Technical Support Document:

Chapter 30
Proposed Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for North Carolina

1. Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (the EPA, we, or us) must designate areas as either "nonattainment," "attainment," or "unclassifiable" for the 2010 1-hour sulfur dioxide (SO_2) primary national ambient air quality standard (NAAQS) (2010 SO_2 NAAQS). The CAA defines a nonattainment area as an area that does not meet the NAAQS or that contributes to a nearby area that does not meet the NAAQS. An attainment area is defined by the CAA as any area that meets the NAAQS and does not contribute to a nearby area that does not meet the NAAQS. Unclassifiable areas are defined by the CAA as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS. In this action, the EPA has defined a nonattainment area as an area that the EPA has determined violates the 2010 SO_2 NAAQS or contributes to a violation in a nearby area, based on the most recent 3 years of air quality monitoring data, appropriate dispersion modeling analysis, and any other relevant information. An unclassifiable/attainment area is defined by the EPA as an area that either: (1) based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.[1] An unclassifiable area is defined by the EPA as an area that either: (1) was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO_2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

[1] The term "attainment area" is not used in this document because the EPA uses that term only to refer to a previous nonattainment area that has been redesignated to attainment as a result of the EPA's approval of a state-submitted maintenance plan.

This technical support document (TSD) addresses designations for nearly all remaining undesignated areas in North Carolina for the 2010 SO_2 NAAQS. In previous final actions, the EPA has issued designations for the 2010 SO_2 NAAQS for selected areas of the country.[2] The EPA is under a December 31, 2017, deadline to designate the areas addressed in this TSD as required by the U.S. District Court for the Northern District of California.[3] We are referring to the set of designations being finalized by the December 31, 2017 deadline as "Round 3" of the designations process for the 2010 SO_2 NAAQS. After the Round 3 designations are completed, the only remaining undesignated areas will be those where a state has installed and begun timely operating a new SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 Data Requirements Rule (DRR) (80 FR 51052). The EPA is required to designate those remaining undesignated areas by December 31, 2020.

North Carolina submitted its first recommendation regarding designations for the 2010 1-hour SO_2 NAAQS on June 2, 2011, requesting the EPA designate a portion of New Hanover County nonattainment based on a violating monitor in Hanover County at that time. This recommendation also requested attainment for 36 counties[4] and unclassifiable/attainment for the rest of the state. On September 18, 2015, the state submitted updated recommendations requesting attainment for Brunswick and New Hanover Counties. The State submitted their latest recommendations on January 13, 2017, requesting the EPA designate the entire state attainment except for those areas designated in previous rounds.[5] In our intended designations, we have considered all the submissions from the State, except where a recommendation in a later submission regarding a particular area indicates that it replaces an earlier recommendation for that area we have considered the recommendation in the later submission.

For the areas in North Carolina that are part of the Round 3 designations process, Table 1 identifies the EPA's intended designations and the counties or portions of counties to which they would apply. It also lists North Carolina's current recommendations. The EPA's final designation for these areas will be based on an assessment and characterization of air quality through ambient air quality data, air dispersion modeling, other evidence and supporting information, or a combination of the above.

[2] A total of 94 areas throughout the U.S. were previously designated in actions published on August 5, 2013 (78 FR 47191), July 12, 2016 (81 FR 45039), and December 13, 2016 (81 FR 89870).

[3] *Sierra Club v. McCarthy*, No. 3-13-cv-3953 (SI) (N.D. Cal. Mar. 2, 2015).

[4] These counties include Alleghany County, Avery County, Beaufort County, Camden County, Caswell County, Cherokee County, Chowan County, Clay County, Currituck County, Dare County, Davie County, Forsyth County, Gates County, Greene County, Henderson County, Hyde County, Jackson County, Jones County, Lee County, Macon County, Madison County, Mecklenburg County, Mitchell County, Pamilco County, Pasquotank County, Pender County, Perquimans County, Polk County, Swain County, Transylvania County, Tyrell County, Wake County, Warren County, Washington County, Watauga County, and Yadkin County.

[5] On June 30, 2016, the EPA designated all of Brunswick County "unclassifiable" for the 2010 1-hour SO_2 NAAQS. See 81 FR 45039.

Table 1. Summary of the EPA's Intended Designations and the Designation Recommendations by North Carolina.

Area/County	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
Stokes County Area	All townships located within the modeling domain for the Duke Energy Belews Creek Generating Station	Attainment	Same as State (see Table 3)	Unclassifiable/ Attainment
Catawba County Area	All townships located within the modeling domain of Duke Energy Marshall Steam Station	Attainment	Same as State (see Table 9)	Unclassifiable/ Attainment
Person County Area (partial)	All townships located within the modeling domain for the Duke Energy Progress Mayo Electric Generating Plant	Attainment	Allensville Township in Person County; Oak Hill and Walnut Grove Townships in Granville County located within the modeling domain for Duke Energy Progress Mayo Electric Generating Plant	Unclassifiable/ Attainment
		Attainment	Holloway, Woodsdale and Roxboro Townships in Person County located within the modeling domain for the Duke Energy Progress Mayo	Unclassifiable

Area/County	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
			Electric Generating Plant	
Gaston County Area	All townships located within the modeling domain of Duke Energy's Allen Steam Station (Cartesian grid extending 50 km in each direction of the facility)	Attainment	Same as State (see Table 22)	Unclassifiable/ Attainment
Beaufort County	All townships within Beaufort County	Attainment	Same as State (see Table 29)	Unclassifiable/ Attainment
Remaining Undesignated Areas to Be Designated in this Action*	All remaining townships outside the modeled and monitored areas*	Attainment	See Table 31	Unclassifiable/ Attainment

* Except for areas that are associated with sources for which North Carolina elected to install and began timely operation of a new SO_2 monitoring network meeting the EPA specifications referenced in the EPA's SO_2 DRR (*see* Table 2), the EPA intends to designate the remaining undesignated counties (or portions of counties) in North Carolina as "unclassifiable/attainment" as these areas were not required to be characterized by the state and cannot be classified on the basis of available information as meeting or not meeting the NAAQS. These areas, to which this row of this table is applicable, are identified more specifically in Section 8 of this document.

Areas for which North Carolina elected to install and began operation of a new, approved SO_2 monitoring network are listed in Table 2. The EPA is required to designate these areas, pursuant to a court ordered schedule, by December 31, 2020. Table 2 also lists the SO_2 emissions sources around which each new, approved monitoring network has been established.

Table 2 – Undesignated Areas Which the EPA Is Not Addressing in this Round of Designations (and Associated Source or Sources)

Township (County)	Source(s)
Beaverdam (Haywood County)	Evergreen Packaging – Canton Mill
Limestone (Buncombe County)	Duke Energy's - Ashville Steam Electric Plant
Cunningham (Person County)	Duke Energy's - Roxboro Plant

Areas that the EPA previously designated unclassifiable in Round 1 (*see* 78 FR 47191) and Round 2 (*see* 81 FR 45039 and 81 FR 89870) are not affected by the designations in Round 3 unless otherwise noted. For North Carolina, the only previously designated area is Brunswick County which was designated "unclassifiable" in Round 2 of designations.[6] The EPA is taking no action on this designated area at this time.

[6] All Townships in Brunswick County were designated unclassifiable in Round 2 due to the EPA's determination that the air dispersion analysis did not indicate whether the area around the CPI Southport facility met or did not meet the 1-hour SO_2 NAAQS. However, CPI is also subject to the DRR and thus chose to characterize the area around CPI through air quality monitoring. Since the area has already been designated, the EPA does not intend to take any action on this designated area at this time.

2. General Approach and Schedule

Updated designations guidance documents were issued by the EPA through a July 22, 2016, memorandum and a March 20, 2015, memorandum from Stephen D. Page, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Air Division Directors, U.S. EPA Regions I-X. These memoranda supersede earlier designation guidance for the 2010 SO_2 NAAQS, issued on March 24, 2011, and identify factors that the EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The documents also contain the factors that the EPA intends to evaluate in determining the boundaries for designated areas. These factors include: 1) air quality characterization via ambient monitoring or dispersion modeling results; 2) emissions-related data; 3) meteorology; 4) geography and topography; and 5) jurisdictional boundaries.

To assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling for sources that emit SO_2, the EPA released its most recent version of a draft document titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) in August 2016.[7]

Readers of this chapter of this TSD should refer to the additional general information for the EPA's Round 3 area designations in Chapter 1 (Background and History of the Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard) and Chapter 2 (Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for States with Sources Not Required to be Characterized).

As specified by the March 2, 2015, court order, the EPA is required to designate by December 31, 2017, all "remaining undesignated areas in which, by January 1, 2017, states have not installed and begun operating a new SO_2 monitoring network meeting the EPA specifications referenced in the EPA's" SO_2 DRR (80 FR 51052). The EPA will therefore designate by December 31, 2017, areas of the country that are not, pursuant to the DRR, timely operating the EPA-approved and valid monitoring networks. The areas to be designated by December 31, 2017, include the areas associated with four sources in North Carolina meeting DRR emissions criteria that states have chosen to be characterized using air dispersion modeling, the areas associated with sources for which air agencies imposed emissions limitations on sources to restrict their SO_2 emissions to less than 2,000 tons per year (tpy) (none of which are in North Carolina), sources that met the DRR requirements by demonstrating shut down of the source (none of which are in North Carolina), areas for which the states chose monitoring for the DRR but did not timely meet the approval and operating deadline, and other areas not specifically required to be characterized by the state under the DRR. Additionally, for North Carolina, the EPA intends to designate an area around a DRR source that chose to be characterized based on an existing attaining air quality monitor.

[7] https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf. In addition to this TAD on modeling, the EPA also has released a technical assistance document addressing SO_2 monitoring network design, to advise states that have elected to install and begin operation of a new SO_2 monitoring network. See Draft SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, February 2016, https://www.epa.gov/sites/production/files/2016-06/documents/so2monitoringtad.pdf.

Because many of the intended designations have been informed by available modeling analyses, this TSD is structured based on the availability of such modeling information. There is a section for each county for which modeling information is available. For some counties, multiple portions of the county have modeling information available and the section on the county is divided accordingly. Next, section 7 addresses one county for which no air quality modeling information is available but for which available air quality monitoring data indicates that there is no NAAQS violation. The remaining to-be-designated counties are then addressed together in section 8.

The EPA does not plan to revise this TSD after consideration of state and public comment on our intended designation. A separate TSD will be prepared as necessary to document how we have addressed such comments in the final designations.

The following are definitions of important terms used in this document:

1) 2010 SO_2 NAAQS – The primary NAAQS for SO_2 promulgated in 2010. This NAAQS is 75 parts per million (ppb), based on the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentrations. See 40 CFR 50.17.
2) Design Value - a statistic computed according to the data handling procedures of the NAAQS (in 40 CFR part 50 Appendix T) that, by comparison to the level of the NAAQS, indicates whether the area is violating the NAAQS.
3) Designated nonattainment area – an area that, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined either: (1) does not meet the 2010 SO_2 NAAQS, or (2) contributes to ambient air quality in a nearby area that does not meet the NAAQS.
4) Designated unclassifiable/attainment area an area that either: (1) based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.[8]
5) Designated unclassifiable area – an area that either: (1) was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO_2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

[8] The term "attainment area" is not used in this document because the EPA uses that term only to refer to a previous nonattainment area that has been redesignated to attainment as a result of the EPA's approval of a state-submitted maintenance plan.

6) Modeled violation – a violation of the SO_2 NAAQS demonstrated by air dispersion modeling.
7) Recommended attainment area – an area that a state, territory, or tribe has recommended that the EPA designate as attainment.
8) Recommended nonattainment area – an area that a state, territory, or tribe has recommended that the EPA designate as nonattainment.
9) Recommended unclassifiable area – an area that a state, territory, or tribe has recommended that the EPA designate as unclassifiable.
10) Recommended unclassifiable/attainment area – an area that a state, territory, or tribe has recommended that the EPA designate as unclassifiable/attainment.
11) Violating monitor – an ambient air monitor meeting 40 CFR parts 50, 53, and 58 requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.
12) We, our, and us – these refer to the EPA.

3. Technical Analysis for the Stokes County Area

3.1. Introduction

The EPA must designate the Stokes County area by December 31, 2017, because the area has not been previously designated and North Carolina has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting the EPA specifications referenced in the EPA's SO_2 DRR for any sources of SO_2 emissions in the State.

3.2. Air Quality Monitoring Data for Stokes County Area Addressing Duke Energy's Belews Creek Generating Station

This factor considers the SO_2 air quality monitoring data in the area of Stokes County addressing the Duke Energy's Belews Creek Generating Station (Belews Creek). The state included monitoring data from the following monitor(s):

- The Hattie Avenue monitor (AQS ID 37-067-0022). This monitor is located at the 1300 block of Hattie Avenue in Forsyth County, and is 15 miles (24 km) southwest of Belews Creek, in Stokes County. Belews Creek is 1.5 miles from the Forsyth County line. Data collected by this monitor is comparable to the NAAQS, and indicates that the most recent SO_2 levels are below the 1-hr NAAQS. The most recent three years of complete, quality-assured, certified data from this monitor (2014-2016) indicate a 1-hr SO_2 design value of 9 ppb. This monitor was not sited to characterize the maximum 1-hr SO_2 concentrations near Belews Creek. Therefore, North Carolina was not able to base its designation recommendation on the monitored data. North Carolina chose to provide an air quality modeling analysis to characterize the maximum 1-hr SO_2 concentrations in the Belews Creek area (see Section 3.3 below).

Additionally, the EPA reviewed the available air quality monitoring data in the Air Quality System (AQS) database and found the following nearby data:

- The Bethany School monitor (AQS ID 37-157-0099). This monitor is located at 36.308889, -79.859167 in Rockingham County, and is 11 miles east of Belews Creek, in Rockingham County. Belews Creek is less than 1.5 miles from the Rockingham County line. Data collected by this monitor is not comparable to the NAAQS, since it is operated as a prevention of significant deterioration background monitor and only runs one year out of every three years. This monitor last operated February 2014 through January 2015. Over this one year of data collection, the fourth highest maximum daily 1-hr value was 14.4 ppb. This monitor was not sited to characterize the maximum 1-hr SO_2 concentrations near Belews Creek. Therefore, North Carolina was not able to base its designation recommendation on the monitored data. North Carolina chose to provide an air quality modeling analysis to characterize the maximum 1-hr SO_2 concentrations in the area (see Section 3.3 below).

In reviewing the available air quality monitoring data in AQS, the EPA determined that other than the data described above, there are no additional relevant data in AQS collected in or near

Gaston County that could inform the intended designation action. The most recent SO_2 design values for all areas of the country are available at https://www.epa.gov/air-trends/air-quality-design-values.

3.3. Air Quality Modeling Analysis for the Stokes County Area Addressing Duke Energy's Belews Creek Generating Station

3.3.1. Introduction

This section 3.3 presents all the available air quality modeling information for a portion of Stokes County that includes Duke Energy's Belews Creek Generating Station, hereinafter referred to as Belews Creek. (This portion of Stokes County will often be referred to as "the Stokes County area" within this section 3.3.). This area contains the following SO_2 sources, principally the sources around which North Carolina is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tpy:

- The Belews Creek facility emitted 2,000 tons or more annually. Specifically, Belews Creek emitted 7,045 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and North Carolina has chosen to characterize it via modeling.

- The Pine Hall Brick Co. Inc. and Wieland Copper Products facilities are not on the SO_2 DRR Source list but were included in the modeling analysis for the Stokes County area. The Pine Hall Brick Co. Inc. and Wieland Copper Products emitted 3.9 and 6.1 tons of SO_2 in 2014, respectively.

Because we have available results of air quality modeling in which these sources are modeled together, the area around this group of sources is being addressed in this section with consideration given to the impacts of all these sources.

In its submission, North Carolina recommended that the area surrounding the Belews Creek facility, specifically the townships bounded by the modeling domain, identified in Table 3, be designated as attainment based in part on an assessment and characterization of air quality impacts from these facilities and other nearby sources that may have a potential impact in the area where the 2010 SO_2 NAAQS may be exceeded. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the State's assessment, supporting documentation, and all available data, the EPA agrees with the State's recommendation and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

Table 3. North Carolina's Townships Bounded by the Belews Creek Facility Modeling Domain.

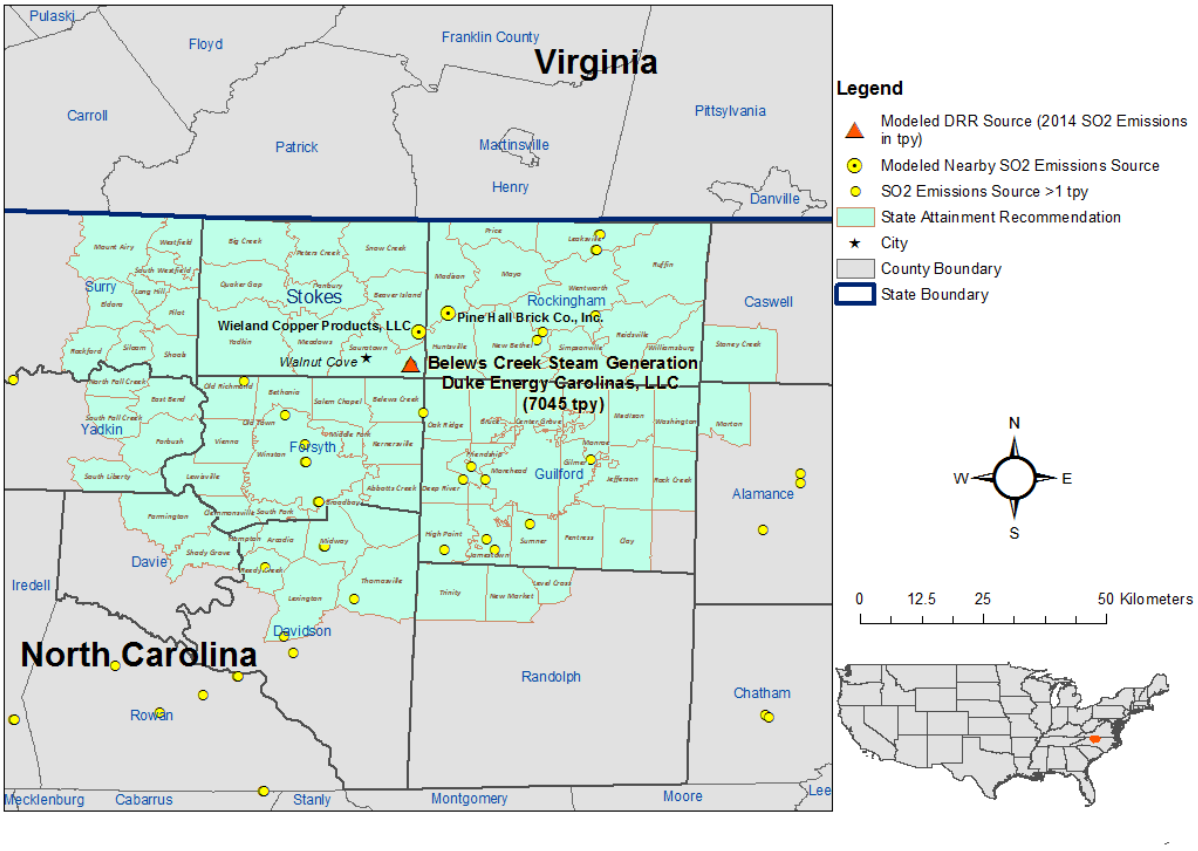
Township	County	North Carolina's Recommended Designation	EPA's Intended Designation
Morton	Alamance (p)	Attainment	Unclassifiable/Attainment
Stoney Creek	Caswell (p)	Attainment	Unclassifiable/Attainment
Abbotts Creek	Davidson (p)	Attainment	Unclassifiable/Attainment
Arcadia		Attainment	Unclassifiable/Attainment
Hampton		Attainment	Unclassifiable/Attainment
Lexington		Attainment	Unclassifiable/Attainment
Midway		Attainment	Unclassifiable/Attainment
Reedy Creek		Attainment	Unclassifiable/Attainment
Thomasville		Attainment	Unclassifiable/Attainment
Farmington	Davie (p)	Attainment	Unclassifiable/Attainment
Shady Grove		Attainment	Unclassifiable/Attainment
Abbotts Creek	Forsyth	Attainment	Unclassifiable/Attainment
Belews Creek		Attainment	Unclassifiable/Attainment
Bethania		Attainment	Unclassifiable/Attainment
Broadbay		Attainment	Unclassifiable/Attainment
Clemmonsville		Attainment	Unclassifiable/Attainment
Kernersville		Attainment	Unclassifiable/Attainment
Lewisville		Attainment	Unclassifiable/Attainment
Middle Fork I		Attainment	Unclassifiable/Attainment
Middle Fork II		Attainment	Unclassifiable/Attainment
Old Richmond		Attainment	Unclassifiable/Attainment
Old Town		Attainment	Unclassifiable/Attainment
Salem Chapel		Attainment	Unclassifiable/Attainment
South Fork		Attainment	Unclassifiable/Attainment
Vienna		Attainment	Unclassifiable/Attainment
Winston		Attainment	Unclassifiable/Attainment
Bruce	Guilford (p)	Attainment	Unclassifiable/Attainment
Center Grove		Attainment	Unclassifiable/Attainment
Clay		Attainment	Unclassifiable/Attainment
Deep River		Attainment	Unclassifiable/Attainment
Fentress		Attainment	Unclassifiable/Attainment
Friendship		Attainment	Unclassifiable/Attainment
Gilmer		Attainment	Unclassifiable/Attainment
High Point		Attainment	Unclassifiable/Attainment
Jamestown		Attainment	Unclassifiable/Attainment
Jefferson		Attainment	Unclassifiable/Attainment
Madison		Attainment	Unclassifiable/Attainment
Monroe		Attainment	Unclassifiable/Attainment
Morehead		Attainment	Unclassifiable/Attainment
Oak Ridge		Attainment	Unclassifiable/Attainment

Township	County	North Carolina's Recommended Designation	EPA's Intended Designation
Rock Creek		Attainment	Unclassifiable/Attainment
Sumner		Attainment	Unclassifiable/Attainment
Washington		Attainment	Unclassifiable/Attainment
Level Cross	Randolph (p)	Attainment	Unclassifiable/Attainment
New Market		Attainment	Unclassifiable/Attainment
Trinity		Attainment	Unclassifiable/Attainment
Huntsville	Rockingham	Attainment	Unclassifiable/Attainment
Leaksville		Attainment	Unclassifiable/Attainment
Madison		Attainment	Unclassifiable/Attainment
Mayo		Attainment	Unclassifiable/Attainment
New Bethel		Attainment	Unclassifiable/Attainment
Price		Attainment	Unclassifiable/Attainment
Reidsville		Attainment	Unclassifiable/Attainment
Ruffin		Attainment	Unclassifiable/Attainment
Simpsonville		Attainment	Unclassifiable/Attainment
Wentworth		Attainment	Unclassifiable/Attainment
Williamsburg		Attainment	Unclassifiable/Attainment
Beaver Island	Stokes	Attainment	Unclassifiable/Attainment
Big Creek		Attainment	Unclassifiable/Attainment
Danbury		Attainment	Unclassifiable/Attainment
Meadows		Attainment	Unclassifiable/Attainment
Peters Creek		Attainment	Unclassifiable/Attainment
Quaker Gap		Attainment	Unclassifiable/Attainment
Sauratown		Attainment	Unclassifiable/Attainment
Snow Creek		Attainment	Unclassifiable/Attainment
Yadkin		Attainment	Unclassifiable/Attainment
Eldora	Surry (p)	Attainment	Unclassifiable/Attainment
Long Hill		Attainment	Unclassifiable/Attainment
Mount Airy		Attainment	Unclassifiable/Attainment
Pilot		Attainment	Unclassifiable/Attainment
Rockford		Attainment	Unclassifiable/Attainment
Shoal		Attainment	Unclassifiable/Attainment
Siloam		Attainment	Unclassifiable/Attainment
South Westfield		Attainment	Unclassifiable/Attainment
Westfield		Attainment	Unclassifiable/Attainment
East Bend	Yadkin (p)	Attainment	Unclassifiable/Attainment
Forbush		Attainment	Unclassifiable/Attainment
North Fall Creek		Attainment	Unclassifiable/Attainment
South Fall Creek		Attainment	Unclassifiable/Attainment
South Liberty		Attainment	Unclassifiable/Attainment

As seen in Figure 1 below, the Belews Creek facility is located in Stokes County, on Belews Lake near the town of Walnut Cove, North Carolina. It is located 7.6 km east from Walnut Cove and 8.5 km east from the Meadow Brook Field airport. Also included in the figure is the State's recommended boundary for the attainment designation. The EPA's intended unclassifiable/attainment designation boundary for the Stokes County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

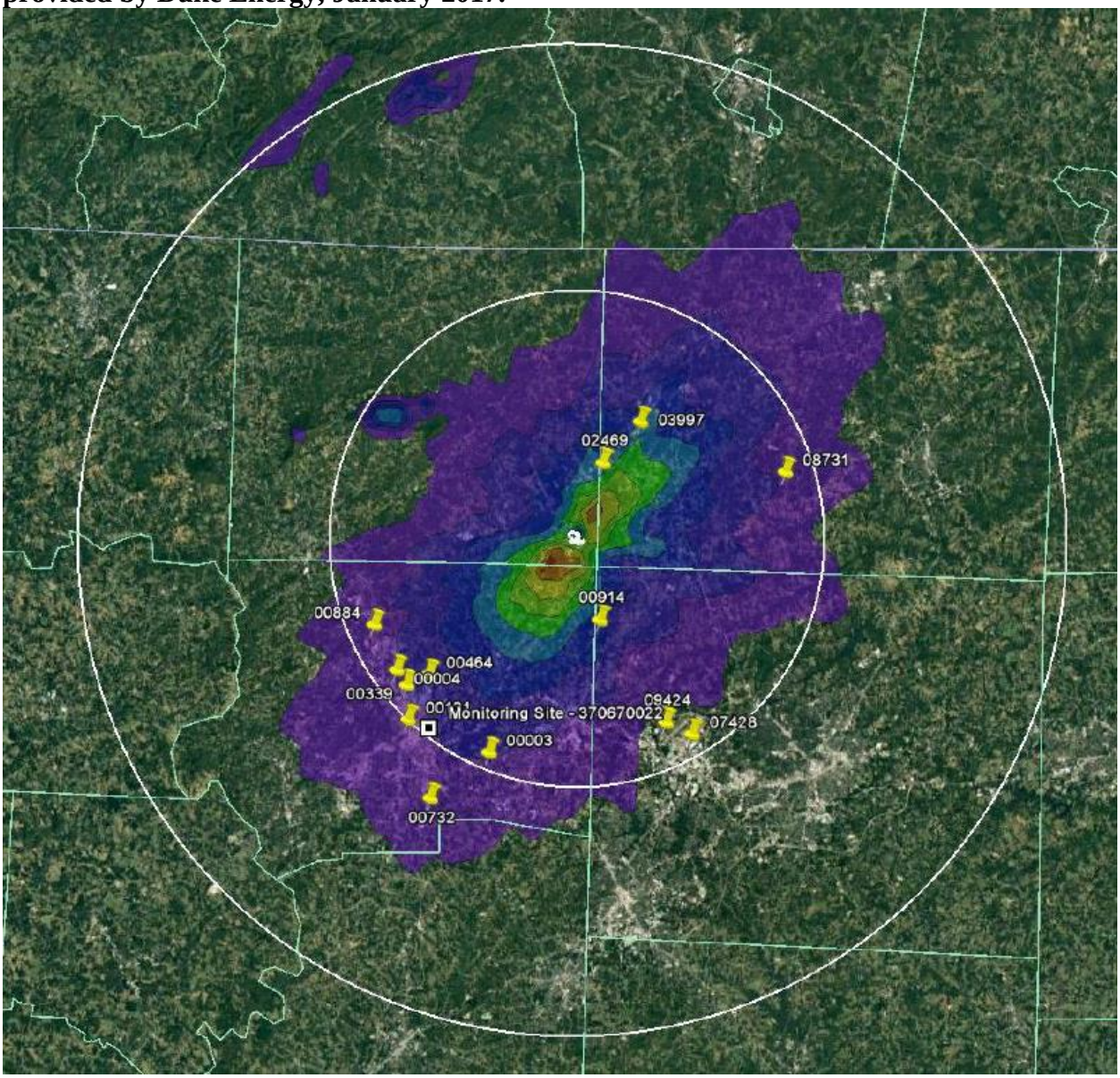
In Figure 2 are other nearby emitters of SO_2.[9] There are 13 sources in the vicinity of the Belews Creed facility that were considered for the modeling within a 50 km radius.
Of these 13 sources, only two where explicitly modeled: The Pine Hall Brick Co, Inc., located 12 km way; and the Wieland Copper Products, LLC, located 6.6 km away.

Figure 1. Map of the Stokes County Area Addressing Duke Energy's Belews Creek Generating Station.



[9] All other SO_2 emitters within 25 km who emitted 1 tpy or more and those between 25 km and 50 km who emitted 50 tpy (based on emissions inventories from the North Carolina's Division of Air Quality, or NCDAQ, and the Forsyth County Office of Environmental Assistance & Protection) are shown in Figure 2.

Figure 2. Map of the Stokes County Area Showing Nearby Sources of the Duke Energy's Belews Creek Generating Station. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered one modeling assessment from the State and no assessments from other parties. The table below indicates when this assessment was received, provides an identifier for the assessment, and identifies any distinguishing features of the modeling assessment.

Table 4. Modeling Assessments for the Stokes County Area

Assessment Submitted by	Date of the Assessment	Identifier Used in this TSD	Distinguishing or Otherwise Key Features
North Carolina	January 13, 2017	Belews Creek Modeling Report	

3.3.2. Modeling Analysis Provided by the State

3.3.2.1. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRM: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The State used AERMOD version 15181, which was the most up-to-date version at the time the modeling was performed, using all regulatory default options. AERMOD version 16216r has since become the regulatory model version. There were no updates from 15181 to 16216r that would significantly affect the concentrations predicted here. A discussion of the State's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

The most current approved version of AERMOD, version 16216r, which was published January 17, 2017 (*see* 82 FR 5203), was not used because North Carolina used the default regulatory setting of the most current version at the time of modeling (15181). Alternative modeling options added to version 16216r of AERMOD were not used. Using the older 15181 version of AERMOD with its default regulatory settings, likely produces the same results as the newer 16216r. For this reason, the EPA believes it is appropriate for the State to use the 15181 version of AERMOD.

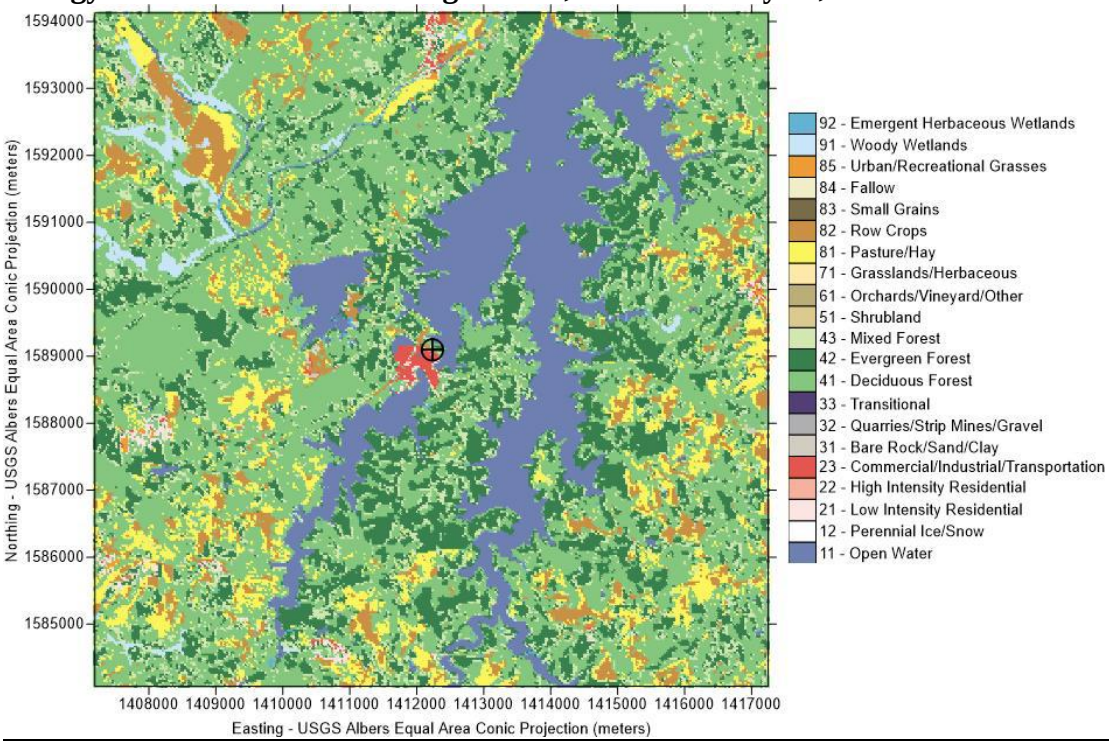
3.3.2.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD

details the procedures used to determine if a source is urban or rural based on land use or population density.

The EPA's recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment within 3 km of the facility. According to the EPA's modeling guidelines, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50 percent of the area within a 3 km radius of the facility is classified as rural. Conversely, if more than 50 percent of the area is urban, urban dispersion coefficients should be used in the modeling analysis. For the purpose of performing the modeling for the area of analysis, the State determined that it was most appropriate to run the model with rural dispersion coefficients or in rural mode and the EPA concurs with this assessment The State analyzed land use using the Auer method for a 3 km radius around the facility. Data from the 2011 National Land Cover Database was used to determine land cover in the area. The results of this analysis indicated that more than 50 percent of surrounding land was Rural. Although complete documentation of the land use analysis was not provided in the modeling report, the methodology used is consistent with one available method in Section 6.3 of the Modeling TAD. The USGS Land Use map for the area around the Belews Creek facility provided in the modeling report (See Figure 3 below) clearly shows that less than 50 percent of land use within a 3 km radius around the facility is classified in urban categories. Therefore, the EPA agrees that the rural option is appropriate.

Figure 3. Plot of land use surrounding Belews Creek. Source: Modeling Report for Duke Energy Belews Creek Generating Station, dated January 13, 2017.



3.3.2.3. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The sources of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Stokes County area, the State included two other emitters of SO_2 within 50 km of Belews Creek. The State determined that this was the appropriate distance to adequately characterize air quality through modeling, to limit the extent of any SO_2 NAAQS exceedances in the area of analysis, and to consider potential SO_2 air quality impacts from other nearby sources. The other emitters of SO_2 included within the modeled area for Belews Creek are Pine Hall Brick Co. and Wieland Copper Products. No other sources beyond 50 km were determined by the State to have the potential to cause concentration gradient impacts in the vicinity of Belews Creek.

In order to determine nearby sources to be considered in the modeling analysis, North Carolina assessed all sources that met two criteria: sources within 25 km of the Belews Creek facility that emitted more than one tpy and sources between 25 km and 50 km of the Belews Creek facility that emitted more than 50 tpy. From this assessment, they identified 13 sources within 50 km of the facility. For sources within the 25 km radius, the State chose to model the closest sources: Pine Hall Brick, Co. (12 km away) and Wieland Copper Products, LLC (6.6 km away). These sources were included in the modeling analysis due to close proximity to Belews Creek. The rest of the sources within 25 km were eliminated due to having a Q/d[10] (annual emission/distance in km) less than 20, specifically all had Q/d's less than 1. Based upon their low levels of emissions and distance from the Belews Creek facility, the EPA agrees that these facilities do not need to be explicitly modeled and any contributions are accounted for using the representative background concentration discussed in Section 3.3.2.8 of this TSD.

[10] Using the "20D" method, if the annual (tpy) emissions (Q) from a candidate source are greater than 20D (20 times the distance in km of the candidate source to Belews Creek) then the source is retained for further consideration for potential inclusion in the modeling analysis. This analysis is sometimes referred to as Q/d (indicating emissions over distance).

Table 5. Assessment of Nearby Source Emissions. Source: Modeling Report for Duke Energy Belews Creek Generating Station, dated January 13, 2017.

Facility ID	Facility Name	UTM E (meters)	UTM N (meters)	Distance (km)	Inventory Year	SO2 (tons)	Q/d
3400732	Ingredion Incorporated - Winston-Salem	569,534	3,988,020	31.4	2014	230.9	7.4
3400131	HANES DYE AND FINISHING CO.	567,231	3,995,875	26.2	2014	54.7	2.1
3400464	Larco Construction	569,274	4,000,434	21.5	2010	8.9	0.4
3403997	R.J. Reynolds Tobacco Company (Whitaker Park)	567,042	3,999,345	23.9	2014	6.6	0.3
3400004	Wieland Copper Products, LLC	586,692	4,021,804	6.6	2015	6.4	1.0
3400884	TIMCO, dba HAECO Americas Airframe Services	595,947	3,994,678	23.9	2014	5.6	0.2
3400914	Pine Hall Brick Co., Inc.	590,456	4,025,980	12.0	2014	4.0	0.3
3400003	Sharpe Bros., a Div. of Vecellio & Grogan, Inc.-Lebanon Rd.	593,278	3,995,814	21.7	2012	3.2	0.1
4100042	Winston Weaver Co., Inc.	566,022	4,000,844	23.6	2011	2.6	0.1
4101176	Salem Energy Systems, L.L.C.	563,720	4,005,372	23.2	2014	2.0	0.1
3400339	Piedmont Landfill and Recycling Center	586,536	4,006,047	9.8	2014	1.7	0.2
7900156	Duke Energy Carolinas, LLC-Rockingham Co Comb. Turb.	605,145	4,021,067	21.4	2014	1.6	0.1
8500028	Wake Forest University	575,418	3,992,656	24.7	2010	0.8	0.03

Two emissions sources were located between 25 km and 50 km of the Belews Creek facility; Ingredion Incorporated and Hanes Dye and Finishing Company. The Ingredion Incorporated facility is located 31 km from Belews Creek and emitted 231 tpy of SO_2 in 2014. The Hanes Dye and Finishing Company facility is located 26 km from Belews Creek and emitted 54 tpy of SO_2 in 2014. An AERMOD modeling assessment was performed by North Carolina for these two sources to determine their concentration gradient near the Belews Creek facility. These two sources were excluded from the final modeling analysis based on their small concentration gradient in the vicinity of Belews Creek. North Carolina's Modeling Report indicates that the concentration gradient in the vicinity of Belews Creek was approximately 1 microgram per cubic meter ($\mu g/m^3$). The EPA agrees that the potential impacts from these two facilities are small and are appropriately accounted for using the representative background concentration discussed in Section 3.3.2.8 of this TSD.

The modeling report mentions one more source within 50 km of Belews Creek, the Miller Coors Brewery LLC Eden Brewery, that emitted 371 tons of SO_2 in 2014. This source is located about 41 km from Belews Creek but was not included in the modeling by the state because the Q/d value is approximately 9, which is less than the 20 threshold, and because the source permanently shut down their coal-fired boilers and removed them from their operating permit in a permit modification dated March 10, 2015.[11] In addition, the EPA found one more source within 50 km, the Owens-Brockway Glass Container Plt 6, that emitted 261 tons of SO_2 in 2014 but was not included or mentioned in the modeling report of the Belews Creek facility. The EPA

[11] In response to the EPA comments, North Carolina provided an "Air Permit Review" for their permit action dated March 10, 2015, which shows that the coal fired boilers have been removed from the facilities operating permit. Additionally, North Carolina states that shutdown of the units was verified in a 2017 facility inspection report.

believes that it is appropriate to not have included this source in the modeling since it is located approximately 40 km away from the Belews Creek (if the Q/d analysis was applied, for reference, it would be around 6.5, less than 20). Any small contributions from this distant facility are adequately accounted for using the representative background concentration discussed in Section 3.3.2.8 of this TSD.

Note that the impacts of emissions from sources that were not used in the modeling analysis were accounted for in the background concentrations discussed in Section 3.3.2.8 of this TSD.

The grid receptor spacing for the area of analysis chosen by the State is provided below. The spacing for the receptors was adjusted based on the distance from the facility, creating nested grids within a 50 km limit. In addition, fence line receptors were placed around the perimeter of the Belews Creek facility.

- Receptors along the fence line every 50 meters (m)
- Receptors every 100 m from fence line to 3 km
- Receptors every 250 m from 3 km to 5 km
- Receptors every 500 m from 5 km to 10 km
- Receptors every 1000 m from 10 km to 20 km
- Receptors every 2000 m from 20 km to 50 km

The receptor network contained 6,961 receptors, and the network covered Stokes, Forsyth, and Rockingham counties, as well as portions of Surry, Yadkin, Davie, Davidson, Randolph, Guilford, Alamance, and Caswell counties in North Carolina and portions of Patrick, Martinsville, and Pittsylvania counties in Virginia.

Figures 4 and 5, included in the State's recommendation, show the State's chosen area of analysis surrounding the Belews Creek facility, as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, the State placed receptors in locations that would be considered ambient air relative to each modeled facility, including other facilities' property with the exceptions of locations described in Section 4.2 of the Modeling TAD as not being feasible locations for placing a monitor. Specifically, no receptors were placed on the Belews Lake. The State also did not place receptors in other locations that it considered to not be ambient air relative to each modeled facility and so excluded receptors within the Belews Creek fence line. The North Carolina Modeling Report provides a figure showing the fence line boundary. However, no information was provided to document that public access to the facility property is prevented by a fence or some other physical barrier. Receptor elevation was included using data from the National Elevation Dataset (NED), and utilizing the AERMP terrain processor of AERMOD.

Figure 4. Area of Analysis for the Stokes County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.

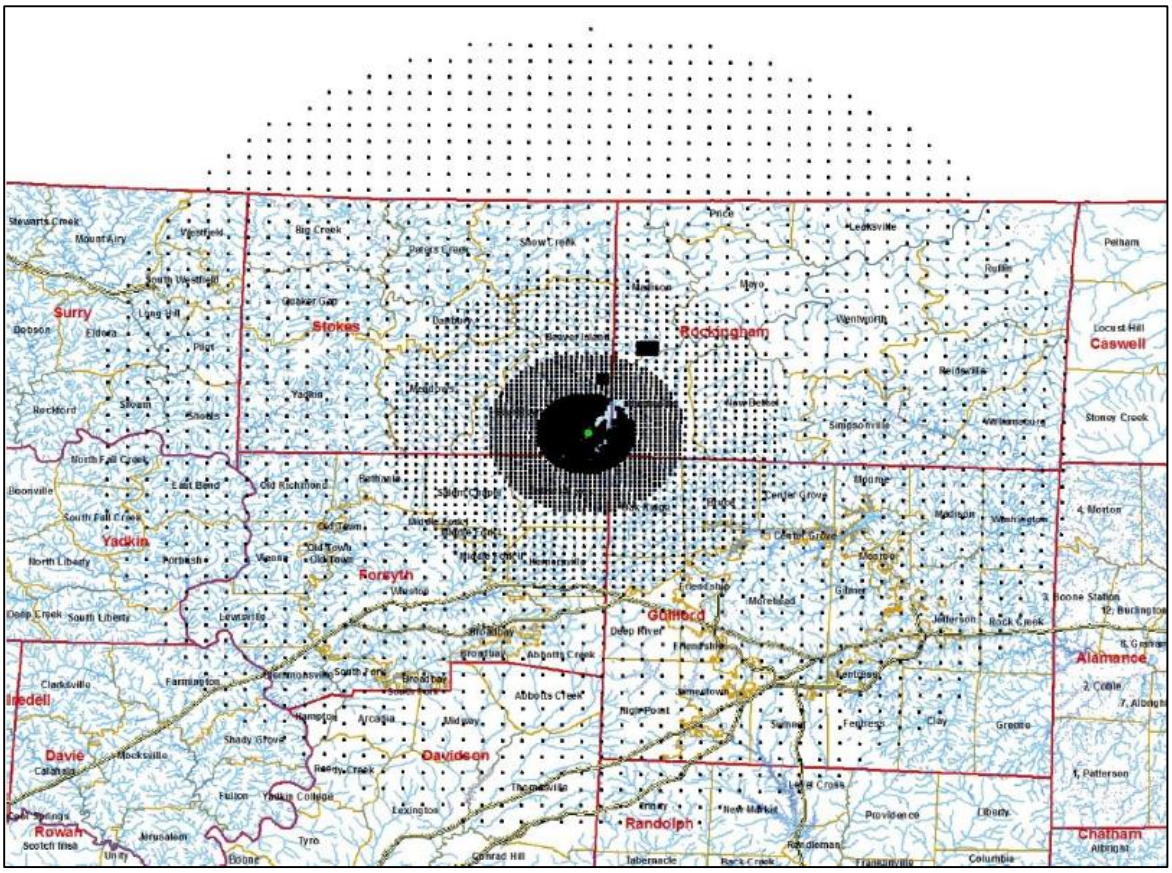
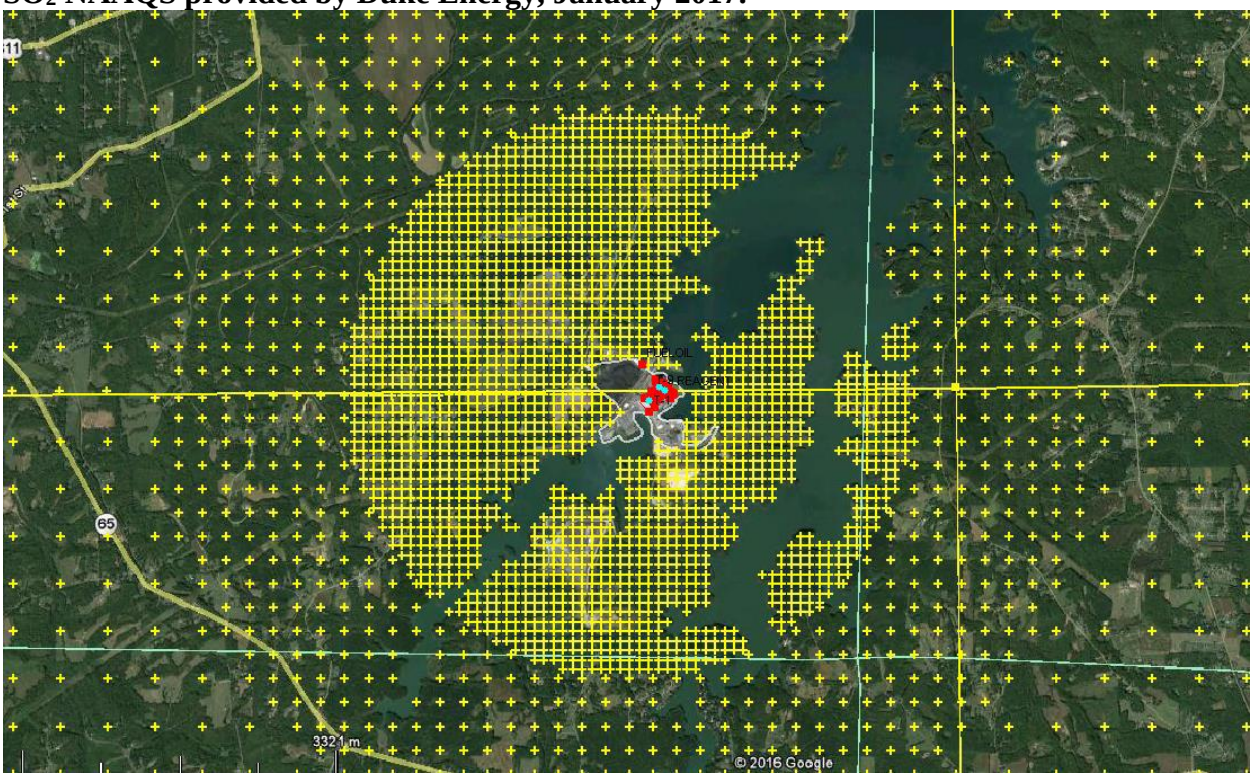


Figure 5. Receptor Grid for the Stokes County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



Based on the information provided in North Carolina's recommendation, the EPA agrees with excluding the receptors over Belews Lake as not feasible to place a monitor. Not enough information was provided by the state for the EPA to determine whether receptors were properly excluded from the Belew's Creek facility property on the basis of it not representing ambient air for the purposes of SO_2 designations modeling. However, the EPA agrees that the receptor grid selected by the State adequately captures maximum concentrations due to the fact that the maximum modeled concentration occurs approximately 2.7 km southwest of the facility (as shown in Figure 7a), and approximately 500 m beyond the facility fence line or property boundary. Therefore, the EPA believes that North Carolina's receptor grid is appropriate for the characterization of the area, considering the impact of SO_2 from the modeled facilities.

3.3.2.4. Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions or following good engineering practices (GEP) policy with allowable emissions.

As described in section 3.3.1, North Carolina included two additional sources in their modeling for the Belews Creek facility area. According to the Belews Creek modeling report, all other SO_2 emitters within 25 km, with emissions of 1 tpy and sources located between 25 km and 50 km with emissions of 50 tpy or more were considered for the modeling. After the screening process described in Section 3.3.2.3, the sources incorporated in the modeling of the Belews Creek

facility included two facilities within 25 km; the Pine Hall Brick Co. and Wieland Copper Products facilities. No other sources within 50 km were included in the modeling assessment.

The Belews Creek facility includes the following sources of SO_2 emissions: two coal fired utility boilers, two oil fired auxiliary boilers and eight emergency engines. The four boilers are included in the modeling. The Utility Boilers, identified as ES-1 and ES-2, vent out separate stacks equipped with CEMS. The CEMS monitor and record hourly SO_2, flow and stack gas temperature data.

The Auxiliary Boilers, identified as ES-3 and ES-4, are operated during startup of the Utility Boilers and to supply building heat when the temperature is cold and the Utility Boilers are not available. During the period from 2013 to 2015, the maximum annual hours of operation were less than 160 hours per year per boiler. These sources were included in the modeling analysis using their annualized hourly SO_2 emission rate and stack exit temperature and velocity at maximum load conditions.

Belews Creek operates eight emergency engines. These engines operate during emergencies and for readiness/maintenance checks. In addition, these engines are limited to operating no more than 100 hours per year for readiness/maintenance checks and combust ultra-low sulfur fuel (USLF) oil. According to the Modeling TAD, Section 5.4, the EPA states that it is most appropriate to include sources of emissions which operate continuously or frequent enough to contribute to the annual distribution of the daily maximum concentrations. The emergency engines do operate enough but because they burn ultra-low sulfur fuel oil, they do not likely have large enough emissions of SO_2 to contribute to the annual distribution of daily maximum 1-hour SO_2 concentrations. Information provided in North Carolina's Modeling report shows that each of these emergency engines have very low SO_2 emissions (less than 0.02 pounds per hour (lb/hr)). Consequently, these engines were considered intermittent sources and excluded from the dispersion modeling analysis.

The State characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the State used actual stack heights in conjunction with actual emissions. The State adequately characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRM (version 04274) was used to assist in addressing building downwash.

The EPA agrees that North Carolina has appropriately characterized the area surrounding the Belews Creek facility. Their criteria for selecting nearby sources resulted in the inclusion of two additional sources, the Pine Hall Brick Co. and Wieland Copper Products facilities, in the modeling analysis. The State has appropriately used the actual emissions and stack heights for both facilities and accounted for the building downwash using BPIPPRM for AERMOD.

3.3.2.5. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it

would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as potential to emit [PTE] or allowable) emissions rate that is federally-enforceable and effective.

The EPA believes that CEMS data provide acceptable historical emissions information, when they are available. These data are available for many electric generating units. In the absence of CEMS data, the EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, the EPA recommends using detailed throughput, operating schedules, and emissions information from the impacted source (s).

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. For example, where a facility has recently adopted a new federally-enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or state implementation plan (SIP) planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the State included Belews Creek and two other emitters of SO_2 within 50 km in the area of analysis. For this area of analysis, the State has opted to model actual emissions from all facilities included in the modeling. The facilities in the State's modeling analysis and their associated actual emission rates are summarized below.

For Belews Creek, the State provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 6. A description of how the State obtained hourly emission rates is given below this table.

Table 6. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the Area of Analysis for the Stokes County Area

	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Belews Creek	5,080	7,045	6,794
Pine Hall Brick Co	3.9	3.9	3.9
Wieland Copper Products	6.1	6.1	6.1
Total Emissions from All Facilities in the Area of Analysis Modeled Based on Actual Emissions	5,090	7,055	6,804

For the Belews Creek facility, the actual hourly emissions data for the coal-fired Utility Boilers (ES-1 & ES-2) were obtained from the CEMS. For the Auxiliary Boilers (Units ES-3 and ES-4), which are only operated during the startup of the Utility Boilers and to supply building heat when the temperature is cold and the utility boilers are not available, hourly emissions were determined from actual annual emission rates rather than the maximum actual hourly values (e.g., annual average actual hourly emission rate).

According to the modeling report, the maximum hourly SO_2 emission rate during 2015 for the Auxiliary boilers was 0.57 lbs/hr based on ULSF being used at the time. During 2013 to 2015 the maximum annual hours of operation were less than 160 hours per year per boiler. Prior to 2015 the fuel used had a higher Sulfur content so the maximum hourly emissions rate for SO_2 was 176 lbs/hr. The annual average hourly emissions rate was conservatively (highly) estimated by multiplying the maximum hourly emissions rate of 176 lbs/hr by an assumed maximum operation of 500 hours and dividing that by the 8,760 hours in a year. Since the 500 hours of operation is well above the highest hours of operation during 2013-2015 time period and the 176 lbs/hr maximum emission rate is much higher than the current emission rate using ULSF, this a conservative approach for calculating the hourly emission rate of these two auxiliary boilers that likely overestimates impacts. The EPA agrees that this an appropriate method to model the maximum impact of the Auxiliary Boilers at the Belews Creek facility to support a determination that the area is meeting the NAAQS.

The emissions for Pine Hall Brick Co. and Wieland Copper Products were determined by the State using hourly SO_2 emission rates that were based on the actual annual emissions for the 2013-2015 time period and assuming continuous hours of operation.

The EPA concurs with this component of the modeling analysis including the use of actual hourly emissions for the Belews Creek utility boilers based on CEMS and worst case actuals for the auxiliary boilers. The two nearby sources were modeled with maximum annual emissions over 2013-2015.

3.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

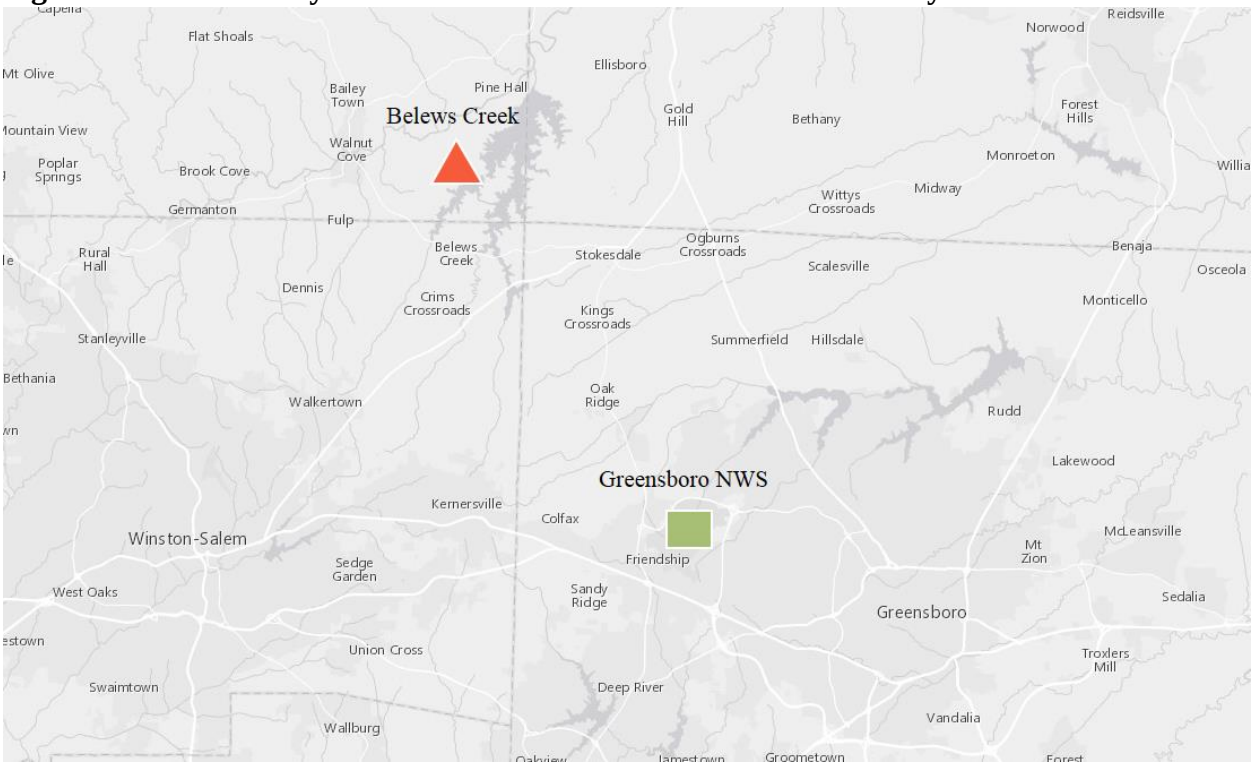
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

For the Stokes County area, the State selected the surface meteorology data for the selected period of 2013 to 2015 from the NWS station at the Piedmont Triad International Airport (KGSO) in Greensborough, North Carolina. The station is located approximately 23 km southeast 36.1 N, 79.94 W of Belews Creek facility. Upper air observations were obtained from the same NWS station. The State also considered use of surface meteorology from the Winston-Salem Airport (KINT) located approximately 21 km SW of the Belews Creek facility. North Carolina determined that the Greensborough Airport station had slightly better data availability, was located with the upper-air station, and had more representative surface roughness when compared to the Belews Creek surrounding land use.

The State used AERSURFACE version 13016 using data from KGSO NWS station to estimate the surface characteristics (albedo, Bowen ratio, and surface roughness [z_o]) of the area of analysis. Albedo is the fraction of solar energy reflected from the earth back into space, the Bowen ratio is the method generally used to calculate heat lost or heat gained in a substance, and the surface roughness is sometimes referred to as “zo” The state estimated surface roughness values for 12 spatial sectors out to 1 km at a seasonal temporal resolution for average conditions.

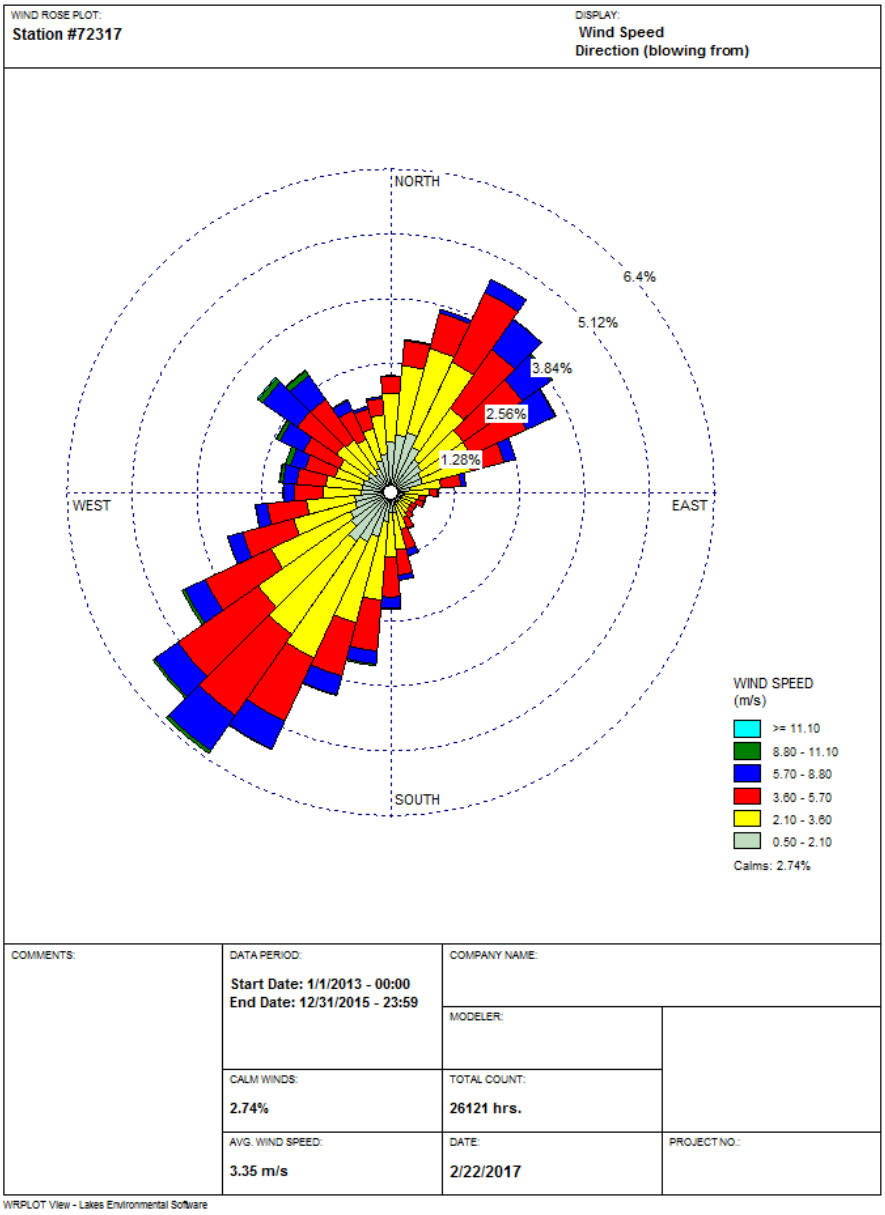
In the figure below, generated by the EPA, the location of this NWS station is shown relative to the area of analysis.

Figure 6. Area of Analysis and the NWS station in the Stokes County Area



The EPA generated wind rose plots with "WRPLOTS View" utility program using state submitted pre-processed AERMET surface meteorology data for the Greensboro, North Carolina NWS site. In Figure 7, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. Analysis of the NWS data indicate winds blow predominantly from the Southwest with an average wind speed of 3.35 meters per second (m/s).

Figure 7. Stokes County Cumulative Annual Wind Rose for Years 2013 – 2015



Meteorological data from the above surface and upper air NWS stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The State followed the methodology and settings presented in the EPA's AERMOD Implementation Guide (AIG) in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1-minute duration was provided from KGSO NWS station, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the State set a minimum threshold of 0.5 m/s in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute wind data.

The EPA agrees with the meteorological and surface data that the State used for the modeling of the Stokes County area in regards to the Belews Creek facility. The data used properly represents meteorological conditions in the area and allows for the proper simulation of SO_2 emissions from the Belews Creek facility and nearby sources. The State used appropriate site specific data from a nearby NWS station.

3.3.2.7. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as gently rolling and it is bounded on two sides by the Belews Lake. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the United States Geological Survey (USGS) National Elevation Database (NED).

The State's final modeling report does not offer any information on the topography or geography of the area, but based upon an evaluation of USGS topography maps of the area, the EPA believes that the area has no complex terrain. The EPA agrees with the State's use of the USGS NED database and AERMAP terrain processor (version 11130) for AERMOD to account for the slight changes in elevation of the area to obtain a more accurate modeling result.

3.3.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, the State elected to use a "tier 1" approach. Data was obtained from the EPA AQS for the 2013-2015 time period from the Hattie Ave. monitor in Forsyth County (AQS Site: 37-067-0022), approximately 23 km southwest of the Belews Creek facility. The single value of the background concentration for this area of analysis was determined by the State to be 23 μg/m^3, equivalent to 8.8 ppb when expressed in 2 significant figures,[12] and that value was incorporated into the final AERMOD results.

The EPA agrees that North Carolina has appropriately chosen the background concentration in accordance with the Modeling TAD. The State has chosen a monitor that is near the modeled source and is adequate for modeling purposes. We believe that the chosen background monitored concentration is representative of the area and accounts for impacts from nearby sources not explicitly included in the modeling. The emissions from point sources near Stokes County that were not explicitly modeled are lower than the emissions from point sources located near the Hattie Ave. monitor. Additionally, the Hattie Ave. monitor is located in an urbanized area so is impacted by a larger amount of nonpoint SO2 emissions sources.

3.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Stokes County area of analysis are summarized below in Table 7

[12] The SO_2 NAAQS level is expressed in ppb but AERMOD gives results in μg/m^3. The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1 ppb = approximately 2.619 μg/m^3.

Table 7. Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Stokes County Area

Input Parameter	Value
AERMOD Version	15181 (Default Setting)
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	10
Modeled Structures	46
Modeled Fencelines	1
Total receptors	6,961
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Piedmont Triad Int. Airport Greensboro, NC
NWS Station Upper Air Meteorology	Piedmont Triad Int. Airport Greensboro, NC
NWS Station for Calculating Surface Characteristics	Piedmont Triad Int. Airport Greensboro, NC
Methodology for Calculating Background SO_2 Concentration	Tier 1 approach using AQS site: 37-067-0022 for 2013 – 2015
Calculated Background SO_2 Concentration	23 $\mu g/m^3$

The results presented below in Table 8 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

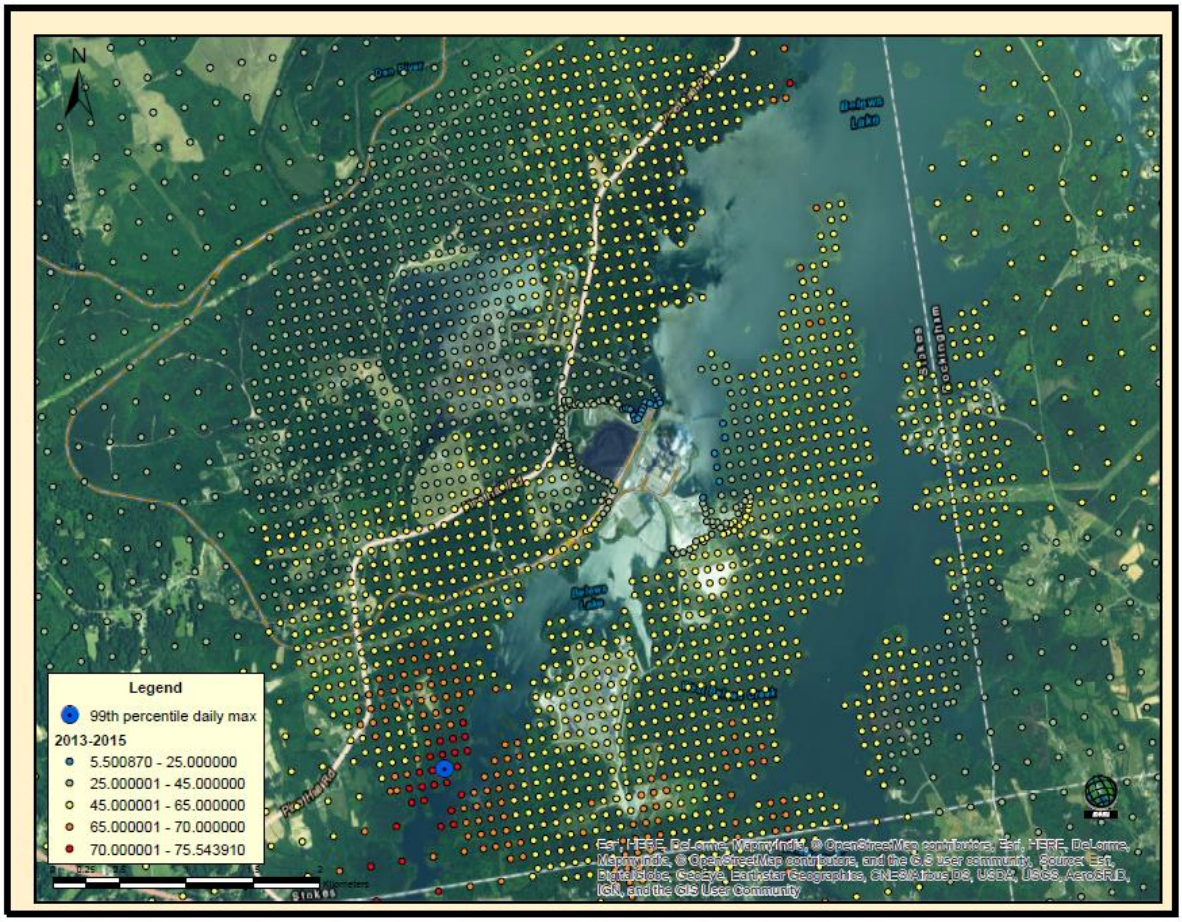
Table 8. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Stokes County Area

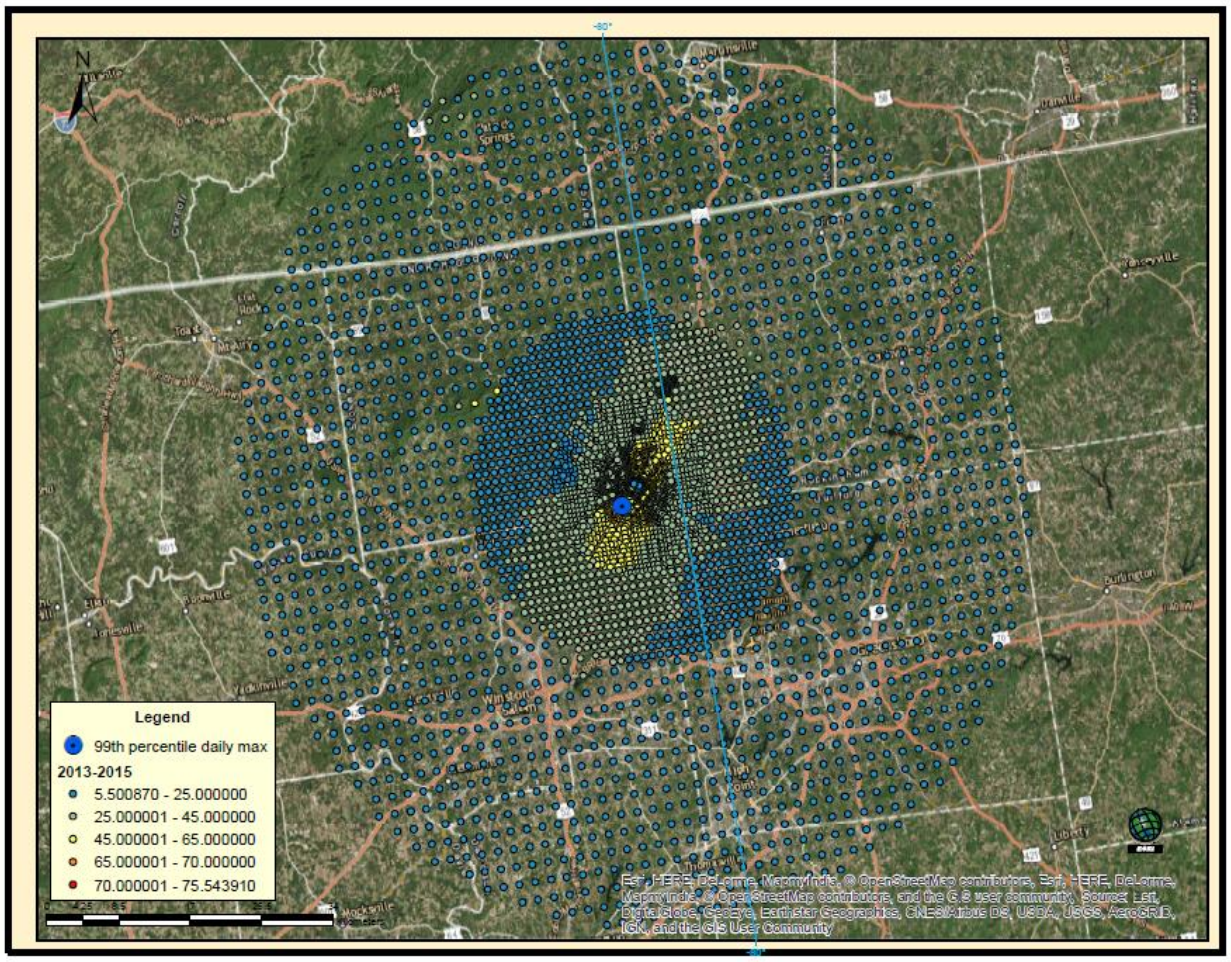
		Receptor Location [UTM zone 17]		**99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)**	
Averaging Period	**Data Period**	**UTM Easting**	**UTM Northing**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	2013-2015	582407	4013755.5	98.5	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

The State's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 98.5 μg/m^3, equivalent to 37.6 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities. Figures 8a and 8b below were generated by the EPA using the model output files provided by North Carolina. Figure 8a shows that the maximum predicted value occurred approximately 2.7 km southwest of the Belews Creek facility and approximately 1.6 km outside the facility's fence line.

Figures 8a and 8b: Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Stokes County Area





The modeling submitted by the State does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration.

3.3.2.10. The EPA's Assessment of the Modeling Information Provided by the State

The EPA agrees with the modeling information provided by the State for the analysis of the Stokes County Area affected by the Belews Creek facility and other nearby sources. After establishing criteria for inclusion, the State modeled three sources including the Belews Creek facility, the Pine Hall Brick Co., Inc. facility, and the Weiland Copper Products, LLC facility. All sources that were included in the modeling were modeled with actual emissions and actual stack heights.

The State also chose an appropriate modeling domain that shows the maximum impact from the facility in the Stokes County area. Not enough information was provided by the state for the EPA to determine whether receptors were properly excluded from the Belew's Creek facility property on the basis of it not representing ambient air for the purposes of SO_2 designations modeling. However, the EPA agrees that the receptor grid selected by the State adequately captures maximum concentrations due to the fact that the maximum modeled concentration occurs approximately 2.7 km southwest of the facility (as shown in Figure 8), which is well beyond the facility fence line or property boundary. Terrain elevations were sufficiently accounted for by AERMAP. In regards to the background concentrations, the State did not choose a monitor within the same county, but, due to the limited availability, the EPA agrees with the chosen monitor location. The EPA also agrees that the surface and upper air meteorological data chosen for this analysis are sufficient for a valid modeling analysis.

The State used AERMOD version 15181 with the default regulatory setting, the most current version at the time of modeling, which does not use the alternative modeling options added to version 16216r of AERMOD. Overall, the EPA agrees that this modeling analysis was mostly performed in a manner consistent with the SO_2 TAD and should be sufficient for predicting SO_2 concentrations in the Stokes County area.

3.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Stokes County Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

3.5. Jurisdictional Boundaries in the Stokes County Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for Stokes County. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

The Belews Creek facility is located in the southeast corner of Stokes County, which is located near the north edge of the state of North Carolina. Stokes County is bounded by Surry County to the west, Rockingham County to the east, and Winston-Salem County to the south. The Stokes county is also bounded to the north by the Virginia state border, which is approximately 30 km from the Belews Creek facility. In its January 2017 recommendation letter, the State recommended attainment for the area surrounding the Belews Creek facility, specifically the townships bounded by the modeling domain, which include those identified in Table 3 in Section 3.3.1 of this document, based in part on an assessment and characterization of air quality impacts from the facilities previously discussed. This modeling domain included Patrick and Martinsville Counties in Virginia, however, no SO_2 emitting sources were considered in the states assessment

and therefore no sources were included in the modeling analysis. The EPA will review all the information available to determine the correct boundaries for the designation. More detail regarding the intended designation for the Stokes County area is provided in in Section 3.8.

3.6. Other Information Relevant to the Designations for the Stokes County Area

No other relevant information is available for the Stokes County area.

3.7. The EPA's Assessment of the Available Information for the Stokes County Area

After evaluating the data from the modeling report for the Belews Creek facility and all other available information, the EPA intends to designate the entire Stokes County area as unclassifiable/attainment for the 2010 SO_2 NAAQS. The State's modeling results indicated that the maximum impact from the Belews Creek facility, including nearby sources and background concentrations, did not violate the 2010 SO_2 NAAQS. The State modeled the Belews Creek facility together with two nearby sources and background concentration data from the Forsyth County monitor, and obtained a total maximum 1-hour average of 98.5 $\mu g/m^3$ (37.6 ppb), which demonstrates compliance with the 196.4 $\mu g/m^3$ (75 ppb) 2010 SO_2 NAAQS. The EPA notes there are no 2010 SO_2 nonattainment areas near Stokes County, North Carolina, or nearby Virginia and no expected nonattainment areas for this third round of designations. Furthermore, there are no nearby Round 4 areas being characterized by December 31, 2020 based on a newly deployed SO_2 monitor. Therefore, based on the available information including monitoring and modeling, the EPA believes the Stokes County area is not expected to contribute to ambient air quality in a nearby area that does not meet the NAAQS.

North Carolina assessed all nearby sources within 25 km of the Belews Creek facility that emitted more than 1 tpy and sources between 25 km and 50 km of the Belews Creek facility that emitted more than 50 tpy. From this assessment, they identified 13 sources within 50 km of the facility. For sources within the 25 km radius, the State chose to model the closest source: Pine Hall Brick, Co. (12 km away) and Wieland Copper Products, LLC (6.6 km away). These sources were included in the modeling analysis due to close proximity to Belews Creek. The rest of the sources within 25 km were eliminated due to having a Q/D[13] (annual emission/distance in km) less than 20, specifically all had Q/D's less than 1. Based upon their low levels of emissions and distance from the Belews Creek facility, the EPA agrees that these facilities do not need to be explicitly modeled and any contributions are accounted for using the representative background concentration discussed in Section 3.3.2.8 of this TSD.

[13] Using the "20D" method, if the annual (tpy) emissions (Q) from a candidate source are greater than 20D (20 times the distance in km of the candidate source to Belews Creek) then the source is retained for further consideration for potential inclusion in the modeling analysis. This analysis is sometimes referred to as Q/d (indicating emissions over distance).

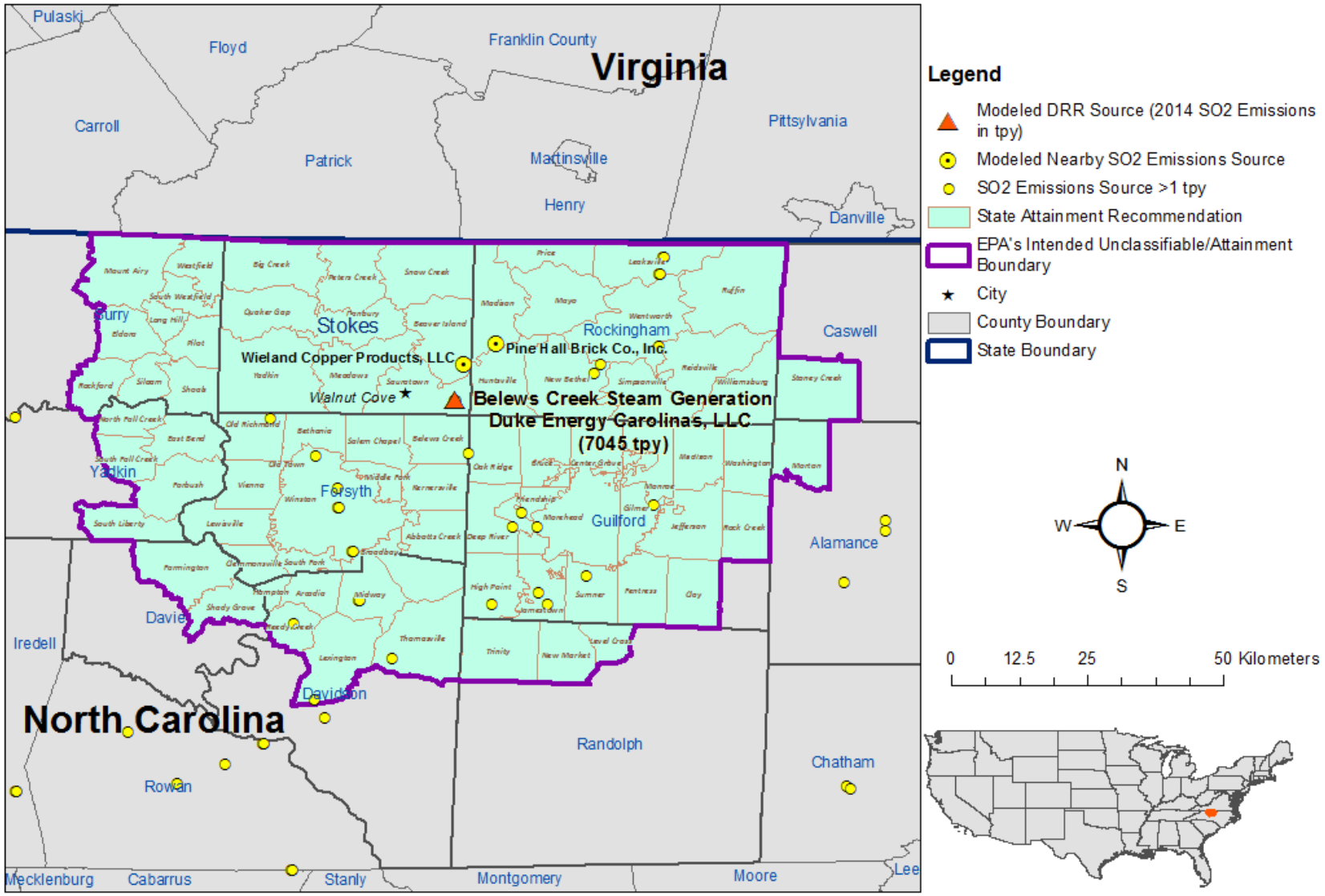
In addition to the modeling results for the Stokes County area, there are two nearby monitors, located approximately 24 and 17 km respectively from the Belews Creek with design values below the 2010 SO_2 NAAQS (9 ppb and 14.4 ppb) respectively. These monitors were not sited to characterize the maximum 1-hr SO_2 concentrations so North Carolina chose to provide an air quality modeling analysis to characterize the maximum 1-hr SO_2 concentrations in the area North Carolina recommended the entire Stokes County area, bounded by all townships within the modeling domain, be designated as attainment based in part on an assessment and characterization of air quality impacts from these facilities. After careful evaluations, the EPA agrees with the State's recommended boundary and intends to designate the entire Stokes County area based on townships as unclassifiable/attainment. This modeling domain included Patrick and Martinsville Counties in Virginia however, no SO_2 emitting sources were identified in these counties that met North Carolina's nearby source screening criteria discussed in Section 3.3.2.3 and therefore no sources were included in the modeling analysis. The EPA believes that emissions from sources in North Carolina will not impact those counties in Virginia from meeting the 2010 SO_2 NAAQS, and do not contribute to ambient air quality in a nearby area that does not meet the NAAQS. Based on review of available information, the EPA agrees with the State's recommendation and intend to designate the Stokes County modeling domain, based on townships unclassifiable/attainment for the 2010 SO_2 NAAQS. Based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined that the area: (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS

The EPA believes that our intended unclassifiable/attainment area, bounded by the modeling domain and including the townships in the table below, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area. For other county designations please refer to the different sections of this document. For the Stokes County area, no other sources remain to be designated by December 31, 2020.

3.8. Summary of Our Intended Designation for the Stokes County Area

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the Stokes County area as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of all townships captured within the Belews Creek modeling domain listed in Table 3 in Section 3.3.1. Figure 9 shows the boundary of this intended designated area. At this time, our intended designations for the State only apply to this area and the other areas presented in this technical support document. The EPA intends in a separate action to evaluate and designate all remaining undesignated areas in North Carolina by December 31, 2020.

Figure 9. Boundary of the Intended Stokes County Unclassifiable/Attainment Area



4. Technical Analysis for the Catawba County Area

4.1. Introduction

The EPA must designate the Catawba County area by December 31, 2017, because the area has not been previously designated and North Carolina has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting the EPA specifications referenced in the EPA's SO_2 DRR for any sources of SO_2 emissions in the state.

4.2. Air Quality Modeling Analysis for the Catawba County Area Addressing Duke Energy's Marshall Steam Station

4.2.1. Introduction

This section 4.2 presents all the available air quality modeling information for a portion of Catawba County that includes the Duke Energy's Marshal Steam Station, also referred to as the Duke-Marshall (This portion of Catawba County will often be referred to as "the Catawba County area" within this section 4.2). This area contains the following SO_2 source, principally the sources around which North Carolina is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tpy:

- The Duke-Marshall facility emitted 2,000 tons or more annually. Specifically, Duke-Marshall emitted 5,917 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and North Carolina has chosen to characterize it via modeling.

- Duke Energy's Allen Steam Station (Duke-Allen) facility did not emit 2,000 tons or more annually. Specifically, Duke-Allen emitted 1,718 tons of SO_2 in 2014. North Carolina decided to include it in the DRR source list and elected to characterize it via air quality modeling. More information on the Duke-Allen modeling report is provided in in Section 6.0.

Because we have available results of air quality modeling in which these sources are modeled together, the area around this group of sources is being addressed in this section with consideration given to the impacts of all these sources.

In its submission, North Carolina recommended that the area surrounding the Duke-Marshall facility, specifically the townships bounded by the modeling domain, identified in Table 10 below, be designated as attainment based on a modeling assessment and characterization of air quality impacts from these facilities and other nearby sources that may have a potential impact in the area where the 2010 SO_2 NAAQS may be exceeded. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions from both facilities. After review of the State's assessment, supporting documentation, and all available data, the EPA believes that the provided air quality impact modeling is

acceptable to characterize the area and agrees with the State's recommendation for the boundary of the and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

Table 9. North Carolina's Townships Bounded by the Duke-Marshall Facility Modeling Domain.

Township	County	North Carolina's Recommended Designation	The EPA's Intended Designation
Ellendale	Alexander	Attainment	Unclassifiable/Attainment
Gwaltneys		Attainment	Unclassifiable/Attainment
Little River		Attainment	Unclassifiable/Attainment
Millers		Attainment	Unclassifiable/Attainment
Sharpes		Attainment	Unclassifiable/Attainment
Sugar Loaf		Attainment	Unclassifiable/Attainment
Taylorsville		Attainment	Unclassifiable/Attainment
Wittenburg		Attainment	Unclassifiable/Attainment
Icard	Burke (p)	Attainment	Unclassifiable/Attainment
Lovelady		Attainment	Unclassifiable/Attainment
Lower Fork		Attainment	Unclassifiable/Attainment
Harrisburg	Cabarrus	Attainment	Unclassifiable/Attainment
Poplar Tent		Attainment	Unclassifiable/Attainment
Odell		Attainment	Unclassifiable/Attainment
Kannapolis		Attainment	Unclassifiable/Attainment
New Gilead		Attainment	Unclassifiable/Attainment
Rimertown		Attainment	Unclassifiable/Attainment
Gold Hill		Attainment	Unclassifiable/Attainment
Mount Pleasant		Attainment	Unclassifiable/Attainment
Georgeville		Attainment	Unclassifiable/Attainment
Midland		Attainment	Unclassifiable/Attainment
Central Cabarrus		Attainment	Unclassifiable/Attainment
Concord		Attainment	Unclassifiable/Attainment
Hudson	Caldwell (p)	Attainment	Unclassifiable/Attainment
Kings Creek		Attainment	Unclassifiable/Attainment
Lenoir		Attainment	Unclassifiable/Attainment
Little River		Attainment	Unclassifiable/Attainment
Lovelady		Attainment	Unclassifiable/Attainment
Lower Creek		Attainment	Unclassifiable/Attainment
North Catawba		Attainment	Unclassifiable/Attainment
Yadkin Valley		Attainment	Unclassifiable/Attainment
Bandy's	Catawba	Attainment	Unclassifiable/Attainment
Caldwell		Attainment	Unclassifiable/Attainment
Catawba		Attainment	Unclassifiable/Attainment
Clines		Attainment	Unclassifiable/Attainment

Township	County	North Carolina's Recommended Designation	The EPA's Intended Designation
Hickory		Attainment	Unclassifiable/Attainment
Jacobs Fork		Attainment	Unclassifiable/Attainment
Mountain Creek		Attainment	Unclassifiable/Attainment
Newton		Attainment	Unclassifiable/Attainment
Cleveland	Cleveland	Attainment	Unclassifiable/Attainment
Boone	Davidson (p)	Attainment	Unclassifiable/Attainment
Tyro		Attainment	Unclassifiable/Attainment
Yadkin College		Attainment	Unclassifiable/Attainment
Calahaln	Davie	Attainment	Unclassifiable/Attainment
Clarksville		Attainment	Unclassifiable/Attainment
Farmington		Attainment	Unclassifiable/Attainment
Fulton		Attainment	Unclassifiable/Attainment
Jerusalem		Attainment	Unclassifiable/Attainment
Mocksville		Attainment	Unclassifiable/Attainment
Shady Grove		Attainment	Unclassifiable/Attainment
Clemmonsville	Forsyth (p)	Attainment	Unclassifiable/Attainment
Lewisville		Attainment	Unclassifiable/Attainment
Cherryville	Gaston	Attainment	Unclassifiable/Attainment
Crowders Mountain		Attainment	Unclassifiable/Attainment
Dallas		Attainment	Unclassifiable/Attainment
Gastonia		Attainment	Unclassifiable/Attainment
Riverbend		Attainment	Unclassifiable/Attainment
South Point		Attainment	Unclassifiable/Attainment
Barringer	Iredell	Attainment	Unclassifiable/Attainment
Bethany		Attainment	Unclassifiable/Attainment
Chambersburg		Attainment	Unclassifiable/Attainment
Coddle Creek		Attainment	Unclassifiable/Attainment
Concord		Attainment	Unclassifiable/Attainment
Cool Springs		Attainment	Unclassifiable/Attainment
Davidson		Attainment	Unclassifiable/Attainment
Eagle Mills		Attainment	Unclassifiable/Attainment
Fallstown		Attainment	Unclassifiable/Attainment
New Hope		Attainment	Unclassifiable/Attainment
Olin		Attainment	Unclassifiable/Attainment
Sharpesburg		Attainment	Unclassifiable/Attainment
Shiloh		Attainment	Unclassifiable/Attainment
Statesville		Attainment	Unclassifiable/Attainment
Turnerburg		Attainment	Unclassifiable/Attainment
Union Grove		Attainment	Unclassifiable/Attainment
Catawba Springs	Lincoln	Attainment	Unclassifiable/Attainment
Howards Creek		Attainment	Unclassifiable/Attainment
Ironton		Attainment	Unclassifiable/Attainment

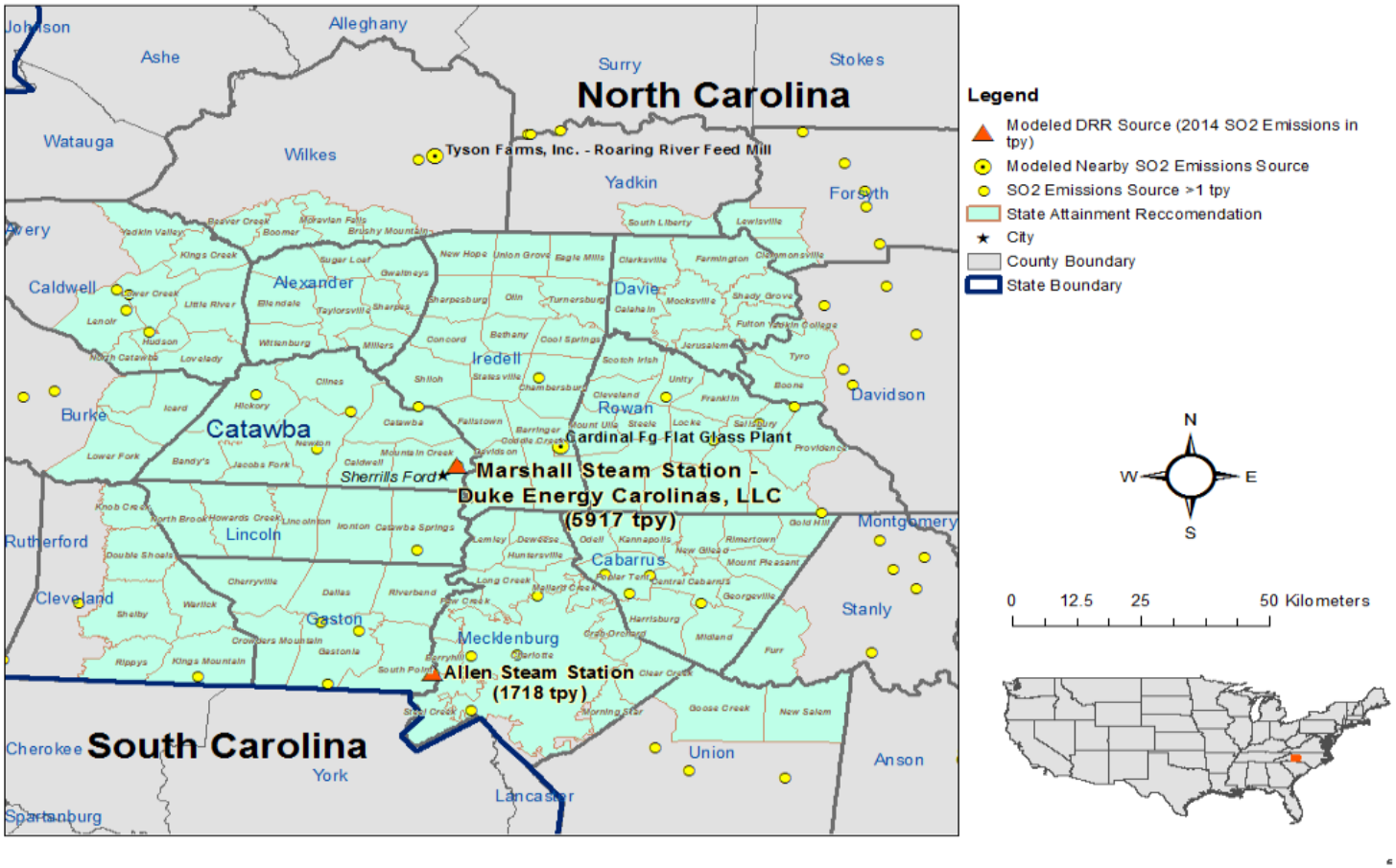
Township	County	North Carolina's Recommended Designation	The EPA's Intended Designation
Lincolnton		Attainment	Unclassifiable/Attainment
North Brook		Attainment	Unclassifiable/Attainment
Charlotte	Mecklenburg (p)	Attainment	Unclassifiable/Attainment
Berryhill		Attainment	Unclassifiable/Attainment
Steele Creek		Attainment	Unclassifiable/Attainment
Clear Creek		Attainment	Unclassifiable/Attainment
Crab Orchard		Attainment	Unclassifiable/Attainment
Mallard Creek		Attainment	Unclassifiable/Attainment
Deweese		Attainment	Unclassifiable/Attainment
Lemley		Attainment	Unclassifiable/Attainment
Long Creek		Attainment	Unclassifiable/Attainment
Paw Creek		Attainment	Unclassifiable/Attainment
Morning Star		Attainment	Unclassifiable/Attainment
Huntersville		Attainment	Unclassifiable/Attainment
Atwell	Rowan (p)	Attainment	Unclassifiable/Attainment
China Grove		Attainment	Unclassifiable/Attainment
Cleveland		Attainment	Unclassifiable/Attainment
Franklin		Attainment	Unclassifiable/Attainment
Gold Hill		Attainment	Unclassifiable/Attainment
Litaker		Attainment	Unclassifiable/Attainment
Locke		Attainment	Unclassifiable/Attainment
Mount Ulla		Attainment	Unclassifiable/Attainment
Providence		Attainment	Unclassifiable/Attainment
Salisbury		Attainment	Unclassifiable/Attainment
Scotch Irish		Attainment	Unclassifiable/Attainment
Steele		Attainment	Unclassifiable/Attainment
Unity		Attainment	Unclassifiable/Attainment
Furr	Stanly (p)	Attainment	Unclassifiable/Attainment
Goose Creek	Union (p)	Attainment	Unclassifiable/Attainment
New Salem		Attainment	Unclassifiable/Attainment
Beaver Creek	Wilkes (p)	Attainment	Unclassifiable/Attainment
Boomer		Attainment	Unclassifiable/Attainment
Brushy Mountain		Attainment	Unclassifiable/Attainment
Moravian Falls		Attainment	Unclassifiable/Attainment
South Liberty	Yadkin (p)	Attainment	Unclassifiable/Attainment

As seen in Figure 10 below, the Duke-Marshall facility is located on Lake Norman south of Sherrills Ford in Catawba County, North Carolina. There are three other nearby SO_2 sources within 50 km of Duke Marshall Steam Station.[14] The nearest SO_2 source of concern is the Duke-

[14] All other SO_2 emitters of 100 tpy or more (based on information in the 2013-2015 NCDAQ emissions inventory) were considered for potential inclusion in the modeling analysis.

Allen facility located about 45 km from the Duke-Marshall facility. The other two sources were not explicitly modeled but were captured in the background concentrations of the area as discussed in Section 4.2.2.4 of this TSD. Included in the figure below is the State's recommended boundary for the attainment designation. The EPA's intended unclassifiable/attainment designation boundary for the Catawba County area is not shown in these figures either, but is shown in a figure in the section below that summarizes our intended designation.

Figure 10. Map of the Catawba County Area Addressing Marshall Steam Station. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered one modeling assessment from the State and no assessments from other parties. The table below indicates when this assessment was received, provides an identifier for the assessment, and identifies any distinguishing features of the modeling assessments.

Table 10. Modeling Assessments for the Catawba County Area

Assessment Submitted by	Date of the Assessment	Identifier Used in this TSD	Distinguishing or Otherwise Key Features
North Carolina	January 13, 2017	Duke-Marshall Modeling Report	

4.2.2. Modeling Analysis Provided by the State

4.2.2.1. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRM: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The State used AERMOD version 15181, which was the most up-to-date version at the time the modeling was performed, using all regulatory default options. AERMOD version 16216r has since become the regulatory model version. There were no updates from 15181 to 16216r that would significantly affect the concentrations predicted here. A discussion of the State's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

The most current approved version of AERMOD, version 16216r, which was published January 17, 2017 (*see* 82 FR 5203), includes updates to the 15181 version as well as bug fixes that were on the previous version 16216. The updates to 15181 include the addition of settings that were previously considered an alternative modeling option. North Carolina used the default regulatory setting of the most current version at the time of modeling (15181), which does not use the alternative modeling options added to version 16216r of AERMOD. Using the older 15181

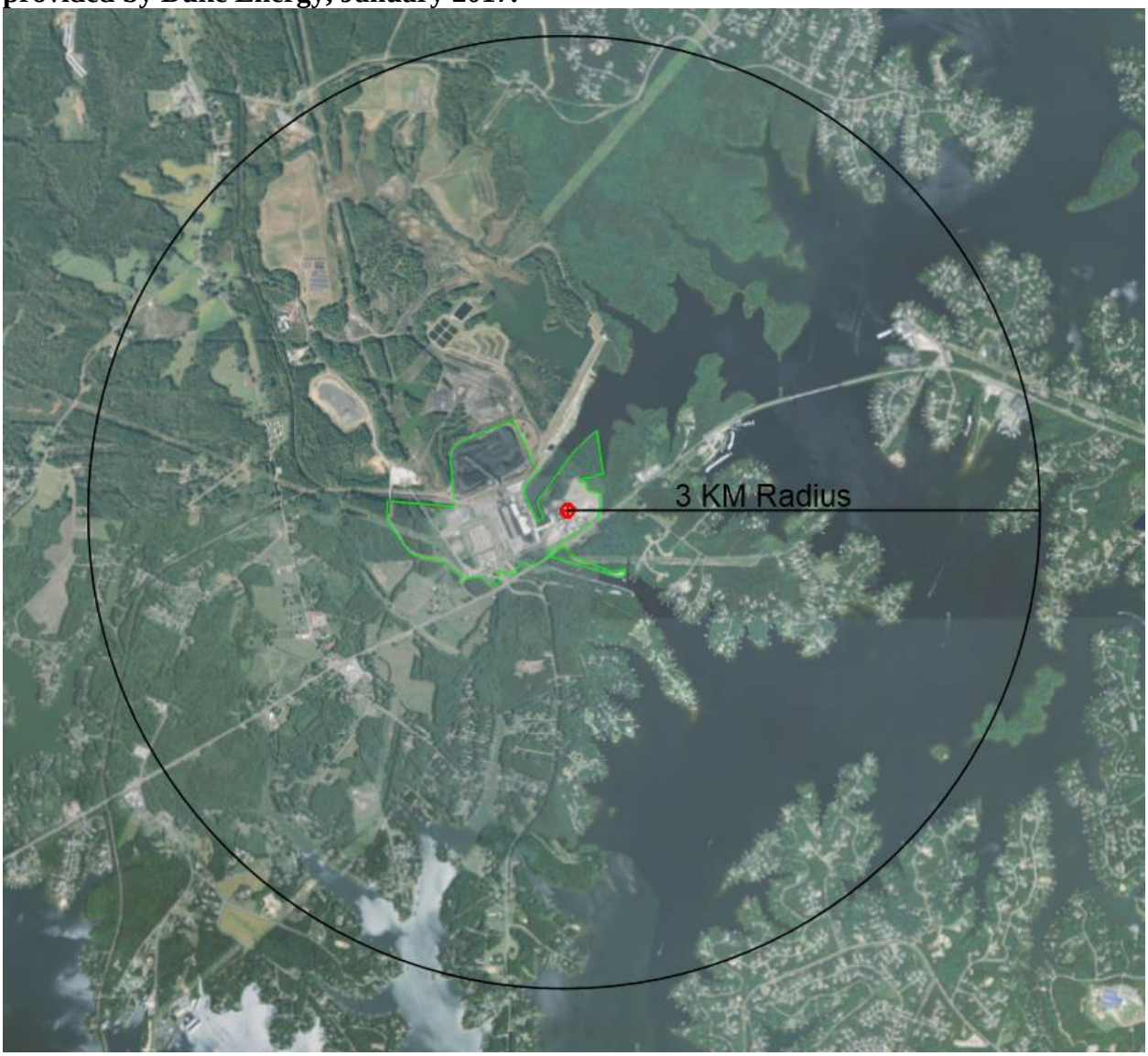
version of AERMOD with its default regulatory settings, likely produces the same results as the newer 16216r. For this reason, the EPA believes it is appropriate for the State to use the 15181 version of AERMOD.

4.2.2.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

The EPA's recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment within 3 km of the facility. According to the EPA's modeling guidelines, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50 percent of the area within a 3 km radius of the facility is classified as rural. Conversely, if more than 50 percent of the area is urban, urban dispersion coefficients should be used in the modeling analysis. For the purpose of performing the modeling for the area of analysis, the State determined that it was most appropriate to run the model in rural mode. To make the determination of using rural mode the State analyzed land use in the area by looking at recent satellite imagery within a 3 km radius of the facility. As seen in Figure 11, the area surrounding the Duke-Marshall facility is mostly open water, forests and agricultural lands. Based on this information and the imagery provided by the State, the EPA agrees with the determination that the area surrounding the source should be classified as rural.

Figure 11. Map of the Catawba County Area Showing Aerial View of land Use Surrounding the Duke-Marshall Facility. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



4.2.2.3. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The sources of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Catawba County area, the State has included one additional SO_2 emission

source within 50 km of the Duke-Marshall facility. The State determined that this was the appropriate distance to adequately characterize air quality through modeling, to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis, and any potential impact on SO_2 air quality from other sources in nearby areas. In addition to the Duke-Marshall facility, the other emitter of SO_2 included in the area of analysis is the Duke-Allen facility. No other sources beyond 50 km were determined by the State to have the potential to have an impact within the area of analysis.

North Carolina conducted an evaluation to determine if other sources of SO_2 emissions in the area surrounding the Duke-Marshall should be included in the modeling to fully characterize the air quality in the area. As a first tier, North Carolina focused on sources located within 10 km from Duke-Marshall. According to the NCDAQ's Emissions Inventory for 2013-2015, there were no other sources of SO_2 located within 10 km of the Marshall plant. Subsequently, North Carolina decided to evaluate large sources that were more than 10 km from Marshall to determine if they should be included in the analysis. As shown in Table 12, three additional sources were identified within 50 km of Duke-Marshall. However, only the Duke-Allen facility, located approximately 45 km south of the Duke-Marshall facility, was determined by North Carolina to have SO_2 emissions that should be explicitly included in the modeling. The Cardinal Fg Flat Glass Plant and Tyson Farms, Inc. Harmony facilities were not explicitly modeled based upon North Carolina's screening criteria of Q/D[15] (annual emission/distance in km) less than 20.

Based upon their low levels of emissions and distance from the Duke-Marshall facility, the EPA agrees that the Cardinal Fg Flat Glass Plant and Tyson Farms, Inc. Harmony facilities identified in Table 11 do not need to be explicitly modeled and any contributions are accounted for using the representative background concentration discussed in Section 4.2.2.8 of this TSD.

Table 11. Assessment of Nearby Source Emissions. Source: Modeling Report for Duke Energy Belews Creek Generating Station, dated January 13, 2017.

Facility Name	Emissions TPY (Q)	Year	Distance km (D)	Q/D
Cardinal Fg Flat Glass Plant	160	2015	16	10
Tyson Farms, Inc. - Harmony	286	2015	44	7
Duke Allen Steam Station	1,128	2015	45	25

The grid receptor spacing for the area of analysis chosen by the State is as follows:

A Cartesian grid was used for the modeling assessment. The grid extends 50 km in each direction and was centered at the Duke-Marshall facility. The 50 km extension was chosen because it captured the nearby sources that were included in the modeling analysis and that could cause a concentration gradient variation near the site.

[15] Using the "20D" method, if the annual (tpy) emissions (Q) from a candidate source are greater than 20D (20 times the distance in km of the candidate source to Duke-Marshall) then the source is retained for further consideration for potential inclusion in the modeling analysis. This analysis is sometimes referred to as Q/d (indicating emissions over distance).

As seen below, the spacing for the receptors was adjusted based on the distance from the facility, creating nested grids within the 50 km area. In addition, boundary receptors were placed within the perimeter of the facility.

- Receptors along the fence line every 50 m
- Receptors every 100 m from fence line to 3 km
- Receptors every 250 m from 3 km to 5 km
- Receptors every 500 m from 5 km to 10 km
- Receptors every 1000 m from 10 km to 20 km
- Receptors every 2000 m from 20 km to 50 km

The receptor network contained 7,746 receptors. The network covered Catawba, Alexander, Cabarrus, Cleveland, Davie, Gaston, Iredell, and Lincoln counties, as well as portions of the Caldwell, Burke, Wilkes, Yadkin, Rowan, Mecklenburg, Union, Forsyth, Davidson, and Stanly counties.

Figures 12 and 13, included in the State's recommendation, show the State's chosen modeling area of analysis surrounding the Duke-Marshall facility, as well as the receptor grid for the area.

Consistent with the Modeling TAD, the State placed receptors for the purposes of characterizing the SO_2 concentrations in locations that would be considered ambient air relative to each modeled facility, including other facilities' property with the exceptions of locations described in Section 4.2 of the Modeling TAD as not being feasible locations for placing a monitor. For the Duke-Marshall facility, no receptors were placed in the areas over water surfaces. The State also did not place receptors in other locations that it considered to not be ambient air relative to each modeled facility and so excluded receptors within the Duke-Marshall fence line. The North Carolina Modeling Report provides a figure showing the fence line boundary. However, no information was provided to document that public access to the facility property is prevented by a fence or some other physical barrier. Receptor elevation was included using data from the NED, and utilizing the AERMP terrain processor of AERMOD.

Figure 12. Area of Analysis for the Catawba County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.

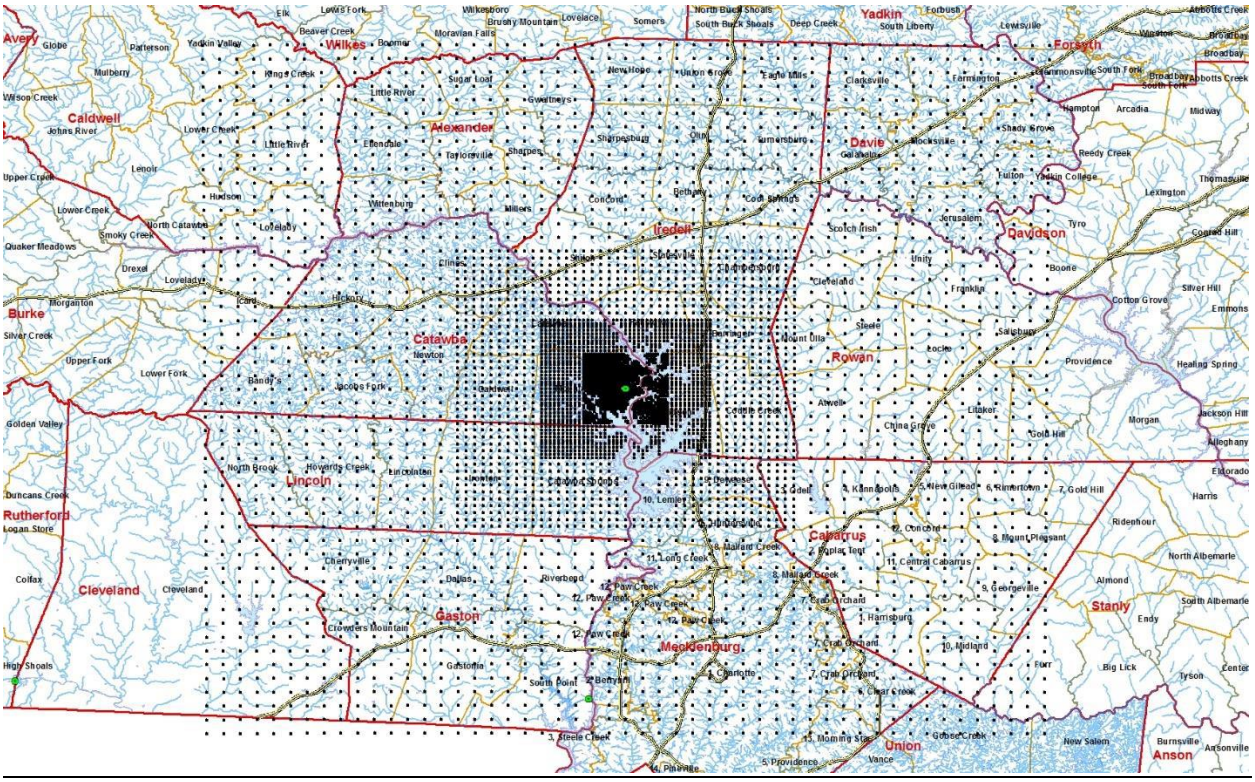
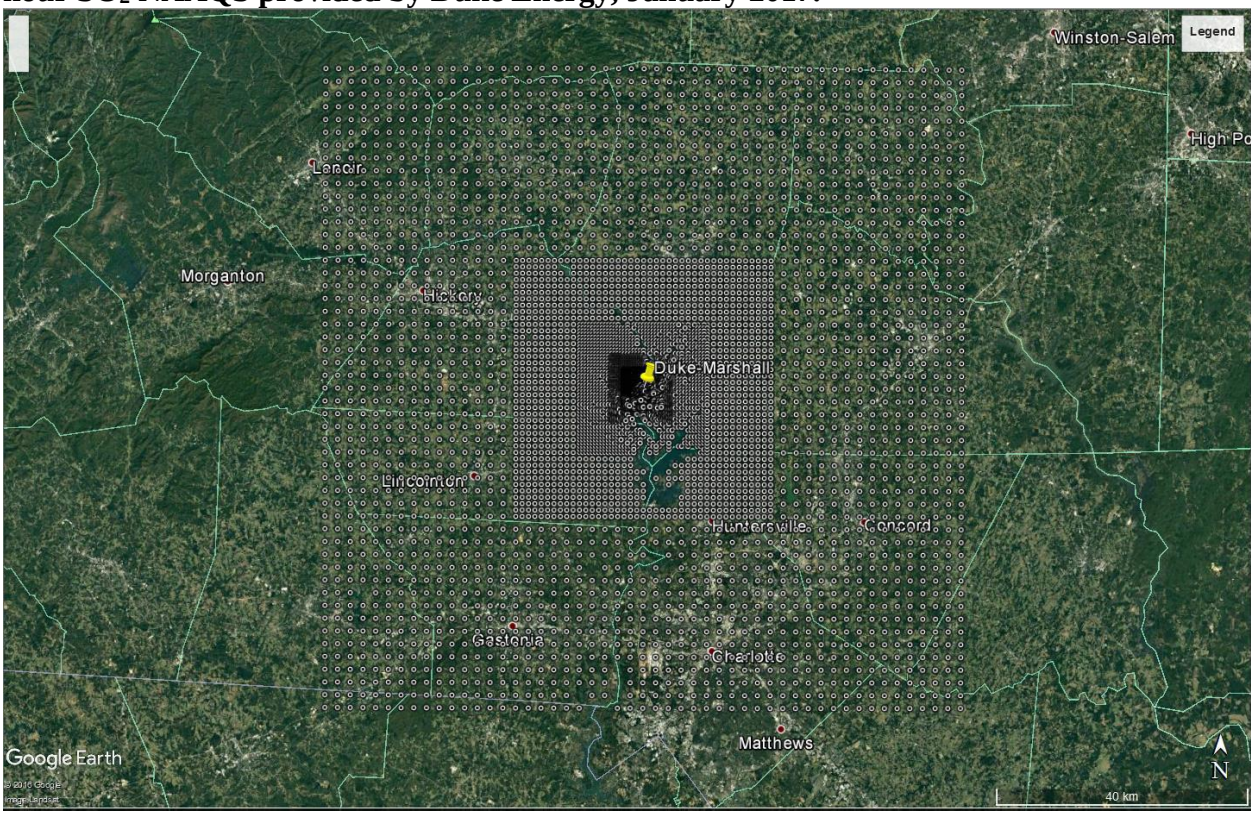


Figure 13. Receptor Grid for the Catawba County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



Based on the information provided in North Carolina's recommendation, the EPA agrees with excluding the receptors over nearby water bodies as areas not feasible to place a monitor. Not enough information was provided by the State for the EPA to determine whether receptors were properly excluded from the Duke-Marshall facility property on the basis of it not representing ambient air for the purposes of SO_2 designations modeling. However, the EPA agrees that the receptor grid selected by the state adequately captures maximum concentrations due to the fact that the maximum modeled concentration occurs approximately 0.8 km northeast of the source (as shown in Figure 16a), and approximately 500 m beyond the facility fence line or property boundary. Therefore, the EPA believes that North Carolina's receptor grid is appropriate for the characterization of the area, considering the impact of SO_2 from the modeled facilities.

4.2.2.4. Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions or following GEP policy with allowable emissions.

Marshall operates four coal fired boilers. Three flues vent through a single combined stack location with Units 1 and 2 venting to a single flue, while units 3 and 4 vent to their own flue. As

recommended in the SO_2 Modeling TAD, the hourly varying emissions and stack release parameters from CEMS were used in the modeling. Most other emitting sources at Duke-Marshall are associated with coal and ash handling, conveying, and transport and do not emit SO_2. Duke-Marshall also operates two emergency generators, an emergency water pump, and an emergency air compressor which operate infrequently, combust ultra-low sulfur diesel, and emit small quantities of SO_2. These intermittent sources have very low SO_2 emissions (maximum hourly emissions less than 0.04 lb/hr) and operate at neither a frequency or magnitude great enough to contribute to the annual distribution of the daily maximum concentrations. Therefore, North Carolina did not include them in the analysis. The EPA concurs with this determination.

As described in Section 4.2.1, North Carolina utilized one additional source in their modeling for the Duke-Marshal facility. In order to determine nearby sources to be considered in the modeling analysis, North Carolina evaluated North Carolina Department of Air Quality's (NCDAQ's) emissions inventory for the 2013-2015 time period to identify those sources within 50 km of the Duke-Marshall facility that emitted 100 tpy of SO_2 or more. Within 50 km of the Duke-Marshall facility, the State identified a total of three sources that met this the emission criteria and that were considered for inclusion in the modeling. These sources included the Cardinal Fg Flat Glass Plant (located 16 km away), the Tyson Farms, Inc. – Harmony facility (located 44 km away), and the Duke-Allen facility (located 45 km away). For all three sources, the State analyzed their emissions and compared them to the distance from the Duke-Marshall facility in order to obtain a Q/d[16] value. The only source that had a Q/d value larger than 20 was the Duke-Allen facility, therefore, it was the only additional source included in the modeling assessment. Based upon their low levels of emissions and distance from the Duke-Marshall facility, the EPA agrees that the Cardinal Fg Flat Glass Plant and Tyson Farms, Inc. Harmony facilities do not need to be explicitly modeled and believes that these sources will not contribute to a violation of the 2010 1-hour SO_2 NAAQS. Any contributions are accounted for using the representative background concentration discussed in Section 4.2.2.8 of this TSD. No other sources within 50 km were identified or included in the modeling assessment.

The State characterized these source(s) within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the State used actual stack heights in conjunction with actual emissions for the two SO_2 facilities modeled. The State also characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash.

The EPA agrees that North Carolina has appropriately characterized the area surrounding the Duke-Marshall facility. Given the criteria for selecting nearby sources, we believe that the decision to only include the Duke-Allen facility in the modeling analysis is appropriate. Also, the State has appropriately used the actual emissions and stack heights for both facilities and correctly accounted for the building downwash using BPIPPRM for AERMOD.

[16]Using the "20D" method, if the emissions from a candidate source are greater than 20D (20 times the distance in km of the candidate source to Duke Marshall) then the source is retained for further consideration for potential inclusion in the modeling analysis. This analysis is sometimes referred to as Q/d (indicating emissions over distance).

4.2.2.5. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective. The EPA believes that CEMS data provide acceptable historical emissions information, when they are available. These data are available for many electric generating units. In the absence of CEMS data, the EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, the EPA recommends using detailed throughput, operating schedules, and emissions information from the impacted source (s).

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. For example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the State included the Duke-Marshall facility and one other emitter (the Duke-Allen facility) of SO_2 within the 50 km area of analysis. The State has chosen to model these facilities using actual emissions. The facilities in the State's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For Duke-Marshall and Duke-Allen facilities, the State provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in the Table 12. A description of how the State obtained hourly emission rates is given below this table.

Table 12. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the Catawba County Area

Facility Name	SO_2 Emissions (tpy)		
	2013	2014	2015
Duke Marshall Steam Station	4,704	5,917	4,624
Duke Allen Steam Station	846	1,718	1,128
Total Emissions from All Modeled Facilities in the State's Area of Analysis	5,550	7,635	5,752

For the Duke-Marshall and Duke-Allen facilities, the actual hourly emissions data were obtained from the CEMS located within these facilities.

Given the data provided by the State, the EPA agrees that the emission data used for modeling was appropriate, complies with the EPA's Modeling TAD, and is representative of actual emissions in the area.

4.2.2.6. Modeling Parameter: Meteorology and Surface Characteristics

As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include NWS stations, site-specific or onsite data, and other sources such as universities, FAA, and military stations.

For the area of analysis for the Catawba County area, the State selected the surface meteorology for the time period of 2013 to 2015 from the NWS station in the Gastonia Municipal Airport (KAKH) in Gastonia, North Carolina. The station is located at 35.2 N, 81.17 W, approximately 45 km south of the Duke-Marshall facility. Upper air observations were obtained from a different NWS station, located in Greensboro, North Carolina, at 36.1 N, 79.94 W. North Carolina determined that these meteorology stations are the most representative of meteorological conditions within the area of analysis based upon similarities in surrounding terrain and proximity to the Duke-Marshall facility. Also, North Carolina evaluated climatology and data completeness of these stations and determined they provide quality data for the modeling assessment.

The State used AERSURFACE version 13016 using data from KAKH NWS to estimate the surface characteristics (albedo, Bowen ratio, and surface roughness [z_o]) of the area of analysis. Albedo is the fraction of solar energy reflected from the earth back into space, the Bowen ratio is the method generally used to calculate heat lost or heat gained in a substance, and the surface

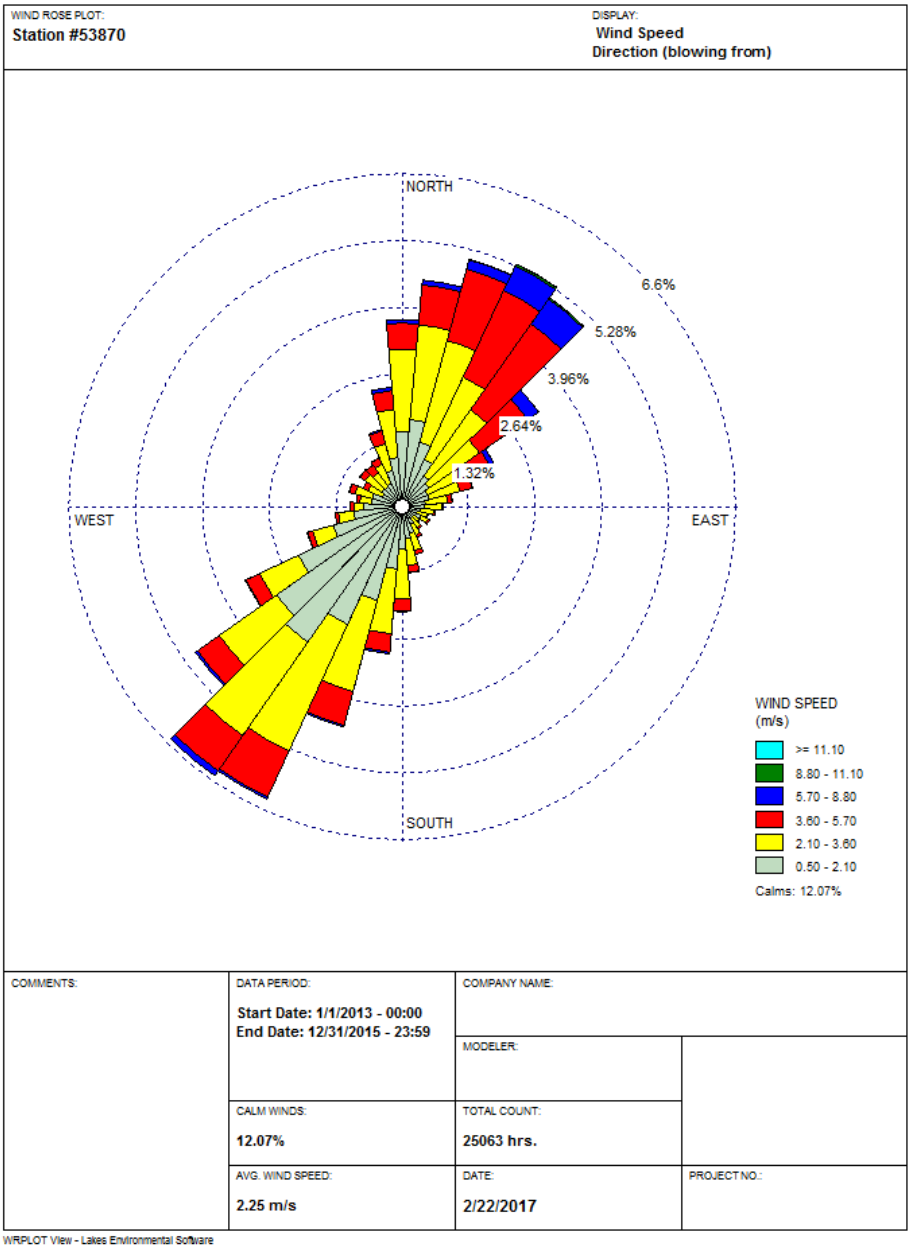
roughness is sometimes referred to as “zo” The state estimated surface roughness values for 12 spatial sectors out to 1 km at a seasonal temporal resolution for wet conditions.

In the figure below, generated by the EPA, the location of these NWS station are shown relative to the area of analysis.

Figure 14. Area of Analysis and the NWS stations in the Gastonia County Area

The EPA generated wind rose plots with "WRPLOTS View" utility program using state submitted pre-processed AERMET surface meteorology data for the KAKH NWS site. In Figure 15, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. Analysis of the NWS data indicate winds blow predominantly from the southwest direction with a secondary maximum from the northeast direction.

Figure 15. Catawba County Cumulative Annual Wind Rose for Years 2013 – 2015



Meteorological data from the above surface and upper air NWS stations were used in generating AERMOD-ready files with the AERMET (version 15181) processor. The output meteorological data created by the AERMET processor are suitable for being input files for AERMOD modeling runs. Upper air data from Greensboro were also processed with AERMET. The needed NWS site land use parameters to derive wind and temperature vertical profiles were derived following the methodology provided in the AIG using AERSURFACE (version 13016).

Hourly surface meteorological data records are read by AERMET and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1-minute duration was provided from the KAKH NWS station, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE (version 13016). These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimated actual hourly average conditions and that are less prone to report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates.

Differences in surface characteristics at the meteorological observation site and application site were reviewed and compared to evaluate representativeness. The seasonal albedo and Bowen ratio values were determined to be similar and, therefore, representative of the project location. The overall average roughness of the airport site was determined to be similar to those at the facility. The wind directions where the surface roughness at the two sites were very similar (i.e., south and southwest) happen to be the same as the prevailing winds. The modeled design concentrations and upper distribution of predicted concentrations were found to be associated with the same south and southwest wind directions. Therefore, the airport surface roughness values were determined to be representative of the project location because of the similar influence on the prevailing winds and resultant design concentrations.

The EPA agrees with the meteorological and surface data that the State used for the modeling of the Catawba County area in regards to the Duke-Marshall facility. The data used properly represents meteorological conditions in the area and allows for the proper simulation of SO_2 emissions from the Duke-Marshall facility and nearby sources. The State used appropriate site specific data from a nearby NWS station.

4.2.2.7. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as gently rolling with the plant bordering surface water (i.e., lake) to the east. To account for these terrain changes, the AERMAP terrain

program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database.

The State's final modeling report does not offer any information on the topography or geography of the area, but based upon an evaluation of USGS topography maps of the area, the EPA believes that the area has no complex terrain. The EPA agrees with the State's use of the USGS NED database and AERMAP terrain processor (version 11130) for AERMOD to account for the slight changes in elevation of the area to obtain a more accurate modeling result.

4.2.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, the State elected to use a "tier 1" approach. Data were obtained from 2013-2015 time period from the Garinger High School monitor located in Mecklenburg County (AQS Site: 37-119-0041), approximately 43 km southeast of the Duke-Marshall facility. The single value of the background concentration for this area of analysis was determined by the State to be 18 μg/m^3, equivalent to 7 ppb,[17] and that value was incorporated into the final AERMOD results.

The EPA agrees that North Carolina has appropriately chosen the background concentration in accordance with the Modeling TAD. The State has chosen a monitor that is near the modeled source and is adequate for modeling purposes, with complete data for the 2013-2015 time period. The EPA believes that the chosen background monitored concentration is representative of the area and accounts for impacts from nearby sources not explicitly included in the modeling. The emissions from point sources near Catawba County that were not explicitly modeled are lower than the emissions from point sources located near the Garinger High School monitor. Additionally, the Garinger High School monitor is located in an urbanized area so is impacted by a larger amount of nonpoint SO2 emissions sources.

[17] The SO_2 NAAQS level is expressed in ppb but AERMOD gives results in μg/m^3. The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1 ppb = approximately 2.619 μg/m^3.

4.2.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Catawba County area of analysis is summarized below in Table 13.

Table 13. Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Catawba County Area

Input Parameter	Value
AERMOD Version	15181 (Default Settings)
Dispersion Characteristics	Rural
Modeled Sources	2
Modeled Stacks	3 (Marshall 1 stack, Allen 2 stack)
Modeled Structures	20
Modeled Fencelines	1
Total receptors	7,746
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Gastonia Municipal Airport Gastonia, NC
NWS Station Upper Air Meteorology	Greensboro, NC
NWS Station for Calculating Surface Characteristics	Gastonia Municipal Airport Gastonia, NC
Methodology for Calculating Background SO_2 Concentration	Tier 1 approach using AQS site: 37-119-0041 for 2013 – 2015
Calculated Background SO_2 Concentration	18 $\mu g/m^3$

The results presented below in Table 14 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

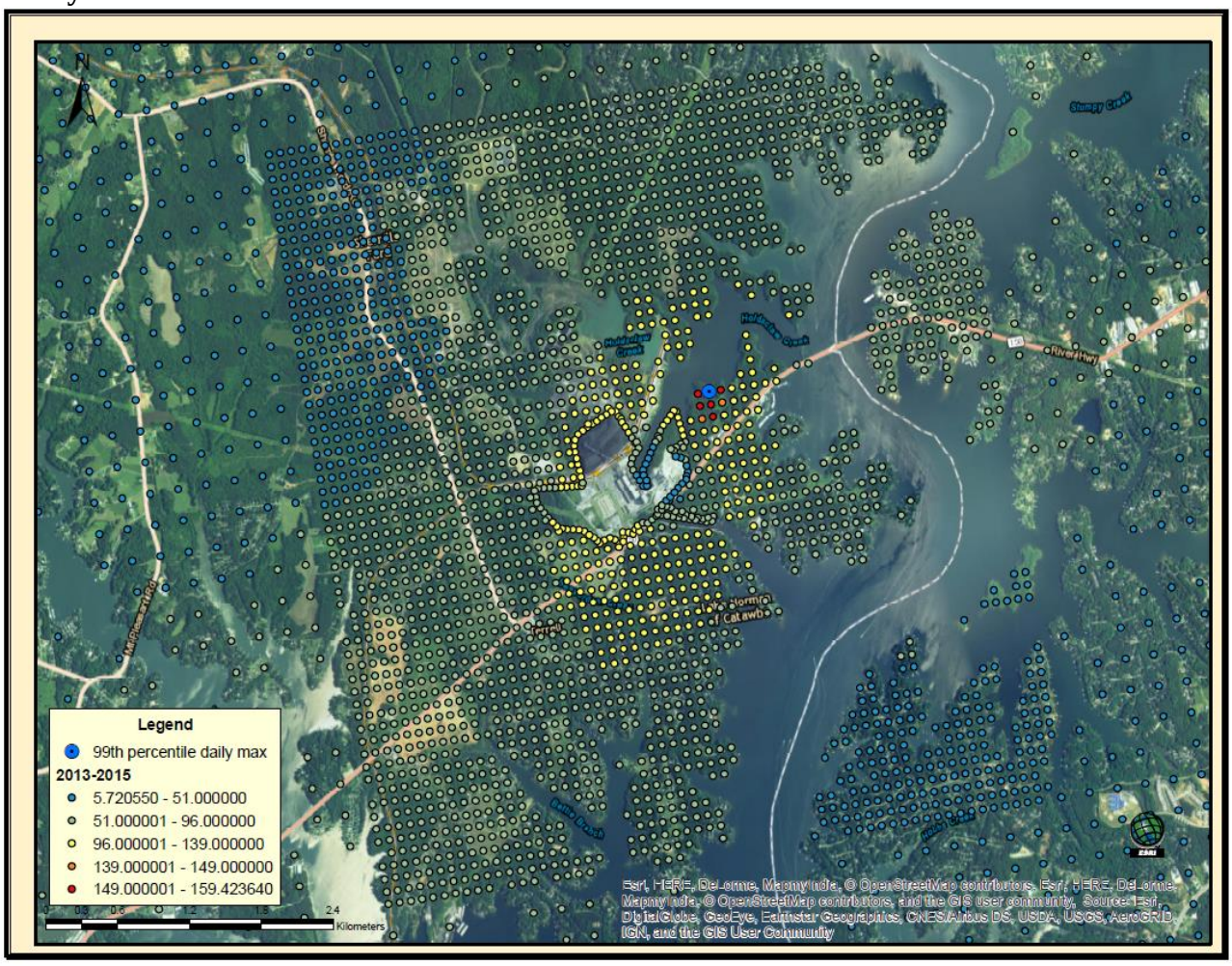
Table 14. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Catawba Count Area

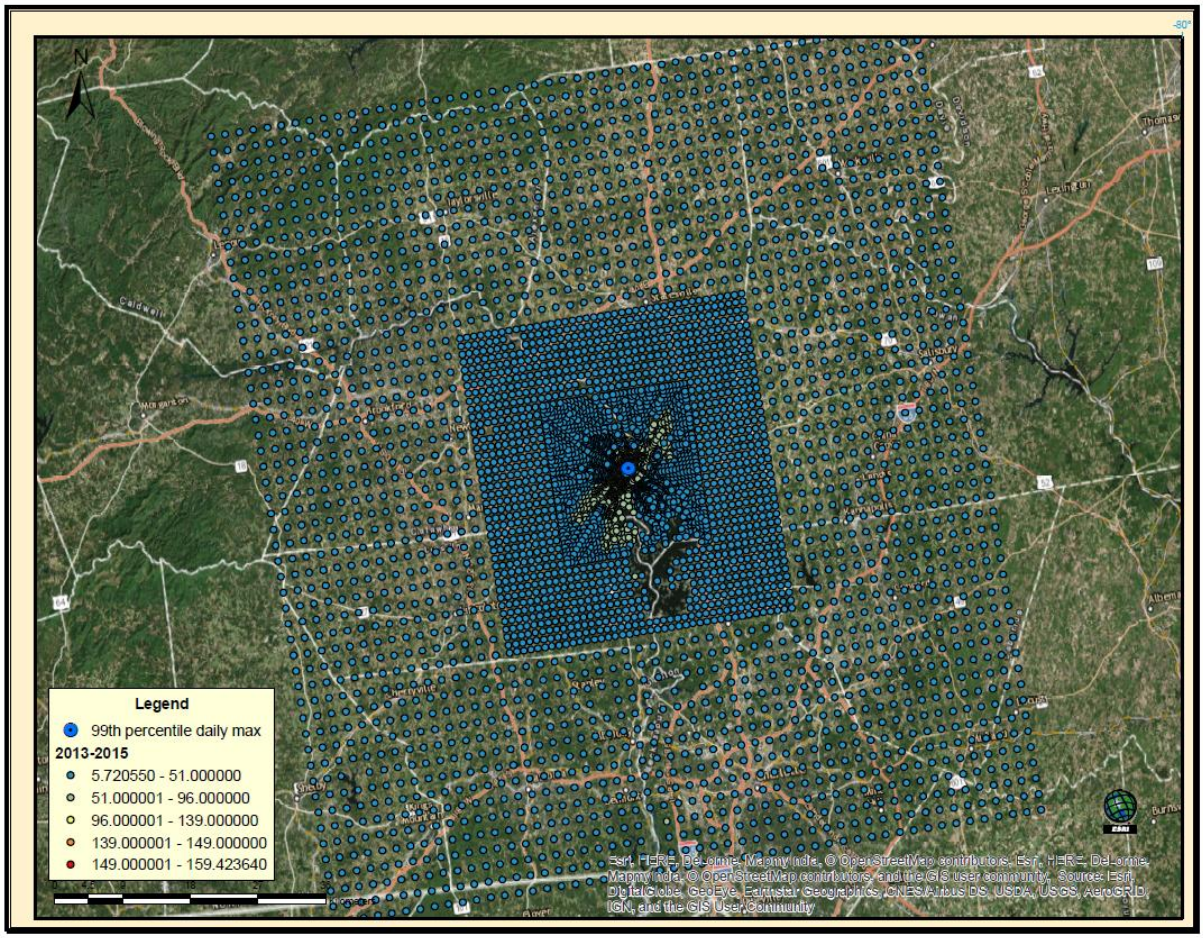
Averaging Period	Data Period	Receptor Location [UTM zone 17]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-2015	504018	3939959	178	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

The State's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 178 $\mu g/m^3$, equivalent to 68 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities. Figures 16a and 16b below were generated by the EPA using the model output files provided by North Carolina. Figure 16a shows that the predicted value occurred approximately 0.8 km northeast of Duke-Marshall's combined stack location and approximately 0.5 km outside the facility's fence line.

Figures 16a and 16b. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Catawba County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.





The modeling submitted by the State does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration.

4.2.2.10. The EPA's Assessment of the Modeling Information Provided by the State

NCDAQ's air quality modeling assessment for the area about the Duke-Marshall facility is the only SO_2 modeling provided for this assessment. NCDAQ followed the Modeling TAD to carry out this modeling assessment. North Carolina used the regulatory default settings for version 15181 available at the time of its modeling preparation and is not making use of any previously alternative modeling options included in version 16216r and the update to Appendix W.

The NWS station in Gastonia, North Carolina, was selected to provide representative surface meteorological data for the modeling assessment. The upper air meteorological data were obtained from the Greensboro, North Carolina, airport site. Both are valid and appropriate sites for the analysis of the DRR source.

For nearby sources, the State modeled only one additional source within a 50 km radius of the Duke-Marshall facility and the EPA agrees with this determination. North Carolina considered three sources within 50 km of Marshall, but due to their distance from the Duke-Marshall facility and their emissions, two of these sources had a Q/d[18] below 20 and so were excluded by the state from inclusion in the modeling. The Duke-Allen facility was the only facility included in the final modeling assessment of the Catawba County area. The EPA agrees with the use of actual hourly emissions data from CEMS for the sources included in the modeling. The EPA agrees that the background concentration monitoring site selected for use in this analysis is appropriate. Finally, the State chose an appropriate modeling domain that adequately resolves the maximum impact from the facilities modeled in the Catawba County area. The State also sufficiently accounted for terrain in the area. The EPA agrees that the maximum concentrations predicted by the modeling analysis are less than the NAAQS.

After evaluating all the relevant information mentioned above, the EPA agrees with the modeling information provided by the State for the analysis of the Catawba County area affected by the Duke-Marshall facility and other nearby sources.

4.3. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Catawba County Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

4.4. Jurisdictional Boundaries in the Catawba County Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for city/county/parish. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

The Duke-Marshall facility is located in the southeast corner of Catawba County, North Carolina. The Catawba County is bounded by Caldwell and Burke counties to the west, Iredell County to the east, Alexander County to the north and Lincoln County to the south. Although no sources were included from South Carolina in the final modeling assessment, the modeling domain of the Duke-Marshall facility does capture a small portion of York and Cherokee Counties in South Carolina.

[18] Q/d is a measure of the annual emission in tons divided by the distance in km from the source.

In its January 2017 recommendation letter, the State suggested to designate the area surrounding the Duke-Marshall facility, specifically the townships bounded by the modeling domain, which include those identified in Table 9 in Section 4.2.1 of this document, as attainment based in part on an assessment and characterization of air quality impacts from the facilities previously discussed. The State's boundary recommendation includes a total of 112 townships covering six whole counties (Catawba, Alexander, Cabarrus, Cleveland, Davie, Gaston, Iredell and Lincoln) and nine partial counties (Burke, Caldwell, Davidson, Forsyth, Mecklenburg, Union, Stanly, Rowan and Yadkin). The EPA considered all the information available to determine the correct boundaries for the intended designation. More detail is given about the intended designation for the Catawba County in Section 4.7 of this document.

4.5. Other Information Relevant to the Designations for the Catawba County Area

No other relevant information is available for the Catawba County area.

4.6. The EPA's Assessment of the Available Information for the Catawba County Area

After evaluating the data from the modeling report for the Duke-Marshall facility, the EPA intends to designate the Catawba County area as unclassifiable/attainment for the 2010 SO_2 NAAQS. The State's modeling results indicated that the maximum impact from the Duke-Marshall facility, including nearby sources and background concentrations, did not violate the 2010 SO_2 NAAQS. The State modeled the Duke-Marshall facility together with one other nearby source and background concentration data from a nearby monitor, and obtained a maximum 1-hour average of 68 ppb, which demonstrates compliance with the 75 ppb 2010 SO_2 NAAQS. The EPA notes there are no 2010 SO_2 nonattainment areas near Catawba County, North Carolina, and no expected nonattainment areas for this third round of designations. Furthermore, there are no nearby Round 4 areas being characterized by December 31, 2020 based on a newly deployed SO_2 monitor. Therefore, based on the available information including monitoring and modeling, the EPA believes the Catawba County area is not expected to contribute to ambient air quality in a nearby area that does not meet the NAAQS. Neither the State or the EPA used any 3rd party for additional modeling information.

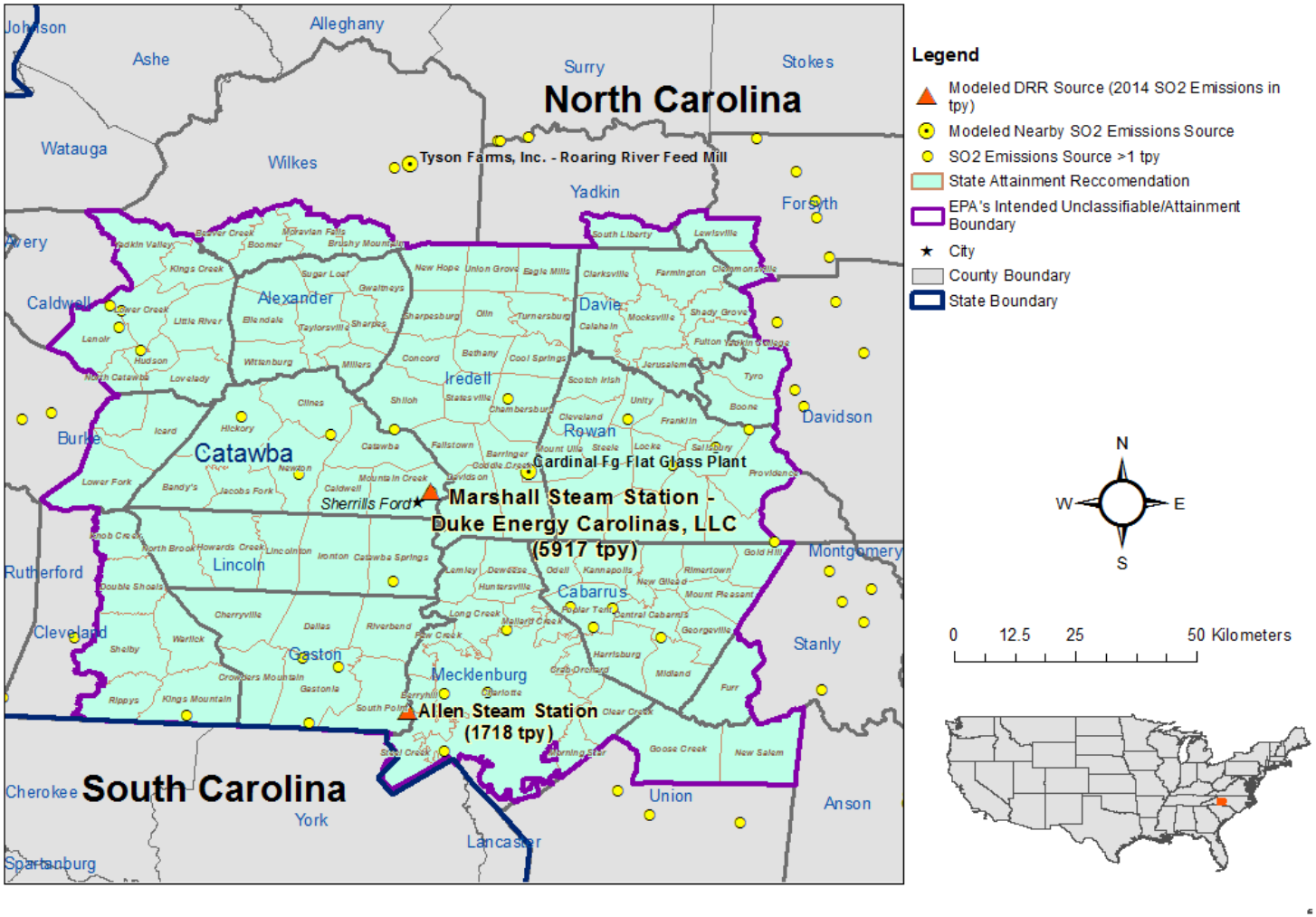
In its submission, North Carolina suggested that the Catawba County area, bounded by all townships within the modeling domain, be designated as attainment based in part on an assessment and characterization of air quality impacts from the modeled facilities. After careful evaluation, the EPA agrees with the State's recommended boundary but is modifying the State's recommended designation, and intends to designate the entire Catawba County area as unclassifiable/attainment for the 2010 SO_2 NAAQS because based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined that the area: (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS.

The EPA believes that our intended unclassifiable/attainment area, bounded by the modeling domain and including the townships in the table below, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area. For the Catawba County area, no other sources are left to be designated by December 31, 2020.

4.7. Summary of Our Intended Designation for the Catawba County Area

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the Catawba County area as unclassifiable/attainment for the 2010 SO_2 NAAQS based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined that the area: (i) meets the 2010 SO2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS. Specifically, the boundaries are comprised of 112 townships captured within the modeling domain of the Duke-Marshall modeling assessment covering a total of 15 counties as listed in Table 9. In the specific case of the Duke-Marshall and the Duke-Allen facilities, due to their relatively close distance from each other, the modeling domains overlap each other and so some of the townships listed in the table will be repeated in the discussion of the Duke-Allen modeling assessment. This further supports the unclassifiable/attainment designation for these townships. Figure 17 shows the boundary of this intended designated area. At this time, our intended designations for the State only apply to this area and the other areas presented in this technical support document chapter. The EPA intends in a separate action to evaluate and designate all remaining undesignated areas in North Carolina by December 31, 2020.

Figure 17. Boundary of the Intended Catawba County Unclassifiable/Attainment Area



5. Technical Analysis for the Person County Area

5.1. Introduction

The EPA must designate the Person County area by December 31, 2017, because the area has not been previously designated and North Carolina has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting the EPA specifications referenced in the EPA's SO_2 DRR for any sources of SO_2 emissions in the State.

5.2. Air Quality Modeling Analysis for the Person County Area Addressing Duke Energy's Progress Mayo Electric Generating Plant

5.2.1. Introduction

This section 5.2 presents all the available air quality modeling information for a portion of Person County that includes Duke Energy's Mayo Electric Generating Plant, also referred to as the Duke-Mayo facility. (This portion of Person County will often be referred to as "the Person County area" within this section 5.2.). This area contains the following SO_2 sources around which North Carolina is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tpy:

- The Duke-Mayo facility emitted 2,000 tons or more annually. Specifically, Duke-Mayo emitted 3,491 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and North Carolina has chosen to characterize it via modeling.

- The CPI USA North Carolina – Roxboro Plant (CPI) facility is not on the SO_2 DRR Source list but was included in the modeling analysis of the Duke-Mayo facility. In 2014, CPI emitted 1,660 tpy, which was below the 2,000 tpy threshold for characterization under the DRR. The EPA notes that CPI's emissions increased to 2,006 tpy in 2015.

- Duke Energy's Roxboro Plant (Duke-Roxboro) facility emitted 2,000 tons or more annually. Specifically, Duke-Roxboro emitted 15,647 tons of SO_2 in 2014. This source meets the DRR criteria. North Carolina has chosen to characterize this source via monitoring and began operation of a new, approved air quality monitor by January 1, 2017. Therefore, the EPA must designate the area around this new monitor by December 31, 2020. Regardless, emissions from the Duke-Roxboro facility were included in the impacts of the area for the modeling analysis of the Duke-Mayo facility.

In its submission, North Carolina recommended that an area that includes the area surrounding the Duke-Mayo facility, specifically the townships bounded by the modeling domain, which include those identified in Table 15, be designated as attainment based in part on an assessment and characterization of air quality impacts from these facilities and other nearby sources that may have a potential impact in the area where the 2010 SO_2 NAAQS may be exceeded. This

assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the State's assessment, supporting documentation, and all available data, the EPA is modifying the State's recommendation and intends to designate the two townships in the State's recommendation containing the Duke-Mayo and the CPI facilities (Holloway and Roxboro Townships), as well as Woosdale Township, as unclassifiable for the 2010 1-hour SO_2 NAAQS. For the remaining townships included in North Carolina's recommendation for the area surrounding the Duke-Mayo facility that is subject to Round 3, the EPA intends to designate them unclassifiable/attainment for the 2010 1-hour SO_2 NAAQS. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

Table 15. North Carolina's Townships Bounded by the Duke-Mayo Facility Modeling Domain.

Township	County of Township	North Carolina's Recommended Designation	The EPA's Intended Designation
Oak Hill	Granville (p)	Attainment	Unclassifiable/Attainment
Walnut Grove		Attainment	Unclassifiable/Attainment
Allensville	Person (p)	Attainment	Unclassifiable/Attainment
Cunningham		None [19]	Designating by December 31, 2020
Holloway		Attainment	Unclassifiable
Roxboro		Attainment	Unclassifiable
Woodsdale		Attainment	Unclassifiable

As seen in Figure 18 below, the Duke-Mayo facility is located just south of the Virginia border in Person County, North Carolina. The facility is approximately 1.7 km from the Virginia border. Also included in the figures is the State's recommended boundary area for the attainment designation. The boundaries for the EPA's intended unclassifiable and unclassifiable/attainment designations for the Person County area are not shown in these figures either, but are shown in a figure in the section below that summarizes our intended designation.

In Figure 19 are other nearby significant emitters of SO_2 that were considered for inclusion in the modeling.[20] There are 11 sources in the vicinity of the Duke-Mayo facility that were considered for inclusion in the modeling within a 50 km radius. Of these 11 sources, only two were explicitly modeled: CPI facility (located 12 km away from the Duke-Mayo facility); and Duke-Roxboro facility (located 17 km away from the DRR source).

[19] North Carolina has chosen to characterize the Duke-Roxboro facility, located in Cunningham Township, via air quality monitoring and began operation of a new, approved air quality monitor by January 1, 2017. Therefore, the EPA must designate the area around this new monitor by December 31, 2020, and was not included in the State's recommended boundary.

[20] Shown in Figure 18 are sources within 50 km of Mayo that were considered in the modeling analysis.

Figure 18. Map of the Person County Area Addressing Duke-Mayo Facility

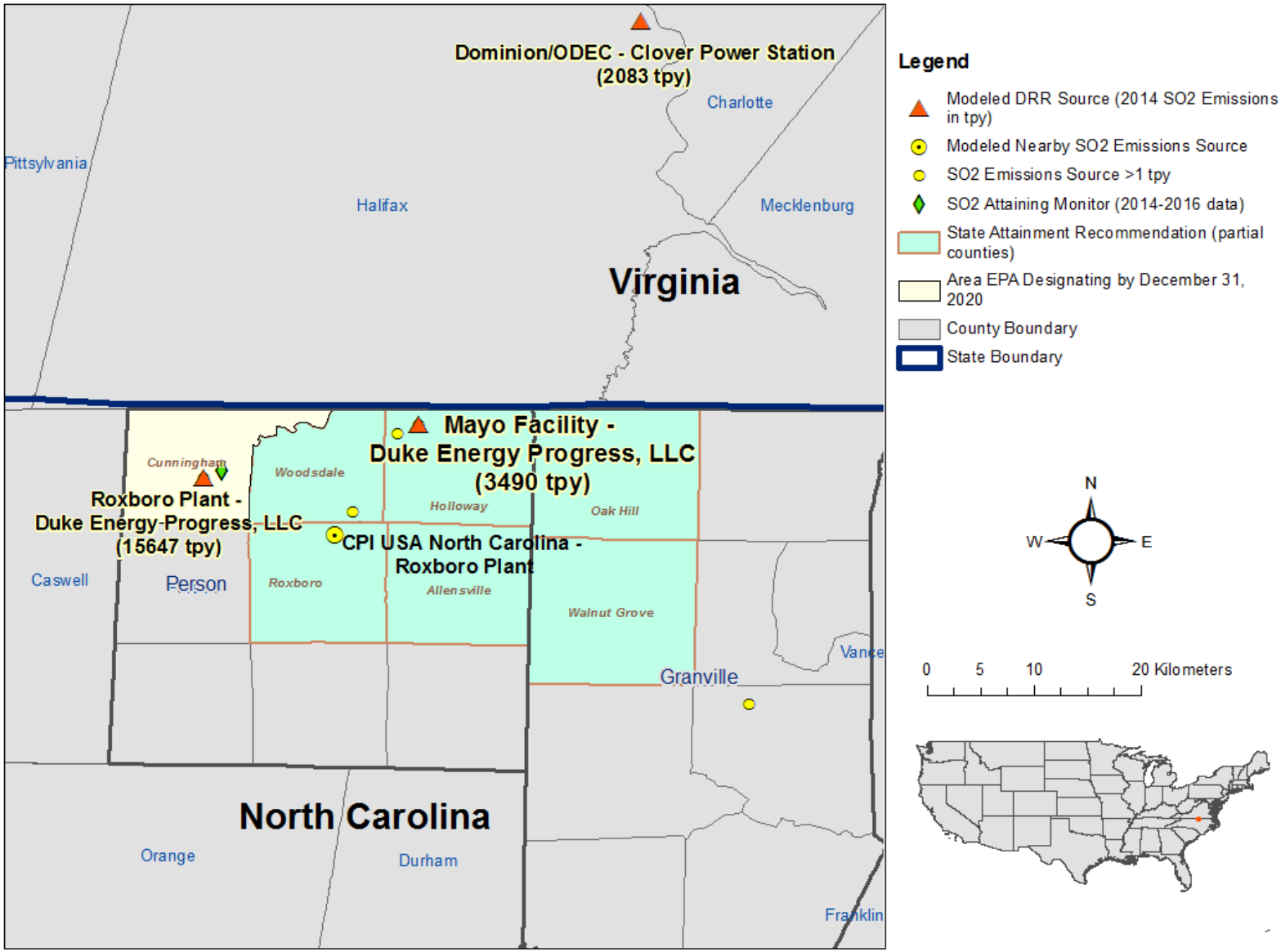
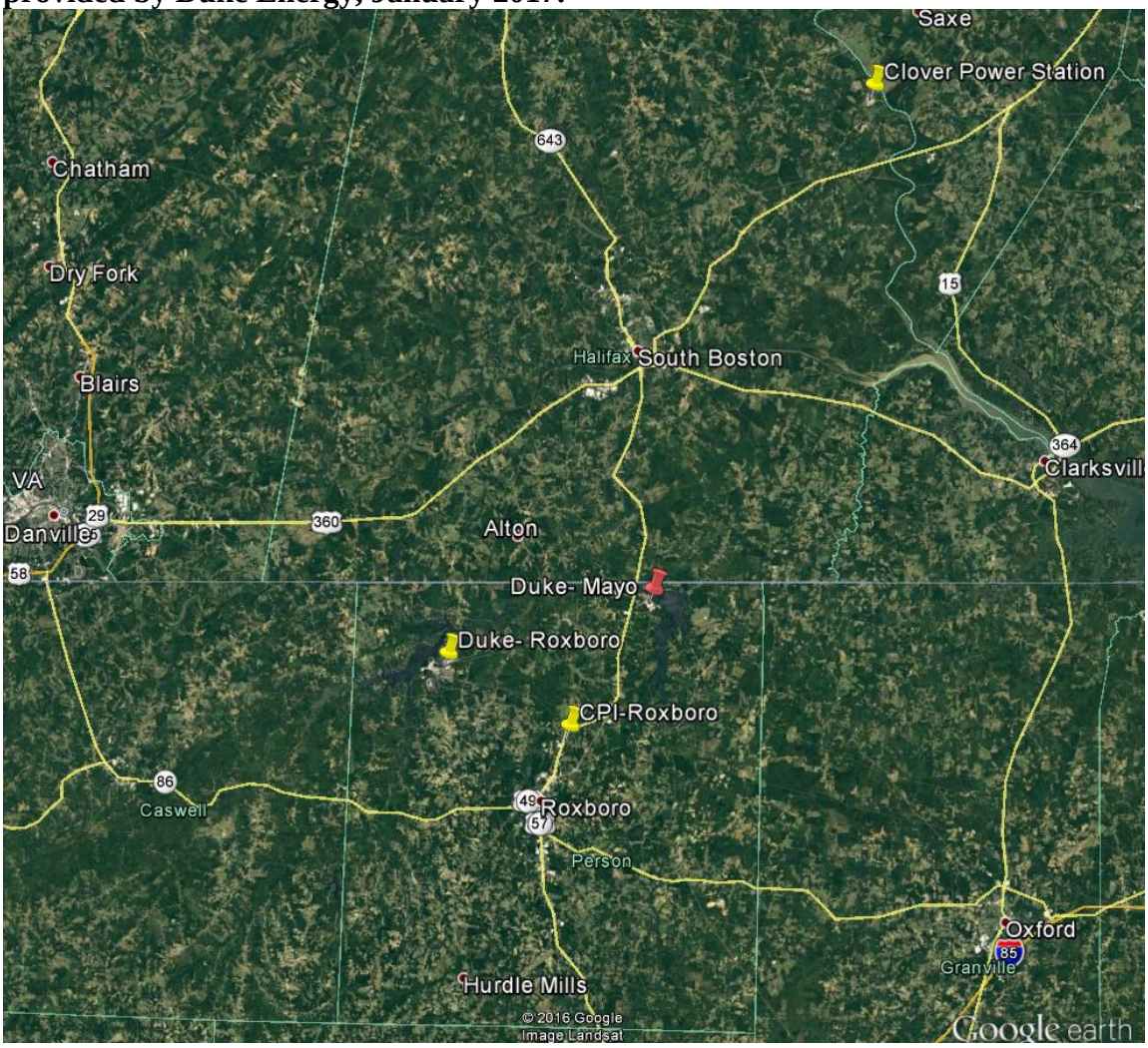


Figure 19. Map of the Person County Area Showing Nearby Sources of the Duke Energy's Mayo Electric Generating Plant. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered one modeling assessment from the State and no assessments from other parties. The table below indicates when this assessment was received, provides an identifier for the assessment, and identifies any distinguishing features of the modeling assessment.

Table 16. Modeling Assessments for the Person County Area

Assessment Submitted by	Date of the Assessment	Identifier Used in this TSD	Distinguishing or Otherwise Key Features
North Carolina	January 13, 2017	Duke-Mayo Modeling Report	

5.2.2. Modeling Analysis Provided by the State

5.2.2.1. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRM: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The State used AERMOD version 15181, which was the most up-to-date version at the time the modeling was performed, using all regulatory default options. AERMOD version 16216r has since become the regulatory model version. There were no updates from 15181 to 16216r that would significantly affect the concentrations predicted here. A discussion of the State's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

The most current approved version of AERMOD, version 16216r, which was published January 17, 2017 (*see* 82 FR 5203), includes updates to the 15181 version as well as bug fixes that were on the previous version 16216. The updates to 15181 include the addition of settings that were previously considered an alternative modeling option. North Carolina used the default regulatory setting of the most current version at the time of modeling (15181), which does not use the alternative modeling options added to version 16216r of AERMOD. Using the older 15181 version of AERMOD with its default regulatory settings, likely produces the same results as the newer 16216r. For this reason, the EPA believes it is appropriate for the State to use the 15181 version of AERMOD.

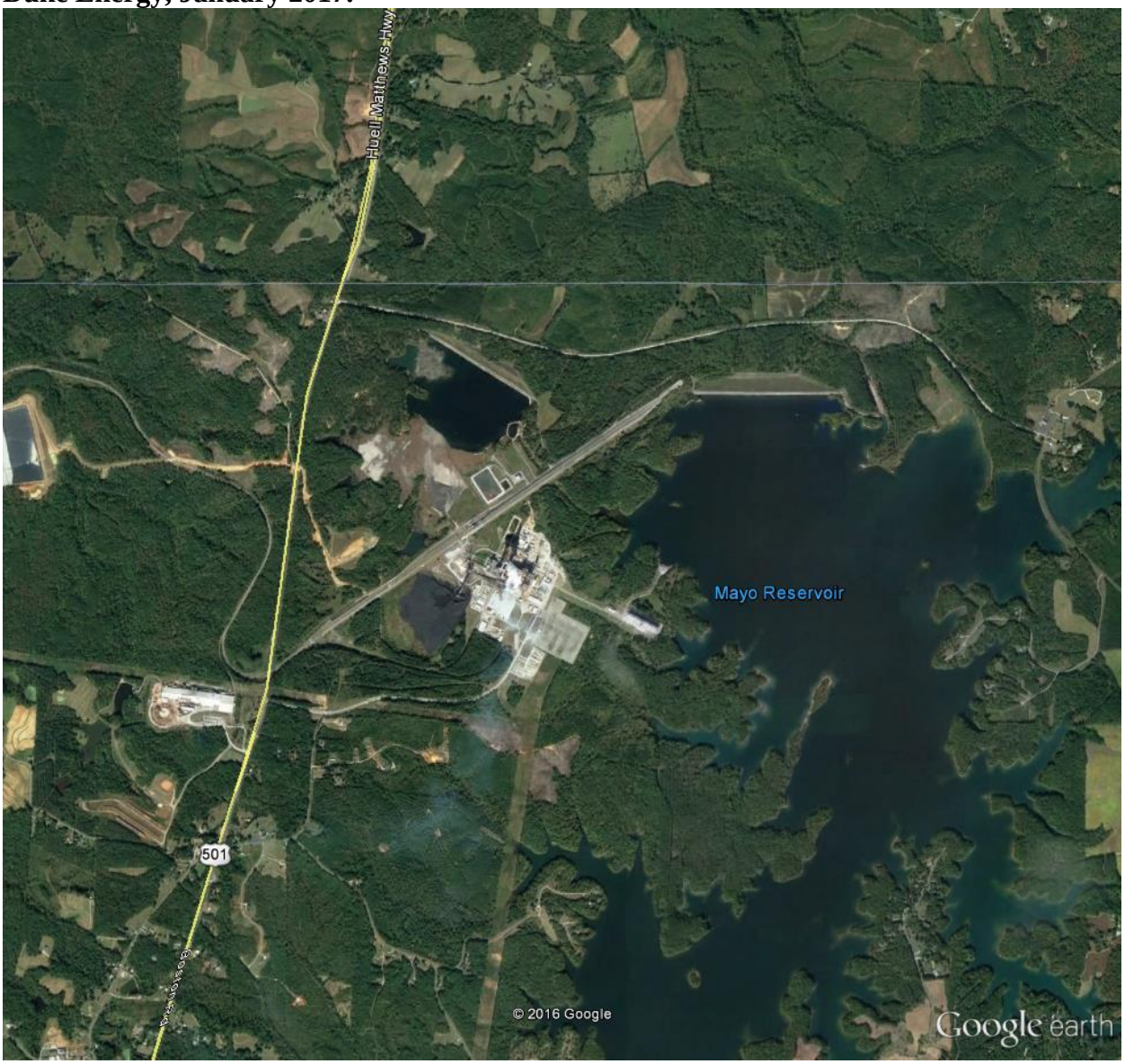
5.2.2.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD

details the procedures used to determine if a source is urban or rural based on land use or population density.

The EPA's recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment within 3 km of the facility. According to the EPA's modeling guidelines, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50 percent of the area within a 3 km radius of the facility is classified as rural. Conversely, if more than 50 percent of the area is urban, urban dispersion coefficients should be used in the modeling analysis. For the purpose of performing the modeling for the area of analysis, the State determined that it was most appropriate to run the model in rural mode. To make the determination of using rural mode the State analyzed land use in the area by looking at recent satellite imagery within a 3 km radius of the facility. As seen in Figure 20, the area surrounding the Duke-Mayo facility is mostly open water, forests and agricultural lands. Based on this information and the imagery provided by the State, the EPA agrees with the determination that the area surrounding the source should be classified as rural.

Figure 20. Map of the Person County Area Showing Aerial View of land Use Surrounding the Duke-Mayo Facility. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



5.2.2.3. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The sources of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Person County area, the State has included two other emitters of SO_2 within 50 km of Duke-Mayo in any direction. The State determined that this was the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. In addition to Duke-Mayo, the other emitters of SO_2 included in the area of analysis are: CPI-Roxboro and Duke-Roxboro. No other sources beyond 50 km were determined by the State to have the potential to cause concentration gradient impacts within the area of analysis.

A Cartesian grid was used for the modeling assessment. The grid extends 10 km in each direction and was centered at the Duke-Mayo facility. The State explained that it chose the 10 km extension because of the Duke-Roxboro facility, which is located 17 km away from the Duke-Mayo facility. The Duke-Roxboro facility falls under the list of DRR sources for North Carolina but the State has chosen to characterize it using monitoring. Due to the ongoing monitoring around that facility, the State explained it chose a receptor grid for the Duke-Mayo facility that does not cover the area surrounding the Duke-Roxboro facility.

The grid receptor spacing for the area of analysis chosen by the State is as follows:

- Receptors along the fence line every 50 m
- Receptors every 100 m out to 3 km
- Receptors every 250 m from 3 km to 5 km
- Receptors every 500 m from 5 km to 10 km

The receptor network contained 7,932 receptors, and the network covered a northeast portion of Person county, North Carolina; a northwest portion of Granville county, North Carolina; and a portion of Halifax County, Virginia.

Figures 21 and 22, included in the State's recommendation, show the State's chosen area of analysis surrounding the Duke-Mayo facility, as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, the State placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to each modeled facility, including other facilities' property with the exceptions of locations described in Section 4.2 of the Modeling TAD as not being feasible locations for placing a monitor. Specifically, no receptors were placed on the Mayo Reservoir, located just east of the facility. The State also did not place receptors in other locations that it considered to not be ambient air relative to each modeled facility and so excluded receptors within the Duke-Mayo facility fence line. The North Carolina Modeling Report provides a figure showing the fence line boundary. However, no information was provided to document that public access to the facility property is prevented by a fence or some other physical barrier. Receptor elevation was included using data from the NED, and utilizing the AERMAP terrain processor of AERMOD.

Figure 21. Area of Analysis for the Person County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.

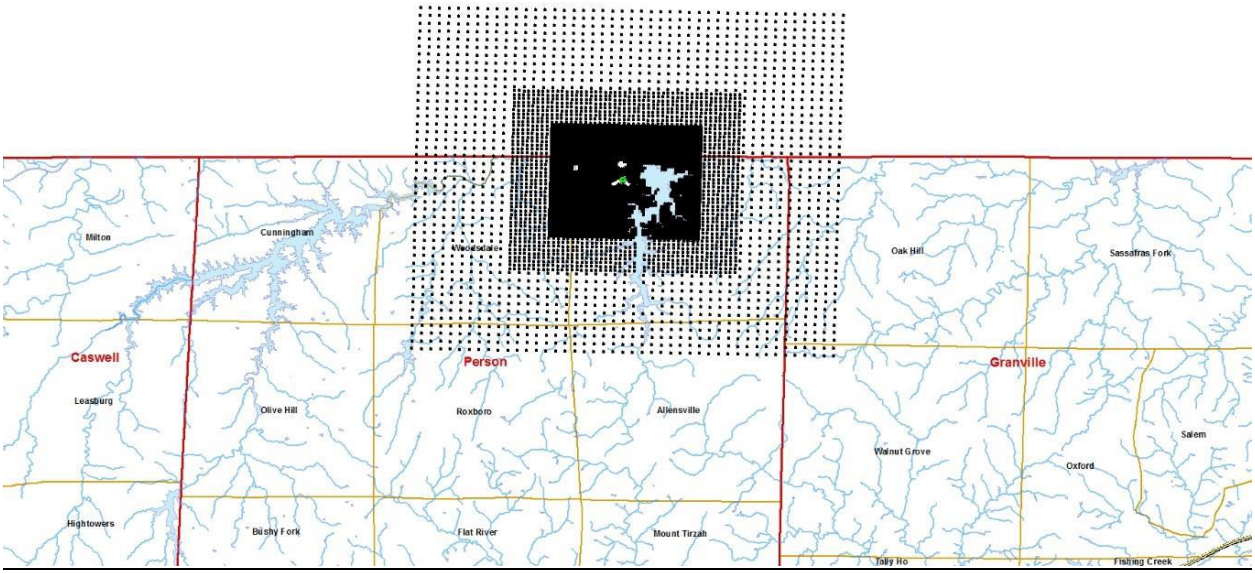
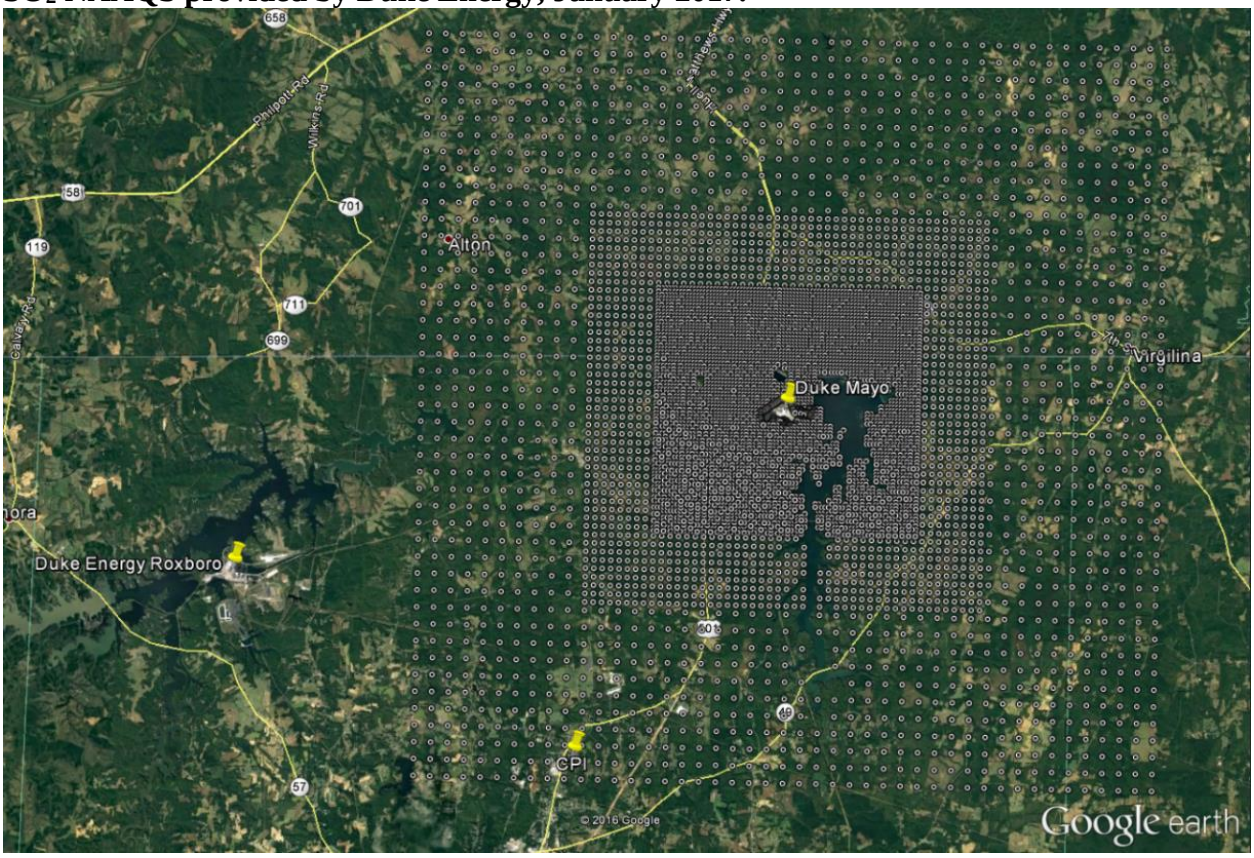


Figure 22. Receptor Grid for the Person County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



Based on the information provided in North Carolina's recommendation, the EPA agrees with excluding the receptors over nearby water bodies as areas not feasible to place a monitor, but not enough information was provided by the state for the EPA to determine whether receptors were properly excluded from the Duke-Mayo facility property on the basis of it not representing ambient air for the purposes of SO_2 designations modeling. However, the EPA agrees that the receptor grid selected by the state adequately captures maximum concentrations due to the fact that the maximum modeled concentration occurs approximately 1.0 km northeast of the source (as shown in Figure 25a), and approximately 700 m beyond the facility fence line or property boundary. Therefore, the EPA believes that North Carolina's receptor grid is appropriate for the characterization of the area (that extends 10 km in each direction, centered at the Duke-Mayo facility) around the Duke-Mayo facility, considering the impact of SO_2 from the modeled facilities.

Although a modeling assessment for the area (that extends 10 km in each direction, centered at the Duke-Mayo facility) was provided by the State, not enough information is available for the EPA to determine if the area is contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS. The modeling provided is showing no violations of the NAAQS in the area surrounding the Duke-Mayo and the CPI facilities (located in Holloway and Roxboro Townships, respectively), but because the modeling domain does not capture the area surrounding the Duke-Roxboro facility, not enough information is available to determine if these

are contributing or not contributing to ambient air quality in a nearby area that may not meet the NAAQS, specifically in Cunningham Township.

5.2.2.4. Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions or following GEP policy with allowable emissions.

Duke-Mayo operates two coal fired boilers. These coal fired boilers vent to individual stacks. As recommended in the SO_2 modeling TAD, the actual hourly emissions data, including exit velocities and temperatures, were used in the modeling. The hourly SO_2 emissions measured by the CEMS located on each of the boiler stacks was used in the modeling analysis.

Most other emitting sources at Duke-Mayo are associated with coal and ash handling, conveying, and transport and do not emit SO_2. Duke-Mayo also operates an emergency generator and an emergency quench pump which operate infrequently, combust ULSD, and emit small quantities of SO_2. According to Section 5.4 of the Modeling TAD, the EPA states that it is most appropriate to include sources of emissions which operate continuously or frequent enough to contribute to the annual distribution of the daily maximum concentrations. Annual emissions of SO_2 from each of these sources is less than 0.2 pound per year, with maximum the hourly emission rates less than 0.02 lbs/hr. Thus, these intermittent sources operate at neither a frequency or magnitude great enough to contribute to the annual distribution of the daily maximum concentrations, and therefore, were not included in the analysis and the EPA concurs with this determination.

As described in section 5.2.1, North Carolina included two additional sources in their modeling for the Duke-Mayo facility area. According to the Duke-Mayo modeling report, all other SO_2 emitters within 50 km, with emissions of 100 tpy or more (based on information from the 2014 emissions inventory provided by NCDAQ) were considered for potential inclusion in the modeling. In order to determine nearby sources to be considered in the modeling analysis, North Carolina evaluated NCDAQ's emissions inventory for the 2013-2015 time period to identify those sources within 50 km of the Duke-Mayo facility that emit 100 tpy of SO_2 or more. Within 50 km of the Duke-Mayo facility, the State identified a total of three sources that met the 100 tpy threshold and were considered for the modeling. These sources were: CPI, located 12 km away; Duke-Roxboro, located 17 km away; and the Dominion-Clover Power Station (Dominion-Clover), located 40 km away in Halifax County, Virginia, which is a DRR source for that State.

The State ran two AERMOD modeling assessments to determine if the inclusion of emissions from the Dominion-Clover power station would impact the final results. One assessment was carried out using only the emissions from the Duke-Mayo facility to create a baseline. The results of this modeling assessment were compared to an assessment which included the Mayo facility in addition to emissions from the Duke-Roxboro and CPI facilities. Given that the modeling results only showed a 3 $\mu g/m^3$ increase in the maximum predicted concentrations when adding the CPI and Duke-Roxboro facilities to the modeling assessment, the State determined that the Dominion-Clover facility would have minimal impact due to having lower emissions

than the other two sources and because of its large distance from the Duke-Mayo facility (40 km away). For these reasons, the State decided to exclude the Dominion-Clover facility from their final modeling assessment and the EPA concurs with this assessment.

Although not mentioned in the Duke-Mayo modeling report, the EPA found two additional sources within 50 km of the Duke-Mayo facility that emitted more than 100 tpy: The Owens-Brockway Glass Container Inc., which emitted 156 tons of SO_2 in 2014; and the Domino-Mecklenburg Power Station, which emitted 371 tons of SO_2 in 2014. The State did not provide an explanation of why these sources were excluded but we believe that this exclusion is appropriate because of their relatively low amount of emissions and large distance from the Duke-Mayo facility. The Owens-Brockway facility is located approximately 40 km away, while the Domino-Mecklenburg facility is located approximately 33 km away. The EPA believes that the State has correctly chosen not to include these facilities in their final modeling assessment of the area and any potential impacts from these sources will be accounted for using the monitored background concentration discussed in Section 5.2.2.8

Therefore, in addition to the Duke Mayo facility, the modeling analysis included two nearby sources including CPI and Duke-Roxboro. No other sources within 50 km were included in the modeling assessment. All the other nearby sources that were not included in the modeling analysis, were accounted for in the background concentrations as discussed in Section 5.2.2.8.

The State characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the State used actual stack heights in conjunction with actual emissions. The State also adequately characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash.

The EPA agrees that North Carolina has appropriately characterized the area surrounding the Duke-Mayo facility. Given the criteria for selecting nearby sources, we believe that the decision to include two additional sources, CPI and Duke-Roxboro, and excluding all other sources from the modeling analysis was correct. Also, the State has appropriately used the actual emissions and stack heights for both facilities and correctly accounted for the building downwash using BPIPPRM for AERMOD. Nevertheless, not enough information is available for the EPA to determine if the Duke-Mayo or CPI facilities are contributing or not contributing to ambient air quality in a nearby area that does not meet the 2010 SO_2 NAAQS due to the fact that the modeling domain does not capture the area surrounding the Duke-Roxboro facility.

5.2.2.5. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective. The EPA believes that CEMS data provide acceptable historical emissions information, when they are available. These data are available for many electric generating units. In the absence of

CEMS data, the EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, the EPA recommends using detailed throughput, operating schedules, and emissions information from the impacted source (s).

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. For example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the State included Duke-Mayo and two other emitters of SO_2 within 50 km in the area of analysis. The State has chosen to model these facilities using actual emissions. The facilities in the State's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For Duke-Mayo, Duke-Roxboro, and CPI facilities, the State provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 18. A description of how the State obtained hourly emission rates is given below this table.

Table 17. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the Person County Area

	SO_2 **Emissions (tpy)**		
Facility Name	**2013**	**2014**	**2015**
Duke-Mayo	4,570	3,491	2,484
Duke-Roxboro	12,643	15,648	10,544
CPI-Roxboro	1,458	1,660	2,006
Total Emissions from All Modeled Facilities in the State's Area of Analysis	18,671	20,798	15,034

For the Duke-Mayo, the Duke-Roxboro and the CPI facilities, the actual hourly emissions data were obtained from the CEMS located within these facilities. Emissions from Duke Mayo in 2016 were 2,737 tons which is slightly higher than 2015 emissions but lower than 2013 and 2014 emissions. In 2016, emissions from CPI Roxboro increased to 2,315 tons from 2,006 tons. Therefore, the 2013-15 period is sufficient for use in this modeling analysis.

Given the data provided by the State, the EPA agrees that the emissions data used for modeling was appropriate, complies with the EPA's Modeling TAD, and is representative of actual emissions in the area.

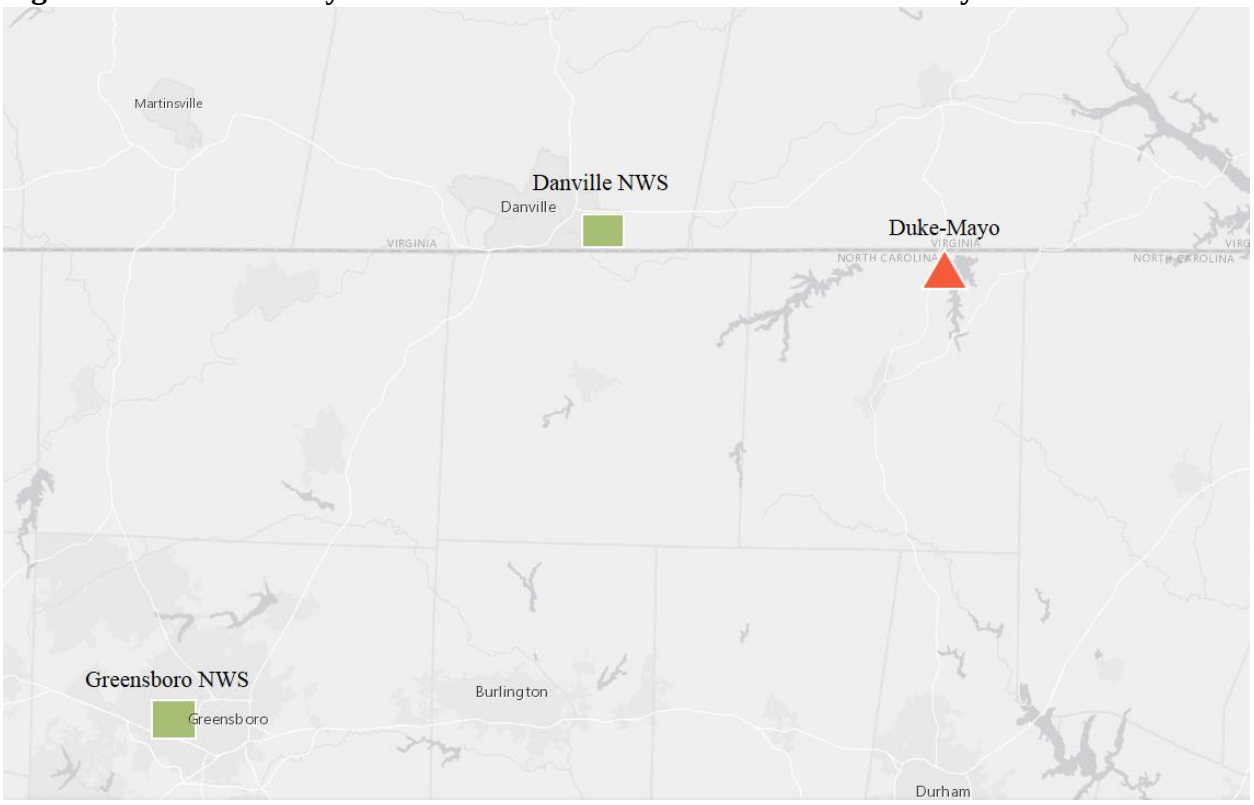
5.2.2.6. Modeling Parameter: Meteorology and Surface Characteristics

As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include NWS stations, site-specific or onsite data, and other sources such as universities, FAA, and military stations.

For the area of analysis for the Person County area, meteorological data from several surrounding sites were considered and the State selected the surface meteorology for the same time period of 2013 to 2015 from the NWS station in the Danville Regional Airport (KDAN) in Danville, VA. The station is located at 36.57 N, 79.34 W, approximately 40 km west of the Duke-Mayo facility. Upper air observations were obtained from a different NWS station, located in Greensboro, North Carolina, at 36.1 N, 79.94 Was best representative of meteorological conditions within the area of analysis.

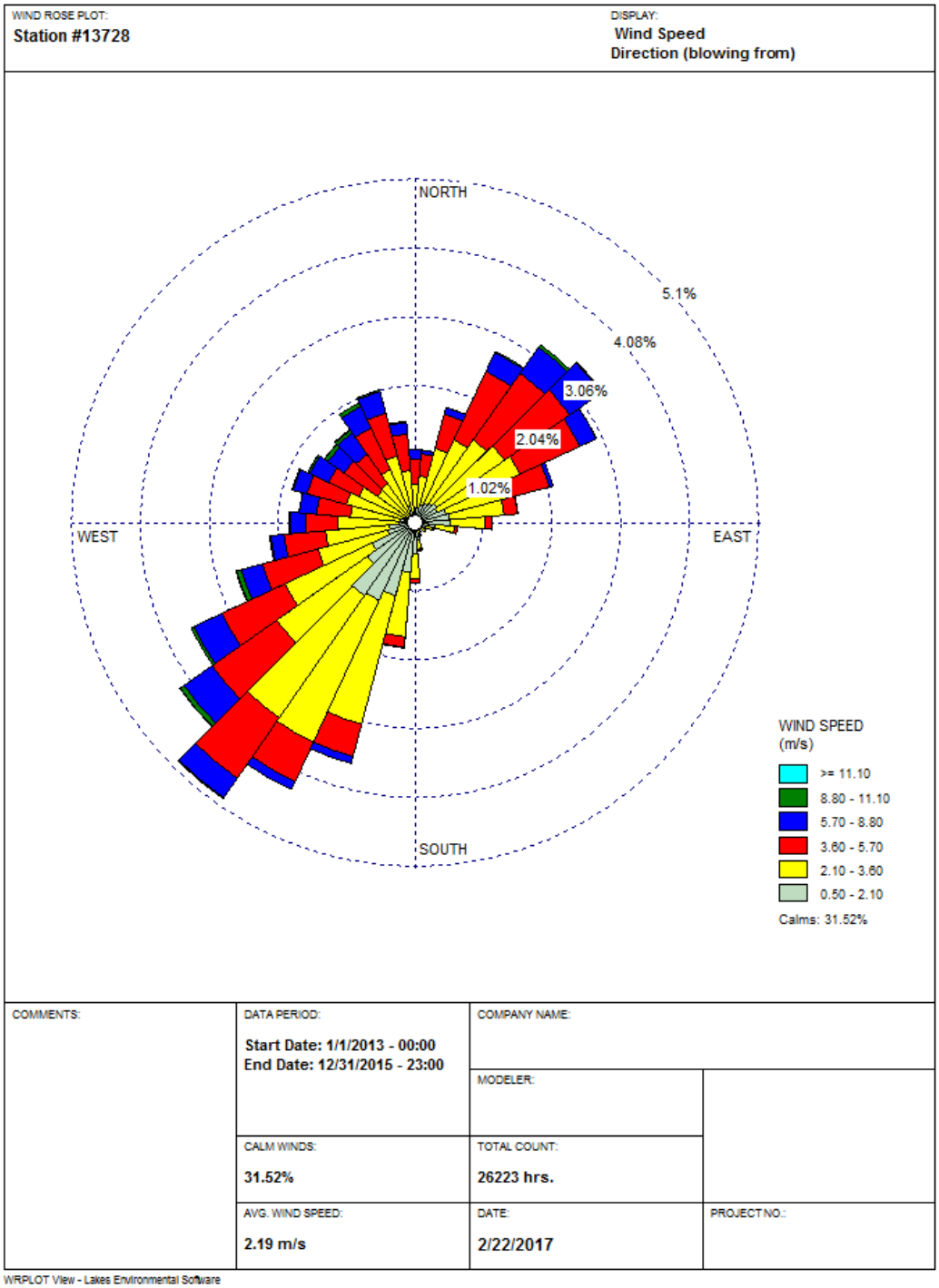
The State used AERSURFACE version 13016 using data from the KDAN NWS station to estimate the surface characteristics (albedo, Bowen ratio, and surface roughness [z_o]) of the area of analysis. Albedo is the fraction of solar energy reflected from the earth back into space, the Bowen ratio is the method generally used to calculate heat lost or heat gained in a substance, and the surface roughness is sometimes referred to as "zo" The state estimated surface roughness values for 12 spatial sectors out to 1 km at a seasonal temporal resolution for average conditions. In the figure below, generated by the EPA, the location of these NWS stations is shown relative to the area of analysis.

Figure 23. Area of Analysis and the NWS stations in the Person County Area



The EPA generated wind rose plots with "WRPLOTS View" utility program using NOAA's National Climatic Data Center for the KDAN NWS site. In Figure 24, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. Analysis of the NWS data indicate winds blow predominantly from the southwest.

Figure 24. Person County Cumulative Annual Wind Rose for Years 2013 – 2015



Meteorological data from the above surface and upper air NWS stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The State followed the methodology and settings presented in the EPA's AIG in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1-minute duration was provided from the KDAN NWS station, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates.

Differences in surface characteristics at the meteorological observation site and the application site were reviewed and compared to evaluate representativeness. The seasonal albedo and Bowen ratio values are similar, and therefore, not expected to bias model concentration estimates. The seasonal, sector averaged surface roughness of the airport site are similar to the project/facility location. The lower surface roughness values at the airport are expected to introduce a degree of conservatism to modeled concentrations predicted under stable atmospheric conditions when the highest 1-hour SO_2 concentrations are expected.

An additional consideration supporting the representativeness of the selected meteorological site is the fact that the prevailing winds in this area are from the south/southwest where the surface roughness values at the airport and facility locations are very similar. Modeled design concentrations and upper distribution of the estimated concentrations were found to coincide with the prevailing wind directions, directions where the surface roughness values were determined to be very similar.

After review, the EPA agrees with the meteorological and surface data that the State used for the modeling of the Person County area in regards to the Duke-Mayo facility. The data used properly represents meteorological conditions in the area and allows for the proper simulation of SO_2 emissions from the Duke-Mayo facility and nearby sources. The State used appropriate site specific data from a nearby NWS station.

5.2.2.7. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as gently rolling and bounded by the Mayo Reservoir to the east. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database.

The State's final modeling report does not offer any information on the topography or geography of the area, but based upon an evaluation of USGS topography maps of the area, the EPA believes that the area has no complex terrain. The EPA agrees with the State's use of the USGS NED database and AERMAP terrain processor (version 11130) for AERMOD to account for the slight changes in elevation of the area to obtain a more accurate modeling result.

5.2.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, the State elected to use a "tier 1" approach. Data was obtained from the EPA's AQS for the 2013-2015 time period from a monitor in Durham, North Carolina (AQS Site: 37-063-0015), located approximately 55 km south of the Duke-Mayo facility. The single value of the background concentration for this area of analysis was determined by the State to be 21 $\mu g/m^3$, equivalent to 8 ppb when expressed in 2 significant figures, and that value was incorporated into the final AERMOD results.

The EPA agrees that North Carolina has appropriately chosen the background concentration in accordance with the Modeling TAD. The State has chosen a monitor that is the closest to the modeled source and is adequate for modeling purposes, with enough data available during the chosen time period. We believe that the chosen background monitored concentration is representative of the area and accounts for impacts from nearby sources not explicitly included in the modeling. The emissions from point sources near Person County that were not explicitly modeled are similar to the point sources located near the Durham monitor. Additionally, the Durham monitor is located in an urbanized area so is impacted by a larger amount of nonpoint SO_2 emissions sources.

5.2.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Person County area of analysis are summarized below in Table 18.

Table 18. Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Person County Area

Input Parameter	Value
AERMOD Version	15181 (Default Setting)
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	6
Modeled Structures	84
Modeled Fencelines	1
Total receptors	7,932
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Danville Regional Airport Danville, VA
NWS Station Upper Air Meteorology	Greensboro, NC
NWS Station for Calculating Surface Characteristics	Danville Regional Airport Danville, VA
Methodology for Calculating Background SO_2 Concentration	Tier 1 approach (AQS site: 37-063-0015) for 2013 – 2015
Calculated Background SO_2 Concentration	21 $\mu g/m^3$

The results presented below in Table19 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

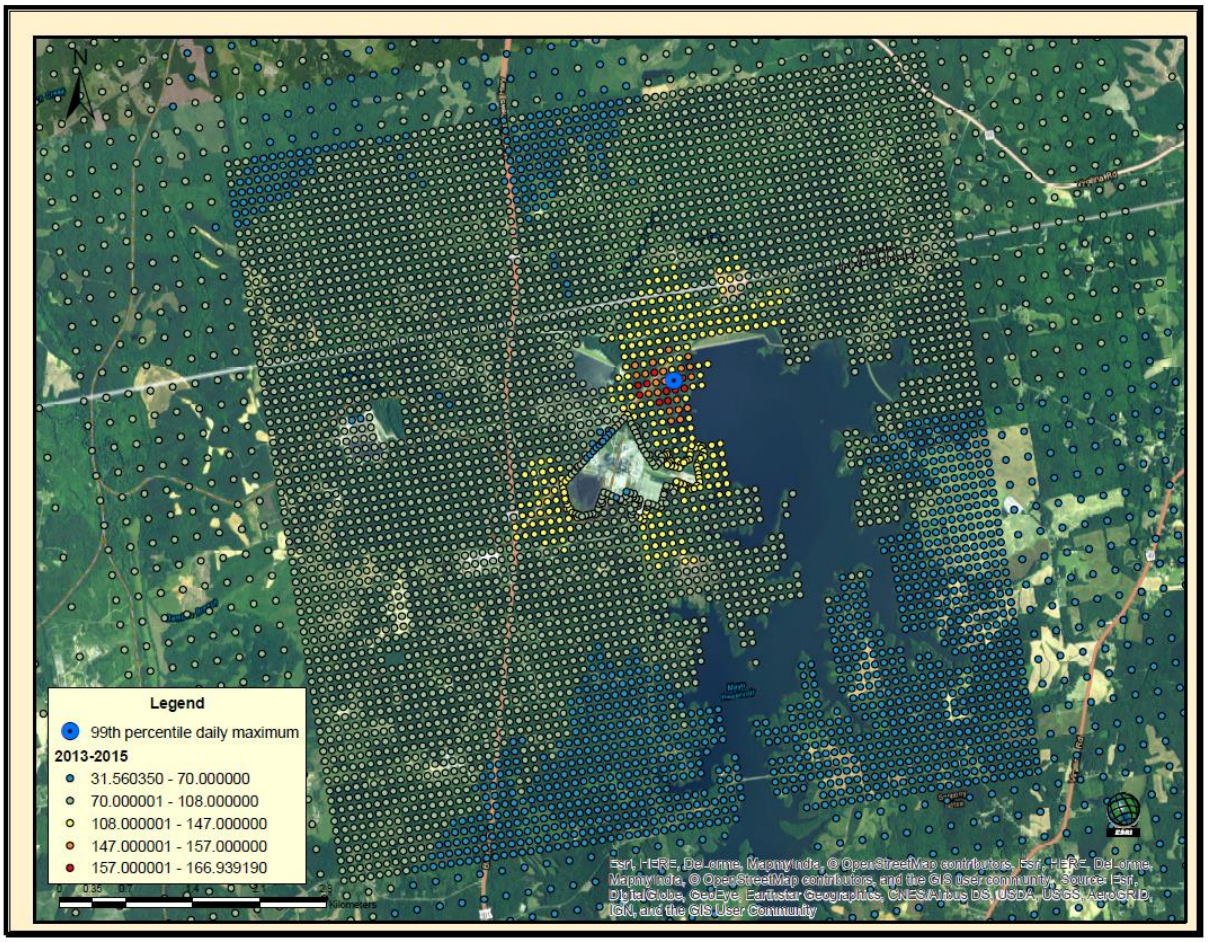
Table 19. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Person County Area

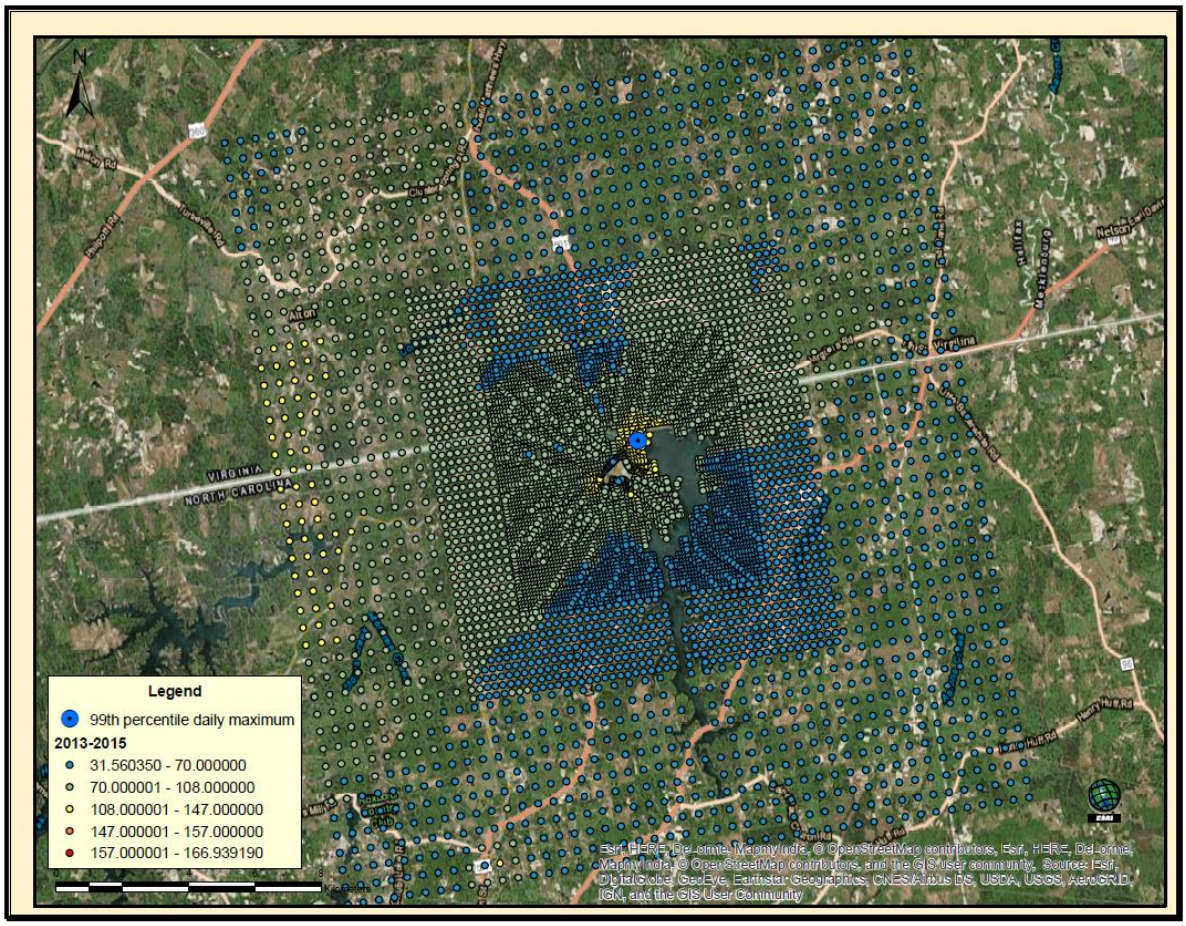
Averaging Period	Data Period	Receptor Location [UTM zone 17]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM Easting (m)	UTM Northing (m)	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-2015	689500	4045300	188	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

The State's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 188 $\mu g/m^3$ (167 $\mu g/m^3$ from the modeled design value, plus 21 $\mu g/m^3$ of background concentration), which is equivalent to 71.8 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities previously mentioned. Figures 25a and 25b below were generated by the EPA using the model output files provided by North Carolina., Figure 25a shows that the predicted value occurred approximately 1 km northeast of the Duke-Mayo facility and approximately 0.7 km outside the facility's fence line.

Figures 25a and 25b: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Person County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.





The modeling submitted by the State does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration.

5.2.2.10. The EPA's Assessment of the Modeling Information Provided by the State

The EPA agrees that North Carolina has appropriately characterized the area surrounding the Duke-Mayo facility. Given the criteria for selecting nearby sources, we believe that the decision to include two additional sources, CPI and Duke-Roxboro, and excluding all other sources from the modeling analysis was correct. Actual emissions from the 2013-2015 period were used in the analysis which provides for an appropriate assessment of SO_2 concentrations in the area. All other nearby sources not included in the modeling were accounted for in the background concentrations used in the modeling. With regards to the background concentrations, the State chose the nearest monitor with valid data for the 2013-2015 time period. The EPA agrees with the monitor chosen for background concentrations. The EPA also agrees that the surface and upper air meteorological data used in this analysis is appropriate for performing a valid modeling assessment.

The EPA has determined that the overall modeling analysis for Duke Mayo and the two nearby facilities was performed in a manner mostly consistent with the SO_2 Modeling TAD for the area included in the modeling grid. However, not enough information is available for the EPA to determine if the Duke-Mayo or CPI facilities are contributing or not contributing to ambient air quality in a nearby area that does not meet the 2010 SO_2 NAAQS due to the fact that the modeling domain does not capture the area surrounding the Duke-Roxboro facility.

5.3. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Person County Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

5.4. Jurisdictional Boundaries in the Person County Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for city/county/parish. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

The Duke-Mayo facility is located in the northern part of the Person County, North Carolina. The Person County is bounded by the Caswell County to the west, the Granville County to the east, and the Orange and Durham counties to the south. The Person County is also bounded to the north by the Virginia state border, which is approximately 1.6 km from the Duke-Mayo facility. This modeling domain included Halifax County in Virginia. The Dominion-Clover Power Station in Halifax County is located 40 km from Duke-Mayo and is a DRR source for that state. North Carolina performed two modeling assessments to determine if the inclusion of emissions from the Dominion-Clover power station would impact the final results. One assessment was carried out using only the emissions from the Duke-Mayo facility to create a baseline. The results of this modeling assessment were compared to an assessment which included the Mayo facility in addition to emissions from the Duke-Roxboro and CPI facilities. Given that the modeling results only showed a 3 $\mu g/m^3$ increase in the maximum predicted concentrations when adding the CPI and Duke-Roxboro facilities to the modeling assessment, the State determined that the Dominion-Clover facility would have minimal impact due to having lower emissions than the other two sources and because of its large distance from the Duke-Mayo facility (40 km away). For these reasons, the State decided to exclude the Dominion-Clover facility from their final modeling assessment and the EPA concurs with this assessment.

In its January 2017 recommendation letter, the State recommended the area surrounding the Duke-Mayo facility, specifically the townships bounded by the modeling domain, identified in Table 15 in Section 5.2.1, be designated as attainment based in part on an assessment and characterization of air quality impacts from the Duke-Mayo and two nearby sources, Duke-Roxboro in Cunningham Township and CPI-Roxboro in Roxboro Township (see Table 18). North Carolina chose to characterize the Duke-Roxboro DRR source in Cunningham Township, through a new air quality monitor and therefore the area will be designated by December 31, 2020. Duke-Roxboro is located approximately 17 km southwest of the Duke-Mayo facility. The EPA considered all the information available to determine the correct boundaries for the designation. More detail is given about the intended designation for the Person County in section 5.7 of this documents.

5.5. Other Information Relevant to the Designations for the Person County Area

No other relevant information is available for the Person County area.

5.6. The EPA's Assessment of the Available Information for the Person County Area

After evaluating the data from the modeling report for the Duke-Mayo facility, the EPA intends to modify the State's recommendation and designate a portion of Person County, based on townships, unclassifiable for the 2010 1-hour SO_2 NAAQS because, information is unavailable to determine if these townships contribute or do not contribute to ambient air quality in a nearby area that may not meet the NAAQS, in particular the area around Duke-Roxboro in Cunningham Township. In its submission, North Carolina recommended attainment for the Person County area, bounded by all townships within the modeling domain (Woodsdale, Holloway, Roxboro, Allensville in Person County and Oak Hill and Walnut Grove, in Granville County) based in part on an assessment and characterization of air quality impacts from the Duke-Mayo, two nearby sources, Duke-Roxboro and CPI-Roxboro, and background concentration data from a nearby monitor in Durham, North Carolina (AQS Site: 37-063-0015). The State's modeling results indicated that the maximum impact from the Duke-Mayo facility, including these nearby sources and background concentrations, resulted in a maximum 1-hour average of 71.8 ppb, which demonstrates compliance with the 75 ppb 2010 SO_2 NAAQS in the modeled area.

North Carolina chose to characterize the Duke-Roxboro DRR source in Cunningham Township, through a new air quality monitor and therefore the area will be designated by December 31, 2020. Duke-Roxboro is located approximately 17 km southwest of the Duke-Mayo facility. Maximum impact from the Duke-Mayo facility, including nearby sources and background concentrations, did not show a violation of the 2010 SO_2 NAAQS in the modeled area's receptor grid. Although the Duke-Mayo modeling included 2013-2015 actual emissions from the Duke-Roxboro facility and the nearby CPI-Roxboro facility in Roxboro Township, information is unavailable to determine if sources in the modeled area contribute or do not contribute to ambient air quality in a nearby area that may not meet the SO_2 NAAQS, in particular the area surrounding the Duke-Roxboro facility. The modeling did not include such information, as no modeling receptors were placed in the area surrounding the Duke-Roxboro facility. The remaining townships in the Duke-Mayo modeling domain include Allensville in Person County and Oak Hill and Walnut Grove in Granville County. The EPA notes that no SO_2 sources were identified in these townships. Therefore, the EPA believes these townships do not contribute to the area around Duke-Roxboro in Cunningham Township because of low-level SO_2 emissions and distance to Duke-Roxboro. The EPA also notes the remaining townships in Person and Granville Counties are addressed in Section 8 for remaining areas in North Carolina. If additional information is provided to the EPA that demonstrates if sources in Roxboro, Woodsdale, and Holloway Townships in Person County contribute or do not contribute to potential violations of the 2010 SO_2 NAAQS in the area surrounding the Duke-Roxboro facility in the Cunningham Township, the EPA may consider modifying its intended designation.

After careful evaluations, the EPA is modifying the State's recommendation and intends to designate the two townships in the State's recommendation containing the Duke-Mayo and the CPI facilities (Holloway and Roxboro Townships), and Woodsdale Township, as unclassifiable for the 2010 1-hour SO_2 NAAQS. The remaining townships included in North Carolina's recommendation for the Duke-Mayo facility modeled domain, the EPA intends to designate them unclassifiable/attainment for the 2010 1-hour SO_2 because the EPA believes these areas do not contribute to the area surrounding the Duke-Roxboro area in Cunningham Township. The EPA believes that our intended unclassifiable and unclassifiable/attainment townships for partial Person and Granville Counties bounded by the townships in table 21 below, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable area. For other designations based on townships, please refer to the other sections of this document.

5.7. Summary of Our Intended Designation for the Person County Area

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to modify the State's recommendation and designate a portion of Person County, based on the Duke-Mayo modeling domain, bounded by Holloway, Woodsdale and Roxboro Townships, as unclassifiable for the 2010 SO_2 NAAQS because, information is unavailable to determine if these townships contribute or do not contribute to ambient air quality in a nearby area that may not meet the NAAQS, in particular the area around Duke-Roxboro in Cunningham Township. North Carolina's modeling results indicated that the maximum impact from the Duke-Mayo facility, including nearby sources and

background concentrations, resulted in a maximum 1-hour average of 71.8 ppb, which demonstrates compliance with the 75 ppb 2010 SO_2 NAAQS in the modeled area. The EPA intends to designate the remaining townships included in North Carolina's modeling domain for the Duke-Mayo facility, Allensville (Person County) and Oak Hill and Walnut Grove (in Granville County) unclassifiable/attainment for the 2010 1-hour SO_2 NAAQS. See Tables 20 and 21 below. Figure 26 shows the boundary of this intended designated area. At this time, our intended designations for the State only apply to this area and the other areas presented in this technical support document. The EPA intends in a separate action to evaluate and designate all remaining undesignated areas in North Carolina by December 31, 2020.

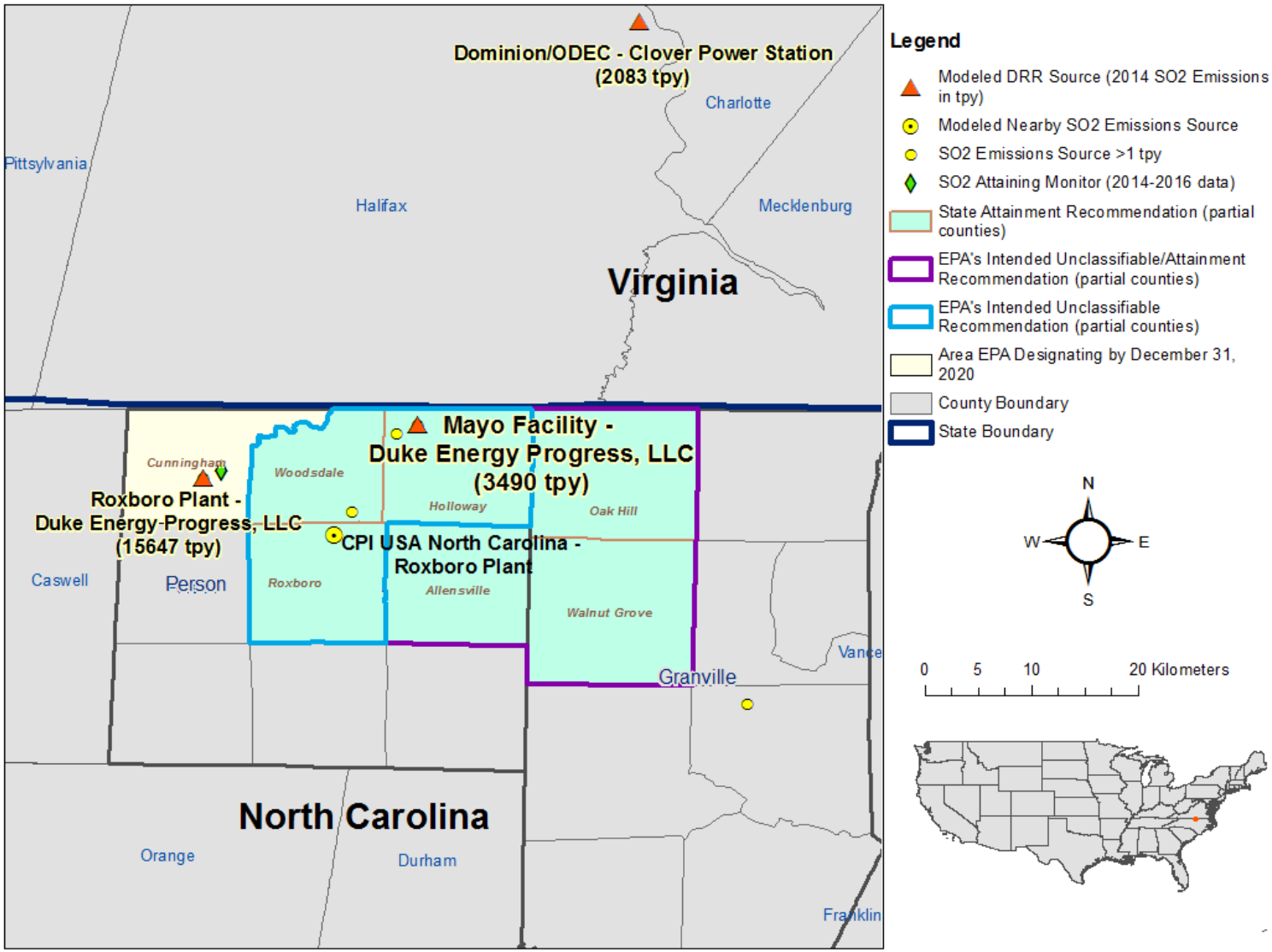
Table 20. EPA's Intended Unclassifiable Area regarding the Duke-Mayo Facility Modeling Domain.

Township	County	North Carolina's Recommended Designation	EPA's Intended Designation
Holloway	Person (p)	Attainment	Unclassifiable
Roxboro		Attainment	Unclassifiable
Woodsdale		Attainment	Unclassifiable

Table 21. EPA's Intended Unclassifiable/Attainment Area regarding the Duke-Mayo Facility Modeling Domain.

Township	County	North Carolina's Recommended Designation	EPA's Intended Designation
Allensville	Person (p)	Attainment	Unclassifiable / Attainment
Oak Hill	Granville	Attainment	Unclassifiable / Attainment
Walnut Grove		Attainment	Unclassifiable / Attainment

Figure 26. Boundary of the EPA's Intended Unclassifiable Area in Person County.



6. Technical Analysis for the Gaston County Area

6.1. Introduction

The EPA must designate the Gaston County area by December 31, 2017, because the area has not been previously designated and North Carolina has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting the EPA specifications referenced in the EPA's SO_2 DRR for any sources of SO_2 emissions in the state.

6.2. Air Quality Monitoring Data for the Gaston County Area Addressing Duke Energy's Allen Steam Station

This factor considers the SO_2 air quality monitoring data in the area of Gaston County, North Carolina. The State included monitoring data from the following monitor:

- The Garinger High School monitor (AQS 37-119-0041). This monitor is located at 1130 Eastway Drive in Mecklenburg County, and is located approximately 13 miles east northeast of the Duke Allen Steam Station in Gaston County. Data collected by this monitor is comparable to the NAAQS, and indicates that the most recent SO_2 levels are below the 1-hr NAAQS. The most recent three years of complete, quality-assured, certified data from this monitor (2014-2016) indicate a 1-hr SO_2 design value of 5 ppb. However, this monitor was not located to characterize the maximum 1-hr SO_2 concentrations near Allen. North Carolina provided an air quality modeling analysis to characterize the maximum 1-hr SO_2 concentrations in the area (see Section 6.3 below).

In reviewing the available air quality monitoring data in AQS, the EPA determined that other than the data described above, there is no additional relevant data in AQS collected in or near Gaston County that could inform the intended designation action. The most recent SO_2 design values for all areas of the country are available at https://www.epa.gov/air-trends/air-quality-design-values.

6.3. Air Quality Modeling Analysis for the Gaston County Area Addressing Duke Energy's Allen Steam Station

6.3.1. Introduction

This section 6.3 presents all the available air quality modeling information for the Gaston County area that includes Duke Energy's Allen Steam Station, hereinafter referred to as Duke-Allen. (This portion of Gaston County will often be referred to as "the Gaston County area" within this section 6.3.). This area contains the following SO_2 sources around which North Carolina is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tpy:

- The Duke-Allen facility did not emit 2,000 tons or more annually in 2014. Specifically, Duke-Allen emitted 1,718 tons of SO_2 in 2014. North Carolina decided to include it on the DRR source list and elected to characterize it via air quality modeling.

- The Duke Energy-Marshall Steam Station located in Catawba County emitted 2,000 tons or more annually. Specifically, Duke-Marshall emitted 5,917 tons of SO_2 in 2014 and is a DRR source. Because Duke Marshall's emissions can potentially impact the area near the Duke Allen Steam Station, Duke Marshall was included in the modeling for the Allen Steam Station.

Because we have available results of air quality modeling in which these sources are modeled together, the area around this group of sources is being addressed in this section with consideration given to the impacts of all these sources.

In its submission, North Carolina recommended that the area surrounding the Duke-Allen facility, specifically the townships bounded by the modeling domain, which includes those townships identified in Table 22, be designated as attainment based on a modeling assessment and characterization of air quality impacts from these facilities and nearby sources. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions for the period of 2013 to 2015 from both facilities. After careful review of the State's assessment, supporting documentation, and all available data, the EPA believes that the provided air quality impact modeling is acceptable to characterize the area, agrees with the State's recommendation for the area and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all information is presented.

Table 22. North Carolina's Townships Bounded by the Duke-Allen Facility Modeling Domain.

Township	County of Township	North Carolina's Recommended Designation	The EPA's Intended Designation
Icard	Burke (p)	Attainment	Unclassifiable/Attainment
Lower Fork		Attainment	Unclassifiable/Attainment
Harrisburg	Cabarrus (p)	Attainment	Unclassifiable/Attainment
Poplar Tent		Attainment	Unclassifiable/Attainment
Odell		Attainment	Unclassifiable/Attainment
Kannapolis		Attainment	Unclassifiable/Attainment
New Gilead		Attainment	Unclassifiable/Attainment
Rimertown		Attainment	Unclassifiable/Attainment
Mount Pleasant		Attainment	Unclassifiable/Attainment
Georgeville		Attainment	Unclassifiable/Attainment
Midland		Attainment	Unclassifiable/Attainment
Central Cabarrus		Attainment	Unclassifiable/Attainment
Concord		Attainment	Unclassifiable/Attainment
Bandy's	Catawba (p)	Attainment	Unclassifiable/Attainment
Caldwell		Attainment	Unclassifiable/Attainment

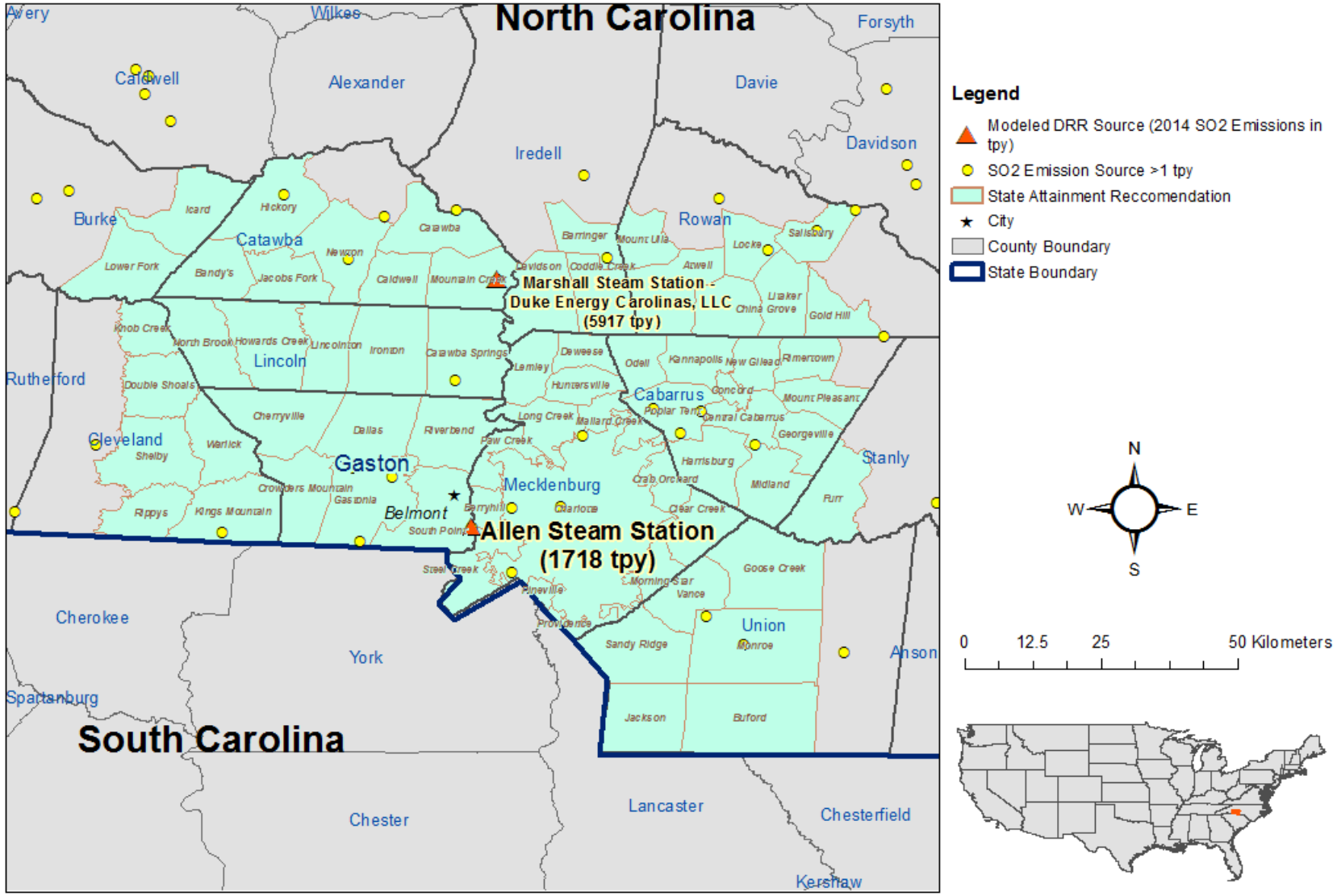
Township	County of Township	North Carolina's Recommended Designation	The EPA's Intended Designation
Catawba		Attainment	Unclassifiable/Attainment
Hickory		Attainment	Unclassifiable/Attainment
Jacobs Fork		Attainment	Unclassifiable/Attainment
Mountain Creek		Attainment	Unclassifiable/Attainment
Newton		Attainment	Unclassifiable/Attainment
Cleveland	Cleveland(p)	Attainment	Unclassifiable/Attainment
Double Shoals		Attainment	Unclassifiable/Attainment
Kings Mountain		Attainment	Unclassifiable/Attainment
Knob Creek		Attainment	Unclassifiable/Attainment
Rippys		Attainment	Unclassifiable/Attainment
Shelby		Attainment	Unclassifiable/Attainment
Warlick		Attainment	Unclassifiable/Attainment
Cherryville	Gaston	Attainment	Unclassifiable/Attainment
Crowders Mountain		Attainment	Unclassifiable/Attainment
Dallas		Attainment	Unclassifiable/Attainment
Gastonia		Attainment	Unclassifiable/Attainment
Riverbend		Attainment	Unclassifiable/Attainment
South Point		Attainment	Unclassifiable/Attainment
Barringer	Iredell (p)	Attainment	Unclassifiable/Attainment
Coddle Creek		Attainment	Unclassifiable/Attainment
Davidson		Attainment	Unclassifiable/Attainment
Catawba Springs	Lincoln	Attainment	Unclassifiable/Attainment
Howards Creek		Attainment	Unclassifiable/Attainment
Ironton		Attainment	Unclassifiable/Attainment
Lincolnton		Attainment	Unclassifiable/Attainment
North Brook		Attainment	Unclassifiable/Attainment
Charlotte	Mecklenburg	Attainment	Unclassifiable/Attainment
Berryhill		Attainment	Unclassifiable/Attainment
Steele Creek		Attainment	Unclassifiable/Attainment
Providence		Attainment	Unclassifiable/Attainment
Clear Creek		Attainment	Unclassifiable/Attainment
Crab Orchard		Attainment	Unclassifiable/Attainment
Mallard Creek		Attainment	Unclassifiable/Attainment
Deweese		Attainment	Unclassifiable/Attainment
Lemley		Attainment	Unclassifiable/Attainment
Long Creek		Attainment	Unclassifiable/Attainment
Paw Creek		Attainment	Unclassifiable/Attainment
Morning Star		Attainment	Unclassifiable/Attainment
Pineville		Attainment	Unclassifiable/Attainment
Huntersville		Attainment	Unclassifiable/Attainment
Atwell	Rowan (p)	Attainment	Unclassifiable/Attainment
China Grove		Attainment	Unclassifiable/Attainment

Township	County of Township	North Carolina's Recommended Designation	The EPA's Intended Designation
Gold Hill		Attainment	Unclassifiable/Attainment
Litaker		Attainment	Unclassifiable/Attainment
Locke		Attainment	Unclassifiable/Attainment
Mount Ulla		Attainment	Unclassifiable/Attainment
Salisbury		Attainment	Unclassifiable/Attainment
Furr	Stanly (p)	Attainment	Unclassifiable/Attainment
Buford	Union (p)	Attainment	Unclassifiable/Attainment
Goose Creek		Attainment	Unclassifiable/Attainment
Jackson		Attainment	Unclassifiable/Attainment
Monroe		Attainment	Unclassifiable/Attainment
Sandy Ridge		Attainment	Unclassifiable/Attainment
Vance		Attainment	Unclassifiable/Attainment

As seen in Figure 27 below, the Duke-Allen facility is located on Lake Wylie Reservoir near the town of Belmont, Gaston County, North Carolina. Also included in the figure is the State's recommended boundary for the attainment designation. Also included in Figure 27 are other nearby emitters of SO_2 in the surrounding area of the Duke-Allen facility.[21] After evaluating these nearby sources, the State included only one other source of SO_2 Duke-Marshall in the modeling analysis of the Duke-Allen facility. The Duke-Marshall facility, also a DRR source is located approximately 45 km away from the Duke-Allen facility. There are no other SO_2 sources within 50 km of Duke-Allen facility that were determined by the State to potentially have an impact on the modeled concentrations. The EPA's intended unclassifiable/attainment designation boundary for the Gaston County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

[21] All other SO_2 emitters within a 10 km and 50 km radius were considered.

Figure 27. Map of the Gaston County Area Addressing Allen Steam Station



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered one modeling assessment from the State and no assessments from other parties. The table below indicates when this assessment was received, provides an identifier for the assessment, and identifies any distinguishing features of the modeling assessment.

Table 23. Modeling Assessments for the Gaston County Area

Assessment Submitted by	Date of the Assessment	Identifier Used in this TSD	Distinguishing or Otherwise Key Features
North Carolina	January 13, 2017	Duke-Allen Modeling Report	

6.3.2. Modeling Analysis Provided by the State

6.3.2.1. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRM: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The State used AERMOD version 15181, which was the most up-to-date version at the time the modeling was performed, using all regulatory default options. AERMOD version 16216r has since become the regulatory model version. There were no updates from 15181 to 16216r that would significantly affect the concentrations predicted here. A discussion of the State's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

The most current approved version of AERMOD, version 16216r, which was published January 17, 2017 (*see* 82 FR 5203), includes updates to the 15181 version as well as bug fixes that were on the previous version 16216. The updates to 15181 include the addition of settings that were previously considered an alternative modeling option. North Carolina used the default regulatory setting of the most current version at the time of modeling (15181), which does not use the

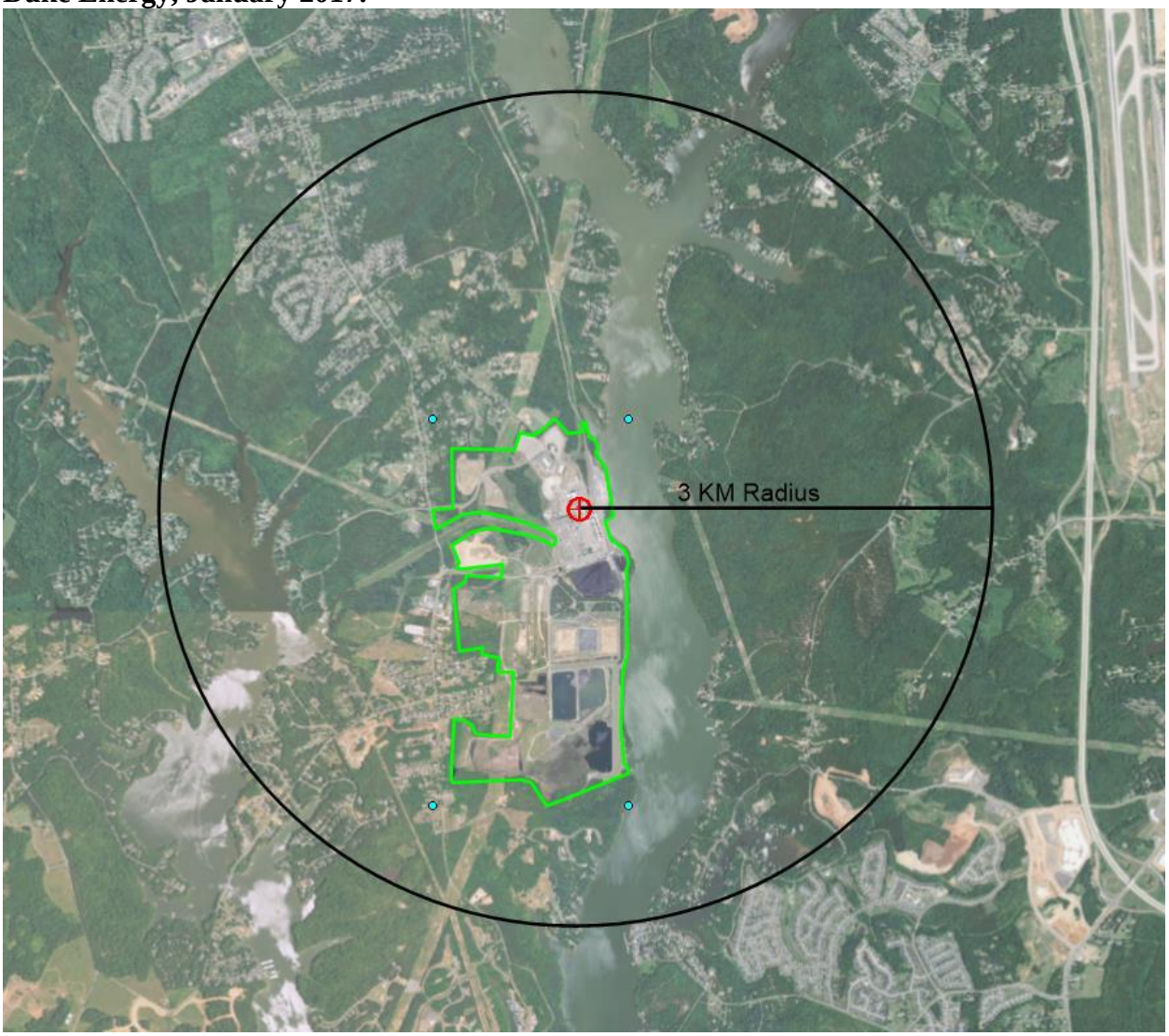
alternative modeling options added to version 16216r of AERMOD. Using the older 15181 version of AERMOD with its default regulatory settings, likely produces the same results as the newer 16216r. For this reason, the EPA believes it is appropriate for the State to use the 15181 version of AERMOD.

6.3.2.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

The EPA's recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment within 3 km of the facility. According to the EPA's modeling guidelines, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50 percent of the area within a 3 km radius of the facility is classified as rural. Conversely, if more than 50 percent of the area is urban, urban dispersion coefficients should be used in the modeling analysis. For the purpose of performing the modeling for the area of analysis, the State determined that it was most appropriate to run the model in rural mode or with rural dispersion coefficients. Although no quantitative land use assessment was performed, to make this determination the State used a qualitative land use assessment based on satellite imagery of the area. The State assessed a 3 km radius around the Duke-Allen facility and determined the area consist mostly of open water, forests, pasture, low intensity residential and agricultural lands. Based on this information and the imagery provided by the State, the EPA agrees with the determination that the area surrounding the source should be classified as rural. See Figure 28.

Figure 28. Map of the Gaston County Area Showing Aerial View of land Use Surrounding the Duke-Allen Facility. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



6.3.2.3. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The sources of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Gaston County area, the State identified one other emitter of SO_2 within 50

km of the Duke-Allen facility in any direction that could have a potential impact. The State determined that this was the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. In addition to Duke-Allen facility, the other emitter of SO_2 included in the area of analysis was another DRR source, the Duke-Marshall facility. No other sources were determined by the State to have the potential to cause concentration gradient impacts within the area of analysis.

In order to determine nearby sources to be considered in the modeling analysis, North Carolina evaluated NCDAQ's emissions inventory for the 2013-2015 time period to identify those sources within 10 km, and then within 50 km, of the Duke-Allen facility that had the potential to impact the concentration of SO_2 in the area. Within a 10 km radius of the Duke-Allen facility, the State did not identify any other sources with the potential to impact the final modeling result. The EPA notes that Charlotte/Douglas International Airport is located approximately 7 km from the Duke-Allen facility and according to the 2014 NEI has 289 tpy of SO_2 emissions. Based upon the types of emissions sources at the airport, it is unlikely that its emissions would have a concentration gradient, nor impact the area, near the Duke-Allen facility. Additionally, the background concentration used in the modeling analysis is from a monitor located in the Charlotte urban area and will potentially account for a portion of the impacts from the airport emissions sources. Therefore, the EPA believes that it is acceptable that the source was not explicitly included in the modeling.

Within the 50 km radius of the Duke-Allen facility, the State identified a total of two sources that emitted more than 100 tpy and were considered for the modeling. These sources were: Resolute Paper (Resolute) facility, located 40 km away in Catawba County, South Carolina; and the Duke-Marshall facility, located 45 km away. Given the high emissions (5,918 tons of SO_2 in 2014) and high Q/d[22] (103) of the Duke-Marshall facility, the State chose to include this nearby source in their final modeling. Since emissions data was not readily accessible for the Resolute facility, the State ran two AERMOD modeling assessments to determine if the emissions from this facility would impact the final results of the Duke-Allen modeling assessment. The first modeling run was carried out using only the emissions from the Duke-Allen facility to create a baseline. These results were then compared to a modeling run that included emissions from both the Duke-Allen and Duke-Marshall facilities. Given that the modeling results only showed a 0.2 $\mu g/m^3$ increase in the maximum concentration when adding the Duke-Marshall facility to the modeling assessment, the State determined that the Resolute Paper facility would have minimal impact in the results due to having much lower emission than the Duke-Marshall facility. For this reason, the State decided to exclude the Resolute Paper facility from their final modeling assessment of the Duke-Allen surrounding area. In addition to information provided by North Carolina, the EPA also considered the modeling results for the Resolute facility provided by the South Carolina Department of Health and Environmental Control (DHEC). The EPA's evaluation of the Resolute modeling is discussed in the South Carolina TSD. The modeling provided by

[22] Using the "20D" method, if the emissions from a candidate source are greater than 20D (20 times the distance in km of the candidate source to Duke Allen) then the source is retained for further consideration for potential inclusion in the modeling analysis. This analysis is sometimes referred to as Q/d (indicating emissions over distance).

DHEC for the Resolute facility confirms North Carolina's conclusion that inclusion of the Resolute facility in the cumulative modeling analysis would have minimal impact on the Duke Allen modeling results. Based on all of the factors discussed above, EPA has determined that the Resolute FP facility is not expected to cause or contribute to an exceedance of the SO_2 NAAQS in the area around Duke Allen. Therefore, the EPA concurs with North Carolina's decision that Resolute did not need to be included in the cumulative modeling analysis.

All the other nearby sources that were not used in the modeling analysis, were accounted for in the background concentrations discussed in Section 6.3.2.8.

The grid receptor spacing for the area of analysis chosen by the State is as follows:

A Cartesian grid was used for the modeling assessment. The grid extends 50 km in each direction and was centered at the Duke-Allen facility. The 50 km extension was chosen because it captured the nearby sources that were included in the modeling analysis and that could cause a concentration gradient variation near the site.

As seen below, the spacing for the receptors was adjusted based on the distance from the facility, creating nested grids within the 50 km limit. In addition, boundary receptors were placed within the perimeter of the facility.

The grid receptor spacing for the area of analysis is as follows:

- Receptors along the fence line every 50 m
- Receptors every 100 m from fence line to 3 km
- Receptors every 250 m from 3 km to 5 km
- Receptors every 500 m from 5 km to 10 km
- Receptors every 1000 m from 10 km to 20 km
- Receptors every 2000 m from 20 km to 50 km

The receptor network contained 8,705 receptors. The network covered the Cleveland, Gaston, Lincoln, and Mecklenburg counties, as well as portions of Burke, Cabarrus, Catawba, Iredell, Rowan, Stanly, and Union counties in North Carolina. Although no sources from South Carolina were explicitly modeled in the Duke-Allen assessments, the receptor network did cover York County and portions of Cherokee, Union, Chester, Lancaster, and Chesterfield counties in South Carolina.

Figures 29 and 30, included in the State's recommendation, show the State's chosen area of analysis surrounding the Duke-Allen, as well as the receptor grid for the area of analysis. Consistent with the Modeling TAD, the State placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to each modeled facility, including other facilities' property with the exception of locations described in Section 4.2 of the Modeling TAD as not being feasible locations for placing a monitor. Specifically, no receptors were placed in areas over water surfaces. The State also did not place receptors in other locations that it considered to not be ambient air relative to each modeled facility and so excluded receptors within the Duke-Allen facility fence line. The North Carolina Modeling Report provides a figure showing the fence line boundary. However, no information was

provided to document that public access to the facility property is prevented by a fence or some other physical barrier. Receptor elevation was also included using data from the NED, and utilizing the AERMAP terrain processor of AERMOD.

Figure 29. Area of Analysis for the Gaston County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.

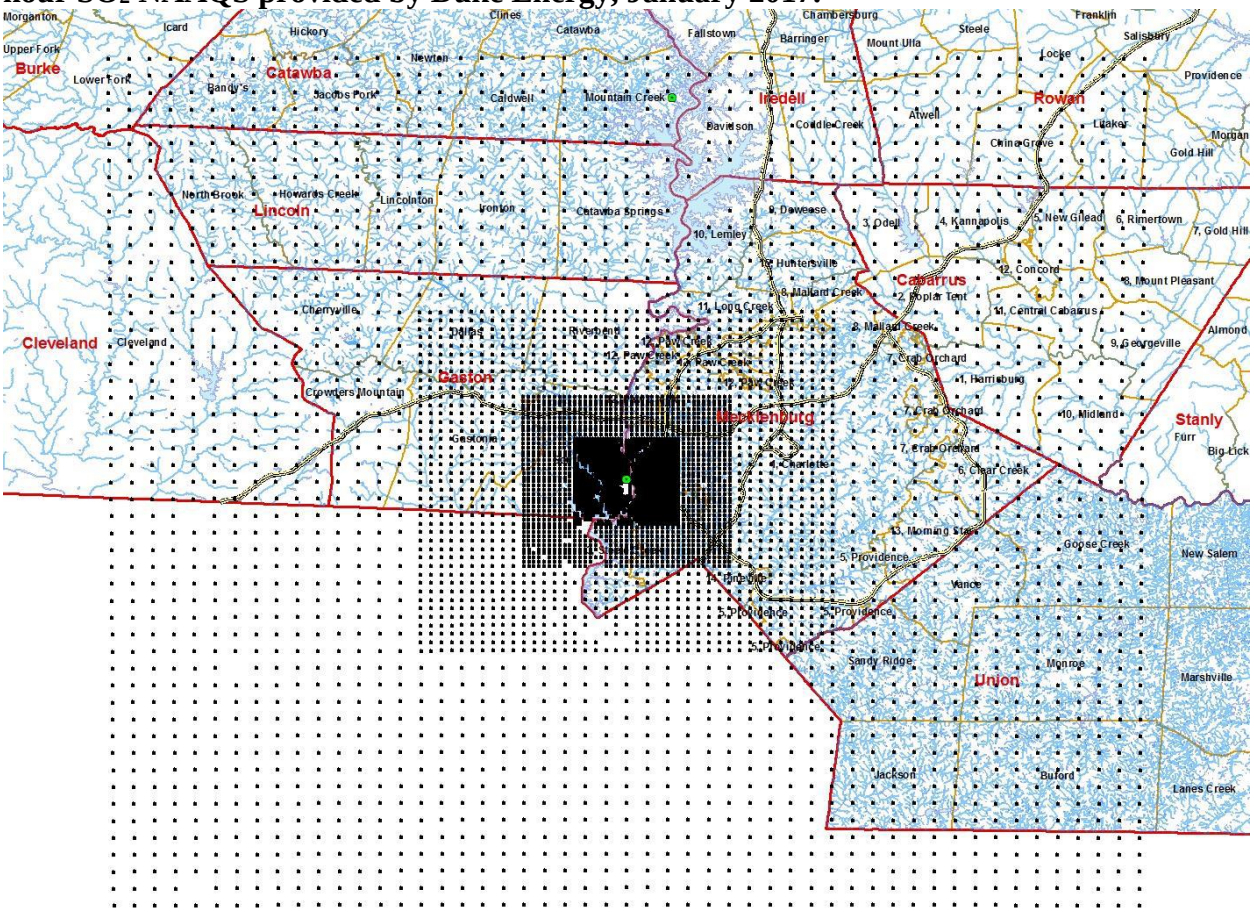
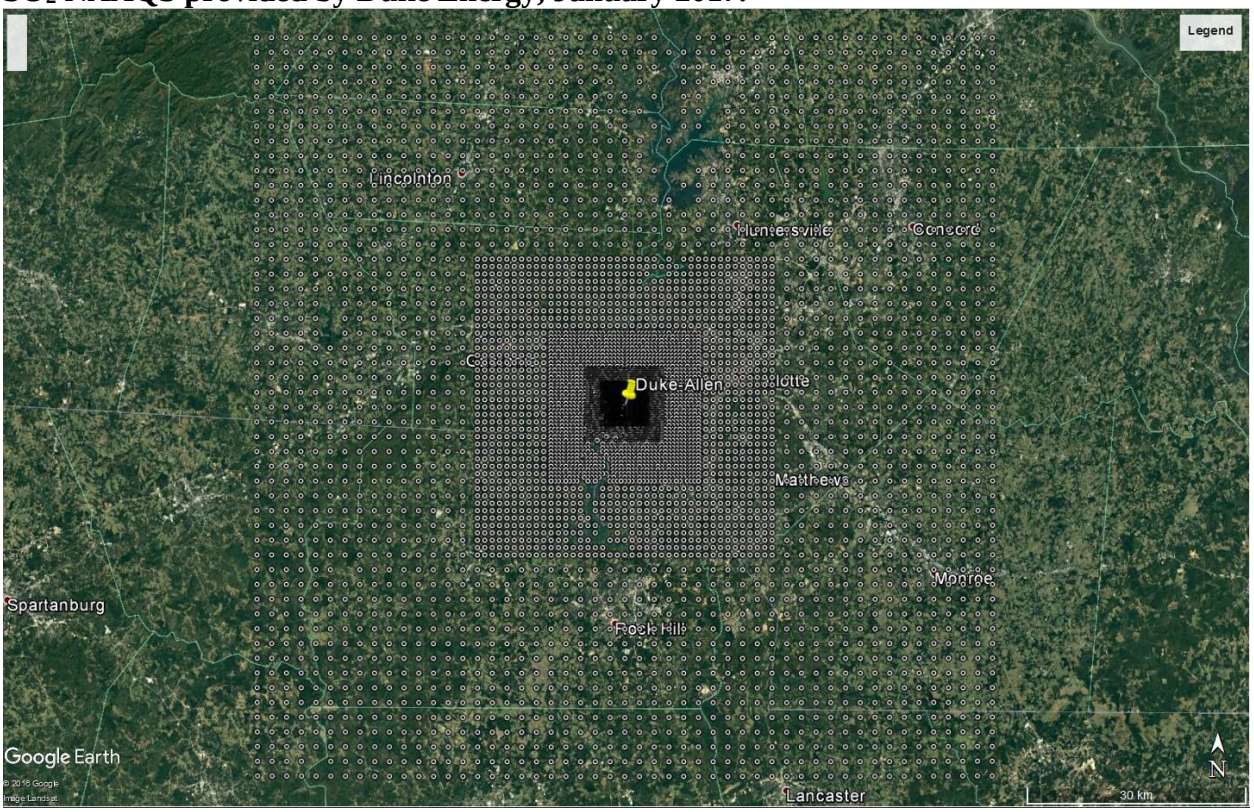


Figure 30. Receptor Grid for the Gaston County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.



Based on the information provided in North Carolina's recommendation, the EPA agrees with excluding the receptors over nearby water bodies as areas not feasible to place a monitor. Not enough information was provided by the state for the EPA to determine whether receptors were properly excluded from the Duke-Allen facility property on the basis of it not representing ambient air for the purposes of SO_2 designations modeling. However, the EPA agrees that the receptor grid selected by the State adequately captures maximum concentrations due to the fact that the maximum modeled concentration occurs approximately 0.9 km northeast of the source (as shown in Figure 33a), and approximately 600 m beyond the facility fence line or property boundary. Therefore, the EPA believes that North Carolina's receptor grid is appropriate for the characterization of the area, considering the impact of SO_2 from the modeled facilities.

Based on the information provided in North Carolina's recommendation, the EPA agrees with exclusion of receptors over water bodies as not feasible to place a monitor and concurs that the grid selected by the State is adequate. Therefore, the EPA believes that North Carolina's receptor grid is appropriate for the characterization of the area, considering the impact of SO_2 from the modeled facilities.

6.3.2.4. Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions or following GEP policy with allowable emissions.

Allen operates five coal fired boilers. The boilers are vented through two separate stacks as follows: Stack 1 – Units 1, 2 & 5 and Stack 2 – Units 3 & 4. As recommended in the SO_2 modeling TAD, the hourly varying emissions and stack release parameters were used in the modeling. The hourly varying emissions and release parameters coincided with the meteorological data for the period 1/1/2013 thru 12/31/2015. The hourly SO_2 emissions, flow rates, and flow temperatures measured by the CEMS located on each of the boiler stacks was used in the modeling analysis.

Most other emitting sources at Duke-Allen are associated with coal and ash handling, conveying, and transport and do not emit SO_2. Duke-Allen also operates one emergency generator, one auxiliary boiler, an emergency fire pump, and an emergency quench pump which operate infrequently, combust ULSD, and emit small quantities of SO_2. According to Section 5.4 of the modeling TAD, the EPA states that it is most appropriate to include sources of emissions which operate continuously or frequent enough to contribute to the annual distribution of the daily maximum concentrations. Total maximum annual emissions of SO_2 from these sources during the period 2013-2015 is 500 pounds per year (0.25 tpy), with maximum hourly emissions less than 0.04 lb/hr. Thus, these intermittent sources operate at neither a frequency or magnitude great enough to contribute to the annual distribution of the daily maximum concentrations, and therefore, were not included in the analysis and the EPA concurs with this determination.

As described in section 6.3.1, North Carolina utilized one additional source in their modeling for the Duke-Allen facility area. According to the Duke-Allen modeling report, all other SO_2 emitters within 50 km (based on information from the 2014 emissions inventory provided by NCDAQ) were considered for the modeling. After the screening process described in Section 6.3.2.3, the only source incorporated in the modeling of the Duke-Allen facility was Duke Energy's – Marshall Steam Station (Duke-Marshall). No other sources within 50 km were included in the modeling assessment.

The State characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the State used actual stack heights in conjunction with actual emissions for the two SO_2 facilities modeled. The State also adequately characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash.

The EPA agrees that North Carolina has appropriately characterized the area surrounding the Duke-Allen facility. Given the criteria for selecting nearby sources, we believe that the decision to include only one additional source, the Duke-Marshall facility, and excluding all other sources from the modeling analysis was correct. Also, the State has appropriately used the actual

emissions and stack heights for both facilities and correctly accounted for the building downwash using BPIPPRM for AERMOD.

6.3.2.5. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

The EPA believes that CEMS data provide acceptable historical emissions information, when they are available. These data are available for many electric generating units. In the absence of CEMS data, the EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, the EPA recommends using detailed throughput, operating schedules, and emissions information from the impacted source (s).

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. For example, a facility has recently adopted a new federally-enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the State included Duke-Allen and one other emitter (Duke-Marshall facility) of SO_2 within 50 km in the area of analysis. The State has chosen to model these facilities using actual emissions. The facilities in the State's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.
For Duke-Allen and Duke-Marshal facilities, the State provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 24. A description of how the State obtained hourly emission rates is given below this table.

Table 24. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the Gaston County Area

Facility Name	SO_2 Emissions (tpy)		
	2013	2014	2015
Duke Allen Steam Station	846	1,718	1,128
Duke Marshall Steam Station	4,704	5,917	4,624
Total Emissions from All Modeled Facilities in the State's Area of Analysis	5,550	7,635	5,752

For the Duke-Allen and Duke-Marshal facilities, the actual hourly emissions data were obtained from the CEMS located within these facilities. As noted in the table above and in Section 6.3.1, the Duke-Allen facility did not emit 2,000 tons or more annually of SO_2 but the state decided to list the source under the DRR and characterized the area around the source using air dispersion modeling. Given the data provided by the State, the EPA agrees that the emission data used for modeling was appropriate, complies with the EPA's Modeling TAD, and is representative of actual emissions in the area.

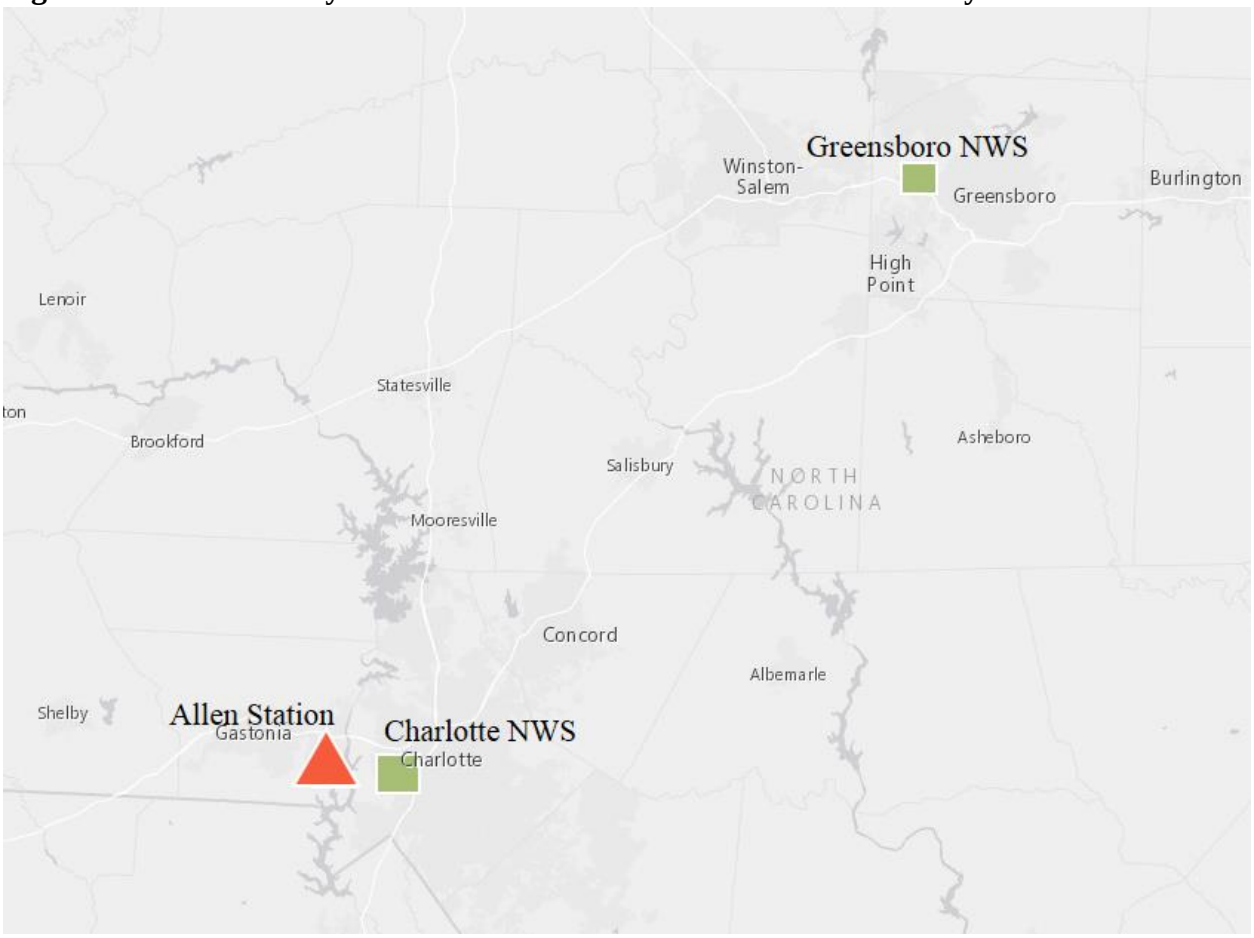
6.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include NWS stations, site-specific or onsite data, and other sources such as universities, FAA, and military stations.

For the area of analysis for the Gaston County area, the State selected the surface meteorology for the same time period of 2013 to 2015 from the NWS station in the Douglas International Airport (KCLT) in Charlotte, North Carolina. The station is located at 35.21 N, 80.95 W, approximately 6 km to the east of the Duke-Allen facility. Upper air observations were obtained from a different NWS station, located in Greensboro, NC, at 36.1 N, 79.94 W as best representative of meteorological conditions within the area of analysis.

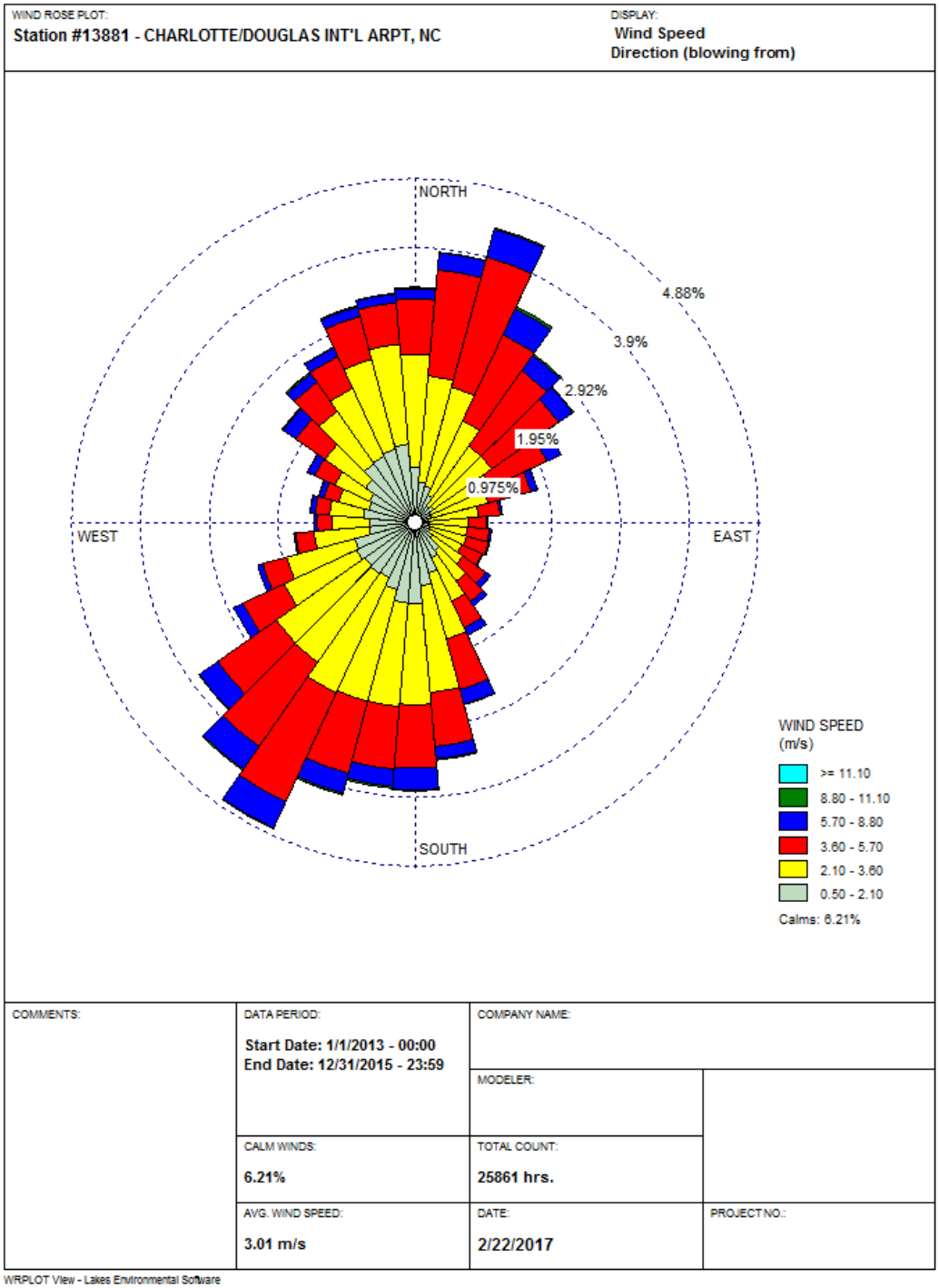
The State used AERSURFACE version 13016 using data from the KCLT NWS to estimate the surface characteristics (albedo, Bowen ratio, and surface roughness [z_o]) of the area of analysis. Albedo is the fraction of solar energy reflected from the earth back into space, the Bowen ratio is the method generally used to calculate heat lost or heat gained in a substance, and the surface roughness is sometimes referred to as “zo” The state estimated surface roughness values for 12 spatial sectors out to 1 km at a seasonal temporal resolution for wet conditions.
In the figure below, generated by the EPA, the location of these NWS stations are shown relative to the area of analysis.

Figure 31. Area of Analysis and the NWS stations in the Gaston County Area



The EPA generated wind rose plots with "WRPLOTS View" utility program using state submitted pre-processed AERMET surface meteorology data for the Charlotte, NC NWS site. In Figure 32, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. Analysis of the NWS data indicate winds blows relatively evenly between Northeast and Southwest.

Figure 32. Gaston County Cumulative Annual Wind Rose for Years 2013 – 2015



Meteorological data from the above surface and upper air NWS stations were used in generating AERMOD-ready files with the AERMET (version 15181) processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. Upper air data from Greensboro were also processed with AERMET. The needed NWS site land use parameters to derive wind and temperature vertical profiles were derived following the methodology provided in the AIG using AERSURFACE version 13016.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1-minute duration was provided from the KCLT NWS station, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE (version 15272). These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates.

Differences in surface characteristics at the meteorological observation site and the application site were reviewed and compared to evaluate representativeness. The seasonal albedo and Bowen ratio values are similar, and therefore, considered representative of the project location. The overall average surface roughness of the airport site was determined to be similar to the project/facility location. The largest differences in surface roughness values between the two sites occur in the northeastern quadrant but the prevailing winds in this area are from the south and southwest - the directions where the surface roughness at the airport and the project site are very similar as well as the directions in which the modeled design concentrations were predominantly found.

After review of all the available information, the EPA agrees with the meteorological and surface data that the State used for the modeling of the Gaston County area in regards to the Duke-Allen facility. The data used properly represents meteorological conditions in the area and allows for the proper simulation of SO_2 emissions from the Duke-Allen facility and nearby sources. The State used appropriate site specific data from a nearby NWS station.

6.3.2.7. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as gently rolling with the plant bordering surface water on the east. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database.

The State's final modeling report does not offer any information on the topography or geography of the area, but based upon an evaluation of USGS topography maps of the area, the EPA believes that the area has no complex terrain. The EPA agrees with the State's use of the USGS NED database and AERMAP terrain processor (version 11130) for AERMOD to account for the slight changes in elevation of the area to obtain a more accurate modeling result.

6.3.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, the State elected to use a "tier 1" approach. The State considered six available monitoring locations surrounding the Duke-Allen facility for the 2013-2015 data period. The selected representative data was obtained for the 2013-2015 period, from the Garinger High School monitor located in Mecklenburg County (AQS Site: 37-119-0041), and was determined to be the best representative of background concentration for this analysis area. The monitor is located approximately 21 km northeast of the Duke-Allen facility. The 2013-2015 1-hour SO_2 design value for the Garinger monitor is 18 μg/m^3, equivalent to 7 ppb when expressed in significant figures,[23] and that value was incorporated into the final AERMOD results.

The EPA agrees that North Carolina has appropriately chosen the background concentration in accordance with the Modeling TAD. The State has chosen a monitor that is near the modeled source and is adequate for modeling purposes, with complete data for the 2013-2015 time period. We believe that the chosen background monitored concentration is representative of the area.

6.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Gaston County area of analysis are summarized below in Table 25.

[23] The SO_2 NAAQS level is expressed in ppb but AERMOD gives results in μg/m^3. The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1ppb = approximately 2.619 μg/m^3.

Table 25. Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Gaston County Area

Input Parameter	Value
AERMOD Version	15181 (Default Setting)
Dispersion Characteristics	Rural
Modeled Sources	2
Modeled Stacks	5
Modeled Structures	55
Modeled Fence lines	1
Total receptors	8,705
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Douglas International Airport, Charlotte, NC
NWS Station Upper Air Meteorology	Greensboro, NC
NWS Station for Calculating Surface Characteristics	Douglas International Airport, Charlotte, NC
Methodology for Calculating Background SO_2 Concentration	Tier 1 approach using AQS site 37-119-0041 for 2013 – 2015
Calculated Background SO_2 Concentration	18 $\mu g/m^3$

The results presented below in Table 26 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

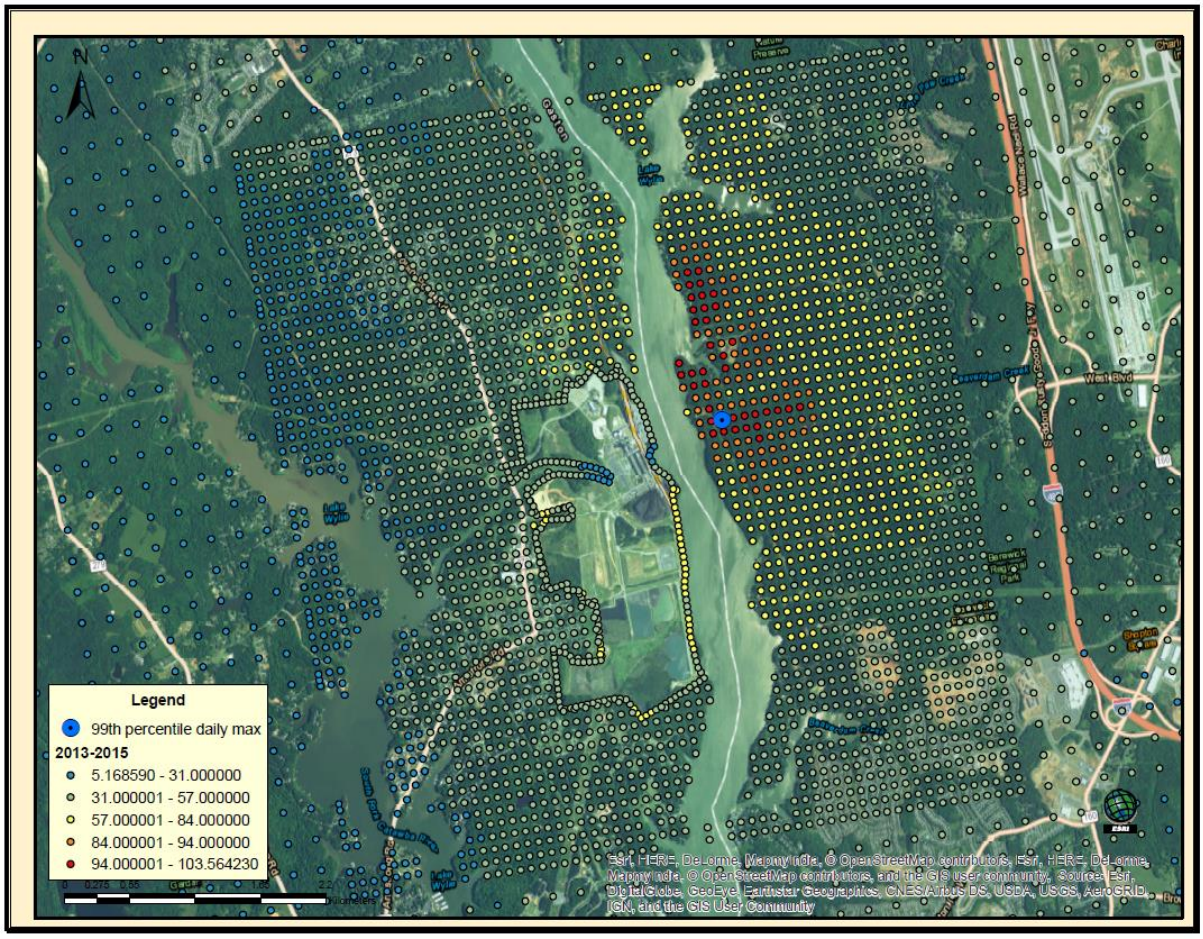
Table 26. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Gastonia Area

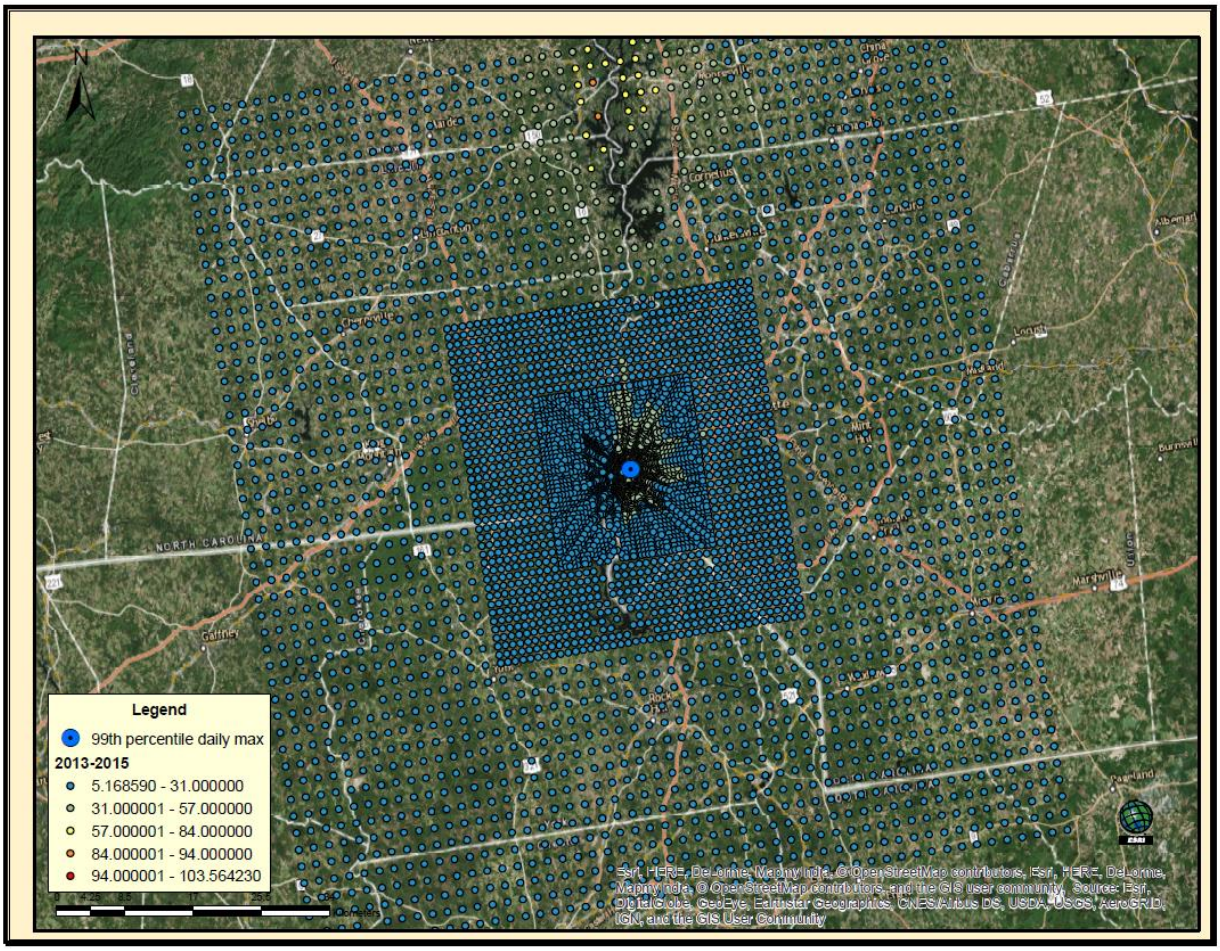
Averaging Period	Data Period	Receptor Location [UTM zone 17]		99th percentile daily maximum 1-hour SO_2 Concentration (µg/m^3)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-2015	499991	3894369	122	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 µg/m^3 conversion factor

The State's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 122 µg/m^3, equivalent to 46.6 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facility/facilities. Figures 33a and 33b below were generated by the EPA using the model output files provided by North Carolina. Figure 33a indicates that the predicted value occurred approximately 0.9 km east of the Duke-Allen's combined stack location and approximately 0.6 km outside the facility's fence line.

Figures 33a and 33b. Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Gastonia County Area. Source: Modeling Report for 1-hour SO_2 NAAQS provided by Duke Energy, January 2017.





The modeling submitted by the State does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration.

6.3.2.10. The EPA's Assessment of the Modeling Information Provided by the State

NCDAQ's air quality modeling assessment for the area about the Duke-Allen facility is the only SO_2 modeling provided for this assessment. NCDAQ followed the SO_2 Modeling TAD to carry out this modeling assessment. North Carolina used the default regulatory setting of the most current version at the time of modeling (15181), which does not use the alternative modeling options added to version 16216r of AERMOD.

The nearest NWS meteorological station in Charlotte, North Carolina was selected to provide representative meteorological data for the impact modeling assessment. The upper air meteorological data were obtained from Greensboro, North Carolina, airport site. Both are valid and appropriate stations for the analysis.

For nearby sources, the State modeled only one additional source within a 50 km radius of the Duke-Allen. North Carolina considered two sources within the 50 km, but after establishing

criteria for inclusion, the Duke-Marshall facility was the only facility included in the final modeling assessment of the Gaston county area. As discussed in Section 6.3.2.3, based upon results of a screening analysis of the impacts of the Duke-Marshall facility and a comparison of the emissions between the Resolute Paper facility and the Duke-Marshall facility, North Carolina determined that it was not necessary to include the Resolute facility in the modeling. In addition to information provided by North Carolina, the EPA also considered the modeling results for the Resolute facility provided by DHEC. The EPA's evaluation of the Resolute modeling is discussed in the South Carolina TSD. The modeling provided by DHEC for the Resolute facility confirms North Carolina's conclusion that inclusion of the Resolute facility in the cumulative modeling analysis would have minimal impact on the Duke Allen modeling results. Therefore, the EPA concurs with North Carolina's decision that Resolute did not need to be included in the cumulative modeling analysis. The State used actual emissions from the 2013-2015 period to predict SO_2 concentrations in the area which was determined by the EPA to be appropriate for this analysis as emissions from Duke Mayo decreased in 2016 relative to the 2013-15 period.

Finally, the State chose an appropriate modeling domain that shows the maximum impact from the facility in the Gaston County area. The air quality impact modeling resulted in the maximum annual 99^{th} percentile daily maximum 1-hour SO_2 value averaged over the 3-year period of any receptor was located 0.9 km east of the Duke-Allen stack location, well within the receptor grid of 100 m spacing (i.e., to 3 km from fence line). This maximum modeled concentration with the addition of the SO_2 background concentration of 18 $\mu g/m^3$ yields the design concentration value of 46.6 ppb (122 $\mu g/m^3$) which is well below the NAAQS of 196 $\mu g/m^3$. After evaluating all the relevant information mentioned above, the EPA agrees with the modeling information provided by the State for the analysis of the Gaston County Area affected by the Duke-Allen facility and other nearby sources.

6.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Gaston County Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

6.5. Jurisdictional Boundaries in the Gaston County Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for city/county/parish. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

The Duke-Allen facility is located in the southeast corner of Gaston County, North Carolina. The Gaston County is bounded by Cleveland County to the west, Mecklenburg County to the east, Lincoln County to the north and York County in South Carolina to the south. Although no

sources were included from South Carolina in the final modeling assessment, the modeling domain of the Duke-Allen facility does capture the entire York County and portions of Cherokee, Union, Chester, Lancaster, and Chesterfield counties, all in South Carolina.

In January 2017, North Carolina recommended the EPA designate attainment the area surrounding the Duke-Allen facility, specifically the townships bounded by the modeling domain in North Carolina, identified in Table 21 in Section 6.3.1 based in part on an assessment and characterization of air quality impacts from the facilities previously discussed. The EPA considered all the information available to determine the correct boundaries for the designation. More detail is given about the intended designation for the Gaston County in section 6.8 of this documents. For nearby sources, the State modeled only one additional source within a 50 km radius of the Duke-Allen. North Carolina considered two sources within the 50 km, but after establishing criteria for inclusion, the Duke-Marshall facility was the only facility included in the final modeling assessment of the Gaston County area. As discussed in Section 6.3.2.3, based upon results of a screening analysis of the impacts of the Duke-Marshall facility and a comparison of the emissions between the Resolute Paper facility and the Duke-Marshall facility, North Carolina determined that it was not necessary to include the Resolute facility in the modeling.

6.6. Other Information Relevant to the Designations for the Gaston County Area

No other relevant information is available for the Gaston County area.

6.7. The EPA's Assessment of the Available Information for the Gaston County Area

After evaluating the data from the modeling report for the Duke-Allen facility, the EPA intends to designate the Gaston County area as unclassifiable/attainment for the 2010 SO_2 NAAQS. The State's modeling results indicated that the maximum impact from the Duke-Allen facility, including nearby sources and background concentrations, did not violate the 2010 SO_2 NAAQS. The State modeled the Duke-Allen facility together with one other nearby source, Duke-Marshall, and background concentration data from a nearby monitor, and obtained a maximum 1-hour average of 46.6 ppb, which demonstrate compliance with the 75 ppb 2010 SO_2 NAAQS. The modeling results also show that the emissions from the Duke-Allen facility do not contribute to ambient air quality in any nearby area that does not meet the NAAQS.

North Carolina's screening criteria for nearby sources evaluated NCDAQ's emissions inventory for the 2013-2015 time period to identify sources within 10 km, and then within 50 km, of the Duke-Allen facility that had the potential to impact the concentration of SO_2 in the area. Within a 10 km radius of the Duke-Allen facility, the State did not identify any other sources with the potential to impact the final modeling result. The EPA notes that Charlotte/Douglas International Airport is located approximately 7 km from the Duke-Allen facility and according to the 2014 NEI has 289 tpy of SO_2 emissions. Based upon the types of emissions sources at the airport, it is unlikely that its emissions would have a significant concentration gradient, nor impact the area,

near the Duke-Allen facility. Additionally, the background concentration used in the modeling analysis is from a monitor located in the Charlotte urban area and will potentially account for a portion of the impacts from the airport emissions sources. Therefore, the EPA believes that it is acceptable that the source was not explicitly included in the modeling. EPA notes that the Duke-Allen facility is located over 100 km from any nearby area in North Carolina that does not meet the standard or any nearby Round 4 area being characterized by December 31, 2020 based on a newly deployed SO_2 monitor.

In its submission, North Carolina suggested that the Gaston County area, bounded by all townships within the modeling domain, be designated as attainment based in part on an assessment and characterization of air quality impacts from the modeled facilities. After careful evaluations, the EPA agrees with the State's recommended boundary and intends to designate the entire Gaston County area, based on townships, as unclassifiable/attainment in regard to the impact from the Duke-Allen facility and nearby sources. The EPA believes that based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined that the area: (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS.

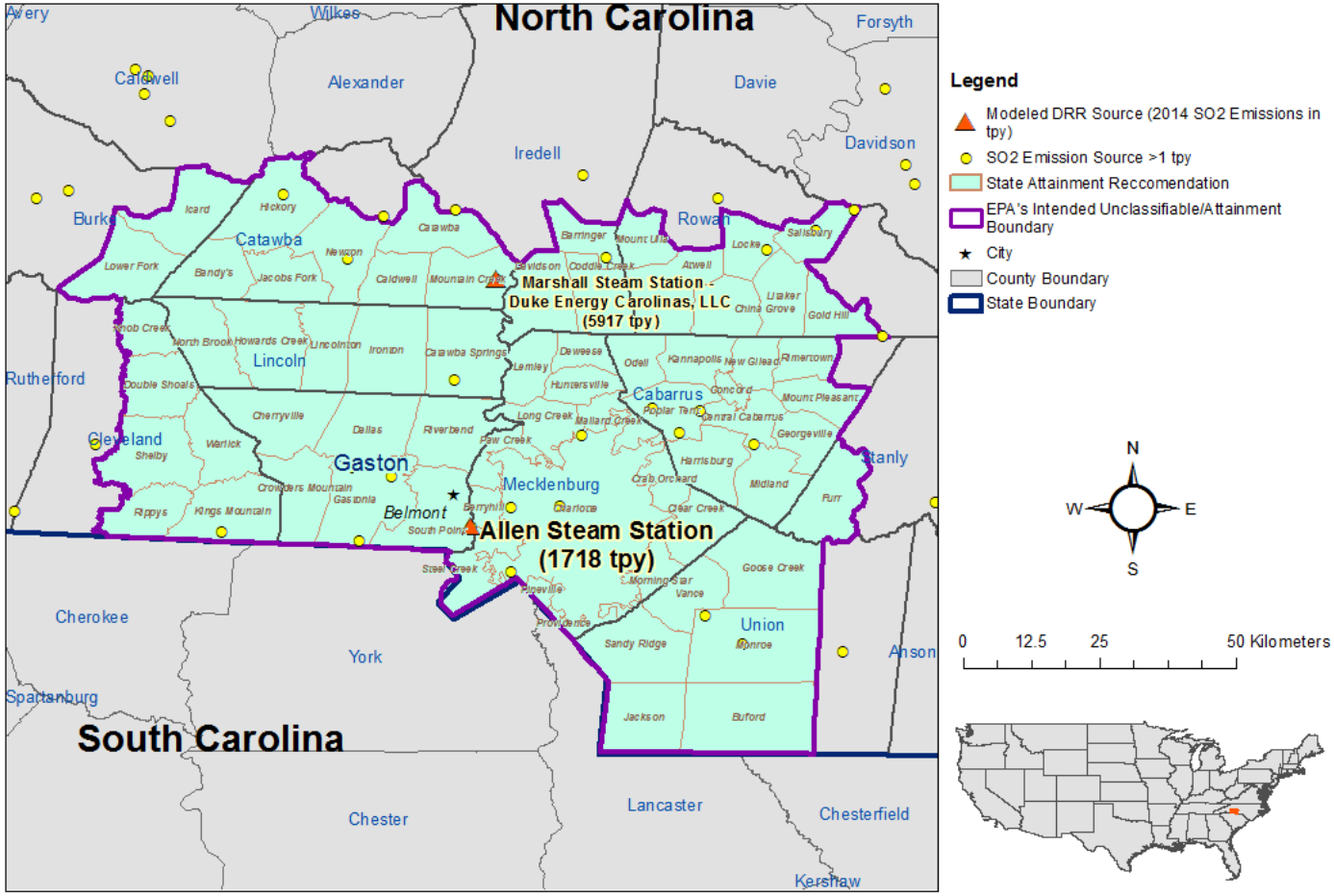
The EPA believes that our intended unclassifiable/attainment area, bounded by the modeling domain and including the townships in the table below, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area.

6.8. Summary of Our Intended Designation for the Gaston County Area

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the Gaston County area as unclassifiable/attainment for the 2010 SO_2 NAAQS based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined that the area: (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS. Specifically, the boundaries are comprised of all townships captured within the modeling domain of the Duke-Allen modeling assessment listed in Table 28 below. In the specific case of the Duke-Allen and the Duke-Marshall facilities, due to their relatively close proximity, the modeling domains for these sources overlap and therefore, these areas share common unclassifiable/attainment counties based on townships listed in Tables 10 and 28 of this document. Figure 34 shows the boundary of this intended designated area.

At this time, our intended designations for the State only apply to this area and the other areas presented in this technical support document. The EPA intends in a separate action to evaluate and designate all remaining undesignated areas in North Carolina by December 31, 2020.

Figure 34. Boundary of the Intended Gaston County Unclassifiable/Attainment Area



7. Technical Analysis for the Beaufort County Area

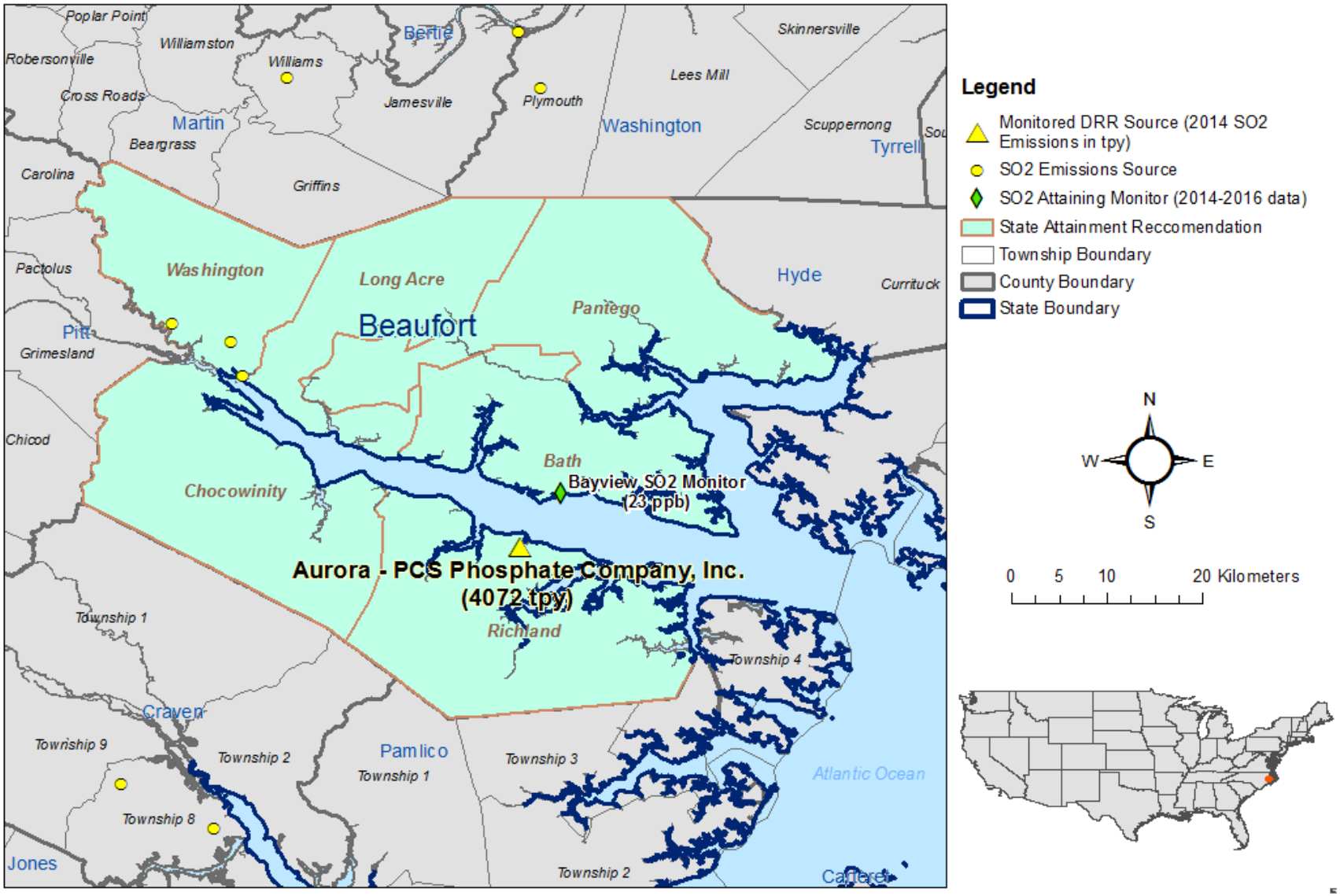
7.1. Introduction

The EPA must designate the Beaufort County area by December 31, 2017, because the area has not been previously designated and North Carolina has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting the EPA specifications referenced in the EPA's SO_2 DRR for any sources of SO_2 emissions in the State. North Carolina elected to characterize the area using air monitoring under the DRR, and an existing monitoring site was approved by the EPA to characterize the maximum 1-hour SO_2 concentrations in the area. Since the area is characterized by an existing monitor with a valid three-year design value and not a new SO_2 monitor, the area must be designated by December 31, 2017.

In its recommendation, the State recommended that Beaufort County be designated as attainment for the 2010 SO_2 NAAQS, based on monitored air quality data for 2013 - 2015. Specifically, the State's recommended boundaries consist of all townships within Beaufort County. The EPA agrees with North Carolina's recommendation for the boundary of the area and intends to designate the entire Beaufort County as unclassifiable/attainment for the 2010 SO_2 NAAQS based upon currently available information for 2014-2016. Our intended boundaries are consistent with the State's recommended boundaries and are described below. The EPA has also evaluated neighboring counties based on a five factor analysis and other relevant information to demonstrate that the area is attaining the 1-hour SO_2 NAAQS in Beaufort County. While the factors are presented individually, they are not independent. Instead, the five-factor analysis process carefully considers their interconnections and the dependence of each factor on one or more of the others.

As seen in Figure 35a below, the PCS Phosphates facility is located just south of the Pamlico River and approximately 1.5 miles south of the Lee Creek Airport. Other emitters of SO_2 within 50 km of PCS Phosphates include Warren Field, Riverside Grain Company, Inc., Flanders Filters, Inc., CarolinaEast Medical Center; S.T. Wooten Corporation – Craven Co Plant; Domtar Paper Company, LLC; Barnhill Contracting Company – Williamston; Plymouth.
Also included in the figure is the State's recommended boundary for the attainment designation. The EPA's intended unclassifiable/attainment designation boundary for the Beaufort County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

Figure 35a. Map of the Beaufort County Area Addressing PCS Phosphates Facility



7.2. Air Quality Monitoring Data

This factor considers the SO_2 air quality monitoring data, in Beaufort County, North Carolina. In the EPA's approval of the 2016 North Carolina Annual Ambient Air Monitoring Network Plan, the EPA approved the existing Bayview SO_2 monitoring site (AQS 37-013-0151) as a DRR monitoring site to characterize the maximum 1-hour SO_2 concentrations in the area of PCS Phosphate Company, Inc. – Aurora Facility (PCS Phosphate). The Bayview monitor is located in Beaufort County, North Carolina, in the Bayview area 35.428, -76.74. It is across the Pamlico River approximately 6 km from the PCS Phosphate Company, Inc. – Aurora Facility (PCS Phosphate), which is listed under the DRR and the State has chosen to characterize through air quality monitoring. See Figure 35b. Table 27 below shows information related to the Bayview monitor. North Carolina considered the 2013-2105 complete, quality-assured, certified design value for the Bayview monitor of 21 ppb which is below the 1-hour SO_2 NAAQS of 75 ppb.[24] Data collected by this monitor is comparable to the NAAQS, and indicates that the most recent SO_2 levels are below the 1-hr NAAQS. The most recent three years of complete, quality-assured, certified data from this monitor (2014-2016) indicate a 1-hr SO_2 design value of 23 ppb. Through an air quality modeling analysis submitted with their 2016 Annual Ambient Air Monitoring Network Plan, North Carolina has demonstrated that the Bayview monitor is properly sited to characterize the maximum 1-hr SO_2 concentrations near the PCS Phosphate DRR source (see Section 7.2.1 below). In reviewing the available air quality monitoring data in AQS, the EPA has determined that other than the data described above, there is no additional relevant data in AQS collected in or the Beaufort County that could inform the intended designation action. The most recent SO_2 design values for all areas of the country are available at https://www.epa.gov/air-trends/air-quality-design-values.

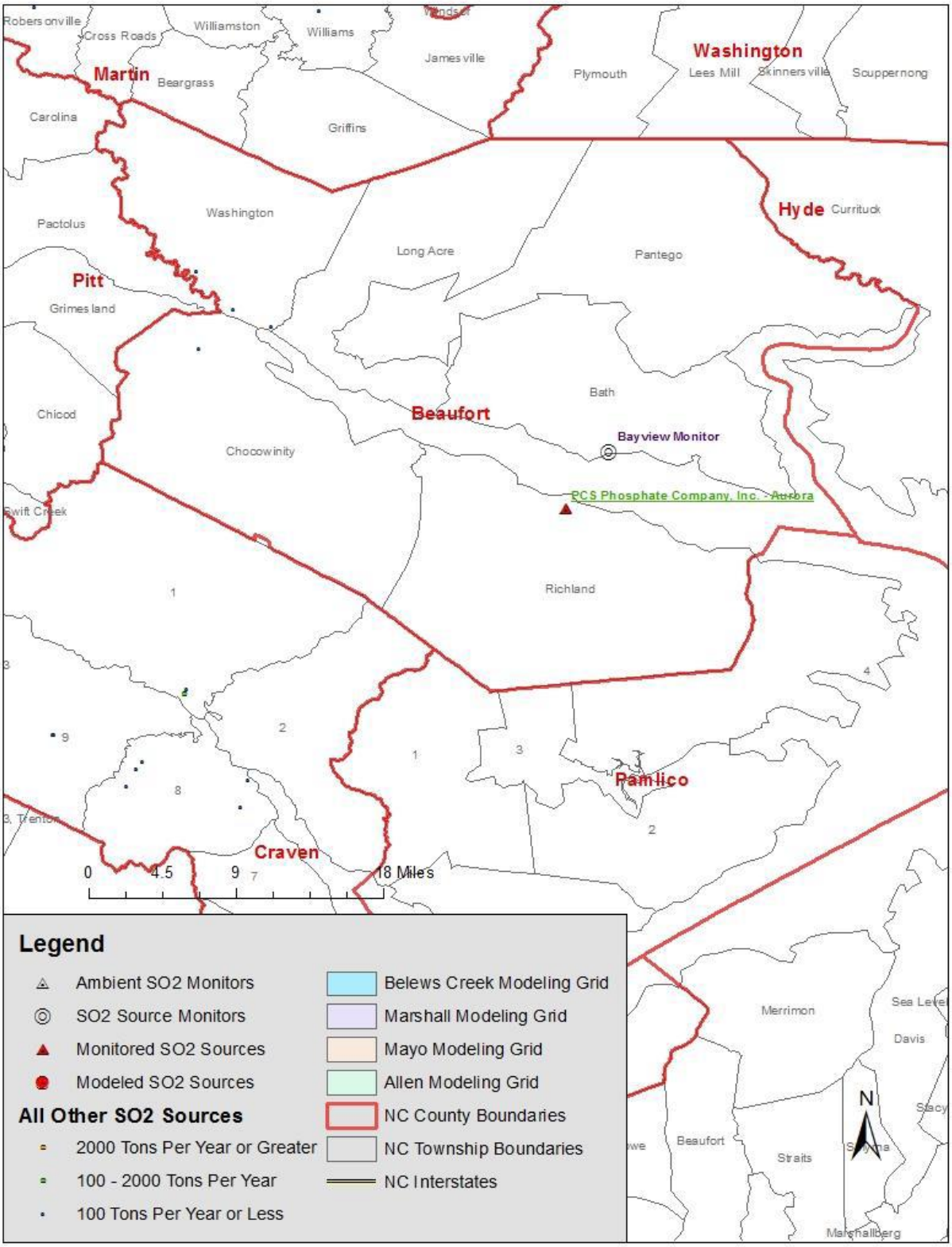
Table 27. Air Quality Data for the EPA's Intended Designation for the Beaufort County

County	Air Quality Systems (AQS) Monitor ID	Monitor Location	2014 – 2016 SO_2 Design Value (ppb)
Beaufort County	37-013-0151	Bayview Ferry 229 NC Highway 306N (35.428, -76.74)	23

Based on ambient air quality collected between 2014 and 2016, from the Bayview monitoring site, Beaufort County does not show a violation of the 2010 SO_2 NAAQS.

[24] The 2013 - 2015 design values for this and other SO_2 monitors are available in a data file posted at https://www.epa.gov/air-trends/air-quality-design-values.

Figure 35b. PCS Phosphate facility and the Bayview SO_2 Monitor Site Map.



As specified by the March 2, 2015, court order, the EPA is required to designate by December 31, 2017, all "remaining undesignated areas in which, by January 1, 2017, states have not installed and begun operating a new SO_2 monitoring network meeting the EPA specifications referenced in the EPA's" DRR. The EPA will therefore designate by December 31, 2017, areas of the country that have not begun timely operation of a new EPA-approved and valid monitoring network, and will designate by December 31, 2020, all those areas that did begin operation of a new EPA approved monitoring network by the January 1, 2017, deadline.

In the case of the Beaufort County area, North Carolina relied on an existing air quality monitor. The Bayview monitor is an existing SO_2 air quality monitor with enough data to produce a valid design value for the 2014-2016 time period. In order to use this monitor to designate the area surrounding PCS Phosphate, North Carolina demonstrated that the Bayview monitor was properly sited to capture the maximum impacts from the PCS Phosphate facility through air dispersion modeling analysis entitled "The SO_2 Data Requirements Rule Monitor Siting Analysis report" (hereinafter referred to as the PCS Monitoring Report) is discussed in more detail below.

7.2.1. Monitor Siting Analysis

In accordance with the EPA's Modeling TAD, AERMOD version 15181 was used to determine the near-field concentrations of SO_2 in the surrounding area of the PCS Phosphate facility. Meteorological data was created by processing surface data from the Marine Corps Air Station (MCAS), upper air data from the Newport, North Carolina, NWS station and onsite meteorological data that was collected by PCS Phosphate. The receptor grid chosen for the analysis consisted of a Cartesian grid extending 20 km in every direction of the facility. The spacing for the receptors varied by distance from the facility and were placed as follows:

- Receptors along the fence line every 100 m
- Receptors every 100 m from fence line to 1 km
- Receptors every 250 m from 1 km to 3 km
- Receptors every 500 m from 3 km to 5 km
- Receptors every 1,000 m from 5 km to 10 km
- Receptors every 2,000 m from 10 km to 20 km

Receptor elevation was also included using data from the NED, and utilizing the AERMAP terrain processor of AERMOD. The emissions data that was used for the modeling included the actual hourly emissions from CEMS monitors located in the three Sulfuric Acid Plants within PCS Phosphate, which account for 96 percent of SO_2 emissions from the facility, and in accordance with the Monitoring TAD, normalized emissions were used for the rest of the point sources in the facility.

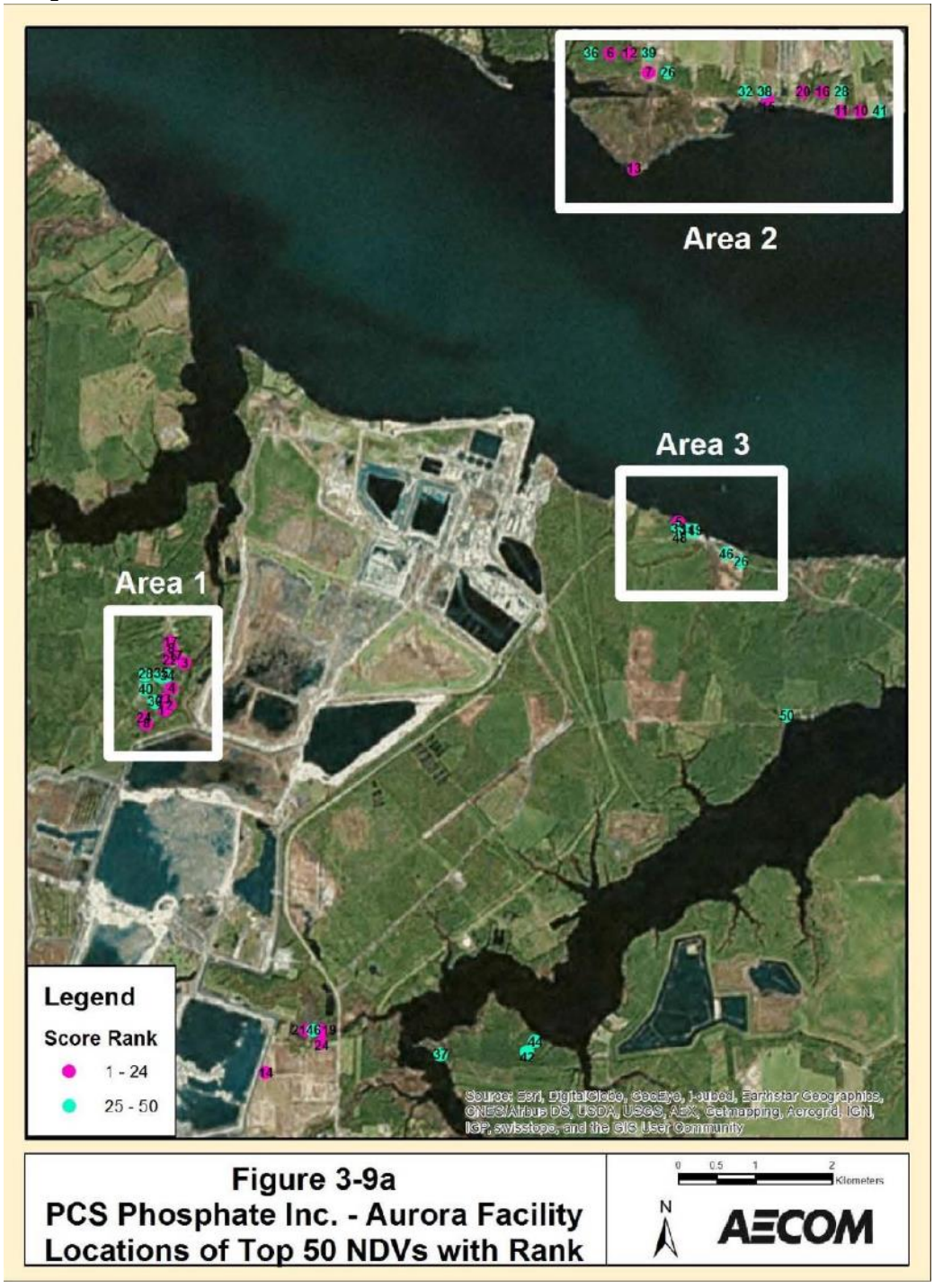
From this modeling analysis, Normalized Design Values (NDV's) were obtained and then ranked to locate the areas with the maximum concentration of SO_2 in the vicinity of the PCS Phosphate facility. In order to determine these areas, each receptor in the grid was analyzed and scored using the process referred to in Appendix A of the Monitoring TAD, as follows:

1. NDV's were ranked from highest to lowest (1 meaning the highest)
2. The frequency of each receptor was ranked from highest to lowest (1 meaning the most number of days with daily maximum value)
3. The NDV ranks and the frequency ranks were added for each receptor to obtain a score.
4. These scores were then ranked from lowest to highest. The receptors with the lowest scores were identified as being in the best place to locate the monitor.

Figure 36, shows the three general areas where the most favorable receptors were located. The Bayview monitoring site is near the 15th ranked modeling receptor. Many of the locations of higher ranked receptors are not feasible or accessible for monitoring due to heavily forested areas or property access issues. Based on the EPA's review of the modeling files and the PCS monitoring report provided by North Carolina, the EPA believes that the Bayview monitor is located in an appropriate location for the characterization of the maximum 1-hour SO_2 concentrations in the vicinity of the PCS Phosphate facility. As seen in Figure 37, in Section 7.4, the wind predominantly blows from the southwest, such that the Bayview monitor is directly downwind from the facility at one of the nearest locations to the facility to feasibly locate a monitoring site, since locating a monitoring site on the river is not practical.

In July 1, 2016, North Carolina submitted their 2016-2017 Annual Monitoring Network Plan for the EPA's approval, which included the modeling assessment for the PCS phosphate facility, along with a justification that the Bayview monitor meets the requirements in 40 CFR Part 58 Appendix D. The EPA reviewed the State's 2016-2017 Annual Monitoring Network Plan and approved the plan on December 15, 2016. We determined that the Bayview monitor was indeed in compliance with Part 58 Appendix D and that it is located in an area to characterize the maximum ambient 1-hour SO_2 concentration near the PCS Phosphate facility.

Figure 36. Beaufort County Area Showing Maximum Concentration Areas near the PCS Phosphate facility. Source: SO_2 Data Requirements Rule Monitoring Siting Analysis prepared April 2016.



7.3. Emissions and Emissions-Related Data

Evidence of SO_2 emissions in the vicinity of a monitor is an important factor for determining air quality conditions in the area. Considerations for this factor also include county level SO_2 emissions data and data for sources within 50 km of DRR monitor. North Carolina evaluated SO_2 emissions for sources within 50 km of the DRR monitor in the State emitting any level of SO_2. The state obtained the emissions data from annual facility reports submitted to the State and the 2014 NEI.[25] The EPA corroborated the emissions data and identified all sources that emitted 1 tpy or more of SO_2 located within 50 km of the PCS Phosphate facility and within 50 km of the Bayview monitor. This information is summarized in Table 28 below.

Table 28. SO_2 Emissions for Beaufort County and the Surrounding Area within 50 km of the PCS Phosphate Facility and the Bayview Monitoring Site

County	Township	Facility Name	Facility Located in State Recom-mended Area?	Facility Located in the EPA's Intended Area?	Facility Location (Distance from the monitor in km)	Facility Total SO_2 Emissions (tpy) – 2014 NEI
Beaufort	Richland	PCS Phosphate Company, Inc – Aurora facility	Yes	Yes	1530 NC Highway 306 S. Aurora, NC (6)	4,072
Beaufort	Washington	Warren Field	Yes	Yes	Unknown (32)	3
Beaufort	Washington	Riverside Grain Company, Inc.	Yes	Yes	1041 East 4th Street, Washington NC (30)	2
Beaufort	Washington	Flanders Filters, Inc.	Yes	Yes	531 Flanders Filters Road, Washington NC (37)	1
Craven	Washington	CarolinaEast Medical Center	No	No	2000 Neuse Boulevard, New Bern, NC (45)	3
Craven	Township 8	S.T. Wooten Corporation –	No	No	245 Parker Road, New	3

[25] Detailed information for the 2014 NEI can be found at this link: https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data

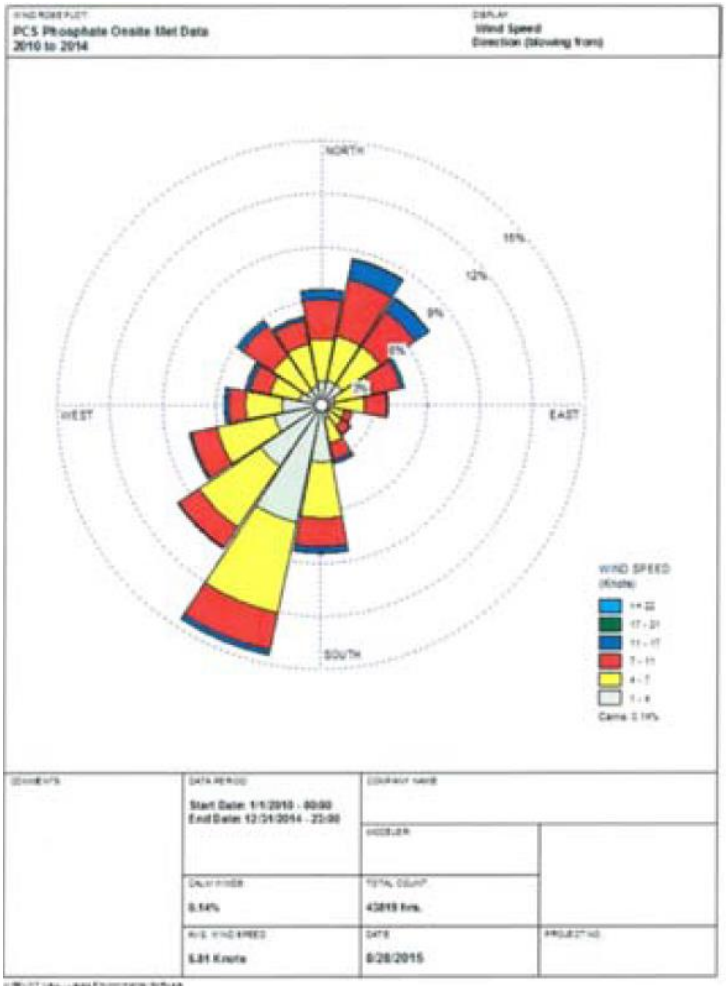
County	Township	Facility Name	Facility Located in State Recom-mended Area?	Facility Located in the EPA's Intended Area?	Facility Location (Distance from the monitor in km)	Facility Total SO_2 Emissions (tpy) – 2014 NEI
		Craven Co Plant			Bern, NC (48)	
Martin	Jamesville	Domtar Paper Company, LLC	No	No	NC Highway 149 North, Plymouth, NC (49)	664
Martin	Williams	Barnhill Contracting Company – Williamston	No	No	1210 West Islands Road, Williamsto wn, NC (49)	4
Washington	Plymouth	Plymouth Muni	No	No	Unknown (42)	1

All sources in Beaufort county, other than the PCS Phosphate facility, emitted a combined total of 5.95 tons of SO_2 in 2014. Given this very low level of emissions, these sources are not expected to cause or contribute to NAAQS exceedances in the Beaufort County area. In addition, the Domtar Paper Company, LLC is located in Martin County north of Beaufort, and emitted 664 tons of SO_2 in 2014. However, the EPA notes Domtar is located approximately 49 km from the Bayview monitor and therefore the EPA believes this source is not contributing to the Beaufort County Area or the Bayview monitor.

7.4. Meteorology for the Beaufort County Area

Evidence of source-receptor relationships between specific emissions sources and high SO_2 concentrations at a monitor is another important factor in determining the air quality conditions in an area. As shown in Figure 37, meteorological records collected from onsite the PCS Phosphate facility indicates winds blow predominantly from the southwest. This figure was obtained from the PCS Monitoring report submitted by the state, where a modeling analysis was carried out to determine if the Bayview monitor was correctly placed to capture maximum impacts form the PCS Phosphate facility. More details on this modeling analysis are found in Section 7.2.1.

Figure 37. Wind Rose for Beaufort County, North Carolina in the area surrounding the PCS Phosphate facility: SO_2 Data Requirements Rule Monitoring Siting Analysis prepared by AECOM, April 2016.



Given the location of the monitor in relation to the PCS Phosphate facility, the EPA believes that the monitoring is capturing the impacts from this facility due to the wind direction of the surrounding area.

7.5. Geography and Topography for the Beaufort County Area

The terrain in the area surrounding the PCS Phosphate facility is best described as gently rolling and it is bounded on two sides by the Pamlico River to the north. The State's latest recommendation does not offer any information on the topography or geography of the area, but from the information obtained from other sources, the EPA believes that the area has no complex terrain and so emissions from the PCS Phosphate facility are being captured by the Bayview monitor located just across the Pamlico River.

7.6. Jurisdictional Boundaries in the Beaufort County Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for Beaufort County. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

The PCS Phosphate facility is located in the southeast region of the Beaufort County, which is located near the eastern edge of the state of North Carolina. Beaufort County is bounded by Hyde County to the northeast, Washington and Martin Counties to the north, Pitt County to the west, and Craven and Pamlico Counties to the south. Beaufort County is also bounded to the east by the mouth of the Pamlico river, which cuts through the center of the county and bounds the PCS Phosphate facility on the north side of the facility's fence line. In its January 2017 recommendation letter, the State recommended that the area surrounding the PCS Phosphate facility, specifically all townships in Beaufort County, be designated as attainment based in part on an assessment and characterization of air quality impacts from the facilities previously discussed. These townships are summarized below in Table 29. More detail is given about the intended designation for the Beaufort County in Section 7.9.

Table 29. North Carolina's Townships Bounded by the PCS Phosphate Facility area.

Township	County of Township	North Carolina's Recommended Designation	EPA's Intended Designation
Bath	Beaufort	Attainment	Unclassifiable/Attainment
Chocowinity		Attainment	Unclassifiable/Attainment
Long Acre		Attainment	Unclassifiable/Attainment
Pantego		Attainment	Unclassifiable/Attainment
Richland		Attainment	Unclassifiable/Attainment
Washington		Attainment	Unclassifiable/Attainment

7.7. Other Information Relevant to the Designations for Beaufort County

No other relevant information is available for the Beaufort County area.

7.8. EPA's Assessment of the Available Information for the Beaufort County Area

After evaluating air quality monitoring data, SO_2 emissions, and other factors, the EPA agrees with the State's recommendation and intends to designate the Beaufort County Area unclassifiable/attainment for the 1-hour SO_2 NAAQS based on attaining air quality monitoring data. Specifically, EPA's intended designation is based on the most recent three years of complete, quality-assured, certified data from this monitor 2014-2016 which measures a 1-hr SO_2 design value of 23 ppb. Data collected by this monitor is comparable to the NAAQS, and indicates that the most recent SO_2 levels are below the 1-hr NAAQS. Through an air quality modeling analysis submitted with their 2016 Annual Ambient Air Monitoring Network Plan,, North Carolina demonstrated that the Bayview monitor is properly sited to characterize the maximum 1-hr SO_2 concentrations near the PCS Phosphate DRR source (see Section 7.2.1 below).North Carolina elected to characterize the area using air monitoring under the DRR, and the existing Bayview air quality monitoring site approved by the EPA to characterize the maximum 1-hour SO_2 concentrations in the area. The EPA agrees with the State's modeling analysis that determined that the existing Bayview monitor is located to capture maximum 1-hour SO_2 concentrations from the PCS Phosphate source and believes, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, that the area meets the 2010 SO_2 NAAQS. The EPA notes there are no 2010 SO_2 nonattainment areas near Beaufort County, North Carolina, and no expected nonattainment areas for this third round of designations. Furthermore, there are no nearby Round 4 areas being characterized by December 31, 2020 based on a newly deployed SO_2 monitor. Therefore, based on the available information including monitoring and modeling, the EPA believes the Beaufort County area is not expected to contribute to ambient air quality in a nearby area that does not meet the NAAQS.

North Carolina considered county level SO_2 emissions data for sources within 50 km of the DRR monitor and determined that that no major SO_2-emitting sources are located within Beaufort County (other than PCS Phosphates) and no cluster of sources emitted a significant amount of SO_2. See Table 28. Specifically, sources in Beaufort County (not including the PCS Phosphate facility) emitted a combined total of 5.95 tons of SO_2 in 2014. In addition, the Domtar Paper Company, LLC is located in Martin County north of Beaufort, and emitted 664 tons of SO_2 in 2014. However, the EPA notes Domtar is located approximately 49 km from the Bayview monitor and therefore the EPA believes this source is not contributing to the Beaufort County Area or the Bayview monitor. The EPA believes that our intended unclassifiable/attainment area, bounded by the entire Beaufort County and including the townships in the table above, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area. For other county designations please refer to the different sections of this document.

7.9. Summary of Our Intended Designation for the Beaufort County Area

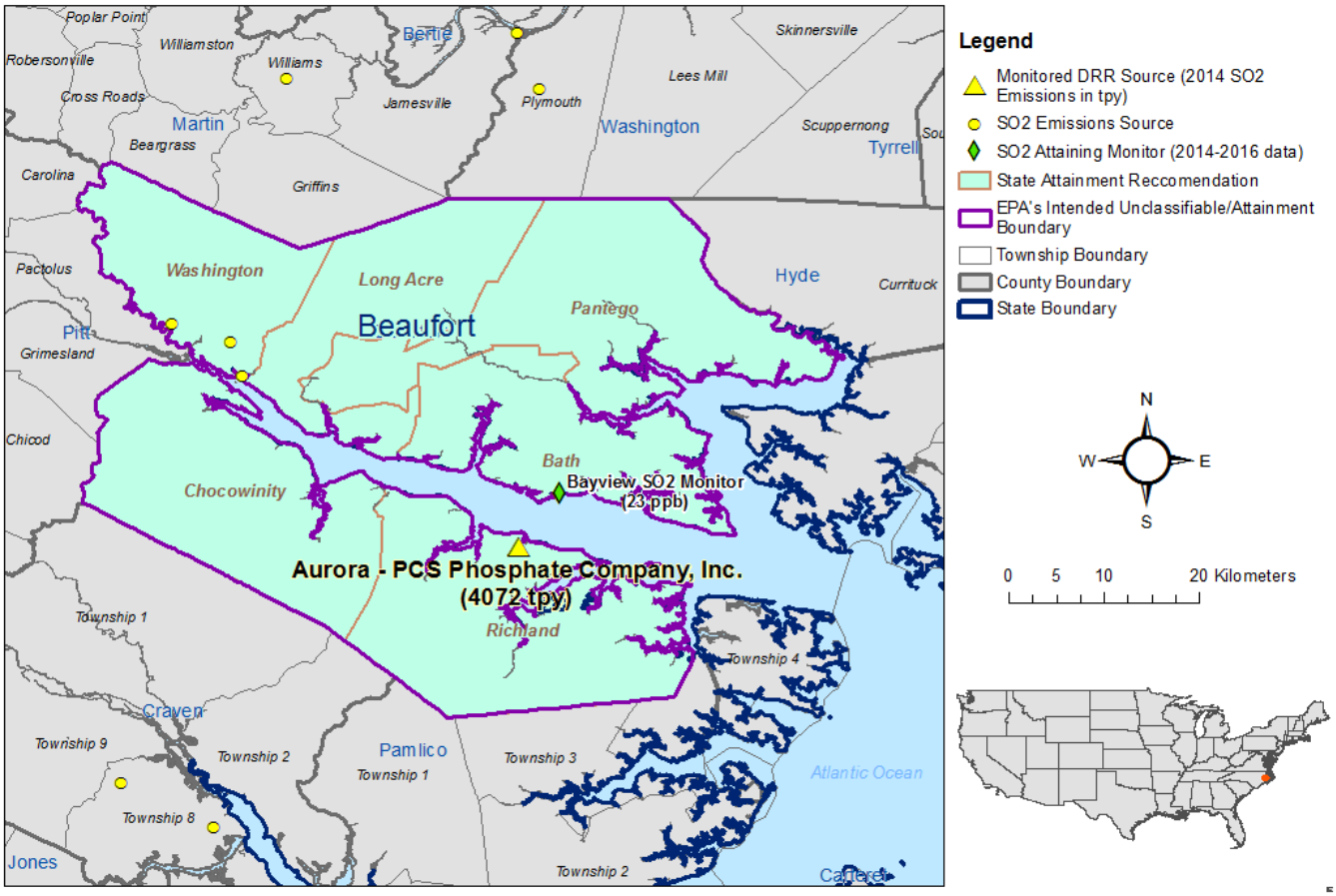
After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate all townships in Beaufort County as unclassifiable/attainment for the 2010 SO_2 NAAQS because based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has

determined that the area: (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS. Specifically, the boundaries are comprised of all townships within the Beaufort county line. Table 30 bellow lists the townships that this boundary includes. In addition, Figure 38 shows a map of the boundary of this intended designated area.

Table 30. North Carolina's Townships Bounded by the Beaufort County.

Township	County of Township	North Carolina's Recommended Designation	EPA's Intended Designation
Bath	Beaufort	Attainment	Unclassifiable/Attainment
Chocowinity		Attainment	Unclassifiable/Attainment
Long Acre		Attainment	Unclassifiable/Attainment
Pantego		Attainment	Unclassifiable/Attainment
Richland		Attainment	Unclassifiable/Attainment
Washington		Attainment	Unclassifiable/Attainment

Figure 38. Boundary of the Intended Beaufort County Unclassifiable/Attainment Area



At this time, our intended designations for the State only apply to this area and the other areas presented in this technical support document. The EPA intends to evaluate and designate all remaining undesignated areas in North Carolina by December 31, 2020.

8. Technical Analysis for Remaining Areas in North Carolina

8.1. Introduction

In its January 13, 2017, submission, the State of North Carolina recommended each county in the State be designated attainment based on townships. Specifically, the State recommended that all townships not included in the modeled or monitored DRR areas of the State, be designated attainment due to these individual townships not having any SO_2 emitting facilities in the area or having only facilities with emissions less than 2,000 tpy. This does not include the areas listed in Table 2 for which the EPA is taking no action at this time but must designate by December 31, 2020.

This assessment and characterization is based an analysis of emissions and air quality monitoring data in the counties and surrounding areas. After careful review of the State's assessment, supporting documentation, and all available data, the EPA agrees with the states recommended boundary and intends to designate the remaining undesignated counties in the state, based on townships as unclassifiable/attainment for the 2010 SO_2 NAAQS. At this time, there are no air quality modeling results available for the remaining areas in the State. In addition, there are no air quality monitoring data that indicate any violation of the 1-hour SO_2 NAAQS in the State. Therefore, the EPA is designating the remaining townships in Table 33 in the State as unclassifiable/attainment since these counties were not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

North Carolina installed and begun operation of new, approved SO_2 monitoring network meeting EPA specifications referenced in the EPA's SO_2 DRR for three DRR sources and one additional source (see Table 2). The EPA notes that no DRR sources in North Carolina elected to restrict their emissions to below 2,000 tpy in lieu of modeling or monitoring nor did any sources officially shutdown prior to January 13, 2017. Table 31 summarizes North Carolina's recommendations for these areas.

After careful review of the State's assessment, supporting documentation, and all available data, the EPA agrees with the State's recommended boundaries for these areas intends to designate the townships in Table 33 as "unclassifiable/attainment." The EPA's unclassifiable/attainment designation for the remaining areas in the state include the Eastern Band of Cherokee Indians' trust lands. The EPA believes the "unclassifiable/attainment" designation is appropriate because these areas were not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the areas may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS. Figure 39 shows the locations of these areas within North Carolina.

Table 31. Remaining Areas in North Carolina that the EPA Intends to Designate

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
Alamance (p)	Patterson	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Coble		Attainment	Same as state	Unclassifiable/ Attainment
	Boone Station		Attainment	Same as state	Unclassifiable/ Attainment
	Faucette		Attainment	Same as state	Unclassifiable/ Attainment
	Graham		Attainment	Same as state	Unclassifiable/ Attainment
	Albright		Attainment	Same as state	Unclassifiable/ Attainment
	Newlin		Attainment	Same as state	Unclassifiable/ Attainment
	Thompson		Attainment	Same as state	Unclassifiable/ Attainment
	Melville		Attainment	Same as state	Unclassifiable/ Attainment
	Pleasant Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Burlington		Attainment	Same as state	Unclassifiable/ Attainment
	Haw River		Attainment	Same as state	Unclassifiable/ Attainment
Allegahny	Cherry Lane	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cranberry		Attainment	Same as state	Unclassifiable/ Attainment
	Gap Civil		Attainment	Same as state	Unclassifiable/ Attainment
	Glade Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Piney Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Prathers Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Whitehead		Attainment	Same as state	Unclassifiable/ Attainment
Anson	Ansonville	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Burnsville		Attainment	Same as state	Unclassifiable/ Attainment
	Gulledge		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Lanesboro		Attainment	Same as state	Unclassifiable/ Attainment
	Lilesville		Attainment	Same as state	Unclassifiable/ Attainment
	Morven		Attainment	Same as state	Unclassifiable/ Attainment
	Wadesboro		Attainment	Same as state	Unclassifiable/ Attainment
	White Store		Attainment	Same as state	Unclassifiable/ Attainment
Ashe	Chestnut Hill	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Clifton		Attainment	Same as state	Unclassifiable/ Attainment
	Creston		Attainment	Same as state	Unclassifiable/ Attainment
	Elk		Attainment	Same as state	Unclassifiable/ Attainment
	Grassy Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Helton		Attainment	Same as state	Unclassifiable/ Attainment
	Horse Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Hurricane		Attainment	Same as state	Unclassifiable/ Attainment
	Jefferson		Attainment	Same as state	Unclassifiable/ Attainment
	Laurel		Attainment	Same as state	Unclassifiable/ Attainment
	North Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Obids		Attainment	Same as state	Unclassifiable/ Attainment
	Old Fields		Attainment	Same as state	Unclassifiable/ Attainment
	Peak Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Pine Swamp		Attainment	Same as state	Unclassifiable/ Attainment
	Piney Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Pond Mountain		Attainment	Same as state	Unclassifiable/ Attainment
	Walnut Hill		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	West Jefferson		Attainment	Same as state	Unclassifiable/ Attainment
Avery	Altamont	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Banner Elk		Attainment	Same as state	Unclassifiable/ Attainment
	Beech Mountain		Attainment	Same as state	Unclassifiable/ Attainment
	Carey's Flat		Attainment	Same as state	Unclassifiable/ Attainment
	Cranberry		Attainment	Same as state	Unclassifiable/ Attainment
	Elk Park		Attainment	Same as state	Unclassifiable/ Attainment
	Frank		Attainment	Same as state	Unclassifiable/ Attainment
	Heaton		Attainment	Same as state	Unclassifiable/ Attainment
	Hughes		Attainment	Same as state	Unclassifiable/ Attainment
	Ingalls		Attainment	Same as state	Unclassifiable/ Attainment
	Linville		Attainment	Same as state	Unclassifiable/ Attainment
	Minneapolis		Attainment	Same as state	Unclassifiable/ Attainment
	Montezuma		Attainment	Same as state	Unclassifiable/ Attainment
	Newland No. 1		Attainment	Same as state	Unclassifiable/ Attainment
	Newland No. 2		Attainment	Same as state	Unclassifiable/ Attainment
	Pineola		Attainment	Same as state	Unclassifiable/ Attainment
	Plumtree		Attainment	Same as state	Unclassifiable/ Attainment
	Pyatte		Attainment	Same as state	Unclassifiable/ Attainment
	Roaring Creek		Attainment	Same as state	Unclassifiable/ Attainment
Bertie	Colerain	All remaining Townships outside the modeled or	Attainment	Same as state	Unclassifiable/ Attainment
	Indian Woods		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Merry Hill	monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Mitchell		Attainment	Same as state	Unclassifiable/ Attainment
	Roxobel		Attainment	Same as state	Unclassifiable/ Attainment
	Snakebite		Attainment	Same as state	Unclassifiable/ Attainment
	Whites		Attainment	Same as state	Unclassifiable/ Attainment
	Windsor		Attainment	Same as state	Unclassifiable/ Attainment
	Woodville		Attainment	Same as state	Unclassifiable/ Attainment
Bladen	Abbotts	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Bethel		Attainment	Same as state	Unclassifiable/ Attainment
	Bladenboro		Attainment	Same as state	Unclassifiable/ Attainment
	Brown Marsh		Attainment	Same as state	Unclassifiable/ Attainment
	Carvers Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Central		Attainment	Same as state	Unclassifiable/ Attainment
	Colly		Attainment	Same as state	Unclassifiable/ Attainment
	Cypress Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Elizabethtown		Attainment	Same as state	Unclassifiable/ Attainment
	Frenches Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Hollow		Attainment	Same as state	Unclassifiable/ Attainment
	Lake Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Turnbull		Attainment	Same as state	Unclassifiable/ Attainment
	White Oak		Attainment	Same as state	Unclassifiable/ Attainment
	Whites Creek		Attainment	Same as state	Unclassifiable/ Attainment
Buncombe	Asheville	All remaining	Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
(p)		Townships outside the modeled or monitored areas			Attainment
	Avery Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Black Mountain		Attainment	Same as state	Unclassifiable/ Attainment
	Broad River		Attainment	Same as state	Unclassifiable/ Attainment
	Fairview		Attainment	Same as state	Unclassifiable/ Attainment
	Flat Creek		Attainment	Same as state	Unclassifiable/ Attainment
	French Broad		Attainment	Same as state	Unclassifiable/ Attainment
	Ivy		Attainment	Same as state	Unclassifiable/ Attainment
	Leicester		Attainment	Same as state	Unclassifiable/ Attainment
	Lower Hominy		Attainment	Same as state	Unclassifiable/ Attainment
	Reems Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Sandy Mush		Attainment	Same as state	Unclassifiable/ Attainment
	Swannanoa		Attainment	Same as state	Unclassifiable/ Attainment
	Upper Hominy		Attainment	Same as state	Unclassifiable/ Attainment
Burke (p)	Drexel	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Jonas Ridge		Attainment	Same as state	Unclassifiable/ Attainment
	Linville		Attainment	Same as state	Unclassifiable/ Attainment
	Lower Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Morganton		Attainment	Same as state	Unclassifiable/ Attainment
	Quaker Meadows		Attainment	Same as state	Unclassifiable/ Attainment
	Silver Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Smoky Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Upper Creek		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Upper Fork		Attainment	Same as state	Unclassifiable/ Attainment
Caldwell (p)	Globe	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Johns River		Attainment	Same as state	Unclassifiable/ Attainment
	Mulberry		Attainment	Same as state	Unclassifiable/ Attainment
	Patterson		Attainment	Same as state	Unclassifiable/ Attainment
	Wilson Creek		Attainment	Same as state	Unclassifiable/ Attainment
Camden	Courthouse	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Shiloh		Attainment	Same as state	Unclassifiable/ Attainment
	South Mills		Attainment	Same as state	Unclassifiable/ Attainment
Carteret	Atlantic	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Beaufort		Attainment	Same as state	Unclassifiable/ Attainment
	Cedar Island		Attainment	Same as state	Unclassifiable/ Attainment
	Davis		Attainment	Same as state	Unclassifiable/ Attainment
	Harkers Island		Attainment	Same as state	Unclassifiable/ Attainment
	Harlowe		Attainment	Same as state	Unclassifiable/ Attainment
	Marshallberg		Attainment	Same as state	Unclassifiable/ Attainment
	Merrimon		Attainment	Same as state	Unclassifiable/ Attainment
	Morehead		Attainment	Same as state	Unclassifiable/ Attainment
	Newport		Attainment	Same as state	Unclassifiable/ Attainment
	Portsmouth		Attainment	Same as state	Unclassifiable/ Attainment
	Sea Level		Attainment	Same as state	Unclassifiable/ Attainment
	Smyrna		Attainment	Same as state	Unclassifiable/ Attainment
	Stacy		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Straits		Attainment	Same as state	Unclassifiable/ Attainment
	White Oak		Attainment	Same as state	Unclassifiable/ Attainment
Caswell (p)	Anderson	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Dan River		Attainment	Same as state	Unclassifiable/ Attainment
	Hightowers		Attainment	Same as state	Unclassifiable/ Attainment
	Leasburg		Attainment	Same as state	Unclassifiable/ Attainment
	Locust Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Milton		Attainment	Same as state	Unclassifiable/ Attainment
	Pelham		Attainment	Same as state	Unclassifiable/ Attainment
	Yanceyville		Attainment	Same as state	Unclassifiable/ Attainment
Chatham	Albright	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Baldwin		Attainment	Same as state	Unclassifiable/ Attainment
	Bear Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Cape Fear		Attainment	Same as state	Unclassifiable/ Attainment
	Center		Attainment	Same as state	Unclassifiable/ Attainment
	Gulf		Attainment	Same as state	Unclassifiable/ Attainment
	Hadley		Attainment	Same as state	Unclassifiable/ Attainment
	Haw River		Attainment	Same as state	Unclassifiable/ Attainment
	Hickory Mountain		Attainment	Same as state	Unclassifiable/ Attainment
	Matthews		Attainment	Same as state	Unclassifiable/ Attainment
	New Hope		Attainment	Same as state	Unclassifiable/ Attainment
	Oakland		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Williams		Attainment	Same as state	Unclassifiable/ Attainment
Cherokee	Beaverdam	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Hothouse		Attainment	Same as state	Unclassifiable/ Attainment
	Murphy		Attainment	Same as state	Unclassifiable/ Attainment
	Notla		Attainment	Same as state	Unclassifiable/ Attainment
	Shoal Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Valleytown		Attainment	Same as state	Unclassifiable/ Attainment
Chowan	Edenton	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Middle		Attainment	Same as state	Unclassifiable/ Attainment
	Upper		Attainment	Same as state	Unclassifiable/ Attainment
	Yeopim		Attainment	Same as state	Unclassifiable/ Attainment
Clay	Brasstown	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Hayesville		Attainment	Same as state	Unclassifiable/ Attainment
	Hiawassee		Attainment	Same as state	Unclassifiable/ Attainment
	Shooting Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Sweetwater		Attainment	Same as state	Unclassifiable/ Attainment
	Tusquittee		Attainment	Same as state	Unclassifiable/ Attainment
Columbus	Bogue	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Bolton		Attainment	Same as state	Unclassifiable/ Attainment
	Bug Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Cerro Gordo		Attainment	Same as state	Unclassifiable/ Attainment
	Chadbourn		Attainment	Same as state	Unclassifiable/ Attainment
	Fair Bluff		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Lees		Attainment	Same as state	Unclassifiable/ Attainment
	Ransom		Attainment	Same as state	Unclassifiable/ Attainment
	South Williams		Attainment	Same as state	Unclassifiable/ Attainment
	Tatums		Attainment	Same as state	Unclassifiable/ Attainment
	Waccamaw		Attainment	Same as state	Unclassifiable/ Attainment
	Welches Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Western Prong		Attainment	Same as state	Unclassifiable/ Attainment
	Whiteville		Attainment	Same as state	Unclassifiable/ Attainment
	Williams		Attainment	Same as state	Unclassifiable/ Attainment
Craven	Township 1	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Township 2		Attainment	Same as state	Unclassifiable/ Attainment
	Township 3		Attainment	Same as state	Unclassifiable/ Attainment
	Township 5		Attainment	Same as state	Unclassifiable/ Attainment
	Township 6		Attainment	Same as state	Unclassifiable/ Attainment
	Township 7		Attainment	Same as state	Unclassifiable/ Attainment
	Township 8		Attainment	Same as state	Unclassifiable/ Attainment
	Township 9		Attainment	Same as state	Unclassifiable/ Attainment
Cumberland	Beaver Dam	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Black River		Attainment	Same as state	Unclassifiable/ Attainment
	Carvers Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Cedar Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Cross Creek		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Eastover		Attainment	Same as state	Unclassifiable/ Attainment
	Grays Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Manchester		Attainment	Same as state	Unclassifiable/ Attainment
	Pearces Mill		Attainment	Same as state	Unclassifiable/ Attainment
	Rockfish		Attainment	Same as state	Unclassifiable/ Attainment
	Seventy-First		Attainment	Same as state	Unclassifiable/ Attainment
Currituck	Crawford	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Fruitville		Attainment	Same as state	Unclassifiable/ Attainment
	Moyock		Attainment	Same as state	Unclassifiable/ Attainment
	Poplar Branch		Attainment	Same as state	Unclassifiable/ Attainment
Dare	Atlantic	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Croatan		Attainment	Same as state	Unclassifiable/ Attainment
	East Lake		Attainment	Same as state	Unclassifiable/ Attainment
	Hatteras		Attainment	Same as state	Unclassifiable/ Attainment
	Kinnakeet		Attainment	Same as state	Unclassifiable/ Attainment
	Nags Head		Attainment	Same as state	Unclassifiable/ Attainment
Davidson (p)	Alleghany	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Conrad Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Cotton Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Emmons		Attainment	Same as state	Unclassifiable/ Attainment
	Healing Spring		Attainment	Same as state	Unclassifiable/ Attainment
	Jackson Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Silver Hill		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
Duplin	Albertson	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cypress Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Faison		Attainment	Same as state	Unclassifiable/ Attainment
	Glisson		Attainment	Same as state	Unclassifiable/ Attainment
	Island Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Kenansville		Attainment	Same as state	Unclassifiable/ Attainment
	Limestone		Attainment	Same as state	Unclassifiable/ Attainment
	Magnolia		Attainment	Same as state	Unclassifiable/ Attainment
	Rockfish		Attainment	Same as state	Unclassifiable/ Attainment
	Rose Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Smith		Attainment	Same as state	Unclassifiable/ Attainment
	Warsaw		Attainment	Same as state	Unclassifiable/ Attainment
	Wolfscrape		Attainment	Same as state	Unclassifiable/ Attainment
Durham	Carr	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Durham		Attainment	Same as state	Unclassifiable/ Attainment
	Lebanon		Attainment	Same as state	Unclassifiable/ Attainment
	Mangum		Attainment	Same as state	Unclassifiable/ Attainment
	Oak Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Triangle		Attainment	Same as state	Unclassifiable/ Attainment
Edgecombe	Tarboro	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Lower Conetoe		Attainment	Same as state	Unclassifiable/ Attainment
	Upper Conetoe		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Deep Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Lower Fishing Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Upper Fishing Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Swift Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Sparta		Attainment	Same as state	Unclassifiable/ Attainment
	Otter Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Lower Town Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Walnut Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Rocky Mount		Attainment	Same as state	Unclassifiable/ Attainment
	Cokey		Attainment	Same as state	Unclassifiable/ Attainment
	Upper Town Creek		Attainment	Same as state	Unclassifiable/ Attainment
Franklin	Cedar Rock	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cypress Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Dunn		Attainment	Same as state	Unclassifiable/ Attainment
	Franklinton		Attainment	Same as state	Unclassifiable/ Attainment
	Gold Mine		Attainment	Same as state	Unclassifiable/ Attainment
	Harris		Attainment	Same as state	Unclassifiable/ Attainment
	Hayesville		Attainment	Same as state	Unclassifiable/ Attainment
	Louisburg		Attainment	Same as state	Unclassifiable/ Attainment
	Sandy Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Youngsville		Attainment	Same as state	Unclassifiable/ Attainment
Gates	Gatesville	All remaining Townships outside the	Attainment	Same as state	Unclassifiable/ Attainment
	Hall		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
		modeled or monitored areas			Attainment
	Haslett		Attainment	Same as state	Unclassifiable/ Attainment
	Holly Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Hunters Mill		Attainment	Same as state	Unclassifiable/ Attainment
	Mintonsville		Attainment	Same as state	Unclassifiable/ Attainment
	Reynoldson		Attainment	Same as state	Unclassifiable/ Attainment
Graham	Cheoah	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Stecoah		Attainment	Same as state	Unclassifiable/ Attainment
	Yellow Creek		Attainment	Same as state	Unclassifiable/ Attainment
Granville (p)	Brassfield	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Dutchville		Attainment	Same as state	Unclassifiable/ Attainment
	Fishing Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Oxford		Attainment	Same as state	Unclassifiable/ Attainment
	Salem		Attainment	Same as state	Unclassifiable/ Attainment
	Sassafras Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Tally Ho		Attainment	Same as state	Unclassifiable/ Attainment
Greene	Bull Head	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Carrs		Attainment	Same as state	Unclassifiable/ Attainment
	Hookerton		Attainment	Same as state	Unclassifiable/ Attainment
	Jason		Attainment	Same as state	Unclassifiable/ Attainment
	Olds		Attainment	Same as state	Unclassifiable/ Attainment
	Ormonds		Attainment	Same as state	Unclassifiable/ Attainment
	Shine		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Snow Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Speights Bridge		Attainment	Same as state	Unclassifiable/ Attainment
Guilford (p)	Greene	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
Halifax	Brinkleyville	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Butterwood		Attainment	Same as state	Unclassifiable/ Attainment
	Conoconnara		Attainment	Same as state	Unclassifiable/ Attainment
	Enfield		Attainment	Same as state	Unclassifiable/ Attainment
	Faucett		Attainment	Same as state	Unclassifiable/ Attainment
	Halifax		Attainment	Same as state	Unclassifiable/ Attainment
	Littleton		Attainment	Same as state	Unclassifiable/ Attainment
	Palmyra		Attainment	Same as state	Unclassifiable/ Attainment
	Roanoke Rapids		Attainment	Same as state	Unclassifiable/ Attainment
	Roseneath		Attainment	Same as state	Unclassifiable/ Attainment
	Scotland Neck		Attainment	Same as state	Unclassifiable/ Attainment
	Weldon		Attainment	Same as state	Unclassifiable/ Attainment
Harnett	Anderson Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Averasboro		Attainment	Same as state	Unclassifiable/ Attainment
	Barbecue		Attainment	Same as state	Unclassifiable/ Attainment
	Black River		Attainment	Same as state	Unclassifiable/ Attainment
	Buckhorn		Attainment	Same as state	Unclassifiable/ Attainment
	Duke		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Hectors Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Johnsonville		Attainment	Same as state	Unclassifiable/ Attainment
	Lillington		Attainment	Same as state	Unclassifiable/ Attainment
	Neills Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Stewarts Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Upper Little River		Attainment	Same as state	Unclassifiable/ Attainment
Haywood (p)	Cataloochee	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cecil		Attainment	Same as state	Unclassifiable/ Attainment
	Clyde		Attainment	Same as state	Unclassifiable/ Attainment
	Crabtree		Attainment	Same as state	Unclassifiable/ Attainment
	East Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Fines Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Iron Duff		Attainment	Same as state	Unclassifiable/ Attainment
	Ivy Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Jonathan Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Pigeon		Attainment	Same as state	Unclassifiable/ Attainment
	Waynesville		Attainment	Same as state	Unclassifiable/ Attainment
	White Oak		Attainment	Same as state	Unclassifiable/ Attainment
Henderson	Blue Ridge	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Clear Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Crab Creek		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Edneyville		Attainment	Same as state	Unclassifiable/ Attainment
	Green River		Attainment	Same as state	Unclassifiable/ Attainment
	Hendersonville		Attainment	Same as state	Unclassifiable/ Attainment
	Hoopers Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Mills River		Attainment	Same as state	Unclassifiable/ Attainment
Hertfor	Ahoskie	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Harrellsville		Attainment	Same as state	Unclassifiable/ Attainment
	Maneys Neck		Attainment	Same as state	Unclassifiable/ Attainment
	Murfreesboro		Attainment	Same as state	Unclassifiable/ Attainment
	St. Johns		Attainment	Same as state	Unclassifiable/ Attainment
	Winton		Attainment	Same as state	Unclassifiable/ Attainment
Hoke	Allendale	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Antioch		Attainment	Same as state	Unclassifiable/ Attainment
	Blue Springs		Attainment	Same as state	Unclassifiable/ Attainment
	Fort Bragg Military Reservation		Attainment	Same as state	Unclassifiable/ Attainment
	McLauchlin		Attainment	Same as state	Unclassifiable/ Attainment
	Quewhiffle		Attainment	Same as state	Unclassifiable/ Attainment
	Raeford		Attainment	Same as state	Unclassifiable/ Attainment
	Stonewall		Attainment	Same as state	Unclassifiable/ Attainment
Hyde	Currituck	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Fairfield		Attainment	Same as state	Unclassifiable/ Attainment
	Lake Landing		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Lake Mattamuskeet		Attainment	Same as state	Unclassifiable/ Attainment
	Ocracoke		Attainment	Same as state	Unclassifiable/ Attainment
	Swan Quarter		Attainment	Same as state	Unclassifiable/ Attainment
Jackson	Barkers Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Canada		Attainment	Same as state	Unclassifiable/ Attainment
	Caney Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Cashiers		Attainment	Same as state	Unclassifiable/ Attainment
	Cullowhee		Attainment	Same as state	Unclassifiable/ Attainment
	Dillsboro		Attainment	Same as state	Unclassifiable/ Attainment
	Greens Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Hamburg		Attainment	Same as state	Unclassifiable/ Attainment
	Mountain		Attainment	Same as state	Unclassifiable/ Attainment
	Qualla		Attainment	Same as state	Unclassifiable/ Attainment
	River		Attainment	Same as state	Unclassifiable/ Attainment
	Savannah		Attainment	Same as state	Unclassifiable/ Attainment
	Scott Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Sylva		Attainment	Same as state	Unclassifiable/ Attainment
	Webster		Attainment	Same as state	Unclassifiable/ Attainment
Johnston	Banner	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Bentonville		Attainment	Same as state	Unclassifiable/ Attainment
	Beulah		Attainment	Same as state	Unclassifiable/ Attainment
	Boon Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Clayton		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Cleveland		Attainment	Same as state	Unclassifiable/ Attainment
	Elevation		Attainment	Same as state	Unclassifiable/ Attainment
	Ingrams		Attainment	Same as state	Unclassifiable/ Attainment
	Meadow		Attainment	Same as state	Unclassifiable/ Attainment
	Micro		Attainment	Same as state	Unclassifiable/ Attainment
	O'Neals		Attainment	Same as state	Unclassifiable/ Attainment
	Pine Level		Attainment	Same as state	Unclassifiable/ Attainment
	Pleasant Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Selma		Attainment	Same as state	Unclassifiable/ Attainment
	Smithfield		Attainment	Same as state	Unclassifiable/ Attainment
	Wilders		Attainment	Same as state	Unclassifiable/ Attainment
	Wilson Mills		Attainment	Same as state	Unclassifiable/ Attainment
Jones	White Oak	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Pollocksville		Attainment	Same as state	Unclassifiable/ Attainment
	Trenton		Attainment	Same as state	Unclassifiable/ Attainment
	Cypress Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Tuckahoe		Attainment	Same as state	Unclassifiable/ Attainment
	Chinquapin		Attainment	Same as state	Unclassifiable/ Attainment
	Beaver Creek		Attainment	Same as state	Unclassifiable/ Attainment
Lee	Greenwood	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Jonesboro		Attainment	Same as state	Unclassifiable/ Attainment
	Cape Fear		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Deep River		Attainment	Same as state	Unclassifiable/ Attainment
	East Sanford		Attainment	Same as state	Unclassifiable/ Attainment
	West Sanford		Attainment	Same as state	Unclassifiable/ Attainment
	Pocket		Attainment	Same as state	Unclassifiable/ Attainment
Lenoir	Contentnea Neck	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Falling Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Institute		Attainment	Same as state	Unclassifiable/ Attainment
	Kinston		Attainment	Same as state	Unclassifiable/ Attainment
	Moseley Hall		Attainment	Same as state	Unclassifiable/ Attainment
	Neuse		Attainment	Same as state	Unclassifiable/ Attainment
	Pink Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Sand Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Southwest		Attainment	Same as state	Unclassifiable/ Attainment
	Trent		Attainment	Same as state	Unclassifiable/ Attainment
	Vance		Attainment	Same as state	Unclassifiable/ Attainment
	Woodington		Attainment	Same as state	Unclassifiable/ Attainment
McDowell	Brackett	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Crooked Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Dysartsville		Attainment	Same as state	Unclassifiable/ Attainment
	Glenwood		Attainment	Same as state	Unclassifiable/ Attainment
	Higgins		Attainment	Same as state	Unclassifiable/ Attainment
	Marion		Attainment	Same as state	Unclassifiable/ Attainment
	Montford		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Cove				Attainment
	Nebo		Attainment	Same as state	Unclassifiable/ Attainment
	North Cove		Attainment	Same as state	Unclassifiable/ Attainment
	Old Fort		Attainment	Same as state	Unclassifiable/ Attainment
Macon	Burningtown	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cartoogechaye		Attainment	Same as state	Unclassifiable/ Attainment
	Cowee		Attainment	Same as state	Unclassifiable/ Attainment
	Ellijay		Attainment	Same as state	Unclassifiable/ Attainment
	Flats		Attainment	Same as state	Unclassifiable/ Attainment
	Franklin		Attainment	Same as state	Unclassifiable/ Attainment
	Highlands		Attainment	Same as state	Unclassifiable/ Attainment
	Millshoal		Attainment	Same as state	Unclassifiable/ Attainment
	Nantahala		Attainment	Same as state	Unclassifiable/ Attainment
	Smithbridge		Attainment	Same as state	Unclassifiable/ Attainment
	Sugarfork		Attainment	Same as state	Unclassifiable/ Attainment
Madison	North Marshall	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	South Marshall		Attainment	Same as state	Unclassifiable/ Attainment
	Laurel		Attainment	Same as state	Unclassifiable/ Attainment
	Mars Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Beech Glenn		Attainment	Same as state	Unclassifiable/ Attainment
	Walnut		Attainment	Same as state	Unclassifiable/ Attainment
	Hot Springs		Attainment	Same as state	Unclassifiable/ Attainment
	Ebbs Chapel		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Spring Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Sandy Mush		Attainment	Same as state	Unclassifiable/ Attainment
	Grapevine		Attainment	Same as state	Unclassifiable/ Attainment
	Revere-Rice Cove		Attainment	Same as state	Unclassifiable/ Attainment
Martin	Beargrass	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cross Roads		Attainment	Same as state	Unclassifiable/ Attainment
	Goose Nest		Attainment	Same as state	Unclassifiable/ Attainment
	Griffins		Attainment	Same as state	Unclassifiable/ Attainment
	Hamilton		Attainment	Same as state	Unclassifiable/ Attainment
	Jamesville		Attainment	Same as state	Unclassifiable/ Attainment
	Poplar Point		Attainment	Same as state	Unclassifiable/ Attainment
	Robersonville		Attainment	Same as state	Unclassifiable/ Attainment
	Williams		Attainment	Same as state	Unclassifiable/ Attainment
	Williamston		Attainment	Same as state	Unclassifiable/ Attainment
Mecklenburg (p)	Long Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Paw Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Morning Star		Attainment	Same as state	Unclassifiable/ Attainment
Mitchell	Bakersville	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Bradshaw		Attainment	Same as state	Unclassifiable/ Attainment
	Cane Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Fork Mountain-Little Rock Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Grassy Creek		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Harrell		Attainment	Same as state	Unclassifiable/ Attainment
	Poplar		Attainment	Same as state	Unclassifiable/ Attainment
	Red Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Snow Creek		Attainment	Same as state	Unclassifiable/ Attainment
Montgomery	Biscoe	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cheek Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Eldorado		Attainment	Same as state	Unclassifiable/ Attainment
	Little River		Attainment	Same as state	Unclassifiable/ Attainment
	Mount Gilead		Attainment	Same as state	Unclassifiable/ Attainment
	Ophir		Attainment	Same as state	Unclassifiable/ Attainment
	Pee Dee		Attainment	Same as state	Unclassifiable/ Attainment
	Rocky Springs		Attainment	Same as state	Unclassifiable/ Attainment
	Star		Attainment	Same as state	Unclassifiable/ Attainment
	Troy		Attainment	Same as state	Unclassifiable/ Attainment
	Uwharrie		Attainment	Same as state	Unclassifiable/ Attainment
Moore	Carthage	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Bensalem		Attainment	Same as state	Unclassifiable/ Attainment
	Sheffield		Attainment	Same as state	Unclassifiable/ Attainment
	Ritter		Attainment	Same as state	Unclassifiable/ Attainment
	Deep River		Attainment	Same as state	Unclassifiable/ Attainment
	Greenwood		Attainment	Same as state	Unclassifiable/ Attainment
	McNeill		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Sandhills		Attainment	Same as state	Unclassifiable/ Attainment
	Mineral Springs		Attainment	Same as state	Unclassifiable/ Attainment
	Little River		Attainment	Same as state	Unclassifiable/ Attainment
Nash	Bailey	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Castalia		Attainment	Same as state	Unclassifiable/ Attainment
	Coopers		Attainment	Same as state	Unclassifiable/ Attainment
	Dry Wells		Attainment	Same as state	Unclassifiable/ Attainment
	Ferrells		Attainment	Same as state	Unclassifiable/ Attainment
	Griffins		Attainment	Same as state	Unclassifiable/ Attainment
	Jackson		Attainment	Same as state	Unclassifiable/ Attainment
	Mannings		Attainment	Same as state	Unclassifiable/ Attainment
	Nashville		Attainment	Same as state	Unclassifiable/ Attainment
	North Whitakers		Attainment	Same as state	Unclassifiable/ Attainment
	Oak Level		Attainment	Same as state	Unclassifiable/ Attainment
	Red Oak		Attainment	Same as state	Unclassifiable/ Attainment
	Rocky Mount		Attainment	Same as state	Unclassifiable/ Attainment
	South Whitakers		Attainment	Same as state	Unclassifiable/ Attainment
	Stony Creek		Attainment	Same as state	Unclassifiable/ Attainment
New Hanover	Cape Fear	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Federal Point		Attainment	Same as state	Unclassifiable/ Attainment
	Harnett		Attainment	Same as state	Unclassifiable/ Attainment
	Masonboro		Attainment	Same as state	Unclassifiable/ Attainment
	Wilmington		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
Northampton	Gaston	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Jackson		Attainment	Same as state	Unclassifiable/ Attainment
	Kirby		Attainment	Same as state	Unclassifiable/ Attainment
	Oconeechee		Attainment	Same as state	Unclassifiable/ Attainment
	Pleasant Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Rich Square		Attainment	Same as state	Unclassifiable/ Attainment
	Roanoke		Attainment	Same as state	Unclassifiable/ Attainment
	Seaboard		Attainment	Same as state	Unclassifiable/ Attainment
	Wiccacanee		Attainment	Same as state	Unclassifiable/ Attainment
Onslow	Camp Lejeune	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Hofmann Forest		Attainment	Same as state	Unclassifiable/ Attainment
	Jacksonville		Attainment	Same as state	Unclassifiable/ Attainment
	Richlands		Attainment	Same as state	Unclassifiable/ Attainment
	Stump Sound		Attainment	Same as state	Unclassifiable/ Attainment
	Swansboro		Attainment	Same as state	Unclassifiable/ Attainment
	White Oak		Attainment	Same as state	Unclassifiable/ Attainment
Orange	Bingham	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cedar Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Chapel Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Cheeks		Attainment	Same as state	Unclassifiable/ Attainment
	Eno		Attainment	Same as state	Unclassifiable/ Attainment
	Hillsborough		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Little River		Attainment	Same as state	Unclassifiable/ Attainment
Pamlico	Township 1	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Township 2		Attainment	Same as state	Unclassifiable/ Attainment
	Township 3		Attainment	Same as state	Unclassifiable/ Attainment
	Township 4		Attainment	Same as state	Unclassifiable/ Attainment
	Township 5		Attainment	Same as state	Unclassifiable/ Attainment
Pasquotak	Elizabeth City	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Mount Hermon		Attainment	Same as state	Unclassifiable/ Attainment
	Newland		Attainment	Same as state	Unclassifiable/ Attainment
	Nixonton		Attainment	Same as state	Unclassifiable/ Attainment
	Providence		Attainment	Same as state	Unclassifiable/ Attainment
	Salem		Attainment	Same as state	Unclassifiable/ Attainment
Pender	Burgaw	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Canetuck		Attainment	Same as state	Unclassifiable/ Attainment
	Caswell		Attainment	Same as state	Unclassifiable/ Attainment
	Columbia		Attainment	Same as state	Unclassifiable/ Attainment
	Grady		Attainment	Same as state	Unclassifiable/ Attainment
	Holly		Attainment	Same as state	Unclassifiable/ Attainment
	Long Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Rocky Point		Attainment	Same as state	Unclassifiable/ Attainment
	Topsail		Attainment	Same as state	Unclassifiable/ Attainment
	Union		Attainment	Same as state	Unclassifiable/ Attainment
Perquimans	Belvidere	All remaining	Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
		Townships outside the modeled or monitored areas			Attainment
	Bethel		Attainment	Same as state	Unclassifiable/ Attainment
	Hertford		Attainment	Same as state	Unclassifiable/ Attainment
	New Hope		Attainment	Same as state	Unclassifiable/ Attainment
	Parkville		Attainment	Same as state	Unclassifiable/ Attainment
Person (p)	Bushy Fork	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Flat River		Attainment	Same as state	Unclassifiable/ Attainment
	Mount Tirzah		Attainment	Same as state	Unclassifiable/ Attainment
	Olive Hill		Attainment	Same as state	Unclassifiable/ Attainment
Pitt	Arthur	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Ayden		Attainment	Same as state	Unclassifiable/ Attainment
	Belvoir		Attainment	Same as state	Unclassifiable/ Attainment
	Bethel		Attainment	Same as state	Unclassifiable/ Attainment
	Carolina		Attainment	Same as state	Unclassifiable/ Attainment
	Chicod		Attainment	Same as state	Unclassifiable/ Attainment
	Falkland		Attainment	Same as state	Unclassifiable/ Attainment
	Farmville		Attainment	Same as state	Unclassifiable/ Attainment
	Fountain		Attainment	Same as state	Unclassifiable/ Attainment
	Greenville		Attainment	Same as state	Unclassifiable/ Attainment
	Grifton		Attainment	Same as state	Unclassifiable/ Attainment
	Grimesland		Attainment	Same as state	Unclassifiable/ Attainment
	Pactolus		Attainment	Same as state	Unclassifiable/ Attainment
	Swift Creek		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Winterville		Attainment	Same as state	Unclassifiable/ Attainment
Polk	Columbus	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cooper Gap		Attainment	Same as state	Unclassifiable/ Attainment
	Green Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Saluda		Attainment	Same as state	Unclassifiable/ Attainment
	Tryon		Attainment	Same as state	Unclassifiable/ Attainment
	White Oak		Attainment	Same as state	Unclassifiable/ Attainment
Randolph (p)	Asheboro	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Back Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Brower		Attainment	Same as state	Unclassifiable/ Attainment
	Cedar Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Coleridge		Attainment	Same as state	Unclassifiable/ Attainment
	Columbia		Attainment	Same as state	Unclassifiable/ Attainment
	Concord		Attainment	Same as state	Unclassifiable/ Attainment
	Franklinville		Attainment	Same as state	Unclassifiable/ Attainment
	Grant		Attainment	Same as state	Unclassifiable/ Attainment
	Liberty		Attainment	Same as state	Unclassifiable/ Attainment
	New Hope		Attainment	Same as state	Unclassifiable/ Attainment
	Pleasant Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Providence		Attainment	Same as state	Unclassifiable/ Attainment
	Randleman		Attainment	Same as state	Unclassifiable/ Attainment
	Richland		Attainment	Same as state	Unclassifiable/ Attainment
	Tabernacle		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Union		Attainment	Same as state	Unclassifiable/ Attainment
Richmond	Beaverdam	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Black Jack		Attainment	Same as state	Unclassifiable/ Attainment
	Marks Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Mineral Springs		Attainment	Same as state	Unclassifiable/ Attainment
	Rockingham		Attainment	Same as state	Unclassifiable/ Attainment
	Steeles		Attainment	Same as state	Unclassifiable/ Attainment
	Wolf Pit		Attainment	Same as state	Unclassifiable/ Attainment
Robeson	Alfordsville	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Back Swamp		Attainment	Same as state	Unclassifiable/ Attainment
	Britts		Attainment	Same as state	Unclassifiable/ Attainment
	Burnt Swamp		Attainment	Same as state	Unclassifiable/ Attainment
	East Howellsville		Attainment	Same as state	Unclassifiable/ Attainment
	Fairmont		Attainment	Same as state	Unclassifiable/ Attainment
	Gaddys		Attainment	Same as state	Unclassifiable/ Attainment
	Lumber Bridge		Attainment	Same as state	Unclassifiable/ Attainment
	Lumberton		Attainment	Same as state	Unclassifiable/ Attainment
	Maxton		Attainment	Same as state	Unclassifiable/ Attainment
	Orrum		Attainment	Same as state	Unclassifiable/ Attainment
	Parkton		Attainment	Same as state	Unclassifiable/ Attainment
	Pembroke		Attainment	Same as state	Unclassifiable/ Attainment
	Philadelphus		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Raft Swamp		Attainment	Same as state	Unclassifiable/ Attainment
	Red Springs		Attainment	Same as state	Unclassifiable/ Attainment
	Rennert		Attainment	Same as state	Unclassifiable/ Attainment
	Rowland		Attainment	Same as state	Unclassifiable/ Attainment
	Saddletree		Attainment	Same as state	Unclassifiable/ Attainment
	St. Pauls		Attainment	Same as state	Unclassifiable/ Attainment
	Shannon		Attainment	Same as state	Unclassifiable/ Attainment
	Smiths		Attainment	Same as state	Unclassifiable/ Attainment
	Smyrna		Attainment	Same as state	Unclassifiable/ Attainment
	Sterlings		Attainment	Same as state	Unclassifiable/ Attainment
	Thompson		Attainment	Same as state	Unclassifiable/ Attainment
	Union		Attainment	Same as state	Unclassifiable/ Attainment
	West Howellsville		Attainment	Same as state	Unclassifiable/ Attainment
	Whitehouse		Attainment	Same as state	Unclassifiable/ Attainment
	Wisharts		Attainment	Same as state	Unclassifiable/ Attainment
Rowan (p)	Morgan	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
Rutherford	Camp Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Chimney Rock		Attainment	Same as state	Unclassifiable/ Attainment
	Colfax		Attainment	Same as state	Unclassifiable/ Attainment
	Cool Spring		Attainment	Same as state	Unclassifiable/ Attainment
	Duncans		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Creek				Attainment
	Gilkey		Attainment	Same as state	Unclassifiable/ Attainment
	Golden Valley		Attainment	Same as state	Unclassifiable/ Attainment
	Green Hill		Attainment	Same as state	Unclassifiable/ Attainment
	High Shoals		Attainment	Same as state	Unclassifiable/ Attainment
	Logan Store		Attainment	Same as state	Unclassifiable/ Attainment
	Morgan		Attainment	Same as state	Unclassifiable/ Attainment
	Rutherfordton		Attainment	Same as state	Unclassifiable/ Attainment
	Sulphur Springs		Attainment	Same as state	Unclassifiable/ Attainment
	Union		Attainment	Same as state	Unclassifiable/ Attainment
Sampson	Belvoir	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Dismal		Attainment	Same as state	Unclassifiable/ Attainment
	Franklin		Attainment	Same as state	Unclassifiable/ Attainment
	Halls		Attainment	Same as state	Unclassifiable/ Attainment
	Herring		Attainment	Same as state	Unclassifiable/ Attainment
	Honeycutt		Attainment	Same as state	Unclassifiable/ Attainment
	Lisbon		Attainment	Same as state	Unclassifiable/ Attainment
	Little Coharie		Attainment	Same as state	Unclassifiable/ Attainment
	McDaniels		Attainment	Same as state	Unclassifiable/ Attainment
	Mingo		Attainment	Same as state	Unclassifiable/ Attainment
	Newton Grove		Attainment	Same as state	Unclassifiable/ Attainment
	North Clinton		Attainment	Same as state	Unclassifiable/ Attainment
	Piney Grove		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Plain View		Attainment	Same as state	Unclassifiable/ Attainment
	South Clinton		Attainment	Same as state	Unclassifiable/ Attainment
	South River		Attainment	Same as state	Unclassifiable/ Attainment
	Taylors Bridge		Attainment	Same as state	Unclassifiable/ Attainment
	Turkey		Attainment	Same as state	Unclassifiable/ Attainment
	Westbrook		Attainment	Same as state	Unclassifiable/ Attainment
Scotland	Laurel Hill	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Spring Hill		Attainment	Same as state	Unclassifiable/ Attainment
	Stewartsville		Attainment	Same as state	Unclassifiable/ Attainment
	Williamson		Attainment	Same as state	Unclassifiable/ Attainment
Stanly (p)	Almond	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Big Lick		Attainment	Same as state	Unclassifiable/ Attainment
	Center		Attainment	Same as state	Unclassifiable/ Attainment
	Endy		Attainment	Same as state	Unclassifiable/ Attainment
	Harris		Attainment	Same as state	Unclassifiable/ Attainment
	North Albemarle		Attainment	Same as state	Unclassifiable/ Attainment
	Ridenhour		Attainment	Same as state	Unclassifiable/ Attainment
	South Albemarle		Attainment	Same as state	Unclassifiable/ Attainment
	Tyson		Attainment	Same as state	Unclassifiable/ Attainment
Surry (p)	Bryan	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Dobson		Attainment	Same as state	Unclassifiable/ Attainment
	Elkin		Attainment	Same as state	Unclassifiable/ Attainment
	Franklin		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Marsh		Attainment	Same as state	Unclassifiable/ Attainment
	Stewarts Creek		Attainment	Same as state	Unclassifiable/ Attainment
Swain	Charleston	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Forneys Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Nantahala		Attainment	Same as state	Unclassifiable/ Attainment
Transylvania	Boyd	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Brevard		Attainment	Same as state	Unclassifiable/ Attainment
	Catheys Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Dunns Rock		Attainment	Same as state	Unclassifiable/ Attainment
	Eastatoe		Attainment	Same as state	Unclassifiable/ Attainment
	Gloucester		Attainment	Same as state	Unclassifiable/ Attainment
	Hogback		Attainment	Same as state	Unclassifiable/ Attainment
	Little River		Attainment	Same as state	Unclassifiable/ Attainment
Tyrrell	Alligator	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Columbia		Attainment	Same as state	Unclassifiable/ Attainment
	Gum Neck		Attainment	Same as state	Unclassifiable/ Attainment
	Scuppernong		Attainment	Same as state	Unclassifiable/ Attainment
	South Fork		Attainment	Same as state	Unclassifiable/ Attainment
Union (p)	Lanes Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Marshville		Attainment	Same as state	Unclassifiable/ Attainment
Vance	Dabney	All remaining Townships	Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Henderson	outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Kittrell		Attainment	Same as state	Unclassifiable/ Attainment
	Middleburg		Attainment	Same as state	Unclassifiable/ Attainment
	Sandy Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Townsville		Attainment	Same as state	Unclassifiable/ Attainment
	Watkins		Attainment	Same as state	Unclassifiable/ Attainment
	Williamsboro		Attainment	Same as state	Unclassifiable/ Attainment
Wake	Bartons Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Buckhorn		Attainment	Same as state	Unclassifiable/ Attainment
	Cary		Attainment	Same as state	Unclassifiable/ Attainment
	Cedar Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Holly Springs		Attainment	Same as state	Unclassifiable/ Attainment
	House Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Leesville		Attainment	Same as state	Unclassifiable/ Attainment
	Little River		Attainment	Same as state	Unclassifiable/ Attainment
	Marks Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Meredith		Attainment	Same as state	Unclassifiable/ Attainment
	Middle Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Neuse		Attainment	Same as state	Unclassifiable/ Attainment
	New Light		Attainment	Same as state	Unclassifiable/ Attainment
	Panther Branch		Attainment	Same as state	Unclassifiable/ Attainment
	Raleigh		Attainment	Same as state	Unclassifiable/ Attainment
	St. Marys		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	St. Matthews		Attainment	Same as state	Unclassifiable/ Attainment
	Swift Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Wake Forest		Attainment	Same as state	Unclassifiable/ Attainment
	White Oak		Attainment	Same as state	Unclassifiable/ Attainment
Warren	Fishing Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Hawtree		Attainment	Same as state	Unclassifiable/ Attainment
	Judkins		Attainment	Same as state	Unclassifiable/ Attainment
	Nutbush		Attainment	Same as state	Unclassifiable/ Attainment
	River		Attainment	Same as state	Unclassifiable/ Attainment
	Roanoke		Attainment	Same as state	Unclassifiable/ Attainment
	Sandy Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Shocco		Attainment	Same as state	Unclassifiable/ Attainment
	Sixpound		Attainment	Same as state	Unclassifiable/ Attainment
	Smith Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Warrenton		Attainment	Same as state	Unclassifiable/ Attainment
Washington	Lees Mill	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Plymouth		Attainment	Same as state	Unclassifiable/ Attainment
	Scuppernong		Attainment	Same as state	Unclassifiable/ Attainment
	Skinnersville		Attainment	Same as state	Unclassifiable/ Attainment
Watauga	Bald Mountain	All remaining Townships outside the modeled or	Attainment	Same as state	Unclassifiable/ Attainment
	Beaverdam		Attainment	Same as state	Unclassifiable/ Attainment

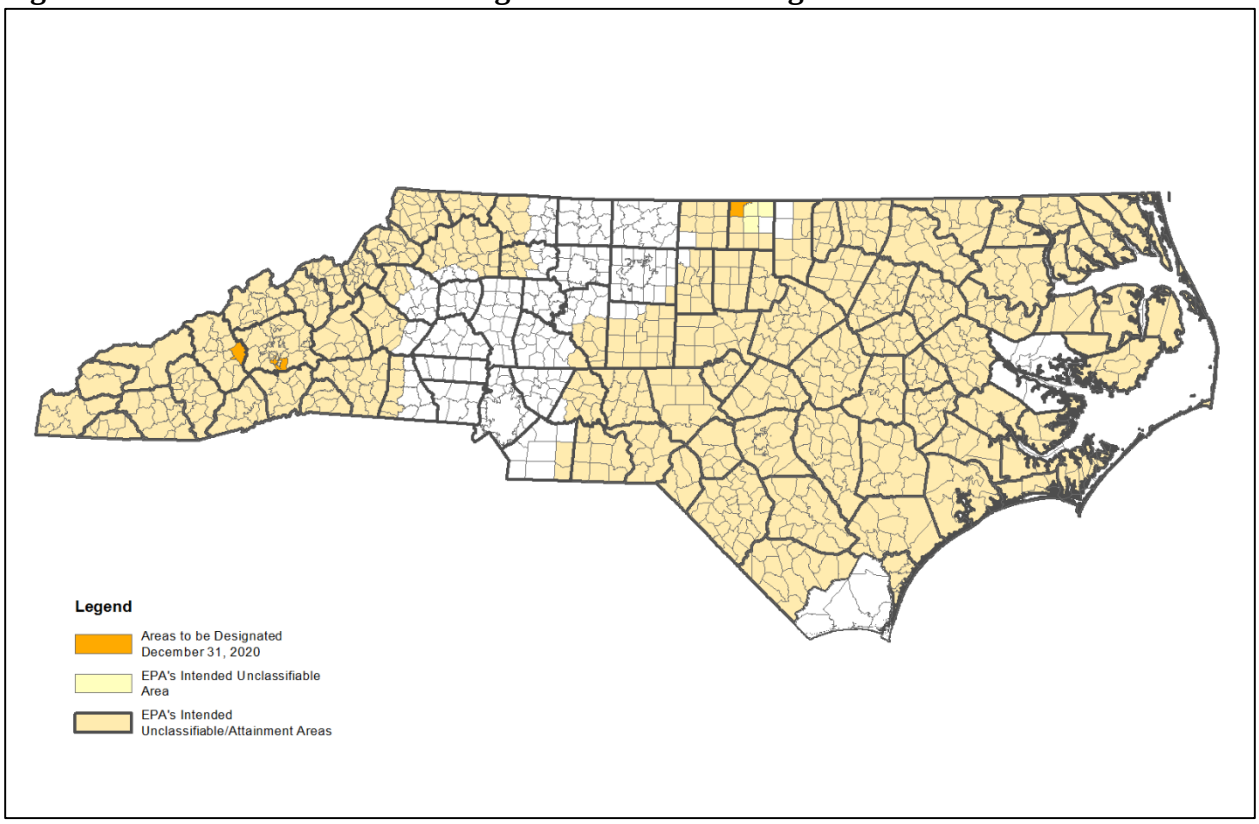
County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Blowing Rock	monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Blue Ridge		Attainment	Same as state	Unclassifiable/ Attainment
	Boone		Attainment	Same as state	Unclassifiable/ Attainment
	Brushy Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Cove Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Elk		Attainment	Same as state	Unclassifiable/ Attainment
	Laurel Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Meat Camp		Attainment	Same as state	Unclassifiable/ Attainment
	New River		Attainment	Same as state	Unclassifiable/ Attainment
	North Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Shawneehaw		Attainment	Same as state	Unclassifiable/ Attainment
	Stony Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Watauga		Attainment	Same as state	Unclassifiable/ Attainment
Wayne	Brogden	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Buck Swamp		Attainment	Same as state	Unclassifiable/ Attainment
	Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Goldsboro		Attainment	Same as state	Unclassifiable/ Attainment
	Grantham		Attainment	Same as state	Unclassifiable/ Attainment
	Great Swamp		Attainment	Same as state	Unclassifiable/ Attainment
	Indian Springs		Attainment	Same as state	Unclassifiable/ Attainment
	Nahunta		Attainment	Same as state	Unclassifiable/ Attainment
	New Hope		Attainment	Same as state	Unclassifiable/ Attainment
	Pikeville		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Saulston		Attainment	Same as state	Unclassifiable/ Attainment
	Stoney Creek		Attainment	Same as state	Unclassifiable/ Attainment
Wilkes (p)	Antioch	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Edwards		Attainment	Same as state	Unclassifiable/ Attainment
	Elk		Attainment	Same as state	Unclassifiable/ Attainment
	Jobs Cabin		Attainment	Same as state	Unclassifiable/ Attainment
	Lewis Fork		Attainment	Same as state	Unclassifiable/ Attainment
	Lovelace		Attainment	Same as state	Unclassifiable/ Attainment
	Mulberry		Attainment	Same as state	Unclassifiable/ Attainment
	New Castle		Attainment	Same as state	Unclassifiable/ Attainment
	North Wilkesboro		Attainment	Same as state	Unclassifiable/ Attainment
	Reddies River		Attainment	Same as state	Unclassifiable/ Attainment
	Rock Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Somers		Attainment	Same as state	Unclassifiable/ Attainment
	Stanton		Attainment	Same as state	Unclassifiable/ Attainment
	Traphill		Attainment	Same as state	Unclassifiable/ Attainment
	Union		Attainment	Same as state	Unclassifiable/ Attainment
	Walnut Grove		Attainment	Same as state	Unclassifiable/ Attainment
	Wilkesboro		Attainment	Same as state	Unclassifiable/ Attainment
Wilson	Black Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Cross Roads		Attainment	Same as state	Unclassifiable/ Attainment
	Gardners		Attainment	Same as state	Unclassifiable/ Attainment

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
	Old Fields		Attainment	Same as state	Unclassifiable/ Attainment
	Saratoga		Attainment	Same as state	Unclassifiable/ Attainment
	Springhill		Attainment	Same as state	Unclassifiable/ Attainment
	Stantonsburg		Attainment	Same as state	Unclassifiable/ Attainment
	Taylors		Attainment	Same as state	Unclassifiable/ Attainment
	Toisnot		Attainment	Same as state	Unclassifiable/ Attainment
	Wilson		Attainment	Same as state	Unclassifiable/ Attainment
Yadkin (p)	Boonville	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Deep Creek		Attainment	Same as state	Unclassifiable/ Attainment
	North Buck Shoals		Attainment	Same as state	Unclassifiable/ Attainment
	North Knobs		Attainment	Same as state	Unclassifiable/ Attainment
	North Liberty		Attainment	Same as state	Unclassifiable/ Attainment
	South Buck Shoals		Attainment	Same as state	Unclassifiable/ Attainment
	South Knobs		Attainment	Same as state	Unclassifiable/ Attainment
Yancey	Brush Creek	All remaining Townships outside the modeled or monitored areas	Attainment	Same as state	Unclassifiable/ Attainment
	Burnsville		Attainment	Same as state	Unclassifiable/ Attainment
	Cane River		Attainment	Same as state	Unclassifiable/ Attainment
	Crabtree		Attainment	Same as state	Unclassifiable/ Attainment
	Egypt		Attainment	Same as state	Unclassifiable/ Attainment
	Green Mountain		Attainment	Same as state	Unclassifiable/ Attainment
	Jacks Creek		Attainment	Same as state	Unclassifiable/ Attainment
	Pensacola		Attainment	Same as state	Unclassifiable/ Attainment
	Price Creek		Attainment	Same as state	Unclassifiable/

County or Partial County (p)	Township	North Carolina's Recommended Area Definition	North Carolina's Recommended Designation	The EPA's Intended Area Definition	The EPA's Intended Designation
					Attainment
	Ramseytown		Attainment	Same as state	Unclassifiable/ Attainment
	South Toe		Attainment	Same as state	Unclassifiable/ Attainment

Figure 39. The EPA's Intended Designation for Remaining Areas in North Carolina.



As referenced in the Introduction (see Table 2), the townships associated with sources for which North Carolina has installed and begun timely operation of a new, approved SO_2 monitoring network are required to be designated by December 31, 2020, but are not being addressed at this time. Areas in North Carolina previously designated unclassifiable in Round 1 (*see* 78 *Federal Register* 4719) or Round 2 (*see* 81 *Federal Register* 45039) will remain unchanged unless otherwise noted.

8.2. Air Quality Monitoring Data for the Remaining Areas in North Carolina

AQS monitors identified in Table 34 located in some of the counties remaining to be designated in North Carolina have sufficient valid data for 2013-2015 and these data indicate that there was no violation of the 2010 SO_2 NAAQS at the monitoring site in that period. These data were available to EPA for consideration in the designations process, however, since it is unclear if these monitors are located in areas of maximum concentration, it is unclear if the data are representative of the area's actual air quality.

Table 32. Other Monitors Available in North Carolina[26]

AQS ID #	Location	County	Design Value 2013-2015 (ppb)	Design Value 2014-2016 (ppb)
37-063-0015	36.0329, -78.9054	Durham	8	7
37-067-0022	36.1107, -80.2264	Forsyth	9	9
37-119-0041	35.2401, -80.7857	Mecklenburg	7	5
37-129-0006	34.2684, -77.9565	New Hanover	17	3
37-183-0014	35.8561, -78.5742	Wake	6	4

In reviewing the available air quality monitoring data in AQS, the EPA determined that other than the data described above, there are no additional relevant data in AQS collected in North Carolina that could inform the intended designation action. The most recent SO_2 design values for all areas of the State are available at https://www.epa.gov/air-trends/air-quality-design-values. Since these areas were not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the areas may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS, the EPA believes that the designation of unclassifiable/attainment is appropriate for these remaining townships in North Carolina.

[26] Table 32 does not include monitors that North Carolina began operating in January 1, 2017, for areas being by December 31, 2020. In addition, the table does not include additional background monitors in North Carolina that do not have complete data for the 2013-2015 or 2014-2016 period. Finally, the table does not include the monitor surrounding the PCS Phosphate facility, in Beaufort County.

8.3. Emissions and Emissions-Related Data for the Remaining Areas in North Carolina

North Carolina reviewed the size and locations of SO_2 facilities in the remaining townships in the State identified in Table 31 and determine that most of the SO_2 emission levels were less than 100 tpy. In addition, the state evaluated SO_2 source clusters located within a 10 km radius of each individual facility, and determined that collectively, these clusters did emit over 2,000 tpy. The State concluded that the low emission levels will not interfere with the attainment of the 1-hour SO_2 NAAQS, and recommended that all such areas be designated attainment. Since these areas were not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the areas may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS, the EPA is modifying the State's recommended designation and intends to designate these areas as "unclassifiable/attainment".

8.4. Jurisdictional Boundaries in the Remaining Areas in North Carolina

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the areas in the above Table 31 as unclassifiable/attainment for the 2010 SO_2 NAAQS. These areas were not required to be Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for these counties or portion counties based on townships. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

In their January 2017 submission, North Carolina recommended that all counties based on townships outside the modeled or monitored areas (including monitored areas designated this round and those not being designated at this time but must be designated no later than December 31, 2020), be designated as attainment. Their reasoning for this recommendation was based on a review of the State's 2015 emissions inventory and existing SO_2 monitors in the area all of which are measuring attainment of the 1-hour SO_2 NAAQS. However, as noted, the EPA does not have information to support that those monitors are located in maximum concentrations for their areas. The EPA's unclassifiable/attainment designation for the remaining areas in the state include the Eastern Band of Cherokee Indians' trust lands.

Given the information provided by the State and the information obtained by the EPA, we believe that the jurisdictional boundaries for this unclassifiable/attainment designation will be bounded by the county lines of those counties being designated completely, and by designated townships. All counties and portions of counties being designated this round are identified in the different sections of this technical support document. For those counties and portions of counties being designated by December 31, 2017, based on air quality modeling or monitoring to characterize a DRR source, please refer to previous sections of this document. For those remaining counties and portions therefore based on townships required to be designated by December 31, 2017, refer to Table 31 of this section. More detail on partial counties being designated this round is given in Section 8.6.

8.5. The EPA's Assessment of the Available Information for the Remaining Areas in North Carolina

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the areas in the above Table 31 as unclassifiable/attainment for the 2010 SO_2 NAAQS. These areas were not required to be Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for these counties or portion counties based on townships. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the areas may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

Our intended unclassifiable/attainment area, bounded by townships identified in Table 31, has clearly defined legal boundaries. We find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area. It is important to note that a portion of the EPA's intended unclassifiable/attainment boundary for the rest of the State includes Eastern Band of the Cherokee tribe trust lands. For other townships designated this round please refer to the different sections of this document.

Not included in this section or previous sections of this document, are the areas already designated in Round 1 or 2 of designations, as well as those areas not being designated at this time but will be designated no later than December 31, 2020. For North Carolina, the only area that has been previously designated includes the entirety of Brunswick County, which was designated unclassifiable June 30, 2016, in Round 2 of designations. The areas that will be addressed in a separate action by December 31, 2020, are identified in Table 2 and include portions of three counties: Haywood, Buncombe, and Person County.
For all other county designations please refer to the different sections of this technical support document. The EPA intends to designate the entire state of North Carolina, with the exception of those areas mentioned above, during this Round 3 of designations.

8.6. Summary of Our Intended Designation for the Remaining Areas in North Carolina

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the counties and portions of counties identified in Table 33 as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the townships within the identified counties; these townships are also identified in Table 31.

Figure 39 above shows the location of these areas within North Carolina.

For those DRR sources for which the State chose to install and timely operate new air quality monitors by January 1, 2017, as chosen by North Carolina, the EPA will designate these areas no later than December 31, 2020. As shown in Table 2, these areas include Beaverdam Township in Haywood County for the Evergreen Packaging - Canton Mill; Limestone Township in Buncombe County for Duke Energy-Asheville Steam Electric Plant, and Cunningham Township in Person County for Duke Energy – Roxboro Plant.

At this time, our intended designations for the State only apply to these areas and the other areas presented in this technical support document. The EPA intends to evaluate and designate all remaining undesignated areas in North Carolina by December 31, 2020.