Urban Riparian & Stream Restoration Program: Introduction to Stream Processes & Restoration

Clare Entwistle

Texas Water Resource Institute

State of the Nation's Rivers

- 55% of the river and stream miles in the United States are reported to be in poor condition due to streamside disturbance and poor riparian vegetation cover (USEPA 2013).
- Increases in human population along with industrial, commercial, and residential development place heavy demands on stream corridors.
- Riparian and stream degradation is a major threat to:
  - Water Quality
  - In-Stream Habitat
  - Terrestrial wildlife
  - Aquatic Species
  - Overall Stream Health

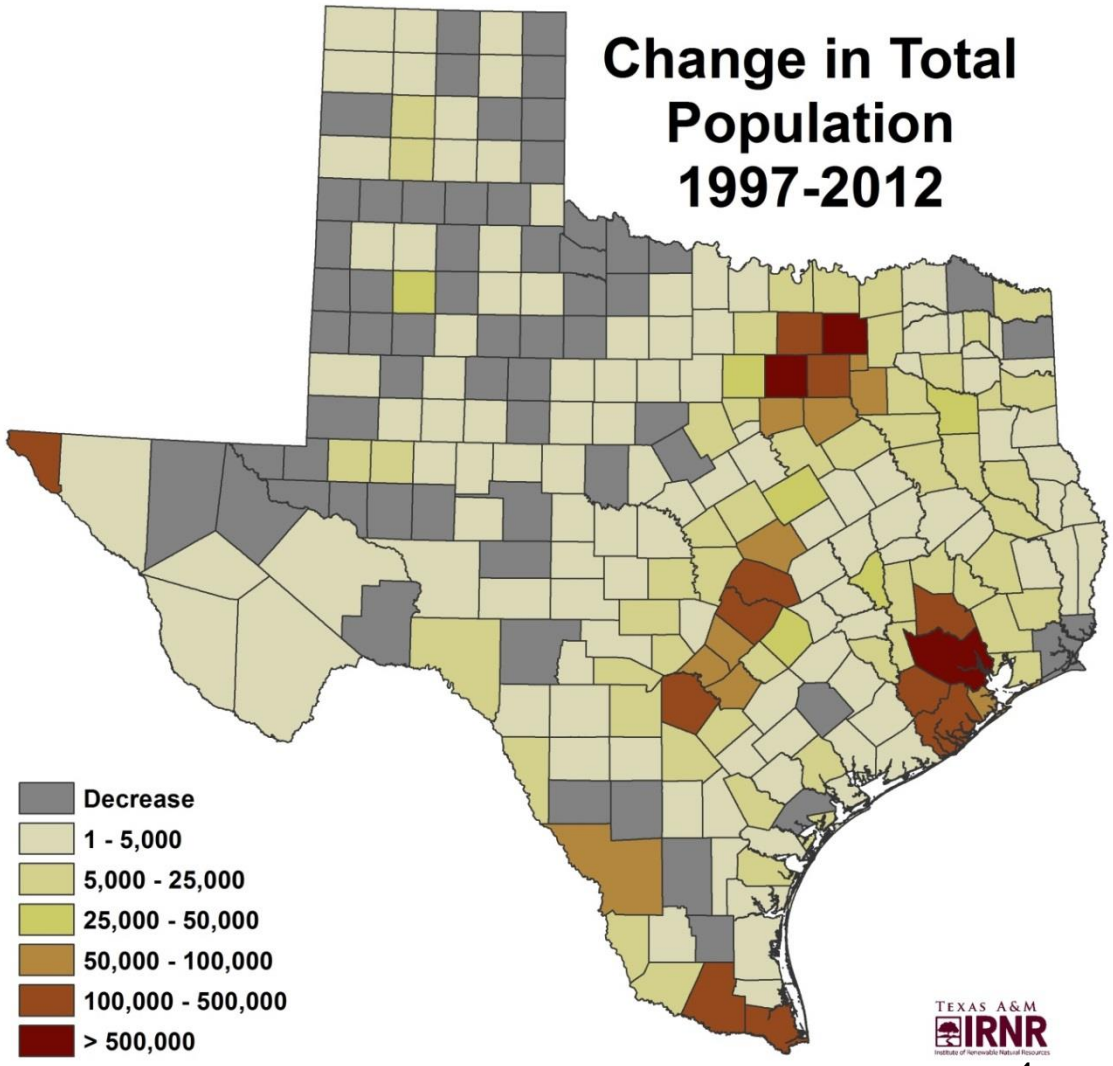
Unhealthy Watersheds

Most streams and rivers in Texas have been adversely affected by past natural and human activities resulting in:

- Increasingly damaging floods
- Lower base flows
- High sediment loads
- Reduced reservoir storage capacity
- Invasion of exotic species
- Loss of natural riparian habitats
- Degraded water quality

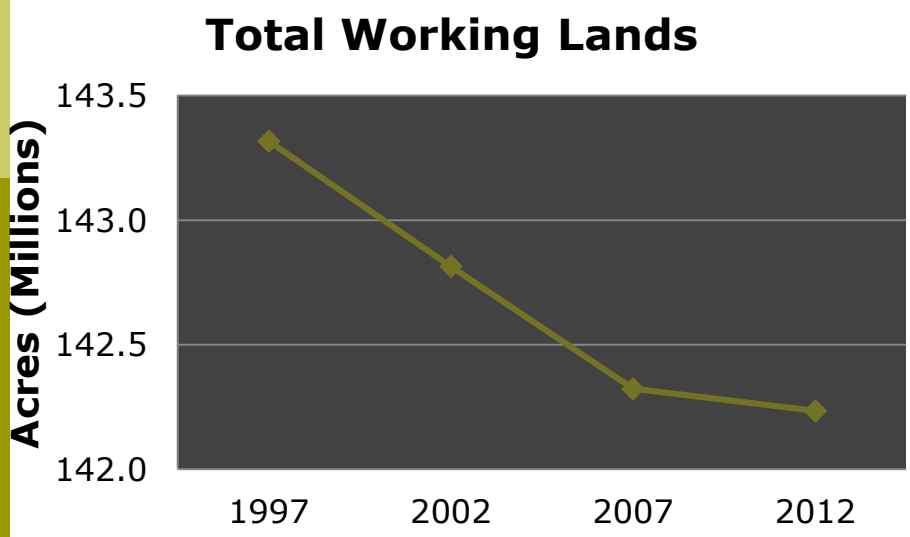
Texas Population

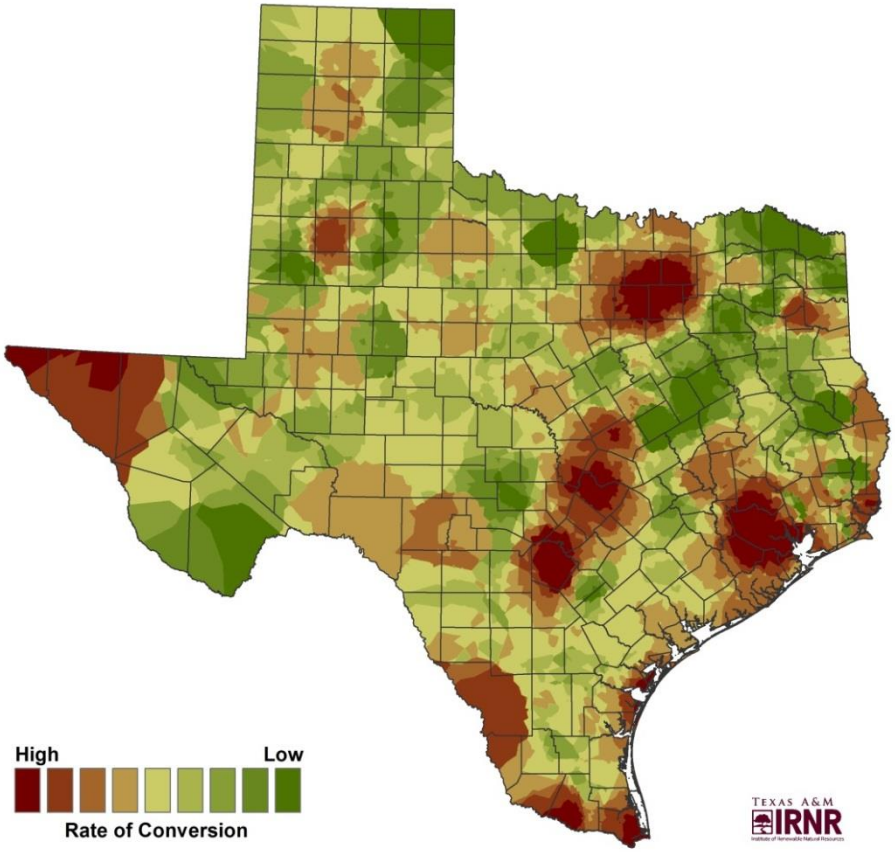
- 1997 – 19 Million
- 2012 – 26 Million
- 36% increase
- 500,000/year
- 65% of increase occurred within *Top Ten Highest Populated* Counties



Loss of Rural Working Lands

- 1997 – 143.4 Million acres
- 2012 – 142.3 Million acres
- Loss 1.1 Million acres





Floods

Erosion and Sedimentation Threatens Water Storage Capacity

- Stream erosion threatens land-use, property values and human safety.
- Texas Water Development Board (TWDB) predicts surface water in Texas will decline by 3 percent from 2020-2070 due to sedimentation, reducing reservoir storage.
- It is estimated that reservoirs will lose 104,000 acre-feet of water storage capacity due to sedimentation during that same time period, which is roughly equal to the amount of water for over 231,100 homes based on a family of four use in one year.

Management Strategies for Water Supply Reservoirs

- TWDB reported that dredging the sediment from reservoirs to increase water storage costs twice as much or more than constructing a new reservoir.
- Cities such as Austin, have found that improving creek and floodplain protection is needed to prevent unsustainable public expense to maintain drainage infrastructure.
- Focusing management efforts on quality land management to stabilize stream banks and riparian areas may be one of the most cost effective strategies for extending the life of the state's water supply reservoirs.

Program Goals

- Promote healthy watersheds and improve water quality through the delivery of Urban Riparian and Stream Restoration training programs in priority watersheds and an Advanced 3-day Stream Restoration training.
- Restoration Demonstration Site to show the benefits of riparian restoration on bank erosion and total suspended solids levels within the creek.

Educational Trainings

- 15 one-day trainings and 1 advanced three-day training in year 3.
- Geared toward professionals interested in conducting restoration projects
- Help attendees understand urban stream functions
  - what the impacts of development on urban streams look like
  - recognize healthy and degraded stream systems
  - assess and classify a stream using the Bank Erosion Hazard Index (BEHI)
  - Comprehend what natural versus traditional restoration techniques

Training Outline

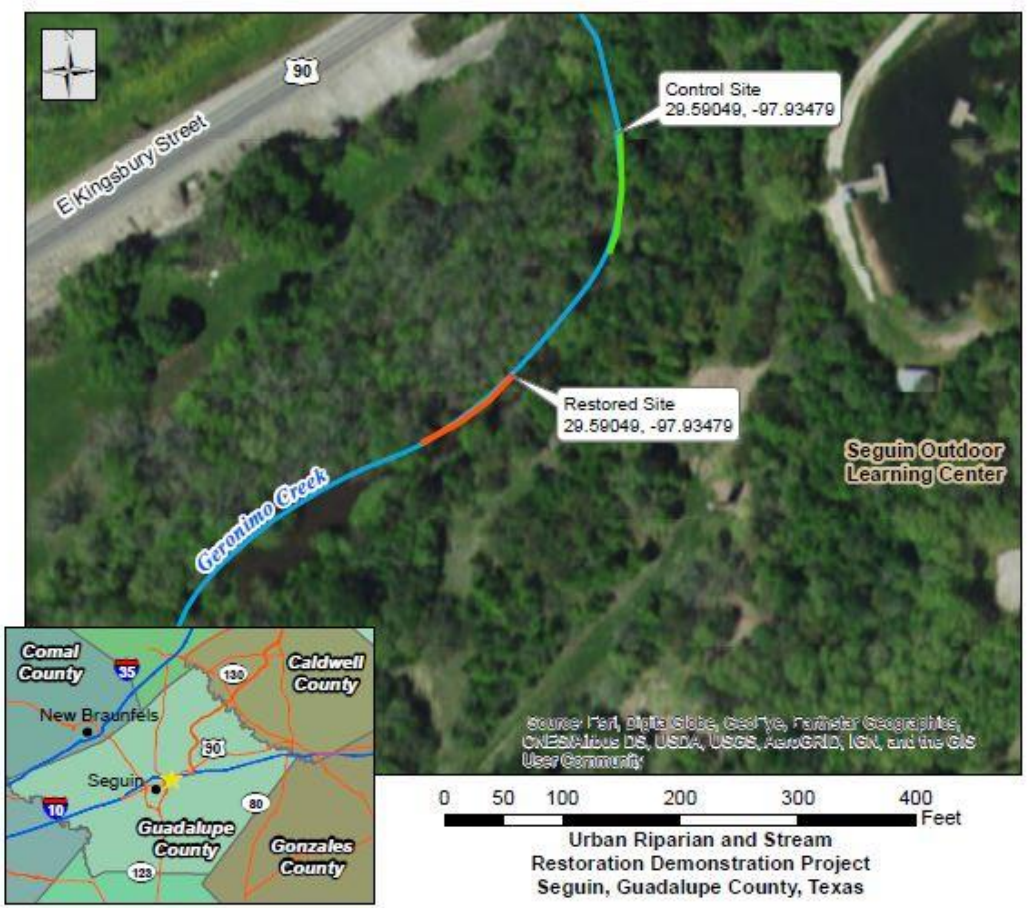
1. Hydrologic cycle
2. Introduction to stream morphology
   a) Bankfull discharge
   b) Stability
   c) Channel measurements
3. Stream classification
4. Stream instability
5. Stream restoration
6. Stabilization structures
7. Vegetation
8. Monitoring and evaluation

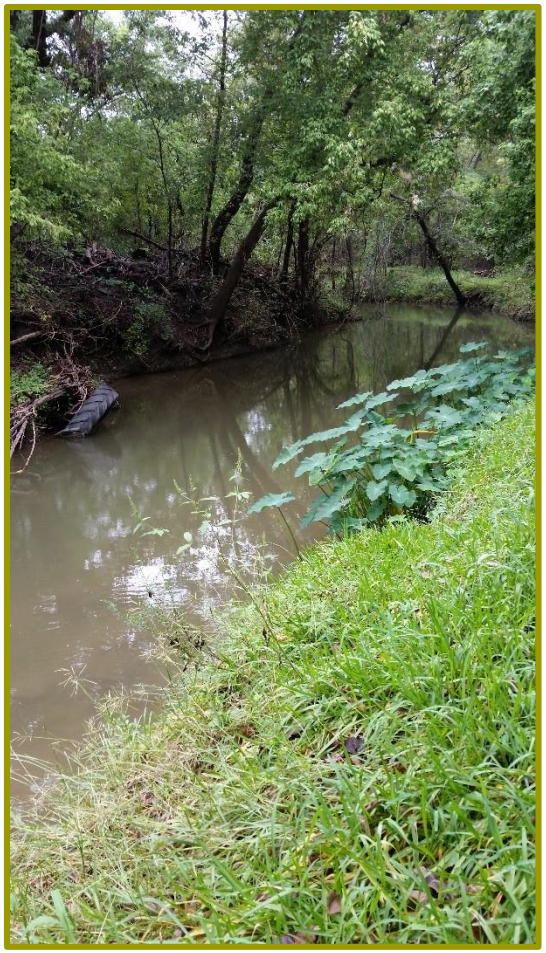
For landowners and land managers to decide to adopt and implement innovative measures and restoration, they must first be informed, understand the benefits and observe demonstrations.

Restoration Demonstration Project

- The demonstration site is owned by the Irma Lewis Seguin Outdoor Learning Center and the Texas Water Resources Institute is coordinating with partners including the Guadalupe-Blanco River Authority and the Geronimo and Alligator Creeks Watershed Partnership.
- The Geronimo and Alligator Creek Watershed Protection Plan, as does most watershed plans, includes implementing riparian forest and herbaceous buffers to reduce pollutant loads in the watershed.
- The demonstration will implement restoration of riparian buffers using natural bank stabilization techniques and planting native vegetation on one of the two sites.
- Both sites will be monitored to demonstrate the difference in bank erosion rates and total suspended solids in the creek.

Restoration Demonstration Project





Properly Functioning Riparian Area

Adequate vegetation, landform or large woody material to:

- Dissipate stream energy
- Stabilize banks
- Reduce erosion
- Trap sediment
- Build / enlarge floodplain
- Store water
- Floodwater retention
- Groundwater recharge
- Sustain baseflow

- Water quality
- Water quantity
- Forage
- Aquatic habitat
- Wildlife habitat
- Recreational value
- Aesthetic beauty

Physical Function → Values

Riparian Vegetation is Key


Water
Catchment
Water Shed

Water Catchment

Water Shed

An Overlooked Opportunity

Catching the water

Storing the water in the land

Benefits of Healthy Riparian and Stream Systems

- Proper management, protection, and restoration of riparian areas decrease:
  - Bacteria, nutrients, sediment loading into stream
  - Lower in-stream temperature
  - Improve dissolved oxygen levels
  - Improve aquatic habitat
  - Improve macrobenthos and fish communities

Riparian Chain Reaction of Adequate Vegetation:

Protects banks from excess erosion

Dissipates energy and slows the velocity of floodwater

Sediment dropped

Sediment trapped and stabilized

Floodplain / riparian sponge is enlarged

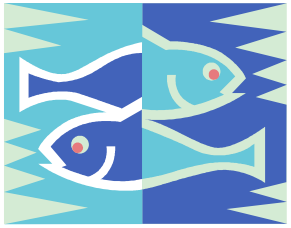
Increased groundwater recharge

Base-flow is sustained over time

Water Quality and Watershed Planning

- Texas has more than 191,000 miles of rivers and streams with riparian zones and floodplains that comprise corridors of great economic, social, cultural, and environmental value.
- The 2014 Texas Integrated report assessed 1,409 water bodies; of those 1,065 had sufficient data for evaluations with 7-10 yrs.
- 2014 303d List has **589** impaired water bodies on it (+21).
- Many WPP and TMDL Implementation projects are ongoing across the state to improve water quality in watersheds.
- Bacteria is the cause for over 43% of impairments followed by low dissolved oxygen (nutrients) for 16% and organics in fish tissue at 19%.

Designated Uses



Aquatic Life

- Protect aquatic species
- Dissolved Oxygen, Toxic Chemicals, Total Dissolved Solids

Recreation

- Estimates the relative risk of swimming and other water recreation activities
- Bacteria

Drinking Water

- Indicates if water is suitable as a source of drinking water
- Metals, Pesticides, Toxic Chemicals, Total Dissolved Solids, Nitrates

Fish Consumption

- Protect public from consuming fish that may be contaminated
- Metals, Pesticides, Other Toxic Chemicals

Surface Water Quality

Numeric

- High Aquatic Life Use
  - Dissolved Oxygen – 5.0 mg/L

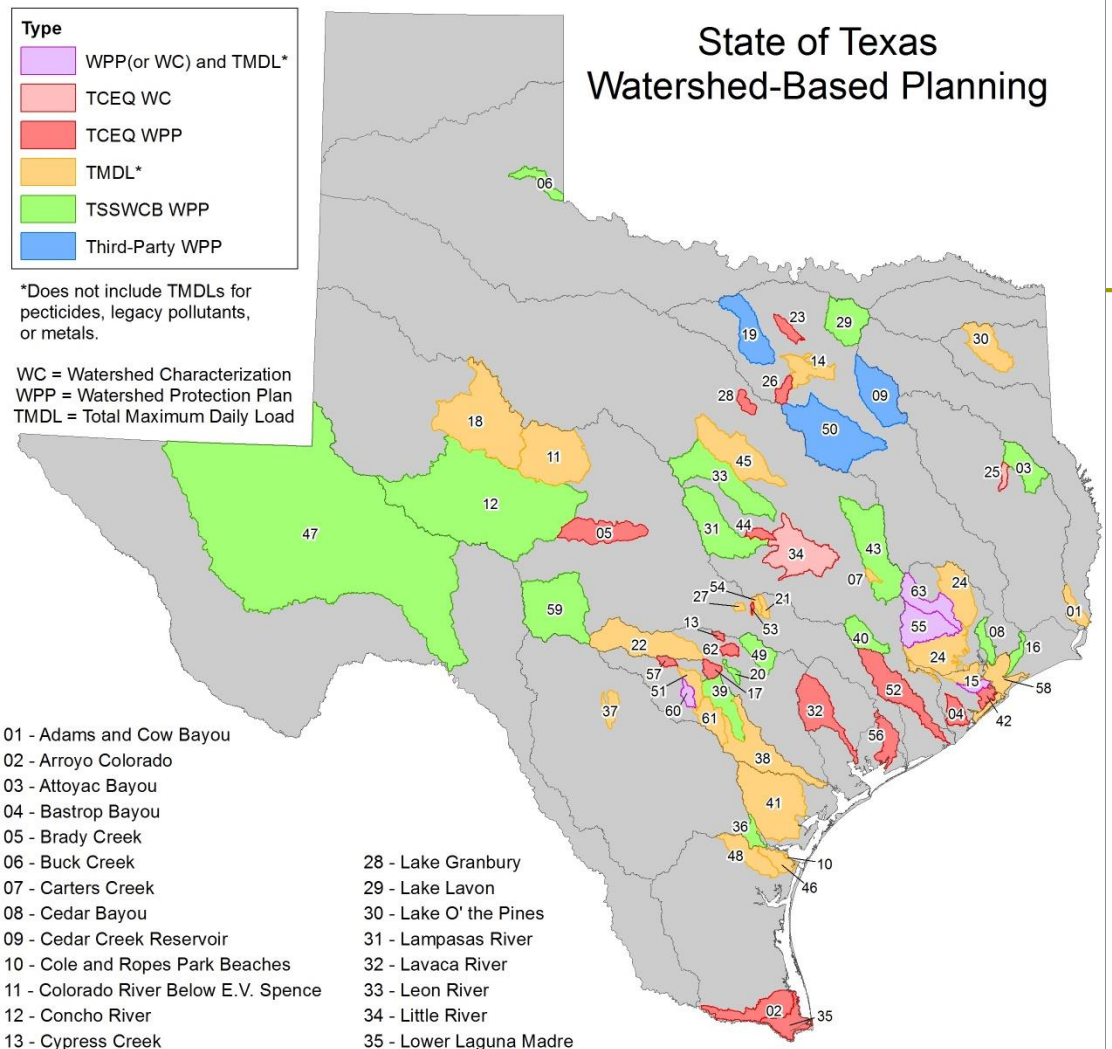
    (4-5 stressed <3 can't survive)
  - pH – Optimum Range 6.5-9.0
  - Temperature – 90 F (32.2 C) common range 68-86 F
  - Total Dissolved Solids – *396 mg/L
  - Sulfate – *48 mg/L
  - Chloride - *70 mg/L

* Specific criteria for segment

Screening Criteria

- Nitrite and Nitrate Nitrogen – 1.95 mg/L
- Phosphorus – 0.69 mg/L
- Ammonia
- Chlorophyll *a* (algae)

State of Texas Watershed-Based Planning



01 - Adams and Cow Bayou
02 - Arroyo Colorado
03 - Attoyac Bayou
04 - Bastrop Bayou
05 - Brady Creek
06 - Buck Creek
07 - Carters Creek
08 - Cedar Bayou
09 - Cedar Creek Reservoir
10 - Cole and Ropes Park Beaches
11 - Colorado River Below E.V. Spence
12 - Concho River
13 - Cypress Creek
14 - Dallas - Fort Worth Area TMDLs
15 - Dickinson Bayou
16 - Double Bayou
17 - Dry Comal/Comal
18 - E.V. Spence Reservoir
19 - Eagle Mountain Reservoir
20 - Geronimo Creek
21 - Gilleland Creek
22 - Guadalupe River Above Canyon Lake
23 - Hickory Creek
24 - Houston Area TMDLs
25 - La Nana Bayou
26 - Lake Arlington and Village Creek
27 - Lake Austin
28 - Lake Granbury
29 - Lake Lavon
30 - Lake O' the Pines
31 - Lampasas River
32 - Lavaca River
33 - Leon River
34 - Little River
35 - Lower Laguna Madre
36 - Lower Nueces River
37 - Lower Sabinal River
38 - Lower San Antonio River
39 - Mid and Lower Cibolo
40 - Mill Creek
41 - Mission and Aransas
42 - Moses-Karankawa Bayous
43 - Navasota Below Lake Limestone
44 - Nolan Creek
45 - North Bosque River
46 - Oso Bay and Oso Creek
47 - Pecos River
48 - Petronila Creek
49 - Plum Creek
50 - Richland-Chambers
51 - Salado Creek
52 - San Bernard
53 - Shoal Creek
54 - Spicewood Springs and Walnut Creek
55 - Spring and Cypress Creek
56 - Tres Palacios
57 - Upper Cibolo Creek
58 - Upper Coast Oyster Waters
59 - Upper Llano River
60 - Upper San Antonio River
61 - Upper San Antonio River
62 - Upper San Marcos
63 - West Fork San Jacinto and Lake Creek

Point Source Pollutant Sources

- Point Source
  - Permitted Discharges
    - Wastewater Treatment Plants
    - Industrial Facilities
    - Confined Animal Feeding Operation
- Stormwater Permit

Nonpoint Sources

- Urban
- Wildlife
- Feral Hogs
- Livestock
- Crops
- Onsite Septic Facilities

Why should we be concerned about the health of the stream and riparian areas?

- Cumulative impacts of natural and man induced disturbances in the drainage area.
- Management not only affects the individual landowner but everyone else downstream.
- They are critical acting as natural water “pipelines” that impact how much surface water and sediment is transported downstream, the quality of that water, as well as the sediment filling up our reservoirs.
- Stream and riparian systems are one of the most important resources found on private and public lands in Texas and they need to be managed and protected.

We need to build more support for resource stewardship through education and use an informed public to mitigate, protect and restore our stream systems.

Questions?

Clare Entwistle

Texas Water Resources Institute

Clare.Entwistle@ag.tamu.edu

(210)-277-0292 Ext. 205