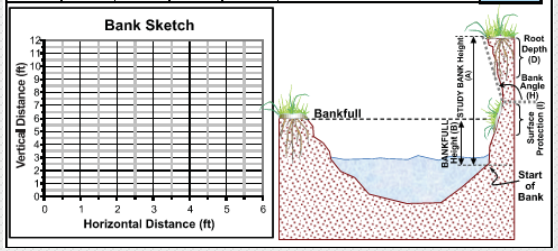
→ Bank Material Adjustment

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

→ Adjective Rating and Total Score

Bank Sketch



Estimating Near-Bank Stress (NBS)

Stream: Location:
Station: Stream Type: Valley Type:
Observers: Date:

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General Prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General Prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General Prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed Prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb}/τ_{bkf})	Level III	Detailed Prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1) Transverse and/or central bars-short and/or discontinuous.....NBS = High / Very High
Extensive deposition (continuous, cross-channel).....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow.....NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	Ratio R_c / W_{bkf}	Near-Bank Stress (NBS)
(3)	Pool Slope S_p	Average Slope S	Ratio S_p / S	Near-Bank Stress (NBS)
(4)	Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	Ratio d_{nb}/ d_{bkf}	Near-Bank Stress (NBS)

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb}/τ_{bkf}	Near-Bank Stress (NBS)

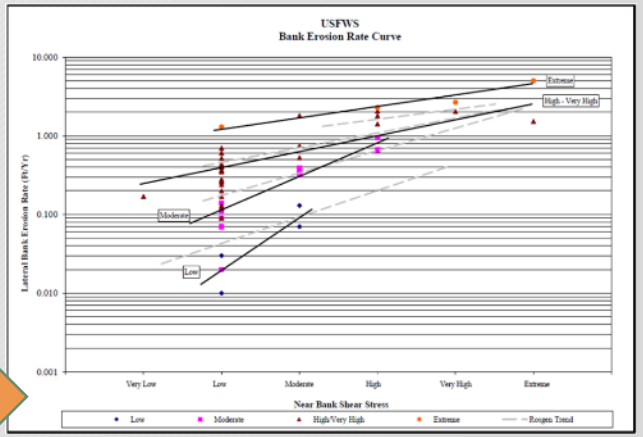
Level IV

(7)	Velocity Gradient (ft / sec/ ft)	Near-Bank Stress (NBS)	

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) Ratings	Method Number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) Rating



x Bank Length
& Bank Height

STREAM BANK EROSION RATES
(TONS / YEAR / FT)

	0.00 - 0.25
	0.26 - 0.50
	0.51 - 1.00
	1.01 - 2.00
	2.000 - 2.999

Dendrogeomorphic Data Collection

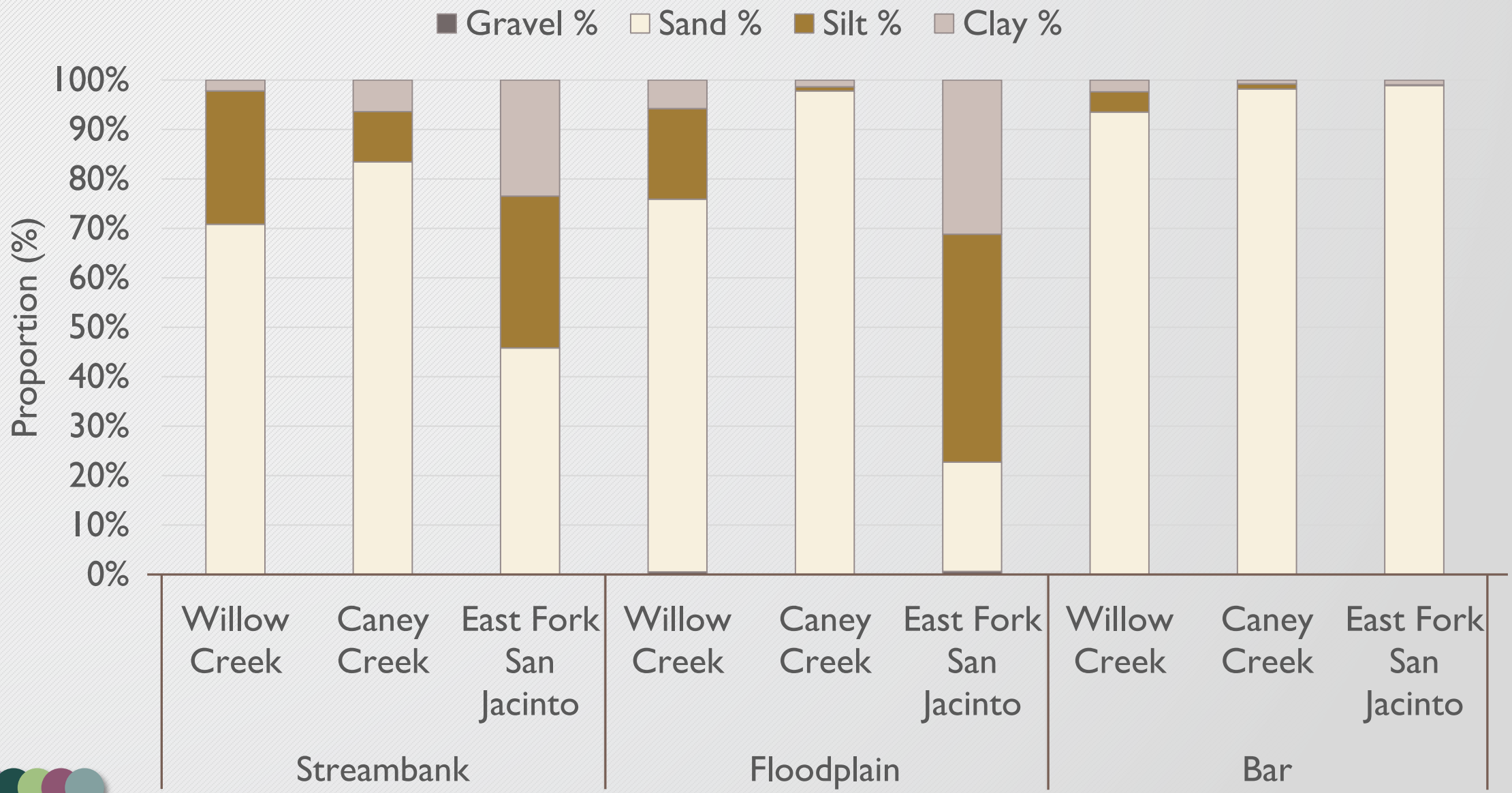
Willow Creek
- 3 Sampling Locations
- 28 Individual Samples

Caney Creek
- 3 Sampling Locations
- 52 Individual Samples

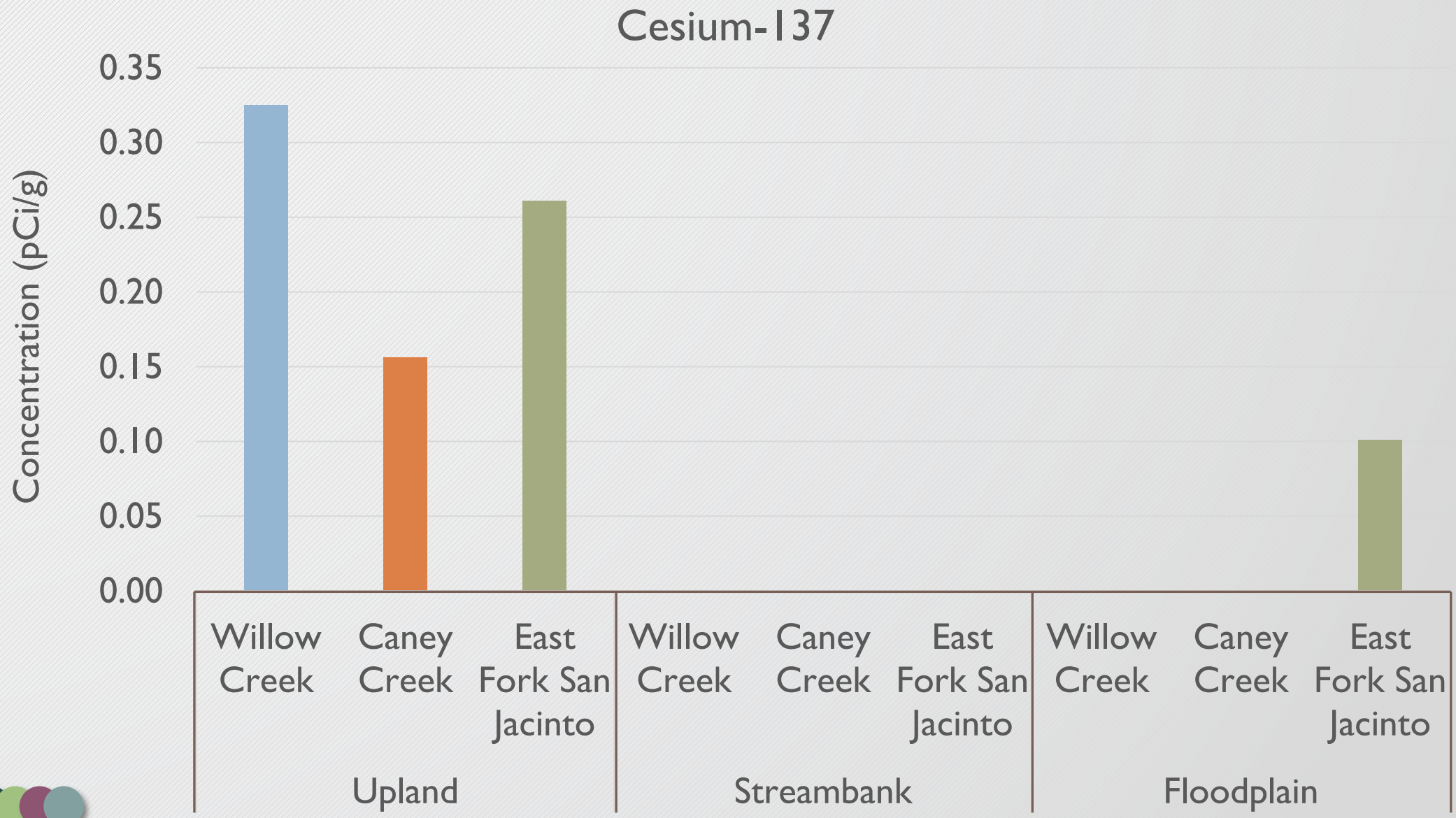
East Fork of San Jacinto
- 3 Sampling Locations
- 22 Individual Samples

- Eroded Distance & Tree Root Age used to determine Erosion Rate in ft/yr.

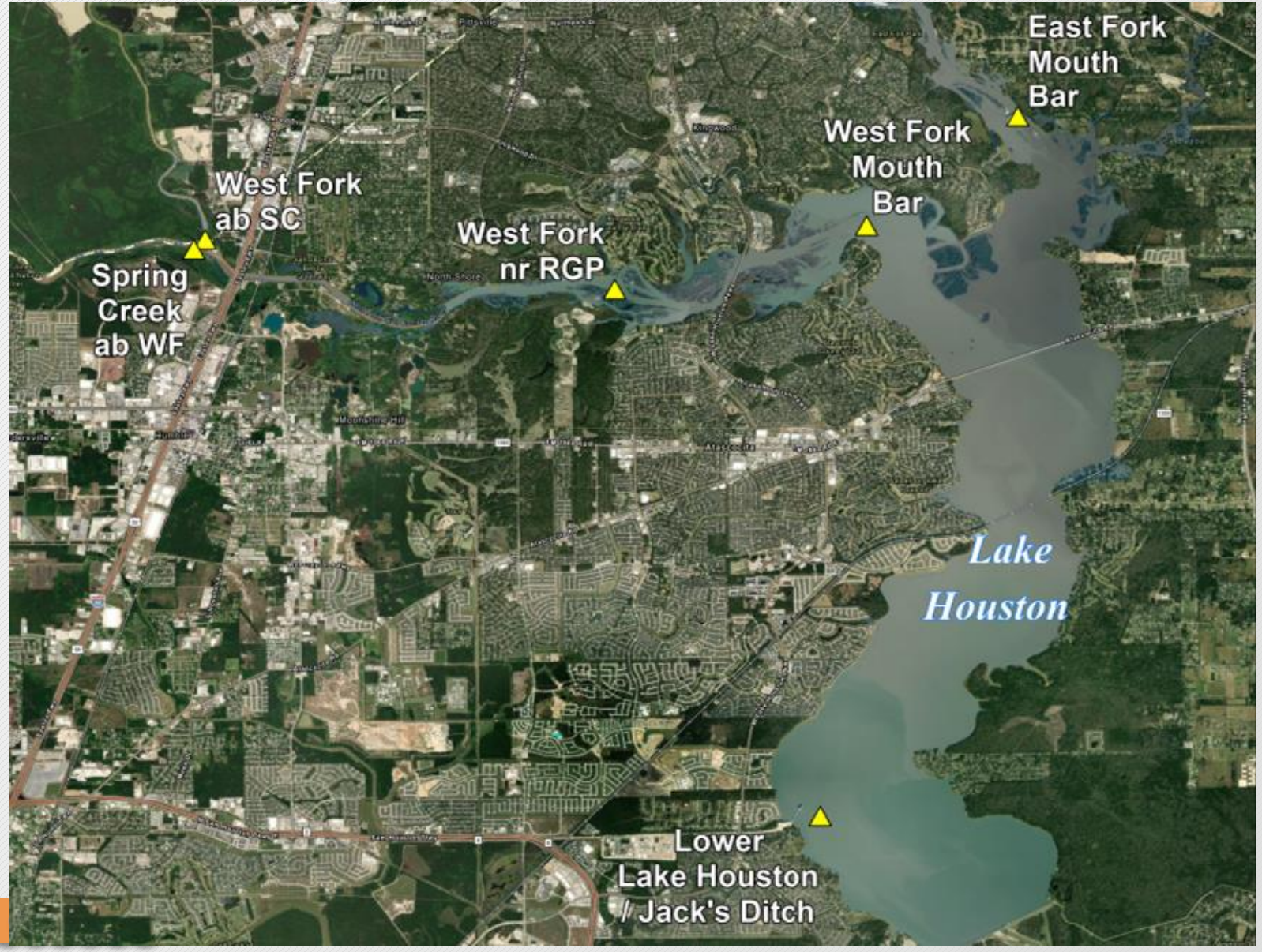
Particle Size Data



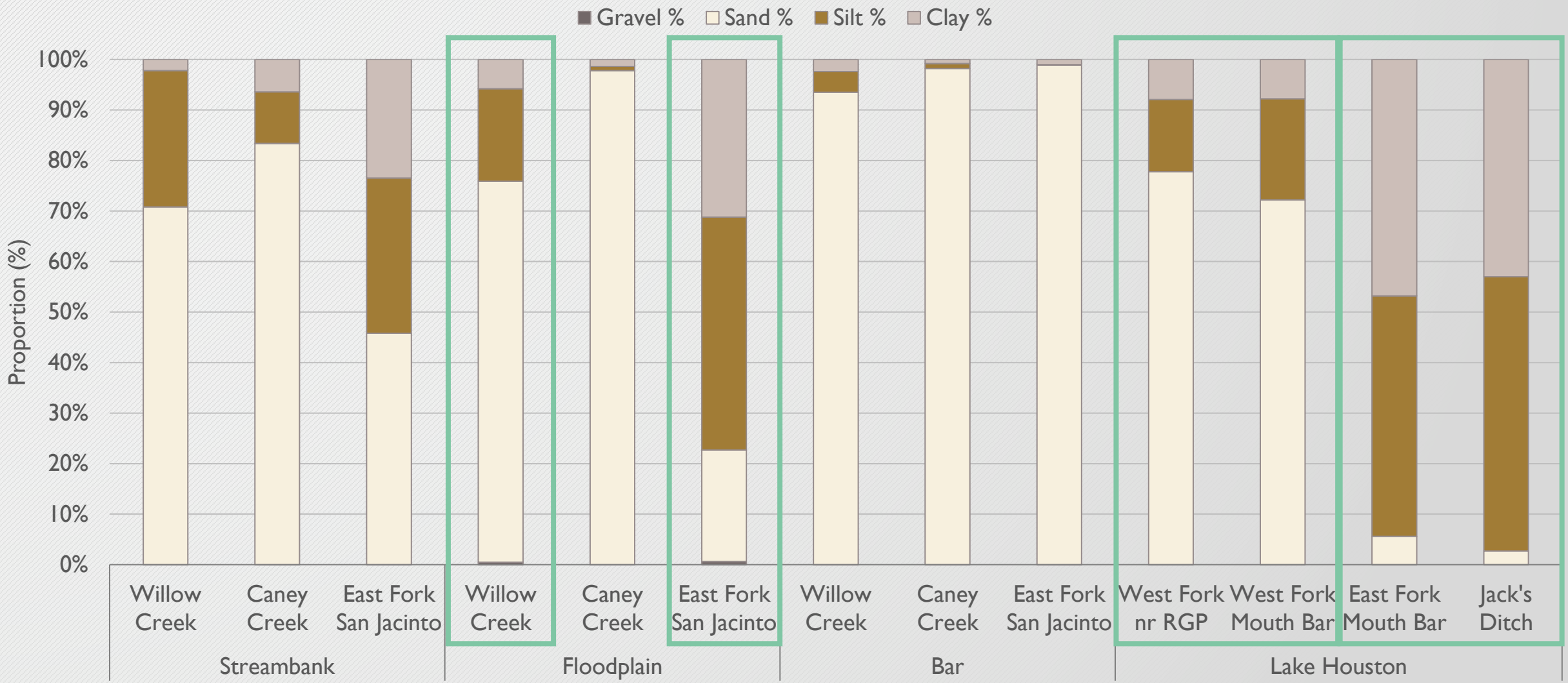
Isotope Data



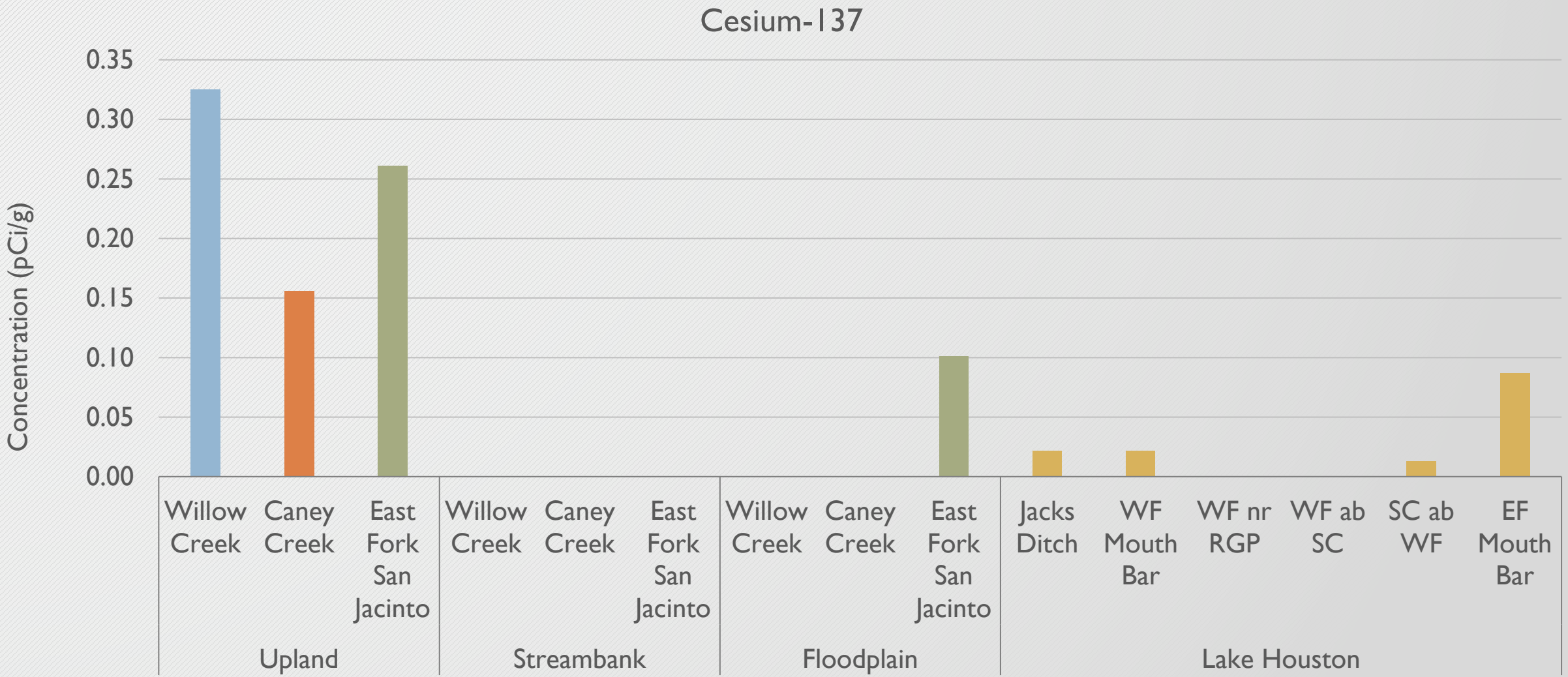
Lake Houston Sampling Locations



Grain Size Results

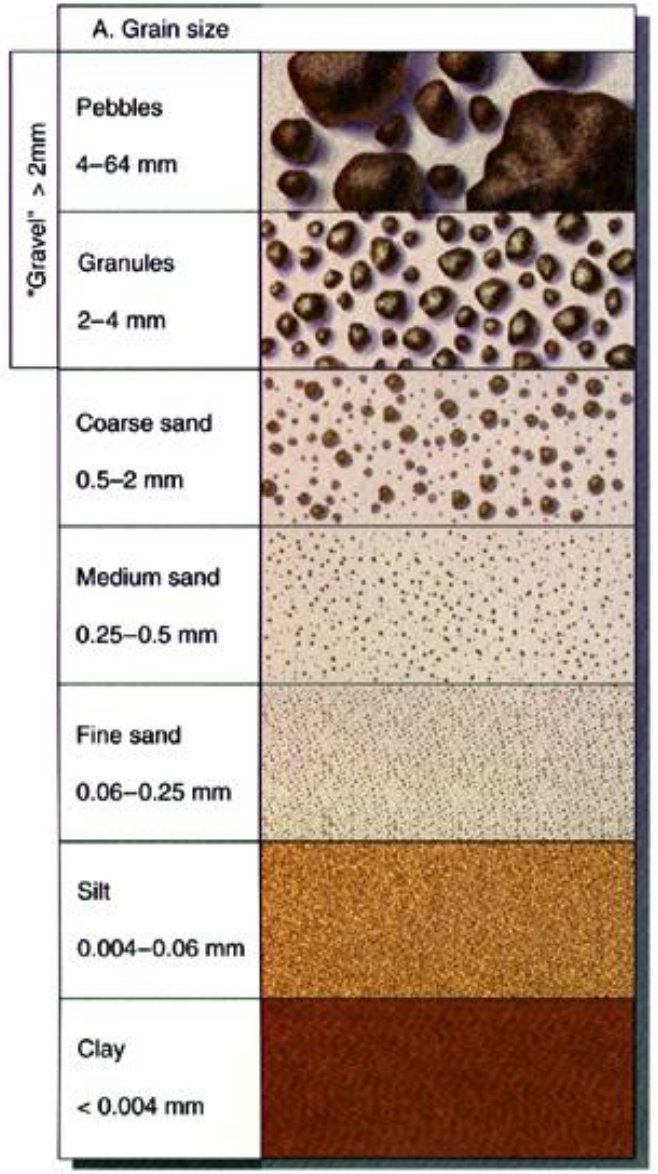


Isotope Results – Cesium



Particle Size and Transport

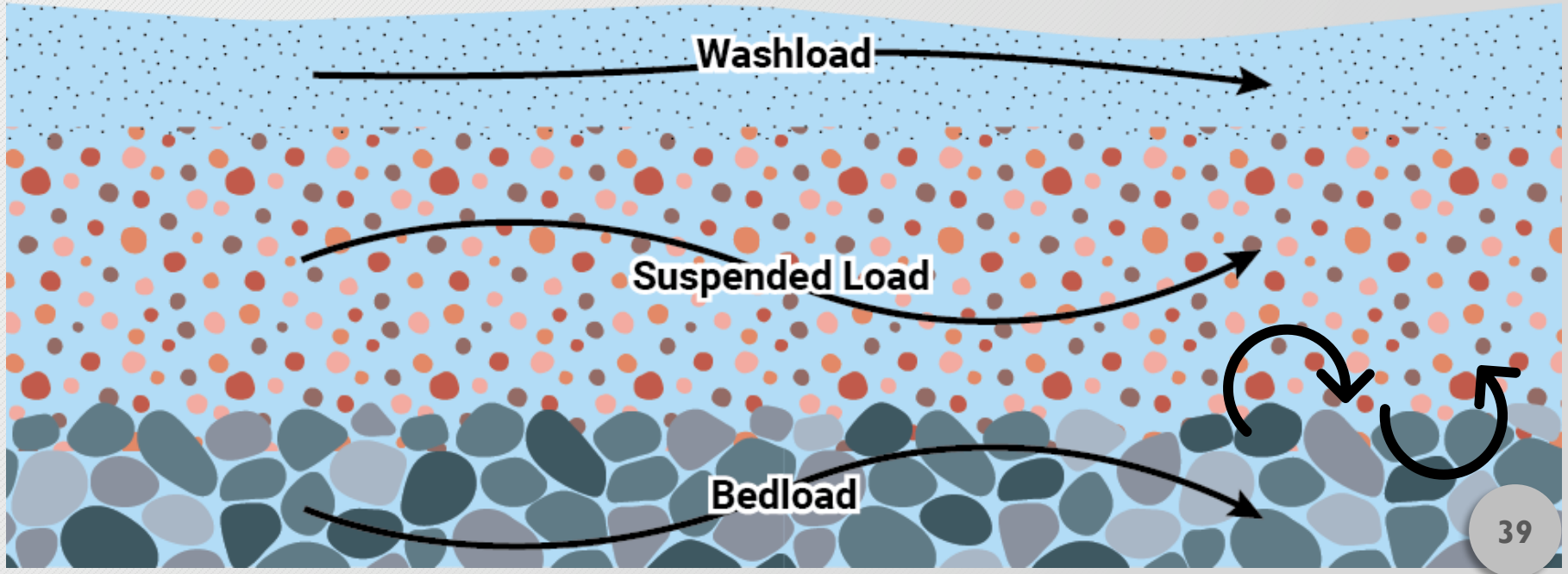
- Sediment transport is dictated by velocity and grain size
- Larger particles settle more quickly
- Fines tend to remain is suspension



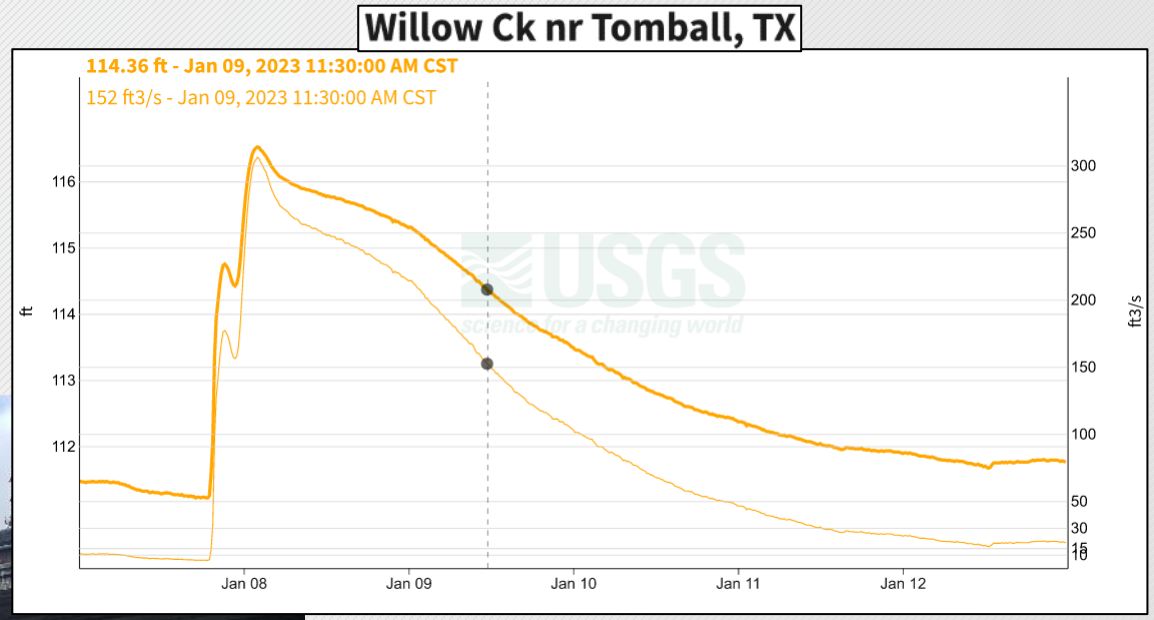
https://www3.nd.edu/~cneal/planetearth/Lab-Sedimentary/GrainSizeLM.jpg

Bedload Transport

- Existing data available for suspended solids (i.e., sediment) concentrations
- However, suspended solids data omit portion of bedload sand transport
- In this Study, we examined bedload transport
  - Collected field bedload data
  - Performed sediment transport modeling

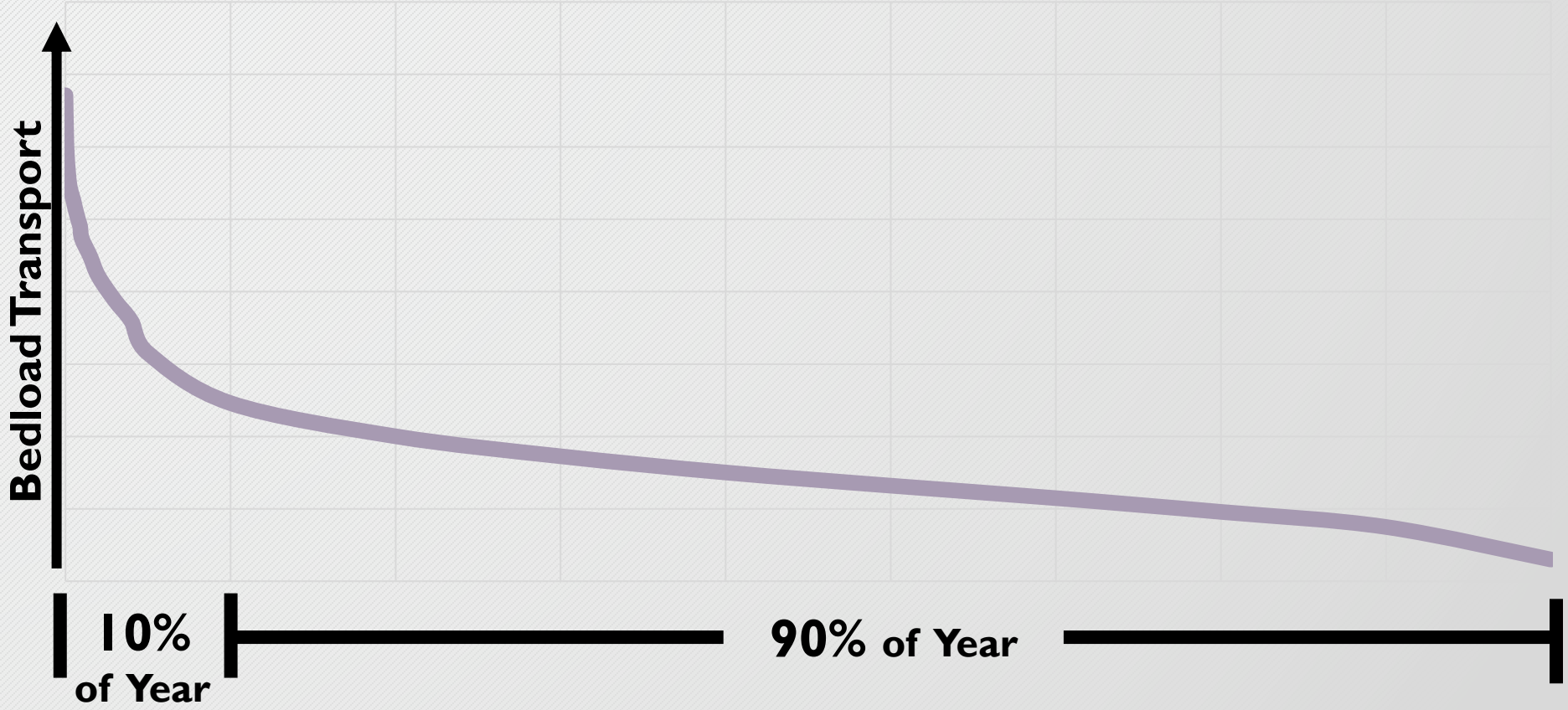


Cross-Section Delineation and Bedload Data Collection



Bedload Transport Modeling Results

- Bedload is a significant form of sediment transport,
  - But still smaller in magnitude than suspended transport



Preliminary Conclusions, Part 1 – Sand

- Development → Increased Surface Runoff → Increased Streamflow → Increased Bank Erosion
- Sand likely originates predominantly from eroding streambanks, gets temporarily stored within channels, and eventually carried downstream
- Sand reaching Lake Houston is trapped in the upper reaches of the lake, particularly the West Fork Arm
- Primary cause of streambank erosion is energy imbalance between streamflow and channel capacity
- Imbalance more extreme in developed western basin, but SH 99 extension will bring development eastward

- Fate of sandy sediments: storage in stream channels, floodplains, Lake Conroe, and upper Lake Houston

Preliminary Conclusions, Part 2 – Fines

- Fine-grained sediments (fines) originate from both upland and streambank sources
- Upland sources can be both point and non-point
  - Upland point sources include runoff from new development
- Fines can be deposited in floodplains, but tend not to collect in streams
- Fate of fines: settling in Lake Conroe and lower Lake Houston; some transport out of basin

Next Steps

5

Third Phase – Data Extrapolation & Solutions Development

Desktop analysis to characterize and prioritize watersheds

Detailed, focused modeling and field investigation

Data extrapolation and solutions development

Upcoming Tasks

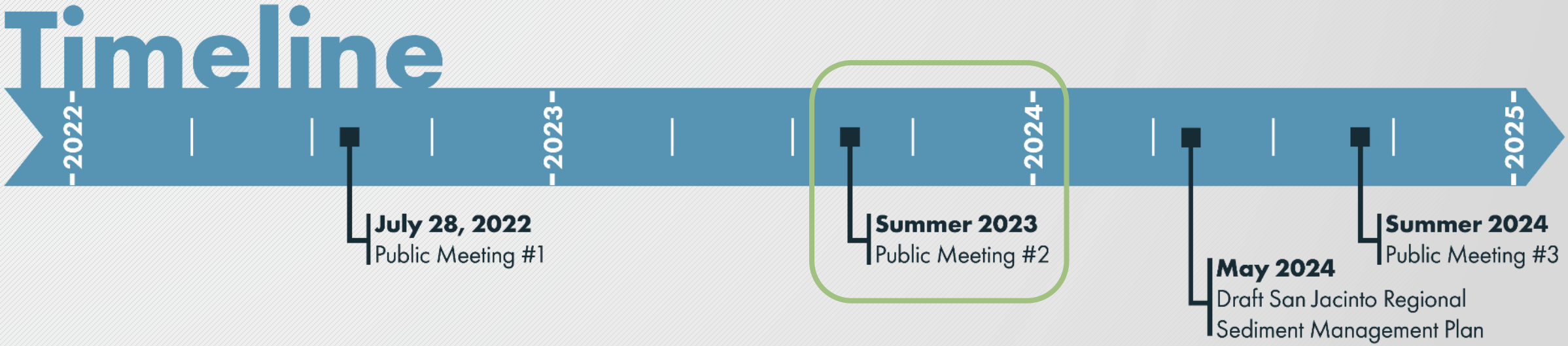
- Data Extrapolation
- Investigation & Location Prioritization
- Solutions Development
- Stakeholder & Permitting Identification
- Technical and Financial Sources

San Jacinto Regional Sediment Management Plan

Schedule

6

Project Schedule



Community Engagement

7

Public Engagement is Two-Way Information Flow

Contact Us

Comment Portal

First name*

Last name*

City*

Affiliation

Email

Please provide your e-mail address if you would like to be added to the distribution list for future project communication.

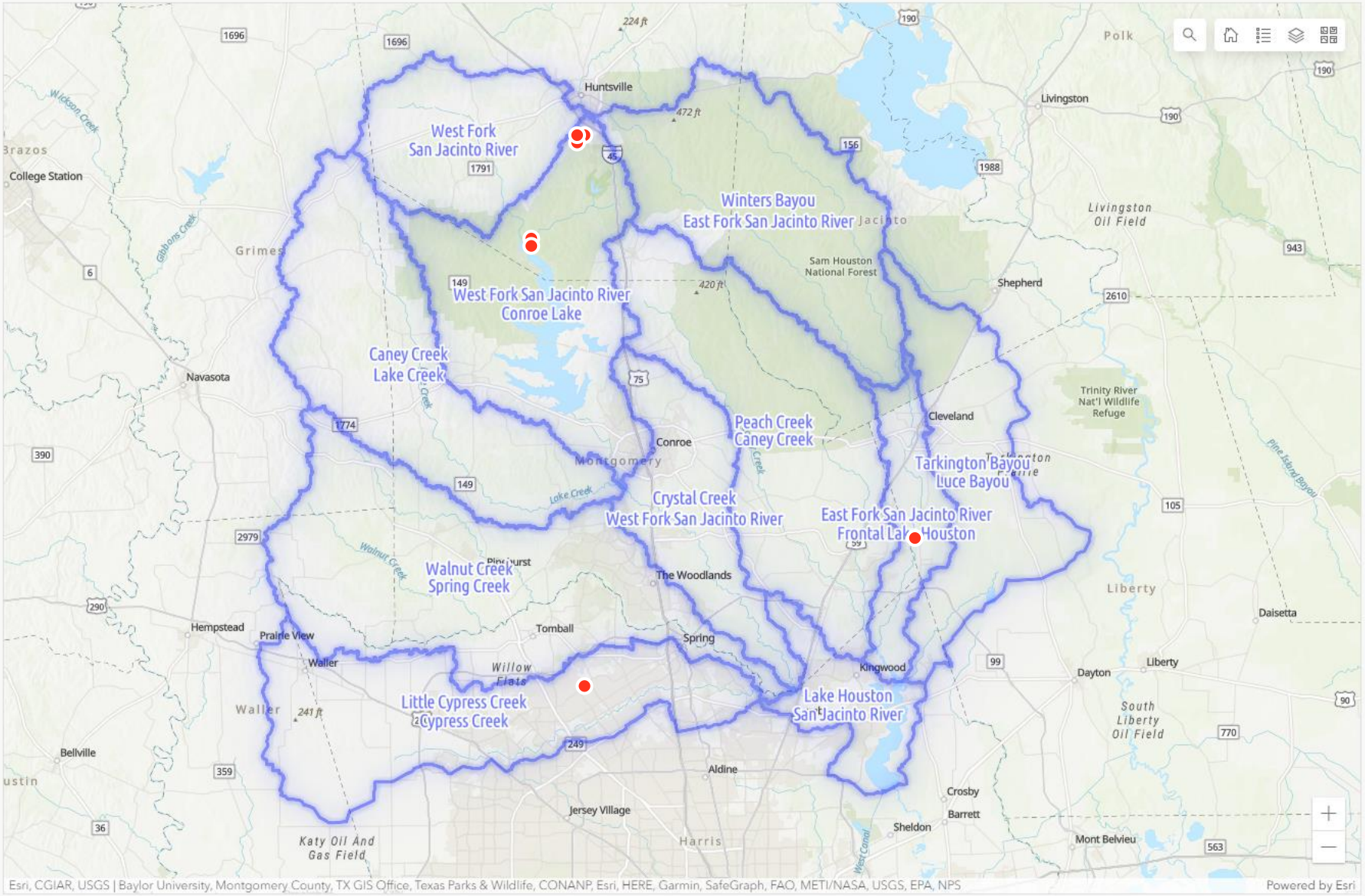
Are you aware of any flood conveyance issues in the Upper San Jacinto River Basin caused by sedimentation? If so, provide location and brief description.

Sedimentation Dashboard

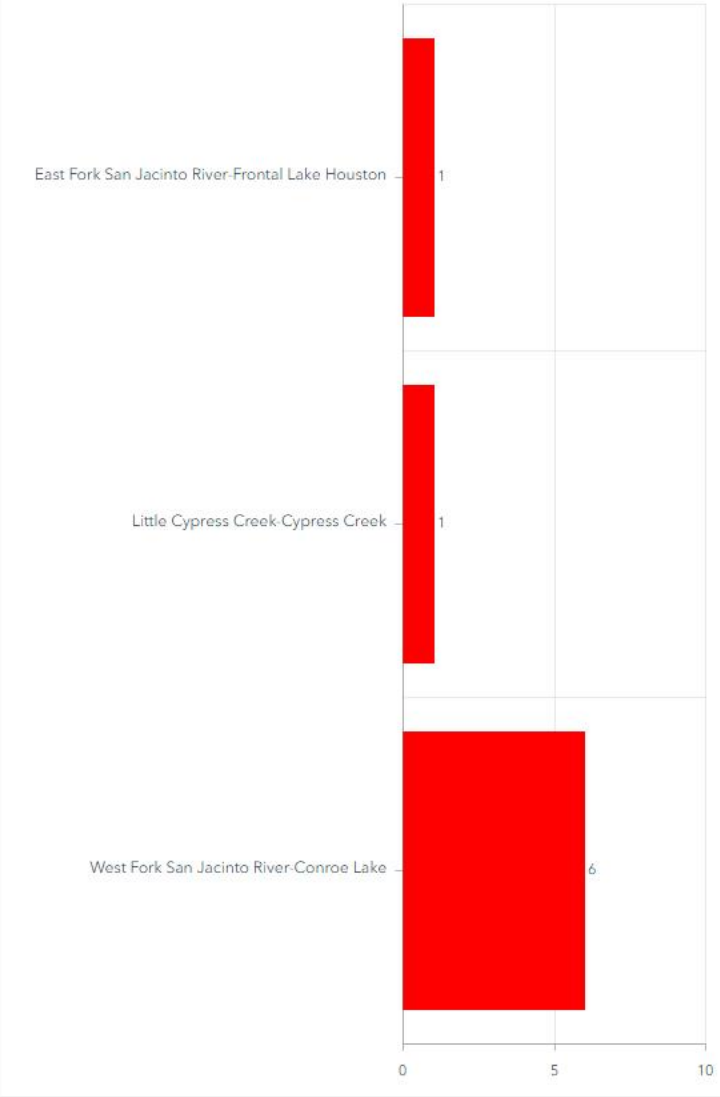
Upper San Jacinto River Basin Regional Sedimentation Study

User-defined known sediment deposition locations

SJRA SAN JACINTO RIVER AUTHORITY



Sediment Deposition Locations per Watershed



Wrap-Up / Q&A

8

Send comments to:
floodmanagementdivision@sjra.net

Website: https://sanjacintosedimentationstudy.com/