

**Forsyth County**  
**Office of Environmental Assistance and Protection**

June 29, 2022

**Katy R. Lusky, Chief**

Air Data and Analysis Section

Air Analysis and Support Branch/Air and Radiation Division

U.S. Environmental Protection Agency – Region 4

61 Forsyth Street, SW

Atlanta, GA 30303

Dear Ms. Lusky:

This letter and accompanying Annual Network Plan report on the status of the **Ambient Air Monitoring** commitments for the FY-22 105 Grant Work plan for Forsyth County, North Carolina (Reporting Organization 37-067). The entire Plan follows the Executive Summary, complete with staff field reviews as well as a copy of the published public notice.

Sincerely,



Jason R. Bodenhamer, Program Manager

Analysis and Monitoring Division

Forsyth County Office of Environmental Assistance and Protection

Enclosures

cc:

Steve Lyda (FCEAP)

Minor Barnette (FCEAP)

Ryan Brown (EPA-Region IV)

Patrick Butler (NCDAQ)

This page intentionally left blank

## Executive Summary

---

*Submit by July 1, 2022 an evaluation to demonstrate the requirements of 40 CFR Part 58.10 (a)(1) (Annual Network Evaluation) have been met.*

This review was conducted and submitted on May 20, 2022 to allow for the entire 30-day public comment period to take place.

### *Quality Assurance Procedures.*

This Office has received approval of the Criteria Pollutant QAPP on September 7, 2017 and has submitted a new revision for approval on March 7, 2022. We are currently working through the approval process with EPA so it will be in place by Sept 7, 2022. \*Post 30-day comment period update/addition: We received an official approval letter for our QAPP on June 29, 2022.\* The QMP was approved on June 18, 2018. SOPs are up to date and approved within our network including: SO<sub>2</sub>, NO<sub>2</sub>, Ozone, PM 2.5 (Cont. & FRM), Calibrators, Zero Air Supplies, and Data Handling.

### *Categorization of Ambient Monitors and Auxiliary Equipment.*

The evaluation was completed in April, 2022. We currently have backup equipment for each monitoring device stored in our office in the case of equipment failure with the exception of our T640(x) and T640. We have plans to purchase new samplers in July of 2022 to satisfy this need. The current emphasis remains maintenance of the monitoring buildings and consolidation of the network. Capital funds are available in limited quantity and are available for proper planning for future network needs.

### *Notify EPA within 30 days after exceedances/violations of NAAQS.*

The Forsyth County Office of Environmental Assistance and Protection remained an active participant in the AirNow program. Part of that program ensures that all local and regional exceedances/violations of the NAAQS are submitted to EPA and all others affected in a timely fashion.

### *Comply with Exceptional Events Policy.*

No situations requiring exceptional event flagging occurred since the last Annual Network Review period.

### *Submit list of urban areas for which AQI is reported.*

Forsyth County reports the AQI for our part of the Greensboro-Winston-Salem-High Point MSA. AQI statistics are available in local newspapers, on the Office's web site at <http://www.forsyth.cc/EAP/>. Real time data (updated hourly) are also available at: <http://www.forsyth.cc/EAP/airmonitoringdata.aspx>

### *Attend Region 4 QA Meeting & AIRS Conference.*

The 2022 EPA Region 4 Ambient Monitoring Workshop was not held this spring due to the Coronavirus and staffing concerns at EPA but there are hopes of one being offered in the fall of 2022 virtually. All of our division will be able to attend, which would be an added benefit to our division.

### *Submit air quality forecasts for MSA's >500,000 population to EPA AIRNOW.*

Forsyth County has been a leader in this area and submits air quality forecasts for multiple pollutants to AIRNOW on a year-round basis. Several presentations on this program have been given at recent EPA National Forecasting and Outreach Conferences.

### *Changes in the SLAMS/NAMS Network*

There were no changes in our SLAMS network.

### *Data Submittal Criteria*

All SLAMS and PARS data were submitted to AQS within 90 days of the end of each quarter. AQS data reports were also reviewed after data submittal was completed to verify AQS data was correct. All data was certified by May 1, 2022.

### *National Performance Audit Program*

All NPAP audits were completed by an EPA contractor and the results were submitted into AQS.

### *Continued-Annual Network Evaluation*

Forsyth County has continued to review the local monitoring network to account for changes in population, land use, and traffic patterns.

### OZONE

The maximum impact downwind site is operated by the State program in Rockingham County (Bethany School, 37-157-0099). The secondary wind direction is measured by the Union Cross site (37-067-1008). In addition, the Clemmons Middle site (37-067-0030), established in 2005, monitors the southwest sector of Forsyth County. Another ozone monitor at Hattie Avenue (37-067-0022) has operated since 1993.

### CARBON MONOXIDE

We no longer operate a CO monitor. The most recently run microscale Peters Creek site (37-067-0023) was shut down December 31, 2015.

### SULFUR DIOXIDE/NITROGEN OXIDES

Sulfur dioxide levels have been measured at the Hattie Avenue site (37-067-0022) since 1983. Readings are considered to be characteristic of background levels in Forsyth County. On occasion, the site is impacted by plume touchdowns from the Duke Energy Belews Creek Generating Station located approximately 20 miles to the northeast in Stokes County. In compliance with the most recent monitoring data requirements, 5-minute SO<sub>2</sub> averaged data from this site is reported along with 1-hour data.

Nitrogen oxide levels have been measured at the Hattie Avenue site (37-067-0022) since 1984. Readings represent the neighborhood impact of major transportation related emissions from inter-city and intra-city traffic on Business I-40 and U.S. 52 bisecting Winston-Salem. Both monitors satisfy the most recent monitoring criteria related to the 1-hour SO<sub>2</sub> and NO<sub>2</sub> standards.

### PARTICULATE

Continuous PM<sub>10</sub> (TAPI 640X) concentrations continue to be recorded at the Hattie Avenue site (37-067-0022) and the Clemmons Middle site (37-067-0030) collects continuous PM<sub>2.5</sub> with a (T640). These readings are representative of a maximum impact particulate site influenced by background emissions and locally generated transportation emissions.

### FRM STATUS

FRM PM<sub>2.5</sub> samplers have been established at Hattie Avenue (37-067-0022); 1/3 frequency and the Clemmons Middle site (37-067-0030); 1/6 frequency collocated with FRM samplers (ref meth 145) as part of Forsyth County's EPA approved PM<sub>2.5</sub> monitoring plan. Due to the shutdown of the state lab, RTI is the new lab, which started in July of 2021.

### CONTINUOUS STATUS

A continuous PM<sub>2.5</sub> TAPI 640x sampler runs at the Hattie Avenue site. This unit measures PM<sub>2.5</sub>, CR, and 10 (STP). The data set from the new 640x continues to indicate a good correlation between the FRM PM<sub>2.5</sub> data and 24-hour averages. An additional PM<sub>2.5</sub> (only) TAPI 640 unit is operated at the Clemmons Middle site (37-067-0030).

### SPECIATION STATUS

A speciated PM2.5 monitor (1/6 frequency) began operation on September 22, 2001 and a carbon speciated PM2.5 monitor (1/6 frequency) began operation on February 28, 2007 at Hattie Avenue. Validated data sets have been received from RTI through March 2022.

### AIR TOXICS

A (1/6) day air toxic sampler operated in conjunction with the NCDAQ has been resident at the Hattie Avenue site since 2000. Air toxic data remains under NCDAQ control. This Office does not review or upload this data to AQS.

### LEAD

No lead monitors are currently in place at any sites within Forsyth County. Based on the interpretation of the lead monitoring requirements, recent population data, and recent source emission inventory data, there are no sources that emit more than 700 lbs of lead per year. Therefore, there are no immediate plans for lead monitoring in the County.

**2022 Annual Monitoring Network Plan**  
**Forsyth County**  
**Office of Environmental Assistance and Protection**

---




♥ Forsyth County Office of Environmental Assistance and Protection  
201 North Chestnut Street, 5<sup>th</sup> Floor  
Winston-Salem, NC 27101  
Phone 336-703-2440 • Fax 336-727-2777  
May 22, 2017

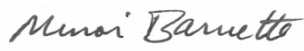
## CERTIFICATION

---

By the signatures below, the Forsyth County Office of Environmental Assistance and Protection (FCEAP) certifies that the information contained in the 2021 Annual Monitoring Network Plan is complete and accurate at the time of submittal to EPA Region 4. However, due to circumstances that may arise during the sampling year, some network information may change. A notification of change and a request for approval will be submitted to EPA Region 4 at that time.

Print Name: Jason R. Bodenhamer Signature:  Date: 5/20/22

Program Manager, Analysis and Monitoring Division, FCEAP

Print Name: W. Minor Barnette Signature:  Date: 5/20/22  
Director, FCEAP

# 2021 ANNUAL MONITORING NETWORK PLAN

---

## TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>EXECUTIVE SUMMARY</b>  | <b>3</b>  |
| <b>CERTIFICATION</b>  | <b>7</b>  |
| <b>2019 ANNUAL MONITORING NETWORK PLAN</b>                        | <b>8</b>  |
| <b>INTRODUCTION</b>   | <b>9</b>  |
| <b>SITE DESCRIPTION BACKGROUND INFORMATION AND DEFINITIONS</b>    | <b>10</b> |
| 1. Site Description   | 10        |
| 2. Date Established   | 10        |
| 3. Site Approval Status   | 10        |
| 4. Monitoring Objectives  | 10        |
| 5. Monitoring Stations' Designations                              | 10        |
| SLAMS   | 11        |
| NAMS  | 11        |
| SPM   | 11        |
| NCORE   | 11        |
| 6. Monitoring Methods   | 11        |
| Particulate Matter 10 microns in size (PM <sub>10</sub> )         | 12        |
| Particulate Matter 2.5 microns in size (PM <sub>2.5</sub> )       | 12        |
| Particulate Matter 10-2.5 microns in size (PM <sub>10-2.5</sub> ) | 12        |
| PM <sub>2.5</sub> Speciation sampling and analysis                | 12        |
| Sulfur Dioxide  | 12        |
| Ozone   | 13        |
| Nitrogen Dioxide  | 13        |
| Air Toxics  | 13        |
| 7. Quality Assurance Status                                       | 13        |
| 8. Scale of Representativeness                                    | 13        |
| 9. Data Processing and Reporting                                  | 14        |
| <i>Network Summary</i>  | 15        |
| 1. Site Table and Criteria Pollutants Monitored                   | 15        |
| 2. Site Map   | 16        |
| 3. Monitoring Methods   | 17        |
| <b>AIR MONITORING STATION DESCRIPTIONS</b>                        | <b>18</b> |
| 1. Clemmons Middle School   | 18        |
| (a) Site Table  | 18        |
| (b) Site Description and Statement of Purpose                     | 18        |
| (c) Site Photographs  | 19        |
| 2. Hattie Avenue  | 20        |
| (a) Site Table  | 20        |
| (b) Description and Statement of Purpose                          | 20        |
| (c) Site Photographs  | 23        |
| 3. Union Cross  | 24        |
| (a) Site Table  | 24        |
| (b) Site Description and Statement of Purpose                     | 24        |
| (c) Site Photographs  | 25        |
| REFERENCES  | 26        |



# INTRODUCTION

---

The Forsyth County Office of Environmental Assistance and Protection's (FCEAP) monitoring program provides air quality monitoring services in Forsyth County, NC. FCEAP is a state "certified local air pollution program" whose purpose(s) are to improve and maintain ambient air quality and reduce exposure to unhealthful air pollutants.

FCEAP has operated an air quality monitoring program since the early 1970's. The air monitoring services provided by the program are conducted to measure concentrations of criteria air pollutants (NO<sub>2</sub>, SO<sub>2</sub>, PM, and O<sub>3</sub>) in accordance with USEPA regulatory requirements. Measurements are used to assess compliance with National Ambient Air Quality Standards (NAAQS). The NAAQS define air pollutant concentration level thresholds judged necessary to protect the public health and welfare.

The FCEAP air monitoring program operates a network of state and local air monitoring stations (SLAMS) in Forsyth County. The current network configuration consists of seven monitoring stations that measure concentrations of criteria air pollutants. In addition to the SLAMS network the county network also includes monitoring for meteorological parameters and visibility conditions.

The annual monitoring network plan, as provided for in 40 CFR Part 58.10, *Annual Monitoring Network Plan and Periodic Network Assessment* must contain the following information for each monitoring station in the network:

1. The Air Quality System (AQS) site identification number for existing stations.
2. The location, including the street address and geographical coordinates, for each monitoring station.
3. The sampling and analysis method used for each measured parameter.
4. The operating schedule for each monitor.
5. Any proposal to remove or move a monitoring station within a period of eighteen months following the plan submittal.
6. The monitoring objective and spatial scale of representativeness for each monitor.
7. The identification of any sites that are suitable and sites that are not suitable for comparison against the annual PM<sub>2.5</sub> NAAQS.
8. The Metropolitan Statistical Area (MSA), Core-Based Statistical Area (CBSA), Combined Statistical Area (CSA) or other area represented by the monitor.

The following information below replicates the Forsyth County Air Quality ambient air monitoring network plan and continues in the following sections outlined below:

**II. Site Description Background Information and Definitions:** An outline of the designations, parameters, monitoring methods, and the basis for site selection.

**III. Network Summary:** This section presents an overview of the total number of sites and monitors in Forsyth County. Also included is a listing of all proposed changes to the current network.

**IV. Air Monitoring Station Description:** Each air monitoring station is described in detail as per the outline in (II.) above. Modification to the network as determined by an annual review process will be made each year to maintain a current up-to-date network description document.

## Site Description Background Information and Definitions

---

### 1. Site Description

Specific information is provided to show the location of the monitoring equipment at the site, if the site is located in a CSA/MSA, the AQS identification number, the GPS coordinates, and evidence that monitors and monitor probes conform to the siting criteria.

### 2. Date Established

The date when each existing monitoring station was established is shown in the description. For those stations, which are proposed, a date is provided when it is expected for the station to be in operation.

### 3. Site Approval Status

Each monitoring station in the existing network has been reviewed with the purpose of determining whether it meets all design criteria for inclusion in the SLAMS network. Stations that do not meet the criteria will either be relocated in a nearby area or, when possible, re-sited at the present location.

### 4. Monitoring Objectives

Per 40 CFR 58 Appendix D, Section 1.1:

*“The ambient air monitoring networks must be designed to meet three basic monitoring objectives. These basic objectives are listed below. The appearance of any one objective in the order of this list is not based upon a prioritized scheme. Each objective is important and must be considered individually.”*

The objectives are summarized below:

- (a) Provide air pollution data to the general public in a timely manner.
- (b) Support compliance with ambient air quality standards and emissions strategy development. Data from FRM (Federal Reference Method), FEM (Federal Equivalent Method), and ARM (Approved Regional Method) monitors for NAAQS pollutants will be used for comparing an area’s air pollution levels against the NAAQS.
- (c) Support for air pollution research studies.

### 5. Monitoring Stations’ Designations

Most stations described in the air quality surveillance network are designated as State and Local Air Monitoring Stations (SLAMS). In addition, some of these stations fulfill other requirements, which must be identified. In this description of the network, designations are also made for National Air Monitoring Stations (NAMS), Special Purpose Monitors (SPM), and National Core (community oriented) stations (NCore). The following is the criteria used for each of these designations.

## ***SLAMS***

Requirements for air quality surveillance systems provide for the establishment of a network of monitoring stations designated as State and Local Air Monitoring Stations (SLAMS) that measure ambient air concentrations of those pollutants for which standards have been established. These stations must meet requirements that relate to four major areas: quality assurance, monitoring methodology, sampling interval and siting of instruments and instrument probes.

## ***NAMS***

Within the SLAMS network certain monitors are selected to provide the USEPA with timely data for use in national trends analysis. These NAMS monitors are identified in the summary of network stations.

## ***SPM***

Not all monitors and monitoring stations in the air quality surveillance network are included in the SLAMS network. In order to allow the capability of providing monitoring for various reasons such as: special studies, modeling verification and compliance status, and other objectives; certain monitors are designated as Special Purpose Monitors (SPM). These monitors are not committed to any one location or for any specified time period. They may be located as separate monitoring stations or be included at SLAMS locations. Monitoring data may be reported, provided that the monitors and stations conform to all requirements of the SLAMS network.

## ***NCORE***

National Core (community-oriented) multi-pollutant monitoring 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.

## ***6. Monitoring Methods***

Sampling and analytical procedures for criteria air pollutant monitoring performed in the FCEAP ambient air monitoring network are conducted in accordance with applicable USEPA Designated Federal Reference (FRM) or Equivalent (FEM) Methods unless otherwise noted. Analytical techniques for non-criteria air pollutant monitoring (methods employed that are not USEPA Designated Federal Reference (FRM) or Equivalent (FEM) Methods) are documented in the applicable FCEAP Quality Assurance Project Plans (QAPP), FCEAP Standard Operating Procedures (SOP), or the appropriate North Carolina Division of Air Quality (NCDAQ) QAPP or SOP. Methods used by FCEAP for criteria pollutant monitoring are listed below:

### ***Particulate Matter 10 microns in size (PM<sub>10</sub>)***

All PM<sub>10</sub> samplers operated by FCEAP are operated as federal reference method (FRM) or equivalent samplers and are operated according to the requirements set forth in 40 CFR 50 and 40 CFR 53. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

| Method                             | Designation Number | Method Code |
|------------------------------------|--------------------|-------------|
| T640 PM Mass Monitor w/640X Option | EQPM-0516-239      | 239         |

### ***Particulate Matter 2.5 microns in size (PM<sub>2.5</sub>)***

With the exception of speciation samplers, all PM<sub>2.5</sub> samplers operated by FCEAP are either FRM or FEM samplers. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

| Method  | Designation Number | Method Code |
|---|--------------------|-------------|
| R & P Partisol-Plus 2025i PM-2.5 Seq.<br>T640 PM Mass Monitor w/640X Option | EQPM-0202-145      | 145         |
|   | EQPM-0516-238      | 238         |
| TAPI Model T640 PM Mass Monitor   | EQPM-0516-236      | 236         |

### ***Particulate Matter 10-2.5 microns in size (PM<sub>10-2.5</sub>)***

With the exception of speciation samplers all PM<sub>2.5</sub> samplers operated by FCEAP are either FRM or FEM samplers. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

| Method                             | Designation Number | Method Code |
|------------------------------------|--------------------|-------------|
| T640 PM Mass Monitor w/640X Option | EQPM-0516-240      | 240         |

### ***PM<sub>2.5</sub> Speciation sampling and analysis***

In addition to operating PM<sub>2.5</sub> samplers that determine only PM<sub>2.5</sub> mass values, FCEAP also operates PM<sub>2.5</sub> speciation samplers that collect samples that are analyzed to determine the chemical makeup of PM<sub>2.5</sub>. Data collected using this method cannot be compared to the NAAQS. Listed below is the method used in the FCEAP monitoring network:

| Method      | Designation Number | Method Code |
|-------------|--------------------|-------------|
| MetOne SASS | NA                 | NA          |
| URG         | NA                 | NA          |

### ***Sulfur Dioxide***

Instruments used to continuously monitor sulfur dioxide levels in the atmosphere employ the pulsed UV fluorescence method. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

| Method             | Designation Number | Method Code |
|--------------------|--------------------|-------------|
| Teledyne API T100U | EQSA-0495-100      | 600         |

### ***Ozone***

Ozone is monitored using the UV photometry method. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

| Method                 | Designation Number | Method Code |
|------------------------|--------------------|-------------|
| TAPI. Model 400E, T400 | EQOA-0992-087      | 087         |

## ***Nitrogen Dioxide***

The chemiluminescence method is used in monitoring the nitrogen dioxide level in the ambient air. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

| Method                  | Designation Number | Method Code |
|-------------------------|--------------------|-------------|
| TAPI Model 200EU, T200U | RFNA-1194-599      | 599         |

## ***Air Toxics***

Air toxics sampling is conducted in Forsyth County using equipment on loan from the State of North Carolina, Division of Air Quality. Listed below is the USEPA Designated Reference or Equivalent Method used in the FCEAP monitoring network:

| Method                               | Designation Number         | Method Code |
|--------------------------------------|----------------------------|-------------|
| Compendium Method for Toxic Organics | Compendium Method<br>TO-15 | 150         |

## ***7. Quality Assurance Status***

FCEAP has an extensive quality assurance procedure to ensure that all air monitoring data collected meets established criteria for precision and accuracy. FCEAP operates according to EPA approved Quality Assurance Project Plans (QAPP) and Standard Operating Procedures. Staff members audit instrumentation on a scheduled basis to ensure that each instrument is calibrated and operating properly. Data validation is performed monthly to ensure data reported by each instrument is recorded accurately in the air quality monitoring database.

## ***8. Scale of Representativeness***

Each station in the monitoring network must be described in terms of the physical dimensions of the air parcel nearest the monitoring station throughout which actual pollutant concentrations are reasonably similar. Area dimensions or scales of representativeness used in the network description are:

- (a) Microscale - defines the concentration in air volumes associated with area dimensions ranging from several meters up to about 100 meters.
- (b) Middle scale - defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometers.
- (c) Neighborhood scale – defines concentrations within an extended area of a city that has relatively uniform land use with dimensions ranging from about 0.5 to 4.0 kilometers.
- (d) Urban scale - defines an overall citywide condition with dimensions on the order of 4 to 50 kilometers.
- (e) Regional Scale - defines air quality levels over areas having dimensions of 50 to hundreds of kilometers.

Closely associated with the area around the monitoring station where pollutant concentrations are reasonably similar are the basic monitoring exposures of the station. There are six basic exposures:

- (a) Sites located to determine the highest concentrations expected to occur in the area covered by the network.
- (b) Sites located to determine representative concentrations in areas of high population density.
- (c) Sites located to determine the impact on ambient pollution levels of significant sources or source categories.
- (d) Sites located to determine general background concentration levels.
- (e) Sites located to determine the extent of regional pollutant transport among populated areas; and in support of secondary standards.

(f) Sites located to measure air pollution impacts on visibility, vegetation damage, or other welfare-based impacts.

The design intent in siting stations is to correctly match the area dimensions represented by the sample of monitored air with the area dimensions most appropriate for the monitoring objective of the station. The following relationship of the six basic objectives and the scales of representativeness are appropriate when siting monitoring stations:

| Site Type                                  | Appropriate Siting Scales  |
|--|--|
| 1. Highest concentration                   | Micro, middle, neighborhood (sometimes urban or regional for secondarily formed pollutants). |
| 2. Population oriented                     | Neighborhood, urban.   |
| 3. Source impact                           | Micro, middle, neighborhood.   |
| 4. General/background & regional transport | Urban, regional.   |
| 5. Welfare-related impacts                 | Urban, regional.   |

**Table 1 - Siting Objectives and Scales**

### ***9. Data Processing and Reporting***

All ambient air quality data are stored on the Achilles Server managed by the Forsyth County MIS (IT) department located on the 3<sup>rd</sup> floor of the Forsyth County Government Center, FCEAP, 201 N. Chestnut Street, Winston-Salem, North Carolina. The AirVision SQL based database is accessed from computers located on the 5th floor of the Forsyth County Government Center, FCEAP, 201 N. Chestnut Street, Winston-Salem, North Carolina. On a daily basis, All data are backed up and maintained at an off-site location. After all monthly data validation procedures are successfully completed, data is transmitted to the USEPA's national Air Quality System (AQS) database. The AQS database is maintained by EPA as the official repository of the fully quality assured ambient air quality dataset.

## Network Summary

### *1. Site Table and Criteria Pollutants Monitored*

| Site                   | AQS ID #    | CO | NO <sub>2</sub> | O <sub>3</sub> | Pb | PM <sub>2.5</sub> | PM <sub>10</sub> | SO <sub>2</sub> | Air<br>Toxics |
|------------------------|-------------|----|-----------------|----------------|----|-------------------|------------------|-----------------|---------------|
| Clemmons Middle School | 37-067-0030 |    |                 | X              |    | X                 |                  |                 |               |
| Hattie Avenue A&B      | 37-067-0022 |    | X               | X              |    | X                 | X                | X               | X             |
| Union Cross            | 37-067-1008 |    |                 | X              |    |                   |                  |                 |               |
|                        |             |    |                 |                |    |                   |                  |                 |               |
|                        |             |    |                 |                |    |                   |                  |                 |               |

**Table 2 - Forsyth County Monitoring Sites**

## 2. Site Map

### AIR QUALITY MONITORING STATIONS FORSYTH COUNTY, NC 2017



Figure 1 - Forsyth County Monitor Locations



### 3. Monitoring Methods

| Site        | Parameter            | Instrument / Method                          | Method Number | Parameter Number | Monitor Type <sup>†</sup> | Serial Number  | Purchase Date | Replace Date | Condition                 |
|-------------|----------------------|--|---------------|------------------|---------------------------|----------------|---------------|--------------|---------------------------|
| 37-067-0022 | Ozone                | UV Photometric                               | 087           | 44201            | SLAMS                     | 3093           | 2017          | 2027         | Good                      |
| 37-067-0022 | SO <sub>2</sub>      | Pulsed UV Fluorescent                        | 600           | 42401            | SLAMS                     | 179            | 2017          | 2027         | Good                      |
| 37-067-0022 | NO                   | Chemi-luminescence                           | 599           | 42601            | SLAMS                     | T200U-214      | 2017          | 2027         | Good                      |
| 37-067-0022 | NO <sub>2</sub>      | Chemi-luminescence                           | 599           | 42602            | SLAMS                     | T200U-214      | 2017          | 2027         | Good                      |
| 37-067-0022 | NO <sub>x</sub>      | Chemi-luminescence                           | 599           | 42603            | SLAMS                     | T200U-214      | 2017          | 2027         | Good                      |
| 37-067-0022 | Air Toxics           | Compendium Method for Toxic Organics (TO) 15 | 150           | Multiple         | NON                       | 4518           | NCDENR Owned  |              |                           |
|             |                      |  |               |                  |                           | 3603           |               |              |                           |
| 37-067-0022 | PM <sub>2.5</sub>    | FRM  | 145           | 88101            | SLAMS                     | 2025I203541302 | 2014          | 2024         | Good                      |
| 37-067-0022 | PM <sub>2.5</sub>    | Speciation                                   | 118           | Multiple         | SLAMS                     | A2591          | 2001          | 2024         | Good                      |
| 37-067-0022 | PM <sub>2.5</sub>    | T640x  | 238           | 88101            | SLAMS                     | 96             | 2017          | 2027         | Good                      |
| 37-067-0022 | PM <sub>2.5</sub> CR | T640x  | 240           | 86101            | SLAMS                     | 96             | 2017          | 2027         | Good                      |
| 37-067-0022 | PM <sub>2.5</sub>    | Carbon Speciation                            | 118           | 88101            | SLAMS                     | 3NB0191        | 2007          | 2024         | Fair-parts being upgraded |
| 37-067-0022 | PM <sub>10</sub>     | T640x  | 239           | 81102            | SLAMS                     | 96             | 2017          | 2027         | Good                      |
|             |                      |  |               |                  |                           |                |               |              |                           |
| 37-067-0030 | Ozone                | UV Photometric                               | 087           | 44201            | SLAMS                     | 4061           | 2018          | 2028         | Good                      |
| 37-067-0030 | PM <sub>2.5</sub>    | T640   | 236           | 88101            | SLAMS                     | 145            | 2017          | 2027         | Good                      |
| 37-067-0030 | PM <sub>2.5</sub>    | FRM  | 145           | 88101            | SLAMS                     | 2025B217080407 | 2010          | 2020         | Good                      |
|             |                      |  |               |                  |                           |                |               |              |                           |
| 37-067-1008 | Ozone                | UV Photometric                               | 087           | 44201            | SLAMS                     | 4060           | 2018          | 2028         | Good                      |
| 37-067-1008 | Temp                 | Climatronics                                 | 020           | 61101            | SLAMS                     |                | 2016          | 2026         | Good                      |
| 37-067-1008 | Humidity             | Climatronics                                 | 020           | 61103            | SLAMS                     |                | 2016          | 2026         | Good                      |
| 37-067-1008 | WD                   | Climatronics                                 | 020           | 61104            | SLAMS                     | 102779         | 2016          | 2026         | Good                      |
| 37-067-1008 | WS                   | Climatronics                                 | 020           | 61103            | SLAMS                     | 102779         | 2016          | 2026         | Good                      |
| 37-067-1008 | Pressure             | Climatronics                                 | 011           | 64101            | SLAMS                     |                | 2016          | 2026         | Good                      |

Table 3 - Forsyth County Monitoring Methods

<sup>†</sup>- Monitor Type:

SLAMS- State and Local Air Monitoring Station

SPM- Special Purpose

NON- Non-regulatory

TRENDS- Trends Speciation

# Air Monitoring Station Descriptions

## 1. Clemmons Middle School

### (a) Site Table

|                              |  |                             |       |
|------------------------------|--|-----------------------------|-------|
| Site Name:                   | Clemmons Middle School                             |                             |       |
| AQS Site Id #:               | 37-067-0030  |                             |       |
| Location:                    | Fraternity Church Road                             |                             |       |
|                              | Winston-Salem, NC                                  |                             |       |
| Latitude:                    | N 36.026612  |                             |       |
| Longitude:                   | W 80.341962  |                             |       |
| Elevation:                   | 245 meters   |                             |       |
| Date Monitor Established:    | Ozone  | April 27, 2005              |       |
| Date Monitor Established:    | PM2.5 T640   | Jan. 1, 2018                |       |
| Date Monitor Established:    | PM2.5 FRM  | Oct 1, 2018                 |       |
| Nearest Road:                | Fraternity Church Road                             | Distance to Road: 40 meters |       |
| Traffic Count <sup>3</sup> : | 4400   | Year of Count:              | 2017  |
| MSA <sup>4</sup> :           | Winston-Salem, NC<br>Metropolitan Statistical Area | MSA #:                      | 49180 |
|                              |  |                             |       |

| Parameter | Method          | Method Number | Sampling Schedule                  |
|-----------|-----------------|---------------|------------------------------------|
| Ozone     | UV Photometric  | 087           | March 1 – Oct. 31,<br>(Continuous) |
| PM2.5     | T640            | 236           | Continuous                         |
| PM2.5     | FRM Gravimetric | 145           | 1/6 day                            |
|           |                 |               |                                    |

Table 4 - Clemmons Middle School Monitoring Station Summary

### (b) Site Description and Statement of Purpose

An ozone monitor and PM<sub>2.5</sub> continuous monitor have been located at a manufactured structure since April 27, 2005. The site is located in a mixed use environment at latitude N36.025931° and longitude W80.342257°. The site elevation is 245 meters above sea level. The nearest road is Fraternity Church Road with an annual traffic volume of 4100 vehicles (2017) at a distance of 40 meters from the sample inlet.

The inlet of the samplers is approximately 3 meters above ground level and 1 meter above roof level. There were trees encroaching on the minimum distance from the inlet and those trees were removed during the summer of 2015. The last official site evaluation was completed in May, 2021. The area is a transition zone of business (~50%) to residential (~50%) within a 1 km radius. The samplers are SLAMS.

The ozone instrument is operated during the North Carolina ozone monitoring season which begins March 1 and ends October 31. The ozone instrument operates continuously during this period.

## OBJECTIVE AND SPATIAL SCALE

The monitoring objectives of the instruments are to measure: 1) upwind background ambient concentrations and 2) population exposure.

The site is a neighborhood spatial scale for ozone and PM<sub>2.5</sub>. Data from this site is used to assess compliance with the NAAQS for ozone and PM<sub>2.5</sub>.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.

### *(c) Site Photographs*



## 2. Hattie Avenue

### (a) Site Table

|                              |   |                   |           |
|------------------------------|---|-------------------|-----------|
| Site Name:                   | Hattie Avenue (Two buildings {A & B} at one location)       |                   |           |
| AQS Site Id #:               | 37-067-0022   |                   |           |
| Location:                    | 1300 Hattie Avenue  |                   |           |
|                              | Winston-Salem, NC   |                   |           |
| Latitude:                    | N 36.110940   |                   |           |
| Longitude:                   | W 80.224501   |                   |           |
| Elevation:                   | 284 meters  |                   |           |
| Date Monitor Established:    | Ozone   | May 21, 1993      |           |
| Date Monitor Established:    | NO <sub>2</sub>   | January 1, 1984   |           |
| Date Monitor Established     | SO <sub>2</sub>   | January 1, 1983   |           |
| Date Monitor Established:    | PM <sub>2.5</sub> – FRM                                     | January 1, 1999   |           |
| Date Monitor Established:    | PM <sub>2.5</sub> - PM <sub>10</sub> - PM <sub>10-2.5</sub> | January 1, 2018   |           |
| Date Monitor Established:    | Air Toxics  | January 1, 2000   |           |
| Date Monitor Established:    | Speciation  | January 1, 2001   |           |
| Date Monitor Established:    | Carbon Speciation   | January 1, 2007   |           |
|                              |   |                   |           |
|                              |   |                   |           |
| Nearest Road:                | Hattie Avenue   | Distance to Road: | 27 meters |
| Traffic Count <sup>3</sup> : | 6000  | Year of Count:    | 2017      |
| MSA <sup>4</sup> :           | Winston-Salem, NC<br>Metropolitan Statistical Area          | MSA #:            | 49180     |

| Parameter   | Method  | Method Number | Sampling Schedule                  |
|---|---|---------------|------------------------------------|
| Ozone   | UV Photometric                                  | 087           | March 1 – Oct. 31,<br>(Continuous) |
| NO <sub>2</sub>   | Chemiluminescence                               | 599           | Continuous                         |
| SO <sub>2</sub>   | UV Pulsed Fluorescence                          | 560           | Continuous                         |
| PM <sub>2.5</sub> FRM                                   | FRM Gravimetric                                 | 145           | 1/3 day                            |
| PM <sub>2.5</sub> PM <sub>10</sub> PM <sub>10-2.5</sub> | T640x, Continuous                               | 238-239-240   | Continuous                         |
| Air Toxics  | Compendium Method for<br>Toxic Organics (TO) 15 | 150           | 1/6 day                            |
| Speciation  | MET-one   | 118           | 1/6 day                            |
| Carbon Speciation                                       | URG Sampler                                     | 118           | 1/6 day                            |

Table 5 - Hattie Avenue "A" Monitoring Station Summary

### (b) Description and Statement of Purpose

The Hattie Avenue A site monitors ozone, sulfur dioxide, oxides of nitrogen, PM<sub>2.5</sub>, PM<sub>10</sub>, PM<sub>10-2.5</sub>, toxics, speciation, and carbon speciation. The site is located in the 1300 block of Hattie Avenue in downtown Winston-Salem. The site is located approximately 2.2 km NE of downtown, 1.1 km E of US52 and approximately 1.8 km NNW of Interstate 40 Business in a residential district at latitude N36.110941° and longitude W80.224423°. The site elevation is 284 meters. The nearest road, Hattie Avenue, is 27 meters from the inlets and has a daily traffic flow of 6000 vehicles (2017). The nearest tallest building is St. Benedict's Church (approximately 10 meters). The inlets are approximately 43 meters from the building. The inlets are approximately 4 meters above the ground and 1 meter above the roof of the monitoring station. The last official

site evaluation was completed in May, 2021. The area is residential. The ozone, sulfur dioxide, and NO<sub>2</sub> monitors are all SLAMS.

The ozone instrument is operated during the North Carolina ozone monitoring season which begins March 1 and ends October 31. The ozone instrument operates continuously during this period.

The SO<sub>2</sub> and NO<sub>2</sub> instruments operate continuously.

The PM<sub>2.5</sub>, PM<sub>10</sub>, and PM<sub>10-2.5</sub> T640x instruments operate continuously.

The PM<sub>2.5</sub> primary monitor is a continuous sampler and the co-located FRM is on the 1 in 3 day schedule. The FRM sampling interval is 24 hours, from midnight to midnight every third day.

The PM<sub>2.5</sub> Speciation sampling frequency is 1 in 6 days. The sampling interval is 24 hours, from midnight to midnight every six days.

Monitoring for Urban Air Toxics (UAT) is currently conducted at this site by the North Carolina Division of Air Quality (NC-DAQ), Toxics Protection Branch (TPB). Currently, the NC-DAQ TPB collects whole air samples in stainless steel 6 liter- pressurized canisters. The samples are then analyzed using cryogenic preconcentration gas chromatography with mass spectrometric detection (GC/MS) via the Compendium Method for Toxic Organics (TO) 15 for the list of 68 compounds (below).

- |                                |                                       |
|--------------------------------|---------------------------------------|
| • <i>Propene</i>               | • <i>Methacrolein</i>                 |
| • <i>Freon 12</i>              | • <i>Vinyl Acetate</i>                |
| • <i>Freon 22</i>              | • <i>1,1-Dichloroethane</i>           |
| • <i>Freon 114</i>             | • <i>Methyl Vinyl Ketone</i>          |
| • <i>Chloro Methane</i>        | • <i>Methyl Ethyl Ketone</i>          |
| • <i>(Methylchloride)</i>      | • <i>1,2 Dichloroethene</i>           |
| • <i>Isobutene</i>             | • <i>Chloroform</i>                   |
| • <i>Vinyl chloride</i>        | • <i>1,1,1-Trichloroethane</i>        |
| • <i>1,3-Butadiene</i>         | • <i>(Methyl chloroform)</i>          |
| • <i>Bromomethane</i>          | • <i>Cyclohexane</i>                  |
| • <i>Chloroethane</i>          | • <i>Carbon Tetrachloride</i>         |
| • <i>Freon 11</i>              | • <i>Benzene</i>                      |
| • <i>Pentane</i>               | • <i>1,2-Dichloroethane</i>           |
| • <i>Ethanol</i>               | • <i>(ethylene dichloride)</i>        |
| • <i>Isoprene</i>              | • <i>1-Butanol</i>                    |
| • <i>Acrolein</i>              | • <i>Trichloroethylene</i>            |
| • <i>1,1-Dichloroethene</i>    | • <i>2-Pentanone</i>                  |
| • <i>(Vinylidene chloride)</i> | • <i>3-Pentanone</i>                  |
| • <i>Freon 113</i>             | • <i>1,2-Dichloropropane</i>          |
| • <i>Methyl Iodide</i>         | • <i>1,4-Dioxane</i>                  |
| • <i>Isopropyl Alcohol</i>     | • <i>Bromodichloromethane</i>         |
| • <i>Carbon Disulfide</i>      | • <i>trans-1,3 Dichloropropene</i>    |
| • <i>Acetonitrile</i>          | • <i>Methyl Isobutyl Ketone</i>       |
| • <i>Methylene chloride</i>    | • <i>Toluene</i>                      |
| • <i>Cyclopentane</i>          | • <i>cis-1,3 Dichloropropene</i>      |
| • <i>MTBE</i>                  | • <i>1,1,2-Trichloroethane (vinyl</i> |
| • <i>Hexane</i>                | <i>trichloride)</i>                   |



- *Ethylpropylketone*
- *Tetrachloroethylene*
- *(perchloroethylene)*
- *Methyl Butyl Ketone*
- *Dibromoethane*
- *Chlorobenzene*
- *(phenylchloride)*
- *Ethylbenzene*
- *m- & p-Xylene*
- *o-Xylene*
- *Styrene*
- *Bromoform*
- *1,1,2,2-Tetrachloroethane*
- *1,3,5-Trimethylbenzene*
- *(mesitylene)*
- *1,2,4-Trimethylbenzene*
- *(pseudocumene)*
- *m-Dichlorobenzene*
- *1,2,3-Trimethylbenzene*
- *p-Dichlorobenzene*
- *Benzylchloride*
- *o-Dichlorobenzene*
- *1,2,4-Trichlorobenzene*

The site complies with the siting requirements of 40CFR58 for criteria air pollutants. It is recommended that the current site status be maintained.





## **OBJECTIVE AND SPATIAL SCALE**

The monitoring objectives of the instruments are to measure: 1) background ambient concentrations and 2) population exposure.

The site is a neighborhood spatial scale. Data from this site is used to assess compliance with the NAAQS for ozone, sulfur dioxide, and nitrogen dioxide.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.

***(c) Site Photographs***

|  |   |
|--|---|
|   |   |
| NORTH (unable to update due to locked gate)  | EAST  |
|  |  |
| SOUTH  | WEST  |

### 3. Union Cross

#### (a) Site Table

|                                 |  |                   |           |
|---------------------------------|--|-------------------|-----------|
| Site Name:                      | Union Cross  |                   |           |
| AQS Site Identification Number: | 37-067-1008  |                   |           |
| Location:                       | 3656 Piedmont Memorial Drive                           |                   |           |
|                                 | Winston-Salem, NC                                      |                   |           |
| Latitude:                       | N 36.051805  |                   |           |
| Longitude:                      | W 80.144933  |                   |           |
| Elevation:                      | 285 meters   |                   |           |
| Date Monitor Established:       | Ozone  | April 1, 1998     |           |
| Nearest Road:                   | Piedmont Memorial Dr.                                  | Distance to Road: | 55 meters |
| Traffic Count <sup>3</sup> :    | 670  | Year of Count:    | 2017      |
| MSA <sup>4</sup> :              | Winston-Salem, NC Metropolitan Statistical Area (2006) | MSA #:            | 49180     |

| Parameter           | Method        | Method Number | Sampling Schedule                 |
|---------------------|---------------|---------------|-----------------------------------|
| Ozone               | UV Photometry | 087           | March 1 – October 31 (Continuous) |
| Wind Speed          | Climatronics  | 020           | Continuous                        |
| Wind Direction      | Climatronics  | 020           | Continuous                        |
| Pressure            | Climatronics  | 011           | Continuous                        |
| Outdoor Temperature | Climatronics  | 020           | Continuous                        |
| Relative Humidity   | Climatronics  | 020           | Continuous                        |

Table 6 - Union Cross Monitoring Station Summary

#### (b) Site Description and Statement of Purpose

An ozone monitor has been located at this site since April 1, 1998 along with a meteorological tower since 1997. The site is located approximately 10 km SE of the central business district at latitude 36.050746° and longitude -80.143826°. The site elevation is 285 meters above sea level. The nearest road is Piedmont Memorial Drive with an annual traffic volume of 670 vehicles (2017) at a distance of 55 meters from the sample inlet.

The inlet is approximately 3 meters above the ground and 1 meter from the roof. The last official site evaluation was completed in May, 2021. The area is residential. The ozone sampler is SLAMS.

The ozone instrument is operated during the North Carolina ozone monitoring season which begins March 1 and ends October 31. The ozone instrument operates continuously during this period.

The site complies with the siting requirements of 40CFR58 for criteria air pollutants. There are no proposed changes for this site. It is recommended that the current site status be maintained. All equipment has been moved from the old building (green exterior) to the new building (white exterior). The old building will be moved from this location and disposed of.

### OBJECTIVE AND SPATIAL SCALE

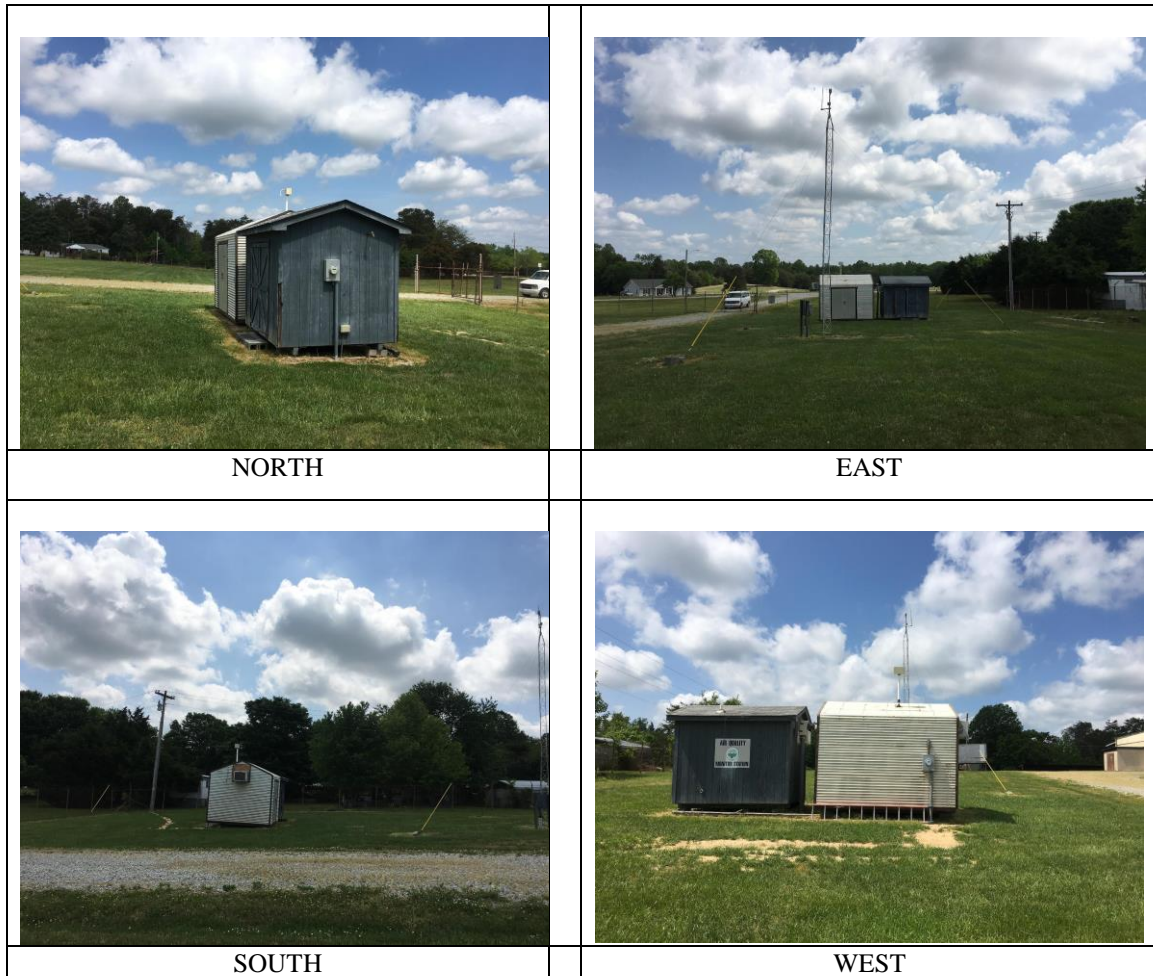


The monitoring objective of the instrument is to measure population exposure.

The site is a neighborhood spatial scale for ozone. Data from this site is used to assess compliance with the NAAQS for ozone.

The site is located in the Winston-Salem, NC Metropolitan Statistical Area<sup>4</sup>. The principal cities and counties in the MSA are Winston-Salem, Davie County, Forsyth County, Stokes County, and Yadkin County, NC.

***(c) Site Photographs***



## ***References***

1. [Title 40 Code of Federal Regulations Part 58, Ambient Air Quality Surveillance](#). Part 58 and Part 58 Amended: Federal Register/Vol. 71 No. 200/Tuesday, October 17, 2006/Rules and Regulations.
2. Watson, John G., Chow, Judith C., DuBois, David, Green, Mark, Frank, Neil, Pitchford, Marc. [Guidance for Network Design and Optimum Site Exposure for PM2.5 and PM10](#). Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711. December 15, 1997.
3.  
Winston-Salem Department of Transportation. [Current Traffic Counts](#)  
Note: Traffic Count taken from nearest road providing most impact to site
4. US Census Bureau. Current Lists of Metropolitan and Micropolitan Statistical Areas and Definitions. <http://www.census.gov/population/metro/data/index.html> .  
(301) 763-2419. 2006.

# **2021 Annual Monitoring Network Plan**

## **Appendix A**

No comments were received.