Pollutant Loading & Removal Summary

281-1 - Baboosic Lake s319 Grant - Phase 2 Watershed Restoration Project 2012

BMP Summary				Total Pollutant Loading			Total Pollutant Removal			
Site Location	BMP Type	Area (acres)[1]	Annual Runoff (cf)	Annual TSS (lbs/yr)	Annual TP (lbs/yr)	Annual TN (lbs/yr)	Annual TSS Removed (lbs/yr)	Annual TP Removed (lbs/yr)	WMP Target TP Removal (lbs/yr)	Annual TN Removed (lbs/yr)
Site 5 (upper) - Greenwood Rd	Plunge Pools & Vegetated Swale	3.31	118,257	1,808	3.5	13.2	539	0.36	0.10	0.65
Site 5 (lower) - Greenwood Rd	Riprap Swale	0.24	16,998	500	0.5	1.5	265	0.04	0.10	0.04
Site 6 - Lakeside Rd	Riprap apron & Vegetated Swale (pavement removed)	0.63	11,542	71	0.2	1.5	20	0.03	0.10	0.17
Site 7 - Jebb Rd	Plunge Pool (pipes un-clogged & headwall stabilized)	8.00	149,301	949	2.9	18.5	237	0.23	0.10	0.56
Site 8 - Lakeside Rd	Forebay & Raingarden	4.55	105,165	1,035	2.5	12.6	221	0.33	0.50	1.53
Site 10 - N. Jebb Rd	Forebay & Raingarden	0.77	26,224	392	0.8	2.9	59	0.07	0.20	0.22
Site 10B - N. Jebb Rd	Forebay & Raingarden	1.32	43,074	625	1.2	4.8	277	0.31	0.20	1.02
Site 12 - Lakeside Rd	Forebay & Vegetated Swale	1.09	36,247	533	1.0	4.1	352	0.27	0.20	0.82
Site 14A - Miriam Rd	Plunge Pools & Vegetated Swale	5.64	167,574	2,136	4.7	19.9	792	0.67	0.10	1.83
Site 14B - Arnold Rd	Forebay & Raingarden	2.13	90,017	1,552	2.8	9.5	75	0.08	0.10	0.24
Site 14C - Carter Rd	Forebay & Raingarden	2.09	88,615	1,533	2.7	9.4	60	0.06	0.10	0.20
Site 16 - Shore Rd	Forebay & Raingarden	2.57	73,056	923	2.0	8.5	258	0.33	0.10	1.27
Site 16A - Shore Rd	Forebay & Raingarden	0.13	8,306	173	0.3	0.8	106	0.11	0.10	0.30
Site 16B - Longa Rd	Plunge Pool (pipes un-clogged & swale stabilized)	3.38	112,235	1,609	3.3	12.8	402	0.26	0.10	0.38
		Area (acres)[1]	Annual Runoff (cf)	Annual TSS Loading (lbs/yr)	Annual TP Loading (lbs/yr)	Annual TN Loading (lbs/yr)	Annual TSS Removed (lbs/yr)	Annual TP Removed (lbs/yr)	WMP Target TP Removal (lbs/yr)	Annual TN Removed (lbs/yr)
	Project Totals	**31.19**	**884,939**	**11,382**	**23.68**	**102.12**	**3,664**	**3.15**	**1.40**	**9.23**
						Percentage Totals	**32%**	**13%**	**6%**	**9%**
				Annual TSS Loading (kgs/yr)	Annual TP Loading (kgs/yr)	Annual TN Loading (kgs/yr)	Annual TSS Removed (kgs/yr)	Annual TP Removed (kgs/yr)	WMP Target TP Removal (kgs/yr)	Annual TN Removed (kgs/yr)
			Project Totals	**5,162**	**10.7**	**46.3**	**1,662**	**1.4**	**0.6**	**4.2**

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 5 (upper) Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.530	Yes	0.212	80	31.5	154	1,539	60,530	1,449	2.07	5.3	29.2
2	Woods	2	Forested	0.000	No	0.000	0	0.0	0.0	0	0	0	0.00	0.0	0.0
3	Residential Area	5	Residential-Low Density	2.780	No	0.000	10	5.7	101	1,009	57,727	359	1.44	7.9	114.7
Total				3.310		0.212			**255**	**2,548**	**118,257**	**1,808**	**3.5**	**13.2**	**143.9**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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The Simple Method to Calculate Urban Stormwater Loads. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm

Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
Model Reviewed by:		Date:		Signature:		Date Accepted:	
Model Evaluated by:		Date:		Signature:		Date Accepted:	

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 5 (upper) Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^				Quantity of Pollutant Removed				Pretreatment / Treatment
					TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	
1st BMP in series													
	BMP Volume (cf) =	290.00	Water Quality Volume %	114%									
1	Roadway	2	Plunge Pool / Forebay**	0.530	25.0%	8.0%	3.0%	12.0%	362	0.17	0.2	3.5	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	2.780	25.0%	8.0%	3.0%	12.0%	90	0.12	0.2	13.8	Pretreatment
Total								**BMP Total**	**452**	**0.28**	**0.4**	**17.3**	
2nd BMP in series													
	BMP Volume (cf) =	25.00	Water Quality Volume %	10%									
1	Roadway	1	Vegetated Swale	0.530	6.4%	2.5%	2.0%	5.9%	69	0.0	0.1	1.5	Pretreatment
3	Residential Area	1	Vegetated Swale	2.780	6.4%	2.5%	2.0%	5.9%	17	0.0	0.2	5.9	Pretreatment
Total								**BMP Total**	**86**	**0.08**	**0.3**	**7.5**	
								TOTAL REMOVAL =	**539**	**0.4**	**0.6**	**24.7**	
								% REMOVAL =	**29.8%**	**10.3%**	**4.9%**	**17.2%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:

Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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References:

Comparative Pollutant Removal Capability of Stormwater Treatment Practices, Technical Note #95 from Watershed Protection Techniques. 2(4): 515-520, Article 64. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/Practice/64-Comparative%20Pollutant%20Removal.pdf
Choi, J & Engel, B. Urban BMPs and Cost Estimation, Structural BMP Expected Pollutant Removal Efficiency & Median Event Mean Concentration for Urban Land Uses. US EPA. (1993) Handbook Urban Runoff Pollution and Control Planning. Retrieved July 22, 2005 from the World Wide Web: http://danpatch.ecn.purdue.edu/~jychoi/ubmp0/emc2.htm
Massachusetts Nonpoint Source Pollution Management Manual. Retrieved October 19, 2006 from the World Wide Web. Web: http://projects.geosyntec.com/NPSManual/
Pennsylvania Stormwater Best Management Practices Manual, Chapter 6 - Structural BMPs. Retrieved October 18, 2006 from the World Wide Web. Web: http://www.starkenvironmental.com/downloads/PADEP.pdf
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^Appendix E, Volume 1 of the New Hampshire Stormwater Manual, December 2008
*Table H-2 of the 2010 Rhode Island Storm Water Manual
**Table H-3 & H-4 of the 2010 Rhode Island Storm Water Manual
***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:	Date:	Signature:	Date Accepted:
Model Reviewed by:	Date:	Signature:	Date Accepted:
Model Evaluated by:	Date:	Signature:	Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 5 (lower) Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.136	Yes	0.087	80	31.5	39	395	15,532	495	0.53	1.4	7.5
2	Woods	2	Forested	0.104	No	0.000	5	3.9	1.9	19	1,465	5	0.01	0.2	0.1
Total				0.240		0.087			**41**	**414**	**16,998**	**500**	**0.5**	**1.5**	**7.6**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
Model Reviewed by:		Date:		Signature:		Date Accepted:	
Model Evaluated by:		Date:		Signature:		Date Accepted:	

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 5 (lower) Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^				Quantity of Pollutant Removed				Pretreatment / Treatment
					TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	
1st BMP in series													
	BMP Volume (cf) =	10.00	Water Quality Volume %	24%									
1	Roadway	2	Plunge Pool / Forebay**	0.136	6.0%	1.9%	0.7%	2.9%	30	0.01	0.01	0.2	Pretreatment
2	Woods	2	Plunge Pool / Forebay**	0.104	6.0%	1.9%	0.7%	2.9%	0	0.00	0.00	0.0	Pretreatment
Total								**BMP Total**	**30**	**0.01**	**0.01**	**0.2**	
2nd BMP in series													
	BMP Volume (cf) =	222.00	Water Quality Volume %	536%									
1	Roadway	5	Riprap Swale***	0.136	50.0%	5.0%	2.0%	5.0%	233	0.03	0.03	0.4	Pretreatment
2	Woods	5	Riprap Swale***	0.104	50.0%	5.0%	2.0%	5.0%	2	0.00	0.00	0.0	Pretreatment
Total								**BMP Total**	**235**	**0.03**	**0.03**	**0.4**	
								TOTAL REMOVAL =	**265**	**0.04**	**0.04**	**0.6**	
								% REMOVAL =	**53.0%**	**6.8%**	**2.7%**	**7.8%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:

Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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References:

Comparative Pollutant Removal Capability of Stormwater Treatment Practices, Technical Note #95 from Watershed Protection Techniques. 2(4): 515-520, Article 64. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/Practice/64-Comparative%20Pollutant%20Removal.pdf
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Pennsylvania Stormwater Best Management Practices Manual, Chapter 6 - Structural BMPs. Retrieved October 18, 2006 from the World Wide Web. Web: http://www.starkenvironmental.com/downloads/PADEP.pdf
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Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:		Date:		Signature:	Date Accepted:
Model Reviewed by:		Date:		Signature:	Date Accepted:
Model Evaluated by:		Date:		Signature:	Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 6 Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.004	Yes	0.003	80	31.5	1	12	457	15	0.02	0.0	0.2
2	Woods	2	Forested	0.293	No	0.000	5	3.9	5.3	53	4,129	13	0.03	0.5	0.4
3	Residential Area	5	Residential-Low Density	0.335	No	0.000	10	5.7	12	122	6,956	43	0.17	1.0	13.8
Total				0.632		0.003			**19**	**186**	**11,542**	**71**	**0.2**	**1.5**	**14.4**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
Model Reviewed by:		Date:		Signature:		Date Accepted:	
Model Evaluated by:		Date:		Signature:		Date Accepted:	

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 6 Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	12.50	Water Quality Volume %	67%									
1	Roadway	2	Plunge Pool / Forebay**	0.004	16.8%	5.4%	2.0%	8.0%	2	0.00	0.0	0.0	Pretreatment
2	Woods	2	Plunge Pool / Forebay**	0.293	16.8%	5.4%	2.0%	8.0%	2	0.00	0.0	0.0	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	0.335	16.8%	5.4%	2.0%	8.0%	7	0.01	0.0	1.1	Pretreatment
Total								**BMP Total**	**12**	**0.01**	**0.0**	**1.2**	
2nd BMP in series													
	BMP Volume (cf) =	29.00	Water Quality Volume %	16%									
1	Roadway	6	Raingarden	0.004	14.0%	10.1%	10.1%	10.9%	2	0.0	0.0	0.0	Treatment
2	Woods	6	Raingarden	0.293	14.0%	10.1%	10.1%	10.9%	2	0.0	0.0	0.0	Treatment
3	Residential Area	6	Raingarden	0.335	14.0%	10.1%	10.1%	10.9%	5	0.0	0.1	1.4	Treatment
Total								**BMP Total**	**8**	**0.02**	**0.1**	**1.4**	
								TOTAL REMOVAL =	**20**	**0.03**	**0.2**	**2.6**	
								% REMOVAL =	**28.4%**	**14.9%**	**11.9%**	**18.1%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:
Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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References:

Comparative Pollutant Removal Capability of Stormwater Treatment Practices, Technical Note #95 from Watershed Protection Techniques. 2(4): 515-520, Article 64. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/Practice/64-Comparative%20Pollutant%20Removal.pdf
Choi, J & Engel, B. Urban BMPs and Cost Estimation, Structural BMP Expected Pollutant Removal Efficiency & Median Event Mean Concentration for Urban Land Uses. US EPA. (1993) Handbook Urban Runoff Pollution and Control Planning. Retrieved July 22, 2005 from the World Wide Web: http://danpatch.ecn.purdue.edu/~jychoi/ubmp0/emc2.htm
Massachusetts Nonpoint Source Pollution Management Manual. Retrieved October 19, 2006 from the World Wide Web. Web: http://projects.geosyntec.com/NPSManual/
Pennsylvania Stormwater Best Management Practices Manual, Chapter 6 - Structural BMPs. Retrieved October 18, 2006 from the World Wide Web. Web: http://www.starkenvironmental.com/downloads/PADEP.pdf
Rhode Island Stormwater Design and Installation Standards Manual Appendix H, December 2010
New Hampshire Stormwater Manual December 2008
^Appendix E, Volume 1 of the New Hampshire Stormwater Manual, December 2008
*Table H-2 of the 2010 Rhode Island Storm Water Manual
**Table H-3 & H-4 of the 2010 Rhode Island Storm Water Manual
***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:		Date:		Signature:		Date Accepted:
Model Reviewed by:		Date:		Signature:		Date Accepted:
Model Evaluated by:		Date:		Signature:		Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 7 Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.090	Yes	0.036	80	31.5	26	261	10,279	246	0.35	0.9	5.0
2	Woods	2	Forested	3.780	No	0.000	5	3.9	68.6	686	53,262	169	0.36	5.9	4.5
3	Residential Area	5	Residential-Low Density	4.130	No	0.000	10	5.7	150	1,499	85,760	534	2.14	11.7	170.3
Total				8.000		0.036			**245**	**2,447**	**149,301**	**949**	**2.9**	**18.5**	**179.8**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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The Simple Method to Calculate Urban Stormwater Loads. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm

Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:	Date:	Signature:	Date Accepted:
Model Reviewed by:	Date:	Signature:	Date Accepted:
Model Evaluated by:	Date:	Signature:	Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 7 Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	321.00	Water Quality Volume %	131%									
1	Roadway	2	Plunge Pool / Forebay**	0.090	25.0%	8.0%	3.0%	12.0%	62	0.03	0.0	0.6	Pretreatment
2	Woods	2	Plunge Pool / Forebay**	3.780	25.0%	8.0%	3.0%	12.0%	42	0.03	0.2	0.5	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	4.130	25.0%	8.0%	3.0%	12.0%	133	0.17	0.4	20.4	Pretreatment
Total								**BMP Total**	**237**	**0.23**	**0.6**	**21.6**	
								TOTAL REMOVAL =	**237**	**0.23**	**0.6**	**22**	
								% REMOVAL =	**25.0%**	**8.0%**	**3.0%**	**12.0%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:
Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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Choi, J & Engel, B. Urban BMPs and Cost Estimation, Structural BMP Expected Pollutant Removal Efficiency & Median Event Mean Concentration for Urban Land Uses. US EPA. (1993) Handbook Urban Runoff Pollution and Control Planning. Retrieved July 22, 2005 from the World Wide Web: http://danpatch.ecn.purdue.edu/~jychoi/ubmp0/emc2.htm
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***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

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Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 8 Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.219	Yes	0.088	80	31.5	64	636	25,012	599	0.86	2.2	12.1
2	Woods	2	Forested	1.459	No	0.000	5	3.9	26.5	265	20,558	65	0.14	2.3	1.7
3	Residential Area	5	Residential-Low Density	2.870	No	0.000	10	5.7	104	1,042	59,596	371	1.48	8.2	118.4
Total				4.548		0.088			**194**	**1,943**	**105,165**	**1,035**	**2.5**	**12.6**	**132.2**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By: _____ Date: _____ Signature: _____ Date Accepted: _____
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Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 8 Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^				Quantity of Pollutant Removed				Pretreatment / Treatment
					TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	
1st BMP in series													
	BMP Volume (cf) =	52.00	Water Quality Volume %	27%									
1	Roadway	2	Plunge Pool / Forebay**	0.219	6.7%	2.1%	0.8%	3.2%	40	0.02	0.0	0.4	Pretreatment
2	Woods	2	Plunge Pool / Forebay**	1.459	6.7%	2.1%	0.8%	3.2%	4	0.00	0.0	0.1	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	2.870	6.7%	2.1%	0.8%	3.2%	25	0.03	0.1	3.8	Pretreatment
Total								**BMP Total**	**69**	**0.05**	**0.1**	**4.2**	
2nd BMP in series													
	BMP Volume (cf) =	340.00	Water Quality Volume %	18%									
1	Roadway	6	Raingarden	0.219	15.8%	11.4%	11.4%	12.3%	88	0.1	0.2	1.4	Treatment
2	Woods	6	Raingarden	1.459	15.8%	11.4%	11.4%	12.3%	10	0.0	0.3	0.2	Treatment
3	Residential Area	6	Raingarden	2.870	15.8%	11.4%	11.4%	12.3%	55	0.2	0.9	14.0	Treatment
Total								**BMP Total**	**152**	**0.28**	**1.4**	**15.7**	
								TOTAL REMOVAL =	**221**	**0.3**	**1.5**	**19.9**	
								% REMOVAL =	**21.4%**	**13.3%**	**12.1%**	**15.1%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:

Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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References:

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*Table H-2 of the 2010 Rhode Island Storm Water Manual
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***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By: _____ Date: _____ Signature: _____ Date Accepted: _____
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Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 10 Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.115	Yes	0.046	80	31.5	33	334	13,134	314	0.45	1.1	6.3
2	Woods	2	Forested	0.089	No	0.000	5	3.9	1.6	16	1,254	4	0.01	0.1	0.1
3	Residential Area	5	Residential-Low Density	0.570	No	0.000	10	5.7	21	207	11,836	74	0.29	1.6	23.5
Total				0.774		0.046			**56**	**557**	**26,224**	**392**	**0.8**	**2.9**	**30.0**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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The Simple Method to Calculate Urban Stormwater Loads. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm

Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
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Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 10 Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	13.00	Water Quality Volume %	23%									
1	Roadway	2	Plunge Pool / Forebay**	0.115	5.8%	1.9%	0.7%	2.8%	18	0.01	0.0	0.2	Pretreatment
2	Woods	2	Plunge Pool / Forebay**	0.089	5.8%	1.9%	0.7%	2.8%	0	0.00	0.0	0.0	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	0.570	5.8%	1.9%	0.7%	2.8%	4	0.01	0.0	0.7	Pretreatment
Total								**BMP Total**	**23**	**0.01**	**0.0**	**0.8**	
2nd BMP in series													
	BMP Volume (cf) =	60.50	Water Quality Volume %	11%									
1	Roadway	6	Raingarden	0.115	9.8%	7.1%	7.1%	7.6%	29	0.0	0.1	0.5	Treatment
2	Woods	6	Raingarden	0.089	9.8%	7.1%	7.1%	7.6%	0	0.0	0.0	0.0	Treatment
3	Residential Area	6	Raingarden	0.570	9.8%	7.1%	7.1%	7.6%	7	0.0	0.1	1.7	Treatment
Total								**BMP Total**	**36**	**0.05**	**0.2**	**2.2**	
								TOTAL REMOVAL =	**59**	**0.1**	**0.2**	**3.1**	
								% REMOVAL =	**15.0%**	**8.8%**	**7.7%**	**10.2%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:
Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By: _____ Date: _____ Signature: _____ Date Accepted: _____
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Model Evaluated by: _____ Date: _____ Signature: _____ Date Accepted: _____

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 10B Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.180	Yes	0.072	80	31.5	52	523	20,557	492	0.70	1.8	9.9
2	Woods	2	Forested	0.170	No	0.000	5	3.9	3.1	31	2,395	8	0.02	0.3	0.2
3	Residential Area	5	Residential-Low Density	0.969	No	0.000	10	5.7	35	352	20,121	125	0.50	2.8	40.0
Total				1.319		0.072			**91**	**905**	**43,074**	**625**	**1.2**	**4.8**	**50.1**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
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Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 10B Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	123.00	Water Quality Volume %	136%									
1	Roadway	2	Plunge Pool / Forebay**	0.180	25.0%	8.0%	3.0%	12.0%	123	0.06	0.1	1.2	Pretreatment
2	Woods	2	Plunge Pool / Forebay**	0.170	25.0%	8.0%	3.0%	12.0%	2	0.00	0.0	0.0	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	0.969	25.0%	8.0%	3.0%	12.0%	31	0.04	0.1	4.8	Pretreatment
Total								**BMP Total**	**156**	**0.10**	**0.1**	**6.0**	
2nd BMP in series													
	BMP Volume (cf) =	260.00	Water Quality Volume %	29%									
1	Roadway	6	Raingarden	0.180	25.8%	18.7%	18.7%	20.1%	95	0.1	0.3	1.8	Treatment
2	Woods	6	Raingarden	0.170	25.8%	18.7%	18.7%	20.1%	1	0.0	0.0	0.0	Treatment
3	Residential Area	6	Raingarden	0.969	25.8%	18.7%	18.7%	20.1%	24	0.1	0.5	7.1	Treatment
Total								**BMP Total**	**121**	**0.21**	**0.9**	**8.9**	
								TOTAL REMOVAL =	**277**	**0.3**	**1.0**	**14.9**	
								% REMOVAL =	**44.4%**	**25.2%**	**21.1%**	**29.7%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:
Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

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Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 12 Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.154	Yes	0.062	80	31.5	45	447	17,588	421	0.60	1.5	8.5
2	Woods	2	Forested	0.104	No	0.000	5	3.9	1.9	19	1,465	5	0.01	0.2	0.1
3	Residential Area	5	Residential-Low Density	0.828	No	0.000	10	5.7	30	301	17,193	107	0.43	2.4	34.2
Total				1.086		0.062			**77**	**767**	**36,247**	**533**	**1.0**	**4.1**	**42.8**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

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Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

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Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
Model Reviewed by:		Date:		Signature:		Date Accepted:	
Model Evaluated by:		Date:		Signature:		Date Accepted:	

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 12 Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	10.00	Water Quality Volume %	13%									
1	Roadway	2	Plunge Pool / Forebay**	0.154	3.3%	1.0%	0.4%	1.6%	14	0.01	0.0	0.1	Pretreatment
2	Woods	2	Plunge Pool / Forebay**	0.104	3.3%	1.0%	0.4%	1.6%	0	0.00	0.0	0.0	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	0.828	3.3%	1.0%	0.4%	1.6%	3	0.00	0.0	0.5	Pretreatment
Total								**BMP Total**	**17**	**0.01**	**0.0**	**0.7**	
2nd BMP in series													
	BMP Volume (cf) =	153.00	Water Quality Volume %	200%									
1	Roadway	1	Vegetated Swale	0.154	65.0%	25.0%	20.0%	60.0%	265	0.1	0.3	5.0	Pretreatment
2	Woods	1	Vegetated Swale	0.104	65.0%	25.0%	20.0%	60.0%	3	0.0	0.0	0.1	Pretreatment
3	Residential Area	1	Vegetated Swale	0.828	65.0%	25.0%	20.0%	60.0%	67	0.1	0.5	20.2	Pretreatment
Total								**BMP Total**	**335**	**0.26**	**0.8**	**25.3**	
								TOTAL REMOVAL =	**352**	**0.3**	**0.8**	**25.9**	
								% REMOVAL =	**66.1%**	**25.8%**	**20.3%**	**60.6%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:

Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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Choi, J & Engel, B. Urban BMPs and Cost Estimation, Structural BMP Expected Pollutant Removal Efficiency & Median Event Mean Concentration for Urban Land Uses. US EPA. (1993) Handbook Urban Runoff Pollution and Control Planning. Retrieved July 22, 2005 from the World Wide Web: http://danpatch.ecn.purdue.edu/~jychoi/ubmp0/emc2.htm
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New Hampshire Stormwater Manual December 2008
^Appendix E, Volume 1 of the New Hampshire Stormwater Manual, December 2008
*Table H-2 of the 2010 Rhode Island Storm Water Manual
**Table H-3 & H-4 of the 2010 Rhode Island Storm Water Manual
***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:		Date:		Signature:		Date Accepted:
Model Reviewed by:		Date:		Signature:		Date Accepted:
Model Evaluated by:		Date:		Signature:		Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 14A Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.540	Yes	0.216	80	31.5	157	1,568	61,672	1,476	2.11	5.4	29.7
2	Woods	2	Forested	0.000	No	0.000	0	0.0	0.0	0	0	0	0.00	0.0	0.0
3	Residential Area	5	Residential-Low Density	5.100	No	0.000	10	5.7	185	1,851	105,902	659	2.64	14.5	210.3
Total				5.640		0.216			**342**	**3,419**	**167,574**	**2,136**	**4.7**	**19.9**	**240.1**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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The Simple Method to Calculate Urban Stormwater Loads. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm

Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
Model Reviewed by:		Date:		Signature:		Date Accepted:	
Model Evaluated by:		Date:		Signature:		Date Accepted:	

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 14A Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	245.00	Water Quality Volume %	72%									
1	Roadway	2	Plunge Pool / Forebay**	0.540	17.9%	5.7%	2.1%	8.6%	264	0.12	0.1	2.6	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	5.100	17.9%	5.7%	2.1%	8.6%	118	0.15	0.3	18.1	Pretreatment
Total								**BMP Total**	**383**	**0.27**	**0.4**	**20.6**	
2nd BMP in series													
	BMP Volume (cf) =	123.00	Water Quality Volume %	36%									
1	Roadway	1	Vegetated Swale	0.540	23.4%	9.0%	7.2%	21.6%	283	0.2	0.4	5.9	Pretreatment
3	Residential Area	1	Vegetated Swale	5.100	23.4%	9.0%	7.2%	21.6%	127	0.2	1.0	41.5	Pretreatment
Total								**BMP Total**	**410**	**0.40**	**1.4**	**47.4**	
								TOTAL REMOVAL =	**792**	**0.7**	**1.8**	**68.0**	
								% REMOVAL =	**37.1%**	**14.2%**	**9.2%**	**28.3%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:
Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:	Date:	Signature:	Date Accepted:
Model Reviewed by:	Date:	Signature:	Date Accepted:
Model Evaluated by:	Date:	Signature:	Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 14B Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.490	Yes	0.196	80	31.5	142	1,423	55,962	1,340	1.92	4.9	27.0
2	Woods	2	Forested	0.000	No	0.000	0	0.0	0.0	0	0	0	0.00	0.0	0.0
3	Residential Area	5	Residential-Low Density	1.640	No	0.000	10	5.7	60	595	34,055	212	0.85	4.7	67.6
Total				2.130		0.196			**202**	**2,018**	**90,017**	**1,552**	**2.8**	**9.5**	**94.6**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
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Model Evaluated by:		Date:		Signature:		Date Accepted:	

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 14B Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	13.00	Water Quality Volume %	6%									
1	Roadway	2	Plunge Pool / Forebay**	0.490	1.6%	0.5%	0.2%	0.8%	22	0.01	0.0	0.2	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	1.640	1.6%	0.5%	0.2%	0.8%	3	0.00	0.0	0.5	Pretreatment
Total								**BMP Total**	**25**	**0.01**	**0.0**	**0.7**	
2nd BMP in series													
	BMP Volume (cf) =	73.50	Water Quality Volume %	4%									
1	Roadway	6	Raingarden	0.490	3.3%	2.4%	2.4%	2.5%	43	0.0	0.1	0.7	Treatment
3	Residential Area	6	Raingarden	1.640	3.3%	2.4%	2.4%	2.5%	7	0.0	0.1	1.7	Treatment
Total								**BMP Total**	**50**	**0.07**	**0.2**	**2.4**	
								TOTAL REMOVAL =	**75**	**0.1**	**0.2**	**3.1**	
								% REMOVAL =	**4.8%**	**2.9%**	**2.6%**	**3.3%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:

Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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*Table H-2 of the 2010 Rhode Island Storm Water Manual
**Table H-3 & H-4 of the 2010 Rhode Island Storm Water Manual
***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:	Date:	Signature:	Date Accepted:
Model Reviewed by:	Date:	Signature:	Date Accepted:
Model Evaluated by:	Date:	Signature:	Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 14C Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.485	Yes	0.194	80	31.5	141	1,408	55,391	1,326	1.90	4.8	26.7
2	Woods	2	Forested	0.000	No	0.000	0	0.0	0.0	0	0	0	0.00	0.0	0.0
3	Residential Area	5	Residential-Low Density	1.600	No	0.000	10	5.7	58	581	33,224	207	0.83	4.6	66.0
Total				2.085		0.194			**199**	**1,989**	**88,615**	**1,533**	**2.7**	**9.4**	**92.7**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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The Simple Method to Calculate Urban Stormwater Loads. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm

Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
Model Reviewed by:		Date:		Signature:		Date Accepted:	
Model Evaluated by:		Date:		Signature:		Date Accepted:	

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 14C Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	10.00	Water Quality Volume %	5%									
1	Roadway	2	Plunge Pool / Forebay**	0.485	1.3%	0.4%	0.2%	0.6%	17	0.01	0.0	0.2	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	1.600	1.3%	0.4%	0.2%	0.6%	3	0.00	0.0	0.4	Pretreatment
Total								**BMP Total**	**19**	**0.01**	**0.0**	**0.6**	
2nd BMP in series													
	BMP Volume (cf) =	60.00	Water Quality Volume %	3%									
1	Roadway	6	Raingarden	0.485	2.7%	2.0%	2.0%	2.1%	36	0.0	0.1	0.6	Treatment
3	Residential Area	6	Raingarden	1.600	2.7%	2.0%	2.0%	2.1%	6	0.0	0.1	1.4	Treatment
Total								**BMP Total**	**41**	**0.05**	**0.2**	**1.9**	
								TOTAL REMOVAL =	**60**	**0.1**	**0.2**	**2.5**	
								% REMOVAL =	**3.9%**	**2.4%**	**2.1%**	**2.7%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:

Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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References:

Comparative Pollutant Removal Capability of Stormwater Treatment Practices, Technical Note #95 from Watershed Protection Techniques. 2(4): 515-520, Article 64. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/Practice/64-Comparative%20Pollutant%20Removal.pdf
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***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:	Date:	Signature:	Date Accepted:
Model Reviewed by:	Date:	Signature:	Date Accepted:
Model Evaluated by:	Date:	Signature:	Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 16 Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.240	Yes	0.096	80	31.5	70	697	27,410	656	0.94	2.4	13.2
2	Woods	2	Forested	0.410	No	0.000	5	3.9	7.4	74	5,777	18	0.04	0.6	0.5
3	Residential Area	5	Residential-Low Density	1.920	No	0.000	10	5.7	70	697	39,869	248	0.99	5.5	79.2
Total				2.570		0.096			**147**	**1,468**	**73,056**	**923**	**2.0**	**8.5**	**92.9**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

Model Entered By:		Date:		Signature:		Date Accepted:	
Model Reviewed by:		Date:		Signature:		Date Accepted:	
Model Evaluated by:		Date:		Signature:		Date Accepted:	

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 16 Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	63.00	Water Quality Volume %	43%									
1	Roadway	2	Plunge Pool / Forebay**	0.240	10.7%	3.4%	1.3%	5.1%	70	0.03	0.0	0.7	Pretreatment
2	Woods	2	Plunge Pool / Forebay**	0.410	10.7%	3.4%	1.3%	5.1%	2	0.00	0.0	0.0	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	1.920	10.7%	3.4%	1.3%	5.1%	27	0.03	0.1	4.1	Pretreatment
Total								**BMP Total**	**99**	**0.07**	**0.1**	**4.8**	
2nd BMP in series													
	BMP Volume (cf) =	314.00	Water Quality Volume %	21%									
1	Roadway	6	Raingarden	0.240	19.2%	13.9%	13.9%	15.0%	113	0.1	0.3	1.9	Treatment
2	Woods	6	Raingarden	0.410	19.2%	13.9%	13.9%	15.0%	3	0.0	0.1	0.1	Treatment
3	Residential Area	6	Raingarden	1.920	19.2%	13.9%	13.9%	15.0%	43	0.1	0.7	11.2	Treatment
Total								**BMP Total**	**159**	**0.26**	**1.2**	**13.2**	
								TOTAL REMOVAL =	**258**	**0.3**	**1.3**	**18.0**	
								% REMOVAL =	**27.9%**	**16.9%**	**15.0%**	**19.3%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:

Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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References:

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Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:		Date:		Signature:		Date Accepted:
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Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 16A Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.060	Yes	0.024	80	31.5	17	174	6,852	164	0.23	0.6	3.3
2	Woods	2	Forested	0.000	No	0.000	0	0.0	0.0	0	0	0	0.00	0.0	0.0
3	Residential Area	5	Residential-Low Density	0.070	No	0.000	10	5.7	3	25	1,454	9	0.04	0.2	2.9
Total				0.130		0.024			**20**	**200**	**8,306**	**173**	**0.3**	**0.8**	**6.2**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
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Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

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Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 16A Pollutant Reduction Estimates

No.	Watershed Name	BMP ID	BMP Type	BMP Drainage Area (acres)	BMP Removal Efficiency^ TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal**(%)	Quantity of Pollutant Removed Annual TSS Removed (lbs)	Annual TP Removed (lbs)	Annual TN Removed (lbs)	Annual Fecal Coliform Removed (billion colonies)	Pretreatment / Treatment
1st BMP in series													
	BMP Volume (cf) =	10.00	Water Quality Volume %	50%									
1	Roadway	1	Vegetated Swale	0.060	32.6%	12.5%	10.0%	30.1%	53	0.03	0.1	1.0	Pretreatment
3	Residential Area	1	Vegetated Swale	0.070	32.6%	12.5%	10.0%	30.1%	3	0.00	0.0	0.9	Pretreatment
Total								**BMP Total**	**56**	**0.03**	**0.1**	**1.9**	
2nd BMP in series													
	BMP Volume (cf) =	94.00	Water Quality Volume %	47%									
1	Roadway	6	Raingarden	0.060	42.4%	30.6%	30.6%	33.0%	47	0.1	0.2	0.8	Treatment
3	Residential Area	6	Raingarden	0.070	42.4%	30.6%	30.6%	33.0%	3	0.0	0.1	0.7	Treatment
Total								**BMP Total**	**49**	**0.07**	**0.2**	**1.4**	
								TOTAL REMOVAL =	**106**	**0.1**	**0.3**	**3.3**	
								% REMOVAL =	**61.1%**	**39.3%**	**37.6%**	**53.1%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

BMP Type	BMP ID (used for v-lookup)	TSS Removal (%)	TP Removal (%)	TN Removal (%)	Fecal Coliform Removal** (%)	Pretreatment / Treatment	BMP Type
Vegetated Swale	1	65%	25%	20%	60%	Pretreatment	Vegetated Swale
Plunge Pool / Forebay**	2	25%	8%	3%	12%	Pretreatment	Plunge Pool / Forebay**
Leaching Catch Basin**	3	90%	55%	40%	90%	Pretreatment	Leaching Catch Basin**
Wet Pond	4	70%	45%	35%	70%	Treatment	Wet Pond
Riprap Swale***	5	50%	5%	2%	5%	Pretreatment	Riprap Swale***
Raingarden	6	90%	65%	65%	70%	Treatment	Raingarden
Infiltration Basin	7	90%	65%	60%	95%	Treatment	Infiltration Basin
Infiltration Chambers**	8	90%	55%	40%	90%	Treatment	Infiltration Chambers**
Gravel Wetland	9	95%	64%	85%	85%	Treatment	Gravel Wetland
Extended Detention Wetland	10	80%	45%	55%	60%	Treatment	Extended Detention Wetland

EXAMPLE:

Pollutant Removal of BMPs in Series Equation:
If removal from the 1st BMP is >80%, the 2nd BMP efficiency shall be 50% of its normal efficiency.
If removal from the 1st BMP is <80%, the 2nd BMP efficiency shall be 75% of its normal efficiency.
Example: TSS load of 100lbs. 1st BMP removal 85%, 2nd BMP removal 40%.
TSS Removal = 100lbs * 85% = 85 lbs in 1st BMP
TSS Removal = (100lb-85lb) * (40% * .5) = 3 lbs in 2nd BMP
Net TSS Removal = 88 lbs

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References:

Comparative Pollutant Removal Capability of Stormwater Treatment Practices, Technical Note #95 from Watershed Protection Techniques. 2(4): 515-520, Article 64. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/Practice/64-Comparative%20Pollutant%20Removal.pdf
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Rhode Island Stormwater Design and Installation Standards Manual Appendix H, December 2010
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*Table H-2 of the 2010 Rhode Island Storm Water Manual
**Table H-3 & H-4 of the 2010 Rhode Island Storm Water Manual
***Assumed value for riprap swale interpolated from estimated removals for forebays and vegetated swales

Remarks / Comments:
BMP Volume for infiltration area assumes a 30% porosity in cruashed stone. Model Calibration has not been completed to date

Model Entered By:	Date:	Signature:	Date Accepted:
Model Reviewed by:	Date:	Signature:	Date Accepted:
Model Evaluated by:	Date:	Signature:	Date Accepted:

Baboosic Lake
Merrimack Amherst, NH

The Simple Method - Pollutant Reduction Model

SITE 16B Pollutant Loading Estimates

No.	Watershed Name	Landuse ID	Landuse	Area (acres)	Sanded?	Sanded Area (acres)	% Impervious	Runoff (in)	Pretreatment (0.1"/ Imp. acre) cf	Treatment (1"/ Imp. acre) cf	Annual Runoff (cf)	Annual TSS (lbs)	Annual TP (lbs)	Annual TN (lbs)	Annual FC (billion colonies)
1	Roadway	8	Roadway/Parking Lot	0.450	Yes	0.180	80	31.5	131	1,307	51,394	1,230	1.76	4.5	24.8
2	Woods	2	Forested	0.000	No	0.000	0	0.0	0.0	0	0	0	0.00	0.0	0.0
3	Residential Area	5	Residential-Low Density	2.930	No	0.000	10	5.7	106	1,064	60,842	379	1.52	8.3	120.8
Total				3.380		0.180			**237**	**2,370**	**112,235**	**1,609**	**3.3**	**12.8**	**145.6**

Landuse[1]	Landuse ID (used for v-lookup)	% Impervious	(C) TSS (mg/l)	(C) TP (mg/l)	(C) TN (mg/l)	*Fecal Coliform (colonies/100 mL)	Landuse
Commercial	1	85	77	0.33	2.97	4600	Commercial
Forested	2	5	51	0.11	1.78	300	Forested
Open Urban Land	3	9	51	0.11	1.74	300	Open Urban Land
Residential-High Density	4	40	100	0.4	2.2	7000	Residential-High Density
Residential-Low Density	5	10	100	0.4	2.2	7000	Residential-Low Density
Residential-Med. Density	6	30	100	0.4	2.2	7000	Residential-Med. Density
Industrial	7	75	149	0.32	3.97	2400	Industrial
Roadway/Parking Lot	8	80	172	0.55	1.4	1700	Roadway/Parking Lot
Pasture	9	5	145	0.37	5.98	300	Pasture

[1] High density residential (<1/4 acre lots); Medium density residential (1/4 to 1/2 acre lots);
Low density residential (>1 acre lots); Multifamily (>7 dwellings per acre).

Annual Rainfall	45.4	inches; user specified
P_j	0.9	%; default
Sanding Rate	500	lbs/acre; default
Sanding Applications	10	times/year; default

References:
Pitt, Robert. (2004, February 16). The National Stormwater Quality Database (NSQD, version 1.1). Retrieved July 22, 2005 from the World Wide Web: http://unix.eng.ua.edu/~rpitt/Research/ms4/Paper/recentpaper.htm
The New York Stormwater Management Design Manual Appendix A. Retrieved July 22, 2005 from the World Wide Web: http://www.dec.state.ny.us/website/dow/toolbox/simple.pdf
The Simple Method to Calculate Urban Stormwater Loads. Retrieved July 22, 2005 from the World Wide Web: http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm

Pollutant Loading Formulas (Simple Method Equations):

TSS, TP, TN

L = 0.226 * R * C * A

Where:

L = Annual Load (lbs)
R = Annual Runoff (inches)
C = Pollutant Concentration (mg/l)
A = Area (acres)
0.226 = Unit Conversion Factor

Fecal Coliform

L = .00103 * R * C * A

Where:

L = Annual Load (Billion Colonies)
R = Annual Runoff (inches)
C = Pollutant Concentration (#col/100mL)
A = Area (acres)
0.00103 = Unit Conversion Factor

$R = P * P_j * Rv$

Where:

R = Annual Runoff (inches)
P = Annual Rainfall (inches)
P_j = % of rainfall events producing runoff
Rv = Runoff Coefficient = 0.05+0.9 * Ia
Ia = Impervious Fraction (%)

Notes:

1. Sanding applications assume 50% of residential and commercial impervious areas are sanded and 66% (2/3) of the impervious area of industrial properties is sanded.
2. Pollutant Concentrations (C) are from Volume 1 Appendix D of the New Hampshire Stormwater Manual (December 2008)

Remarks / Comments:
Model watershed information based on attached watershed map & ortho imagery. Annual precipitation from Weather Underground Website

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1st BMP in series													
	BMP Volume (cf) =	273.00	Water Quality Volume %	115%									
1	Roadway	2	Plunge Pool / Forebay**	0.450	25.0%	8.0%	3.0%	12.0%	308	0.14	0.1	3.0	Pretreatment
3	Residential Area	2	Plunge Pool / Forebay**	2.930	25.0%	8.0%	3.0%	12.0%	95	0.12	0.3	14.5	Pretreatment
Total								**BMP Total**	**402**	**0.26**	**0.4**	**17.5**	
								TOTAL REMOVAL =	**402**	**0.3**	**0.4**	**17.5**	
								% REMOVAL =	**25.0%**	**8.0%**	**3.0%**	**12.0%**	

Note: The removal efficiencies shown for all BMPs in series after the first BMP have been adjusted downward to account for the reduced efficiency (e.g., 50% or 75%) as explained in "Pollutant Removal of BMPs in Series Equation"

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