POLLUTANT REDUCTION TARGETS IN AN MS4 PERMIT

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NEWTON TEDDER EPA REGION 1

BOSTON



WATER QUALITY STANDARDS IN MS4 PERMITS

GENERIC

- NO AUTHORIZATION FOR THOSE DISCHARGES NOT MEETING WATER QUALITY STANDARDS
- 2003 PHASE II MA/NH PERMIT APPROACH

SPECIFIC

- SPECIFIC BMP IMPLEMENTATION
 REQUIREMENTS ABOVE MEP
- NUMERIC TARGETS WHERE APPLICABLE
- SCHEDULES WHERE APPROPRIATE
 2016 PHASE II MA PERMIT APPROACH

HISTORICAL OVERVIEW



PERFORMANCE CURVE CONCEPT

SW Control Performance Curves Surface Infiltration Practices rain gardens, swales, basins, etc. (Saturated Soil Infiltration Rate 0.52 in/hr) 100% 100% 90% 90% Load Removal 80% 70% 70% 60% 60% **Cumulative Phosphorus** 50% 40% 40% 30% 30% 20% 20% 10% 10% 0% 0% 1.2 0.2 0.6 0.8 1.4 1.8 0.4 1.6 n 2 Physical Storage Design Capacity, Impervious Surface Runoff Depth (inches) -TP - Volume



Small Rain Garden http://www.flickr.com/photos/cdwilliams1/2915660839/ Larger Stormwater Basin http://www.flickr.com/photos/leonizzy/6232922661

Cost per Pound of Phosphorus Removed by Gravel Wetland System Based on Design Capacity, \$/Ib P



Estimated Construction Costs for Structural Stormwater Controls to Achieve a 40 % Reduction in Phosphorus Load form the Charles **River Watershed in Milford, Bellingham & Franklin based on Amount of Impervious Area Treated**



CNEW ENGLAND REGION PRECIPITATION PATTERNS

MOST RAIN EVENTS ARE SMALL IN SIZE;

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- OCCUR REGULARLY (AVERAGE ABOUT ONCE EVERY THREE DAYS)
- THE TOTAL VOLUME AND EVENT SIZE
 DISTRIBUTION ARE RELATIVELY CONSISTENT
 ACROSS NEW ENGLAND REGION
- IMPORTANT DRIVER FOR POLLUTANT LOAD DELIVERY AND CUMULATIVE PERFORMANCE OF SW CONTROLS

Distribution of Precipitation Events by Depth; Boston, MA 1992-2014 (excludes all events with depths < 0.05 inches)





2 PHOSPHORUS TMDLS -**CHARLES RIVER** WATERSHED

- 308 SQUARE MILE WATERSHED (61 SQ. MI. (39,000 AC.) OF IMPERVIOUS COVER (IC)
- 80 MILES IN LENGTH

CAMBRIDGE AND

- 35 CITIES AND TOWNS
- ~900,000 POPULATION

- ~747,000 IN BOSTON,

BROOKLINE



LOWER CHARLES RIVER PHOSPHORUS TMDL WASTE LOAD ALLOCATIONS

Source	Existing Load (kg/year) (1998-2002)	Waste Load Allocation (kg/year)	Load Allocation (kg/year)	TMDL (kg/year)	% Reduction
Upstream Watershed at Watertown Dam ^a	28,925	15,109	0	15,109	48%
CSOsb	2,263	90°	0	90°	96%
Stony Brook Watershed	5,123	1,950	0	1,950	62%
Muddy River Watershed	1,549	590	0	590	62%
Laundry Brook Watershed	409	155	0	155	62%
Faneuil Brook Watershed	326	125	0	125	62%
Other Drainage Areas	1,455	550	0	550	62%
Explicit Margin of Safety	-	-	-	979	
TOTAL	40,050	18,565	0	19,544	54%

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UPPER/MIDDLE AND LOWER CHARLES TMDL WLAS

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Land Use Group	Upper TMDL WLA % Reduction Rate	Lower TMDL WLA % Reduction Rate
Commercial	65%	62%
Industrial	65%	62%
High Density Residential	65%	62%
Medium Density Residential	65%	62%
Low Density Residential	45%	62%
Highway	65%	62%
Open Space	35%	62%
Agriculture	35%	62%
Forest	0%	0%

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INTERPRETATION OF WLAS

Final Lower Charles River Phosphorus Load Reduction Recommendations

Charles River Watershed	All Commercial	All Industrial	High Density Residential	Medium Density Residential	Low Density Residential	Agriculture	Forest	Open Land	WWTF	CSO	Total
Drainage Area (hectares)	2168	3891	9232	9331	11077	2063	30844	8428	NA	NA	77034
Annual Phosphorus Loads (kg/yr)	3676	5718	10437	5278	503	1042	4018	289	6825	2263	40050
TMDL Recommended Phosphorus Loads (kg/yr)	1268	1972	3600	1820	276	672	4018	187	4663	90	18565
Needed % Reduction	65%	65%	65%	65%	45%	35%	0%	35%	32%	96%	53.6%

Phosphorus load reductions by source category based on Final Total Maximum Daily Load for Nutrients In the Lower Charles River Basin, Massachusetts (CN 301.0), June, 2007.

Charles River Watershed Community	Commercial	Industrial	High Denisty Residential	Medium Density Residential	Low Density Residential	Agriculture	Forest	Open Land	Total	Percent Reduction Required
Bellingham										
Drainage Area (ha)	58.8	212.0	134.2	240.0	212.2	57.1	1315.9	245.0	2475.3	ן ו
1998-2002 Loading (kg/yr)	99.8	311.7	151.9	135.9	9.7	28.8	171.6	8.4	917.8	
TMDL Loading (kg/yr)	34.4	107.5	52.4	46.9	5.3	18.6	171.6	5.4	442.1	51.8%
Belmont	Belmont									
Drainage Area (ha)	7.2	10.0	105.1	0.9	30.5	0.0	99.9	96.5	350.1	
1998-2002 Loading (kg/yr)	12.3	14.7	118.9	0.5	1.4	0.0	13.0	3.3	164.1	
TMDL Loading (kg/yr)	4.2	5.1	41.0	0.2	0.8	0.0	13.0	2.1	66.4	59.5%
Boston										
Drainage Area (ha)	587.1	541.5	2556.5	43.4	20.2	7.4	688.2	1444.0	5888.3	
1998-2002 Loading (kg/yr)	996.4	796.4	2892.4	24.6	0.9	3.7	89.7	49.6	4853.8	
TMDL Loading (kg/yr)	343.7	274.7	997.6	8.5	0.5	2.4	89.7	32.0	1749.0	64.0%
Brookline										
Drainage Area (ha)	135.9	10.0	588.2	209.4	254.8	42.9	157.0	357.1	1755.5	
1998-2002 Loading (kg/yr)	230.7	14.8	665.5	118.5	11.6	21.7	20.5	12.3	1095.5	
TMDL Loading (kg/yr)	79.6	5.1	229.5	40.9	6.3	14.0	20.5	7.9	403.8	63.1%
Cambridge										
Drainage Area (ha)	123.1	126.9	205.7	0.0	0.0	0.0	3.1	181.7	640.4	
1998-2002 Loading (kg/yr)	208.9	186.6	232.7	0.0	0.0	0.0	0.4	6.2	634.8	
TMDL Loading (kg/yr)	72.0	64.3	80.3	0.0	0.0	0.0	0.4	4.0	221.1	65.2%

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• NUMERIC REDUCTION REQUIREMENTS IN THE PERMIT

	Com	munity - Tab	le F1	Regulated Area - Table F2			
	Baseline	Reduction	Reduction	Baseline	Reduction	Reduction	
Community	(lb/yr)	(lb/yr)	(%)	(lb/yr)	(lb/yr)	(%)	
Bellingham	2,112	759	36	1,790	670	37	
Franklin	5,219	1,916	37	5,146	1,905	37	
Medway	2,351	743	32	2,293	723	32	
Natick	2,531	946	37	2,276	886	39	
Somerville	1,870	300	16	448	95	21	

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5 years after permit effective date	5-10 years after permit effective date	10-15 years after permit effective date	15-20 years after permit effective date
Create Phase 1 Plan	Implement Phase 1 Plan		
	Create Phase 2 Plan	Implement Phase 2 Plan	
		Create Phase 3 Plan	Implement Phase 3 Plan

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IMPLEMENTATION SCHEDULE

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DEMONSTRATING COMPLIANCE

 $P_{exp}(\frac{mass}{yr}) = P_{base}(\frac{mass}{yr}) - \left(P_{Sred}(\frac{mass}{yr}) + P_{NSred}(\frac{mass}{yr})\right) + P_{DEVinc}(\frac{mass}{yr})$ Equation 1. Equation used to calculate yearly phosphorus export rate from the chosen PCP Area. P_{exp} =Current phosphorus export rate from the PCP Area in mass/year. P_{base} =baseline phosphorus export rate from LPCP Area in mass/year. P_{Sred} = yearly phosphorus reduction from implemented structural controls in the PCP Area in mass/year. P_{NSred} = yearly phosphorus reduction from in the PCP Area in mass/year. P_{DEVinc} = yearly phosphorus increase resulting from development since 2005 in the PCP Area in mass/year.

GENERATION OF SW CONTROL PERFORMANCE CURVES FOR NEW ENGLAND REGION

SW Controls

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Surface Infiltration (6 infiltration rates)

Infiltration trenches (6 infiltration rates)

Bio-filtration

Porous pavement with underdrain

WQ Swales (non-infiltration)

Gravel wetland

Enhanced Bio-filtration*
* Optimized for N and P removal



	BATT	(
d/Edit Project Select a Jurisdiction		
Existing Project Select a Structural BMP Project	Edit Delete	
Select a Non-Structural BMP Project Select a Land Use Conversion Project	View Project Summary	
New Project Add BMP (Structural) (Non-Structural	BMP Projects Select a Jurisdiction Structural BMPs Non-Structural BMPs Land Use	Conversion
	Project Summary Credit Structural Non-Structural LU Com Phosphorus Reduced Load (lb/yr)	version Total
	Nitrogen Reduced Load (lb/yr) Sediment Reduced Load (lb/yr)	
		Close
		0

BATT AUTOMATED CALCULATIONS

D LAND AREA POLLUTANT LOADING:

- BASED ON LAND USE, SOIL TYPE, IMPERVIOUS AREA
- ANNUAL PHOSPHORUS LOAD EXPORT RATES (PLERS) FROM PERMIT BUILT INTO TOOL



BMP POLLUTANT REDUCTIONS:

 EPA/TETRATECH WORK ON BMP CURVES FOR STRUCTURAL BMPS IN PERMIT AND BUILT INTO TOOL



OPTI-TOOL

- A SPREADSHEET-BASED BMP
 OPTIMIZATION TOOL
 - PLANNING LEVEL ANALYSIS (EPA REGION 1 BMP PERFORMANCE CURVES)
 - IMPLEMENTATION LEVEL ANALYSIS (EPA SUSTAIN BMP SIMULATION AND OPTIMIZATION ENGINE)
- CUSTOMIZED FOR EPA REGION 1





THANK YOU

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MA SMALL MS4 WEBSITE:

HTTPS://WWW.EPA.GOV/NPDES-PERMITS/MASSACHUSETTS-SMALL-MS4-GENERAL-PERMIT

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