Evaluation of Riparian Re-Vegetation on Streambank Stability and Erosion

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Unhealthy Streambanks

- 55% of the river and stream miles in the U.S. 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.
- Increase of introduced invasive vegetation that hinders the growth of native species and reduces the habitat variety.

Unhealthy Streambanks

The increased stress placed on many streams and rivers have been adversely affected resulting in streambank erosion causing:

- High sediment loads
- Reduced reservoir storage capacity
- Degraded water quality
- Effect aquatic wildlife species and richness
- Loss of natural riparian habitats
- Loss of landuse, property values, and human safety

Unhealthy Streambanks

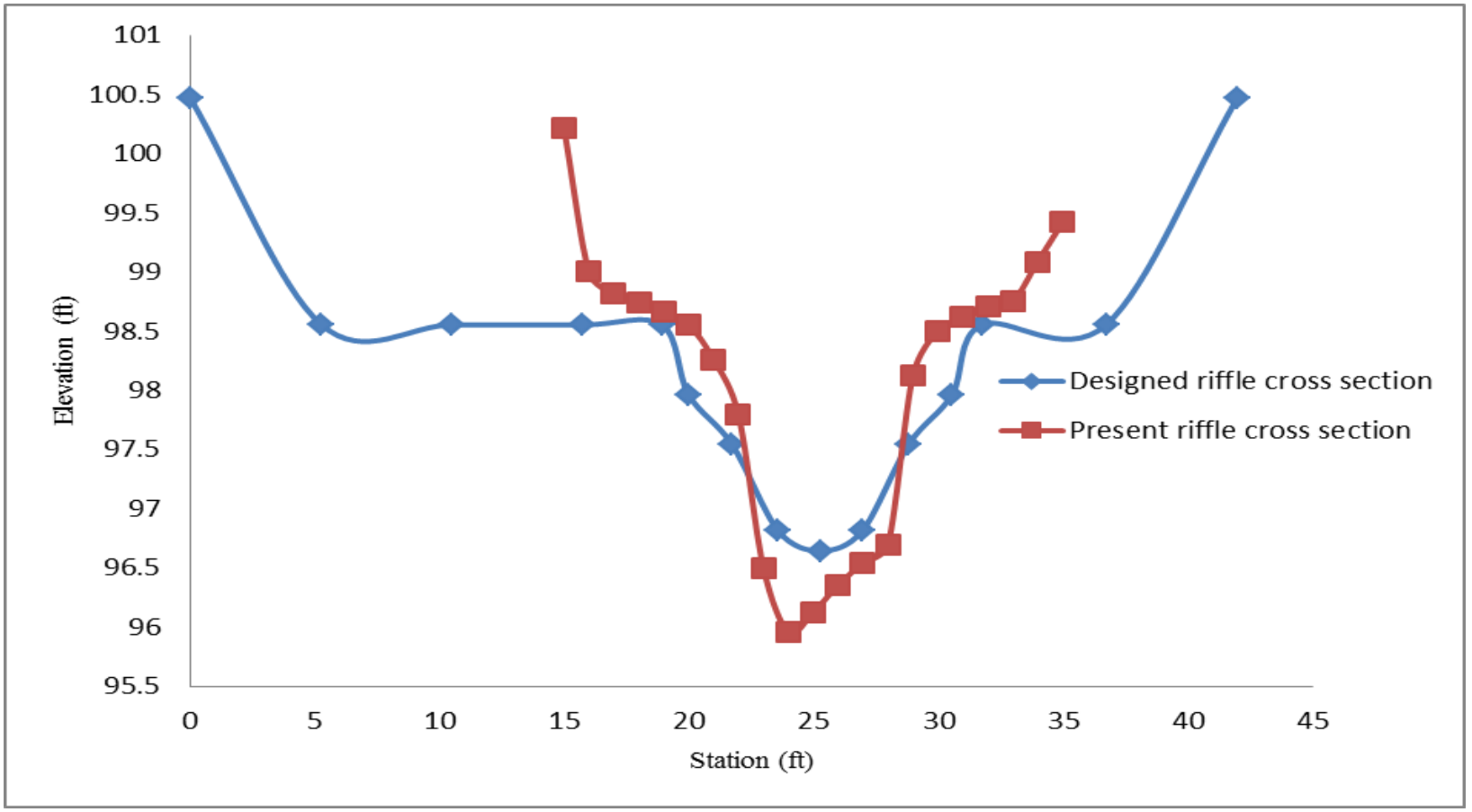
- Approximate instream damage from erosion is a minimum of $5 billion each year (Pimentel et al., 1995; Bernhardt et al., 2005)

Stream Restoration

- Due to erosion and its effects, historically engineers have channelized and destroyed the ecology and function of streams along with the streams riparian vegetation.

Natural Channel Approach

- Dimension
- Pattern
- Profile



Natural Channel Approach

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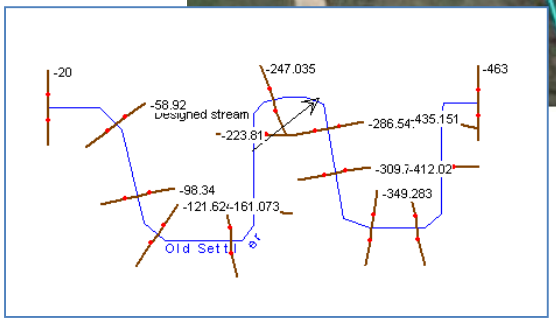
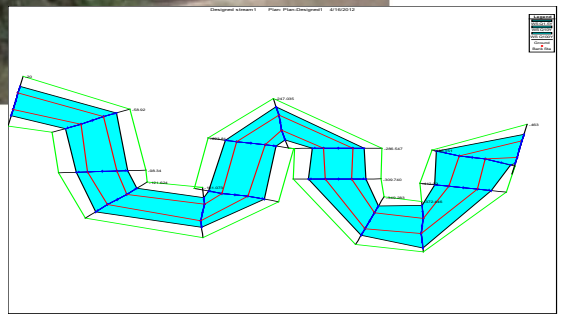


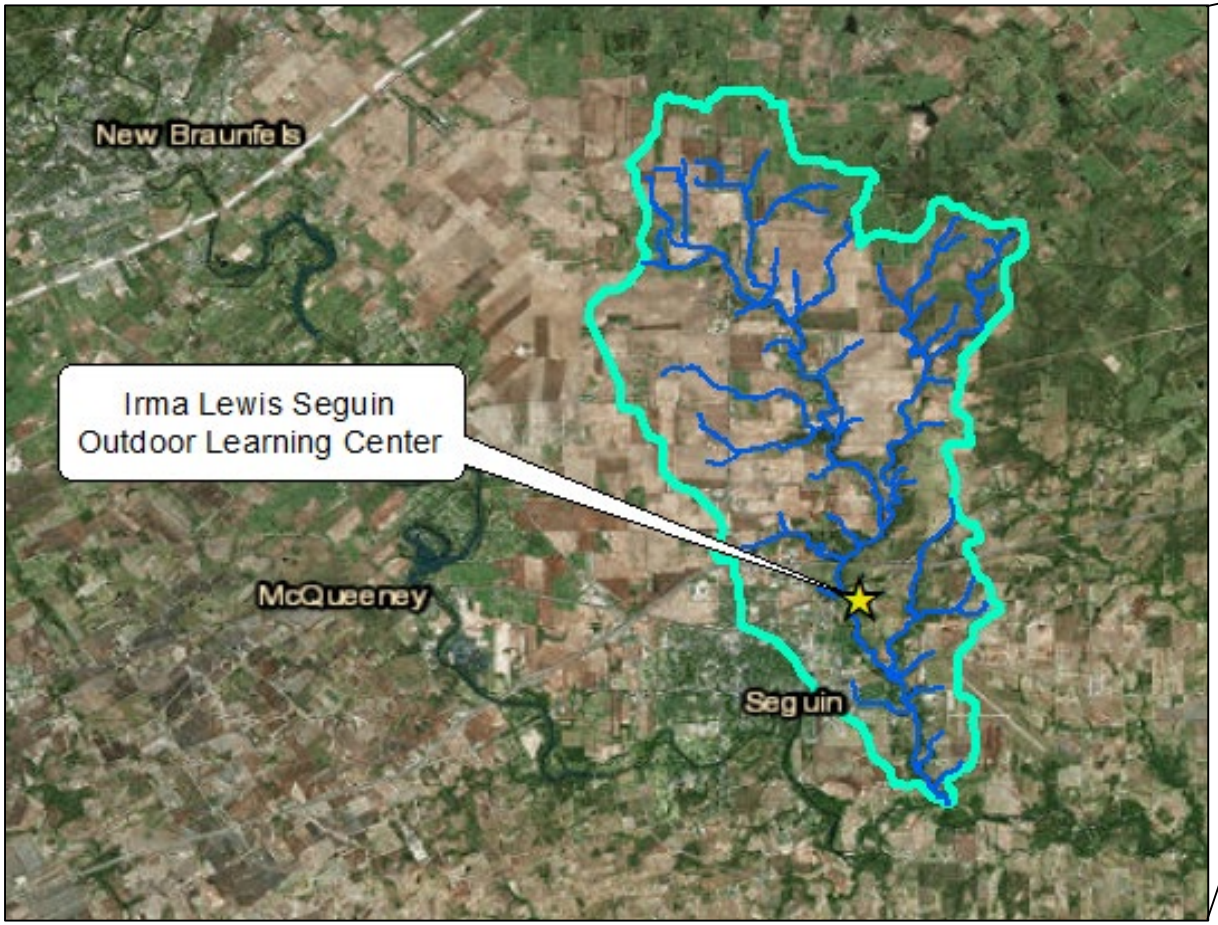


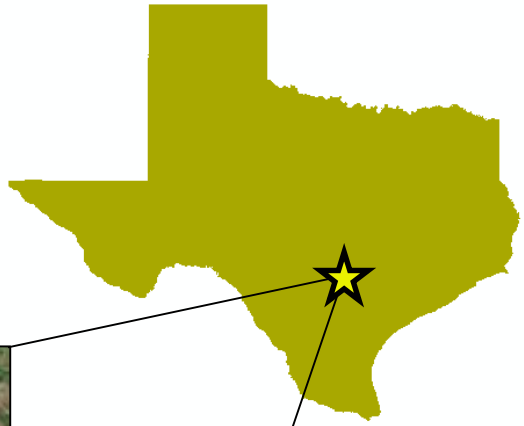
Project Description

- Natural Channel Approach can be costly and work intensive. Study a more cost efficient way to stabilize banks and lower erosion in urbanized areas.

- Hypothesis: Implementation of streambank revegetation along moderately eroded streambanks along with a buffer strip can reduce the streambank erosion and degradation.

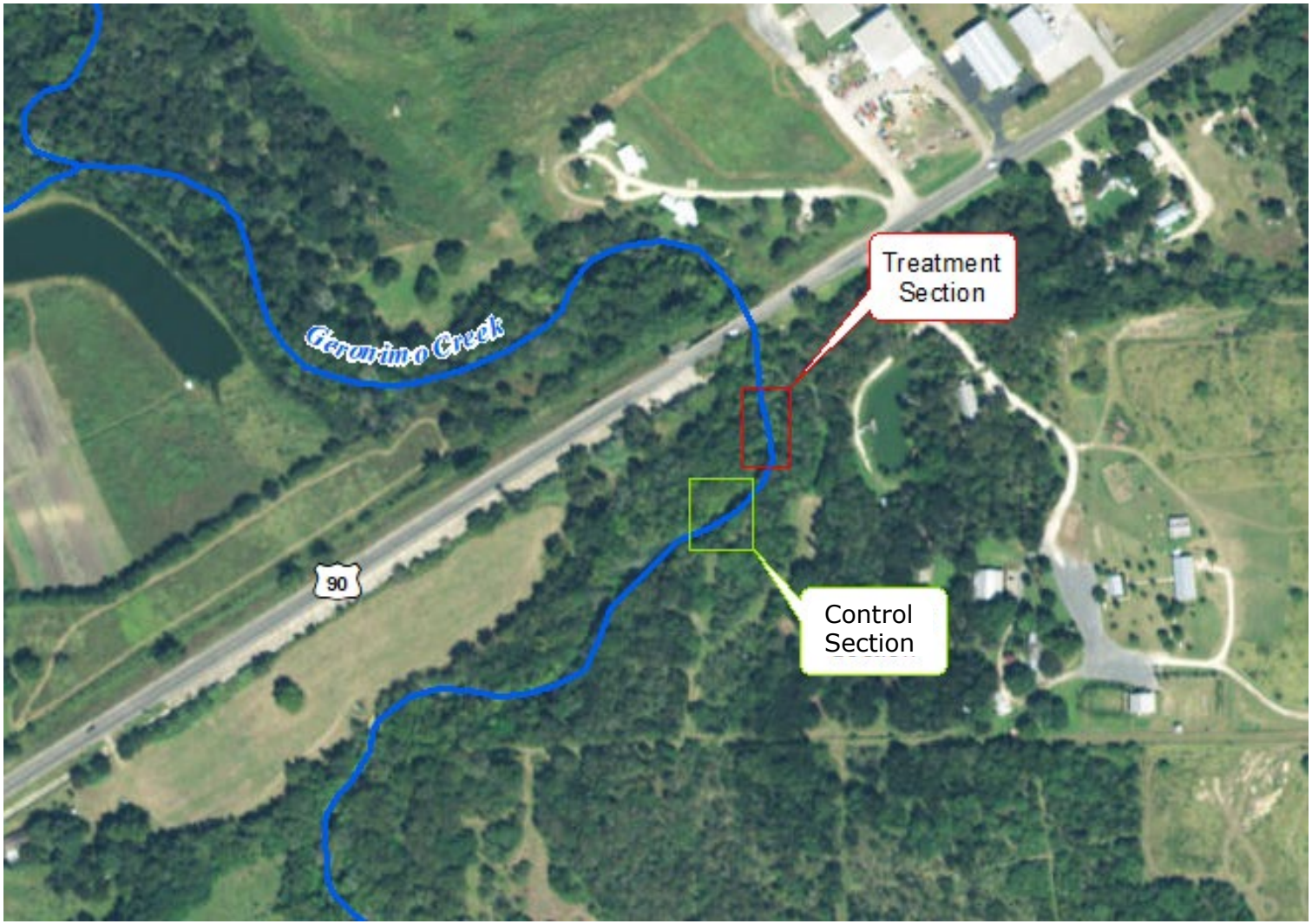
Study Site
Geronimo Creek





- 41 mi^2
- Spring fed
- Clay soils
- 31” annual rainfall

Study Site



Study Site

Treatment Section (Upstream)

Study Site

Control Section (Downstream)

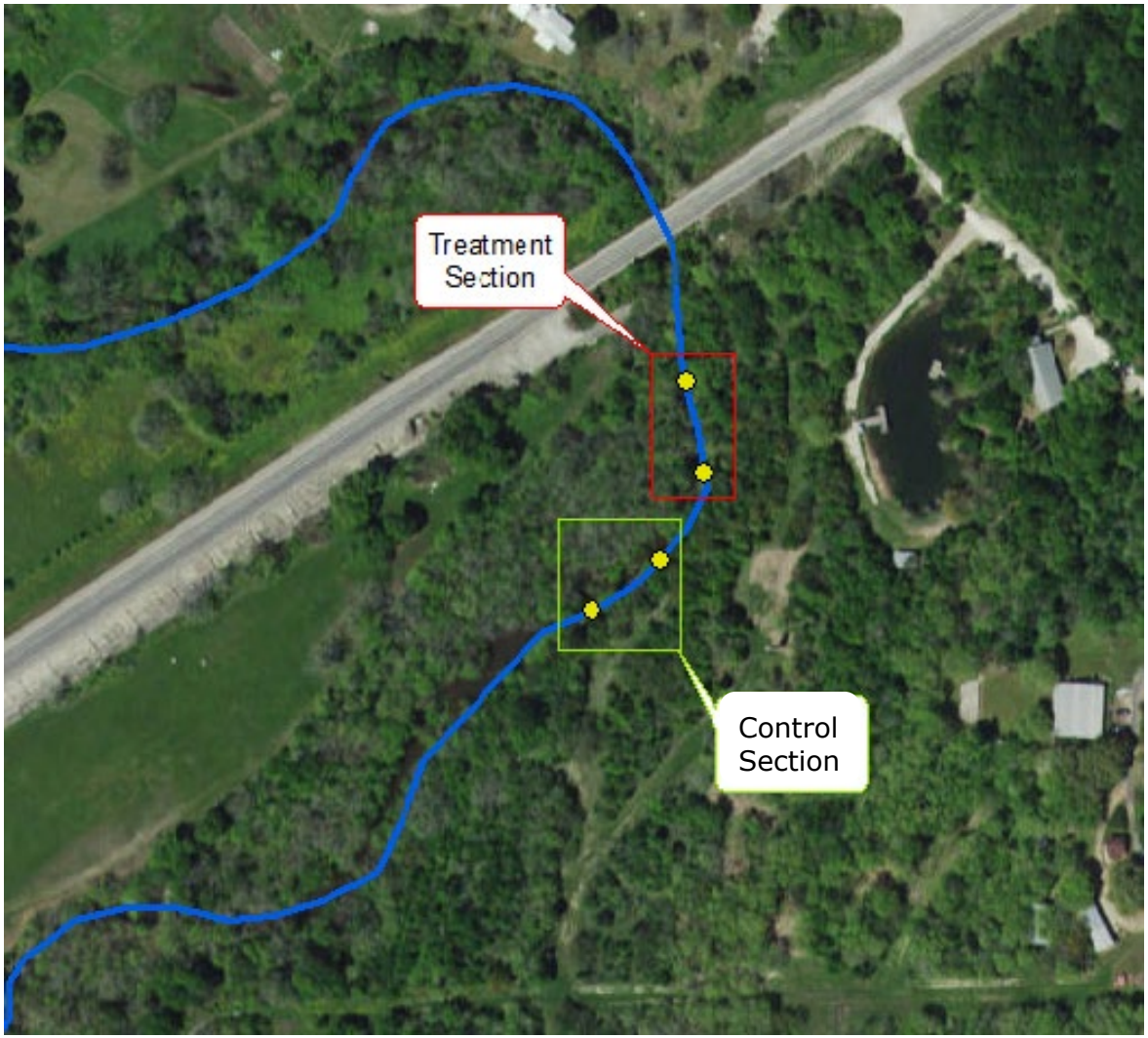
Project Methods

- Total Suspended Solids (TSS) sampling
- Cross-sectional surveys
- Pebble Counts
- Erosion pins
- Bank Erosion Hazard Index (BEHI)

Project Monitoring

- Sampling for Total Suspended Solids (TSS) quarterly and storm event-based.
- Measure sediment load coming in and out of each section.

Project Monitoring



Treatment Section

Control Section

ISCO Automated Water Samplers

Project Monitoring

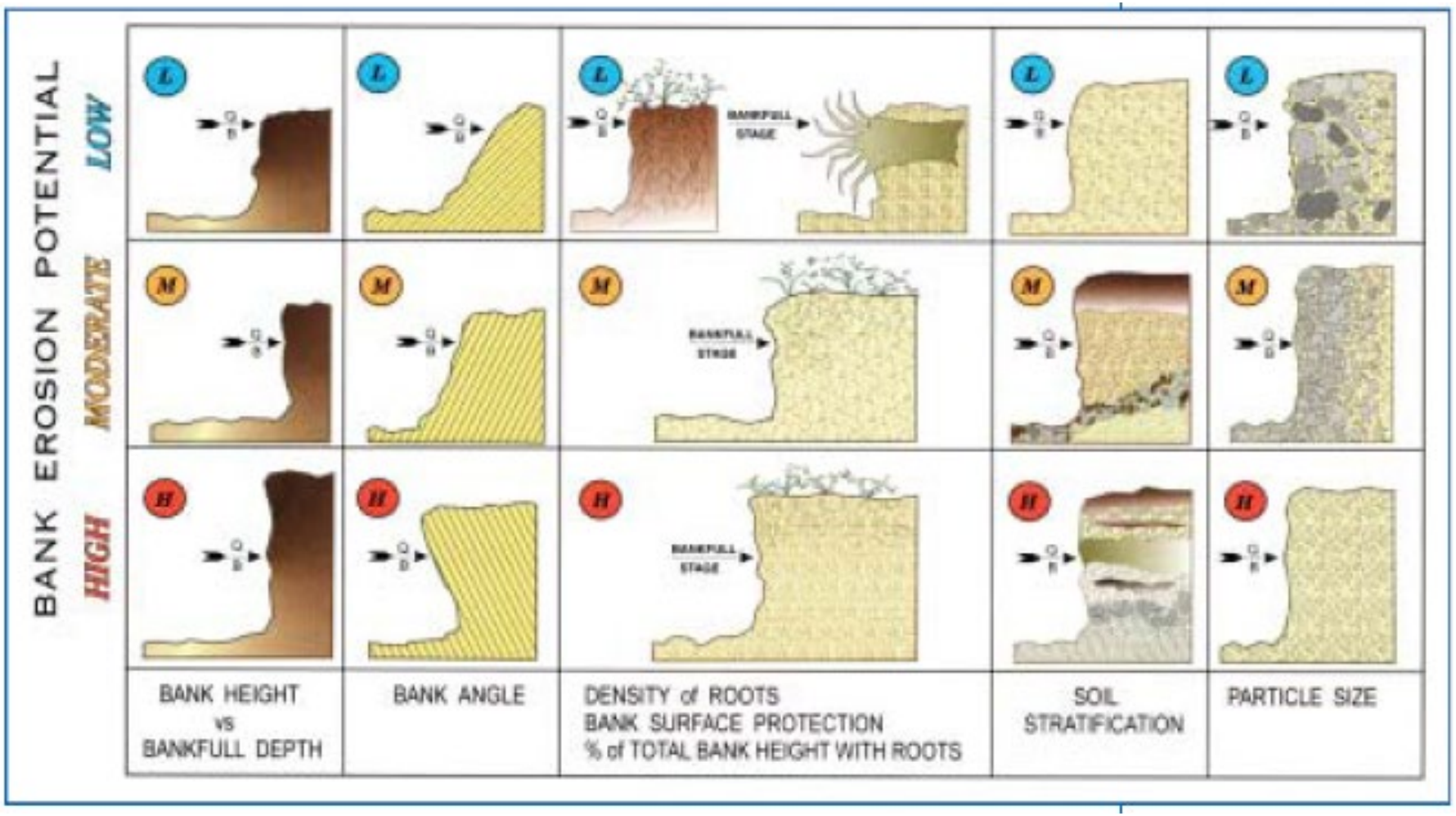
- 4 cross-sections each at treatment and control section.
- Conduct pebble counts and surveys of each cross-section and the longitudinal profile of the stream annually.

Project Monitoring

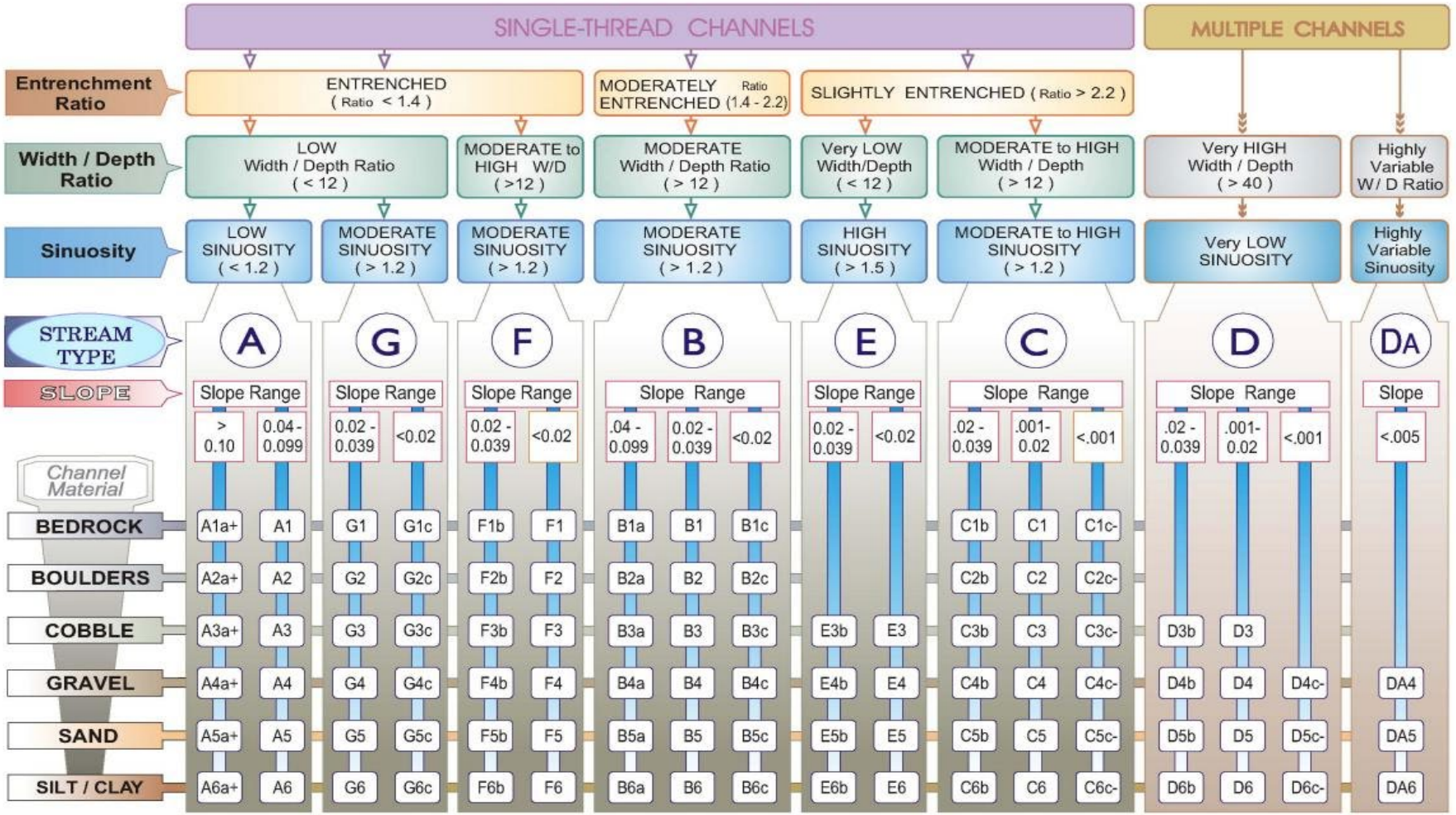
- Measure erosion pins quarterly to monitor streambank recession rate.
- 6 pins at each cross-section.

Project Monitoring

Erosion Hazard Index (BEHI)



The Key to the Rosgen Classification of Natural Rivers



KEY to the *ROSGEN* CLASSIFICATION of NATURAL RIVERS. As a function of the *"continuum of physical variables"* within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

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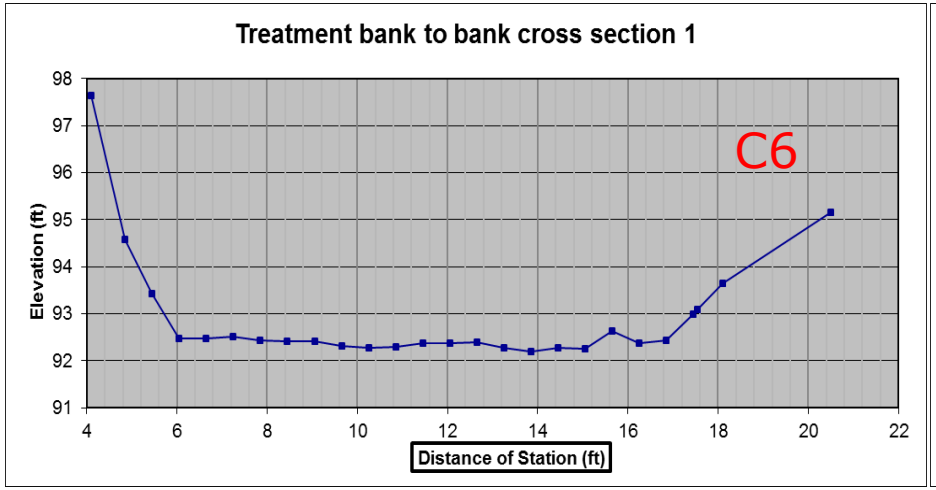
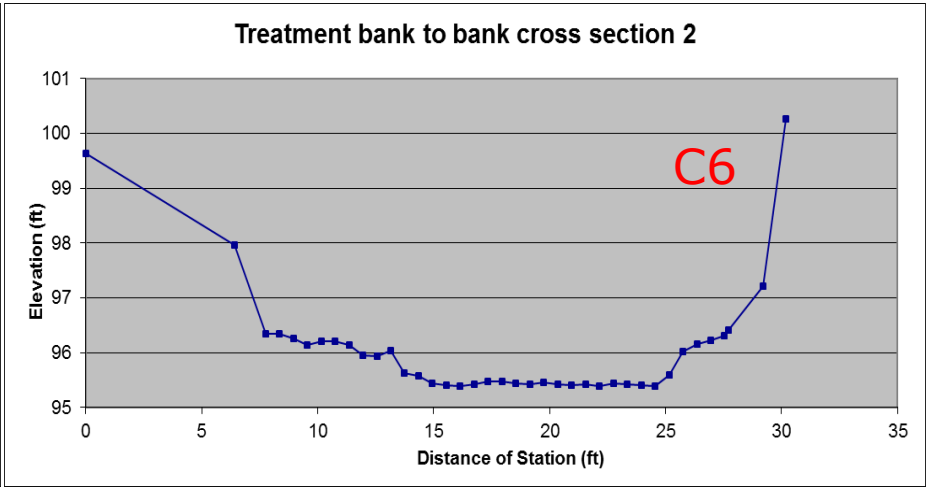
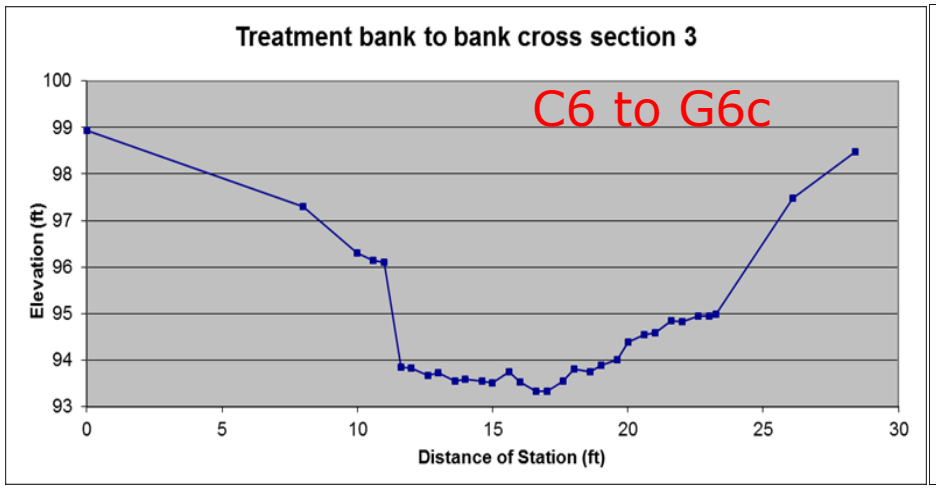
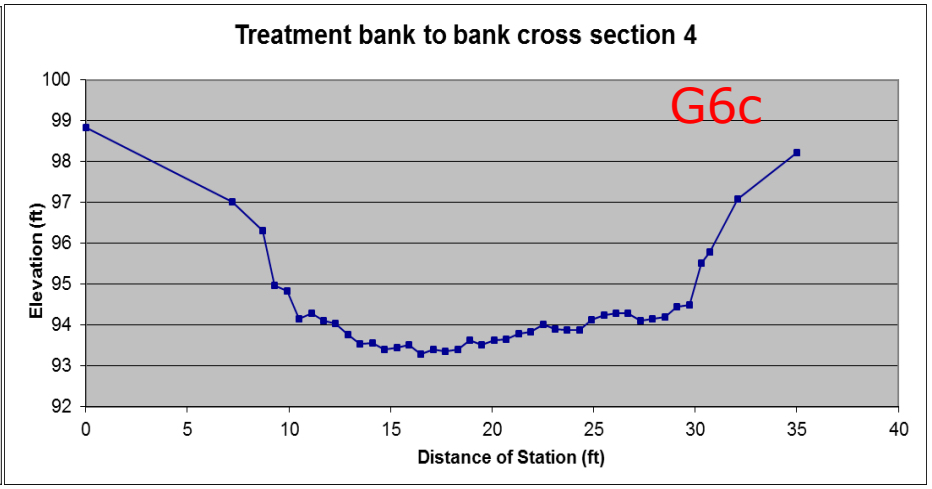
Treatment Section D_{50}: Clay

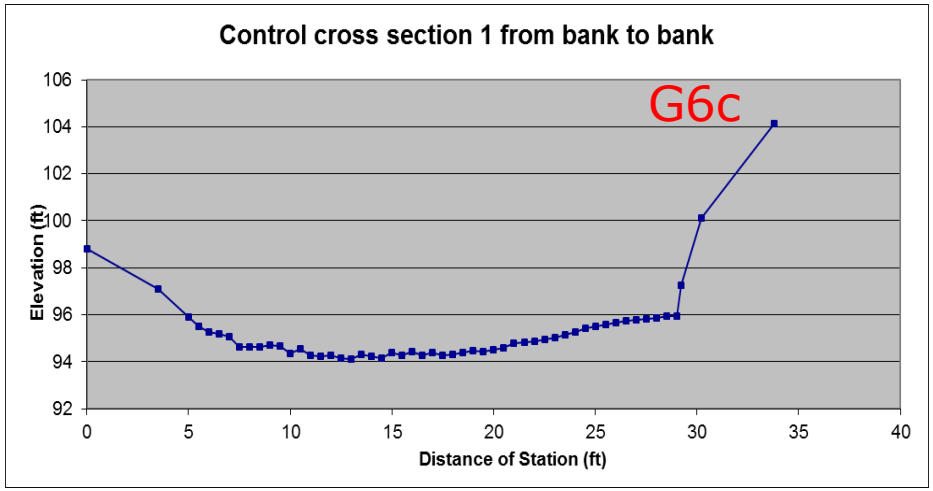


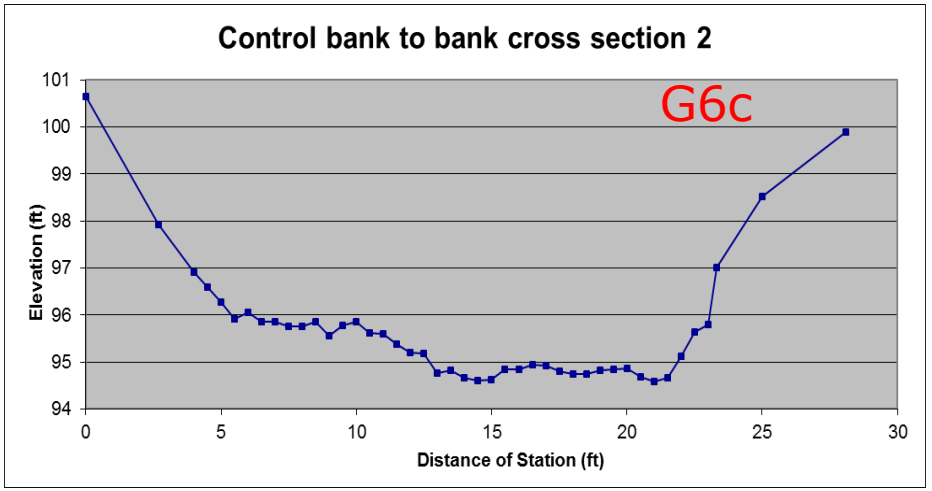


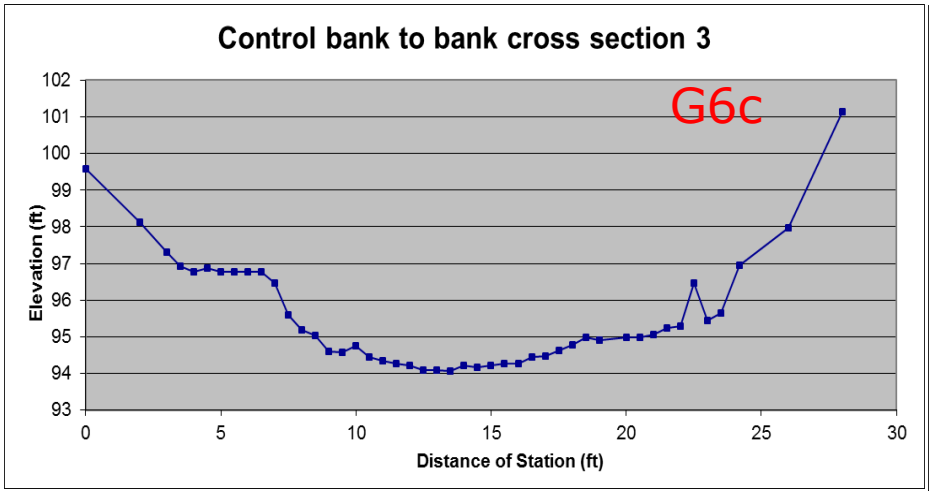


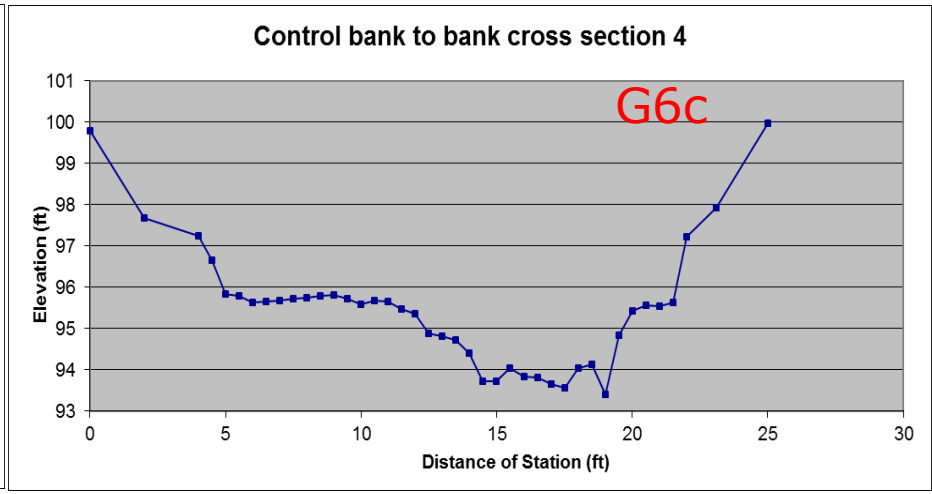


Control Section D_{50}: Clay

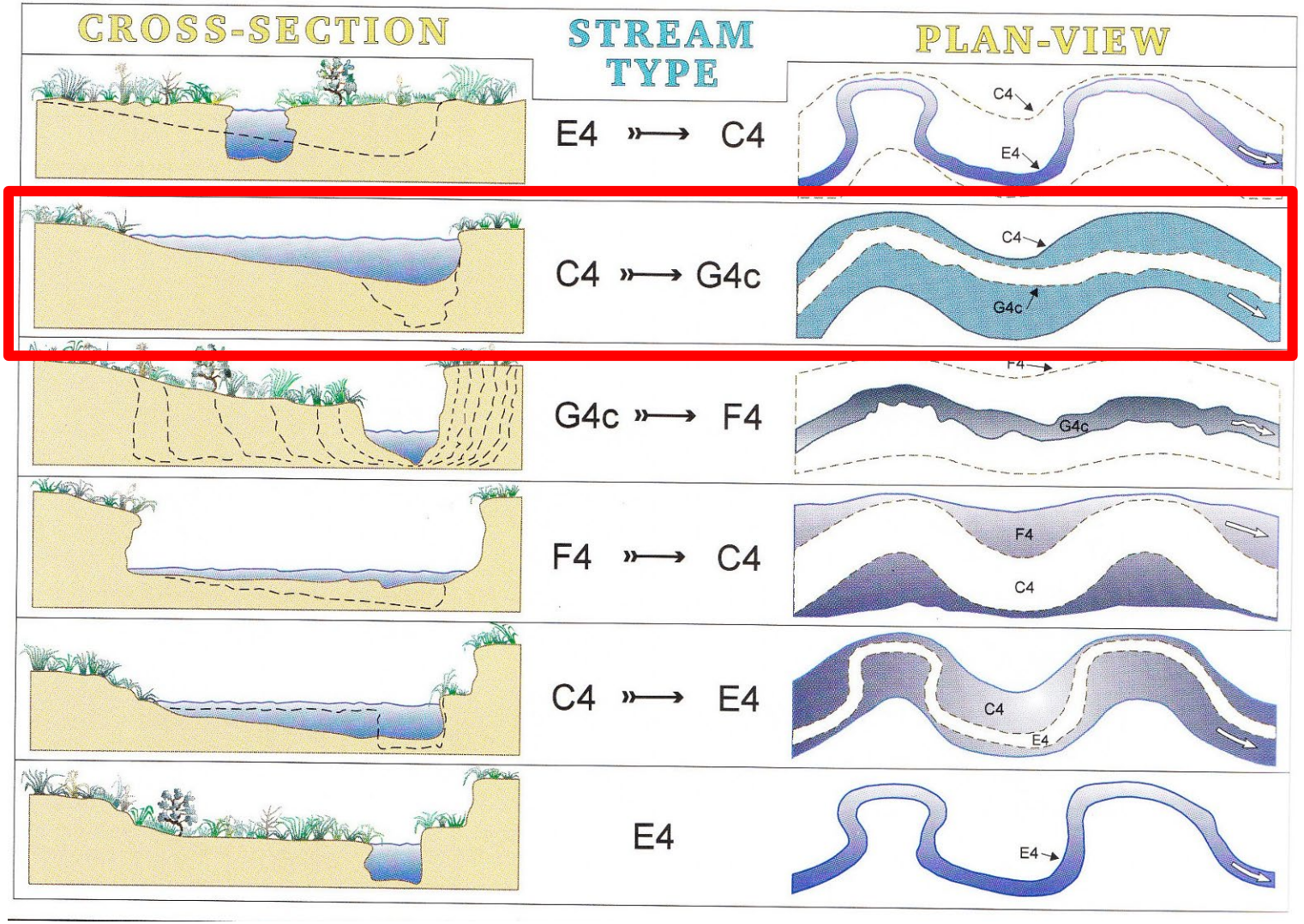








Initial Evaluation Conclusion



Planting of Native Vegetation

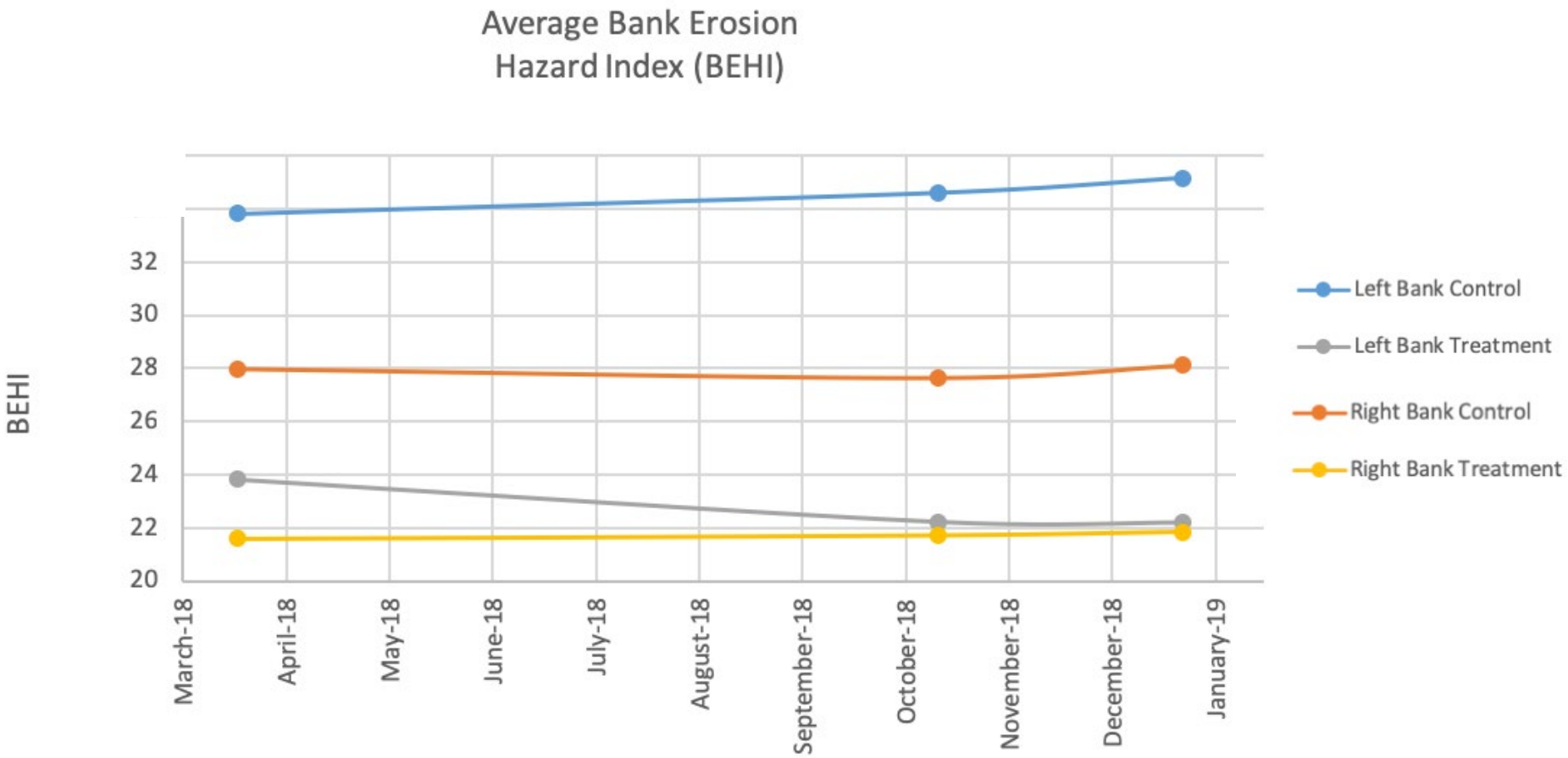
Consulted:

- Natural Resources Conservation Service
- Texas Parks & Wildlife Department
- Local plant nurseries.

Common Name	**Scientific Name**
cardinalflower	*Lobelia cardinalis*
obedient plant	*Physostegia virginiana*
Emory's sedge	*Carex emoryi*
creeping spikerush	*Eleocharis montevidensis*
beaked spikerush	*Eleocharis rostellata*
scouringrush horsetail	*Equisetum hyemale*
white star sedge	*Rhynchospora colorata*
Cherokee sedge	*Carex cherokeensis*
purpletop tridens	*Triden flavus*
Texas blue grass	*Poa arachnifera*
Leavenworth's sedge	*Carex leavenworthii*
stream sedge	*Carex blanda*
creek sedge	*Carex amphibola*
inland sea oats	*Chasmanthium latifolium*
Turk's cap	*Malvaviscus arboreus*
roughleaf dogwood	*Cornus drummondii*
black willow	*Salix nigra*

Treatment Section

Control Section



Changing parameters:

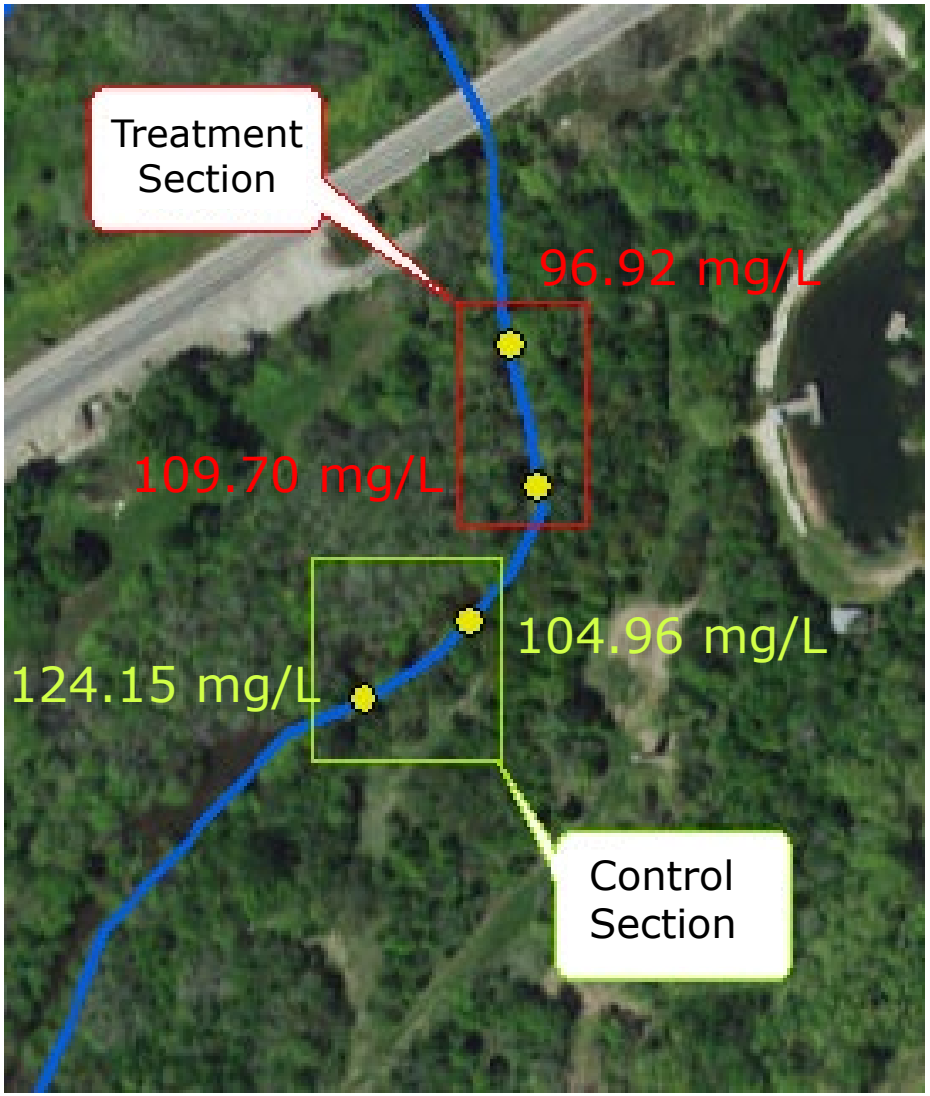
- Surface cover
- Root to height ratio
- Root density

BEHI Change in:

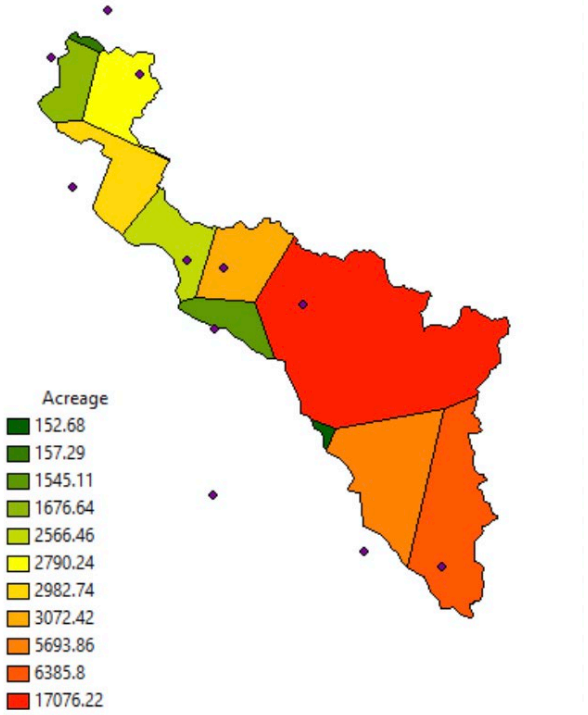
Control vs Treatment p-value = 0.0012

Left Bank Control vs Left Bank Treatment p-value = 0.0009

Average Total Suspended Sediment Load



Storm events of approximately 1 inch or more since July of 2018.



Expected Results

- After 2 years of monitoring, results should show that the treatment section compared to the control section should have:
  - Lower sediment loads
  - Lower erosion rates
  - Lower BEHI score
  - Better stabilized banks

  Just by planting native vegetation and leaving a buffer strip.

Urban Stream Restoration Education

- Fifteen 1-day trainings in large urban cities
- One 3-day advanced training toward end of project (2020)
- Topics: restoring riparian buffers, stream classification and restoration, watersheds and environmentally sensitive areas with field portion at a creek site

Urban Stream Restoration Education

- 99.9% of respondents mostly or completely satisfied with the program
- 65% plan to take actions or make changes based on the information from the program
- 37% anticipate benefitting economically as a direct result of what they learned
- Almost all respondents (99%) would recommend this course to others

	Mean Knowledge Before	Mean Knowledge After
Stream Function	2.86	3.56
Bankfull stage and discharge	2.13	3.35
Stream assessment for natural channel design	2.08	3.33
Watershed and local scale instability	2.48	3.31
Channel evolution	2.33	3.36
Stream restoration priorities	2.18	3.38
In-stream structures	2.29	3.25
Evaluation and monitoring	2.21	3.27
Stream Surveying	2.08	3.21
Pebble Count	1.8	3.3

	Def. will not %	Prob. Will not %	Undecided %	Prob. Will %	Def. will %	Already adopted %	Not applicable %
Stream design and construction	0	5.6	13.6	33.6	15.2	7.2	24.8
Riparian re-vegetation	0	0.8	5.5	29.1	35.5	18.1	11
Vanes	0	10.5	33.1	20.2	12.9	4	19.3
J-Hook	0	11.2	28	28	12.8	3.2	16.8
Cross vane	0	13.2	29.8	20.7	13.2	4.1	19
Manage Bare Ground	0.8	3.2	6.5	32.3	29	16.1	12.1
Managing Invasives	0	0	8.9	28.5	30.9	20.3	11.4
Limiting access of humans and animals to streams	0.8	4.1	12.2	34.1	22	12.2	14.6
Photo monitoring	1.6	3.2	12.8	21.6	37.6	12.8	10.4

Upcoming Urban Riparian Trainings

- April 17th – Corpus Christi
  - South Texas Botanical Gardens
- April 23rd – Pearland
  - John Hargrove Environmental Nature Center
- May 7th – Junction
  - Upper Llano River Field Station

Sign up workshops at http://texasriparian.org/

Questions?

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