FINAL REPORT

TEESWATER CONCRETE WATSON PIT APPLICATION

MOUNT FOREST, ONTARIO

AIR QUALITY ASSESSMENT
RWDI # 2401387
January 23, 2024

SUBMITTED TO

Aaron Armstrong
Manager
aaron@teeswaterconcrete.com

Teeswater Concrete
1201 Bruce County Road 6
Teeswater, Ontario N0G 2S0

SUBMITTED BY

Brian G. Sulley, B.A.Sc., P.Eng.
Technical Director, Principal
Brian.Sulley@rwdi.com

Claire Finoro P.Eng., PMP
Project Manager
Claire.Finoro@rwdi.com

RWDI AIR Inc.
Consulting Engineers & Scientists
600 Southgate Drive
Guelph, Ontario N1G 4P6
T: 519.823.1311
F: 519.823.1316

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

RWDI was retained by Teeswater Concrete to complete an air quality assessment in support of an Official Plan Amendment and Zoning By-Law Amendment with an Aggregate Resources Act (ARA) Category 1, Class A License application for a proposed pit extension to the existing Teeswater Watson Pit. The new application will extend current operations at the adjacent licensed site. This assessment quantifies and evaluates air quality impacts from the various air emission sources for the proposed pit extension operations. These sources included aggregate material handling and processing and all associated equipment.

2 SITE DESCRIPTION & OPERATIONS

The current Teeswater Concrete Watson Pit is located at 311804 Highway 6 in Mount Forest, Ontario. The site will operate from 6:00 AM – 7:00 PM Monday through Friday and 7.00 AM to 3.00 PM on Saturdays with an annual maximum extraction limit of approximately 750,000 tonnes. The proposed pit extension will ship aggregate material year-round but in general peak operations align with construction season, typically starting in April or early May, and ending in November or early December. The extraction and handling of aggregate materials will be completed by a combination of front-end loaders, haul trucks, field conveyors, and an excavator. Aggregate crushing and wash plants will be used to process the aggregates for various markets and will be powered by a combination of line power and generator. The final product mixes will be a blend of washed sands and gravels, granular materials for road base, and specialty sand products **Figure 1** illustrates the location of the site and the proposed phasing of the proposed pit extension.

3 SENSITIVE RECEPTOR LOCATIONS

There are various rural homes located around the proposed Pit extension. The nearest significant sensitive receptors are located east of the subject site along Highway 6. Additional residences were also considered along Grey Road 9, Concession Road 2, and 49 Road. These sensitive receptors were included as the basis for the assessment. These receptor locations are shown on **Figure 1**.

4 CONTAMINANTS & SOURCES

The primary contaminant of interest is airborne dust generated by operations at the site. The following key components of dust were modelled:

- Suspended particulate matter, which consists of particles with an aerodynamic diameter of 44 micrometres (µm) or less (known as TSP);
- Inhalable particulate matter, which consists of particles with an aerodynamic diameter of 10 micrometres (µm) or less (known as PM_{10});
- Crystalline silica within the PM_{10} portion of the dust; and,
- Respirable particulate matter, which consists of particles with an aerodynamic diameter of 2.5 micrometres (µm) or less (known as $PM_{2.5}$).

In addition to dust, on-site vehicles and heavy equipment also emit products of combustion. Nitrogen dioxide gas (NO_2), TSP, PM_{10}, and $PM_{2.5}$ were modelled as the key representatives of combustion products.

The potential sources of emissions in the Pit are as follows:

- Overburden stripping and rehabilitation operations;
- Extraction of sand and gravel from the working face by excavator;
- Material handling operations (dumping material at the processing and wash plant, and loading highway trucks at the plant for shipping);
- Equipment travel over unpaved surfaces (front-end loaders and highway trucks);
- Material crushing, screening, and stockpiling; and,
- Tailpipe emissions from on-site vehicles, heavy equipment, and the crusher and screen deck engine.

Figure 2 presents modelled source locations for operations in representative locations.

5 EMISSION CALCULATIONS

Emissions were estimated in accordance with relevant guidance, using published emission factors. Detailed emission calculations are provided in the appendices to this report. The appendices contain details on assumptions, equipment types, sample calculations, and other details that provide clarity as to RWDI's methodology. The emissions from sources that are wind-speed dependent (e.g., material handling) were calculated on an hour-by-hour basis, using the wind speed for each hour in the meteorological record. The emission values shown in the appendices for the wind-speed dependent emissions sources are example values, based on the average wind speed from the meteorological data.

6 DISCUSSION OF MITIGATION MEASURES

The volume of truck and heavy equipment movement on unpaved surfaces within the proposed extension require above-average level of control, especially when operations are near sensitive receptors.

The 95% level of control used in the assessment for dust on the internal haul route is an outcome of the modelling, not an input assumption requiring justification. It represents the level of control found to be needed to achieve acceptable results at the nearest receptors. Published studies show that it is achievable. Rosbury (1985)[1] summarized results from various studies showing that levels of control as high as 98% were attained in some cases. Rosbury went on to prescribe a watering rate that would achieve near 100% control (approximately 1.7 L/m²/h). The U.S. EPA (AP-42, Chapter 13.2.2) showed that by maintaining a road surface moisture level of five times that of the ambient soil, a 95% level of control could be achieved. It is clear, therefore, that the 95% level of control prescribed by RWDI is attainable through sufficient watering. This finding of the studies is consistent with RWDI's experience in observing the effect of intensive watering programs.

[1] Rosbury, Keith D. "Dust Control at Hazardous Waste Sites". Hazardous Waste Engineering Research Laboratory, Office of Research and Development, U.S. EPA. EPA/540/2-85/003,

The dispersion modelling analysis reflects the implementation of controls. The location of modelled sources also reflects the application of specific controls when extraction is occurring and winds are blowing toward that receptor under dry conditions.

7 ATMOSPHERIC DISPERSION MODELLING

The dispersion modelling was conducted to confirm that the proposed dust control recommendations will be sufficient to control off-site impacts at the sensitive impact locations. The modelling was conducted in accordance with MECP Guideline A11: Air Dispersion Modelling Guideline for Ontario, using the U.S. EPA AERMOD dispersion model, version 22112. AERMOD assesses multiple sources of emissions at discrete off-site receptors and is the current state-of-the-art regulatory model in Ontario.

Site-specific Meteorological Data for version 22112 was requested from the Ministry of Environment and Climate Change and were used within the model, in accordance with section 13 of Ontario Regulation 419/05. Terrain information for the site was also obtained from the MECP, in accordance with Guideline A11, but base elevations for sources within the site reflect the pit floor or appropriate elevations as provided by the proponent.

The model was run using the regulatory default options, without the addition of the dry depletion algorithms for particulate matter. The AERMOD model produced 1-hour, 24-hour, and annual average concentrations, as appropriate for each contaminant. As a conservative simplification, all sources were modelled as operating over the entire year, when in fact peak extraction and processing operations do not occur for the entire year, as noted in **Section 2**.

Handling and processing sources were generally modelled using volume sources, in accordance with guidance from the National Stone Sand and Gravel Association (NSSGA)[2]. Haul routes and heavy equipment movement were modelled using adjacent volume sources, in accordance with the MECP and NSSGA. Point sources were modelled using the appropriate source parameters.

The dispersion modelling files are available electronically upon request.

8 LOCAL EMISSION SOURCES

Environment Canada's National Pollutant Release Inventory (NPRI) is Canada's legislated, publicly accessible inventory of pollutant releases. Data for 2022 (the most recent available at the time of this report) was reviewed for locally significant emission sources that would have similar emission profiles to the Pit. There are no facilities reporting emissions to NPRI within five (5) kilometers of the Pit.

With respect to other aggregate operations near the subject site, impacts from such operations are more localized, and, in RWDI's experience, are typically indistinguishable from regional background air quality levels at distances beyond one (1) kilometer. As a conservative measure, RWDI used two (2) kilometres for this review. The Ministry of Natural Resources and Forestry Pits and Quarries Online tool, as well as aerial photography for the area, was used to identify other aggregate operations. It was confirmed that there were no other licensed pits located within a 2 km radius of the site.

[2] National Stone Sand and Gravel Association, "Modeling Fugitive Dust Sources with AERMOD", January 2007.

9 BACKGROUND AIR QUALITY

Background ambient air monitoring data was used in conjunction with the emissions from the proposed operations. For the purposes of this assessment, 90th percentile background concentrations of particulate matter, nitrogen dioxide, and ozone were obtained from an MECP monitoring station that most closely resembles the land uses in the region surrounding the site. For this purpose, MECP Station 62601, located in Simcoe was used.

The use of historical data from a representative monitoring station operated by the MECP somewhere in the surrounding region is a widely accepted approach to estimating background air quality conditions. In the present case, the most representative station would be one that is in a rural location, without significant built-up areas, major industrial sources, or other aggregate operations nearby. There are no such monitoring stations operating anywhere in Southern Ontario. Therefore, the decision was made to use monitoring data from a station located in a rural environment, but with more local sources of air emissions. The Simcoe monitoring station is located less than 2 km from the former Town of Simcoe, which has many smaller sources of air emissions, including the local road network and small industries. The station is also located approximately 15 km west northwest of the Stelco Inc. Lake Erie Works and approximately 18 km west of the Imperial Oil Nanticoke Refinery. Given the lack of built-up areas or any significant industry near the subject site, the Simcoe data set is expected to provide a reasonable and conservative estimate of background air quality levels.

This data is provided on **Table 1**. TSP and PM_{10} were estimated from station measured $PM_{2.5}$ data using factors derived from the analysis of extensive monitoring data from other sites, as presented by the 2004 report by Lall et. al.[3]. Silica was estimated using published data for cities in the northeast U.S.[4].

10 CHEMICAL REACTIONS AMONG CONTAMINANTS

The only chemical reaction among the emitted contaminants of relevance to local air quality impacts is the conversion of nitric oxide (NO) to nitrogen dioxide (NO_2). Oxides of nitrogen (NO_X) emitted in diesel exhaust are composed primarily of NO. However, once the exhaust is emitted to the atmosphere and begins to mix with outside air, some of the NO is oxidized in reactions with other contaminants, principally ground-level ozone (O_3), to produce NO_2. This is important to the cumulative effects assessment, as the criteria used in this assessment apply only to NO_2, which has a much greater toxicity than NO.

The Ozone Limiting Method (OLM) was used in the cumulative effects assessment to estimate the maximum short-term NO_2 concentrations resulting from emissions of NO_X. The OLM assumes that the conversion of NO to NO_2 is limited only by the amount of O_3 present in the outside air. If the concentration of available O_3 (ppb) is less than that of the NO contributed by the modelled roadway emissions, then the portion of NO that is converted to NO_2 equals the available O_3. If the concentration of available O_3 exceeds that of the NO contributed by the modelled roadway, then all NO is converted to NO_2.

[3] Lall, R., M. Kendall, K. Ito and G. D. Thurston (2004). Estimation of Historical Annual $PM_{2.5}$ Exposures for Health Effects Assessments, Atmos. Env., 38, pp. 5217-5226.
[4] United States Environmental Protection Agency (1996). Ambient Levels and Noncancer Health effects of Inhaled Crystalline Silica and Amorphous Silica: Health Issue Assessment. EPA/600/R-95-115.

This calculation is performed in the AERMOD dispersion model. A simplified version of the OLM was used to estimate the short-term concentration of NO_2 resulting from emissions of NOX. Concentrations of NO_X predicted by AERMOD are converted to NO_2 based on the background ozone concentration. To represent background ozone conditions, 99th percentile ozone concentrations by hour of day were derived from measurements recorded by the MECP at the Newmarket monitoring station. The portion of emitted total NO_X that is already in the form of NO_2 before exiting the tailpipe was estimated to be 10%.

11 RESULTS

The results of the assessment are presented in **Tables 2a and 2b** for the following scenarios:

Scenario A: Extraction of aggregate from Phase 1A.
Scenario B: Simultaneous extraction of aggregate from Phase 1A, 1B, and 1C.

Maximum predicted concentrations from the proposed pit extension are below the relevant criteria for all contaminants at the modelled receptors, with the recommended dust control measures in place.

When the 90th percentile background concentration from the Simcoe ambient monitoring station was added to the predicted impacts from operations at the proposed pit extension, the cumulative concentrations continue to be below the relevant criteria for all contaminants at nearby receptors. As 90th percentile 24-hour values for NO_2 are not available, the 90th percentile 1-hour values were used as background concentrations for the 24-hour modelling results, which is conservative.

Based on these modelling results, the proposed pit extension is not predicted to cause a significant air quality impact, with appropriate mitigation measures in place.

12 RECOMMENDATIONS

The pit must operate in accordance with the operating standards pertaining to dust outlined in section 0.12 (2) Ontario Regulation 244/97, which include:

- The licensee or permittee shall apply water or another provincially approved dust suppressant to internal haul roads and processing areas, as necessary to mitigate dust, if the pit or quarry is located within 1,000 metres of a sensitive receptor.
- The licensee or permittee shall equip any processing equipment that creates dust with dust suppressing or collection devices if it is located within 300 metres of a sensitive receptor.
- The licensee or permittee shall obtain an environmental compliance approval under the Environmental Protection Act where required to carry out operations at the pit or quarry.

Furthermore, this assessment is based on the following recommendation, which is to be included in the Site Plans:

- The site will operate in accordance with Teeswater's Best Management Practices Plan for The Control of Fugitive Dust Emissions, which may be amended from time to time, considering actual impacts and operational considerations. The recommendations in the BMPP are based on the maximum daily production rates. At lower production rates, the control measures specified in the BMPP can be reduced accordingly, provided dust remains mitigated on site.

13 RECOMMENDED MANAGEMENT PRACTICES

RWDI also recommends the following mitigation measures be incorporated into the BMPP:

- Excavation
  - Excavation and loading operations should be monitored hourly when all of the following criteria are met:
    - Dry weather is anticipated;
    - Winds are anticipated to be blowing towards the residence.
  - If visible dust is observed under these conditions, these operations shall be reduced, or additional mitigation measures shall be undertaken, such that visible dust is prevented from leaving the site.
  - The excavation rate shall not exceed 4,000 tonnes/day.
- Portable Plant
  - The portable plant may only operate within the area shown on the Site Plans.
  - The processing plant shall be equipped with a water spray system. Spray bars shall be located at the crushers and screen.
  - Watering rate will be set as needed to suppress visible dust.
  - For screenings and other high-fines materials, stackers will be kept as close to the tops of stockpiles as is feasible, to achieve a drop height of approximately 1m or less.
  - The dry processing rate shall not exceed 4,000 tonnes/day.
- Unpaved Haul Roads
  - A water truck and sufficient water supply or other type of approved dust suppression like calcium chloride shall be used to all significant unpaved traffic areas.
  - The watering system shall be able to deliver the water evenly over the haul route surface and shall have the capacity to deploy water on all active haul routes at a rate of at least 1.5 L/m^2/hour.
  - The actual watering rate shall vary, depending on surface moisture conditions and traffic conditions, and shall be triggered by the Operational Watering Forecasting guidance provided in the BMPP.
  - At the start of each day, prior to trucks accessing the haul routes, the travel surfaces will be inspected, and water will be applied if dry conditions are found.
  - A speed limit of 20 km/h shall be posted near the site entrance. Haul truck and highway truck operators will be directed to observe the speed limit.

Specific mitigation measures are not normally listed on the Site Plans, as the BMPP contains provisions for periodic review and updates based on operating experience.

14 CONCLUSIONS

Based on these conservative modelling results, the predicted impacts associated with the proposed Watson Pit Application will remain below the relevant air quality criteria at all receptors. As a result, the proposed Watson Pit Application is not expected to pose a risk of adverse impacts to surrounding sensitive receptors, with appropriate mitigation measures in place.

RWDI aims to accommodate. If you require this document in a different format in order to aid accessibility, please contact the sender of this document, email solutions@rwdi.com or call +1.519.823.1311

TABLES

Table 1: Ambient Air Quality Data

Project 2401387

Year	TSP [2]		PM10 [2]	Silica	PM2.5		NO2 [4]						O3 [4]	
	90th Percentile 24-hour	Annual Average	90th Percentile 24-hour	90th Percentile 24-hour [3]	90th Percentile 24-hour	Annual Average	90th Percentile 1-Hour		90th Percentile 24-Hour		Annual Average		99th Percentile 1-Hour	
	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(ppb)	(µg/m³)	(ppb)	(µg/m³)	(ppb)	(µg/m³)	(ppb)	(µg/m³)
2017	49	23	27	1.6	14.7	6.8	6.0	12	11.6	23	7.2	14	59	122
2018	53	24	30	1.8	16	7.3	6.0	12	11	22	6.3	12	63	130
2019	43	21	24	1.4	13	6.4	6.0	12	12	24	6.3	13	57	118
2020	37	19	20	1.2	11	5.8	5.0	10	10	20	5.5	11	59	122
2021	40	22	22	1.3	12	6.5	5.0	10	11	22	5.6	11	60	124
Average	43	22	24	1.4	13	6.5	6	11	11	22	6	12	60	112

Notes:

[1] All data from NAPS Station 32601 in Simcoe, Ontario, downloaded from:
https://donnees-data.ec.gc.ca/data/air/monitor/national-air-pollution-surveillance-naps-program/Data-Donnees/?lang=en

[2] Estimated from $PM_{2.5}$ measurements using published factors (Lall et al., 2004)

[3] Estimated as 6% of PM_{10}, from published data for cities in the northeast US (U.S. EPA, 1996)

[4] Conversion from ppb to µg/m³ based on 10°C

Revision Date: 2023-10-26

Table 2a: Cumulative Effects Analysis with Mitigation_Phase 1A

RWDI Project 2401387

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R01	Residence	516,622	4,876,209	TSP	24	120	9	7%	52	43%
					Annual	60	0.4	1%	22	37%
				PM10	24	50	3.6	7%	28	55%
				Silica (<10µm)	24	5	0.4	7%	1.8	35%
				PM2.5	24	27	2.0	7%	15	55%
					Annual	8.8	0.13	1%	6.6	75%
				NO2	1	400	146	36%	157	39%
					24	200	24.3	12%	46	23%
					Annual	40	0.95	2%	13	32%
R02	Residence	516,665	4,876,383	TSP	24	120	11	9%	54	45%
					Annual	60	0.5	1%	23	38%
				PM10	24	50	5.4	11%	29	59%
				Silica (<10µm)	24	5	0.56	11%	2.0	39%
				PM2.5	24	27	2.5	9%	15	57%
					Annual	9	0.16	2%	6.7	76%
				NO2	1	400	161	40%	172	43%
					24	200	30.7	15%	53	26%
					Annual	40	1.20	3%	13	33%
R03	Residence	516,665	4,876,423	TSP	24	120	12	10%	55	45%
					Annual	60	0.6	1%	23	38%
				PM10	24	50	5.3	11%	29	59%
				Silica (<10µm)	24	5	0.5	11%	1.9	39%
				PM2.5	24	27	2.5	9%	15	57%
					Annual	8.8	0.17	2%	6.7	76%
				NO2	1	400	167	42%	178	45%
					24	200	32.3	16%	54	27%
					Annual	40	1.26	3%	13	33%
R04	Residence	516,603	4,876,581	TSP	24	120	10	9%	53	45%
					Annual	60	0.8	1%	23	38%
				PM10	24	50	4.8	10%	29	58%
				Silica (<10µm)	24	5	0.54	11%	1.9	39%
				PM2.5	24	27	3.2	12%	16	60%
					Annual	9	0.22	3%	6.7	76%
				NO2	1	400	187	47%	198	49%
					24	200	34.4	17%	56	28%
					Annual	40	1.76	4%	14	34%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R05	Residence	516,559	4,876,816	TSP	24	120	16	13%	59	49%
					Annual	60	1.1	2%	23	38%
				PM10	24	50	7.3	15%	31	63%
				Silica (<10µm)	24	5	0.7	15%	2.1	43%
				PM2.5	24	27	3.9	14%	17	63%
					Annual	8.8	0.30	3%	6.8	77%
				NO2	1	400	250	62%	261	65%
					24	200	44.8	22%	67	33%
					Annual	40	2.50	6%	14	36%
R06	Residence	516,511	4,877,012	TSP	24	120	17	14%	60	50%
					Annual	60	1.3	2%	23	39%
				PM10	24	50	8.4	17%	32	65%
				Silica (<10µm)	24	5	0.87	17%	2.3	45%
				PM2.5	24	27	4.8	18%	18	66%
					Annual	9	0.39	4%	6.9	78%
				NO2	1	400	305	76%	316	79%
					24	200	46.4	23%	68	34%
					Annual	40	3.28	8%	15	38%
R07	Residence	515,712	4,877,414	TSP	24	120	19	16%	62	52%
					Annual	60	0.9	1%	23	38%
				PM10	24	50	6.5	13%	31	61%
				Silica (<10µm)	24	5	0.7	14%	2.1	42%
				PM2.5	24	27	3.4	13%	16	61%
					Annual	8.8	0.13	2%	6.6	75%
				NO2	1	400	210	52%	221	55%
					24	200	35.5	18%	57	29%
					Annual	40	1.27	3%	13	33%
R08	Residence	515,633	4,877,383	TSP	24	120	14	12%	57	48%
					Annual	60	0.7	1%	23	38%
				PM10	24	50	5.4	11%	29	59%
				Silica (<10µm)	24	5	0.56	11%	2.0	39%
				PM2.5	24	27	2.7	10%	16	58%
					Annual	9	0.12	1%	6.6	75%
				NO2	1	400	195	49%	206	52%
					24	200	30.1	15%	52	26%
					Annual	40	1.10	3%	13	33%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R09	Residence	515,545	4,877,397	TSP	24	120	9	8%	52	44%
					Annual	60	0.5	1%	22	37%
				PM10	24	50	3.7	7%	28	55%
				Silica (<10µm)	24	5	0.4	8%	1.8	36%
				PM2.5	24	27	1.9	7%	15	55%
					Annual	8.8	0.09	1%	6.6	75%
				NO2	1	400	152	38%	163	41%
					24	200	21.0	10%	43	21%
					Annual	40	0.87	2%	13	32%
R10	Residence	515,302	4,877,457	TSP	24	120	8	7%	51	42%
					Annual	60	0.3	0%	22	37%
				PM10	24	50	3.3	7%	27	55%
				Silica (<10µm)	24	5	0.33	7%	1.7	35%
				PM2.5	24	27	1.8	7%	15	55%
					Annual	9	0.05	1%	6.6	74%
				NO2	1	400	120	30%	131	33%
					24	200	19.7	10%	42	21%
					Annual	40	0.53	1%	13	31%
R11	Residence	515,181	4,877,171	TSP	24	120	5	5%	48	40%
					Annual	60	0.3	0%	22	37%
				PM10	24	50	2.3	5%	26	53%
				Silica (<10µm)	24	5	0.2	5%	1.6	33%
				PM2.5	24	27	1.3	5%	14	53%
					Annual	8.8	0.06	1%	6.6	74%
				NO2	1	400	127	32%	138	34%
					24	200	14.9	7%	37	18%
					Annual	40	0.54	1%	13	31%
R12	Residence	514,658	4,877,059	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.7	3%	26	51%
				Silica (<10µm)	24	5	0.16	3%	1.6	31%
				PM2.5	24	27	0.9	3%	14	52%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	83	21%	94	23%
					24	200	12.5	6%	35	17%
					Annual	40	0.23	1%	12	31%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R13	Residence	514,518	4,877,046	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.6	3%	26	51%
				Silica (<10µm)	24	5	0.2	3%	1.6	31%
				PM2.5	24	27	0.9	3%	14	51%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	73	18%	84	21%
					24	200	11.8	6%	34	17%
					Annual	40	0.20	0%	12	30%
R14	Residence	514,413	4,877,095	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.3	3%	25	51%
				Silica (<10µm)	24	5	0.12	2%	1.5	30%
				PM2.5	24	27	0.7	3%	14	51%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	68	17%	79	20%
					24	200	9.5	5%	31	16%
					Annual	40	0.18	0%	12	30%
R15	Residence	514,241	4,876,999	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.6	3%	26	51%
				Silica (<10µm)	24	5	0.1	3%	1.5	31%
				PM2.5	24	27	0.9	3%	14	51%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	59	15%	70	17%
					24	200	10.8	5%	33	16%
					Annual	40	0.15	0%	12	30%
R16	Residence	514,056	4,876,973	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.5	3%	25	51%
				Silica (<10µm)	24	5	0.14	3%	1.5	31%
				PM2.5	24	27	0.8	3%	14	51%
					Annual	9	0.01	0%	6.5	74%
				NO2	1	400	55	14%	66	16%
					24	200	9.9	5%	32	16%
					Annual	40	0.13	0%	12	30%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R17	Residence	514,198	4,876,718	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.6	3%	26	51%
				Silica (<10µm)	24	5	0.2	3%	1.6	31%
				PM2.5	24	27	0.9	3%	14	51%
					Annual	8.8	0.01	0%	6.5	74%
				NO2	1	400	56	14%	67	17%
					24	200	9.9	5%	32	16%
					Annual	40	0.13	0%	12	30%
R18	Residence	514,283	4,876,550	TSP	24	120	3	2%	46	38%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.2	2%	25	50%
				Silica (<10µm)	24	5	0.12	2%	1.5	30%
				PM2.5	24	27	0.7	3%	14	51%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	79	20%	90	23%
					24	200	9.2	5%	31	16%
					Annual	40	0.15	0%	12	30%
R19	Residence	513,968	4,876,233	TSP	24	120	2.50	2%	45	38%
					Annual	60	0.05	0%	22	37%
				PM10	24	50	1.15	2%	25	50%
				Silica (<10µm)	24	5	0.12	2%	1.5	30%
				PM2.5	24	27	0.65	2%	14	51%
					Annual	8.8	0.01	0%	6.5	74%
				NO2	1	400	72.92	18%	84	21%
					24	200	5.90	3%	28	14%
					Annual	40	0.12	0%	12	30%
R20	Residence	514,531	4,875,422	TSP	24	120	2	2%	45	38%
					Annual	60	0.0	0%	22	37%
				PM10	24	50	1.1	2%	25	50%
				Silica (<10µm)	24	5	0.11	2%	1.5	30%
				PM2.5	24	27	0.6	2%	14	50%
					Annual	9	0.01	0%	6.5	74%
				NO2	1	400	73	18%	84	21%
					24	200	6.3	3%	28	14%
					Annual	40	0.09	0%	12	30%
				TSP	24	120	2	2%	45	37%
					Annual	60	0.0	0%	22	37%
				PM10	24	50	0.7	1%	25	49%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R21	Residence	514,652	4,875,363	Silica (<10µm)	24	5	0.1	1%	1.5	29%
				PM2.5	24	27	0.4	2%	13	50%
					Annual	8.8	0.01	0%	6.5	74%
				NO2	1	400	69	17%	80	20%
					24	200	4.6	2%	27	13%
					Annual	40	0.09	0%	12	30%
R22	Residence	514,741	4,875,396	TSP	24	120	2	2%	45	38%
					Annual	60	0.0	0%	22	37%
				PM10	24	50	0.9	2%	25	50%
				Silica (<10µm)	24	5	0.09	2%	1.5	30%
				PM2.5	24	27	0.5	2%	14	50%
					Annual	9	0.01	0%	6.5	74%
				NO2	1	400	75	19%	86	22%
					24	200	5.6	3%	28	14%
					Annual	40	0.10	0%	12	30%
R23	Residence	514,862	4,875,399	TSP	24	120	2.66	2%	46	38%
					Annual	60	0.05	0%	22	37%
				PM10	24	50	1.21	2%	25	50%
				Silica (<10µm)	24	5	0.12	2%	1.5	30%
				PM2.5	24	27	0.74	3%	14	51%
					Annual	8.8	0.01	0%	6.5	74%
				NO2	1	400	80.97	20%	92	23%
					24	200	7.37	4%	29	15%
					Annual	40	0.11	0%	12	30%
R24	Residence	514,912	4,875,405	TSP	24	120	3	2%	46	38%
					Annual	60	0.0	0%	22	37%
				PM10	24	50	1.3	3%	25	51%
				Silica (<10µm)	24	5	0.13	3%	1.5	31%
				PM2.5	24	27	0.8	3%	14	51%
					Annual	9	0.01	0%	6.5	74%
				NO2	1	400	89	22%	100	25%
					24	200	7.7	4%	30	15%
					Annual	40	0.11	0%	12	30%
R25	Residence	514,974	4,875,412	TSP	24	120	3	2%	46	38%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.3	3%	25	51%
				Silica (<10µm)	24	5	0.1	3%	1.5	31%
				PM2.5	24	27	0.8	3%	14	51%
					Annual	8.8	0.01	0%	6.5	74%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
				NO2	1	400	92	23%	103	26%
					24	200	7.8	4%	30	15%
					Annual	40	0.12	0%	12	30%
R26	Residence	515,026	4,875,560	TSP	24	120	3	3%	46	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.5	3%	26	51%
				Silica (<10µm)	24	5	0.15	3%	1.6	31%
				PM2.5	24	27	1.0	4%	14	52%
					Annual	9	0.01	0%	6.5	74%
				NO2	1	400	104	26%	115	29%
					24	200	9.2	5%	31	16%
					Annual	40	0.14	0%	12	30%
R27	Residence	515,096	4,875,638	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.8	4%	26	52%
				Silica (<10µm)	24	5	0.2	4%	1.6	32%
				PM2.5	24	27	1.1	4%	14	52%
					Annual	8.8	0.01	0%	6.5	74%
				NO2	1	400	130	32%	141	35%
					24	200	10.8	5%	33	16%
					Annual	40	0.14	0%	12	30%
R28	Residence	515,198	4,875,480	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.6	3%	26	51%
				Silica (<10µm)	24	5	0.16	3%	1.6	31%
				PM2.5	24	27	0.8	3%	14	51%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	105	26%	116	29%
					24	200	11.1	6%	33	17%
					Annual	40	0.16	0%	12	30%
R29	Residence	515,254	4,875,682	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.7	3%	26	51%
				Silica (<10µm)	24	5	0.2	3%	1.6	31%
				PM2.5	24	27	1.1	4%	14	52%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	121	30%	132	33%
					24	200	10.7	5%	33	16%
					Annual	40	0.19	0%	12	30%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R30	Residence	515,409	4,875,745	TSP	24	120	5	5%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	2.4	5%	26	53%
				Silica (<10µm)	24	5	0.23	5%	1.6	33%
				PM2.5	24	27	1.2	4%	14	53%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	134	34%	145	36%
					24	200	15.7	8%	38	19%
					Annual	40	0.24	1%	12	31%
R31	Residence	515,539	4,875,533	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.6	3%	26	51%
				Silica (<10µm)	24	5	0.2	3%	1.6	31%
				PM2.5	24	27	0.9	3%	14	51%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	122	31%	133	33%
					24	200	10.4	5%	32	16%
					Annual	40	0.23	1%	12	31%
R32	Residence	515,684	4,875,620	TSP	24	120	8	6%	51	42%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	3.2	6%	27	54%
				Silica (<10µm)	24	5	0.32	6%	1.7	34%
				PM2.5	24	27	1.7	6%	15	54%
					Annual	9	0.03	0%	6.5	74%
				NO2	1	400	133	33%	144	36%
					24	200	19.4	10%	41	21%
					Annual	40	0.27	1%	12	31%
R33	Residence	516,177	4,875,479	TSP	24	120	3	3%	46	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.5	3%	25	51%
				Silica (<10µm)	24	5	0.1	3%	1.5	31%
				PM2.5	24	27	0.8	3%	14	51%
					Annual	8.8	0.03	0%	6.5	74%
				NO2	1	400	86	22%	97	24%
					24	200	8.9	4%	31	15%
					Annual	40	0.22	1%	12	31%
				TSP	24	120	10	8%	53	44%
					Annual	60	0.5	1%	22	37%
				PM10	24	50	4.7	9%	29	57%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R34	Residence	516,572	4,877,743	Silica (<10µm)	24	5	0.45	9%	1.8	37%
				PM2.5	24	27	3.0	11%	16	59%
					Annual	9	0.12	1%	6.6	75%
				NO2	1	400	218	54%	229	57%
					24	200	33.1	17%	55	28%
					Annual	40	0.97	2%	13	32%
R35	Residence	516,479	4,877,713	TSP	24	120	11	9%	54	45%
					Annual	60	0.5	1%	23	38%
				PM10	24	50	4.9	10%	29	58%
				Silica (<10µm)	24	5	0.5	9%	1.9	37%
				PM2.5	24	27	3.0	11%	16	59%
					Annual	8.8	0.13	1%	6.6	75%
				NO2	1	400	238	59%	249	62%
					24	200	33.6	17%	56	28%
					Annual	40	1.06	3%	13	33%

Revision Date: 2024-01-16

Prepared by: Arman

Table 2b: Cumulative Effects Analysis with Mitigation_Phase 1A, 1B, & 1C

RWDI Project 2401387

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R01	Residence	516,622	4,876,209	TSP	24	120	12	10%	55	46%
					Annual	60	0.7	1%	23	38%
				PM10	24	50	5.0	10%	29	58%
				Silica (<10µm)	24	5	0.4	9%	1.8	37%
				PM2.5	24	27	3.2	12%	16	60%
					Annual	8.8	0.23	3%	6.7	77%
				NO2	1	400	262	65%	273	68%
					24	200	43.2	22%	65	33%
					Annual	40	2.35	6%	14	36%
R02	Residence	516,665	4,876,383	TSP	24	120	16	13%	59	49%
					Annual	60	0.8	1%	23	38%
				PM10	24	50	7.5	15%	31	63%
				Silica (<10µm)	24	5	0.65	13%	2.0	41%
				PM2.5	24	27	4.3	16%	17	64%
					Annual	9	0.27	3%	6.8	77%
				NO2	1	400	288	72%	299	75%
					24	200	55.4	28%	77	39%
					Annual	40	2.73	7%	15	37%
R03	Residence	516,665	4,876,423	TSP	24	120	15	13%	58	48%
					Annual	60	0.9	1%	23	38%
				PM10	24	50	6.8	14%	31	62%
				Silica (<10µm)	24	5	0.6	12%	2.0	40%
				PM2.5	24	27	3.8	14%	17	62%
					Annual	8.8	0.28	3%	6.8	77%
				NO2	1	400	289	72%	300	75%
					24	200	51.0	26%	73	37%
					Annual	40	2.83	7%	15	37%
R04	Residence	516,603	4,876,581	TSP	24	120	15	12%	58	48%
					Annual	60	1.2	2%	23	39%
				PM10	24	50	6.8	14%	31	62%
				Silica (<10µm)	24	5	0.60	12%	2.0	40%
				PM2.5	24	27	4.6	17%	18	65%
					Annual	9	0.38	4%	6.9	78%
				NO2	1	400	301	75%	312	78%
					24	200	53.7	27%	76	38%
					Annual	40	3.89	10%	16	40%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R05	Residence	516,559	4,876,816	TSP	24	120	18	15%	61	51%
					Annual	60	1.6	3%	24	39%
				PM10	24	50	8.1	16%	32	64%
				Silica (<10µm)	24	5	0.8	16%	2.2	44%
				PM2.5	24	27	5.2	19%	18	67%
					Annual	8.8	0.50	6%	7.0	80%
				NO2	1	400	295	74%	306	76%
					24	200	61.3	31%	83	42%
					Annual	40	5.13	13%	17	43%
R06	Residence	516,511	4,877,012	TSP	24	120	22	18%	65	54%
					Annual	60	1.8	3%	24	40%
				PM10	24	50	9.9	20%	34	68%
				Silica (<10µm)	24	5	0.92	18%	2.3	46%
				PM2.5	24	27	6.3	23%	19	71%
					Annual	9	0.56	6%	7.1	80%
				NO2	1	400	318	80%	329	82%
					24	200	73.0	37%	95	48%
					Annual	40	5.69	14%	18	44%
R07	Residence	515,712	4,877,414	TSP	24	120	22	18%	65	54%
					Annual	60	1.0	2%	23	38%
				PM10	24	50	7.7	15%	32	63%
				Silica (<10µm)	24	5	0.8	15%	2.2	43%
				PM2.5	24	27	4.5	17%	18	65%
					Annual	8.8	0.18	2%	6.7	76%
				NO2	1	400	303	76%	314	78%
					24	200	46.7	23%	69	34%
					Annual	40	2.09	5%	14	35%
R08	Residence	515,633	4,877,383	TSP	24	120	17	14%	60	50%
					Annual	60	0.8	1%	23	38%
				PM10	24	50	6.6	13%	31	61%
				Silica (<10µm)	24	5	0.62	12%	2.0	40%
				PM2.5	24	27	3.5	13%	17	61%
					Annual	9	0.16	2%	6.7	76%
				NO2	1	400	302	76%	313	78%
					24	200	44.6	22%	67	33%
					Annual	40	1.87	5%	14	35%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R09	Residence	515,545	4,877,397	TSP	24	120	12	10%	55	46%
					Annual	60	0.6	1%	23	38%
				PM10	24	50	4.8	10%	29	58%
				Silica (<10µm)	24	5	0.4	9%	1.8	37%
				PM2.5	24	27	2.7	10%	16	58%
					Annual	8.8	0.13	1%	6.6	75%
				NO2	1	400	270	68%	281	70%
					24	200	36.4	18%	58	29%
					Annual	40	1.53	4%	14	34%
R10	Residence	515,302	4,877,457	TSP	24	120	9	8%	52	44%
					Annual	60	0.4	1%	22	37%
				PM10	24	50	3.9	8%	28	56%
				Silica (<10µm)	24	5	0.36	7%	1.8	35%
				PM2.5	24	27	2.3	9%	15	57%
					Annual	9	0.08	1%	6.6	75%
				NO2	1	400	195	49%	206	51%
					24	200	29.4	15%	51	26%
					Annual	40	0.98	2%	13	32%
R11	Residence	515,181	4,877,171	TSP	24	120	7	6%	50	41%
					Annual	60	0.3	1%	22	37%
				PM10	24	50	2.9	6%	27	54%
				Silica (<10µm)	24	5	0.3	5%	1.7	33%
				PM2.5	24	27	1.7	6%	15	55%
					Annual	8.8	0.08	1%	6.6	75%
				NO2	1	400	189	47%	200	50%
					24	200	23.2	12%	45	23%
					Annual	40	1.00	2%	13	32%
R12	Residence	514,658	4,877,059	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.8	4%	26	52%
				Silica (<10µm)	24	5	0.16	3%	1.6	31%
				PM2.5	24	27	1.0	4%	14	52%
					Annual	9	0.04	0%	6.5	74%
				NO2	1	400	123	31%	134	34%
					24	200	15.1	8%	37	19%
					Annual	40	0.48	1%	12	31%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R13	Residence	514,518	4,877,046	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.8	4%	26	52%
				Silica (<10µm)	24	5	0.2	3%	1.6	31%
				PM2.5	24	27	1.0	4%	14	52%
					Annual	8.8	0.03	0%	6.5	74%
				NO2	1	400	110	28%	121	30%
					24	200	14.5	7%	37	18%
					Annual	40	0.41	1%	12	31%
R14	Residence	514,413	4,877,095	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.4	3%	25	51%
				Silica (<10µm)	24	5	0.13	3%	1.5	31%
				PM2.5	24	27	0.8	3%	14	51%
					Annual	9	0.03	0%	6.5	74%
				NO2	1	400	104	26%	115	29%
					24	200	12.5	6%	35	17%
					Annual	40	0.36	1%	12	31%
R15	Residence	514,241	4,876,999	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.8	4%	26	52%
				Silica (<10µm)	24	5	0.2	3%	1.6	31%
				PM2.5	24	27	1.0	4%	14	52%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	96	24%	107	27%
					24	200	14.8	7%	37	18%
					Annual	40	0.30	1%	12	31%
R16	Residence	514,056	4,876,973	TSP	24	120	4	4%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.7	3%	26	51%
				Silica (<10µm)	24	5	0.15	3%	1.6	31%
				PM2.5	24	27	1.0	4%	14	52%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	87	22%	98	25%
					24	200	14.5	7%	36	18%
					Annual	40	0.26	1%	12	31%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R17	Residence	514,198	4,876,718	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	2.3	5%	26	53%
				Silica (<10µm)	24	5	0.2	4%	1.6	32%
				PM2.5	24	27	1.4	5%	14	53%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	92	23%	103	26%
					24	200	20.2	10%	42	21%
					Annual	40	0.28	1%	12	31%
R18	Residence	514,283	4,876,550	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	2.1	4%	26	52%
				Silica (<10µm)	24	5	0.17	3%	1.6	31%
				PM2.5	24	27	1.4	5%	14	53%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	99	25%	110	28%
					24	200	19.5	10%	42	21%
					Annual	40	0.30	1%	12	31%
R19	Residence	513,968	4,876,233	TSP	24	120	3.47	3%	46	39%
					Annual	60	0.07	0%	22	37%
				PM10	24	50	1.52	3%	26	51%
				Silica (<10µm)	24	5	0.14	3%	1.5	31%
				PM2.5	24	27	0.95	4%	14	52%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	127.33	32%	138	35%
					24	200	12.91	6%	35	17%
					Annual	40	0.23	1%	12	31%
R20	Residence	514,531	4,875,422	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.7	3%	26	51%
				Silica (<10µm)	24	5	0.14	3%	1.5	31%
				PM2.5	24	27	1.1	4%	14	52%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	167	42%	178	44%
					24	200	15.6	8%	38	19%
					Annual	40	0.22	1%	12	31%
				TSP	24	120	3	2%	46	38%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.3	3%	25	51%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R21	Residence	514,652	4,875,363	Silica (<10µm)	24	5	0.1	2%	1.5	30%
				PM2.5	24	27	0.9	3%	14	52%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	132	33%	143	36%
					24	200	12.5	6%	35	17%
					Annual	40	0.21	1%	12	31%
R22	Residence	514,741	4,875,396	TSP	24	120	3	2%	46	38%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.2	2%	25	50%
				Silica (<10µm)	24	5	0.10	2%	1.5	30%
				PM2.5	24	27	0.9	3%	14	51%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	131	33%	142	36%
					24	200	11.6	6%	34	17%
					Annual	40	0.22	1%	12	31%
R23	Residence	514,862	4,875,399	TSP	24	120	3.59	3%	47	39%
					Annual	60	0.07	0%	22	37%
				PM10	24	50	1.56	3%	26	51%
				Silica (<10µm)	24	5	0.14	3%	1.5	31%
				PM2.5	24	27	1.01	4%	14	52%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	155.58	39%	167	42%
					24	200	12.39	6%	34	17%
					Annual	40	0.24	1%	12	31%
R24	Residence	514,912	4,875,405	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.7	3%	26	51%
				Silica (<10µm)	24	5	0.15	3%	1.6	31%
				PM2.5	24	27	1.1	4%	14	52%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	162	41%	173	43%
					24	200	13.9	7%	36	18%
					Annual	40	0.25	1%	12	31%
R25	Residence	514,974	4,875,412	TSP	24	120	4	3%	47	39%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	1.9	4%	26	52%
				Silica (<10µm)	24	5	0.2	3%	1.6	31%
				PM2.5	24	27	1.3	5%	14	53%
					Annual	8.8	0.02	0%	6.5	74%

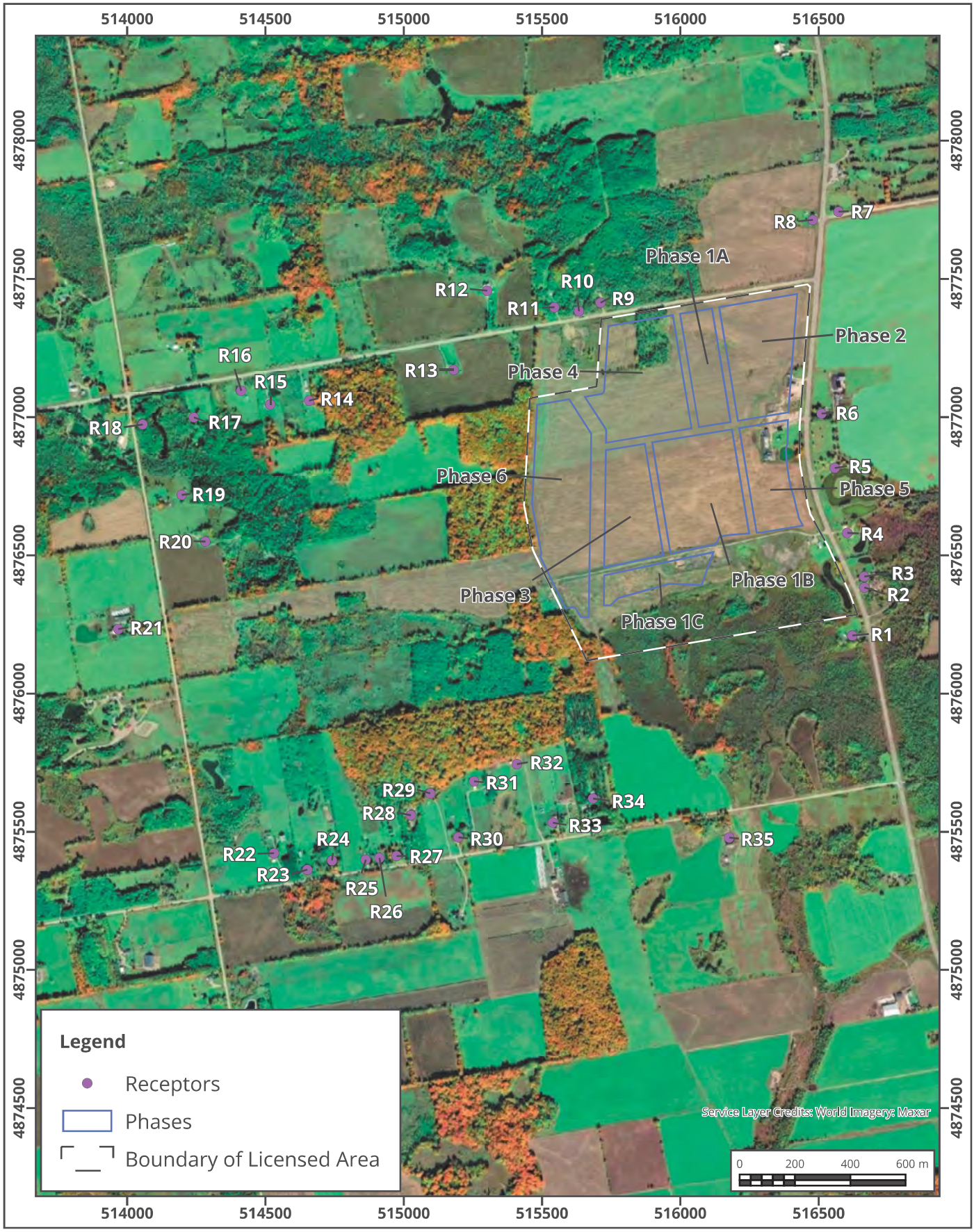
Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
				NO2	1	400	165	41%	176	44%
					24	200	15.4	8%	37	19%
					Annual	40	0.27	1%	12	31%
R26	Residence	515,026	4,875,560	TSP	24	120	4	4%	47	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	2.0	4%	26	52%
				Silica (<10µm)	24	5	0.18	4%	1.6	32%
				PM2.5	24	27	1.3	5%	14	53%
					Annual	9	0.02	0%	6.5	74%
				NO2	1	400	202	50%	213	53%
					24	200	15.8	8%	38	19%
					Annual	40	0.29	1%	12	31%
R27	Residence	515,096	4,875,638	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	2.3	5%	26	53%
				Silica (<10µm)	24	5	0.2	4%	1.6	32%
				PM2.5	24	27	1.5	6%	14	54%
					Annual	8.8	0.02	0%	6.5	74%
				NO2	1	400	230	57%	241	60%
					24	200	18.1	9%	40	20%
					Annual	40	0.31	1%	12	31%
R28	Residence	515,198	4,875,480	TSP	24	120	5	4%	48	40%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	2.1	4%	26	52%
				Silica (<10µm)	24	5	0.18	4%	1.6	32%
				PM2.5	24	27	1.3	5%	14	53%
					Annual	9	0.03	0%	6.5	74%
				NO2	1	400	185	46%	196	49%
					24	200	19.1	10%	41	21%
					Annual	40	0.35	1%	12	31%
R29	Residence	515,254	4,875,682	TSP	24	120	6	5%	49	41%
					Annual	60	0.1	0%	22	37%
				PM10	24	50	2.6	5%	27	53%
				Silica (<10µm)	24	5	0.2	5%	1.6	33%
				PM2.5	24	27	1.8	7%	15	55%
					Annual	8.8	0.03	0%	6.5	74%
				NO2	1	400	213	53%	224	56%
					24	200	21.8	11%	44	22%
					Annual	40	0.42	1%	12	31%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R30	Residence	515,409	4,875,745	TSP	24	120	8	7%	51	42%
					Annual	60	0.2	0%	22	37%
				PM10	24	50	3.3	7%	27	55%
				Silica (<10µm)	24	5	0.28	6%	1.7	34%
				PM2.5	24	27	1.9	7%	15	55%
					Annual	9	0.04	0%	6.5	74%
				NO2	1	400	239	60%	250	63%
					24	200	28.3	14%	50	25%
					Annual	40	0.53	1%	13	31%
R31	Residence	515,539	4,875,533	TSP	24	120	6	5%	49	41%
					Annual	60	0.2	0%	22	37%
				PM10	24	50	2.7	5%	27	53%
				Silica (<10µm)	24	5	0.2	4%	1.6	32%
				PM2.5	24	27	1.7	6%	15	55%
					Annual	8.8	0.04	0%	6.5	74%
				NO2	1	400	214	54%	225	56%
					24	200	26.3	13%	48	24%
					Annual	40	0.53	1%	13	31%
R32	Residence	515,684	4,875,620	TSP	24	120	12	10%	55	46%
					Annual	60	0.2	0%	22	37%
				PM10	24	50	4.8	10%	29	58%
				Silica (<10µm)	24	5	0.41	8%	1.8	36%
				PM2.5	24	27	2.9	11%	16	59%
					Annual	9	0.06	1%	6.6	74%
				NO2	1	400	247	62%	258	65%
					24	200	37.6	19%	60	30%
					Annual	40	0.65	2%	13	32%
R33	Residence	516,177	4,875,479	TSP	24	120	5	4%	48	40%
					Annual	60	0.2	0%	22	37%
				PM10	24	50	2.2	4%	26	52%
				Silica (<10µm)	24	5	0.2	4%	1.6	32%
				PM2.5	24	27	1.4	5%	14	53%
					Annual	8.8	0.05	1%	6.6	74%
				NO2	1	400	166	41%	177	44%
					24	200	20.2	10%	42	21%
					Annual	40	0.56	1%	13	31%
				TSP	24	120	13	11%	56	47%
					Annual	60	0.6	1%	23	38%
				PM10	24	50	6.0	12%	30	60%

Receptor		UTM Coordinates		Contaminant	Averaging Period	Recommended Criteria for Cumulative Effects Analysis	Without Background		With Background	
ID	Type	X (m)	Y (m)		(hours)	(µg/m³)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)	Predicted Concentration (µg/m³)	Percentage of Revelant Criteria (%)
R34	Residence	515,684	4,875,620	Silica (<10µm)	24	5	0.52	10%	1.9	38%
				PM2.5	24	27	3.9	15%	17	63%
					Annual	9	0.16	2%	6.7	76%
				NO2	1	400	272	68%	283	71%
					24	200	48.8	24%	71	35%
					Annual	40	1.54	4%	14	34%
R35	Residence	516,177	4,875,479	TSP	24	120	14	12%	57	48%
					Annual	60	0.7	1%	23	38%
				PM10	24	50	6.0	12%	30	60%
				Silica (<10µm)	24	5	0.5	11%	1.9	39%
				PM2.5	24	27	3.8	14%	17	62%
					Annual	8.8	0.17	2%	6.7	76%
				NO2	1	400	295	74%	306	77%
					24	200	44.9	22%	67	33%
					Annual	40	1.66	4%	14	34%

Revision Date: 2024-01-16
Prepared by: Arman

FIGURES



Site Location and Phasing

True North

Drawn by:	PIP	Figure:	1
Approx. Scale:			1:19,000
Date Revised:			Jan 15, 2024

Map Projection: NAD 1983 UTM Zone 17N

Watson Pit - Grey County, Ontario

Project #: 2401387

Map Document: C:\WorkingFolder\Jobs_Americas\P2401387_WatsonPit\P2401387_WatsonPit.aprx

Site Plan Showing Significant Sources and Receptors

Map Projection: NAD 1983 UTM Zone 17N

Watson Pit - Grey County, Ontario

True North

Project #: 2401387

Drawn by:	PIP	Figure:	2
Approx. Scale:		1:19,000	
Date Revised:		Jan 12, 2024	

Map Document: C:\WorkingFolder\Jobs_Americas\P2401387_WatsonPit\P2401387_WatsonPit.aprx

APPENDIX A

Appendix A: Bulk Material Handling Emissions Spreadsheet

Project #2401387

Teeswater Watson Pit

Material handling emissions: $E = 0.0016\ k\ (U / 2.2)^{1.3} / (M / 2)^{1.4}$

E emission factor
k particle size multiplier (0.8, 0.35 and 0.053 for TSP, PM_{10} and $PM_{2.5}$) [3]
U mean wind speed, meters per second (m/s)
M material moisture content (%)

AGGREGATE HANDLING AND STORAGE PILES - AP-42 Section 13.2.4

Average recorded hourly wind speed (m/s): 4.25
(used for sample calculations & factor validation)

Source ID [1]	Description	Processing Rate		Site Data				Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied	Final Controlled Emission Rate at 4.25 m/s							
		Hourly	Daily	Site Specific Data?	Silt Content	Moisture Content	Source Conditions Valid [2]	TSP	PM_{10}	$PM_{2.5}$	Silica	TSP	PM_{10}	$PM_{2.5}$	Silica		TSP	Data Quality Rating	PM_{10}	Data Quality Rating	$PM_{2.5}$	Data Quality Rating	Silica	Data Quality Rating
		(Mg/h)	(Mg/d)	(y/n)	(%)	(%)		(kg/Mg)	(kg/Mg)	(kg/Mg)	(kg/Mg)	(g/s)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)		(g/s)	
EXCVATOR1	Excavator Loading Trucks	308	4000	n	7.5%	4.8%	valid	8.8E-04	3.9E-04	1.3E-04	5.2E-05	7.6E-02	3.3E-02	1.1E-02	4.4E-03		7.6E-02	B	3.3E-02	B	1.1E-02	B	4.4E-03	B
EXCVATOR2	Excavator Loading Trucks	308	4000	n	7.5%	4.8%	valid	8.8E-04	3.9E-04	1.3E-04	5.2E-05	7.6E-02	3.3E-02	1.1E-02	4.4E-03		7.6E-02	B	3.3E-02	B	1.1E-02	B	4.4E-03	B
EXCVATOR3	Excavator Loading Trucks	308	4000	n	7.5%	4.8%	valid	8.8E-04	3.9E-04	1.3E-04	5.2E-05	7.6E-02	3.3E-02	1.1E-02	4.4E-03		7.6E-02	B	3.3E-02	B	1.1E-02	B	4.4E-03	B
GR	Truck / Loader Drop to Grizzly	308	4000	n	7.5%	4.8%	valid	8.8E-04	3.9E-04	1.3E-04	5.2E-05	7.6E-02	3.3E-02	1.1E-02	4.4E-03		7.6E-02	B	3.3E-02	B	1.1E-02	B	4.4E-03	B
LS	Loading of trucks for shipping	308	4000	n	7.5%	4.8%	valid	8.8E-04	3.9E-04	1.3E-04	5.2E-05	7.6E-02	3.3E-02	1.1E-02	4.4E-03		7.6E-02	B	3.3E-02	B	1.1E-02	B	4.4E-03	B
ST1	Stacker 1	103	1333	n	7.5%	2.1%	valid	2.8E-03	1.2E-03	4.1E-04	1.6E-04	8.0E-02	3.5E-02	1.2E-02	4.7E-03		8.0E-02	B	3.5E-02	B	1.2E-02	B	4.7E-03	B
ST2	Stacker 2	103	1333	n	7.5%	2.1%	valid	2.8E-03	1.2E-03	4.1E-04	1.6E-04	8.0E-02	3.5E-02	1.2E-02	4.7E-03		8.0E-02	B	3.5E-02	B	1.2E-02	B	4.7E-03	B
ST3	Stacker 3	103	1333	n	7.5%	2.1%	valid	2.8E-03	1.2E-03	4.1E-04	1.6E-04	8.0E-02	3.5E-02	1.2E-02	4.7E-03		8.0E-02	B	3.5E-02	B	1.2E-02	B	4.7E-03	B

Sample calculation for uncontrolled TSP emission factor for Source EXCVATOR1: Excavator Loading Trucks, at a sample wind speed of 5 m/s

EF = 0.0016 x (0.8) x ((4.25 m/s) / 2.2)^1.3 / ((4.8%) / 2)^1.4 8.8E-04 kg TSP / Mg handled

Sample calculation for TSP emission rate for Source EXCVATOR1: Excavator Loading Trucks, at a sample wind speed of 5 m/s

$$\frac{308\ Mg_{handled}}{1\ h} \times \frac{8.8E\text{-}04\ kg_{TSP}}{1\ Mg_{handled}} \times \frac{1\ h}{3600\ s} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 7.6E\text{-}02\ g_{TSP} / s$$

Comments

k-factor for TSP (PM44) scaled up logarithmically to 0.8 from published k-factor of 0.74 which refers to PM30.
Source condition validity used to determine the data quality rating, in accordance with AP-42.
Moisture and silt values reflect sampling conducted by RWDI at pits Southern Ontario
Average moisture content from the stockpiles at sampled sites was 4.1%, silt was 6.4%
Silica emission rate is equivalent to 13.4% of PM10 emissions. SGS certificate of analysis, Dec 13, 2023. LR. Ref. : MI4501-DEC23
Hourly processing rate based on 13 hours of operation for shipping handling sources (0600h - 1900h)

APPENDIX B

Appendix B: Processing Emissions Spreadsheet

Project #2401387

Teeswater Watson Pit

Soource ID [1]	Source Description / Process Decription	AP-42 Process Description [1]	Process Code	AP-42 Chapter	Processing Rate		Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied (%)	Final Controlled Emission Rate							
					Hourly (Mg/h)	Daily (Mg/d)	TSP [3] (kg/Mg)	PM_{10} (kg/Mg)	$PM_{2.5}$ (kg/Mg)	Silica (kg/Mg)	TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	Silica (g/s)		TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating	Silica (g/s)	Data Quality Rating
CR1	Primary Crusher	Primary crushing (controlled)	6	11.19.2-1	308	4000	3.4E-04	2.7E-04	5.0E-05	3.6E-05	2.9E-02	2.3E-02	4.3E-03	3.1E-03		2.9E-02	E	2.3E-02	E	4.3E-03	E	3.1E-03	E
C04	Conveyor	Conveyor transfer point (controlled)	14	11.19.2-1	377	4896	3.7E-05	2.3E-05	6.5E-06	3.1E-06	3.9E-03	2.4E-03	6.8E-04	3.2E-04		3.9E-03	E	2.4E-03	D	6.8E-04	E	3.2E-04	E
SCR	Triple Deck Screen	Screening (controlled)	2	11.19.2-1	377	4896	5.6E-04	3.7E-04	2.5E-05	5.0E-05	5.9E-02	3.9E-02	2.6E-03	5.2E-03		5.9E-02	E	3.9E-02	C	2.6E-03	E	5.2E-03	E
CR2	Secondary Crusher	Secondary crushing (controlled)	7	11.19.2-1	69	900	3.4E-04	2.7E-04	5.0E-05	3.6E-05	6.5E-03	5.2E-03	9.6E-04	7.0E-04		6.5E-03	E	5.2E-03	E	9.6E-04	E	7.0E-04	E
C01	Conveyor from SCR to ST01	Conveyor transfer point (controlled)	14	11.19.2-1	103	1333	3.7E-05	2.3E-05	6.5E-06	3.1E-06	1.1E-03	6.6E-04	1.9E-04	8.8E-05		1.1E-03	E	6.6E-04	D	1.9E-04	E	8.8E-05	E
C02	Conveyor from SCR to ST02	Conveyor transfer point (controlled)	14	11.19.2-1	103	1333	3.7E-05	2.3E-05	6.5E-06	3.1E-06	1.1E-03	6.6E-04	1.9E-04	8.8E-05		1.1E-03	E	6.6E-04	D	1.9E-04	E	8.8E-05	E
C03	Conveyor from SCR to ST03	Conveyor transfer point (controlled)	14	11.19.2-1	103	1333	3.7E-05	2.3E-05	6.5E-06	3.1E-06	1.1E-03	6.6E-04	1.9E-04	8.8E-05		1.1E-03	E	6.6E-04	D	1.9E-04	E	8.8E-05	E

Sample calculation for TSP emissions from Source SCR: Triple Deck Screen

$$\frac{377\ Mg_{processed}}{1\ h} \times \frac{5.6E\text{-}04\ kg_{TSP}}{1\ Mg_{processed}} \times \frac{1\ h}{3600\ s} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 5.9E\text{-}02\ g_{TSP}/s$$

Comments
Silica emission rate is equivalent to 13.4% of PM10 emissions. SGS certificate of analysis, Dec 13, 2023. LR. Ref. : MI4501-DEC23
AP-42 process listed as "controlled" reflects between 70-90% control due to high moisture / water sprays (AP-42 11.19.2).
AP-42 Emission Factor is based on PM100. The values have been corrected to reflect PM44.
Hourly processing rate based on 13 hours of operation for processing sources (0600h - 1900h)

APPENDIX C

Appendix C: On-Site Mobile Equipment Emissions Spreadsheet - Fugitive Dust

Project #2401387

Teeswater Watson Pit

UNPAVED ROAD SECTIONS - AP-42 Section 13.2.2
PAVED ROAD SECTIONS - AP-42 Section 13.2.1

Paved Roads:	$E = k\,(sL)^{0.91}\,(W)^{1.02}$
Unpaved Roads - Industrial:	$E = 281.9\,k\,(s/12)^{a}\,(W/3)^{b}$
Unpaved Roads - Public:	$E = 281.9\,k\,(s/12)^{a}\,(S/30)^{d}\,/\,(M/0.5)^{c}$ **-** C

E particulate emission factor (g/VKT) — **k** particle size multiplier (see below) — **sL** road surface silt loading (g/m^2)
W average weight of the vehicles traveling the road (US short tons) — **s** surface material silt content (%) — **C** emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear
M surface material moisture content (%) — **S** mean vehicle speed (mph) — **a,b,c,d** constants (see below)

Route ID [1]	Route Description	Traffic Passes Hourly	Traffic Passes Daily	Segment Length	Road Surface	Roadway Type	Mean Vehicle Speed		Average Vehicle Weight	Surface Material Moisture Content	Surface Silt Content	Road Surface Silt Loading	Base AP-42 Emission Factor TSP	Base AP-42 Emission Factor PM_{10}	Base AP-42 Emission Factor $PM_{2.5}$	Base AP-42 Emission Factor Silica	Base Emission Rate TSP	Base Emission Rate PM_{10}	Base Emission Rate $PM_{2.5}$	Base Emission Rate Silica	Additional Control Efficiency Applied	Final Controlled Emission Rate TSP	Data Quality Rating	Final Controlled Emission Rate PM_{10}	Data Quality Rating	Final Controlled Emission Rate $PM_{2.5}$	Data Quality Rating	Final Controlled Emission Rate Silica	Data Quality Rating
		(#/h)	(#/d)	(m)			(km/h)	(mph)	(tons)	(%)	(%)	(g/m^2)	(g/VKT)	(g/VKT)	(g/VKT)	(g/VKT)	(g/s)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)		(g/s)	
ELOADER1	Extraction Loader	9	114	184	Unpaved	Industrial	20	12	15.4		4.8%		2.5E+03	3.9E+02	3.9E+01	5.2E+01	1.1E+00	1.8E-01	1.8E-02	2.4E-02	95%	5.7E-02	C	8.9E-03	B	8.9E-04	C	1.2E-03	C
ELOADER2	Extraction Loader	9	114	152	Unpaved	Industrial	20	12	15.4		4.8%		2.5E+03	3.9E+02	3.9E+01	5.2E+01	9.4E-01	1.5E-01	1.5E-02	2.0E-02	95%	4.7E-02	C	7.3E-03	B	7.3E-04	C	9.8E-04	C
ELOADER3	Extraction Loader	9	114	297	Unpaved	Industrial	20	12	15.4		4.8%		2.5E+03	3.9E+02	3.9E+01	5.2E+01	1.8E+00	2.9E-01	2.9E-02	3.9E-02	95%	9.2E-02	C	1.4E-02	B	1.4E-03	C	1.9E-03	C
SLOADER	Shipping Loader	9	114	60	Unpaved	Industrial	20	12	14.7		4.8%		2.4E+03	3.8E+02	3.8E+01	5.1E+01	3.6E-01	5.7E-02	5.7E-03	7.6E-03	95%	1.8E-02	C	2.8E-03	B	2.8E-04	C	3.8E-04	C
UNPAVEDA	Unpaved Haul Route	9	114	536	Unpaved	Industrial	20	12	29.0		4.8%		3.3E+03	5.1E+02	5.1E+01	6.9E+01	4.4E+00	6.9E-01	6.9E-02	9.2E-02	95%	2.2E-01	C	3.4E-02	B	3.4E-03	C	4.6E-03	C

Constants for Mobile Emission Equations

Roadway Type	Contaminant	k	a	b	c	d	Quality
Paved Roads:	$PM_{2.5}$	0.15	-	-	-	-	-
	PM_{10}	0.62	-	-	-	-	-
	PM_{30}	3.23	-	-	-	-	-
	TSP	4.79	-	-	-	-	-
Unpaved Roads - Industrial:	$PM_{2.5}$	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	PM_{30}	4.9	0.7	0.45	-	-	B
	TSP	7.32	0.6	0.45	-	-	C
Unpaved Roads - Public:	$PM_{2.5}$	0.18	1	**-**	0.2	0.5	C
	PM_{10}	1.8	1	**-**	0.2	0.1	B
	PM_{30}	6	1	**-**	0.3	0.3	B
	TSP	8.96	1	**-**	0.49	0.2	C

Comments

Hourly shipping traffic based on a peak of 114 trips per day, as per information provided (e-mail dated 10/31/2023)
- Traffic mix approximately 50% tri-axle, with 50% tri-axle plus trailer:
95% control applied to unpaved roads based on watering as per the recommendations in the report (hourly watering under dry conditions)
Silt values for unpaved roads reflect mean values from AP-42
Silt loading on the paved entrance road reflects a combination of flushing and sweeping as per the recommendations in the report.
Silica emission rate is equivalent to 13.4% of PM10 emissions. SGS certificate of analysis, Dec 13, 2023. LR. Ref. : MI4501-DEC23
Loader trips based on daily production rate and assumed bucket capacity of 15 tonnes
Hourly passes for shipping loader and trucks based on 13 hours of operation for shipping handling sources (0600h - 1900h)

Sample calculation for uncontrolled TSP emission factor for Source UNPAVEDA: Unpaved Haul Route

EF = 281.9 x (4.9) x [(4.8% / 12)]^(0.7) x [(28.95 tons) / 3]^(0.45) = 3.30E+03 g TSP / vehicle kilometer travelled (vkt)

APPENDIX D

Appendix D: Summary of Combustion Exhaust Emissions (Mobile and Stationary Sources)

Project #2401387

Teeswater Watson Pit

Source ID	Description	Gross Power Rating (kW)	Number Of Units	Traffic Passes		Segment Length	Mean Vehicle Speed	Load Factor	Tailpipe Emission Factor [5]								Tailpipe Emission Rate				Tailpipe + Fugitive Emission Rate [6]			
				Hourly	Daily				TSP		PM10		PM2.5		NOx		TSP	PM10	PM2.5	NOx	TSP	PM10	PM2.5	NOx
				(#/h)	(#/d)	(m)	(km/h)	(%)	(g/vkt)	(g/kW-h)	(g/vkt)	(g/kW-h)	(g/vkt)	(g/kW-h)	(g/vkt)	(g/kW-h)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)	(g/s)
On-Site Mobile Equipment																								
EXC_TP1	Excavator	400	1	n/a	n/a	n/a	n/a	53%	--	0.2	--	0.2	--	0.2	--	4	1.2E-02	1.2E-02	1.2E-02	2.4E-01	--	--	--	--
EXC_TP2	Excavator	400	1	n/a	n/a	n/a	n/a	53%	--	0.2	--	0.2	--	0.2	--	4	1.2E-02	1.2E-02	1.2E-02	2.4E-01	--	--	--	--
EXC_TP3	Excavator	400	1	n/a	n/a	n/a	n/a	53%	--	0.2	--	0.2	--	0.2	--	4	1.2E-02	1.2E-02	1.2E-02	2.4E-01	--	--	--	--
ELOADER1	Extraction Loader	607	1	n/a	n/a	n/a	n/a	53%	--	0.2	--	0.2	--	0.2	--	6.4	1.8E-02	1.8E-02	1.8E-02	5.7E-01	7.5E-02	2.7E-02	1.9E-02	5.7E-01
ELOADER2	Extraction Loader	607	1	n/a	n/a	n/a	n/a	53%	--	0.2	--	0.2	--	0.2	--	6.4	1.8E-02	1.8E-02	1.8E-02	5.7E-01	6.5E-02	2.5E-02	1.9E-02	5.7E-01
ELOADER3	Extraction Loader	607	1	n/a	n/a	n/a	n/a	53%	--	0.2	--	0.2	--	0.2	--	6.4	1.8E-02	1.8E-02	1.8E-02	5.7E-01	1.1E-01	3.2E-02	1.9E-02	5.7E-01
SLOADER	Shipping Loader	607	1	n/a	n/a	n/a	n/a	53%	--	0.2	--	0.2	--	0.2	--	6.4	1.8E-02	1.8E-02	1.8E-02	5.7E-01	3.6E-02	2.1E-02	1.8E-02	5.7E-01
UNPAVEDA	Two-way Unpaved Haul Route	n/a	n/a	9	114	536	20	n/a	0.95	--	0.95	--	0.95	--	11.4	--	1.3E-03	1.3E-03	1.3E-03	1.5E-02	2.2E-01	3.6E-02	1.3E-03	1.5E-02
Stationary Combustion Equipment																								
CRUSHER1	Primary Crusher Engine	100	1	n/a	n/a	n/a	n/a	100%	--	0.2	--	0.2	--	0.2	--	4	5.6E-03	5.6E-03	5.6E-03	1.1E-01	5.6E-03	5.6E-03	5.6E-03	1.1E-01
CRUSHER2	Secondary Crusher Engine	100	1	n/a	n/a	n/a	n/a	100%	--	0.2	--	0.2	--	0.2	--	4	5.6E-03	5.6E-03	5.6E-03	1.1E-01	5.6E-03	5.6E-03	5.6E-03	1.1E-01
SCREEN	Screening Plant Engine	100	1	n/a	n/a	n/a	n/a	100%	--	0.2	--	0.2	--	0.2	--	4	5.6E-03	5.6E-03	5.6E-03	1.1E-01	5.6E-03	5.6E-03	5.6E-03	1.1E-01

Sample Calculations

Excavator Exhaust TSP Emissions:

$$\frac{400\ \text{kW}}{1}\times\frac{0.2\ \text{g}}{1\ \text{kW h}}\times\frac{53\%\ \text{Load}}{1}\times\frac{1\ \text{h}}{3600\ \text{s}} = 1.2\text{E-}02\ g_{TSP}/\text{s}$$

Trucks Exhaust TSP Emissions on Two-way Unpaved

$$\frac{9\ \text{Vehicles}}{1\ \text{h}}\times\frac{536\ \text{m}}{1}\times\frac{0.95\ \text{g}}{1\ \text{Veh. Km}}\times\frac{1\ \text{km}}{1000\ \text{m}}\times\frac{1\ \text{h}}{3600\ \text{s}} = 1.3\text{E-}03\ g_{TSP}/\text{s}$$

Comments

Excavator assumed to be CAT 324T or similar.
Loaders assumed to be CAT 992 or similar.
Screening plant engine assumed to be 100 kW (typical)
Excavator and screen plant engine emissions based on Tier 3 emission limits.
Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010
Exhaust parameters for processing plant engines based on typical specs

Flow	745 cfm	=	0.35 m³/s
Temp	1010 °F	=	816 K
Diameter	0.1 m		
Velocity	45 m/s		