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1 SNOW AND ICE REMOVAL PLAN 2022

Beginning in 2019, DOEE began coordinating with the District of Columbia Department of Public Works (DPW) to design a pilot project that would evaluate different strategies to reduce road salt use in the District. The goal of the project is to test alternative treatment scenarios that could be incorporated into standard snow removal practices. During the 2021-2022 winter season, there was only one qualifying snow event, and the pilot project was implemented successfully during that event. The pilot will continue in the 2022-2023 winter season with a goal of implementing the pilot for 2-3 additional events. DOEE has communicated this need to EPA and received permission to continue the project in 2022-2023.

In addition to the one successful test run of the pilot, DOEE and DPW accomplished the following during the current reporting year:

- DOEE and DPW held bi-weekly planning meetings through the fall/winter of 2021-2022.
- Additional calcium magnesium acetate was procured to target additional weather events (up to 3 or 4 total events).
- DOEE and DPW worked closely with secured contractor support to ensure data collection accompanied the pilot's implementation.
- DPW held an in-person training for the truck drivers detailed to this pilot on November 19, 2021. An additional training for truck drivers is being planned in advance of the 2022-2023 winter season.

The following page provides a current overview of the road salt pilot as of the date of this report's submission.

District of Columbia Deicing Alternatives Pilot Overview
"Road Salt Reduction Pilot"

Background: The 2018 District of Columbia Government Municipal Separate Stormwater Sewer System (MS4) Permit requires the District to pilot salt alternatives and incorporate its findings into the District's snow removal strategy. This Road Salt Reduction Pilot will be continued during the FY23 Snow Season, provided favorable weather conditions occur.

Goal: DOEE will compare the effectiveness of alternative deicing practices including the use of a salt alternative, Calcium Magnesium Acetate (CMA) and the use of brine, with the existing deicing practice of dry road salt application (control scenario).

Selection of Alternatives: The deicing alternatives that were selected for this study represent treatment options that have shown success at reducing salt use in other jurisdictions. Calcium Magnesium Acetate (CMA) has been shown to be a more environmentally friendly alternative to road salt, while still protecting public safety in deicing operations. The use of brine has also shown the ability to reduce the use of salt in deicing operations, since brine is less likely to bounce off the road.

Qualifying Events: To best target the effectiveness of each deicing treatment scenario, the pilot will only be deployed during events where plowing will not be needed. The qualifying weather conditions are listed below:

- Ice, freezing rain, slush, and winter mix
- Trace to 2 inches of snow

Test Design: DOEE and DPW have identified 6 snow plow routes (specifically the primary road portions of these routes) to execute the pilot testing during winter weather events. The three treatment scenarios (Control, brine, and CMA) will be run in duplicate for each event. It is anticipated that this pilot test will be deployed on the identified routes during as many qualifying events as feasible during the 2022-2023 snow season. It is the goal of this project to deploy and evaluate the treatment scenarios described in this pilot plan during at least 3 events beyond the initial "test" event. Limitations such as quantity of deicing chemicals and qualifying events will ultimately determine the total number events captured by this pilot.

Evaluation of Alternatives: DOEE anticipates using a variety of data points collected during the pilot test to evaluate the effectiveness of each treatment alternative including:

- Cost of treatment
- Weather and road conditions after product application
- District Snow Team - Road Conditions Rating after application
- Feedback on implementation procedures and product effectiveness from snow plow drivers, Tetra Tech staff, and the public

2 EVALUATION OF THE STORMWATER MANAGEMENT PROGRAM

The District's MS4 Annual Report, Section 4.6, requires a data synthesis of programmatic and watershed indicators.

4.6.1 Programmatic Indicators

The Permittee shall evaluate the effectiveness of the SWMP using multiple programmatic indicators linked to the requirements in Part 3 of this permit. The Annual Reporting Template in Appendix A of this permit identifies the programmatic indicators used to evaluate the success of implementing stormwater control measures.

As required by Section 4.6.1, the effectiveness of the Stormwater Management Program is evaluated using the programmatic indicators found in Part 3 of the MS4 Permit. The Annual Report describes implementation of these programs in this reporting year. In interest of doing a complete synthesis, indicators are being reviewed over the life of multiple permit terms. As seen in the text and figures below, major program indicators have seen a steady progression in implementation.

Catch Basin Cleaning Activities (Section 3.3.4)

Through the development of the DC Water Catch Basin Cleaning App, DOEE has increased the resolution at which it can report catch basin cleaning within the District. In previous permit terms DOEE was limited to reporting the number of catch basins cleaned over the entire jurisdiction. Now DOEE is able to report the number of catch basins that were cleaned specifically within the area of the city serviced by the MS4. Using data from the DC Water Catch Basin Cleaning App, DOEE has determined that there are 16,790 total catch basins within the MS4 area of the District. The number of catch basins cleaned in the MS4 area of DC was 12,473 in reporting year 2020, 11,859 in reporting year 2021 and 13,967 in reporting year 2022. These values represent the number of unique catch basins that were cleaned, not the number of cleaning events. It should be noted that some catch basins were cleaned more than once during the reporting year, which is not reflected in the numbers reported. The reduction in the number of catch basins cleaned in reporting year 2021 is due to a temporary pause in cleanings due to Covid-19.

Construction Activities (Section 3.5)

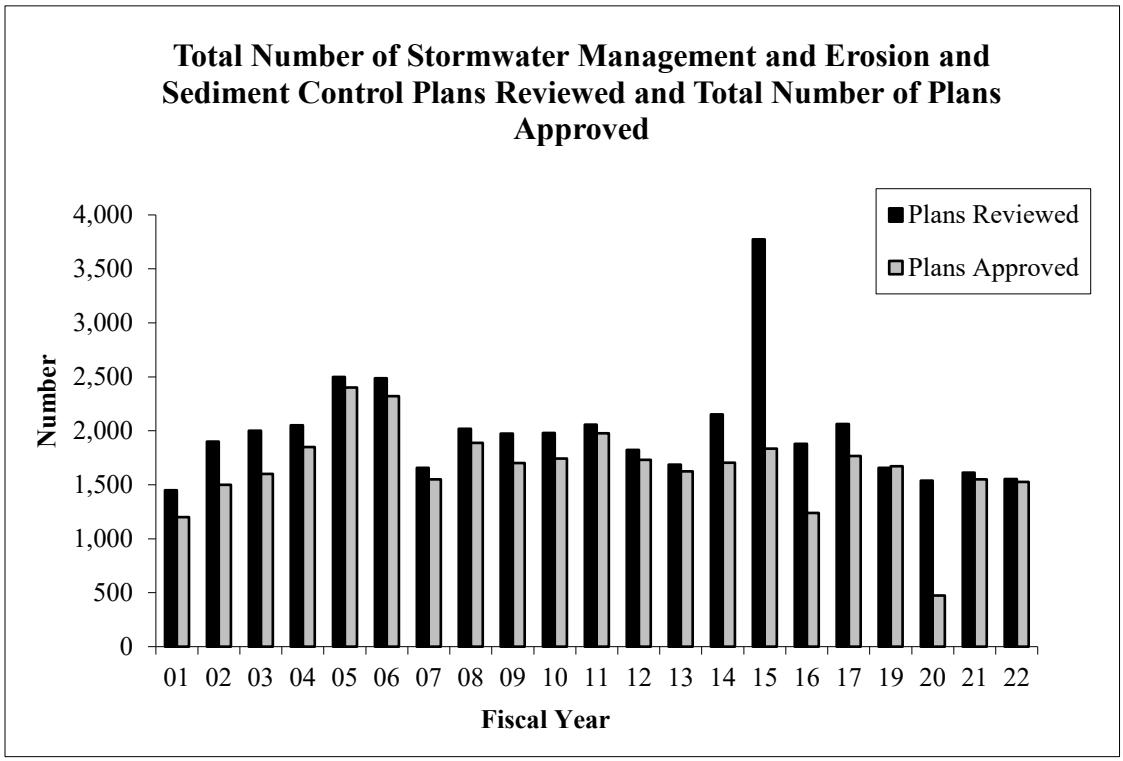

Figure 1 Total Number of Stormwater Management and Erosion and Sediment Control Plans Reviewed and Total Number of Plans Approved Over Time

Targeted Trash and Litter Pollutant Controls (Section 3.7)

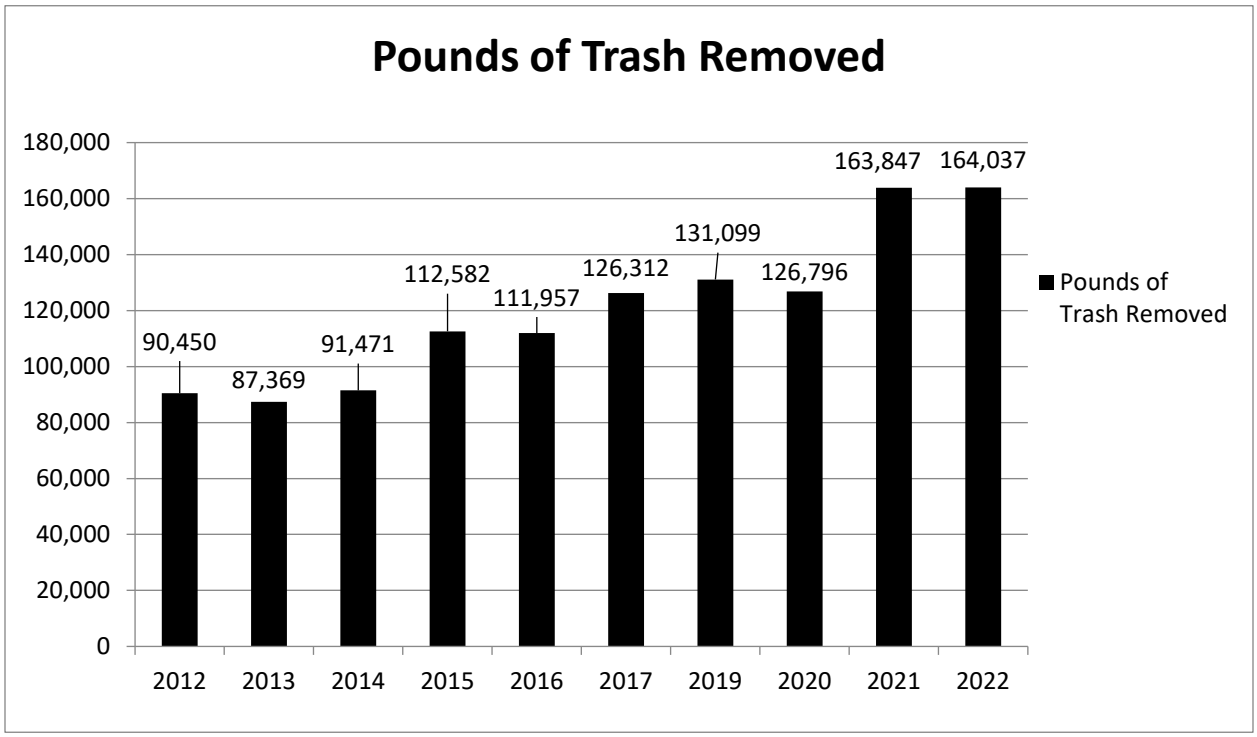

Figure 2 Annual Pounds of Trash Removed Over Time

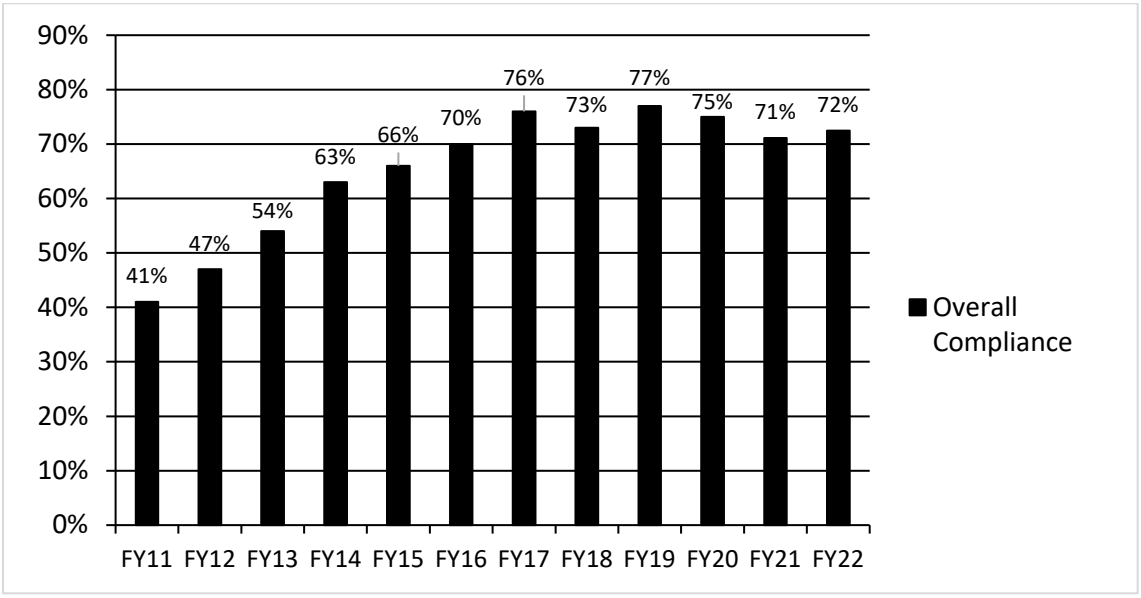

Figure 3 Bag Law Compliance Rates Over Time

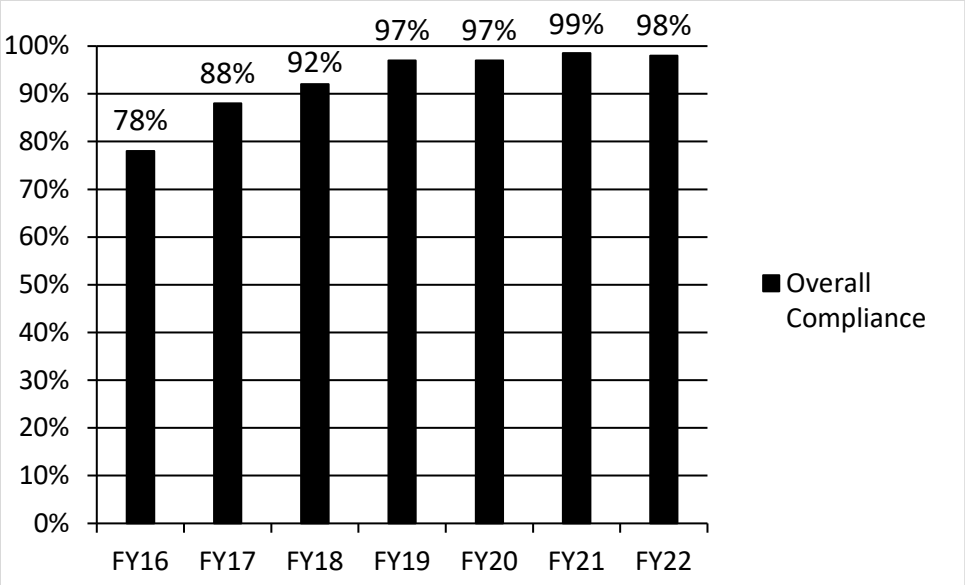

Figure 4 Foam Ban Compliance Rates

Table 1 Coal Tar Pavement Sealant Ban Inspections and Compliance Rates

Fiscal Year	Inspections	Positive CT Field Tests	Overall Compliance (%)
FY11	36	13	66.7
FY12	79	2	96.21
FY13	163	6	97.6
FY14	190	9	99.48
FY15	83	1	100
FY16	60	0	100
FY17	64	4*	100
FY18	60	6*	100
FY19	63	1	100
FY20	63	0	100
FY21	45	0	100
FY22	**60**	**0**	**100**
TOTALS:	737	32	

4.6.2 Watershed Indicators

The Permittee shall also evaluate the effectiveness of the SWMP using multiple watershed indicators linked mostly to the assessment requirements of Part 4 of this permit, and the synthesis of those data through analysis and modeling.

In the 2022 reporting year, DOEE continued implementing the Receiving Waters Assessment Program as required in Section 4.3 of the District's MS4 Permit. As part of this program, DOEE has developed a Rapid Stream Assessment. The intent of the Rapid Stream Assessment (RSA) is to collect information to provide a high-level overview of the entire wadeable stream network within the District. This information can help identify potential issues as well as locations that may warrant follow-up inspections or more in-depth evaluations. The information from the RSA can also serve as a baseline with which to compare information from these assessments in the future. All data collected as part of this program is housed in ArcGIS.

DOEE has assessed a total of 89 miles of streams within the District since the Rapid Stream Assessments began in 2019. DOEE field teams surveyed approximately 22 miles of stream during the 2022 reporting period, primarily within the Rock Creek watershed. Figure 5 shows all assessed streams to date, highlighting those assessed during the 2022 reporting year in orange. DOEE will continue surveying the remaining wadable streams in reporting year 2023 and anticipates beginning to return to previously assessed streams thereafter.

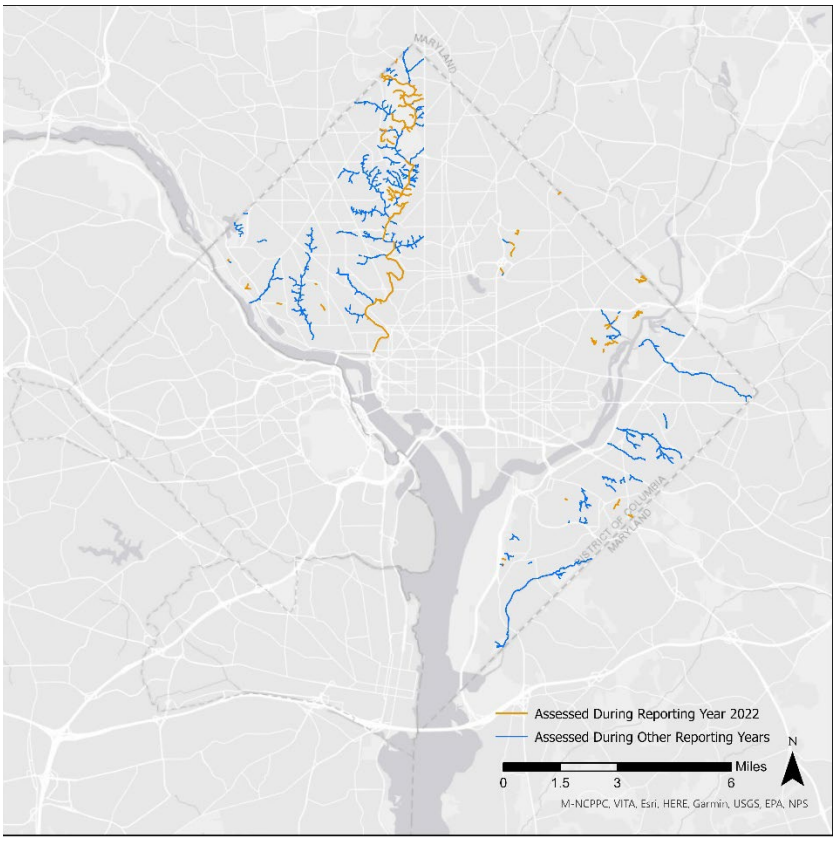

Figure 5 Rapid Stream Assessment Achievements

4.6.2.1 Estimate Annual Cumulative Pollutant Loadings

The Permittee shall estimate annual cumulative pollutant loadings for all pollutants listed in Table 7 of this permit.

DOEE continues to implement a wet weather monitoring program at representative outfalls, Table 2. The wet weather sampling summary data for the required monitoring parameters is detailed in Table 3, Table 4, and Table 5. The geometric mean for each parameter was calculated to represent the event mean concentration (EMC).

Table 2 Monitoring Site Information

Site	Outfall	Watershed
SW1	Outfall 999 - Gallatin	Anacostia
SW2	Outfall 124* - Oxon Run	Potomac
SW3	Outfall 851 - Soapstone Creek	Rock Creek
SW4	Outfall 1035 - Kenilworth and Douglas	Anacostia
SW5	Outfall 260 - 53rd and Dix Street	Anacostia
SW6	Outfall 950 - Potomac Tributary	Potomac
SW7	Outfall 103 - Oxon Run	Potomac
SW8	Outfall 825 - Tilden and Reno	Rock Creek
SW9	Outfall 901 - Tributary to Pinehurst Br.	Rock Creek

*Outfall 124 has been reported as Outfall 123 in past annual reports (typographical error).

Table 3 Potomac Watershed Wet Weather Sampling Data 2021-2022, geometric mean

Potomac River Watershed				
Parameter	**Unit**	**SW2**	**SW6**	**SW7**
E. Coli	MPN/100ml	1600.00	206.71	1600.00
Cadmium	mg/L	0.00	0.00	0.00
Copper	mg/L	0.0061	0.0195	0.0242
Lead	mg/L	0.0039	0.0028	0.0025
Zinc	mg/L	0.04	0.05	0.09
Total Suspended Solids	mg/L	13.09	15.71	18.77
Phosphorus, Total	mg/L	0.0950	0.2218	0.3699
Nitrogen, Total	mg/L	2.486110	2.518087	2.499947

n=3

Note: where value is < (less than) or non-detect, the Detection Limit (DL) value is used

Table 4 Anacostia Watershed Wet Weather Sampling Data 2021-2022, geometric mean

Anacostia River Watershed				
Parameter	**Unit**	**SW1**	**SW4**	**SW5**
E. Coli	MPN/100ml	1600.00	1600.00	655.46
Cadmium	mg/L	0.00	0.00	0.00
Copper	mg/L	0.0127	0.0103	0.0058
Lead	mg/L	0.0058	0.0035	0.0015
Zinc	mg/L	0.06	0.05	0.04
Total Suspended Solids	mg/L	35.04	16.18	13.01
Phosphorus, Total	mg/L	0.3799	0.1608	0.1592
Nitrogen, Total	mg/L	2.059857	1.374293	1.765645

n=3
Note: where value is < (less than) or non-detect, the Detection Limit (DL) value is used

Table 5 Rock Creek Watershed Wet Weather Sampling Data 2021-2022, geometric mean

Rock Creek Watershed				
Parameter	**Unit**	**SW3**	**SW8**	**SW9**
E. Coli	MPN/100ml	1600.00	1600.00	757.81
Cadmium	mg/L	0.00	0.00	0.00
Copper	mg/L	0.0145	0.0153	0.0108
Lead	mg/L	0.0028	0.0026	0.0016
Zinc	mg/L	0.03	0.04	0.02
Total Suspended Solids	mg/L	4.10	29.62	7.32
Phosphorus, Total	mg/L	0.2300	0.2937	0.2805
Nitrogen, Total	mg/L	2.070000	2.124431	1.123885

n=3 except SW3, which is n=1
Note: where value is < (less than) or non-detect, the Detection Limit (DL) value is used

Table 6 provides the annual cumulative pollutant load occurring in the three main watersheds within the District.

Table 6 Annual Cumulative Pollutant Load in Each Watershed

	Rock Creek	Anacostia River	Potomac River	Total	Units
Total Suspended Solids	458,960	1.872e+6	709680	3040640	pounds
Total Nitrogen	120130	121174	111904	253,208.04	Pounds
Total Phosphorous	11244	19924	8444	39.611.88	Pounds
Copper	347	1465	461	2,272.88	Pounds
Lead	67	632	94	792.87	Pounds
Zinc	1264	3601	1883	6,747.72	Pounds
Cadmium	6	57	57	90.05	Pounds
E. coli	2.05E+14	9.36E+14	2.35E+14	1.38E+15	MPN

DOEE calculated the potential pollutant load and volume reductions achieved through the annual BMP implementation, Table 7. The load and volume reduction estimates were developed using the District's Implementation Plan Modeling Tool (IPMT). With the permit's green roof installation requirement being met this reporting period, DOEE has also included the square footage of green roofs installed in each watershed to date, Table 8.

Table 7 Pollutant Load Reductions, 07/01/2021 - 06/30/2022

Watershed	Runoff Retained (gallons)	TN (lbs)	TP (lbs)	TSS (lbs)	Copper (lbs)	Lead (lbs)	Cadmium[1] (lbs)	Zinc (lbs)	E. *coli* (Billion MPN)
Anacostia	40,619,197	1,208	141	27,944	19.45	6.00	6.57	45.00	9,265
Rock Creek	23,398,622	705	82	10,854	11.26	3.49	3.82	21.85	5,375
Potomac River	12,628,220	383	44	5,479	6.02	1.87	2.05	11.68	2,877
Total	**76,646,039**	**2,297**	**267**	**44,276**	**36.73**	**11.36**	**12.44**	**78.53**	**17,516**

1 An EPA report (402-R-99-004B- linked below) that reviewed several studies with varied site conditions has documented mean partition coefficients for metals. DOEE used these metal-specific partition coefficients (Kd) and associated particle associated fraction (fp) values to model pollutant reduction for these metals through BMP implementation. Since many of the relevant low impact development (LID) practices have similar removal rates for lead and cadmium, the relationship between these two metals, their fp values, and the areas retrofitted were used to estimate cadmium reductions achieved through the Retrofit Program. DOEE will continue to use this methodology to estimate the pollutant load reduction for cadmium in Annual Reports.
EPA Report: http://www.epa.gov/sites/production/files/2015-05/documents/402-r-99-004b.pdf
2. Note that summations include MS4, Direct Drainage, and CSS areas.

Table 8 Square Feet of Green Roofs Installed in Each Watershed

	2018-2019	2019-2020	2020-2021	2021-202	Total
Anacostia	89,378	214,551	257,529	88,494	**561,458**
Rock Creek	15,895	217	101,182	76,125	**117,294**
Potomac	62,912	60,754	53,643	21,461	**177,309**
Total	**168,185**	**275,522**	**412,354**	**186,080**	**856,061**

As required, DOEE has attached all WLA benchmarks to this annual report, Table 11. This table provides a watershed scale summary that includes load reductions MS4 and direct drainage area for each non-CSS watersheds. The color coding indicates whether the Wasteload Allocation (WLA) has been achieved for that waterbody/pollutant combination, Table 10.

Table 9 Table Key

Green cells indicate that the WLA has already been achieved for that waterbody and pollutant combination.
Blue cells indicate that the benchmark load reduction was achieved or exceeded for that waterbody and pollutant combination.
Orange cells indicate that the benchmark load reduction was not achieved for that waterbody and pollutant combination.
Grey cells indicate that there is no MS4 WLA for that waterbody and pollutant combination, and therefore no benchmark has been established. Load reductions are provided for informational purposes only.

Table 10 Overall Summary of WLA Benchmark Achievements, 07/01/2021 - 06/30/2022

WLA Achieved	26
Benchmark Achieved	31
Benchmark Not Achieved	105
No WLA or benchmark	894

Table 11 Pollutant Load Reductions from BMP Implementation with WLA Benchmarks, 07/01/2021 to 06/30/2022

Watershed	Runoff Retained (gallons)	TN (lbs)	TP (lbs)	TSS (lbs)	Fecal Coliform (billion MPN)	BOD (lbs)	Oil and Grease (lbs)	Arsenic (lbs)	Copper (lbs)	Lead (lbs)	Cadmium[1] (lbs)	Mercury (lbs)	Zinc (lbs)	Chlordane (lbs)	DDD (lbs)	DDE (lbs)	DDT (lbs)	Dieldrin (lbs)	Heptachlor Epoxide (lbs)	PAH 1 (lbs)	PAH 2 (lbs)	TPCB (lbs)	E. *coli* (Billion MPN)
Anacostia	19,603,524	600.25	71.25	14,277.4	11,666	6,544	658.2	2.8E-01	9.8E+00	3.0E+00	3.3E+00	3.5E-02	2.3E+01	1.7E-03	5.6E-04	2.5E-03	6.4E-03	4.7E-05	1.6E-04	1.1E-01	7.3E-01	1.5E-02	4,682.1
Anacostia Lower	5,621,753	179.10	20.81	4,261.4	3,459	1,786	193.3	8.3E-02	2.9E+00	9.1E-01	9.9E-01	1.0E-02	6.7E+00	4.8E-04	1.6E-04	7.5E-04	1.9E-03	1.4E-05	4.5E-05	3.1E-02	2.1E-01	4.3E-03	1,388.2
Anacostia Upper	13,981,772	421.15	50.44	10,016.0	8,207	4,759	464.9	2.0E-01	6.9E+00	2.1E+00	2.3E+00	2.4E-02	1.6E+01	1.2E-03	3.9E-04	1.8E-03	4.5E-03	3.4E-05	1.1E-04	7.7E-02	5.2E-01	1.0E-02	3,293.9

ANATF_DC	15,390,811	376.29	45.81	9,331.6	7,564	4,188	421.6	1.8E-01	6.3E+00	2.0E+00	2.2E+00	2.2E-02	1.5E+01	1.0E-03	3.6E-04	1.6E-03	4.2E-03	2.9E-05	9.4E-05	6.5E-02	4.5E-01	9.4E-03	3,035.5
ANATF_MD	4,654,723	105.47	11.90	2,256.5	1,890	1,055	107.1	4.7E-02	1.6E+00	4.9E-01	5.3E-01	5.7E-03	3.7E+00	2.9E-04	9.1E-05	4.1E-04	1.0E-03	8.5E-06	2.8E-05	1.9E-02	1.2E-01	2.4E-03	758.5
Battery Kemble Creek	654,838	18.15	2.08	229.9	339	153	18.3	8.4E-03	2.9E-01	8.7E-02	9.5E-02	1.0E-03	5.5E-01	5.4E-05	1.6E-05	7.3E-05	1.9E-04	1.6E-06	5.2E-06	3.6E-03	2.3E-02	4.4E-04	136.1
Broad Branch	1,310,569	37.87	4.34	673.4	695	259	50.7	1.7E-02	5.9E-01	1.8E-01	2.0E-01	2.1E-03	1.1E+00	1.1E-04	3.4E-05	1.5E-04	3.8E-04	3.2E-06	1.0E-05	7.2E-03	4.6E-02	9.0E-04	279.1
C&O Canal	646,995	18.62	2.12	234.2	342	152	18.1	8.4E-03	2.9E-01	8.8E-02	9.7E-02	1.0E-03	5.6E-01	5.3E-05	1.6E-05	7.3E-05	1.9E-04	1.6E-06	5.2E-06	3.6E-03	2.3E-02	4.4E-04	137.3
Dalecarlia Tributary	794,128	22.80	2.59	283.1	415	186	22.2	1.0E-02	3.5E-01	1.1E-01	1.2E-01	1.3E-03	1.8E-01	6.5E-05	2.0E-05	8.9E-05	2.3E-04	1.9E-06	6.3E-06	4.4E-03	2.8E-02	5.4E-04	166.7
Dumbarton Oaks	218,765	6.06	0.69	108.7	113	43	7.6	2.8E-03	9.7E-02	2.9E-02	3.2E-02	3.5E-04	1.9E-01	1.8E-05	5.5E-06	2.4E-05	6.2E-05	5.3E-07	1.7E-06	1.2E-03	7.6E-03	1.5E-04	45.5
Fenwick Branch	524,476	14.71	1.68	260.5	272	104	18.2	6.7E-03	2.3E-01	7.0E-02	7.6E-02	8.3E-04	4.5E-01	4.3E-05	1.3E-05	5.8E-05	1.5E-04	1.3E-06	4.2E-06	2.9E-03	1.8E-02	3.5E-04	109.0
Fort Chaplin Tributary	9,489	0.50	0.05	5.8	5	3	0.3	1.2E-04	4.2E-03	1.3E-03	1.4E-03	1.5E-05	9.6E-03	7.8E-07	2.4E-07	1.1E-06	2.7E-06	2.3E-08	7.6E-08	5.2E-05	3.3E-04	6.4E-06	2.0
Fort Davis Tributary	30,116	0.90	0.10	18.4	16	9	0.9	3.9E-04	1.3E-02	4.0E-03	4.4E-03	4.8E-05	3.0E-02	2.5E-06	7.5E-07	3.3E-06	8.6E-06	7.3E-08	2.4E-07	1.7E-04	1.0E-03	2.0E-05	6.3
Fort Dupont Tributary	2,106	0.06	0.01	1.3	1	1	0.1	2.7E-05	9.3E-04	2.8E-04	3.1E-04	3.3E-06	2.1E-03	1.7E-07	5.3E-08	2.3E-07	6.0E-07	5.1E-09	1.7E-08	1.2E-05	7.3E-05	1.4E-06	0.4
Fort Stanton Tributary	6,343	0.18	0.02	3.9	3	2	0.2	8.2E-05	2.8E-03	8.4E-04	9.2E-04	1.0E-05	6.4E-03	5.2E-07	1.6E-07	7.0E-07	1.8E-06	1.5E-08	5.1E-08	3.5E-05	2.2E-04	4.3E-06	1.3
Foundry Branch	317,092	8.79	1.01	111.3	164	74	8.9	4.1E-03	1.4E-01	4.2E-02	4.6E-02	5.0E-04	2.7E-01	2.6E-05	7.9E-06	3.5E-05	9.1E-05	7.7E-07	2.5E-06	1.7E-03	1.1E-02	2.1E-04	65.9

Hickey Run	4,496,149	142.35	18.70	3,849.9	3,057	1,851	174.3	7.2E-02	2.5E+00	8.1E-01	8.9E-01	8.8E-03	6.0E+00	4.0E-04	1.4E-04	6.6E-04	1.7E-03	1.1E-05	3.6E-05	2.5E-02	1.8E-01	3.8E-03	1,226.9
Kingman Lake	101,748	3.46	0.39	76.0	62	31	3.1	1.5E-03	5.2E-02	1.6E-02	1.8E-02	1.8E-04	1.2E-01	8.7E-06	2.9E-06	1.3E-05	3.4E-05	2.5E-07	8.1E-07	5.6E-04	3.8E-03	7.8E-05	24.8
Klingle Valley Run	47,592	1.32	0.15	23.6	25	9	1.6	6.1E-04	2.1E-02	6.3E-03	6.9E-03	7.5E-05	4.0E-02	3.9E-06	1.2E-06	5.3E-06	1.4E-05	1.2E-07	3.8E-07	2.6E-04	1.7E-03	3.2E-05	9.9
Lower Beaverdam Creek																							
Luzon Branch	3,815,777	107.86	12.41	1,947.2	2,015	754	142.5	5.0E-02	1.7E+00	5.2E-01	5.7E-01	6.1E-03	3.3E+00	3.1E-04	9.7E-05	4.3E-04	1.1E-03	9.2E-06	3.0E-05	2.1E-02	1.3E-01	2.6E-03	808.7
Melvin Hazen Valley Branch	1,050,351	40.18	4.65	839.4	791	261	36.4	1.8E-02	6.4E-01	2.1E-01	2.3E-01	2.2E-03	1.3E+00	9.6E-05	3.7E-05	1.7E-04	4.3E-04	2.5E-06	8.4E-06	5.8E-03	4.3E-02	9.5E-04	317.4
Nash Run	220,642	6.25	0.71	135.1	114	66	6.7	2.8E-03	9.7E-02	2.9E-02	3.2E-02	3.5E-04	2.2E-01	1.8E-05	5.5E-06	2.4E-05	6.3E-05	5.3E-07	1.8E-06	1.2E-03	7.7E-03	1.5E-04	45.8
Normanstone Creek	30,131	0.84	0.10	15.0	16	6	1.0	3.9E-04	1.3E-02	4.0E-03	4.4E-03	4.8E-05	2.6E-02	2.5E-06	7.5E-07	3.3E-06	8.6E-06	7.3E-08	2.4E-07	1.7E-04	1.0E-03	2.0E-05	6.3
Northwest Branch	4,174,332	123.08	13.95	2,662.8	2,234	1,255	127.5	5.5E-02	1.9E+00	5.8E-01	6.3E-01	6.8E-03	4.4E+00	3.5E-04	1.1E-04	4.8E-04	1.2E-03	1.0E-05	3.3E-05	2.3E-02	1.5E-01	2.9E-03	896.6
Oxon Run	4,492,787	149.32	17.20	2,060.7	2,805	1,163	125.6	6.6E-02	2.3E+00	7.5E-01	8.2E-01	8.1E-03	4.6E+00	3.8E-04	1.3E-04	1.1E-04	1.5E-03	1.1E-05	3.6E-05	2.5E-02	1.7E-01	3.5E-03	1,125.7
Pinehurst Branch	166,154	4.60	0.53	82.5	86	33	5.8	2.1E-03	7.3E-02	2.2E-02	2.4E-02	2.6E-04	1.4E-01	1.4E-05	4.2E-06	1.8E-05	4.7E-05	4.0E-07	1.3E-06	9.1E-04	5.8E-03	1.1E-04	34.5
Piney Branch	20,616	0.57	0.07	10.2	11	4	0.7	2.7E-04	9.1E-03	2.7E-03	3.0E-03	3.3E-05	1.8E-02	1.7E-06	5.2E-07	2.3E-06	5.9E-06	5.0E-08	1.6E-07	1.1E-04	7.2E-04	1.4E-05	4.3
Pope Branch	36,053	1.12	0.12	22.1	19	11	1.1	4.6E-04	1.6E-02	4.8E-03	5.3E-03	5.7E-05	3.6E-02	3.0E-06	9.0E-07	4.0E-06	1.0E-05	8.7E-08	2.9E-07	2.0E-04	1.3E-03	2.4E-05	7.5

Portal Branch	11,101	0.31	0.04	5.5	6	2	0.4	1.4E-04	4.9E-03	1.5E-03	1.6E-03	1.8E-05	9.4E-03	9.1E-07	2.8E-07	1.2E-06	3.2E-06	2.7E-08	8.9E-08	6.1E-05	3.9E-04	7.5E-06	2.3
Potomac Lower	4,657,467	157.11	18.45	2,200.0	2,974	1,202	170.7	7.0E-02	2.5E+00	7.9E-01	8.7E-01	8.6E-03	4.8E+00	4.0E-04	1.4E-04	6.5E-04	1.6E-03	1.1E-05	3.7E-05	2.6E-02	1.7E-01	3.7E-03	1,193.7
Potomac Middle	484,707	13.56	1.57	173.5	254	114	15.2	6.3E-03	2.2E-01	6.5E-02	7.2E-02	7.8E-04	4.1E-01	4.0E-05	1.2E-05	5.5E-05	1.4E-04	1.2E-06	3.9E-06	2.7E-03	1.7E-02	3.3E-04	102.1
Potomac Upper	4,755,937	134.15	15.32	1,693.2	2,486	1,115	133.0	6.2E-02	2.1E+00	6.4E-01	7.0E-01	7.6E-03	4.0E+00	3.9E-04	1.2E-04	5.3E-04	1.4E-03	1.2E-05	3.8E-05	2.6E-02	1.7E-01	3.2E-03	997.6
POTTF_DC	17,551,499	412.58	48.01	6,593.5	7,769	2,996	486.9	1.9E-01	6.5E+00	2.0E+00	2.2E+00	2.3E-02	1.3E+01	1.1E-03	3.7E-04	1.7E-03	4.3E-03	3.1E-05	1.0E-04	7.2E-02	4.8E-01	9.8E-03	3,117.9
POTTF_MD	831,123	15.50	1.75	190.7	279	124	14.8	6.9E-03	2.4E-01	7.2E-02	7.9E-02	8.5E-04	4.5E-01	4.4E-05	1.3E-05	6.0E-05	1.5E-04	1.3E-06	4.2E-06	2.9E-03	1.9E-02	3.6E-04	112.0
Rock Creek Lower	2,197,326	72.79	8.41	1,430.2	1,401	488	80.4	3.3E-02	1.2E+00	3.7E-01	4.0E-01	4.1E-03	2.3E+00	1.9E-04	6.6E-05	3.0E-04	7.7E-04	5.3E-06	1.8E-05	1.2E-02	8.4E-02	1.7E-03	562.3
Rock Creek Upper	6,729,195	197.29	22.83	3,595.7	3,676	1,330	272.5	9.0E-02	3.1E+00	9.5E-01	1.0E+00	1.1E-02	6.0E+00	5.6E-04	1.8E-04	7.9E-04	2.0E-03	1.6E-05	5.4E-05	3.7E-02	2.4E-01	4.7E-03	1,475.5
Soapstone Creek	561,363	17.78	2.19	340.2	336	111	43.3	8.0E-03	2.8E-01	8.9E-02	9.8E-02	9.9E-04	5.5E-01	4.8E-05	1.6E-05	7.3E-05	1.9E-04	1.4E-06	4.5E-06	3.1E-03	2.1E-02	4.3E-04	134.7
Texas Avenue Tributary	40,286	1.12	0.13	24.7	21	12	1.2	5.2E-04	1.8E-02	5.4E-03	5.9E-03	6.4E-05	4.1E-02	3.3E-06	1.0E-06	4.5E-06	1.2E-05	9.8E-08	3.2E-07	2.2E-04	1.4E-03	2.7E-05	8.4
Tidal Basin																							
Washington Ship Channel	442,010	12.38	1.43	158.5	232	104	14.0	5.7E-03	2.0E-01	6.0E-02	6.5E-02	7.1E-04	3.8E-01	3.6E-05	1.1E-05	5.0E-05	1.3E-04	1.1E-06	3.5E-06	2.4E-03	1.5E-02	3.0E-04	93.2
Watts Branch	2,235,429	65.01	7.49	1,529.5	1,263	728	69.2	3.1E-02	1.1E+00	3.3E-01	3.6E-01	3.8E-03	2.5E+00	1.9E-04	6.1E-05	2.7E-04	7.0E-04	5.4E-06	1.8E-05	1.2E-02	8.1E-02	1.6E-03	506.8

Watts Branch - Lower	50,296	1.46	0.16	30.8	26	15	1.5	6.5E-04	2.2E-02	6.7E-03	7.3E-03	8.0E-05	5.1E-02	4.1E-06	1.3E-06	5.6E-06	1.4E-05	1.2E-07	4.0E-07	2.8E-04	1.7E-03	3.4E-05	10.5
Watts Branch - Upper	2,185,133	63.56	7.33	1,498.7	1,237	713	67.7	3.0E-02	1.0E+00	3.2E-01	3.5E-01	3.7E-03	2.4E+00	1.8E-04	5.9E-05	2.7E-04	6.8E-04	5.3E-06	1.7E-05	1.2E-02	7.9E-02	1.6E-03	496.3
CSS - Anacostia	21,015,672	608.21	69.62	13,666.4	11,418	6,451	641.6	2.8E-01	9.7E+00	3.0E+00	3.2E+00	3.5E-02	2.2E+01	1.7E-03	5.5E-04	2.5E-03	6.3E-03	5.1E-05	1.7E-04	1.2E-01	7.5E-01	1.5E-02	4,582.5
CSS - Potomac	2,730,109	78.20	8.95	1,411.8	1,454	539	94.6	3.6E-02	1.2E+00	3.8E-01	4.1E-01	4.4E-03	2.4E+00	2.3E-04	7.0E-05	3.1E-04	8.0E-04	6.6E-06	2.2E-05	1.5E-02	9.6E-02	1.9E-03	583.4
CSS - Rock Creek	14,472,101	434.99	50.77	5,828.0	8,315	3,628	413.3	2.0E-01	7.0E+00	2.2E+00	2.4E+00	2.5E-02	1.4E+01	1.2E-03	4.0E-04	1.8E-03	4.6E-03	3.5E-05	1.2E-04	8.0E-02	5.2E-01	1.1E-02	3,337.0

Note that summations include MS4 and Direct Drainage areas. There is no distinction between runoff draining into a water body and runoff that is conveyed in collection system within the three CSS segments.

"-" indicates no reductions resulted from BMP implementation.

1. An EPA report (402-R-99-004B- linked below) that reviewed several studies with varied site conditions has documented mean partition coefficients for metals. DOEE used these metal-specific partition coefficients (Kd) and associated particle associated fraction (fp) values to model pollutant reduction for these metals through BMP implementation. Since many of the relevant low impact development (LID) practices have similar removal rates for lead and cadmium, the relationship between these two metals, their fp values, and the areas retrofitted were used to estimate cadmium reductions achieved through the Retrofit Program. DOEE will continue to use this methodology to estimate the pollutant load reduction for cadmium in Annual Reports. http://www.epa.gov/sites/production/files/2015-05/documents/402-r-99-004b.pdf.

4.6.2.2 Estimate Progress Towards all Numeric Limits

The Permittee shall estimate annual progress towards all numeric limits in Subsection 1.5.3.1 of this permit for acres managed and pounds of trash in the Anacostia River.

The District continues to implement and enforce its Stormwater Management Program in accordance with the MS4 Permit and the Revised Stormwater Management Plan. This reporting year, the District has made progress toward achieving the numeric limits of section 1.5.3.1 of the District's MS4 Permit (Table 13, Table 18). Based on current implementation rates, DOEE expects to achieve or surpass the requirements by the end of this permit term.

DOEE has made progress towards the Acres Managed requirements of Section 1.5. Table 12 shows the acres managed reported in the 2021 annual report. Table 13 provides the updated acres managed numbers as reported in the 2022 annual report. Rerunning the analysis this year resulted in a four acre decrease in the 2021 acres managed due to updated BMP records. The progress achieved during the 2022 reporting period is outlined in Table 14. Table 15 outlines the updated progress toward acres managed for the 2021 reporting period. Table 16 shows the updated progress toward acres managed for the 2020 reporting period. Table 17 shows the progress toward acres managed for the 2019 and gap year reporting period.

Table 12 Acres Managed Table (As Published in 2021 MS4 Annual Report)

Reporting Year	**2019*±**	**2020***	**2021±**	**2022**	**2023**
Date Range	10/01/17-06/30/2019	07/01/19 - 06/30/20	07/01/20 - 06/3/21		
Anacostia River	148	86	81		
Rock Creek	55	24	36		
Potomac River	134	126	39		
Public Right- of-Way	25	108	19		
Total	362	344	176		

*DOEE continuously reviews and updates BMP records in the Surface and Groundwater System. Updated BMP records resulted in increased 2019 and 2020 acres managed values.
±Includes equivalent acres managed for stream restorations (43 acres in 2019, 9 acres in 2021).

Table 13 Revised Acres Managed Table

Reporting Year	2019	2020	2021	2022	2023
Date Range	10/01/17-06/30/2019	07/01/19 - 06/30/20	07/01/20 - 06/30/21	07/01/21 – 06/30/22	
Anacostia	148	86	76	61	
Rock Creek	55	24	37	26	
Potomac River	134	126	40	24	
Public Right-of-Way	25	108	19	72	
Total	362	344	172	183	

Table 14 Annual Progress Towards Numeric Limits of the MS4 Permit for Acres Managed, 07/01/2021 - 06/30/2022

Major Drainage Basin	Sewershed	Regulated PROW (square feet)	Regulated Non-PROW Parcels (square feet)	Voluntary Retrofits (square feet)	Total (square feet)	Total (acres)	TMDL IP Target (acres)
Anacostia	**CSS**	417,022	1,842,093	425,590	**2,684,705**	**62**	
	MS4	396,543	1,412,794	1,876,918	**3,686,255**	**85**	**110**
	MS4 + CSS	813,565	3,254,887	2,302,508	**6,370,959**	**146**	
Rock Creek	**CSS**	465,943	1,364,845	644,858	**2,475,645**	**57**	
	MS4	230,215	832,023	412,208	**1,474,446**	**34**	**30**
	MS4 + CSS	696,158	2,196,868	1,057,066	**3,950,092**	**91**	
Potomac	**CSS**	720	302,814	114,568	**418,102**	**10**	
	MS4	1,150,889	897,865	749,680	**2,798,434**	**64**	**67**
	MS4 + CSS	1,151,609	1,200,678	864,248	**3,216,536**	**74**	
TOTAL	**CSS**	883,685	3,509,752	1,185,015	**5,578,452**	**128**	**-**
	MS4	1,777,647	3,142,682	3,038,806	**7,959,135**	**183**	**208**
	MS4 + CSS	2,661,332	6,652,434	4,223,821	**13,537,587**	**311**	**-**

Table 15 Annual Progress Towards Numeric Limits of the MS4 Permit for Acres Managed, 07/01/2020 - 06/30/2021

Major Drainage Basin	Sewershed	Regulated PROW (square feet)	Regulated Non-PROW Parcels (square feet)	Voluntary Retrofits (square feet)	Total (square feet)	Total (acres)	TMDL IP Target (acres)
Anacostia	CSS	245,030	2,076,261	367,428	**2,688,719**	**62**	
	MS4	663,803	2,650,187	888,413	**4,202,404**	**96**	**110**
	MS4 + CSS	908,833	4,726,448	1,255,842	**6,891,123**	**158**	
Rock Creek	CSS	19,453	312,049	344,602	**676,104**	**16**	
	MS4	2,016	1,073,969	495,804	**1,571,789**	**36**	**30**
	MS4 + CSS	21,469	1,386,018	840,406	**2,247,893**	**52**	
Potomac	CSS	9,830	223,282	60,793	**293,905**	**7**	
	MS4	174,413	905,698	799,590	**1,879,702**	**43**	**67**
	MS4 + CSS	184,244	1,128,980	860,383	**2,173,607**	**50**	
TOTAL	CSS	274,313	2,611,592	772,823	**3,658,728**	**84**	-
	MS4	840,232	4,629,854	2,183,807	**7,653,894**	**176**	**208**
	MS4 + CSS	1,114,546	7,241,446	2,956,631	**11,312,623**	**260**	-

Table 16 Annual Progress Towards Numeric Limits of the MS4 Permit for Acres Managed, 07/01/2019 - 06/30/2020

Major Drainage Basin	Sewershed	Regulated PROW (square feet)	Regulated Non-PROW Parcels (square feet)	Voluntary Retrofits (square feet)	Total (square feet)	Total (acres)	TMDL IP Target (acres)
Anacostia	CSS	727,035	2,494,569	676,268	**3,897,872**	**89**	
	MS4	184,450	2,943,193	1,473,297	**4,600,940**	**106**	**110**
	MS4 + CSS	911,485	5,437,762	2,149,565	**8,498,813**	**195**	
Rock Creek	CSS	471,870	1,613,312	298,394	**2,383,576**	**55**	
	MS4	2,833,729	241,283	1,227,236	**4,302,248**	**99**	**30**
	MS4 + CSS	3,305,600	1,854,595	1,525,629	**6,685,824**	**153**	
Potomac	CSS	146,836	250,074	390,284	**787,194**	**18**	
	MS4	509,443	5,202,178	384,843	**6,096,464**	**140**	**67**
	MS4 + CSS	656,279	5,452,252	775,127	**6,883,658**	**158**	
TOTAL	CSS	1,345,742	4,357,954	1,364,946	**7,068,642**	**162**	**-**
	MS4	3,527,622	8,386,654	3,085,376	**14,999,653**	**344**	**208**
	MS4 + CSS	4,873,364	12,744,609	4,450,321	**22,068,294**	**507**	**-**

Table 17 Annual Progress Towards Numeric Limits of the MS4 Permit for Acres Managed, 10/1/2017 - 06/30/2019

Major Drainage Basin	Sewershed	Regulated PROW (square feet)	Regulated Non-PROW Parcels (square feet)	Voluntary Retrofits (square feet)	Total (square feet)	Total (acres)	TMDL IP Target (acres)
Anacostia	CSS	137,224	3,459,475	895,614	**4,492,313**	**103.13**	
	MS4	882,142	4,288,673	2,177,371	**7,348,185**	**168.69**	**110**
	MS4 + CSS	1,019,366	7,748,148	3,072,984	**11,840,498**	**271.82**	
Rock Creek	CSS	488,901	1,134,972	491,841	**2,115,715**	**48.57**	
	MS4	51,868	1,894,974	616,521	**2,563,363**	**58.85**	**30**
	MS4 + CSS	540,770	3,029,947	1,108,362	**4,679,078**	**107.42**	
Potomac	CSS	52,384	597,453	90,762	**740,599**	**17.00**	
	MS4	41,509	3,281,355	2,534,410	**5,857,274**	**134.46**	**67**
	MS4 + CSS	93,893	3,878,808	2,625,172	**6,597,873**	**151.47**	
TOTAL	CSS	678,509	5,191,901	1,478,217	**7,348,626**	**168.70**	**-**
	MS4	975,520	9,465,002	5,328,301	**15,768,823**	**362.00**	**208**
	MS4 + CSS	1,654,028	14,656,903	6,806,518	**23,117,449**	**530.70**	**-**

Table 18 Annual Progress Towards Numeric Limits of the MS4 Permit for Trees Planted, Green Roofs Installed, and Trash Removed

Numeric Requirement	Achievement During Reporting Year	Percent Complete	Achievement During Permit Term
Achieve a minimum net increase of 33,525 trees in the MS4 Permit Area	6,065 trees	97.7%	32,751 trees
Install 350,000 square feet of green roofs within the MS4 Permit area	186,080 square feet	297.6%	1,041,511 square feet
Remove 108,347 pounds of trash annually from the Anacostia River	163,037 lbs	NA	Meeting annual trash reduction goal

4.6.2.3 Multi-faceted Suite of Indicators

Using all other data and information collected per the water quality assessment requirements of Part 4 of this permit, the Permittee shall establish a multi-faceted suite of indicators to be reported over multiple permit terms. These indicators shall address discharge quality as well as receiving water quality. These indicators shall balance current status with long-term trends in order to determine elements of the program that are effective and those needing additional improvement. This suite of indicators shall be developed in consultation with EPA and other stakeholders and finalized with submittal of the updated SWMP submitted to EPA as part of the application package for permit renewal per Section 2.10 of this permit. These indicators shall be established as long-term metrics for the SWMP and may be included as requirements in future permits.

DOEE is on track to meet this permit requirement and will be working with EPA and stakeholders to develop a multi-faceted suite of indicators that address discharge and receiving water quality.

4.6.3 Synthesis of Strengths and Areas of Improvement

In each annual report the Permittee shall provide a short synthesis of areas of the program deemed effective with ongoing effort, and areas where additional strategies are needed to effectively address certain pollutants or sources, supported by interpretation of both programmatic and watershed indicators. Conclusions shall be based on interpretations of the indicators.

Strengths

DOEE has had continued success implementing many stormwater management programs. Notable achievements include:

1. Since the expiration of the last permit and through the end of this reporting period, the District has retrofitted 183 acres in the MS4 Permit area.
2. The District has installed 186,080 square feet of green roof this reporting year (1,041,511 square feet of green roof area during the permit term).
3. Planted 6,065 net trees in MS4 area during this reporting period (accounting for mortality). This keeps the District on track to achieve the District's 40% tree canopy goal.
4. Installed 27.75 acres of green infrastructure through the Stormwater Retention Credit (SRC) Price Lock Program, with another 8.83 acres in design, permitting, and/or construction.
5. Continued the targeted trash and litter source control programs that include any food service product designed for single use, which includes foam and straws.
6. In addition to the outreach components of the Anacostia River Clean Up and Protection Fertilizer Act of 2012, DOEE updated delegations of authority that established the lawn fertilizer inspection and compliance program.
7. Steady increase in compliance rates for bag law, foam ban, and coal tar ban inspections.
8. Established a green infrastructure maintenance team that will ensure the upkeep of District-owned BMPs and will install educational signage.

9. Submitted and received approval from EPA on a stream restoration equivalency for Acres Managed. This will help meet the District's Acres Managed requirement.

Areas of Improvement

DOEE has identified several program areas that could be improved: interagency coordination, pollution prevention.

The District has a number of mechanisms in place to ensure that coordination across all agencies with responsibilities to implement Permit provisions occurs. However, with the increasing complexity of the Stormwater Management Program DOEE continues to need increased sister agency coordination. Previous coordination activities included monthly Technical Working Group meetings and quarterly Director level meetings with other agencies. To improve, DOEE has elevated interagency coordination to include the following;

1. Working with the City Administrator, Deputy Mayor for Operations and Infrastructure (DMOI), and Executive Office of the Mayor to leverage funding, support, and set priorities.
2. Holding regular BMP maintenance meetings between DOEE, DDOT, and DPW staff.
3. Increasing sister agency coordination for pollution prevention measures and compliance at District facilities, including street sweeping.
4. Since the last permit, DOEE has made large strides in District Pollution Prevention implementation. All District critical source facilities have an approved SWPPP. However, not all sister agencies are meeting all compliance requirements. Strategies that DOEE is using to improve this program are: O&M report cards, increased interagency coordination, targeted Stormwater Pollution Prevention Plan development efforts, and increased municipal staff training.

4.6.3.2 Assessing Strengths and Weakness of the Program

With the annual report in the fourth year of the permit the Permittee shall provide a synopsis of progress made towards meeting all WLAs allocated to the DC MS4, and a summary of program elements that shall be enhanced in the updated SWMP in order to make timely progress towards the water quality objectives of this permit and meeting the District's water quality standards.

<u>WLAs update</u>

BMPs continue to be implemented throughout the District and contribute towards load reductions needed to meet WLAs. DOEE uses "milestones" and "benchmarks" to track progress made towards meeting WLAs by the projected timeline. As shown in the annual report number two, DOEE is on track to meeting the "acres managed" milestone by the end of the permit term.

DOEE also developed annual benchmarks that represent target average annual load reductions that are needed to meet WLAs by the projected timeline. If the load reduction from BMP implementation meets or exceeds the benchmark over the projected attainment timeline of any given WLA, then it is expected that the WLA will be attained by the projected attainment date. Since BMP implementation does not occur evenly across the MS4, and the BMP performance can vary greatly depending on the BMP type, it is expected that there will be significant variation over time in meeting individual WLA benchmarks. For example, Battery Kemble Creek has one

WLA for E. coli. The load reductions achieved in the 2019 and 2021 reporting years were both lower than the benchmark. However, in 2020 and 2022, the load reductions achieved far surpassed what was needed to meet the benchmark. This additional load reduction offset low values in the other years to allow for the WLA to overall remain on target for meeting the projected attainment date.

As noted in the 2022 Consolidated TMDL IP Report, there are 162 Annual WLAs. A total of 26 annual WLAs have been achieved to date. Out of the 136 WLAs not yet achieved, 47 are meeting or exceeding the target benchmarks during this permit cycle and are therefore currently on target to meet their projected attainment date. The remaining 89 WLAs are on average falling short of the benchmarks for this permit cycle, meaning more BMP implementation will need to occur in the future in these segments to meet the WLA by the projected attainment date.

The benchmarks can also be used to help assess which watersheds have had sufficient BMP implementation to-date and which areas need more future implementation. The TMDL segments are listed below based on their benchmark achievement status as of year 4 of this permit cycle.

- Segments with all WLAs achieved: Tidal Basin and Washington Ship Channel
- Segments meeting or exceeding all benchmarks, or meeting some WLAs: Anacostia, Anacostia Lower, Battery Kemble Creek, Dumbarton Oaks, Fort Dupont Tributary, Fort Stanton Tributary, Hickey Run, Luzon Branch, Melvin Hazen Valley Branch, Piney Branch, and Texas Avenue Tributary
- Segments falling short of the benchmarks and WLAs are not yet achieved: Broad Branch, C&O Canal, Dalecarlia Tributary, Fenwick Branch, Fort Chaplin Tributary, Fort Davis Tributary, Foundry Branch, Klingle Valley Run, Normanstone Creek, Northwest Branch, Oxon Run, Pinehurst Branch, Portal Branch, Potomac Lower, Potomac Middle, Potomac Upper, Soapstone Creek, Watts Branch, and Watts Branch Upper
- Segments with mixed achievement (both met and unmet benchmarks or WLAs): Anacostia Upper, ANATF_DC, ANATF_MD, Kingman Lake, Lower Beaverdam Creek, Nash Run, Pope Branch, POTTF_DC, POTTF_MD, Rock Creek Lower, Rock Creek Upper, and Watts Branch Lower.

Enhanced Program Elements in the Updated Stormwater Management Plan

The District of Columbia's Stormwater Management Plan describes the District's existing and new strategies, elements, initiatives, schedules, and programs to reduce the discharge of pollutants from stormwater runoff into the MS4. In accordance with this requirement, the Department has developed a draft Stormwater Management Plan and strategy for implementing a sustainable approach to managing stormwater runoff. The SWMP builds on the 2016 SWMP and has enhanced the following programmatic elements:

- Regulatory updates
  - 2020 Stormwater Regulation amendments
  - Sustainable DC Omnibus Act of 2014 expansion to include foam food service ware, containers, packaging material
  - Zero Waste Omnibus Amendment Act of 2020 to cover battery disposal
  - Limitations on Products Containing Polycyclic Aromatic hydrocarbons Amendment Act of 2018

    - Control Discharges to the Wastewater System: 21 DCMR Chapter 15 provides extensive regulatory authority to control discharges to the wastewater system. Additionally, 21 DCMR Chapter 5 provides adequate inspection and monitoring authority
- Continuous updates and use of the Surface and Groundwater System
- DOEE continuously updates the IPMT, for example, the Acres Managed credit from Stream Restoration, approval from Bay Program for conservation landscaping
- Flood control projects: DOEE will identify areas that are vulnerable to stormwater flooding through the Integrated Flood Model Project
- Catch Basin Cleaning Activities: DC Water is using a catch basin cleaning application tracking system and DOEE has developed a catch basin cleaning SOP to estimate the total volume or weight of materials removed from the catch basins.
- Monitoring efforts: DOEE has implemented the Rapid Stream Assessment (RSA) and the Citizen Science Water Quality Monitoring Program.
    - The RSA collects information to provide a high-level overview of the entire wadeable stream network within the District and help identify potential issues as well as locations that may warrant follow-up inspections or more in-depth evaluations.
    - The Citizen Science Water Quality Monitoring Program will monitor the levels of bacteria including E. coli in the District's surface waters in areas where recreational activities take place.
- Direct Investment in Retrofits
    - Green Bank: In July 2018, the District established the Green Finance Authority Establishment Act, officially making the District the second city in the country to establish a Green Bank. DC Green Bank is an innovative policy tool that will use public purpose funding to attract private investment
    - Tree Fund monies: An Memorandum of Understanding between DDOT and DOEE that funds an additional 3,500 trees planted annually in private and public planting locations across the District
- Pollution Prevention: staff training on how to manage facilities to reduce and mitigate pollutants in stormwater runoff. The P2 team works to increase interagency coordination to address pollution prevention requirements.
- Education and Outreach: Program improvements to RiverSmart schools, boat trips, Green Zone Environmental Program, Watershed Stewards Academy, GreenWrench

3 BACTERIA SOURCE TRACKING REPORT

Microbial Source Tracking in the Anacostia River

Receiving water samples were collected from seven low-order tributaries of the Anacostia River in the District of Columbia. A total of 231 water samples were collected across 33 sampling events over 57-weeks from November 2019 to December 2020. Paired measurements of *Escherichia coli*, precipitation, and host-associated genetic markers indicative of human (HF183/BacR287 and HumM2), ruminant (Rum2Bac), dog (DG3), and avian (GFD) fecal sources were assessed in all the 231 samples.

The results indicate that:

- 44.6% of receiving water samples exceeded the single sample maximum value of 410 MPN/100 ml demonstrating that these urban streams frequently harbor fecal pollution levels that compromise water quality.
- *E. coli* levels were considerably higher across sites after rain events indicating that fecal pollution from urban landscape run-off and stormwater outfalls contribute substantially to water impairment.
- Human fecal pollution was detected at all sites, but occurrence was highly variable between different sites.
- Human fecal pollution average concentrations were significantly higher in samples where *E. coli* levels exceeded the 410 MPN/100 ml benchmark or after rain events indicating a close link between human waste, precipitation, and reduced water quality.
- Dog, avian and ruminant sources were always higher after rain or when *E. coli* levels exceeded the local water quality assessment benchmark (410 MPN/100 ml).
- Ruminant waste was often not detected in the absence of rainfall. Avian fecal scores exhibited a different trend where waste was detected regardless of sample groupings.

Conclusions:

- Findings suggest that the elimination of human waste sources alone may not reduce *E. coli* to an acceptable level due to the presence of dog, ruminant, and avian sources.
- Prioritizing sites with the highest average concentration of human waste may be an effective strategy to minimize potential exposure to human pathogens reducing public health risks.

Microbial Source Tracking for Rock Creek in Washington DC

The purpose of this report is to summarize water-quality data collected from February 2021 through February 2022 from three monitoring sites along Rock Creek in Washington, District of Columbia (D.C.). Ongoing ambient water quality monitoring of D.C. streams and tributaries revealed chronic elevated levels of *Escherichia coli* (*E. coli*) contamination that exceeded D.C.'s surface water quality standards. Surface waters that suffer high concentration of fecal indicator bacteria (FIB), such as *E. coli*, may pose public health risks to recreational users. In highly urbanized environments, including D.C., the source of the fecal bacteria is not always evident. A 12-month monitoring study of Rock Creek was undertaken to investigate the likely source of fecal coliform contamination. The District Department of Energy and Environment (DOEE) and Metropolitan Washington Council of Governments (COG) designed an initial baseline sampling

program for three monitoring stations along Rock Creek and its tributaries. The monitoring project was contracted to the Occoquan Watershed Monitoring Laboratory (OWML) of the Charles E. Via, Jr. Department of Civil and Environmental Engineering at the Virginia Polytechnic Institute and State University (Virginia Tech). Four bacteroide genetic markers were studied to aid the identification of hypothetical sources of fecal contamination: Human-associated (HF183/BacR287), Ruminant-associated (Rum2Bac), Dog-associated (DG3), and Avian-associated (GFD). Additionionally, water-quality analysis also included fecal indicator bacteria (FIB) *E. coli*, dissolved oxygen, turbidity, flow, water temperature, specific conductance, and pH at each sampling site.

For the purpose to trace the likelihood of human coliform marker detection, sampling sites were selected based on their geographic location as well as historic data of continuing monitoring effort by DOEE. All three sites in this study are located within the Rock Creek watershed in D.C. One of these sites, RCR01 is just upstream of RCP on the border with the state of Maryland. The second site (BRB01) is on Broad Branch, just upstream of the confluence with Rock Creek, and the third site (RCR0P) is below the National Zoo, further downstream on Rock Creek at the P Street Bridge (Figure 2.1). Because two of these sites (RCR01 and BRB01) are located within Rock Creek Park (i.e. national park Service Property), a sample collection permit was obtained from the Park Service to ensure field crew access to all sites.

Sampling schedule was designed to include four seasons to investigate influence of temperature and season change on FIB and four genetic markers. A Total of 96 samples were collected at a bi-weekly frequency over the duration of 12 months. Among the total 96 samples, 78 samples were from the baseflow of dry weather and 18 samples were from the storm flow of wet weather. Sampling was conducted from the bank and/or the walking bridge over the creek using the grab sample method. One liter of surface water was collected one foot below the surface in a sterilized glass jar for microbial source tracking (MST) and a separate 250mL water sample was poured into a plastic bottle (certified sterilized, and preserved with sodium thiosulfate) for *E. coli* analysis.

Study output indicated pervasive contamination of FIB. Results of *E. coli* enumeration showed 96 positives (100% of samples). Among the positive cases, 41 were below the 2012 EPA Recreational Water Quality Criteria (RWQC) single sample maximum level (SSM) 410 MPN/100mL (42.7%). Therefore, the overall exceedance for the three sites was 57.3%. Base flow *E. coli* concentration were in the range of 35.5 - 9,330 MPN/100mL, whilst those of wet weather *E. coli* ranged from 1046.2 - 51,720 MPN/100mL. Samples from all six storms required a dilution of 100x in order to generate quantifiable data (quantification limit 2419.6 MPN/100mL), therefore all exceeded the SSM. The highest *E. coli* detected was 51,720 MPN/100mL at RCR01 on July 2, 2021 during a storm event. The minimum *E. coli* was 35.5 MPN/100mL of a base flow condition at RCR0P. Instances of *E. coli* below the 410 SSM coincide with dry weather/baseflow sampling events. There were four consecutive baseflow sampling events which returned a 100% pass (i.e. below the 410 SSM) for November/December, 2021 sampling at RCR01 (mean 248 MPN/100mL, geometric mean 243 MPN/100mL) and BRB01 (mean 124 MPN/100mL, geometric mean 120 MPN/100mL). A similar pass was found in May/June sampling for RCR0P (mean 221 MPN/100mL, geometric mean 203 MPN/100mL). Other shorter segment with a 100% pass for two consecutive baseflow sampling was also noticed in March, May/June, and July (Figure 3.9 and Appendix3). In general, results from sampling

conducted in the three monitoring stations indicate frequently exceeding RWQC of fecal coliform contamination, especially during storm events, thus supporting the likeliness of storm runoff as the major cause of bacterial contamination.

To interpret the MST data in this study, it is important to note that the values of the four markers reported are best used in a relative manner. Percent detection provided henceforth was assessed using a ratio of cases greater than the quantification limit to the total number of samples attempted. It is thus intended to provide a general evaluation across all samples collected across different sites and weather conditions.

The human-derived HF183 marker was detected in majority of the samples throughout the study period, with 80 out of 96 total samples returning a positive detection (83.3%). The ruminant-derived Rum2Bac marker and dog-derived DG3 marker were rarely detected at a positive rate of 15%. Avian-derived GFD marker registered a positive rate at 47%, and showed seasonality associated with fall and the beginning of winter.

Study outputs revealed that the human-derived marker was present throughout all three monitoring sites. A 100% detection rate was recorded at site BRB01, while 63% and 88% were found at site RCR01 and RCR0P, respectively. In contrast, ruminant-derived fecal contamination was relatively rare and concentrations were generally low. The ruminant-derived marker Rum2Bac was detected at rate of 19%, 9%, and 13% for RCR01, BRB01, and RCR0P, respectively. Similarly, dog-derived DG3 marker returned a relatively low rate of 13%, 22%, and 9% at RCR01, BRB01, and RCR0P, respectively. The results indicated the likeliness that neither ruminant-derived nor dog-derived are one of the associated predictors of *E. coli* contamination.

The broadly targeted avian-associated marker GFD showed an overall detection rate of 59%, 38%, and 44% at RCR01, BRB01, and RCR0P, respectively. Prospective land use such as parkland and gardens in the watershed favored habitat to wildlife, waterfowl, psittacine birds, and game birds. Thus, linked to more frequent detection of avian-associated marker relatively to DG3 and Rum2Bac. Certain association of positive cases with wet weather were observed. Seasonal factors were not supported by correlation or regression analysis (temperature $R < 0.4$).

In summary, human-associated HF183 marker was consistently detected in a majority of the samples at all sampling sites throughout the study period. Results clearly suggested human-derived sources were the leading predictor of *E. coli* contamination in Rock Creek.

4 DISTRICT DEPARTMENT OF TRANSPORTATION PUBLIC RIGHT OF WAY OPTIMAL DESIGNS

Section 2.4 Public Right of Way Optimal Design

With the 2021 Annual Report, for PROW projects that do not include a design process, the Permittee shall submit a determination of standardized designs that optimize cost, performance, community palatability, climate resilience and other relevant factors.

The DDOT Green Infrastructure Standards (2014) include supplemental standard drawings and specifications for green infrastructure. DDOT also provides design guidance for green infrastructure in the public right of way (ROW) in the 2019 Design and Engineering Manual. DDOT is utilizing the existing standards to develop standardized designs for green infrastructure in the ROW. The standardized designs are intended to reduce the time and cost required for design, such that the standardized design can be used for construction quickly while being customized to local site conditions. To do this, DDOT has identified target best management practices to standardize and has identified how the existing standards can be grouped and simplified further to minimize/eliminate design. Methods to streamline the design include developing flow charts, tables, and companion worksheets. The standardized designs include approximate stormwater retention volume, area treated, volume treated, and the draw-down time for each BMP.

The deliverables for this task include but are not limited to the following:

1. List of scenarios where standardized designs can be applied
2. Standardized designs including drawings, decision trees, calculations, excel files and all files in PDF and digital formats (.dgn, .xlsx, etc.)
3. Standardized design report outlining the methodology utilized in preparing the designs, the basis for the designs and when/where each design applies. The Consultant shall prepare an outline of the report for DDOT's review and approval.

Attached is an example of deliverables for a ROW bioretention standardized design.

5 EPA CONSENT AGREEMENT REPORTING

As required, DOEE is posting the Consent Order Status Report concurrently with the MS4 Annual Report. This report will be posted to DOEE's website by December 23, 2022 and will be found at: https://doee.dc.gov/publication/ms4-discharge-monitoring-and-annual-reports.