East Fork San Jacinto River, Segment 1003

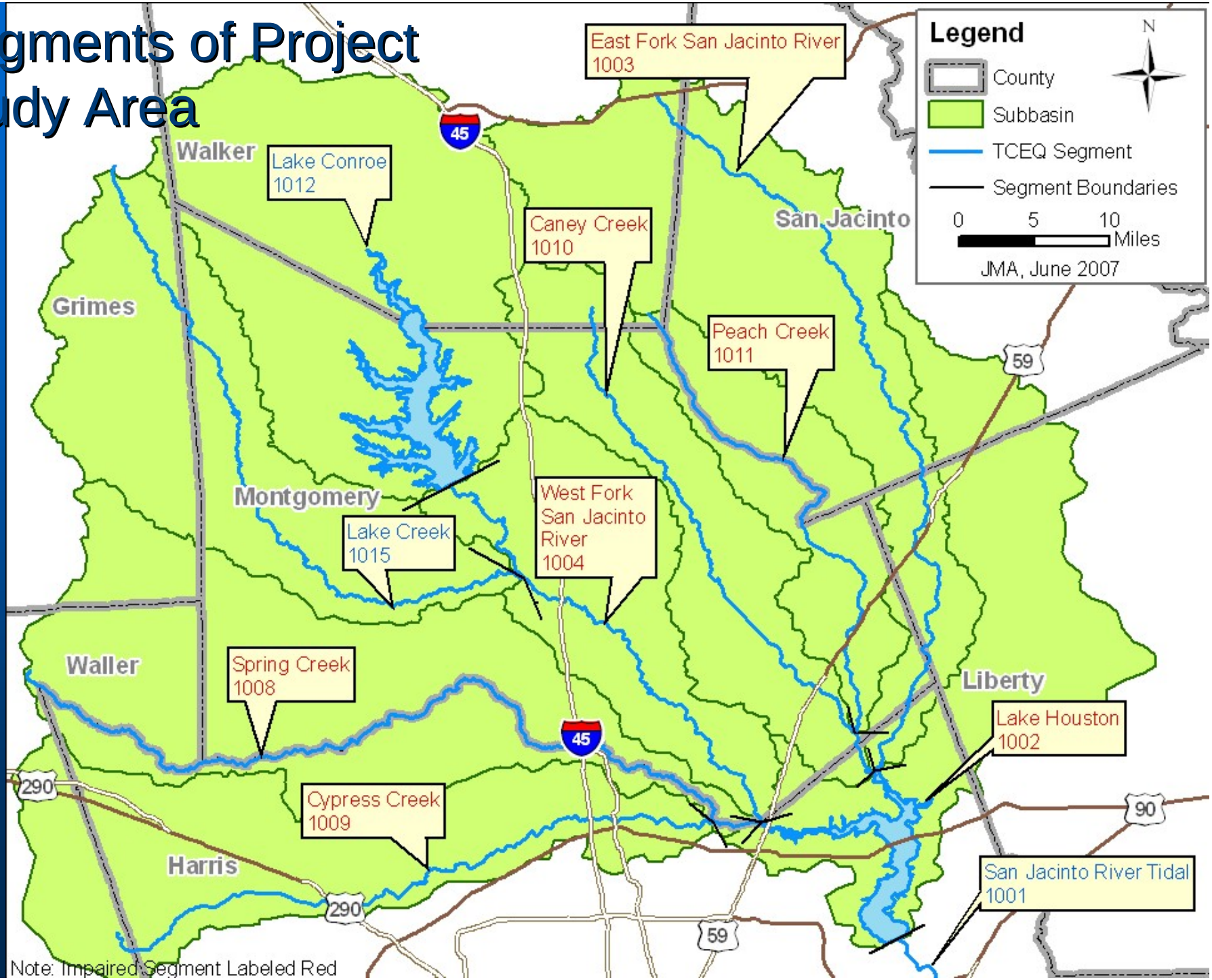
Preliminary Data Review & Monitoring Plan

James Miertschin, PhD,PE
James Miertschin & Associates
Environmental Engineering

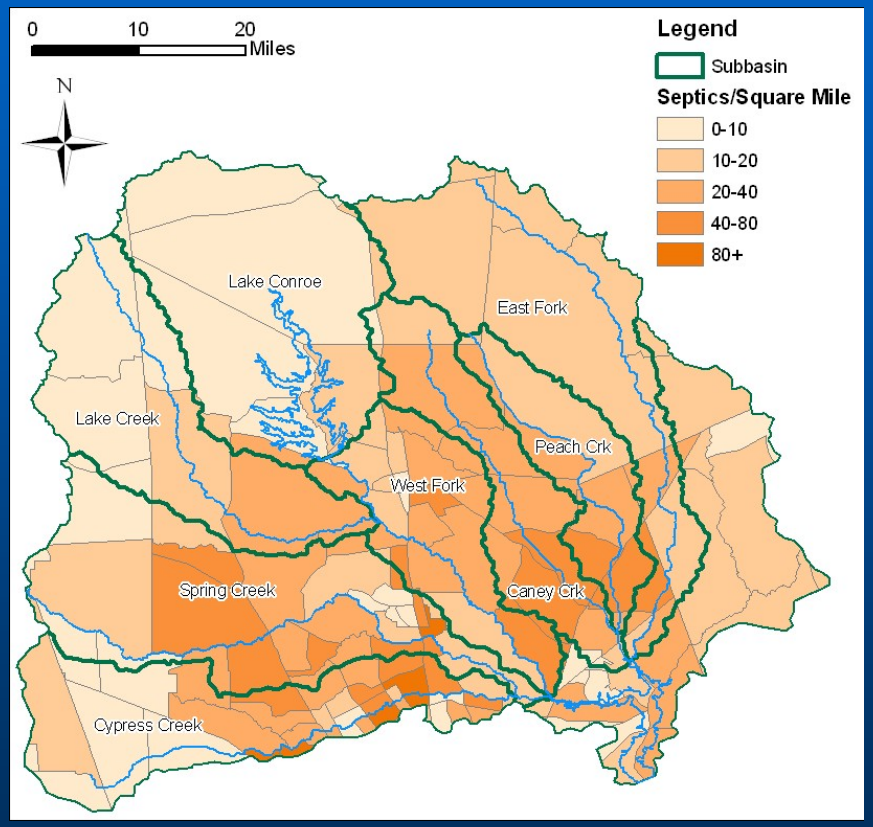
Introduction

- Several stream segments of San Jacinto River Basin above Lake Houston identified as impaired
- TCEQ divides segments into assessment units (AU) to refine spatial resolution
- Stream segment is considered impaired when geometric mean of *E. coli* exceeds criterion of 126 org/100mL

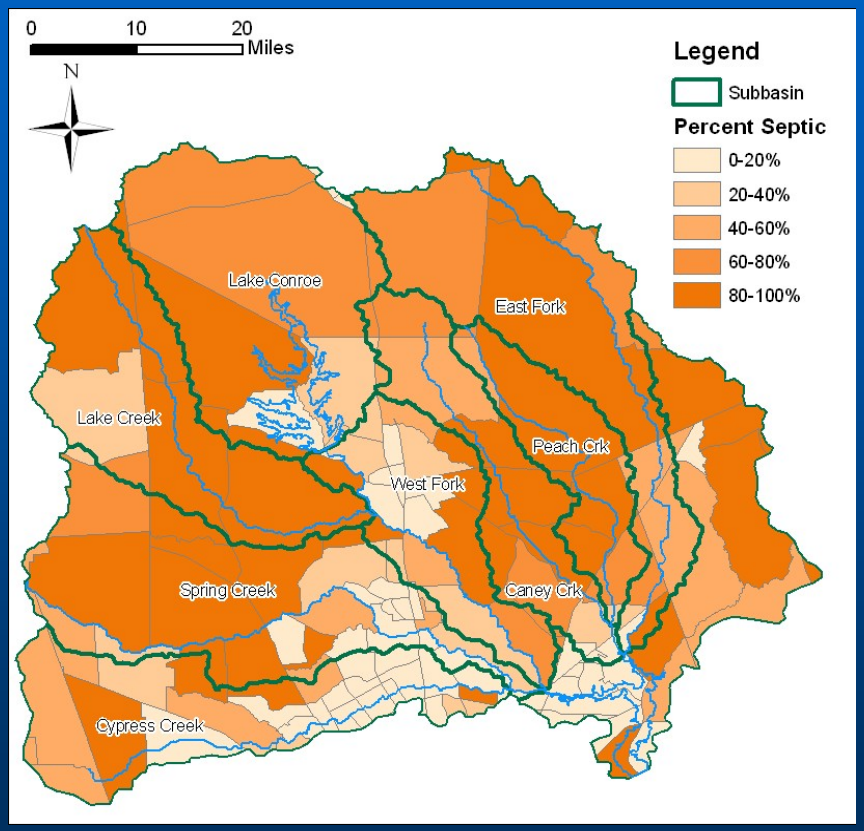
Segments of Project Study Area



Septic Systems



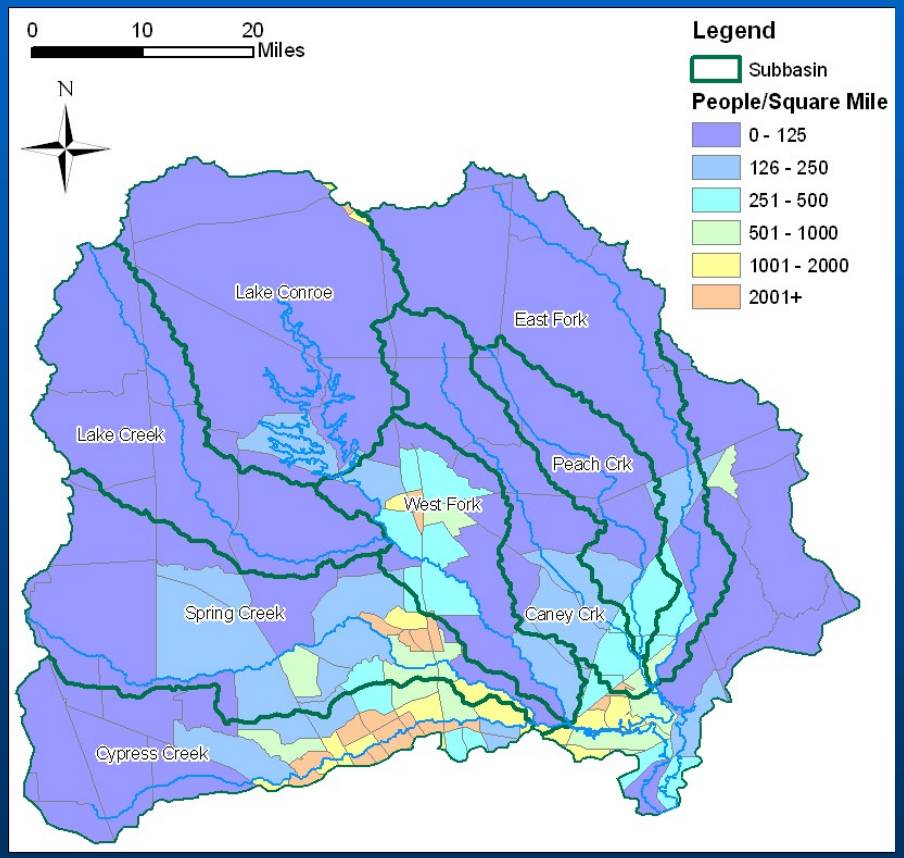
Septic System Density (1990)



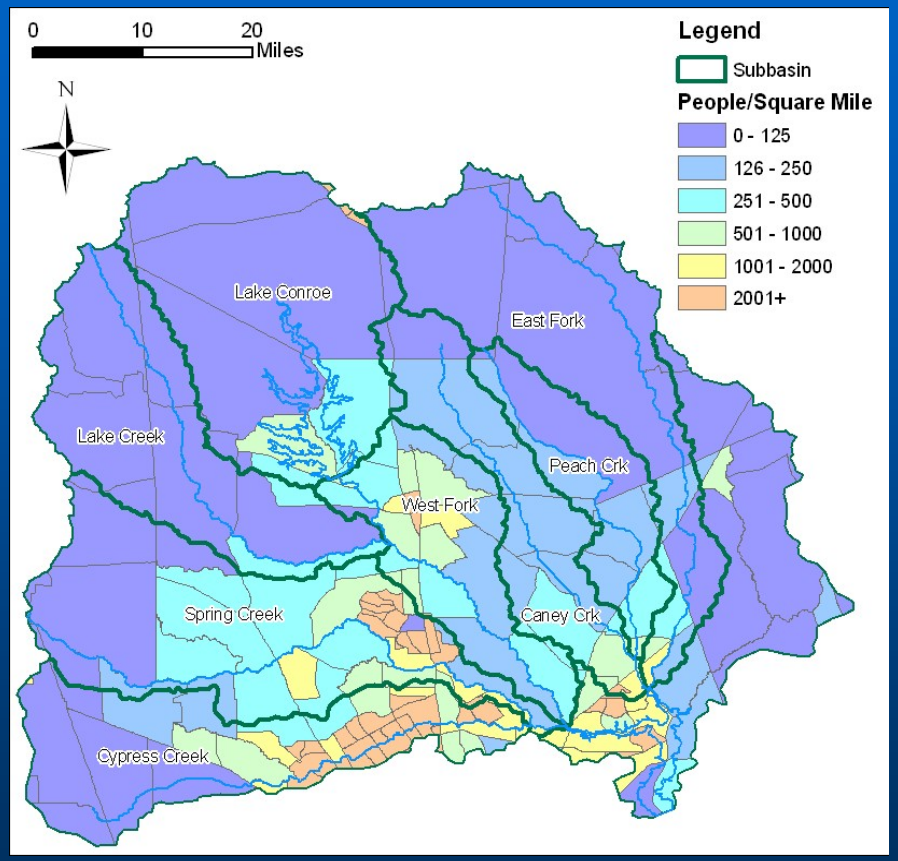
Percentage of Households Served by Septic Systems (1990)

US Census Bureau

Population Density



Project Area Population Density (1990)



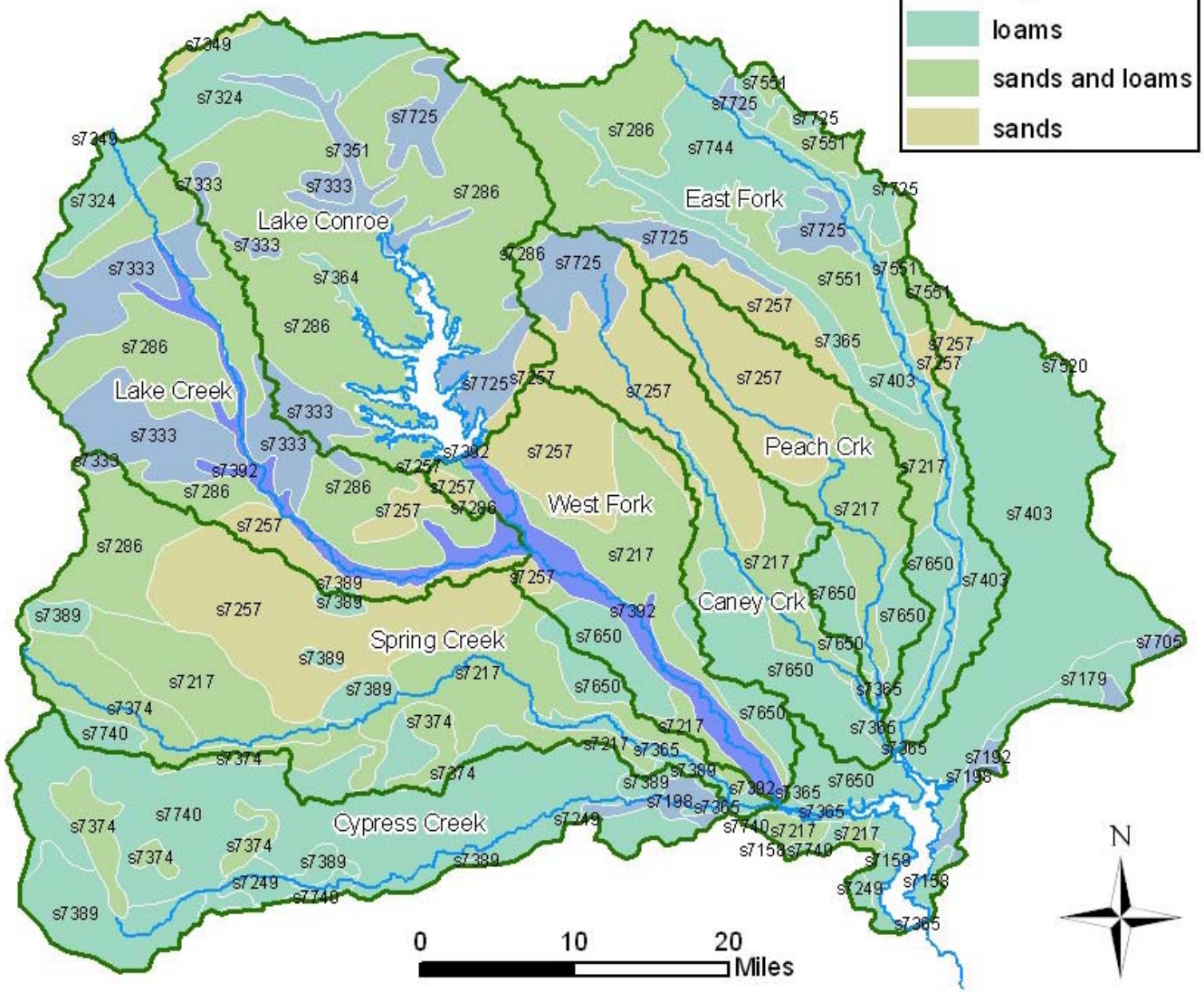
Project Area Population Density (2005)

US Census Bureau

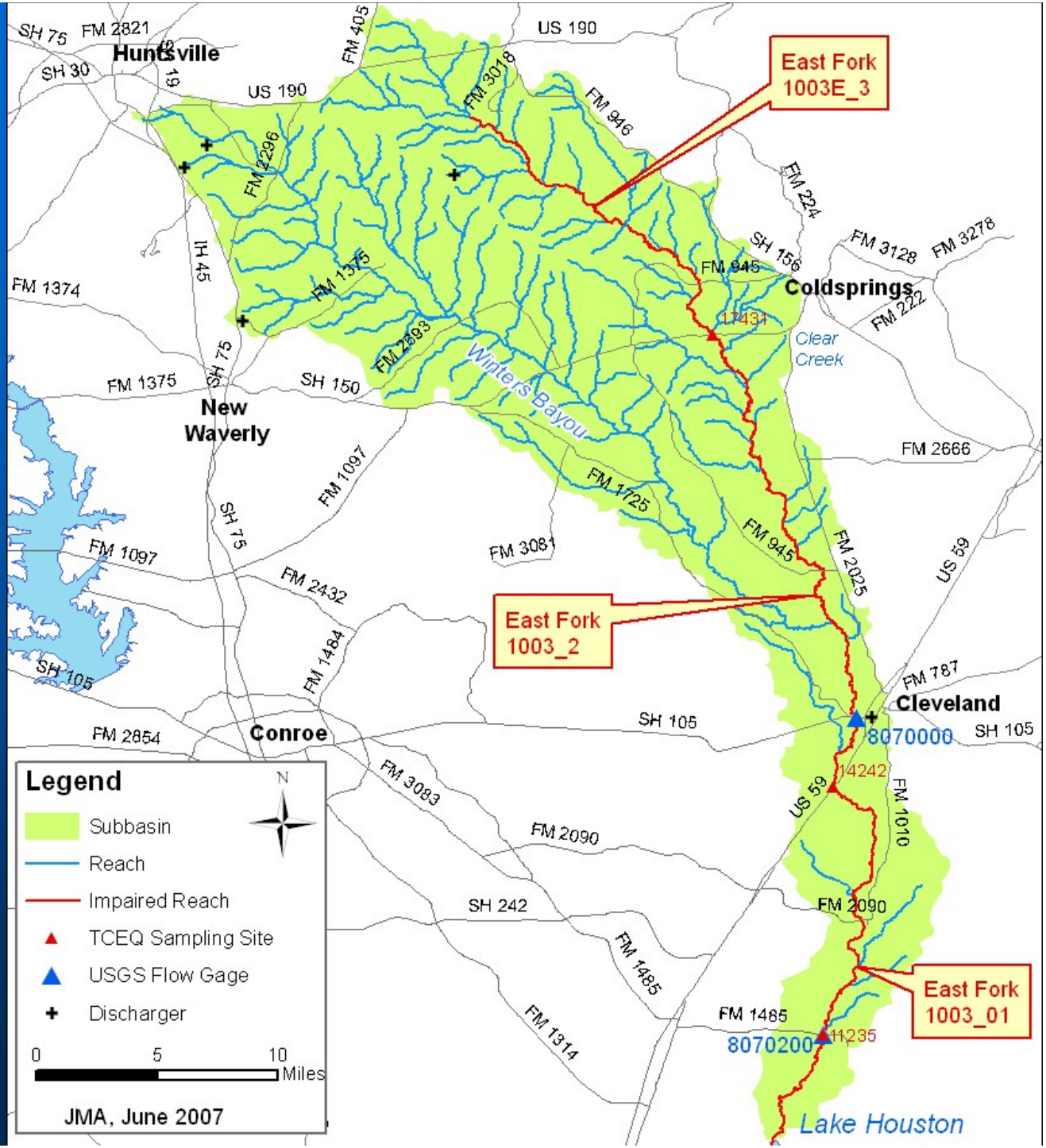
Soil Associations

Key	Soil Association
s7158	Ozan-Atasco-Aldine
s7179	Brackett-Bolar-Aledo
s7192	Lake charles-Beaumont
s7198	Morey-Mocarey-Bernard
s7217	Splendora-Segno-Landman-Boy
s7249	Gessner-Clodine-Addicks
s7257	Conroe
s7286	Huntsburg-Fetzer-Depcor-Boy-Annona
s7324	Greenvine-Falba-Burlewash-Arol
s7333	Latium-Frelsburg-Crockett-Carbengle-Brenham-Bosque-Bleiblerville
s7349	Tonkavar-Shiro-Gomery-Elmina
s7351	Nahatche-Kaufman-Gowker
s7364	Nahatche-Hatliff
s7365	Pluck-Kian-Hatliff
s7374	Wockley-Segno-Monaville-Hockley
s7389	Katy-Clodine-Aris
s7392	Tinn-Kaufman-Gladewater

Key	Soil Association
s7398	Sealy-Kenney-Chazos
s7403	Waller-Sorter-Kirbyville
s7520	Waller-Otanya-Kirbyville-Dallardsville
s7551	Pinetucky-Doucette
s7650	Waller-Sorter
s7705	Woodville-Vamont
s7725	Woodville-Wiergate-Burkeville
s7740	Wockley-Hockley-Gessner
s7744	Woodville-Pinetucky



East Fork Study Area



East Fork Assessment Units and Results

Assessment Unit	Segment Name	Assessment Unit Description	# Samples	# Exceed	Geo. Mean	Impaired
1003_01	East Fork San Jacinto River	Confluence with Caney Creek upstream to US 59	77	18	183	Yes
1003_02	East Fork San Jacinto River	US Hwy 59 to 25 miles upstream (just upstream of Clear Creek confluence)	36	10	189	Yes
1003_03	East Fork San Jacinto River	25 miles upstream of US 59 to US 190 (upper segment boundary)	11	3	197	Yes

East Fork Sampling Sites

TCEQ #	TCEQ Description
17431	EAST FORK SAN JACINTO RIVER IMMEDIATELY DOWNSTREAM OF SH 150 WEST OF COLDSPRING
14242	EAST FORK SAN JACINTO RIVER IMMEDIATELY DOWNSTREAM OF US 59 AT RED GULLY
11235	EAST FORK SAN JACINTO RIVER AT FM 1485

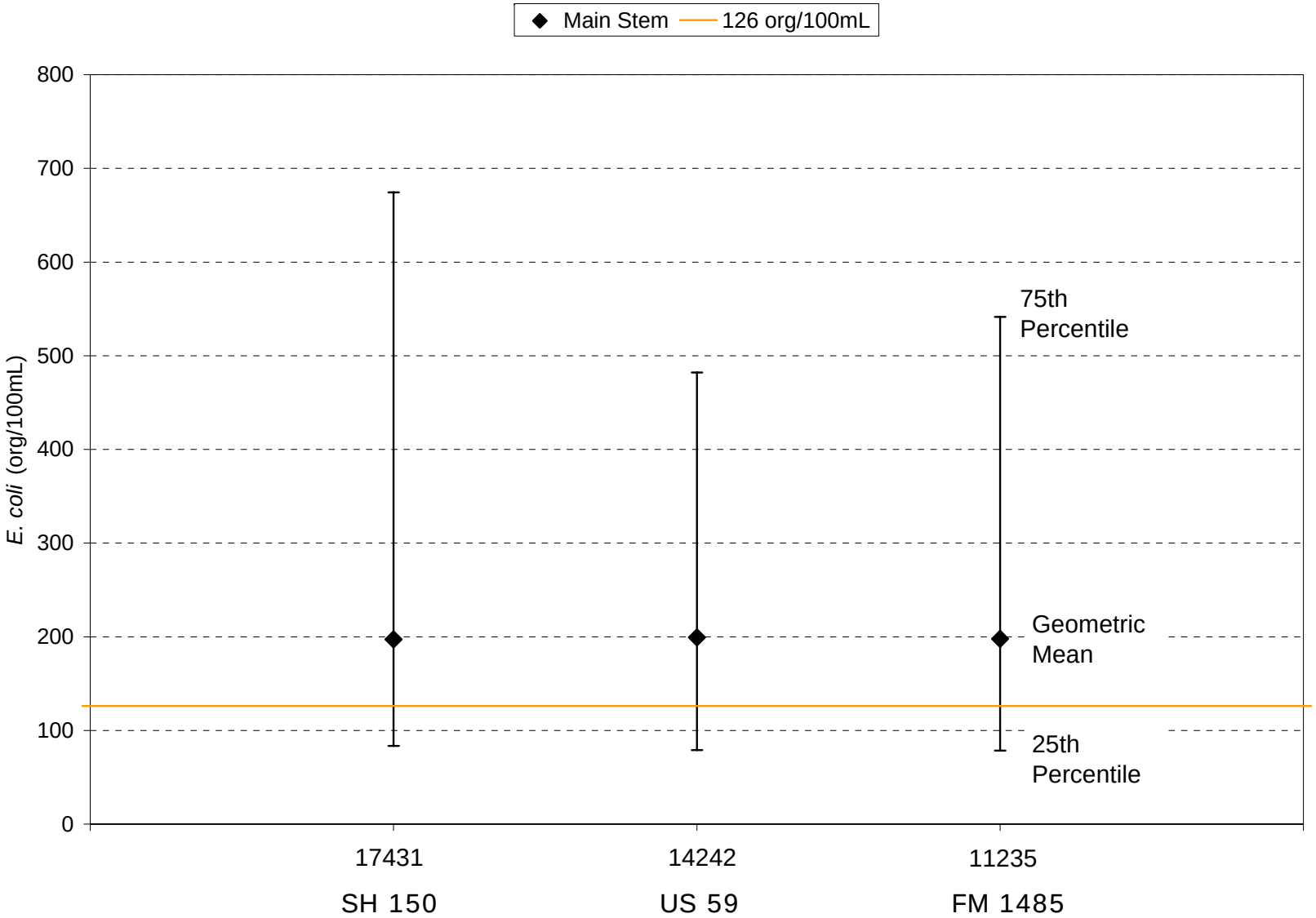
East Fork *E. coli* Data Summary

Station	17431	14242	11235
Location	SH 150	US 59	FM 1485
Reach	E Fork	E Fork	E Fork
Begin Date	Mar-02	Jun-00	Jun-00
End Date	Jul-04	Apr-05	May-05
Count	11	39	86
75th Percentile	**620**	**492**	**423**
Geometric mean	**197**	**199**	**198**
25th Percentile	84	79	79

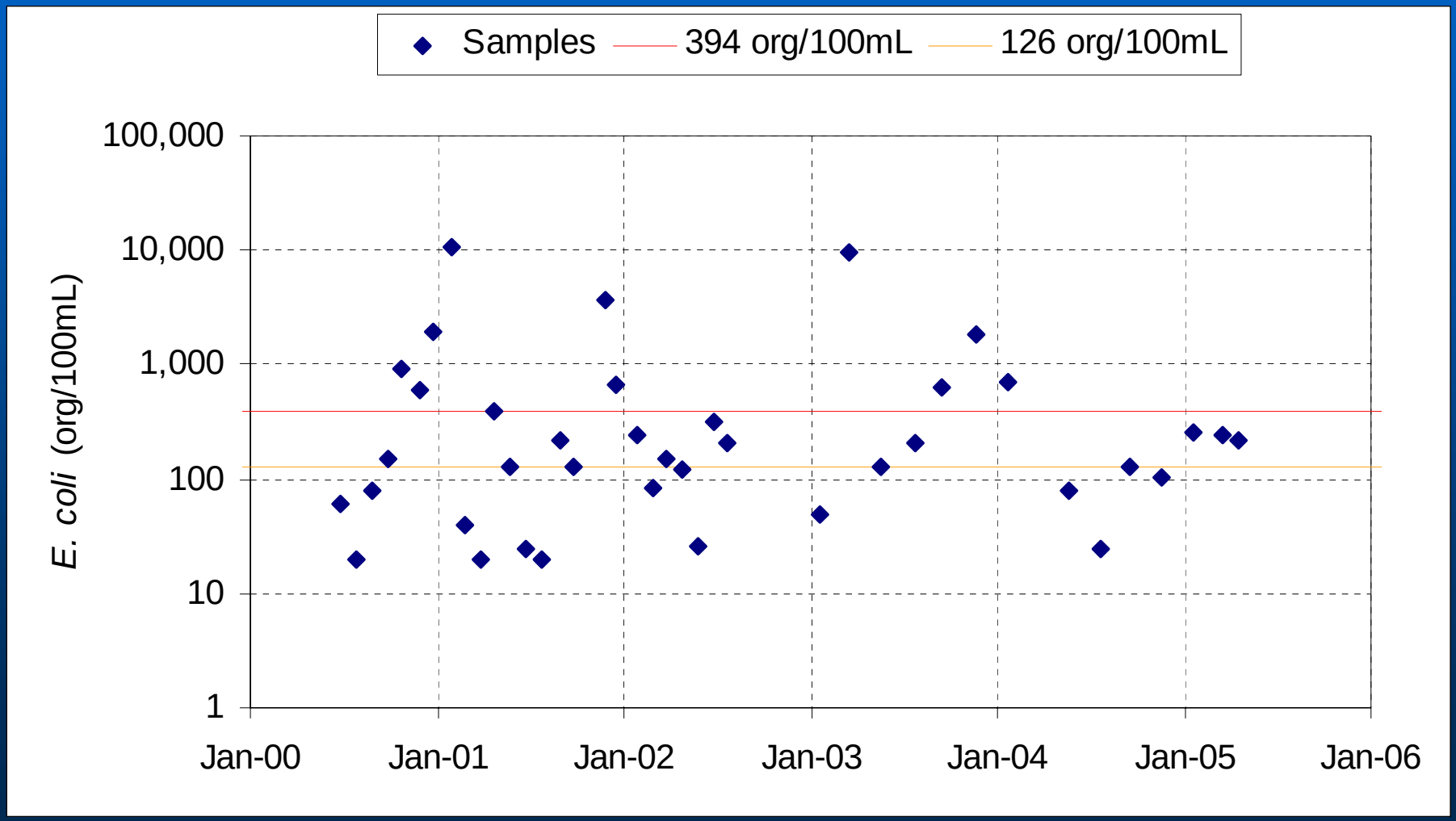
Spatial and Temporal Analysis

- Spatial analysis can be helpful when attempting to locate sources of bacteria
- Temporal analysis can be useful for determining changes in sources over time

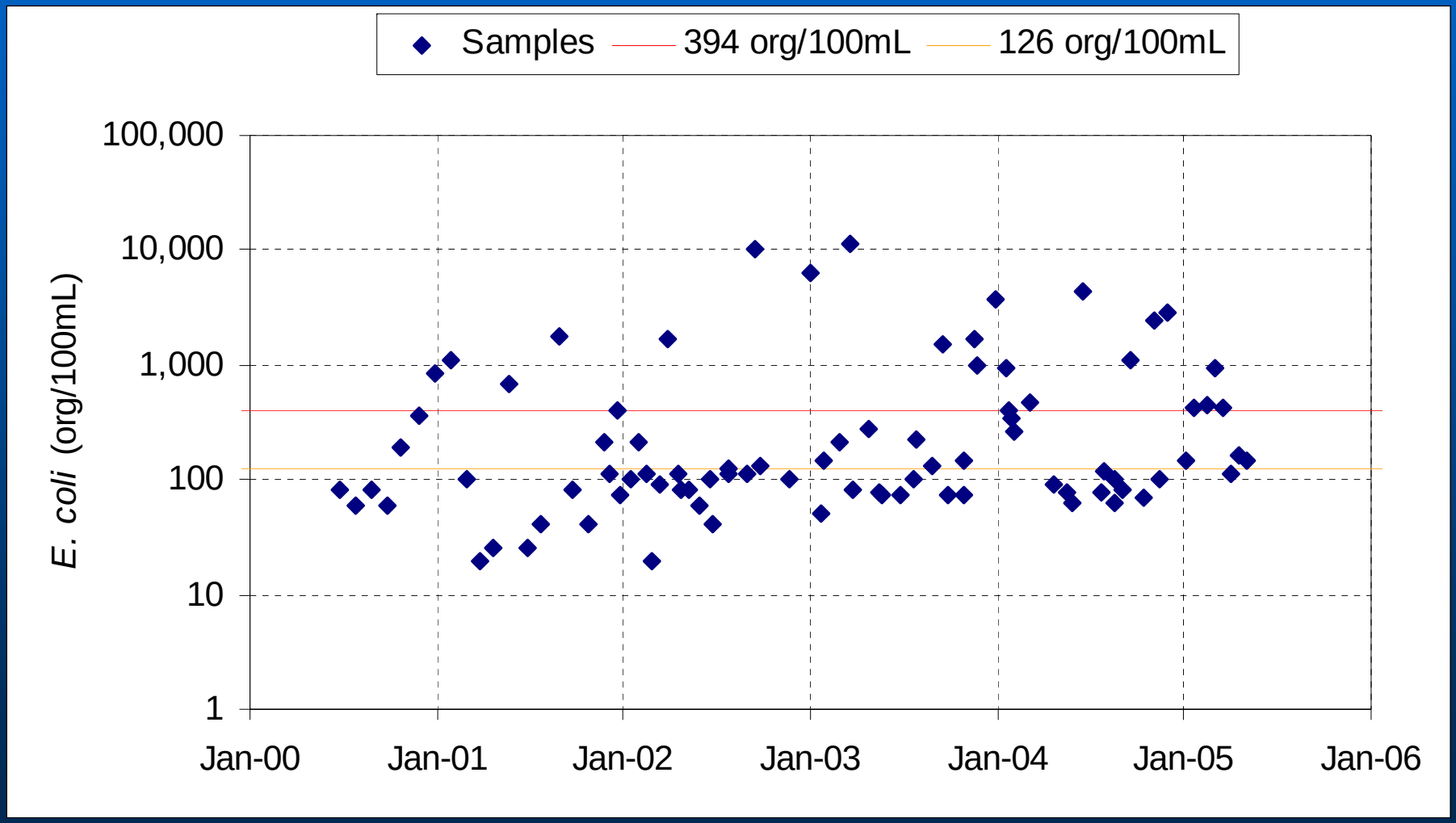
East Fork Spatial Analysis



Temporal Analysis: East Fork at US 59 (#14242)



Temporal Analysis: East Fork at FM 1485 (#11235)



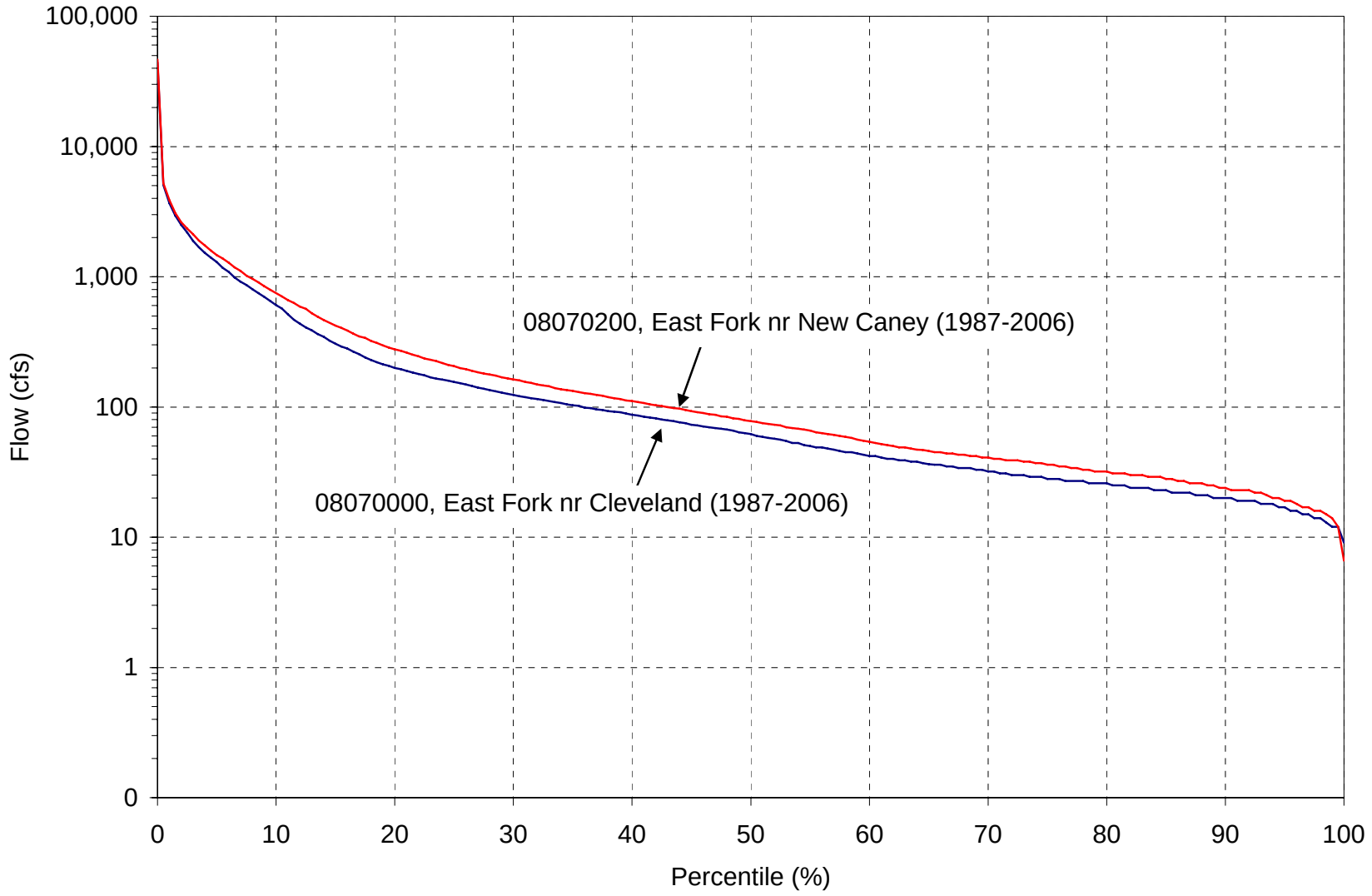
Flow Duration Curves

- A flow duration curve (FDC) is a graph of daily average streamflow versus the percent of days that the average streamflow value is exceeded
- FDCs are typically developed using daily flow data collected at USGS gaging stations
- Since most sampling sites do not have a corresponding USGS gage, flow records were synthesized using nearby gages and drainage area adjustment factors

East Fork USGS Flow Gages

Station	Stream	Location	Available FDC data
08070000	East Fork San Jacinto River	near Cleveland, TX	1987-2006
08070200	East Fork San Jacinto River	near New Caney, TX	1987-2006

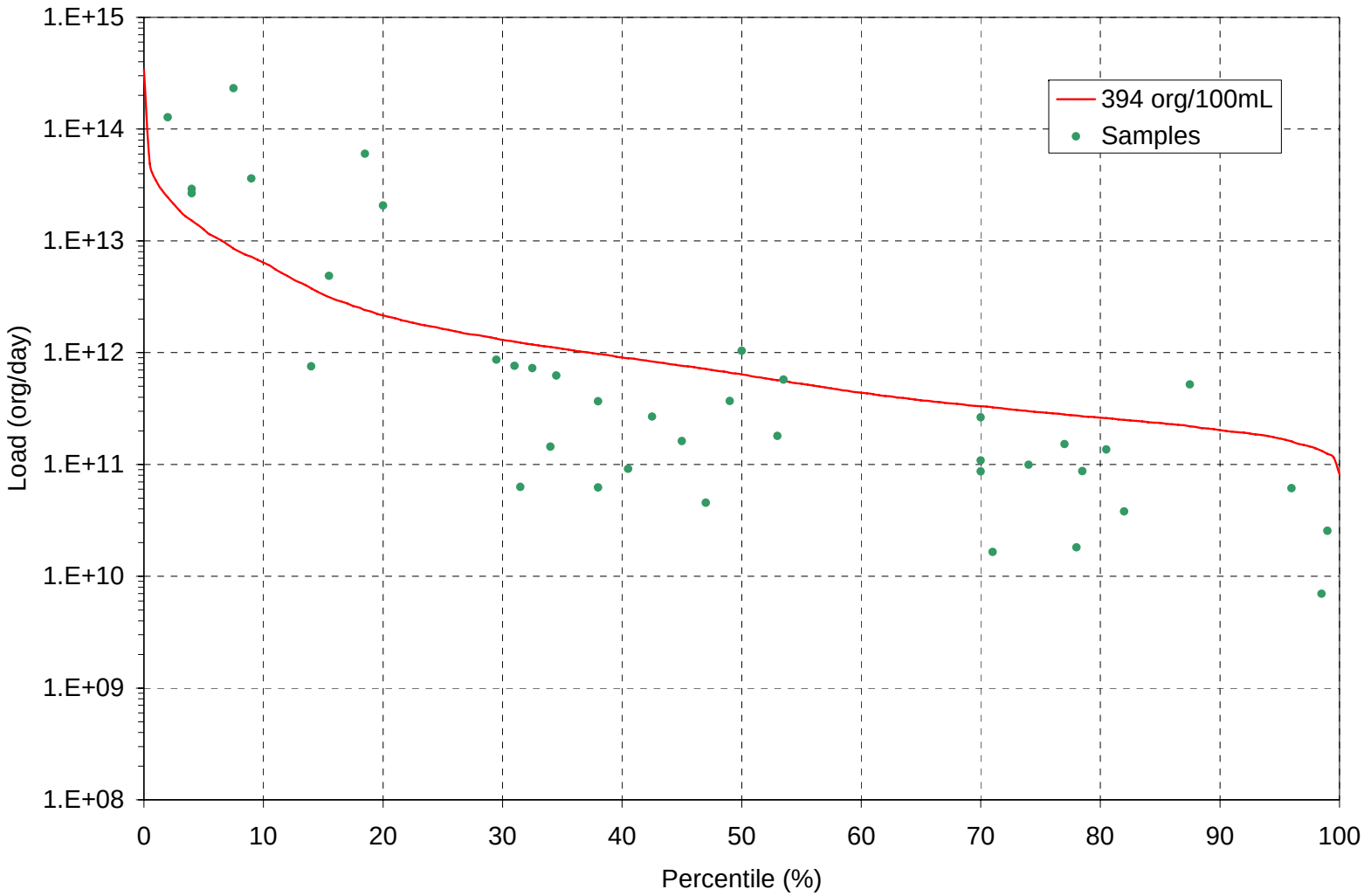
East Fork Flow Duration Curve



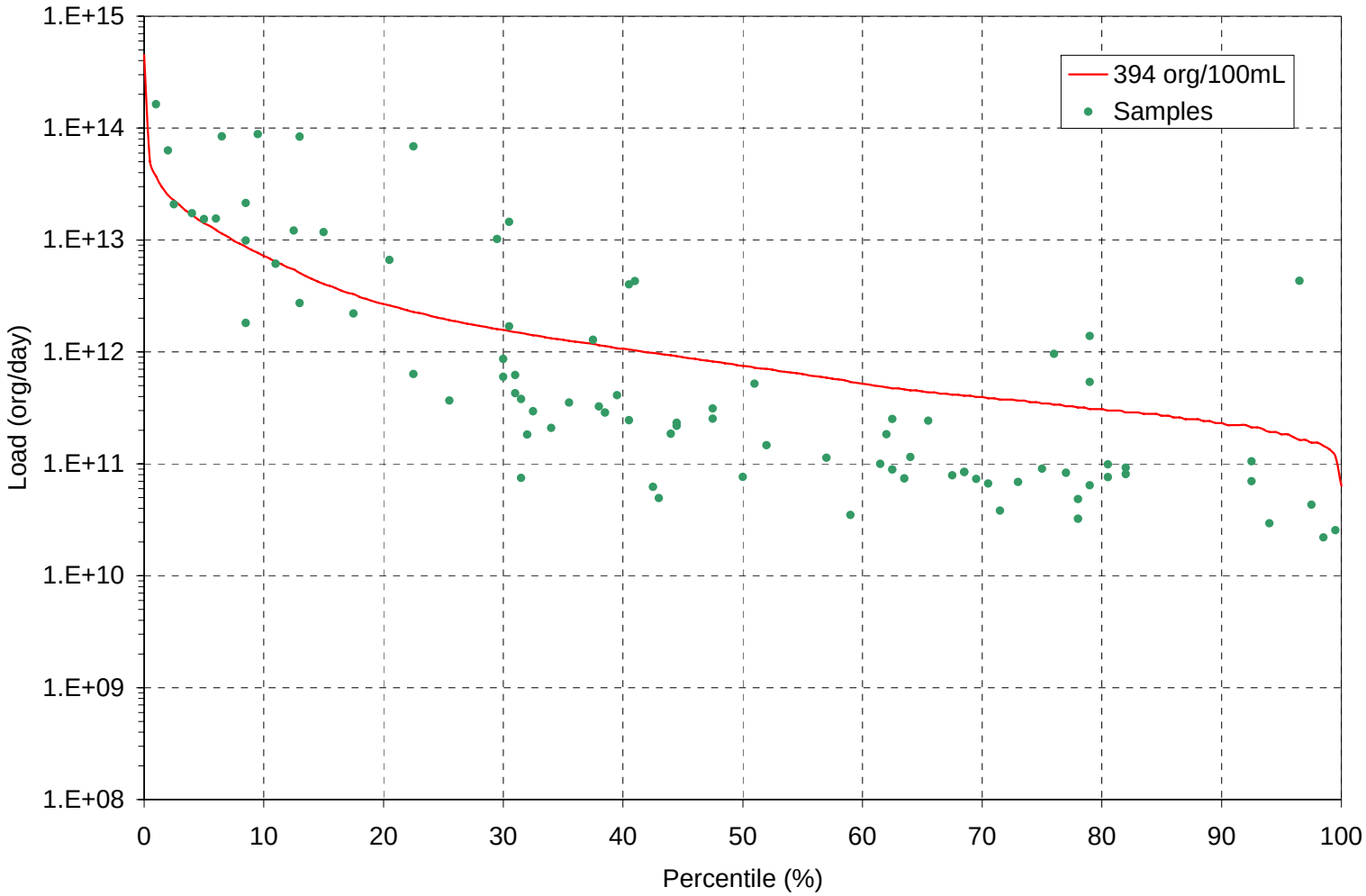
Load Duration Curves

- Load duration curves are presented from upstream to downstream
- Bacterial loads are the product of each grab sample bacteria concentration and the corresponding mean daily streamflow rate.
- The greatest exceedances typically occur under high flow conditions

LDC for East Fork at US 59 (#14242)



LDC for East Fork at FM 1485 (#11235)



Potential Sources

- Two primary source categories:
  - Wasteloads (WL) - any source flowing into a waterway and covered by a permit
    - wastewater treatment plants
    - discharges of runoff from municipal areas covered under stormwater permits (MS4s)
  - Loads (L) - remaining diffuse sources of pollutants that are not covered by permit
    - runoff from rural or urban areas outside of permitting jurisdictions

Runoff Sources

- Natural areas typically produce the smallest runoff source loads because they tend to produce the least runoff volume and tend to have the lowest density of fecal sources
- Rural areas may also have smaller source loads due to lower runoff volumes and less impervious cover
- Urban areas may produce larger bacteria loads because of high impervious cover, which can increase the frequency and intensity of runoff events
- Monitoring plan will seek to characterize sources

Wastewater Treatment Facilities

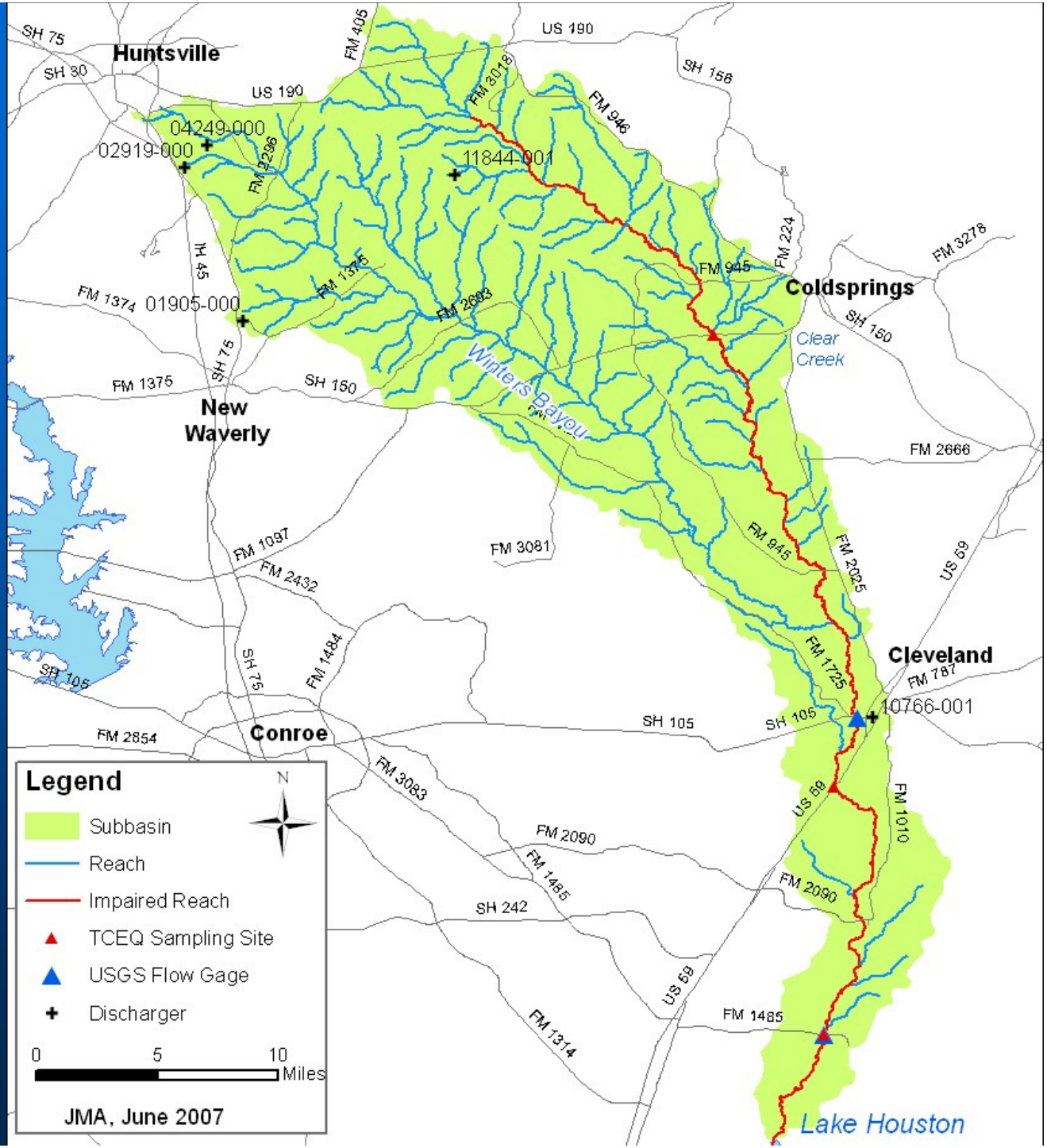
- Potential to contribute significant bacteria loads if complete disinfection is not achieved
- Loads may be most noticeable under low flow conditions, during which some streams may be effluent dominated
- Also possible for treatment plants to contribute significant loads under wet weather conditions
- Increased loading due to stormwater inflow and infiltration may result in poorer plant performance

East Fork

Wastewater Treatment Facility Summary

- 5 permitted facilities
- Total current flow 0.6 MGD (0.9 cfs)
- Total Permitted flow 0.9 MGD (1.4 cfs)
- WWTP flows account for 6% of the stream flow at the 99th percentile regime (low flow), 1% of the flow at the 50th percentile (median flow)

East Fork Treatment Facility Discharge Locations



Monitoring Plan

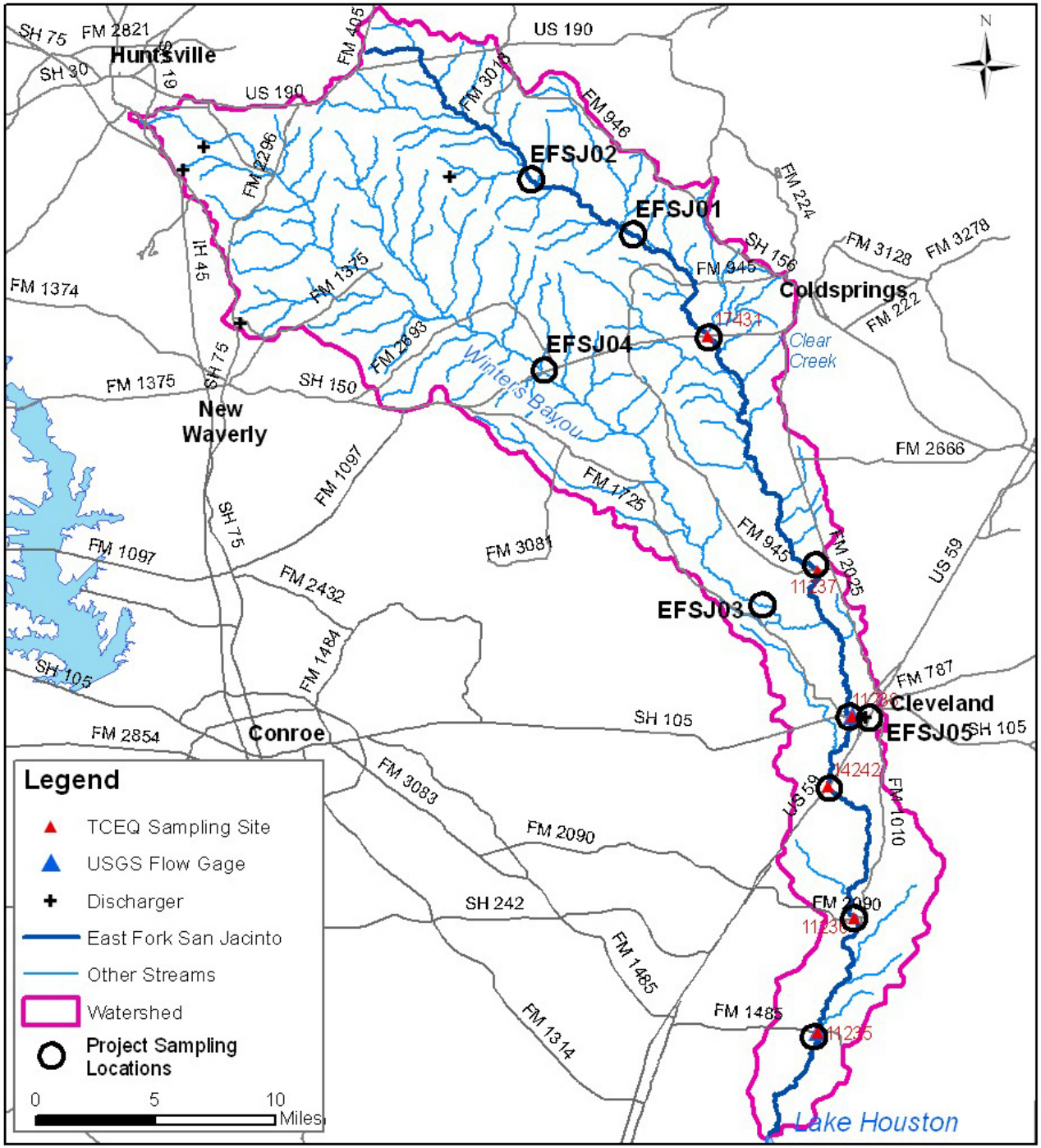
Monitoring Objectives

- Provide:
  - better definition of the water quality conditions on the study segments with respect to bacterial indicators,
  - definition of source areas or loading points that contribute to conditions in the segment,
  - data sufficient for estimation of loadings and support of allocation activities.

Synoptic Sampling Surveys

- Samples to be collected under baseflow conditions
- Ascertain source areas, longitudinal trends, extent of impairment
- Routine monitoring stations and additional sites
- Two synoptic sampling surveys on each study segment
- General schedule for these events November 2007 to July 2008
- Sampling commences after Quality Assurance Project Plan (QAPP) is approved by TCEQ

Sampling Stations for East Fork San Jacinto River, Segment 1003



Spatially-Intensive Source Studies

- Upper East Fork San Jacinto River, Segment 1003; Stewarts Creek, Segment 1004E; Willow Creek Segment, 1008H; and Spring Gully, Segment 1009 D
- Evaluate specific source locations in detail
- Baseflow Conditions
- Selected segments: urban, rural
- Numerous sampling points, eg, 1000-ft intervals
- Sample pipes, outfalls, tributaries
- Test for bacteria, optical brighteners
- Extrapolate to similar areas in study area

Sediment Source Studies

- Upper East Fork San Jacinto River, Segment 1003; Stewarts Creek, Segment 1004E; Willow Creek Segment, 1008H; and Spring Gully, Segment 1009 D
- Evaluate sediment as potential bacteria source
- Baseflow conditions
- Sediment sampling at varying distance from stream bed

Resuspension Study

- Willow Creek Segment, 1008H; and Spring Gully, Segment 1009D
- Evaluate resuspension of bed sediments as bacteria source
- Baseflow Conditions
- Track bacteria in water column over 1-2 days

Kinetics Study

- One location at each of the following: Willow Creek Segment, 1008H; and Spring Gully, Segment 1009D
- Evaluate regrowth of bacteria from point sources
- Baseflow Conditions
- In situ bacteria kinetic rates

Wet Weather WWTP Sampling Study

- Willow Creek Segment, 1008H
- Estimate WWTP loads under wet weather conditions
- Sample 10-30 WWTPs at outfall pipes
- Sample receiving stream at downstream monitoring station
- Estimate total event loading of bacteria from point sources
- Estimate proportion of total stream loading derived from point sources

Microbial Source Tracking

- Spring Gully, Segment 1009D
- Conduct sampling and testing for qPCR
- Test for human presence/absence
- Test raw wastewater samples
- Rapid turn-around of results may guide additional testing
- One baseline survey
- Repeat if warranted

TCEQ Website for Project Information

http://www.tceq.state.tx.us/implementation/water/tmdl/82-lakehouston.html