NONPOINT SOURCE SUCCESS STORY

Georgia

Proactive Approach Improves St. Marys River and Promotes Green Infrastructure in Tidal Estuary

Waterbody Improved

The City of St. Marys in Camden County, Georgia, installed green infrastructure (GI) in two phases to infiltrate and treat polluted stormwater runoff flowing directly to the St. Marys River from a highly impervious urban coastal riverfront landscape. This project demonstrated GI effectiveness to mitigate nuisance flooding, sea level rise, and low dissolved oxygen (DO) in the coastal environment (flat topography, shallow water tables, sandy underlying soils, and tidal influence). A comparison of pre- and post-installation storm sampling showed reduction in sediment, total nitrogen, and total phosphorus loads and higher monthly DO averages for six out of 12 months, indicating a measured improvement in water quality.

Problem

The Council on Environmental Quality's draft *Climate and Economic Justice Screening Tool* identifies census tracts in the City of St. Marys as overburdened by pollution and suffering economic loss rate to building value caused by natural hazards such as annual flooding. The St. Marys River is a coastal river that discharges into an ocean estuary. A six-mile segment (Catfish Creek to Millers Branch) was placed on Georgia's 2004 Integrated 305(b)/303(d) List of Coastal Streams as "not supporting" the designated use of fishing due to low DO caused by urban runoff from impervious surfaces that decrease base flow and send oxygen-demanding pollutants into the river. Another six-mile segment of the St. Marys River (Millers Branch to Burrells Creek) was moved from "supporting" status between 2012 and 2014 and remains listed as "assessment pending" for DO while the Georgia Environmental Protection Division (EPD) determines the natural DO for the area.

A total maximum daily load (TMDL) revised in August 2017 for the Catfish Creek to Millers Branch segment limits pollutant load allocations from nonpoint sources, expressed as Ultimate Oxygen Demand, to 2,685 pounds (lbs) per day to help meet Georgia's fishing DO standard of a daily average of 5.0 milligrams per liter (mg/L) and not less than 4.0 mg/L. The 2003 water quality data from EPD Station #08011021 on the St. Marys River at Interstate 95 (I-95) show that low DO usually occurred during the summer months.

Figure 1. Rainwater collects in front of City Hall (on Osborne Street) before project construction.

Story Highlights

The city received Clean Water Act section 319(h) grant funds in 2017 and 2018 to implement Phases 1 and 2 of the "Coastal Urban Stormwater BMP Retrofits using GI/LID Project." The city installed bioretention systems and permeable interlocking pavers along St. Marys and Osborne streets, two Historic Downtown areas prone to flooding (Figure 1).

During Phase 1, 74 parking stalls of permeable pavers (15,885 square feet) and 18 individual bioretention cells (6,210 square feet) captured rain draining from 2.50 acres onto St. Marys Street within 250 feet of the St. Marys River (Figure 2). Outfalls from the GI discharging downstream of the "not supporting" segment become "upstream" during incoming tides. Evaluating GI performance at St. Marys Street, a site impacted by

coastal constraints (shallow water tables, tidal influences), indicated the need for tide control measures (check valves, tide flaps) on the outfall pipes to limit the back-flow of river water into the subsurface storage layer.

Rain draining from 0.75 acres onto Osborne Street was captured during Phase 2 with 20 parking stalls of permeable pavers (3,465 square feet) and two bioretention cells (1,010 square feet) in front of City Hall (Figure 3). Infiltrated stormwater was fully stored and treated on site due to no underdrains, a feasible design because of a deeper water table and no tidal influx. Like the Phase 1 project area, the eventual outfall is downstream of the "not supporting" segment but becomes "upstream" during incoming tides. GI at the City Hall site proved to infiltrate and remove pollutants at high levels, serving as a measurable example of GI for future development.

While not ready to adopt performance standards from the Georgia Stormwater Management Manual Coastal Stormwater Supplement (CSS), the city proposed to reference infiltration design and performance standards from the CSS in future updates for new or redevelopment. Operations and maintenance factsheets and inspection checklists for the GI installations were assembled for the city's Public Works Department staff. Project partners disseminated research results and lessons learned through education and outreach activities.

Results

Before this project, only one GI system had been built in Camden County. Consequently, an essential element of this project was to demonstrate, monitor, and compare GI performance at the two sites. Water quality data from St. Marys Street showed GI performance was impacted by coastal constraints (shallow water tables, tidal influences) compared to Osborne Street conditions (deeper water tables, sandy soils) where GI performed as an effective solution. Combined post-installation hydrology and water quality was monitored over 12 months at both sites (October 2020–September 2021). Data showed a total of 2.34 million gallons (66% of 3.55 million gallons) of runoff infiltrated. In addition, 2,419 lbs (81% of 2,989.7 lbs) of sediment, 41 lbs (77% of 53.6 lbs) of total nitrogen, and 5.73 lbs (70% of 8.16 lbs) of total phosphorus from runoff were removed. Post-installation testing of DO during July 2020–August 2021 showed the average monthly DO concentration was 0.73 mg/L higher during November 2020–January 2021 and 0.47 mg/L higher during April–June 2021. These results indicated water quality improvement even though DO was lower for six out of the 12 months. The impaired segment remains listed. Design adjustments to fit the more challenging coastal conditions as well as wider implementation will improve future GI performance.

Figure 2. A bioretention system at "Market on Square" reaches capacity and overflows onto permeable pavement (St. Marys Street).

Figure 3. A full bioretention practice near City Hall (Osborne Street) with monitoring wells in the foreground.

Partners and Funding

The Phase 1 total cost of $895,190 consisted of $397,133 in 319(h) grant funds and $498,057 in match. Local stakeholders serving on the stakeholder committee contributed 76.5 hours of volunteer match totaling $1,866. Phase 2 totaled $241,213 with $103,600 in 319(h) grant funds and $137,613 in match. Combined Phases 1 and 2 match sources included $291,218 in state funds from a Georgia Department of Transportation Local Maintenance and Improvement Grant and $342,586 through the City of St. Marys General Fund and as in-kind contributions from city staff. U.S. Geological Survey maintained instruments at their I-95 gaging station for post-project monitoring of DO in the St. Marys River.

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