FINAL REPORT PROJECT 20-600

J. PENSE STREAM BANK STABILIZATION PROJECT

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INTRODUCTION

In 2020, the City of Fort Smith Utilities Department received grant #20-600 for the "J. Pense Streambank Stabilization" project. The project included the stabilization of 1200 feet of stream bank by implementing Bend-way weirs and longitudinal stone toe protection devices, re-sloping existing vertical banks, and establishing a 30 feet deep riparian zone. Priority areas were determined by referencing Frog Bayou Watershed Management Plan, which listed this site as a high priority project for stream bank stabilization. The project would reduce an estimated 21,500 ft^3 per year of sediment from entering the Frog Bayou receiving stream, approximately 1.2 miles above Lake Fort Smith, which is a major drinking water reservoir for Western Arkansas.

The stream is eroding a vertical bank approx. 14 ft. in height. Over the last 10 years, this bank has contributed approx. 21,500 ft^3 of sediment to the receiving stream each year. This was determined by using satellite-mapping technologies that showed the stream channel widening. Approx. 600 ft. of the vertical stream bank needs to be re-sloped, stabilized and re-vegetated.

During the Spring of 2021 prior to the start of the project, the Jones Fork basin experienced a 100 year flood event. This event occurred over three days (April 29th to May 1st 2021). During the flood event and additional 240,000 cubic feet of material was eroded.

SITE CHARACTERISTICS

Jones Fork Creek, HUC #111102010401, is in Western Crawford County. Watershed drainage area is approximately 15 mi^2. The source of the waterbody is located in the Boston Mountains ecoregion in Crawford County. Land uses are 83% forest and 11% pastureland. Soils are nella-enders, enders, and linker-mountainburg complexes. Slopes are steep and range from 3-60%, with over half the slopes exceeding 16%. This area receives between 45 – 65 inches of rainfall annually.

TASKS

Tasks for the project are outlined in Table 1. Tasks were completed on time with few exceptions. Weather played an important role in those tasks that were not completed on time.

Table I
Project Tasks and Tentative Dates

Task	Subtask Number	Description	Start Date	Completion Date
1	**1.1**	Financial review year 1	June 2021	December 2021
2	**2.1**	Identify professional contract services	October 2020	December 2020

	2.2	Site planning, COE permit application process, and implementation schedule	December 2020	March 2021
	2.3	Construction contractor identification and scheduling.	December 2020	March 2021
3	**3.1**	Bendway weir stone purchased and moved to project site.	January 2021	April 2021
	3.2	Key lock and longitudinal stone toe protection purchased and hauled to site.	January 2021	May 2021
	3.3	Vegetation purchased and harvest of willow and sycamore poles on site.	May 2021	June 2021
4	**4.1**	Final project design and layout.	July 2021	August 2021
	4.2	Heavy equipment arrival and deployment.	July 2021	September 2021
	4.3	Key lock construction and installation of willow and sycamore poles.	July 2021	September 2021
	4.4	Longitudinal stone toe protection installation.	July 2021	September 2021
	4.5	Bendway weir installation.	July 2021	September 2021
	4.6	Bank re-sloping and creation of flood plain shelf.	July 2021	September 2021
	4.7	Bendway weirs will have a 3 to 1 front slope and a 7 to 1 back slope that will be accomplished using on site materials.	July 2021	September 2021
	4.8	Site cleanup and project repair	September 2021	October 2021
	4.9	Planting of vegetation.	July - September 2021	October 2021
5	**5.1**	Quarterly Reports	January 2021	January 2022
	5.2	Annual Reports	October 2021	October 2022
	5.3	Annual Project Review Meetings	October 2021	October 2022
	5.4	Final Report	October 2021	October 2022

Project Materials:

- 670 tons of 23 to 33 inch diameter stones
- 230 tons of 18 to 24 inch rip-rap
- 270 tons of 40 inch diameter stones
- 300 tons of 6 to 12 inch diameter stones

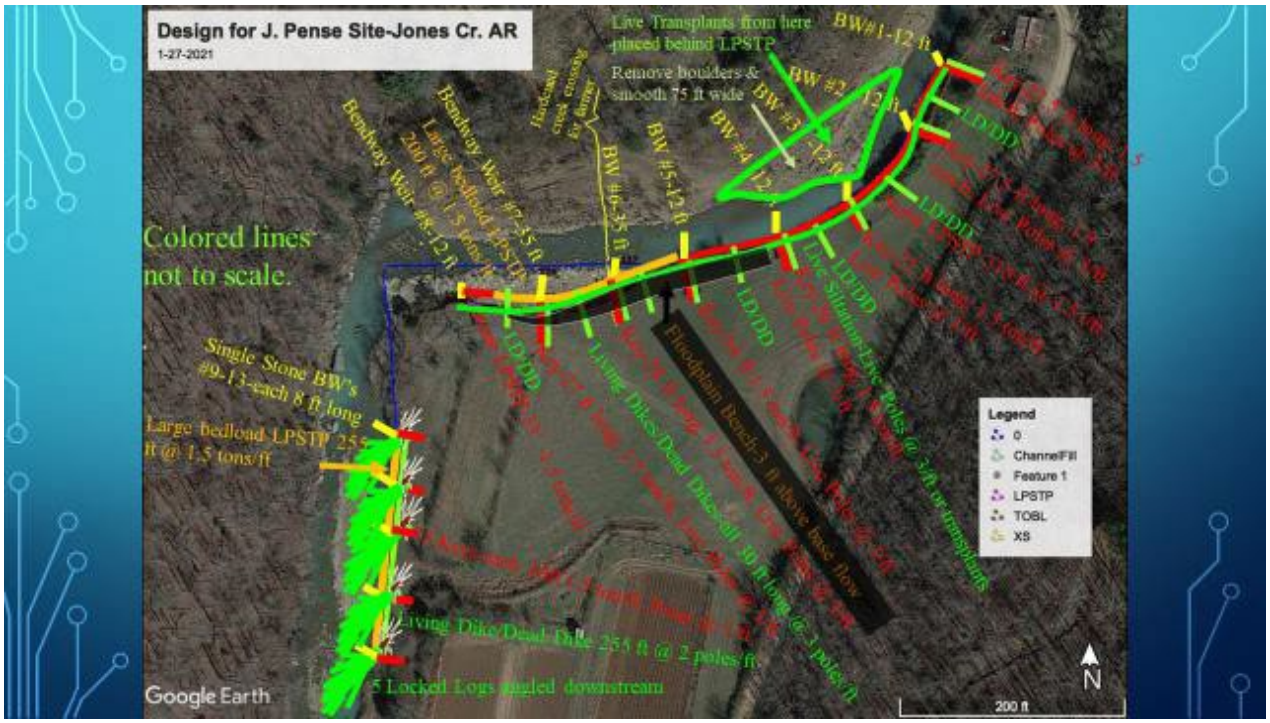
- 750 tons of large stones (3 to 5 tons per stone)
- 2500 Black Willow/Sycamore poles and 300 witch hazel and streambank willows trees
- 400 lbs. of grass seed

PROJECT CONSTRUCTION

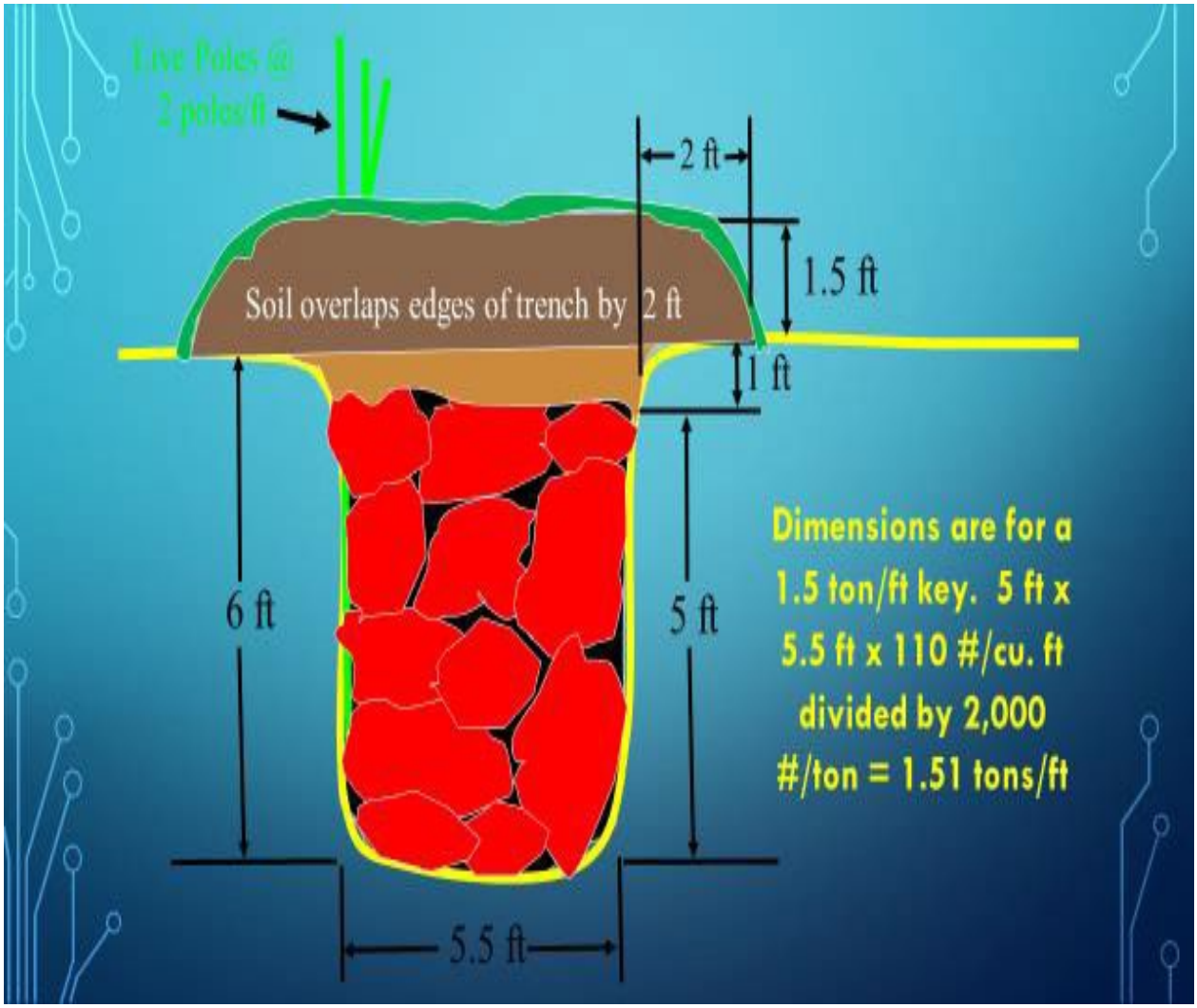
Project construction started September 20, 2021.

- Installed 8 Bend-way weirs
- Installed 8 25 foot stone key-locks
- Installed 3 35 foot stone key-locks
- Installed 650 feet of Longitudinal Peak Stone Toe Protection
- Created 650 feet of flood plain shelf
- Installed 25 single stone bend-way weirs
- Installed 12 locked log structures
- Re-sloped 1,000 feet of vertical stream-bank
- Constructed stream crossing for the farmer
- Planted and transplanted approximately 2000 trees
- Seeded entire site
- All told stabilized 1,220 feet of stream bank

J. Pense project site.



Site plan for J. Pense project on Jones Fork Creek, Crawford County Ar.



Key-Lock design

UPSTREAM ACTIVITIES

Upstream section prior to construction #1

Upstream section prior to construction #2

Key–Lock # 1

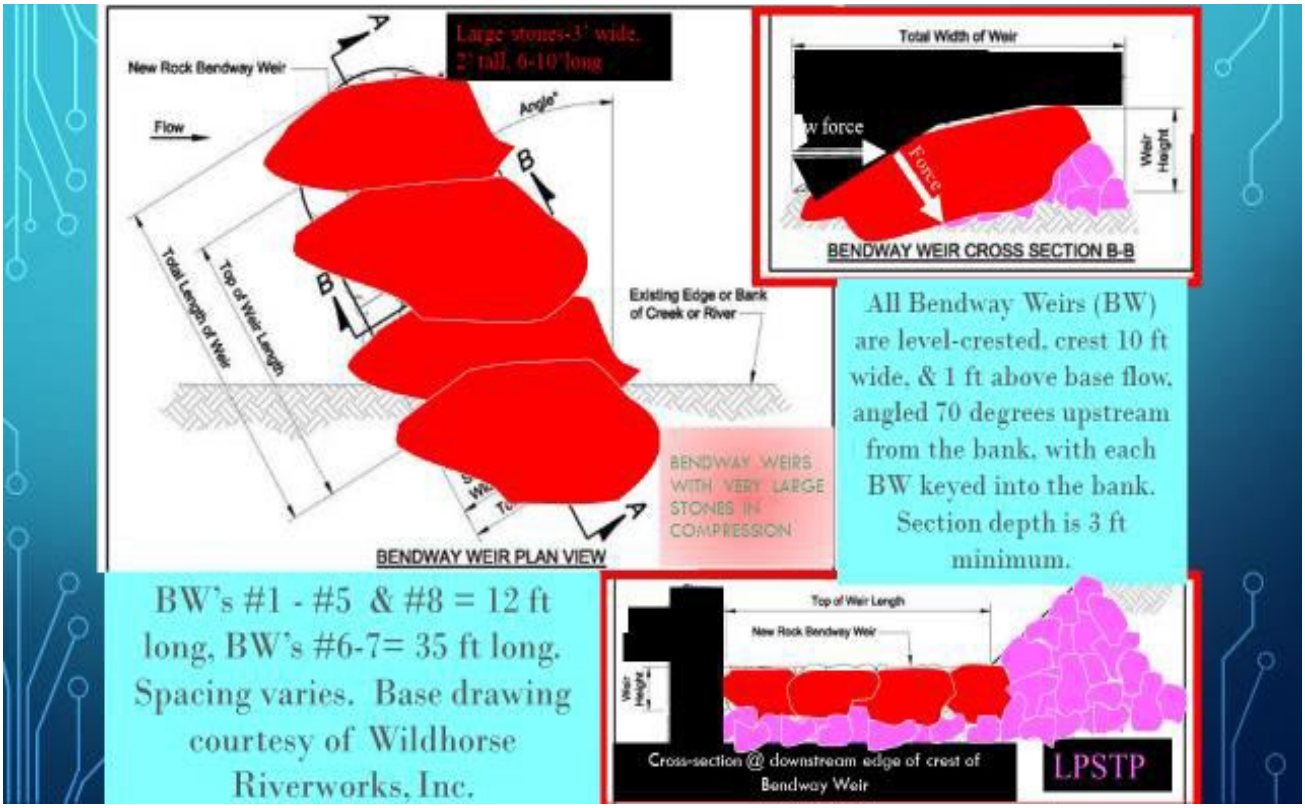
Key-Lock # 1 with willow poles added.

Key-lock # 1 with poles and stone added.

Key-lock # 2 completed

Key-lock # 3

Key-lock # 4



Bend-way weir construction design (detail).

Bend-way weirs # 1, 2 and three installed, starting construction of bend-way weir # 4

Bend-way weir construction.

4 Bend-way weir installation.

Bend-way weir # 5 installed.

Road crossing and Bend-way weir # 6 being constructed.

Bend-way weir # 7 sited for elevation drop.

Key-lock and bend-way weir # 8 being constructed.

Upstream section: Longitudinal Peak Stone Toe Protection being installed.

Upstream section: Stream bank being re-sloped.

Upstream section: Bend-way # 8 and bank re-sloping.

Upstream Section: LPSTP installed, transplanting vegetation to flood plain shelf.

Upstream section: Three weeks after seeding #1.

Upstream section: Three weeks after seeding #2.

DOWNSTREAM ACTIVITIES

Downstream section prior to construction.

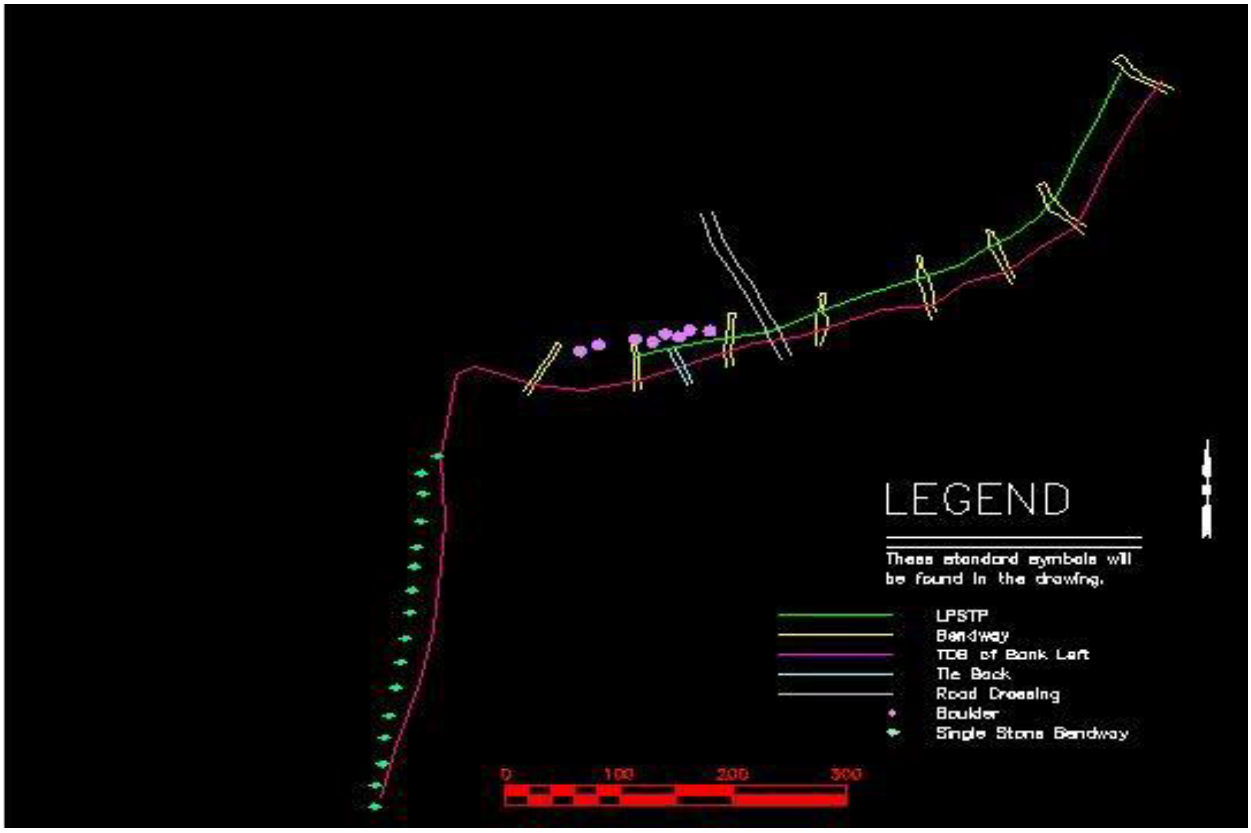
Downstream Section: Locked log and single stone Bend-way weirs installed.

Downstream section banks being re-sloped.

Downstream section banks re-sloped.

Downstream section: Willow and Sycamore poles in place (approximately 300).

Downstream section: Three weeks after seeding.



As built diagram for Jackie Pense project: Courtesy of David Derrick

Initial project Completed Thursday, September 30, 2021. Project site was seeded the first week of October 2021. 250 bare root Sycamore trees 2 to 3 feet tall were planted on the site during December of 2021.

Conclusions:

The project stabilized approximately 1,220 feet of eroding stream bank. This stabilization project prevents 21,000 cubic feet of material from entering Jones Fork Creek and eventually entering Lake Fort Smith.

- Installed 8 Bend-way weirs
- Installed 8 25 foot stone key-locks
- Installed 3 35 foot stone key-locks
- Installed 650 feet of Longitudinal Peak Stone Toe Protection
- Created 650 feet of flood plain shelf
- Installed 25 single stone bend-way weirs
- Installed 12 locked log structures

- Re-sloped 1,000 feet of vertical stream-bank
- Constructed stream crossing for the farmer
- Planted and transplanted approximately 2000 trees

- Seeded entire site
- All told stabilized 1,220 feet of stream bank

The project site experienced another 100-year flood in June of 2022 when 5.25 inches of rainfall fell within a 24-hour period. Approximately 1,000 cubic of material was eroded from the project site.

The bend-way weirs all held under the flow conditions, but a 100-foot section of the Longitudinal Peak Stone Toe Protection devise between bend-way weir # 3 and # 4 were over-topped and some erosion occurred behind the LPSTP.

Upstream section post flood.

Erosion also occurred within the downstream section of the project as a transverse longitudinal bar migrated downstream. This was relatively minor damage given the size and intensity of the flood event.

Downstream section post flood.

The issues created by the flood event have been addressed. 140 tons of 24 to 33 inch stone was purchased to reinforce the LPSTP between bend-way weir # 3 and # 4. An additional 40 feet of LPSTP was installed at the mid-point of the project to prevent erosion in that area. The point of impact of the flow on the downstream section of the project was also addressed by installing additional LPSTP. This is projected to be accomplished by the end of September of 2022. Additional vegetation and poles will also be planted to replace what was lost during the spring flood events.

Through the installation of streambank armoring, bendways and the reestablishment of a riparian zone, Project 20-600 was successful in reducing the sediment loading of Jones Fork Creek to Lake Fort Smith. As experienced during the spring of 2022, continued maintenance will be required on an annual basis to repair flood damage caused by increasingly heavy rain events. This continued effort will ensure reduced sediment loading and lower chemical costs for the Lake Fort Smith Water Treatment Plant.

Fund	Budgeted Amount	Actual Amount	Debit/Surplus
Fund Request	$112,927	$112,927	$0
Anticipated Match	$115,097	$115,097	$0

Project 20-600 Completion Financials

Budgeted and actual spending/matching goals were consistent with the initial projected values. Both the City's Fund Request and City Match was the anticipated estimate. Project completion was on time and within budget constraints.

ACKNOWLEDGEMENTS

The Fort Smith Utilities appreciates the continued funding support provided by the Department of Agriculture, Natural Resources Division (NRD), in assisting in the reduction of sediment loading to Lake Fort Smith. We look forward to working with the NRD in future streambank stabilization projects.