

**GOVERNMENT OF THE DISTRICT OF COLUMBIA  
WASHINGTON, DC**

**Municipal Separate Storm Sewer System  
NPDES Permit No. DC0000221**

**DISCHARGE MONITORING REPORT**

**August 19, 2006**



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DISTRICT OF COLUMBIA  
WATER AND SEWER AUTHORITY  
Washington, D.C.

*Municipal Separate Storm Sewer System  
NPDES Permit No. DC 0000221  
2006 Discharge Monitoring Report*

## **1.0 INTRODUCTION**

The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) – Permit No. DC 0000221 (the Permit) requires monitoring of storm event discharges to characterize the quality of storm water discharges, monitoring of dry weather flows to detect illicit connections and improper discharges, and wet weather screening to further investigate excessive levels of pollutants.

This report describes the monitoring sites, sample collection, record keeping, monitoring results, and estimates of loadings from the Anacostia River, Potomac River, and Rock Creek watersheds that have occurred since July 2005.

The District's current MS4 Permit was issued by U.S. Environmental Protection Agency (EPA) on August 19, 2004. Section IV.A.1, states that the Rock Creek stations are to be sampled within calendar year 2003, the Potomac River stations within calendar year 2004, and the Anacostia River stations within calendar year 2005. The field activities and analytical results of samples collected at nine Anacostia River stations, seven Potomac River stations, and ten Rock Creek stations are the focus of this report. Calendar year 2005 marks the end of the second cycle of sampling the Anacostia River, therefore, calculated trends of selected water quality data from 2002 and 2005 are presented in Section 8.0.

## **2.0 MONITORING STATIONS**

The permit specifies representative sampling locations for each of the three subwatersheds designated within the MS4 area of the District: Anacostia River, Potomac River, and Rock Creek. One subwatershed is monitored in each calendar year on a rotating basis. Each of the sites is to be monitored for at least three wet weather events per year. At sites with dry weather flows, dry weather screening samples are collected two times per year as part of the District's dry weather screening program. Samples are collected in accordance with the Permit and monitoring requirements at 40 CFR 122.26 (d)(2)(iii), by Maryland Environmental Services (MES) and EA Engineering, Science, and Technology, Inc. (EA),

contractors with DOH and WASA, respectively. The Anacostia River, Potomac River, and Rock Creek sampling stations are described in the following sections.

## 2.1 Anacostia River

Nine stations from the Anacostia River watershed are included in the Permit under Section IV.A.1. A listing of these nine sampling stations and their associated drainage area is provided in Table 2-1. Figure 2-1 shows the Anacostia River MS4 sampling sites. In addition, large-scale location maps showing individual Anacostia River MS4 sampling sites are provided in Appendix A. Land use types associated with each Anacostia River MS4 monitoring site are identified in Appendix B.

**TABLE 2-1. ANACOSTIA RIVER MONITORING STATIONS**

Site Number	Sampling Location	Estimated Acreage of Drainage Area
1	<b>Stickfoot Sewer</b> - 2400 block of Martin Luther King, Jr. Ave., SE, near Metro bus entrance	367
2	<b>O St. Pump Station</b> - 125 O. St., 125 O SE – just outside front gate at O St. Pump Station	253
3	<b>Anacostia High School</b> /Anacostia Recreation Center – corner of 17 <sup>th</sup> St. and Minnesota Ave., SE	413
4	<b>Gallatin &amp; 14<sup>th</sup> St., NE</b> – across from the intersection of 14 <sup>th</sup> St. and Gallatin St. in a large outfall	620
5	<b>Varnum &amp; 19<sup>th</sup> Place, NE</b> – 2100 Block of Varnum St. <sup>a</sup>	1,215
6	<b>Nash Run</b> – intersection of Anacostia Dr. and Polk St., NE	344
7	<b>East Capitol St.</b> – 200 Block of Oklahoma Ave., NE <sup>b</sup>	92
8	<b>Ft. Lincoln</b> – Newton BMP- in the brush along the side of New York Ave. West after the bridge	230
9	<b>Hickey Run</b> -33 <sup>rd</sup> and V Streets, NE, across road from post office access	150

<sup>a</sup> Sample location moved three blocks east to Varnum and 22<sup>nd</sup> St, NE, due to access issues.

<sup>b</sup> Location is more specifically noted as Oklahoma Ave. and D. St., NE.

Wet weather and dry weather monitoring has been completed for the nine Anacostia River stations. Table 2-2 below lists the dates and location of each sample collected.

**TABLE 2-2. SUMMARY OF WET AND DRY WEATHER SAMPLING FOR NINE ANACOSTIA RIVER STATIONS**

<b>Site Number</b>	<b>Sampling Location</b>	<b>Wet Weather</b>	<b>Dry Weather</b>
1	Stickfoot	11 Jan 2006 21 Apr 2006 12 Jul 2006	11 May 2006 19 Jul 2006
2	O St. Pump Station	18 Jan 2006 11 May 2006 NA*	N/A
3	Anacostia High	21 Apr 2006	11 May 2006 20 Jul 2006
4	Gallatin	11 Jan 2006 7 Apr 2006 19 Jun 2006	11 May 2006 12 Jul 2006
5	Varnum	21 Apr 2006	11 May 2006 19 Jul 2006
6	Nash Run	21 Apr 2006	N/A
7	East Capitol	21 Apr 2006	N/A
8	Ft. Lincoln	21 Nov 2005 11 May 2006	N/A
9	Hickey Run	21 Apr 2006 19 Jun 2006	N/A

N/A: There are no dry-weather flows at this station.

\*O St. Pump Station – on May 11, monitoring crews collected the wet weather sample and noted significant construction for the baseball stadium around the area , therefore no additional samples could be collected from this station.

## **2.2 Potomac River**

Seven stations from the Potomac River watershed are included in the Permit under Section IV.A.1. A listing of the seven sampling stations and the associated drainage area for each is provided in Table 2-3. Figure 2-2 shows the Potomac River MS4 sampling sites. In addition, large-scale location maps showing individual Potomac River MS4 sampling sites are provided in Appendix A. Land use types associated with each Potomac River MS4 monitoring sites are identified in Appendix B.

**TABLE 2-3. POTOMAC RIVER MONITORING STATIONS**

Site Number	Sampling Location	Estimated Acreage of Drainage Area
1	<b>Battery Kemble Creek</b> - 49th and Hawthorne Streets, NW. <sup>a</sup>	12
2	<b>Foundary Branch</b> - at Van Ness and Upton Streets, NW in the park.	51
3	<b>Dalecarlia Tributary</b> - Van Ness Street and Dalecarlia Parkway.	33
4	<b>Oxon Run</b> - Mississippi Avenue and 15 <sup>th</sup> Street, SE	44
5	<b>Tidal Basin</b> - 17th Street and Constitution Avenue, NW <sup>b</sup>	120
6	<b>Washington Ship Channel</b> - Washington Marina parking lot, SW <sup>c</sup>	42
7	<b>C and O Canal</b> - Potomac Avenue and Foxhall Road, NW	627

<sup>a</sup> Sample location moved one block to 49<sup>th</sup> and Garfield St., NW due to access issues.

<sup>b</sup> Original location subject to tidal influence. Location moved up-pipe to 12<sup>th</sup> & Constitution.

<sup>c</sup> Original location subject to tidal influence. Location moved up-pipe to 14<sup>th</sup> and Main.

In the 2005 DMR report, approximately 50% of the wet weather samples were collected and the data were reported. Results of the dry weather samples were not reported in the 2005 DMR since collection occurred in August, and the analytical results were not received until September 2005. Since that time, wet weather and dry weather monitoring have been completed for the seven Potomac River stations. This report includes a summary of the data collected since July 2005 that were not reported in previous DMR reports; however the complete dataset (i.e. all data collected in 2005 and 2006) will be included in the loadings calculations summarized in Section 7 of this report. Additionally, only those data collected since July 2005 will be included on the preprinted DMR forms received from the EPA (Appendix D). Please note that the preprinted DMR form provided by EPA for Dalecarlia Tributary (Potomac watershed) does not include 'PCB 1242'. Results for this missing parameter are included in the sample result summary tables appended to the report, but they are not included in the complete, signed preprinted DMR forms.

Table 2-4 lists the dates and location of each sample collected.

**TABLE 2-4. SUMMARY OF WET AND DRY WEATHER SAMPLING FOR SEVEN POTOMAC STATIONS**

Site No.	Location	Wet Weather	Dry Weather
1	Battery Kemble Creek	20 May 2005 <sup>a</sup> 6 Jun 2005 <sup>a</sup> 29 Jun 2005 <sup>a</sup>	N/A
2	Foundary Branch	20 May 2005 <sup>a</sup> 6 Jun 2005 <sup>a</sup> 29 Nov 2005	4 Aug 2005 23 Aug 2005

Site No.	Location	Wet Weather	Dry Weather
3	Dalecarlia Tributary	20 May 2005 <sup>a</sup> 6 Jun 2005 <sup>a</sup> 29 Jun 2005 <sup>a</sup>	N/A
4	Oxon Run	8 Nov 2005 29 Dec 2005 7 Apr 2006	3 Aug 2005 23 Aug 2005
5	Tidal Basin	27 Jul 2005 16 Nov 2005 18 Jan 2006	N/A
6	Washington Ship Channel	6 Jun 2005 <sup>a</sup> 16 Nov 2005 29 Dec 2005	3 Aug 2005 4 Aug 2006
7	C & O Canal	22 Jun 2005 <sup>a</sup> 29 Nov 2005 23 Jan 2006	4 Aug 2005 24 Aug 2005

<sup>a</sup> Analytical results reported in the 2005 DMR Report  
N/A: no dry-weather flows at this station

### 2.3 Rock Creek

Six stations from the Rock Creek watershed are included in the Permit under Section IV.A.1. Four additional sites were added by DDOE to better characterize discharges from MS4 to Rock Creek.

A listing of the ten sampling stations and the associated drainage area of each is provided in Table 2-5. Sites 1, 2, and 7 were completed in 2003 and 2004, and were reported in the 2004 and 2005 DMR, respectively. Ten Rock Creek sampling stations are shown in Figure 2-3. Large-scale location maps of the ten permit-required monitoring stations representing Rock Creek are provided in Appendix A. The land use types associated with each Rock Creek MS4 monitoring site are provided in Appendix B.

Table 2-6 summarizes the sampling locations, number of samples collected, dates, and weather types for storm water monitoring activities at Rock Creek since 2003.

Approximately half of the wet weather samples for Rock Creek were collected in 2003, 2004, and part of 2005. These data were reported in previous DMR reports. Results of the dry weather samples reported in the 2005 DMR and therefore will not be presented in this report. This report, instead, includes a summary of the data collected since July 2005 that were not reported in previous DMR reports; however the complete dataset (i.e. all data collected from 2003 to 2005) will be included in the loadings calculations summarized in Section 7 of this report. Additionally, only those data collected since July 2005 will be included on the

preprinted DMR forms (Appendix D). Please note that the preprinted DMR forms provided by EPA do not include the Rock Creek watershed sample locations. Results for these sites are included in the sample result summary tables appended to the report, but they are not included in the complete, signed preprinted DMR forms.

In 2005, twelve wet weather samples were collected from seven Rock Creek stations for the period between July 27, 2005 and November 29, 2005.

**TABLE 2-5. ROCK CREEK MONITORING STATIONS**

Site Number	Sampling Location	Estimated Drainage Area (acres)
1	Walter Reed - Fort Stevens Dr.	25
2	Military Rd and Beach Dr.	37
3	Soapstone Creek – Connecticut Ave. and Ablemarle St.	330
4	Melvin Hazen Valley Branch – Melvin Hazen Park and Quebec St.	146
5	Klinge Valley Creek – Devonshire Place and 30 <sup>th</sup> St.	52
6	Normanstone Creek – Normanstone Dr. and Normanstone Pkwy.	45
7	Portal and 16 <sup>th</sup> Streets <sup>a</sup>	N/A
8	Broad Branch <sup>a</sup> - Broad Branch and 30 <sup>th</sup> St., NW near the Ivory Coast Embassy	540
9	Oregon and Pinehurst <sup>a</sup>	---
10	Archbold Parkway <sup>a</sup> – Intersection of New Mexico Ave. and Garfield St., NW	---

<sup>a</sup>Non-permitted sampling stations

N/A: No acreage of drainage area has been estimated because much of the drainage area is in MD.

---Unknown drainage area

**TABLE 2-6. SUMMARY OF WET AND DRY WEATHER SAMPLING FOR TEN ROCK CREEK STATIONS**

Site No.	Location	Wet Weather	Dry Weather <sup>a</sup>
1	Ft. Stevens Dr.	12 Sept 2003 <sup>a</sup> 4 Nov 2004 <sup>b</sup> 7 Apr 2005 <sup>b</sup>	4 Nov 2003 30 Jun 2004
2	Military Rd. and Beach Dr.	12 Sept 2003 <sup>a</sup> 4 Nov 2004 <sup>b</sup> 7 Apr 2005 <sup>b</sup>	4 Nov 2003 30 Jun 2004
3	Soapstone Creek	22 Jul 2004 <sup>b</sup> 7 Apr 2005 <sup>b</sup> 27 July 2005	4 Nov 2003 30 Jun 2004
4	Melvin Hazen Valley	27 July 2005	4 Nov 2003

Site No.	Location	Wet Weather	Dry Weather <sup>a</sup>
	Branch	21 Nov 2005 29 Nov 2005	30 Jun 2004
5	Klinge Valley Creek	14 Oct 2003 <sup>a</sup> 29 Nov 2005	4 Nov 2003 30 Jun 2004
6	Normanstone Creek	27 Jul 2005 21 Nov 2005 29 Nov 2005	4 Nov 2003 30 Jun 2004
7	Portal and 16 <sup>th</sup> Streets <sup>c</sup>	14 Oct 2003 <sup>a</sup> 4 Nov 2004 <sup>b</sup> 7 Apr 2005 <sup>b</sup>	N/A
8	Broad Branch <sup>c</sup>	14 Oct 2003 <sup>a</sup> 7 Apr 2005 <sup>b</sup> 27 Jul 2005	N/A
9	Oregon and Pinehurst <sup>c</sup>	22 Jul 2004 <sup>b</sup> 27 Jul 2005	N/A
10	Archbold Parkway <sup>c</sup>	7 Apr 2005 <sup>b</sup> 21 Nov 2005 29 Nov 2005	N/A

<sup>a</sup> Analytical results reported in the 2004 DMR Report

<sup>b</sup> Analytical results reported in the 2005 DMR Report

<sup>c</sup> Non-permitted sampling stations

N/A: no dry-weather flows at this station

### 3.0 WEATHER INFORMATION

Table 3-1 lists the actual and normal precipitation for Washington, D.C. for the period of January 2005 through July 2006.

**TABLE 3-1. PRECIPITATION RECORD FOR WASHINGTON, DC**

Precipitation <sup>a</sup>			
Month	Actual (in.)	No. Days in Month with Storms >0.10 <sup>b,c</sup>	Monthly Average (in.)
<b>2005</b>			
January	3.94 <sup>b</sup>	5	3.21
February	2.15 <sup>b</sup>	3	2.63
March	4.54 <sup>b</sup>	4	3.92
April	3.84	9	2.77
May	4.61	5	3.82
June	2.87	3	3.13
July	6.06	8	3.66
August	2.33	6	3.44

Precipitation <sup>a</sup>			
Month	Actual (in.)	No. Days in Month with Storms >0.10 <sup>b,c</sup>	Monthly Average (in.)
September	0.11	0	3.79
October	9.41	6	3.22
November	1.92	4	3.03
December	3.82 <sup>b</sup>	7	3.05
<b>2006</b>			
January	3.25	8	3.21
February	3.34 <sup>b</sup>	5	2.63
March	0.06 <sup>b</sup>	0	3.92
April	3.10	6	2.77
May	2.21	8	3.82
June	14.02	9	3.13
July	3.56	6	3.66

<sup>a</sup> Precipitation data from Ronald Reagan National Airport; Source: [www.accuweather.com](http://www.accuweather.com) and [www.weather.gov](http://www.weather.gov)

<sup>b</sup> During months with rainfall and snowfall, a conversion factor (10 in. snow = 1 in. rain) was used to calculate total precipitation amount.

<sup>c</sup> Note: some storm events were consecutive and could not be sampled due to the 72-h requirement between events

The weather gauge at Ronald Reagan National Airport was used to represent rainfall at the Anacostia River and Potomac River stations. Three rain gauges at were used to represent rainfall at the Rock Creek stations (Section 3.3, Table 3-5). A summary of the rain events and their narrative descriptions for all wet and dry weather events sampled in calendar years 2005 and 2006 for the Anacostia River, Potomac River and Rock Creek are provided below.

### 3.1 Anacostia River

The National Weather Service rain gauge, located at Reagan National Airport, was used to represent rainfall at the Anacostia River stations. Descriptions of each rain event are provided in Table 3-2. Narrative descriptions for storm events are provided below:

**November 21, 2005:** A sample was collected during this storm event at Site #8 (Ft. Lincoln). A duplicate and trip blank were also collected from this station during the storm event. Rain began to fall at about 4:00 PM and continued to about 12:00 PM, a duration of 8 hours. A total of 0.63 inches of rain fell during this interval. The last previous rainfall occurred approximately five days prior to this measured rain event.

**January 11, 2006:** Samples were collected during this storm event at Site #1 (Stickfoot) and Site #4 (Gallatin). Rain began to fall at about 2:30 PM and continued

to about 4:05 PM, a duration of about 1.5 hours. A total of 0.24 inches of rain fell during this interval. The last previous rainfall occurred approximately 13 days prior to this measured rain event.

**January 18, 2006:** A sample was collected during this storm event at Site #2 (O St. Pump Station). A field blank was also collected for this site during the event. Rain began to fall at 9:15 PM and continued to 10:05 PM, a duration of approximately 45 minutes. A total of 0.60 inches of rain fell during this interval. The last previous rainfall occurred approximately four days prior to this measured rain event.

**April 7, 2006:** A sample was collected during this storm event at Site #4 (Gallatin). Rain began to fall at about 9:15 PM and continued to 10:05 PM, a duration of one hour, for a total of 0.18 inches of rain fell during this interval. The last previous storm event occurred approximately four days prior to this measured rain event.

**April 21, 2006:** Samples were collected during this storm event at Site #1 (Stickfoot), Site #3 (Anacostia High), Site #5 (Varnum), Site #6 (Nash Run), Site #7 (East Capitol), and Site #9 (Hickey Run). Rain began to fall at about 7:00 PM and continued to 9:05 PM, a duration of about two hours. A total of 0.37 inches of rain fell during this interval. The last previous storm event occurred approximately 4 days prior to this measured rain event.

**May 11, 2006:** Samples were collected during this storm event at Site #2 (O St. Pump Station) and Site #8 (Fort Lincoln). Rain began to fall at about 7:15 PM and continued to 8:45 PM, a duration of 1.5 hours. A total of 0.81 inches of rain fell during this interval. The last previous storm event occurred approximately 4 days prior to this measured rain event.

**June 19, 2006:** Samples were collected during this storm event at Site #4 (Gallatin) and Site #9 (Hickey Run). Rain began to fall at about 4:10 PM and continued to 4:40 PM, a duration of 0.5 hours. A total of 1.99 inches of rain fell during this interval. The last previous storm event occurred approximately 6 days prior to this measured rain event.

**July 12, 2006:** A sample was collected during this storm event at Site #1 (Stickfoot). Rain began to fall at about 7:00 PM and continued to 7:30 PM, a duration of 0.5 hours. A total of 0.69 inches of rain fell during this interval. The last previous storm event occurred approximately five days prior to this measured rain event.

**TABLE 3-2. STORM SAMPLING CHARACTERISTICS FOR ANACOSTIA RIVER EVENTS**

<b>Date</b>	<b>Precipitation (in.)</b>	<b>Duration (hr)</b>	<b>Time to Previous (hr)</b>	<b>Gauge Location</b>	<b>Sites Sampled</b>
11-21-05	0.63	8	120	RNA	8
1-11-06	0.20	1.5	192	RNA	1,4
1-18-06	0.62	0.75	96	RNA	2
4-7-06	0.18	1	96	RNA	4
4-21-06	0.37	2	96	RNA	1,3,5,6,7,9
5-11-06	0.81	1.5	96	RNA	2,7,8
6-19-06	1.99	0.5	144	RNA	4,9
7/12/06	0.69	0.5	120	RNA	1

RNA: Reagan National Airport

As part of the dry weather program requirement, four Anacostia River stations with dry weather flow were sampled during the year. The first dry weather monitoring event occurred on May 11, 2006 for four stations and a second collection occurred on July 12, 2006 for one station. A narrative description for these sampling events is provided below:

**May 11, 2006:** A sample set was collected at Site #1 (Stickfoot), #3 (Anacostia High), #4 (Gallatin), and Site #5 (Varnum). The last previous rainfall event that was  $\geq 0.1$ " occurred approximately 96 hours prior to this dry weather monitoring event. Dry weather samples were collected early in the morning. Late in the afternoon a storm event occurred and wet weather samples were collected at one station (O St. Pump Station); narrative description for this wet weather event is provided in Section 3.1 under the same date heading.

**July 12, 2006:** A sample was collected at Site #4 (Gallatin). The last previous rainfall event that was  $\geq 0.1$ " occurred approximately five days prior to this dry weather monitoring event. Dry weather samples were collected early in the morning. Late in the afternoon a storm event occurred and wet weather samples were collected at one station (Stickfoot); narrative description for this wet weather event is provided in Section 3.1 under the same date heading.

**July 19, 2006:** Samples were collected at Site #1 (Stickfoot) and Site #5 (Varnum). The last previous rainfall event that was  $\geq 0.1$ " occurred approximately six days prior to this dry weather monitoring event. Dry weather samples were collected from the late morning to early afternoon.

**July 20, 2006:** A sample was collected at Site #3 (Anacostia High School). The last previous rainfall event that was  $\geq 0.1$ " occurred approximately eight days prior to this dry weather monitoring event. Dry weather samples were collected in the early afternoon.

### **3.2 Potomac River**

The National Weather Service rain gauge, located at Reagan National Airport, was used to represent rainfall at the Potomac River stations. Descriptions of each rain event are provided in Table 3-3. Narrative descriptions for storm events are provided below:

**July 27, 2005:** A sample was collected during this storm event at Site #5 (Tidal Basin). Rain began to fall at about 6:40 PM and continued to 7:20 PM, a duration of 40 minutes. A total of 0.11 inches of rain fell during this interval. The last previous rainfall occurred approximately four days prior to this measured rain event.

**November 8, 2005:** A sample was collected during this storm event at Site #4 (Oxon Run). Rain began to fall at about 9:15 PM and continued to about 10:40 PM, a duration of about 1.5 hours. A total of 0.05 inches of rain fell during this interval. The last previous rainfall occurred approximately 13 days prior to this measured rain event.

**November 16, 2005:** Samples were collected during this storm event at Site #5 (Tidal Basin) and Site #6 (Ship Channel). Rain began to fall at about 5:50 PM and continued to about 7:10 PM, giving duration of about 1.5 hours. A total of 0.48 inch of rain fell during this interval. The last previous rainfall occurred approximately eight days prior to this measured rain event.

**November 29, 2005:** Samples were collected during this storm event at Site #2 (Foundary Branch) and Site #7 (C&O Canal). Rain began to fall at about 2:30 PM and continued to about 5:15 PM, giving duration of approximately three hours. A total of 0.48 inches of rain fell during this interval. The last previous storm event occurred approximately seven days prior to this measured rain event.

**December 29, 2005:** Samples were collected during this storm event at Site #4 (Oxon Run) and Site #6 (Ship Channel). Rain began to fall at about 1:00 AM and continued to about 3:00 AM, a duration of two hours. A total of 0.34 inches of rain fell during this interval. The last previous storm event occurred approximately four days prior to this measured rain event.

**January 18, 2006:** A sample was collected during this storm event at Site #5 (Tidal Basin). While it began drizzling at about 1:45 AM, the heaviest rain began to fall at 3:58 AM and continued to about 6:30 AM, giving duration of 2.5 hours. A total of 0.62 inches of rain fell during this interval. The last previous storm event occurred approximately four days prior to this measured rain event.

**January 23, 2006:** A sample was collected during this storm event at Site #7 (C&O Canal). Rain began to fall at about 10:00 PM on January 22<sup>nd</sup> and continued to about 9:30 AM on January 23<sup>rd</sup>, a duration of 11.5 hours. A total of 0.79 inches of rain fell during this interval. The last previous storm event occurred approximately four days prior to this two-day rain event.

**April 7, 2006:** A sample was collected during this storm event at Site #4 (Oxon Run). A duplicate sample was also collected for this site during the event. Rain began to fall at about 9:00 PM and continued to about 10:00 PM, a duration of one hour. A total of 0.18 inches of rain fell during this interval. The last previous storm event occurred approximately four days prior to this measured rain event.

**TABLE 3-3. STORM SAMPLING CHARACTERISTICS FOR POTOMAC RIVER EVENTS**

Date	Precipitation (in.)	Duration (hr)	Time to Previous (hr)	Gauge Location	Sites Sampled
7-25-05	0.11	0.75	96	RNA	5
11-8-05	0.05	1.5	312	RNA	4
11-16-05	0.48	1.5	192	RNA	5,6
11-29-05	0.48	3	168	RNA	2,7
12-29-05	0.34	2	96	RNA	4,6
1-18-06	0.62	2.5	96	RNA	5
1-23-06	0.79	11.5	96	RNA	7
4-7-06	0.18	1	96	RNA	4

RNA: Reagan National Airport

As part of the dry weather program requirement, four Potomac River stations with dry weather flow were sampled during the year. The first dry weather monitoring event occurred on August 3, 2005 and the last occurred on August 24, 2005. A narrative description for these sampling events is provided below:

**August 3, 2005:** Samples were collected at Site #4 (Oxon Run) and Site #6 (Ship Channel). The last previous rainfall occurred approximately 120 hours prior to this dry weather monitoring event. On this same day, two other sites (Site #1 Battery Kemble and site #3 Dalecarlia Tributary) were also checked for sample collection, however both were dry and no water was available for analysis.

**August 4, 2005:** Samples were collected at Site #2 (Foundary Branch) and Site #7 (C&O Canal). The last previous rainfall occurred approximately 144 hours prior to this dry weather monitoring event. On this same day, Site #5 (Tidal Basin) was checked for sample collection, however it was dry and no water was available for analysis.

**August 23, 2005:** Samples were collected at Site #2 (Foundary Branch) and Site #4 (Oxon Run). The last previous rainfall occurred approximately 96 hours prior to this dry weather monitoring event.

**August 24, 2005:** A sample was collected at Site #7 (C&O Canal). The last previous rainfall occurred approximately 120 hours prior to this dry weather monitoring event. On this same day, Site #6 (Ship Channel) was checked for sample collection, however it was dry and no water was available for analysis.

### **3.3 Rock Creek**

Two data logging rain gauges within the Rock Creek watershed were used to represent the District of Columbia's wet weather sampling stations. Rain gauge site locations and the monitoring stations they represent are presented in Table 3-4. Rain events for which samples were collected are provided in Table 3-5. Narrative descriptions for storm events are provided below:

**July 27, 2005:** Samples were collected during this storm event at Site #3 (Soapstone Creek), Site #4 (Melvin Hazen), Site #6 (Normanstone), Site #8 (Broad Branch), and Site #9 (Oregon and Pinehurst). Sites #8 and #9 are non-permitted sampling stations. Rain data were taken at a rain gauge placed at Site No. 3. Rain began to fall at about 6:00 PM and continued to about 7:35 PM, this rain event lasted approximately two hours. A total of 0.19 inches of rain fell during this interval. The last previous rainfall occurred approximately five days prior to this measured rain event.

**November 21, 2005:** Samples were collected during this storm event at Site #4 (Melvin Hazen), Site #6 (Normanstone), and Site #10 (Archbold Pkwy). Sites #10 is a

non-permitted sampling station. Rain data were taken at a rain gauge placed at Site #1. Rain began to fall at about 12:00 PM on November 21 and continued to about 12:00 PM on November 22, lasting approximately 24 hours. A total of 0.63 inches of rain fell during this interval. The last previous rainfall occurred approximately four days prior to this measured rain event.

**November 29, 2005:** Samples were collected during this storm event at Site #4 (Melvin Hazen), Site #5 (Klinge Valley), Site #6 (Normanstone), and Site #10 (Archbold Pky). Site #10 is a non-permitted sampling station. Rain data were taken at a rain gauge placed at Site No. 2. Rain began to fall on November 29th at 3:00 PM and continued to about 11:00 PM on November 29<sup>th</sup>, lasting approximately eight hours. A total of 0.48 inches of rain fell during this interval. The last previous rainfall occurred approximately seven days prior to this measured rain event.

**TABLE 3-4. LOCATION OF RAIN GAUGES REPRESENTING THE ROCK CREEK MONITORING STATIONS**

Gauge No.	Location Description
1	Ft. Stevens Dr.
2	Military Rd. & Beach Dr.
3	Connecticut Ave. and Ablemarle St.

**TABLE 3-5. STORM SAMPLING CHARACTERISTICS FOR ROCK CREEK EVENTS**

Date	Precipitation (in.)	Duration (hr)	Time to Previous (hr)	Gauge Location	Sites Sampled
7/27/05	0.19	1.5	120	#3	3,4,6,8,9
11/21/05	0.63	24	96	#1	4,6,10
11/29/05	0.48	8	168	#2	4,5,6,10

#### 4.0 SAMPLE COLLECTION

The list of sampled parameters, the detection limits, and EPA-approved methods utilized for monitoring activities are included in Table 4-1. A Quality Assurance Project Plan (QAPP) for the wet and dry weather monitoring is provided in Appendix C.

**TABLE 4-1. SAMPLE ANALYSIS REQUIREMENTS FOR WET AND DRY WEATHER SAMPLING**

<b>Bottle Type</b>	<b>Sample Type</b>	<b>Parameter</b>	<b>Method</b>	<b>Units</b>	<b>MDL</b>
1-L Plastic Unpreserved	Composite	Biochemical Oxygen Demand (5d)	SM5210B	mg/L	<5.0
		Total Dissolved Solids	SM2540C	mg/L	<1.0
		Total Suspended Solids	SM2540D	mg/L	<1.0
500 mL Plastic H <sub>2</sub> SO <sub>4</sub>	Composite	Ammonia Nitrogen	SM4500-NH3-E	mg/L	<1.0
		Phosphorus, Total	EPA 365.3	mg/L	<0.05
		Nitrite + Nitrate	EPA 353.2	mg/L	<0.05
		Chemical Oxygen Demand	EPA 410.4	mg/L	<10.0
		Total Kjeldahl Nitrogen	EPA 351.3	mg/L	<0.5
250 mL Plastic, Filtered, H <sub>2</sub> SO <sub>4</sub>	Composite	Phosphorus, Dissolved	EPA 365.3	mg/L	<0.5
1000 mL Plastic HNO <sub>3</sub>	Composite	Hardness, Total	EPA 130.2	mg/L	
		Antimony, Total	EPA 200.8	µg/L	0.21
		Arsenic, Total	EPA 200.8	µg/L	0.25
		Beryllium, Total	EPA 200.8	µg/L	0.22
		Cadmium, Total	EPA 200.8	µg/L	0.22
		Chromium, Total	EPA 200.8	µg/L	0.18
		Copper, Total	EPA 200.8	µg/L	1.52
		Lead, Total	EPA 200.8	µg/L	0.23
		Mercury, Total (by cold vapor)	EPA 245.1	µg/L	0.20
		Nickel, Total	EPA 200.8	µg/L	0.46
		Selenium, Total	EPA 200.8	µg/L	0.31
		Silver, Total	EPA 200.8	µg/L	0.35
		Thallium, Total	EPA 200.8	µg/L	0.21
		Zinc, Total	EPA 200.8	µg/L	1.52
(2) 1-L Glass Amber	Grab	Dioxin (2,3,7,8) TCDD	EPA 1613	pg/L	4.4
1000 mL Plastic, Sterile	Grab	Fecal Coliform	SM9221E	MPN	
		Fecal Streptococcus	SM9230B	MPN	
250 mL Plastic, NaOH	Grab	Cyanide, Total	EPA 335.2	mg/L	<0.01
(2) 1-L Glass Amber Unpreserved	Composite	BNA Compounds	EPA 625	µg/L	Various
(2) 40 mL Glass Vials Teflon Lids	Grab	Volatile Organic Compound	EPA 624	µg/L	0.5
1-L Glass Amber H <sub>2</sub> SO <sub>4</sub> Teflon Lids	Grab	Phenols, Total	EPA 420.2	mg/L	1.9
1-L Glass Amber H <sub>2</sub> SO <sub>4</sub> Teflon Lids	Composite	PCBs / Pesticides	EPA 608	µg/L	0.01-1.7
1-L Glass Amber Teflon Lids	Composite	PCBs	EPA 8082 modified	ng/L	0.25-5.0
1-L Glass Amber 1:1 HCl	Grab	Fats (oil and grease)	EPA 1664	mg/L	1.6

<b>Bottle Type</b>	<b>Sample Type</b>	<b>Parameter</b>	<b>Method</b>	<b>Units</b>	<b>MDL</b>
100 mL Plastic	Composite	Chlorophyll-a	SM 10020H2	mg/m <sup>3</sup>	2
500 mL Plastic H <sub>2</sub> SO <sub>4</sub>	Composite	Total Ammonia + Organic Nitrogen (TKN)	EPA 351.3	mg/L	0.2
	Field Test	Dissolved Oxygen	EPA 360.1	mg/L	N/A
500 mL Plastic H <sub>2</sub> SO <sub>4</sub>	Composite	Organic Nitrogen	TKN – NH <sub>3</sub>	mg/L	N/A
500 mL Plastic H <sub>2</sub> SO <sub>4</sub>	Composite	Total Nitrogen	NO <sub>2</sub> + NO <sub>3</sub> + TKN	mg/L	N/A

## 5.0 RECORDKEEPING

DDOE WQD maintains the records of monitoring information including:

- Description of Sampling
  - Location/Collection Time
  - Sampling Collection
  - Field Test
  - MES and EA personnel who collected samples
- Storm Event Data
  - Date and duration of the storm events samples
  - Rainfall measurements
  - Duration between storm event sampled and the end of the previous measurable storm event
  - Estimate of the total volume of the discharge sampled
- Sampling Difficulties/Field Notes
- QA/QC Review and Clarification
  - Field Test Results
  - Laboratory Results Tables

## 6.0 MONITORING RESULTS

### 6.1 Anacostia River

Monitoring results for all wet weather sampling events in the Anacostia River are reported on discharge monitoring report (DMR) forms. Copies of the completed DMR forms for the Anacostia River stations are provided in Appendix D. Complete analytical results are included in Appendix E. Ambient water quality data collected during the wet and dry weather sampling events are summarized in Table 6-1.

**TABLE 6-1. AMBIENT WATER QUALITY DATA FOR NINE ANACOSTIA RIVER STATIONS DURING WET AND DRY WEATHER EVENTS**

Station	Date	pH (s.u.)	Temp (°F)
<b>WET</b>			
Stickfoot	11 Jan 2006	---	---
	21 Apr 2006	---	---
	12 Jul 2006	7.1	83.3
O St. Pump Station <sup>a</sup>	18 Jan 2006	9.0	51.8
	11 May 2006	---	---
Anacostia High	21 Apr 2006	---	60.3
Gallatin	11 Jan 2006	6.7	52.3
	7 Apr 2006	7.7	62.1
	19 Jun 2006	7.8	83.7
Varnum	21 Apr 2006	---	---
Nash Run	21 Apr 2006	---	---
East Capitol	21 Apr 2006	---	---
Ft. Lincoln	21 Nov 2005	7.8	52.7
	11 May 2006	6.1	65.8
Hickey Run	21 Apr 2006	8.4	69.3
	19 Jun 2006	7.6	78.6
<b>DRY</b>			
Stickfoot	11 May 2006	8.5	73.5
	19 Jul 2006	9.0	74.7
Anacostia High	11 May 2006	---	---
	20 Jul 2006	7.8	72.9
Gallatin	11 May 2006	---	---
	12 Jul 2006	7.7	70.5
Varnum	11 May 2006	---	---
	19 Jul 2006	8.0	71.6

---no data due to water quality meter malfunction

<sup>a</sup>O St. Pump Station has significant construction activities occurring near the manhole, therefore, no additional wet or dry samples can be collected at this station.

## 6.2 Potomac River

Monitoring results for the wet weather sampling events are reported on discharge monitoring report (DMR) forms. Copies of the completed DMR forms for the Potomac River stations are provided in Appendix D. Complete analytical results are included in Appendix E. Ambient water quality data collected during the wet and dry weather sampling events are summarized in Table 6-2.

**TABLE 6-2. AMBIENT WATER QUALITY DATA FOR FIVE POTOMAC RIVER STATIONS DURING WET AND DRY WEATHER EVENTS**

Station	Date	pH (s.u.)	Temp (°F)
<b>WET</b>			
Foundary Branch	29 Nov 2005	8.8	64.2
Oxon Run	8 Nov 2005	7.5	61.9
	29 Dec 2005	6.4	49.8
	7 Apr 2006	7.7	61.7
Tidal Basin	27 Jul 2005	---	---
	16 Nov 2005	7.5	66.0
	18 Jan 2006	7.2	57.9
Ship Channel	16 Nov 2005	8.4	57.4
	29 Dec 2005	8.6	54.7
C&O Canal	29 Nov 2005	8.6	63.5
	23 Jan 2006	5.6	46.4
<b>DRY</b>			
Foundary Branch	4 Aug 2005	---	---
	23 Aug 2005	---	---
Oxon Run	3 Aug 2005	---	---
	23 Aug 2005	---	---
Ship Channel	3 Aug 2005	---	---
C&O Canal	4 Aug 2005	---	---
	24 Aug 2005	---	---

--equipment malfunction

### 6.3 Rock Creek

Monitoring results for the wet weather sampling events are reported on DMR forms. Copies of the completed DMR forms for the monitoring results are provided in Appendix D.

Ambient water quality data collected during the wet and dry weather sampling events are summarized in Table 6-3.

**TABLE 6-3. AMBIENT WATER QUALITY DATA FOR SEVEN ROCK CREEK STATIONS DURING 2005 WET WEATHER EVENTS**

Station	Date	pH (s.u.)	Temp (°F)	TRC (mg/L)	DO (mg/L)
<b>WET</b>					
Soapstone	7/27/05	6.55	75.4	0.41	5.29
Melvin Hazen	7/27/05	6.30	75.2	0.09	6.56
	11/29/05	7.63	58.3	0.04	7.89
Klinge Valley	11/29/05	5.23	62.9	0.03	8.25
Normanstone	7/27/05	---	---	---	---
	11/22/05	7.92	57.0	0.99	5.9
	11/29/05	6.16	57.0	0.02	7.67
Broad Branch <sup>a</sup>	7/27/05	6.98	76.3	0.10	5.20
Oregon and Pinehurst <sup>a</sup>	7/27/05	--	--	--	--
Archbold <sup>a</sup>	11/22/05	6.8	54.3	2.2	7.5
	11/29/05	6.37	56.1	0.09	7.25

<sup>a</sup>non-permitted sampling stations

TRC: Total Residual Chlorine

--Field measurements at Normanstone and Oregon and Pinehurst are incomplete due to US Park Service request to cease activities at the site.

## 7.0 ESTIMATES OF CUMULATIVE LOADINGS

The annual pollutant loads for each sewershed sampled for wet and dry weather events were calculated by the Simple Method (EPA 1992) utilizing the event mean concentrations from the sample analysis results and the total area and land use distribution within each sewershed. The Simple Method can estimate pollutant loads without extensive rainfall-runoff volume data using the sample analysis results available. Generally, the Simple Method is expected to overestimate pollutant loads as compared to more dynamic models that incorporate pollutant concentration and runoff coefficients as functions of initial conditions and rainfall intensity and duration in estimating total pollutant loads.

The Simple Method is given by the following equation:

$$L = \sum_{i=1}^{\text{No. of landuse types}} \left( \frac{P}{12} \times CF \times Rv_i \times C_i \times A_i \times 2.72 \right) \quad \text{(Equation 1)}$$

where

L = pollutant loading (lb/year for chemical constituents, MPN/yr for bacteria)

P = average annual rainfall (inches)

- CF = Correction factor (0.9) to adjust for storms where no runoff occurs (dimensionless)
- Rv<sub>i</sub> = runoff coefficient for the land use type (dimensionless)
- C<sub>i</sub> = average event mean concentration (mg/L for chemical constituents)
- A<sub>i</sub> = land use area (acres)

The average EMCs (C<sub>i</sub>) for each monitoring station was calculated as the geomean of the measured EMCs in accordance with EPA's *Urban Stormwater BMP Performance Monitoring: Guidance Manual* (ASCE/EPA, 2002).

$$\text{Geomean of EMCs} = \left[ \prod_{j=1}^m \text{EMC}_j \right]^{\frac{1}{m}}$$

Where:

- EMC<sub>j</sub> = Event Mean Concentration of storm *j*
- m = Number of storms at monitoring location

Annual precipitation for 2004 within the District of Columbia was 42.5 inches as reported by the NWS weather station at Washington National Airport (COOP ID: 448906). The sewershed area was obtained from the sewershed coverage. A key parameter in Equation 1 is the runoff coefficient (Rv<sub>i</sub>), which is directly related to imperviousness and land use. Land use categories, impervious surfaces, and runoff coefficients were calculated for each sewershed and presented in Appendix F.

For EMCs calculated in this report, the geometric mean of each parameter was calculated as an estimate of the average EMC for each station. These data are presented in the following sections for Anacostia River, Potomac River, and Rock Creek.

## 7.1 Anacostia River

The geometric mean of the analytical results for each sample station are provided for twelve priority pollutants in Table 7-1. The highest mean concentration of TSS was reported at O St. and Gallatin where both stations were 190 mg/L, and the lowest was reported at East Capitol (54 mg/L). All other stations had TSS concentrations between 63 and 171 mg/L. Total nitrogen concentrations from Anacostia River stations ranged from 0.7 mg/L (Ft. Lincoln) to 9.1 mg/L (Varnum) and total phosphorus concentrations ranged from 0.2 mg/L (Ft. Lincoln and Hickey Run) to 1.5 mg/L (Varnum). Total metal concentrations ranged from non-detect to 0.73 ug/L for cadmium, 26.0 to 250 ug/L for copper, 14.0 to 67.0 ug/L for lead, and 135 to

365 ug/L for zinc. Complete analytical results for wet weather data are included in Appendix E.

Four stations were sampled for dry weather flows in May and July of 2006. The geometric mean of the dry weather sample analysis results for each station are presented in Table 7-2. The highest mean concentration of TSS was reported at Anacostia High (22 mg/L) and the lowest reported at Varnum (3 mg/L). Total nitrogen concentrations from Anacostia River stations ranged from 1.06 mg/L (Stickfoot) to 3.91 mg/L (Gallatin) and total phosphorus concentrations ranged from 0.23 mg/L (Anacostia High) to 0.49 mg/L (Gallatin). Total metal concentrations ranged from non-detect to 0.49 ug/L for cadmium, 8.2 to 31.9 ug/L for copper, 1.95 to 4.02 ug/L for lead, and 19.0 to 82.6 ug/L for zinc. Complete analytical results for dry weather data are included in Appendix E.

## **7.2 Potomac River**

The geometric mean of the analytical results for each sample station are provided for twelve priority pollutants in Table 7-3. The highest mean concentration of TSS was reported at Battery Kemble (63.4 mg/L) and the lowest reported at Dalecarlia (5.8 mg/L). All other stations had TSS concentrations below 56 mg/L. Total nitrogen concentrations from Potomac River stations ranged from 1.02 mg/L (Ship Channel) to 2.9 mg/L (Oxon Run) and total phosphorus concentrations ranged from 0.16 mg/L (Ship Channel) to 0.63 mg/L (Foundary Branch). Total metal concentrations ranged from 0.11 to 0.27 ug/L for cadmium, 12.5 to 149 ug/L for copper, 1.34 to 172 ug/L for lead, and 1.2 to 198 ug/L for zinc. Complete analytical results for wet weather data are included in Appendix E.

Four stations were sampled for dry weather flows in August 2005. The geometric mean of the dry weather sample analysis results for each station are presented in Table 7-4. The highest mean concentration of TSS was reported at Oxon Run (20.2 mg/L) and the lowest reported at Foundary Branch and C&O Canal (7.94 mg/L). Total nitrogen concentrations from Potomac River stations ranged from 3.75 mg/L (Oxon Run) to 22.9 mg/L (Ship Channel) and total phosphorus concentrations ranged from 0.13 mg/L (Oxon Run) to 1.02 mg/L (Ship Channel). Total metal concentrations ranged from 0.22 to 0.48 ug/L for cadmium, 5.9 to 480 ug/L for copper, 0.42 to 72.0 ug/L for lead, and 15.9 to 230 ug/L for zinc. Complete analytical results for dry weather data are included in Appendix E.

**TABLE 7-1. SUMMARY DATA OF ALL WET WEATHER EVENTS (2005-2006) FOR THE ANACOSTIA RIVER MONITORING STATIONS. VALUES REPRESENT GEOMETRIC MEAN FOR EACH STATION.**

Parameters (mg/L, except where noted)												
Station	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>a</sup>	Cu <sup>a</sup>	Pb <sup>a</sup>	Zn <sup>a</sup>
Stickfoot (n=3)	114	51	177	224	2.4	1.95	0.64	0.37	BDL	54.6	21.4	135
O St. Pump (n=2)	190	105	120	84	1.1	1.0	0.40	0.08	0.36	40.6	37.9	151
Anacostia High (n=1)	63	63	81	44	3.7	3.1	0.40	0.12	BDL	260	67.0	120
Gallatin (n=3)	190	105	197	245	1.8	1.21	0.39	0.19	0.27	35.3	25.0	146
Varnum (n=1)	110	360	750	150	9.1	8.1	1.5	0.16	BDL	53.0	16.0	150
Nash Run (n=1)	93	180	530	62	2.8	2.0	1.2	0.51	BDL	26.0	14.0	160
East Capitol (n=1)	54	140	530	98	5.4	4.2	1.1	0.51	BDL	29.0	24.0	140
Ft. Lincoln (n=2)	106	34	71	97	0.7	1.0	0.21	0.16	0.48	33.1	16.0	152
Hickey Run (n=2)	171	73	287	80	3.8	3.1	0.22	0.09	0.73	51.4	35.3	365

BDL: below detectable limits

<sup>a</sup>Total recoverable metals (ug/L)

**TABLE 7-2. SUMMARY DATA OF ALL DRY WEATHER EVENTS (2006) FOR THE ANACOSTIA RIVER MONITORING STATIONS. VALUES REPRESENT GEOMETRIC MEAN FOR EACH STATION (n=2)**

Parameters (mg/L, except where noted)												
Station	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>b</sup>	Cu <sup>b</sup>	Pb <sup>b</sup>	Zn <sup>b</sup>
Stickfoot	5	11	29	417	1.06	BDL	0.24	0.13	BDL	8.2	1.95	19.0
Anacostia High	22	49	37	270	1.54	BDL	0.23	0.17	0.41	31.9	4.02	49.8
Gallatin	15	18	76	265	3.91	1.4	0.49	0.35	0.49	11.8	2.77	82.6
Varnum	3	11	55	357	3.86	1.1	0.29	0.17	BDL	20.8	2.32	23.0

BDL: below detectable limits

<sup>a</sup>Only four of the nine Anacostia River stations have dry weather flow

<sup>b</sup>Total recoverable metals (ug/L)

**TABLE 7-3. SUMMARY DATA OF ALL WET WEATHER EVENTS (2005-2006) FOR THE POTOMAC RIVER MONITORING STATIONS. VALUES REPRESENT GEOMETRIC MEAN FOR EACH STATION (n=3).**

Parameters (mg/L, except where noted)												
Station	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>a</sup>	Cu <sup>a</sup>	Pb <sup>a</sup>	Zn <sup>a</sup>
Battery Kemble	63.4	21.6	95.6	165	1.56	1.42	0.523	0.367	0.175	29.7	2.91	86.7
Foundary Branch	6.14	16.4	37.3	50.8	2.62	0.899	0.627	0.22	0.182	12.5	2.33	18.9
Dalecarlia	5.77	16.2	56	144	1.92	1.57	0.304	0.277	0.11	13.9	1.34	1.2
Oxon Run	25.6	53.6	79.7	155	2.85	1.19	0.289	0.166	0.25	34.8	8.39	134
Tidal Basin	55.7	89.7	183	101	1.55	1.26	0.407	0.201	0.19	45.1	8.99	66.9
Ship Channel	23.8	23.6	39.5	99.1	1.02	0.837	0.155	0.11	0.274	149	172	198
C&O Canal	9.23	32.8	60.5	302	1.93	1.42	0.24	0.199	0.19	36.9	7.02	55.4

<sup>a</sup>Total Recoverable Metals (ug/L)

**TABLE 7-4. SUMMARY DATA OF ALL DRY WEATHER EVENTS (2005) FOR THE POTOMAC RIVER MONITORING STATIONS. VALUES REPRESENT GEOMETRIC MEAN FOR EACH STATION (n=2).**

Parameters (mg/L)												
Station <sup>a</sup>	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>b</sup>	Cu <sup>b</sup>	Pb <sup>b</sup>	Zn <sup>b</sup>
Foundary Branch	7.94	9.52	29.6	363	7.55	2.19	0.649	--	0.253	38.5	3.46	101
Oxon Run	20.2	5.69	31.4	252	3.75	0.889	0.126	--	0.261	17.7	5.2	48.2
Ship Channel	14	39.6	51	238	22.9	12.1	1.02	--	0.48	480	72.0	230
C&O Canal	7.94	5.09	17.3	555	5.01	1.01	0.201	--	0.22	5.9	0.415	15.9

<sup>a</sup>Only four of the seven Potomac River stations have dry weather flow

<sup>b</sup>Total Recoverable Metals (ug/L)

--No data results

### 7.3 Rock Creek

The geometric mean of the analytical results for each sample station are provided for twelve priority pollutants in Table 7-5. The highest mean concentration of TSS was reported at Military Road (96.9 mg/L) and the lowest reported at Soapstone (17.9 mg/L). All other stations had TSS concentrations below 83 mg/L. Total nitrogen concentrations from Rock Creek stations ranged from 1.61 mg/L (Klinge Valley) to 4.24 mg/L (Ft. Stevens) and total phosphorus concentrations ranged from 0.23 mg/L (Klinge Valley) to 0.47 mg/L (Melvin Hazen). Total metal concentrations ranged from 0.25 to 0.55 ug/L for cadmium, 23.5 to 95.8 ug/L for copper, 4.9 to 104 ug/L for lead, and 40 to 161 ug/L for zinc. Complete analytical results are included in Appendix E.

Six stations were sampled for dry weather flows in November 2003 and June 2004. The geometric mean of the dry weather sample analysis results for each station are presented in Table 7-6. TSS concentrations (5 mg/L) were the same for all stations sampled during this period. Total nitrogen concentrations from Rock Creek stations ranged from 2.43 mg/L (Military Rd.) to 4.47 mg/L (Normanstone) and total phosphorus concentrations ranged from 0.03 mg/L (Normanstone) to 0.13 mg/L (Soapstone). Cadmium concentrations (0.25 ug/L) were the same for all stations. Other metal concentrations ranged from 1.0 to 15.9 ug/L for copper, 1.0 to 6.5 ug/L for lead, and 7.1 to 32.9 ug/L for zinc. Complete analytical results for dry weather data are included in Appendix E.

**TABLE 7-5. SUMMARY DATA OF ALL WET WEATHER EVENTS (2003-2005) FOR ROCK CREEK MONITORING STATIONS. VALUES REPRESENT GEOMETRIC MEAN FOR EACH STATION (n=3).**

Parameters (mg/L, except where noted)												
Station	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>a</sup>	Cu <sup>a</sup>	Pb <sup>a</sup>	Zn <sup>a</sup>
Ft. Stevens	42.7	73.8	110	153	4.24	2.28	0.39	0.25	0.25	49.4	13.1	129
Military Rd.	96.9	37.1	167	165	3.81	2.15	0.33	0.22	0.49	48.7	17.6	137
Soapstone	17.9	11.9	43.1	189	3.38	1.28	0.24	0.20	0.37	41.0	12.2	114
Melvin Hazen	77.3	21.7	128	168	2.82	1.49	0.47	0.33	0.52	61.5	21.5	122
Klinge Valley	46.5	16.9	49.9	76.8	1.61	0.65	0.23	0.21	0.25	66.8	104	47.7
Normanstone	49.7	10.3	58	187	2.81	1.5	0.30	0.20	0.55	83.8	14.5	93.6
Portal & 16 <sup>th</sup> <sup>b</sup>	77.6	48.9	94.4	219	3.41	1.47	0.30	0.23	0.25	37.3	11.8	161
Broad Branch <sup>b</sup>	50	29.5	58.2	291	3.72	1.54	0.31	0.32	0.49	60.9	16.8	81.5
Oregon and Pinehurst <sup>b</sup>	33.1	45.5	87.5	106	3.33	1.9	0.28	0.24	0.25	23.5	4.9	40
Archbold Pkwy <sup>b</sup>	83.2	14.4	133	237	4.2	1.9	0.38	0.17	0.38	95.8	45.2	132

<sup>a</sup>Total recoverable metals (ug/L)  
<sup>b</sup> non-permitted sampling stations

**TABLE 7-6. SUMMARY DATA OF ALL DRY WEATHER EVENTS (2003-2004) FOR ROCK CREEK MONITORING STATIONS. VALUES REPRESENT GEOMETRIC MEAN FOR EACH STATION (n=3).**

Parameters (mg/L, except where noted)												
Station	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>a</sup>	Cu <sup>a</sup>	Pb <sup>a</sup>	Zn <sup>a</sup>
Ft. Stevens	5	3.6	5	626	4.04	0.1	0.05	0.05	0.25	1.0	1.0	13.4
Military Rd.	5	1.8	5	271	2.43	0.1	0.05	0.05	0.25	1.7	1.0	7.1
Soapstone	5	4.4	9.2	380	3.15	0.44	0.13	0.11	0.25	7.0	1.0	21.2
Melvin Hazen	5	3.1	5	312	2.98	0.24	0.07	0.11	0.25	7.0	1.0	14.9
Klinge Valley	5	2.6	7.1	307	3.81	0.41	0.11	0.11	0.25	15.9	6.5	32.9
Normanstone	5	1.8	5	341	4.47	0.1	0.03	0.03	0.25	7.2	1.0	10.4

<sup>a</sup>Total recoverable metals (ug/L)

#### **7.4 Pollutant Loads**

For the Anacostia River, the data indicate that some metals are contributed in minor amounts, and among these, copper, lead, and zinc are the highest on average (Table 7-7). Varnum had the highest overall loads among all stations for the 12 selected parameters, and Ft. Lincoln had the lowest overall loads. All stations had high loads (3,010 to 59,600 lbs/yr) of total nitrogen, with the exception O Street, Nash Run, and Ft. Lincoln, which all had loads less than 403 lbs/yr. A majority of the stations contributed higher loads (482 to 8,850 lbs/yr) of total phosphorus than others, however four stations had lower calculated loads of total phosphorus that ranged from 15 lbs/yr (Ft. Lincoln) to 170 lbs/yr (Hickey Run). Relatively low concentrations (ND to 1.98 lbs/yr) of cadmium are contributed from all of the Anacostia River stations, while higher loads of copper (2.3 to 393 lbs/yr), lead (1.11 to 160 lbs/yr), and zinc (10.6 to 1,190 lbs/yr) are contributed from these same stations. Total suspended solids are contributed in moderate amounts for two stations (Nash Run with 8,250 lbs/yr and Ft. Lincoln with 7,350 lbs/yr), but in much higher amounts in the remaining seven stations. Calculated loads of TSS for these seven stations (Stickfoot, O Street, Anacostia High, Gallatin, Varnum, East Capitol, and Hickey Run) ranged from 18,700 to 947,000 lbs/yr. BOD loadings ranged from 2,390 lbs/yr (Ft. Lincoln) to 1,830,000 lbs/yr (Varnum), and COD loadings ranged from 4,930 lbs/yr (Ft. Lincoln) to 4,020,000 lbs/yr (Varnum).

Calculated loads of selected parameters for the Potomac River are presented in Table 7-8. Tidal Basin and Ship Channel had the highest overall loads among all stations for the 12 selected parameters, and Dalecarlia had the lowest overall loads. One station (Dalecarlia) had a moderate load (34 lbs/yr) of total nitrogen, and all other Potomac River stations had higher calculated loads ranging from 220 to 758 lbs/yr. Three stations, Dalecarlia, Ship Channel and C&O Canal, had low to moderate loadings (5.4, 33.2, and 34.4 lbs/yr, respectively) of total phosphorus, while all other stations had higher loads (77 to 154 lbs/yr, respectively) of total phosphorus. Relatively low concentrations (ND to 0.05 lbs/yr) of cadmium are contributed from all of the Potomac River stations, while higher loads of copper (0.25 to 32 lbs/yr), lead (0.02 to 37 lbs/yr), and zinc (0.02 to 42.4 lbs/yr) are contributed from these same stations. Total suspended solids are contributed in low to moderate amounts (103 to 6,800 lbs/yr) from five stations (Dalecarlia, C&O Canal, Foundary Branch, Ship Channel, and Oxon Run), but in much higher amounts from Battery Kemble (12,700 lbs/yr) and Tidal Basin (20,400 lbs/yr). Calculated BOD loadings ranged from 289 lbs/yr (Dalecarlia) to 32,800 lbs/yr (Tidal Basin), and COD loadings ranged from 998 lbs/yr (Dalecarlia) to 66,900 lbs/yr (Tidal Basin) at all Potomac River monitoring stations.

For Rock Creek, Broad Branch station had the highest loads for the 12 selected parameters among all stations collected during 2003-2005, and Portal had the lowest overall loads (Table 7-9). Half of the Rock Creek stations had moderate to high loads (1,030 to 8,100 lbs/yr) of total nitrogen, while the other half (Ft. Stevens, Military Rd, Klinge Valley, Normanstone, and Portal) was noticeably lower and ranged from 74 to 402 lbs/yr. Three stations (Soapstone, Melvin Hazen, and Broad Branch) had higher loads of total phosphorus than all other stations, while the loads from the other seven stations were lower and ranged from 6.5 to 98.7 lbs/yr. Relatively low concentrations (ND to 1.07 lbs/yr) of cadmium are contributed from all of the Rock Creek stations, while higher loads of copper (0.81 to 132 lbs/yr), lead (0.25 to 36.5 lbs/yr), and zinc (3.48 to 177 lbs/yr) are contributed from these same stations. Total suspended solids are contributed in relatively high amounts (4,050 to 109,000 lbs/yr) from all stations, with the exception of two stations (Normanstone and Portal), which had TSS loads of 1,970 and 1,670 lbs/yr, respectively. Normanstone had the lowest calculated BOD loadings (410 lbs/yr), while all other stations ranged from 1,050 (Portal) to 64,300 lbs/yr (Broad Branch). COD loadings were moderate to high for all Rock Creek stations and ranged from 2,040 to 127,000 lbs/yr.

**TABLE 7-7. LOAD ESTIMATES OF 12 POLLUTANTS FOR THE ANACOSTIA RIVER MONITORING STATIONS  
(2005-2006)**

Station	Parameters (lbs/year)											
	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>a</sup>	Cu <sup>a</sup>	Pb <sup>a</sup>	Zn <sup>a</sup>
Stickfoot	548,000	312,000	814,000	1,270,000	17,600	11,300	2,800	1,670	ND	377	116	708
O Street	18,700	13,300	19,600	20,300	375	311	54.8	26.8	0.059	5.68	4.11	19.4
Anacostia High	129,000	84,800	160,000	286,000	6,780	5,170	663	315	ND	268	71.5	201
Gallatin	796,000	404,000	954,000	1,220,000	13,200	10,500	2,230	1,250	1.98	148	152	910
Varnum	947,000	1,830,000	4,020,000	1,400,000	59,600	48,600	8,850	1,880	ND	393	160	1,190
Nash Run	8,250	16,200	45,700	10,900	403	271	110	55.4	ND	6.49	1.51	22.7
East Capitol	23,200	48,800	194,000	85,100	3,080	1,950	482	231	ND	16	13.1	101
Ft. Lincoln	7,350	2,390	4,930	6,740	46.6	69.4	14.8	11.1	0.034	2.3	1.11	10.6
Hickey Run	98,700	46,200	174,000	71,700	3,010	2,120	170	99.5	ND	40.7	26.2	257

<sup>a</sup>Total recoverable metals

ND: non detectable

**TABLE 7-8. LOAD ESTIMATES OF 12 POLLUTANTS FOR THE POTOMAC RIVER MONITORING STATIONS  
(2005-2006)**

Station	Parameters (lbs/year)											
	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>a</sup>	Cu <sup>a</sup>	Pb <sup>a</sup>	Zn <sup>a</sup>
Battery Kemble	12,700	4,320	19,100	33,100	311	285	105	73.4	0.035	5.93	0.58	17.3
Foundary Branch	1,510	4,030	9,150	12,400	643	220	154	53.9	0.045	3.06	0.57	4.63
Dalecarlia	103	289	998	2,570	34.3	28	5.41	4.94	ND	0.25	0.02	0.02
Oxon Run	6,800	14,200	21,200	41,100	758	317	76.9	44	ND	9.23	2.23	35.6
Tidal Basin	20,400	32,800	66,900	36,800	566	462	149	73.3	ND	16.5	3.28	24.4
Ship Channel	5,100	5,060	8,470	21,300	220	180	33.2	23.6	0.059	32.0	37.0	42.4
C&O Canal	1,320	4,700	8,660	43,300	277	203	34.4	28.5	ND	5.28	1.0	7.94

<sup>a</sup>Total recoverable metals

ND: non-detectable

**TABLE 7-9. LOAD ESTIMATES OF 12 POLLUTANTS FOR THE ROCK CREEK MONITORING STATIONS  
(2003-2005)**

Station	Parameters (lbs/year)											
	TSS	BOD	COD	TDS	TN	TKN	TP	DP	Cd <sup>a</sup>	Cu <sup>a</sup>	Pb <sup>a</sup>	Zn <sup>a</sup>
Ft. Stevens	4,050	6,990	10,400	14,500	402	216	37.3	24	ND	4.68	1.25	12.2
Military Rd.	8,340	3,200	14,400	14,200	328	185	28.2	19.3	0.042	4.19	1.52	11.8
Soapstone	25,400	16,900	61,200	269,000	4,810	1,810	331	278	0.523	58.2	17.3	161
Melvin Hazen	30,300	8,510	50,100	65,900	1,100	584	183	129	0.202	24.1	8.4	47.7
Klinge Valley	11,300	4,090	12,100	18,600	390	156	54.7	50.3	ND	16.2	25.2	11.6
Normanstone	1,970	410	2,300	7,420	111	59.7	12	7.92	0.022	3.32	0.58	3.71
Portal & 16 <sup>th</sup> <sup>b</sup>	1,670	1,050	2,040	4,730	73.6	31.6	6.53	4.86	ND	0.81	0.25	3.48
Broad Branch <sup>b</sup>	109,000	64,300	127,000	632,000	8,100	3,350	674	704	1.07	132	36.5	177
Oregon and Pinehurst <sup>b</sup>	11,800	16,200	31,100	37,500	1,190	676	98.7	83.5	ND	8.35	1.74	14.2
Archbold <sup>b</sup>	20,400	3,520	32,700	58,200	1,030	465	94.2	41.3	0.094	23.5	11.1	32.4

<sup>a</sup>Total recoverable metals

<sup>b</sup>non-permitted sampling stations

## 8.0 ANACOSTIA RIVER WATER QUALITY TRENDS ANALYSIS

The permit requires that watersheds be sampled on a four-year rotational basis. The Anacostia River monitoring stations are the only ones that have been sampled for two complete rotations, the first occurred from 2001-2002, and the second occurred from 2005-2006. The first rotation (2001-2002) from the Anacostia River has a complete set of water quality data for three storm events at each of nine stations. The second rotation (2005-2006) is incomplete, however we have calculated loads from the existing dataset and presented the loads for comparison (Table 8-1). These data are used for comparison of select water quality data from the collections of wet weather events since 2001. The data indicate that there are small declines in calculated loads between Rotation 1 and Rotation 2, primarily from the organic compounds (chlordane, dieldrin, DDT, DDE). Nitrogen and oil and grease have also shown a slight decline in loads over the three-year rotation. Other parameters (some metals, TSS, phosphorus, fecal coliform, and PAHs) have shown increases in calculated loads, while others (chlordane, DDD, heptachlor, and PCBs) are reported as non detectable for both Rotations. With the exception of a few parameters, including BOD, COD, fecal coliform, PAHs, phosphorus, metals, and TSS, a majority of the calculated loads showed little change.

Careful consideration of the data is necessary when interpreting these results, primarily because changes in analytical techniques and detection limits makes it difficult to compare with older data that don't have the same precision. In addition, calculated pollutant loads for Rotation 1 and Rotation 2 can be misleading when the sample sizes are currently very small ( $n \leq 3$ ). As monitoring continues, the dataset will increase and provide not only a more precise evaluation of the historic and current trends for these parameters, but also indicate how effective the activities for reducing storm water pollutants in the District waterways have been.

**TABLE 8-1. COMPARISON OF EVENT MEAN CONCENTRATIONS FROM TWO ROTATIONS OF WET WEATHER MONITORING FOR THE ANACOSTIA RIVER**

Parameter	Rotation 1 (2001-2002)	Rotation 2 <sup>a</sup> (2005-2006)
Arsenic (ug/L)	1.38	1.8
BOD (mg/L)	44.4	124
Cadmium, total (ug/L)	0.35	0.34
Chlordane (ug/L)	BDL	BDL
COD (mg/L)	110	305
Copper (ug/L)	41.2	64.9

<b>Parameter</b>	<b>Rotation 1 (2001-2002)</b>	<b>Rotation 2<sup>a</sup> (2005-2006)</b>
DDD (ug/L)	BDL	BDL
DDE (ug/L)	0.00036	BDL
DDT (ug/L)	0.00068	BDL
Dieldrin (ug/L)	0.00014	BDL
Fecal coliform (mpn)	2,090	24,500
Heptachlor epoxide (ug/L)	BDL	BDL
Lead (ug/L)	19.0	28.5
Nitrogen, total (mg/L)	3.56	3.42
Oil & Grease (mg/L)	6.25	3.45
PAHs (ug/L)	5.38	67.6
PCBs, total (ng/L)	BDL	BDL
Phosphorus, dissolved (mg/L)	0.233	0.244
Phosphorus, total (mg/L)	0.353	0.673
Total Dissolved Solids (mg/L)	172	120
Total Suspended Solids (mg/L)	65.6	121
Zinc (ug/L)	142	169

<sup>a</sup> partial dataset

BDL: below detectable limits