1-HOUR SO_2 AIR DISPERSION MODELING PROTOCOL FOR COMANCHE GENERATING STATION

Prepared for

Xcel Energy (Public Service Company of Colorado)

Submitted to

US EPA Region 8

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1. INTRODUCTION

The Colorado Department of Public Health and Environment, Air Pollution Control Division (CDPHE) has requested that Xcel Energy evaluate Sulfur Dioxide (SO_2) concentrations in proximity to the Comanche Generating Station located south of Pueblo, Colorado. The purpose of this request is to determine if modeling can be used to demonstrate compliance with the one-hour SO_2 National Ambient Air Quality Standard (NAAQS).

Xcel has requested assistance from Trinity Consultants in conducting the modeling study. The modeling will follow applicable U.S. Environmental Protection Agency (EPA) and CDPHE guidance and will use the EPA AERMOD model. The modeling will be conducted per the recommended guidance in the EPA draft August 2016 document, *SO_2 NAAQS Designations Modeling Technical Assistance Document (TAD)* (referred to herein as the 2016 SO_2 NAAQS Modeling TAD).

In June 2010, EPA promulgated the new one-hour Sulfur Dioxide (SO_2) National Ambient Air Quality Standard (NAAQS) at a level of 75 parts per billion (196 μg/m^3) based on the three year average of the annual 99th percentile of 1-hour daily maximum concentrations. In 2013, EPA initially designated 29 areas in 16 states as nonattainment (referred to as "Round 1"). As a result of litigation, EPA is conducting three other rounds of designations for July 2016 (Round 2), December 2017 (Round 3) and December 2020 (Round 4). EPA also finalized the SO_2 Data Requirements Rule (DRR) in August 2015 that requires states to gather and submit information to EPA regarding analysis of areas with larger sources of SO_2 emissions specifically related to Rounds 3 and 4.

The State of Colorado is required to characterize sources of SO_2 greater than 2,000 tons/year (based on the most recent year of data). If modeling does not demonstrate compliance with the one-hour SO_2 NAAQS, then ambient SO_2 monitoring, located based on modeling results, would be implemented by January 1, 2017 to collect the necessary three years of data.

Therefore, in line with the EPA's May 2014 proposed Data Requirements Rule, an SO_2 designation for the area surrounding the Comanche Generating Station will be based on the predictions of an air dispersion model. The TAD indicates that actual hourly emission rates should be included in the model. For sources with SO_2 Continuous Emission Monitoring Systems (CEMS), the CEMS data should be used to characterize emissions.

The remainder of this protocol summarizes the data and procedures that will be used in the modeling described above.

2. DESCRIPTION OF UTILITY SOURCES

The modeling analysis will include the three coal-fired electric utility units at the Comanche Generating Station shown in Table 2-1. All three units have SO_2 air pollution control systems.

Table 2-1. Utility Units included in Modeling Study

Unit ID	Size (MW)	Air Pollution Control Equipment
Unit 1	325	Dry Scrubber and Fabric Filter
Unit 2	335	Dry Scrubber and Fabric Filter
Unit 3	750	Dry Scrubber, Selective Catalytic Reduction, and Fabric Filter

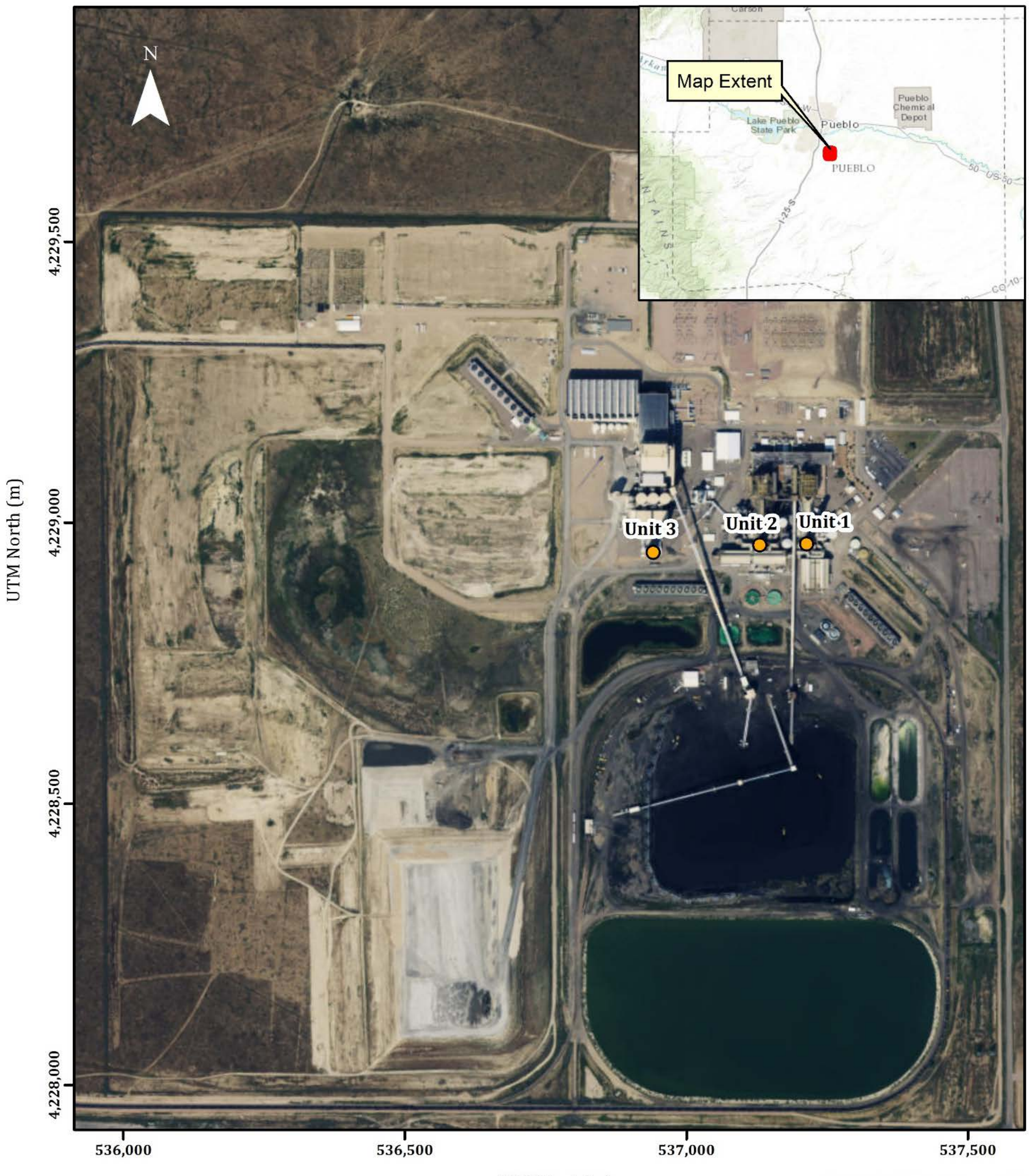
Unit stack parameters and location coordinates are shown in Table 2-2.

Table 2-2. Utility Unit Stack Parameters

Unit Description	Stack Height (feet)	Stack Exit ID (feet)	Elevation (feet)	Latitude	Longitude
Unit 1	498	24.5	4,837.2	38.2078°	-104.5749°
Unit 2	498	23.9	4,833.2	38.2078°	-104.5759°
Unit 3	500	29	4,817.1	38.2077°	-104.5781°

Figure 2-1 shows an aerial image of the location of the three sources, as well as the location of the Comanche Generating Station relative to the surrounding area.

Figure 2-1. Location of Comanche Generating Station



3. AIR QUALITY MODELING METHODOLOGY

3.1. MODEL SELECTION

The EPA AERMOD model is recommended for predicting impacts from industrial point sources as well as area and volume sources. Trinity will perform 1-hour SO_2 modeling using the latest AERMOD version along with Trinity's *BREEZE™* AERMOD software. The *BREEZE™* AERMOD graphical user interface (GUI) will be used to set up the AERMOD input file. The final model runs will be performed using the current version (Version 15181) of the EPA AERMOD executable. The AERMOD model combines simple and complex terrain algorithms, and includes the Plume Rise Model Enhancement (PRIME) algorithms to account for building downwash and cavity zone impacts. All regulatory default options will be used in the modeling. The pollutant ID will be set to SO_2 and the output options will be configured such that the model will predict an SO_2 design value based on the 3-year average of the 99th percentile of the annual distribution of the daily maximum 1-hour concentrations for comparison with the 1-hour SO_2 NAAQS of 196 $\mu g/m^3$.

The complete AERMOD modeling system is comprised of three parts: the AERMET preprocessor, the AERMAP pre-processor, and the AERMOD model. The AERMET preprocessor compiles the surface and upper-air meteorological data and formats the data for AERMOD input. The AERMAP preprocessor is used to obtain elevation and controlling hill heights for AERMOD input.

3.2. METEOROLOGICAL DATA

3.2.1. Surface Data

Trinity will use surface meteorological data collected at the Rocky Mountain Steel Mill (RMSM) meteorological tower as input to the AERMOD model. A determination of whether the meteorological data from the Rocky Mountain Steel Mill is appropriate for use in this modeling analysis is considered by determining whether the data were representative of the location of the modeled sources. Per the SO_2 Modeling TAD, the representativeness of the data is 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. Each of these criteria are addressed below.

Both the Rocky Mountain Steel Mill meteorological tower and the Comanche Generating Station are located between the St. Charles River and the Arkansas River, southwest of Pueblo, Colorado. The relative locations of the Rocky Mountain Steel Mill meteorological tower and the Comanche Generating Station are shown in Figure 3-1, below. As shown in the figure, the meteorological tower is approximately 4 km from the Comanche Generating Station, and there are no significant terrain features separating the Comanche Generating Station from the meteorological tower. The close proximity of the RMSM with respect to the sources (less than 5 km distance) and the similarity in the climatology and topography both support that the meteorological conditions at the RMSM are representative of the meteorological conditions at the Comanche sources. Furthermore, since the elevation of the Comanche Generating Station is slightly higher than that of the RMSM, the Comanche sources are more exposed than the RMSM and therefore the dispersion characteristics at the facility are expected to be slightly better than at the RMSM.[1] This makes the use of RMSM data a conservative choice.

The exposure and siting of the meteorological tower at the Rocky Mountain Steel Mill is appropriate for the area. The meteorological tower is not located near terrain features or structures that would have the potential to influence data collected at the monitor.

Data from the RMSM is available for the period of March 2008 to February 2009, and July 2013 to December 2015. Since RMSM data is not available for January to June 2013, data for this missing period will be filled with data for the corresponding months from 2008 and 2009 from the RMSM. Per the SO_2 Modeling TAD, dates of the 2008 and 2009 data will be adjusted to match the dates of the 2013 actual hourly emissions data.

The following meteorological parameters are available at the RMSM:

- Wind Speed (10 m)
- Wind Direction (10 m)
- Sigma Theta (Standard Deviation of Wind Direction, 10 m)
- Air Temperature, °C (1.83 m)
- Vertical Temperature Difference, °C (1.83 m, 7.62 m)
- Precipitation
- Relative Humidity (7.62 m)
- Insolation

Raw data from the RMSM is enclosed, as is the associated quality assurance project plan (QAPP).

Processed data for 2013, 2014, and 2015 collected at the National Weather Service (NWS) ASOS meteorological station located at the Pueblo Memorial Airport in Pueblo, Colorado (KPUB) will be used during hours that on-site data from the RMSM tower is missing. Since, after the substitution described in the preceding paragraph, there are very few missing hours in the RMSM data, data from the NWS station will be used for less than 1% of the hours included in the analysis. A determination of whether the meteorological data from the Pueblo Memorial Airport is appropriate for use in this modeling analysis is considered by determining whether the data were representative of the location of the modeled sources. The proximity of the airport with respect to the sources (approximately 11 km distance), in addition to the similarity in the climatology and topography (the airport elevation is approximately 4,680 feet and source elevations are approximately 4,830 feet) support that the meteorological conditions at the airport are also representative of the meteorological conditions at the sources.

A wind rose is included below in Figure 3-2.

AERMOD-ready meteorological data will be prepared using the latest version of the U.S. EPA's AERMET meteorological processing utility (anticipate version 15181 as part of the new AERMOD release). Standard U.S. EPA meteorological data processing guidance will be used and described in the modeling report for the analysis.

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[1] The RMSM meteorological tower elevation is approximately 4,767 feet and Comanche source elevations are approximately 4,830 feet

Figure 3-1. Rocky Mountain Steel Mill Meteorological Tower Location

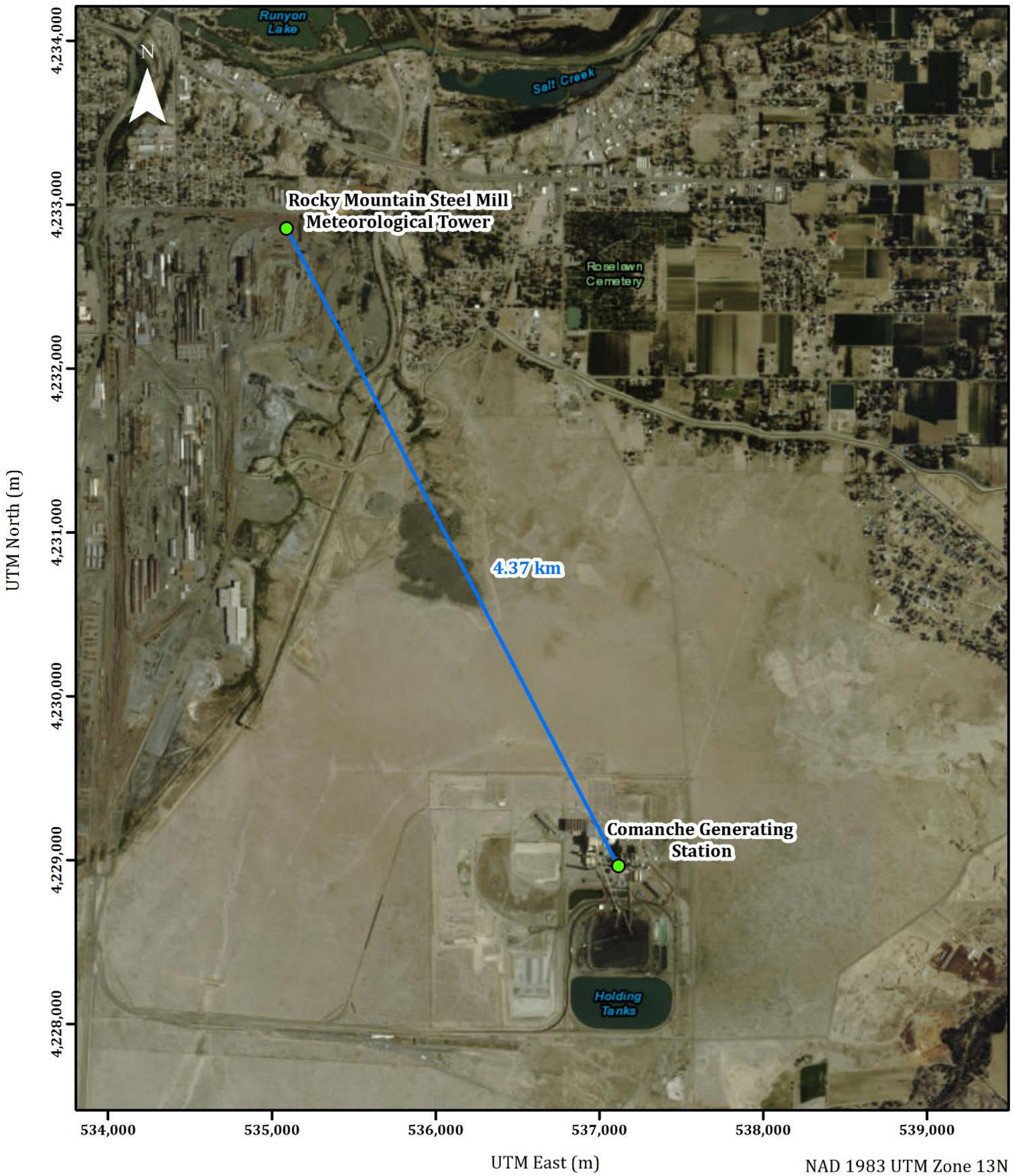
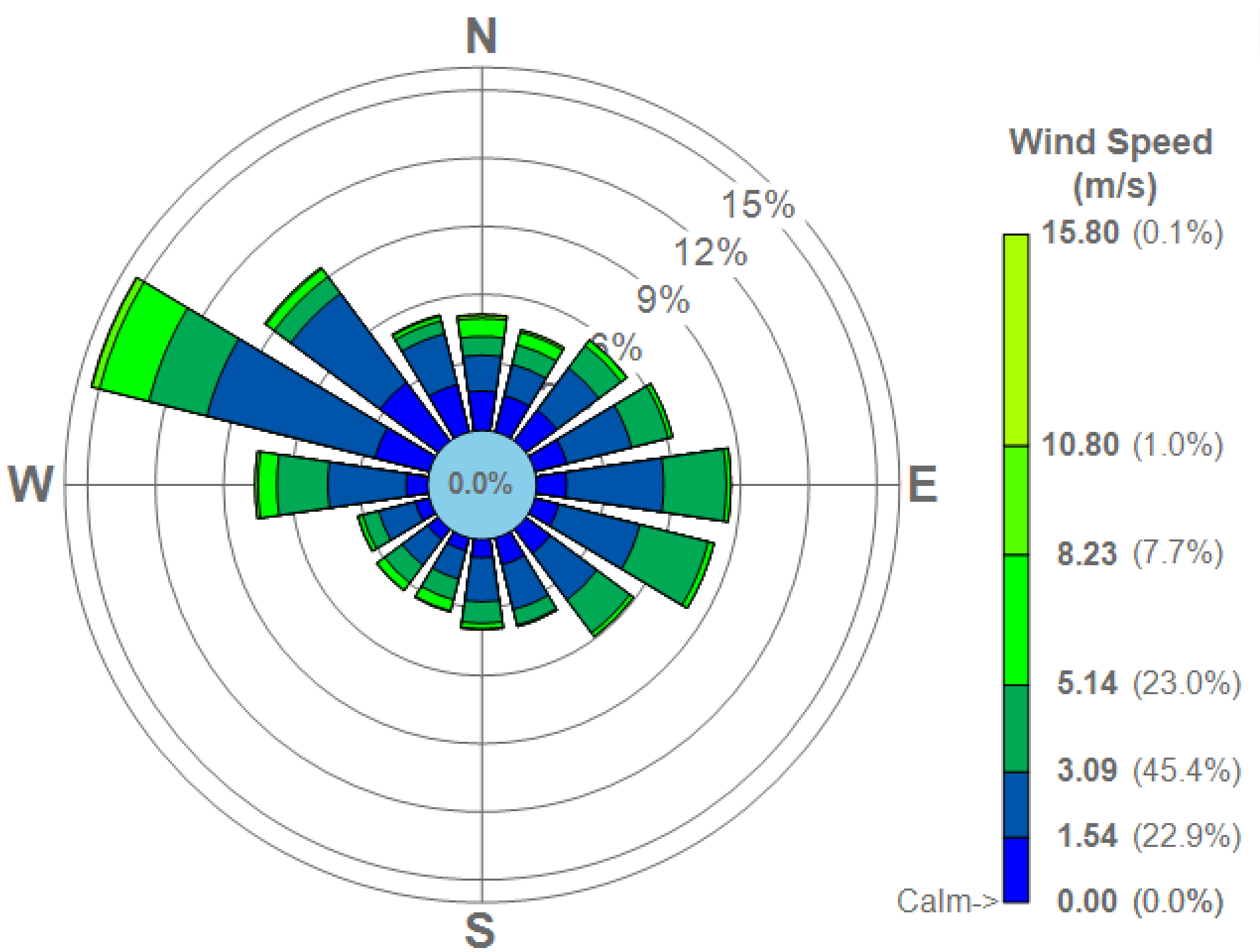


Figure 3-2. Wind Rose Plot for Rocky Mountain Steel Mill Meteorological Data



3.2.2. Upper Air Data

In addition to surface meteorological data, AERMET requires the use of data from a sunrise-time upper air sounding to estimate daytime mixing heights. Upper air data from the nearest U.S. National Weather Service (NWS) upper-air balloon station, located in Denver, Colorado (KDNR), will be obtained from the National Oceanic and Atmospheric Administration (NOAA) in Forecast Systems Laboratory (FSL) format. The period of the upper air data is concurrent with the period of the surface data.

3.2.3. Land Use Analysis

Parameters derived from analysis of land use data (surface roughness, Bowen ratio, and albedo) are also required by AERMET. In accordance with U.S. EPA guidance, these values will be determined using the latest version of the U.S. EPA AERSURFACE tool (version 13016)[2]. The AERSURFACE settings that will be used for processing are summarized in Table 3-1 below. The met station coordinates are for the RMSM meteorological station and KPUB meteorological station. National Land Cover Dataset (NLCD) 1992 (CONUS) Land Cover data that will be used in AERSURFACE processing was obtained from the Multi-Resolution Land Use Consortium (MRLC).

U.S. EPA guidance dictates that on at least an annual basis, soil moisture at a surface site should be classified as wet, dry, or average in comparison to the 30-year climatological record at the site. This determination is used to set the Bowen ratio estimated by AERSURFACE. To make the determination, annual precipitation in each modeled year (2013, 2014, and 2015), will be compared to the historical climatological record for the area surrounding the RMSM and KPUB towers. Specifically, precipitation of a modeled period is compared to 1981-2010 precipitation record.

Precipitation data for station KPUB will be obtained. The 30th and 70th percentile values of the annual precipitation distribution from the dataset will be calculated. Per U.S. EPA guidance, each modeled year will be classified for AERSURFACE processing as “wet” if its seasonal precipitation was higher than the 70th percentile value, “dry” if its seasonal precipitation was lower than the 30th percentile value, and “average” if it was between the 30th and 70th percentile values.

Climate Normal snow records for 1981-2010 will be reviewed to determine whether the area had continuous winter snow cover. Continuous winter snow cover will be assumed for months in which at least 10 days had a snow depth of at least 1 inch.

The values proposed for the AERSURFACE analysis are summarized in Table 3-1.

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[2] U.S. Environmental Protection Agency. 2013. “AERSURFACE User’s Guide.” EPA-454/B-08-001, Revised 01/16/2013. Available Online: http://www.epa.gov/scram001/7thconf/aermod/aersurface_userguide.pdf

Table 3-1. AERSURFACE Input Parameters

AERSURFACE Parameter	RMSM	KPUB
Met Station Latitude	38.243	38.289
Met Station Longitude	-104.599	-104.507
Datum	NAD 1983	NAD 1983
Radius for surface roughness (km)	1.0	1.0
Vary by Sector?	Yes	Yes
Number of Sectors	12	12
Temporal Resolution	Seasonal	Seasonal
Continuous Winter Snow Cover?	No	No
Station Located at Airport?	No	Yes
Arid Region?	No	No
Surface Moisture Classification	Determined based on 30th and 70th percentile of climate normals	Determined based on 30th and 70th percentile of climate normals

3.2.4. AERMET Data Processing

The surface and upper air data will be processed with AERMET along with the output from the AERSURFACE processing. Standard AERMET processing options will be used.[3,4] The preparation of the meteorological data files using AERMET will be a three stage process. The first stage will include the extraction of raw hourly surface observations and upper air soundings. The extracted files will be checked by AERMET module for consistency and any missing or calm hours will be identified. The second stage merges the surface and upper air data. The third stage estimates the boundary layer parameters required by AERMOD using the AERSURFACE output.

The Bulk Richardson scheme for heat flux estimation will be used in the processing in order to allow local on-site meteorological data to be used rather than more distant airport meteorological data. The representativeness of the meteorological data that will be used for the Bulk Richardson processing is discussed in Section 3.2.1.

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[3] Fox, Tyler, U.S. Environmental Protection Agency. 2013. "Use of ASOS Meteorological Data in AERMOD Dispersion Modeling." Available Online: http://www.epa.gov/ttn/scram/guidance/clarification/20130308_Met_Data_Clarification.pdf

[4] U.S. Environmental Protection Agency. 2014. "User's Guide for the AERMOD Meteorological Preprocessor (AERMET)". EPA-454/B-03-002, November 2004).

Options proposed to be elected include:

- THRESHOLD 0.25: Keyword to provide a calm wind threshold 0.25 m/s for RMSM data;
- MODIFY: Keyword for upper air data;
- THRESH_1MIN 0.5: Keyword to provide calm wind threshold 0.5 m/s for in-minute wind data
- AUDIT: Keyword to provide additional QA/QC and diagnostic information;
- NWS_HGT WIND 10: Keyword to designate the anemometer height as 10 meters;
- METHOD WIND_DIR RANDOM: Keyword to correct for any wind direction rounding in the raw Integrated Surface Hourly Data (ISHD) data;
- METHOD REFLEVEL SUBNWS: Keyword to allow use of airport surface station data;
- METHOD STABLEBL BULKRN: Keyword to allow use of onsite measurements of temperature difference for the RMSM;
- Default substitution options for cloud cover and temperature data will not be overridden;
- Default ASOS_ADJ option for correction of truncated wind speeds will not be overridden; and
- ADJ_U* beta option will not be used.

3.3. COORDINATE SYSTEM

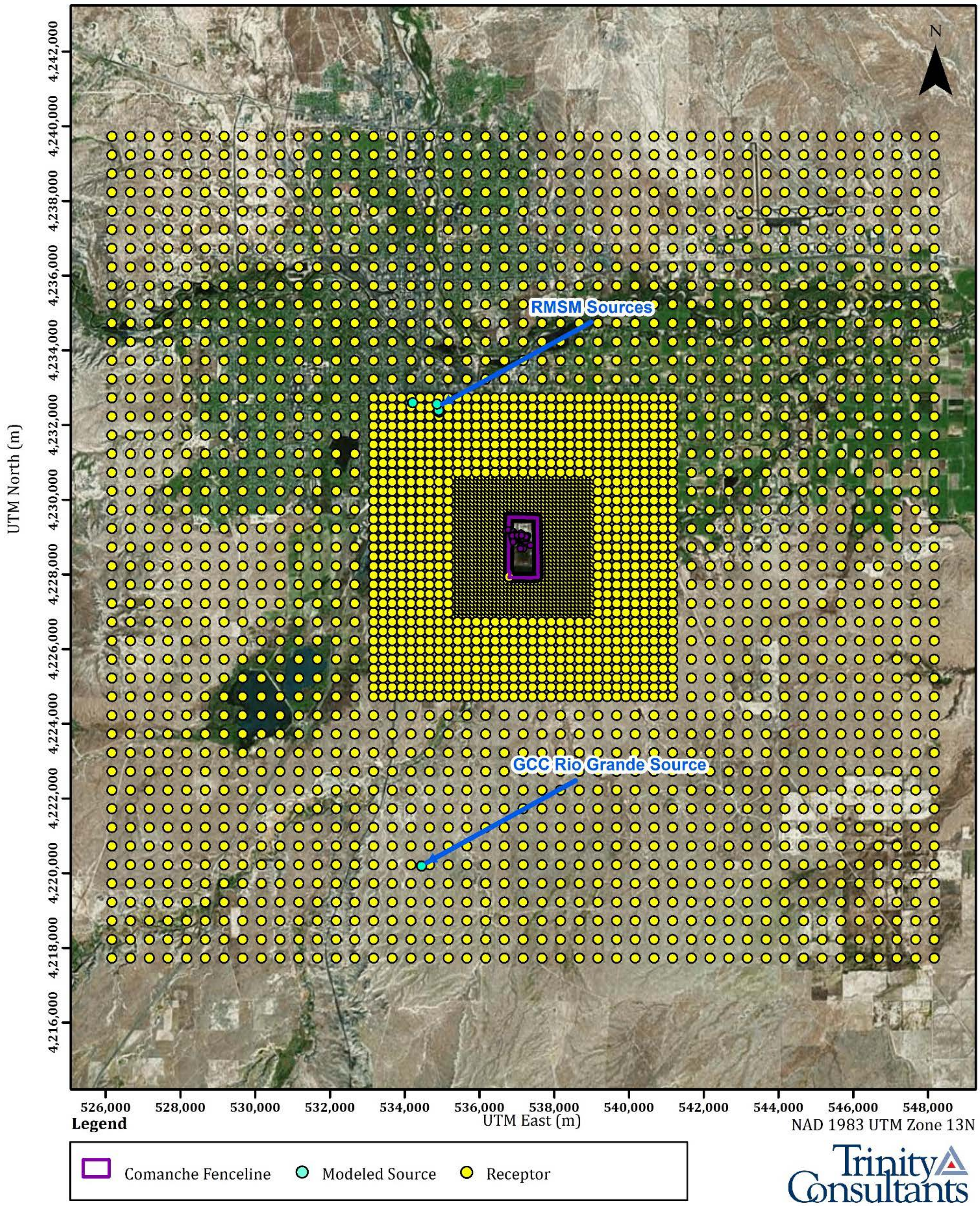
In all modeling input and output files, the locations of emission sources, structures, and receptors will be represented in Zone 13 of the Universal Transverse Mercator (UTM) coordinate system using datum World Geodetic System (WGS) 1984, which is comparable to the North American Datum 1983 (NAD83). The locations for the three units to be included in the modeling are shown in Table 2-2 and in Figure 2-1. The base elevation of the facility is approximately 4,830 feet above mean sea level.

3.4. RECEPTOR LOCATIONS

The dispersion modeling will use a combination of a Cartesian grid system centered on the facility and discrete receptor points along the facility fence line. Receptors will be placed at 25 meter intervals along the fence line for the facility, 100 meter intervals out to a distance of at least 1 kilometer (km) from the facility, 250 meter intervals out to a distance of at least 3 km from the facility, and at 500 meter intervals out to at least 10 km. Based on the 2016 SO_2 NAAQS Modeling TAD and the 2015 SO_2 Area Designation Guidance, the receptor grid will cover the entire modeling domain and will be expanded or adjusted as needed if elevated levels of SO_2 (at least 90% of the standard) are encountered near the edge of the receptor grid. On-site receptors (i.e., those located within the Comanche facility fence line) will be removed. In accordance with Section 4.2 the 2016 SO_2 NAAQS Modeling TAD, receptors located on other facilities' property will be included in the analysis.[5] The receptor locations, as well as modeled sources discussed in Sections 3.6 and 3.7, are depicted in Figure 3-3, below.

[5] SO_2 NAAQS Designations Modeling Technical Assistance Document, U.S. EPA, August 2016.

Figure 3-3. Comanche Generating Station Analysis Receptor Grid and Modeled Sources



3.5. TERRAIN ELEVATIONS

The terrain elevation for each receptor, building, and emission source will be determined using USGS 1/3 arc-second National Elevation Data (NED). The NED, obtained from the USGS, has terrain elevations at 10-meter intervals. Using the AERMOD terrain processor, AERMAP (version 11103), the terrain height for each receptor, building, and emission source included in the model will be determined by assigning the interpolated height from the digital terrain elevations surrounding each source.

In addition, AERMAP will be used to compute the hill height scales for each receptor. AERMAP searches all NED points for the terrain height and location that has the greatest influence on each receptor to determine the hill height scale for that receptor. AERMOD then uses the hill height scale in order to select the correct critical dividing streamline and concentration algorithm for each receptor.

3.6. EMISSION SOURCES

The three coal-fired electric utility units shown in Table 2-1 will be included in the analysis. Hourly 40 CFR Part 75 CEMS data from the EPA Air Market Program have been prepared for the years 2013, 2014, and 2015 for each of the units. This three year period is representative of normal operations for the three units. The raw CEMS parameters collected for each unit are shown in Table 3-2.

Table 3-2. Hourly CEMS Data Collected for Each Unit

Parameter	Units
Date	
Hour	
Operating Time	Minutes
SO_2 Mass Flow	lb/hr
Stack Velocity	ft/s
Stack Temperature	°F

The modeling will be conducted based on the actual hourly SO_2 emissions, stack temperatures and stack velocities. Furthermore, in accordance with Section 6.4 of the SO_2 Modeling TAD, actual (not GEP) stack heights for the utility units will be used in the modeling analysis. [6]

3.7. OTHER SOURCES

Modeling included sources of SO_2 emissions from the RMSM and the GCC Rio Grande Cement Plant, both of which are within 10 km of the facility. The CDPHE provided actual annual emissions from 2014 and 2015 for the RMSM and the GCC Rio Grande Cement Plant, respectively, as well as an SO_2 modeling AERMOD input file submitted for the RMSM using meteorological data from March 1, 2008 through February 28, 2009. Of the two data sets provided by the CDPHE, the modeled emissions are greater than the actual emissions. As a conservative measure, Xcel will model using the higher emissions. Modeled parameters for these sources (both

[6] SO_2 NAAQS Designations Modeling Technical Assistance Document, U.S. EPA, August 2016.

GCC and RMSM) will be taken from the CDPHE-provided RMSM modeling file. Stack heights for these sources follow the GEP stack height policy. Note that the stack heights of all RMSM and GCC sources included in the analysis are below the GEP stack height. As such, actual stack heights are used in the analysis. Based on potential emissions represented in that modeling analysis, the following large-emitting sources at these facilities are proposed to be included in the analysis:

Table 3-3. Nearby Source Emission Rates

Facility Name	Source ID	Modeled Emissions (g/s)	Modeled Annual Emissions (tpy) [1]	Average Actual Annual Emissions (tpy)
RMSM	SRC001	1.340	46.6	12.23
RMSM	SRC003	1.573	54.7	14.2
RMSM	SRC005	10.225	355.4	85.77
GCC Rio Grande	GCCRG	27.14	942.1	6.75

[1] Annual emissions were calculated using the modeled emission rate (g/s) assuming 8,760 hrs of operation per year.

[2] Average actual annual emissions are based on actual emissions from 2013, 2014, and 2015. With the exception of 2013 for the RMSM SRC005, emissions data was obtained using a CEMS. Actual 2013 emissions for the RMSM SRC005 is based on the most recent stack test data for the source paired with actual 2013 production data.

Modeling parameters for these sources are provided in the table below.

Table 3-4. Nearby Source Stack Parameters

Source ID	Stack Height (m)	Stack Temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
SRC001	20.4	310.9	2.12	11.89
SRC003	33.78	377.6	8.04	4.88
SRC020	54	688.6	9.87	2.29
SRC005	18.59	314.8	20.466	1.76
GCCRG	115.7	478	18.87	3.12

SO_2 emissions from other sources at these facilities are negligible (i.e. < 1 tpy) and will therefore not be included in this analysis.

3.8. BUILDING INFLUENCES

The U.S. EPA's Building Profile Input Program (BPIP) with Plume Rise Model Enhancement (PRIME) (version 04274) will be used to account for building/structure downwash influences at the Comanche Generating Station. The purpose of a building downwash analysis is to determine if the plume discharged from a stack will become caught in the turbulent wake of a building or other structure, resulting in downwash of the plume. The downwash of a plume can result in elevated ground-level concentrations. The height for the structures considered in the downwash analysis will be provided in the air dispersion modeling report. The location and dimensions of the modeled downwash structures are shown below in Table 3-5 and Figures 3-4, 3-5, and 3-6. No non-default configuration options will be used in the building downwash analysis.

Table 3-5. Comanche Downwash Structures

Diagram ID	Model ID	Height (ft)
1	WETCOOL	39.4
2	DRYCOOL	121.1
3	7	291.4
4	2A	102.0
5	2B	102.0
6	RECY3	29.9
7	RECY2	29.9
8	FLYASH3	48.0
9	U2BHA	88.0
10	U2BH100A	98.5
11	U2BHB	88.0
12	U2BH100B	98.5
13	BOIL1	213.8
14	BOIL2	216.0
15	TURB1/2	92.2
16	U1BHA	88.0
17	U1BH100A	98.5
18	U1BHB	88.0
19	U1BH100B	98.0
20	COOL2	60.0
21	COALDUMP	29.9
22	CRUSH1/2	89.9
23	CRUSH3	120.0
24	SERV2	24.0
25	SORBENT	30.0
26	RECY1	30.0
27	10	116.1
28	COALSILO	236.0
29	LIME3	29.9
30	FLYASH1	29.9

Diagram ID	Model ID	Height (ft)
30	FLYASH1	29.9
31	FLYASH2	96.8
32	COOL1	60.0
33	SERV1	30.0
34	FGD1	164.5
35	FGD2	164.5
36	FGD3	164.5
37	FLYASH1B	72.0
38	FLYASH2B	72.0
39	FLYASH3B	115.0
40	5_2A	130.0
41	5_2B	130.0
42	5_1A	150.8
43	5_1B	150.0
44	RECY3B	121.5
45	RECY3A	121.5
46	CARB3A	55.0
47	CARB3B	55.0
48	RECY2A	75.0
49	RECY2B	75.0
50	LIME3A	84.0
51	LIME3B	84.0
52	RECY1A	75.0
53	RECY1B	75.0
54	SORB1A	80.0
55	SORB1B	80.0
56	NMAINT	36.6
57	WARE3	22.5
58	CABLE	65.3
59	MAINT	35.0
60	ADMIN	17.0

Figure 3-4. Comanche Downwash Structures – Northwest Section

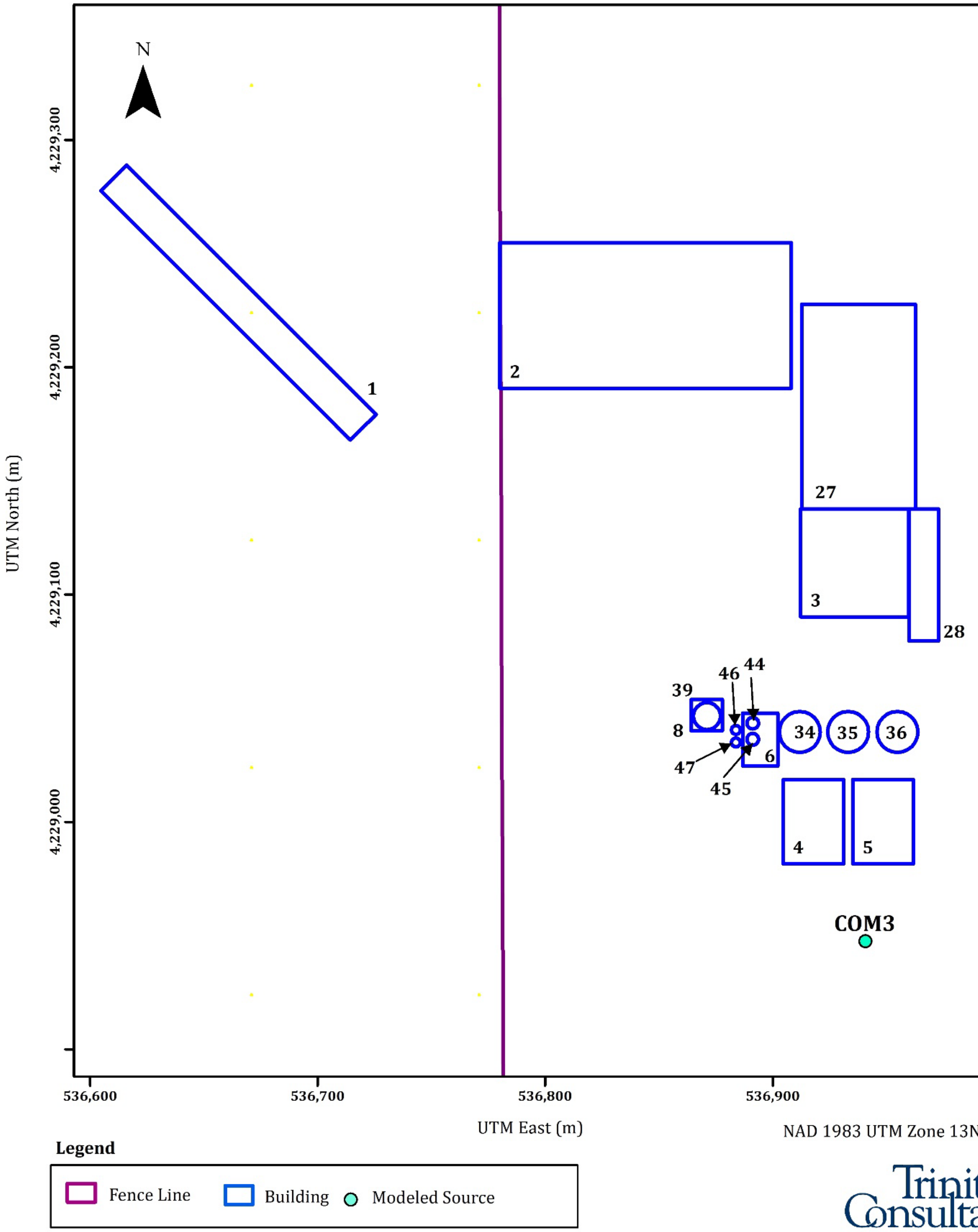


Figure 3-5. Comanche Downwash Structures – Northeast Section

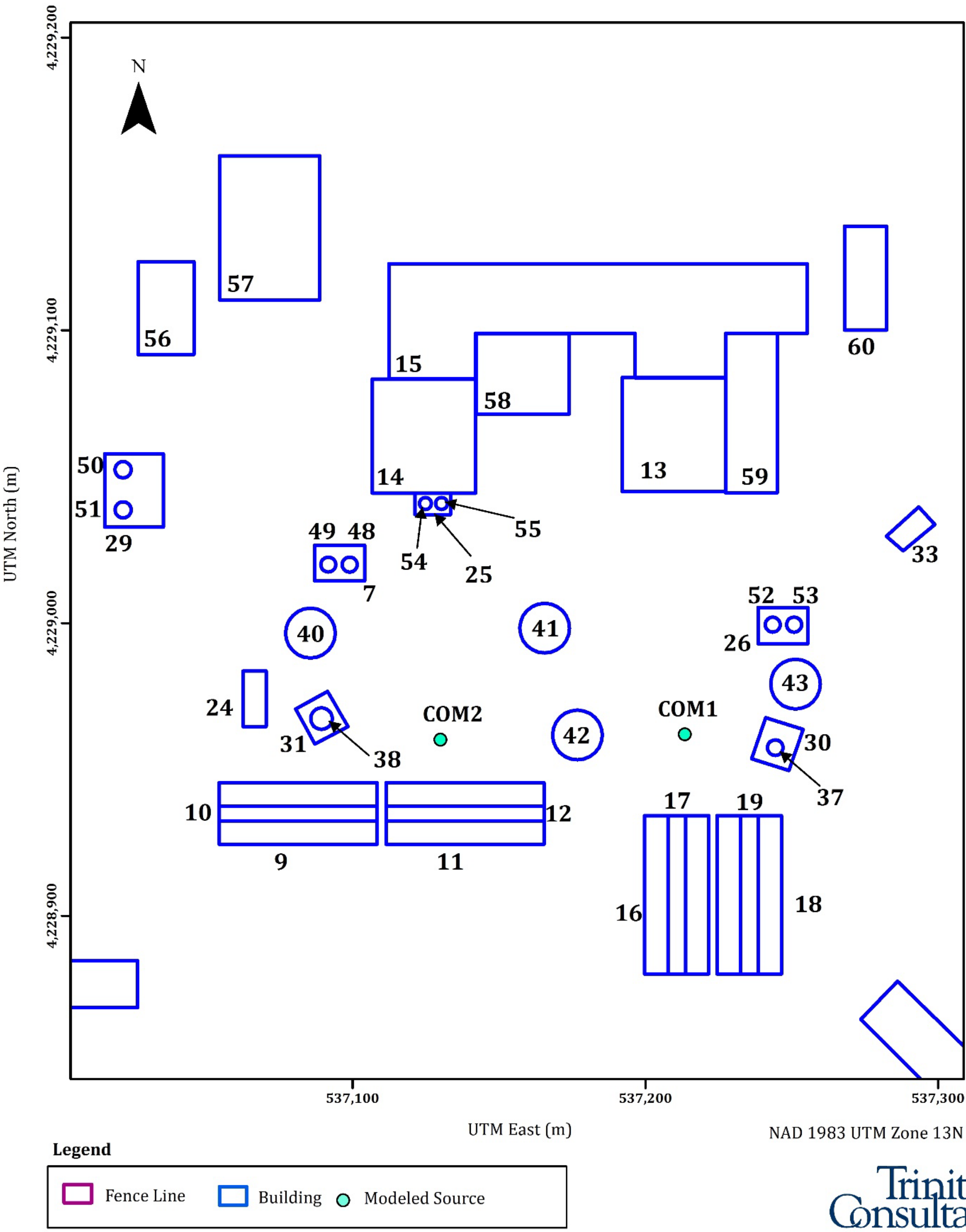
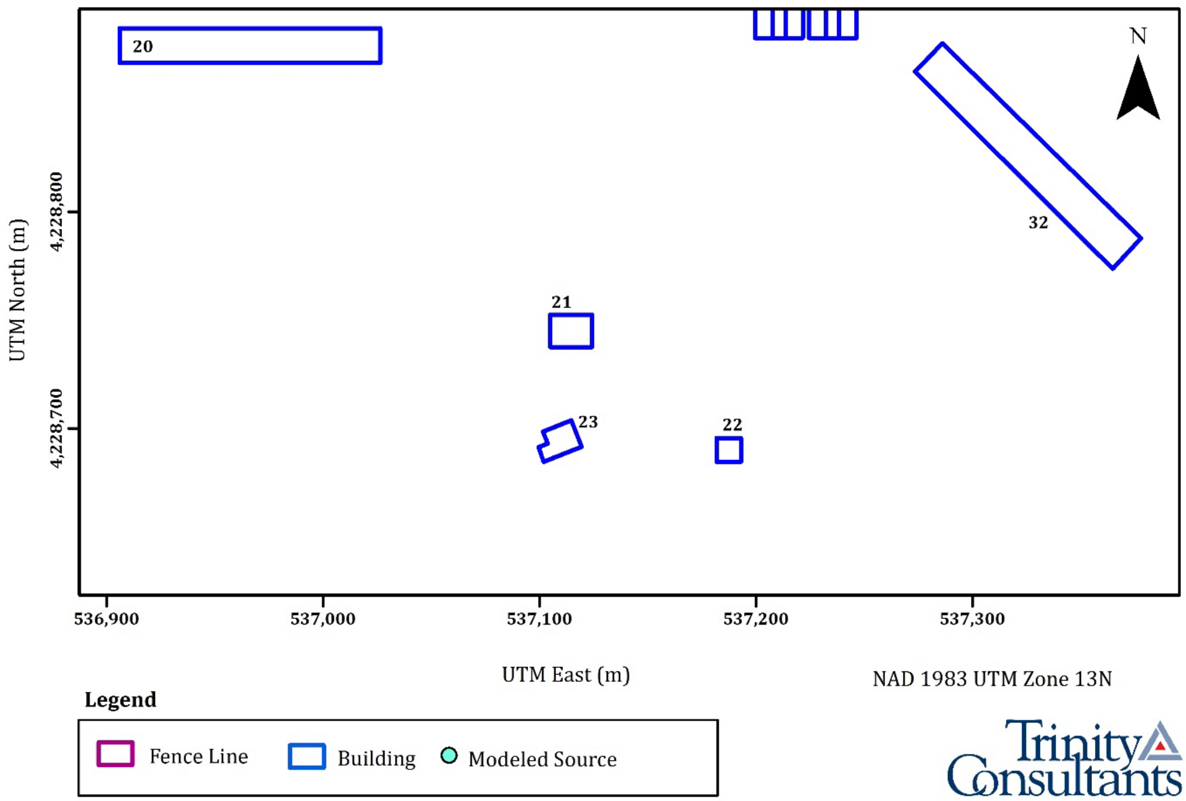


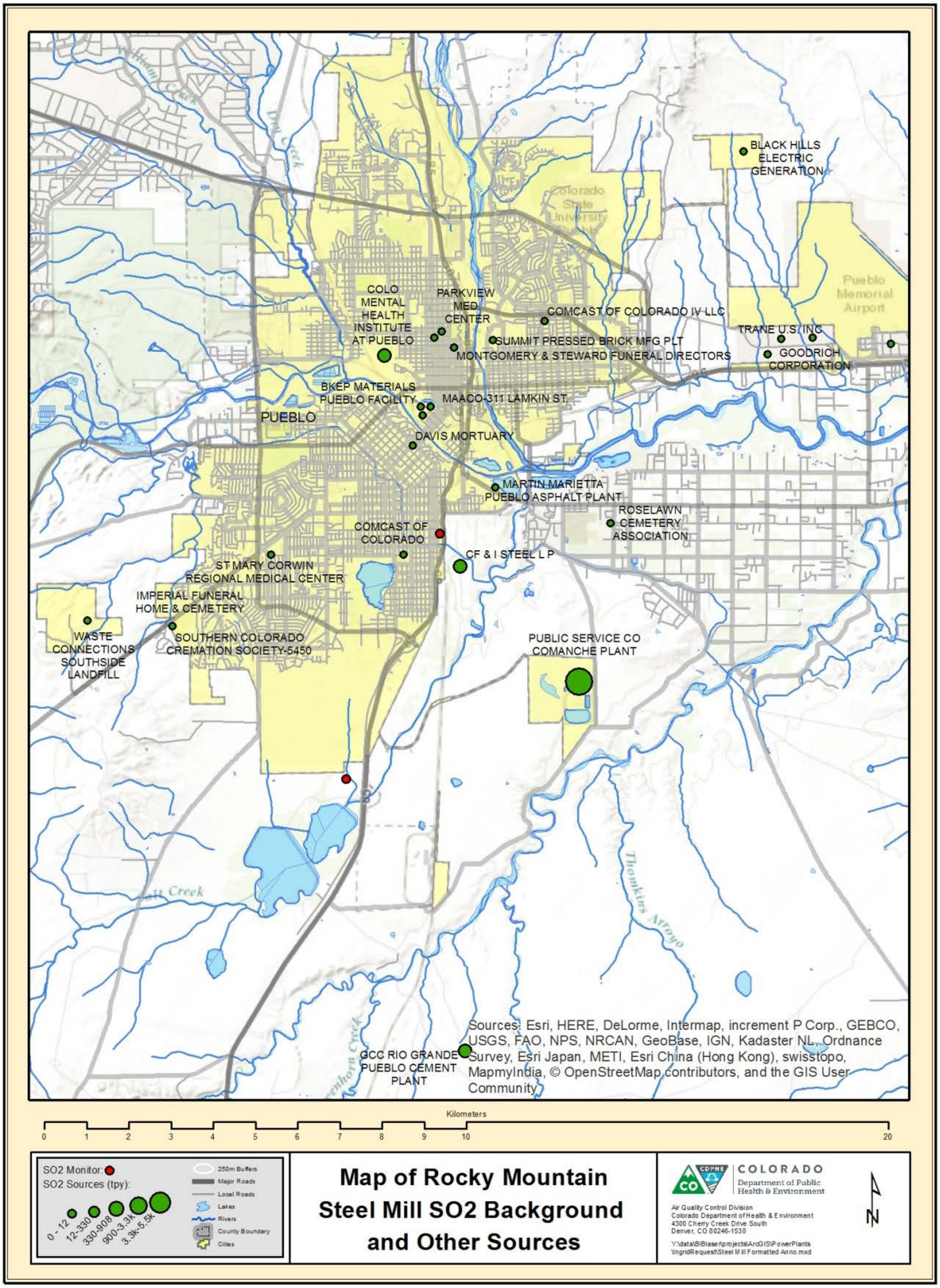
Figure 3-6. Comanche Downwash Structures – South Section



3.9. BACKGROUND CONCENTRATION

The figure below shows the Evraz - Rocky Mountain Steel Mill Facility (RMSM) with the two nearby off-site SO_2 monitoring stations previously maintained by RMSM, as well as additional SO_2 sources within 10 km of the RM Reservoir monitor. As shown in the map, the RMSM Print Shop monitor is located within the city of Pueblo, near the highway. The RM Reservoir monitor is located south of the city, and is isolated from the city's impacts. The RM Reservoir location is believed to be the most representative location for an estimate of SO_2 background in the area of the Comanche Generating Station which also included in the map. SO_2 sources are shown as green circles on the map.

Figure 3-7. Map of Monitoring Location and Sources Impacting Holcim Monitor



Other than Comanche Generating Station, the GCC Rio Grande Cement Plant, and the RMSM facility, which are the most significant sources of SO_2 in Pueblo county, the majority of nearby SO_2 sources are very small (less than 5 tpy). Annual emissions from the thirteen facilities located within 10 km of the RM Reservoir monitor are presented in the following table.

Table 3-6. Annual SO_2 Emissions from sources within 10 km of the RM Reservoir SO_2 Monitor

	2013	2014	2015
PUBLIC SERVICE CO COMANCHE PLT	3496.0 tpy	3157.3 tpy	3294.7 tpy
EVRAZ – ROCKY MOUNTAIN STEEL MILL FACILITY	311.2 tpy	310.7 tpy	310.7 tpy
GCC RIO GRANDE - PUEBLO CEMENT PLANT	12.8 tpy	12.8 tpy*	9.3 tpy
MARTIN MARIETTA - PUEBLO ASPHALT PLANT	2.7 tpy*	2.7 tpy*	2.7 tpy*
WASTE CONNECTIONS - SOUTHSIDE LANDFILL	1.3 tpy*	1.3 tpy*	1.3 tpy
ST MARY CORWIN REGIONAL MEDICAL CENTER10	1.2 tpy	1.2 tpy	1.2 tpy*
ROSELAWN CEMETERY ASSOCIATION	0.2 tpy*	0.2 tpy*	<0.1 tpy
SOUTHERN COLORADO CREMATION SOCIETY-5450**	--	--	0.2 tpy
BLACK HILLS ELECTRIC- PUEBLO POWER PLANT	<0.1 tpy*	<0.1 tpy	<0.1 tpy*
DAVIS MORTUARY	<0.1 tpy*	<0.1 tpy*	<0.1 tpy*
COMCAST OF COLORADO IV LLC	<0.1 tpy	<0.1 tpy*	<0.1 tpy*
BKEP MATERIALS - PUEBLO FACILITY	<0.1 tpy	<0.1 tpy*	<0.1 tpy*
MAACO-311 LAMKIN ST.**	--	--	<0.1 tpy*
Totals	**3,825 tpy**	**3,486 tpy**	**3,620 tpy**

*These sources did not submit revised Air Pollution Emission Notices to the CDPHE in the indicated years, indicating that their emissions did not change significantly. Thus the values reflected above represent the most recent data year reported.
**This source commenced operation in 2015.

The State of Colorado has very limited ambient SO_2 data available because compared to the past National Ambient Air Quality Standards, the state has had very low ambient concentrations. Therefore, ambient monitoring of SO_2 was rarely required and a "regional site" (one that is located away from the area of interest but is impacted by similar natural and distant man-made sources) was used to determine an appropriate background concentration (USEPA's *Guideline on Air Quality Models,* Section 8.2.2.c).

The RMSM Reservoir Site, which APCD feels is most representative of conditions at Comanche, only has two years of data (2014-2015). These data were collected voluntarily by RMSM, in anticipation of a permit application requiring preconstruction monitoring under Prevention of Significant Deterioration (PSD) regulations. While Colorado agrees that 3 years of data would be better, PSD requirements specify one year of data, which was actually exceeded by an additional year. RMSM did collect three years of data at its Print Shop site. From 2013 – 2015, this site showed .012 ppm as the 99th percentile, as opposed to the Reservoir site with .010 ppm for two years. The Print Shop site is within Pueblo, west of the RMSM Plant, and on the other side of I-25; this site is more influenced by local urban and highway sources than the Reservoir Site. The Reservoir Site is south of Pueblo, outside the city limits. The RMSM Reservoir site represents a rural area, and Colorado feels it is representative in this case, as it is a rural plains location outside of Pueblo, with the inclusion of regional highway impacts, for the area surrounding the Comanche Power Plant.

CDPHE has 1-hr SO_2 monitoring data from sites in Denver, Colorado Springs, Pueblo, a remote western slope site (Williams Energy Willow Creek), the Holcim Cement facility near Florence, a Tri-State monitoring location outside of Holly, Southwest Generation south of Colorado Springs, and the RM Reservoir site. CDPHE used best professional judgment to determine that data from large urban areas would not be representative of the area around the Comanche Generating Station since Comanche is not located inside a large urban area. Similarly, the Southwest Generation data has a value of 0.045 ppm, which is an extremely high value that is non-representative. The Holly data are from a location on the plains of eastern Colorado, and are not representative of conditions along the Front Range of Colorado. The Williams Willow Creek data were collected in a remote area and the Holcim data were collected in a rural area of the state outside of a small city both of which are less representative of the area around the Comanche Generating Station. Therefore, CDPHE determined that the RM Reservoir monitor data are the most appropriate and most representative for use in this case based on the criteria listed below.

CDPHE believes that the RM Reservoir monitor is the most representative monitor for characterizing background concentrations of SO_2 at Comanche Generating Station due the following factors:

1. Both the Comanche Generating Station and the RM Reservoir monitor are located in rural areas within 10 km of Pueblo, Colorado, a large urban center. The population of Pueblo is approximately 106,600.
2. Both Comanche Generating Station and the RM Reservoir monitor are located along the Front Range of Colorado in areas of similar topography.
3. Both the Comanche Generating Station and the RM Reservoir monitor are located south of the city of Pueblo, and are isolated from the city's impacts.
4. The Comanche Generating Station and the RM Reservoir monitor are within 4 miles of each other.

Furthermore, the RM Reservoir monitor provides a conservative estimate of background SO_2 concentrations at Comanche Generating Station because of the nearby industrial sources of SO_2 emissions. There are thirteen industrial sources of SO_2 emissions within 10 km of the RM Reservoir monitor totaling approximately 3,620 tpy (as shown in Table 3-6 above), including Comanche and RMSM. By contrast, there are twenty sources of SO_2 emissions within 10 km of Comanche Generating Station totaling approximately 351 tpy (excluding SO_2 emissions from Comanche Generating Station itself for background concentration comparison purposes). The location of Comanche Generating Station in relation to surrounding SO_2 sources in show in the figure above.

Because of the significantly higher source emissions around the RM Reservoir monitor (3,620 tpy vs 351 tpy), the RM Reservoir monitoring data provides a conservative estimate of the background SO_2 emissions that could be found near the Comanche Generating Station. CDPHE used best professional judgment to determine that this data is the best estimate of background concentrations at the Comanche Generating Station. The RM Reservoir monitor could be overly conservative based on the above information and the fact that the Comanche Generating Station itself, a large SO_2 source, is located near the monitor.

CDPHE has provided a 1-hour SO_2 background concentration of 10 ppb (based on the design value) that is representative of the background concentration in the vicinity of the Comanche Generating Station. The design value is from the RM Reservoir Site, and is the 99th percentile two year average (2014-2015). Note that this background concentration is conservative since the data were collected at or near the sources modeled in this analysis and likely includes contributions from these sources.

Consistent with EPA air quality modeling guidance, the constant background concentration will be added to the modeling results and will not be explicitly included in the model.

3.10. CHARACTERIZATION OF MODELED AREA

The Comanche Generating Station is located approximately 5 km southeast of the city of Pueblo, Colorado. The area is in a high desert area of terrain and has a semi-arid climate. The area receives some snow during the winter, but periods of snow cover are brief. The sources are located on relatively flat terrain between Pueblo and the Royal Gorge. The area is classified as attainment or unclassified for all criteria pollutants.

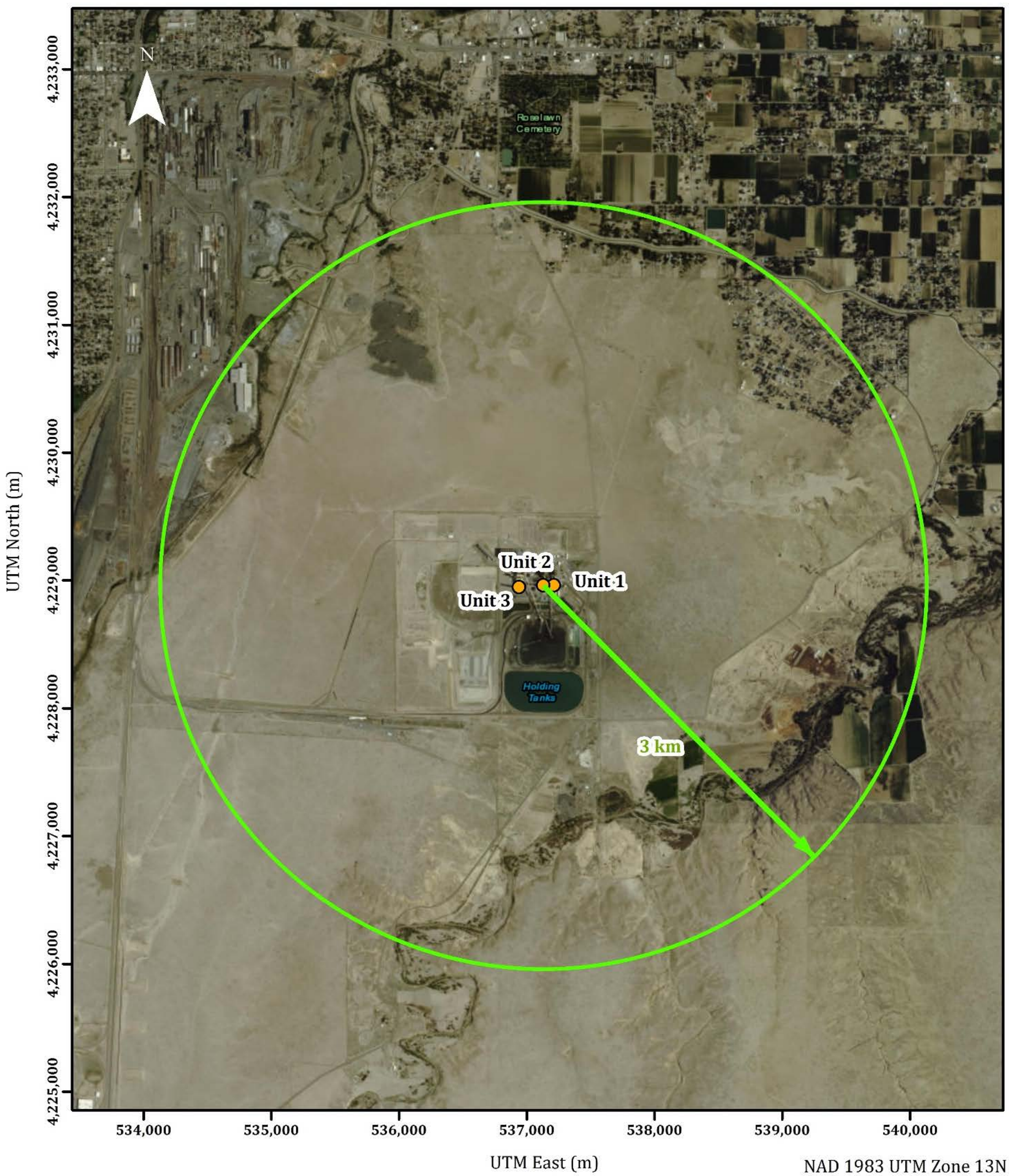
In order to categorize the area as rural or urban for modeling purposes, National Land Cover Dataset (NLCD) 1992 (CONUS) Land Cover data was obtained from the Multi-Resolution Land Use Consortium (MRLC). Data within a 3 km radius of each source was analyzed using the EPA AERSURFACE tool (version 13016).[7] Per Section 6.3 of the 2016 SO_2 NAAQS Modeling TAD, a source is considered urban if the land use types I1 (heavy industrial), I2 (light-moderate industrial), C1 (commercial), R2 (common residential), and R3 (compact residential) are 50 percent or more of the area within the 3 km radius circle. Otherwise, the source is considered a rural source.[8]

Based on the analysis using NLCD 1992 Land Cover data, only approximately 3.5% of the land within 3 km of the facility falls into the land use type categories listed above. Although some land development has occurred in the area since the 1992 data was published, it is clear from the aerial images provided in Figure 3-7 that significantly less than 50% of the land within 3 km of the sources can be considered urban. As such, the sources will be considered rural for the modeling analysis.

[7] U.S. Environmental Protection Agency. 2013. "AERSURFACE User's Guide." EPA-454/B-08-001, Revised 01/16/2013. Available Online: http://www.epa.gov/scram001/7thconf/aermod/aersurface_userguide.pdf

[8] SO_2 NAAQS Designations Modeling Technical Assistance Document, U.S. EPA, August 2016.

Figure 3-8. Aerial Image – Comanche Facility Area



4. PRESENTATION OF MODELING RESULTS

The three year average of the annual 99th percentile one hour modeled ground-level concentrations obtained using the approach described in Section 3 and comparison to the 1-hour SO_2 standard will be presented in the final modeling report. If applicable, recommendations for potential ambient SO_2 monitor locations will also be presented based on maximum model impact locations where it is feasible to place a monitor. As appropriate, figures depicting the concentration gradient of the modeled impacts will be included in the final report.

5. ELECTRONIC FILES

The air dispersion modeling input and output electronic data files will be provided to the EPA Region 8 with the final modeling report. The meteorological data files, AERSURFACE output files, data associated with the background concentration, building specifications, the utility unit hourly CEMS data files utilized in the analysis, and any other information used to support the modeling analysis will also be provided in electronic form. A copy of the air dispersion modeling report will also be provided in electronic form.

An electronic copy of the hourly emissions and stack parameters to be used in the modeling analysis is also included electronically with this modeling protocol.