

Townwood Park Green Stormwater Infrastructure (GSI)

Final Report



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Abbreviations

GBEP	Galveston Bay Estuary Program
GSI	Green Stormwater Infrastructure
HPARD	Houston Parks and Recreation Department
NRM	Natural Resources Management Division
TCEQ	Texas Commission on Environmental Quality

Executive Summary

The Townwood Park Green Stormwater Infrastructure project focused on the creation of a large bioretention feature in Townwood Park, a park located in southwest Houston that is managed by the Houston Parks and Recreation Department's Natural Resources Management Division. The project included the removal an existing concrete swale in the middle of the large southern parking lot, burial of electrical lines, creation of a linear swale, and planting of native plants. A large interpretive sign was installed at one end of the swale to provide information on the feature to park users.

Introduction

The Houston Parks and Recreation Department's (HPARD) Natural Resources Management Division (NRM) is tasked with managing over 17,000 acres of natural habitat, water features, and wildlife within city parks. While habitat restoration projects throughout the city are numerous, only small numbers of green stormwater infrastructure features are present across the park system. With an increase in occurrence of extreme flooding events, poor water quality in Houston's waterways, and urban heat island impacts from increasing impervious cover, NRM is seeking to create green stormwater infrastructure (GSI) projects in parks across the city. Additionally, NRM created the Riparian Restoration Initiative that targets parks adjacent to bayous and tributaries for the revitalization of forested riparian buffers. NRM sought a park location with a large existing parking lot adjacent to a bayou, where the Riparian Restoration Initiative could be implemented concurrently, having an immediate impact on the adjacent waterway.

The bioretention feature was created in an existing parking lot and originated as a concrete swale. HPARD contracted the existing concrete to be removed, electric lines to be buried deeper into the ground, and a contractor to create a bioswale. All plants used in the project are native to Houston, and most were grown in HPARD's greenhouse from seed that is hand collected by Natural Resources staff. This GSI feature meets the Resilient Houston goal of creating 100 GSI features by 2030.

Project Significance and Background

Townwood Park GSI is the largest bioswale that has been created in a city of Houston park. This project has directly impacted the water quality of Sims Bayou and ultimately Galveston Bay, while the native plants used within the swale have provided habitat for native wildlife. Replacement of the concrete with a green feature has also helped to cool the large parking lot within the park.

The methods used at Townwood Park will inform NRM about best management practices that will be used in future GSI projects. The overall project will help the

department reach a broader goal to increase GSI within parks to mitigate flooding, improve water quality, reduce heat, and create wildlife habitat.

Methods

Engineering and Design

The city did not require formal engineering and design for this project. The existing concrete swale was already graded to move water from the parking lot into the swale and into a grate that flows directly into Sims Bayou. Existing electric lines were found to be at a shallow depth of 18 inches, which would not support the creation of a swale. NRM contracted removal of the existing concrete and had the existing electrical lines buried to a depth of 48 inches.

Design efforts included discussions between NRM and the bioswale construction contractor on depth, widths, planting locations, media layers, and placement of rocks. NRM created the informal design of the bioswale (Appendix A).

Construction

The initial concrete removal, burial of electrical lines, and removal of existing soil was conducted by HPARD's electrical contractor. A GSI contractor installed a 210-foot vegetated swale in addition to a 26.5-foot bioswale, resulting in a 236.5 foot by 8-foot feature. Before, during, and after construction photos can be found in Appendix B. The vegetated swale consists of soil, filter fabric, rocks, mulch and native plants. The bioswale consists of an outer six-inch-deep river rock border with a 4:1 slope that covers two feet on each side of the bioswale. The middle three feet of the feature consists of the following, for a total depth of two feet:

- zero to 3-inch depth: mulch and vegetation.
- 3- to 15-inch depth: High flow media.
- 15- to 21-inch depth: bridging stone and underdrain (underdrain XD RTank). The underdrain tank was installed within the bridging stone layer. A FP100 open mesh geotextile layer was installed surrounding the underdrain tank. The underdrain tank has a minimum of 19 square inches of orifice opening per square foot.
- 21- to 24-inch depth: stone base.

The contractor used containment geotextile to line the bottom and sides of the bioswale with a 6-inch diameter observation and maintenance port with inspection port cap. Additionally, a storm sewer connection was created from the bioswale overflow.

An additional contractor was hired to install a curb around the swale with curb cuts for water inflow.

HPARD added enriched topsoil with compost, fineless¹ hardwood mulch, and planted 249 native plants (Appendix C, Table 2). A total of 179 plants came from HPARD's greenhouse where the seed was hand collected from remnant prairies around Houston and grown.

Education and Signage

HPARD subcontracted the design and fabrication of one interpretive sign that discusses the benefits of bioswales on water quality, urban heat, and wildlife (Appendix D).

Results and Observations

The project resulted in the replacement of a concrete swale with a GSI feature that contains 249 native plants, and installation of one interpretive sign. These accomplishments result in a more resilient and educational park.

Table 1. Summary of Project Costs.

Summary of Project Costs	GBEP (Cash)	In-kind and Other Sources
Task 2: Contractual Services		
Construction	\$19,696.50 electrical and concrete removal contractor \$48,596.36 bioswale Contractor \$7,393.00 curb contractor	
Native Species Planting	\$2,008.16 native plants, soil, mulch	\$1,790 in native plants grown by HPARD HPARD staff manually weed and water the bioswale
Interpretive Signage	\$1,175.00 sign design \$1,130.98 sign printing	HPARD staff created the content and wrote the text for the signs.
Total Project Cost	\$80,000	\$1,790

¹ Fine particles are removed from hardwood mulch to make it “fineless.” Fineless hardwood mulch helps prevent clogs in the bioswale system.

Lessons Learned

The presence of the shallow electrical lines was an unforeseen problem discovered after the concrete removal took place. In the future, electrical work will be considered in the project timeline and budget if features such as light poles are located in the project area. The compacted soil underneath the concrete was also difficult to work with and required the placement of additional topsoil with compost to support plants. Additionally, existing soil beneath concrete should be removed by the contractor and replaced with healthy topsoil.

Appendix A. Informal Design of Townwood Bioswale.

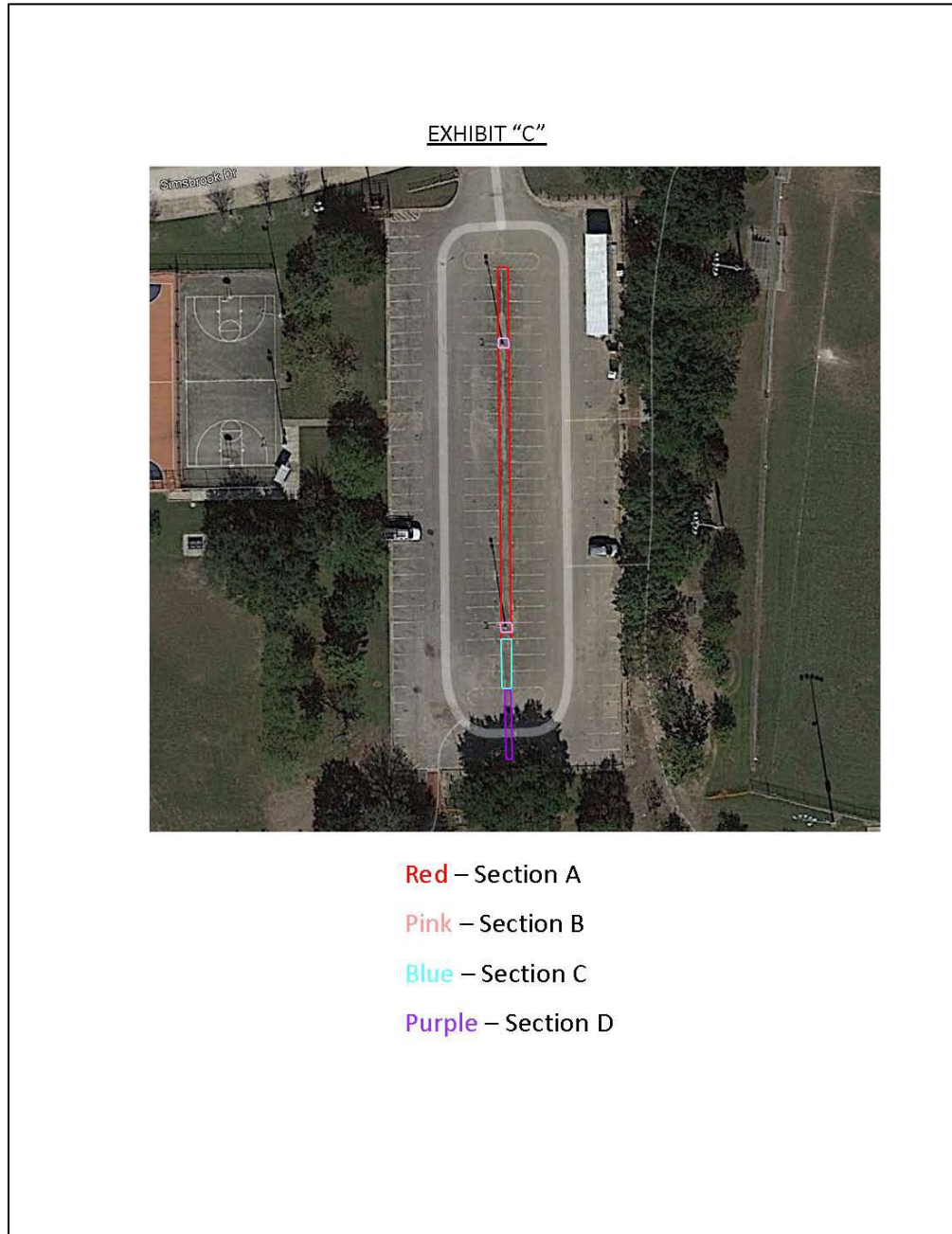


Figure 1. Informal design of Townwood Park GSI project.

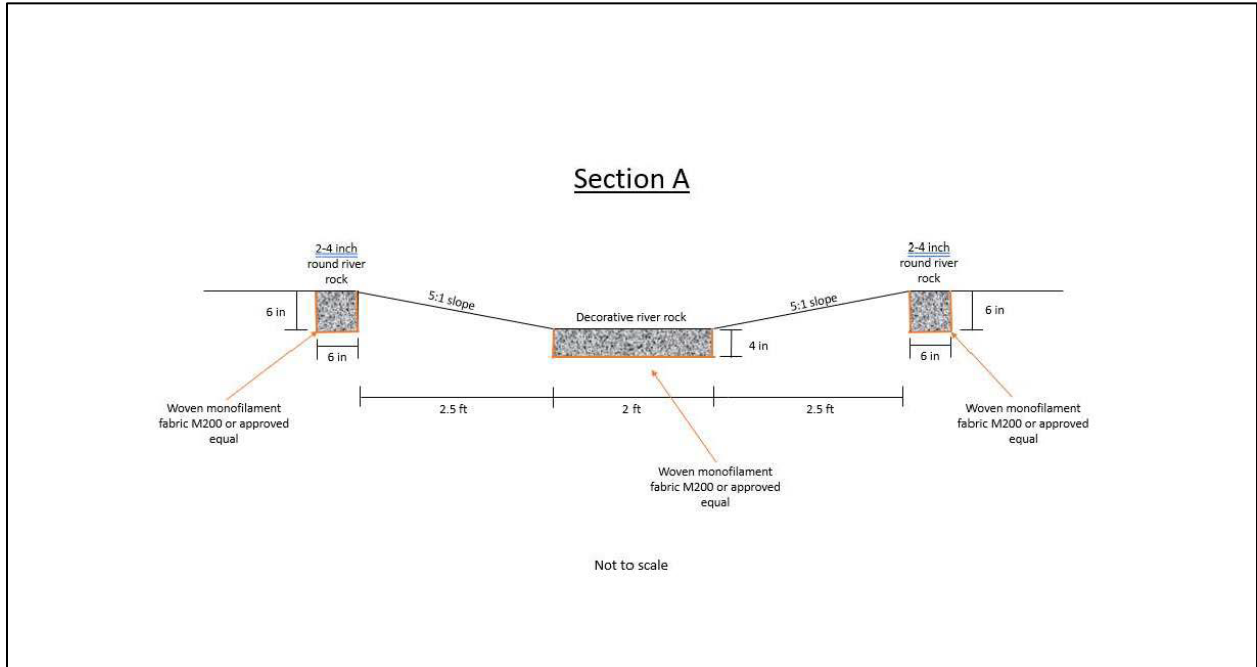


Figure 2. Cross-section design for Section A of the Townwood Park GSI project.

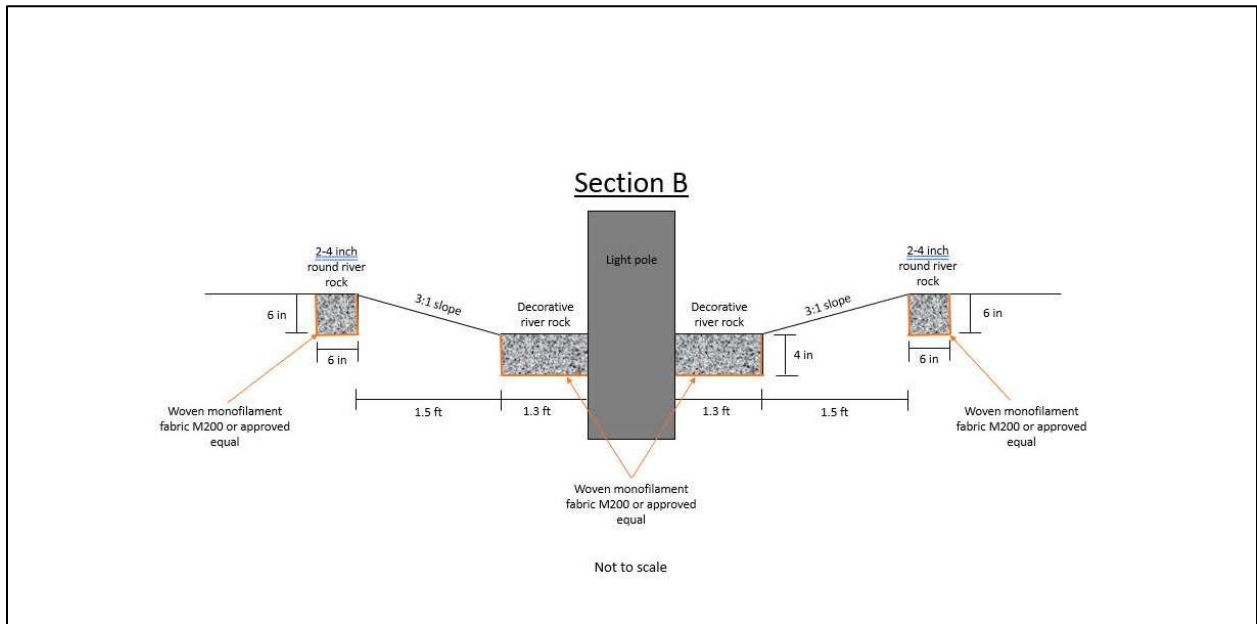


Figure 3. Cross-section design for Section B of the Townwood Park GSI project.

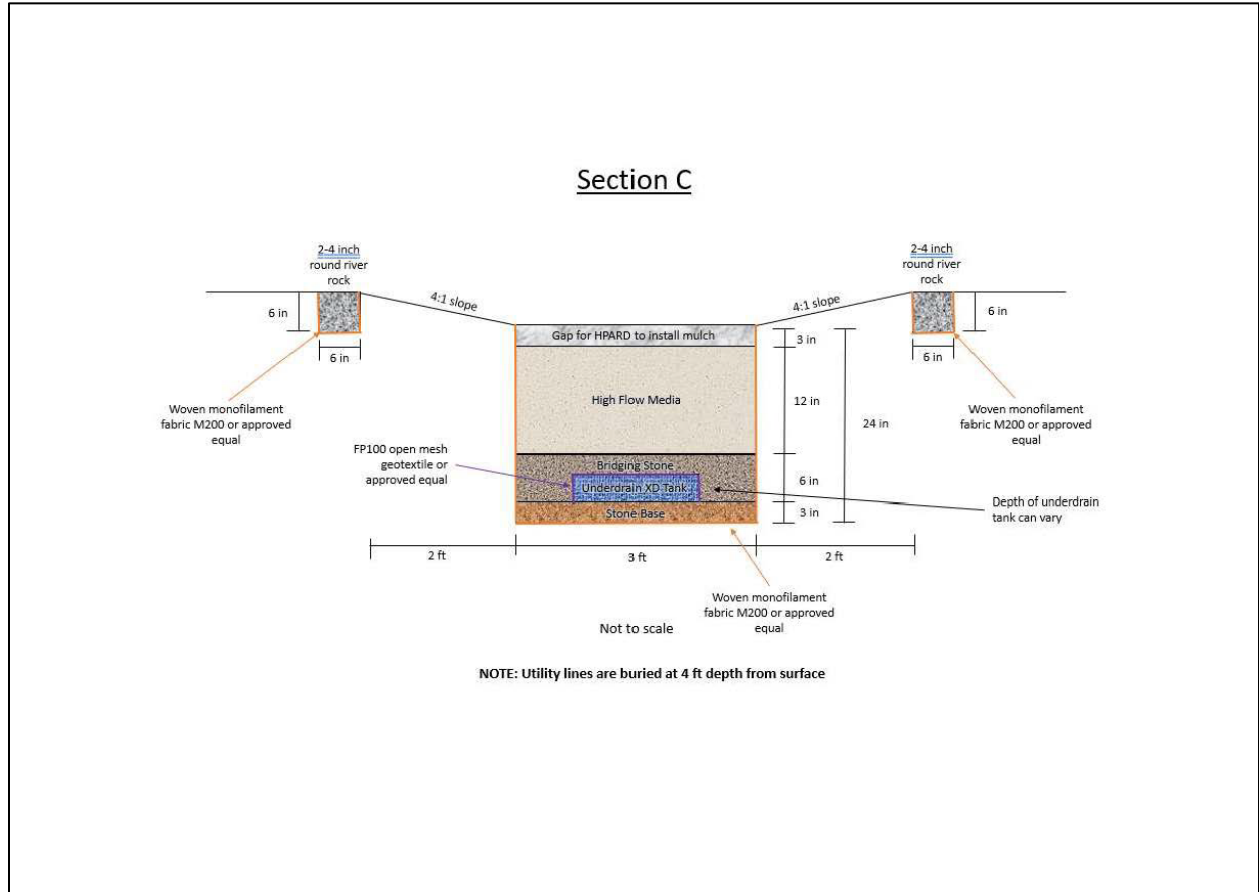


Figure 4. Cross-section design for Section C of the Townwood Park GSI project.

Appendix B. Photos of Project Implementation



Figure 5. Image of Townwood Park concrete swale prior to construction.



Figure 6. Townwood Bioswale during construction.



Figure 7. Townwood Bioswale after construction.

Appendix C. List of Plants Planted in Townwood Bioswale

Table 2. List of native plants installed in Townwood Bioswale.

Species	Size	Number
Texas lantana	4-inch	8
Frogfruit	4-inch	26
Winecup	1-gallon	46
Liatis acidota	1-gallon	34
Red lovegrass	1-gallon	28
Purple lovegrass	1-gallon	27
Little bluestem	1-gallon	20
Longspike tridens	1-gallon	30
Lyreleaf sage	1-gallon	10
Texas coneflower	1-gallon	20
Yellow Indian grass	1-gallon	10

Appendix D. Interpretive Sign

Using Nature to Clean Water

Bioswales are special features that capture and transport rainwater. As water passes through a bioswale, it is filtered and cleaned before entering our bayous. Bioswales also cool surrounding areas and provide habitat for wildlife!

When rain falls in this parking lot, it becomes polluted with oil, grease, trash, and other contaminants

River stones slow down the flow of water

Water filters through the soil while microorganisms on the plant roots remove even more pollutants

Native plants remove pollutants from the water

Water collects in an underground pipe and enters the bayou

The plants in this bioswale are native to the Houston area! This means that these plants have special relationships with our local wildlife and provide critical habitat in this urban setting.

Monarch butterflies drink nectar from native wildflowers.

Native bees like this northern carpenter bee gather pollen from flowers to feed their young.

Savannah sparrows eat the seeds of our native grass species.

Did You Know?
Green Stormwater Infrastructure uses natural systems to manage stormwater, and includes bioswales, rain gardens, and constructed wetlands.

Houston Parks and Recreation Department
Natural Resources Division

HPARD
HOUSTON PARKS AND RECREATION
A DUTCH COMPANY

Figure 8. Interpretive signage design for Townwood Bioswale.



Figure 9. Interpretive signage installed within Townwood Bioswale.