# Report as of FY2006 for 2006TX228B: "Post-Restoration Evaluation of Urban Streams in Central Texas"

## Publications

Project 2006TX228B has resulted in no reported publications as of FY2006.

## Report Follows

**USGS/TWRI Research Progress Report**

# POST-RESTORATION EVALUATION OF URBAN STREAMS IN CENTRAL TEXAS

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## INTRODUCTION

Research over the past few decades have revealed the impacts of urbanization on stream channels. Even though this knowledge is increasingly used to restore degraded urban streams, few studies have investigated what occurs post-restoration. In this study, physical and biological characteristics of three restored reaches in the Colorado River basin in Austin, Texas, are analyzed during a "one-shot" post-project evaluation[1]. These characteristics are compared with pre-restoration data to test the hypothesis that restoration has improved stream stability and health. This research is significant in that it is the first comprehensive analysis of restoration efforts on urban streams in Texas, and one of the few in the United States.

## OBJECTIVES

The research questions are:

(1) How effective are stream restoration efforts in improving stream stability in the Colorado River watershed in Austin, Texas?

(2) How effective is stream restoration in improving ecological conditions?

Testable hypotheses are as follows:

(1) Because restoration increases channel bank and bed resistance, increased channel stability is expected through an increase in channel capacity and a

reduction in slope and stability parameter scores from the Pfankuch channel stability evaluation protocol[2].

(2) Through the introduction of vegetation and bank protection measures, leading to a reduction in erosion, enhanced habitat conditions are expected to result in higher habitat scores and improvements in the benthic macroinvertebrate community, such as an increase in taxa richness.

## STUDY AREA

The city of Austin, located in central Texas, has developed around the Colorado River and its tributaries (Fig. 1). Rapid urban development over the past decade has increased stormwater runoff, leading to greater erosion within these steep-sloped stream channels. By 1995, Austin had identified 947 cases of localized stream erosion, with 160 channel reaches classified as unstable. To minimize the threat of property damage from stream erosion, the City of Austin has restored approximately 30 channel reaches since the late 1990s. This study evaluates three of these reaches, with the following characteristics:

### Bartholomew Park Site

- Drainage area is approximately 10 $km^2$ (Fig. 1)
- Main land use is residential.
- The restored reach is ~ 710 m.
- The lower reach was restored in 2001 and an upper reach was completed in 2006.

- The channel was reconstructed using rock to armor banks and to provide grade control within the channel. Native vegetation was also planted (Fig. 2)

**Lovell Site**

- Site is located next to Morris Williams Golf Course on Lovell Drive (Fig. 1).
- Restoration of a ~100 m reach was completed in 2005.
  - The channel was reconstructed using rock armor along the meander bend and installation of a pool-riffle system. Native vegetation was also planted (Fig. 3)

**Shipe Park Site**

- This site is located within one of the most urbanized watersheds in Austin, containing the University of Texas and the State Capitol building (Fig. 1)
- Drainage area is approximately 16 $km^2$
- Restoration of a 95 m reach was completed in 1998.
  - Rock armor and native vegetation stabilized channel banks. A pool-riffle system was also constructed to protect the stream bed (Fig. 4).

## METHODS

The analysis consists of the following components:

(1) Collect morphological data from restored reaches and compare to topographic surveys conducted before restoration by the City of Austin;

(2) Collect bed sediment samples at restored reaches and analyze particle size distributions; compare with pre-restoration data;

(3) Evaluate channel stability using Pfankuch channel stability evaluation protocol[2] at restored reaches and adjacent reaches; compare to pre-restoration stability scores from adjacent reaches (available from the City of Austin);

(4) Evaluate habitat condition of the restored reaches and adjacent reaches using the Rapid Bioassessment Protocol of the United States Environmental Protection Agency[3];

(5) Collect benthic macroinvertebrate samples from selected riffles within the restored reaches and adjacent reaches. Identify organisms and calculate biological metrics (such as taxa richness); compare to pre-restoration biological data from adjacent reaches, available from the City of Austin.

## PRELIMINARY RESULTS

### Channel Morphology

Preliminary results indicate:

- Enlargement of channel capacity, with most changes in the width dimension (Fig. 5)

### Bed Sediment

Data thus far reveal:

- Bartholomew Park average sediment size was coarser in the lower end of the reach than the upper part of the reach

- Lovell and Shipe Park average sediment size was coarse (> 2mm) at all sites

## CONTINUING RESEARCH

Continuing research includes collection and analysis of biological data as well as further analysis of morphological changes in the restored reaches. The information gained from this one-shot post-project evaluation provides the basis upon which longer-term monitoring and assessment can be conducted. These data will augment knowledge of geomorphological and ecological adjustments of urban stream restoration practices in Texas and in the United States. Such knowledge will improve future restoration projects, thus leading to more successful mitigation of flood hazards and enhancement of aquatic ecosystems.

## ACKNOWLEDGEMENTS

The Texas Water Resources Institute and the United States Geological Survey provided funding for this research. The city of Austin (Mikeproviding valuable data and background to the restoration projects. Adriana Martinez and Russell Meier served as able field assistants

## REFERENCES

1 Downs, P.W. and Kondolf, G.M., 2002. Post-Project Appraisals in Adaptive Management of River Channel Restoration. Environmental Management, 29(4): 477-496.

2 Pfankuch, D. J. 1975. Stream reach inventory and channel stability evaluation. United States Department of Agriculture Forest Service. Government Printing Office #696-260/200, Washington, D. C., RI-75-002.

3 United States Environmental Protection Agency (USEPA). 1999. In: Barbour, M.T., Gerritsen, J., Snyder, B.D., and Stribling, J.B. (Eds.), Rapid bioassessment protocols for use in wadeable streams and rivers: periphyton, benthic, macroinvertebrates and fish, second ed. U.S. Environmental Protection Agency, Washington, DC, EPA 841-B-99-002.

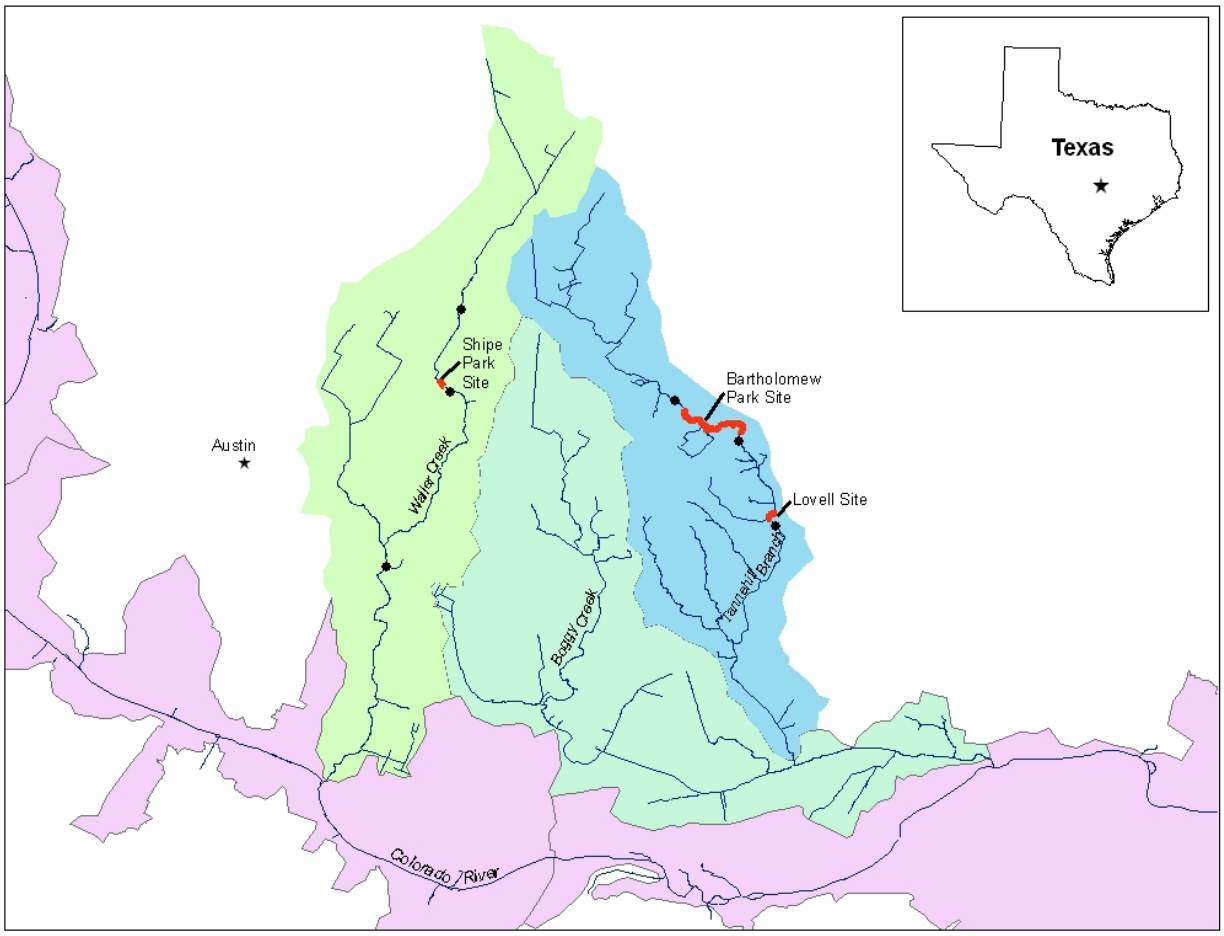


Figure 1. Location of restoration study sites and City of Austin water quality study sites (represented by ●).

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*b)*

Figure 2. Tannehill Branch Creek at Bartholomew Park a) before restoration in 2003 (M. Rotar) and b) after restoration in 2007.

*a)*

*b)*

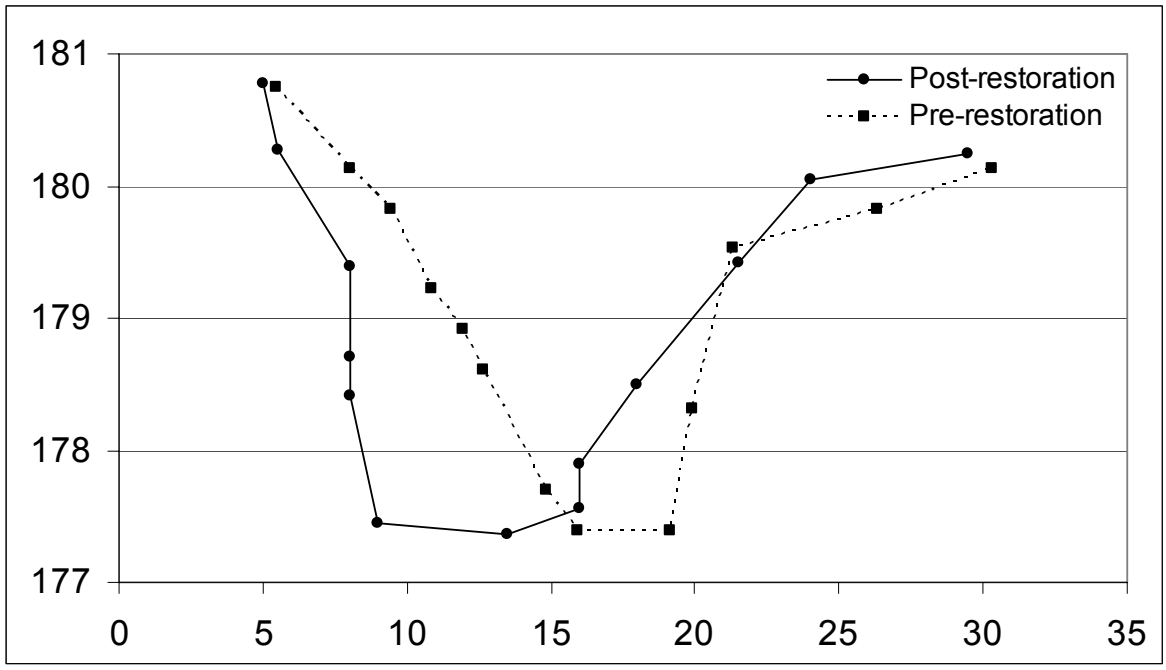
Figure 3. Tannehill Branch Creek at Lovell Drive a) before restoration and b) after restoration, both from 2005 (City of Austin, 2001b).

*a)*

*b)*

Figure 4. Waller Creek at Shipe Park a) before restoration in 1997 (City of Austin, 2001b) and b) after restoration in 2007.

*a)*

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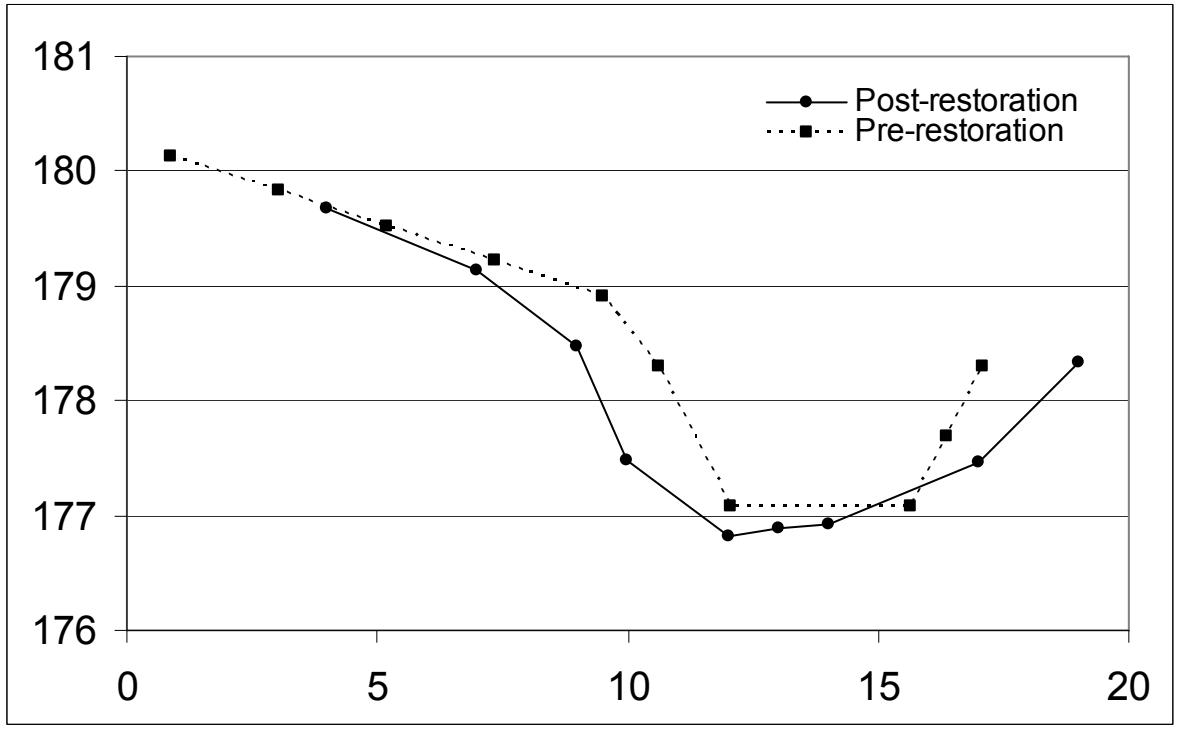


Figure 5. Channel cross-sections from a) Bartholomew Park Pool 1, and b) Bartholomew Park Riffle 1.