STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

RICK SNYDER
GOVERNOR

C. HEIDI GRETHER
DIRECTOR

January 13, 2017

Mr. John Mooney
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard (AR-18J)
Chicago, Illinois 60604-3507

Dear Mr. Mooney:

The Michigan Department of Environmental Quality (MDEQ) is submitting its recommended designations for the 1-hour sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS) as required by the Data Requirements Rule (DRR). These recommendations are based on the dispersion modeling of two SO_2 sources identified to the United States Environmental Protection Agency (USEPA) in a letter from me dated January 15, 2016. Specifically with this submittal, the MDEQ is recommending the counties of Delta and Alpena be designated as attainment.

This attainment recommendation was determined using dispersion modeling, emissions-related data, and meteorology as outlined in the USEPA's guidance memorandum dated March 20, 2015. However, the modeling for the Lafarge Cement facility is based on two years and eleven months of data, not the required full three years of actual emissions. Lafarge Cement will submit their December 2016 data to the MDEQ in late January 2017, and the MDEQ will re-run the model using the three full years of data; 2014-2016. The results will be forwarded to the USEPA as an addendum to this submittal in February 2017.

A description of the MDEQ's analysis is provided in the enclosed Support Document for Sulfur Dioxide Designation Recommendations for the 2010 SO_2 NAAQS.

If you have additional questions regarding this matter, please contact Mr. Robert Irvine, Air Quality Division, at 517-284-6749; irviner@michigan.gov; or MDEQ, P.O. Box 30260, Lansing, Michigan 48909-7760; or you may contact me.

Sincerely,

Lynn Fiedler

Lynn Fiedler, Division Director
Air Quality Division
517-284-6773

cc: Mr. Robert Irvine, MDEQ

Support Documentation for Sulfur Dioxide Designation Recommendations for the 2010 SO_2 NAAQS

Michigan Department of Environmental Quality
Air Quality Division
P.O. Box 30260
Lansing, Michigan 48909-7760

January 13, 2017

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Support Documentation for Sulfur Dioxide Designation Recommendations for the 2010 SO_2 NAAQS

Executive Summary

The Michigan Department of Environmental Quality (MDEQ) is submitting its recommended designations for the 1-hour sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS). These recommendations are based on the dispersion modeling for two SO_2 sources, which are subject to the United States Environmental Protection Agency (USEPA) Data Requirements Rule (DRR) because their emissions are greater than 2,000 tons per year. These facilities, Escanaba Paper in Escanaba and Lafarge Cement in Alpena, were identified in a letter dated January 15, 2016, to the USEPA, from Lynn Fiedler, MDEQ, Air Quality Division. The MDEQ is recommending attainment for the counties of Delta and Alpena. A description of the MDEQ's analysis for the attainment areas is provided in this document.

Introduction

The USEPA revised the primary NAAQS for SO_2 on June 2, 2010. This new, short-term standard is based on the 3-year average of the 99^{th} percentile of the yearly distribution of 1-hour daily maximum concentrations. The level was set at 75 parts per billion (ppb). In July 2013, the USEPA identified areas in 16 states as nonattainment and expressed their intent to address designations for the remainder of the country in future actions.

On March 2, 2015, a consent decree was reached between the USEPA, the Sierra Club, and the Natural Resources Defense Council to resolve litigation concerning the deadline for completing designations. The first deadline was July 2, 2016. The second deadline was for stationary sources which fell under requirements of the August 10, 2015, DRR. Under this rule, designations had to be made for areas having sources that emit more than 2,000 tons per year of SO_2. State designation recommendations for these areas must be submitted to the USEPA by January 13, 2017. On March 20, 2015, the USEPA updated guidance to the states on designating areas. Areas were designated as either attainment, nonattainment, or unclassifiable.

Michigan Impacts

Two facilities have been identified as falling within the emissions levels referenced in the DRR:

- Escanaba Paper Company in Escanaba (Delta County), and;
- Lafarge Cement facility in Alpena (Alpena County).

The MDEQ is responsible for developing SO_2 designation recommendations for the areas surrounding these facilities. The MDEQ and the companies that own the two affected facilities performed the necessary dispersion modeling to quantify SO_2 impacts and to determine if the 1-hour NAAQS was being violated. The MDEQ followed USEPA guidance throughout the modeling and designation process. This guidance included the *Updated Guidance for Area Designations for the 2010 Primary Sulfur Dioxide National Ambient Air Quality Standard,* dated March 20, 2015, and the *Draft SO_2 NAAQS Designations Modeling Technical Assistance Document (TAD),* dated August 2016.

Based on this analysis, the MDEQ can provide recommendations to the USEPA on appropriate SO_2 attainment classifications.

Stack and Emissions Information

- Escanaba Paper Company: Actual hourly emissions from 2012-2014 were modeled for the No. 7 Boiler, No. 8 Boiler, No. 10 Recovery Furnace, and the PCC Plant (Lime Kiln) while potential-to-emit (PTE) emissions were modeled for the remaining facility sources. For the No. 7 Boiler and No. 8 Boiler, actual hourly emissions were developed based on daily fuel usage, hours of operation, and emission factors. A similar method was used to calculate hourly emissions for the No. 10 Recovery Furnace. The PCC plant does not generate SO_2 emissions; however, SO_2 emissions from the Lime Kiln are exhausted out of the PCC Plant Stack. For more detailed information on emissions, see the Escanaba SO_2 DRR Protocol and Modeling report located in Appendices B1 and B2. The modeled source parameters are shown in Table 1, along with the PTE emissions if applicable. The PTE emissions calculations are shown in Appendix B3.

- Lafarge Cement: Lafarge operates continuous emissions monitors (CEMS) on their kiln stacks. This actual CEMS emissions data was modeled for all sources at the facility, along with the actual hourly stack gas temperature, and gas flow rate. One of their kilns, KG6 (WGS) did not have controlled emissions until December 2013. Because of this, the facility and the MDEQ decided to use actual emissions starting January 1, 2014 through November 30, 2016 to account for the current regular operation. Modeling for this facility will be updated early in 2017 to evaluate the full three years of CEMS data. For more information, see the Lafarge Alpena 1-hour SO_2 Modeling Protocol in Appendix B4. The modeled source parameters can be found in Table 2.

Table 1. Escanaba Paper Modeled Stack Parameters and PTE Emissions

Stack ID	Stack Height (meters)	Stack Diameter (meters)	Exit Velocity (meters/sec)	Exit Temperature (Kelvin)	Emission Rate (gram/sec) [1]
KILN	44.99	1.42	8.94	341.48	-
RECOVST3	86.57	3.96	18.10	520.90	-
SDT	87.78	1.22	13.90	361.50	0.05040
INCSCRB	45.20	1.22	8.05	355.90	1.51198
1COAT1	29.87	1.22	9.70	410.80	0.00139
1COAT2	29.87	1.22	9.70	410.80	0.00139
1COAT3	29.87	1.22	18.60	366.30	0.00078
1COAT4	29.87	1.22	18.60	366.30	0.00069
3COAT1	19.87	1.57	0.00	449.70	0.00033
3COAT2	21.58	1.49	0.00	449.70	0.00030
3COAT3	21.64	1.49	0.00	449.70	0.00037
3COAT4	21.64	1.49	0.00	449.70	0.00030
3COAT5	21.64	1.49	0.00	449.70	0.00030
3COAT6	21.64	1.49	0.00	449.70	0.00037
BLR07	29.26	1.98	11.48	449.80	-
BLR08	49.07	2.13	11.22	422.10	-
BARKBL1	86.87	2.13	9.59	338.70	0.73079
BARKBL2	86.87	2.13	7.45	338.70	0.73079
COMBBLR	100.58	3.35	21.10	454.30	157.24540
PCC	59.44	0.71	18.12	328.71	-

[1] Stack emission rates listed in table reflect potential emissions, and emission rates not listed were accounted for by the actual hourly emissions file input into the model run.

Table 2. Lafarge Cement Modeled Stack Parameters

Stack ID	Stack Height (meters)	Stack Diameter (meters)	Exit Velocity (meters/sec)	Exit Temperature (Kelvin)
K19	67.06	3.96	5.00	481.87
K20	67.06	3.96	5.40	467.98
K21	67.06	3.96	5.52	462.54
WGS	76.20	2.54	16.12	326.09

Summary of Modeling

Analysis began with the MDEQ requesting each facility to provide a modeling protocol that included the facility description, model selection, emissions characterization, source description, background concentration, meteorology, modeling domain and off-site emissions inventory. The draft modeling protocols were reviewed by the MDEQ and then sent to the USEPA before the required July 1, 2016, deadline. The facilities revised protocols based on recommendations by the MDEQ and the USEPA. The updated protocols were again reviewed by the MDEQ and the USEPA. These protocols and modeling results can be found in Appendix B.

Modeling of the facilities was performed on an individual basis. Table 3 summarizes the results from the modeling runs and the background SO_2 concentration for each area. The final column represents the expected highest impacts by adding the modeled high value and background value for each modeled facility. A narrative describing the individual facility modeling follows.

- Escanaba Paper Company: The modeling for this facility was carried out by All4, Inc. using the AERMOD model with 2012-2014 hourly meteorological data from the National Weather Service station at the Ford Airport in Iron Mountain/Kingsford, MI. When processing the met data, the Adj_U* option was selected in AERMET to adjust the surface friction velocity (U*) to address issues with over prediction under stable, low wind speed conditions. The facility was modeled by itself because no other SO_2 sources were found in the immediate area. The maximum 3-year average of the 99^{th} percentile of the maximum daily 1-hour concentrations for off-site receptors was found to be 36.2 ppb. Adding the ambient background concentration of 7 ppb derived from the Forest County, WI monitoring station gives a total predicted impact of 43.2 ppb, which is well below the NAAQS of 75 ppb.

- Lafarge Cement: The modeling for this facility was performed by RTP Environmental Associates using the AERMOD model with the 2014-2016 hourly meteorological data from the National Weather Service station at the Alpena County Regional Airport (APN) in Alpena, MI. No immediate SO_2 sources were found near the facility; therefore, the facility was modeled by itself. Background concentrations of SO_2 were input into the model as varying concentrations by hour of day and season. This is a less conservative, but allowed, approach for including background. The background concentrations were added to the modeled concentration within AERMOD; therefore, the end result is a combined impact of both facility emissions and background concentrations of SO_2. The total predicted impact is 74.3 ppb, which is below the NAAQS of 75 ppb.

Table 3. Source Modeling Impacts

County	Facility Name	3-year average of the 99% daily max. 1-hour (ppb)	Background Concentration (ppb)[1]	Combined SO_2 Impact (ppb)
Delta	Escanaba Paper Company	36.2	7	43.2
Alpena[2]	Lafarge Portland Cement Manufacturing	74.3	-	74.3

[1] Contemporaneous SO_2 background concentrations were input into the Lafarge model run; therefore, the 3-year average of the 99% daily max. 1-hour includes background.

[2] The modeling for Lafarge Cement was done with actual emissions data for 2014, 2015, and January through November 2016. The model will be re-run by the MDEQ using the full 3-year dataset, 2014-2016, after the facility provides the December 2016 data in January 2017.

Based on the modeling results displayed in Table 3, both facilities meet the 1-hour SO_2 NAAQS. Figures 1 and 2 show concentration isopleth plots and the maximum impact location for each demonstration. The following figures demonstrate areas in attainment.

Figure 1. Isopleth and Maximum Impact (ppb) for the Escanaba Paper Company (including background)

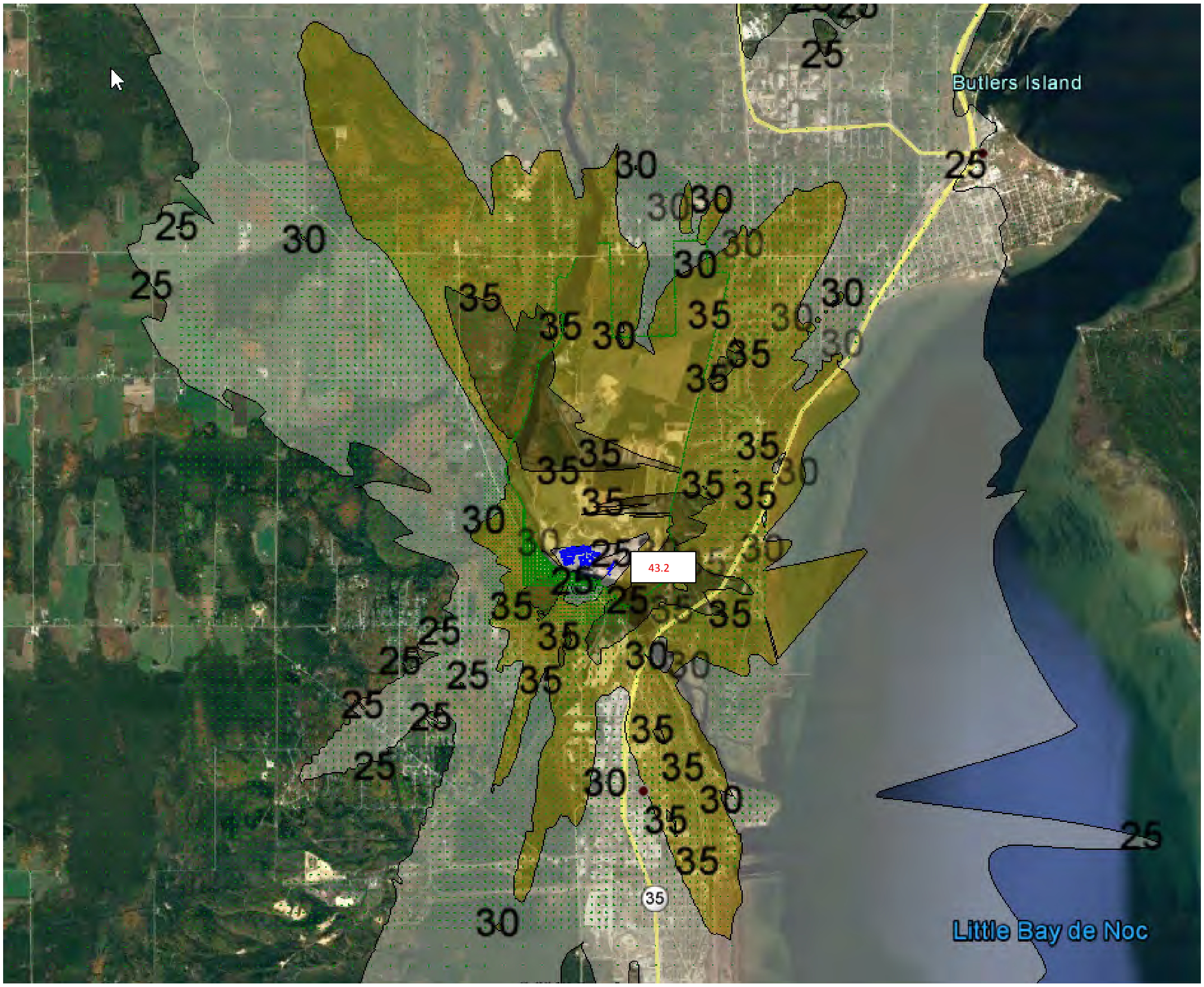
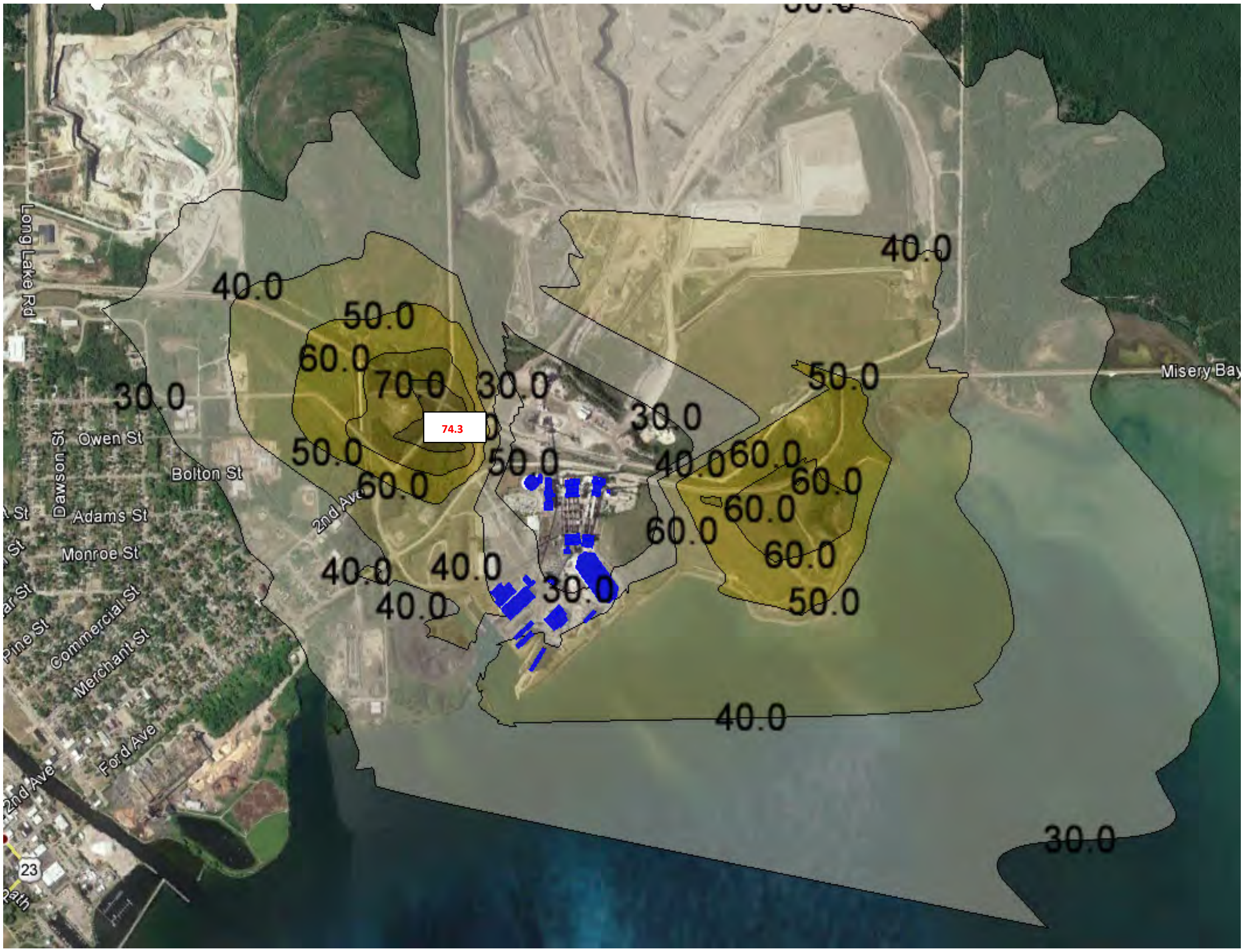


Figure 2. Isopleth and Maximum Impact (ppb) for Lafarge Cement
(including background)



Recommended Attainment Areas

Based on the source modeling described above, the areas surrounding the Escanaba Paper Company and the Lafarge Cement Facility were found to be in attainment of the 2010 SO_2 1-hour NAAQS. For each, the MDEQ recommends attainment boundaries to include the entire county in which the facility is located. This follows the recommended approach for facilities modeling attainment as described in the March 20, 2015, USEPA guidance. Therefore, the MDEQ recommends an attainment designation for the 1-hour SO_2 NAAQS for both Delta and Alpena Counties.

Appendix A

MI-WI Monitor Values

2013-2015 Michigan/Wisconsin 1-hour SO_2 Monitor Design Values

Monitor Location	3-year 1-hour SO_2 Design Value (ppb)
Allen Park	44.1
Detroit – W. Fort St.	64.1
Grand Rapids	10.3
Lansing	15.7
Port Huron	70.2
Sterling State Park, Monroe	18.0
Forest County, WI	6.7

Appendix B1

Escanaba SO_2 DRR Protocol

SO_2 DATA REQUIREMENTS RULE

AIR QUALITY MODELING PROTOCOL

ESCANABA PAPER COMPANY

JUNE 2016

Submitted by:

Escanaba Paper Company
7100 County Road 426
Escanaba, MI 49829

Submitted to:

State of Michigan DEQ Department of Environmental Quality

Michigan Department of Environmental Quality
Air Quality Division
525 West Allegan Street
Constitution Hall
Lansing, MI 48933

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1. INTRODUCTION

Escanaba Paper Company (EPC) owns and operates a bleached Kraft pulp and paper mill (Mill) in Escanaba, Michigan. The Mill is a major source as defined by the Federal operating permit program (40 CFR Part 70) and Michigan Department of Environmental Quality (MDEQ) Chapters R336.1210 through R336.1218 and operates under renewable operating permit (ROP) A0884. The Mill has been identified by MDEQ as a source for which attainment with the 1-hour sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS) needs to be demonstrated. The U.S. Environmental Protection Agency (U.S. EPA) issued the final 1-hour SO_2 NAAQS on June 22, 2010. On August 21, 2015, U.S. EPA promulgated 40 CFR Part 51, Subpart BB (Data Requirements for Characterizing Air Quality for the Primary SO_2 NAAQS, also known as the SO_2 DRR) per 80 Federal Register (FR) 51051, which outlined the air quality modeling and ambient air monitoring options that State and Local agencies could use to designate attainment with the 2010 1-hour SO_2 NAAQS. As part of the 1-hour SO_2 NAAQS designation process, EPC is assisting MDEQ in evaluating the designation for the immediate area surrounding the Mill.

By July 2016, MDEQ is required to provide a formal submittal declaring which compliance option will be used for the designation analysis in areas surrounding large, stationary SO_2 emitting sources for the U.S. EPA's SO_2 DRR. The SO_2 DRR has three (3) compliance options.

1. The ambient air around the subject facility may be characterized by installing one (1) or more air monitors around the facility.

2. The ambient air around the subject facility may be characterized by conducting air quality modeling.

3. Enforceable emissions limits may be taken for the affected processes at the facility, limiting facility SO_2 emissions to below a 2,000 tons per year (tpy) threshold. This eliminates the requirement to characterize the ambient air around the facility through air quality modeling or ambient air monitoring.

The MDEQ formal submittal will require air quality modeling protocols for areas relying on air quality modeling. In addition, ambient air monitoring details are required to be submitted to U.S. EPA as part of MDEQ's annual Monitoring Network Plan submission.

EPC has chosen to use air quality modeling to support designation of the attainment status for the 2010 1-hour SO_2 NAAQS. This air quality modeling protocol summarizes the proposed air quality modeling analysis. EPC will conduct the air quality modeling consistent with the procedures outlined in U.S. EPA's February 2016 Draft "Sulfur Dioxide (SO_2) National Ambient Air Quality Standards Designations Modeling Technical Assistance Document" (Modeling TAD).

Additional sections of this air quality modeling protocol contain the following information:

- **Section 2 – Mill Overview** – provides an overview of the Mill's current configuration and operations.
- **Section 3 – SO_2 Emissions Inventory Summary** – provides a detailed description of the hourly SO_2 emissions inventory.
- **Section 4 – Air Quality Modeling Approach and Technical Information** – outlines the technical approach that will be used to conduct the SO_2 DRR modeling evaluation.
- **Section 5 – Submittal of Air Quality Modeling Results** – discusses the submittal of the SO_2 DRR air quality modeling evaluation.
- **Section 6 – References** – provides a detailed list of the reference documents that will be utilized for the SO_2 DRR air quality modeling evaluation.

2. MILL OVERVIEW

This section of the air quality modeling protocol contains a description of the Mill which includes the Mill's geographic and topographic settings.

2.1 FACILITY LOCATION

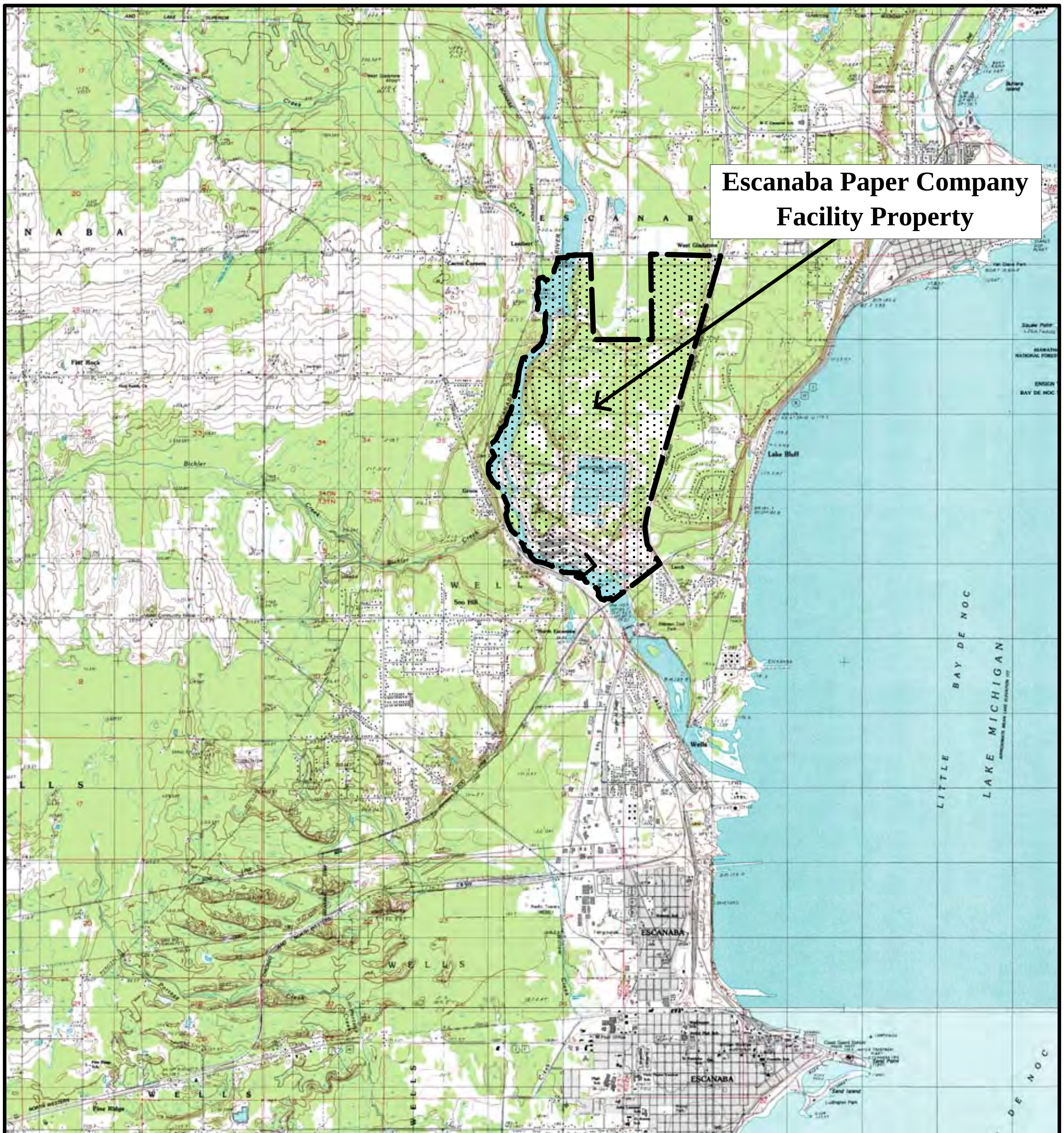
The Mill is located north and adjacent to the town of Escanaba, in Delta County. The location of the Mill is depicted in Figure 2-1 on a section of United States Geological Survey (USGS) quadrangle. The geographical coordinates for the approximate center of the processing area of the Mill are presented in Table 2-1.

Table 2-1
Geographical Coordinates

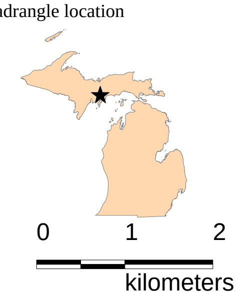
Universal Transverse Mercator (UTM) Easting:	492,721.6 meters (m)
Universal Transverse Mercator (UTM) Northing:	5,072,501.6 m
UTM Zone:	16
North American Datum (NAD):	1983
Longitude (degrees, minutes, seconds):	87° 5’ 22.7”W (87.0896°)
Latitude (degrees, minutes, seconds):	45° 48’ 18.3”N (45.8051°)

The Mill is located in the Upper Michigan Intrastate Air Quality Control Region (AQCR No. 126). Within this AQCR, Delta County is in attainment or unclassifiable/attainment for all New Source Review (NSR)-regulated pollutants as of the date of this submittal.

The area surrounding the Mill is rural. The topography is generally flat with some isolated, gently rolling hills. The base elevation of the main buildings at the Mill is 186 m [610 feet] above mean sea level (amsl), based upon the USGS 1:24,000 scale topographic map of the area.



approximate quadrangle location



Based on USGS 1:24,000 topographical map for Escanaba, Ford River, Chandler, and Gladstone, MI.

N

Escanaba Paper Company
Escanaba, Michigan

Figure 2-1
Facility Location Map

2.2 MILL PROCESS DESCRIPTION

The facility includes the following general process operations: woodyard, refiner mechanical pulp (RMP) mill, Kraft pulp mill, chemical recovery, recausticizing system, bleach plant, boiler house, and coated paper manufacturing operations.

The Mill uses four (4) power boilers to produce steam for energy generation and to provide heat for the pulping and papermaking processes. The organic or lignin laden filtrates (weak black liquor) from the Kraft pulping and washing processes are concentrated through evaporators and concentrators. The concentrated black liquor is burned in a recovery furnace. The recovery furnace also produces steam for energy generation and heat for the pulp and papermaking processes. The molten inorganic ash (smelt) from the recovery furnace is dissolved in water or weak wash to make green liquor which is reprocessed into reusable cooking chemicals. The causticizing process combines lime with the green liquor in a slaker to produce a sodium hydroxide and sodium sulfide solution (white liquor). The lime mud from slaking is washed and reburned in a rotary lime kiln to produce reusable lime.

Uncoated paper is manufactured using one (1) of three (3) paper machines using a combination of RMP and Kraft pulp produced on-site as well as some purchased pulp. Following the paper machines, coating is applied using one (1) of three (3) coaters. Two (2) of the coaters have dryers that combust natural gas. After the coating application, the paper is cut into rolls for customers. Excess Kraft pulp is formed and dried on a pulp dryer for future use during pulp mill outages or for sale to external customers.

There is also a precipitated calcium carbonate (PCC) plant located at the Mill. The exhaust gases from the lime kiln are routed to the PCC plant for use in the production of calcium carbonate. Calcium carbonate is used as a filler and whitening agent in the production of paper. Refer to Section 3.1 for specific equipment at the Mill that emits SO_2.

3. SO_2 EMISSIONS INVENTORY SUMMARY

This section of the air quality modeling protocol discusses the SO_2 emissions inventory and the physical stack characteristics that will be used as part of the SO_2 DRR air quality modeling evaluation.

3.1 HOURLY SO_2 EMISSIONS INVENTORY

The Mill will evaluate actual hourly SO_2 emissions from 2012, 2013, and 2014 calendar years for the No. 7 Boiler, No. 8 Boiler, and No. 10 Recovery Furnace while using potential-to-emit (PTE) SO_2 emissions from the remaining sources at the Mill. The units at the Mill that will be considered in the emissions inventory are in Table 3-1.

Table 3-1
SO_2 Emissions Unit IDs

Emissions Unit	Air Quality Modeling ID	Title V Operating Permit ID
No. 10 Recovery Furnace	RECOVST3	EURF15
Smelt Dissolving Tank	SDT	EUST15
Lime Kiln	KILN	EULK29
Thermal Oxidizer	INCSCRB	EUOC33
No. 1 Coater	1COAT1-4	EU1C36
No. 3 Coater	3COAT1-6	EU3C27
No. 7 Boiler	BLR07	EU7B17
No. 8 Boiler	BLR08	EU8B13
No. 9 Boiler	BARKBL1-2	EU9B03
No. 11 Boiler	COMBBLR	EU11B68
PCC Plant	PCC	EUCARBONATORS

Note that the air quality modeling IDs listed in Table 3-1 above indicate the Stack ID reference that will be used in the air quality modeling files and the corresponding Emissions Unit ID in the Mill's renewable operating permit has been included for cross-reference. The units listed above exhaust to various stacks at the Mill. Each emissions unit vents to its own individual stack, except for the No. 9 Boiler and coaters. The No. 9 Boiler vents to two (2) separate stacks and the coaters have multiple stacks per unit. The PCC plant does not generate SO_2 emissions. However, SO_2 emissions from the Lime Kiln are in the exhaust gas routed to the PCC plant and are exhausted to atmosphere out of the PCC plant stack.

Hourly SO_2 emissions will be required as inputs to conduct air quality modeling. EPC will quantify hourly SO_2 emissions using various emissions factor methodologies. For the No. 7 Boiler and No. 8 Boiler, actual hourly emissions will be developed based on daily fuel usage, hours of operation, and emissions factors. The hourly heat input rate (MMBtu/hr) from the combustion of No. 6 oil and natural gas will be calculated by dividing the daily heat input (MMBtu/day) for each fuel by daily hours of operation (hrs/day). Using Michigan Air Emissions Reporting System (MAERS) emissions factors and the calculated hourly heat input rate, the SO_2 pound per hour (lb/hr) emissions rate for each day will be calculated.

The No. 10 Recovery Furnace hourly SO_2 emissions will also be calculated similarly. Production records will be used to calculate hourly black liquor (MMBtu/hr) and No. 6 fuel oil (gal/hr) fuel firing rates. A site-specific SO_2 emissions factor of 0.0199 lb/MMBtu will be used for black liquor firing. From AP-42, an emissions factor of 157 lb/1,000 gal multiplied by fuel sulfur content will be applied to fuel oil firing. Using the corresponding emissions factors and the calculated hourly fuel firing rate for each fuel, the SO_2 pound per hour (lb/hr) emissions rate for each day will be calculated.

EPC will conservatively model the same calculated hourly SO_2 emissions rate for each of the 24-hours where the boiler operated for at least one (1) hour during the calendar day (i.e., midnight to midnight). For example, if the boiler operated for only one (1) hour out of the day, it will be assumed that the same SO_2 emissions rate for that one (1) hour will be emitted for all 24 hours of that day.

For the remaining SO_2 emissions units, EPC will conservatively utilize 1-hour PTE emissions. The SO_2 PTE rates will be calculated by utilizing permitted emissions limits or MAERS emissions factors and the maximum rated heat input capacity of each emissions unit. Emissions factors were utilized from the following sources:

- Site-specific emissions factors developed through stack testing,
- National Council for Air and Stream Improvement (NCASI) emissions factors, and
- U.S. EPA's AP-42 emissions factors.

In 2014 EPC oversaw the installation and operation of a PCC plant that utilized approximately 28% of the flow from the Lime Kiln. Thus the 2014 emissions profile for the PCC plant will reflect the actual measured flow from PCC plant and 28% percent of the SO_2 emissions from the Lime Kiln while the Lime Kiln emissions profile will reflect 72% of its potential flow and 72% of its potential SO_2 emissions.

3.2 PHYSICAL STACK INVENTORY

The physical stack characteristics that will be used for this air quality modeling evaluation are provided in Table 3-2 below:

Table 3-2
Physical Stack Characteristics

Air Quality Modeling ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height (m)	Stack Diameter (m)	Stack Temperature (K)	Stack Velocity (m/s)
RECOVST3	493,028.58	5,072,331.72	187.8	86.57	3.962	520.9	18.096
SDT	493,024.39	5,072,335.95	187.8	87.78	1.219	361.5	13.903
KILN	493,134.80	5,072,260.61	185.9	44.99	1.423	341.5	8.938/6.44[(a)]
PCC	493,218.80	5,072,394.70	191.0	59.44	0.711	328.7	18.120
INCSCRB	493,138.28	5,072,450.04	185.9	45.20	1.219	355.9	8.048
1COAT1	492,767.59	5,072,386.14	187.5	29.87	1.219	410.8	9.700
1COAT2	492,778.59	5,072,388.14	187.5	29.87	1.219	410.8	9.700
1COAT3	492,749.59	5,072,383.14	187.5	29.87	1.219	366.3	18.600
1COAT4	492,737.60	5,072,381.14	187.5	29.87	1.219	366.3	18.600
3COAT1	492,841.59	5,072,477.14	187.5	19.87	1.574	449.7	0.001
3COAT2	492,842.59	5,072,476.14	187.5	21.58	1.490	449.7	0.001
3COAT3	492,834.59	5,072,475.14	187.5	21.64	1.490	449.7	0.001
3COAT4	492,817.59	5,072,473.14	187.5	21.64	1.490	449.7	0.001
3COAT5	492,827.59	5,072,474.14	187.5	21.64	1.490	449.7	0.001
3COAT6	492,820.59	5,072,473.14	187.5	21.64	1.490	449.7	0.001

Table 3-2
Physical Stack Characteristics

Air Quality Modeling ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height (m)	Stack Diameter (m)	Stack Temperature (K)	Stack Velocity (m/s)
BLR07	492,885.94	5,072,287.89	187.5	29.26	1.981	449.8	11.482
BLR08	492,994.82	5,072,363.76	187.5	49.07	2.134	422.1	11.216
BARKBL1	493,026.88	5,072,333.39	185.9	86.87	2.134	338.7	9.587
BARKBL2	493,026.88	5,072,333.39	185.9	86.87	2.134	338.7	7.454
COMBBLR	492,966.76	5,072,230.46	185.9	100.58	3.353	454.3	21.098

[a] On July 1, 2014 the Lime Kiln stack exit velocity changes to 6.44 m/sec to reflect the routing of 28% of the exhaust flow to the PCC Plant.

4. AIR QUALITY MODELING APPROACH AND TECHNICAL INFORMATION

This section of the air quality modeling protocol outlines information on the technical approach that will be followed in the SO_2 DRR air quality modeling evaluation. This includes what air dispersion model will be selected as well as the model options that will be used. The supporting information, including land use determinations, building downwash analyses, meteorological data, and terrain data is presented. The guidance provided in 40 CFR Part 51 Appendix W "Guideline on Air Quality Models" (U.S. EPA 2005) and U.S. EPA's Draft Modeling TAD (U.S. EPA 2016) will be used to conduct the air quality modeling analysis.

4.1 AIR DISPERSION MODEL SELECTION

The AERMOD (**AER**MIC **MOD**el) air dispersion model will be used to predict ambient air concentrations from the Mill. It is an Appendix W air dispersion model approved for regulatory modeling applications. The current regulatory version of AERMOD is 15181.

The AERMOD modeling system consists of two (2) pre-processors and the dispersion model. AERMAP (Version 11103) is the terrain pre-processor component and AERMET (Version 15181) is the meteorological pre-processor component. The AERMAP pre-processor characterizes the surrounding terrain and generates receptor elevations. The AERMET pre-processor is used to generate an hourly profile of the atmosphere and uses a pre-processor, AERSURFACE (Version 13016), to process land use data for determining micrometeorological variables that are inputs to AERMET.

The AERMOD air dispersion model has various user selectable options that must be considered. U.S. EPA has recommended that certain options be selected when performing air quality modeling studies for regulatory purposes. The following regulatory default options will be used in the AERMOD air quality modeling study:

- Stack-Tip Downwash,
- Model Accounts for Elevated Terrain Effects,
- Calms Processing Routine Used,

- No Exponential Decay for Rural Mode, and
- Missing Data Processing.

4.2 LAND USE ANALYSIS

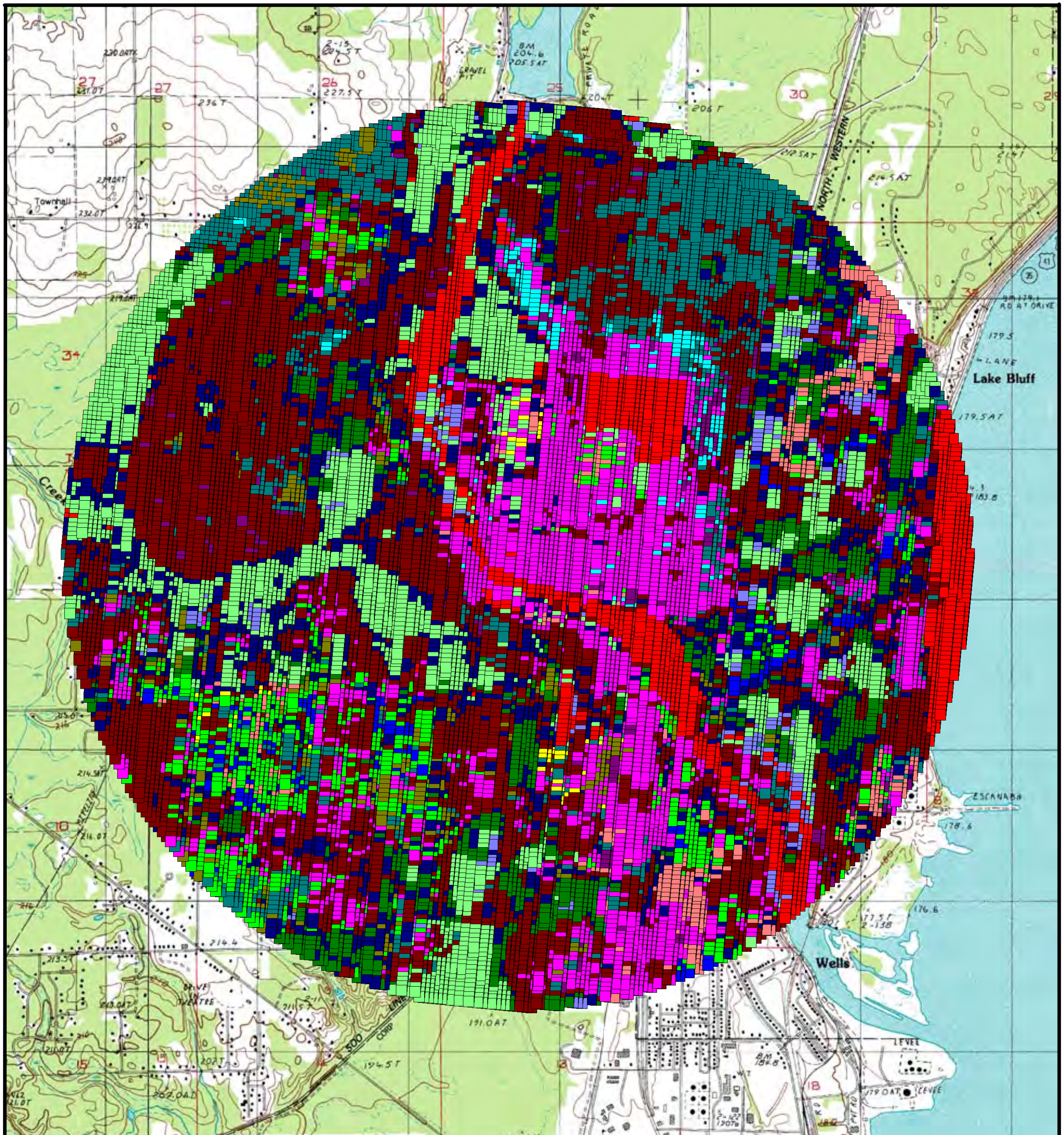
A land use analysis for the area surrounding the Mill has been compiled. The land use analysis is based on United States Geological Survey (USGS) electronic land use data for the area. Following U.S. EPA guidance (U.S. EPA 2005), the land use designation was based on the land use typing scheme developed by Auer (Auer 1978). Using the Auer land use classifications, industrial, commercial, and residential areas are classified as urban land use while agricultural, undeveloped, and common residential areas are considered to be rural land use. If more than 50% of the land use within a three (3) km radius of the Mill is rural, then a rural designation should be used in the air dispersion model.

To perform the land use analysis, geographical information system (GIS) software was used to summarize the various land use types contained in the USGS electronic land use dataset. Based on the GIS summary, the land use within a three (3) km radius of the Mill is overwhelmingly rural. Approximately 85% of the land use is rural with the remaining percentage of land use being urban. Therefore, the urban option will not be selected in the AERMOD air dispersion model. The three (3) km radius land use summary for the area surrounding the Mill is shown in Figure 4-1.

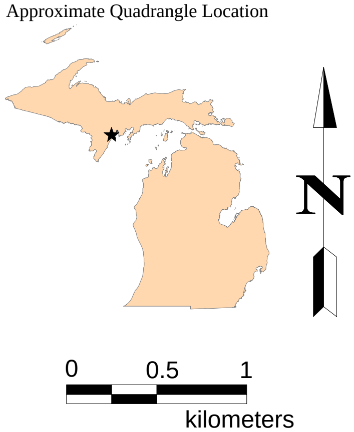
4.3 RECEPTOR GRID

A receptor grid for the AERMOD analysis will be developed to cover a 20-by-20 km square area centered on the Mill. All receptors will be referenced to the UTM coordinate system, Zone 16, using NAD 83 datum. Rectangular coordinates will be used to identify each receptor location. The rectangular receptor grid will be centered on 492,721.6 m easting and 5,072,501.6 m northing and will have the following grid spacing:

- 25 m spacing out to ± 0.5 km,
- 50 m spacing beginning at ± 0.5 km and extending out to ± 1 km,
- 100 m spacing beginning at ± 1 km and extending out to ± 5 km, and
- 250 m spacing beginning at ± 5 km and extending out to ± 10 km.



Approximate Quadrangle Location



Based on USGS 1:24,000 topographical map for Chandler, MI (1985) and Gladstone, MI (1985).

Figure 4-1
Land Use Analysis Within 3 km of the Escanaba Mill

Escanaba Paper Company
Escanaba, MI

1992 National Land Use Cover Data

- 11 - Open Water (6.2%)
- 21 - Low Intensity Residential (4.4%)
- 22 - High Intensity Residential (1.2%)
- 23 - Commercial/Industrial/Transportation (13.5%)
- 32 - Quarries/Strip Mines/Gravel Pits (0.2%)
- 33 - Transitional (0.9%)
- 41 - Deciduous Forest (30.9%)
- 42 - Evergreen Forest (6.0%)
- 43 - Mixed Forest (11.1%)
- 71 - Grasslands/Herbaceous (1.2%)
- 81 - Pasture/Hay (1.9%)
- 82 - Row Crops (7.6%)
- 85 - Urban/Recreational Grasses (2.0%)
- 91 - Woody Wetlands (11.5%)
- 92 - Emergent Herbaceous Wetlands (1.5%)

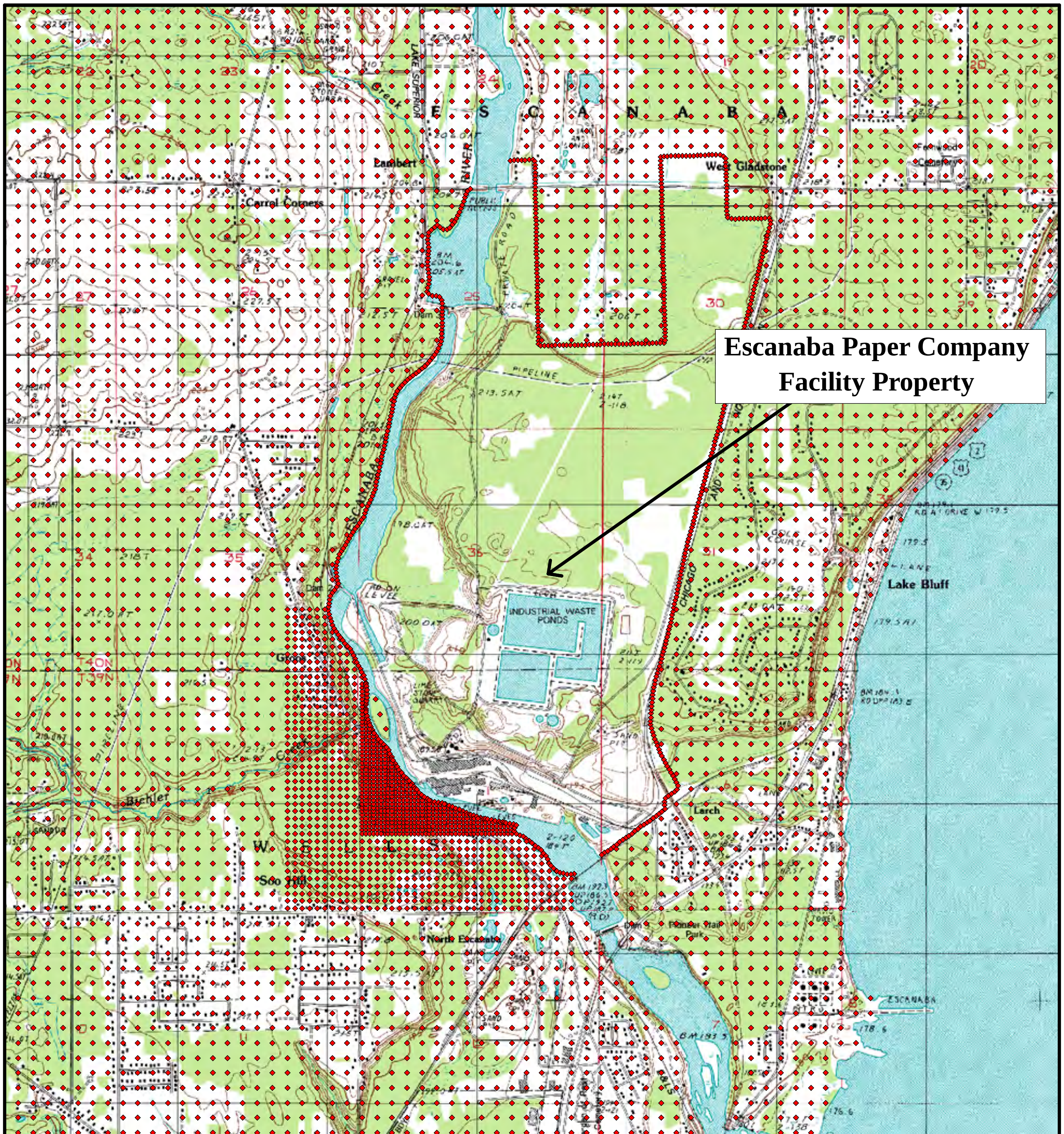
In addition to the main rectangular coordinate receptor grid, property line receptors will be used in the air quality modeling analysis. The property line receptors will be spaced approximately every 25 m. The entire property line is either fenced or spanned by natural barriers that restrict public access to EPC property. The natural barrier includes the Escanaba River which has multiple dams limiting access to the river. Additionally, gated ingress and egress points include cameras monitored by security personnel and Mill security performs daily inspections of numerous check points throughout the Mill as an additional measure to monitor any suspicious activity or unauthorized access. Lastly, following guidance contained in the Modeling TAD, no receptors will be place in locations where an ambient monitor cannot be physically located (i.e., over bodies of water). The inner portion of the receptor grid is shown in Figure 4-2.

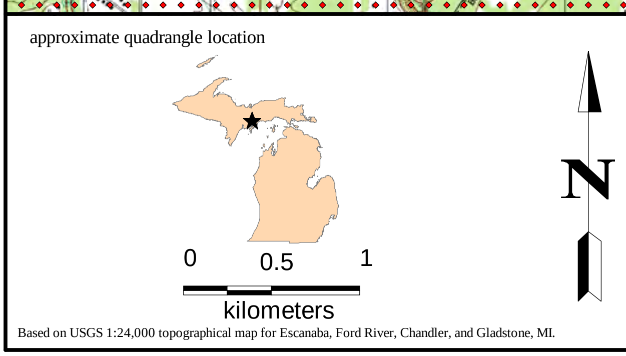
Terrain elevations will be assigned to all receptors. The AERMAP terrain pre-processor (Version 11103) and USGS 1:24,000 National Elevation Dataset (NED) files will be used to determine representative terrain elevations for all of the receptors. The horizontal resolution of the NED data is every 10 m.

Additional receptors may be added to the original receptor grid if a peak concentration is predicted to occur in an area where the receptor grid spacing is greater than 100 m. A refined 100 m spacing grid will be centered on the peak predicted receptor and will extend out 500 m to confirm that the overall maximum concentration is determined.

4.4 METEOROLOGICAL DATA

The meteorological database for the AERMOD air dispersion modeling study will consist of three (3) years (2012 to 2014) of Iron Mountain (IMT) National Weather Service (NWS) data (station ID 94893) and three (3) years of corresponding upper air data from Green Bay, Wisconsin (GRB) (station ID 14898) that were processed with the AERMET pre-processor by MDEQ and obtained from the MDEQ website. The IMT NWS station is located approximately 70 kilometers (43 miles) west of EPC. The Mill has historically utilized Escanaba (ESC) NWS station data for MDEQ air toxics air quality modeling. The ESC NWS station is located approximately 9 kilometers (5.7 miles) south of EPC.





Escanaba Paper Company
Escanaba, Michigan

Figure 4-2
Inner Portion of the Receptor Grid

The ESC NWS station is considered representative of the meteorological conditions at the EPC due to similar topographic settings, Lake Michigan influence, and proximity to the EPC. Due to these similarities the micro-meteorological conditions (i.e., surface roughness, albedo, and Bowen Ratio) at the ESC NWS are also similar to those at the EPC. There are no significant terrain features between the two (2) sites, and there are no terrain features that would influence one site and not the other.

However, the ESC NWS station does not collect 1-minute average wind measurements and therefore the AERMINUTE preprocessor cannot be utilized to developed refined hourly average wind speed and wind direction measurements for input into the AERMET preprocessor. The lack of 1-minute average wind measurements results in more calm and missing wind measurements values in the ESC NWS station dataset than compared to the IMT NWS dataset for the same time period. For the 2012 to 2014 ESC dataset there are three quarters that fell just outside the 90% data recovery rate required by U.S. EPA for SO_2 DRR air quality modeling. The IMT NWS does collect 1-minute average wind measurements which results in all 12 quarters from 2012 to 2014 having a data recovery rate greater than 90%. Although the ESC NWS is more representative of the conditions at the EPC than the IMT NWS station, EPC is utilizing the IMT dataset for the SO_2 DRR air quality modeling analysis. Both IMT and ESC NWS datasets are processed with Green Bay, WI upper air data. Upper air measurements made at the Green Bay upper air station, while located south of EPC, are representative of general atmospheric conditions along Lake Michigan.

4.5 GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT ANALYSIS

During a previous air quality modeling assessment at EPC, an analysis was conducted to determine the potential for building downwash. Guidance contained in the U.S. EPA "Guideline for Determination of Good Engineering Practice (GEP) Stack Height (Revised)" (U.S. EPA 1985) and the U.S. EPA Building Profile Input Program (BPIP, Version 04274) that contains the PRIME algorithms was followed. Since EPC is utilizing a mix of PTE and actual emissions rates the GEP stack height policy will be utilized for sources utilizing PTE emissions rates. It should be noted that all the stacks at EPC are less than or equal to GEP formula height; therefore, the actual stack heights will be utilized for all sources in the modeling analysis since no stacks are greater than GEP formula height. This approach is consistent with the requirements in the SO_2 DRR and the Modeling TAD. The GIS digitization of the Mill is presented in Figure 4-3.

4.6 BACKGROUND AMBIENT AIR DATA

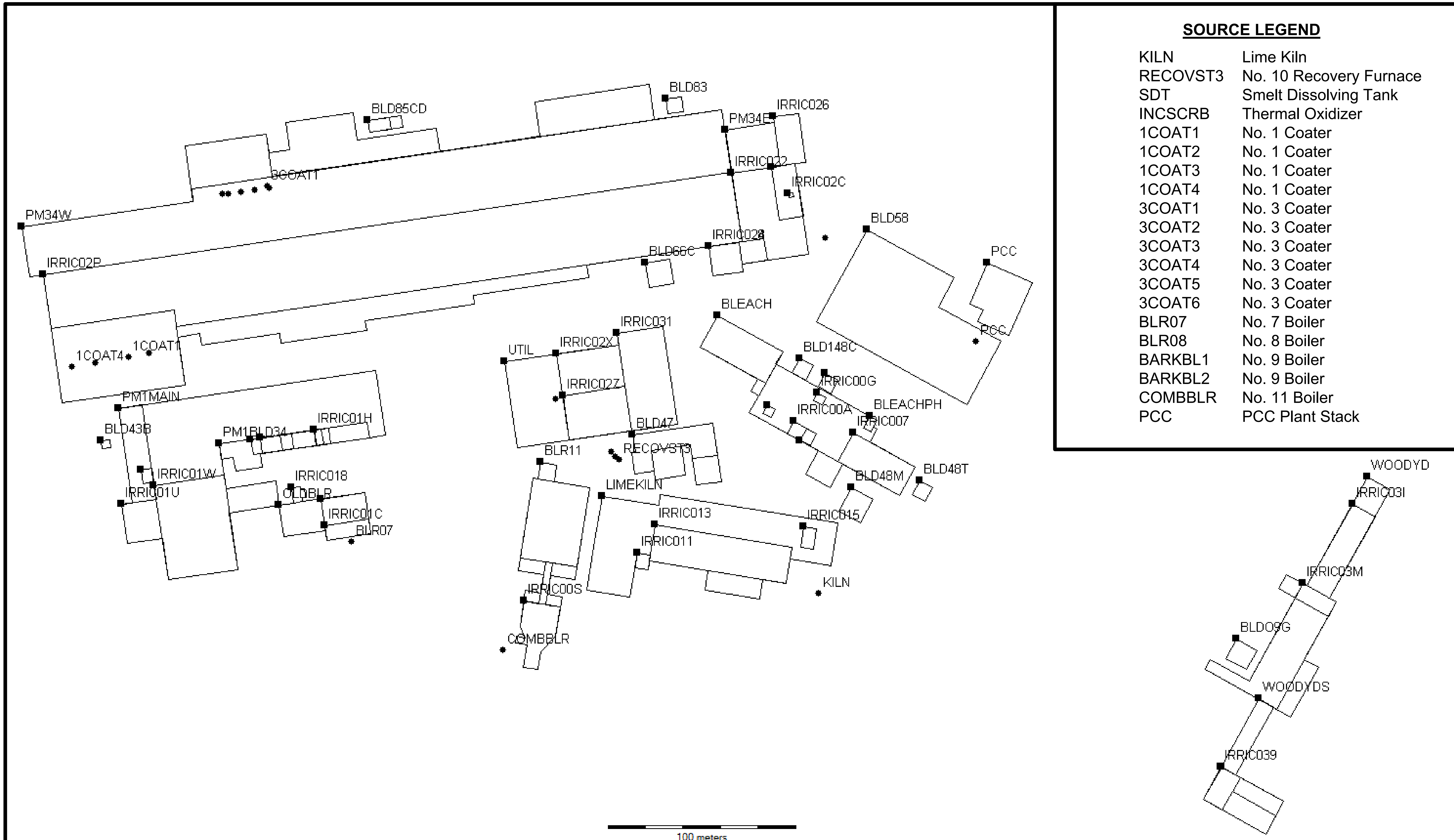
Ambient background 1-hour SO_2 concentrations will be considered in this analysis. The ambient background concentrations will be added to the cumulative modeled concentrations resulting from the Mill sources. EPC will follow guidance contained in U.S. EPA's March 1, 2011 memorandum (U.S. EPA 2011) which outlines a "Tier 1" approach to including background ambient SO_2 concentrations. The "Tier 1" approach is the most conservative and incorporates a 3-year average of the 99th percentile of daily maximum 1-hour concentrations from a representative background monitor.

EPC will utilized background data from the U.S. EPA Air Quality System (AQS) for the 2012, 2013, and 2014 calendar years. The data is from the Forest County, WI monitor located near Crandon, WI (Site ID: 55-041-0007). The background data is summarized in Table 4-1, below.

Table 4-1
99th Percentile SO_2 Concentrations

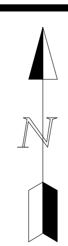
Site	2012 (ppb)	2013 (ppb)	2014 (ppb)	Average (ppb)
55-041-0007	5	4	12	**7**

EPC proposes that the ambient SO_2 measurements from the Forest County, WI monitor site are representative of background conditions at the Mill. The Forest County, WI monitor is located 160 km east of the Mill and is the closest SO_2 ambient monitoring station located in a similar rural setting.



SOURCE LEGEND

KILN	Lime Kiln
RECOVST3	No. 10 Recovery Furnace
SDT	Smelt Dissolving Tank
INCSCRB	Thermal Oxidizer
1COAT1	No. 1 Coater
1COAT2	No. 1 Coater
1COAT3	No. 1 Coater
1COAT4	No. 1 Coater
3COAT1	No. 3 Coater
3COAT2	No. 3 Coater
3COAT3	No. 3 Coater
3COAT4	No. 3 Coater
3COAT5	No. 3 Coater
3COAT6	No. 3 Coater
BLR07	No. 7 Boiler
BLR08	No. 8 Boiler
BARKBL1	No. 9 Boiler
BARKBL2	No. 9 Boiler
COMBBLR	No. 11 Boiler
PCC	PCC Plant Stack



59.6 ft. Tier Height Above Grade

Source Location

Building Tier Outlines

Figure 4-3
Structures and Sources for Building Downwash Analysis Escanaba Paper Company

5. SUBMITTAL OF AIR QUALITY MODELING RESULTS

This detailed air quality modeling protocol is being submitted as part of the SO_2 DRR air quality modeling evaluation. The air quality modeling protocol identifies the procedures that are followed in the air quality modeling analysis. An electronic copy of the air quality modeling input and output files, as well as supporting files (e.g., meteorological data, building downwash analysis, etc.), will be supplied in an Electronic Appendix. Hardcopy supporting information will also be included in an Appendix.

6. REFERENCES

Auer 1978, Auer Jr., A.H., – "Correlation of Land Use and Cover with Meteorological Anomalies", Journal of Applied Meteorology, 17:636-643, 1978.

U.S. EPA 1985 – "Guideline for Determination of Good Engineering Practice (GEP) Stack Height (Technical Support Document for Stack Height Regulations) Revised" EPA-450:4-80-023R, June 1985.

U.S. EPA 2004 – "Revised Draft User's Guide for the AERMOD Terrain Preprocessor (AERMAP)". U.S. Environmental Protection Agency Office of Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division, Research Triangle Park, NC, August 2002.

U.S. EPA 2005 – 40 CFR Part 51 Appendix W "Guideline on Air Quality Models (Revised) April 2005.

U.S. EPA 2011 – "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour Nitrogen Dioxide (NO_2) National Ambient Air Quality Standard". U.S. Environmental Protection Agency Office of Air Quality Planning and Standards, Air Quality Modeling Group, Research Triangle Park, NC, March 2011.

U.S. EPA 2016 – "Sulfur Dioxide (SO_2) National Ambient Air Quality Standards Designations Modeling Technical Assistance Document." U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division, February 2016.

U.S. EPA 2015 – "Addendum to the User's Guide for the AMS/EPA Regulatory Default Model – AERMOD". U.S. Environmental Protection Agency Office of Air Quality Planning and Standards, Air Quality Assessment Division, Research Triangle Park, NC, June 2015.

Appendix B2

Escanaba SO_2 DRR Modeling Report

August 31, 2016

Ms. Stephanie Hengesbach
Michigan Department of Environmental Quality
Division of Air Quality
Constitution Hall, 2nd Floor South Tower
525 West Allegan Street
P.O. Box 30260
Lansing, Michigan 48909-7760

Re: SO_2 Data Requirements Rule (DRR) Air Quality Modeling Report for the Escanaba Paper Company (EPC), Escanaba, Michigan

Dear Stephanie:

On behalf of Escanaba Paper Company (EPC), All4 Inc. (ALL4) is submitting the enclosed SO_2 Data Requirements Rule (DRR) Air Quality Modeling Report. EPC has conducted the air quality modeling consistent with the procedures in the protocol that was submitted to Michigan Department of Environmental Quality (MDEQ). EPC has concluded that the air quality modeling demonstrates compliance with the 2010 1-hour SO_2 National Ambient Air Quality Standard (NAAQS). EPC has included two hardcopies of air quality modeling report and electronic media containing the supporting air quality modeling files.

If you have questions concerning the information contained in this report, please do not hesitate to contact myself at 610-422-1121 or via e-mail at nleone@all4inc.com

Sincerely,
All4 Inc.

Nicholas Leone
Digitally signed by Nicholas Leone
DN: cn=Nicholas Leone, o=All4 Inc., ou, email=nleone@all4inc.com, c=US
Date: 2016.08.31 08:03:55 -04'00'

Nicholas Leone, P.E.
Project Manager

cc: Bob Irvine – MDEQ (Electronically)

ALL4 INC. • 2393 Kimberton Road • P.O. Box 299 • Kimberton, PA 19442 • p.610.933.5246 • f.610.933.5127 • www.all4inc.com

SO_2 DATA REQUIREMENTS RULE

AIR QUALITY MODELING REPORT

ESCANABA PAPER COMPANY

AUGUST 2016

Submitted by:

Submitted to:

Escanaba Paper Company
7100 County Road 426
Escanaba, MI 49829

Michigan Department of Environmental Quality
Air Quality Division
525 West Allegan Street
Constitution Hall
Lansing, MI 48909

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1. INTRODUCTION

Escanaba Paper Company (EPC) owns and operates a bleached Kraft pulp and paper mill (Mill) in Escanaba, Michigan. The Mill is a major source as defined by the Federal operating permit program (40 CFR Part 70) and Michigan Department of Environmental Quality (MDEQ) Chapters R336.1210 through R336.1218 and operates under renewable operating permit (ROP) A0884. The Mill has been identified by MDEQ as a source for which attainment with the 1-hour sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS) needs to be demonstrated. The U.S. Environmental Protection Agency (U.S. EPA) issued the final 1-hour SO_2 NAAQS on June 22, 2010. On August 21, 2015, U.S. EPA promulgated 40 CFR Part 51, Subpart BB (Data Requirements for Characterizing Air Quality for the Primary SO_2 NAAQS, also known as the SO_2 DRR) per 80 Federal Register (FR) 51051, which outlined the air quality modeling and ambient air monitoring options that State and Local agencies could use to designate attainment with the 2010 1-hour SO_2 NAAQS. As part of the 1-hour SO_2 NAAQS designation process, EPC has assisted MDEQ in evaluating the designation for the immediate area surrounding the Mill.

By July 2016, MDEQ was required to provide a formal submittal declaring which compliance option would be used for the designation analysis in areas surrounding large, stationary SO_2 emitting sources for the U.S. EPA's SO_2 DRR. The SO_2 DRR has three compliance options.

1. The ambient air around the subject facility may be characterized by installing one or more air monitors around the facility.

2. The ambient air around the subject facility may be characterized by conducting air quality modeling.

3. Enforceable emissions limits may be taken for the affected processes at the facility, limiting facility SO_2 emissions to below a 2,000 tons per year (tpy) threshold. This eliminates the requirement to characterize the ambient air around the facility through air quality modeling or ambient air monitoring.

The MDEQ formal submittal required air quality modeling protocols for areas relying on air quality modeling. In addition, ambient air monitoring details were required to be submitted to U.S. EPA as part of MDEQ's annual Monitoring Network Plan submission.

EPC chose to use air quality modeling to support designation of the attainment status for the 2010 1-hour SO_2 NAAQS. This air quality modeling report summarizes the air quality modeling analysis and results. EPC conducted the air quality modeling consistent with the procedures outlined in U.S. EPA's February 2016 Draft "Sulfur Dioxide (SO_2) National Ambient Air Quality Standards Designations Modeling Technical Assistance Document" (Modeling TAD).

Additional sections of this air quality modeling report contain the following information:

- **Section 2 – Mill Overview –** provides an overview of the Mill's current configuration and operations.
- **Section 3 – SO_2 Emissions Inventory Summary** – provides a detailed description of the hourly SO_2 emissions inventory.
- **Section 4 – Air Quality Modeling Approach and Technical Information** – outlines the technical approach that was used to conduct the SO_2 DRR modeling evaluation.
- **Section 5 – Submittal of Air Quality Modeling Results** – discusses the results and submittal of the SO_2 DRR air quality modeling evaluation.
- **Section 6 – References –** provides a detailed list of the reference documents that were utilized for the SO_2 DRR air quality modeling evaluation.

2. MILL OVERVIEW

This section of the air quality modeling report contains a description of the Mill which includes the Mill's geographic and topographic settings.

2.1 FACILITY LOCATION

The Mill is located north and adjacent to the town of Escanaba, in Delta County. The location of the Mill is depicted in Figure 2-1 on a section of United States Geological Survey (USGS) quadrangle. The geographical coordinates for the approximate center of the processing area of the Mill are presented in Table 2-1.

Table 2-1
Geographical Coordinates

Universal Transverse Mercator (UTM) Easting:	492,721.6 meters (m)
Universal Transverse Mercator (UTM) Northing:	5,072,501.6 m
UTM Zone:	16
North American Datum (NAD):	1983
Longitude (degrees, minutes, seconds):	87° 5' 22.7"W (87.0896°)
Latitude (degrees, minutes, seconds):	45° 48' 18.3"N (45.8051°)

The Mill is located in the Upper Michigan Intrastate Air Quality Control Region (AQCR No. 126). Within this AQCR, Delta County is in attainment or unclassifiable/attainment for all New Source Review (NSR)-regulated pollutants as of the date of this submittal.

The area surrounding the Mill is rural. The topography is generally flat with some isolated, gently rolling hills. The base elevation of the main buildings at the Mill is 186 m (610 feet) above mean sea level (amsl), based upon the USGS 1:24,000 scale topographic map of the area.

Escanaba Paper Company
Escanaba, Michigan

Figure 2-1
Facility Location Map

2.2 MILL PROCESS DESCRIPTION

The facility includes the following general process operations: woodyard, refiner mechanical pulp (RMP) mill, Kraft pulp mill, chemical recovery, recausticizing system, bleach plant, boiler house, and coated paper manufacturing operations.

The Mill uses four power boilers to produce steam for energy generation and to provide heat for the pulping and papermaking processes. The organic or lignin laden filtrates (weak black liquor) from the Kraft pulping and washing processes are concentrated through evaporators and concentrators. The concentrated black liquor is burned in a recovery furnace. The recovery furnace also produces steam for energy generation and heat for the pulp and papermaking processes. The molten inorganic ash (smelt) from the recovery furnace is dissolved in water or weak wash to make green liquor which is reprocessed into reusable cooking chemicals. The causticizing process combines lime with the green liquor in a slaker to produce a sodium hydroxide and sodium sulfide solution (white liquor). The lime mud from slaking is washed and reburned in a rotary lime kiln to produce reusable lime.

Uncoated paper is manufactured using one of three paper machines using a combination of RMP and Kraft pulp produced on-site as well as some purchased pulp. Following the paper machines, coating is applied using one of three coaters. Two of the coaters have dryers that combust natural gas. After the coating application, the paper is cut into rolls for customers. Excess Kraft pulp is formed and dried on a pulp dryer for future use during pulp mill outages or for sale to external customers.

There is also a precipitated calcium carbonate (PCC) plant located at the Mill. The exhaust gases from the lime kiln are routed to the PCC plant for use in the production of calcium carbonate. Calcium carbonate is used as a filler and whitening agent in the production of paper. Refer to Section 3.1 for specific equipment at the Mill that emits SO_2.

3. SO_2 EMISSIONS INVENTORY SUMMARY

This section of the air quality modeling report discusses the SO_2 emissions inventory and the physical stack characteristics that were used as part of the SO_2 DRR air quality modeling evaluation.

3.1 HOURLY SO_2 EMISSIONS INVENTORY

The Mill evaluated actual hourly SO_2 emissions from 2012, 2013, and 2014 calendar years for the PCC Plant, No. 7 Boiler, No. 8 Boiler, and No. 10 Recovery Furnace while using potential-to-emit (PTE) SO_2 emissions for the remaining sources at the Mill. The units at the Mill that were evaluated in the emissions inventory are summarized in Table 3-1.

Table 3-1
SO_2 Emissions Unit IDs

Emissions Unit	Air Quality Modeling ID	Title V Operating Permit ID
No. 10 Recovery Furnace	RECOVST3	EURF15
Smelt Dissolving Tank	SDT	EUST15
Lime Kiln	KILN	EULK29
Thermal Oxidizer	INCSCRB	EUOC33
No. 1 Coater	1COAT1-4	EU1C36
No. 3 Coater	3COAT1-6	EU3C27
No. 7 Boiler	BLR07	EU7B17
No. 8 Boiler	BLR08	EU8B13
No. 9 Boiler	BARKBL1-2	EU9B03
No. 11 Boiler	COMBBLR	EU11B68
PCC Plant	PCC	EUCARBONATORS

Note that the air quality modeling IDs listed in Table 3-1 above indicate the Stack ID reference that were used in the air quality modeling files and the corresponding Emissions Unit ID in the Mill's renewable operating permit has been included for cross-reference. The units listed above exhaust to various stacks at the Mill. Each emissions unit vents to its own individual stack, except for the No. 9 Boiler and coaters. The No. 9 Boiler vents to two separate stacks and the coaters have multiple stacks per unit. The PCC plant does not generate SO_2 emissions. However, SO_2 emissions from the Lime Kiln are in the exhaust gas routed to the PCC plant and are exhausted to atmosphere out of the PCC plant stack.

Hourly SO_2 emissions are required as inputs to conduct air quality modeling. EPC quantified hourly SO_2 emissions using various emissions factor methodologies. For the No. 7 Boiler and No. 8 Boiler, actual hourly emissions were developed based on daily fuel usage, hours of operation, and emissions factors. The hourly heat input rate (MMBtu/hr) from the combustion of No. 6 oil and natural gas was calculated by dividing the daily heat input (MMBtu/day) for each fuel by daily hours of operation (hrs/day). Using Michigan Air Emissions Reporting System (MAERS) emissions factors and the calculated hourly heat input rate, the SO_2 pound per hour (lb/hr) emissions rate for each day was calculated.

The No. 10 Recovery Furnace hourly SO_2 emissions were also calculated similarly. Production records were used to calculate hourly black liquor (MMBtu/hr) and No. 6 fuel oil (gal/hr) fuel firing rates. A site-specific SO_2 emissions factor of 0.0199 lb/MMBtu was used for black liquor firing. From AP-42, an emissions factor of 157 lb/1,000 gal multiplied by fuel sulfur content was applied to fuel oil firing. Using the corresponding emissions factors and the calculated hourly fuel firing rate for each fuel, the SO_2 pound per hour (lb/hr) emissions rate for each day was calculated.

EPC conservatively modeled the same calculated hourly SO_2 emissions rate for each of the 24-hours where the boilers and recovery furnace operated for at least one hour during the calendar day (i.e., midnight to midnight). For example, if a boiler operated for only one hour out of the day, it was assumed that the same SO_2 emissions rate for that one hour was emitted for all 24 hours of that day.

In 2014 EPC oversaw the installation and operation of a PCC plant that utilized approximately 28% of the flow from the Lime Kiln. Thus the 2014 emissions profile for the PCC plant reflected the actual measured flow from PCC plant and 28% percent of the SO_2 emissions from the Lime

Kiln while the Lime Kiln emissions profile reflected 72% of its potential flow and 72% of its potential SO_2 emissions.

For the remaining SO_2 emissions units, EPC conservatively utilized 1-hour PTE emissions. The SO_2 PTE rates were calculated by utilizing permitted emissions limits or MAERS emissions factors and the maximum rated heat input capacity of each emissions unit. Emissions factors were utilized from the following sources:

- Site-specific emissions factors developed through stack testing,
- National Council for Air and Stream Improvement (NCASI) emissions factors, and
- U.S. EPA's AP-42 emissions factors.

3.2 PHYSICAL STACK INVENTORY

The physical stack characteristics used for this air quality modeling evaluation are provided in Table 3-2. EPC utilized a fixed exhaust flowrate and temperature for the PCC Plant, No. 7 Boiler, No. 8 Boiler, and No. 10 Recovery Furnace (emissions units that utilized actual hourly emissions rates) that are consistent with typical operations for all three modeled calendar years. Additionally, the fixed exhaust flowrate and temperature have been utilized for previous air quality modeling analyses submitted to MDEQ and are representative of normal operations.

Table 3-2
Physical Stack Characteristics

Air Quality Modeling ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height (m)	Stack Diameter (m)	Stack Temperature (K)	Stack Velocity (m/s)
RECOVST3	493,028.58	5,072,331.72	187.8	86.57	3.962	520.9	18.096
SDT	493,024.39	5,072,335.95	187.8	87.78	1.219	361.5	13.903
KILN	493,134.80	5,072,260.61	185.9	44.99	1.423	341.5	8.938/6.436[(a)]
PCC	493,218.80	5,072,394.70	191.0	59.44	0.711	328.7	18.120
INCSCRB	493,138.28	5,072,450.04	185.9	45.20	1.219	355.9	8.048
1COAT1	492,767.59	5,072,386.14	187.5	29.87	1.219	410.8	9.700
1COAT2	492,778.59	5,072,388.14	187.5	29.87	1.219	410.8	9.700
1COAT3	492,749.59	5,072,383.14	187.5	29.87	1.219	366.3	18.600
1COAT4	492,737.60	5,072,381.14	187.5	29.87	1.219	366.3	18.600
3COAT1	492,841.59	5,072,477.14	187.5	19.87	1.574	449.7	0.001
3COAT2	492,842.59	5,072,476.14	187.5	21.58	1.490	449.7	0.001
3COAT3	492,834.59	5,072,475.14	187.5	21.64	1.490	449.7	0.001
3COAT4	492,817.59	5,072,473.14	187.5	21.64	1.490	449.7	0.001
3COAT5	492,827.59	5,072,474.14	187.5	21.64	1.490	449.7	0.001
3COAT6	492,820.59	5,072,473.14	187.5	21.64	1.490	449.7	0.001

Table 3-2
Physical Stack Characteristics

Air Quality Modeling ID	UTM Easting (m)	UTM Northing (m)	Elevation (m)	Stack Height (m)	Stack Diameter (m)	Stack Temperature (K)	Stack Velocity (m/s)
BLR07	492,885.94	5,072,287.89	187.5	29.26	1.981	449.8	11.482
BLR08	492,994.82	5,072,363.76	187.5	49.07	2.134	422.1	11.216
BARKBL1	493,026.88	5,072,333.39	185.9	86.87	2.134	338.7	9.587
BARKBL2	493,026.88	5,072,333.39	185.9	86.87	2.134	338.7	7.454
COMBBLR	492,966.76	5,072,230.46	185.9	100.58	3.353	454.3	21.098

[a] On July 1, 2014 the Lime Kiln stack exit velocity changed to 6.436 m/sec to reflect the routing of 28% of the exhaust flow to the PCC Plant. This was accounted for in the modeling evaluation by changing the lime kiln exhaust flow rate in the hourly modeling input files.

4. AIR QUALITY MODELING APPROACH AND TECHNICAL INFORMATION

This section of the air quality modeling report outlines information on the technical approach that was followed in the SO_2 DRR air quality modeling evaluation. This includes what air dispersion model was selected as well as the model options that were used. The supporting information, including land use determinations, building downwash analyses, meteorological data, and terrain data is presented. The guidance provided in 40 CFR Part 51 Appendix W "Guideline on Air Quality Models" (U.S. EPA 2005) and U.S. EPA's Draft Modeling TAD (U.S. EPA 2016) was used to conduct the air quality modeling analysis.

4.1 AIR DISPERSION MODEL SELECTION

The AERMOD (**AER**MIC **MOD**el) air dispersion model was used to predict ambient air concentrations from the Mill. It is an Appendix W air dispersion model approved for regulatory modeling applications. The current regulatory version of AERMOD is 15181.

The AERMOD modeling system consists of two pre-processors and the dispersion model. AERMAP (Version 11103) is the terrain pre-processor component and AERMET (Version 15181) is the meteorological pre-processor component. The AERMAP pre-processor characterizes the surrounding terrain and generates receptor elevations. The AERMET pre-processor is used to generate an hourly profile of the atmosphere and uses a pre-processor, AERSURFACE (Version 13016), to process land use data for determining micrometeorological variables that are inputs to AERMET.

The AERMOD air dispersion model has various user selectable options that were considered. U.S. EPA recommends that certain options be selected when performing air quality modeling studies for regulatory purposes. The following regulatory default options was used in the AERMOD air quality modeling study:

- Stack-Tip Downwash,
- Model Accounts for Elevated Terrain Effects,
- Calms Processing Routine Used,

- No Exponential Decay for Rural Mode, and
- Missing Data Processing.

4.2 LAND USE ANALYSIS

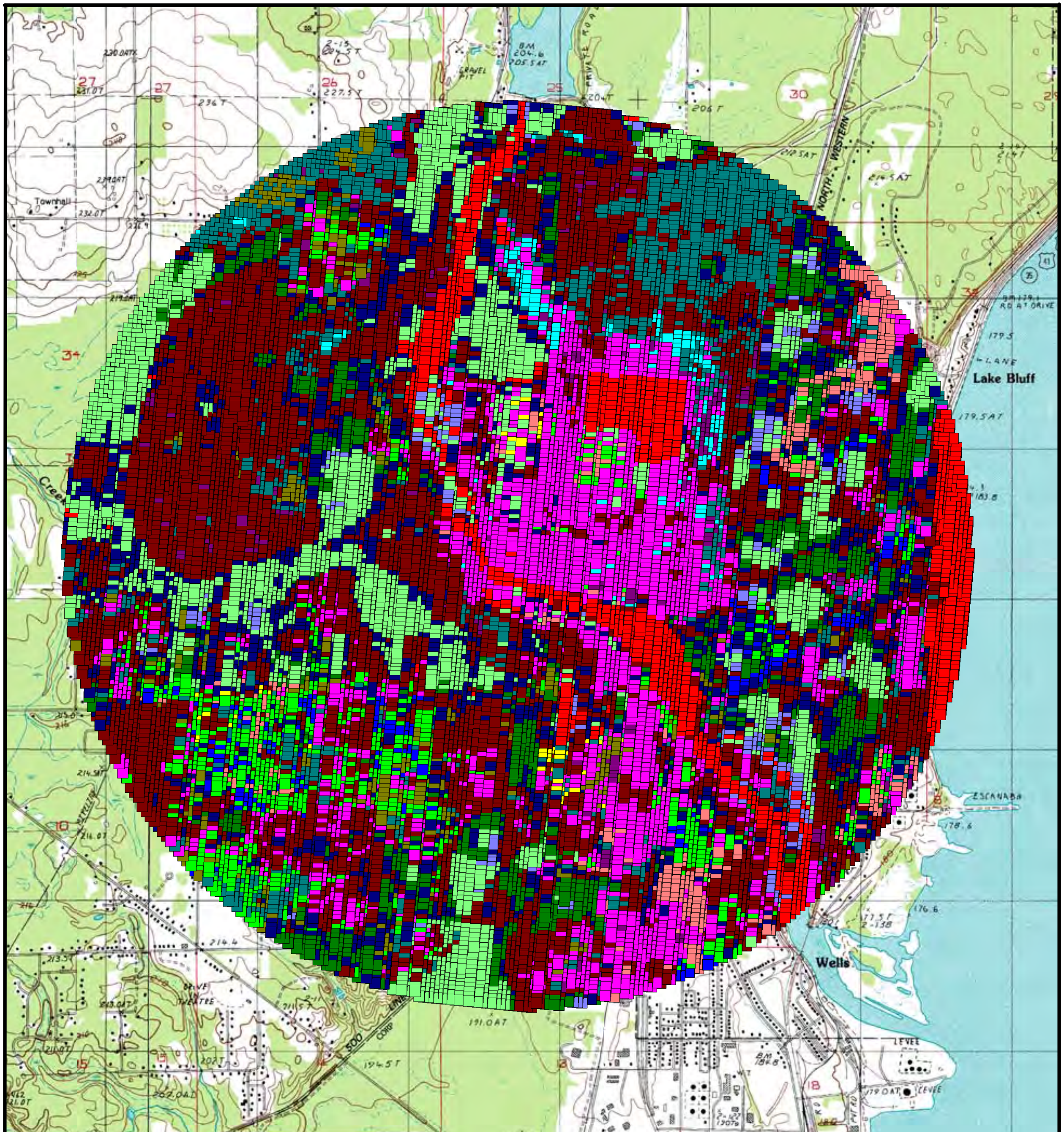
A land use analysis for the area surrounding the Mill was compiled. The land use analysis is based on United States Geological Survey (USGS) electronic land use data for the area. Following U.S. EPA guidance (U.S. EPA 2005), the land use designation was based on the land use typing scheme developed by Auer (Auer 1978). Using the Auer land use classifications, industrial, commercial, and residential areas are classified as urban land use while agricultural, undeveloped, and common residential areas are considered to be rural land use. If more than 50% of the land use within a three km radius of the Mill is rural, then a rural designation should be used in the air dispersion model.

To perform the land use analysis, geographical information system (GIS) software was used to summarize the various land use types contained in the USGS electronic land use dataset. Based on the GIS summary, the land use within a three km radius of the Mill is overwhelmingly rural. Approximately 85% of the land use is rural with the remaining percentage of land use being urban. Therefore, the urban option was not selected in the AERMOD air dispersion model. The three km radius land use summary for the area surrounding the Mill is shown in Figure 4-1.

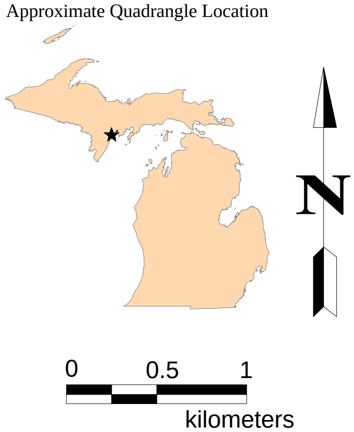
4.3 RECEPTOR GRID

A receptor grid for the AERMOD analysis was developed to cover a 20-by-20 km square area centered on the Mill. All receptors were referenced to the UTM coordinate system, Zone 16, using NAD 83 datum. Rectangular coordinates were used to identify each receptor location. The rectangular receptor grid was centered on 492,721.6 m easting and 5,072,501.6 m northing and has the following grid spacing:

- 25 m spacing out to ± 0.5 km,
- 50 m spacing beginning at ± 0.5 km and extending out to ± 1 km,
- 100 m spacing beginning at ± 1 km and extending out to ± 5 km, and
- 250 m spacing beginning at ± 5 km and extending out to ± 10 km.



Approximate Quadrangle Location



Based on USGS 1:24,000 topographical map for Chandler, MI (1985) and Gladstone, MI (1985).

Figure 4-1
Land Use Analysis Within 3 km of the Escanaba Mill

Escanaba Paper Company
Escanaba, MI

1992 National Land Use Cover Data

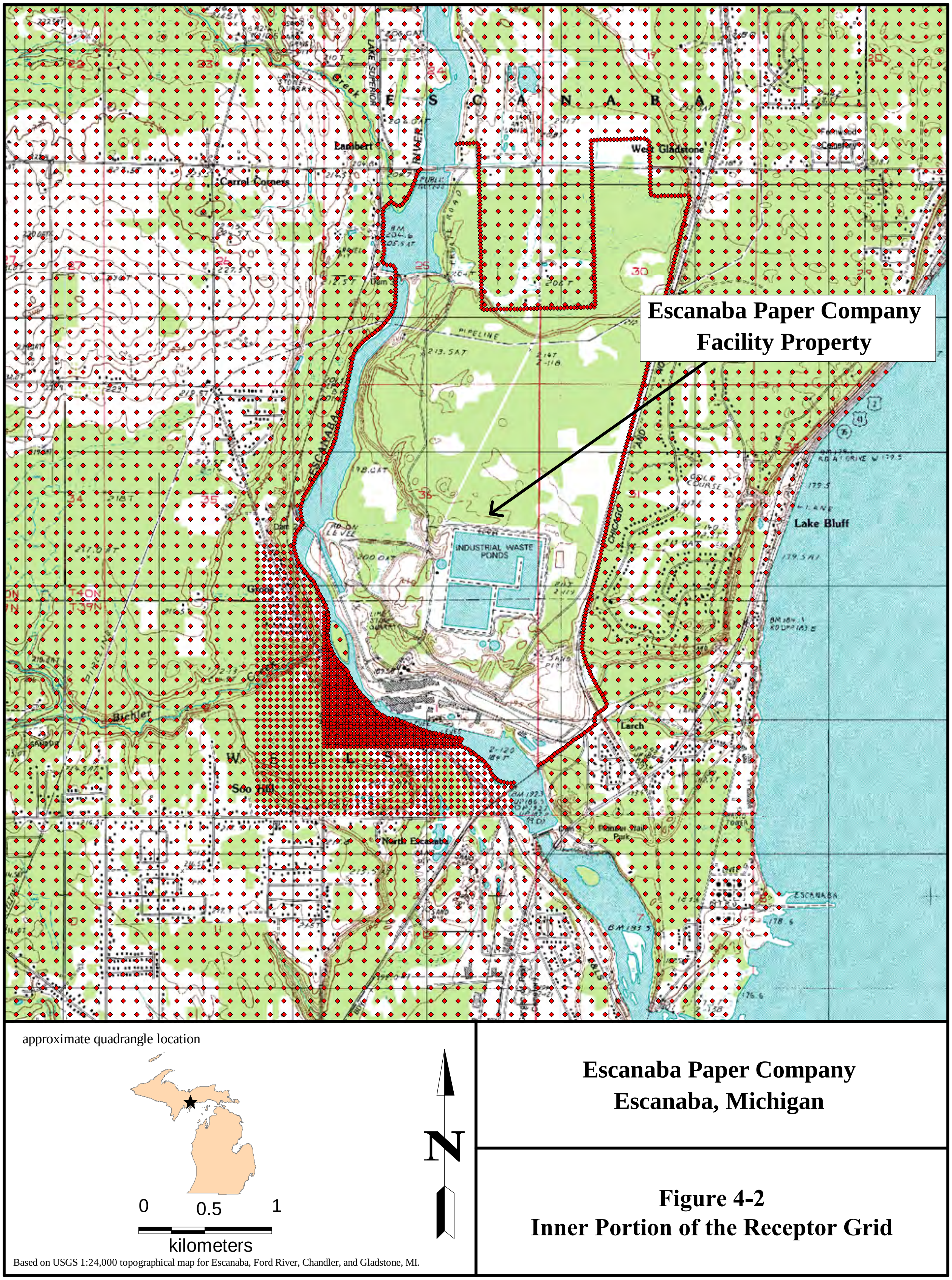
- 11 - Open Water (6.2%)
- 21 - Low Intensity Residential (4.4%)
- 22 - High Intensity Residential (1.2%)
- 23 - Commercial/Industrial/Transportation (13.5%)
- 32 - Quarries/Strip Mines/Gravel Pits (0.2%)
- 33 - Transitional (0.9%)
- 41 - Deciduous Forest (30.9%)
- 42 - Evergreen Forest (6.0%)
- 43 - Mixed Forest (11.1%)
- 71 - Grasslands/Herbaceous (1.2%)
- 81 - Pasture/Hay (1.9%)
- 82 - Row Crops (7.6%)
- 85 - Urban/Recreational Grasses (2.0%)
- 91 - Woody Wetlands (11.5%)
- 92 - Emergent Herbaceous Wetlands (1.5%)

In addition to the main rectangular coordinate receptor grid, property line receptors were used in the air quality modeling analysis. The property line receptors were spaced approximately every 25 m. The entire property line is either fenced or spanned by natural barriers that restrict public access to EPC property. The natural barrier includes the Escanaba River which includes multiple dams limiting access to the river. Additionally, gated ingress and egress points include cameras monitored by security personnel and Mill security performs daily inspections of numerous check points throughout the Mill as an additional measure to monitor any suspicious activity or unauthorized access. Lastly, following guidance contained in the Modeling TAD, no receptors were placed in locations where an ambient monitor could not be physically located (i.e., over bodies of water). The inner portion of the receptor grid is shown in Figure 4-2.

Terrain elevations were assigned to all receptors. The AERMAP terrain pre-processor (Version 11103) and USGS 1:24,000 National Elevation Dataset (NED) files were used to determine representative terrain elevations for all of the receptors. The horizontal resolution of the NED data is every 10 m.

4.4 METEOROLOGICAL DATA

The meteorological database for the AERMOD air dispersion modeling study consisted of three years (2012 to 2014) of Iron Mountain (IMT) National Weather Service (NWS) data (station ID 94893) and three years of corresponding upper air data from Green Bay, Wisconsin (GRB) (station ID 14898) that were processed with the AERMET pre-processor by MDEQ and obtained from the MDEQ website. The IMT NWS station is located approximately 70 kilometers (43 miles) west of EPC. The Mill has historically utilized Escanaba (ESC) NWS station data for MDEQ air toxics air quality modeling. The ESC NWS station is located approximately 9 kilometers (5.7 miles) south of EPC. The ESC NWS station is considered representative of the meteorological conditions at the EPC due to similar topographic settings, Lake Michigan influence, and proximity to the EPC. Due to these similarities the micro-meteorological conditions (i.e., surface roughness, albedo, and Bowen Ratio) at the ESC NWS are also similar to those at the EPC. There are no significant terrain features between the two sites and there are no terrain features that would



Escanaba Paper Company
Escanaba, Michigan

Figure 4-2
Inner Portion of the Receptor Grid

influence one site and not the other.

However, the ESC NWS station does not collect 1-minute average wind measurements and therefore the AERMINUTE preprocessor cannot be utilized to developed refined hourly average wind speed and wind direction measurements for input into the AERMET preprocessor. The lack of 1-minute average wind measurements results in more calm and missing wind measurements values in the ESC NWS station dataset than compared to the IMT NWS dataset for the same period. For the 2012 to 2014 ESC dataset there are three quarters that fall just outside the 90% data recovery rate required by U.S. EPA for SO_2 DRR air quality modeling. The IMT NWS does collect 1-minute average wind measurements which results in all 12 quarters from 2012 to 2014 having a data recovery rate greater than 90%. Although the ESC NWS is more representative of the conditions at the EPC than the IMT NWS station, EPC is utilizing the IMT dataset for the SO_2 DRR air quality modeling analysis. Both IMT and ESC NWS datasets are processed with Green Bay, WI upper air data. Upper air measurements made at the Green Bay upper air station, while located south of EPC, are representative of general atmospheric conditions along Lake Michigan.

4.5 GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT ANALYSIS

During a previous air quality modeling assessment at EPC, an analysis was conducted to determine the potential for building downwash. Guidance contained in the U.S. EPA "Guideline for Determination of Good Engineering Practice (GEP) Stack Height (Revised)" (U.S. EPA 1985) and the U.S. EPA Building Profile Input Program (BPIP, Version 04274) that contains the PRIME algorithms was followed. Since EPC is utilizing a mix of PTE and actual emissions rates the GEP stack height policy will be utilized for sources utilizing PTE emission rates. It should be noted that all the stacks at EPC are less than or equal to GEP formula height; therefore, the actual stack heights were utilized for all sources in the modeling analysis since no stacks are greater than GEP formula height. This approach is consistent with the requirements in the SO_2 DRR and the Modeling TAD. The GIS digitization of the Mill is presented in Figure 4-3.

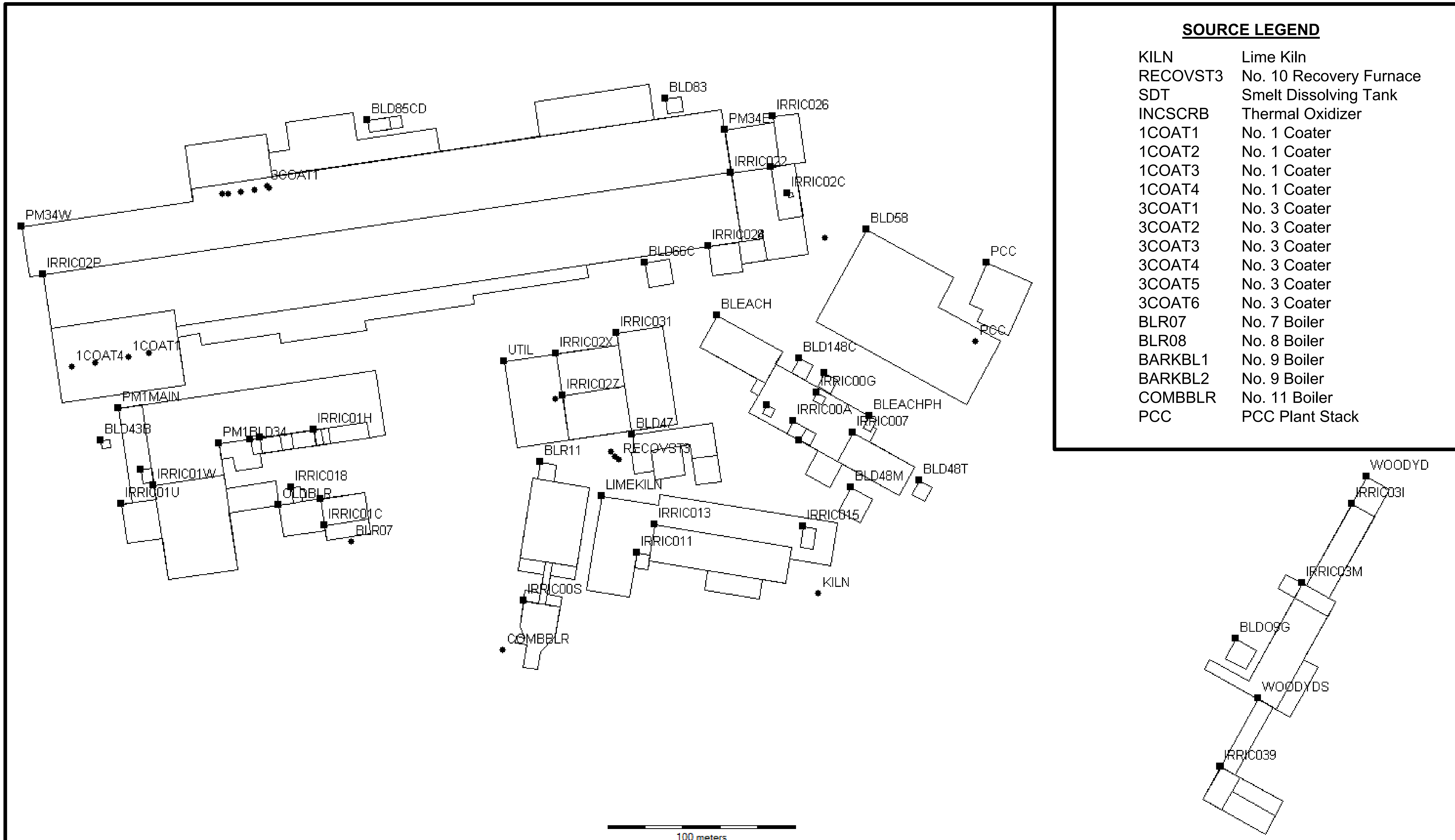


Figure 4-3
Structures and Sources for Building Downwash Analysis
Escanaba Paper Company

4.6 BACKGROUND AMBIENT AIR DATA

Ambient background 1-hour SO_2 concentrations were considered in this analysis. The ambient background concentrations were added to the cumulative modeled concentrations resulting from the Mill sources. EPC followed guidance contained in U.S. EPA's March 1, 2011 memorandum (U.S. EPA 2011) which outlines a "Tier 1" approach to including background ambient SO_2 concentrations. The "Tier 1" approach is the most conservative and incorporates a 3-year average of the 99th percentile of daily maximum 1-hour concentrations from a representative background monitor.

EPC utilized background data from the U.S. EPA Air Quality System (AQS) for the 2012, 2013, and 2014 calendar years. The data is from the Forest County, WI monitor located near Crandon, WI (Site ID: 55-041-0007). The background data is summarized in Table 4-1, below.

Table 4-1
99th Percentile SO_2 Concentrations

Site	2012 (ppb)	2013 (ppb)	2014 (ppb)	Average (ppb)
55-041-0007	5	4	12	**7**

EPC understands that the ambient SO_2 measurements from the Forest County, WI monitor site are representative of background conditions at the Mill. The Forest County, WI monitor is located 160 km east of the Mill and is the closest SO_2 ambient monitoring station located in a similar rural setting.

5. SUBMITTAL OF AIR QUALITY MODELING RESULTS

Meteorological data from the 2012, 2013, and 2014 calendar years along with SO_2 emissions data were utilized to model ambient SO_2 concentrations. The results of the 1-hour SO_2 DRR analysis reflect the three year average of the 99th percentile of daily maximum 1-hour SO_2 concentrations for the EPC and are summarized in Table 5-1. When the background concentration is included, the resulting concentrations are less than the 1-hour SO_2 DRR thresholds.

This detailed air quality modeling report is being submitted as part of the SO_2 DRR air quality modeling evaluation. The air quality modeling report identifies the procedures that were followed in the air quality modeling analysis. An electronic copy of the air quality modeling inputs and output files, as well as supporting files (e.g., meteorological data, building downwash analysis, and hourly emission files), are supplied in an Electronic Appendix.

Table 5-1
Results of the 1-Hour SO_2 DRR Modeling Analysis

Pollutant	Averaging Period	Form	Threshold ($\mu g/m^3$)	Escanaba ($\mu g/m^3$)	Background ($\mu g/m^3$)	Modeled + Monitored ($\mu g/m^3$)
SO_2	1-Hour	Three Year Average of 99^{th} Percentile of Daily Maximum 1-hour Concentrations	196	94.81	18.34	113.15

6. REFERENCES

Auer 1978, Auer Jr., A.H., – "Correlation of Land Use and Cover with Meteorological Anomalies", Journal of Applied Meteorology, 17:636-643, 1978.

U.S. EPA 1985 – "Guideline for Determination of Good Engineering Practice (GEP) Stack Height (Technical Support Document for Stack Height Regulations) Revised" EPA-450:4-80-023R, June 1985.

U.S. EPA 2004 – "Revised Draft User's Guide for the AERMOD Terrain Preprocessor (AERMAP)". U.S. Environmental Protection Agency Office of Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division, Research Triangle Park, NC, August 2002.

U.S. EPA 2005 – 40 CFR Part 51 Appendix W "Guideline on Air Quality Models (Revised) April 2005.

U.S. EPA 2011 – "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour Nitrogen Dioxide (NO_2) National Ambient Air Quality Standard". U.S. Environmental Protection Agency Office of Air Quality Planning and Standards, Air Quality Modeling Group, Research Triangle Park, NC, March 2011.

U.S. EPA 2016 – "Sulfur Dioxide (SO_2) National Ambient Air Quality Standards Designations Modeling Technical Assistance Document." U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division, February 2016.

U.S. EPA 2015 – "Addendum to the User's Guide for the AMS/EPA Regulatory Default Model – AERMOD". U.S. Environmental Protection Agency Office of Air Quality Planning and Standards, Air Quality Assessment Division, Research Triangle Park, NC, June 2015.

Appendix B3

Escanaba SO_2 DRR

Potential to Emit Calculations

Table 1

SO_2 Data Requirements Rule Modeling Emissions Inventory - Potential To Emit

Escanaba Paper Company - Escanaba, MI

Emissions Unit	AERMOD Modeling ID	Capacity/Throughput	Emissions Factor	SO_2 Emissions Rate (lb/hr)	SO_2 Emissions Rate (g/sec)	Basis for Emissions Rate
Smelt Dissolving Tank	SDT	87.5 TBLS/hr	0.005 lb/TBLS	0.44	0.06	NCASI TB 884 Table 4.15 Median Emission Factor & 87.5 TBLS/hr
Thermal Oxidizer	INCSCRB	-	12 lb/hr	12	1.51	12 lb/hr permit limit
No. 1 Coater	1COAT1	17.8 MMBtu/hr	0.0006 lb/MMBtu	1.07E-02	1.35E-03	AP-42 Chapter 1.4, Table 1.4-2 & 17.8 MMBtu/hr
No. 1 Coater	1COAT2	18.8 MMBtu/hr	0.0006 lb/MMBtu	1.13E-02	1.42E-03	AP-42 Chapter 1.4, Table 1.4-2 & 17.8 MMBtu/hr
No. 1 Coater	1COAT3	10.4 MMBtu/hr	0.0006 lb/MMBtu	6.24E-03	7.86E-04	AP-42 Chapter 1.4, Table 1.4-2 & 10.4 MMBtu/hr
No. 1 Coater	1COAT4	9.1 MMBtu/hr	0.0006 lb/MMBtu	5.46E-03	6.88E-04	AP-42 Chapter 1.4, Table 1.4-2 & 9.1 MMBtu/hr
No. 3 Coater	3COAT1	4.4 MMBtu/hr	0.0006 lb/MMBtu	2.64E-03	3.33E-04	AP-42 Chapter 1.4, Table 1.4-2 & 4.4 MMBtu/hr
No. 3 Coater	3COAT2	4 MMBtu/hr	0.0006 lb/MMBtu	2.40E-03	3.02E-04	AP-42 Chapter 1.4, Table 1.4-2 & 4 MMBtu/hr
No. 3 Coater	3COAT3	4.8 MMBtu/hr	0.0006 lb/MMBtu	2.88E-03	3.63E-04	AP-42 Chapter 1.4, Table 1.4-2 & 4.8 MMBtu/hr
No. 3 Coater	3COAT4	4 MMBtu/hr	0.0006 lb/MMBtu	2.40E-03	3.02E-04	AP-42 Chapter 1.4, Table 1.4-2 & 4 MMBtu/hr
No. 3 Coater	3COAT5	4 MMBtu/hr	0.0006 lb/MMBtu	2.40E-03	3.02E-04	AP-42 Chapter 1.4, Table 1.4-2 & 4 MMBtu/hr
No. 3 Coater	3COAT6	4.8 MMBtu/hr	0.0006 lb/MMBtu	2.88E-03	3.63E-04	AP-42 Chapter 1.4, Table 1.4-2 & 4.8 MMBtu/hr
No. 9 Boiler	BARKBL1	360 MMBtu/hr	0.032 lb/MMBtu	5.76	0.73	Test Emission Factor & 360 MMBtu/hr
No. 9 Boiler	BARKBL2	360 MMBtu/hr	0.032 lb/MMBtu	5.76	0.73	Test Emission Factor & 360 MMBtu/hr
No. 11 Boiler	COMBBLR	1040 MMBtu/hr	1.2 lb/MMBtu	1,248	157.25	1.2 lbs/MMBtu Permit Limit & 1040 MMBtu

Appendix B4

Lafarge Alpena 1-hour SO_2

Model Protocol

AIR DISPERSION MODELING PROTOCOL FOR EVALUATING COMPLIANCE WITH THE 1-HOUR SO_2 NATIONAL AMBIENT AIR QUALITY STANDARD AT THE LAFARGE PORTLAND CEMENT MANUFACTURING FACILITY IN ALPENA, MICHIGAN

Prepared for:
Lafarge Midwest Inc.
1435 Ford Avenue
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Original Submittal February 2016
First Revised Submittal June 2016
Second Revised Submittal October 2016

Table of Contents

List of Figures

1.0 INTRODUCTION

This document presents the protocol for the air quality dispersion modeling analysis to be conducted for the Lafarge Portland Cement manufacturing facility in Alpena, Michigan. The modeling will be conducted to evaluate compliance with the 1-hour SO_2 National Ambient Air Quality Standard (NAAQS) as required by the Data Requirements Rule (DRR) of 40 CFR Part 51, Subpart BB.

The protocol conforms with the modeling procedures outlined in the U.S. Environmental Protection Agency's (EPA) Guideline on Air Quality Models[1] (Guideline), the EPA SO_2 NAAQS Designations Modeling Technical Assistance Document (Draft), or TAD[2], and associated EPA modeling policy and guidance. This protocol was initially submitted the Michigan Department of Environmental Quality (MDEQ) on February 8, 2016. The MDEQ subsequently forwarded the protocol to US EPA Region V for review and comment. The MDEQ and EPA comments on the draft protocol were provided to Lafarge on June 6, 2016. The protocol was subsequently revised to address these comments and reissued on June 23, 2016. Upon review of the revised protocol, EPA stated that they did not agree with the methodology proposed by Lafarge for estimating modeled emissions from Kiln Group (KG) 6 using a combination of federally enforceable emission limits and actual emissions.[a] EPA stated that either actual or allowable emissions would need to be modeled and that there cannot be a combination of both. Lafarge is therefore issuing this second revision to the protocol to propose an approach consistent with that described by EPA.

[a]Lafarge installed a SO_2 wet gas scrubber on KG6 that became operational at the end of 2013. Based upon demonstrated optimized operation of the wet gas scrubber, USEPA and MDEQ established SO_2 intensity rate limitations for KG6 in 2015. Prior to installation of the scrubber, Lafarge was not subject to a meaningful federally enforceable SO2 emissions limit on KG6. In the first revised protocol, Lafarge proposed to model the currently allowable emissions for KG6 in 2013 and actual emissions in 2014 and 2015.

2.0 SITE DESCRIPTION

The Lafarge facility is located to the east of Alpena, Michigan along the the north shore of Lake Huron's Thunder Bay in north eastern Michigan in Alpena County. Alpena county is classified as attainment or unclassified for all regulated air pollutants. The approximate Universal Transverse Mercator (UTM) coordinates of the facility are 310,700 meters east and 4,993,720 meters north (UTM Zone 17, NAD 27). Figure 1 shows the general location of the facility on the Alpena 7.5 minute USGS quadrangle. Figure 2 shows the specific facility location on a 7.5-minute U.S. Geological Survey (USGS) topographic map.

The plant includes five dry process kilns, a quarry, raw material grinding and storage, finish grinding, and cement loading operations. In March of 2010, the US District Court for the Southern District of Illinois entered a consent decree (CD) between Lafarge Midwest Inc., the United States, the State of Michigan and others. Amongst other requirements, the CD required that Lafarge reduce SO_2 emissions. As a result, a wet gas scrubber system (WGS) is currently employed to reduce SO_2 emissions from the two larger kilns (Kilns 22 and 23, or Kiln Group 6). The scrubber became fully operational in December of 2013. Lafarge must reduce emissions from KG 6 to less than 1.98 pound of SO_2 per ton of clinker produced, on a 30 day rolling average basis. The three smaller kilns (Kilns 19-21, or Kiln Group 5) are controlled using a dry absorbent addition (DAA) system. The DAA systems became fully operational in 2011. Lafarge must meet an SO_2 limitation of 4.07, 4.09, and 3.93 pound of SO_2 per ton of clinker produced on Kilns 19-21, respectively, also based on a 30 day rolling average.

The facility is defined as a major source of air pollution per Rule 336.1211 of the Michigan Administrative Rules for Air Pollution Control and under the Federal Prevention of Significant Deterioration regulation of 40 CFR 52.21. The facility operates under Renewable Operating Permit (ROP) No. MI-ROP-B1477-2012a. The CD SO_2 emission limitations have been incorporated into NSR Permits to Install and the ROP and are therefore currently federally enforceable.

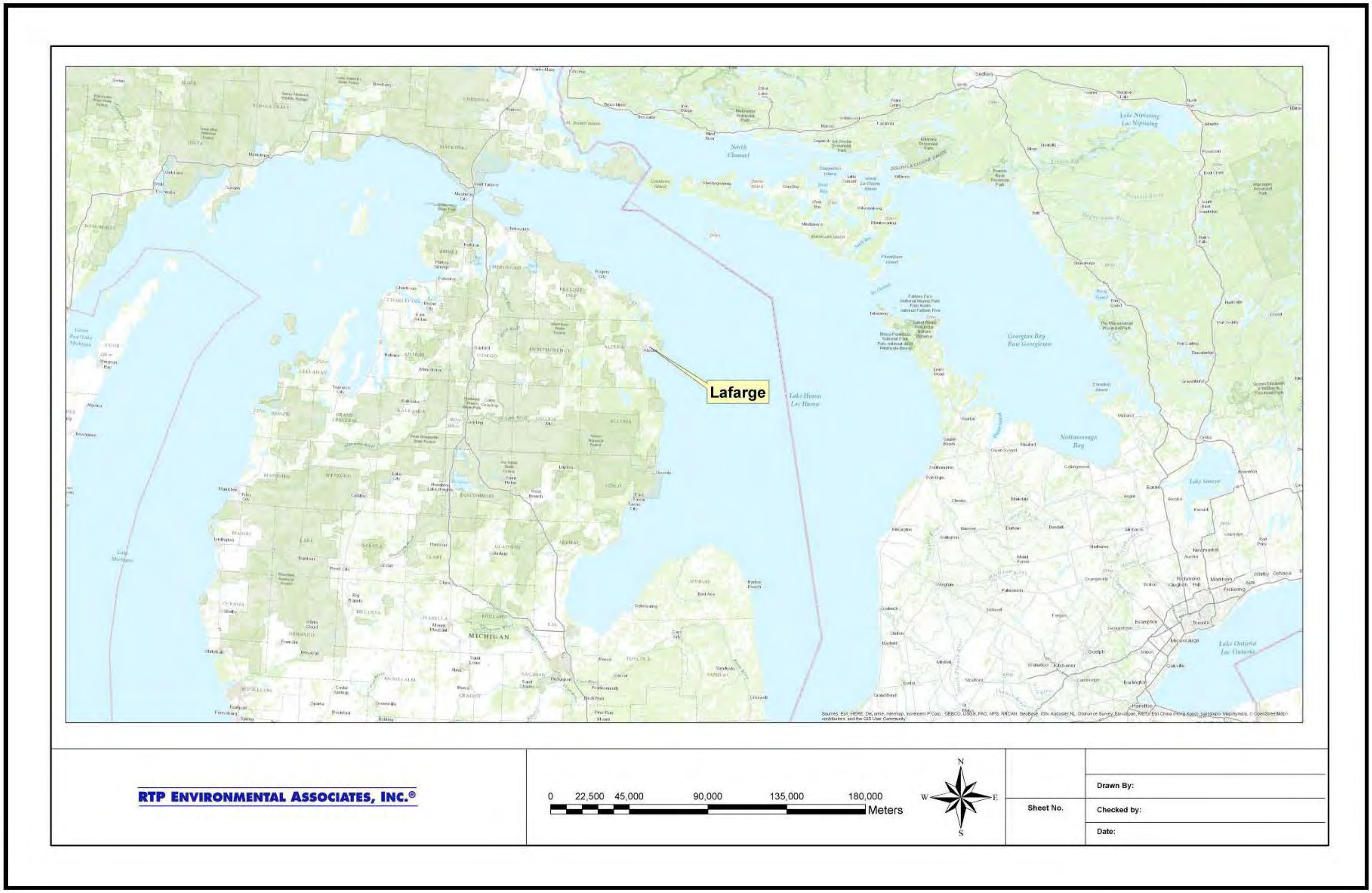

Figure 1. General Location of the Lafarge Facility

LAFARGE

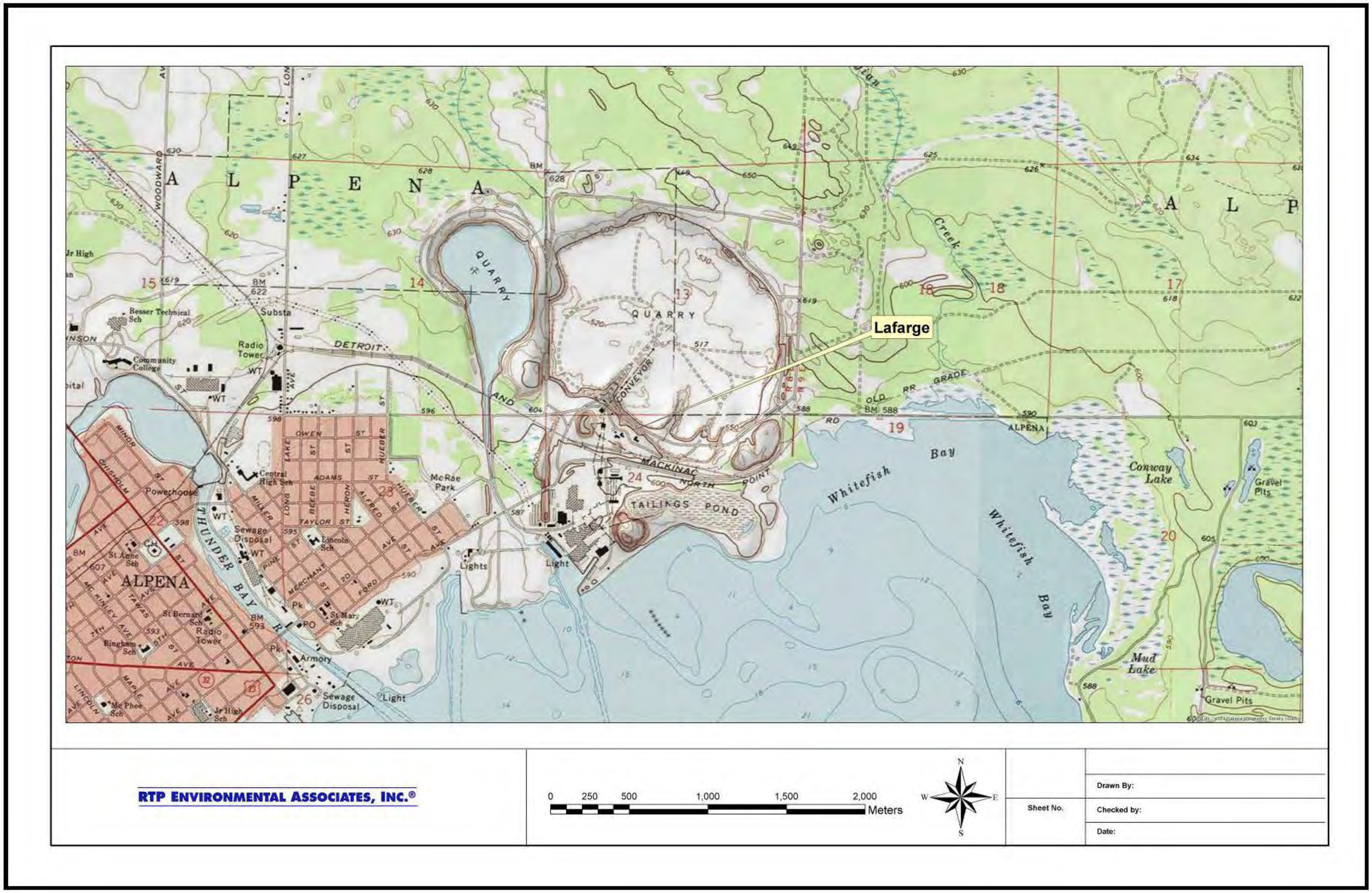

Figure 2. Specific Location of the Lafarge Facility

3.0 MODEL SELECTION AND MODEL INPUT

3.1 Model Selection

The latest version of the AMS/EPA Regulatory Model (AERMOD, Version 15181) is proposed for conducting the dispersion modeling analysis. AERMOD is a Gaussian plume dispersion model that is based on planetary boundary layer principals for characterizing atmospheric stability. The model evaluates the non-Gaussian vertical behavior of plumes during convective conditions with the probability density function and the superposition of several Gaussian plumes. AERMOD is a modeling system with three components: AERMAP is the terrain preprocessor program, AERMET is the meteorological data preprocessor and AERMOD includes the dispersion modeling algorithms.

AERMOD is the most appropriate model for calculating ambient concentrations near the facility based on the model's ability to incorporate multiple sources and source types. The model can also account for convective updrafts and downdrafts and meteorological data throughout the plume depth. The model also provides parameters required for use with up to date planetary boundary layer parameterization. The model also has the ability to incorporate building wake effects and to calculate concentrations within the cavity recirculation zone. All model options will be selected as recommended in the EPA Guideline on Air Quality Models.

Oris Solution's BEEST Graphical User Interface (GUI) will be used to run AERMOD. The GUI uses an altered version of the AERMOD code to allow for flexibility in the file naming convention. The dispersion algorithms of AERMOD are not altered. Lafarge therefore believes that there is no need for a model equivalency evaluation pursuant to Section 3.2 of 40 CFR 51, Appendix W. However, an equivalency demonstration has been made available to the MDEQ.

3.2 Model Control Options and Land Use

AERMOD will be run in the regulatory default mode with the rural dispersion coefficients. Use of rural dispersion coefficients is supported by the Land Use Procedure consistent with subsection 7.2.3(c) of the Guideline and Section 5.1 of the AERMOD Implementation Guide.

The USGS 2006 National Land Cover Data (NLCD) within 3km of the site were converted to Auer 1978 land use types and evaluated.[3] It was determined that the land use in the vicinity of the facility is predominantly rural (Figure 3). Only the red and dark red areas in the figure are classified as urban by Auer. Less than 20% of the landuse within 3km of the site is classified as urban. Therefore, the potential for urban heat island affects, which are regional in character, was considered and determined not to be of concern.

3.3 Source Data

Source Characterization

The kilns are the only major sources of SO_2 at the facility. There are also several emergency generators and fire water pumps at the facility. These sources operate intermittently (generally once per month for approximately 10 minutes) and do not have the capability to contribute significantly to the annual distribution of maximum daily 1-hr SO_2 concentrations. In addition, there are two raw material dryers at the site which also emit SO_2; however, actual emissions in 2015 from these dryers was less than 0.25 tons per year. These sources also do not have the capability to contribute signifcantly to the annual distribution of maximum daily 1-hr SO_2 concentrations. The raw material dryers and generators will therefore not be included in the evaluation.

The kilns will be modeled as point sources in AERMOD. No fugitive sources will require evaluation.

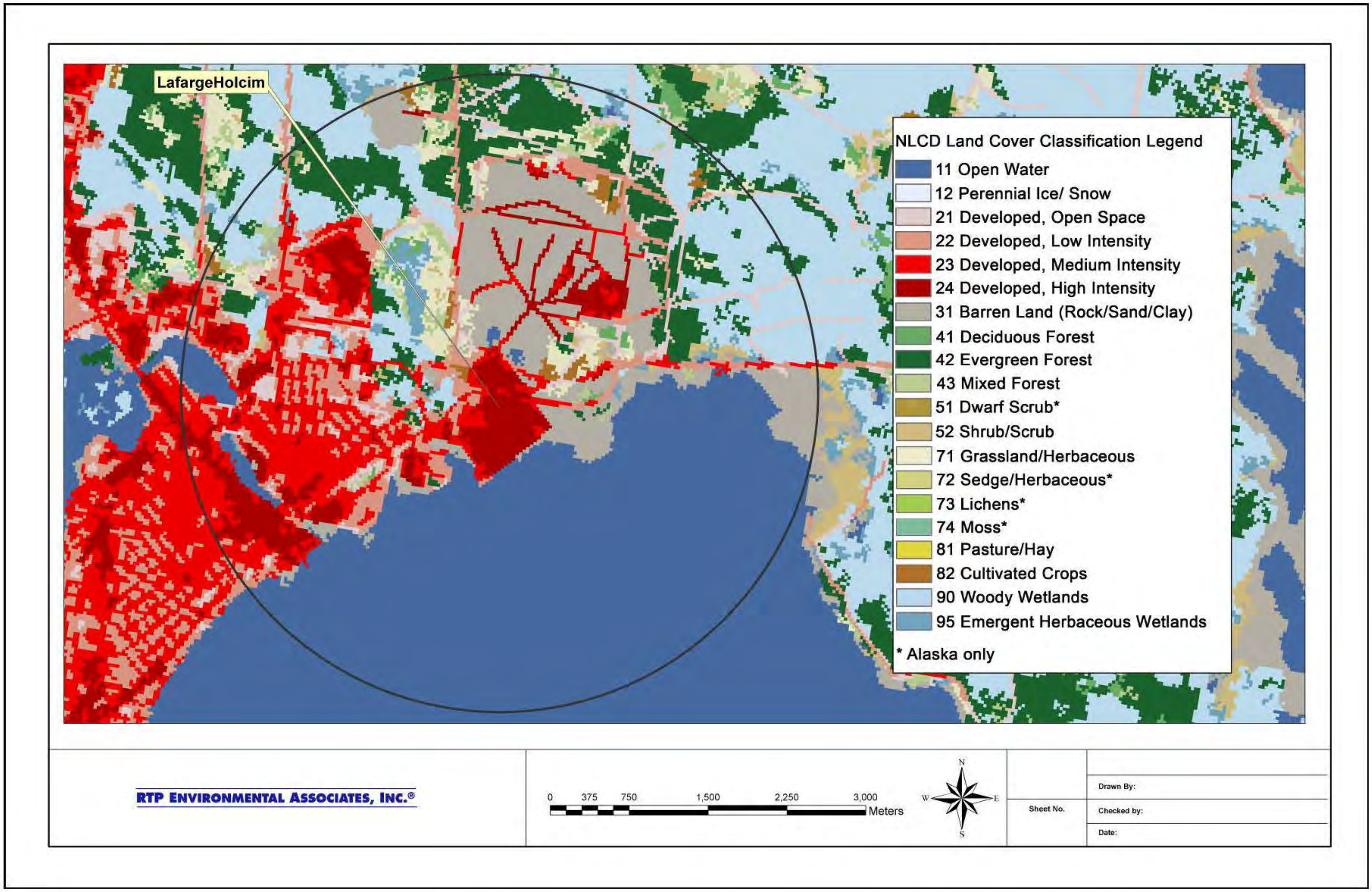

Figure 3. Land Use within Three Kilometers (3km Radius Shown)

Source Emissions

For purposes of SO_2 designation modeling, where modeling is used as a surrogate for ambient monitoring, the EPA provided an option to base the SO_2 designations on actual emissions. EPA recommends that the most recent three years of actual emissions be modeled.[4] Lafarge operates continuous emissions monitors (CEMS) on the kiln stacks. Actual, hourly stack gas temperature, gas flow rate and SO_2 emissions from 2014-2016, as obtained from the CEMS, will be modeled for all sources. A file of hourly emissions, stack gas temperature and velocity has been developed. Use of the most recent three years of emissions will allow Lafarge to use a complete record of controlled emissions from KG6 and address EPA's disallowance of the use of a combination of allowable and actual emissions. While a complete record for 2016 is not yet available, sufficient data is available to allow the MDEQ to recommend an area designation. Lafarge will model the complete three year dataset and submit to the MDEQ in advance of the January 13, 2017 regulatory deadline.[5]

Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height evaluation will be conducted to determine appropriate building dimensions to include in the model. Procedures to be used will be in accordance with those described in the EPA Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations-Revised)[6]. GEP formula stack height, as defined in 40 CFR 51, is expressed as $GEP = H_b + 1.5L$, where H_b is the building height and L is the lesser of the building height or maximum projected width. Building/structure locations will be determined from a facility plot plan. The structure locations and heights will be input to the EPA's Building Profile Input Program (BPIP-PRIME) computer program to calculate the direction-specific building dimensions needed for AERMOD. Actual stack heights will be modeled. The Lafarge facility plot plan is shown in Figure 4. A three dimensional rendering of the facility is shown in Figure 5.

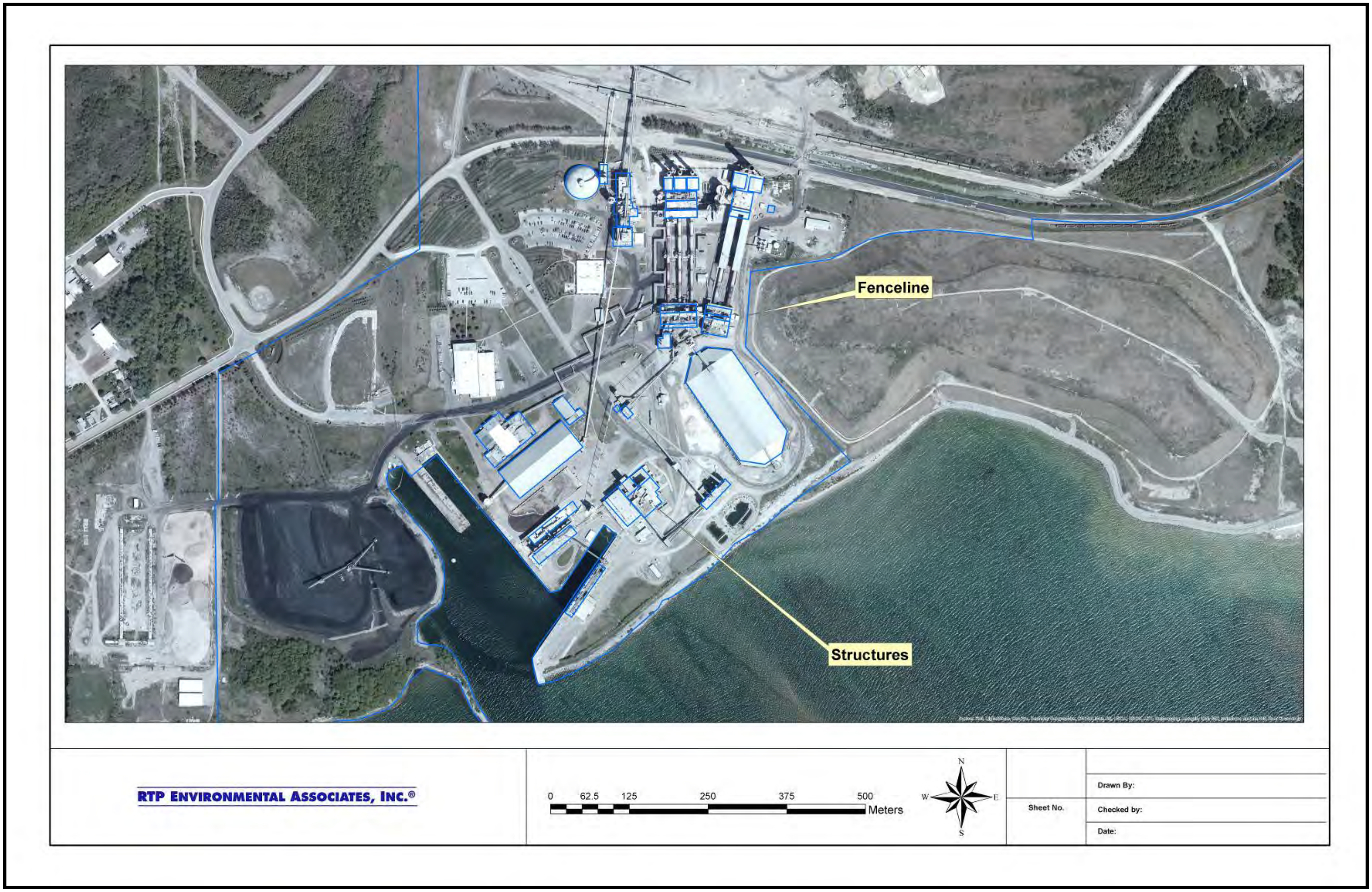

Figure 4. Lafarge Facility Plot Plan

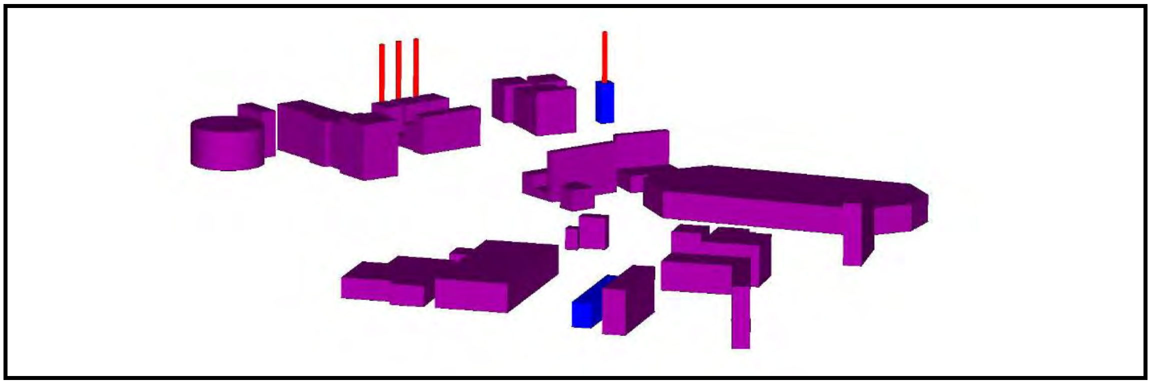

Figure 5. Lafarge Three Dimensional Plot Plan (View from SW)

3.4 Monitored Background Concentrations

Ambient, background pollutant concentrations are needed to establish the cumulative impact of the facility and other contributing nearby sources. The DRR and other EPA Guidance[7] suggest a first tier approach of adding a uniform monitored background contribution based on adding the overall highest hourly background SO_2 concentration from a representative monitor to the modeled design value. This approach is overly conservative and is prone to increasing the potential for double counting modeled and monitored contributions. Therefore, as discussed in EPA's 2010 clarification memo, we propose a less conservative approach of adding a temporally varying background concentration by hour of day and season to the modeled design concentration. RTP Environmental has developed such a temporally varying dataset based upon the 99% concentration for each season.

Of the active, ambient SO_2 monitors operated in the upper Midwest, only the Potawatomi monitor in Forest Co., Wisconsin is located in a rural environment similar to Lafarge (Figure 6). The Forest Co. monitor is also located at a similar latitude as Lafarge. All of the other monitors are located downstate in either urban areas or adjacent to large SO_2 emission sources. The Forest Co. monitor is therefore most representative of the background ambient SO_2 concentrations near Lafarge. The 2013-2015 hourly SO_2 values from the Forest County Wisconsin monitor (AQS Site No. 55-041-007) were processed to derive the 99% values. This SO_2 monitor and its use has been discussed with the MDEQ.[8]

Figure 6. Active Ambient SO2 Monitors within 500km of Lafarge Alpena

3.5 Receptor Data

As stated in the TAD, the strategy for placement of receptors for modeling of SO_2 designations differs from the modeling conducted for SIP, PSD, or NSR. Receptors may be ignored or not placed in areas where it is not feasible to place a monitor (water bodies, etc.). The Lafarge facility is located on the shore of Lake Huron. Therefore, any receptors located over the lake, or other nearby bodies of water, will be excluded from the analysis. RTP has conservatively included receptors along Ford Avenue which transects the facility.

Approximately 7,800 receptors will be used in the AERMOD analysis. The receptor grid will consist of fence line receptors and several Cartesian grids. Public access to the Lafarge facility and the quarry to the north of the facility is precluded by a fence. Receptors will be placed along the facility fence line at 50m intervals. The first Cartesian grid will extend to approximately 2.5km from the facility in all directions. Receptors in this region will be spaced at 100m intervals. The second Cartesian grid will extend from 2.5km to 5km from the facility. Receptor spacing in this region will be 250m. A third Cartesian grid will be employed that will extend from 5km to 15km from the facility. Receptor spacing in this region will be 500m. The receptor grid is designed such that maximum facility impacts fall within the 100m spacing of receptors. If maximum impacts fall outside of the 2.5km grid, the impacts will be refined to 100m.

The Lafarge facility is located in northern Michigan. The terrain in the vicinity of the facility is generally flat. Receptor elevations and hill height scale factors will be calculated with AERMAP (11103). The elevation data will be obtained from the USGS 1/3 arc second National Elevation Data (NED) obtained from the USGS. Locations will be based upon a NAD27, UTM Zone 17 projection. The secure boundary that encompasses the Lafarge facility and the proposed near-field receptor grid is presented in Figure 7. Figure 8 presents the entire receptor grid.

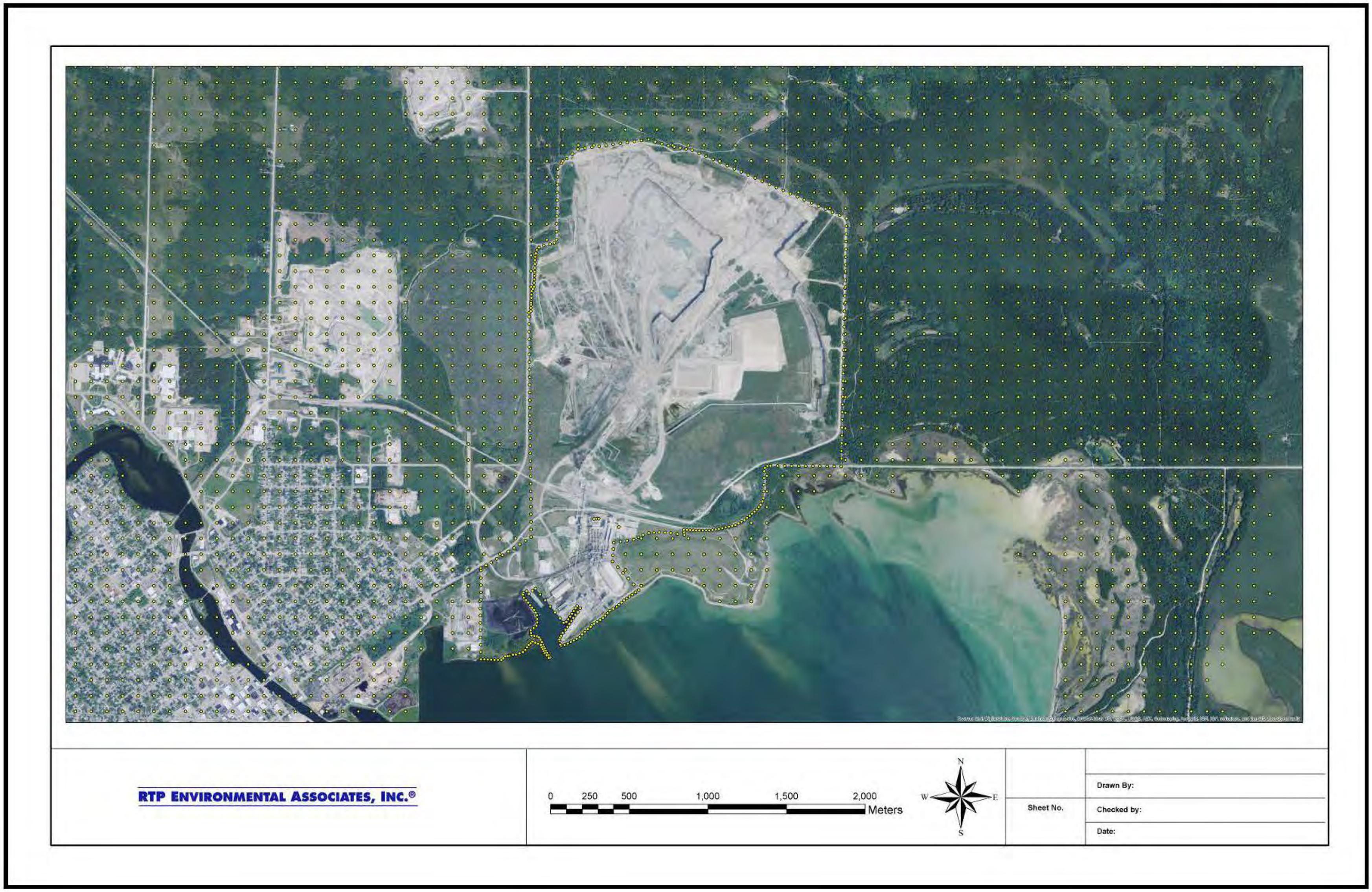

Figure 7. Lafarge Near-field Receptor Grid

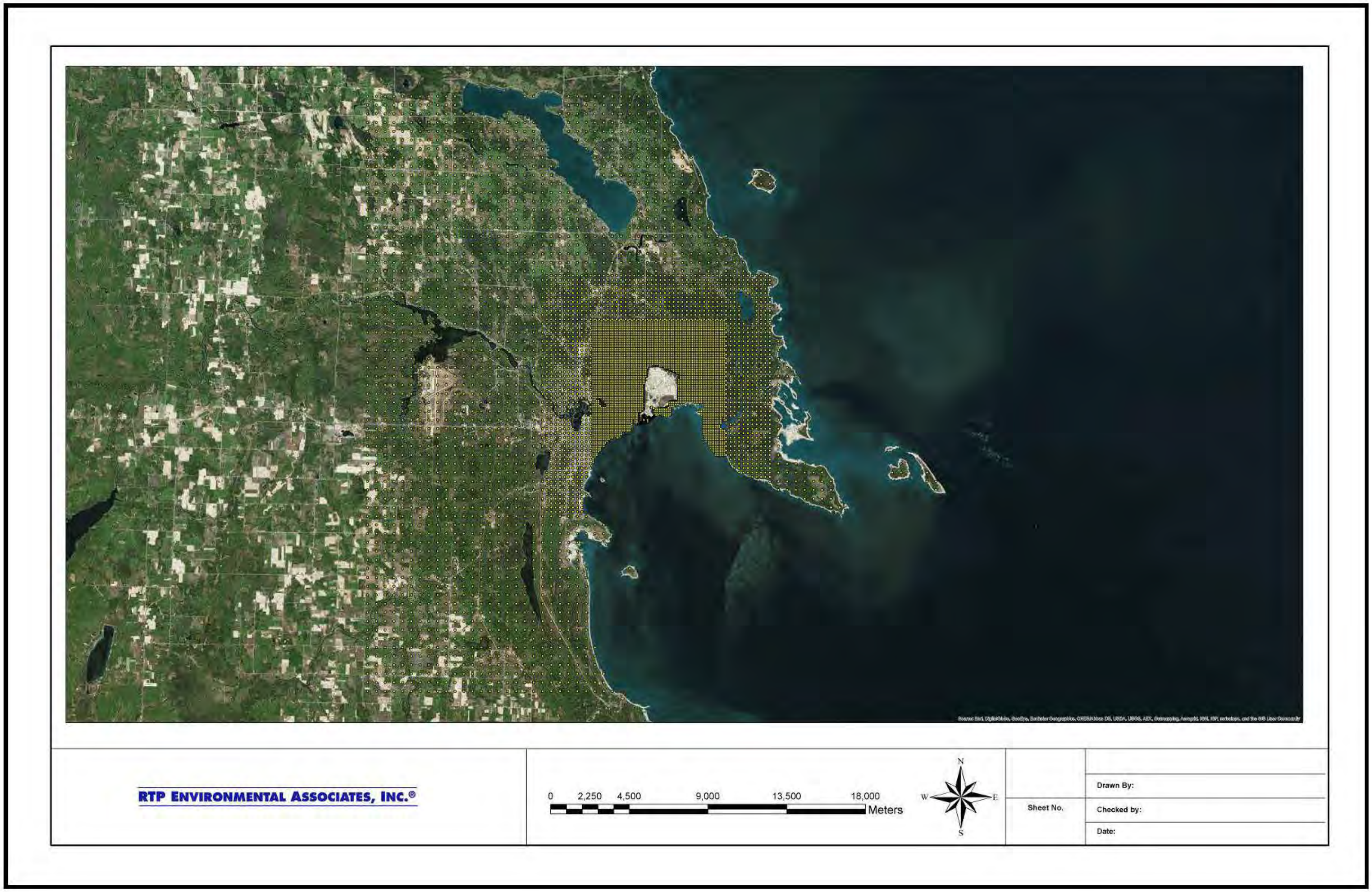

Figure 8. Lafarge Entire Receptor Grid

3.6 Meteorological Data

The 2014-2016, 3-year sequential hourly surface meteorological data collected at the National Weather Service (NWS) station in Alpena (WBAN No.94849) and upper air data from the NWS station in Flint (WBAN No. 14826) will be used in the analysis. The data were processed using AERMET (version 14134 for 2014 and version 15181 for 2015 and 2016) by the MDEQ and provided to RTP Environmental in a “model-ready” format. A three year wind rose is presented in Figure 9.

The use of NWS meteorological data for dispersion modeling can often lead to a high incidence of calms and variable wind conditions if the data are collected by Automated Surface Observing Stations (ASOS), as are in use at most NWS stations since the mid-1990’s. A calm wind is defined as a wind speed less than 3 knots and is assigned a value of 0 knots. In addition, variable wind observations may include wind speeds up to 6 knots, but the wind direction is reported as missing, if the wind direction varies more than 60 degrees during the 2-minute averaging period for the observation. The AERMOD model currently cannot simulate dispersion under calm or missing wind conditions.

To reduce the number of calms and missing winds in the surface data, archived 1-minute winds for the ASOS stations were used to calculate hourly average wind speed and directions, which were used to supplement the standard archive of hourly observed winds processed in AERMET. The EPA AERMINUTE program was used for these calculations.

The TAD states that the selection of the meteorological data should be considered carefully. The data should be based on spatial and climatological representativeness. 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 the data are collected. The Alpena NWS is located approximately 12km west of the Lafarge

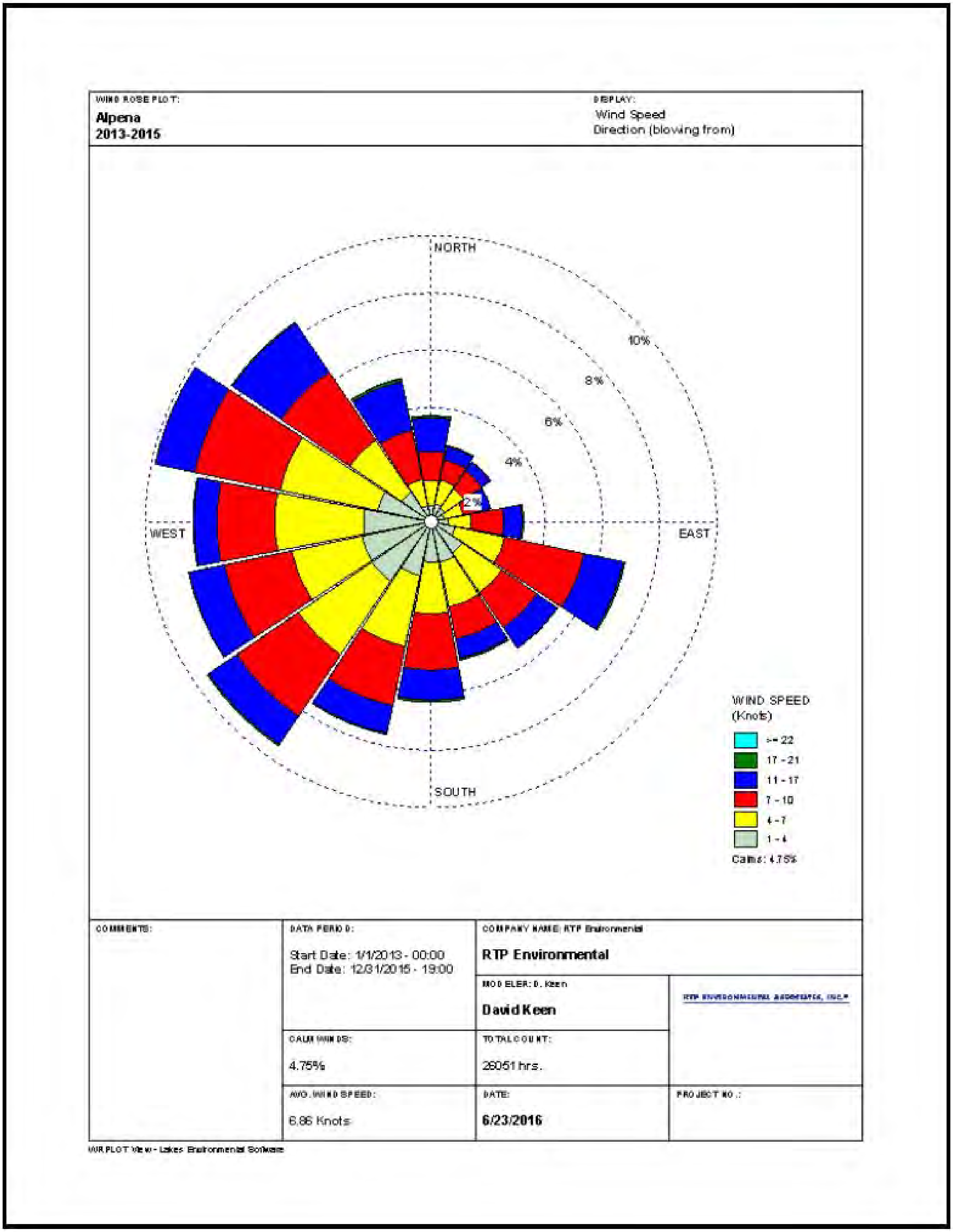

Figure 9. Alpena 2013-2015 Wind Rose

facility (Figure 10). The meteorological data collected at this site are representative of the Lafarge study area based upon the proximity of the site and the lack of significant terrain. The data are also current.

Since the Lafarge facility is located on the shore of Lake Huron, a discussion of the potential for lake effects will be provided in the final report.

3.7 Output Options

The output options will be specified to generate graph files of concentrations for each pollutant and averaging period. Modeled concentrations will not be rounded or truncated when compared to the NAAQS.

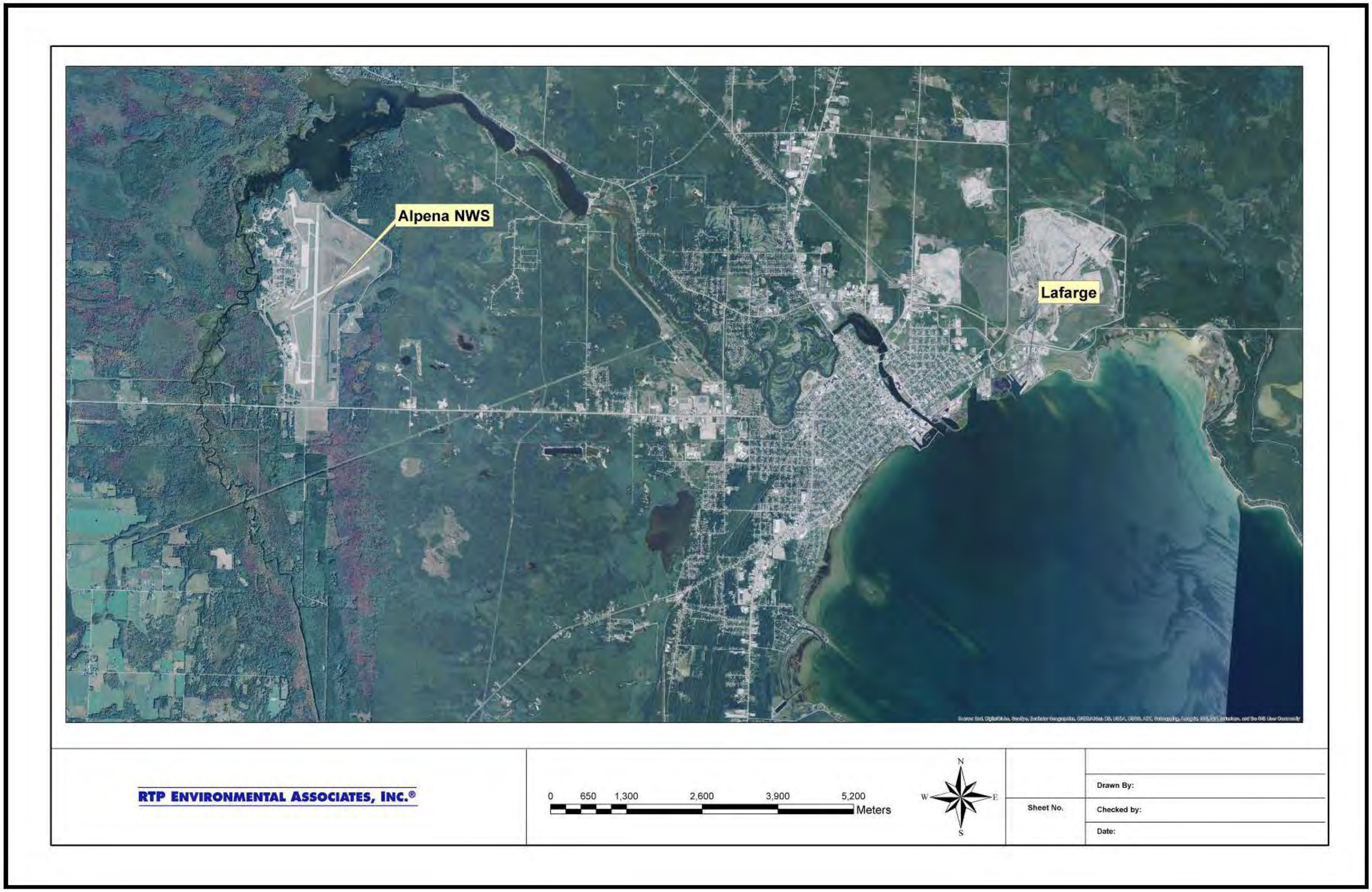

Figure 10. Location of Alpena NWS Relative to the Lafarge Facility

4.0 NAAQS COMPLIANCE ASSESSMENT AND MODEL REPORT

The three-year average of the 99th percentile maximum daily 1-hr SO_2 modeled values will be added to the background monitor values and compared to the NAAQS.

A modeling report, documenting the procedures and the results of the analysis, will be submitted to the ADEM. The report will include summary tables of results, a facility plot plan showing emission release locations, buildings, and fence lines. The plot plan will be drawn to scale. A topographical map of the area will also be submitted. Computer generated modeling results files as well as all model and BPIP input files will be submitted electronically.

REFERENCES

1. Guidelines on Air Quality Models, (Revised). Appendix W of 40 CFR Part 51, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. November 9, 2005.

2. SO_2 NAAQS Designations Modeling Technical Assistance Document (Draft), US EPA Office of Air and Radiation, August 2016.

3. Auer, Jr., A.H. "Correlation of Land Use and Cover with Meteorological Anomalies." Journal of Applied Meteorology, 17:636-643, 1978.

4. SO_2 NAAQS Designations Modeling Technical Assistance Document (Draft), US EPA Office of Air and Radiation, August 2016., pp 10 and 11.

5 See 40 CFR 51.1203(b).

6. Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for Stack Height Regulations (Revised). EPA-450/4-80-023R, U.S. Environmental Protection Agency, June 1985.

7. "Applicability of Appendix W Modeling Guidance for the 1-hr SO_2 National Ambient Air Quality Standard", U.S. Environmental Protection Agency, August 23, 2010.

8. June 23, 2016 Telecon, Stephanie Hengesbach, MDEQ, and David Keen, RTP Environmental.