GOVERNMENT OF THE DISTRICT OF COLUMBIA

District Department of the Environment

June 26, 2015

Shawn M. Garvin
Regional Administrator
U.S. Environmental Protection Agency, Region III
Mail Code 3RA00
1650 Arch Street
Philadelphia, PA 19103

Attention: Air Protection Division

Re: Five-Year Assessment - District of Columbia's Ambient Air Monitoring Network

Dear Mr. Garvin,

In accordance with 40 CFR § 58.10(d), the Monitoring and Assessment Branch in District Department of the Environment's Air Quality Division conducted a five-year technical assessment of the District of Columbia's Ambient Air Monitoring Network. Enclosed please find a copy of the five-year network assessment report.

I can be reached on phone at (202) 535-2989 to answer any questions.

Sincerely,

June 26, 2015

Rama S. Tangirala, Ph.D.
Chief, Monitoring and Assessment Branch

Enclosure (1)

cc: Diana Esher, Air Protection Division, US EPA Region III
Alice Chow, Air Quality Analysis Branch, Air Protection Division, US EPA Region III
Cecily Beall, Air Quality Division, DDOE

Five-Year Assessment of the District of Columbia's Ambient Air Monitoring Network

June 26, 2015

Prepared by:

Monitoring and Assessment Branch
Air Quality Division
District Department of the Environment
1200 First Street, N.E., Fifth Floor
Washington, DC 20002

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Acronyms and Definitions

AADT	Annual Average Daily Traffic
AQS	Air Quality System
BAM/BAMM	Beta Attenuation (Mass) Monitor
CAA	Clean Air Act
CAP	Criteria Air Pollutant
CBSA	Core-Based Statistical Area
C.F.R.	Code of Federal Regulations
CSN	Chemical Speciation Network
CO	Carbon Monoxide
DISTRICT	District of Columbia
DDOE	District Department of the Environment
DV	Design Value
EPA	U.S. Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GIS	Geographic Information System
HAPs	Hazardous Air Pollutants
IMPROVE	Interagency Monitoring of Protected Visual Environments
MD	Maryland
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standard
NATTS	National Air Toxic Trends Stations
NAMS	National Air Monitoring Station
NCore	National Core Monitoring Network
NEI	National Emissions Inventory
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen (ozone precursor)
NO_y	Total Reactive Nitrogen Species (ozone precursor)
O_3	Ozone
OC/EC	Organic Carbon/Elemental Carbon
PAMS	Photochemical Assessment Monitoring network Stations
Pb	Lead
$PM_{2.5}$	Particulate matter with an equivalent diameter less than or equal to 2.5 µm
PM_{10}	Particulate matter with an equivalent diameter less than or equal to 10 µm
PPB	Parts per Billion
PWEI	Population Weighted Emissions Index
QA	Quality Assurance
QC	Quality Control
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations
SO_2	Sulfur Dioxide
STN	PM2.5 Speciation Trends Network
VA	Virginia
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

The Clean Air Act mandates an ambient air quality surveillance system in state and local jurisdictions including the District of Columbia (District). The U.S. Environmental Protection Agency (EPA) codified the national ambient air monitoring regulations in Title 40 Code of Federal Regulations (C.F.R.) Part 58.

The District Department of the Environment (DDOE) is the responsible state agency for establishing and maintaining an ambient air quality surveillance system for the District. The Monitoring and Assessment Branch in DDOE's Air Quality Division operates and maintains the District's ambient air monitoring network and ensures quality assurance of the collected ambient air data. Air sampling in the District covers criteria air pollutants, fine particulate pollution chemical species, enhanced monitoring for ozone and its precursor pollutants, air toxics, and surface meteorological parameters. Data from the District's network is delivered to EPA's Air Quality System (AQS) national database and reported on a schedule set forth in 40 C.F.R. Part 58.

The federal regulations require state and local monitoring agencies to conduct a periodic assessment of ambient air monitoring networks and propose any changes in an annual air monitoring network plan. Annual network plans need to be submitted to EPA by July 1st of every year. Additionally, the national regulations also require a comprehensive review of each jurisdiction's ambient monitoring network once every five years. The primary goal of a five-year network assessment is to optimize the network to meet the most important data uses. These assessments are to be transmitted to EPA by July 1st on a five-year interval beginning in 2010.

DDOE completed the first five-year assessment of the District's ambient air monitoring network in 2010. This document presents findings and recommendations for the second assessment conducted this year (2015) covering the 2009-2013 five-year period.

During the 2009-2013 assessment period, the District's network consisted of five (5) monitoring sites. In 2015, the District's network expanded to a six-station network with the addition of a new Anacostia Freeway Near-Road air monitoring station. Also, in early 2015, an experimental "Village Green" park bench air monitoring station with low-cost emerging air sensor technology was established. The park bench air monitoring station is primarily for technology demonstration and public education purposes and it is not part of the District's regulatory network of air monitoring stations. The two sites that have been added to the network since 2013 were not included in this five-year assessment.

The assessment focused on criteria pollutant networks. Findings of the District's network assessment for the (2009-2013) five-year period are summarized below. Subsequent sections of this document provide additional details.

- The minimum required number of sites for all criteria pollutant networks is either met or exceeded.

- Ground-level ozone: The existing network of ozone monitors needs to be maintained and no changes are recommended.

- Carbon monoxide: The District's existing carbon monoxide network (two evaluated sites plus a trace level monitor and a new near-road monitor) far exceeds the requirement. At least two sites are redundant and are good candidates for decommissioning.

- Nitrogen dioxide: Because of the recent introduction of a near-road monitoring station, one nitrogen dioxide monitoring site may be somewhat redundant. This preliminary observation will be evaluated further in the coming years as more data becomes available from the new near-road station.

- Sulfur dioxide: The District's existing sulfur dioxide monitoring network (one evaluated site plus a trace level monitor) exceeds the requirement. One site is redundant and is a good candidate for network optimization.

- Fine particulate matter ($PM_{2.5}$): Gradual phase-in of the $PM_{2.5}$ continuous monitoring technology utilizing $PM_{2.5}$ Federal Equivalent Method (FEM) monitors is recommended to conserve resources. One $PM_{2.5}$ monitoring site may appear as somewhat redundant if the assessment is expanded beyond the District's boundaries to include all monitors in the entire metropolitan area.

In addition, coarse particulate matter (PM_{10}) and ambient lead are each part of a one station network that was not evaluated in this report. Both networks meet the monitoring requirements and no changes are recommended.

1.0 INTRODUCTION

To comply with the federal Clean Air Act (CAA), state and local air agencies are required to operate and maintain ambient air monitoring networks. Ambient air monitoring objectives shift over time, causing air quality agencies to re-evaluate and reconfigure their networks. A variety of factors contribute to these shifting monitoring objectives:

- Air quality changes – for the better in most geographic areas. For example, since the adoption of the CAA and National Ambient Air Quality Standards (NAAQS), the problems of high ambient concentrations of lead and carbon monoxide have largely been solved.

- Populations and behaviors change. For example, the U.S. population has (on average) grown, aged, and shifted toward urban and suburban areas over the past four decades. In addition, rates of vehicle ownership and annual miles driven have grown.

- New air quality objectives are established. For example, rules have been developed to reduce air toxics, fine particulate matter ($PM_{2.5}$), and regional haze.

- The understanding of air quality issues and the capability to monitor air quality improve. Together, the enhanced understanding and capabilities can be used to design more effective air monitoring networks.

As a result of these changes, air monitoring networks may have unnecessary or redundant monitors or ineffective and inefficient monitoring locations for some pollutants, while other regions suffer from a lack of monitors. Air monitoring agencies should, according to the U.S. Environmental Protection Agency (EPA), refocus monitoring resources on pollutants that are new or persistent challenges, such as $PM_{2.5}$, air toxics, and ground-level ozone and precursors, and should deemphasize pollutants that are steadily becoming less problematic and better understood, such as lead and carbon monoxide.

In addition, monitoring agencies need to adjust networks to protect today's population and environment, while maintaining the ability to understand long-term historical air quality trends. Moreover, monitoring networks can take advantage of the benefits of new air monitoring technologies and improved scientific understanding of air quality issues. Existing monitoring networks should be designed to address multiple, interrelated air quality issues and to better operate in conjunction with other types of air quality assessments (*e.g.*, photochemical modeling, emission inventory assessments). Reconfiguring air monitoring networks can enhance their value to stakeholders, scientists, and the general public.[1]

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[1] U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems*, Volume II, EPA-454/B-08-003 (2008).

1.1 Purpose of the Network Assessment

In October 2006, the EPA issued final regulations (Title 40 of the Code of Regulations, or C.F.R., Part 58) concerning state and local agency ambient air monitoring networks. The five-year Network Assessment requirements, as stated in 40 C.F.R. §58.10(d), read as follows:

> *"(d) The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in [Appendix D of 40 CFR 58], whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For $PM_{2.5}$, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator."*

In short, the purpose of this Network Assessment is, at a minimum, to:

- Re-evaluate the objectives for ambient air monitoring;
- Evaluate the network's effectiveness and efficiency relative to its objectives; and
- Develop recommendations for network reconfigurations and improvements.

This document is the second five-year assessment of the District's monitoring network. It addresses the five-year period from 2009-2013. Included are descriptions of federal monitoring network requirements, the District's unique characteristics that may influence the monitoring program, and the District's air monitoring network. These materials are used to evaluate whether the current network contains redundant, inefficient, or otherwise ineffective monitoring sites. The document also includes monitoring network recommendations.

2.0 AMBIENT AIR MONITORING NETWORK REQUIREMENTS

Ambient air monitoring data is collected to measure the concentration of pollutants in the outdoor air. One main purpose is to provide timely air quality data to EPA as a basis for national assessment and policy decision-making.

Under the CAA, EPA is authorized to establish federal pollution limits to protect public health and the environment. EPA standards for the most common ("criteria") pollutants throughout the country are called National Ambient Air Quality Standards (NAAQS). There are NAAQS for six criteria air pollutants: ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter (less than 10 microns, PM_{10}, and less than 2.5 microns aerodynamic diameter, $PM_{2.5}$) and lead (Pb). Primary standards are set according to criteria designed to protect public health, including an adequate margin of safety to protect sensitive populations such as children and elderly. Secondary standards are set to protect public welfare and the environment (*e.g.*, decreased visibility, damage to crops, vegetation, and buildings). The following chart displays the current NAAQS levels and how the pollutant concentrations are to be measured and evaluated to determine compliance with the NAAQS.

Table 1. National Ambient Air Quality Standards

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month average	0.15 μg/m³ (1)	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	Annual	53 ppb (2)	Annual Mean
Ozone [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.075 ppm (3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution Dec 14, 2012	$PM_{2.5}$	primary	Annual	12 μg/m³	annual mean, avgd over 3 years
		secondary	Annual	15 μg/m³	annual mean, avgd over 3 years
		primary and secondary	24-hour	35 μg/m³	98th percentile, avgd over 3 years
	PM_{10}	primary and secondary	24-hour	150 μg/m³	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source and for more details: U.S. EPA (http://www.epa.gov/air/criteria.html)

When air quality does not meet the NAAQS for a criteria pollutant, the area is said to be in "nonattainment" for that pollutant. The District is in nonattainment of the NAAQS for ground-level ozone.

EPA also establishes limits for hazardous air pollutants, otherwise known as air toxics. Although states and the District are required to conduct air toxics monitoring, most emissions control programs for toxics are implemented by EPA. Toxics monitoring is not addressed in this report.

2.1 Monitoring Objectives

According to 40 C.F.R. Part 58, Appendix D, the ambient air monitoring network must be designed to meet three basic monitoring objectives (in no specific order):

1. *Provide air pollution data to the general public in a timely manner. Data can be presented to the public in a number of attractive ways including through air quality maps, newspapers, Internet sites, and as part of weather forecasts and public advisories.*

2. *Support compliance with ambient air quality standards and emissions strategy development. Data from [Federal Reference Method (FRM), Federal Equivalency Method (FEM), and Automated Reference Method (ARM) monitors] for NAAQS pollutants will be used for comparing an area's air pollution levels against the NAAQS. Data from monitors of various types can be used in the development of attainment and maintenance plans. SLAMS, and especially NCore station data, will be used to evaluate the regional air quality models used in developing emission strategies, and to track trends in air pollution abatement control measures' impact on improving air quality. In monitoring locations near major air pollution sources, source-oriented monitoring data can provide insight into how all industrial sources are controlling their pollutant emissions.*

3. *Support for air pollution research studies. Air pollution data from the NCore network can be used to supplement data collected by researchers working on health effects assessments and atmospheric processes, or for monitoring methods development work.*

In order to meet these objectives, there are several types of monitoring sites that provide information about air pollutant concentrations to meet a variety of data needs. Monitors can be designed to focus on:

- Highest Concentration – To determine the highest concentrations expected to occur in the area covered by the network;
- Population Exposure – To measure typical concentrations in areas of high population density;
- Source Impact – To determine the impact of significant sources or source categories of air quality;

- General/ Background Conditions – To determine general background air pollutant concentration levels;
- Regional Transport – To determine the extent of regional pollutant transport among populated areas; or
- Welfare-Related Impacts – To measure air pollutant impacts on visibility, vegetation damage, or other welfare-based impacts.

The total number and type of sites and optimum size of an ambient air quality network often involves trade-offs among data needs to meet monitoring objectives, physical characteristics of a site location, and available resources, so there is some flexibility included in EPA monitoring network requirements.

2.2 Spatial Scales

According to 40 C.F.R. Part 58, Appendix D, the goal in locating monitors is to correctly match the spatial scale represented by the sample of monitored air with the spatial scale most appropriate for the monitoring site type, air pollutant to be measured, and the monitoring objective. Scales of representativeness are defined based on the following population and geographic characteristics:

- Microscale – Range of several meters up to about 100 meters;
- Middle Scale – Several city blocks in size, with a range of about 100 meters to 0.5 kilometers;
- Neighborhood Scale – Extended area of the city with relatively uniform land use, with a range of about 0.5 to 4.0 kilometers;
- Urban Scale – City-like, with a range of about 4 to 50 kilometers;
- Regional Scale – Rural area of reasonably homogenous geography, with a range of tens to hundreds of kilometers; or
- National and Global Scale – The nation or globe as a whole.

Table 2 illustrates the relationship between the various site types that can be used to support the three basic monitoring objectives, and the scales of representativeness that are generally most appropriate for that type of site:

Table 2. Spatial Scale per Monitoring Site Type

Site Type	Appropriate Siting Scales
Highest Concentration	Micro, middle, neighborhood (sometimes urban or regional for secondarily formed pollutants)
Population Exposure	Neighborhood, urban
Source Impact	Micro, middle, neighborhood
General / Background Conditions & Regional Transport	Urban, regional
Welfare-Related Impacts	Urban, regional

Source: 40 C.F.R. Part 58, Table D-1 of Appendix D

2.3 Nationwide Air Monitoring Networks Represented in the District

EPA specifies design criteria for each type of national ambient air monitor networks. Seven national monitoring networks are represented in the District.

- *State and Local Air Monitoring Stations* (SLAMS) – The SLAMS network is designed to quantify ambient levels of gaseous and particulate criteria pollutants. The monitors frequently measure single pollutants for direct comparison to the NAAQS to determine whether areas are in attainment or nonattainment of federal air quality standards and to evaluate population exposure. The District operates SLAMS sites at five air monitoring stations throughout the city: McMillan Reservoir, River Terrace, Verizon, Hains Point, and the Takoma Recreation Center.

- *National Air Monitoring Stations* (NAMS) – The NAMS network is a subset of the SLAMS network. NAMS sites are designated as national trends sites and, in some cases, also serve as design value sites for Metropolitan Statistical Areas (MSAs). The District operates one NAMS site at the Verizon station.

- *NCore Multipollutant Monitoring Network* – NCore is a nationwide network that began in January 2011. It uses highly sensitive air pollutant monitors for the characterization of the precursor gases CO, SO_2, and total reactive oxides of nitrogen (NO_y). Precursor gas analyzers in the network provide measurements at much lower detection limits than are achievable by monitors in other networks. The capability for accurate measurements at low concentrations supports long-term epidemiological studies, reduces uncertainties in data for modeling of air pollution episodes, and supports source apportionment and observational analyses. There are several NCore monitors at the McMillan Reservoir site.

- *Photochemical Assessment Monitoring Stations* (PAMS) – The PAMS network was developed in the 1990s to provide an air quality database to help evaluate and modify control strategies for attaining the ozone NAAQS. The District operates several PAMS monitors at the McMillan station that measure concentrations of dozens of volatile organic compounds (VOCs) and carbonyls in the ambient air.

- *Special Purpose Monitors* (SPM) – SPM networks are designated for special study and are not generally used to determine compliance with a NAAQS. Data is collected using federal reference methods (FRM), federal equivalent methods (FEM), or approved regional methods (ARM). Given below are SPM currently operated at the McMillan site:
    - One National Air Toxic Trends Station (NATTS), out of roughly 30 stations in the NATTS national network[2]. The NATTS network was developed to fulfill the need for long-term hazardous air pollutants (HAPs) monitoring data of consistent quality;

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[2] U.S. Environmental Protection Agency. *Listing of NATTS sites*, found at: http://www.epa.gov/ttnamti1/files/ambient/airtox/nattsite.pdf (August 15, 2012).

- One $PM_{2.5}$ Chemical Speciation Network (CSN) site, part of a national network designed to provide a first order characterization of the metals, ions, and carbon constituents of $PM_{2.5}$ and assist in identifying sources; and
- One organic carbon/elemental carbon (OC/EC) semi-continuous carbon analyzer for special field pilot study of atmospheric particulate matter chemical species measurement technology by EPA.

- *Interagency Monitoring of Protected Visual Environments Network* (IMPROVE) – The IMPROVE program was established in 1985 to help implement plans to reduce visibility impairment in Class I areas (large federally-protected national parks and wilderness areas) as stipulated in the CAA. There are about 110 IMPROVE sites in Class I visibility protection areas. The site in the District is one of the very few IMPROVE sites in an urban area.

- *Village Green Park Bench Air Monitoring Stations* – A new Village Green station, developed by EPA, was deployed at the Smithsonian's National Zoo in 2015 as an innovative prototype air and weather measurement system. "Village Green" solar and wind-powered air monitoring stations are fitted into park benches to demonstrate the capabilities of new real-time monitoring technology for residents and citizen scientists to learn about local air quality. Access to local air quality information from the benches is available through a mobile-friendly website. Village Green stations are intended for research and education on air quality and are not designed for regulatory purposes.

The SLAMS criteria air pollutant (CAP) networks in the District are evaluated in this five-year network assessment. The NAMS, NCore, PAMS, SPMs, IMPROVE, and Village Green networks are reviewed and assessed by EPA periodically, and therefore are not evaluated in this report.

3.0 THE DISTRICT'S MONITORING NETWORK

The District has operated an ambient air monitoring network to meet regulatory requirements of the Clean Air Act since the early 1970s. The District Department of the Environment (DDOE) is the responsible state agency for establishing and maintaining an ambient air quality surveillance system for the District. The Monitoring and Assessment Branch in DDOE's Air Quality Division operates and maintains the District's ambient air monitoring network and ensures quality assurance of the collected data. Air sampling in the District covers criteria air pollutants, fine particulate pollution chemical species, enhanced monitoring for ozone and its precursor pollutants, air toxics, and surface meteorological parameters. Data from the District's network is delivered to EPA's AQS national database on a schedule set forth in 40 C.F.R. Part 58. Formal certifications of the District's data are also transmitted to EPA on an annual basis.

A complete description of the District's air monitoring network (along with the agency's adherence to EPA's technical guidance on designing and maintaining each pollutant network) can be found in the District's *Annual Ambient Air Monitoring Network Plan*, which is updated every year and goes through public comment. Below is a summary of many factors that can influence monitoring network design.

3.1 About the District

The District is predominantly a built urban environment scattered with forested parks and open spaces. It is situated close to sea level at the confluence of the Anacostia and Potomac Rivers and, not including water, is roughly 61 square miles (158 square kilometers) in size. As the Nation's capital, there is a large federal government presence and little industry.

3.1.1 Population

The District fits within many statistical-based definitions for metropolitan areas provided by the U.S. Office of Management and Budget and U.S. Census Bureau:

- A core-based statistical area (CBSA) is a geographic area that is socioeconomically tied to an urban center by commuting. A CBSA associated with at least one urbanized area of 50,000 people or more is called a metropolitan statistical area (MSA).
- Two or more adjacent CBSAs are called a combined statistical area (CSA).

The District is part of the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA. It is also part of the larger Washington-Baltimore-Arlington, DC-MD-VA-WV-PA CSA.

Table 3. Population of the District and Surrounding Area

Year	CSA	MSA (= CBSA)	District
1990	6,726,395	4,222,830*	606,900
2000	7,603,090	4,821,031	571,744
2009	8,440,617	5,476,241	599,657
2010	9,087,417	5,664,789	605,210
2011	9,219,624	5,771,506	620,427
2012	9,334,630	5,862,594	635,040
2013	9,443,180	5,949,859	649,111

Source: U.S. Census (as of July 1 of each year);
MSA and CSA: http://www.census.gov/popest/data/metro/totals/2013/index.html;
District: http://www.census.gov/popest/data/state/totals/2014/index.html
** In 1990, the MSA was considered a Primary MSA, or PMSA.*

The population represented by the District's monitoring network dropped during the 1990s, accompanied by a rise in population in surrounding areas. Population has grown over the past decade in all parts of the metropolitan region, and continued growth is projected.

3.1.2 Sensitive Groups

The NAAQS are designed to include a margin of error to protect groups of the population that are particularly susceptible to health impacts associated with poor air quality, such as children and the elderly. According to the U.S. Census, approximately 14 percent of the District's total population is between the ages of 0 and 14, and nearly 11.5 percent is over the age of 65[3]. Using these age groups as a proxy for children and the elderly, this means that roughly one quarter of the District's population are considered part of a sensitive group.

3.1.3 Meteorological Summary

The District lies in the Mid-Atlantic region between the rigorous climates of the North and the warm temperate climates of the South. The District is located adjacent to the modifying influences of the Chesapeake Bay and Atlantic Ocean to the east and the Appalachian Mountains to the west and north. Since the region is near the average path of the low pressure systems that move across the country, changes in wind direction are frequent. The following tables include a monthly climate summary for 2013 and the monthly normals (long-term averages) for the period between 1981 and 2010 for the closest National Weather Service Automated Surface Observation System (ASOS) site located at Washington Reagan National Airport.

[3] U.S. Department of Commerce, U.S. Census. *American Fact Finder*, found at: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml (accessed in 2015).

Table 4. Local Climate Summary, 2013

2013 Annual Climatological Summary - Washington Reagan National Airport													
Parameter	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	Summary
Mean Daily Max Temperature (˚F)	47.50	45.10	51.50	68.90	75.80	84.40	88.30	84.70	80.90	70.50	54.80	49.80	66.90
Mean Daily Temperature (˚F)	40.30	38.30	43.80	58.90	66.70	76.50	81.20	77.10	71.30	62.40	46.60	42.30	58.80
Mean Daily Min Temperature (˚F)	33.10	31.60	36.10	48.90	57.50	68.60	74.20	69.40	61.70	54.30	38.50	34.70	50.70
Total Precipitation (in.)	2.52	1.67	2.80	2.76	2.82	9.97	4.43	1.34	1.22	6.25	2.92	5.53	44.23
Total Snowfall (in.)	0.90	0.40	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	4.40
Source: National Climatic Data Center													

Source: National Oceanic and Atmospheric Administration,
National Climatic Data Center: http://www.ncdc.noaa.gov/cdo-web/search

Table 5. Local Weather Normals, 1981 to 2010

Monthly Normals 1981-2010 - Washington Reagan National Airport													
Parameter	Month												
	J	F	M	A	M	J	J	A	S	O	N	D	Summary
Mean Daily Max Temperature (˚F)	43.40	47.10	55.90	66.60	75.40	84.20	88.40	86.50	79.50	68.40	57.90	46.80	66.70
Mean Daily Temperature (˚F)	36.00	39.00	46.80	56.80	66.00	75.20	79.80	78.10	71.00	59.50	49.60	39.70	58.10
Mean Daily Min Temperature (˚F)	28.60	30.90	37.60	47.00	56.50	66.30	71.10	69.70	62.40	50.60	41.20	32.50	49.50
Total Means Precipitation (in.)	2.81	2.62	3.48	3.06	3.99	3.78	3.73	2.93	3.72	3.40	3.17	3.05	39.74
Tota Means Snowfall (in.)	5.60	5.70	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	2.30	15.40
Source: National Climatic Data Center													

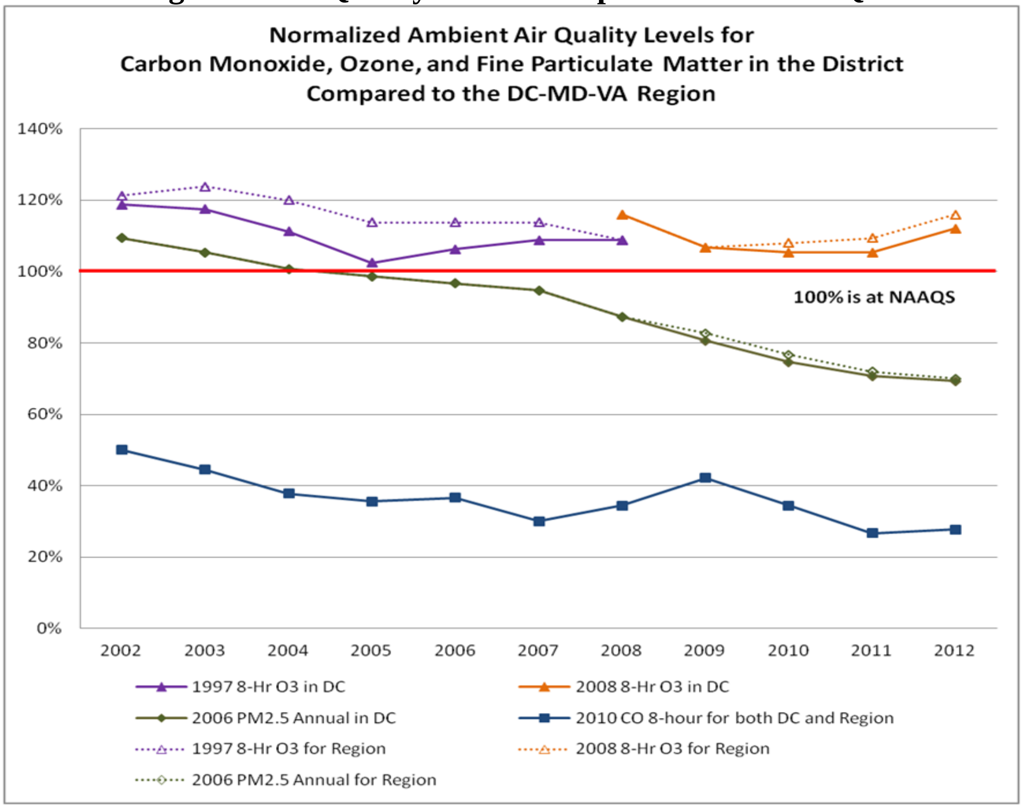
Source: National Oceanic and Atmospheric Administration,
National Climatic Data Center: http://www.ncdc.noaa.gov/cdo-web/search;
https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals

Rainfall distribution is generally uniform throughout the year, although there were summertime fluctuations in 2013. During summer, the area tends to be under the influence of the large semi-permanent high pressure system commonly known as the Bermuda High that is centered over the Atlantic Ocean near 30 North Latitude. The pressure system brings warm humid air to the area. The proximity of large water areas and the inflow of southerly winds contribute to high relative humidity during much of the year.

3.1.4 Air Quality Trends

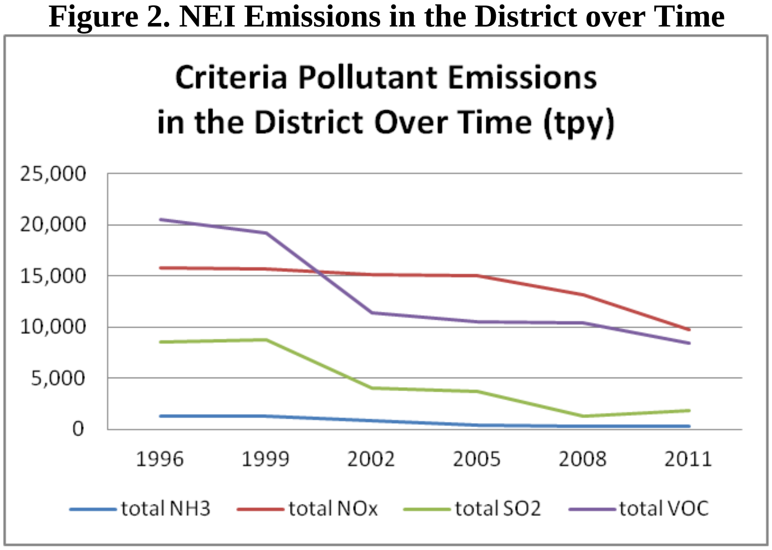
Despite increases in population and related activities, ambient concentrations of all criteria pollutants have dropped over time. To date, the District has always been in compliance with the federal standards for three of the six criteria air pollutants: NO_2, SO_2, and Pb. The District was in nonattainment of the CO standards until 1996 and of the $PM_{2.5}$ standards until recent years. Ozone continues to be the biggest air pollution challenge the region faces.

Figure 1. Air Quality Levels Compared to the NAAQS



Monitored air quality values can at least partially be understood by considering emissions. Based on official EPA National Emissions Inventory (NEI) estimates (not including biogenics)[4], emissions of criteria pollutants and their precursors in the District have dropped gradually since 1996.

Figure 2. NEI Emissions in the District over Time

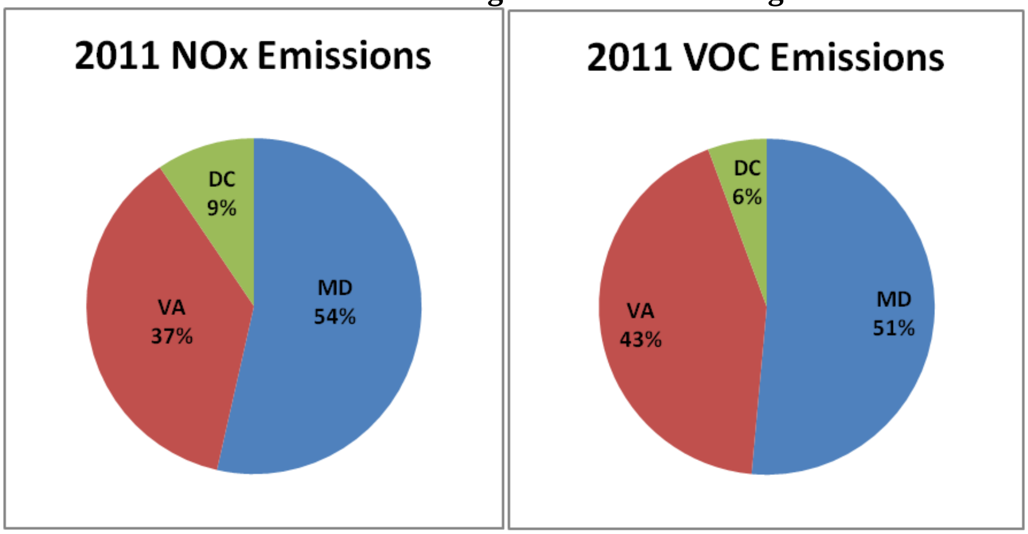


[4] U.S. Environmental Protection Agency. *The 2011 National Emissions Inventory: Version 1*, found at: http://www.epa.gov/ttnchie1/net/2011inventory.html (September 30, 2013).

Such evidence suggests that measures to control pollution have been successful to date. There are similar overall trends for CO and $PM_{2.5}$-primary, but on different scales.

Emissions in the District are generally low compared to emissions from other parts of the Washington DC-MD-VA metropolitan region. The District contributes less than 10% of ozone precursor emissions generated in the Washington DC-MD-VA region.

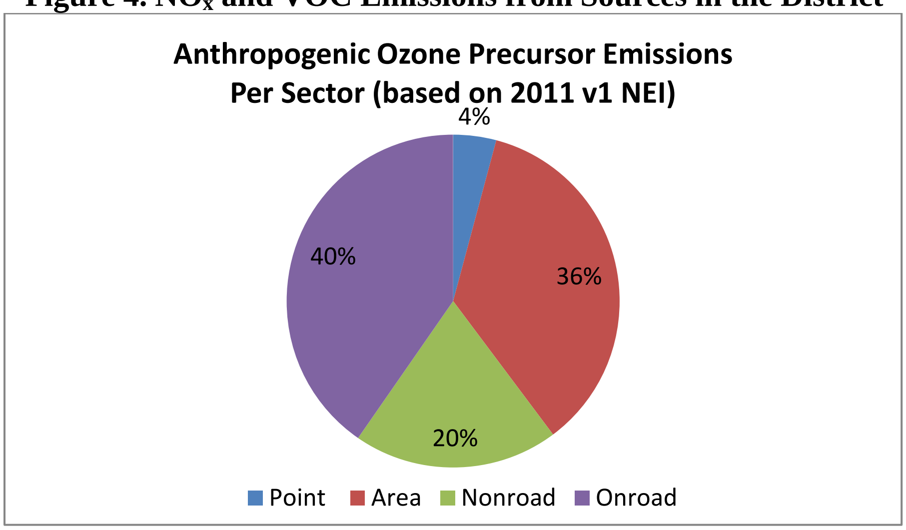
Figure 3. Comparison of Ozone Precursor Emissions Contributions in the Washington DC-MD-VA Region in 2011



A majority of ozone precursor emissions in the District come from power plants and industrial facilities in upwind states.

Most air pollution generated within the District is from motor vehicles. For example, roughly 60% of NO_x and VOC emissions come from cars, trucks, construction equipment, lawn mowers, and other fuel-powered mobile sources.

Figure 4. NO_x and VOC Emissions from Sources in the District

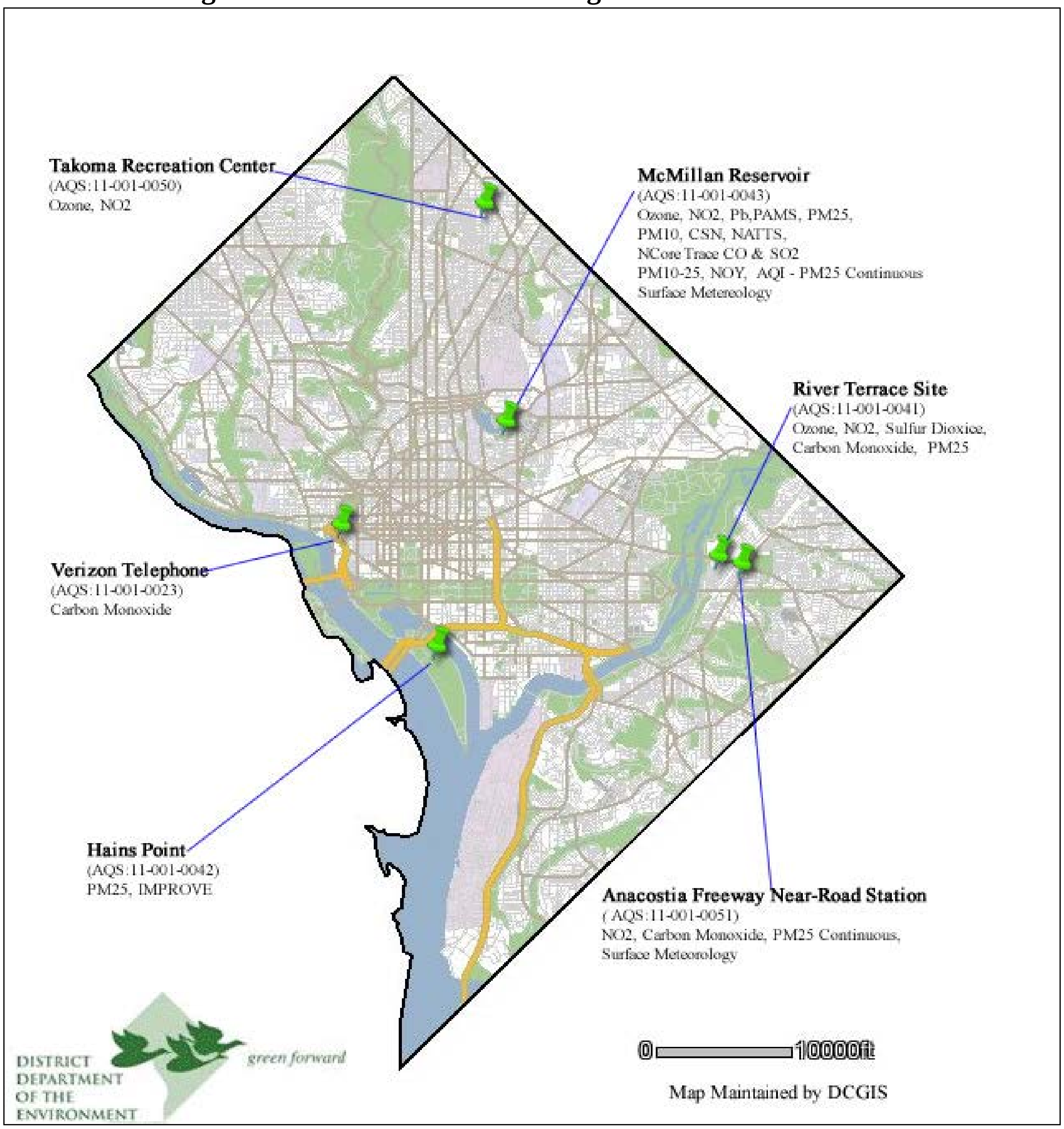


Stationary sources such as large hospitals and universities, dry cleaners, autobody shops, and fumes from commercial and consumer products such as paints, adhesives, and solvents account for the remaining 40 percent.

3.2 The District's Ambient Air Monitoring Network

From 2009 to 2013, the District's air monitoring network included over 30 monitors at five air monitoring stations: McMillan Reservoir, River Terrace, Takoma Recreation Center, Verizon, and Hains Point. A new near-road NO_2 monitoring station was deployed in 2015 in Ward 7 along the Anacostia Freeway. Monitors at the new Anacostia Freeway station are not discussed in this report since there is no data to date.

Figure 5. Ambient Air Monitoring Stations in the District



3.2.1 McMillan Reservoir

The McMillan monitoring station is the most comprehensive ambient air station in the District. It is located in Ward 1 on a 25-acre property near the middle of the city next to a reservoir that supplies the majority of the city's municipal water. This station is located between Georgia Avenue NW and North Capitol Street NE, adjacent to Howard University and surrounded by three hospitals (Children's National Medical Center, Washington Hospital Center, and the Veterans Affairs Medical Center) and residential row houses.

The McMillan station was launched in 1994 as a PAMS station. In 2001, it became the first NATTS site in EPA Region 3. All of the District's Special Purpose Monitors are at the McMillan station. The SLAMS sites at the station are urban-scaled and are designed to measure population exposure and maximum concentrations or trends, or general and background conditions.

3.2.2 River Terrace

The River Terrace monitoring station has been operational since May of 1993. It was initially established because of environmental justice concerns associated with a nearby oil-fired power plant, which shut down in 2012. The station is located in Ward 7 at an elementary school. The neighborhood is bordered by the Anacostia River (near Kingman Island) and three major roadways: Benning Road, East Capitol Street, and Anacostia Freeway. The school closed temporarily in March 2014 for renovations and is expected to reopen during the summer of 2015 as a special education center. DDOE expects to resume the air monitoring operations in the Summer or Fall 2015. All of the SLAMS monitors at the River Terrace School site are neighborhood-scaled, designed primarily to measure population exposure.

3.2.3 Takoma Recreation Center

A fire incident in 2011 caused the Takoma School monitoring station in Ward 4, operational since January 1980, to shut down. It was replaced with a new station on the roof of a nearby recreation center in January 2013. The Takoma Recreation Center monitoring station is surrounded by residential homes, close to the Maryland border between Rock Creek and Sligo Creek Parkways. It is several blocks northeast of the intersection of the Georgia Avenue and Piney Branch Road in northwest, and approximately two blocks from local transit and commercial railroad train lines. . The SLAMS monitors at the Takoma station are neighborhood-scaled, designed to measure population exposure.

3.2.4 Verizon

The Verizon station is the only NAMS site in the District. The station was launched in October 1980 and has one carbon monoxide monitor. It is located in a building in a city canyon environment in Ward 2. The dense urban center is heavily congested with pedestrian and automobile traffic.

3.2.5 Hains Point

The Hains Point monitoring station in Ward 2 has been operational since January 1988. The SLAMS monitors are on the rooftop of a U.S. National Park Service building on a strip of national park land between the Potomac River and a boat channel that leads to the Tidal Basin. Route 395, a heavily traveled highway, crosses over the park and into northern Virginia between Arlington National Cemetery and Washington National Airport. The District operates one $PM_{2.5}$ FRM monitor at this location. In addition, the U.S. National Park Service operates one of the few urban IMPROVE site monitors at Hains Point to measure pollutants that impair visibility.

4.0 EVALUATION OF SPECIFIC POLLUTANT NETWORKS

One criteria air pollutant (CAP) network can include several SLAMS monitors at multiple sites. DDOE maintains a total of 12 monitors as part of five CAP networks for the following criteria pollutants:

Table 6. Number of Monitors in Assessed Criteria Pollutant Networks

Criteria Pollutant	# Total CAP Monitors	*# Special Purpose or Other Monitors*	*# New Near-Road Monitors*	**# Monitors Under Consideration**	In VA	In MD
O_3	3	*0*	*0*	**3**	6	6
CO	2	*1 (NCore trace-McMillan)*	*1*	**2**	2	1
NO_2	3	*1*	*1*	**3**	5	1
SO_2	1	*1 (NCore trace-McMillan)*	*0*	**1**	1	1
$PM_{2.5}$	3	*2 (chemical speciation, (continuous-McMillan)*	*1 (continuous)*	**3**	3	3
			TOTAL:	**12**		

Table 6 above also shows the number of monitors per CAP network that are located in other parts of the DC-VA-MD-WV MSA.

Additional SLAMS in the District that are the sole monitor (for TSP-Lead, $PM_{10-2.5}$ coarse, PM_{10} continuous, $PM_{10-2.5}$ continuous) or are not for CAPs (black carbon, oxides of nitrogen) are not evaluated in this report.

To determine the value of each monitor within each pollutant network, the monitors per pollutant network are ranked using up to five separate analysis methods (described in Section 4.1) and then are scored using a decision matrix (described in Section 4.2).

4.1 Analysis Methods

The District chose to evaluate individual pollutant network monitors using the following analysis methods:

- **Area Served –** Monitors were ranked based on their area of coverage or representation, where sites used to represent a large physical swath of land scored high in this analysis. The technique requires using a Geographic Information System (GIS) to develop Thiessen polygons[5], where a polygon is derived from a point that represents an air monitoring station in the CAP network. All imaginary "points" closer to one particular monitor than any other site are included in the "area served" for that monitor. Monitors that are not close to other monitors, such as those in rural locations, tend to be ranked

[5] ESRI. *GIS Dictionary*, found at: http://support.esri.com/en/knowledgebase/GISDictionary/term/Thiessen%20polygons (accessed May 2015).

higher than monitors on the edge of an urban area or within a cluster of monitors. The "area served" technique is not a true indication of which monitor is most representative of the pollutant concentration in a given area. Meteorology (including pollutant transport), topography, and proximity to population or emission sources are not considered, so some areas assigned to a particular monitor may actually be better represented by a different monitor.

- **Population Served –** Monitors were ranked based on the number of people they represent. Population data for each census-tract or block-group (based on the 2010 U.S. Census) was spatially joined to the Thiessen polygons created in the Area Served analysis. Populations that fell within the GIS-developed area of representation (polygon) associated with a monitor were assigned to that monitor. This technique gives the most weight to monitors in large areas of high population.
    - ***Sensitive populations*** were considered separately. Age ranges were used as a proxy for health-related data. The age ranges used to define the groups most "sensitive" to air pollution were 0-14 years of age and ages greater than 65. A sensitive group population was estimated for all census-tracts in the District, and the population of sensitive residents was divided by the total population represented by an Area Served polygon to produce the percent of sensitive people in that area.

- **Measured Concentrations –** Individual monitors were ranked based on a statistical average of the concentrations of pollutants they measure, called the design values (DVs). Monitors that measure high concentrations (with high DVs) ranked higher than monitors that measure low concentrations (with low DVs). When more than one standard exists for a pollutant (*e.g.*, annual and 24-hr average), monitors were scored for each standard.

- **Trend Impacts –** Monitors that have a long historical record are valuable for tracking trends. Individual monitors were ranked based on the number of years with continuous measurement records. The most important monitors using this method are those that have been operating the longest without major interruptions.

4.2 Decision Matrix

Next, the decision matrix equation in Figure 6 was used to determine the relative value of each monitor in each CAP network.

Figure 6. Decision Matrix Equation

$$Score = 100 * weight * \frac{Vi - Vmin}{Vmax - Vmin}$$

Vi = Value of interest
Vmin = Minimum value for a parameter
Vmax= Maximum value for a parameter

Source: Cavender, 2009
(http://www.epa.gov/ttnamti1/files/2009conference/CavenderDecision.pdf)

1. Each analysis method was subjectively assigned a "weight" (between zero and one) based on the quality of the data and the usage of the data for regulatory purposes.

   For example, for a "population served" analysis for ozone, population estimates are based on data from the 2010 U.S. Census, which is now five years old and may no longer represent the population within the District in 2015. Therefore, the weight given to the "population served" analysis is relatively low at 0.33.

2. The results of each analysis method were normalized to a value using the raw results per analysis, regardless of the unit of measurement.

   For example, for a "population served" analysis for ozone, the parameter is the population (total number of people). If the "value of interest" (*Vi*) is the population served by the ozone monitor at McMillan, then the *Vmin* is the population represented by the ozone monitor that serves the smallest population, and the *Vmax* is the population represented by the monitor that serves the largest population:

   $$\frac{Vi - Vmin}{Vmax - Vmin} = (302{,}855 - 92{,}086) / (302{,}855 - 92{,}086) = 1$$

3. The normalized value is multiplied by the subjectively assigned weight and by 100 to produce a points-based score for each site.

   For example, for the same "population served" analysis:

   Score = 100 * 0.30 * 1 = 30 points

4. Then, the scores from each analysis per monitor are summed to produce a final score per monitor, and that final score is used to rank each monitor per pollutant network.

The following sections include the decision matrix per CAP network. In addition, federal regulations are reviewed to ensure that minimum network requirements are met. Monitoring trends, analysis results, and potential revisions to the monitoring requirements per NAAQS are considered to conclude with an assessment of the value of each monitor per pollutant network.

4.3 Ozone Monitoring Network

The District is designated as a marginal nonattainment area for the 2008 NAAQS for 8-hour ozone. The ozone network includes monitors at three monitoring stations: River Terrace, McMillan Reservoir, and Takoma Recreation Center. All three sites use monitors that measure ground-level ozone ambient air quality based on ultra violet photometry measurement method.

4.3.1 Compliance with Network Requirements

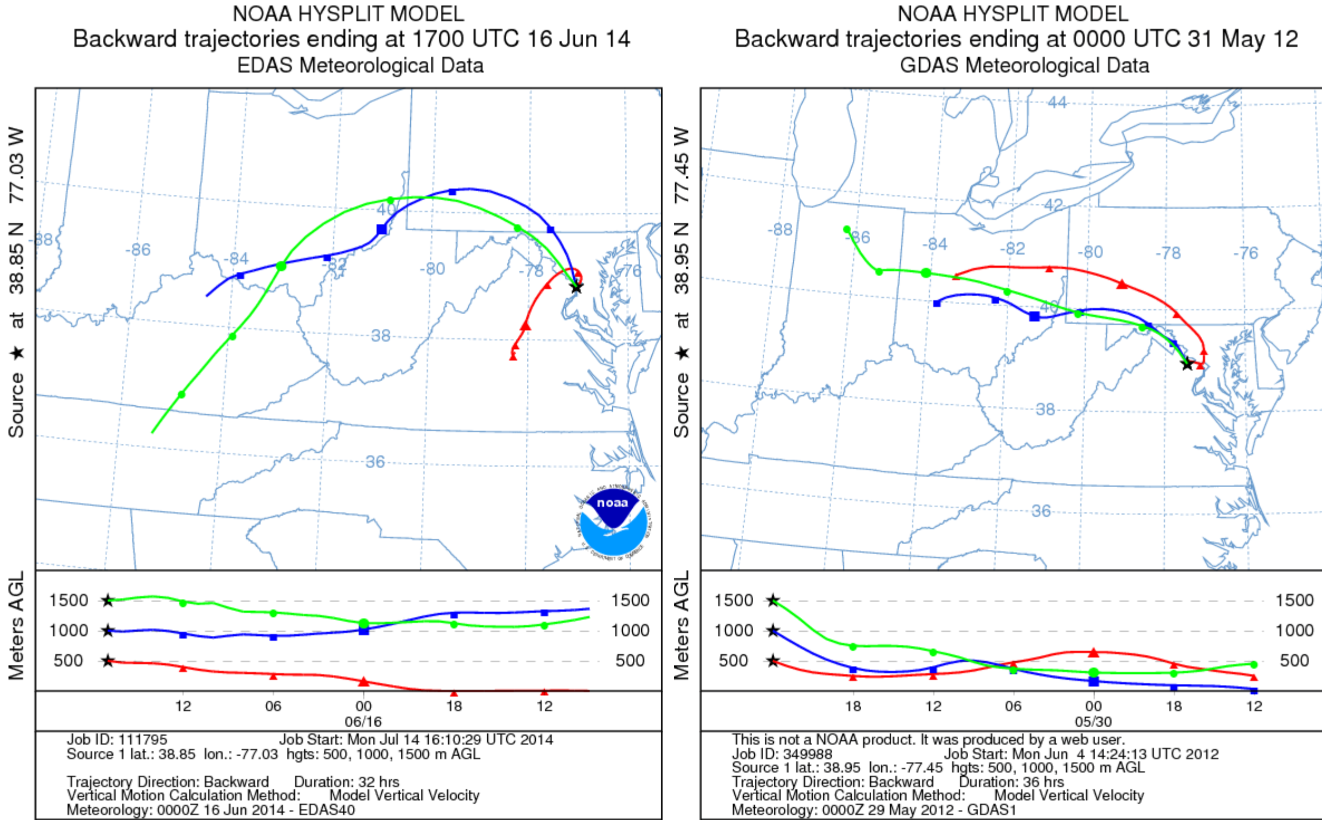
The basic design criteria for ozone can be found at 40 C.F.R. Part 58, Appendix D (section 4.1). The District meets at least the minimum requirements, although additional factors may be considered or required by EPA to design a more complete ozone monitoring program for the area.

For an MSA of over 10 million people, the minimum monitoring requirement is to have at least four monitoring sites when the most recent DV concentrations are equal to or over 85% of the ozone NAAQS, and at least two sites when the most recent DVs are less than 85% of the ozone NAAQS. As indicated in Table 6, there are 15 monitors throughout the region that, combined, presumably support the basic monitoring objectives of public data reporting, air quality mapping, compliance, and understanding ozone-related atmospheric processes.

At least one site in the MSA must be designed to record the maximum concentration for the metropolitan area. The McMillan site meets this criterion.

The appropriate spatial scales for ozone sites are neighborhood, urban, and regional. The McMillan site is an urban-scaled monitor. Measurements are used to determine trends and design area-wide control strategies. The site is not heavily influenced by large sources of non-methane hydrocarbons, NO_x, or other ozone precursor emissions. Since the entire DC-MD-VA region is not attaining the ozone standards, the site is considered to be downwind of areas with high precursor emissions. For example, the wind trajectories analyses in Figure 7 demonstrate how emissions in upwind states travel to downwind areas and contribute to ozone exceedance days (one in 2014 and one in 2012) in the Washington DC-MD-VA metropolitan region. During both episodes, emissions came from Ohio and Pennsylvania, states with large coal-fired power plants and high ozone precursor emissions.

Figure 7. Wind Trajectories for an Ozone Exceedance Day in 2014 and Another in 2012



Source: Kumar, 2014 (http://www.mwcog.org/uploads/committee-documents/aF1YW1ta20140715110951.pdf) and Kumar, 2012 (http://www.mwcog.org/uploads/committee-documents/Zl1dXVZW20120611143553.pdf)

The monitors at River Terrace and the Takoma Recreation Center are neighborhood-scaled, so are useful when defining the processes that take periods of hours to occur and hence involve considerable mixing and transport. They may experience peak concentration levels under stagnation conditions. Both sites are in reasonably homogenous geographical areas near the center of the region and meet the criteria. All sites are placed in locations that meet EPA requirements.

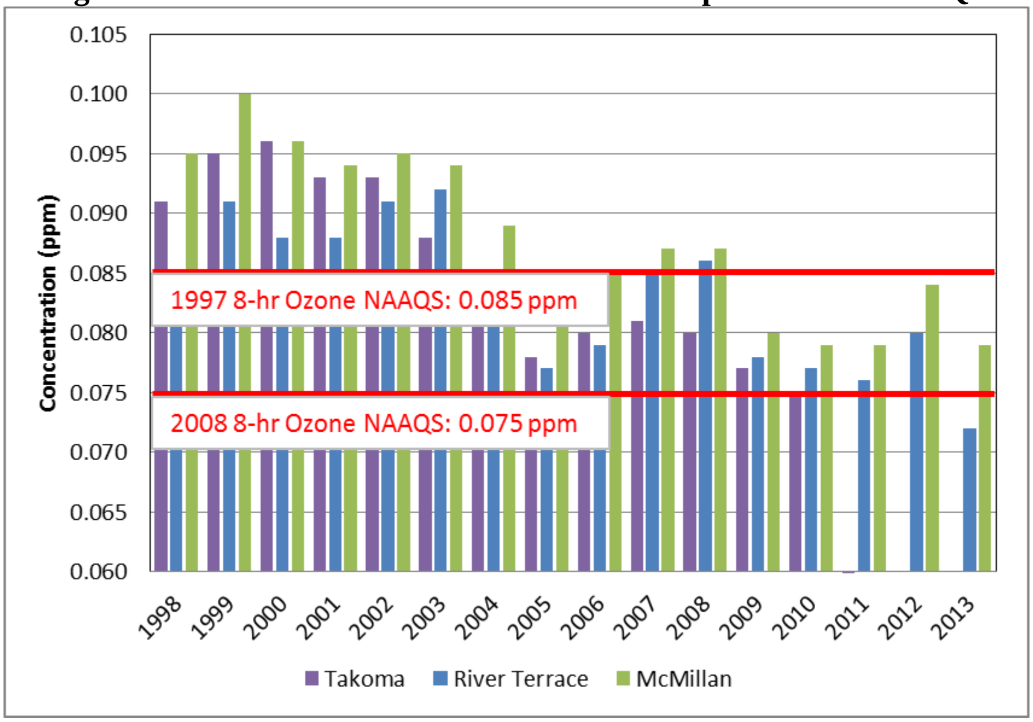
EPA requires ozone monitoring primarily during the ozone season, which begins on April 1 and ends on October 31 (Table D-3 to Appendix D of 40 C.F.R. Part 58). All three of the District's ozone monitors operate continuously year-round, so they exceed this requirement.

4.3.2 Monitoring Results

The 2008 8-hour ozone NAAQS is based on the fourth highest maximum reading in one year. Data is collected hourly, with 8-hour forward-rolling averages established for every hour in a day. (There are 24 8-hour averages per day). An arithmetic mean over three consecutive years is used to determine the DV.

The following chart demonstrates how, over time, 8-hour ozone concentrations have generally dropped at all three monitoring stations that measure ozone in the District. The McMillan station consistently measures the highest levels of ozone.

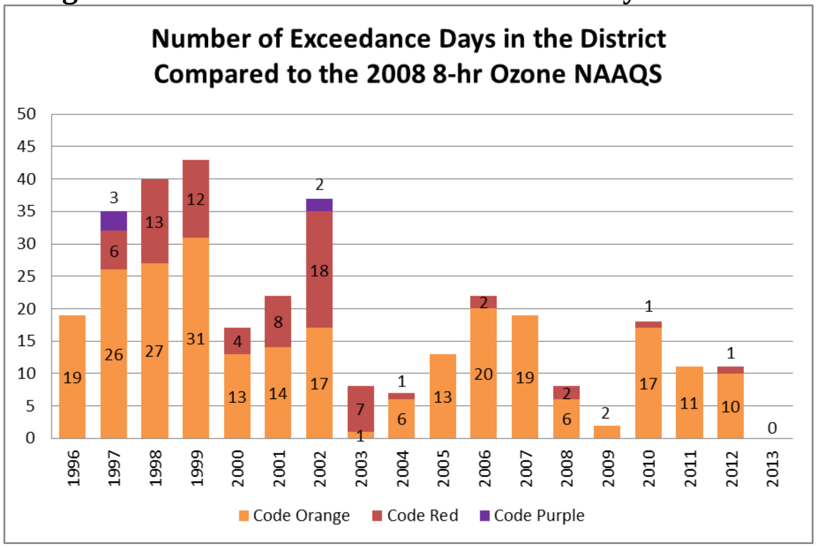
Figure 8. Ozone Concentrations over Time Compared to the NAAQS



The Takoma School site, represented in the chart, stopped operating in 2011 due to fire. A new replacement station was established at the Takoma Recreation Center in 2013.

The trend for the number of NAAQS exceedance days in Figure 9 follows the same cyclical trend. There have been relatively few exceedances in recent years.

Figure 9. Number of Ozone Exceedance Days Per Year



4.3.3 Identification of Redundant Sites or New Sites Needed

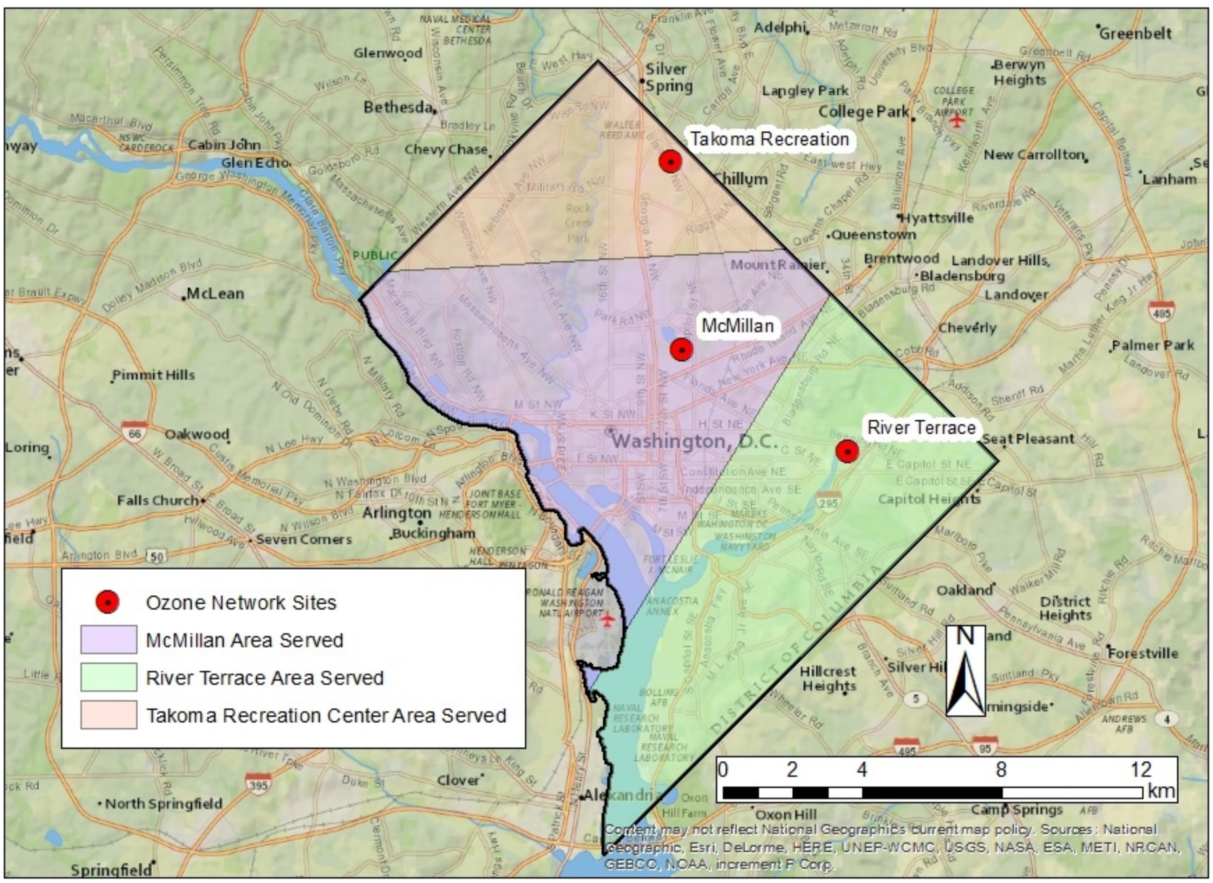
When focused on the three ozone monitors at McMillan, River Terrace, and Takoma Recreation (Rec.) Center, the results of the five analysis methods are as follows:

Table 7. Results of Ozone Analyses

Type of Analysis	Ranked First	Ranked Second	Ranked Third
Area Served	McMillan	River Terrace	Takoma Recreation Center
Population Served	McMillan	River Terrace	Takoma Recreation Center
Sensitive Population Served	*Takoma Recreation Center*	*River Terrace*	*McMillan*
Measured Concentrations	McMillan	River Terrace	Takoma Recreation Center
Trend Impacts	River Terrace	McMillan	Takoma Recreation Center

- **Area Served –** The GIS Thiessen polygon analysis results are in Figure 10. The monitor that serves the largest portion of land is the McMillan site, with an area of 74 square kilometers (sq. km). The site that serves the smallest physical area is Takoma Recreation Center station, which covers 32 sq. km.

Figure 10. Area Served for the Ozone Network



- **Population Served** – Two distinct analyses were performed: one on the total population covered by the monitor, and one on the percent of the population that is most sensitive to high levels of air pollution.
    - *Total Population* – The population of the area represented by the McMillan station is 302,855, which is larger than the population of the area served by both the River Terrace and the Takoma Recreation Center stations that represent 206,782 and 92,086 people (respectively).
    - *Sensitive Populations* – The Takoma Recreation Center Station and the River Terrace Station have the highest percentage of people in the sensitive group with 33 percent and 30 percent (respectively), and the sensitive population represented by the McMillan station is the smallest at 20%.

- **Measured Concentrations** – The highest DVs for 2009-2013 were evaluated for each station except Takoma Recreation Center, which did not have a valid DV for every year[6]. The site with the highest DV was the McMillan station with a value of 0.087 parts per million (ppm), and the site with the lowest DV was the River Terrace station with a value of 0.080 ppm.

- **Trends Impact** – The station with the longest continuous sampling period (between the first year of sampling and 2014) was River Terrace with 21 years of operation, and the station with shortest continuous sampling period was the Takoma Recreation Center with 1 year. The McMillan station has continuously sampled for 20 years.

The results from the Decision Matrix performed on the ozone network are presented in Table 8.

Table 8. Ozone Network Decision Matrix

Ozone Network											
SITE	Area Served (sq. km)		Pop. Total 2010		Sensitive Pop. 2010		Measured Conc. 8 Hr (ppm)		Trends Impact		Score
	Weight	0.30	Weight	0.30	Weight	0.30	Weight	1.00	Weight	0.50	
	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	
McMillan	74.00	**30**	302855	**30**	0.1975	**0**	0.0870	**100**	20.00	**48**	208
River Terrace	71.00	**28**	206782	**16**	0.3035	**25**	0.0800	**0**	21.00	**50**	119
Verizon											
Haines Point											
Takoma Rec.*	32.00	**0**	92086	**0**	0.3261	**30**			1.00	**0**	30
Rank 1: McMillan (208)				Rank 2: River Terrace (119)				Rank 3: Takoma Rec. (30)			
* Incomplete Design Value											

Based on the scores produced using the decision matrix, the site of highest value is McMillan. The second most valued station is River Terrace, and the station of lowest value is Takoma Recreation Center.

6 *The Takoma School site stopped operating in 2011 due to fire. A new replacement station was established at the Takoma Recreation Center in 2013.*

4.3.4 Proposed Regulations

EPA proposed to lower the NAAQS for ground-level ozone on December 17, 2014 (79 Fed. Reg. 75234). The proposal suggests revising the length of state-by-state monitoring seasons, PAMS monitoring requirements, FRM for measuring ozone, and FEM testing requirements (for ozone as well as for NO2 and $PM_{2.5}$). A final rule is anticipated in late 2015.

The 2008 NAAQS for 8-hour ozone underwent substantial legal challenges. The State Implementation Plan (SIP) Requirements and Final Rule for the NAAQS was finalized on March 6, 2015 (80 Fed. Reg. 12264). The final rule made no changes to existing ozone monitoring requirements in 40 C.F.R. Part 58.

4.3.5 Network Recommendations

No new stations are recommended for addition to the ozone network at this point.

Since the District is still in marginal nonattainment of the 8-hour NAAQS for ground-level ozone, no existing monitors are considered redundant and no sites within the ozone network are under consideration for decommissioning.

4.4 CO Monitoring Network

The District is in attainment of federal standards for both 8-hour and 1-hour CO. The District was in nonattainment of the 1994 8-hour standard but attained the standard in 1996. Maintenance with the standard has been demonstrated through 2016, as required by the Clean Air Act.

The CO network includes monitors at two stations: River Terrace and Verizon. Both sites measure concentrations using nondispersive infrared phototremy. There is a third CO monitor at the McMillan site that is not evaluated in this report because it measures trace levels as part of the NCore network, which is required and evaluated by EPA. Also, a fourth CO site at the near-road monitoring station was established recently in 2015 to meet the monitoring requirements of the 2011 CO standards.

4.4.1 Compliance with Network Requirements

The basic design criteria for CO are specified in 40 C.F.R. Part 58, Appendix D (section 4.2). The District meets the minimum requirements, although additional factors may be considered or required by EPA to design a more complete CO monitoring program for the area.

One CO monitor must be collated with one required near-road NO_2 monitor in each CBSA of one million people or more. The newly established near-road monitoring station in the District with a CO monitor began operating in 2015. There is no evidence that peak ambient CO concentrations would occur in any other near-road location. The near-road site classification is microscale, which is one of the most useful. Most people have the potential for exposure at the microscale and middle scale. Exposure primarily occurs near major roadways and intersections with high traffic density and poor ventilation.

Neighborhood scale measurements are also useful for providing relative urban background concentrations, supporting health and scientific research, and in modeling. The River Terrace site is neighborhood-scaled.

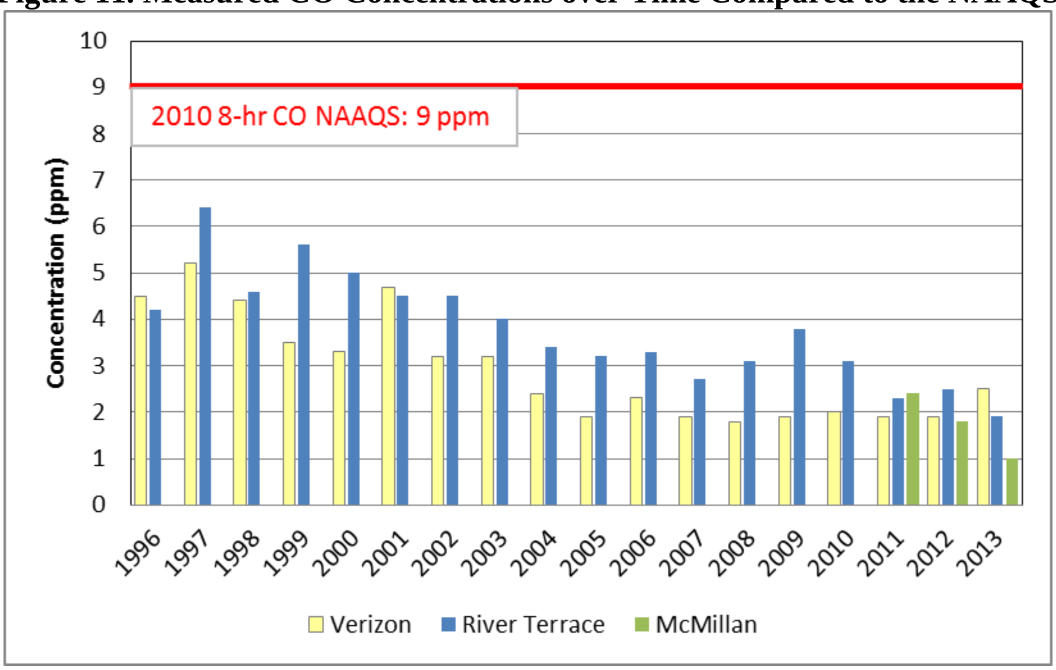
The additional monitor at the Verizon station is urban-scaled.

4.4.2 Monitoring Results

For the 8-hour CO standard, hourly measurements are averaged over eight hours on a backward-rolling basis to establish daily 8-hour averages. The second highest maximum reading is taken per year to determine an annual estimate, and the DV is the highest annual estimate over two consecutive years. For the 1-hour standard, concentration levels are represented by the highest value (1st Max) compared to the second highest value (2nd Max) per year, and the NAAQS is not to be exceeded more than once per year.

As demonstrated in Figure 11, the District's CO concentration levels have remained well below the NAAQS since 1996.

Figure 11. Measured CO Concentrations over Time Compared to the NAAQS



4.4.3 Identification of Redundant Sites or New Sites Needed

Since the District operates only two carbon monoxide monitoring stations as part of the SLAMS network, only two analyses were completed. The results are follows:

Table 8. Results of CO Analyses

Type of Analysis	Ranked First	Ranked Second
Area Served		
Population Served		
Sensitive Population Served		
Trend Impacts	Verizon (8-hr & 1-hr)	River Terrace (8-hr & 1-hr)
Measured Concentrations	River Terrace (8-hr) Verizon (1-hr)	Verizon (8-hr) River Terrace (1-hr)

- **Measured Concentration –** Since there are multiple NAAQS for carbon monoxide, both the 8-hour and 1-hour DVs were considered in the analysis. For the 8-hour standard, the highest DV between 2009 and 2013 was observed at River Terrace at 3.0 parts per million (ppm), and the lowest DV was observed at the Verizon station at 2.5 ppm. For the 1-hour standard, the highest was observed at the Verizon station with a DV of 4.4 ppm, and the lowest was at River Terrace with a DV of 4.2 ppm.

- **Trends Impact –** The station with the longest continuous sampling time was the Verizon station with 34 years of operation, and the station that ran continuously for the shortest sampling time of 21 years was River Terrace.

Table 9. CO Network Decision Matrix

Carbon Monoxide Network													
SITE	**Area Served (sq. km)**		**Pop. Total 2010**		**Sensitive Pop. 2010**		**Measured Conc. 8 Hr (ppm)**		**Meausred Conc. 1Hr (ppm)**		**Trends Impact**		**Score**
	Weight	0.30	Weight	0.30	Weight	0.30	Weight	1.00	Weight	1.00	Weight	0.50	
	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	
McMillan													
River Terrace							3.80	**100**	4.20	**0**	21.00	**50**	150
Verizon							2.50	**0**	4.40	**100**	34.00	**0**	100
Haines Point													
Takoma Rec.													
Rank 1: Verizon (150.00)				Rank 2: River Terrace (100.00)						Rank 3:			

Based on the decision matrix in Table 9, the station with a greatest value is the Verizon Station and the station with the lowest value was the River Terrace.

4.4.4 Proposed Regulations

There are no proposed regulations related to the CO NAAQS at this time.

EPA revised the CO NAAQS and retained the existing primary standards on August 31, 2011 (76 Fed. Reg. 54294). No secondary standard was set. Ambient air monitoring requirements were expanded. Relatively minor changes were made to the federal reference methods (FRM) to support the NAAQS. Network design requirements were revised to add near-road collocation siting requirements. The District met this requirement by adding a CO monitor to the near-road station, so measurements of ambient CO exposures in microenvironments influenced by onroad mobile sources will commence in 2015.

4.4.5 Network Recommendations

CO concentrations at all sites are well below the NAAQS and the network requirements are being met, so the District does not recommend establishing any new CO monitors.

Based on the analysis and existing network requirements, two sites are highly redundant: the River Terrace Station and the Verizon site. The District recommends decommissioning of the Verizon site (as a SLAMs site) before considering removal of the River Terrace site. Even though the River Terrace station ranked lower than the Verizon site, there are access issues with the Verizon site that make it a better candidate for removal. The proximity of the River Terrace station to the new nearby Anacostia Freeway Near-Road Station adds value to the River Terrace station. Once data is available from the near-road site, there will be opportunity to compare CO values between the two sites to examine the spatial gradient of CO.

4.5 NO_2 Monitoring Network

The District is an unclassifiable/attainment area for the 2010 1-hour NO_2 NAAQS. The District is attaining the 1996 and 2010 annual NAAQS.

The NO_2 network includes monitors at three stations: McMillan Reservoir, River Terrace, and Takoma Recreation Center. All three monitors measure concentrations using chemiluminescence analyzers. There is also a NO_y monitor at McMillan, which is part of the NCore network to collect data on total reactive nitrogen species for understanding ozone photochemistry. Also not evaluated in this report is a new near-road monitor, which began operating in 2015 to meet the monitoring requirements of the new 1-hour standard. Once three years of quality-assured data is collected, the District's designation status may change.

4.5.1 Compliance with Network Requirements

The basic design criteria for NO_2 are specified in 40 C.F.R. Part 58, Appendix D (section 4.3). The District meets the minimum requirements, although additional factors may be considered or required by EPA to design a more complete NO_2 monitoring program for the area.

To meet Appendix D requirements, there must be one microscale near-road NO_2 monitoring station in each CBSA with a population of 500,000 people or more to monitor a location of expected maximum hourly concentrations. A near-road station that includes an NO_2 monitor was established in the District in 2015, so the criterion is met. An additional near-road NO_2 station is required if the CBSA population exceeds 2.5 million, or if a CBSA with over 500,000 has one or more roadway segments with 250,000 or greater annual average daily traffic (AADT) counts. A second near-road NO_2 monitoring station is planned for deployment in Springfield, VA, so it is likely that this criterion is met. The District anticipates that both sites will measure a minimum of NO, NO_2, and NO_x.

To meet area-wide monitoring requirements, there must be a monitor in a location with expected highest NO_2 concentrations representing the neighborhood or larger spatial scale within each

CBSA of one million people or more. The McMillan site meets the criteria. It is urban-scaled and is co-located with a PAMS site that is operated year-round.

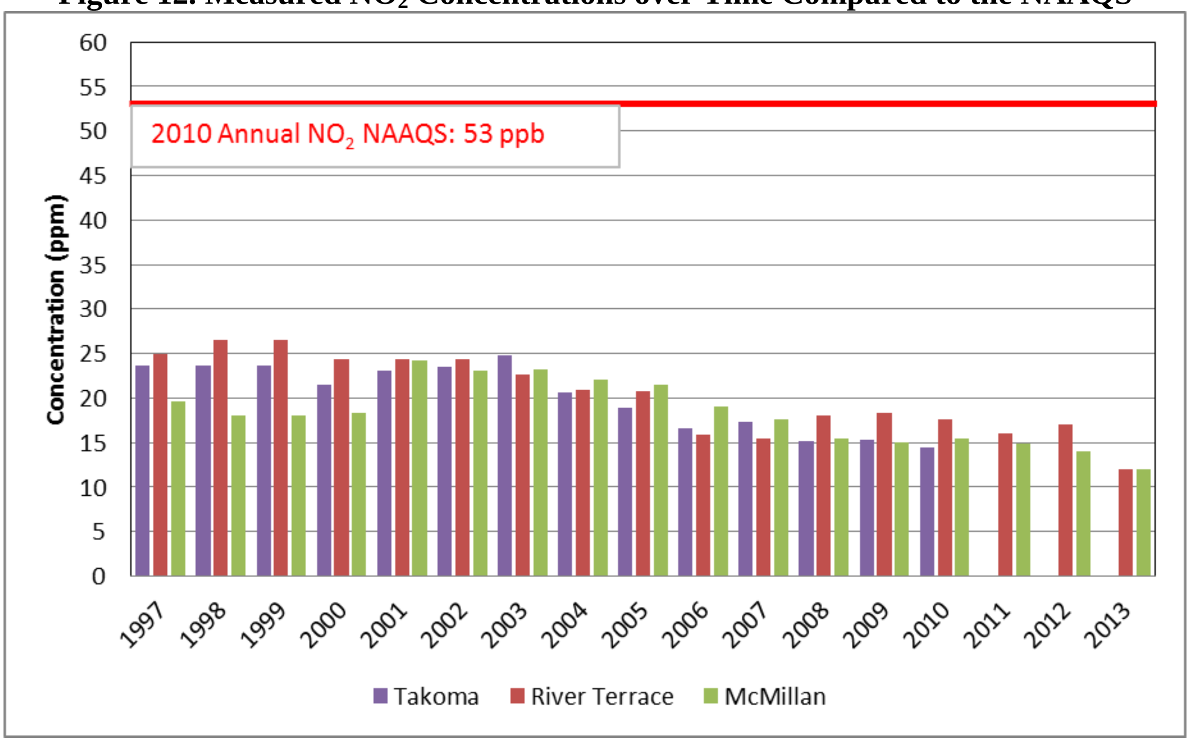
The other two NO_2 sites in the District are neighborhood-scaled. Both the River Terrace and Takoma sites are located away from immediate NO_2 sources, so are considered useful in representing typical air quality values for a larger residential area.

In addition, NO/NO_y measurements are taken at the McMillan site to produce conservative estimates for NO_2 that can be used to ensure tracking continued compliance with the NO_2 NAAQS. The sensors are part of the NCore and PAMS networks. Data on total reactive nitrogen species can help understand ozone photochemistry.

4.5.2 Monitoring Results

For the 2010 1-hour NO_2 standard, an annual estimate is the 99th percentile reading of hourly measurements ranked from high to low. The annual NAAQS is the average of hourly measurements per year. For both, the DV is the highest estimate over two consecutive years. Over the past fifteen years, the maximum annual average NO_2 levels have remained at approximately half of the federal standard at all monitoring stations, and ambient air concentrations continue to remain well below the NAAQS.

Figure 12. Measured NO_2 Concentrations over Time Compared to the NAAQS



The Takoma School site, represented in the chart, stopped operating in 2011 due to fire.
A new replacement station was established at the Takoma Recreation Center in 2013.

4.5.3 Identification of Redundant Sites or New Sites Needed

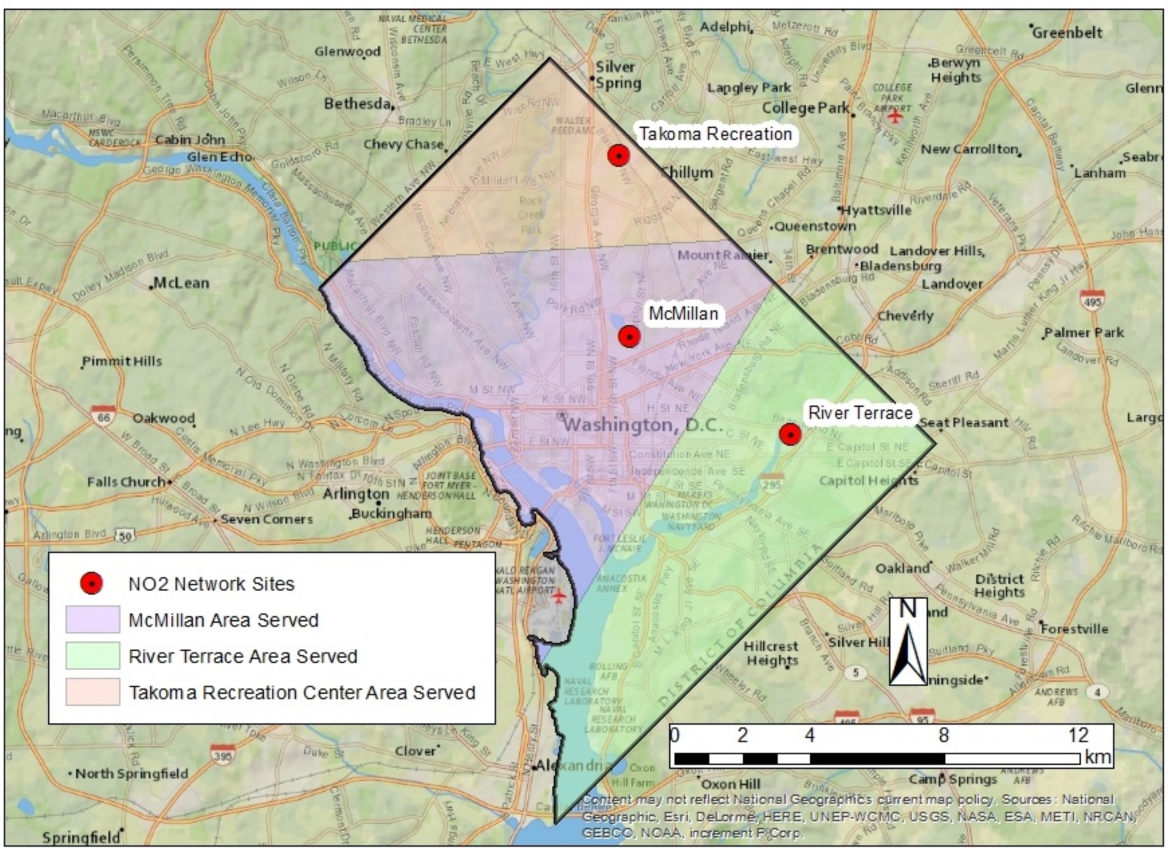
The results of analysis of the three NO_2 monitors are as follows:

Table 10. Results of NO_2 Analyses

Type of Analysis	Ranked First	Ranked Second	
Area Served	McMillan	River Terrace	Takoma Recreation Center
Population Served	McMillan	River Terrace	Takoma Recreation Center
Sensitive Population Served	*Takoma Recreation Center*	*River Terrace*	*McMillan*
Trend Impacts	River Terrace (annual & 1-hr)	McMillan (annual & 1-hr)	Takoma (annual & 1-hr)
Measured Concentrations	River Terrace (annual & 1-hr)	McMillan (annual & 1-hr) Takoma (annual)	Takoma (1-hr)

- **Area Served –** The River Terrace Station, the area covered by the River Terrace monitor is 71 sq. km. The McMillan Station serves the largest area (74 sq. km), and the Takoma Recreation Center station covers the smallest area (32 sq. km).

Figure 13. Area Served for the Nitrogen Dioxide Network



- **Population Served –** Since NO_2 is monitored at the same stations as ozone, similar values for the Population Severed and Area Served analysis were observed.
    - *Total Population* – The area served by the McMillan Station had the greatest total population (303,855). The population of the area served by the River Terrace monitor was 206,782, and the Takoma Recreation Center station covered the smallest population (92,086).
    - *Sensitive Populations* – The smallest percentage of people sensitive to high air pollution concentrations reside in the area served by the McMillan Station (20%). In the area served by the River Terrace monitor, the percent of the population that is sensitive to high air pollution is 30%. The Takoma Recreation Center station has the largest population that is sensitive to high air pollution (33%).

- **Measured Concentration –** The highest DVs between 2009 and 2013 for the Annual and 1-hour NAAQS was used in the analysis. As with the ozone analysis, the Takoma Recreation Center station was excluded from the analysis because of incomplete data. The River Terrace station observed this highest DV for both the annual standard at 18 parts per billion (ppb) and the 1-hour standard at 61 ppb. The McMillan station had the lowest DV for both standards at 15 ppb and 59 ppb, respectively.

- **Trends Impact –** The station with the longest continuous sampling period was the River Terrace station at 21 years and the shortest continuous sampling period was at the Takoma Recreation Center station with 1 year of continuous operation.

Table 11. NO_2 Network Decision Matrix

Nitrogen Dioxide Network													
SITE	**Area Served (sq. km)**		**Pop. Total 2010**		**Sensitive Pop. 2010**		**Measured Conc. Annual (ppb)**		**Meausred Conc. 1Hr (ppb)**		**Trends Impact**		**Score**
	Weight	0.30	Weight	0.30	Weight	0.30	Weight	1.00	Weight	1.00	Weight	0.50	
	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	Points	
McMillan	74.00	**30**	302855	**30**	0.1975	**0**	15.00	**0**	59.00	**78**	20.00	**50**	188
River Terrace	71.00	**28**	206782	**16**	0.3035	**25**	18.00	**100**	61.00	**100**	21.00	**48**	317
Verizon													
Haines Point													
Takoma Rec.*	32.00	**0**	92086	**0**	0.3261	**30**					1.00	**0**	30
Rank 1: River Terrace (317.00)				Rank 2: McMillan (188.00)					Rank 3: Takoma Rec. (30.00)				

The scores from the decision matrix show that the River Terrace is the most valuable site in the Nitrogen Dioxide network. The next most valuable station in the network is the McMillan station, and the least valuable station is the Takoma Recreation Center station.

4.5.4 Proposed Regulations

There are no proposed regulations related to the primary NO_2 NAAQS.

On February 9, 2010, EPA established a new 1-hour NO_2 standard at the level of 100 parts per billion (ppb) (75 Fed. Reg. 6474). With the new 1-hour NO_2 NAAQS, EPA revised the monitoring requirements. Only FRM or FEMs that are capable of providing hourly data may be used to determine compliance with both the annual and 1-hour NAAQS. EPA also required a two-tiered network design composed of (1) near-road monitors near heavily trafficked roads in urban areas, and (2) monitors at the neighborhood and larger spatial scales (area-wide). The rule includes new siting criteria. Third, EPA finalized the approach to develop data quality objectives and established goals for acceptable measurement uncertainty.

On April 3, 2012 (77 Fed. Reg. 20218), EPA retained the existing secondary NAAQS for both NO_2 and SO_2 and proposed to evaluate potential monitoring methods as new FRMs. The methods under consideration would be used to measure the ambient concentrations of three components (SO_2, p-SO_4, and NO_y) that would be needed to determine compliance with a potential secondary standard based on an aquatic acidification index (AAI).

4.5.5 Network Recommendations

The District recently added a near-road NO_2 monitor at the new Anacostia Freeway station, so does not recommend establishing any new sites at this time.

Two monitors in the District's NO_2 network are redundant – at Takoma Recreation and the River Terrace stations. The District recommends decommissioning the NO_2 monitor at the Takoma Recreation Station. The River Terrace station is also considered redundant, but it is a Regional Administrator designated monitor under 40 C.F.R. Part 58 Appendix D Section 4.3.4 ("RA 40") and the site can be used the analyze the spatial gradient of NO_2 between the River Terrace station and the new Anacostia Freeway Near-Road Station.

4.6 SO_2 Monitoring Network

The District has not been designated for the 2010 1-hour SO_2 standard. EPA is designating areas in three rounds based on nearby source characteristics, monitored violations, or modeling: by July 2, 2016; December 31, 2017; or December 31, 2010. The District is attaining the 1996 annual and 24-hour NAAQS. There is one SO_2 monitor at the River Terrace station that uses a pulsed fluorescence sample analyzer. Additionally, a trace-level SO_2 monitor, located at the McMillan station as part of the NCore network, is not included in this analysis.

4.6.1 Compliance with Network Requirements

The basic design criteria for SO_2 can be found at 40 C.F.R. Part 58, Appendix D (section 4.4). The District meets the minimum requirements, although additional factors may be considered or required by EPA to design a more complete SO_2 monitoring program for the area.

The number of required SO_2 monitors per CBSA depends on the calculated population weighted emissions index (PWEI). The PWEI value units are in person-tons per year, calculated by multiplying the population of a CBSA by the total amount of SO_2 in tons per year emitted within the CBSA, divided by one million. When the PWEI is equal to or greater than one million, as presumed for the region, a minimum of three SO_2 monitors are required in the CBSA.

According to the rule, NCore-based SO_2 monitors within a CBSA may satisfy minimum monitoring requirements if it measures population exposure, highest concentration, source impacts, general background, or regional transport. There is one NCore-based SO_2-trace monitor at the McMillan Station that complies with SO_2 network design requirements. It is urban-scaled, so is not suitable for determining maximum hourly concentrations but it can be useful for identifying SO_2 transport, trends, and potentially background concentrations if it is not upwind from a local source. Since there are at least two other SO_2 monitors in the region, the District presumes that network requirements are being met.

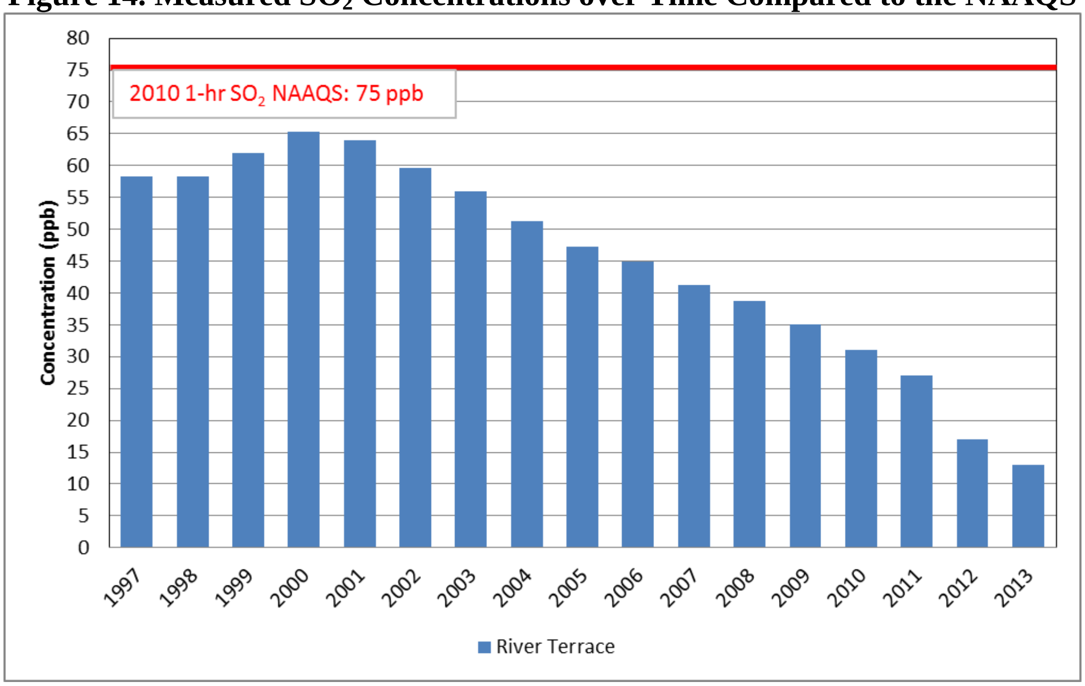
Additional monitors may be required by the EPA Regional Administrator in areas impacted by a source that may cause violations of the NAAQS, or in locations with susceptible and vulnerable populations that are not already represented by monitors. There are three coal-fired power plants within roughly 50 miles of the District: Chalk Point, Morgantown, and Dickerson. However, the District does not anticipate that emissions from these plants would ever cause a violation in the District, and therefore does not believe that new source-specific monitoring is necessary.

4.6.2 Monitoring Results

The 99^{th} percentile reading averaged over three consecutive years determines the SO_2 DV concentration. For the 1996 24-hour NAAQS, an average of hourly measurements per day is averaged per year, and the DV is the highest of the three annual values over three consecutive years.

The District's SO_2 levels have consistently remained below the NAAQS and have dropped since the highest readings in 2000. Figure 14 shows that existing SO_2 monitoring results are still below the federal standards, even compared to the new 2010 NAAQS.

Figure 14. Measured SO_2 Concentrations over Time Compared to the NAAQS



4.6.3 Identification of Redundant Sites or New Sites Needed

None of the analysis techniques chosen by the District are applicable when evaluating one monitor.

4.6.4 Proposed Regulations

A proposed "Data Requirements Rule for the 1-Hour SO_2 Primary NAAQS" was published on May 13, 2014 (79 Fed. Reg. 27446). It directs states to provide data to characterize current air quality in areas with large sources of SO_2 and describes criteria for identifying such sources. The District does not have any large sources of SO_2. There is one coal-burning facility in the District that does not meet the thresholds for consideration, and two oil-fired power plants that used to be large sources of SO_2 emissions were shut down in 2012[7].

On June 22, 2010, EPA issued the final primary SO_2 NAAQS to establish a new 1-hour SO_2 standard (75 Fed. Reg. 35520). They adopted a hybrid analytic approach to assess compliance with the 1-hour NAAQS. Modeling is permitted as the principle means of assessing compliance for medium to larger sources, and monitoring may be relied upon more for smaller sources and sources not conducive to modeling. EPA plans to update source-oriented monitoring and additional modeling guidance documents when a Data Requirements Rule is finalized.

The revised NAAQS resulted in more monitoring network siting flexibility because it broadened monitoring objectives to include: emissions sources, highest concentration, population exposure, background concentrations, regional transport, and welfare-based impact. Any SO_2 monitors required in a particular CBSA, based on PWEI values, satisfy minimum monitoring requirements as long as they are sited at locations where they meet one or more of the monitoring objectives (35561). The new PWEI metric is intended to focus monitoring resources in areas where groups of people are in close proximity to SO_2 emissions, to account for exposure.

On April 3, 2012 (77 Fed. Reg. 20218), EPA retained the existing secondary NAAQS for both NO_2 and SO_2 and proposed to evaluate potential monitoring methods as new FRMs. The methods under consideration would be used to measure the ambient concentrations of three components (SO_2, p-SO_4, and NO_y) needed to determine compliance with a potential secondary standard based on an aquatic acidification index (AAI).

4.6.5 Network Recommendations

The SO_2 monitor at the River Terrace station is a candidate for decommissioning, since the nearby power station shut down in 2012. To maintain the minimum requirements for SO_2 monitoring, the responsibility can be delegated to the trace level SO_2 monitor located at the McMillan Station.

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[7] Capitol Power is the facility that is permitted to burn minimal amounts of coal. Two electric generating units (EGUs) at the Pepco Benning facility shut down in 2012.

4.7 $PM_{2.5}$ Monitoring Network

The District is designated as an attainment area for the 2012 annual $PM_{2.5}$ NAAQS, as well as the 2006 annual and 24-hour $PM_{2.5}$ standards. In October 2014, EPA took final action to redesignate the region from nonattainment to attainment for the 1997 annual NAAQS (79 Fed. Reg. 60081), so is now required to demonstrate maintenance with the 1997 standard for 20 years. The $PM_{2.5}$ network includes three SLAMS monitors: one monitor at the McMillan Reservoir (which is also considered a NCore monitor), one at River Terrace, and one at Hains Point. All three use a gravimetric measuring technique and $PM_{2.5}$ sampling is carried out with manual non-continuous federal reference method (FRM) monitors.

In addition to the three $PM_{2.5}$ FRM monitors, the District has been operating continuous federal equivalent method (FEM) $PM_{2.5}$ monitors at McMillan Reservoir and the new Anacostia Freeway Near-Road stations. The continuous $PM_{2.5}$ FEM samplers are beta attenuation mass monitors (BAMM) that measure concentrations with glass fiber filter tape. Unlike the manual FRM samplers, the $PM_{2.5}$ FEM samplers provide hourly data and do not require resource intensive laboratory services. The District uses the services of an external weighing laboratory for the gravimetic analysis of filters from its $PM_{2.5}$ FRM monitors.

The District also operates a $PM_{2.5}$ chemical speciation monitor at McMillan that is part of the nationwide CSN network and is not evaluated in this report.

4.7.1 Compliance with Network Requirements

The basic design criteria for $PM_{2.5}$ can be found at 40 C.F.R. Part 58, Appendix D (section 4.7). The District meets the minimum requirements, although additional factors may be considered or required by EPA to design a more complete $PM_{2.5}$ monitoring program for the area.

At a minimum, three monitors must be located in MSAs with populations greater than 1,000,000, when the most recent DV is over or equal to 85 percent of any $PM_{2.5}$ NAAQS. Two are required when the most recent DV is less than 85 percent of any $PM_{2.5}$ NAAQS. With nine monitors in the region, this criterion is likely met.

The required monitors must be sited to represent community-wide air quality, and are typically at neighborhood or urban scale. At least one monitoring station is to be sited at neighborhood or larger scale in an area of expected maximum concentration. This criterion is met by the McMillan NCore monitor. Both McMillan monitors as well as the Hains Point monitor are urban-scaled and represent large homogenous areas, so all three monitors can be used to characterize regional transport. At least one station – River Terrace – is sited at neighborhood scale. The neighborhood scale is the most important to effectively characterize the emissions of particulate matter from both mobile and stationary sources. It is representative of conditions in the immediate neighborhood as well as neighborhoods of the same type in other parts of the city, and provides good information about trends and compliance with the standards.

For CBSAs with a population of one million or more, at least one $PM_{2.5}$ monitor is to be collocated at a near-road NO_2 station. A $PM_{2.5}$ continuous monitor is located at the District's new Anacostia Freeway station.

To meet continuous $PM_{2.5}$ monitoring requirements, at least half of the minimum number or sites in the MSA must operate continuously, and at least one continuous analyzer must be collocated with one of the required FRM/FEM/ARM monitors (if that monitor does not run continuously). The continuous $PM_{2.5}$ monitor at McMillan is also an FEM monitor. Quality assurance and quality control (QA/QC) procedures approved by EPA are used to evaluate this monitor, as required.

At least one $PM_{2.5}$ site per state must be operated for regional background, and at least one monitor for regional transport. The District does not have a monitor designated to characterize regional background or transport, but acceptable methods such as IMPROVE or continuous $PM_{2.5}$ monitors may satisfy the requirement. The Hains Point $PM_{2.5}$ monitor is collocated with the U.S. National Park Service's IMPROVE $PM_{2.5}$ mass and speciation monitors, and there is a continuous $PM_{2.5}$ monitor at McMillan. QA/QC procedures are used at both sites.

To meet chemical speciation requirements, chemical speciation monitoring and analysis is conducted using the McMillan $PM_{2.5}$ CSN analyzers, designated to be part of the $PM_{2.5}$ Speciation Trends Network (STN). The CSN urban trends site includes analysis for elements, selected anions and cations, and carbon and may be useful in developing SIPs and supporting atmospheric or health effects studies.

Spatial averaging approaches are only used to supplement existing data in the District on occasion, so any special network requirements are not addressed in this report.

In addition, a $PM_{10-2.5}$ monitor is required at NCore stations, and there is one as part of the NCore station at McMillan. The station is not classified as microscale, middle scale, or neighborhood scale, so it is not one of the most important monitors for assessing the variation in coarse particulate concentrations that would be expected across populated areas that are in proximity to large emissions sources.

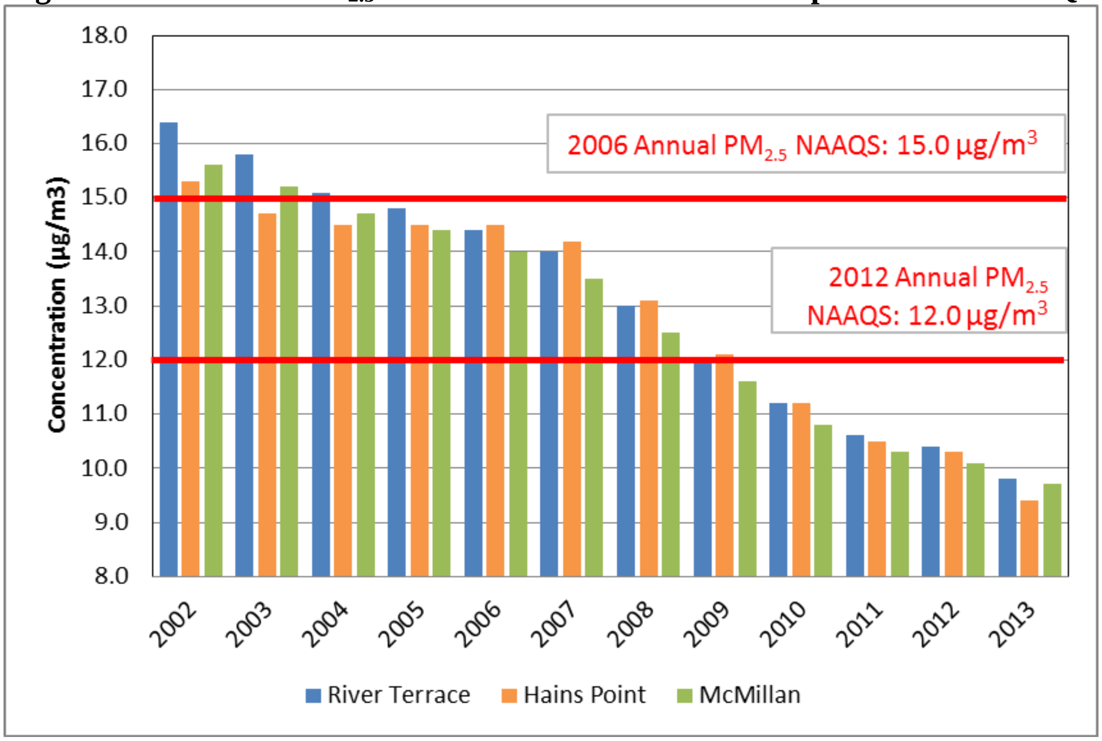
4.7.2 Monitoring Results

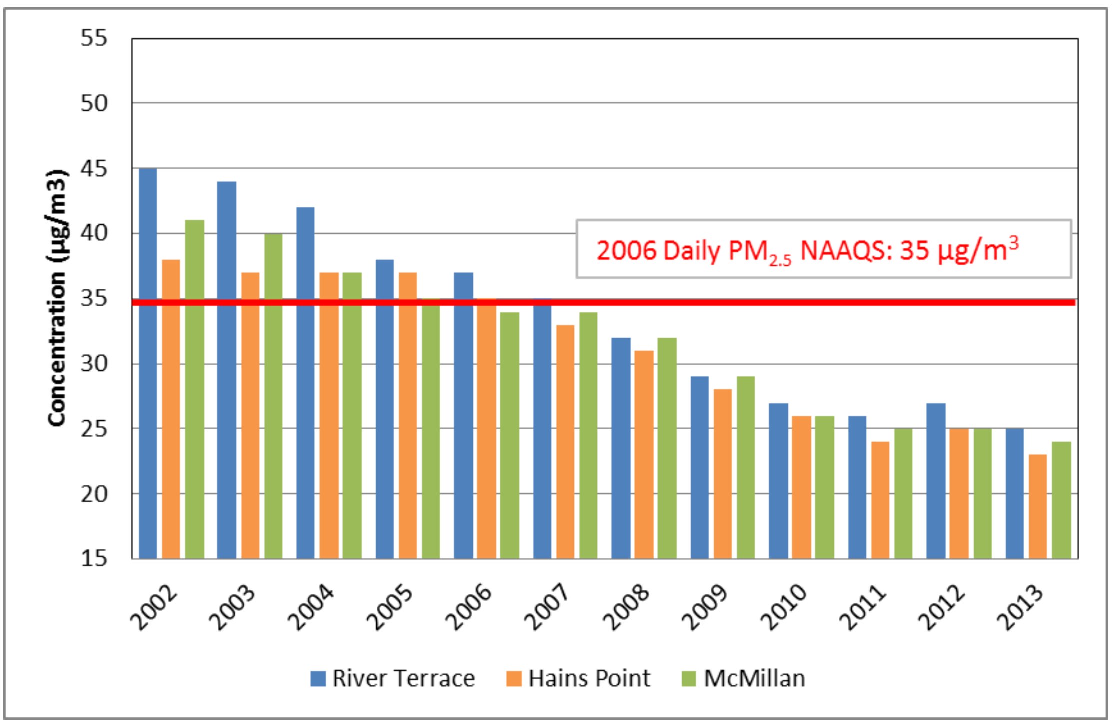
The annual $PM_{2.5}$ NAAQS is measured using the arithmetic mean of four quarterly averages per year. The 24-hour standard is based on the 98^{th} percentile reading per year, where data is ranked from highest to lowest. Each station collects data using one 24-hour filter per day.

Annual $PM_{2.5}$ levels have gradually declined each year since 2004. Data shows that the region has been in attainment of the standards long enough to submit a formal request to change its designation status to attainment.

Since 2004, 24-hour $PM_{2.5}$ levels also have declined. Shorter-term daily exposures are meeting the standards.

Figure 15. Measured $PM_{2.5}$ Concentrations over Time Compared to the NAAQS





4.7.3 Identification of Redundant Sites or New Sites Needed

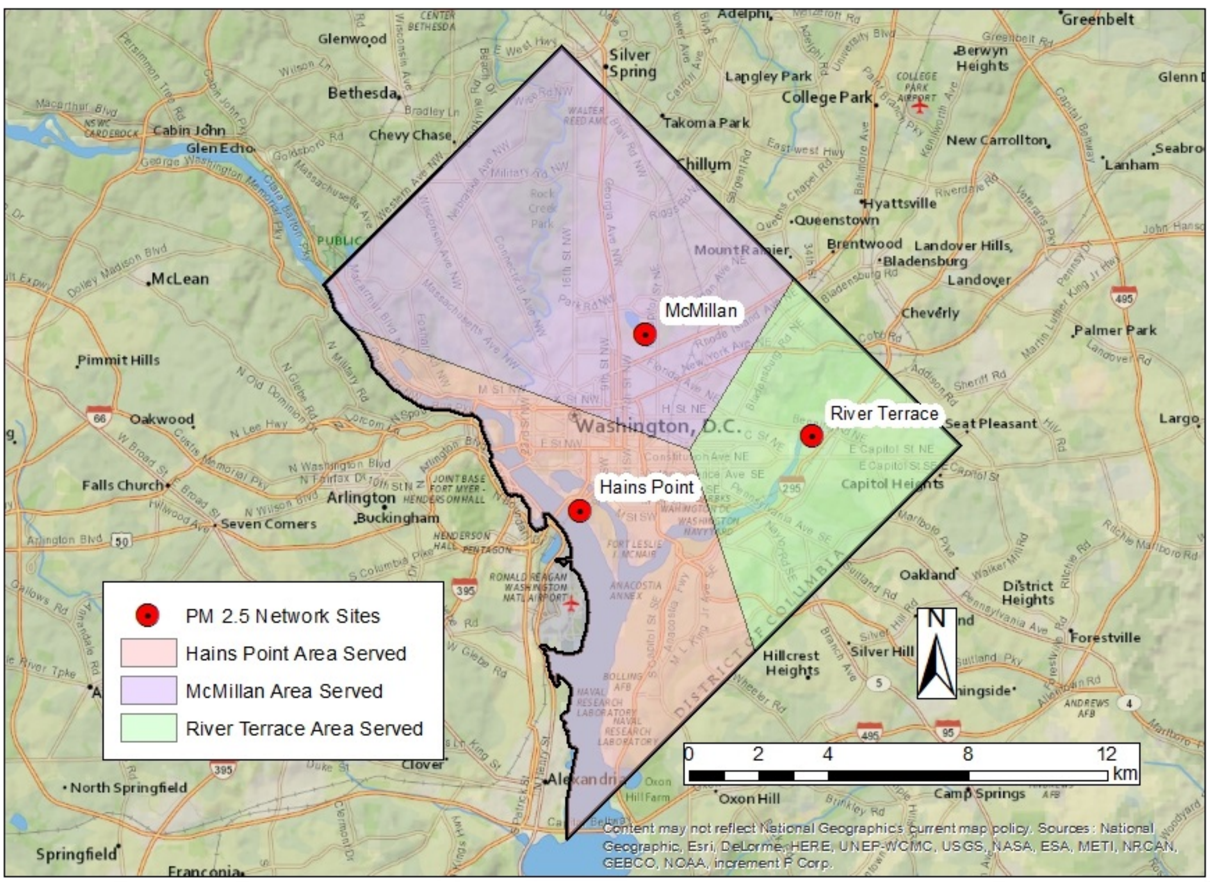
When focused on the three $PM_{2.5}$ monitors, the results of analysis are as follows:

Table 12. Results of $PM_{2.5}$ Analyses

Type of Analysis	Ranked First	Ranked Second	Ranked Third
Area Served	McMillan	Hains Point	River Terrace
Population Served	McMillan	River Terrace	Hains Point
Sensitive Population Served	*River Terrace*	*McMillan*	*Hains Point*
Trend Impacts	River Terrace (annual & 24-hr)	McMillan (annual & 24-hr) Hains Point (annual & 24-hr)	
Measured Concentrations	Hains Point (annual) River Terrace (24-hr) McMillan (24-hr)	River Terrace (annual) Hains Point (24-hr)	McMillan (annual)

- **Area Served –** The station with the greatest area is the McMillan station, which covers an area of 83 sq. km. The station with the least coverage was River Terrace, at 41 sq. km.

Figure 16. Area Served for the Fine Particulate Matter Network



- **Population Served** – As with the other pollutant networks, the Population Served analysis was broken down into total population and the percent of population in the sensitive group.
    - *Total Population* – McMillan covered the greatest number of people with a total population of 344,611 and the least number of people covered was the Haines Point station with a total population of 109,643.
    - *Sensitive Populations* – When focusing of the percent of the population in the sensitive group, River Terrace had the greatest percent of the total population that is sensitive to high air pollution (31%), while Haines Point had the least perception of total population in the sensitive group at 23%.

- **Measured Concentration** – As with the other pollutant networks, this analysis used both the annual and 24-hour standard and used the highest DV observed between 2009 and 2013. When examining the annual standard, the station with the highest DV of 12.1 micrograms per cubic meter (µg/m^3) was the Hains Point station. The lowest DV observed for the annual standard was at the McMillan station with a value of 11.6 µg/m^3. For the 24-hour standard, the highest DV was observed at the McMillan and River Terrace stations with a value of 29 µg/m^3. The lowest DV was observed at the Hains Point with a value of 28 µg/m^3.

- **Trends Impact** – The analysis showed that the longest continuous sampling station was the River Terrace station, which has continuously sampled for 21 years. The shortest sampling period was at both Hains Point and the McMillan stations, which sampled for 15 years.

Table 13. $PM_{2.5}$ Network Decision Matrix

$PM_{2.5}$ Network													
SITE	**Pop. Total 2010**		**Sensitive Pop. 2010**		**Area Served (sq. km)**		**Measured Conc. Annual (µg/m^3)**		**Meausred Conc. 24Hr. (µg/m^3)**		**Trends Impact**		**Score**
	Weight	0.30	Weight	0.30	Weight	0.30	Weight	1.00	Weight	1.00	Weight	0.50	
	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	Raw	**Points**	
McMillan	344611	**30**	0.2385	**3**	83.00	**30**	11.60	**0**	29.00	**100**	15.00	**0**	163
River Terrace	147469	**5**	0.3057	**30**	41.00	**0**	12.00	**80**	29.00	**100**	21.00	**50**	265
Verizon													
Haines Point	109643	**0**	0.2311	**0**	53.00	**9**	12.10	**100**	28.00	**0**	15.00	**0**	109
Takoma Rec.													
Rank 1: River Terrace (265.00)				Rank 2: McMillan (163.00)					Rank 3: Hains Point (109.00)				

Scores derived from the decision matrix show that the most valuable station in the $PM_{2.5}$ network is the River Terrace station. The second and third most valuable stations are the McMillan station and the Hains Point station.

4.7.4 Proposed Regulations

On March 23, 2015, EPA proposed state implementation plan requirements for $PM_{2.5}$ (80 Fed. Reg. 15340). The proposal includes improved stationary source emissions monitoring, which is not applicable in the District because there are few large stationary sources. Otherwise, there are no proposed regulations related to the $PM_{2.5}$ NAAQS.

The primary annual $PM_{2.5}$ standard was revised on January 15, 2013 (78 Fed. Reg. 3086). Numerous changes were made to the monitoring, reporting, and network design requirements. For example, the form of the standard was revised to avoid potential disproportionate impacts on at-risk populations. EPA added a modest near-road component to the network and revised data handling procedures, computations to determine compliance, quality assurance requirements, and terminology to clarify relationships between varieties of national air monitoring networks that include $PM_{2.5}$ monitoring. The secondary annual standard and the 24-hour $PM_{2.5}$ NAAQS were not revised.

4.7.5 Network Recommendations

A $PM_{2.5}$ monitor was recently added to the Anacostia Freeway station in the District, so no new $PM_{2.5}$ stations are recommended at this time.

The analysis shows that of the three stations that monitor $PM_{2.5}$, the Hains Point station provides the least value. The District recommends decommissioning the Hains Point monitor due to declining $PM_{2.5}$ values as well as the fact that there are two nearby monitors that serve similar functions – the U.S. National Park Service IMPROVE monitor collocated with DDOE $PM_{2.5}$ FRM at Hains Point, and the $PM_{2.5}$ monitor located in the Arlington-Alexandria area that is operated by the Virginia Department of Environmental Quality.

The manual FRM samplers in the District's $PM_{2.5}$ network are resource intensive in terms of regular operations and maintenance. They also require weighing laboratory services from an external laboratory. Hence, a gradual phase-in of the continuous measurement technology utilizing $PM_{2.5}$ FEM monitors is recommended to realize savings in resources and time effort.

5.0 AIR MONITORING PROGRAM AND DATA CONTACTS

The Monitoring and Assessment Branch in DDOE's Air Quality Division maintains the District's ambient air monitoring network and ensures quality assurance of the data. Quality assured data from the District's network is delivered to EPA's AQS national database on a schedule set forth in 40 C.F.R. Part 58 and the data are certified by DDOE on an annual basis. Data is also stored locally at DDOE offices for use by staff and for preparation of special reports, data charts, and special requests such as Freedom of Information Act requests.

DDOE uploaded fully quality assured data for all calendar years through 2014 for the District's network to EPA's AQS national database. Formal data certifications were also transmitted to EPA on an annual basis according to Data Reporting Requirement of 40 C.F.R. Part 58. Data requests can be directed via email to robert.day@dc.gov.

The District's ambient air monitoring program main contact is:

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