Mitigation of Nutrient Runoff in Sarasota Bay

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ABSTRACT
Runoff is an everyday part of coastal environments, and it is especially problematic in areas with dense human development. Sarasota, Florida is a coastal city with nearly 400,000 inhabitants, all of whom have an impact on Sarasota Bay. To investigate nutrient impacts humans have on the coastal environment, we sampled water from nine sites in flowing and stationary waters around Sarasota Bay. Comparing our data with other studies from the area (Janicki Environmental 2010), we determined that nutrient levels in stormwater and street runoff are higher than ambient levels for the Sarasota Bay. We found that additional treatment processes, such as swales and ponds, can reduce anthropogenic-caused nutrients from entering Sarasota Bay.

BACKGROUND
Sarasota Bay beaches are an important tourist draw and subsequently an economic driver. An increase in development and populous has resulted in a large amount of runoff into the bay everyday, a problem exacerbated by Florida's rainy season. Typically, runoff is high in pollutants ultimately impacting the environment. Our study tested three nutrients - nitrate, ammonia nitrogen, and phosphate (Table 1) - known to cause eutrophication in aquatic environments, loss of seagrass, harmful algae blooms, and fish kills (NRC 2000). Runoff nutrient levels higher than ambient bay levels would suggest treatment measures should be implemented to reduce nutrients prior to their entrance into the bay.

SITE ABBREVIATIONS
SWP: Seawall Pipe
SBP: Secret Beach Pipe
BP: Beach Pipe
32SR: 32nd Street River
BRR: Bradenton Road River
LS9: Lift Station 9 Pond
AP: Airport Pond
CP: Caples Pond


Figure 3. Lift Station 9 Pond


Figure 4. Collecting water samples from the Beach Pipe Site

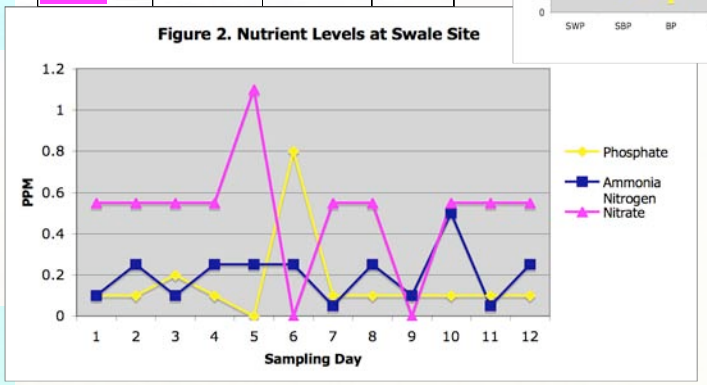
Table 1 Nutrient Level Ranges

Nutrient	Maximum	Minimum	Mode
Phosphate	6.00	0.00	1.00
Ammonia nitrogen	4.00	0.00	0.10
Nitrate	13.2	0.00	1.10

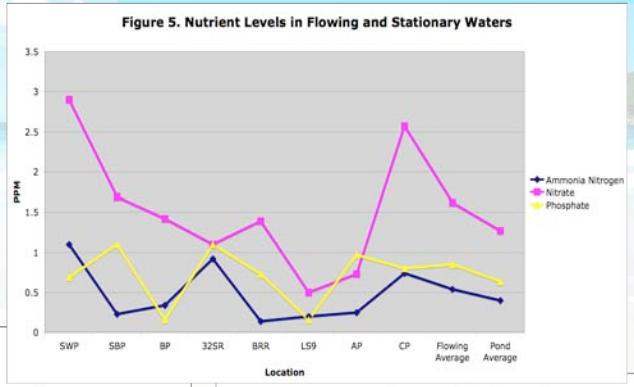

Figure 1a. Swale before Construction

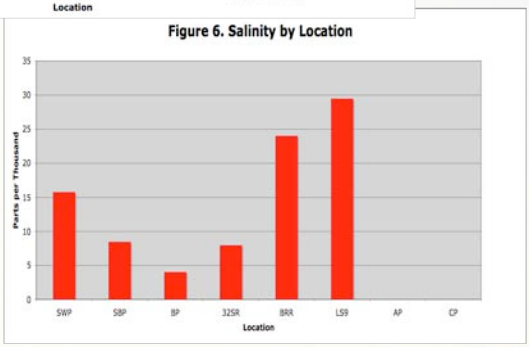

Figure 1b. Swale after Construction

BIOSWALES
A bioswale (Fig. 1) is a low impact method of capturing stormwater runoff and allowing it to infiltrate the soil to improve water quality. Compared to curb and gutter systems, swales have been shown to reduce nitrate and ammonia nitrogen in stormwater runoff (PBS&J 2010). At the Lift Station 9 pond, construction of a swale began prior to our study (Fig. 1a). After the swale was completed (sampling day 7) (Fig. 1b), we found that phosphate concentrations stabilized and nitrate concentrations dropped slightly in the pond (Fig. 2), suggesting the bioswale at Lift Station 9 did indeed reduce nutrient concentrations in the runoff entering the pond.



RETENTION PONDS
Stormwater retention ponds, like the ponds we sampled (Fig. 3), are created to hold runoff before it makes its journey to the bay and in the process traps pollutants (Illinois EPA 1998). All of our sampling locations had some form of runoff, which provided opportunities to compare difference techniques [pipes, ponds, and unimpeded flow] for stormwater runoff management. Runoff would go straight into the bay at pipes (Fig. 4) and river sites as they did not have water treatment at any point, leading to higher nutrient levels than pond sites. However, we found that the stormwater retention ponds played an important role in keeping harmful nutrients out of the bay (Fig. 5).





CONCLUSIONS
Our data showed bioswales (Fig. 2) and retention ponds (Fig. 5) can reduce nutrient levels in stormwater runoff. Salinity may affect these results because of its importance in coastal environments but in this study, it was not apparent (Fig. 6), possibly due to our limited sampling time. There is an obvious need for stormwater treatment in urban coastal areas throughout the world. We suggest coastal communities promote the use of these and other treatment methods to reduce impacts on the organisms that inhabit the coastal ecosystems, thereby ensuring the aesthetics enjoyed by humans and the health of our bays are maintained.

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