Statewide Best Management Practice (BMP) Efficiencies for Nonpoint Source Management of Surface Waters
Draft – July 2018

This document describes the DEP methods to calculate total nitrogen (TN) and total phosphorus (TP) reductions for urban stormwater loads related to surface watershed restoration, when site-specific information is not available. These calculation methods represent typical BMP performance, which may be useful to stakeholders when selecting BMPs to achieve surface water nutrient load reductions related to the development and implementation of basin management action plans (BMAPs), 4e plans, and 4b/reasonable assurance plans (RAPs). DEP assigns nutrient removal efficiencies and nutrient credits to BMPs on a case-by-case basis, using the information in this document as a guide during the decision-making process. This working document will be updated periodically as new information becomes available. To download the latest version, visit: http://publicfiles.dep.state.fl.us/DEAR/BMAP/Resources/.

These calculation methods are not designed for use with Environmental Resource Permits (ERPs). The appropriate permitting agency should be consulted for its approved calculation methods.

Table 1 lists the removal efficiencies for various standard BMP types. **Table 2** lists the TN and TP reductions for provisional nonpoint source management BMPs. **Table 3** lists the BMPs for which data are lacking and water quality benefits are unknown. As additional data become available, these BMPs may be assigned provisional load reduction credits.

It should be noted that for certain BMPs, reductions resulting from regular required maintenance are implicit in the initial credit given during installation or implementation. Therefore, operations and maintenance (O&M) required for the BMP will not qualify for additional credits. However, if a project did not receive credits for the initial installation or implementation of the BMP, regular maintenance may qualify for credit. Decisions will be made on a case-by-case basis.

Specific activities ineligible for nutrient credits include macroalgal harvesting and natural wetlands as filters, as listed in **Table 4**. Macroalgal harvesting from an impaired waterbody is not eligible for credits, because it is a biological result of nutrient loading that should be abated before it reaches the waterbody of concern. See **Table 2** for information about aquatic vegetation harvesting that **is** eligible for credit, based on specific conditions. Filtration from natural wetlands is ineligible for credit, because this is considered part of the existing conditions when required load reductions are determined. Various types of artificial wetlands and modular wetland treatment systems **are** eligible for nutrient credits.

Equations for online and offline retention BMPs are listed in **Table 5** and are based on the volume resulting from multiplying the corresponding inches of retention and the sub-basin area. In addition, this document includes the wet detention removal efficiency curves for TP (**Figure** 1) and TN (**Figure 2**).

Table 1: Efficiencies for nonpoint source management BMPs

N/A = Not applicable
All BMPs must be designed to manufacturers' recommendations and 80 % removal of total suspended solids (TSS).
[1] The benefits of a baffle box—including BMP maintenance—are included in the baffle box credits when they are installed.

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
Retention	**Offline retention BMPs (must limit catchment to <10 acres)**	See **Table 5** for formulas	See **Table 5** for formulas	*Evaluation of current stormwater design criteria within the state of Florida*, Harper, H., and D. Baker 2007; and DEP evaluation/ regression of Harper and Baker 2007
	Online retention BMPs	See **Table 5** for formulas	See **Table 5** for formulas	DEP evaluation/regression of Harper and Baker 2007
	Grass swales with swale blocks or raised culverts	Use on-line retention BMPs	Use online retention BMPs	DEP evaluation/regression of Harper and Baker 2007
	Grass swales without swale blocks or raised culverts	50 % of value for grass swales with swale blocks or raised culverts	50 % of value for grass swales with swale blocks or raised culverts	DEP evaluation/regression of Harper and Baker 2007
Detention	**Wet detention ponds**	Formula shown in Figure 13.2 of *Draft stormwater treatment applicant's handbook* (see **Figure 1** below for formula)	Formula shown in Figure 13.3 of *Draft stormwater treatment applicant's handbook* (see **Figure 2** below for formula)	March 2010 draft DEP and water management districts (WMDs) *ERP Stormwater Quality Applicant's Handbook*
	Dry detention ponds	10 %	10 %	DEP evaluation/regression of Harper and Baker 2007

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
Baffle Boxes	**Baffle boxes—First generation (hydrodynamic separator)[1]**	2.30 %	0.50 %	Final report, Contract S0236, *Effectiveness of baffle boxes plus media filter*, by GPI Southeast 2010; *Demonstration bio media for ultra-urban stormwater treatment*, by University of Central Florida (UCF) for Florida Department of Transportation (FDOT); and Final report, Contract S0497, *Baffle box with media filtration installation and effectiveness evaluation* by City of Casselberry
	Baffle boxes—Second generation[1]	15.5 %	19.05 %	
	Baffle boxes—Second generation plus media filter[1]	BMPTRAINs model	BMPTRAINs model	
Hydrodynamic Separators	**Hydrodynamic separators**	10 %	N/A	May 2016, *Draft Pinellas County stormwater manual*

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
Material Collection	**Street sweeping (materials collected from roadway and gutter sweeping)** **Do not include baffle box material collected[1]—see baffle box category above that includes maintenance benefits**	Determine dry weight/volume of material collected annually and multiply by values provided by Florida Stormwater Association (FSA) University of Florida (UF) Municipal Separate Storm Sewer (MS4) BMP Project (FINAL MS4 Load Reduction Tool Version 1.2)	Determine dry weight/volume of material collected annually and multiply by values to be provided by FSA UF MS4 BMP Project (FINAL MS4 Load Reduction Tool Version 1.2)	Final report, FSA UF MS4 BMP Project
	Catch basin inserts/inlet filter cleanout (drainage features and units with no specific water quality treatment mechanism), including the following: • Curb inlets. • Area catch basins. • Pavement catch basins. • Projects serving drainage and conveyance functions. • Swales (calculating under BMP cleanout category also acceptable). • Ditches (calculating under BMP cleanout category also acceptable). **Do not include baffle box material collected[1]—see baffle box category above that includes maintenance benefits**	Determine dry weight/volume of material collected annually and multiply by values provided by FSA UF MS4 BMP Project (FINAL MS4 Load Reduction Tool Version 1.2)	Determine dry weight/volume of material collected annually and multiply by values provided by FSA UF MS4 BMP Project (FINAL MS4 Load Reduction Tool Version 1.2)	Final report, FSA UF MS4 BMP Project

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
Material Collection (continued)	**BMP cleanout (volumetric stormwater features designed to catch solids and particles), including the following:** • Basins. • Tanks. • Vaults. • Wet ponds. • Dry ponds. • Swales (calculating under catch basin cleanout category also acceptable). • Ditches (calculating under catch basin cleanout category also acceptable). **Do not include baffle box material collected[1]—see baffle box category above that includes maintenance benefits.**	Determine dry weight/volume of material collected annually and multiply by values provided by FSA UF MS4 BMP Project (FINAL MS4 Load Reduction Tool Version 1.2)	Determine dry weight/volume of material collected annually and multiply by values provided by FSA UF MS4 BMP Project (FINAL MS4 Load Reduction Tool Version 1.2)	Final report of FSA UF MS4 BMP Project
Green Infrastructure Efforts	**Green roofs (with or without cistern)**	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
	Rain gardens and bioswales	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
	Tree boxes/tree wells	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
	Vegetated natural buffers/ vegetated filter strip	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
	Pervious pavers	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
Other BMP Types	**Alum injection systems**	90 %	50 %	Harper, H., and J. Herr 1998 study for DEP – *Alum treatment of stormwater: The first ten years*
	Floating islands/managed aquatic plant systems (MAPS)	10 % removal with 5 % pond coverage	10 % removal with 5 % pond coverage	UCF studies (two different studies with two different manufacturers)
	Stormwater reuse	Estimate annual load of stormwater (and percentage of total if not 100 %) not discharged because used for irrigation	Estimate annual load of stormwater (and percentage of total if not 100 %) not discharged because used for irrigation	Evaluated on case-by-case basis (to estimate volume of stormwater reuse, use rate-efficiency-volume [REV] curve methodology in Northwest Florida Water Management District [NWFWMD] *ERP Applicant's Handbook, Volume II*)
	Advanced wetland treatment process	Reduction is specific to site design and confirmed by monitoring	Reduction is specific to site design and confirmed by monitoring	Based on data and past performance for similar projects.
	BMP treatment trains using a combination of BMPs	BMP Treatment Train equation: Efficiency =Eff1 +((1-Eff1) *Eff2) or BMPTRAINS model	BMP Treatment Train equation: Efficiency =Eff1 +((1-Eff1) *Eff2) or BMPTRAINS model	March 2010 draft DEP and WMDs *ERP Stormwater Quality Applicant's Handbook* and UCF Stormwater Management Academy BMPTRAINS model

Table 2: Efficiencies for provisional nonpoint source management BMPs

N/A =Not applicable

Provisional BMPs	TP % Reduction	TN % Reduction	Data Source
Public education	0.25 % to 6 %, depending on extent of program	0.25 % to 6 %, depending on extent of program	Evaluation of Center for Watershed Protection. 2002. Watershed Treatment Model Version 3.1. Separate calculation spreadsheet available
Muck removal/ restoration dredging	Case-by-case depending on nutrient flux of muck	Case-by-case depending on nutrient flux of muck	DEP Muck Removal Credit Guidance (developed for Indian River Lagoon [IRL] BMAPs)
Aquatic vegetation harvesting	Based on total mass of material collected, type of plant(s), and associated nutrient content in dry material	Based on total mass of material collected, type of plant(s), and associated nutrient content in dry material	DEP Removal of Aquatic Vegetation for Nutrient Credits (developed for IRL BMAPs)
Septic system phase-out (proper condemnation and hook-up to sewer service)	N/A	Based on values from ArcNLET model	ArcNLET model
Dispersed water management (DWM)	Based on measured data or acre-feet (ac-ft) of storage and land use concentration	Based on measured data or ac-ft of storage and land use concentration	Determined through discussions between DEP and South Florida Water Management District (SFWMD)
Stormwater treatment areas (STAs)	Based on engineering design calculations	Based on engineering design calculations	SFWMD
Denitrification walls	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
Biosorption activated media (BAM)	BMPTRAINS model	BMPTRAINS model	UCF Stormwater Management Academy BMPTRAINS model
Land use change	Dependent on difference between land use classification at BMAP adoption and updated land use classification	Dependent on difference between land use classification at BMAP adoption and updated land use classification	Determined on case-by-case basis
Fertilizer cessation	Based on acreage previously fertilized, fertilization rates, and fertilizer composition	Based on acreage previously fertilized, fertilization rates, and fertilizer composition	Determined on case-by-case basis (see Orange Creek Basin BMAP for example)

Table 3: BMPs for which data are lacking to assign credit/unknown benefits/no credit

BMPs Lacking Data for Credit
Creating/enhancing living shoreline
Creating/enhancing oyster reefs
Seagrass planting
Local code changes/economic incentives
Reduction of nutrients in reclaimed water
Enhanced public education
Plugging artesian wells
Retention of storm events larger than 4.0 inches
Turbidity-reducing polymers
Dragline restoration

Table 4: Specific activities ineligible for nutrient credit

Ineligible BMPs/Activities
Macroalgal harvesting
Natural wetlands as filters

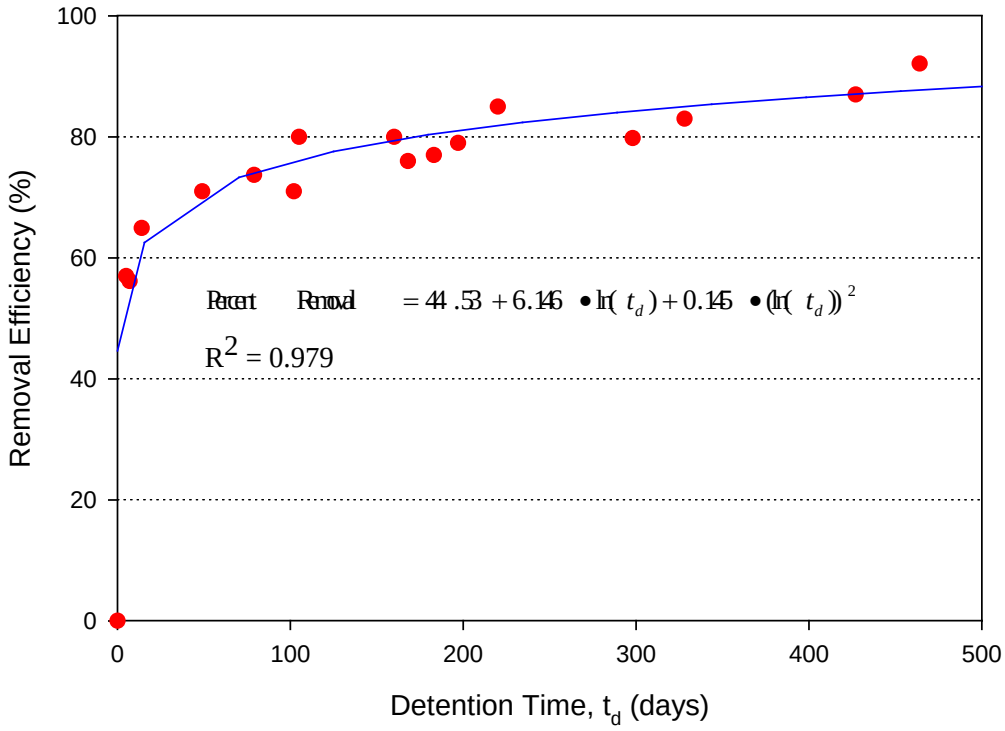

Figure 1: Wet detention removal efficiency curve for TP

T_d = (PPV/RO)*CF

where:
T_d = Detention time (days)
PPV = Permanent pool volume (ac-ft)
RO = Annual runoff inputs (ac-ft/year [yr])
CF = Conversion factor (365 days/yr)

and

RO =DA*C*R*CF

where:
RO = Annual runoff inputs (ac-ft/yr)
DA = Drainage area to pond (ac)
C = Mean annual runoff coefficient (BMPTrains or Harper)
R = Mean annual rainfall (inches [in]/yr)
CF = Conversion factor (1 ft/12 in)

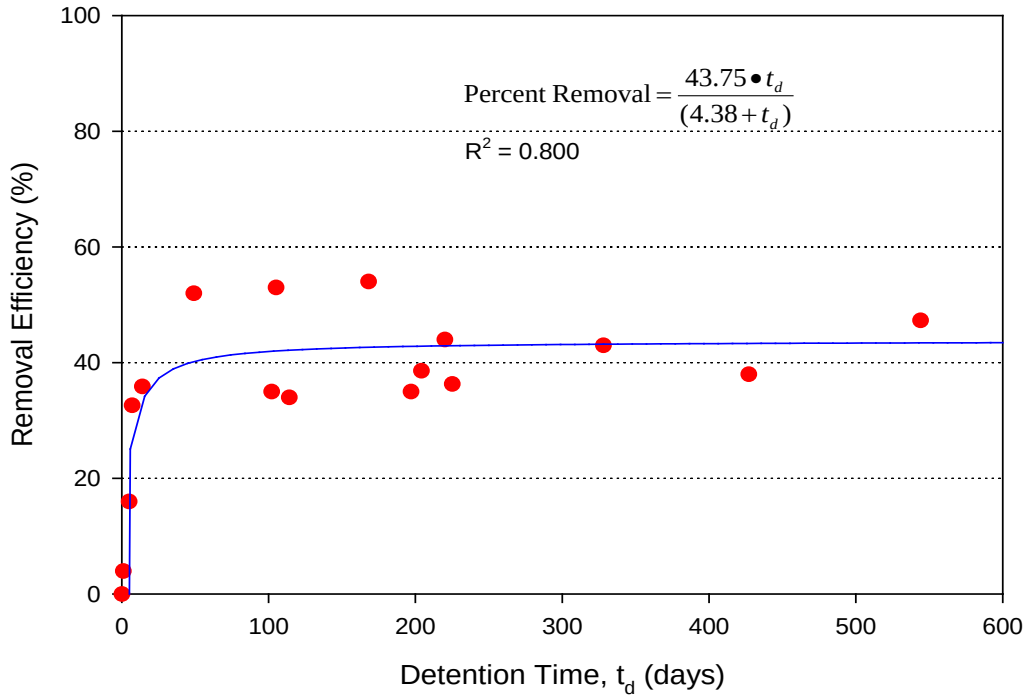

Figure 2: Wet detention removal efficiency curve for TN

T_d= (PPV/RO)*CF

where:
T_d = Detention time (days)
PPV = Permanent pool volume (ac-ft)
RO = Annual runoff inputs (ac-ft/yr)
CF = Conversion factor (365 days/yr)

and

RO =DA*C*R*CF

where:
RO = Annual runoff inputs (ac-ft/yr)
DA = Drainage area to pond (ac)
C = Mean Annual Runoff coefficient (BMPTrains or Harper)
R = Mean annual rainfall (in/yr)
CF = Conversion factor (1 ft/12 in)

Table 5: Equations for online and offline retention BMPs

Standard BMPs	Inches of Retention	TP and TN % Reduction	Data Source
Retention BMPs (includes basins, exfiltration trenches, etc.)	0.1 to 4.0	Based on percent reduction using project's percent directly connected impervious area (DCIA), non-DCIA curve number (CN), and rainfall zone	Appendix F, March 2010 Draft DEP and WMDs *ERP stormwater quality applicant's handbook* and *Evaluation of current stormwater design criteria within the state of Florida*, Harper and Baker 2007
Offline retention BMPs	0.1 to 1.6	0.3178 * ln(x) + 0.8405	DEP evaluation/regression of Harper and Baker 2007
Online retention BMPs	0.1 to 2.2	0.3178 * ln(x) + 0.7405	DEP evaluation/regression of Harper and Baker 2007