

# **Stormwater Implementation for the Dickinson Bayou Watershed**

## **Final Report**

January 2012

### **Executive Summary**

Working with local partners, the Texas Coastal Watershed Program staff were able to install two demonstration stormwater management practices in the Dickinson Bayou Watershed, a treatment wetland and a rain garden. The Dickinson Bayou Watershed Protection plan identifies stormwater wetlands as one of the top three mechanisms for improving water quality in Dickinson Bayou. It also identifies rain gardens and other low impact development best management practices as a key to success in the watershed. Work was also educate the community on rain gardens and the important role they can play in improving water quality in the Bayou.

### **Background and Objectives**

Dickinson Bayou is impaired for both low levels of dissolved oxygen and high levels of bacteria and the rapid development in this watershed makes it especially susceptible to continued degradation. However, the watershed community has come together and created a Watershed Protection Plan (WPP) in hopes of improving water quality.

As part of this project to begin implementation of the WPP we installed a stormwater wetland in an existing 11 acre detention basin at the Clear Creek Independent School District's (CCISD) Education Village as a demonstration project. This required re-designing and excavating the bottom of the pond and using volunteer labor to plant the site with native wetland vegetation.

We also install a 1,000 rain garden at the City of Dickinson Public Library which will serve as a demonstration site in the watershed. This is an example of what a stormwater best management practice can look like and how it can be incorporated into a commercial site. We also worked to educate the public about rain gardens before, during and after the project though a variety of methods.

## **Grant Activities – Accomplishments and Shortfalls**

### **Grant Activity 1 – *Wetland Engineering and Design***

TCWP completed a competitive request for qualifications process and hired S&B Infrastructure to compete the design and engineering documents to retrofit the CCISD detention basin and create a stormwater wetland. TCWP staff worked with S&B Infrastructure staff to complete a conceptual design for the wetland and then met with representatives from CCISD and League City. The designs were re-worked based on input from these partners and new information about the outfall structure.

Design plans were finalized in September 2011 and on the ground construction began in October. CCISD staff arranged for the pond to be pumped dry and kept dry during construction. City of League City staff spent 10 days implementing the engineering design to re-contour the detention basin. Out of pocket cost for pumping and contouring work would have been about \$45,000, but was provided for free by these partners. Once construction was completed TCWP staff and volunteers installed native wetland plants (see Grant Activity 2 for full details).

Survey work coordinated by S&B indicated some discrepancies between the original detention pond plans and the existing conditions on-site. Because of this, CCISD will install a backflow preventer on the existing outfall to prevent water from Gum Bayou from backing up into the detention basin. This change was taken into account in our wetland plans. The new backflow preventer will still allow the pond to hold water to support wetland vegetation but will prevent tidal surges that may reduce capacity within the pond.

One of the unexpectedly difficult aspects of this task was working with the existing outfall structure in the detention pond. Engineering and construction work to redesign the outfall would have cost an additional \$50,000 or more. This pond has a concrete weir and stand pipe that allows the pond to draw down slowly over 24-48 hours. A portion of the pond now pools below the elevation of the stand pipe, allowing permanent standing water. Also, CCISD wanted to maintain the existing concrete pilot channels in the basin, so we were required to work around these which was not difficult but did require special consideration during the design phase.



Detention basin after the water was pumped out to prepare for construction



The existing weir and stand pipe were re-used to allow treated water to slowly drain down after a rain



Survey stakes to direct the City of League City crew during construction



Construction and survey crews from the City of League City working on site



League City crew re-contouring the site



Wildlife utilizing the site during construction



Beginning construction



During construction



Post construction, before planting



Outfall during construction



Deeper portions of the wetland, post construction

## **Grant Activity 2 – Wetland Planting**

TCWP staff worked with volunteers from the Texas Master Naturalist's and the community to install over 7,300 plants and 5 lbs of native plant seed at the wetland site.

The wetland was planted with: *Eleocharis montana* (spikerush), *E. montevidensis* (sand spikerush), *E. quadrangulata* (square-stem spikerush), *Iris virginica* (southern blue flag), *Leersia hexandra* (southern cutgrass), *Nymphaea odorata* (white waterlily), *Pontederia cordata* (pickrelweed), *Sagittaria platyphylla* (delta arrowhead), *Scirpus pungens* (American bulrush), *Spartina patens* (marsh hay cordgrass), *Thalia dealbata* (thalia)

The slopes of the detention basin were seeded with two seed mixes from Native American Seed that include: *Tripsacum dactyloides* (gamma grass), *Andropogon gerardii* (big bluestem), *Chamaecrista fasciculata* (partridge pea), *Coreopsis tinctoria* (plain coreopsis), *Cyperus virens* (green flat sedge), *Dalea candida* var. *candida* (white prairie clover), *D. purpurea* var. *purpurea* (purple prairie clover), *Elymus canadensis* (prairie wildrye), *Gaillardia pulchella* (Indian blanket), *Leptochloa dubia* (green sprangletop), *Liatris mucronata* (gayfeather), *Lindheimeri texana* (Texas yellow star), *Lupinus texensis* (Texas bluebonnet), *Monarda citridora* (lemon mint), *Panicum virgatum* (switchgrass), *Secale cereale* (cereal rye grain), *Trident albescens* (white tridens)

Volunteers donated over 80 hours of work to this project.



TCWP staff and a master naturalist volunteer planting the first wetland plant



CCISD student and parent volunteers planting wetland vegetation



Master Naturalist volunteers planting wetland vegetation



CCISD student and parent volunteers planting wetland vegetation



Waterlilies on the north side of the wetland



Waterlilies on the south side of the wetland



*Spartina patens* (marsh hay cordgrass) in the higher portion of the wetland that will be sporadically inundated depending on rainfall.

### **Grant Activity 3 – *Outreach with local school(s) and Master Naturalist Volunteers***

Volunteers donated over 80 hours of work to plant this wetland. Teachers at the CCISD Education Village were contacted to participate in wetland planting but only a couple were interested in participating. This is partly due to the High School currently only having grades 10 & 11 and thus few advanced placement classes and no science club, two typical venues for bringing student volunteers into a wetland. Interested teachers were added to the project email list but a short planting period that overlapped with school holidays (October to December) made student involvement difficult. However, some CCISD volunteers did come out to plant in December and CCISD science coordinators are still encouraging teachers to use the site in their lesson plans.

#### **Grant Activity 4 - *Rain garden installation***

TCWP staff worked with City of Dickinson Staff, Asakura-Robinson staff and volunteers to install a 1,000 square foot rain garden. TCWP staff and ARC staff designed the rain garden and created a concept plan. City of Dickinson staff completed the construction phase of the garden including: digging the garden and hauling extra soil off site, installing the rock layer, landscape cloth and soil. Volunteers from the Galveston County Master Gardeners, Galveston County Master Naturalists, Keep Dickinson Beautiful, and the Girl Scouts planted and mulched the garden. Finally, Keep Dickinson Beautiful provided funding to install a drip irrigation system in the garden. This irrigation proved invaluable as 2011 was one of the worst drought years on history in Texas. The drip irrigation system was programmed to run at night three days each week and kept the plants alive and healthy until rain resumed in the fall.



Rain Garden Planned and Sketched Out.



Excavating the Garden Site.



Spreading the Base Rock Layer.



Pre-planting- filled with mix of composed humus, top soil, and sharp sand.



Volunteers and Staff Placing Plants According to Plan.



Charriss York and Chris LaChance Instructing the Group.



Girl Scouts Planting.



Master Gardeners Hard at Work.



Volunteers Planting.



Volunteers Mulching the Garden.



Finished Garden.



: Group Shot of all Volunteers and Staff Behind Finished Garden.

### **Grant Activity 5 – Rain garden Media Campaign**

TCWP worked with project partners to hold a ribbon cutting ceremony for the garden on Saturday, September 24. City official, volunteers, library staff, friends of the library, TCEQ, GBEP, EPA and Extension officials were invited. ## people attended the ceremony. The Galveston County Daily News, a local newspaper with a readership over 25,000, ran a front page article with two photos about the rain garden the day before the dedication ceremony.

TCWP staff also created a photo slide show of the rain garden installation process that is available here: [www.dickinsonbayou.org/raingarden](http://www.dickinsonbayou.org/raingarden).

Finally, two interpretative displays about the garden were installed at the project site, one inside and one outside. The outdoor sign features a diagram explaining how the garden is designed and how a rain garden works. It also includes a smart phone quick response bar code that interested parties can scan with their I-phone or Android phone that will take them to the above listed webpage to find more information about the rain garden project. The inside permanent display was installed between two library windows overlooking the garden. This display includes a copy of the outdoor sign as well as a series of photographs explaining the installation process and a photo thanking all of the volunteers involved with the project.



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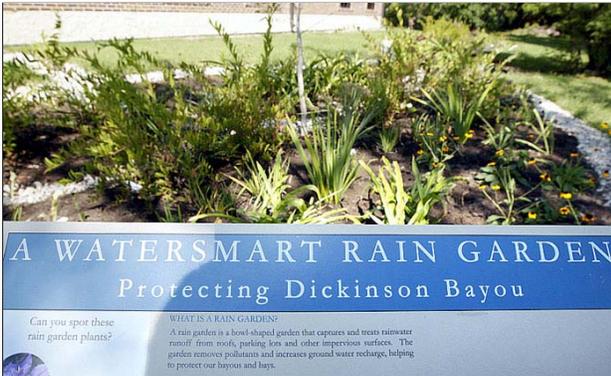
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Can you spot these rain garden plants?

#### WHAT IS A RAIN GARDEN?

A rain garden is a low-shaped garden that captures and treats rainwater runoff from roofs, parking lots and other impervious surfaces. The garden removes pollutants and increases ground water recharge, helping to protect our bayous and bays.

Photo by Kevin M. Cox - See More Photos

A new watersmart rain garden at the Dickinson Public Library will be officially unveiled to the public Saturday. The 1,000-square-foot garden will collect rainwater, clean and filter it before it flows into Dickinson Bayou.

## New garden designed to filter runoff

By **Christopher Smith Gonzalez**

The Daily News

Published September 23, 2011

DICKINSON — On Saturday, the city of Dickinson will unveil a new garden at the public library that is more than just pretty flowers. The new, 1,000-foot garden is a what's known as a rain garden.

The garden next to the library, 4411 State Highway 3, will take rain water that comes down off the roof then clean and filter it before it flows into Dickinson Bayou, said Charriss York, Texas AgriLife Extension Service program specialist.

"It's a flower garden that's meant to look attractive," York said, but it also plays an important role in cleaning water in the 100-square-mile Dickinson Bayou watershed.

Dickinson Bayou has higher levels of bacteria than the state allows. York has been working with area residents to develop a plan to lower those levels, and the rain garden is part of the solution.

Unlike a typical garden with a raised bed, the rain garden starts 3 feet under ground where a layer of gravel is put down. After that, a layer of weaved cloth is followed by blend of top soil, compost and sand that allows water to percolate more easily than the normal clay soil found in the area, York said.

At the top is a layer of mulch and native plants, such as dwarf palmettos and giant rudbeckias. Four small gravel pathways will then lead water from the library's downspouts to the rain garden.

Microbes found naturally in the soil will breakdown the pollutants in the water. The process of a rain garden are similar to those in wetlands only on a smaller scale. Rainwater will flow through the garden in about 24 hours, York said.

"This garden looks nice, but it also has a function," York said.

She said data has shown rain gardens can reduce bacteria and levels of nitrogen

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and phosphorus.

A water filtration system doesn't necessarily bring to mind beautiful plants and grasses, Dickinson Mayor Julie Masters said. But the garden does bring the ideas of conservation and landscaping together. She said she hoped residents would consider planting their own garden.

"This rain garden not only slows and filters storm water runoff, its aesthetic charm adds to the scenic appeal of the library's landscape," Masters said.

Funding for the project came from grants provided by the Texas Commission on Environmental Quality and the Galveston Bay Estuary Program. The city of Dickinson also helped by providing equipment and workers to help with the garden, York said.

York said she hoped this garden could lead to the creation of similar ones across the county. The Texas Commission on Environmental Quality has consistently found higher than acceptable levels of bacteria in the bayou. York said the causes of bacteria contamination came from a number of sources but cleaning rainwater would help.

"We could easily be putting these in at businesses, municipal buildings and places all over the watershed," York said. The extension service has a workshop planned for the near future to teach homeowners how to make their own rain garden.

In the mean time, the garden in Dickinson is an example from which people can walk through and learn.

"This is only one garden, but a hundred of them would make a huge difference," York said.

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At A Glance

WHAT: Rain Garden ribbon cutting

WHEN: 11:30 a.m. Saturday

WHERE: Dickinson Public Library, 4411 state Highway 3, Dickinson

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Rain garden information display inside the Dickinson Public Library, the garden is just outside the windows in the photo.



Indoor rain garden display at the Dickinson Public Library



Interpretative sign at the rain garden.



Rain garden ribbon cutting ceremony with TCWP staff, library staff, Mayor Masters and volunteers

### **Recommendations for Further Study**

TCWP staff are working with a professor at TAMU to begin collecting water quality and flow data for the stormwater wetland. An automated sampler has been located and arrangements are underway to obtain a flow meter. Additional resources still need to be secured to measure additional resources such as E. coli, but initial monitoring should begin in the Spring of 2012.

TCWP staff and partners from the Texas AgriLife Extension Service in Dallas have obtained grant funding to monitor several post-construction stormwater best management practices in the Houston-Galveston region and the rain garden installed through this project is on the list of possible sites for water quality monitoring.