EWP Channel Bank Stabilization
Cane Island Branch and Willow Fork of Buffalo Bayou
For Fort Bend County Drainage District

PROJECT DESCRIPTION

The Fort Bend County Drainage District (FBCDD) is a governmental entity of Fort Bend County. The basic objective of the FBCDD is to construct and maintain facilities intended to minimize the threat of flooding to all areas of the county. In August of 2017, Hurricane Harvey brought record breaking rainfall to the area causing widespread flooding and major damage to stream banks throughout the county. The FBCDD applied for federal assistance through the NRCS Emergency Watershed Protection program. The assistance was for channel bank stabilization along the Cane Island Branch and Willow Fork Branch of Buffalo. NRCS performed Damage Survey Reports (DSR), submitted for funding and receive approval for Phase I to Phase VI.

The existing channel banks vary from near vertical to 3 horizontal:1 vertical. The channel bottom elevation drops approximately: 24.8 feet from the upper site on Phase I, to the lowest site on Phase VI, from 114.5 msl to 89.7 msl in 34,060 feet. Existing channel bottom slope is 0.00072 ft per ft. The grade is not uniform and has highs and lows throughout the length. The channel alignment has straight sections mixed with varying degrees of left and right curves. The channel bank failures are can be attributed to (1) dispersive soils; (2) soil erosion at the bottom toe; and/or (3) lack of soil strength due to saturated channel banks after a rapid drop of the water surface in the channel.

Project Map – Phase I - VI

PLANNING AND SELECTION OF CHANNEL BANK PROTECTION

In order to meet the program criteria, the following listing and explanations were considered for planning; Watershed data, including prior stream modifications and past stability problems and treatments. Causes and extent of erosion problems, the channel grade has been stabilized and not degrading therefore the bank erosion is localized and each site was inspected. The Hydraulic data, using channel slope, width, depth and shape (wetted perimeter) used to estimate flow capacities, and velocities. Stream reach characteristics including alignment, vegetative cover, soil and channel material, obstructions present, existing hardened or paved cross sections at bridges. Social and economic factors such as installation cost and long-term maintenance, durability, replacement cost, and aesthetics. The final selection of steel sheet pile walls for each site was selected and provides, channel toe and slope protection, wall heights 4-7 foot above the existing channel bottom allow installation of a drainage system behind each wall, will not alter the cross section of the existing channel, will not change the water surface profile, provide ease and access for maintenance, and meet the sponsors requirements for low cost best alternative treatment.

GENERAL DESIGN

The final design considerations included:

1) sponsor maintenance and safety. This includes providing final finished slopes at the repair sites within the easement, not to alter ingress and egress access for maintenance, and sloped to allow safe operation of maintenance equipment.

Phase 2 – Completed pre-vegetation

2) Channel flow capacities. Channel flow capacities were performed using the hydraulic modeling software HEC-RAS for the existing and proposed conditions. These models were performed to confirm the channel modification would not alter the existing water surface elevation. Cross sections were generated for existing and proposed conditions using the surface model developed by AutoCAD Civil 3D and imported into HEC-RAS. Various flow discharges were analyzed for existing and proposed conditions to compare in water surface profiles. The analysis focused on the discharges just below to just above bank full flow. Since all the work is to be performed in the channel, if flows at the bank full condition are not changes then larger flows should not change. The analysis proved to show no change in the water surface profile between existing and proposed conditions.

Phase 2- Waler installation

Phase 3 – Completed pre-vegetation

3) Structural design. This repair consists of constructing steel sheet pile walls along the channel bottom. The walls will consist of Z shaped sheet piles supported with a walers and helical anchors. Wall heights will vary to best match the height and channel slope above the wall to fit within the established easement held by the FBCDD. The design software Pile Buck (SPW911, v2.40) and HeliCAP (v2.5.1) were used to design the sheet piling and helical anchors respectively. Placing rock riprap on both the beginning and ending of each sheet pile wall site will insure flow transition without scour on either side of the steel sheet pile wall.

Phase 6 – Site 316 Rock Riprap

Phase 6 – Site 316 Pinning Sheet Piles

Phase 4 – Setting alignment piles for wall

Phase 5- ABI Sheet pipe driver