Collaborative Co-design of Green Infrastructure to Improve Water Quality and Advance Environmental Justice

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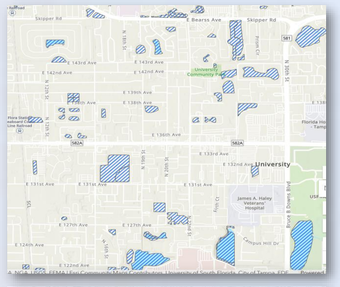
- Overview -

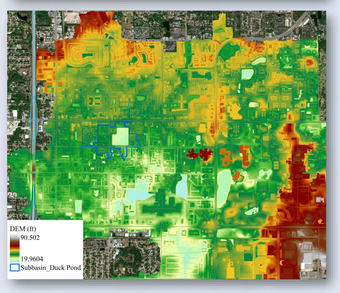
Stormwater ponds are important forms of green infrastructure designed to address pluvial flooding in urban environments. In the Tampa region, they can also attenuate the flow of excess nutrients into the Tampa Bay estuary, which can cause harmful algal blooms that produce toxic effects on people and marine life. However, with increasing frequency and intensity of coastal flooding due to climate change, many ponds have developed poor water quality that negatively impact human and environmental health.

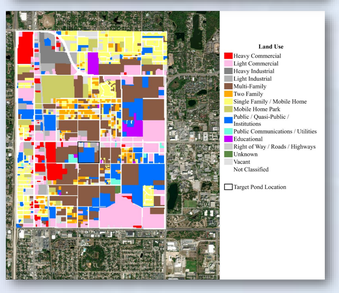
This research works with community residents and environmental engineers to co-design solutions to impaired stormwater ponds in Tampa's University Area Community, a disadvantaged underserved area. Students and faculty from anthropology and environmental engineering at USF are conducting interviews, focus groups, and participant observation with residents and engineers to assess how both groups can engage in collaborative design.

- Research Context: University Area Community -

The University Area Community is an 864-acre (ca. 1.35 sq. mi.) disadvantaged residential/commercial/industrial neighborhood located in unincorporated Hillsborough County on the northern edge of the City of Tampa. The community is characterized by a high proportion of Black and Hispanic residents (74%), high unemployment (16%), a high poverty rate (58%), lack of education 32%), and a high population of renters (89%).



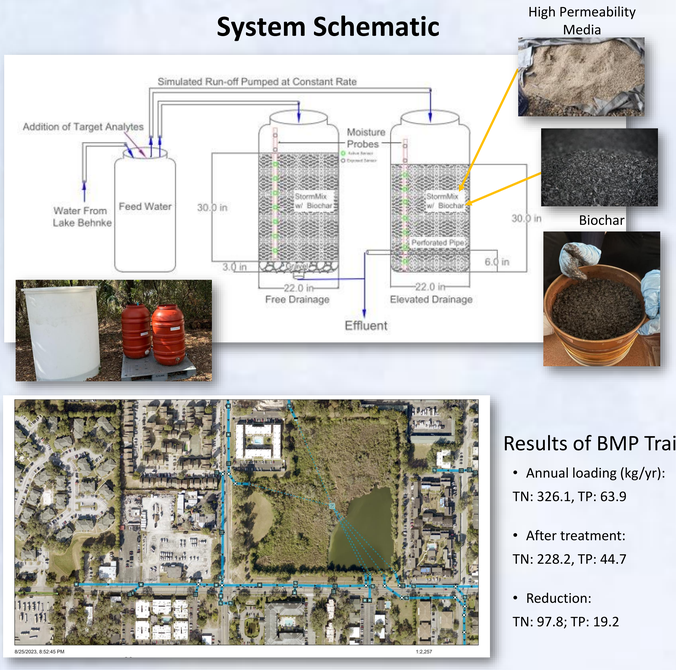




- Green Infrastructure and Stormwater Ponds -

Bio-infiltration systems, such as rain gardens/bioswales, are promising green infrastructure solutions to stormwater management problems like those experienced in the University Area Community. These systems use engineered porous media within shallow depressions to temporarily retain and treat contaminants in stormwater and increase filtration rates, thereby reducing flows and contaminant loads to ponds. Bio-infiltration systems can be planted as rain gardens to improve pollutant removal and provide the community with functional greenspace with permeable surfaces.

System Schematic



Results of BMP Trains

- Annual loading (kg/yr):

TN: 326.1, TP: 63.9

- After treatment:

TN: 228.2, TP: 44.7

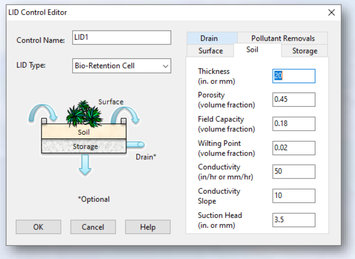
- Reduction:

TN: 97.8; TP: 19.2

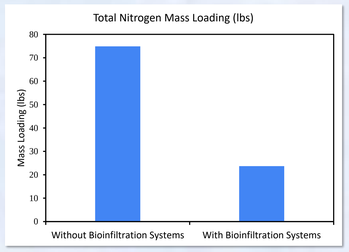
With funding from a grant from the U.S. EPA Gulf of Mexico program, engineers and anthropologists at the University of South Florida are working with UAC residents to co-design novel bio-infiltration systems at Aaran's Pond. Our research is a partnership with a private engineering company that produces low-impact bio-infiltration systems and infrastructure for filtration, sorption, and biological uptake to remove dissolved metals, nutrients, trash, and debris as well as petroleum hydrocarbons from stormwater runoff.

SWMM Modeling

Different parameters of surface and soil properties, such as surface roughness, soil porosity, field capacity, conductivity, influence pollutant removal of surface runoff.



Total nitrogen (TN) loading with and without the bio-infiltration systems



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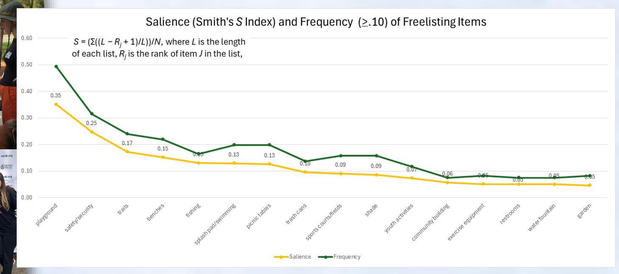
- Methods for Collaborative Co-design -

This collaborative process enables multi-sectoral stakeholders to be involved in co-designing pond revitalization and to engage in all aspects of the planning effort, with the greater goal of building *trust*, *respect*, *equity*, *shared knowledge*, and *empowerment*.

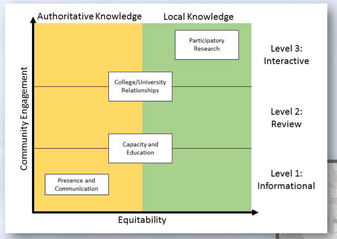
Phase 1

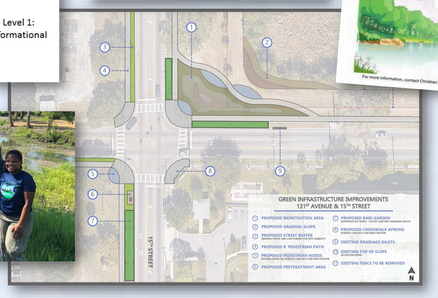
- Semi-structured interviews with key stakeholders (n=20+ until thematic saturation)
  - perceptions and knowledge of stormwater ponds and their function in community life
  - individual/group interests, constraints, and opportunities involved in pond revitalization
  - organizational management (e.g., governmental and non-governmental) structures needed to support pond revitalization and long-term care and maintenance
  - concept mapping (freelisting and pile sorting) using hierarchical cluster analysis
- Social network visualizations (text link analyses and salience statistics to extract key topics from the interviews based on their weighted frequencies of occurrence)
- Thematic analysis (Otter.ai, MAXQDA, QDA Miner)
- Cross-tabulation analysis, correspondence analysis, and multidimensional scaling



Phase 2

- Focus group workshops (n=4, 10 in each group)
  - share project information, story map, and details of the results of Phase 1
  - co-design pondscape features and amenities through charrette-style planning
  - conduct rapid assessments using structured survey instruments to assess workshop effectiveness
- Follow-up individual interviews with self-selected workshop participants (n=10)
  - examine perceptions of stormwater ponds in the community and how revitalization might alter those perceptions





Phase 3

- Return to Phase 1 participants to review the results of Phase 1 and share with them the results of Phase 2, asking for additional feedback.