GRANT AGREEMENT #GR-0063-15

FINAL REPORT

Green Infrastructure for Stormwater Treatment in Benton County

Water Conservation, Reuse & Storage Grant Program

See the student produced film that documents the creation of the "OSU-Benton County Green Stormwater Infrastructure Facility (OSGIR), an Oregon BEST lab, a research facility designed to study the effectiveness of bioswales in regulating flow patterns and improving water quality"
https://media.oregonstate.edu/media/t/0_03knf8eg

Submitted: June 16th, 2015

COLLABORATING PARTNERS:

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Background

The 'OSU-Benton County Green Stormwater Infrastructure Research Facility, an Oregon BEST Lab' project is a collaborative project between Benton County, OSU, Oregon Water Resources Department, Northwest PAC TRANS, Oregon BEST, and City of Corvallis. Project goals include:

1. Investigate and demonstrate the feasibility of alternate stormwater treatment and collection systems based on their performance and costs.

2. Develop a long term, unique, research facility for field-scale experiments and testing on green infrastructure (e.g., raingardens, bioswales, etc.) to test various stormwater treatment technologies and treatment of various stormwater contaminants and mitigation of peak flows in urbanized environments.

3. Support public outreach and education of water resources quality and supply, utilizing an attractive research facility within a high public use area for diverse members of the public.

Project Activities Summary

Starting in December 2013, consistent work on the design of the facility was initiated. OSU researchers led by Dr. Meghna Babbar-Sebens, and graduate student Grant Livingston within the Biological and Ecological Engineering Department. Preliminary design concepts were presented to Benton County staff through May 2014. County staff also provided a range of consistent support including engineering review, AutoCAD design, surveying, materials and contracting support throughout the project. County staff worked with City of Corvallis to gain planning approval, with all construction occurring on Benton County owned property. After final schematic design was completed, Benton County led construction work began on June 16th, 2014 (see Figure 1).

Figure 1. Clearing and excavation of the site (6/17/14)

After initial dig out of project facility, several on-the-ground design updates occurred. These included minor alterations to facility wall height and individual research 'cell' widths to accommodate the final excavation footprint. In addition, depths and locations of pipe trenches were modified to accommodate the required slope. OSU and Benton County worked closely to update designs as needed throughout the project, to ensure that the facility would function effectively to complete all intended research and stormwater treatment. The next phase of excavation was constructing trenches for the underdrains that run within each treatment cell, followed by securing pressure treated wooden boards (1.5 ft. high x 10 ft.

long x 1.5 wide x 4 inches depth). Each cell is approximately 93 feet 4 inches long and 10.5 feet wide. The depth of each cell is 3 feet. The underdrain for each cell was laid in an 18 inch trench covered in drain rock with a bottom that is 4 feet from the top of the cell walls (see **Figure 2**). To examine performance of plants, soils, etc. without interference from surrounding water table, the cells are all self-contained by a 45 mil EPDM fish safe pond liner. Above this is a 6 oz geotextile material to protect the pond liner. In case of excessive inflow, there is an emergency overflow drain.

Figure 2. Piping for underdrain, valve control, overflow drain, and in-line weir is constructed and lining of cell walls and cell materials (rock, sand, soil) are layered

The research facility intercepts the flow from the existing piped stormwater infrastructure using an in-line underground storage tank. The captured water is automatically pumped (using a 1/3 HP cast iron Liberty 250 sump/effluent pump) from the storage tank into an above ground sediment bay. The stormwater flows out of the sediment bay through weirs into the three treatment cells that were constructed to be identical in size and dimensions. Water infiltrates through the cells into an underdrain pipe before exiting the system and returning to the existing piped stormwater infrastructure downstream of the storage tank (see **Figure 3**).

Figure 3. Cement sediment bay formed by county staff with final soil mix placed in cells

The 32 feet long, 4 feet wide, and 1.5 feet high concrete sediment bay was installed to discharge the flow from the underground pump, settle large particles, and measure flow into each cell. The sediment bay contains three 45°, 4 inch height V-notch weirs for use with the triangular weir equation for measuring flow. The V-notch weirs were installed with surveying assistance by Benton County at the same elevation for equal flow discharge into each cell (see **Figure 4**).

Figure 4, 5. Placement of underground storage tank within parking lot excavation, with coring of 2,000 gallon tank to collect stormwater from existing drain pipe for storage and pumping to the sediment bay

At the underdrain outflow side of each cell, there is a valve, stilling well, 6" Thel-Mar weir, and an overflow outlet. After passing through the weir, the stormwater runs through a pipe that then reconnects the outlet with the site's existing stormwater infrastructure to drain into the Mill Race.

Installation of monitoring equipment began in August, 2014 after final surface stabilization and creation of meandering rock channels within each cell. In addition, final weather monitoring and monitoring data logging equipment was mounted (see **Figure 7, 8**). Following the majority of monitoring equipment, 1,800 native plants were planted and irrigation lines secured within each cell (see **Figure 9)**. Each cell was planted according to the adopted landscape plan and contained specific types of native grasses and forbs (Cell 3), native grasses only (Cell 2), and no plants (Cell 1). Cell 3 was not planted, due to the use of the cell for testing synthetic storm water treatment technology.

Figure 7,8. Installation of in-ground and weather monitoring equipment, and data logging station including outdoor shed

Figure 9. Planting of City of Corvallis purchased native plants within Cell #3 and Cell #2 on September 8th, 2014

Continuous monitoring of these cells at the site is a critical part of the research facility. The monitoring enables research and help inform the benefits of this field-scale project to all stakeholders (see **Figure 10**). Some of the monitored environmental parameters and the instrumentation at the site are mentioned below.

Figure 10. Water sample collection during February 2015 storm event.

Continuously monitored water quality parameters within the stormwater facility included:

- Stormwater Inflow
- Pump Usage
- Stormwater Outflow
- Precipitation
- Wind Speed
- Wind Direction
- Solar Radiation
- Relative Humidity
- Barometric Pressure
- Atmospheric Temperature
- Soil Water Pressure
- Soil Moisture Content
- Soil Temperature

On October 16th, 2014 Benton County and OSU with support from Oregon BEST, coordinated a 'ribbon cutting' ceremony. Over 60 people participated in the dedication event, including county commissioners, federal/state/local managers, employees, students, and the general public attended (see **Figure 11**). Local and regional newspapers covered the event and successful completion of the research facility.

Figure 11. Dedication of the stormwater facility by 'ceremonial pouring' by major partners

Future Work

Benton County and OSU, currently have a five-year agreement with option for renewal for OSU/partner use of research facility for various data collection projects. Benton County is dedicated to supporting maintenance of the facility in perpetuity, to support a diverse range of ongoing water quality treatment and research; specifically attenuating peak flows, in addition to treating stormwater runoff from the Benton County Public Works industrial yard.