Ambient Air Monitoring Work Plan

National Core (NCore) Monitoring Station

Hamilton County, Ohio MSA

Hamilton County Department of Environmental Services
250 William Howard Taft Rd
Cincinnati, OH 45219

Introduction

State and local environmental protection agencies across the country monitor the ambient air to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) and to protect the health of the public. Each monitoring agency is responsible for developing a network that can accomplish these goals. The strategy for monitoring the ambient air must change over time in response to changes in monitoring needs, updated standards, population shifts, technological improvements, and other factors.

When the United States Environmental Protection Agency (USEPA) was created, the monitoring strategy sought to measure many pollutants at a few sites in a local area. Over time, the strategy shifted to emphasize measuring select pollutants at more locations. USEPA's newest strategy seeks to establish a National Core (NCore) network of "representative" sites across the nation. USEPA intends to site these stations primarily to observe pollutant concentrations at the neighborhood (0.5 to 4.0 km) or urban (4 to 40 km) scales. These sites will assist in determining pollutant trends between regions over differing time periods.

The NCore network will address several objectives:

- timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms
- support development of emission strategies through air quality model evaluation and other observational methods
- accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors
- support long-term health assessments that contribute to ongoing reviews of the National Ambient Air Quality Standards (NAAQS)
- compliance through establishing nonattainment/attainment areas by comparison with the NAAQS
- support multiple disciplines of scientific research, including: public health, atmospheric and ecological

The criteria pollutants, CO, NO2, and SO2, are included in the NCore monitoring strategy because of their roles as precursors for other pollutants. These pollutants will be monitored at significantly lower levels. The monitoring equipment must be able to reliably measure low concentrations of these pollutants. In the future, Hamilton County Department of Environmental Services (HCDOES) anticipates purchasing low level monitors for many of its other monitoring sites due to the lower ambient concentrations of these pollutants.

History

HCDOES learned that it would operate an NCore station in 2005, and the agency immediately began preparations. Staff members attended USEPA sponsored training in Research Triangle Park, North Carolina. HCDOES managers reviewed the existing sites within its network to identify which location best fulfilled the preferred characteristics for an NCore site. EPA provided several points to consider. The site chosen should:

- Represent a broad urban or regional scale
- Not be impacted by local sources that do not influence the entire area
- When possible, include NCore with other air monitoring program sites

    - Photochemical Assessment Monitoring Station (PAMS), National Air Toxic Trend Sites (NATTS), Speciation Trend Network (STN)
- Be long term
- Have space available for multiple monitors, calibration tanks, and meteorological equipment
- Contain greater calibration/verification/audit needs
- Have the capability to store and transmit shorter-term data intervals

Several existing monitoring locations were considered in the process of choosing the NCore site. The Colerain site (39-061-0010) was selected; it has a long data history (over 30 years), will remain in our network indefinitely since the parcel is owned by the County, and the site is not located near any large industrial air pollution sources. The shelter at the site has plenty of space for the monitors that measure the NCore pollutants of interest, as well as room for additional monitoring or studies. The site is well situated to accommodate any calibration, audit, verification, and data recording/transmitting needs. Installation at this site seemed straightforward, and an early installation date would give our office experience running the equipment prior to the January 1, 2011 implementation deadline.

Staff investigated different vendors to judge what equipment to purchase. In 2006 HCDOES purchased a turn-key system from American Ecotech. Installation of an SO2, CO, and 2 NOy units occurred in July (these are all trace level instruments). Two NOy units were installed to compare the concentrations from a unit operating as EPA stipulates (converter on a 10 meter high tower) and a unit operating as American Ecotech suggests (drawing air from a heated glass manifold into a converter inside the station).

In 2007 the agency built a wooden deck over the station in anticipation of the filter-based particulate monitoring. The deck also assists in cleaning the glass manifold for the analyzers and reaching the telescoping tower at the station that holds the NOy unit converter and meteorological equipment. Due to costs, the stairway to get to the deck construction was postponed; an existing ladder on the station would be used in the interim. Annual service of the equipment was performed by American Ecotech and observed by Hamilton county staff.

In 2008, HCDOES began work with Ohio EPA to try to audit the NCore monitors at much lower audit levels than usual since they are trace level instruments. The attempt was not successful due to the limitations of the audit equipment. However, this exercise brought to light some of the additional resources and training that will be necessary to operate the equipment in the future. Annual service of the equipment was performed by Hamilton county staff alone.

In December 2008 the Office of Air Quality Planning and Standards (OAQPS) began reviewing candidate NCore sites. The Office suggested Colerain may not be the best site for our area, and suggested HCDOES consider moving the NCORE equipment to another site called Sycamore, (39-061-0006). While the stations are structurally similar, Sycamore has not aged as well and will require complete replacement. More importantly, Sycamore barely meets siting criteria; monitoring inlets are required to be >250 meters from a roadway with >110,000 vehicles per day for ozone and oxides of nitrogen (NO, NO2, NOx, NOy). Sycamore station is near Cincinnati's Interstate 275. In 2005, the average daily traffic count for the segment of highway close to the station was 108,069 and in 2002 the count was 115,350. The site is 252 meters from the roadway. We believe the traffic count was lower in 2005 than in 2002 because fewer people were travelling this segment of highway due to construction to add a lane in each direction. More recent data is not yet available, but we expect the next traffic count to exceed the count in 2002 due to the new lanes and completion of the construction, which will put it back in the >110,000 vehicles category. By contrast, the most recent traffic count for the Colerain site was 69,270 which only requires the site to be 100 meters from the roadway. The Colerain site is 210 meters from I-275, which is more than twice the requirement.

Future

Efforts continue to prepare Colerain for the official NCore start date. By autumn 2009 the wooden deck will have a set of stairs added to provide better access to the deck. Electrical power will be run to the deck. Additional monitors will be added: PM2.5 FRM, and PM2.5 hourly monitoring, as well as relative humidity. All of the meteorological equipment will be checked, and the staff will gain greater proficiency in operating, repairing, and verifying/calibrating the equipment. The Quality Management Plan (QMP) will be updated and Quality Assurance Project Plans (QAPPs) will be written, as well as any unwritten SOPs. The site operator, field manager, quality assurance manager, and others will attend training for the data acquisition system at the site and the HCDOES main office.

In 2010, the equipment will be taken off-line and completely serviced. The calibrator will be checked to ensure it is operating correctly. Method Detection Limit (MDL) testing will be performed, and the equipment calibrated; the NOy converter efficiency also will be checked. Monitors that have not yet been installed will be added to the site: PM2.5 speciation, PM10-2.5 mass, and PM10-2.5 speciation. The latter two are added last because the methods have not been completely selected and the cost of analysis is high. Additional parameters that may be added include volatile organic compounds, ammonia and nitric acid.

Operation will officially begin on January 1, 2011.

Changes to Ambient Air Monitoring Network to accommodate NCore's sampling strategy

HCDOES anticipates only a few changes to its network to accommodate the addition of the NCore site at Colerain. The site already operates as an ozone and SO2 site. The other gaseous monitors were added to the site but no monitors from other sites will be turned off to compensate; there will be a net gain of monitors with the addition of NCore to the network. The site already had a number of meteorological parameters; relative humidity will be a new parameter for the site, and the meteorological instruments may be changed in order to be in-line with EPA suggestions/requirements.

NCore sites are required to collect PM2.5 data, by a Federal Reference Method (FRM) and using a continuous/hourly monitor. HCDOES already planned to add a continuous and FRM monitor to the Colerain site to better cover its jurisdiction for the Air Quality Index (AQI). Thus, the only previously unplanned PM2.5 monitor to be added to Colerain will be the chemical speciation (CS) monitor. The cost of the analysis necessitates moving CS equipment from another site. The options are Taft (39-061-0040) or Middletown (39-017-1004). Both the MetOne SASS unit and the URG unit will be re-located.

New monitoring will include PM10-2.5 (PM Coarse) mass and speciation measurements.

By choosing American Ecotech to handle logging the data for the parameters, HCDOES has added an additional Data Acquisition System (DAS) to its network. This duplicate system has posed a great challenge for the agency, requiring a great deal of time and resources to learn, set-up, operate, and maintain. Start-up hurdles and changes in staff have added difficulties to the process.

Monitoring Methodologies

At a minimum, NCore sites must measure PM2.5 mass using continuous and filter-based samplers, speciated PM2.5, PM10-2.5 (PM Coarse) particle mass, PM Coarse speciation, O3, SO2, CO, NO/NOy, wind speed and direction, relative

humidity and ambient temperature (40 CFR 58 appendix D). EPA states that continuous monitoring methods are to be used at NCore sites whenever available. Continuous monitors will generate data over a common time period, and this data will be available more quickly than other methods.

HCDOES intends to operate monitors that are Federal Reference Methods or Federal Equivalent Methods whenever possible. The table below outlines the existing or new monitoring parameters and methods for the proposed NCore site.

Parameter	Frequency	Analysis Method Designation	Designation	Existing or New
PM2.5 mass	continuously	To Be Determined	NCore/AQI	New
PM2.5 mass	1/3 day	BGI PQ200 Manual Reference Method RFPS-0498-116	NCore	New
PM2.5 speciation	1/3 day	MetOne SASS	NCore	New
PM10-2.5 mass		To Be Determined	NCore	New
PM10-2.5 speciation		To Be Determined	NCore	New
Ozone	continuously	API 400E EQOA-0992-087	NAAQS/NCore	Existing
Sulfur Dioxide	continuously	Ecotech 9850 EQSA-0193-092	NAAQS/NCore	Existing/ Added trace level monitor July 2006
Carbon Monoxide	continuously	Ecotech 9830 RFCA-0992-088	NCore	Added trace level monitor July 2006
Total Reactive Nitrogen	continuously	Ecotech 9843	NCore	Added 2 trace level monitors July 2006
Wind speed	Continuously			Existing
Wind direction	Continuously			Existing
Relative humidity	Continuously	To Be Determined		New
Ambient temperature	Continuously			Existing
Solar radiation	continuously			Existing

Quality Assurance Status

The Code of Federal Regulations (CFR) states that each monitoring agency must develop a quality system that includes both a Quality Management Plan (QMP) and a Quality Assurance Project Plan (QAPP) in 40 CFR 58 Appendix A. HCDOES needs to update its current QMP and has not written QAPPs in the past. HCDOES is currently revising its QMP and writing all of its QAPPs, and hopes to have those documents specific to NCore monitoring ready by the end of 2009.

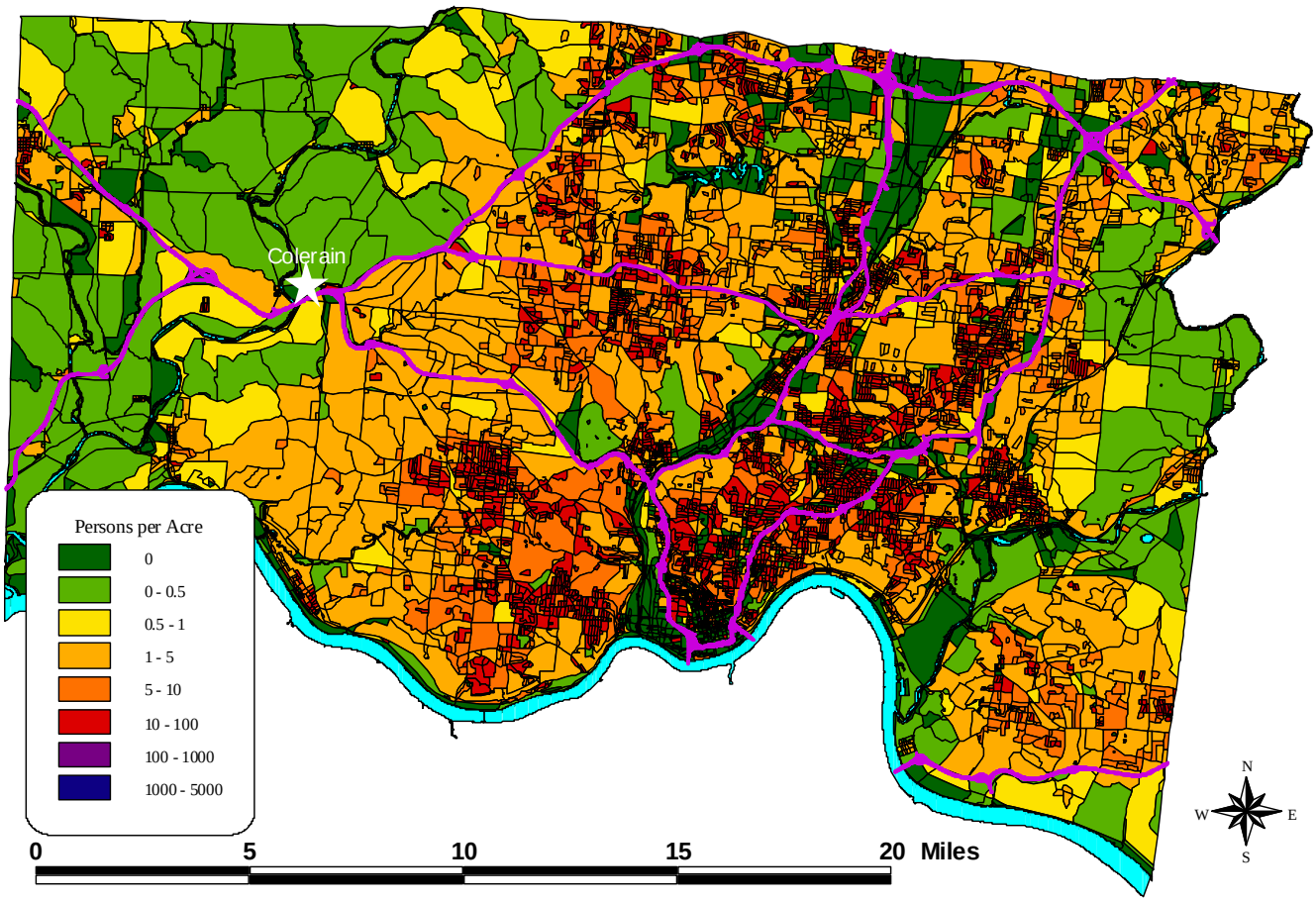
Area of Representativeness

40 CFR part 58 Appendix D section 3.d.1 states,

Urban NCore stations are to be generally located at urban or neighborhood scale to provide representative concentrations of exposure expected throughout the metropolitan area; however, a middle-scale site may be acceptable in cases where the site can represent many such locations throughout a metropolitan area.

Neighborhood scale is defined as an area with relative uniform land-use within a city between 0.5 and 4.0 kilometers in scale. Urban scale defines pollutant concentrations on the scale of a city, or between 4 to 50 kilometers.

Colerain Monitoring Site with
Hamilton County Population Density
2000 Census Data



Site Description and Spacing

Metropolitan Statistical Area: Hamilton County, Ohio

Site Name: Colerain

AQS site number: 39-061-0010

Street Address: 6950 Ripple Road

GPS coordinates: 39.214931, -84.690723

Original Established date: January 1, 1978

NCore equipment installation dates: CO/SO2/NOy 1 and 2: July 2006

PM2.5 FRM and hourly: Pending

PM2.5 speciation: Pending

PM10-2.5 mass: Pending

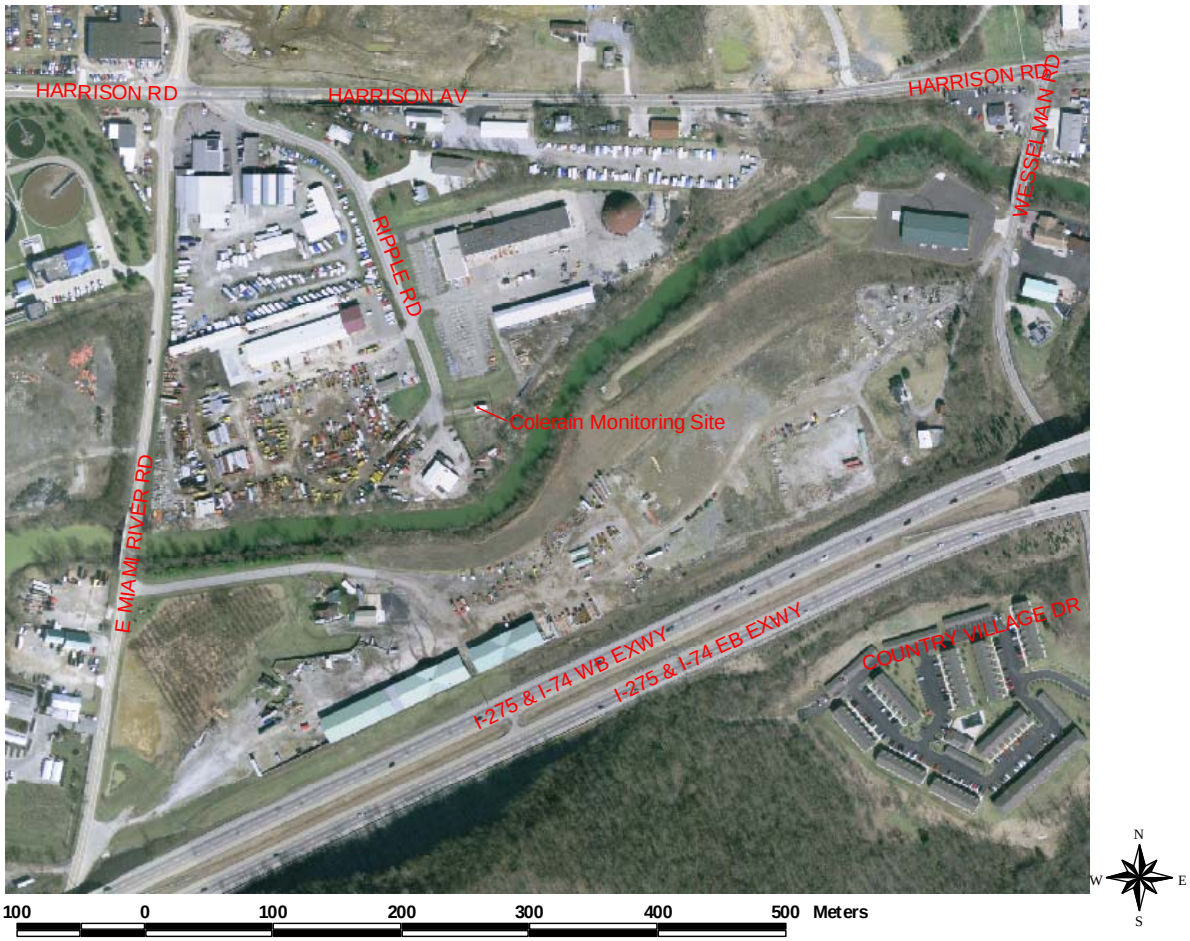
PM10-2.5 speciation: Pending

Inspection Date: Pending

Inspection By: Pending

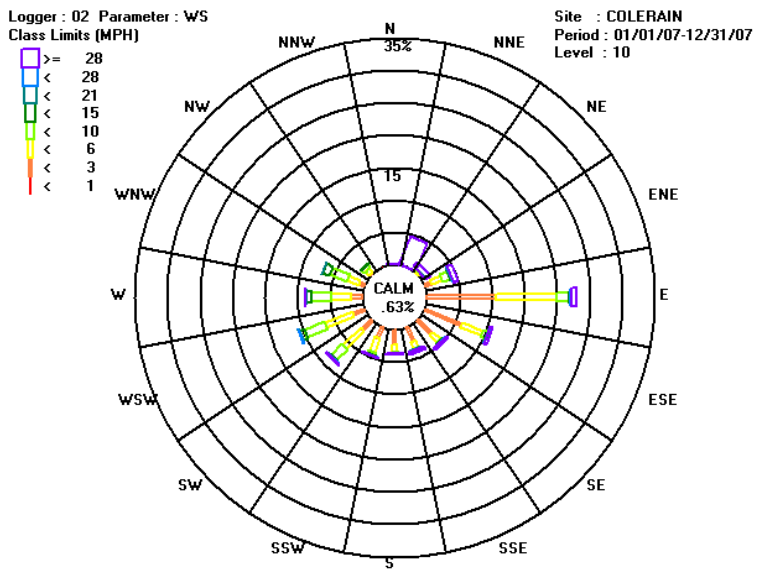
Site Approval Date: Pending

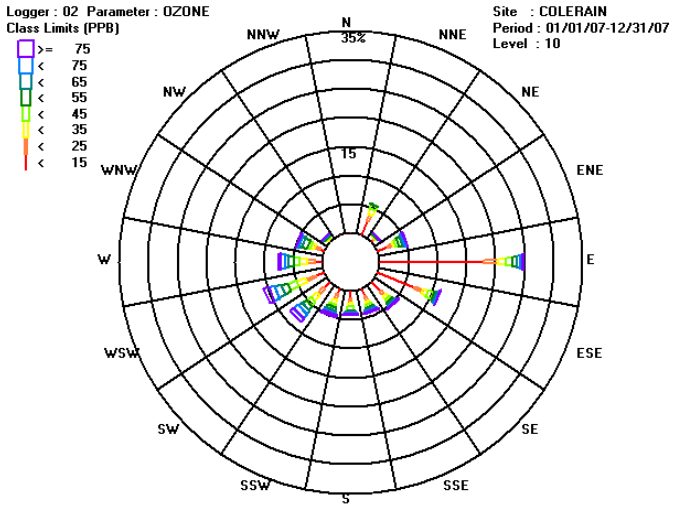
Colerain Monitoring Site - Aerial Photo 2007

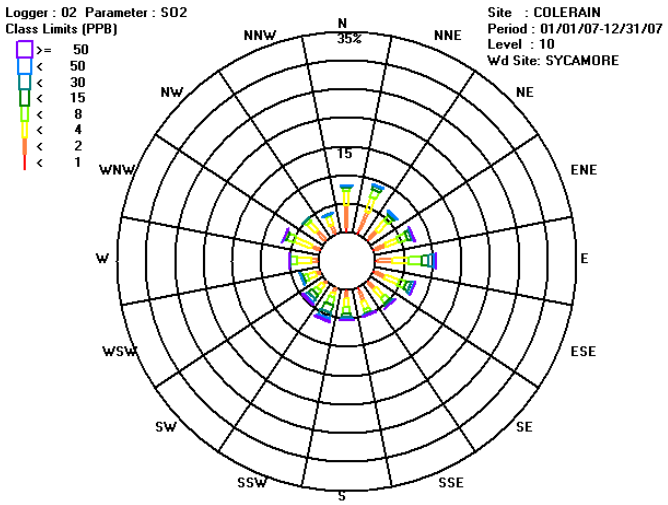


The Colerain Monitoring Site is located northwest of the urban core. A large stream runs to the east and south of the site, as shown in the aerial photo above. The nearby area mainly consists of light industry, warehouses, parking and offices. The wind rose was generated from data collected from the 10 meter tower, while the pollution roses came from instruments whose inlets are mounted on the side of the station; all data is from 2007. The wind rose shows that the

prevailing winds for this site are mostly easterly and westerly, with some southerly winds. The high occurrence of low speed winds from the east is somewhat unusual for this area and may be a result of downwash from the stream valley in the evenings.







NCore Siting Criteria

Siting criteria are important points to consider when choosing a sampling site. 40 CFR Part 58 Appendix E lists many restrictions and considerations to ensure monitors are sited correctly.

Horizontal and Vertical Placement of Probe/Inlet

The gaseous monitors will be inside the monitoring site shelter (dimensions are 3.6 m w x 9.1 m l x 3.6 m h). The CO, SO2, and one of the NOy monitors will draw their samples from a heated manifold that extends up through the roof of the structure and above the deck. The manifold inlet is approximately 6.4 meters above the ground. A telescoping

tower is at the station, and can be raised to a 10 meter height above the ground for the meteorological sensors and the NOy converter.

The particulate samplers will be placed on the wooden deck above the station. Their inlet heights will be 6.4 m meters above the ground.

Siting Criteria met?

Yes. Inlets for all monitors will be between 2 and 15 meters above the ground, and more than 1 meter from any vertical or horizontal supporting structures or walls.

Spacing from minor sources

Several minor sources share the same zip code as the station; however all are hundreds of meters away. It is believed that the plume from these local minor sources will not inappropriately impact the data from the site. Particulate matter data will be collected at NCore sites; this site is surrounded by ground with vegetative cover and paved areas. Some athletic fields and rodeos are in the neighborhood of the station, but CFR offers no guidance for spacing away from these areas.

Based on research of sources in the area, the source with the highest potential impact to the site might be the Duke Energy Ohio, Miami Fort Station, 11021 Brower Road, North Bend, OH 45052 (Premise Number: 1431350093). The Miami Fort Station is located 15 km southwest of the site. This source is a coal-fired power plant with 12,372 annual tons of NOx emissions and 24,693 annual tons of SO2 emissions reported for 2008. Miami Fort has two 5025 mmbtu/hr coal fired, dry bottom boilers with low NOx burners, selective catalytic reduction (SCR) for NOx control, electrostatic precipitators (ESP) to remove particulate, and wet scrubbers to remove sulfur dioxide from the stack emissions. The plant also has a 1534 mmbtu/hr pulverized coal dry bottom boiler with low NOx burners and an ESP. While this source may have some influence on the monitors at Colerain, it will have a similar influence on the region represented by the site.

Siting Criteria met?

Yes, there are no minor sources near the monitoring site that will impact the measured pollutants and the major source identified is 15 km away and will similarly influence the region represented by this site.

Spacing from Roadways

			Minimum Distance Required (meters)			
Roadway	Average Daily Count	Distance from site	Ozone	NO/NOy	CO	Particulate
Harrison Ave	11,700 (2000 data)	234 m	~14 m	~14 m	~16 m	~15 m
Wesselman Rd	5100 (2000 data)	402 m	10 m	10 m	10 m	10 m
Interstate 74	69,720 (2006 data)	210 m	100 m	100 m	150 m	~70 m
Ripple Road	**Not Available**	26 m	NA	NA	NA	NA
E Miami River Road	1170 (2004 data)	250 m	10 m	10 m	10 m	~2 m

Siting Criteria met?

Yes. Average daily traffic counts were not available for Ripple Road, which is the street for the station. Ripple is a cul-de-sac, and has little daily traffic; the station is at the end of the street. Based on the traffic counts for the other four roadways that make up the “block” around the station, the inlets are spaced far enough from the roadways.

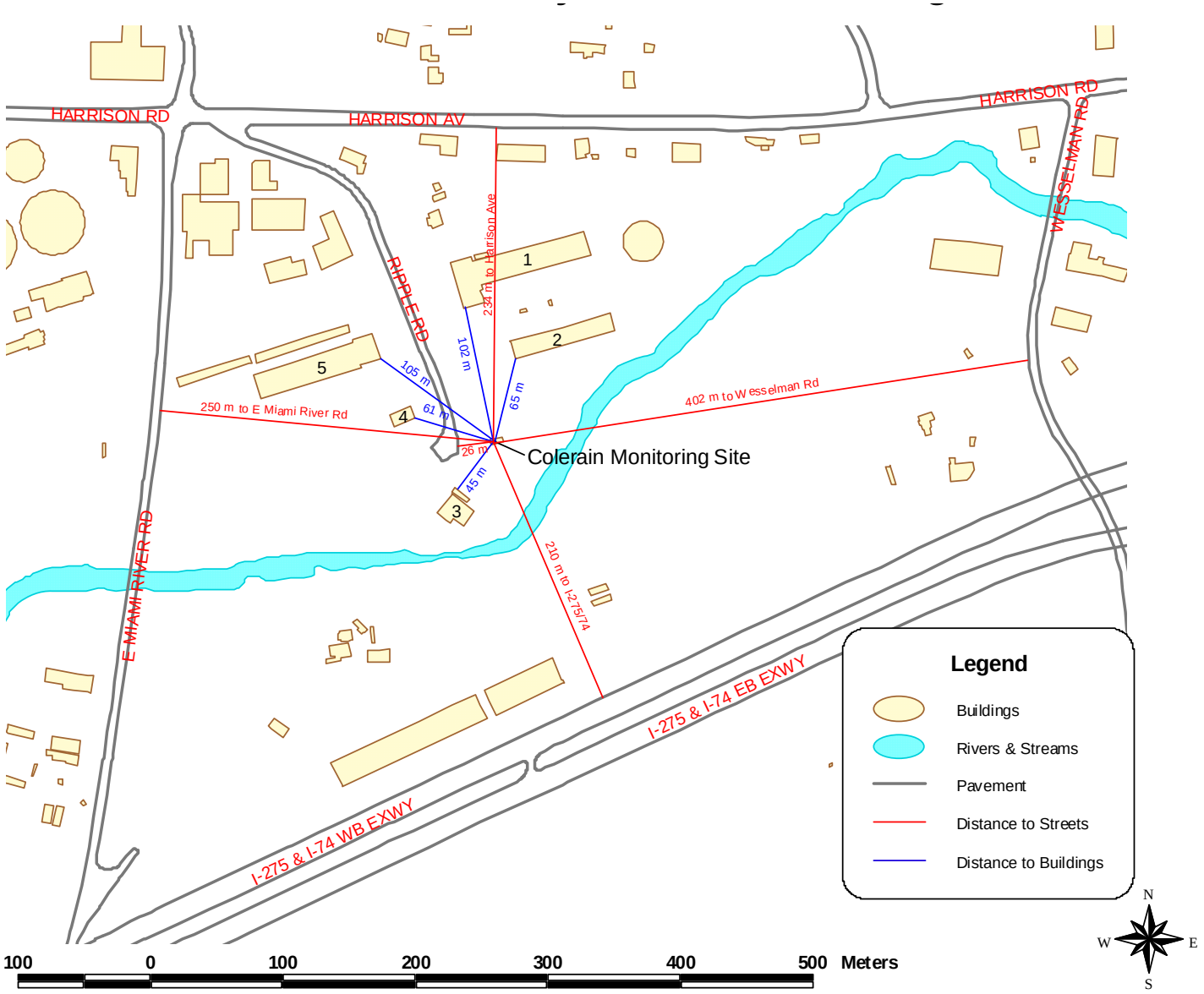
Spacing from Obstructions

1. County Engineer's Office/Garage: 102 m
2. County Building: 65 m
3. Private Business: 45 m
4. Office/Small business: 61 m
5. West Side Warehouse: 105 m

<u>Siting Criteria met?</u>

Yes, the nearby buildings are all only one or two story structures. The distances from all of the obstacles to the inlets are more than twice the height the obstacle protrudes above the inlets.

Colerain Monitoring Site - Distances to Nearby Streets and Buildings



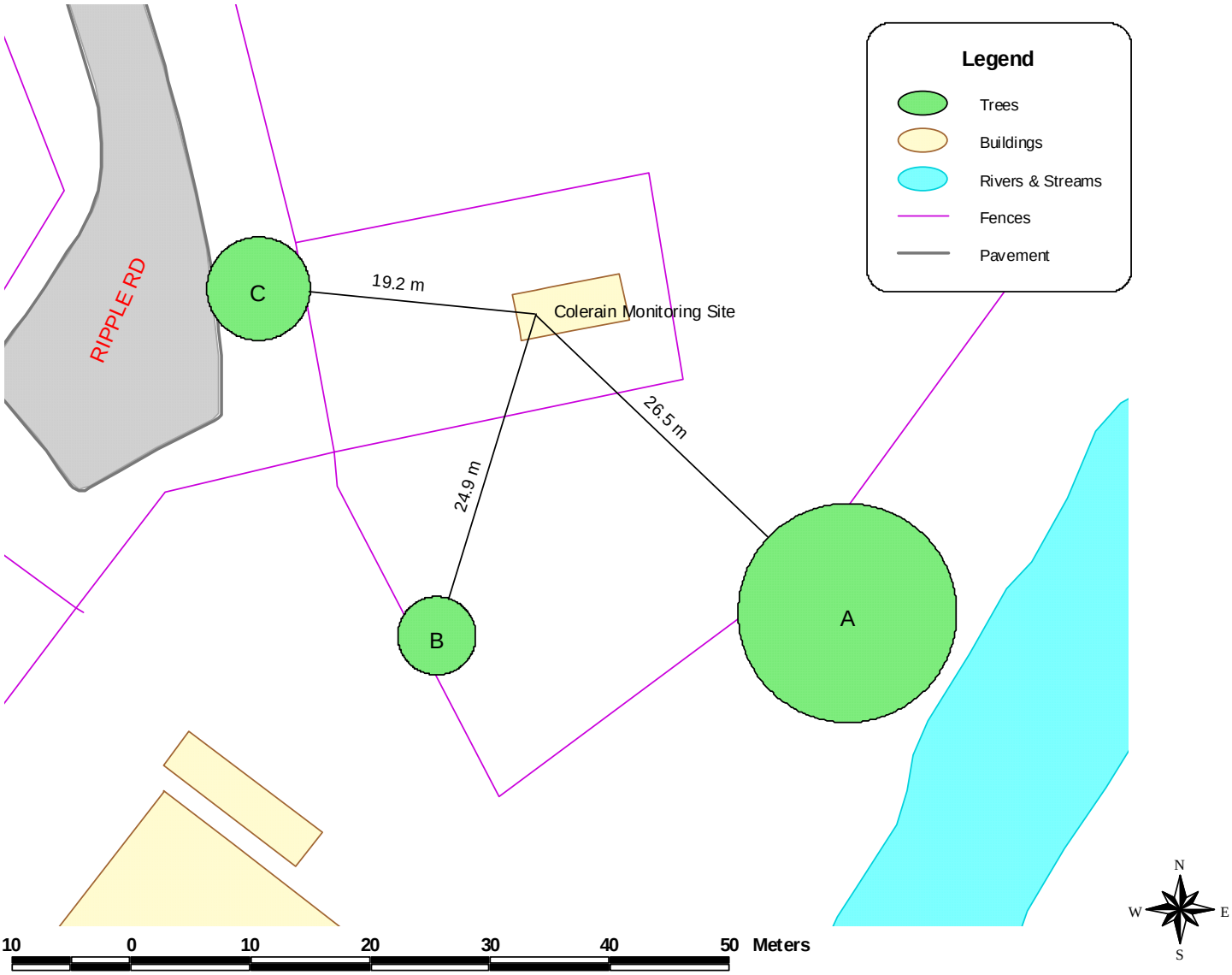
Spacing from Trees

A. Southeast Sycamore: 26.5 m
B. South Small Tree: 24.9 m
C. West Sycamore Tree: 19.2 m

<u>Siting Criteria met?</u>

Yes. The probes for the all of the monitors will be more than 10 meters from the drip line of all trees.

Colerain Monitoring Site – Distances to Nearest Tree Drip Lines



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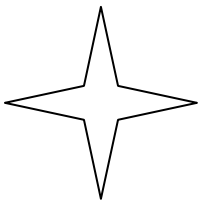

Direction	Photo Description
North	County Engineer's office and parking lot
Northeast	County Storage Building
East	River/Ravine/Vegetation
Southeast	River/Ravine/Vegetation
South	River/Ravine/Vegetation
Southwest	Private Business
West	Office/Small Business
Northwest	West Side Warehouse

References/Additional Information Sources

40 CFR 58 Appendices D and E:

http://www.access.gpo.gov/nara/cfr/waisidx_08/40cfr58_08.html

Ambient Air Monitoring Strategy for State, Local, and Tribal Air Agencies:

http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/AAMS%20for%20SLTs%20%20-%20FINAL%20Dec%202008.pdf

Technical Assistance Document for Precursor Gas Measurements in the NCore Multi-pollutant Monitoring Network:

http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/precursor/tadversion4.pdf