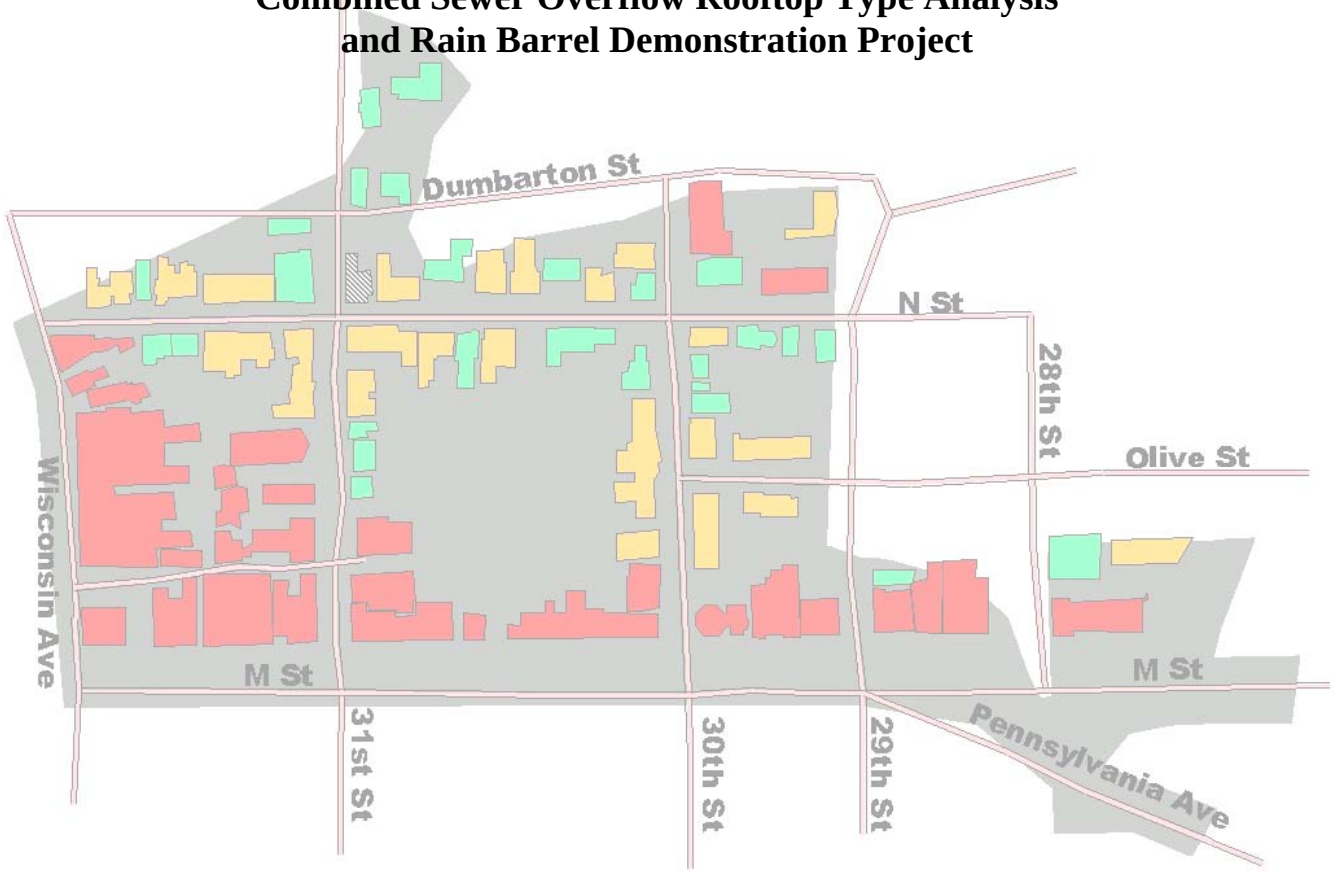
Combined Sewer Overflow Rooftop Type Analysis and Rain Barrel Demonstration Project



Prepared for:

The District of Columbia Water and Sewer Authority

Prepared by:

Department of Environmental Programs
Metropolitan Washington Council of Governments

December 2001

Combined Sewer Overflow Rooftop Type Analysis and Rain Barrel Demonstration Project

Prepared for:

CSO Control Program
District of Columbia Water and Sewer Authority

Prepared by:

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Executive Summary

1. Introduction

The District of Columbia Water and Sewer Authority (DC-WASA) operates a combined sewer system (CSS), which serves approximately 12,946.5 acres or 33 percent of the 60-square mile District of Columbia. During heavy or extended rainstorm events, stormwater runoff is conveyed via the CSS wherein it mixes with sanitary sewage destined for treatment at Blue Plains Wastewater Treatment Facility. When flow surpasses maximum conveyance capacity for treatment, a combined sewer overflow (CSO) event occurs. This generally untreated mixture then flows directly into the Anacostia and Potomac Rivers and Rock Creek. Contributing to this problem is the city's large amount of impervious surface. Controlling stormwater runoff from rooftop areas, which account for a significant portion of this imperviousness, presents both a serious challenge and promising solution for reducing both the frequency and volume of CSO events.

As a part of its ongoing efforts to solve the CSO problem, DC-WASA and its team of consultants have developed a CSO Long Term Control Plan (LTCP). The draft LTCP report, published in June 2001, recommends the excavation of four large CSO storage tunnels with a combined capacity of approximately 127 million gallons, extensive pump upgrades and conveyance system improvements and the evaluation and implementation of a variety of Low Impact Development and Retrofit projects (LID-R) such as green roofing, bioretention systems and cisterns.

Relying on extensive input from its CSO Stakeholders group, DC-WASA selected the Metropolitan Washington Council of Governments (COG) in March 2000 to complete a year-long project to analyze rooftop surfaces, evaluate rain barrels as a means of reducing CSO flows and conduct research into the potential for alternative CSO flow reduction techniques. The project's six major objectives included:

- The calculation of aggregate and individual surface areas of all rooftops in the CSO portion of the District of Columbia;

- The estimation of the volume of rooftop runoff resulting from rainfalls ranging from 0.19" to 1.00" (i.e., a working range of rooftop contributions to the CSO volume);

- The calculation of runoff capture efficiency by rain barrels based on a 0.19" rainfall event (i.e., the expected storage capacity of two barrels serving a typical 25' x 50' rowhouse roof, per September 7, 1999 memo to DC-WASA from Greeley and Hansen, LLP);

- An evaluation of seasonal rain barrel performance using water quantity and quality data and participant input with respect to maintenance experiences and overall satisfaction; and

- The development of scenarios for the most cost effective rain barrel use under a broad range of runoff control levels.

This report documents the above efforts and addresses the following questions:

1. Is the installation and maintenance of rain barrels within the range of abilities of the typical homeowner?

2. Would the widespread use of rain barrels be a cost effective approach to reducing stormwater runoff volumes and thus, the potential size of CSO events in the District of Columbia?

3. Based on factors such as space constraints, ease of installation and unit cost, which building type(s) offer(s) the greatest potential for rooftop runoff controls?

2. Rooftop Type Analysis[1]

As previously noted, the objective of the rooftop type analysis was to calculate the area and determine the composition of residential, institutional, commercial and federal rooftops in the CSO portion of the city. To accomplish this, COG staff analyzed 0.2-meter resolution 1996 Vargis, LLC aerial orthophotos provided by the National Capital Planning Commission (NCPC) and used ArcView Geographic Information Systems (GIS) to digitize and categorize rooftop surfaces.

The rooftop analysis yielded a total combined rooftop area of approximately 2,898 acres in the CSO portion of the District of Columbia. Approximately 1,490 of these rooftop acres drain to the Anacostia River, 1,060 drain to Rock Creek and 348 drain to the Potomac River. Further analysis of the GIS polygon shapefiles associated with each of the major rooftop types yielded approximate acreage totals of 193 for detached houses, 83 for semi-detached houses, 1,038 for rowhouses, 297 for apartments, 1060 for commercial/ institutional buildings, and 227 for federal buildings.

The above results were then used in calculating the rooftop area runoff control requirements for achieving a range of runoff management levels and in projecting rooftop runoff volumes in the Anacostia, Rock Creek, and Potomac CSO catchment areas resulting from rainfall events ranging from 0.19 to 1.00 inches. In this manner, COG staff determined that the total maximum runoff volume following a 0.19-inch rain from the 2,898 rooftop acres in the CSO portion of the city would be approximately 15.1 million gallons. Of this, approximately 1.0 million gallons would be runoff from detached houses, 5.3 million from rowhouses, 1.5 million from apartments, 5.4 million from commercial/institutional buildings and 1.2 million from federal buildings.

The results indicate that detaining runoff from rowhouses would offer the greatest overall runoff reduction potential in the Anacostia River and Rock Creek CSO area since row

[1] Due to minor rounding variations numbers appearing in both text and tables may differ slightly

houses represent the predominant roof type and are generally better suited for rain barrel use than are apartment and/or commercial/institutional roofs. In the Potomac River CSO area, detaining commercial/institutional runoff represents the greatest potential.

3. Rain Barrel Demonstration Project

To evaluate rain barrels as a means of detaining runoff from the stormwater system and thus, reducing CSO flows, COG staff recruited study participants from a total of 10 representative, privately owned detached, semi-detached, and rowhouses in the NW, NE and SE quadrants of the District of Columbia, mostly within the CSO portion of the city. COG also installed a 'control' rain barrel at a detached residence located in the NW quadrant and fitted the site with a rain gauge and temperature and dissolved oxygen recorders.

In late October 2000, upon receipt of project agreement/consent forms from each participant, a subcontractor, under COG supervision, performed gutter inspection and cleaning and installed a total of sixteen 36-inch high, 75-gallon recycled plastic rain barrels. Following barrel installation, COG provided the study participants with a rain barrel orientation packet, including detailed operation and maintenance guidelines along with a simple data log instructing participants to note barrel draining frequency and any maintenance-related activities and/or problems. Also included in the packet was information to assist in the identification of mosquito larvae, in the event that they were observed.

COG staff conducted regular site visits throughout the nine-month (December 2000-August 2001) study period to ensure proper functioning and to evaluate seasonal effects on performance. In addition to collecting water samples, recording water depth and noting the accumulation of organic material in the barrels, COG staff regularly downloaded precipitation data from several monitoring stations in the Washington DC area. Water quality analysis showed that concentrations of some pollutants in the rain barrels were higher than ambient wet weather levels. The mean level of total phosphorus was 0.150 mg/l, compared to an ambient range of 0.09-0.06 mg/l. Nitrate was encountered at a mean concentration of 1.66 mg/l in rain barrel water samples, compared to a weighted mean concentration of level of 1.23 mg/l at a regional monitoring site in eastern Maryland. Water temperature in the control barrel closely tracked ambient air temperatures, while dissolved oxygen levels remained below 5mg/l for the duration of the monitoring period.

The rain barrels' runoff capture efficiency was determined based on calculations of rooftop area at each rain barrel site, the number of 75-gallon capacity barrels at each site and the associated runoff volume resulting from a 0.19" rainfall event. Using these results it was possible to project runoff levels and associated management benefits for both detached and semi-detached houses and rowhouses. These findings, coupled with those of the rooftop analysis, enabled COG staff to estimate both the number of rain barrels required to control a 0.19-inch rainfall and the associated cost of implementing a rain barrel-based runoff management program under a range of runoff management levels.

Approximately 0.21 acres out of the total of 0.25 acres of rooftop area was controlled during the rain barrel demonstration project. This represents approximately 82 percent of the total combined rooftop area of the 10 sites. Results show that the rain barrels controlled approximately 27,521 gallons out of a total of 211,950 gallons of runoff during the study period. This represents an 11.5 percent average runoff capture efficiency across all of the sites.

COG's calculations of cost per acre of rooftop area controlled and cost per million gallons of storage show that rain barrel-based runoff control would be more cost effective for controlling runoff from rowhouses than from detached houses (i.e., $8,095/acre vs. $16,079/acre). The results further indicate that, to achieve a modest 1,000,000-gallon reduction in CSO volume, it would be necessary to install rain barrels at approximately 20 percent of rowhouses (i.e., approximately 6,981 units) in the CSO portion of the city at an estimated cost of roughly $1.7 million. Full implementation of the above scenario could take as long as 10 to 15 years at a rate of 400-600 units per year (installation, maintenance and other problems notwithstanding).

At the conclusion of the study period, COG provided each participant with an evaluation form requesting input on barrel draining frequency, water use and/or draining location, the presence of mosquitoes, maintenance concerns and level of satisfaction with their rain barrel(s). Six (60 percent) of the participants chose to assume ownership of their barrel(s) and four (40 percent) did not. Six participants (60 percent) responded that they were "very satisfied" with overall rain barrel performance, while three participants (30 percent) expressed dissatisfaction. One participant (10 percent) was generally satisfied.

Rain barrel draining frequency by participants averaged 2.7 times per month. The majority of participants did not drain barrels after each rainfall event, in spite of written and verbal instructions strongly recommending this practice. Water level measurements by COG staff showed that on average barrels remained nearly 60 percent full throughout the study period. This condition greatly reduced their overall effectiveness. It should also be noted that the barrel water was often frozen during the winter months, causing frequent overflows and further reducing their effectiveness.

While there were no reports of either adult or larval mosquitoes from the study participants, COG staff observed one mosquito larva in a participant's barrel. Approximately 15 mosquito larvae were also observed during an inspection of the COG 'control' barrel.

4. Summary of Major Findings

Rooftop Type Analysis

- The approximate total CSO area-wide rooftop area calculated by COG staff is 2,898 acres. Of this total, approximately 1,490 acres are associated with the

Anacostia River CSO area, 1,060 acres with Rock Creek and 348 acres with the Potomac River CSO area;

- The CSO area-wide rooftop type distribution is as follows: 1) detached house - 193 acres (7%), 2) semi-detached house - 83 acres (3%), 3) rowhouse - 1,038 acres (36%), 4) apartment - 297 acres (10%), 5) commercial/ institutional - 1060 acres (36%), and 6) federal - 227 acres (8%);

- The Anacostia CSO area had the highest percentage of rowhouse, commercial/institutional, and federal roofs, while the Rock Creek CSO area had the highest percentage of detached house and apartment roofs; and

- The estimated CSO area-wide rooftop runoff volume detention requirements associated with 0.19 to 1.0-inch rainfall events ranges from 15.1 to 79.2 million gallons.

Rain Barrels

- Results from this study indicate that rain barrels can be a good public relations tool for promoting a more environmentally friendly lifestyle and for increasing awareness about both the CSO problem and the need for stormwater management in the city;

- Results also suggest that, with clear instructions and basic tools, the average homeowner could properly install a rain barrel with little or no assistance from the city. However, without an ongoing educational campaign and periodic inspection and maintenance assistance from the city, it is unlikely that meaningful, long-term CSO flow reductions will be achieved;

- Only 60 percent of the participants were satisfied with their rain barrels and chose to assume ownership at the end of the evaluation period. Among the reasons given for dissatisfaction were excessive maintenance demands, insufficient yard area for drainage and a lack of need for the water;

- To be effective, rain barrels require regular dewatering and occasional maintenance by homeowners, as there is little or no attenuation unless barrels are drained between rainfall events;

- Draining frequency by participants averaged 2.7 times per month. This frequency was far below the recommended level for effective operation (i.e., detention of stormwater volumes at or near the 75-gallon capacity of the barrels) in spite of written and verbal instructions strongly recommending this practice;

- When the barrels remained full (i.e., undrained) under freezing conditions during the months of January and February, ice formed at or below on the surface of the

screened lids. Under such conditions, additional runoff spilled over and out of the barrels resulting in ice formation on walkways and surrounding areas;

- The appearance and apparent expansion of West Nile virus in the Washington, DC metropolitan area since 1999 has heightened public awareness of and concern about the presence of mosquito breeding habitat. Although only two of the rain barrels used in the study were found to contain larvae, improperly installed and/or maintained rain barrels could inadvertently provide additional breeding habitat for mosquitoes;

- On a unit cost/acre of roof basis, rain barrel-based runoff control appears to be more cost effective for rowhouses than for detached houses (i.e., $8,095/acre vs. $16,079/acre);

- COG staff calculations indicate that to achieve a modest 1,000,000-gallon reduction in stormwater volume to the CSS, it would be necessary to install rain barrels at approximately 20 percent of rowhouses (i.e., approximately 6,981 units) in the CSO portion of the city at an estimated cost of roughly $1.7 million; and

- The cost effectiveness of rain barrels as an integral part of the Long Term Control Plan stormwater volume control is somewhat questionable at this time because of the large number of 75-gallon barrels required to control a significant percentage of roof area.

<u>District of Columbia Building Code</u>

- Review of the District of Columbia's Building Code revealed that the potential for rooftop storage alternatives (e.g., green roofing) is governed by a minimum structural load requirement of 50 pounds per square foot (pfs) for a uniformly distributed live load (DC Register, 1999). Alterations to existing buildings built before July 1, 1925 are allowed a maximum reduction of 30 percent of the specified minimum live load, with a minimum live load of 40 psf for nonresidential buildings (DC Register, 1999).

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1.0 Introduction

1.1 Background

The District of Columbia Water and Sewer Authority (DC-WASA) operates a combined sewer system (CSS), which serves approximately 12,946.5 acres or 33 percent of the city (Figure 1). During heavy or extended rainstorm events, stormwater runoff is conveyed via the CSS wherein it mixes with sanitary sewage destined for treatment at Blue Plains Wastewater Treatment Facility. When flow surpasses maximum conveyance capacity for treatment, a combined sewer overflow (CSO) event occurs. This generally untreated mixture then flows directly into the Anacostia and Potomac Rivers and Rock Creek.

To address this problem, DC-WASA and its team of consultants have developed a CSO Long Term Control Plan (LTCP) in accordance with the requirements of its NPDES permit. A draft LTCP, published in June 2001, recommends the excavation of four large CSO storage tunnels with a combined capacity of approximately 127 million gallons, extensive pump upgrades and conveyance system improvements and the evaluation and implementation of a variety of Low Impact Development and Retrofit projects (LID-R) such as green roofing, bioretention systems and cisterns.

DC-WASA, in keeping with its ongoing efforts to reduce both the frequency and volume of CSOs, contracted the Metropolitan Washington Council of Governments (COG) in March 2000 to conduct a one-year study involving the calculation of rooftop surface area in the CSO portion of the District of Columbia, an evaluation of rain barrels as a means of detaining stormwater runoff from roof surfaces and a literature review of alternative CSO flow reduction techniques.

1.2 Project Description

Rooftop Type Analysis

The 60-square mile District of Columbia, which is home to 570,000 residents (2000 census), is a densely developed urban area with a large amount of impervious surface. Along with transportation-related surfaces such as streets, parking areas and sidewalks, rooftop surfaces accounts for a significant portion of this imperviousness. In older cities such as the District of Columbia this rooftop component is largely fixed thanks to density zoning codes and the general lack of undeveloped land for new construction.

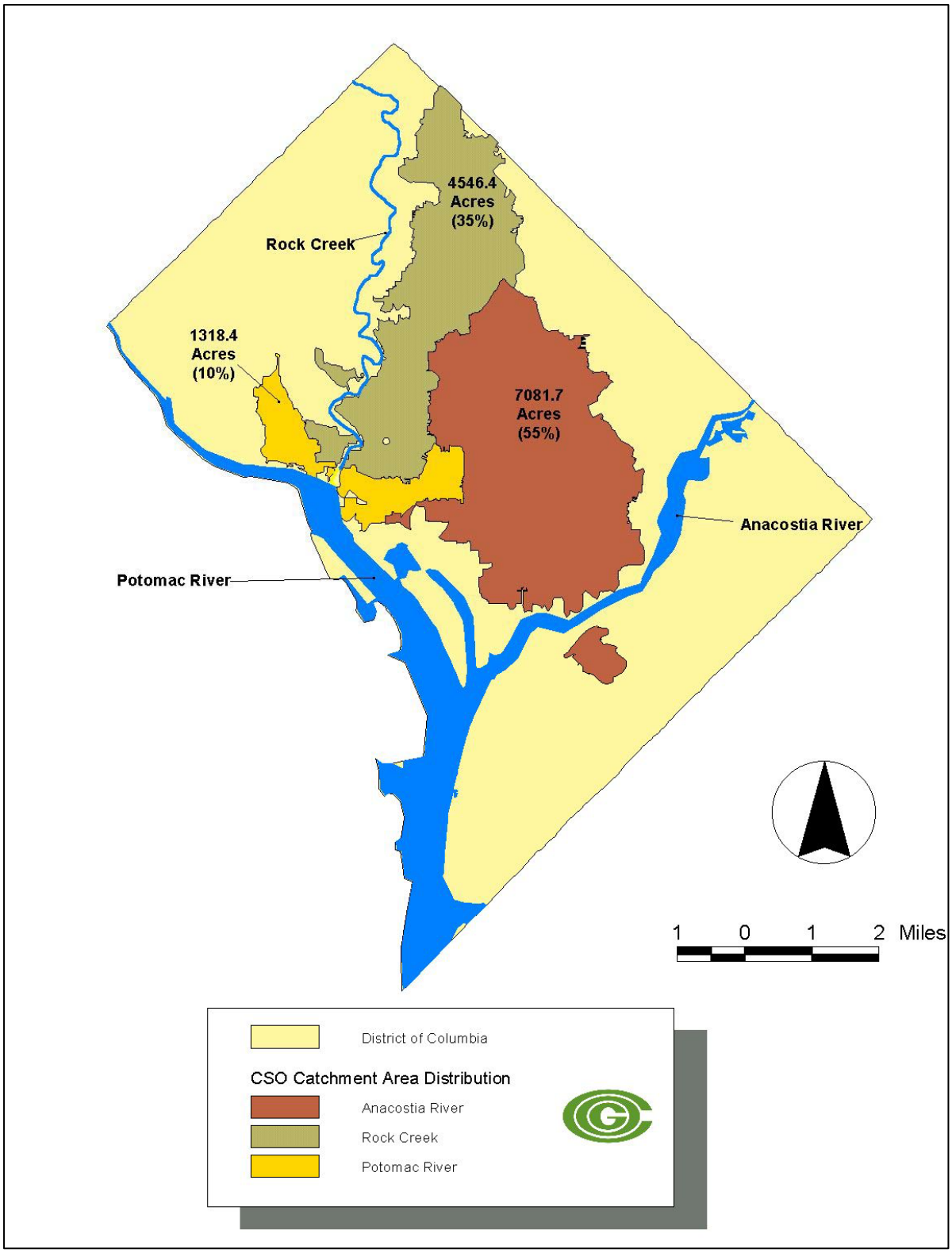


Figure 1. CSO Catchment Acreage Totals and Receiving Water Body

This situation together with the city's CSO problem and need for viable flow reduction alternatives has increased the interest in the potential for rooftop control. This has made the quantification and categorization of rooftop area for the purpose of future CSO flow reduction and stormwater management planning a timely and important endeavor.

The objective of the rooftop type analysis was to calculate the combined area and determine the composition of residential, institutional, commercial and federal building rooftops in the CSO portion of the city. To accomplish this, COG staff analyzed high-resolution 1996 Vargis, LLC aerial photographs using Geographic Information Systems (GIS) and conducted limited ground truthing. The results of these efforts will be used to help DC-WASA evaluate the potential for the implementation of rooftop oriented LID-R approaches such as rain barrels.

Rain Barrel Demonstration Project

In many residential areas, roof runoff from smaller storms can be detained temporarily and then spread over pervious areas, such as lawns, as an alternative to flowing directly into the storm drains, which lead to the combined sewer system. Rain barrels provide a simple and inexpensive means of detaining such water and have often been used for small-scale yard irrigation during dry periods. Increasingly, they are being offered by municipalities in both Canada and the United States as a means of water conservation. More recently, they have received attention as a possible approach for reducing the volume of stormwater runoff from residential rooftops.

While many models currently exist, a typical plastic rain barrel holds approximately 50 to 75 gallons and is available at a cost of between $80 and $140 (Figure 2). Most commercially available rain barrels are fitted with either a solid or screened lid to accommodate a downspout and to both restrict entry by mosquitoes and prevent the accumulation of organic and mineral debris. Most barrels are also equipped with both an overflow hose and a hose for watering and draining. Rain barrels are designed to be placed adjacent to a wall at the end of a shortened downspout and to provide water for flowerpots, flower gardens, shrubs and lawns. Alternatively, when the water is not needed, it may be released into the combined sewer system once the CSO event has ceased.

Figure 2. A Typical Rain Barrel

In response to recommendations from the DC-WASA CSO Stakeholders group, COG, in cooperation with DC-WASA, developed a project to evaluate rain barrels as a means of

providing stormwater management, and ultimately, CSO flow reduction. To accomplish this, COG staff recruited homeowners throughout the CSO portion of the District of Columbia to participate in a voluntary study with the goal of determining how much water collected from residential rooftops could be diverted from the stormsewer system during rainfall events.

Throughout the study period, COG staff collected and analyzed water quantity and quality data and sought extensive feedback from participants on matters such as maintenance-related experiences, their use of rain barrel water, and their overall satisfaction with rain barrel ownership. These results were used along with other data to evaluate the potential for an expanded rain barrel installation program designed to reduce CSO volumes.

1.3 Study Objectives

As previously stated, COG was selected by DC-WASA in March 2000 to perform a year-long study. In doing so, COG staff quantified the total rooftop area and categorized rooftop types in the CSO portion of the District of Columbia, evaluated the effectiveness of rain barrels as a means of reducing CSO flows and conducted research into the potential for other CSO flow reduction techniques. The project's six major objectives included:

- The calculation of aggregate and individual surface areas of all rooftops in the CSO portion of the District of Columbia;

- The estimation of the volume of rooftop runoff resulting from rainfalls ranging from 0.19" to 1.00" (i.e., a working range of rooftop contributions to CSO volume);

- The calculation of potential runoff capture efficiency by rain barrels based on a 0.19" rainfall event (i.e., the expected storage capacity of two barrels serving a typical 25' x 50' rowhouse roof, per September 7, 1999 memo to DC-WASA from Greeley and Hansen, LLP);

- An evaluation of seasonal rain barrel performance using water quantity and quality data and participant input with respect to maintenance experiences and overall satisfaction; and

- The development of scenarios for the most cost effective rain barrel use under a broad range of runoff control levels.

This report documents the above efforts and addresses the following three questions:

1. Is the installation and maintenance of rain barrels within the range of abilities of the typical homeowner?

2. Would the widespread use of rain barrels be a cost effective approach to reducing stormwater runoff volumes and thus, the potential size of CSO events in the District of Columbia?

3. Based on factors such as space constraints, ease of installation and unit cost, which building type(s) offer(s) the greatest potential for rooftop runoff controls?

2.0 Methodology

2.1 Rooftop Type Analysis

As previously stated, COG staff digitized and categorized rooftop surfaces in the CSO portion of the District of Columbia using ArcView GIS and 0.2-meter resolution Vargis, LLC aerial orthophotos provided by the National Capital Planning Commission (NCPC)[2]. The resulting GIS polygon shapefiles were then used to calculate the rooftop surface area of each residential, commercial/institutional and federal structure, as well as aggregate totals for each building category (Appendix 1, Tables 1-40). Figure 3, which features Rock Creek CSO catchment 052, provides an example of the use of color-coded polygons in building type categorization, rooftop delineation and area calculation.

The results of the rooftop analysis were then used to calculate the amount of rooftop area requiring stormwater runoff controls in order to achieve either the 5, 10, 25, 50 or 75 percent runoff management level. In addition, COG staff calculated projected rooftop runoff volumes in the Anacostia, Rock Creek, and Potomac CSO catchment areas resulting from 0.19, 0.25, 0.50 and 1.00-inch rainfalls and estimated the runoff volume reduction potential for each rooftop type based on a 0.19-inch rainfall.

2.2 Rain Barrel Project

Following a project plan developed with extensive input from DC-WASA and its CSO Stakeholders group, COG staff began by inspecting numerous potential rain barrel sites throughout the District of Columbia. A total of 10 privately owned residences were then selected as rain barrel installation sites. These were located in the NW, NE and SE quadrants of the city, mostly within the CSO catchment area, and included detached, semi-detached, and rowhouses (Table 1 and Figure 4). Residences with a variety of rooftop configurations were included deliberately to ensure a representative sample of the District of Columbia's housing stock (Figures 5 and 6). In addition, COG maintained a rain barrel 'control' site at a detached residence located in the NW quadrant. Each prospective participant was provided with an agreement/consent form describing the project, assigning maintenance responsibility to the participant, establishing that, at the end of the study period, he or she would elect either to keep the rain barrel(s) or to have the downspout(s) replaced at no cost, and holding DC-WASA, COG and the subcontractor blameless for injury or damages.

[2] A more detailed rooftop analysis methodology is included in Appendix 1

Representative impervious rooftop area in CSO 052 Catchment

Rooftop Types	Acres	% of Total[1]
Detached House	8.2	31.8
Semi-Detached House	1.6	6.2
Rowhouse	11.7	45.3
Apartment	2.4	9.3
Federal	0.0	0.0
Commercial/Institutional	1.9	7.4
Total	25.8	100.0

[1] Total CSO 052 Area = 111.7 Acres

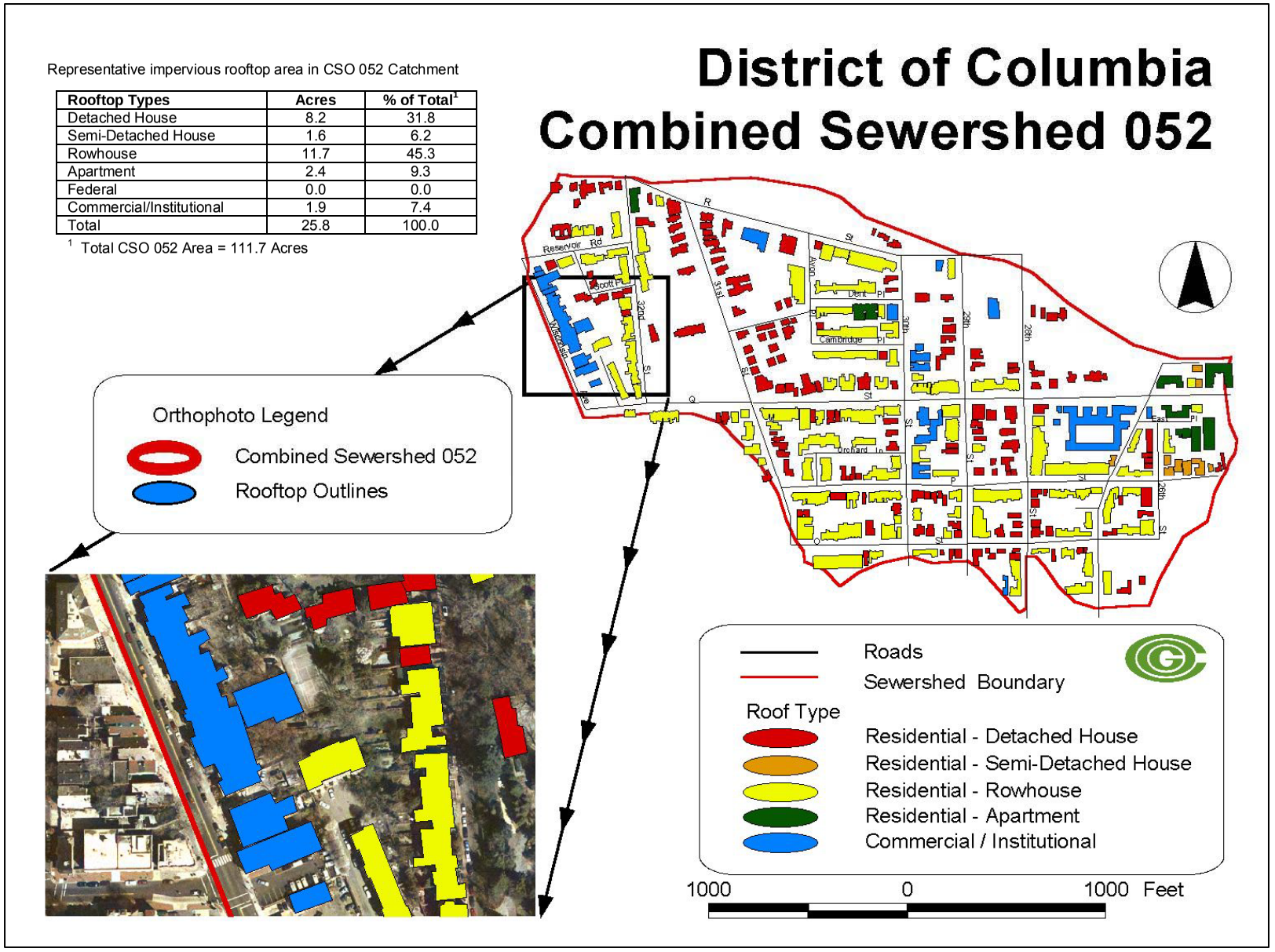


Figure 3. Map of CSO 052 Sewershed with Detail of Aerial Photo Overlayed with Color-Coded Rooftop Types

After careful comparison of rain barrels from eight prospective suppliers, COG purchased a total of 20 36-inch high, 75-gallon recycled plastic rain barrels from Gardener's Supply, Inc. at a cost of approximately $95 each[3]. Upon receipt of the consent forms, COG staff worked closely with its subcontractor, Wood and Whitacre, LLC, overseeing gutter inspection and cleaning and providing site-specific instructions for downspout removal and/or modification and barrel installation. In planning barrel placement, an effort was made to install a number of barrels proportional to rooftop area and projected runoff volumes. However, due to space constraints and/or downspout configuration, several residences that would otherwise require two rain barrels accommodated only one.

To ensure uniform installation, COG staff provided the contractor with an eight-foot section of 4" diameter flexible plastic tubing and two downspout adapters for each barrel. Due to space constraints and generally soft, uneven ground, cinder blocks were used at several residences to ensure barrel stability and proper elevation for positive drainage.

Table 1. Rain Barrel Demonstration Project Site Location Summary

Participant ID No.	CSO Shed Location	Ward No.	Building Type	Approximate Rooftop Area ft^2	Total Number of Downspouts	Number of Rain Barrels Installed	Estimated Rooftop Area (ft^2) Served by Rain Barrel(s)
1	49	4	Detached	1,910	4	4	1,910
2	49	4	Rowhouse	1,071	2	1	975
3	49	4	Detached	1,340	6	4	452
4	49	4	Rowhouse	665	2	1	561
5	45	1	Detached	1,245	2	1	932
6	NA[1]	6	Rowhouse	701	2	1	626
7	12	6	Rowhouse	784	1	1	784
8	12	6	Rowhouse	1,266	1	1	1,266
9	12	6	Rowhouse	881	1	1	881
10	NA	8	Semi-Detached	385	1	1	385
Control	NA	3	Detached	675	2	1	274
			Total	**10,923**	**24**	**17**	**9,046**

[1]N/A = Outside of CSO area

[3] Many rain barrel retailers offer significant discounts to non-profit organizations and to individuals, groups and agencies purchasing large numbers of barrels.

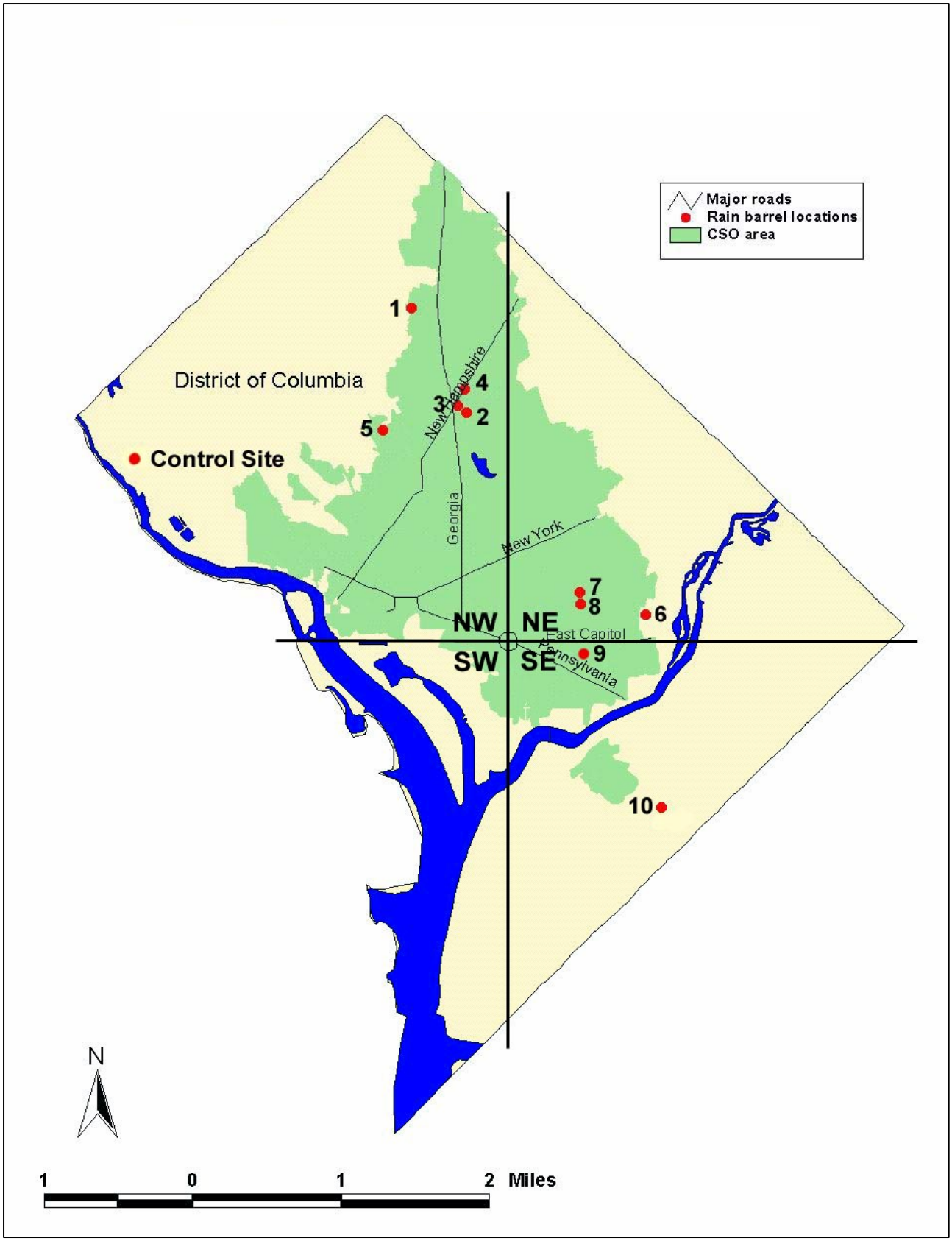


Figure 4. Rain Barrel Site Locations

Figure 5. Typical Washington DC Rowhouse

Figure 6. Complex Roof Design at Rain Barrel Site No. 3

To prevent entry by small animals and to maintain a level of control over the rain barrel contents, the barrels' screened lids were secured using tamper resistant nylon electrical ties. To facilitate the observation and recording of barrel water levels, an external polyurethane tube designed to function as a water level meter was added to each barrel (Figure 7).

The installation of 16 barrels at the 10 participating residences was completed in late October 2000 (Figures 8-11). As previously noted, one additional barrel was installed at the COG 'control' site. This site featured a rain gauge, a Hobo TempMentor™ temperature recorder to measure rain barrel water temperature and a calibrated, handheld Horiba U10 Water Quality Checker™ to measure both dissolved oxygen levels and ambient air temperature (monitoring period March - September 2001).

Following barrel installation, COG provided the study participants with a rain barrel orientation packet (Appendix 2, Item 1). Included were detailed operation and maintenance guidelines along with a simple data log instructing participants to note barrel draining frequency and any maintenance-related activities and/or problems. COG also provided self-addressed, stamped envelopes and requested that participants submit data monthly via either mail or email. Also included in the packet was information to assist in the identification of mosquito larvae, in the event that they were observed. COG staff also attempted to convey the necessary instructions and information verbally during visits to each residence.

To ensure proper functioning and to collect water samples, record water depth and note the accumulation of organic material, COG staff inspected the barrels on a monthly basis for the duration of the nine-month study period (December 2000-August 2001). Water quality parameters including nitrate, total phosphorus (TP), copper, aluminum, iron, and total dissolved solids concentrations were measured using handheld Hach Pocket Colorimeter™ meters. In addition, COG staff regularly downloaded precipitation data

Figure 7. Barrel with Water Level Indicator Hose and Gallon Marks

Figure 8. Rain Barrel Installation at Site No. 10

Figure 9. Rain Barrel Site No. 8 Prior to Installation

Figure 10. Site No. 8 Site After Rain Barrel Installation

from the Greeley and Hansen CSO rain gauge station network, the USDA-Beltsville Agricultural Research Center (BARC) weather station network, Reagan National Airport, and an Isco Model 3220 Tipping Rain Gauge located near Delcarlia Reservoir in the District of Columbia.

Figure 11. Space Constraints around Row Houses Limit Barrel Placement

As previously stated, COG staff used calculations of rooftop area at each rain barrel site to determine the runoff volume resulting from a 0.19" rainfall (i.e., the expected storage capacity of two barrels connected to a typical 1,000 square foot, 25' x 50' rowhouse roof, per Greeley and Hansen, LLP, 1999). Runoff capture efficiency at each site was, therefore, easily calculated based on the 75-gallon capacity of each barrel and the number of barrels at each site. The results were then used to calculate both projected runoff volumes and the associated volume control requirements. These results, coupled with those of the rooftop analysis, enabled COG staff to additionally estimate both the number of rain barrels required to control a 0.19-inch rainfall and the associated costs of implementing potential rain barrel-based runoff controls under a range of runoff management levels.

At the conclusion of the study period each participant was provided with an evaluation form (Appendix 2, Item 2) requesting input on barrel draining frequency, water use and/or draining location, the presence of mosquitoes, maintenance concerns and level of satisfaction with their rain barrel(s). The survey also asked whether the participant intended to assume ownership of the barrel or to have it removed. Where possible, COG staff also conducted telephone interviews with the participants.

3.0 Results

3.1 Rooftop Type Analysis

Interpretation of the Vargis, LLC high-resolution aerial orthophotos yielded an estimated total combined rooftop area of approximately 2,898 acres in the CSO portion of the District of Columbia. Approximately 1,490 of these rooftop acres drain to the Anacostia River, 1,060 drain to Rock Creek and 348 drain to the Potomac River (Table 2).

Further analysis of the GIS polygon shapefiles associated with each of the rooftop types yielded approximate acreage totals of 193 for detached houses, 83 for semi-detached houses, 1,038 for rowhouses, 297 for apartments, 1060 for commercial/institutional buildings, and 227 for federal buildings (Figure 12 and Table 2). Total rooftop area in the Anacostia River, Rock Creek and Potomac River CSO catchments, as well as the total

rooftop area that would be controlled in each under the 5, 10, 25, 50 and 75 percent runoff management levels are also shown in Table 3.

As shown in Table 4 detached house rooftops in the Rock Creek CSO area account for approximately 154 acres out of a total of approximately 193 detached house rooftop acres (80 percent) in the combined Anacostia River, Rock Creek and Potomac River CSO areas (i.e., the overall CSO area). Achieving a five percent stormwater management control level for the total, CSO-wide detached house rooftop area would involve adding controls to nearly 10 rooftop acres, while achieving a 75 percent management level would require controls for nearly 144 rooftop acres.

Semi-detached house rooftop area totals approximately 54 acres in the Rock Creek CSO area. This represents just over 64 percent of semi-detached house rooftops in the citywide CSO area. Achieving a five percent stormwater management level for the total semi-detached house rooftop area would involve controlling runoff from approximately 4 acres, while achieving a 75 percent management level would require the addition of controls to nearly 63 acres (Table 5).

Rowhouse rooftop area totals 629 acres in the Anacostia River CSO area. This represents nearly 61 percent of rowhouse rooftops in the citywide CSO area. Achieving a five percent stormwater management level for the total rowhouse rooftop area would involve controlling runoff from nearly 52 acres, while achieving a 75 percent management level would require the addition of controls to nearly 777 acres (Table 6).

Apartment rooftop area is highest in the Rock Creek CSO area, with approximately173 acres out of nearly 297 total (58 percent) in the citywide CSO area. Achieving a five percent stormwater management level for the total apartment rooftop area would involve adding control to nearly 15 acres, while achieving a 75 percent management level would require addition of controls to nearly 223 acres (Table 7).

As shown in Table 8, the area of commercial/institutional rooftops is greatest in the Anacostia River CSO, totaling approximately 551 acres out of 1060 total (52 percent) in the citywide CSO area. To achieve a five percent stormwater management level for the total commercial/institutional rooftop area it would be necessary to control runoff from over 52 acres. Achieving the 75 percent management level would involve adding runoff control to nearly 786 acres.

Federal building rooftops in the Anacostia River CSO area total approximately158 acres out of a total of 227 (70 percent) in the citywide CSO area. Managing runoff from all federal building rooftops in the citywide CSO area at the five and 75 percent levels would involve adding controls to nearly 11 and 171 acres, respectively (Table 9).

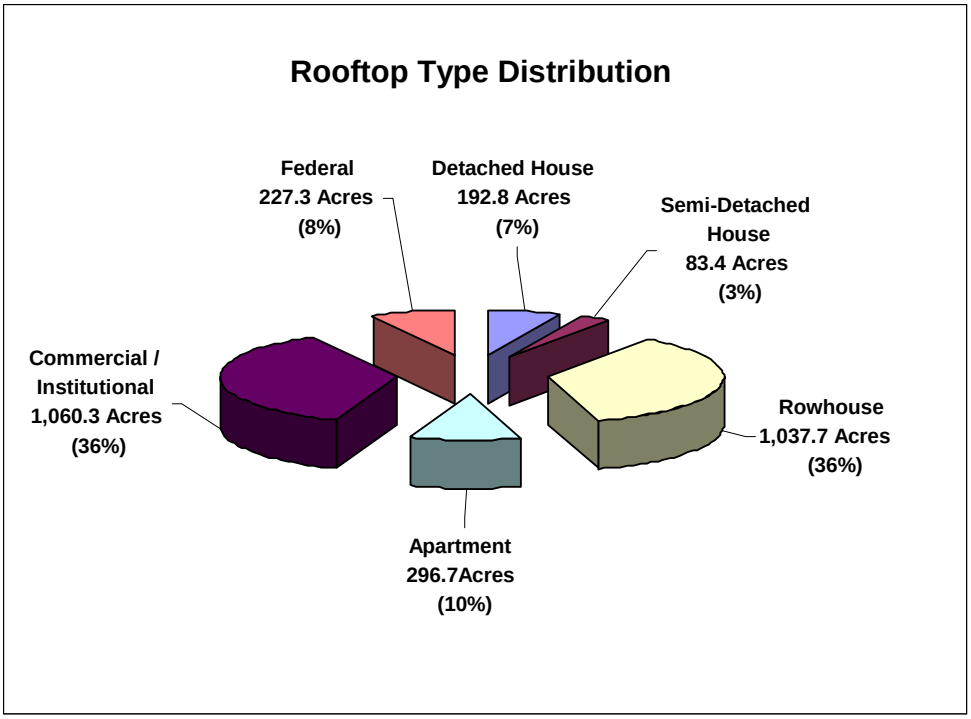


Figure 12. Area-Wide CSO Rooftop Type Distribution

Table 2. Summary: CSO Area Rooftop Type Distribution

Watershed	Residential						Apartment		Commercial / Institutional		Federal	
	Detached House		Semi-Detached House		Rowhouse							
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Anacostia River	30.6	15.8	26.2	31.4	629.1	60.6	94.8	31.9	550.6	51.9	158.4	69.7
Rock Creek	154.3	80.1	53.7	64.4	343.0	33.1	173.1	58.4	311.9	29.4	24.4	10.7
Potomac River	7.9	4.1	3.5	4.2	65.6	6.3	28.8	9.7	197.8	18.7	44.5	19.6
Total	**192.8**		**83.4**		**1,037.7**		**296.7**		**1,060.3**		**227.3**	

Table 3. Summary: CSO Area Rooftop Control Acreages at 5 - 75 Percent Management Levels

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
Anacostia River	7,081.7	1,489.6	74.5	149.0	372.4	744.8	1117.2
Rock Creek	4,546.4	1,060.4	53.0	106.0	265.1	530.2	795.3
Potomac River	1,318.4	348.2	17.4	34.8	87.0	174.1	261.1
Total	**12,946.5**	**2,898.2**	**144.9**	**289.8**	**724.5**	**1449.1**	**2173.6**

Table 4. Detached House Rooftop Acreages at 5 - 75 Percent Management Levels

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Detached House Rooftop Area (Acres)	Management Level (%) and Area (Acres)				
				5%	10%	25%	50%	75%
Anacostia River	7,081.7	1,489.6	30.6	1.5	3.1	7.6	15.3	22.9
Rock Creek	4,546.4	1,060.4	154.3	7.6	15.3	38.2	76.5	114.7
Potomac River	1,318.4	348.2	7.9	0.4	0.8	2.0	4.0	6.0
Total	**12,946.5**	**2,898.2**	**192.8**	**9.5**	**19.2**	**47.9**	**95.8**	**143.6**

Table 5. Semi-Detached House Rooftop Acreages at 5 - 75 Percent Management Levels

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Semi–Detached Rooftop Area (Acres)	Management Level (%) and Area (Acres)				
				5%	10%	25%	50%	75%
Anacostia River	7,081.7	1,489.6	26.2	1.3	0.1	6.6	13.1	19.6
Rock Creek	4,546.4	1,060.4	53.7	2.7	0.3	13.4	26.9	40.3
Potomac River	1,318.4	348.2	3.5	0.2	0.02	0.9	1.74	2.6
Total	**12,946.5**	**2898.2**	**83.4**	**4.2**	**0.4**	**20.9**	**41.7**	**62.5**

Table 6. Rowhouse Rooftop Acreages at 5 - 75 Percent Management Levels

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Rowhouse Rooftop Area (Acres)	Management Level (%) and Area (Acres)				
				5%	10%	25%	50%	75%
Anacostia River	7,081.7	1,489.6	629.1	31.5	62.9	157.3	314.5	471.8
Rock Creek	4,546.4	1,060.4	343.0	17.0	34.1	85.1	170.3	255.4
Potomac River	1,318.4	348.2	65.6	3.3	6.6	16.4	32.8	49.2
Total	**12,946.5**	**2898.2**	**1,037.7**	**51.8**	**103.6**	**258.8**	**517.6**	**776.5**

Table 7. Apartment Rooftop Acreages at 5 - 75 Percent Management Levels

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Apartment Rooftop Area (Acres)	Management Level (%) and Area (Acres)				
				5%	10%	25%	50%	75%
Anacostia River	7,081.7	1,489.6	94.8	4.7	9.5	23.7	47.4	71.1
Rock Creek	4,546.4	1,060.4	173.1	8.7	17.3	43.3	86.6	129.8
Potomac River	1,318.4	348.2	28.8	1.4	2.9	7.2	14.4	21.6
Total	**12,946.5**	**2898.2**	**296.7**	**14.8**	**29.7**	**74.2**	**148.4**	**222.5**

Table 8. Commercial/Institutional Rooftop Acreages at 5 - 75 Percent Management Levels

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Commercial/ Institutional Rooftop Area (Acres)	Management Level (%) and Area (Acres)				
				5%	10%	25%	50%	75%
Anacostia River	7,081.7	1,489.6	550.6	27.5	55.1	137.7	275.3	413.0
Rock Creek	4,546.4	1,060.4	311.9	15.0	29.9	74.8	149.6	224.4
Potomac River	1,318.4	348.2	197.8	9.9	19.8	49.5	98.9	148.4
Total	**12,946.5**	**2898.2**	**1,060.3**	**52.4**	**104.8**	**262.0**	**523.8**	**785.7**

Table 9. Federal Building Rooftop Acreages at 5 - 75 Percent Management Levels

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Federal Rooftop Area (Acres)	Management Level (%) and Area (Acres)				
				5%	10%	25%	50%	75%
Anacostia River	7,081.7	1,489.6	158.4	7.9	15.8	39.6	79.2	118.8
Rock Creek	4,546.4	1,060.4	24.4	1.2	2.4	6.1	12.2	18.3
Potomac River	1,318.4	348.2	44.5	2.2	4.5	11.1	22.3	33.4
Total	**12,946.5**	**2,898.2**	**227.3**	**11.3**	**22.7**	**56.8**	**113.7**	**170.5**

Based on a 0.19" rainfall event, the total maximum possible runoff volume calculated from the 2,898 rooftop acres in the CSO portion of the city would be approximately 15 million gallons (Table 10)[4]. Of this, approximately 1.0 million gallons would be runoff from detached houses, 0.4 million from semi-detached houses, 5.3 million from rowhouses, 1.5 million from apartments, 5.4 million from commercial/ institutional buildings, and 1.2 million from federal buildings. These totals and those for the 0.25, 0.50 and 1.00-inch rainfall events are also summarized in Table 10. The estimated stormwater runoff detention potential based on a 0.19-inch rainfall event is provided for each of the major building categories in Table 11.

As seen in Table 11, detaining runoff from rowhouses offers the greatest overall runoff reduction potential in the Anacostia River CSO area (i.e., 3.2 million gallons or 42 percent of the total 0.19" runoff volume for the Anacostia River CSO sewershed). Detaining rowhouse runoff also offers the greatest runoff reduction potential in the Rock Creek CSO area, accounting for an estimated 1.8 million gallons or nearly 33 percent of the total. In the Potomac River CSO area, detaining commercial/institutional runoff would result in an estimated runoff reduction of one million gallons or nearly 57 percent of the total for that CSO area.

Table 10. Estimated CSO Area-Wide Rooftop Runoff Detention Requirements at 0.19, 0.25, 0.50 and 1.00-inch Rainfall Levels

Rooftop Type	Total Rooftop Area (Acres)	Estimated Runoff Detention (Million of Gallons) at 0.19" – 1.00" Rainfall Levels			
		0.19"	0.25"	0.50"	1.00"
Detached House	192.82	1.0	1.3	2.6	5.2
Semi – Detached House	83.39	0.4	0.6	1.1	2.2
Rowhouse	1,037.66	5.3	7.0	14.1	28.1
Apartment	296.74	1.5	2.0	4.0	8.1
Comm./Inst.	1,060.29	5.4	7.1	14.2	28.4
Federal	227.29	1.2	1.5	3.1	6.2
Total	**2,898.19**	**14.8**	**19.5**	**39.1**	**78.2**

Table 11. Estimated Runoff Volume Reduction Potential for Anacostia, Rock Creek and Potomac CSO Areas Based on a 0.19-Inch Rainfall Event

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Estimated Runoff Volume in Millions of Gallons (m.g.) and Percent (%) of Total												
			Detached House		Semi-Detached		Rowhouse		Apartment		Commercial/ Institution		Federal		Total (m.g.)
			m.g.	%	m.g.	%	m.g.	%	m.g.	%	m.g.	%	m.g.	%	
Anacostia River	7,081.7	1,489.6	0.2	2.1	0.1	1.8	3.2	42.2	0.5	6.4	2.8	37.0	0.8	10.6	7.7
Rock Creek	4,546.4	1,060.4	0.8	14.7	0.3	5.1	1.8	32.6	0.9	16.6	1.5	28.7	0.1	2.3	5.4
Potomac River	1,318.4	348.2	0.0	2.3	0.0	1.0	0.3	18.9	0.1	8.3	1.0	56.8	0.2	12.8	1.8
Total	**12,946.5**	**2,898.2**	**1.0**		**0.4**		**5.3**		**1.5**		**5.3**		**1.1**		**14.9**

[4] Assumed 100 percent runoff (i.e., no depression storage, evaporation, etc.).

3.2 Rain Barrel Performance and User Satisfaction

Excepting regular and timely feedback from one participant, the level of response to COG's request for monthly water level and maintenance data was extremely poor. This was in spite of each participant's possession of both data logs and self-addressed, stamped envelopes. However, it is important to note that every participant returned a project evaluation form at the conclusion of the study period.

As summarized in Table 12, six (60 percent) of the participants chose to assume ownership of their barrel(s) and four (40 percent) did not. Six participants (60 percent) responded that they were "very satisfied" with overall rain barrel performance, while three participants (30 percent) expressed dissatisfaction. One participant (10 percent) was generally satisfied. The reasons given for dissatisfaction included excessive maintenance demands, insufficient yard drainage area and a lack of need for the water stored in rain barrels. Nine participants (90 percent) reported that they drained their barrel(s) onto their yards, gardens and/or plant beds, while one (10 percent) drained her barrel into an alleyway.

Rain barrel draining frequency by participants averaged 2.7 times per month, ranging from less than once to as many as six times. The majority of participants did not drain barrels after each rainfall event, in spite of written and verbal instructions strongly recommending this practice. An important consequence of the failure to drain barrels is their reduced capacity and the resulting increase in overflow frequency beyond that which would be expected based on roof area and barrel capacity.

Regular site visits by COG staff also played an important part in the evaluation of rain barrel performance (Figure 13). These inspections revealed the accumulation of organic and mineral debris on the barrel screens, covering an average of 8 percent and ranging from two (2) percent to as much as 18 percent of the surface (Figure 14, Table 13). While a small portion of this material passed through the screened lids, resulting in an accumulation up to 0.24 inches deep in the bottom of some barrels, it did not appear to affect barrel performance. Water level measurements by COG staff showed that the 36-inch tall barrels contained on average approximately 20 inches of standing water. This level represents over 60 percent of the available capacity and, as previously noted, greatly reduced the overall effectiveness of the rain barrels. On more than one occasion, COG staff also detected a mild odor emanating from the standing water in several of the barrels. It should also be noted that barrel water was often frozen for extended periods during the months of January and February. When the barrels remained full (i.e., undrained) under freezing conditions, ice formed on or below the surface of the screened lids, causing additional runoff to spill over and out of the barrels and resulting in ice formation on walkways and surrounding areas (Figure 15). This situation potentially limits rain barrel use in the Washington DC area to three and a half-season use and further, strongly suggests that barrel owners need to maintain rain barrel drain valves in an open position during winter months to reduce the likelihood of these ice-related problems.

As previously noted, qualitative rain barrel water quality testing was accomplished using Hach Pocket Colorimeter™ meters, shown in Figure 16. The mean rain barrel water levels of some pollutants of concern in the region were found to be higher than ambient wet weather levels (Table 14). The mean level of total phosphorus was 0.15 mg/l, compared to an ambient range of 0.09-0.06 mg/l (Watershed Protection Techniques Article 15 Technical note #105). Nitrate was encountered at a mean concentration of 1.66 mg/l in rain barrel water samples, compared to a weighted mean concentration of level of 1.23 mg/l in eastern Maryland (National Atmospheric Deposition Program, 2001). Nitrate levels are of particular importance, since atmospheric deposition of nitrogen accounts for 21 percent of the nitrogen pollution entering the Chesapeake Bay (EPA, 2000).

The Hobo TempMentor™ temperature gauge showed that water temperature in the control barrel closely tracked ambient air temperatures, while data from the Horiba U10 Water Quality Checker™ indicated that dissolved oxygen levels remained below 5mg/l for the duration of the monitoring period. Cumulative precipitation totals along with water and air temperature and dissolved oxygen levels are presented in Appendix 2, Table 1.

Although the water quality benefits resulting from an expanded rain barrel program in the District of Columbia would be somewhat difficult to quantify due to the difficulty of data collection and to variability in rain barrel maintenance and draining frequency by homeowners, any additional stormwater runoff control would likely result in some reduction in associated pollutant loads. This, in conjunction with the current region-wide trend toward improved air quality (COG, 2001), would help to reduce the impacts on the region's aquatic ecosystems.

Table 12. Participant Rain Barrel Performance Assessment

Site ID No.	Building Type	Total Number of Rain Barrels	Approximate Number of Monthly Rain Barrel Dewatering Events		Overall Rain Barrel Performance			Declined Ownership of Rain Barrel
			per Rain Barrel	Discharge Location	Dissatisfied	Satisfied	Very Satisfied	
1	Detached	4	4	Yard			•	
2	Rowhouse	1	3	Alleyway		•		•
3	Detached	3[1]	6	Yard	•			•
4	Rowhouse	1	1	Plant Bed	•			•
5	Detached	1	4	Pond/Yard			•	
6	Rowhouse	1	1	Garden			•	
7	Rowhouse	1	3	Yard			•	
8	Rowhouse	1	<1	Yard	•			•
9	Rowhouse	1	2	Garden/Yard			•	
10	Semi-Det.	1	2	Yard			•	
Total	**10**	**15**	**Mean=2.7**		**3 (30%)**	**1 (10%)**	**6 (60%)**	**4 (40%)**

[1] One barrel removed in April at participant's request

Table 13. Summary: Rain Barrel Site Inspection Summary (January - September 2001)

Site ID No.	Building Type	Total Number of Barrels Installed	Total Number of Site Visits by COG Staff	Larval Mosquito Presence/ Abundance and Date[1]	Approx. Percent of Screen Covered by Debris	Average Monthly Barrel Water Level	
						Water Level (Inches)	Remaining Storage Capacity (%)[4]
1	Detached	4	6	None	13	20.0	39.6
2	Rowhouse	1	6	None	9	26.4	19.0
3	Detached	3[2]	6	None	8	7.0	78.5
4	Rowhouse	1	6	None	11	27.7	15.0
5	Detached	1	6	None	2	6.4	80.4
6	Rowhouse	1	6	None	2	30.2	7.3
7	Rowhouse	1	6	None	5	15.0	54.0
8	Rowhouse	1	No data[3]	None	No data	No data	No data
9	Rowhouse	1	6	None	4	26.3	19.3
10	Semi-Det.	1	6	L (7/13)	18	21.8	33.1
	Total	**15**		**Average**	**8**	**20.1**	**38.4**

[1]Relative abundance of mosquito larvae: L = 0-10, M = 11-50, H = 51 +
[2] One barrel removed in April at participant's request
[3]Access to barrel by COG staff restricted by locked gate
[4]Based on gallons

While the study participants did not report finding either adult or larval mosquitoes, COG staff did, however, observe one mosquito larva in a participant's barrel. In addition, approximately 15 mosquito larvae were also observed during an inspection of the COG 'control' barrel. Although the evidence suggests that adult mosquitoes were able to gain access to both of these barrels, the screened lids were determined to be an effective deterrent if mounted correctly and free of holes or other defects.

Figure 13. Rain Barrel Inspection by COG Staff

Figure 14. Organic Debris on Rain Barrel Screen

Figure 15. Ice Accumulation on Rain Barrel Screen

It should also be noted that upon the request of one of the participants, the subcontractor removed one out of four rain barrels from her home in April to remedy a yard drainage problem. This action reduced the number of project barrels from 16 to 15, excluding the 'control' barrel. At present, according to the terms of the participant contract, the subcontractor is in the process of reconnecting the gutter and downspout systems of those participants who elected to remove their barrel(s).

Figure 16. Sample Rain Barrel Water Quality Testing Equipment

Table 14. Summary: Rain Barrel Water Quality Monitoring Results

Level	Water Quality Parameter					
	Nitrate (mg/L)	Total Phosphorus (mg/L)	Copper (µg/L)	Aluminum (mg/L)	Total Iron (mg/L)	TDS (mg/L)
Min	0.92	0.07	38	0.05	0.06	0
Max	2.46	0.29	158	0.18	0.66	21
Mean	1.66	0.15	88	0.08	0.27	16
Ambient	1.23[1]	0.09-0.06[2]	6.6-17.8[3]	-	-	-
DC W.Q. Std.	N/A	N/A	*	N/A	≤ 1.0[4]	N/A

N/A – Not Applicable/No current standard
* Variable alkalinity-based hourly maximum standard currently in use. Note: 0.18 µg/L instantaneous concentration criterion widely accepted level for protecting freshwater aquatic life.
[1] Wye River, Maryland station (National Atmospheric Deposition Program, 2001).
[2] Marquette, Michigan data (Watershed Protection Techniques Article 15 Technical note #105)
[3] Marquette, Michigan data (Watershed Protection Techniques Article 15 Technical note #105)
[4] Soluble form

3.3 Rooftop Volume Control with Rain Barrels

Based on rooftop area, runoff volume from a 0.19" rainfall and the 75-gallon barrel capacity, approximately 0.21 acres out of the total 0.25 acres of rooftop area was controlled during the rain barrel demonstration project. This represents approximately 82 percent of the total combined rooftop area of the 10 sites. Using barrel draining frequency data from the final participant survey in the calculations, the rain barrels controlled approximately 27,521 gallons out of a total of 211,950 gallons of runoff during the study period[5]. This represents an 11.5 percent average runoff capture efficiency across all of the sites (Table 15).

In addition, COG staff developed a set of generalized curves showing acreage and runoff volume control relationships for a 0.19-inch rainfall event for both detached houses and rowhouses (Figure 17). Next, to provide additional insight, the number of barrels

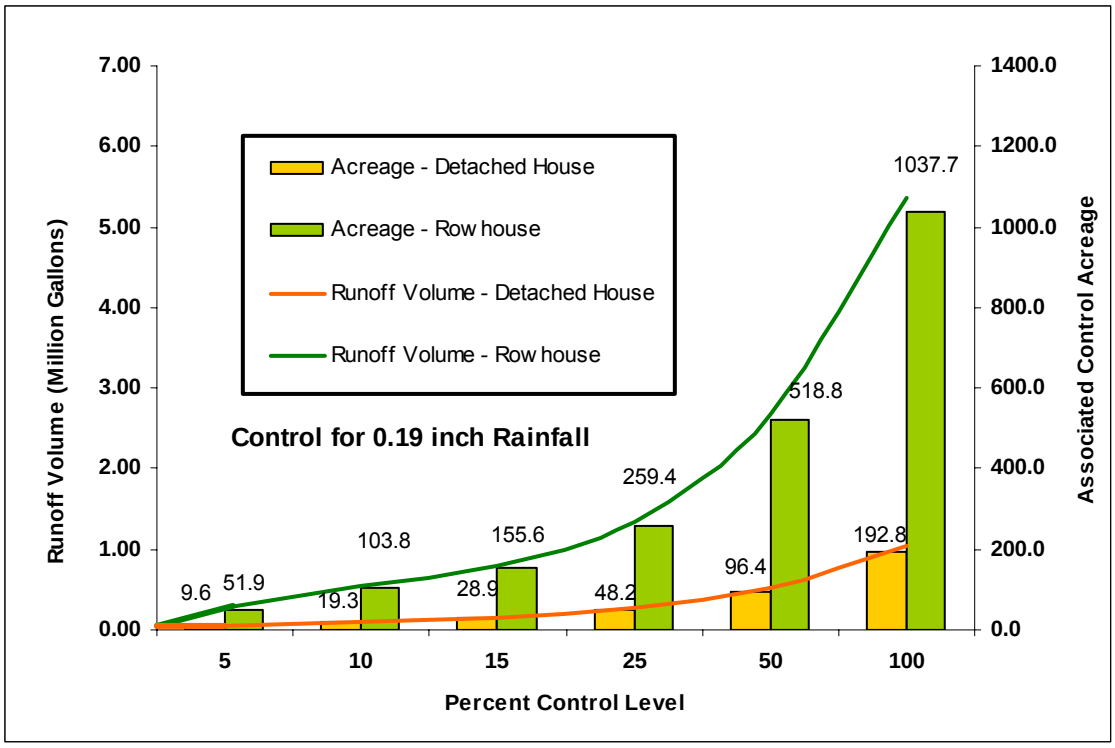
[5] Total runoff volume calculations based on precipitation totals measured at Reagan National Airport (Appendix 2)

required for each building type to control the runoff volume produced from this rainfall event was calculated. The results are included as Table 16. Using the preceding results, COG staff then calculated the cost per acre and cost per million gallons of storage associated with implementing a hypothetical residential rooftop rain barrel-based runoff control program under a range of runoff management levels (Table 17).

Table 15. Summary: Rooftop Area and Monthly Runoff Volume Controlled by Participant Rain Barrels

Total Rooftop Area		Rooftop Area Controlled by Barrels[1]		Jan	Feb	March	April	May	June	July	Aug	Total	% of Total
Ft^2	acres	Ft^2	acres	Controlled Rainfall Volume (Gallons)									
10,922	0.25	9,046	0.21	3,066	3,504	3,796	3,139	3,504	2,993	4,526	2,993	**27,521**	**11.5**
				Uncontrolled Rainfall Volume (Gallons)									
				17,532	13,475	32,482	12,448	30,918	40,522	39,917	24,656	**211,950**	**88.5**

[1]Rooftop area controlled by rain barrels represents 82% of the combined rooftop area of the study houses



Note: Semi-detached houses, which comprise only 3% of total rooftop area, were not included

Figure 17. Management Level Relationship for Detached versus Rowhouse Rooftop Types

Table 16. Estimated Total Number of Rain Barrels Required to Store Runoff from a 0.19-Inch Rainfall

Watershed	CSO Area (Acres)	Total Rooftop Area (Acres)	Number Rain Barrels Required					
			Detached House[1]	Semi Detached House[2]	Rowhouse[3]	Apartment	Commercial/ Institutional	Federal
Anacostia River	7,081.7	1,489.6	2,102	1,802	43,273	6,521	37,876	10,894
Rock Creek River	4,546.4	1,060.4	10,612	3,695	23,592	11,914	21,455	1,681
Potomac River	1,318.4	348.2	550	239	4,515	1,978	13,607	3,061
Total	**12,946.5**	**2,898.2**	**13,264**	**5,736**	**71,380**	**20,413**	**72,938**	**15,636**

[1]Calculations based on a total of four barrels per structure
[2, 3]Calculations based on a total of two barrels per structure

Results (Table 17) show that on a strictly cost/acre of roof basis, rain barrel-based runoff control appears to be more cost effective for rowhouses than for detached houses (i.e., $8,095/acre vs. $16,079/acre). The results further suggest that it would be necessary to control approximately 20 percent of rowhouses (i.e., approximately 6,981 units) in the CSO portion of the city at an estimated cost of roughly $1.7 million to achieve a meaningful (e.g., 1,000,000 gallon) reduction in runoff volume. It is estimated that full implementation of the above scenario could take as long as 10 to 15 years at an assumed rate of 400-600 units per year, installation, maintenance and other problems notwithstanding.

Table 17. CSO-Wide Residential Rooftop Control Cost Comparison to Store Runoff from a 0.19-Inch Rainfall

Control Level (%)	Rooftop Area Required (Acres)			Storage Volume Required (Million gallons)			Associated Number of Units			Associated Rain Barrel Cost ($)[1]		
	Detached House	Semi-Detached House	Row-house	Detached House	Semi-Detached House	Row-house	Detached House	Semi-Detached House	Row-house	Detached House	Semi-Detached House	Row-house
5.0	9.6	4.2	51.9	0.05	0.02	0.27	324.3	140.2	1,745.3	$155K	$34K	$418K
10.0	19.3	8.3	103.8	0.10	0.05	0.54	648.6	280.5	3,490.6	$311K	$67K	$837K
15.0	28.9	12.5	155.6	0.16	0.07	0.80	972.9	420.7	5,235.9	$466K	$100K	$1.3Mil.
25.0	48.2	20.8	259.4	0.26	0.11	1.34	1,621.5	701.2	8,726.5	$778K	$168K	$2.1 Mil.
50.0	96.4	41.7	518.8	0.52	0.23	2.68	3,242.9	1,402.5	17,453.1	$1.6 Mil.	$336K	$4.2Mil.
100.0	192.8	83.4	1,037.7	1.05	0.45	5.35	6,485.9	2,805.0	34,906.1	$3.1 Mil.	$673K	$8.4 Mil.

[1]Cost estimates based on $95 Govt./Non-Profit rain barrel purchase price, $25 in materials, and no-cost installation by homeowners

In addition to cost, maintenance requirements and installation constraints must be considered in future rain barrel installation planning. While fairly straightforward, effective rain barrel implementation requires that, at a minimum, consideration be given to the following:

1. Site location (e.g., level surface, ample clearance, especially between rowhouses, appropriate location for discharge, etc.);

2. Presence of a structurally sound and properly functioning gutter and downspout system;

3. Ability of the installer to perform necessary modification to downspouts (i.e., cutting, fitting curved sections, tightening of machine screws and sealing system where necessary); and
4. Willingness/ability of homeowner to ensure proper functioning through rain barrel monitoring and maintenance. More specifically:

    - Weekly inspections should be performed during the summer months to prevent colonization by mosquitoes and/or eliminate existing mosquito larvae.

    - Rain barrel drain valves should be kept in the 'open' position for a two to three-month period during the winter months (e.g., December – February) to reduce the likelihood of ice formation and excessive overflows.

    - Gutters and downspouts should be inspected seasonally and cleaned when necessary.

3.4 Summary of Major Findings

Rooftop Type Analysis

- The total CSO area-wide rooftop area calculated by COG staff is approximately 2,898 acres. Of this total, approximately 1,490 acres are associated with the Anacostia River CSO area, 1,060 acres with Rock Creek and 348 acres with the Potomac River CSO area;

- The CSO area-wide rooftop type distribution is as follows: 1) detached house - 193 acres (7%), 2) semi-detached house - 83 acres (3%), 3) rowhouse – 1,038 acres (36%), 4) apartment - 297 acres (10%), 5) commercial/ institutional - 1060 acres (36%), and 6) federal - 227 acres (8%);

- The Anacostia CSO area had the highest percentage of rowhouse, commercial/institutional, and federal roofs, while the Rock Creek CSO area had the highest percentage of detached house and apartment roofs; and

- The estimated CSO area-wide rooftop runoff volume detention requirements associated with 0.19 to 1.0-inch rainfall events ranges from 15.1 to 79.2 million gallons.

Rain Barrels

- Results from this study indicate that rain barrels have tremendous potential as a public relations tool for promoting a more environmentally friendly lifestyle and for increasing awareness about both the CSO problem and the need for stormwater management in the city;

- Results also suggest that, given clear instructions, the average District of Columbia homeowner could properly install a rain barrel with little or no assistance from the city. However, without an ongoing educational campaign and periodic inspection and maintenance assistance from the city, it is unlikely that meaningful, long-term CSO flow reductions will be achieved;

- Only 60 percent of the participants were satisfied with their rain barrels and chose to assume ownership at the end of the evaluation period. Among the reasons given for dissatisfaction were excessive maintenance demands, insufficient yard area for drainage and a lack of need for the water;

- To be effective, rain barrels require regular dewatering and occasional maintenance by homeowners, as there is little or no attenuation unless barrels are drained between rainfall events;

- Draining frequency by participants averaged 2.7 times per month. This frequency was far below the recommended level for effective operation (i.e., detention of stormwater volumes at or near the 75-gallon capacity of the barrels) in spite of written and verbal instructions strongly recommending this practice;

- When the barrels remained full (i.e., undrained) under freezing conditions during the months of January and February, ice formed at or below on the surface of the screened lids. Under such conditions, additional runoff spilled over and out of the barrels resulting in ice formation on walkways and surrounding areas. These findings suggest that the effective use of rain barrels in the District of Columbia is limited to three and half seasons;

- The appearance and apparent expansion of West Nile virus in the Washington, DC metropolitan area since 1999 has heightened public awareness of and concern about the presence of mosquito breeding habitat. Although only two of the rain barrels used in the study were found to contain larvae, improperly installed and/or maintained rain barrels could inadvertently provide additional breeding habitat for mosquitoes;

- On a unit cost/acre of roof basis, rain barrel-based runoff control appears to be more cost effective for rowhouses than for detached houses (i.e., $8,095/acre vs. $16,079/acre);

- COG staff calculations indicate that to achieve a modest 1,000,000-gallon reduction in stormwater volume to the CSS, it would be necessary to install rain barrels at approximately 20 percent of rowhouses (i.e., approximately 6,981 units) in the CSO portion of the city at an estimated cost of roughly $1.7 million; and

- The relative cost effectiveness of rain barrels as an integral part of the Long Term Control Plan stormwater volume control is somewhat questionable at this time

because of the large number of barrels required to control a significant percentage of roof area.

District of Columbia Building Code

- Review of the District of Columbia's Building Code revealed that the potential for rooftop storage alternatives (e.g., green roofing) is governed by a minimum structural load requirement of 50 pounds per square foot (pfs) for a uniformly distributed live load (DC Register, 1999). Alterations to existing buildings built before July 1, 1925 are allowed a maximum reduction of 30 percent of the specified minimum live load, with a minimum live load of 40 psf for nonresidential buildings (DC Register, 1999).

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Appendix 1

Item 1. Rooftop Analysis Methodology

Using 0.2-meter resolution Vargis, LLC aerial orthophotos provided by the National Capital Planning Commission (NCPC), COG staff digitized rooftop surfaces in the CSO portion of the District of Columbia using ESRI ArcView Version 3.2 GIS.

Attribute data from the COG GIS database along with the NCPC's District of Columbia zoning regulation planemetric layer were then used to categorize rooftop types. Buildings were placed into one of six rooftop type categories including detached houses, semi-detached houses, rowhouses, apartments, commercial/institutional buildings, and federal buildings. COG staff then created CSO area, river, and road data layers to correspond with each of the three CSS Receiving water body areas, Anacostia, Rock Creek, and Potomac. These data layers and the digitized building rooftop layer were used in the creation of separate maps for each CSS catchment area.

Following creation of the first draft maps, COG staff performed limited ground truthing to confirm building classification. The final rooftop type classification and area calculation yielded data on potential stormwater runoff volumes from each rooftop type in each of the three CSO sewersheds.

Appendix 1. Rooftop Type Analysis Data

Anacostia River

Rock Creek

Potomac River

Appendix 1

Table 1. CSO Area Description and Associated Rooftop Type Acreage

Watershed	Npdes Outfall Facility #	CSO Ward #	CSO Name	CSO Area (Acres)	Detached House	Semi-Detached House	Rowhouse	Apartment	Commercial/ Institutional	Federal	Total Rooftop Area (Acres)
Anacostia River	O19	1,2,4,5,6	Northeast Boundary	4246.3	19.72	17.31	441.33	53.32	344.24	13.03	888.95
Anacostia River	O12	2,5,6	Tiber Creek	1195.7	1.81	2.97	88.32	20.45	101.67	72.20	287.42
Anacostia River	O10	2,6	B St/N.J. Ave	437.3	0.00	0.00	0.00	0.00	41.36	62.74	104.10
Anacostia River	O17	6	Navy Yard - M St. 14th to Penn. Ave.	259.9	0.50	0.72	30.78	1.96	8.20	0.00	42.16
Anacostia River	OO7	6	Fort Stanton 3	191.2	5.01	2.63	8.36	6.16	5.73	0.00	27.89
Anacostia River	O16	6	Navy Yard - 9th to 12th	152.6	0.28	0.43	17.30	2.17	3.80	0.43	24.41
Anacostia River	O10	2,6	B St/N.J. Ave	145.4	0.22	0.00	11.29	4.66	9.90	0.00	26.07
Anacostia River	O14	6	Navy Yard - 6th and 7th	97.1	0.32	0.50	12.92	2.09	9.54	0.75	26.12
Anacostia River	OO5	6,8	Fort Stanton 1	74.9	2.15	0.80	3.76	1.41	6.28	0.00	14.40
Anacostia River	O10	2	B St/N.J. Ave	62.3	0.00	0.00	0.00	0.00	2.29	0.73	3.02
Anacostia River	O18	6	Barney Circle	38.9	0.07	0.08	6.41	0.19	1.33	0.00	8.08
Anacostia River	O18	6	E. Barney Circle	38.7	0.07	0.07	4.69	0.27	1.29	0.00	6.39
Anacostia River	O14	6	Navy Yard - 6th and 7th	30.9	0.00	0.00	0.00	1.21	3.04	0.00	4.25
Anacostia River	O15	6	Navy Yard	23.8	0.00	0.02	0.23	0.50	0.66	0.00	1.41
Anacostia River	O10	6	B St/N.J. Ave	16.4	0.00	0.00	0.00	0.00	1.12	5.39	6.51
Anacostia River	OO6	6	Fort Stanton 2	15.6	0.33	0.33	0.35	0.00	3.17	0.00	4.18
Anacostia River	O13	6	Canal Street Sewer	14.7	0.08	0.16	1.15	0.41	0.27	0.00	2.07
Anacostia River	O18	6	Kentucky Ave.	13.0	0.00	0.05	2.01	0.00	0.19	0.00	2.25
Anacostia River	OO9	6	B St/N.J. Ave	11.9	0.00	0.00	0.00	0.00	0.75	3.09	3.84
Anacostia River	OO9	6	B St/N.J. Ave	7.9	0.00	0.12	0.16	0.00	1.92	0.00	2.20
Anacostia River	OO9	6	B St/N.J. Ave	5.3	0.00	0.00	0.00	0.00	2.51	0.00	2.51
Anacostia River	OO9	6	B St/N.J. Ave	2.1	0.00	0.00	0.00	0.00	1.34	0.00	1.34
	Subtotal			**7081.7**	**30.56**	**26.19**	**629.06**	**94.80**	**550.60**	**158.36**	**1489.57**
Rock Creek	O31	2	Penn Ave. - (East)	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Creek	UD	2	NONE	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Creek	O58	1	Connecticut Avenue (West)	3.5	0.00	0.00	0.41	0.42	0.00	0.00	0.83
Rock Creek	UD	2	NONE	3.6	0.00	0.00	0.26	0.00	1.15	0.00	1.41
Rock Creek	UD	2	NONE	4.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Creek	O53	2,1	Q-St. West Rock Creek	4.5	0.00	0.00	0.00	0.00	0.99	0.00	0.99
Rock Creek	UD	2	NONE	4.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Creek	O36	2	Mass. Ave & 24th St.. E. Rock Creek	5.7	0.00	0.00	0.00	0.00	0.43	0.00	0.43
Rock Creek	O47	1	Ingleside Terrace - Upper East Rock Creek	6.5	0.05	0.04	1.68	0.00	0.00	0.00	1.77
Rock Creek	O50	2	M St. 27th St	7.2	0.55	0.06	0.88	0.00	0.21	0.00	1.70
Rock Creek	O58	1,3	Connecticut Avenue (West)	8.2	0.00	0.00	0.00	0.00	0.73	0.00	0.73
Rock Creek	O58	3	Connecticut Avenue (West)	10.0	0.00	0.00	0.00	3.69	0.00	0.00	3.69
Rock Creek	O38	1	Kalorama Circle East - East Rock Creek	10.2	0.93	0.00	0.00	0.00	0.31	0.00	1.24
Rock Creek	O33	2	N St. to 25th St.	12.0	0.00	0.00	0.00	0.00	5.70	0.00	5.70
Rock Creek	O27	2	Georgetown	12.7	0.26	0.00	0.37	0.00	2.15	0.00	2.78
Rock Creek	O50	2,3	M St. 27th St.	12.9	0.79	0.46	2.46	0.06	0.36	0.00	4.13
Rock Creek	O32	2	26 St. - M St. (East)	13.5	0.00	0.00	0.50	0.00	2.33	0.00	2.83
Rock Creek	O57	1	28th St. and Conn. Ave.	13.8	2.58	0.00	0.00	0.00	0.10	0.00	2.68
Rock Creek	O41	1	Ontario Road - Upper East Rock Creek	15.0	0.23	0.20	2.89	2.22	0.12	0.00	5.66
Rock Creek	O44	1	Kenyon Street - Upper East Rock Creek	15.7	0.02	0.00	4.49	0.12	0.00	0.00	4.63
Rock Creek	O46	1	Park Road - Upper East Rock Creek	15.9	0.88	0.08	3.35	0.60	0.00	0.00	4.91
Rock Creek	O40	1	Biltmore Road - East Rock Creek	17.2	0.11	0.39	3.45	0.71	0.91	0.00	5.57
Rock Creek	O48	1	Upper East Rock Creek	17.7	0.68	0.11	2.72	1.41	0.00	0.00	4.92
Rock Creek	O45	1	Lamont St.- Upper East Rock Creek	19.4	0.06	0.31	4.16	0.00	0.00	0.00	4.53
Rock Creek	O51	2	Olive 29th St.	30.2	1.31	0.54	1.87	0.06	4.72	0.00	8.50
Rock Creek	UD	2	NONE	31.7	0.00	0.00	0.00	0.69	1.25	0.00	1.94
Rock Creek	O42	1	Quarry Road - Upper East Rock Creek	35.2	0.31	0.19	2.67	6.04	0.20	0.00	9.41
Rock Creek	O39	1	Belmont Road - East Rock Creek	42.7	0.88	0.32	2.92	5.11	0.96	0.00	10.19
Rock Creek	O55	3	Abandoned	47.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock Creek	O36	1,2	Mass. Ave. & 24th St.	59.8	6.35	0.00	2.35	2.50	1.83	0.00	13.03
Rock Creek	O58	3	Connecticut Avenue (West)	73.5	5.90	0.05	0.00	0.65	9.40	0.00	16.00
Rock Creek	O43	1	Irving Street - Upper East Rock Creek	75.6	0.29	0.57	12.19	5.41	5.47	0.00	23.93
Rock Creek	O52	2	O St. to 31st St.	111.7	8.22	1.58	11.72	2.41	1.92	0.00	25.85
Rock Creek	O34	2	Slash Run	424.3	0.29	1.33	16.75	25.51	115.06	2.00	160.94
Rock Creek	O59	4	Luzon Valley	459.4	31.55	6.52	4.50	12.95	7.44	21.68	84.64
Rock Creek	O35	1,2	Northwest Boundary	534.0	4.29	2.05	60.92	48.02	53.41	0.00	168.69
Rock Creek	O49	1,4	Piney Branch	2384.3	87.74	38.92	199.45	54.61	94.74	0.75	476.21
	Subtotal			**4546.4**	**154.27**	**53.72**	**342.96**	**173.19**	**311.89**	**24.43**	**1060.46**
Potomac River	O21	2	Water Street	1.3	0.00	0.00	0.08	0.00	0.00	0.00	0.08
Potomac River	O23	2	Diversion Sewer	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potomac River	O27	2	Georgetown	2.8	0.00	0.00	0.00	0.00	0.83	0.00	0.83
Potomac River	O27	2	Water Street	4.8	0.00	0.00	0.65	0.22	1.55	0.00	2.42
Potomac River	O23	2	Diversion Sewer	9.8	0.00	0.00	0.27	0.00	3.57	0.81	4.65
Potomac River	O21	2	31St & K St.	10.0	0.00	0.00	0.73	0.00	3.43	0.00	4.16
Potomac River	O23	2	Diversion Sewer	13.8	0.02	0.00	0.42	0.00	6.44	0.00	6.88

Appendix 1

Watershed	Npdes Outfall Facility #	CSO Ward #	CSO Name	CSO Area (Acres)	Detached House	Semi-Detached House	Rowhouse	Apartment	Commercial/ Institutional	Federal	Total Rooftop Area (Acres)
Potomac River	O21	2	Slash Run	14.0	0.00	0.00	0.00	4.11	0.00	0.00	4.11
Potomac River	O28	2	Key Bridge/Whitehurst Frwy	16.1	0.31	0.11	1.21	1.49	1.06	0.00	4.18
Potomac River	O21	2	Slash Run	33.1	0.00	0.00	0.00	0.00	0.00	1.01	1.01
Potomac River	O22	2	Slash Run	141.6	0.07	0.05	4.01	8.80	22.09	2.23	37.25
Potomac River	O27	2	Georgetown	159.2	5.37	0.91	23.23	0.93	19.90	0.00	50.34
Potomac River	O29	2, 3	College Pond	286.0	2.05	2.08	28.15	1.59	19.08	0.00	52.95
Potomac River	O20	2	Easby Point	623.7	0.17	0.33	6.89	11.61	119.85	40.45	179.30
	Subtotal			**1318.4**	**7.99**	**3.48**	**65.64**	**28.75**	**197.80**	**44.50**	**348.16**
	Total			**12946.5**	**192.82**	**83.39**	**1,037.66**	**296.74**	**1,060.29**	**227.29**	**2,898.19**

Appendix 1

Anacostia CSO Catchment

Table 2. Summary: Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
					5	10	25	50	75
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	44.4	88.9	222.2	444.5	666.7
Anacostia River	O12	2,5,6	1195.7	287.4	14.4	28.7	71.9	143.7	215.6
Anacostia River	O10	2,6	437.3	104.1	5.2	10.4	26.0	52.1	78.1
Anacostia River	O17	6	259.9	42.2	2.1	4.2	10.5	21.1	31.6
Anacostia River	OO7	6	191.2	27.9	1.4	2.8	7.0	13.9	20.9
Anacostia River	O16	6	152.6	24.4	1.2	2.4	6.1	12.2	18.3
Anacostia River	O10	2,6	145.4	26.1	1.3	2.6	6.5	13.0	19.6
Anacostia River	O14	6	97.1	26.1	1.3	2.6	6.5	13.1	19.6
Anacostia River	OO5	6,8	74.9	14.4	0.7	1.4	3.6	7.2	10.8
Anacostia River	O10	2	62.3	3.0	0.2	0.3	0.8	1.5	2.3
Anacostia River	O18	6	38.9	8.1	0.4	0.8	2.0	4.0	6.1
Anacostia River	O18	6	38.7	6.4	0.3	0.6	1.6	3.2	4.8
Anacostia River	O14	6	30.9	4.3	0.2	0.4	1.1	2.1	3.2
Anacostia River	O15	6	23.8	1.4	0.1	0.1	0.4	0.7	1.1
Anacostia River	O10	6	16.4	6.5	0.3	0.7	1.6	3.3	4.9
Anacostia River	OO6	6	15.6	4.2	0.2	0.4	1.0	2.1	3.1
Anacostia River	O13	6	14.7	2.1	0.1	0.2	0.5	1.0	1.6
Anacostia River	O18	6	13.0	2.3	0.1	0.2	0.6	1.1	1.7
Anacostia River	OO9	6	11.9	3.8	0.2	0.4	1.0	1.9	2.9
Anacostia River	OO9	6	7.9	2.2	0.1	0.2	0.6	1.1	1.7
Anacostia River	OO9	6	5.3	2.5	0.1	0.3	0.6	1.3	1.9
Anacostia River	OO9	6	2.1	1.3	0.1	0.1	0.3	0.7	1.0
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**79.5**	**159.0**	**397.4**	**794.8**	**1192.2**

Table 3. Summary: Detached House Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Detached Rooftop Area (Acre)	Detached House Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	19.7	1.0	2.0	4.9	9.9	14.8
Anacostia River	O12	2,5,6	1195.7	287.4	1.8	0.1	0.2	0.5	0.9	1.4
Anacostia River	O10	2,6	437.3	104.1	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O17	6	259.9	42.2	0.5	0.0	0.1	0.1	0.3	0.4
Anacostia River	OO7	6	191.2	27.9	5.0	0.3	0.5	1.3	2.5	3.8
Anacostia River	O16	6	152.6	24.4	0.3	0.0	0.0	0.1	0.1	0.2
Anacostia River	O10	2,6	145.4	26.1	0.2	0.0	0.0	0.1	0.1	0.2
Anacostia River	O14	6	97.1	26.1	0.3	0.0	0.0	0.1	0.2	0.2
Anacostia River	OO5	6,8	74.9	14.4	2.2	0.1	0.2	0.5	1.1	1.6
Anacostia River	O10	2	62.3	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O18	6	38.9	8.1	0.1	0.0	0.0	0.0	0.0	0.1
Anacostia River	O18	6	38.7	6.4	0.1	0.0	0.0	0.0	0.0	0.1
Anacostia River	O14	6	30.9	4.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O15	6	23.8	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O10	6	16.4	6.5	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO6	6	15.6	4.2	0.3	0.0	0.0	0.1	0.2	0.2
Anacostia River	O13	6	14.7	2.1	0.1	0.0	0.0	0.0	0.0	0.1
Anacostia River	O18	6	13.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	11.9	3.8	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	7.9	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	5.3	2.5	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	2.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**30.6**	**1.5**	**3.1**	**7.6**	**15.3**	**22.9**

Appendix 1

Anacostia CSO Catchment

Table 4. Summary: Semi-Detached House Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Semi-Detached Rooftop Area (Acre)	Semi-Detached House Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	17.31	0.87	0.09	4.33	8.66	13.0
Anacostia River	O12	2,5,6	1195.7	287.4	2.97	0.15	0.01	0.74	1.49	2.2
Anacostia River	O10	2,6	437.3	104.1	0.00	0.00	0.00	0.00	0.00	0.0
Anacostia River	O17	6	259.9	42.2	0.72	0.04	0.00	0.18	0.36	0.5
Anacostia River	OO7	6	191.2	27.9	2.63	0.13	0.01	0.66	1.32	2.0
Anacostia River	O16	6	152.6	24.4	0.43	0.02	0.00	0.11	0.22	0.3
Anacostia River	O10	2,6	145.4	26.1	0.00	0.00	0.00	0.00	0.00	0.0
Anacostia River	O14	6	97.1	26.1	0.50	0.03	0.00	0.13	0.25	0.4
Anacostia River	OO5	6,8	74.9	14.4	0.80	0.04	0.00	0.20	0.40	0.6
Anacostia River	O10	2	62.3	3.0	0.00	0.00	0.00	0.00	0.00	0.0
Anacostia River	O18	6	38.9	8.1	0.08	0.00	0.00	0.02	0.04	0.1
Anacostia River	O18	6	38.7	6.4	0.07	0.00	0.00	0.02	0.04	0.1
Anacostia River	O14	6	30.9	4.3	0.00	0.00	0.00	0.00	0.00	0.0
Anacostia River	O15	6	23.8	1.4	0.02	0.00	0.00	0.01	0.01	0.0
Anacostia River	O10	6	16.4	6.5	0.00	0.00	0.00	0.00	0.00	0.0
Anacostia River	OO6	6	15.6	4.2	0.33	0.02	0.00	0.08	0.17	0.2
Anacostia River	O13	6	14.7	2.1	0.16	0.01	0.00	0.04	0.08	0.1
Anacostia River	O18	6	13.0	2.3	0.05	0.00	0.00	0.01	0.03	0.0
Anacostia River	OO9	6	11.9	3.8	0.00	0.00	0.00	0.00	0.00	0.0
Anacostia River	OO9	6	7.9	2.2	0.12	0.01	0.00	0.03	0.06	0.1
Anacostia River	OO9	6	5.3	2.5	0.00	0.00	0.00	0.00	0.00	0.0
Anacostia River	OO9	6	2.1	1.3	0.00	0.00	0.00	0.00	0.00	0.0
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**26.19**	**1.31**	**0.13**	**6.55**	**13.10**	**19.6**

Table 5. Summary: Rowhouse Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rowhouse Rooftop Areas (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	441.3	22.1	44.1	110.3	220.7	331.0
Anacostia River	O12	2,5,6	1195.7	287.4	88.3	4.4	8.8	22.1	44.2	66.2
Anacostia River	O10	2,6	437.3	104.1	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O17	6	259.9	42.2	30.8	1.5	3.1	7.7	15.4	23.1
Anacostia River	OO7	6	191.2	27.9	8.4	0.4	0.8	2.1	4.2	6.3
Anacostia River	O16	6	152.6	24.4	17.3	0.9	1.7	4.3	8.7	13.0
Anacostia River	O10	2,6	145.4	26.1	11.3	0.6	1.1	2.8	5.6	8.5
Anacostia River	O14	6	97.1	26.1	12.9	0.6	1.3	3.2	6.5	9.7
Anacostia River	OO5	6,8	74.9	14.4	3.8	0.2	0.4	0.9	1.9	2.8
Anacostia River	O10	2	62.3	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O18	6	38.9	8.1	6.4	0.3	0.6	1.6	3.2	4.8
Anacostia River	O18	6	38.7	6.4	4.7	0.2	0.5	1.2	2.3	3.5
Anacostia River	O14	6	30.9	4.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O15	6	23.8	1.4	0.2	0.0	0.0	0.1	0.1	0.2
Anacostia River	O10	6	16.4	6.5	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO6	6	15.6	4.2	0.4	0.0	0.0	0.1	0.2	0.3
Anacostia River	O13	6	14.7	2.1	1.2	0.1	0.1	0.3	0.6	0.9
Anacostia River	O18	6	13.0	2.3	2.0	0.1	0.2	0.5	1.0	1.5
Anacostia River	OO9	6	11.9	3.8	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	7.9	2.2	0.2	0.0	0.0	0.0	0.1	0.1
Anacostia River	OO9	6	5.3	2.5	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	2.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**629.1**	**31.5**	**62.9**	**157.3**	**314.5**	**471.8**

Appendix 1

Anacostia CSO Catchment

Table 6. Summary: Apartment Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Apartment Rooftop Areas (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	53.3	2.7	5.3	13.3	26.7	40.0
Anacostia River	O12	2,5,6	1195.7	287.4	20.5	1.0	2.0	5.1	10.2	15.3
Anacostia River	O10	2,6	437.3	104.1	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O17	6	259.9	42.2	2.0	0.1	0.2	0.5	1.0	1.5
Anacostia River	OO7	6	191.2	27.9	6.2	0.3	0.6	1.5	3.1	4.6
Anacostia River	O16	6	152.6	24.4	2.2	0.1	0.2	0.5	1.1	1.6
Anacostia River	O10	2,6	145.4	26.1	4.7	0.2	0.5	1.2	2.3	3.5
Anacostia River	O14	6	97.1	26.1	2.1	0.1	0.2	0.5	1.0	1.6
Anacostia River	OO5	6,8	74.9	14.4	1.4	0.1	0.1	0.4	0.7	1.1
Anacostia River	O10	2	62.3	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O18	6	38.9	8.1	0.2	0.0	0.0	0.0	0.1	0.1
Anacostia River	O18	6	38.7	6.4	0.3	0.0	0.0	0.1	0.1	0.2
Anacostia River	O14	6	30.9	4.3	1.2	0.1	0.1	0.3	0.6	0.9
Anacostia River	O15	6	23.8	1.4	0.5	0.0	0.1	0.1	0.3	0.4
Anacostia River	O10	6	16.4	6.5	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO6	6	15.6	4.2	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O13	6	14.7	2.1	0.4	0.0	0.0	0.1	0.2	0.3
Anacostia River	O18	6	13.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	11.9	3.8	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	7.9	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	5.3	2.5	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	2.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**94.8**	**4.7**	**9.5**	**23.7**	**47.4**	**71.1**

Appendix 1

Anacostia CSO Catchment

Table 7. Summary: Commercial/Institutional Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Commercial/ Institutional Rooftop Areas (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	344.2	17.2	34.4	86.1	172.1	258.2
Anacostia River	O12	2,5,6	1195.7	287.4	101.7	5.1	10.2	25.4	50.8	76.3
Anacostia River	O10	2,6	437.3	104.1	41.4	2.1	4.1	10.3	20.7	31.0
Anacostia River	O17	6	259.9	42.2	8.2	0.4	0.8	2.1	4.1	6.2
Anacostia River	OO7	6	191.2	27.9	5.7	0.3	0.6	1.4	2.9	4.3
Anacostia River	O16	6	152.6	24.4	3.8	0.2	0.4	1.0	1.9	2.9
Anacostia River	O10	2,6	145.4	26.1	9.9	0.5	1.0	2.5	5.0	7.4
Anacostia River	O14	6	97.1	26.1	9.5	0.5	1.0	2.4	4.8	7.2
Anacostia River	OO5	6,8	74.9	14.4	6.3	0.3	0.6	1.6	3.1	4.7
Anacostia River	O10	2	62.3	3.0	2.3	0.1	0.2	0.6	1.1	1.7
Anacostia River	O18	6	38.9	8.1	1.3	0.1	0.1	0.3	0.7	1.0
Anacostia River	O18	6	38.7	6.4	1.3	0.1	0.1	0.3	0.6	1.0
Anacostia River	O14	6	30.9	4.3	3.0	0.2	0.3	0.8	1.5	2.3
Anacostia River	O15	6	23.8	1.4	0.7	0.0	0.1	0.2	0.3	0.5
Anacostia River	O10	6	16.4	6.5	1.1	0.1	0.1	0.3	0.6	0.8
Anacostia River	OO6	6	15.6	4.2	3.2	0.2	0.3	0.8	1.6	2.4
Anacostia River	O13	6	14.7	2.1	0.3	0.0	0.0	0.1	0.1	0.2
Anacostia River	O18	6	13.0	2.3	0.2	0.0	0.0	0.0	0.1	0.1
Anacostia River	OO9	6	11.9	3.8	0.8	0.0	0.1	0.2	0.4	0.6
Anacostia River	OO9	6	7.9	2.2	1.9	0.1	0.2	0.5	1.0	1.4
Anacostia River	OO9	6	5.3	2.5	2.5	0.1	0.3	0.6	1.3	1.9
Anacostia River	OO9	6	2.1	1.3	1.3	0.1	0.1	0.3	0.7	1.0
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**550.6**	**27.5**	**55.1**	**137.7**	**275.3**	**413.0**

Table 8. Summary: Federal Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Federal Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	13.0	0.7	1.3	3.3	6.5	9.8
Anacostia River	O12	2,5,6	1195.7	287.4	72.2	3.6	7.2	18.1	36.1	54.2
Anacostia River	O10	2,6	437.3	104.1	62.7	3.1	6.3	15.7	31.4	47.1
Anacostia River	O17	6	259.9	42.2	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO7	6	191.2	27.9	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O16	6	152.6	24.4	0.4	0.0	0.0	0.1	0.2	0.3
Anacostia River	O10	2,6	145.4	26.1	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O14	6	97.1	26.1	0.8	0.0	0.1	0.2	0.4	0.6
Anacostia River	OO5	6,8	74.9	14.4	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O10	2	62.3	3.0	0.7	0.0	0.1	0.2	0.4	0.5
Anacostia River	O18	6	38.9	8.1	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O18	6	38.7	6.4	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O14	6	30.9	4.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O15	6	23.8	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O10	6	16.4	6.5	5.4	0.3	0.5	1.3	2.7	4.0
Anacostia River	OO6	6	15.6	4.2	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O13	6	14.7	2.1	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	O18	6	13.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	11.9	3.8	3.1	0.2	0.3	0.8	1.5	2.3
Anacostia River	OO9	6	7.9	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	5.3	2.5	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	OO9	6	2.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**158.4**	**7.9**	**15.8**	**39.6**	**79.2**	**118.8**

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Anacostia CSO Catchment

Table 9. Summary: Detached House Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Detached House Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.251**	**0.50**	**1.00**
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	19.7	0.10	0.13	0.27	0.54
Anacostia River	O12	2,5,6	1195.7	287.4	1.8	0.01	0.01	0.02	0.05
Anacostia River	O10	2,6	437.3	104.1	0.0	0.00	0.00	0.00	0.00
Anacostia River	O17	6	259.9	42.2	0.5	0.00	0.00	0.01	0.01
Anacostia River	OO7	6	191.2	27.9	5.0	0.03	0.03	0.07	0.14
Anacostia River	O16	6	152.6	24.4	0.3	0.00	0.00	0.00	0.01
Anacostia River	O10	2,6	145.4	26.1	0.2	0.00	0.00	0.00	0.01
Anacostia River	O14	6	97.1	26.1	0.3	0.00	0.00	0.00	0.01
Anacostia River	OO5	6,8	74.9	14.4	2.2	0.01	0.01	0.03	0.06
Anacostia River	O10	2	62.3	3.0	0.0	0.00	0.00	0.00	0.00
Anacostia River	O18	6	38.9	8.1	0.1	0.00	0.00	0.00	0.00
Anacostia River	O18	6	38.7	6.4	0.1	0.00	0.00	0.00	0.00
Anacostia River	O14	6	30.9	4.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	O15	6	23.8	1.4	0.0	0.00	0.00	0.00	0.00
Anacostia River	O10	6	16.4	6.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO6	6	15.6	4.2	0.3	0.00	0.00	0.00	0.01
Anacostia River	O13	6	14.7	2.1	0.1	0.00	0.00	0.00	0.00
Anacostia River	O18	6	13.0	2.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	11.9	3.8	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	7.9	2.2	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	5.3	2.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	2.1	1.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**30.6**	**0.16**	**0.21**	**0.41**	**0.83**

Table 10. Summary: Semi-Detached House Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Semi-Detached House Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.251**	**0.50**	**1.00**
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	17.3	0.09	0.12	0.24	0.47
Anacostia River	O12	2,5,6	1195.7	287.4	3.0	0.02	0.02	0.04	0.08
Anacostia River	O10	2,6	437.3	104.1	0.0	0.00	0.00	0.00	0.00
Anacostia River	O17	6	259.9	42.2	0.7	0.00	0.00	0.01	0.02
Anacostia River	OO7	6	191.2	27.9	2.6	0.01	0.02	0.04	0.07
Anacostia River	O16	6	152.6	24.4	0.4	0.00	0.00	0.01	0.01
Anacostia River	O10	2,6	145.4	26.1	0.0	0.00	0.00	0.00	0.00
Anacostia River	O14	6	97.1	26.1	0.5	0.00	0.00	0.01	0.01
Anacostia River	OO5	6,8	74.9	14.4	0.8	0.00	0.01	0.01	0.02
Anacostia River	O10	2	62.3	3.0	0.0	0.00	0.00	0.00	0.00
Anacostia River	O18	6	38.9	8.1	0.1	0.00	0.00	0.00	0.00
Anacostia River	O18	6	38.7	6.4	0.1	0.00	0.00	0.00	0.00
Anacostia River	O14	6	30.9	4.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	O15	6	23.8	1.4	0.0	0.00	0.00	0.00	0.00
Anacostia River	O10	6	16.4	6.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO6	6	15.6	4.2	0.3	0.00	0.00	0.00	0.01
Anacostia River	O13	6	14.7	2.1	0.2	0.00	0.00	0.00	0.00
Anacostia River	O18	6	13.0	2.3	0.1	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	11.9	3.8	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	7.9	2.2	0.1	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	5.3	2.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	2.1	1.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**26.2**	**0.14**	**0.18**	**0.36**	**0.71**

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Anacostia CSO Catchment

Table 11. Summary: Rowhouse Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rowhouse Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.251**	**0.50**	**1.00**
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	441.3	2.28	3.00	5.99	11.98
Anacostia River	O12	2,5,6	1195.7	287.4	88.3	0.46	0.60	1.20	2.40
Anacostia River	O10	2,6	437.3	104.1	0.0	0.00	0.00	0.00	0.00
Anacostia River	O17	6	259.9	42.2	30.8	0.16	0.21	0.42	0.84
Anacostia River	OO7	6	191.2	27.9	8.4	0.04	0.06	0.11	0.23
Anacostia River	O16	6	152.6	24.4	17.3	0.09	0.12	0.23	0.47
Anacostia River	O10	2,6	145.4	26.1	11.3	0.06	0.08	0.15	0.31
Anacostia River	O14	6	97.1	26.1	12.9	0.07	0.09	0.18	0.35
Anacostia River	OO5	6,8	74.9	14.4	3.8	0.02	0.03	0.05	0.10
Anacostia River	O10	2	62.3	3.0	0.0	0.00	0.00	0.00	0.00
Anacostia River	O18	6	38.9	8.1	6.4	0.03	0.04	0.09	0.17
Anacostia River	O18	6	38.7	6.4	4.7	0.02	0.03	0.06	0.13
Anacostia River	O14	6	30.9	4.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	O15	6	23.8	1.4	0.2	0.00	0.00	0.00	0.01
Anacostia River	O10	6	16.4	6.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO6	6	15.6	4.2	0.4	0.00	0.00	0.00	0.01
Anacostia River	O13	6	14.7	2.1	1.2	0.01	0.01	0.02	0.03
Anacostia River	O18	6	13.0	2.3	2.0	0.01	0.01	0.03	0.05
Anacostia River	OO9	6	11.9	3.8	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	7.9	2.2	0.2	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	5.3	2.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	2.1	1.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**629.1**	**3.25**	**4.27**	**8.54**	**17.08**

Table 12. Summary: Apartment Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Apartment Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.251**	**0.50**	**1.00**
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	53.3	0.28	0.36	0.72	1.45
Anacostia River	O12	2,5,6	1195.7	287.4	20.5	0.11	0.14	0.28	0.56
Anacostia River	O10	2,6	437.3	104.1	0.0	0.00	0.00	0.00	0.00
Anacostia River	O17	6	259.9	42.2	2.0	0.01	0.01	0.03	0.05
Anacostia River	OO7	6	191.2	27.9	6.2	0.03	0.04	0.08	0.17
Anacostia River	O16	6	152.6	24.4	2.2	0.01	0.01	0.03	0.06
Anacostia River	O10	2,6	145.4	26.1	4.7	0.02	0.03	0.06	0.13
Anacostia River	O14	6	97.1	26.1	2.1	0.01	0.01	0.03	0.06
Anacostia River	OO5	6,8	74.9	14.4	1.4	0.01	0.01	0.02	0.04
Anacostia River	O10	2	62.3	3.0	0.0	0.00	0.00	0.00	0.00
Anacostia River	O18	6	38.9	8.1	0.2	0.00	0.00	0.00	0.01
Anacostia River	O18	6	38.7	6.4	0.3	0.00	0.00	0.00	0.01
Anacostia River	O14	6	30.9	4.3	1.2	0.01	0.01	0.02	0.03
Anacostia River	O15	6	23.8	1.4	0.5	0.00	0.00	0.01	0.01
Anacostia River	O10	6	16.4	6.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO6	6	15.6	4.2	0.0	0.00	0.00	0.00	0.00
Anacostia River	O13	6	14.7	2.1	0.4	0.00	0.00	0.01	0.01
Anacostia River	O18	6	13.0	2.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	11.9	3.8	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	7.9	2.2	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	5.3	2.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	2.1	1.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**94.8**	**0.49**	**0.64**	**1.29**	**2.57**

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Anacostia CSO Catchment

Table 13. Summary: Commercial/Institutional Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Commercial/ Institutional Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.251**	**0.50**	**1.00**
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	344.2	1.78	2.34	4.67	9.35
Anacostia River	O12	2,5,6	1195.7	287.4	101.7	0.52	0.69	1.38	2.76
Anacostia River	O10	2,6	437.3	104.1	41.4	0.21	0.28	0.56	1.12
Anacostia River	O17	6	259.9	42.2	8.2	0.04	0.06	0.11	0.22
Anacostia River	OO7	6	191.2	27.9	5.7	0.03	0.04	0.08	0.16
Anacostia River	O16	6	152.6	24.4	3.8	0.02	0.03	0.05	0.10
Anacostia River	O10	2,6	145.4	26.1	9.9	0.05	0.07	0.13	0.27
Anacostia River	O14	6	97.1	26.1	9.5	0.05	0.06	0.13	0.26
Anacostia River	OO5	6,8	74.9	14.4	6.3	0.03	0.04	0.09	0.17
Anacostia River	O10	2	62.3	3.0	2.3	0.01	0.02	0.03	0.06
Anacostia River	O18	6	38.9	8.1	1.3	0.01	0.01	0.02	0.04
Anacostia River	O18	6	38.7	6.4	1.3	0.01	0.01	0.02	0.04
Anacostia River	O14	6	30.9	4.3	3.0	0.02	0.02	0.04	0.08
Anacostia River	O15	6	23.8	1.4	0.7	0.00	0.00	0.01	0.02
Anacostia River	O10	6	16.4	6.5	1.1	0.01	0.01	0.02	0.03
Anacostia River	OO6	6	15.6	4.2	3.2	0.02	0.02	0.04	0.09
Anacostia River	O13	6	14.7	2.1	0.3	0.00	0.00	0.00	0.01
Anacostia River	O18	6	13.0	2.3	0.2	0.00	0.00	0.00	0.01
Anacostia River	OO9	6	11.9	3.8	0.8	0.00	0.01	0.01	0.02
Anacostia River	OO9	6	7.9	2.2	1.9	0.01	0.01	0.03	0.05
Anacostia River	OO9	6	5.3	2.5	2.5	0.01	0.02	0.03	0.07
Anacostia River	OO9	6	2.1	1.3	1.3	0.01	0.01	0.02	0.04
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**550.6**	**2.84**	**3.74**	**7.48**	**14.95**

Table 14. Summary: Federal Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Federal Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.251**	**0.50**	**1.00**
Anacostia River	O19	1,2,4,5,6	4246.3	889.0	13.0	0.07	0.09	0.18	0.35
Anacostia River	O12	2,5,6	1195.7	287.4	72.2	0.37	0.49	0.98	1.96
Anacostia River	O10	2,6	437.3	104.1	62.7	0.32	0.43	0.85	1.70
Anacostia River	O17	6	259.9	42.2	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO7	6	191.2	27.9	0.0	0.00	0.00	0.00	0.00
Anacostia River	O16	6	152.6	24.4	0.4	0.00	0.00	0.01	0.01
Anacostia River	O10	2,6	145.4	26.1	0.0	0.00	0.00	0.00	0.00
Anacostia River	O14	6	97.1	26.1	0.8	0.00	0.01	0.01	0.02
Anacostia River	OO5	6,8	74.9	14.4	0.0	0.00	0.00	0.00	0.00
Anacostia River	O10	2	62.3	3.0	0.7	0.00	0.00	0.01	0.02
Anacostia River	O18	6	38.9	8.1	0.0	0.00	0.00	0.00	0.00
Anacostia River	O18	6	38.7	6.4	0.0	0.00	0.00	0.00	0.00
Anacostia River	O14	6	30.9	4.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	O15	6	23.8	1.4	0.0	0.00	0.00	0.00	0.00
Anacostia River	O10	6	16.4	6.5	5.4	0.03	0.04	0.07	0.15
Anacostia River	OO6	6	15.6	4.2	0.0	0.00	0.00	0.00	0.00
Anacostia River	O13	6	14.7	2.1	0.0	0.00	0.00	0.00	0.00
Anacostia River	O18	6	13.0	2.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	11.9	3.8	3.1	0.02	0.02	0.04	0.08
Anacostia River	OO9	6	7.9	2.2	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	5.3	2.5	0.0	0.00	0.00	0.00	0.00
Anacostia River	OO9	6	2.1	1.3	0.0	0.00	0.00	0.00	0.00
Anacostia River	**Subtotal**		**7081.7**	**1489.6**	**158.4**	**0.82**	**1.08**	**2.15**	**4.30**

Appendix 1 **Rock Creek CSO Catchment**

Table 15. Summary: Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
					5	10	25	50	75
Rock Creek	O31	2	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1	3.5	0.8	0.0	0.1	0.2	0.4	0.6
Rock Creek	UD	2	3.6	1.4	0.1	0.1	0.4	0.7	1.1
Rock Creek	UD	2	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O53	2,1	4.5	1.0	0.0	0.1	0.2	0.5	0.7
Rock Creek	UD	2	4.8	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	2	5.7	0.4	0.0	0.0	0.1	0.2	0.3
Rock Creek	O47	1	6.5	1.8	0.1	0.2	0.4	0.9	1.3
Rock Creek	O50	2	7.2	1.7	0.1	0.2	0.4	0.9	1.3
Rock Creek	O58	1,3	8.2	0.7	0.0	0.1	0.2	0.4	0.5
Rock Creek	O58	3	10.0	3.7	0.2	0.4	0.9	1.8	2.8
Rock Creek	O38	1	10.2	1.2	0.1	0.1	0.3	0.6	0.9
Rock Creek	O33	2	12.0	5.7	0.3	0.6	1.4	2.9	4.3
Rock Creek	O27	2	12.7	2.8	0.1	0.3	0.7	1.4	2.1
Rock Creek	O50	2,3	12.9	4.1	0.2	0.4	1.0	2.1	3.1
Rock Creek	O32	2	13.5	2.8	0.1	0.3	0.7	1.4	2.1
Rock Creek	O57	1	13.8	2.7	0.1	0.3	0.7	1.3	2.0
Rock Creek	O41	1	15.0	5.7	0.3	0.6	1.4	2.8	4.2
Rock Creek	O44	1	15.7	4.6	0.2	0.5	1.2	2.3	3.5
Rock Creek	O46	1	15.9	4.9	0.2	0.5	1.2	2.5	3.7
Rock Creek	O40	1	17.2	5.6	0.3	0.6	1.4	2.8	4.2
Rock Creek	O48	1	17.7	4.9	0.2	0.5	1.2	2.5	3.7
Rock Creek	O45	1	19.4	4.5	0.2	0.5	1.1	2.3	3.4
Rock Creek	O51	2	30.2	8.5	0.4	0.9	2.1	4.3	6.4
Rock Creek	UD	2	31.7	1.9	0.1	0.2	0.5	1.0	1.5
Rock Creek	O42	1	35.2	9.4	0.5	0.9	2.4	4.7	7.1
Rock Creek	O39	1	42.7	10.2	0.5	1.0	2.5	5.1	7.6
Rock Creek	O55	3	47.9	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	1,2	59.8	13.0	0.7	1.3	3.3	6.5	9.8
Rock Creek	O58	3	73.5	16.0	0.8	1.6	4.0	8.0	12.0
Rock Creek	O43	1	75.6	23.9	1.2	2.4	6.0	12.0	17.9
Rock Creek	O52	2	111.7	25.9	1.3	2.6	6.5	12.9	19.4
Rock Creek	O34	2	424.3	160.9	8.0	16.1	40.2	80.5	120.7
Rock Creek	O59	4	459.4	84.6	4.2	8.5	21.2	42.3	63.5
Rock Creek	O35	1,2	534.0	168.7	8.4	16.9	42.2	84.3	126.5
Rock Creek	O49	1,4	2384.3	476.2	23.8	47.6	119.1	238.1	357.2
Rock Creek	**Subtotal**		**4546.4**	**1060.5**	**53.0**	**106.0**	**265.1**	**530.2**	**795.3**

UD = Undetermined CSS area and/or facility outfall

Appendix 1 Rock Creek CSO Catchment

Table 16. Summary: Detached House Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Detached House Rooftop Area (Acre)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Rock Creek	O31	2.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1.0	3.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2.0	3.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O53	2,1	4.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	2.0	5.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O47	1.0	6.5	1.8	0.1	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2.0	7.2	1.7	0.6	0.0	0.1	0.1	0.3	0.4
Rock Creek	O58	1,3	8.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	3.0	10.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O38	1.0	10.2	1.2	0.9	0.0	0.1	0.2	0.5	0.7
Rock Creek	O33	2.0	12.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O27	2.0	12.7	2.8	0.3	0.1	0.2	0.4	0.8	1.1
Rock Creek	O50	2,3	12.9	4.1	0.8	0.0	0.1	0.2	0.4	0.6
Rock Creek	O32	2.0	13.5	2.8	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O57	1.0	13.8	2.7	2.6	0.1	0.3	0.6	1.3	1.9
Rock Creek	O41	1.0	15.0	5.7	0.2	0.0	0.0	0.1	0.1	0.2
Rock Creek	O44	1.0	15.7	4.6	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O46	1.0	15.9	4.9	0.9	0.0	0.1	0.2	0.4	0.7
Rock Creek	O40	1.0	17.2	5.6	0.1	0.0	0.0	0.0	0.1	0.1
Rock Creek	O48	1.0	17.7	4.9	0.7	0.0	0.1	0.2	0.3	0.5
Rock Creek	O45	1.0	19.4	4.5	0.1	0.0	0.0	0.0	0.0	0.0
Rock Creek	O51	2.0	30.2	8.5	1.3	0.1	0.1	0.3	0.7	1.0
Rock Creek	UD	2.0	31.7	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O42	1.0	35.2	9.4	0.3	0.0	0.0	0.1	0.2	0.2
Rock Creek	O39	1.0	42.7	10.2	0.9	0.0	0.1	0.2	0.4	0.7
Rock Creek	O55	3.0	47.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	1,2	59.8	13.0	6.4	0.3	0.6	1.6	3.2	4.8
Rock Creek	O58	3.0	73.5	16.0	5.9	0.3	0.6	1.5	3.0	4.4
Rock Creek	O43	1.0	75.6	23.9	0.3	0.0	0.0	0.1	0.1	0.2
Rock Creek	O52	2.0	111.7	25.9	8.2	0.4	0.8	2.1	4.1	6.2
Rock Creek	O34	2.0	424.3	160.9	0.3	0.0	0.0	0.1	0.1	0.2
Rock Creek	O59	4.0	459.4	84.6	31.5	1.6	3.2	7.9	15.8	23.7
Rock Creek	O35	1,2	534.0	168.7	4.3	0.2	0.4	1.1	2.1	3.2
Rock Creek	O49	1,4	2384.3	476.2	87.7	4.4	8.8	21.9	43.9	65.8
Rock Creek	**Subtotal**		**4546.4**	**1060.5**	**154.3**	**7.7**	**15.4**	**38.6**	**77.1**	**115.7**

UD = Undetermined CSS area and/or facility outfall

Appendix 1 Rock Creek CSO Catchment

Table 17. Summary: Semi-Detached Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Semi-Detached Rooftop Areas (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Rock Creek	O31	2	0.79	0.0	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	UD	2	1.42	0.0	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O58	1	3.47	0.8	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	UD	2	3.59	1.4	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	UD	2	4	0.0	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O53	2,1	4.46	1.0	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	UD	2	4.82	0.0	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O36	2	5.74	0.4	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O47	1	6.48	1.8	0.0	0.00	0.00	0.01	0.02	0.0
Rock Creek	O50	2	7.22	1.7	0.1	0.00	0.01	0.02	0.03	0.0
Rock Creek	O58	1,3	8.2	0.7	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O58	3	9.95	3.7	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O38	1	10.16	1.2	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O33	2	12.02	5.7	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O27	2	12.73	2.8	0.0	0.00	0.00	0.03	0.05	0.1
Rock Creek	O50	2,3	12.94	4.1	0.5	0.02	0.05	0.12	0.23	0.3
Rock Creek	O32	2	13.52	2.8	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O57	1	13.78	2.7	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O41	1	15.03	5.7	0.2	0.01	0.02	0.05	0.10	0.2
Rock Creek	O44	1	15.66	4.6	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O46	1	15.85	4.9	0.1	0.00	0.01	0.02	0.04	0.1
Rock Creek	O40	1	17.24	5.6	0.4	0.02	0.04	0.10	0.20	0.3
Rock Creek	O48	1	17.69	4.9	0.1	0.01	0.01	0.03	0.06	0.1
Rock Creek	O45	1	19.39	4.5	0.3	0.02	0.03	0.08	0.16	0.2
Rock Creek	O51	2	30.15	8.5	0.5	0.03	0.05	0.14	0.27	0.4
Rock Creek	UD	2	31.71	1.9	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O42	1	35.2	9.4	0.2	0.01	0.02	0.05	0.10	0.1
Rock Creek	O39	1	42.74	10.2	0.3	0.02	0.03	0.08	0.16	0.2
Rock Creek	O55	3	47.86	0.0	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O36	1,2	59.82	13.0	0.0	0.00	0.00	0.00	0.00	0.0
Rock Creek	O58	3	73.45	16.0	0.1	0.00	0.01	0.01	0.03	0.0
Rock Creek	O43	1	75.61	23.9	0.6	0.03	0.06	0.14	0.29	0.4
Rock Creek	O52	2	111.7	25.9	1.6	0.08	0.16	0.40	0.79	1.2
Rock Creek	O34	2	424.31	160.9	1.3	0.07	0.13	0.33	0.67	1.0
Rock Creek	O59	4	459.44	84.6	6.5	0.33	0.65	1.63	3.26	4.9
Rock Creek	O35	1,2	533.95	168.7	2.1	0.10	0.21	0.51	1.03	1.5
Rock Creek	O49	1,4	2384.3	476.2	38.9	1.95	3.89	9.73	19.46	29.2
Rock Creek	**Subtotal**		**4546.39**	**1060.5**	**53.7**	**2.7**	**5.4**	**13.5**	**26.9**	**40.4**

UD = Undetermined CSS area and/or facility outfall

Appendix 1 **Rock Creek CSO Catchment**

Table 18. Summary: Rowhouse Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rowhouse Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Rock Creek	O31	2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1	3.5	1.1	0.4	0.0	0.0	0.1	0.2	0.3
Rock Creek	UD	2	3.6	0.7	0.3	0.0	0.0	0.1	0.1	0.2
Rock Creek	UD	2	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O53	2,1	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	2	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O47	1	6.5	4.5	1.7	0.1	0.2	0.4	0.8	1.3
Rock Creek	O50	2	7.2	2.3	0.9	0.0	0.1	0.2	0.4	0.7
Rock Creek	O58	1,3	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O38	1	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O33	2	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O27	2	12.7	5.7	0.4	0.2	0.3	0.8	1.6	2.4
Rock Creek	O50	2,3	12.9	6.5	2.5	0.1	0.2	0.6	1.2	1.8
Rock Creek	O32	2	13.5	1.3	0.5	0.0	0.1	0.1	0.3	0.4
Rock Creek	O57	1	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O41	1	15.0	7.7	2.9	0.1	0.3	0.7	1.4	2.2
Rock Creek	O44	1	15.7	11.9	4.5	0.2	0.4	1.1	2.2	3.4
Rock Creek	O46	1	15.9	8.9	3.4	0.2	0.3	0.8	1.7	2.5
Rock Creek	O40	1	17.2	9.1	3.5	0.2	0.3	0.9	1.7	2.6
Rock Creek	O48	1	17.7	7.2	2.7	0.1	0.3	0.7	1.4	2.0
Rock Creek	O45	1	19.4	11.0	4.2	0.2	0.4	1.0	2.1	3.1
Rock Creek	O51	2	30.2	5.0	1.9	0.1	0.2	0.5	0.9	1.4
Rock Creek	UD	2	31.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O42	1	35.2	7.1	2.7	0.1	0.3	0.7	1.3	2.0
Rock Creek	O39	1	42.7	7.7	2.9	0.1	0.3	0.7	1.5	2.2
Rock Creek	O55	3	47.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	1,2	59.8	6.2	2.4	0.1	0.2	0.6	1.2	1.8
Rock Creek	O58	3	73.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O43	1	75.6	32.3	12.2	0.6	1.2	3.0	6.1	9.1
Rock Creek	O52	2	111.7	31.1	11.7	0.6	1.2	2.9	5.9	8.8
Rock Creek	O34	2	424.3	44.4	16.8	0.8	1.7	4.2	8.4	12.6
Rock Creek	O59	4	459.4	11.9	4.5	0.2	0.5	1.1	2.3	3.4
Rock Creek	O35	1,2	534.0	161.4	60.9	3.0	6.1	15.2	30.5	45.7
Rock Creek	O49	1,4	2384.3	528.5	199.5	10.0	19.9	49.9	99.7	149.6
Rock Creek	**Subtotal**		**4546.4**	**908.8**	**343.0**	**17.1**	**34.3**	**85.7**	**171.5**	**257.2**

UD = Undetermined CSS area and/or facility outfall

Appendix 1 **Rock Creek CSO Catchment**

Table 19. Summary: Apartment Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Apartment Rooftop Areas (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Rock Creek	O31	2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1	3.5	0.8	0.4	0.0	0.0	0.1	0.2	0.3
Rock Creek	UD	2	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O53	2,1	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	2	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O47	1	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1,3	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	3	10.0	7.0	3.7	0.2	0.4	0.9	1.8	2.8
Rock Creek	O38	1	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O33	2	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O27	2	12.7	3.7	0.0	0.2	0.4	1.0	2.1	3.1
Rock Creek	O50	2,3	12.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Rock Creek	O32	2	13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O57	1	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O41	1	15.0	4.2	2.2	0.1	0.2	0.6	1.1	1.7
Rock Creek	O44	1	15.7	0.2	0.1	0.0	0.0	0.0	0.1	0.1
Rock Creek	O46	1	15.9	1.1	0.6	0.0	0.1	0.2	0.3	0.5
Rock Creek	O40	1	17.2	1.3	0.7	0.0	0.1	0.2	0.4	0.5
Rock Creek	O48	1	17.7	2.7	1.4	0.1	0.1	0.4	0.7	1.1
Rock Creek	O45	1	19.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O51	2	30.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	31.7	1.3	0.7	0.0	0.1	0.2	0.3	0.5
Rock Creek	O42	1	35.2	11.5	6.0	0.3	0.6	1.5	3.0	4.5
Rock Creek	O39	1	42.7	9.7	5.1	0.3	0.5	1.3	2.6	3.8
Rock Creek	O55	3	47.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	1,2	59.8	4.8	2.5	0.1	0.3	0.6	1.3	1.9
Rock Creek	O58	3	73.5	1.2	0.7	0.0	0.1	0.2	0.3	0.5
Rock Creek	O43	1	75.6	10.3	5.4	0.3	0.5	1.4	2.7	4.1
Rock Creek	O52	2	111.7	4.6	2.4	0.1	0.2	0.6	1.2	1.8
Rock Creek	O34	2	424.3	48.5	25.5	1.3	2.6	6.4	12.8	19.1
Rock Creek	O59	4	459.4	24.6	13.0	0.6	1.3	3.2	6.5	9.7
Rock Creek	O35	1,2	534.0	91.2	48.0	2.4	4.8	12.0	24.0	36.0
Rock Creek	O49	1,4	2384.3	103.8	54.6	2.7	5.5	13.7	27.3	41.0
Rock Creek	**Subtotal**		**4546.4**	**329.1**	**173.2**	**8.7**	**17.3**	**43.3**	**86.6**	**129.9**

UD = Undetermined CSS area and/or facility outfall

Table 20. Summary: Commercial/Institutional Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Commercial/ Institutional Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Rock Creek	O31	2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	3.6	3.0	1.2	0.1	0.1	0.3	0.6	0.9
Rock Creek	UD	2	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O53	2,1	4.5	2.6	1.0	0.0	0.1	0.2	0.5	0.7
Rock Creek	UD	2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	2	5.7	1.1	0.4	0.0	0.0	0.1	0.2	0.3
Rock Creek	O47	1	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2	7.2	0.6	0.2	0.0	0.0	0.1	0.1	0.2
Rock Creek	O58	1,3	8.2	1.9	0.7	0.0	0.1	0.2	0.4	0.5
Rock Creek	O58	3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O38	1	10.2	0.8	0.3	0.0	0.0	0.1	0.2	0.2
Rock Creek	O33	2	12.0	15.1	5.7	0.3	0.6	1.4	2.9	4.3
Rock Creek	O27	2	12.7	17.9	2.2	0.5	1.0	2.4	4.8	7.1
Rock Creek	O50	2,3	12.9	1.0	0.4	0.0	0.0	0.1	0.2	0.3
Rock Creek	O32	2	13.5	6.2	2.3	0.1	0.2	0.6	1.2	1.7
Rock Creek	O57	1	13.8	0.3	0.1	0.0	0.0	0.0	0.1	0.1
Rock Creek	O41	1	15.0	0.3	0.1	0.0	0.0	0.0	0.1	0.1
Rock Creek	O44	1	15.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O46	1	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O40	1	17.2	2.4	0.9	0.0	0.1	0.2	0.5	0.7
Rock Creek	O48	1	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O45	1	19.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O51	2	30.2	12.5	4.7	0.2	0.5	1.2	2.4	3.5
Rock Creek	UD	2	31.7	3.3	1.3	0.1	0.1	0.3	0.6	0.9
Rock Creek	O42	1	35.2	0.5	0.2	0.0	0.0	0.1	0.1	0.2
Rock Creek	O39	1	42.7	2.5	1.0	0.0	0.1	0.2	0.5	0.7
Rock Creek	O55	3	47.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	1,2	59.8	4.8	1.8	0.1	0.2	0.5	0.9	1.4
Rock Creek	O58	3	73.5	24.9	9.4	0.5	0.9	2.4	4.7	7.1
Rock Creek	O43	1	75.6	14.5	5.5	0.3	0.5	1.4	2.7	4.1
Rock Creek	O52	2	111.7	5.1	1.9	0.1	0.2	0.5	1.0	1.4
Rock Creek	O34	2	424.3	304.9	115.1	5.8	11.5	28.8	57.5	86.3
Rock Creek	O59	4	459.4	19.7	7.4	0.4	0.7	1.9	3.7	5.6
Rock Creek	O35	1,2	534.0	141.5	53.4	2.7	5.3	13.4	26.7	40.1
Rock Creek	O49	1,4	2384.3	251.1	94.7	4.7	9.5	23.7	47.4	71.1
Rock Creek	**Subtotal**		**4546.4**	**826.5**	**311.9**	**15.6**	**31.2**	**78.0**	**155.9**	**233.9**

UD = Undetermined CSS area and/or facility outfall

Appendix 1 **Rock Creek CSO Catchment**

Table 21. Summary: Federal Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Federal Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Rock Creek	O31	2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O53	2,1	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	2	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O47	1	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1,3	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	3	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O38	1	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O33	2	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O27	2	12.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2,3	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O32	2	13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O57	1	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O41	1	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O44	1	15.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O46	1	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O40	1	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O48	1	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O45	1	19.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O51	2	30.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	31.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O42	1	35.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O39	1	42.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O55	3	47.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	1,2	59.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	3	73.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O43	1	75.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O52	2	111.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O34	2	424.3	5.3	2.0	0.1	0.2	0.5	1.0	1.5
Rock Creek	O59	4	459.4	57.5	21.7	1.1	2.2	5.4	10.8	16.3
Rock Creek	O35	1,2	534.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O49	1,4	2384.3	2.0	0.8	0.0	0.1	0.2	0.4	0.6
Rock Creek	**Subtotal**		**4546.4**	**64.7**	**24.4**	**1.2**	**2.4**	**6.1**	**12.2**	**18.3**

UD = Undetermined CSS area and/or facility outfall

Table 22. Summary: Detached House Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Detached House Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.25**	**0.50**	**1.00**
Rock Creek	O31	2	0.8	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	1.4	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O58	1	3.5	0.8	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	3.6	1.4	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	4.0	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O53	2,1	4.5	1.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	4.8	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O36	2	5.7	0.4	0.0	0.00	0.00	0.00	0.00
Rock Creek	O47	1	6.5	1.8	0.1	0.00	0.00	0.00	0.00
Rock Creek	O50	2	7.2	1.7	0.6	0.00	0.00	0.01	0.01
Rock Creek	O58	1,3	8.2	0.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O58	3	10.0	3.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O38	1	10.2	1.2	0.9	0.00	0.01	0.01	0.03
Rock Creek	O33	2	12.0	5.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O27	2	12.7	2.8	0.3	0.00	0.00	0.00	0.01
Rock Creek	O50	2,3	12.9	4.1	0.8	0.00	0.01	0.01	0.02
Rock Creek	O32	2	13.5	2.8	0.0	0.00	0.00	0.00	0.00
Rock Creek	O57	1	13.8	2.7	2.6	0.01	0.02	0.04	0.07
Rock Creek	O41	1	15.0	5.7	0.2	0.00	0.00	0.00	0.01
Rock Creek	O44	1	15.7	4.6	0.0	0.00	0.00	0.00	0.00
Rock Creek	O46	1	15.9	4.9	0.9	0.00	0.01	0.01	0.02
Rock Creek	O40	1	17.2	5.6	0.1	0.00	0.00	0.00	0.00
Rock Creek	O48	1	17.7	4.9	0.7	0.00	0.00	0.01	0.02
Rock Creek	O45	1	19.4	4.5	0.1	0.00	0.00	0.00	0.00
Rock Creek	O51	2	30.2	8.5	1.3	0.01	0.01	0.02	0.04
Rock Creek	UD	2	31.7	1.9	0.0	0.00	0.00	0.00	0.00
Rock Creek	O42	1	35.2	9.4	0.3	0.00	0.00	0.00	0.01
Rock Creek	O39	1	42.7	10.2	0.9	0.00	0.01	0.01	0.02
Rock Creek	O55	3	47.9	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O36	1,2	59.8	13.0	6.4	0.03	0.04	0.09	0.17
Rock Creek	O58	3	73.5	16.0	5.9	0.03	0.04	0.08	0.16
Rock Creek	O43	1	75.6	23.9	0.3	0.00	0.00	0.00	0.01
Rock Creek	O52	2	111.7	25.9	8.2	0.04	0.06	0.11	0.22
Rock Creek	O34	2	424.3	160.9	0.3	0.00	0.00	0.00	0.01
Rock Creek	O59	4	459.4	84.6	31.5	0.16	0.21	0.43	0.86
Rock Creek	O35	1,2	534.0	168.7	4.3	0.02	0.03	0.06	0.12
Rock Creek	O49	1,4	2384.3	476.2	87.7	0.45	0.60	1.19	2.38
Rock Creek	**Subtotal**	**0**	**4546.4**	**1,060.5**	**154.3**	**0.8**	**1.0**	**2.1**	**4.2**

UD = Undetermined CSS area and/or facility outfall

Appendix 1 **Rock Creek CSO Catchment**

Table 23. Summary: Semi-Detached House Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Semi-Detached House Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.25**	**0.50**	**1.00**
Rock Creek	O31	2	0.8	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	1.4	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O58	1	3.5	0.8	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	3.6	1.4	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	4.0	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O53	2,1	4.5	1.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	4.8	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O36	2	5.7	0.4	0.0	0.00	0.00	0.00	0.00
Rock Creek	O47	1	6.5	1.8	0.0	0.00	0.00	0.00	0.00
Rock Creek	O50	2	7.2	1.7	0.1	0.00	0.00	0.00	0.00
Rock Creek	O58	1,3	8.2	0.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O58	3	10.0	3.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O38	1	10.2	1.2	0.0	0.00	0.00	0.00	0.00
Rock Creek	O33	2	12.0	5.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O27	2	12.7	2.8	0.0	0.00	0.00	0.00	0.00
Rock Creek	O50	2,3	12.9	4.1	0.5	0.00	0.00	0.01	0.01
Rock Creek	O32	2	13.5	2.8	0.0	0.00	0.00	0.00	0.00
Rock Creek	O57	1	13.8	2.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O41	1	15.0	5.7	0.2	0.00	0.00	0.00	0.01
Rock Creek	O44	1	15.7	4.6	0.0	0.00	0.00	0.00	0.00
Rock Creek	O46	1	15.9	4.9	0.1	0.00	0.00	0.00	0.00
Rock Creek	O40	1	17.2	5.6	0.4	0.00	0.00	0.01	0.01
Rock Creek	O48	1	17.7	4.9	0.1	0.00	0.00	0.00	0.00
Rock Creek	O45	1	19.4	4.5	0.3	0.00	0.00	0.00	0.01
Rock Creek	O51	2	30.2	8.5	0.5	0.00	0.00	0.01	0.01
Rock Creek	UD	2	31.7	1.9	0.0	0.00	0.00	0.00	0.00
Rock Creek	O42	1	35.2	9.4	0.2	0.00	0.00	0.00	0.01
Rock Creek	O39	1	42.7	10.2	0.3	0.00	0.00	0.00	0.01
Rock Creek	O55	3	47.9	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O36	1,2	59.8	13.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O58	3	73.5	16.0	0.1	0.00	0.00	0.00	0.00
Rock Creek	O43	1	75.6	23.9	0.6	0.00	0.00	0.01	0.02
Rock Creek	O52	2	111.7	25.9	1.6	0.01	0.01	0.02	0.04
Rock Creek	O34	2	424.3	160.9	1.3	0.01	0.01	0.02	0.04
Rock Creek	O59	4	459.4	84.6	6.5	0.03	0.04	0.09	0.18
Rock Creek	O35	1,2	534.0	168.7	2.1	0.01	0.01	0.03	0.06
Rock Creek	O49	1,4	2384.3	476.2	38.9	0.20	0.26	0.53	1.06
Rock Creek	**Subtotal**	**0**	**4546.4**	**1,060.5**	**53.7**	**0.3**	**0.4**	**0.7**	**1.5**

UD = Undetermined CSS area and/or facility outfall

Table 24. Summary: Rowhouse Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rowhouse Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.25**	**0.50**	**1.00**
Rock Creek	O31	2	0.8	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	1.4	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O58	1	3.5	0.8	0.4	0.00	0.00	0.01	0.01
Rock Creek	UD	2	3.6	1.4	0.3	0.00	0.00	0.00	0.01
Rock Creek	UD	2	4.0	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O53	2,1	4.5	1.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	4.8	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O36	2	5.7	0.4	0.0	0.00	0.00	0.00	0.00
Rock Creek	O47	1	6.5	1.8	1.7	0.01	0.01	0.02	0.05
Rock Creek	O50	2	7.2	1.7	0.9	0.00	0.01	0.01	0.02
Rock Creek	O58	1,3	8.2	0.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O58	3	10.0	3.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O38	1	10.2	1.2	0.0	0.00	0.00	0.00	0.00
Rock Creek	O33	2	12.0	5.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O27	2	12.7	2.8	0.4	0.00	0.00	0.01	0.01
Rock Creek	O50	2,3	12.9	4.1	2.5	0.01	0.02	0.03	0.07
Rock Creek	O32	2	13.5	2.8	0.5	0.00	0.00	0.01	0.01
Rock Creek	O57	1	13.8	2.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O41	1	15.0	5.7	2.9	0.01	0.02	0.04	0.08
Rock Creek	O44	1	15.7	4.6	4.5	0.02	0.03	0.06	0.12
Rock Creek	O46	1	15.9	4.9	3.4	0.02	0.02	0.05	0.09
Rock Creek	O40	1	17.2	5.6	3.5	0.02	0.02	0.05	0.09
Rock Creek	O48	1	17.7	4.9	2.7	0.01	0.02	0.04	0.07
Rock Creek	O45	1	19.4	4.5	4.2	0.02	0.03	0.06	0.11
Rock Creek	O51	2	30.2	8.5	1.9	0.01	0.01	0.03	0.05
Rock Creek	UD	2	31.7	1.9	0.0	0.00	0.00	0.00	0.00
Rock Creek	O42	1	35.2	9.4	2.7	0.01	0.02	0.04	0.07
Rock Creek	O39	1	42.7	10.2	2.9	0.02	0.02	0.04	0.08
Rock Creek	O55	3	47.9	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O36	1,2	59.8	13.0	2.4	0.01	0.02	0.03	0.06
Rock Creek	O58	3	73.5	16.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O43	1	75.6	23.9	12.2	0.06	0.08	0.17	0.33
Rock Creek	O52	2	111.7	25.9	11.7	0.06	0.08	0.16	0.32
Rock Creek	O34	2	424.3	160.9	16.8	0.09	0.11	0.23	0.45
Rock Creek	O59	4	459.4	84.6	4.5	0.02	0.03	0.06	0.12
Rock Creek	O35	1,2	534.0	168.7	60.9	0.31	0.41	0.83	1.65
Rock Creek	O49	1,4	2384.3	476.2	199.5	1.03	1.35	2.71	5.42
Rock Creek	**Subtotal**	**0**	**4546.4**	**1,060.5**	**343.0**	**1.8**	**2.3**	**4.7**	**9.3**

UD = Undetermined CSS area and/or facility outfall

Appendix 1 **Rock Creek CSO Catchment**

Table 25. Summary: Apartment Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Apartment Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	0.25	0.50	1.00
Rock Creek	O31	2	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1	3.5	0.8	0.4	0.0	0.0	0.0	0.0
Rock Creek	UD	2	3.6	1.4	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O53	2,1	4.5	1.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.8	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	2	5.7	0.4	0.0	0.0	0.0	0.0	0.0
Rock Creek	O47	1	6.5	1.8	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2	7.2	1.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1,3	8.2	0.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	3	10.0	3.7	3.7	0.0	0.0	0.1	0.1
Rock Creek	O38	1	10.2	1.2	0.0	0.0	0.0	0.0	0.0
Rock Creek	O33	2	12.0	5.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O27	2	12.7	2.8	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2,3	12.9	4.1	0.1	0.0	0.0	0.0	0.0
Rock Creek	O32	2	13.5	2.8	0.0	0.0	0.0	0.0	0.0
Rock Creek	O57	1	13.8	2.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O41	1	15.0	5.7	2.2	0.0	0.0	0.0	0.1
Rock Creek	O44	1	15.7	4.6	0.1	0.0	0.0	0.0	0.0
Rock Creek	O46	1	15.9	4.9	0.6	0.0	0.0	0.0	0.0
Rock Creek	O40	1	17.2	5.6	0.7	0.0	0.0	0.0	0.0
Rock Creek	O48	1	17.7	4.9	1.4	0.0	0.0	0.0	0.0
Rock Creek	O45	1	19.4	4.5	0.0	0.0	0.0	0.0	0.0
Rock Creek	O51	2	30.2	8.5	0.1	0.0	0.0	0.0	0.0
Rock Creek	UD	2	31.7	1.9	0.7	0.0	0.0	0.0	0.0
Rock Creek	O42	1	35.2	9.4	6.0	0.0	0.0	0.1	0.2
Rock Creek	O39	1	42.7	10.2	5.1	0.0	0.0	0.1	0.1
Rock Creek	O55	3	47.9	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	1,2	59.8	13.0	2.5	0.0	0.0	0.0	0.1
Rock Creek	O58	3	73.5	16.0	0.7	0.0	0.0	0.0	0.0
Rock Creek	O43	1	75.6	23.9	5.4	0.0	0.0	0.1	0.1
Rock Creek	O52	2	111.7	25.9	2.4	0.0	0.0	0.0	0.1
Rock Creek	O34	2	424.3	160.9	25.5	0.1	0.2	0.3	0.7
Rock Creek	O59	4	459.4	84.6	13.0	0.1	0.1	0.2	0.4
Rock Creek	O35	1,2	534.0	168.7	48.0	0.2	0.3	0.7	1.3
Rock Creek	O49	1,4	2384.3	476.2	54.6	0.3	0.4	0.7	1.5
Rock Creek	**Subtotal**	**0**	**4546.4**	**1,060.5**	**173.2**	**0.9**	**1.2**	**2.4**	**4.7**

UD = Undetermined CSS area and/or facility outfall

Appendix 1 **Rock Creek CSO Catchment**

Table 26. Summary: Commercial/Institutional Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Commercial/ Institutional Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.25**	**0.50**	**1.00**
Rock Creek	O31	2	0.8	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	1.4	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O58	1	3.5	0.8	0.0	0.00	0.00	0.00	0.00
Rock Creek	UD	2	3.6	1.4	1.2	0.01	0.01	0.02	0.03
Rock Creek	UD	2	4.0	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O53	2,1	4.5	1.0	1.0	0.01	0.01	0.01	0.03
Rock Creek	UD	2	4.8	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O36	2	5.7	0.4	0.4	0.00	0.00	0.01	0.01
Rock Creek	O47	1	6.5	1.8	0.0	0.00	0.00	0.00	0.00
Rock Creek	O50	2	7.2	1.7	0.2	0.00	0.00	0.00	0.01
Rock Creek	O58	1,3	8.2	0.7	0.7	0.00	0.00	0.01	0.02
Rock Creek	O58	3	10.0	3.7	0.0	0.00	0.00	0.00	0.00
Rock Creek	O38	1	10.2	1.2	0.3	0.00	0.00	0.00	0.01
Rock Creek	O33	2	12.0	5.7	5.7	0.03	0.04	0.08	0.15
Rock Creek	O27	2	12.7	2.8	2.2	0.01	0.01	0.03	0.06
Rock Creek	O50	2,3	12.9	4.1	0.4	0.00	0.00	0.00	0.01
Rock Creek	O32	2	13.5	2.8	2.3	0.01	0.02	0.03	0.06
Rock Creek	O57	1	13.8	2.7	0.1	0.00	0.00	0.00	0.00
Rock Creek	O41	1	15.0	5.7	0.1	0.00	0.00	0.00	0.00
Rock Creek	O44	1	15.7	4.6	0.0	0.00	0.00	0.00	0.00
Rock Creek	O46	1	15.9	4.9	0.0	0.00	0.00	0.00	0.00
Rock Creek	O40	1	17.2	5.6	0.9	0.00	0.01	0.01	0.02
Rock Creek	O48	1	17.7	4.9	0.0	0.00	0.00	0.00	0.00
Rock Creek	O45	1	19.4	4.5	0.0	0.00	0.00	0.00	0.00
Rock Creek	O51	2	30.2	8.5	4.7	0.02	0.03	0.06	0.13
Rock Creek	UD	2	31.7	1.9	1.3	0.01	0.01	0.02	0.03
Rock Creek	O42	1	35.2	9.4	0.2	0.00	0.00	0.00	0.01
Rock Creek	O39	1	42.7	10.2	1.0	0.00	0.01	0.01	0.03
Rock Creek	O55	3	47.9	0.0	0.0	0.00	0.00	0.00	0.00
Rock Creek	O36	1,2	59.8	13.0	1.8	0.01	0.01	0.02	0.05
Rock Creek	O58	3	73.5	16.0	9.4	0.05	0.06	0.13	0.26
Rock Creek	O43	1	75.6	23.9	5.5	0.03	0.04	0.07	0.15
Rock Creek	O52	2	111.7	25.9	1.9	0.01	0.01	0.03	0.05
Rock Creek	O34	2	424.3	160.9	115.1	0.59	0.78	1.56	3.12
Rock Creek	O59	4	459.4	84.6	7.4	0.04	0.05	0.10	0.20
Rock Creek	O35	1,2	534.0	168.7	53.4	0.28	0.36	0.73	1.45
Rock Creek	O49	1,4	2384.3	476.2	94.7	0.49	0.64	1.29	2.57
Rock Creek	**Subtotal**	**0**	**4546.4**	**1,060.5**	**311.9**	**1.6**	**2.1**	**4.2**	**8.5**

UD = Undetermined CSS area and/or facility outfall

Table 27. Summary: Federal Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Federal Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	0.25	0.50	1.00
Rock Creek	O31	2	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1	3.5	0.8	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	3.6	1.4	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O53	2,1	4.5	1.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	4.8	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	2	5.7	0.4	0.0	0.0	0.0	0.0	0.0
Rock Creek	O47	1	6.5	1.8	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2	7.2	1.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	1,3	8.2	0.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	3	10.0	3.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O38	1	10.2	1.2	0.0	0.0	0.0	0.0	0.0
Rock Creek	O33	2	12.0	5.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O27	2	12.7	2.8	0.0	0.0	0.0	0.0	0.0
Rock Creek	O50	2,3	12.9	4.1	0.0	0.0	0.0	0.0	0.0
Rock Creek	O32	2	13.5	2.8	0.0	0.0	0.0	0.0	0.0
Rock Creek	O57	1	13.8	2.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O41	1	15.0	5.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O44	1	15.7	4.6	0.0	0.0	0.0	0.0	0.0
Rock Creek	O46	1	15.9	4.9	0.0	0.0	0.0	0.0	0.0
Rock Creek	O40	1	17.2	5.6	0.0	0.0	0.0	0.0	0.0
Rock Creek	O48	1	17.7	4.9	0.0	0.0	0.0	0.0	0.0
Rock Creek	O45	1	19.4	4.5	0.0	0.0	0.0	0.0	0.0
Rock Creek	O51	2	30.2	8.5	0.0	0.0	0.0	0.0	0.0
Rock Creek	UD	2	31.7	1.9	0.0	0.0	0.0	0.0	0.0
Rock Creek	O42	1	35.2	9.4	0.0	0.0	0.0	0.0	0.0
Rock Creek	O39	1	42.7	10.2	0.0	0.0	0.0	0.0	0.0
Rock Creek	O55	3	47.9	0.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O36	1,2	59.8	13.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O58	3	73.5	16.0	0.0	0.0	0.0	0.0	0.0
Rock Creek	O43	1	75.6	23.9	0.0	0.0	0.0	0.0	0.0
Rock Creek	O52	2	111.7	25.9	0.0	0.0	0.0	0.0	0.0
Rock Creek	O34	2	424.3	160.9	2.0	0.0	0.0	0.0	0.1
Rock Creek	O59	4	459.4	84.6	21.7	0.1	0.1	0.3	0.6
Rock Creek	O35	1,2	534.0	168.7	0.0	0.0	0.0	0.0	0.0
Rock Creek	O49	1,4	2384.3	476.2	0.8	0.0	0.0	0.0	0.0
Rock Creek	**Subtotal**	**0**	**4546.4**	**1,060.5**	**24.4**	**0.1**	**0.2**	**0.3**	**0.7**

UD = Undetermined CSS area and/or facility outfall

Appendix 1

Potomac CSO Catchment

Table 28. Summary: Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
					5	10	25	50	75
Potomac River	O21	2	1.3	0.1	0.0	0.0	0.0	0.0	0.1
Potomac River	O23	2	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	2.8	0.8	0.0	0.1	0.2	0.4	0.6
Potomac River	O27	2	4.8	2.4	0.1	0.2	0.6	1.2	1.8
Potomac River	O23	2	9.8	4.7	0.2	0.5	1.2	2.3	3.5
Potomac River	O21	2	10.0	4.2	0.2	0.4	1.0	2.1	3.1
Potomac River	O23	2	13.8	6.9	0.3	0.7	1.7	3.4	5.2
Potomac River	O21	2	14.0	4.1	0.2	0.4	1.0	2.1	3.1
Potomac River	O28	2	16.1	4.2	0.2	0.4	1.0	2.1	3.1
Potomac River	O21	2	33.1	1.0	0.1	0.1	0.3	0.5	0.8
Potomac River	O22	2	141.6	37.3	1.9	3.7	9.3	18.6	27.9
Potomac River	O27	2	159.2	50.3	2.5	5.0	12.6	25.2	37.8
Potomac River	O29	2, 3	286.0	53.0	2.6	5.3	13.2	26.5	39.7
Potomac River	O20	2	623.7	179.3	9.0	17.9	44.8	89.7	134.5
Potomac River	**Subtotal**		**1318.4**	**348.2**	**17.4**	**34.8**	**87.0**	**174.1**	**261.1**

Table 29. Summary: Detached House Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Detached House Rooftop Area (Acre)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Potomac River	O21	2.0	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2.0	2.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2.0	4.8	2.4	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2.0	9.8	4.7	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2.0	10.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2.0	13.8	6.9	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2.0	14.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O28	2.0	16.1	4.2	0.3	0.0	0.0	0.1	0.2	0.2
Potomac River	O21	2.0	33.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O22	2.0	141.6	37.3	0.1	0.0	0.0	0.0	0.0	0.1
Potomac River	O27	2.0	159.2	50.3	5.4	0.3	0.5	1.3	2.7	4.0
Potomac River	O29	2, 3	286.0	53.0	2.1	0.1	0.2	0.5	1.0	1.5
Potomac River	O20	2.0	623.7	179.3	0.2	0.0	0.0	0.0	0.1	0.1
Potomac River	**Subtotal**		**1318.4**	**348.2**	**8.0**	**0.4**	**0.8**	**2.0**	**4.0**	**6.0**

UD = Undetermined CSS area and/or facility outfall

Appendix 1

Potomac CSO Catchment

Table 30. Summary: Semi-Detached House Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Semi-Detached House Rooftop Area (Acre)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
O21	2	1.27	0.1	0.0	0.00	0.00	0.00	0.00	0.0	O21
O23	2	2.24	0.0	0.0	0.00	0.00	0.00	0.00	0.0	O23
O27	2	2.83	0.8	0.0	0.00	0.00	0.00	0.00	0.0	O27
O27	2	4.81	2.4	0.0	0.00	0.00	0.00	0.00	0.0	O27
O23	2	9.82	4.7	0.0	0.00	0.00	0.00	0.00	0.0	O23
O21	2	9.97	4.2	0.0	0.00	0.00	0.00	0.00	0.0	O21
O23	2	13.83	6.9	0.0	0.00	0.00	0.00	0.00	0.0	O23
O21	2	13.99	4.1	0.0	0.00	0.00	0.00	0.00	0.0	O21
O28	2	16.07	4.2	0.1	0.01	0.01	0.03	0.06	0.1	O28
O21	2	33.09	1.0	0.0	0.00	0.00	0.00	0.00	0.0	O21
O22	2	141.55	37.3	0.1	0.00	0.01	0.01	0.03	0.0	O22
O27	2	159.15	50.3	0.9	0.05	0.09	0.23	0.46	0.7	O27
O29	2, 3	286	53.0	2.1	0.10	0.21	0.52	1.04	1.6	O29
O20	2	623.74	179.3	0.3	0.02	0.03	0.08	0.17	0.2	O20
Subtotal		**1318.36**	**348.2**	**3.5**	**0.2**	**0.3**	**0.9**	**1.7**	**2.6**	**Subtotal**

Table 31. Summary: Rowhouse Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rowhouse Rooftop Areas (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Potomac River	O21	2	1.3	0.2	0.1	0.0	0.0	0.0	0.0	0.1
Potomac River	O23	2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	4.8	1.7	0.7	0.0	0.1	0.2	0.3	0.5
Potomac River	O23	2	9.8	0.7	0.3	0.0	0.0	0.1	0.1	0.2
Potomac River	O21	2	10.0	1.9	0.7	0.0	0.1	0.2	0.4	0.5
Potomac River	O23	2	13.8	1.1	0.4	0.0	0.0	0.1	0.2	0.3
Potomac River	O21	2	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O28	2	16.1	3.2	1.2	0.1	0.1	0.3	0.6	0.9
Potomac River	O21	2	33.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O22	2	141.6	10.6	4.0	0.2	0.4	1.0	2.0	3.0
Potomac River	O27	2	159.2	61.6	23.2	1.2	2.3	5.8	11.6	17.4
Potomac River	O29	2, 3	286.0	74.6	28.2	1.4	2.8	7.0	14.1	21.1
Potomac River	O20	2	623.7	18.3	6.9	0.3	0.7	1.7	3.4	5.2
Potomac River	**Subtotal**		**1318.4**	**173.9**	**65.6**	**3.3**	**6.6**	**16.4**	**32.8**	**49.2**

UD = Undetermined CSS area and/or facility outfall

Appendix 1

Potomac CSO Catchment

Table 32. Summary: Apartment Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Apartment Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Potomac River	O21	2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	4.8	0.4	0.2	0.0	0.0	0.1	0.1	0.2
Potomac River	O23	2	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2	14.0	7.8	4.1	0.2	0.4	1.0	2.1	3.1
Potomac River	O28	2	16.1	2.8	1.5	0.1	0.1	0.4	0.7	1.1
Potomac River	O21	2	33.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O22	2	141.6	16.7	8.8	0.4	0.9	2.2	4.4	6.6
Potomac River	O27	2	159.2	1.8	0.9	0.0	0.1	0.2	0.5	0.7
Potomac River	O29	2, 3	286.0	3.0	1.6	0.1	0.2	0.4	0.8	1.2
Potomac River	O20	2	623.7	22.1	11.6	0.6	1.2	2.9	5.8	8.7
Potomac River	**Subtotal**		**1318.4**	**54.6**	**28.8**	**1.4**	**2.9**	**7.2**	**14.4**	**21.6**

Table 33. Summary: Commercial/Institutional Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Commercial/ Institutional Rooftop Areas (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Potomac River	O21	2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	2.8	2.2	0.8	0.0	0.1	0.2	0.4	0.6
Potomac River	O27	2	4.8	4.1	1.6	0.1	0.2	0.4	0.8	1.2
Potomac River	O23	2	9.8	9.5	3.6	0.2	0.4	0.9	1.8	2.7
Potomac River	O21	2	10.0	9.1	3.4	0.2	0.3	0.9	1.7	2.6
Potomac River	O23	2	13.8	17.1	6.4	0.3	0.6	1.6	3.2	4.8
Potomac River	O21	2	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O28	2	16.1	2.8	1.1	0.1	0.1	0.3	0.5	0.8
Potomac River	O21	2	33.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O22	2	141.6	58.5	22.1	1.1	2.2	5.5	11.0	16.6
Potomac River	O27	2	159.2	52.7	19.9	1.0	2.0	5.0	10.0	14.9
Potomac River	O29	2, 3	286.0	50.6	19.1	1.0	1.9	4.8	9.5	14.3
Potomac River	O20	2	623.7	317.6	119.9	6.0	12.0	30.0	59.9	89.9
Potomac River	**Subtotal**		**1318.4**	**524.2**	**197.8**	**9.9**	**19.8**	**49.5**	**98.9**	**148.4**

UD = Undetermined CSS area and/or facility outfall

Appendix 1

Potomac CSO Catchment

Table 34. Summary: Federal Rooftop Control at 5, 10, 25, 50 and 75 Percent Management Levels

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Federal Rooftop Area (Acres)	Rooftop Control Level (%) and Associated Acreage				
						5	10	25	50	75
Potomac River	O21	2	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	9.8	2.1	0.8	0.0	0.1	0.2	0.4	0.6
Potomac River	O21	2	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O28	2	16.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2	33.1	2.7	1.0	0.1	0.1	0.3	0.5	0.8
Potomac River	O22	2	141.6	5.9	2.2	0.1	0.2	0.6	1.1	1.7
Potomac River	O27	2	159.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O29	2, 3	286.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O20	2	623.7	107.2	40.5	2.0	4.0	10.1	20.2	30.3
Potomac River	**Subtotal**		**1318.4**	**117.9**	**44.5**	**2.2**	**4.5**	**11.1**	**22.3**	**33.4**

Table 35. Summary: Detached House Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Detached House Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	0.25	0.50	1.00
Potomac River	O21	2	1.3	0.1	0.0	0.00	0.00	0.00	0.00
Potomac River	O23	2	2.2	0.0	0.0	0.00	0.00	0.00	0.00
Potomac River	O27	2	2.8	0.8	0.0	0.00	0.00	0.00	0.00
Potomac River	O27	2	4.8	2.4	0.0	0.00	0.00	0.00	0.00
Potomac River	O23	2	9.8	4.7	0.0	0.00	0.00	0.00	0.00
Potomac River	O21	2	10.0	4.2	0.0	0.00	0.00	0.00	0.00
Potomac River	O23	2	13.8	6.9	0.0	0.00	0.00	0.00	0.00
Potomac River	O21	2	14.0	4.1	0.0	0.00	0.00	0.00	0.00
Potomac River	O28	2	16.1	4.2	0.3	0.00	0.00	0.00	0.01
Potomac River	O21	2	33.1	1.0	0.0	0.00	0.00	0.00	0.00
Potomac River	O22	2	141.6	37.3	0.1	0.00	0.00	0.00	0.00
Potomac River	O27	2	159.2	50.3	5.4	0.03	0.04	0.07	0.15
Potomac River	O29	2, 3	286.0	53.0	2.1	0.01	0.01	0.03	0.06
Potomac River	O20	2	623.7	179.3	0.2	0.00	0.00	0.00	0.00
Potomac River	**Subtotal**	**0**	**1318.4**	**348.2**	**8.0**	**0.04**	**0.05**	**0.11**	**0.22**

UD = Undetermined CSS area and/or facility outfall

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Potomac CSO Catchment

Table 36. Summary: Semi-Detached House Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Semi-Detached House Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.25**	**0.50**	**1.00**
Potomac River	O21	2	1.3	0.1	0.0	0.00	0.00	0.00	0.00
Potomac River	O23	2	2.2	0.0	0.0	0.00	0.00	0.00	0.00
Potomac River	O27	2	2.8	0.8	0.0	0.00	0.00	0.00	0.00
Potomac River	O27	2	4.8	2.4	0.0	0.00	0.00	0.00	0.00
Potomac River	O23	2	9.8	4.7	0.0	0.00	0.00	0.00	0.00
Potomac River	O21	2	10.0	4.2	0.0	0.00	0.00	0.00	0.00
Potomac River	O23	2	13.8	6.9	0.0	0.00	0.00	0.00	0.00
Potomac River	O21	2	14.0	4.1	0.0	0.00	0.00	0.00	0.00
Potomac River	O28	2	16.1	4.2	0.1	0.00	0.00	0.00	0.00
Potomac River	O21	2	33.1	1.0	0.0	0.00	0.00	0.00	0.00
Potomac River	O22	2	141.6	37.3	0.1	0.00	0.00	0.00	0.00
Potomac River	O27	2	159.2	50.3	0.9	0.00	0.01	0.01	0.02
Potomac River	O29	2, 3	286.0	53.0	2.1	0.01	0.01	0.03	0.06
Potomac River	O20	2	623.7	179.3	0.3	0.00	0.00	0.00	0.01
Potomac River	**Subtotal**	**0**	**1318.4**	**348.2**	**3.5**	**0.0**	**0.0**	**0.0**	**0.1**

Table 37. Summary: Rowhouse Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Rowhouse Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.25**	**0.50**	**1.00**
Potomac River	O21	2	1.3	0.1	0.1	0.00	0.00	0.00	0.00
Potomac River	O23	2	2.2	0.0	0.0	0.00	0.00	0.00	0.00
Potomac River	O27	2	2.8	0.8	0.0	0.00	0.00	0.00	0.00
Potomac River	O27	2	4.8	2.4	0.7	0.00	0.00	0.01	0.02
Potomac River	O23	2	9.8	4.7	0.3	0.00	0.00	0.00	0.01
Potomac River	O21	2	10.0	4.2	0.7	0.00	0.00	0.01	0.02
Potomac River	O23	2	13.8	6.9	0.4	0.00	0.00	0.01	0.01
Potomac River	O21	2	14.0	4.1	0.0	0.00	0.00	0.00	0.00
Potomac River	O28	2	16.1	4.2	1.2	0.01	0.01	0.02	0.03
Potomac River	O21	2	33.1	1.0	0.0	0.00	0.00	0.00	0.00
Potomac River	O22	2	141.6	37.3	4.0	0.02	0.03	0.05	0.11
Potomac River	O27	2	159.2	50.3	23.2	0.12	0.16	0.32	0.63
Potomac River	O29	2, 3	286.0	53.0	28.2	0.15	0.19	0.38	0.76
Potomac River	O20	2	623.7	179.3	6.9	0.04	0.05	0.09	0.19
Potomac River	**Subtotal**	**0**	**1318.4**	**348.2**	**65.6**	**0.3**	**0.4**	**0.9**	**1.8**

UD = Undetermined CSS area and/or facility outfall

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Table 38. Summary: Apartment Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Apartment Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	0.25	0.50	1.00
Potomac River	O21	2	1.3	0.1	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	2.8	0.8	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	4.8	2.4	0.2	0.0	0.0	0.0	0.0
Potomac River	O23	2	9.8	4.7	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2	10.0	4.2	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	13.8	6.9	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2	14.0	4.1	4.1	0.0	0.0	0.1	0.1
Potomac River	O28	2	16.1	4.2	1.5	0.0	0.0	0.0	0.0
Potomac River	O21	2	33.1	1.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O22	2	141.6	37.3	8.8	0.0	0.1	0.1	0.2
Potomac River	O27	2	159.2	50.3	0.9	0.0	0.0	0.0	0.0
Potomac River	O29	2, 3	286.0	53.0	1.6	0.0	0.0	0.0	0.0
Potomac River	O20	2	623.7	179.3	11.6	0.1	0.1	0.2	0.3
Potomac River	**Subtotal**	**0**	**1318.4**	**348.2**	**28.8**	**0.1**	**0.2**	**0.4**	**0.8**

Table 39. Summary: Commercial/Institutional Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Commercial/ Institutional Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	0.25	0.50	1.00
Potomac River	O21	2	1.3	0.1	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	2.8	0.8	0.8	0.0	0.0	0.0	0.0
Potomac River	O27	2	4.8	2.4	1.6	0.0	0.0	0.0	0.0
Potomac River	O23	2	9.8	4.7	3.6	0.0	0.0	0.0	0.1
Potomac River	O21	2	10.0	4.2	3.4	0.0	0.0	0.0	0.1
Potomac River	O23	2	13.8	6.9	6.4	0.0	0.0	0.1	0.2
Potomac River	O21	2	14.0	4.1	0.0	0.0	0.0	0.0	0.0
Potomac River	O28	2	16.1	4.2	1.1	0.0	0.0	0.0	0.0
Potomac River	O21	2	33.1	1.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O22	2	141.6	37.3	22.1	0.1	0.1	0.3	0.6
Potomac River	O27	2	159.2	50.3	19.9	0.1	0.1	0.3	0.5
Potomac River	O29	2, 3	286.0	53.0	19.1	0.1	0.1	0.3	0.5
Potomac River	O20	2	623.7	179.3	119.9	0.6	0.8	1.6	3.3
Potomac River	**Subtotal**	**0**	**1318.4**	**348.2**	**197.8**	**1.0**	**1.3**	**2.7**	**5.4**

UD = Undetermined CSS area and/or facility outfall

Appendix 1

Potomac CSO Catchment

Table 40. Summary: Federal Rooftop Rainfall Volumes (Millions of Gallons) at 0.19, 0.25, 0.50 and 1.0 Total Rainfall Scenarios

WATERSHED	CSO Outfall Facility	CSO Ward #	CSO Area (Acres)	Total Rooftop Area (Acres)	Federal Rooftop Area (Acres)	Rainfall Amount (Inches) Control Scenarios (Millions of Gallons)			
						0.19	**0.25**	**0.50**	**1.00**
Potomac River	O21	2	1.3	0.1	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	2.2	0.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	2.8	0.8	0.0	0.0	0.0	0.0	0.0
Potomac River	O27	2	4.8	2.4	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	9.8	4.7	0.8	0.0	0.0	0.0	0.0
Potomac River	O21	2	10.0	4.2	0.0	0.0	0.0	0.0	0.0
Potomac River	O23	2	13.8	6.9	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2	14.0	4.1	0.0	0.0	0.0	0.0	0.0
Potomac River	O28	2	16.1	4.2	0.0	0.0	0.0	0.0	0.0
Potomac River	O21	2	33.1	1.0	1.0	0.0	0.0	0.0	0.0
Potomac River	O22	2	141.6	37.3	2.2	0.0	0.0	0.0	0.1
Potomac River	O27	2	159.2	50.3	0.0	0.0	0.0	0.0	0.0
Potomac River	O29	2, 3	286.0	53.0	0.0	0.0	0.0	0.0	0.0
Potomac River	O20	2	623.7	179.3	40.5	0.2	0.3	0.5	1.1
Potomac River	**Subtotal**	**0**	**1318.4**	**348.2**	**44.5**	**0.2**	**0.3**	**0.6**	**1.2**

UD = Undetermined CSS area and/or facility outfall

DC-WASA/COG Rain Barrel Demonstration Project Orientation Packet

Thank you for participating in the DC-WASA/COG Rain Barrel Demonstration Project. You are a part of an important investigation into the effectiveness of rain barrels as a means of controlling stormwater runoff. Since this is a groundbreaking project for our staff, your input and cooperation are vital. During the first month of the study period COG staff will visit on a bi-weekly basis to inspect your barrel(s) and to make minor adjustments as needed. Thereafter, COG staff will visit on a monthly basis.

Given the recent appearance in our area of the West Nile Virus we have provided barrels with screened covers. These have been secured to the barrels using plastic "zip" ties and should prevent entry by mosquitoes. Periodically, COG staff will remove the ties and the covers to inspect the interior of the barrels. Following such inspections we will re-secure the covers with new ties. We request that you do not remove the covers during the study period.

Based on your input and on our own findings, the procedures outlined in this packet may change. In the event that such changes are made we will inform you in writing. One factor that may affect the effectiveness of your barrel(s) is the buildup of ice during winter months. We ask that you note, to the best of your ability, any related findings (e.g., excessive overflow, inability to drain barrel, etc.). Please feel free to contact COG staff with questions or comments at one of the numbers listed below.

Materials enclosed in this packet include:
- Rain Barrel Description
- Rain Barrel Performance Survey Form
- Mosquito Awareness Packet

Rain Barrel Maintenance Tips and Survey Procedures

After every rainfall event:

Visually inspect the barrel and screen cover
- Check for signs of overflow
- Remove leaves and other debris from the screen

Fill out the survey form provided by COG
- Note water level using the clear plastic hose attached to one of the two small outlets

At the end of each month or when your survey sheet is full (whichever comes first), send the form to COG using a self-addressed, stamped envelope provided by COG.

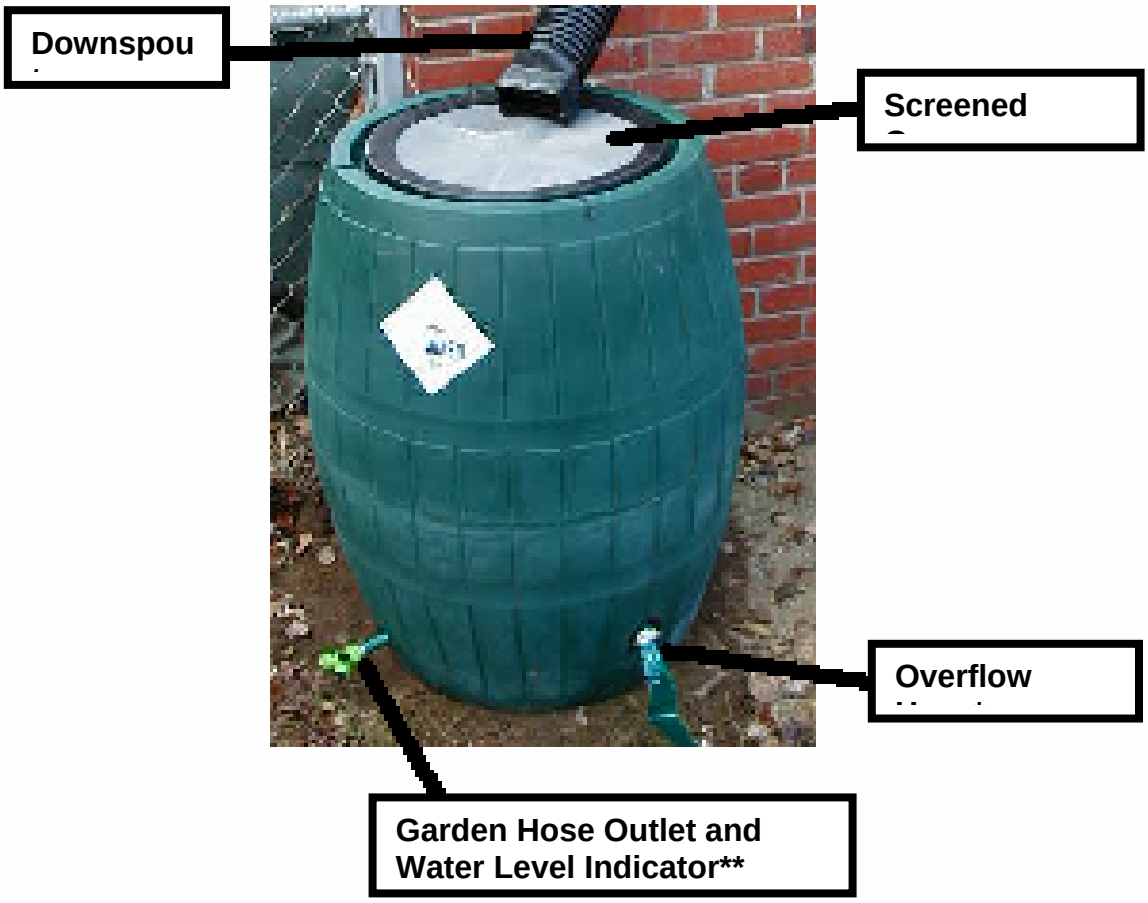
If you have any questions or concerns please contact:

Peter Guillozet
(202) 962-3233 (day)
(301) 270-4424 (evenings)
pguillozet@mwcog.org

Phong Trieu
(202) 962-3291
ptrieu@mwcog.org

UD = Undetermined CSS area and/or facility outfall

Anatomy of a Rain Barrel



* Drains to yard or to Combined Sewer Overflow (CSO) pipe. May be black or green.
** Green “Y” with two outlets. A clear vinyl water level indicator hose is attached to one, the other is used to drain the barrel following a rainfall event or to water plants. A common garden hose may be attached.

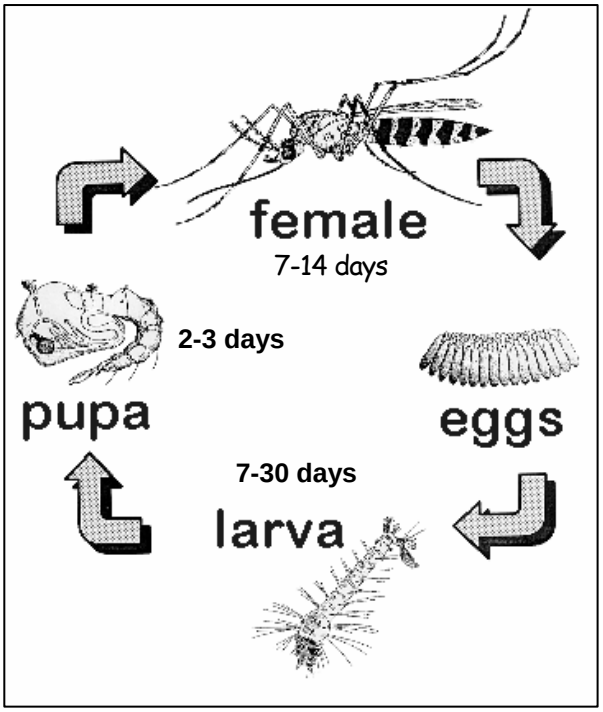
UD = Undetermined CSS area and/or facility outfall

CSO Rain Barrel – Mosquito Identification and Fact Sheet

Life Cycle of a Mosquito

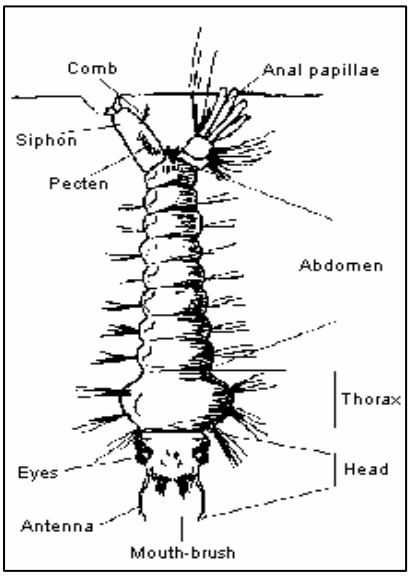
Mosquitoes of different species lay their eggs in a variety of water bodies that range from small containers such as old tires and cans to vast expanses of slow moving, natural marshland. The larval stage or ”wriggler” is always aquatic and shuttles from the subsurface where it feeds on micro-organisms to the surface to obtain oxygen through a snorkel-like breathing apparatus. Depending on the species, mosquito larvae can take from seven days to a month to mature into pupae. The pupal stage does not feed but unlike most insect pupae is extremely active. The adult emerges from the pupal case in about two to three days and assumes a terrestrial existence. For a period of seven to fourteen days, the adult male feeds on nectar while the female searches for hosts such as birds, small mammals, horses and people from which to extract blood to nourish her eggs.

Mosquitoes are most active during dawn, dusk and early evening. Adult females are attracted to warm bodies that emit carbon dioxide (e.g., dogs, cats, and humans). The bite is a sensation felt after the mosquito injects its needlelike “proboscis” and draws blood. Mosquitoes spread diseases such as malaria, yellow fever, and West Nile fever.

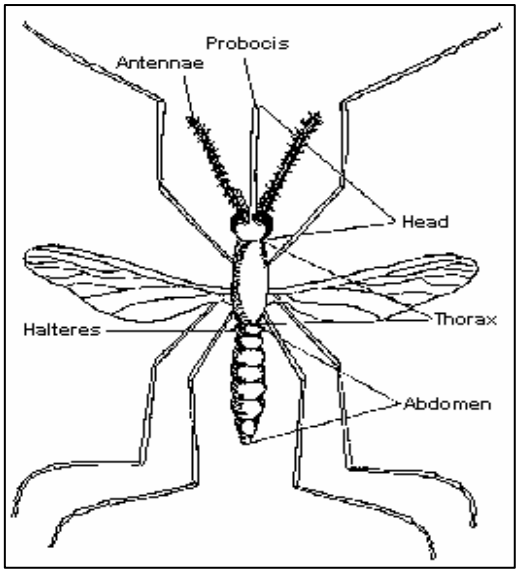


Drawing by Brett Crans

Larva



Adult

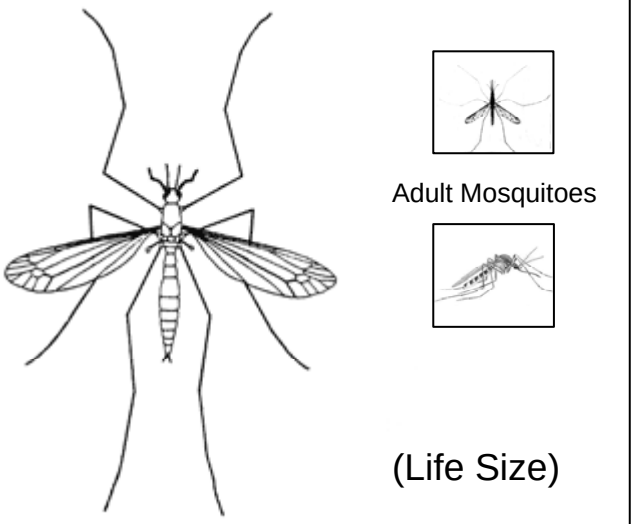


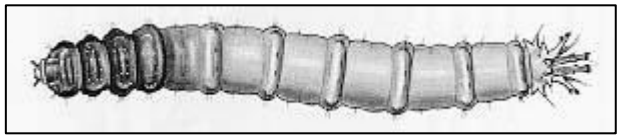
UD = Undetermined CSS area and/or facility outfall

CSO Rain Barrel – Mosquito Identification and Fact Sheet

Mosquito or Cranefly?

Adult craneflies are often mistaken for giant mosquitoes. As shown in the image below, cranefly adults are generally larger than adult mosquitoes. Craneflies are usually brown or gray, and some have dark markings on their wings. Like mosquitoes, craneflies are common near moist or wet areas where vegetation is plentiful. However, unlike the mosquitoes, craneflies do not bite.





Cranefly - Larva

For More Information:

District of Columbia - Department of Health/Environmental Health Administration (202) 576-7934
Centers for Disease Control and Prevention (800) 331-3435
U.S. Department of Health and Human Services (202) 619-0257
Mr. Phong Trieu (MWCOG) (202) 962-3291

www.mosquitoes.com
www.dchealth.com/mosquitoes.htm
www-rci.rutgers.edu/~insects/njmos.htm
www.mosquitoes.org
www.co.okaloosa.fl.us/pub_mosq_life.html
www.ext.vt.edu/departments/entomology/factsheets/mosquito.html
www.ag.ohio-state.edu/~ohioline/hyg-fact/2000/2058.html
http://edis.ifas.ufl.edu/scripts/htmlgen.exe?DOCUMENT_IG081
www.colostate.edu/Depts/IPM/natparks/mosquito.h

UD = Undetermined CSS area and/or facility outfall

Appendix 2. Rain Barrel Demonstration Project
Item 2

Site No. 1

Site No. 1

Site No. 1

Site No. 1

Site No. 2

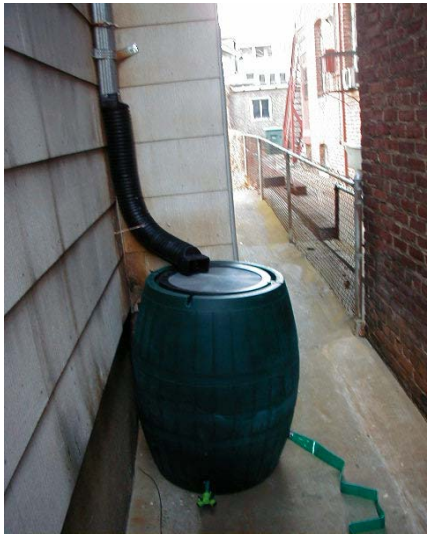
Site No. 3

UD = Undetermined CSS area and/or facility outfall

Appendix 2. Rain Barrel Demonstration Project
Item 2

Site No. 3

Site No. 3



Site No. 3

Site No. 4

Site No. 5

Site No. 6

UD = Undetermined CSS area and/or facility outfall

Appendix 2. Rain Barrel Demonstration Project
Item 2

Site No. 7

Site No. 8

Site No. 9

Site No. 10

UD = Undetermined CSS area and/or facility outfall

Item 3. Sample Rain Barrel Performance Data Log

Survey Date	Approx. Time	Rain Barrel Water Depth (ft)	Did Barrel Overflow? (Y/N)	Date Rain Barrel Last Drained	Barrel Water Release Destination (Drain, Lawn, Alleyway etc.)	Barrel Water Color (Clear, Dark, etc.)	Any Water Odor? (Y/N)	Leaves, Twigs, Grits, etc. Covering Top Debris Screen? (Y/N)	Approx. Percent of Debris Screen Area Clean (0%, 10%, 50% etc.)	Are Mosquito Larvae Present? (Y/N)

Date	Comments/ Observations	Date	Comments/ Observations

UD = Undetermined CSS area and/or facility outfall

Rain Barrel Demonstration Project Final Evaluation Form

Name: **Date:**

Total Number of Rain Barrels:

1. Will you be assuming full ownership of the rain barrel(s) after September 14, 2001 (Yes or No)?

2. What was the approximate number of times, in a month, you drained the rain barrel(s) from the 4-foot long hose?

3. (Relating to Question 2) Where was the most frequent destination for the water that was drained from the rain barrel(s) (i.e., yard, aquarium, down to city storm drain, etc.)?

4. When you drained the rain barrel, did you notice any mosquito larva or organic material exiting from the 4-foot long hose (Yes or No)?

5. At the onset of the demonstration project, was/were the rain barrel(s) drainage a concern to you (Yes or No)?

6. Have the rain barrel(s) caused any drainage problems on your property (Yes or No)?

7. What is your overall evaluation for your rain barrel(s) performance (Not Satisfied, Satisfied, or Very Satisfied)?

8. Did neighbors ever inquire about the purpose of the rain barrel (Yes or No)?

Please provide any comments below and, if necessary, on the backside of this page. Use the enclosed envelope to mail survey back to the Metropolitan Washington Council of Governments.

Figure 1. Precipitation and Ambient and Rain Barrel Water Temperatures