Lower Rio Grande Valley Low Impact Development Outreach, Education and Demonstration Program

GLO Contract 16-070-000-9114

Final Report

Project Team

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Executive Summary

In this project, Texas A&M University Kingsville (TAMUK) collaborated with Cameron County and the University of Texas Rio Grande Valley (UTRGV) and local stakeholders to design and construct a bioretention system at the La Esquina subdivision in Cameron County. The objective of the bioretention system implementation was to manage and improve NPS flows, help mitigate flooding and drainage issues, and address NPS pollution water quality concerns; this volume of runoff reduction would also remove pollutants from stormwater runoff and enhance the quality of water in and around the selected colonia.

Two separate bioretention cells were designed (Ambiotec Civil Engineering Group, Texas) and constructed in January 2018 at the La Esquina Subdivision on the east entrance to the colonia, approximately 1,050 feet (0.2 miles) south from the intersection of La Esquina Circle and San Jose Road in Los Fresnos, Cameron County, Texas. Education and outreach was provided to community leaders and the general public. A training course was held to educate colonia residents on post-construction maintenance of the bioretention system. Four community workshops were held to demonstrate LID technology and practices to stakeholders outside of the selected colonia.

Following construction, TAMUK collected data at another regional bioretention installation and calibrated a WinSLAMM runoff model for this exact site in order to reliably predict unit performance in runoff flow reduction. More data collection is planned for sampling and monitoring to confirm the effectiveness of the bioretention system through the TCEQ CWA 319 program in 2019.

Task 1: Planning and Design

UTRGV assisted TAMUK in planning several workshops to engage local stakeholders and provide project information and technical guidance. The Planning and Design Activities for this project were conducted in two sections: engineering design and community input (described in detail in the Outreach and Education section). The first activity involved the participation of:

- TAMUK: Project leader, and technical advisor
- UTRGV: subcontractor, county liaison and technical advisors.
- Cameron County: Subcontractor and Surveying services.
- Millenium Engineers: Geotechnical consultants and
- Ambiotec Inc: Civil design team.

UTRGV, Cameron County and TAMUK coordinated a geotechnical study to test infiltration capacity of natural soils at the site. For the study, it was found that the project location soil characteristics are:

- Stratum I (0-2ft depth) is composed of fat clay and has a high potential to exhibit volumetric changes (contraction and expansion).

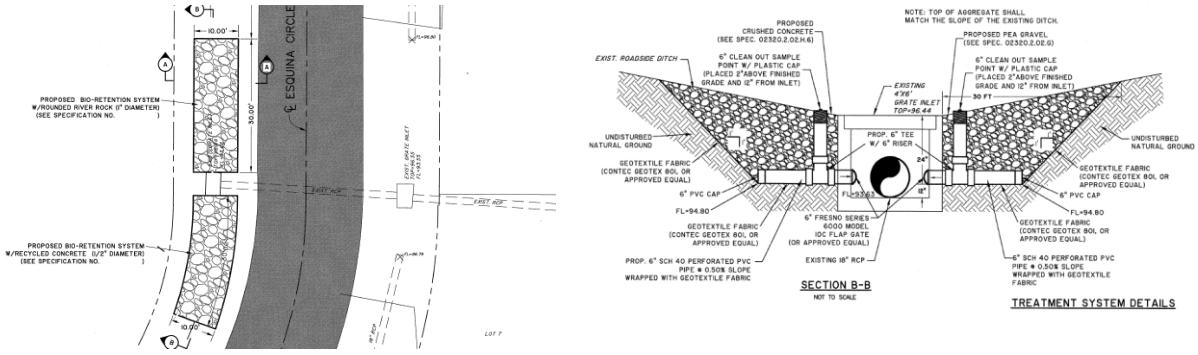
- Stratum II (2-4ft depth) is composed of lean clay and has a moderate potential to exhibit volumetric changes.
- Stratum III (4+ ft depth) is composed of fat clay and has a high potential to exhibit volumetric changes. The potential for soil volumetric changes is dependent on variations in moisture contents of the underlying soils.

Using the soil characterization and the survey conducted by Cameron County Transportation Department, the County hired Ambiotec Inc. to develop the engineering design of the bioretention system. Table 1 is a listing of the planning and design meetings conducted for the project.

Table 1. Summary of planning and design meetings for the La Esquina project

Date	Participants	Topics discussed
11/08/2016	UTRGV TAMUK Cameron County Ambiotec Inc.	Scope of the CMP grant Scope of the project Green Infrastructure Bioretation rationale
11/22/2016	UTRGV TAMUK Cameron County Ambiotec Inc.	Local materials availability and vendors Outreach elements of the project Design Precipitation Graduate student involvement
01/11/2017	UTRGV TAMUK Cameron County Ambiotec Inc.	Greenspace, lighting, picnic table Location of monitoring equipment Ambiotec will develop the as-builts once construction is done. Two treatment cells, different media Signage
02/22/2017	TAMUK Cameron County Ambiotec Inc.	Geotech testing on aggregates Vendors First design draft review
04/06/2018	UTRGV TAMUK Cameron County Ambiotec Inc.	Final design Review of engineering drawings.

The final bioretetion system included two treatment cells with locally sourced river rock and recycled concrete. Both cells were connected to a concrete storm grate with perforated underdrains. This storm grate outfalls to a nearby drainage ditch, which has still been known to flood downstream. See Figure 1.



A B

Figure 1. Plan view of two treatment cells (A); cross-section view of bio retention cells.

Task 2: Planning and Design

TAMUK developed a contract with Cameron County to construct the bioretention system at La Esquina Colonias site. Before construction, several field site visits were conducted by the project stakeholders to discuss and decide the optimum location for the bioretention cell (Figure 2). In December 2017, the construction started based on a design developed by Ambiotec Inc. and approved by the project stakeholders. Figure 3 shows the bioretention cell after construction that was completed by January 2018. The GLO shipped a permanent CMP signage to Cameron County, which TAMUK will be installed at the project site upon arrival.

Figure 2. View of the bioretention cell areas before construction.


Figure 3. View of the La Esquina Colonia bioretention cells after construction.

Task 3: Monitoring:

A monitoring plan was also developed as a cooperative effort between UTRGV and TAMUK. A Quality Assurance Project Plan (QAPP) was developed which described the monitoring plan, to conduct sampling at the site and analyses to determine the effectiveness of the bioretention system. Due to regional flooding upstream of the LID structure which created weather-related saturated local conditions in July 2018, the project team was unable to install the monitoring equipment as planned but will install some flow meters, after the location dries out. More monitoring will be conducted in late 2018 and 2019 under a new TCEQ CWA 319 Non-point source grant as part of the Arroyo Colorado Watershed Protection Plan.

Even with the weather related delays, progress was made to predict the hydrologic performance of the two bioretention systems; a WinSLAMM calibrated model was used based on performance flow and sampling data used from another bioretention demonstration site with similar soil types at South Texas College (STC) in McAllen. The model was calibrated (Figure 4) using field data that was collected over the monitoring period of 13 months (from March 2016 to March 2017), 45 storm events were observed. The STC calibrated model parameters and rainfall data were uploaded to the WinSLAMM model along with the design parameters for La Esquina colonias two cells, with both recycled concrete, and river rock media. The outflow results were plotted at different rainfall depth for both cells before and after calibration (Figure 5).

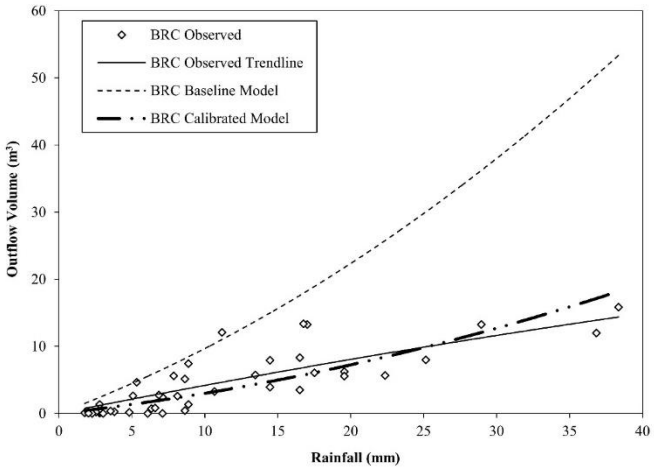


Figure 4. Showing Outflow Volume for STC Bioretention Cell (BRC) (m^3) at different rainfall depths (mm) with trend lines for observed, baseline model without calibration and for calibrated model.

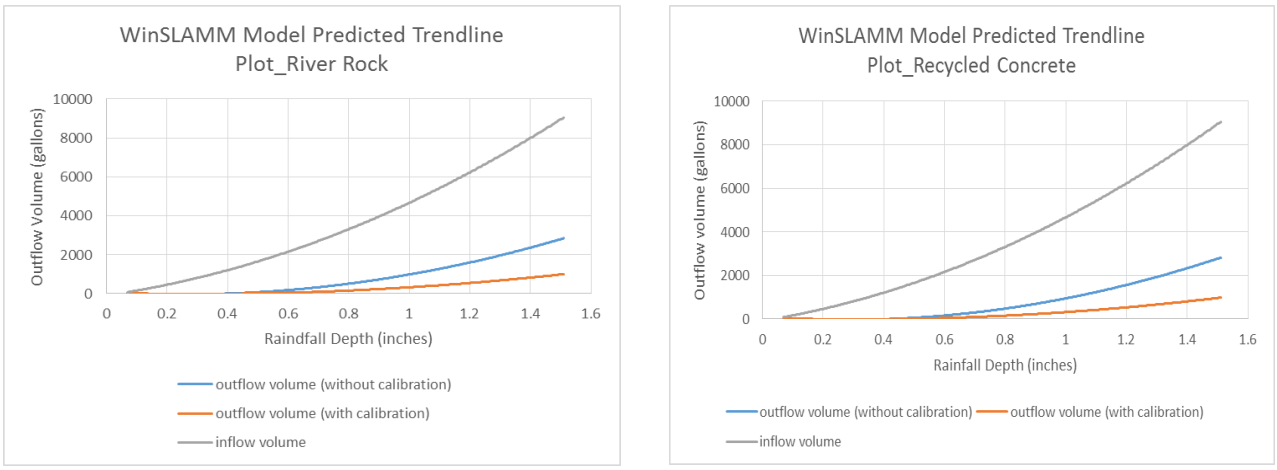


Figure 5. WinSLAMM model predicted results for both bioretention cells at La Esquina.

It is clear from the calibrated model outputs in Figure 5 that both media can significantly reduce the runoff volumes and potential nutrient pollution by as much as 80% in some cases. These results will be incorporated in more outreach events and publications and factsheets developed from the project.

Task 4: Education and Outreach

Education and outreach through this LID project demonstration was provided to community leaders and the general public in several workshops and meetings. A training course was also held to educate colonia residents on post-construction maintenance of the bioretention system. Four community workshops were held to demonstrate LID technology and practices to stakeholders outside of the selected colonia. The community input part of the planning process and the educational activities were conducted by

- TAMUK: Project leader, and technical advisor

- UTRGV: subcontractor, county liaison and technical advisors.
- [bc]Workshop: Landscape design and Outreach
- LUPE: Community liaison and engagement

A summary of all the workshops conducted with the community are detailed in Table 2 below.

Table 2. Listing of the community workshops, dates and activities at the La Esquina subdivision.

Date	Topics/Activities	No. Participants
07/19/2016	- Introduction to non-point source pollution, stormwater runoff and low impact development. - Brief survey about the community's preferences about vegetation and amenities around the bio retention system. - Q&A from the community	15
05/15/2018	- Review of LID conceptsDescription and explanation of the designed bio retention systems. - Expected benefits of the bioretention cells. - Q&A from the community	14
06/14/2018	- Presentation of a draft site plan. - Presentation of suitable native vegetation for determination - Exercise with the community to select the plant species for the bio retention plan. - Q&A from the community	14
07/10/2018	- Presentation of final draft of site plan. - Operation and maintenance presentation. - Water quality monitoring activities.	14

From the first workshop, community residents appeared to favor the use of picnic tables (for community gardening) and tall trees (shading) in and around the BMP with the idea of turning the bioretention system into a type of pocket park. Below are the full results of the amenities survey from the La Esquina residents (Table 3).

Table 3. BMP amenities Survey at La Esquina subdivision.

Survey #	Tables	Benches	Trees	Flowers	Other
1	4	2	5	3	
2	3	4	1	2	
3	2		1		
4	2	4	1	3	
5	2				
6	1				
7	2				
8	1		2		
9	1	3	2		
10	3	4	1	2	
11	1	3	2	4	5
12	1	2	4	3	

An Operation and Maintenance factsheet/manual for the bioretention system was developed and distributed to the participants. During the last workshop the manual was reviewed and explained to the attendees. The manual covers the following concepts:

- O&M of structural components (over flow pipes and outlets, grate screens)
- Vegetation: dead or strained vegetation, weeds, water needs.
- Sediment build up and debris cleaning.
- Bioretention media including soil and gravels (clogging, erosion, etc).

Figure 2. Workshop flyer in Spanish and La Esquina residents participating in the survey.

In addition, an educational brochure was developed by bc Workshop for the communities to learn more about LID practices and different BMPs that have been implemented in the region and can potentially be implemented in their community.

Figure 6. Education LID brochure.