MS4 Name	Permit Number	HUC 12 Name	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)
Westmoreland County				
HEMPFIELD TWP	PAG136331	Jacks Run, Little Sewickley Creek	Little Sewickley Creek, Unnamed Tributaries to Jacks Run, Unnamed Tributaries to Little Sewickley Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids
		Jacks Run, Upper Sewickley Creek	Jacks Run, Sewickley Creek	Appendix B-Pathogens
		Jacks Run, Lower Sewickley Creek, Upper Sewickley Creek	Coal Tar Run, Jacks Run, Sewickley Creek, Wilson Run, Zellers Run	Appendix A-Metals, pH
		Brush Creek	Brush Creek, Unnamed Tributaries to Brush Creek	Appendix A-Metals, pH, Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids
		Crabtree Creek, Lower Loyalhanna Creek	Crabtree Creek, Kiskiminetas-Conemaugh River Watersheds TMDL, Little Crabtree Creek, Loyalhanna Creek, Unnamed Tributaries to Little Crabtree Creek	Appendix A-Metals, pH, Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation, Suspended Solids
HUNKER BORO	PAG136167	Lower Sewickley Creek	Sewickley Creek	Appendix A-Metals, pH
HYDE PARK BORO		Kiskiminetas River-Allegheny River	Kiskiminetas River	Appendix A-Metals, pH, Appendix E-Suspended Solids
		Chartiers Run-Allegheny River	Kiskiminetas River	Appendix A-Metals, pH, Appendix E-Suspended Solids
IRWIN BORO	PAG136164	Brush Creek	Brush Creek, Coal Run, Tinkers Run, Turtle Creek	Appendix A-Metals, pH, Appendix E-Siltation
JEANNETTE CITY	PAG136299	Brush Creek	Brush Creek, Unnamed Tributaries to Brush Creek	Appendix A-Metals, pH, Appendix E-Nutrients, Siltation
LATROBE BORO	PAG136329	Lower Loyalhanna Creek, Middle Loyalhanna Creek	Kiskiminetas-Conemaugh River Watersheds TMDL, Loyalhanna Creek, Saxman Run, Unity Run	Appendix A-Metals, pH, Appendix E-Siltation, Suspended Solids
LOWER BURRELL CITY	PAG136180	Chartiers Run-Allegheny River	Allegheny River	Appendix C-Chlordane, PCB
		Pucketa Creek	Pucketa Creek	Appendix E-Siltation
MANOR BORO	PAG136294	Brush Creek	Brush Creek, Bushy Run, Turtle Creek	Appendix A-Metals, pH, Appendix E-Siltation
MONESSEN CITY	PAG136283	Fallen Timber Run-Monongahela River, Little Redstone Creek-Monongahela River, Maple Creek-Monongahela River	Monongahela River	Appendix C-PCB
		Little Redstone Creek-Monongahela River	Speers Run	Appendix A-Metals, pH
		Little Redstone Creek-Monongahela River, Maple Creek-Monongahela River	Speers Run, Unnamed Tributaries to Monongahela River	Appendix E-Siltation
MOUNT PLEASANT BORO	PAG136179	Headwaters Jacobs Creek, Jacobs Creek-Youghiogheny River	Jacobs Creek, Shupe Run	Appendix E-Siltation
		Headwaters Jacobs Creek	Shupe Run, Unnamed Tributaries to Jacobs Creek	Appendix A-Metals
MOUNT PLEASANT TWP	PAI136127	Headwaters Jacobs Creek, Jacobs Creek-Youghiogheny River	Jacobs Creek, Shupe Run	Appendix E-Organic Enrichment/Low D.O., Siltation
		Headwaters Jacobs Creek	Shupe Run, Unnamed Tributaries to Jacobs Creek	Appendix A-Metals, pH
		Upper Sewickley Creek	Sewickley Creek	Appendix B-Pathogens, Appendix E-Organic Enrichment/Low D.O., Siltation
		Lower Sewickley Creek, Upper Sewickley Creek	Boyer Run, Brinker Run, Sewickley Creek, Welty Run	Appendix A-Metals, pH

APPENDIX D

STATEWIDE MS4 LAND COVER ESTIMATES

Statewide MS4 Land Cover Estimates

County	Municipality	UA % Impervious	UA % Pervious	Outside of UA % Impervious	Outside of UA % Pervious	UA Acres
Cumberland	MIDDLESEX TWP	28%	72%	10%	90%	2,674.8
Monroe	MIDDLE SMITHFIELD TWP	22%	78%	6%	94%	3,447.7
Cambria	MIDDLE TAYLOR TWP	6%	94%	3%	97%	52.2
Bucks	MIDDLETOWN TWP	34%	66%	34%	66%	12,357.7
Dauphin	MIDDLETOWN BORO	46%	54%	47%	53%	1,308.7
Delaware	MIDDLETOWN TWP	19%	81%	17%	83%	7,438.7
Washington	MIDWAY BORO	42%	58%	36%	64%	223.8
Columbia	MIFFLIN TWP	35%	65%	5%	95%	582.8
Bucks	MILFORD TWP	16%	84%	8%	92%	3,873.9
Delaware	MILLBOURNE BORO	60%	40%	55%	45%	44.2
Erie	MILLCREEK TWP	38%	62%	33%	67%	16,622.1
Lebanon	MILLCREEK TWP	34%	66%	4%	96%	525.2
Lancaster	MILLERSVILLE BORO	41%	59%	41%	59%	1,238.6
Allegheny	MILLVALE BORO	52%	48%	52%	48%	438.6
Chester	MODENA BORO	20%	80%	20%	80%	222.8
Berks	MOHNTON BORO	41%	59%	42%	58%	490.8
Beaver	MONACA BORO	39%	61%	39%	61%	1,530.3
York	MONAGHAN TWP	9%	91%	4%	96%	1,094.9
Westmoreland	MONESSEN CITY	31%	69%	30%	70%	1,835.2
Washington	MONONGAHELA CITY	31%	69%	30%	70%	1,257.7
Cumberland	MONROE TWP	24%	76%	6%	94%	901.8
Allegheny	MONROEVILLE BORO	29%	71%	29%	71%	12,573.2
Montgomery	MONTGOMERY TWP	49%	51%	49%	51%	6,802.7
Columbia	MONTOUR TWP	27%	73%	6%	94%	612.6
Lycoming	MONTOURSVILLE BORO	52%	48%	32%	68%	1,328.7
Allegheny	MOON TWP	27%	73%	26%	74%	13,376.9
Northampton	MOORE TWP	16%	84%	5%	95%	2,935.7
Lackawanna	MOOSIC BORO	26%	74%	25%	75%	3,923.4
Bucks	MORRISVILLE BORO	50%	50%	46%	54%	1,136.1
Delaware	MORTON BORO	57%	43%	57%	43%	232.6
Lancaster	MT JOY BORO	42%	58%	42%	58%	1,551.1
Lancaster	MOUNT JOY TWP	26%	74%	9%	91%	2,809.7
Allegheny	MT LEBANON TWP	50%	50%	50%	50%	3,893.1
Allegheny	MT OLIVER BORO	48%	52%	48%	52%	221.4
Berks	MT PENN BORO	55%	45%	55%	45%	273.1
Adams	MOUNT PLEASANT TWP	11%	89%	4%	96%	513.5
Washington	MOUNT PLEASANT TWP	38%	62%	2%	98%	158.4
Westmoreland	MOUNT PLEASANT BORO	38%	62%	38%	62%	644.1
Westmoreland	MOUNT PLEASANT TWP	12%	88%	4%	96%	3,271.0
Lancaster	MOUNTVILLE BORO	44%	56%	44%	56%	550.9
York	MOUNT WOLF BORO	35%	65%	35%	65%	335.1
Berks	MUHLENBERG TWP	48%	52%	39%	61%	5,880.6
Allegheny	MUNHALL BORO	47%	53%	47%	53%	1,517.6
Westmoreland	MURRYSVILLE BORO	15%	85%	8%	92%	8,692.5
Lebanon	MYERSTOWN BORO	47%	53%	48%	52%	546.0
Luzerne	NANTICOKE CITY	35%	65%	34%	66%	2,224.2
Montgomery	NARBERTH BORO	67%	33%	67%	33%	322.9
Northampton	NAZARETH BORO	44%	56%	44%	56%	1,068.3
Luzerne	NESCOPECK BORO	38%	62%	27%	73%	403.2
Delaware	NETHER PROVIDENCE TWP	33%	67%	33%	67%	3,034.3
Allegheny	NEVILLE TWP	37%	63%	37%	63%	1,499.3

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATEWIDE MS4 LAND COVER ESTIMATES

The Pennsylvania Department of Environmental Protection (DEP) has developed this table of impervious and pervious land cover percentages within and outside of urbanized areas (UAs) to assist municipal MS4 permittees and applicants in developing estimates of existing pollutant loading for Pollutant Reduction Plans (PRPs) and TMDL Plans. DEP does not require that the data in this table be utilized and offers it only as a possible resource to MS4s. An MS4 may determine based on its own analysis that different percentages of impervious and pervious surfaces exist within the municipality. In addition, this table was developed without consideration to whether a PRP and/or TMDL Plan must be developed by an MS4; the MS4 Requirements Table identifies DEP's expectations for development of a PRP and/or TMDL Plan. In other words, the presence of a municipality in this table does not mean a PRP and/or TMDL Plan must be developed.

For those MS4s that do need to develop a plan, this table may be used to streamline the existing pollutant loading calculation. After determining the planning area (i.e., the storm sewershed(s) that drain to the Chesapeake Bay and/or locally impaired waters), DEP's simplified method of calculating existing pollutant loads as described in its PRP Instructions document calls for the determination of the percentages of impervious and pervious land cover within the planning area. The planning area will consist of the UA (or a portion thereof) and may include areas outside of the UA (if stormwater drains into the MS4 from outside the UA).

An example of how this table can be used is as follows:

Abbottstown Boro determines that its planning area for a Chesapeake Bay PRP is 500 acres. This includes all of the UA (321 acres) as well as 179 acres that drain into the MS4 from outside the UA. Abbottstown would like to determine its existing load of sediment (prior to any consideration of existing structural BMPs). Using Attachment B of DEP's PRP Instructions for sediment loading rates, Abbottstown calculates the following existing load:

321 acres UA x 0.3 (30% UA Impervious from table below) x 1,398.77 lbs/acre/yr =	134,702 lbs/yr
321 acres UA x 0.7 (70% UA Pervious from table below) x 207.67 lbs/acre/yr =	46,663 lbs/yr
179 acres outside UA x 0.28 (28% Outside UA Impervious from table below) x 1,398.77 lbs/acre/yr =	70,106 lbs/yr*
179 acres outside UA x 0.72 (72% Outside UA Pervious from table below) x 207.67 lbs/acre/yr =	26,765 lbs/yr*
Total:	278,236 lbs/yr

* MS4s may also elect to use loading rates for undeveloped land presented in Attachment B of DEP's PRP Instructions for areas outside of the UA.

The column for "UA Acres" in the table may or may not be useful in this calculation. If only a portion of the UA is part of the planning area, the MS4 will need to determine the applicable area using different methods.

DEP developed this table using the following methods:

Cartographic Boundary Shapefiles - Urban Areas 2010 were overlain on NLCD 2011 Land Cover (2011 Edition, amended 2014) - National Geospatial Data Asset (NGDA) Land Use/Land Cover data in order to calculate the percentages in the table. The High, Medium and Low Density Residential and mixed land uses were parsed to account for pervious and impervious surfaces within each land use classification. High Density is considered 87% impervious, Medium Density is 52% impervious, and Low Density is 15% impervious. This analysis was performed for entire municipalities but broken out into areas within the UA and outside of the UA.

APPENDIX E

DEVELOPED LAND LOADING RATES FOR PA COUNTIES
(ATTACHMENT B OF PRP INSTRUCTIONS)

ATTACHMENT B

DEVELOPED LAND LOADING RATES FOR PA COUNTIES[1,2,3]

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
Adams	impervious developed	10,373.2	33.43	2.1	1,398.77
	pervious developed	44,028.6	22.99	0.8	207.67
Bedford	impervious developed	9,815.2	19.42	1.9	2,034.34
	pervious developed	19,425	17.97	0.68	301.22
Berks	impervious developed	1,292.4	36.81	2.26	1,925.79
	pervious developed	5,178.8	34.02	0.98	264.29
Blair	impervious developed	3,587.9	20.88	1.73	1,813.55
	pervious developed	9,177.5	18.9	0.62	267.34
Bradford	impervious developed	10,423	14.82	2.37	1,880.87
	pervious developed	23,709.7	13.05	0.85	272.25
Cambria	impervious developed	3,237.9	20.91	2.9	2,155.29
	pervious developed	8,455.4	19.86	1.12	325.3
Cameron	impervious developed	1,743.2	18.46	2.98	2,574.49
	pervious developed	1,334.5	19.41	1.21	379.36
Carbon	impervious developed	25.1	28.61	3.97	2,177.04
	pervious developed	54.2	30.37	2.04	323.36
Centre	impervious developed	7,828.2	19.21	2.32	1,771.63
	pervious developed	15,037.1	18.52	0.61	215.84
Chester	impervious developed	1,838.4	21.15	1.46	1,504.78
	pervious developed	10,439.8	14.09	0.36	185.12
Clearfield	impervious developed	9,638.5	17.54	2.78	1,902.9
	pervious developed	17,444.3	18.89	1.05	266.62
Clinton	impervious developed	7,238.5	18.02	2.80	1,856.91
	pervious developed	11,153.8	16.88	0.92	275.81
Columbia	impervious developed	7,343.1	21.21	3.08	1,929.18
	pervious developed	21,848.2	22.15	1.22	280.39
Cumberland	impervious developed	8,774.8	28.93	1.11	2,065.1
	pervious developed	26,908.6	23.29	0.34	306.95
Dauphin	impervious developed	3,482.4	28.59	1.07	1,999.14
	pervious developed	9,405.8	21.24	0.34	299.62
Elks	impervious developed	1,317.7	18.91	2.91	1,556.93
	pervious developed	1,250.1	19.32	1.19	239.85
Franklin	impervious developed	13,832.3	31.6	2.72	1,944.85
	pervious developed	49,908.6	24.37	0.76	308.31
Fulton	impervious developed	3,712.9	22.28	2.41	1,586.75
	pervious developed	4,462.3	18.75	0.91	236.54
Huntington	impervious developed	7,321.9	18.58	1.63	1,647.53
	pervious developed	11,375.4	17.8	0.61	260.15
Indiana	impervious developed	589	19.29	2.79	1,621.25
	pervious developed	972	20.1	1.16	220.68
Jefferson	impervious developed	21.4	18.07	2.76	1,369.63
	pervious developed	20.4	19.96	1.24	198.60
Juniata	impervious developed	3,770.2	22.58	1.69	1,903.96
	pervious developed	8,928.3	17.84	0.55	260.68
Lackawana	impervious developed	2,969.7	19.89	2.84	1,305.05
	pervious developed	7,783.9	17.51	0.76	132.98
Lancaster	impervious developed	4,918.7	38.53	1.55	1,480.43
	pervious developed	21,649.7	22.24	0.36	190.93
Lebanon	impervious developed	1,192.1	40.58	1.85	1,948.53
	pervious developed	5,150	27.11	0.4	269.81
Luzerne	impervious developed	5,857	20.43	3	1,648.22
	pervious developed	13,482.9	19.46	0.98	221.19
Lycoming	impervious developed	10,031.7	16.48	2.57	1,989.64
	pervious developed	19,995.5	16	0.84	277.38

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
McKean	impervious developed	38.7	20.93	3.21	1,843.27
	pervious developed	5.3	22.58	1.45	249.26
Mifflin	impervious developed	5,560.2	21.83	1.79	1,979.13
	pervious developed	16,405.5	21.13	0.71	296.07
Montour	impervious developed	5,560.2	21.83	1.79	1,979.13
	pervious developed	16,405.5	21.13	0.71	296.07
Northumberland	impervious developed	8,687.3	25.73	1.54	2,197.08
	pervious developed	25,168.3	24.63	0.54	367.84
Perry	impervious developed	5,041.1	26.77	1.32	2,314.7
	pervious developed	9,977	23.94	0.51	343.16
Potter	impervious developed	2,936.3	16.95	2.75	1,728.34
	pervious developed	2,699.3	17.11	1.09	265.2
Schuylkill	impervious developed	5,638.7	30.49	1.56	1,921.08
	pervious developed	14,797.2	29.41	0.57	264.04
Snyder	impervious developed	4,934.2	28.6	1.11	2,068.16
	pervious developed	14,718.1	24.35	0.4	301.5
Somerset	impervious developed	1,013.6	25.13	2.79	1,845.7
	pervious developed	851.2	25.71	1.14	293.42
Sullivan	impervious developed	3,031.7	19.08	2.85	2,013.9
	pervious developed	3,943.4	21.55	1.31	301.58
Susquehanna	impervious developed	7,042.1	19.29	2.86	1,405.73
	pervious developed	14,749.7	20.77	1.21	203.85
Tioga	impervious developed	7,966.9	12.37	2.09	1,767.75
	pervious developed	18,090.3	12.22	0.76	261.94
Union	impervious developed	4,382.6	22.98	2.04	2,393.55
	pervious developed	14,065.3	20.88	0.69	343.81
Wayne	impervious developed	320.5	18.69	2.89	1,002.58
	pervious developed	509	21.14	1.31	158.48
Wyoming	impervious developed	3,634.4	16.03	2.53	2,022.32
	pervious developed	10,792.9	13.75	0.7	238.26
York	impervious developed	10,330.7	29.69	1.18	1,614.15
	pervious developed	40,374.8	18.73	0.29	220.4
All Other Counties	impervious developed	-	23.06	2.28	1,839
	pervious developed	-	20.72	0.84	264.96

Notes:

1 These land loading rate values may be used to derive existing pollutant loading estimates under DEP's simplified method for PRP development. MS4s may choose to develop estimates using other scientifically sound methods.

2 Acres and land loading rate values for named counties in the Chesapeake Bay watershed are derived from CAST. (The column for Acres represents acres within the Chesapeake Bay watershed). For MS4s located outside of the Chesapeake Bay watershed, the land loading rates for "All Other Counties" may be used to develop PRPs under Appendix E; these values are average values across the Chesapeake Bay watershed.

3 For land area outside of the urbanized area, undeveloped land loading rates may be used where appropriate. When using the simplified method, DEP recommends the following loading rates (for any county) for undeveloped land:

- TN – 10 lbs/acre/yr
- TP – 0.33 lbs/acre/yr
- TSS (Sediment) – 234.6 lbs/acre/yr

These values were derived by using the existing loads for each pollutant, according to the 2014 Chesapeake Bay Progress Run, and dividing by the number of acres for the unregulated stormwater subsector.

APPENDIX F

EXISTING LOADING SUPPORTING CALCULATIONS

Existing Pollution Loading Calculations

Monessen Land Cover Estimates within Urbanized Area

Pervious	69%
Impervious	31%

**See Appendix D*

Monessen TSS (Sediment) lbs/acre/yr "All other Counties"

Pervious	264.96
Impervious	1839

***See Appendix E*

UNT#1 to Monongahela River

Total Drainage Area = 556.80 acres

		Area (ac)	Sediment Loading Rate (lbs/ac/yr)	Calculated Sediment Load (lbs/ac/yr)
Pervious	69%	384.19	264.96	101794.98
Impervious	31%	172.61	1839	317429.79
			Total:	**419224.77**
			Required 10% Reduction:	**41922.48**

UNT#2 to Monongahela River

Total Drainage Area = 192.00 acres

		Area (ac)	Sediment Loading Rate (lbs/ac/yr)	Calculated Sediment Load (lbs/ac/yr)
Pervious	69%	132.48	264.96	35101.90
Impervious	31%	59.52	1839	109457.28
			Total:	**144559.18**
			Required 10% Reduction:	**14455.92**

UNT to Speers Run

Total Drainage Area = 83.20 acres

		Area (ac)	Sediment Loading Rate (lbs/ac/yr)	Calculated Sediment Load (lbs/ac/yr)
Pervious	69%	57.41	264.96	15211.35
Impervious	31%	25.79	1839	47427.81
			Total:	**62639.16**
			Required 10% Reduction:	**6263.92**

APPENDIX G

PROPOSED BMP SUPPORTING CALCULATIONS

Proposed BMP's Supporting Calculations

UNT to Speers Run

Monessen Land Cover Estimates within Urbanized Area

Pervious	69%
Impervious	31%

**See Appendix D*

Monessen TSS (Sediment) lbs/acre/yr "All other Counties"

Pervious	264.96
Impervious	1839

***See Appendix E*

Water Quality Inlet Filters

Total Drainage Area = 10 acres

		Area (ac)	Sediment Loading Rate (lbs/ac/yr)	Calculated Sediment Load Removed (lbs/ac/yr)
Pervious	69%	6.9	264.96	1828.22
Impervious	31%	3.1	1839	5700.90
			Total:	7529.12
			82% Sediment Removal Rate:	**6173.88**

Note: FlexStorm Inlet Filters Proposed. See attached Specifications for additional Manufacturer's information (Appendix G)

Bioretention Area at Monessen High School Facility

Total Drainage Area = 2 acres

		Area (ac)	Sediment Loading Rate (lbs/ac/yr)	Calculated Sediment Load Removed (lbs/ac/yr)
Pervious	69%	1.38	264.96	365.64
Impervious	31%	0.62	1839	1140.18
			Total:	1505.82
			55% Sediment Removal Rate:	**828.20**

Note: Please refer to the attached BMP Effectiveness Values Spreadsheet for additional BMP Design requirements (Appendix G)

Total Proposed Sediment Reduction:	**7002.09**

Proposed BMP's Supporting Calculations

UNT #1 to the Monongahela River

Monessen Land Cover Estimates within Urbanized Area

Pervious	69%
Impervious	31%

**See Appendix D*

Monessen TSS (Sediment) lbs/acre/yr "All other Counties"

Pervious	264.96
Impervious	1839

***See Appendix E*

Water Quality Inlet Filters

Total Drainage Area = 10 acres

		Area (ac)	Sediment Loading Rate (lbs/ac/yr)	Calculated Sediment Load Removed (lbs/ac/yr)
Pervious	69%	6.9	264.96	1828.22
Impervious	31%	3.1	1839	5700.90
			Total:	7529.12
			82% Sediment Removal Rate:	**6173.88**

Note: FlexStorm Inlet Filters Proposed. See attached Specifications for additional Manufacturer's information (Appendix G)

City Park Stream Restoration

Total Project Length: 500 LF

	Length (lf)	Sediment Loading Rate (lbs/lf/yr)	Calculated Sediment Load Removed (lbs/lf/yr)
UNT#1 to Mon River	500	44.88	22440.00
		Total:	**22440.00**

Note: Please refer to attached BMP Effectiveness Value spreadsheet for additional BMP design requirements (Appendix G)

Grand Boulevard Stream Restoration

Total Project Length: 300 LF

	Length (lf)	Sediment Loading Rate (lbs/lf/yr)	Calculated Sediment Load Removed (lbs/lf/yr)
UNT#1 to Mon River	300	44.88	13464.00
		Total:	**13464.00**

Note: Please refer to attached BMP Effectiveness Value spreadsheet for additional BMP design requirements (Appendix G)

Total Proposed Sediment Reduction:	**42077.88**

Proposed BMP's Supporting Calculations

UNT #2 to the Monongahela River

Monessen Land Cover Estimates within Urbanized Area

Pervious	69%
Impervious	31%

**See Appendix D*

Monessen TSS (Sediment) lbs/acre/yr "All other Counties"

Pervious	264.96
Impervious	1839

***See Appendix E*

Water Quality Inlet Filters

Total Drainage Area = 3 acres

		Area (ac)	Sediment Loading Rate (lbs/ac/yr)	Calculated Sediment Load Removed (lbs/ac/yr)
Pervious	69%	2.07	264.96	548.47
Impervious	31%	0.93	1839	1710.27
			Total:	2258.74
			82% Sediment Removal Rate:	**1852.16**

Note: FlexStorm Inlet Filters Proposed. See attached Specifications for additional Manufacturer's information (Appendix G)

City Park Stream Restoration

Total Project Length: 100 LF

	Length (lf)	Sediment Loading Rate (lbs/lf/yr)	Calculated Sediment Load Removed (lbs/lf/yr)
UNT#1 to Mon River	100	44.88	4488.00
		Total:	**4488.00**

Note: Please refer to attached BMP Effectiveness Value spreadsheet for additional BMP design requirements (Appendix G)

Hydrodynamic Separator along Tyrol Boulevard

Total Drainage Area = 16.77 acres

		Area (ac)	Sediment Loading Rate (lbs/ac/yr)	Calculated Sediment Load Removed (lbs/ac/yr)
Pervious	69%	11.57	264.96	3065.59
Impervious	31%	5.2	1839	9562.80
			Total:	12628.39
			75% Sediment Removal Rate:	**9471.29**

Note: Stormceptor Hydrodynamic Separator Proposed. See attached Specifications for additional Manufacturer's information (Appendix G)

Total Proposed Sediment Reduction:	**15811.45**

FLEXSTORM™ Inlet Filter Specifications and Work Instructions

Product: **FLEXSTORM Inlet Filters**

Manufacturer: **Inlet & Pipe Protection, Inc** www.inletfilters.com

A subsidiary of **Advanced Drainage Systems (ADS)** www.ads-pipe.com

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1.0 Description of Work:

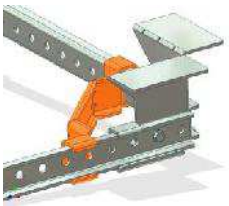
1.1 The work covered shall consist of supplying, installing, and maintaining/cleaning of the FLEXSTORM Inlet Filter assembly. The purpose of the FLEXSTORM Inlet Filter system is to collect silt and sediment from surface storm water runoff at drainage locations shown on the plans or as directed by the Engineer. FLEXSTORM PURE, permanent filters, are capable of removing small particles, hydrocarbons, and other contaminants from drainage "hot spots".

2.0 Material:

2.1 The FLEXSTORM Inlet Filter system is comprised of a corrosion resistant steel frame and a replaceable geotextile sediment bag attached to the frame with a stainless steel locking band. The sediment bag hangs suspended from the rigid frame at a distance below the grate that shall allow full water flow into the drainage structure if the bag is completely filled with sediment.




2.2 The FLEXSTORM Inlet Filter frame includes lifting handles in addition to the standard overflow feature. A FLEXSTORM Removal Tool engages the lifting bars or handles to allow manual removal of the assembly without machine assistance. The frame suspension system on most rectangular designs is adjustable in ½" increments up to 5" per side should the casting or drainage structure have imperfections.


2.3 **FLEXSTORM CATCH-IT** Inlet Filters for temporary inlet protection: The FLEXSTORM CATCH-IT framing is galvanized or zinc plated for corrosion resistance. The **"FX"** Woven Polypropylene filter bag is the design standard, although the **"IL"** Nonwoven geotextile is also available if preferred by the engineer. These products are typically used for temporary inlet protection lasting 3 months (short term road work) to 5 years (residential developments).

2.4 **FLEXSTORM PURE** Inlet Filters for permanent inlet protection: The FLEXSTORM PURE framing is comprised of 304 stainless steel with a 25 year life rating. Multiple filter bags are available: **FX, FX+, PC, PC+, LL** and others. The Post Construction **"PC+"** is the design standard consisting of the **"FX"** Woven Polypropylene sediment bag lined with Adsorb-it filter fabric, which is made from recycled polyester fibers. The **"PC+"** includes a replaceable hydrocarbon skimmer pouch strapped to the bottom of the bag for advanced TPH removal.

3.0 Filter Bag Specifications and Capabilities:

3.1 Material Properties (taken from manufacturers average roll value):

FLEXSTORM FILTER BAGS	(22" depth) STD Bag P/N	(12" depth) Short Bag P/N	Clean Water Flow Rate (GPM/SqFt)	Min A.O.S. (US Sieve)
FX: Standard Woven Bag	FX	FX-S	200	40
FX+: Woven w/ Oil Skimmer	FXP	FXP-S	200	40
FXO: Woven w/ Oil Boom	FXO	FXO-S	200	40
PC: Post Construction Bag	PC	PC-S	137	140
PC+: PC w/ Oil Skimmer	PCP	PCP-S	137	140
LL: Litter and Leaf Bag	LL	LL-S	High	3.5
IL: IDOT Non-Woven Bag	IL	IL-S	145	70

3.2 Standard Bag Sizes and Capabilities: Bag Sizes are determined by clear opening dimensions of the drainage structure. Once frame design size is confirmed, Small - XL bag ratings can be confirmed to meet design criteria. Ratings below are for standard 22" deep bags.

Standard Bag Size§	Solids Storage Capacity (CuFt)	Filtered Flow Rate at 50% Max (CFS)			Oil Retention (Oz)	
		FX	PC	IL	PC*	PCP**
Small	1.6	1.2	0.8	0.9	66	155
Medium	2.1	1.8	1.2	1.3	96	185
Large	3.8	2.2	1.5	1.6	120	209
XL	4.2	3.6	2.4	2.6	192	370

4.0 Tested Filtration Efficiency and Removal Rates: Filtration Efficiency, TSS, and TPH testing performed under large scale, real world conditions at accredited third party erosion and sediment control testing laboratory. (See Full Test Reports at www.inletfilters.com)

Inside View of Hopper Agitator

Hopper With Outlet Pipe Leading To Area Inlet

Area Inlet Simulated Showing Influent Discharge From Pipe

4.1 **FLEXSTORM "FX" Filtration Efficiency Test Results:** All testing performed in general accordance with the ASTM D 7351, *Standard Test Method For Determination of Sediment Retention Device Effectiveness in Sheet Flow Application,* with flow diverted into an area inlet. Test Soil used as sediment had the following characteristics with a nominal 7% sediment to water concentration mix. This is representative of a heavy sediment load running off of a construction site.

Soil Characteristics	Test Method	Value		Filtration Efficiency of "FX" FLEXSTORM Bag
% Gravel	ASTM D 422	2		**82%**
% Sand		60		
% Silt		24		
% Clay		14		
Liquid Limit, %	ASTM D 4318	34		
Plasticity Index, %		9		
Soil Classification	USDA	Sandy Loam		
Soil Classification	USCS	Silty Sand (SM)		

4.2 **FLEXSTORM "PC" and "PC+" Test Results:** TSS measured on effluent samples in accordance with SM 2540D and TPH in accordance with EPA 1664A.

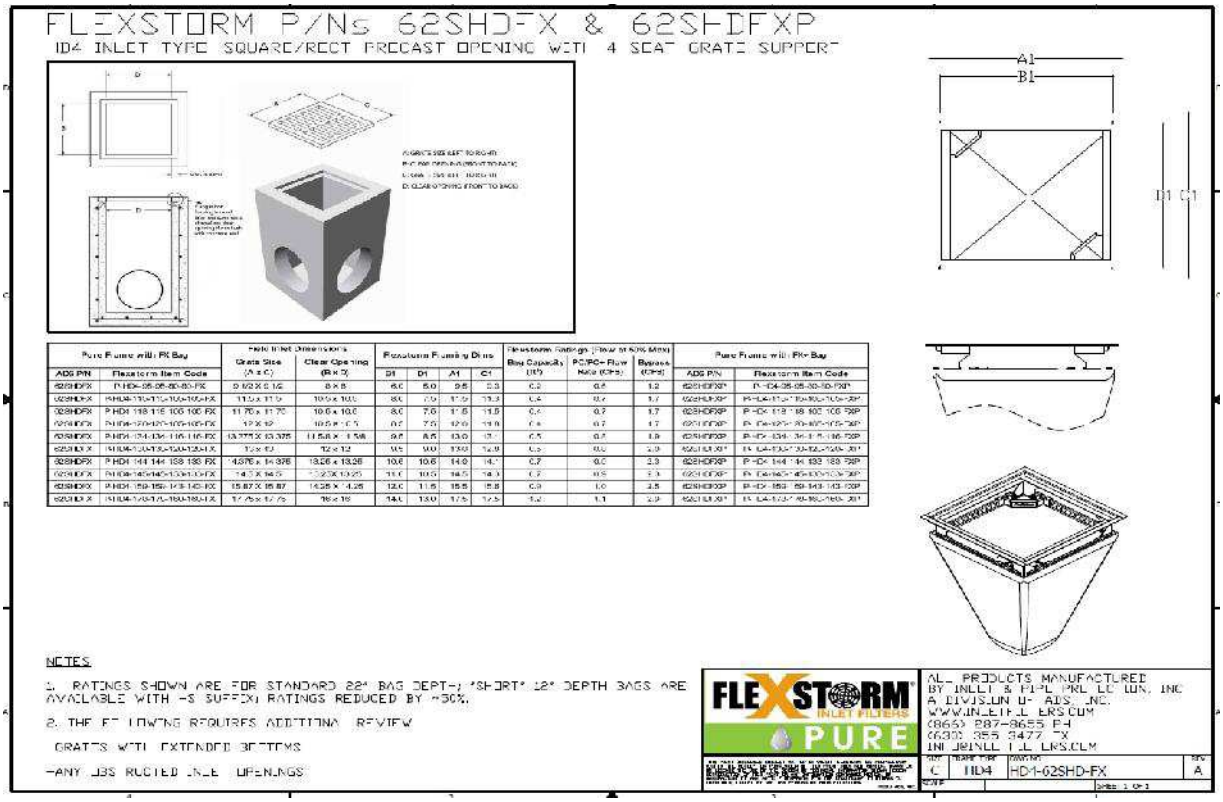
Product Tested	110 micron Sediment Load	Ave Flow Rate GPM	% TSS Removal	Soil Retention Efficiency
FLEXSTORM PC Sediment Bag	1750 mg/L using OK-110 Silica Sand and Clean Water	23	**99.28%**	98.96%
		48	**99.32%**	99.25%
		70	**98.89%**	98.80%

Product Tested	Street Sweep Sediment Load	Particle Size of Sediment Load	% TSS Removal	Soil Retention Efficiency
FLEXSTORM PC Sediment Bag	2.5% = 100 lbs Sed / 4000 lbs water	.001 mm – 10.0 mm (median 200 micron)	**99.68%**	95.61%

Product Tested	Hydrocarbon Load	Ave Flow Rate GPM	% TPH Removal	Oil Retention Efficiency
FLEXSTORM PC+	243 mg/L using 750 mL (1.45 lb) used motor oil + lube oil and clean water	19	**99.04%**	97.22%
FLEXSTORM PC		20	**97.67%**	91.61%
FLEXSTORM PC+		92	**96.88%**	99.11%

5.0 Identification of Drainage Structures to Determine FLEXSTORM Item Codes:

5.1 The Installer (Contactor) shall inspect the plans and/or worksite to determine the quantity of each drainage structure casting type. The foundry casting number or the exact grate size and clear opening size will provide the information necessary to identify the required FLEXSTORM Inlet Filter part number. Inlet Filters are supplied to the field pre-configured to fit the specified drainage structure. Item Codes can be built using the FLEXSTORM Product Configurator at www.inletfilters.com. Detailed Submittal / Specification drawings are linked to each Item Code and available for download by engineers and contractors to include on plans and/or verify field inlet requirements. An example of a typical drawing is shown below.



6.0 Installation Into Standard Grated Drainage Structures:

6.1 Remove the grate from the casting or concrete drainage structure. Clean the ledge (lip) of the casting frame or drainage structure to ensure it is free of stone and dirt. Drop in the FLEXSTORM Inlet Filter through the clear opening and be sure the suspension hangers rest firmly on the inside ledge (lip) of the casting. Replace the grate and confirm it is elevated no more than 1/8", which is the thickness of the steel hangers. For Curb Box Inlet Filters: Insert FLEXSTORM CATCH IT Inlet Filter as described above, pull the rear curb guard flap up and over the open curb box until tight, align magnets to ensure firm attachment to the top portion of the curb box casting. If the curb back opening is not magnetic, slide a typical rock sack or 2 x 4 through the 2-ply rear curb box flap to create a dam which will direct runoff into the sediment bag.




7.0 Maintenance Guidelines: The frequency of maintenance will vary depending on the application (during construction, post construction, or industrial use), the area of installation (relative to grade and runoff exposure), and the time of year relative to the geographic location (infrequent rain, year round rain, rain and snow conditions). The FLEXSTORM Operation & Maintenance Plan (as shown in 7.5) or other maintenance log should be kept on file.

7.1 Frequency of Inspections: Construction site inspection should occur following each ½" or more rain event. Post Construction inspections should occur three times per year (every four months) in areas with year round rainfall and three times per year (every three months) in areas with rainy seasons before and after snowfall season. Industrial application site inspections (loading ramps, wash racks, maintenance facilities) should occur on a regularly scheduled basis no less than three times per year.

7.2 General Maintenance for standard sediment bags: Upon inspection, the FLEXSTORM Inlet Filter should be emptied if the sediment bag is more than half filled with sediment and debris, or as directed by the Engineer. Remove the grate, engage the lifting bars or handles with the FLEXSTORM Removal Tool, and lift the FLEXSTORM Inlet Filter from the drainage structure. Machine assistance is not required. Dispose of the sediment or debris as directed by the Engineer. As an alternative, an industrial vacuum may be used to collect the accumulated sediment if available. Remove any caked on silt from the sediment bag and reverse flush the bag for optimal filtration. Replace the bag if the geotextile is torn or punctured to ½" diameter or greater on the lower half of the bag. If properly maintained, the Woven sediment bag will last a minimum of 4 years in the field.

7.3 Inspection and Handling of the FLEXSTORM PC / PC+ post construction sediment bag: The PC+ sediment bags will collect oil until saturated. Both the Adsorb-it filter liner and the skimmer pouch will retain oil. The volume of oils retained will depend on sediment bag size. Unlike other passive oil sorbent products, Adsorb-it filter fabric has the ability to remove hydrocarbons at high flow rates while retaining 10- 20 times its weight in oil (weight of fabric is 12.8 oz / sq yd). The average 2' x 2' PC Bag contains approx .8 sq yds, or 10 oz of fabric. At 50% saturation, the average Adsorb-it lined PC filter will retain approximately 75 oz (4.2 lbs) of oil. Once the bag has become saturated with oils, it can be centrifuged or passed through a wringer to recover the oils, and the fabric reused with 85% to 90% efficacy. If it is determined, per Maintenance Contracts or Engineering Instructions, that the saturated PC sediment bags will be completely replaced, it is the responsibility of the service technician to place the filter medium and associated debris in an approved container and dispose of in accordance with EPA regulations. Spent Adsorb-it can be recycled for its fuel value through waste to energy incineration with a higher BTU per pound value than coal. The oil skimmers start white in color and will gradually turn brown/black as they become saturated, indicating time for replacement. The average skimmer pouch will absorb approximately 62 oz (4 lbs) of oil before requiring replacement. To remove the pouch simply unclip it from the swivel strap sewn to the bottom of the bag. Dispose of all oil contaminated products in accordance to EPA guidelines. The ClearTec Rubberizer media used in the pouch, since a solidifier, will not leach under pressure and can be disposed of in most landfills, recycled for industrial applications, or burned as fuel.

7.4 Sediment Bag Replacement: When replacing a Sediment Bag, remove the bag by loosening or cutting off the clamping band. Take the new sediment bag, which is equipped with a stainless steel worm drive clamping band, and use a drill or screw driver to tighten the bag around the frame channel. Ensure the bag is secure and that there is no slack around the perimeter of the band. For Oil absorbent boom bags, simply replace the oil boom or pouch when saturated by sliding it through the mesh support sleeve.

7.5 Operation & Maintenance Plan. (Download at www.inletfilters.com or www.ads-pipe.com)

FLEXSTORM OPERATION AND MAINTENANCE PLAN

OPERATION & MAINTENANCE PLAN

Installation Instructions:

1. Remove grate from the drainage structure
2. Clean stone and dirt from ledge (lip) of drainage structure
3. Drop the FLEXSTORM inlet filter through the clear opening such that the hangers rest firmly on the lip of the structure.
4. Replace the grate and confirm it is not elevated more than 1/8", the thickness of the steel hangers.

Frequency of Inspections:

1. Inspection should occur following any rain event >½".
2. Post construction inspections should occur 4 times per year. In snowfall affected regions additional inspections should take place before and after snowfall season.
3. Industrial application site inspections (loading ramps, wash racks, maintenance facilities) should occur on a regularly scheduled basis no less than 3 times/year.

Maintenance Guidelines:

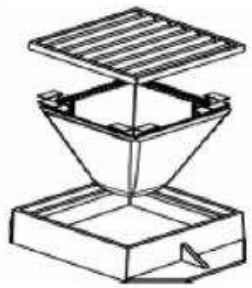
1. Empty the sediment bag if more than half filled with sediment and debris, or as directed.
2. Remove the grate, engage the lifting bars with the FLEXSTORM Removal Tool, and lift from drainage structure.
3. Dispose of sediment or debris as directed by the Engineer or Maintenance contract.
4. An industrial vacuum can be used to collect sediment.
5. Remove caked on silt from sediment bag and flush with Medium spray with optimal filtration.
6. Replace bag if torn or punctured to >½" diameter on lower half of bag.

Post Construction PC Bag Maintenance:

1. At 50% saturation the average 2'x2' Adsorb-it lined PC filter will retain approximately 75 oz (4.2 lbs) of oil and should be serviced. To recover the oils the filter can be centrifuged or passed through a wringer.
2. Oil skimmer pouches start to turn black when saturated, indicating time for replacement. Each ClearTec Rubberizer pouch will absorb ~62oz (4 lbs) of oil before needing replacement.
3. Dispose of all oil contaminated products in accordance with EPA guidelines. ClearTec Rubberizer, since a solidifier, will not leach under pressure and can be disposed of in most landfills, recycled for industrial applications, or burned as fuel.

Sediment Bag Replacement:

1. Remove the bag by loosening or cutting off clamping bag.
2. Take new sediment bag and secure worm drive clamping band to the frame channel.
3. Ensure Bag is secure and there is no slack around perimeter.



STRUCTURE ID#/LOCATION:

DATE	TASK PERFORMED	INSPECTOR

Stormceptor®

Stormceptor® System Overview

imbrium®

About Imbrium® Systems

Imbrium Systems is an engineered stormwater treatment company that designs and manufactures stormwater treatment solutions that protect water resources from harmful pollutants. By developing technologies to address the long-term impact of urban runoff, Imbrium ensures our clients' projects are compliant with government water quality regulations.

Imbrium products are sold through our network of value-added partners. These partners provide the highest level of service at every stage of your project.

To find your local Stormceptor representative please visit **www.imbriumsystems.com/localrep**.

Stormceptor® STC

Stormceptor STC is the recognized leader in stormwater treatment, offering a range of versatile treatment systems that effectively remove pollutants from stormwater and snowmelt runoff. Stormceptor is flexibly designed to protect waterways from hazardous material spills and stormwater pollution, including suspended sediment, free oils, and other pollutants that attach to particles, no matter how fierce the storm. Stormceptor's scour prevention technology ensures pollutants are captured and contained during all rainfall events.

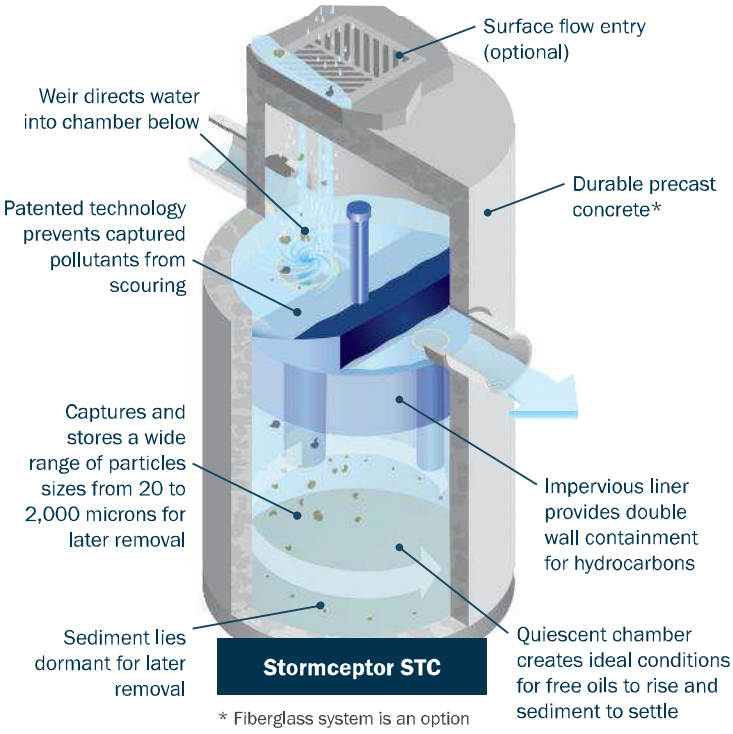
Ideal Uses

- Sediment (TSS) removal
- Spill control
- Debris and small floatables capture
- Pretreatment for filtration, detention/retention systems, ponds, wetlands, Low Impact Development (LID), green infrastructure, and water-sensitive urban design

Stormceptor STC

How the Stormceptor® STC Works

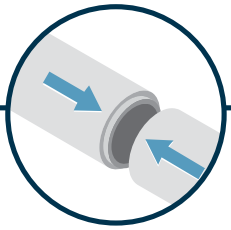
- Stormwater enters the Stormceptor through the inlet pipe(s) or inlet grate. A specially designed insert slows the water down, pulling hydrocarbons, debris and sediment into a lower chamber
- The non-turbulent chamber allows free oils and floatable debris to rise and sediment to settle
- Free oils and other floatables remain trapped underneath the insert
- Sediment settles to the sump and is retained for later removal
- Stormceptor's scour prevention technology ensures pollutants are captured and contained during all rainfall events, even extreme storms
- Treated stormwater exits the unit via the outlet pipe



* Fiberglass system is an option

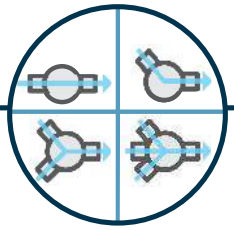
EASY TO INSTALL

Small footprint saves time and money with limited disruption to your site.



SEAMLESS

Minimal drop between inlet and outlet pipes makes Stormceptor ideal for retrofits and new development projects.



FLEXIBLE

Multiple inlets can connect to a single unit. Can be used as a bend structure.

FEATURES	BENEFITS
1. Patented scour prevention technology	1. Superior pollutant removal and retention
2. Can take the place of a conventional junction or inlet structure	2. Eliminates the need for additional structures
3. Minimal drop between inlet and outlet	3. Site flexibility
4. Multiple inlets can connect to a single unit	4. Design flexibility
5. 3rd party tested and verified performance (Sediment & Oil)	5. Treatment with confidence

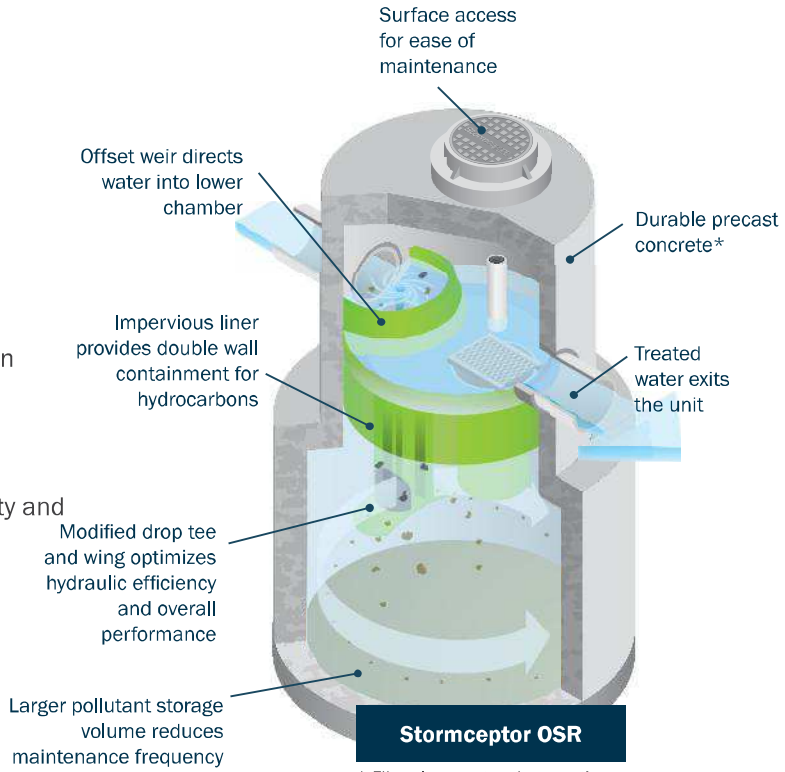
ADDITIONAL MODELS

Stormceptor® OSR

Engineered to meet stormwater quality requirements centered on capture of fine sand-sized particles.

BENEFITS

- Patented design is optimized for increased hydraulic capacity and fine sand-sized particle removal.
- 3rd party performance tested and verified.
- Ideal for pretreatment and redevelopment.



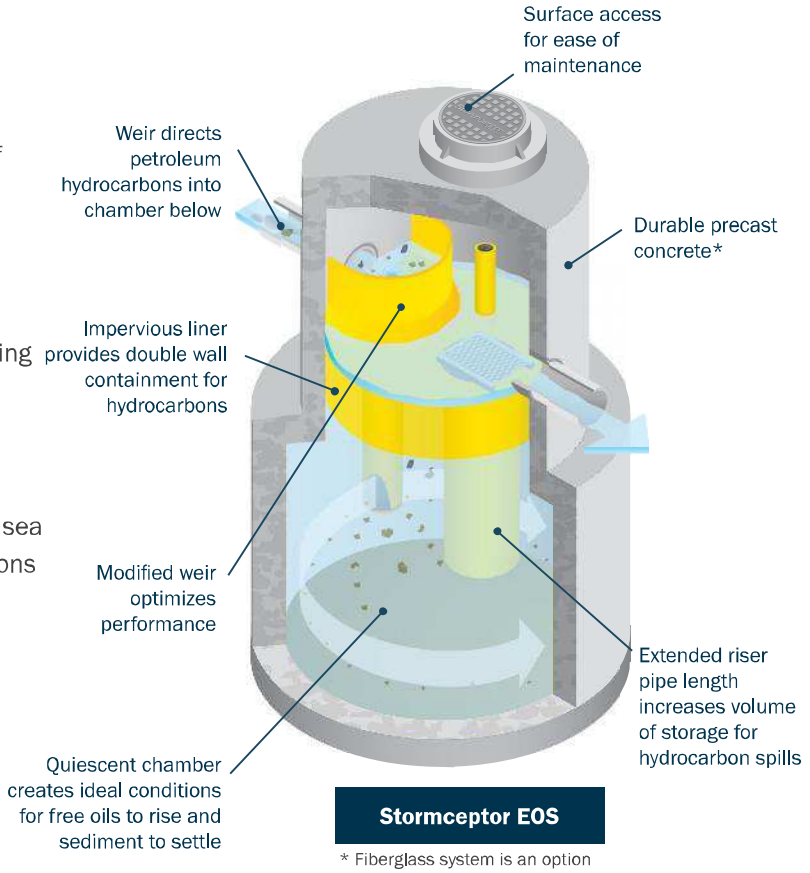
* Fiberglass system is an option

Stormceptor® EOS

Engineered for dry weather spill protection by providing increased storage for the safe capture and containment of hydrocarbons.

BENEFITS

- Increased storage volume for safe oil containment.
- Creates a non-turbulent treatment environment, allowing oils to rise and remain captured.
- Optional oil alarm for spill occurrence or maintenance notification.
- Ideal for gas/petrol stations, fuel depots, airports and sea ports, garages, loading docks, high-collision intersections and other spill-prone areas.



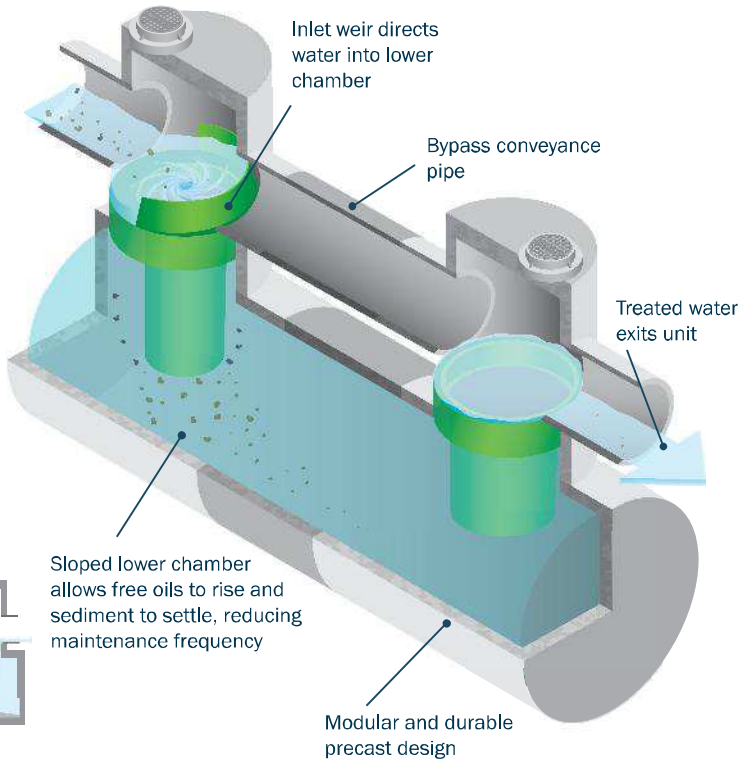
* Fiberglass system is an option

Stormceptor® MAX

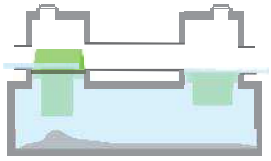
Stormceptor MAX expands the Stormceptor technology platform by use of its modular and expandable design to treat large drainage areas. Stormceptor MAX is commonly used in industrial sites, and urban retrofit and redevelopment projects.

BENEFITS

- Designed to provide treatment for large drainage areas (20+ acres or 8 + hectares) and large spill volume capture (15,000+ gallons or 55,000+ liters).
- Flexible design that is modular and expandable, designed to fit your site.
- Bypass is incorporated directly into your drainage network.



Stormceptor®MAX



Stormceptor MAX – provides stormwater treatment for a highway in Montreal, Québec, Canada

Stormceptor® Approvals & Acceptance

With more than 20-years of industry experience and the most installations, Stormceptor is the most widely recognized and accepted stormwater treatment technology globally.

Stormceptor STC has been tested and verified by some of the most stringent technology evaluation organizations in North America, as well as globally. Stormceptor is approved through numerous State, Provincial, and Federal verification programs.

STORMCEPTOR APPLICATIONS

Stormceptor is used to remove pollutants and provide spill protection, commonly in the following applications:

- Anywhere there is pavement and stormwater quality treatment is needed:
  - » Commercial sites
  - » Roadways/highways
  - » Municipal sites
  - » Airports/ports
  - » Gas stations and other fuel depots
  - » Military sites
  - » Residential development
  - » Industrial sites
- Retrofit projects
- Redevelopment projects
- Pretreatment to other stormwater management systems (retention/detention, filtration, ponds, LID, green infrastructure, water-sensitive urban design)

Multiple Stormceptor STC units – provides stormwater treatment and spill capture at the Delta Port in Vancouver, British Columbia, Canada

Stormceptor® Options & Accessories

The following options and accessories are available for specific functions and site conditions:

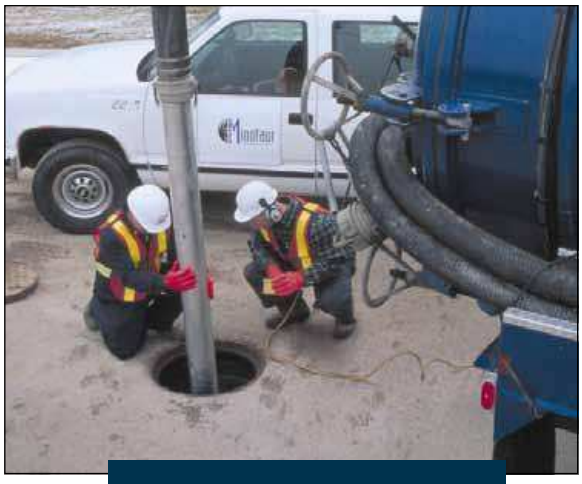
- **Oil Alarm** – To mitigate spill liability through detention, a monitoring system can be employed to trigger a visual and audible alarm when an oil spill occurs.
- **Additional Oil Capture** – A draw-off tank can be incorporated to increase spill storage capacity.
- **High Load** – Standard design loading is CHBDC or AASHTO H-20. Specialized loading can be designed to withstand very high loadings typical of airports and port facilities.
- **Submerged / Tail Water** – This design is often implemented to provide treatment during tail water conditions when nearby lakes, rivers, and coastal areas.
- **Shallow Units** – Designs can accommodate shallow depths for sites with bedrock, high groundwater or other underground obstructions.
- **Lightweight** – Sites that required lightweight above ground units are available as fiberglass systems.

Stormceptor® Maintenance

Conducted at grade, Stormceptor's design makes inspections and maintenance an easy and an inexpensive process. Once maintained, the Stormceptor is functionally restored as designed, with full pollutant capture capacity.

MAINTENANCE RECOMMENDATIONS:

- Inspect every six months for the first year to determine the oil and sediment accumulation rate
- In subsequent years, inspections can be based on observations or local requirements
- Inspect the unit immediately after an oil, fuel or chemical spill. A licensed waste management company should remove oil and sediment and dispose responsibly.



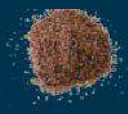
Stormceptor maintenance is performed at grade with a standard vacuum truck

FILTERRA BIORETENTION

The Filterra® Bioretention System is an engineered biofiltration device with components that make it similar to bioretention in pollutant removal and application, but has been optimized for high volume/flow treatment in a compact system.

JELLYFISH FILTER

The Jellyfish® Filter is a stormwater treatment technology featuring pretreatment and membrane filtration in a compact stand-alone treatment system that removes a high level and a wide variety of stormwater pollutants.



SORBTIVE MEDIA

Sorbtive® Media is an engineered media that adsorbs and retains large amounts of dissolved phosphorus. Sorbtive Media provides up to 1,000 times more pollutant removal capability than conventional filtration media, and unlike other media, it does not leach pollutants.

LEARN MORE

- Call us at (888) 279-8826 or 301-279-8827 to talk to one of our engineers for technical support or design assistance.
- Visit **www.imbriumsystems.com/localrep** for contact information for your local Imbrium representative.

PCSWMM FOR STORMCEPTOR - *Advanced stormwater treatment sizing & design software*

PCSWMM for Stormceptor is an online design tool that uses continuous simulation modelling to determine the most appropriate Stormceptor treatment system for your site.

PCSWMM for Stormceptor highlights:

- Region specific design – Localized rainfall data from over 1,900 NOAA weather stations across North America allow for region specific design
- Accessible – Within a single project, multiple Stormceptor units can be sized and the information revisited as project parameters change
- Fast – Easy to use online system allows for a quick turn around
- Optimal sizing – Unit sizing is based on your specific site conditions, including a variety of particle size distributions and targeted annual sediment removal
- Useful reports – Provides a summary report that includes projected performance calculations. Also available online is specifications and standard drawings; all of which can be used in client meetings and regulatory approvals.

www.stormceptor.com/PCSWMMforStormceptor

imbrium®

+1 416-960-9900

www.imbriumsystems.com

Imbrium® Systems is an engineered stormwater treatment company that designs and manufactures stormwater treatment solutions that protect water resources from harmful pollutants. By developing technologies to address the long-term impact of urban runoff, Imbrium ensures our clients' projects are compliant with government water quality regulations. For information, visit www.imbriumsystems.com or call +1 416-960-9900.

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FSC

Printed with soy inks

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS
BMP EFFECTIVENESS VALUES

This table of BMP effectiveness values (i.e., pollutant removal efficiencies) is intended for use by MS4s that are developing and implementing Pollutant Reduction Plans and TMDL Plans to comply with NPDES permit requirements. The values used in this table generally consider pollutant reductions from both overland flow and reduced downstream erosion, and are based primarily on average values within the Chesapeake Assessment Scenario Tool (CAST) (www.casttool.org). Design considerations, operation and maintenance, and construction sequences should be as outlined in the Pennsylvania Stormwater BMP Manual, Chesapeake Bay Program guidance, or other technical sources. The Department of Environmental Protection (DEP) will update the information contained in this table as new information becomes available. Interested parties may submit information to DEP for consideration in updating this table to DEP's MS4 resource account, RA-EPPAMS4@pa.gov. Where an MS4 proposes a BMP not identified in this document or in Chesapeake Bay Program expert panel reports, other technical resources may be consulted for BMP effectiveness values. Note – TN = Total Nitrogen and TP = Total Phosphorus.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Wet Ponds and Wetlands	20%	45%	60%	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
Dry Extended Detention Basins	20%	20%	60%	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Infiltration Practices w/ Sand, Veg.	85%	85%	95%	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil, they are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approval to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.
Filtering Practices	40%	60%	80%	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
Filter Strip Runoff Reduction	20%	54%	56%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips.
Filter Strip Stormwater Treatment	0%	0%	22%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips.
Bioretention – Raingarden (C/D soils w/ underdrain)	25%	45%	55%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.
Bioretention / Raingarden (A/B soils w/ underdrain)	70%	75%	80%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Bioretention / Raingarden (A/B soils w/o underdrain)	80%	85%	90%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.
Vegetated Open Channels (C/D Soils)	10%	10%	50%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.
Vegetated Open Channels (A/B Soils)	45%	45%	70%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.
Bioswale	70%	75%	80%	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	10%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/ underdrain)	45%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/o underdrain)	75%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (A/B Soils w/ underdrain)	50%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Permeable Pavement w/ Sand or Veg. (A/B Soils w/o underdrain)	80%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (C/D Soils w/ underdrain)	20%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.
Stream Restoration	0.075 lbs/ft/yr	0.068 lbs/ft/yr	44.88 lbs/ft/yr	An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol.
Forest Buffers	25%	50%	50%	An area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. (Note – the values represent pollutant load reductions from stormwater draining through buffers).
Tree Planting	10%	15%	20%	The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given.
Street Sweeping	3%	3%	9%	Street sweeping must be conducted 25 times annually. Only count those streets that have been swept at least 25 times in a year. The acres associated with all streets that have been swept at least 25 times in a year would be eligible for pollutant reductions consistent with the given BMP effectiveness values.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1 – TN and TP concentrations	This BMP (also referred to as "Storm Drain Cleaning") involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. To determine pollutant reductions for this BMP, these steps must be taken: 1) Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected. 2) Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter). 3) Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the sediment removal efficiency specified by the manufacturer may be assumed, but no higher than 80%.

STANDARD SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE FOR LARGE DRAINGE AREAS

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, designing, maintaining, and constructing an underground, modular Oil Grit Separator (OGS) device for stormwater quality treatment of large drainage areas. Work includes supply and installation of concrete bases, precast sections, and the appropriate precast section with all internal components completely and correctly installed within the OGS device, water tight seals prior to arrival to the project site.

1.2 REFERENCE STANDARDS

1.2.1 For Canadian projects only, the following reference standards apply:

Canadian Standards Association
CAN/CSA-A257.3-M92: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets
CAN/CSA-A257.4-M92: Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings
CAN/CSA-S6-00: Canadian Highway Bridge Design Code

1.2.2 For ALL projects, the following reference standards apply:

ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D2563: Standard Practice for Classification of Visual Defects in Reinforced Plastics
ASTM D2584: Test Method for Ignition Loss of Cured Reinforced Plastics

1.3 SHOP DRAWINGS

1.3.1 Shop drawings shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail the precast concrete components and all OGS internal components prior to shipment, including the sequence for installation.

1.3.2 Unless directed otherwise by the Engineer of Record, OGS product substitutions submitted within 10 days prior to project bid shall not be accepted. All substitutions submitted shall be based on the exact same Performance and Design criteria detailed in Section 3, subject to review and approval by the Engineer of Record. Any and all changes to project cost estimates, bonding amounts, plan check fees for revision of approved documents, or design impacts due to regulatory requirements as a result of a product substitution shall be coordinated by the Contractor with the Engineer of Record.

1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

1.4.1 Internal OGS device materials supplied by the Manufacturer for connection to the precast concrete shall be pre-fabricated and bolted to the precast and watertight sealed to the precast surface prior to delivery to the project site to ensure Manufacturer's internal assembly process and quality control processes are fully adhered to, and to prevent

damage to the materials on site. Internal OGS materials shall not be installed, bolted or sealed at the job site. No exceptions will be accepted.

1.4.2 Follow all instructions including the sequence for installation in the shop drawings during installation.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The OGS inlet and outlet chambers shall be circular and vertically-oriented cylindrical precast concrete structures. The OGS's settling chamber shall be either a horizontally-oriented cylindrical precast concrete structure or a box-shaped precast concrete structure. The bypass shall be a horizontally-oriented cylindrical or box-shaped precast concrete structure of the same dimension as the inlet or outlet conveyance network, connecting between both the inlet and outlet chambers.

2.1.2 The OGS inlet and outlet chambers shall each include a fiberglass insert bolted and sealed watertight inside the vertically-oriented cylindrical precast concrete structure. The fiberglass inserts shall be installed inside their respective precast concrete risers prior to delivery to the project site. The fiberglass inserts shall provide a double-wall lining of 18 inches (450 mm) for oil storage and retention as a secondary containment system within the OGS.

2.1.3 The OGS shall be allowed to be specified as a bend structure in the stormwater drainage system.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be designed and manufactured to meet highway loading conditions per State/Provincial or local requirements.

2.3 GASKETS

2.3.1 For round structures:Only profile neoprene or nitrile rubber gaskets that are oil resistant in will be accepted. For Canadian projects only, gaskets shall be in accordance to CSA A257.3-M92. Mastic sealants, butyl tape/rope or Conseal CS-101 alone are not acceptable gasket materials

2.3.2 For box structures: Gaskets shall meet all national and municipal specifications. Ensuring water tightness is the responsibility of the contractor.

2.4 JOINTS

The concrete joints shall be water-tight and meet the design criteria according to ASTM C-990, as well as all national and municipal specifications. For projects where joints require gaskets, the concrete joints shall be water-tight, and oil resistant and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape/rope alone are not an acceptable alternatives. Ensuring that the joints are watertight is the responsibility of the contractor.

2.5 FRAMES AND COVERS

Frame and covers shall be manufactured in accordance with per State/Provincial or local requirements, and for inspection and maintenance access purposes shall be at least 24 inch (600 mm) in diameter. A minimum one cover shall be clearly embossed with OGS manufacturer's product name to properly identify this asset's purpose is for stormwater quality treatment.

2.6 PRECAST CONCRETE

All precast concrete components shall conform to the appropriate CSA or ASTM specifications.

2.7 FIBERGLASS

The fiberglass portion of the OGS water treatment device shall be constructed in accordance with the following ASTM D-4097 standard, and shall be installed, bolted and watertight sealed prior to arrival to the project site.

2.8 LADDERS

Ladder rungs to be provided upon request per State/Provincial or local requirements.

2.9 INSPECTION

All precast concrete sections shall be level at the designated slope per the shop drawings, and inspected to ensure dimensions, appearance, integrity of internal components, and quality of the product meets State/Provincial or local specifications and associated standards.

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be designed to treat drainage areas greater than 8 impervious acres (3.25 ha) and remove oil and sediment from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events within the OGS lower chamber for later removal during maintenance.

3.2 RUNOFF VOLUME

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the annual runoff volume using a widely accepted continuous simulation runoff model using historical rainfall data which includes antecedent conditions as well as rainfall periods. Rainfall data sets should be comprised of a minimum of 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases at least a minimum of 5-years continuous rainfall.

3.3 TOTAL SUSPENDED SOLIDS (TSS)

The OGS device shall be capable of removing the Engineer-specified total suspended solids (TSS) load, without scouring previously captured pollutants.

3.4 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the annual runoff volume using a widely accepted continuous simulation runoff model using historical rainfall data which includes antecedent conditions as well as rainfall periods. Rainfall data sets should be comprised of a minimum of 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases at least a minimum of 5-years continuous rainfall. The Peclet Number and volumetric scaling are not approved methods for modeling or calculating TSS removal, sizing, or scaling of OGS devices.

3.5 PARTICLE SIZE DISTRIBUTION (PSD) FOR SIZING

The OGS device shall typically be sized to remove the Engineer-specified sediment (TSS) load using the particle size distribution (PSD) shown in Table 3.5, in addition to adhering to sections

3.2 and 3.4 of this specification. The Engineer may specify an alternative PSD to determine OGS sizing for sediment (TSS) load removal and meet water quality objectives.

Table 3.5 – Particle Size Distribution		
Particle Size Distribution to be used to size OGS		
Particle Diameter (Micron)	**% by Mass of All Particles**	**Specific Gravity**
1000	5%	2.65
500	5%	2.65
250	15%	2.65
150	15%	2.65
100	10%	2.65
75	5%	2.65
50	10%	2.65
20	15%	2.65
8	10%	2.65
5	5%	2.65
2	5%	2.65

3.6 BYPASS DESIGN

OGS devices for larger drainage areas shall incorporate a bypass as a horizontally-oriented cylindrical or box-shaped precast concrete structure of the same dimension as the inlet or outlet conveyance network, and shall connect both the inlet and outlet chambers to the inlet and outlet conveyance network, thereby eliminating the requirement for an upstream bypass manhole and downstream junction manhole for management of less frequent high flow wet weather events and prevention of the washout of previously captured pollutants.

3.7 SEDIMENT STORAGE CAPACITY

Manufacturer's sediment storage capacity guidelines for the OGS stormwater quality treatment device shall be confirmed by the Engineer to have adequate minimum storage and comply with Section 3.6.1.1 for the anticipated annual sediment (TSS) loadings. Sediment loadings shall be determined by land-use and defined as a minimum of 450 kg (992 lb) of sediment (TSS) per impervious hectare of drainage area per year, or greater as noted in the Table 3.7 below. The OGS device's sediment storage capacity shall be specified as to not require maintenance (sediment removal) more frequently than once per year.

TABLE 3.7 - Typical Urban Areas and Pollutant Yields (Sediment) (Burton and Pitt, 2002)								
Pollutant	**Sediment Pollutant Load by Land Use (kg/ha/year)**							
	Commercial	**Parking Lot**	**Residential Density**			**Highways**	**Industrial**	**Shopping Centers**
			High	**Med.**	**Low**			
TSS	**1000**	**400**	**400**	**250**	**10**	**880**	**500**	**440**

Source: U.S. EPA Stormwater Best Management Practice Design Guide, Volume 1, Appendix D, Table D-1
NOTE: to determine volume of adequate sediment storage capacity a bulk density of 1602 kg/m^3 (100 lbs/ft^3) shall be applied.

3.8 PETROLEUM HYDROCARBON CAPTURE AND STORAGE

3.8.1 The OGS device internal hydrocarbon storage area shall include a minimum of 16 inches (405 mm) of double wall containment for the full circumference of the device to provide safe oil and other hydrocarbon material storage and ground water protection.

3.8.2 Petroleum hydrocarbon storage capacity of solely the double wall containment area of the OGS device shall be a minimum of 600 gallons (2,270 Liters), or more as specified within this area. The total petroleum hydrocarbon storage capacity of this OGS device

shall be greater than 600 gallons (2,270 Liters) in all cases, and this value shall be specified in all submittals, the shop drawings as a critical performance and design parameter.

PART 4 – INSPECTION & MAINTENENACE

The OGS manufacturer shall provide an Owner's Manual upon request.

4.1 A Quality Assurance Plan that provides inspection and maintenance for up to 5 years shall be included with the OGS stormwater quality device, and written into the Environmental Compliance Approval (ECA) or the appropriate State/Provincial or local approval document.

4.2 Inspection of the OGS device, which includes determination of sediment depth and presence of petroleum hydrocarbons in the lower chamber, shall be easily conducted from finished grade through a Frame and Cover of at least 24 inch (600 mm) in diameter, at a minimum through both the OGS vertically-oriented cylindrical inlet and outlet chambers, and their respective Oil Inspection Ports.

4.3 Pollutant removal from the OGS's lower chamber shall be conducted as a periodic maintenance practice using a standard maintenance truck and vacuum apparatus, and shall be easily conducted from finished grade through a Frame and Cover of at least 24 inch (600 mm) in diameter, at a minimum through both the OGS vertically-oriented cylindrical inlet and outlet chambers, and their respective Oil Inspection Ports.

4.4 No confined space for annual inspections or normal operation shall be required.

PART 5 – EXECUTION

5.1 PRECAST CONCRETE INSTALLATION

The installation of the precast concrete OGS device shall conform to highway, State/Provincial, or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below.

5.2 EXCAVATION

5.2.1 Excavation for the installation of the OGS stormwater quality treatment device shall conform to highway, State/Provincial or local specifications. Topsoil that is removed during the excavation for the OGS stormwater quality treatment device shall be stockpiled in designated areas and not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the OGS water quality device shall conform to highway, State/Provincial or local specifications.

5.2.2 The OGS device shall not be installed on frozen ground. Excavation shall extend a minimum of 12 inch (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

5.2.3 In areas with a high water table, continuous dewatering shall be provided to ensure that the excavation is stable and free of water.

5.3 BACKFILLING

Backfill material shall conform to highway, State/Provincial or local specifications. Backfill material shall be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to highway, State/Provincial or local specifications.

5.4 OGS WATER QUALITY DEVICE CONSTRUCTION SEQUENCE

5.4.1 The precast concrete OGS water quality device is installed and leveled in sections in the following sequence:

- aggregate base
- lower horizontal-oriented chamber section(s)
- transition slab (if required)
- inlet and outlet vertical riser upper chamber sections w/ pre-installed fiberglass inserts
- upper riser section(s) (as required)
- connect inlet and outlet pipes
- riser section and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

5.4.2 The precast concrete base shall be placed level or at the designated slope per the shop drawings at the specified grade. The entire base shall be in contact with the underlying compacted granular material. Subsequent sections, complete with oil resistant, water tight joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations.

5.4.3 Adjustment of the OGS stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the OGS stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

5.5 DROP PIPE, RISER PIPE, AND OIL PORT

Once the OGS vertically-oriented cylindrical inlet and outlet chambers have been set on the lower chamber, the inlet fiberglass drop pipe and oil ports must be attached to the inlet fiberglass insert, the outlet riser and oil port must be attached to the outlet fiberglass insert. Installation instructions and required materials shall be provided by the OGS manufacturer.

5.6 INLET AND OUTLET PIPES

Inlet and outlet pipes shall be securely set into the upper chamber using grout or approved pipe seals (flexible boot connections, where applicable) so that the conveyance network and OGS structure is watertight. Non-secure inlets and outlets will result in improper performance.

5.7 FRAME AND COVER OR FRAME AND GRATE INSTALLATION

Precast concrete adjustment units shall be installed to set the frame and cover at the required elevation. The adjustment units shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

Sample test conducted demonstrating TSS removal potential:

TESTING SUMMARY

Como Park, Minnesota

Summary: Monitoring was conducted on a Stormceptor model STC 1800 during eight storm events from August, 1998 to September, 1999. The results from this test indicated a high level of removal of total suspended solids during this period.

TSS Removal	TKN Removal	TP Removal
76 %	65 %	32 %

All removal rates are based on mass reduction over the eight event period. The removal efficiency was based on load reduction since the concentrations of pollutants varied with each storm. Estimates of pollutant removal based on concentrations would be misleading during storms when the pollutant concentrations are low or near the laboratory detection limits.

Methodology: Service Environmental and Engineering (Service E&E) of St. Paul, Minnesota was retained to perform independent field monitoring on a STC 1800 Stormceptor. Service E&E installed two ISCO Model 3700 automatic samplers upstream and downstream of the unit. An area velocity flow meter was installed in the Stormceptor unit itself. A tipping bucket rain gauge was mounted on a pole near the Stormceptor with data cables connected to activate the samplers.

The sampler collected samples on a time proportional data. The flow data was used to composite the quality samples for laboratory analysis in seven of the eight events. In the other event the rain data was used in conjunction with the 24 individual bottle samples to create a flow proportional composite sample for laboratory analysis due to equipment problems with the flow meter during this storm (Aug. 3)

No significant results were observed for metals and petroleum hydrocarbons (effluent < 2 ppm) from the newly constructed parking lot. Detailed results for each storm are provided on the back of this page.

Two sludge samples were taken from the Stormceptor at the end of the monitoring period. Both samples indicated a large percentage of the sludge was fine in nature (70% to 80% silt and clay) with approximately 45% of the material by weight less than 25 μm in size.

Project Details: The monitoring site is a newly paved 1.03 acre parking lot in the middle of Como Park, St. Paul, Minnesota. Como Park is heavily utilized in the summer and is considered a tourist attraction in the Twin Cities area. The parking lot, which is designed for a maximum of 120 cars, drains to a STC 1800 Stormceptor which then outlets to a drywell and pond.

Como Park - Minnesota

STC 1800 (1800 US Gallons) equivalent to STC1500 in Canada (1500 British Gallons)

Pollutant EMC in mg/l	8/3/98	8/7/98	8/27/98	9/19/98	9/23/98	9/7/99	9/11/99	9/19/99
TSS in	64.00	318.00	196.00	26.00	33.00	22.70	48.00	13.30
TSS out	16.00	59.00	58.00	31.00	41.00	19.30	7.60	3.30
P in	0.15	0.43	0.10	0.16	0.23	0.37	0.46	0.19
P out	0.35	0.27	0.17	0.11	0.11	0.23	0.25	0.14
TKN in	2.27	2.33	1.55	2.80	0.54	1.20	1.60	0.65
TKN out	1.33	0.92	1.82	1.20	0.51	0.09	0.29	0.88
Flow US gallon	N/A	16173	1823	14455	5750	2896	80297	2501
Rain (in)	0.77	0.40	0.12	0.53	0.19	0.11	1.96	0.11
Storm Duration (hr)	6	7.5	1	1.5	2.5	2.5	2.5	1

TSS Removals (8 events)		**TKN Removals** (8 events)		**TP Removals** (8 events)	
All events (load)		All events (load)		All events (load)	
Total in	43.14 kg	Total in	1.01 kg	Total in	0.20 kg
Total out	10.46 kg	Total out	0.35 kg	Total out	0.14 kg
% removal	**76%**	% removal	**65%**	% removal	**32%**

Sludge Particle Size Distribution		
Particle Size (um)	Sample 1	Sample 2
	% finer	% finer
500	94.9	85.3
250	92.4	82.6
150	88.1	77.5
106	84.0	73.6
75	80.7	69.9
53	73.6	64.3
38	69.6	57.0
25	46.0	44.9

Removal rates are mass reduction based on flow composite quality samples

APPENDIX H

APPENDIX E OF THE PAG-13 GENERAL PERMIT

APPENDIX E

POLLUTANT REDUCTION PLAN REQUIREMENTS FOR DISCHARGES TO WATERS IMPAIRED FOR NUTRIENTS AND/OR SEDIMENT

MS4 permittees with at least one stormwater discharge to surface waters considered impaired for nutrients (nitrogen and phosphorus) and/or sediment, in which a TMDL has not been developed or the TMDL has not identified a wasteload allocation (WLA) for the permittee, must develop and submit a Pollutant Reduction Plan (PRP) with the NOI to reduce the pollutant loads to those waters. In the event the permittee also has at least one stormwater discharge to surface waters within the Chesapeake Bay watershed, the PRP may be combined with the CBPRP described in Appendix D.

The PRP is approved upon DEP's approval of coverage under this General Permit. The permittee shall implement its approved PRP and comply with the following:

A. The permittee shall achieve the pollutant load reduction(s) (lbs/year) proposed in its PRP within 5 years following DEP's approval of coverage under the General Permit (identified on page 1). The minimum percent reduction for pollutant loadings of sediment and Total Phosphorus (TP) shall be 10% and 5%, respectively. If the surface water is impaired for both sediment and nutrients, both sediment (10%) and TP (5%) reductions must be achieved. If the surface water is impaired for sediment alone, a sediment (10%) reduction must be achieved. If the cause of impairment is nutrients, a TP (5%) reduction must be achieved. Pollutant reduction efficiencies for selected BMPs shall be in accordance with the BMP Effectiveness Values document published by DEP (3800-PM-BCW0100m) or Chesapeake Bay Program Office expert panel reports. The permittee shall submit a report demonstrating implementation of the PRP as an attachment to the first Annual MS4 Status Report that is due following completion of the 5th year of General Permit coverage.

B. The BMPs proposed in the PRP for the term of General Permit coverage shall be implemented in accordance with the schedule in the PRP. In the event the permittee decides to modify the location, type or number of proposed BMPs or modify the storm sewershed map, the permittee shall submit an update to its PRP to DEP prior to implementing the changes. A modified PRP that meets the conditions of paragraphs 1 – 3 herein may be implemented upon submission to DEP unless DEP issues an objection in writing within 60 days.

C. Where submission of a modified PRP to DEP is required, the permittee shall solicit public involvement and participation, as follows:

1. The permittee shall make a complete copy of the PRP available for public review.

2. The permittee shall publish, in a newspaper of general circulation in the area, a public notice containing a statement describing the plan, where it may be reviewed by the public, and the length of time the permittee will provide for the receipt of comments. The public notice must be published at least 45 days prior to the deadline for submission of the PRP to DEP.

3. The permittee shall accept written comments for a minimum of 30 days from the date of public notice.

4. The permittee shall accept comments from any interested member of the public at a public meeting or hearing, which may include a regularly scheduled meeting of the governing body of the municipality or municipal authority that is the permittee.

5. The permittee shall consider and make a record of the consideration of each timely comment received from the public during the public comment period concerning the plan, identifying any changes made to the plan in response to the comment.

Modified PRPs submitted to DEP must include a copy of the newspaper notice, a copy of all written comments received from the public and a copy of the permittee's record of consideration of all timely comments received in the public comment period.

D. Progress with achieving the required pollutant load reductions shall be reported in each Annual MS4 Status Report.