BMP Trains 2020 Model

Example Applications

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Potential Cost Saving Examples using on-site BMPs

LID are those that take no additional land, reduce runoff volume and mass.

- **Less Impervious Area** Reduce directly connected impervious surfaces
- **Rain Gardens/depression areas** landscape in parking islands, around buildings and the medium of roadways
- **Green Roofs** Plants and growth media on roof tops
- **Pervious Pavement** Pavers and pervious concrete
- **Stormwater Harvesting** Reuse to reduce surface discharges
- **Tree Wells** Landscape with vegetation in a limited area
- **Vegetated Filter Strips** Overland flow with pollution removal media, such as BAM
- **BAM (Bio-sorption Activated Media)** To reduce size of wetlands or wet detention ponds
- **Exfiltration** underground perforated or slotted pipe with or without BAM
Decrease Impervious Area

Disconnect the roof impervious areas. Building down drain into depression areas.

Limit impervious area widths in streets and parking.

Less single purpose land required for stormwater treatment resulted in more development space.
Subject site to be re-developed

Objectives are:
meet codes, increase density, and control stormwater

Neighbors:
Get rid of the big muddy ponds.
TWO DEVELOPMENT DESIGNS

Scenario A with “nice” Ponds

Scenario B with LID

Developer likes the look of:

Note: Using “A” no LID: results in some of the development area for ponds and less square footage for retail, commercial and residential use.

Using “B” with LID: results in more developed area thus higher tax revenues.
42-year-old BMP: On-site treatment rain gardens or depression storage

Reduces the need for a single purpose treatment area and thus the cost of land for the single use area. It uses the planned site feature such as medians in parking lots, and roadways, building planting strips, pervious parking, green roofs, exfiltration pipe, and conservation areas dedicated for joint use.

To meet Orange County stormwater rule, DEP/City/Developer in Florida 1977

Greater use of the land (more commercial space)
Greater Tax Revenue to the City, and sales for the development community
More recent example of Catchment BMPs

Use of BAM in LIDs for estuary protection (meet TMDL)
Cost was less than all other stormwater options

Very high cost land could be made available for a special purpose treatment area. The City wants to preserve the character of the business and residential area without taking any existing land for a structure.
Minutemen Street Cocoa Beach
tree wells, rain gardens, pervious pavements and storage

Alternative: Two regional ponds requiring land purchase ~ $1.5 million more
Under Ground Retention with BAM

SOURCE (on-site) Treatment

Use of BAM in LIDs for springs and estuary protection
Cost was less than all other stormwater options
Urban Area (Pervious Pave + Rain gardens)

Land cost for the alternative single purpose ponds was greater than the LID cost
Treatment Site Along Route 26 (approximately 4 miles from springs)

Dual use Swales

Springs

Groundwater and runoff treatment

Very sandy native soils, no NOx removal expected
Install a Down-Flow BAM Media Excavation with BAM media plus Native Flowers

Backfill with BAM which is called CTS from Environmental Conservation Solutions (ECS)
Water Loading, Pollutant Loading and Unit Cost

The volume of groundwater treated in 10 months was 1,000,834 gallons – shoulder area was 150 feet long.

Using 2’ CTS, 1 MG loading, an average NOx input of 5.2 mg/L and a removal of 80%, the yearly removal is 35 pounds/year or 700 pounds in 20 years. The construction cost is about $23,000, thus ~ $33/pound NOx removed.

Note: construction cost includes site work, excavation, traffic control, permit and regulatory, media cost, transportation of media, 10% contingencies, but no land cost, and no maintenance cost.

Use of BAM in LIDs for springs and estuary protection
Cost was less than all other stormwater options.
Stormwater reuse for I-4: stormwater treatment options involved 1. purchase of land or 2. LID
Stormwater reuse

• Plan – Provide water on golf course to improve the play and image of the course.
• FDOT – invested around $10 million.
• WIN WIN  FDOT and a high school get stormwater plans, citizens get an improved golf course.
• All get stormwater treatment and saving of potable water that would otherwise be used for irrigation.
• And alternative plan considering additional purchase of land is about $23 million.

Over 300 stormwater reuse plans in Florida
City of Miramar, FDOT, & Broward County
Providing irrigation quality water

- Estimated Capital Cost - $1.3 Million
- Capacity – 1 MGD
- Cost per 1,000 gallons (Reclaimed & Harvested IQ) - $0.80/1,000 gallons
  - Original estimate with no reuse is $3.50 /1000 gallons
South Florida and Orlando: Exfiltration
Reduced the size of pond needed and thus increased the building footprint as well as parking spaces

Using green roof, pervious pavement and parking island depression (rain gardens)
ESCAMBIA COUNTY CENTRAL OFFICE LARGEST municipal roof in FLORIDA ~ 33,000 SF

Thanks to: County, Bay Design Arch, AENew Jr., FDEP, and IFAS
Photo Credits to Escambia County.
Reuse of the green roof water for car washing and irrigation of ground plants. Thus reducing the cost of providing potable water. And air conditioner unit functions more efficiently because of lower air temperature around the compressor.
VEGETATED FILTER STRIPS (VFS)

Reduced the need for a stormwater pond

Four Lane Divided Roadway

The VFS
VFS DESIGN SECTION

Source: BMPTRAINS MODEL, UCF latest release, 2020
Example problem # 14 – Holding Basin

A holding basin is in an area where the seasonal high-water table or soils limit the amount of natural infiltration. The basin does not hold water all year, and a fraction of the water infiltrates into the ground or filters through media to discharge.

The engineered filter typically includes sorption media and a transport pipe or channel. The design treatment volume is calculated based on the recovery time as specified by the review agency.

The sorption media is used to obtain average annual removal credit. These facilities are sometimes referred to as dry detention or wet retention ponds with filters.
Design (basin with a bottom or side filter)

1. Within a holding basin there is a trench with filter media.
2. The filter trench media is 5’ wide and 96’ long or 480 SF. It drains at 0.052 GPM/SF. The volume of water removed by a drain with sorption media is 4792 CF (0.11 Ac-ft). Expressed as inches over the 5.5 Acre catchment, the treatment depth is 0.24 inch (12 in/ft x 0.11/5.5).
There is natural infiltration into the ground with recovery in 3 days (check with reviewers) equal to 0.15 inch over the catchment.
Add up to 4 BMP’s to each catchment in order of routing

BMP 1: Retention
BMP 2: Filtration
BMP 3: None
BMP 4: None

Calculate
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Analysis Type: BMP Analysis
BMP Types:
Catchment 1 - Multiple BMP

Summary Report
Nitrogen
Surface Water Discharge
Total N post load: 33.82 kg/yr
Percent N load reduction: 32%
Provided N discharge load: 23.02 kg/yr, 50.75 lb/yr
Provided N load removed: 10.8 kg/yr, 23.82 lb/yr

Phosphorus
Surface Water Discharge
Total P post load: 4.45 kg/yr
Percent P load reduction: 36%
Provided P discharge load: 2.84 kg/yr, 6.26 lb/yr
Provided P load removed: 1.61 kg/yr, 3.55 lb/yr
Question from a professional attending the class
Enter Watershed Characteristics Worksheet Data

**Current Catchment Number (use 1 if single catchment):** 1

**Land Use**
- **Pre:** Agricultural - General: TN=2.800 TP=0.487
- **Post:** Highway: TN=1.520 TP=0.200

**Catchment Name:** Highway

**Concentrations used in Analysis**
- **EMC(N) mg/l**
  - Pre: 2.800
  - Post: 1.520
- **EMC(P) mg/l**
  - Pre: 0.487
  - Post: 0.200
- **Annual C**
  - Pre: 0.189
  - Post: 0.5206
- **Runoff (ac-ft/yr)**
  - Pre: 3.537
  - Post: 9.743
- **N Loading (kg/yr)**
  - Pre: 12.212
  - Post: 18.260
- **P Loading (kg/yr)**
  - Pre: 2.124
  - Post: 2.403

**Additional Calculations**
- **Total Pre-Development Catchment Area (ac):** 3.94
- **Total Post-Development Catchment Area (ac):** 3.94
- **Pre-Development Non DCIA Curve Number:** 80
- **Pre-Development DCIA Percentage (0 - 100%):** 5.0
- **Post-Development Non DCIA Curve Number:** 85
- **Post-Development DCIA Percentage (0 - 100%):** 52.0
- **Wet Pond Area (No loading from this area, ac):** 0.00

[Buttons: Report, Calculate, Cancel, Back]
BMP Trains 2020 Workshop Example Continued

Retention System Worksheet Analysis: Net Improvement Required Removal N: 33% P: 12%

Provided Retention Depth (in over Catchment): 0.125

Multiple BMP Worksheet for Catchment 1

Add up to 4 BMP’s to each catchment in order of routing

BMP 1: Retention
BMP 2: Filtration
BMP 3: None
BMP 4: None

Open

Media
B&G CTS24

Treatment Depth (0.0-4.0 inches): 0.25

Decision to Select Media: No

Required filtration for a Wet Detention Pond?

Efficiency (%) 33
Efficiency (%) 24
Efficiency (%) 12
Efficiency (%) 30

Load
N: 18.26 kg/yr
P: 2.40 kg/yr

Treatment
N: 36 %
P: 42 %

Surface Discharge
N: 11.64 kg/yr
P: 1.40 kg/yr

Cost
Calculate
Dynamic and Continuing Efforts

1. Continue to make changes based on user input. Thus, this workshop input is important.
2. We can reduce the land needed to achieve a desired concentration or loading using LIDs, including sorption media.
3. All model updates posted on: www.stormwater.ucf.edu/stars.library.ucf.edu/bmptrains/
BMP Trains 2020 Model

Questions, Comments and Discussion
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