REPORT

WALKER AGGREGATES INC.

NIAGARA FALLS, ON

AIR QUALITY ASSESSMENT FOR THE PROPOSED UPPER'S QUARRY

RWDI # 1603157

December 5, 2023

SUBMITTED TO

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

REPORT SIGNATURES

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1 INTRODUCTION

RWDI was retained by Walker Aggregates Inc. (WAI) to conduct an air quality assessment for the proposed Upper's Quarry (Upper's Quarry) in Niagara Falls, Ontario. The air quality assessment includes a dispersion modelling analysis of estimated emissions of key contaminants from proposed on-site operations. The results of this analysis are combined with an appropriate background air quality concentration to provide a cumulative estimate of impacts on surrounding receptors. If predicted impacts are above the relevant criteria at nearby sensitive impact locations, mitigation measures are recommended, and the assessment is repeated. This process continues until predicted impacts are below the criteria. Mitigation measures are incorporated into the Best Management Practices Plan (BMPP) for dust. A list of suitable references for understanding dust control practices are provided in **Section 18**.

2 SITE DESCRIPTION & OPERATIONS

The proposed Upper's Quarry is located on Part of Lots 119, 120, 136 and 137, and Part of the Road Allowance between Lots 120 and 136 (geographic township of Stamford) in the City of Niagara Falls, Regional Municipality of Niagara. Two municipal road allowances separate the proposed quarry site into three extraction areas:

1. North Extraction Area: extraction area north of Upper's Lane;
2. Mid Extraction Area: extraction area south of Upper's Lane and north of the unopened road allowance between Township Lots 120 & 136 in the former Township of Stamford, now in the City of Niagara Falls ("unopened road allowance"); and
3. South Extraction Area: extraction area south of the unopened road allowance.

Operations at the proposed quarry will consist of overburden stripping; berm construction; drilling, blasting, extraction, transportation, processing, washing, stockpiling, and shipping of aggregate; and rehabilitation. The annual production limit will be 1,800,000 tonnes of aggregate per year, however during several phases of operation, the maximum annual tonnage will be lower due to operational constraints.

There are 5 main phases of operations. Some phases move into different areas over time, as denoted by "A" or "B". Main operations in each of the phases consist of the following:

1. Aggregate extraction with processing in a single plant, initially at the top of rock. Plant will move to bottom of quarry in north of Uppers Lane and remain there as extraction moves south of Uppers Lane.
2. Aggregate extraction with processing in a single plant, initially at the top of rock. Plant will move to bottom of quarry in Phase 2A once sufficient area is available. Plant remains here for initial extraction of Phase 3A.
3. Aggregate extraction in Phases 3A and 3B with processing in two identical plants at the bottom elevation of the quarry in Phase 3A area (once sufficient area is cleared). The hot mix asphalt (HMA) plant will begin operation at the quarry floor in Phase 1A area.
4. Aggregate extraction in Phases 4A and 4B with processing in two identical plants at the bottom elevation of the quarry in Phase 1A and 4A areas. The HMA plant will continue operation at the quarry floor in Phase 1A area.

5. Aggregate extraction in Phase 5 with processing in two identical plants at the bottom elevation of the quarry in Phase 1A and 4A areas. The HMA plant will continue operation at the quarry floor in Phase 1A area.

Clearing of overburden and berm construction will take place prior to drilling and blasting in each phase. At the start of extraction operations, four sinking cuts will be required to allow extraction to being. One sinking cut is required in each of Phases 1A, 2A, 3B, and 5.

Shot rock will be loaded by front-end loaders into a primary crusher. In the early phases of operation, the primary crusher is integrated into a single portable plant located near the working face. Once sufficient area has been established, two plants will be established, fed by a primary crusher and conveyor which follow the working face. The processing plant will be located at varying elevations, beginning at the top of rock during the sinking cut portion of operations, and moving to the first bench and then the final quarry floor as space becomes available.

At the processing plant, aggregate will be processed, washed and stockpiled, prior to loading into shipping trucks by front-end loaders. Progressive rehabilitation operations will take place throughout the life of the quarry.

In addition to aggregate extraction and processing, the site will also include a HMA batch plant, to be located in Phase 1A, capable of producing 4,900 tonnes per day of HMA. Operations include the receipt and drying of washed aggregate, receipt and storage of asphalt cement, mixing and storage of HMA, and loading highway trucks for shipment to the job site. The asphalt plant will become operational once Phases 1A and 1B have been extracted to the extent to allow for space for the plant.

3 HOURS OF OPERATION

The hours of operation at the quarry vary depending on the nature of the activity:

- Blasting: Monday to Friday 0800 - 1800h (no more than one blast on any given day);
- Drilling and extraction at the working face: Monday to Saturday 0700 – 1900h;
- Loading shot rock into the primary crusher: Monday to Saturday 0700 – 1900h;
- Aggregate processing: Monday to Saturday 0700 – 1900h;
- Aggregate shipping from stockpiles: 24 hours per day, 7 days a week;
- Asphalt plant: 24 hours per day, 7 days a week;
- Asphalt cement (AC) and reclaimed asphalt pavement (RAP) receiving: 24 hours per day, 7 days a week; and
- HMA shipping: 24 hours per day, 7 days a week.

4 OPERATING SCENARIO

The maximum operating scenario examined in the assessment reflects the maximum production and shipping operations at the site during multiple phases in both the Proposed Operating Scenario. This scenario is meant to provide a conservative estimate of potential emissions, also known as an upper range emission scenario, as well as the location of operations. In all cases, it is expected that operations would realistically occur at levels below these levels over most of the life of the quarry.

Overburden stripping and berm construction are not examined explicitly in the assessment. These are considered short-term construction activities and are not part of the maximum operating scenario used in the assessment. Impacts associated with overburden stripping and berm construction are best managed through the development and implementation of a BMPP for dust. These controls would help to ensure that localized impacts due to the overburden stripping and berm construction are minimized, especially when they are occurring in close proximity to potential receptors.

5 POTENTIAL IMPACT LOCATIONS

There are eleven (11) discrete receptors consisting of commercial and residential buildings as well as outdoor locations potentially related to residential or business activity in the area near the Upper's Quarry. Due to the nature of the sources of emission, potential receptor locations further from the site were not assessed, as impacts decrease rapidly with distance. The receptor locations are shown on **Figure 1**.

Receptors were modelled at a height of 1.5 metres above grade. The overwhelming majority of the modelled sources are low-level volume sources located below grade. Sources located at the top of rock during the initial sinking cuts (i.e., portable plant operations only) are primarily at 177 metres above sea level (masl). Sources associated with peak operations, including the asphalt plant, are all located on the quarry floor, at approximately 144 masl. In contrast, the receptors range from 175 to 185 masl. It is therefore very clear that the highest predicted impacts will occur at grade level. No additional heights above grade are necessary to predict the maximum impacts.

6 IDENTIFICATION OF CONTAMINANTS AND SOURCES

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

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

On-site vehicles and heavy equipment also emit products of combustion. TSP, PM_{10}, $PM_{2.5}$, and Nitrogen dioxide gas (NO_2) were modelled as the key representatives of combustion products. In addition, the on-site asphalt plant emits NO_2, PM, silica, benzene, benzo(a)pyrene, naphthalene, arsenic, lead, and nickel which were all modelled as well.

The potential sources of emissions for the Upper's Quarry are as follows:

- Drilling and blasting operations;
- Material crushing, screening, conveying, and stockpiling;
- Material handling operations (loaders loading haul trucks and highway trucks);
- Equipment travel over unpaved surfaces (haul trucks, loaders, and highway trucks);
- Tailpipe emissions from on-site vehicles and heavy equipment; and
- Asphalt Plant operations.

Figure 2 through **Figure 5** presents modelled source locations for various phases in the Proposed Extraction Scenario. The source locations for the modelled extraction operations reflect the presumed worst-case locations for operations at the working face, relative to sensitive receptor locations.

7 CRITERIA

The Ministry of the Environment, Conservation and Parks (MECP) has published Ambient Air Quality Criteria (AAQC), which are desirable concentrations of contaminants in air, based on protection against adverse effects on health or the environment. Environment Canada also has Canadian Ambient Air Quality Standards (CAAQS) for certain contaminants, which are used by provinces and territories to implement air quality improvements within their jurisdictions. The AAQCs and CAAQS are not enforceable standards. They are used as indicators for desirable air quality conditions.

8 EMISSION ESTIMATION

Emissions were estimated in accordance with relevant guidance, using published emission factors as provided in **Appendix A** - **F**. 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. Emissions of crystalline silica were estimated using a very conservative silica content in the resource of 10% in PM_{10}. As this resource is comprised of dolostone, 10% reflects an upper bound, with values closer to 2% being the norm in this deposit.[1]

This is supported by a recent review of silica data in Ontario by the MECP, which showed that a silica value of 2.72% is appropriate for limestone and dolostone. This value is recommended when conducting air quality assessments for the aggregate, ready-mix concrete, and hot-mix asphalt industries.[2]

Mitigation measures recommended in this assessment are incorporated into a BMPP for dust for the site. The emission estimates account for the effect of these dust mitigation measures, such as watering of haul roads, and use of spray bars on processing equipment. The levels of control shown in the Appendices can be achieved with the combination of measures described in the BMPP, and are supported by the dust control references provided in Section 0, most notably Rosbury (1985) who 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). Cowherd, Muleski, and Kinsey (1988) provide an empirical equation for estimating the control efficiency of a watering program, relating the evaporation rate, traffic rate, time between application and water application intensity. This equation shows that 95% control is possible, based on evaporation rates in Southern Ontario, especially when the time between application is reduced to 1 hour and water application intensity is at the recommended 1.5 L/m²/h. This report also provides the basis for the data presented by the US EPA (2006).

[1] Ontario Division of Mines, "The Limestone Industries of Ontario", by D. F. Hewitt, as revised by M. A. Vos and D. F. Hewitt.
[2] Ministry of the Environment Conservations and Parks, Ontario Road Builders Association, Ontario Asphalt Paving Council, Concrete Ontario and the Ontario Stone Sand and Gravel Association, BCX Environmental Consulting and RWDI. On-going research by the Hot Mix Asphalt and Ready-Mix Concrete Working Group.

9 DISPERSION MODELLING

The dispersion modelling was conducted to confirm that the proposed mitigation measures will be sufficient to control off-site impacts at the residential receptor locations. The modelling was conducted in accordance with the MECP's Guideline A-11: Air Dispersion Modelling Guideline for Ontario, using the U.S. EPA AERMOD version 19191 dispersion model. AERMOD assesses multiple sources of emissions at discrete off-site receptors and is the current state-of-the-art regulatory model in Ontario.

Ontario recently adopted the 22112 version of AERMOD; however, sensitivity runs by the MECP and others, including RWDI have shown that there is no statistically significant difference in the model outputs. Therefore, the modelling analysis has not been reprocessed.

Regional meteorological data obtained from the MECP website were used within the model, in accordance with the MECP's Guideline A-11. The regional data set for the "CROPS" land use pattern was chosen as it is reflective of the land use patterns around the site. Terrain information for the site was also obtained from the MECP, in accordance with Guideline A-11, but base elevations for sources within the site reflect the quarry floor.

The AERMOD model was run using the regulatory default options; and modelled for 1-hour, 24-hour, and annual average concentrations as appropriate for each contaminant. The hours of operation described in Section 2 were used in the modelling analysis.

10 LOCAL EMISSION SOURCES

Environment Canada's National Pollutant Release Inventory (NPRI) is Canada's legislated, publicly accessible inventory of pollutant releases. Data for 2016 (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 proposed quarry.

Within 2 kilometers of the extension area, there are no facilities reporting emissions to the NPRI. Just beyond this radius are:

- Resolute FP Canada Inc, Thorold Division;
- Northland Power Inc. Thorold Cogen Generating Station;
- Walker Environmental Group Inc. - Landfill Site (WEG); and
- Walker Aggregates Inc., Walker Brothers Quarries (WBQ).

Of these, only the WEG and WBQ sites are expected to have similar emission profiles to the proposed quarry. Both are located over 2 kilometers north of the subject site. Due to this distance, impacts from this site are not expected to significantly influence the predicted impacts from the extension, and the adoption of a suitable background air quality level will provide an appropriate estimate of cumulative impacts.

Aerial photography for the area was also reviewed, along with the Ministry of Natural Resources and Forestry Pits and Quarries Online tool. Aside from the WBQ, the next nearest aggregate license is over 7 kilometers away, and therefore would cause no significant impact on the assessment.

As there are no locally significant sources of potential air quality impacts, RWDI believes that the adoption of a suitable background air quality level will provide an appropriate estimate of cumulative impacts. Ubiquitous air quality sources dominate, such as the road network, agriculture, etc. A suitable background air quality level is therefore provided by the nearest air quality monitoring station with the appropriate data sets.

11 BACKGROUND AIR QUALITY

The cumulative effect assessment considered the impact of the project's emissions in combination with background contaminant levels from other sources in the surrounding area. Background values of $PM_{2.5}$, NO_2, and O_3 and were estimated using data from the nearest MECP monitoring station (MECP Station 27067 in St. Catharines. As per the Air Quality in Ontario Reports, published by the MECP, the St. Catharines monitoring station is located at latitude 43°09'36.2" and longitude -79°14'05.1". The street address is 62 Argyle Crescent, St. Catharines. It is located approximately 8.5 km from the subject site. This AQ station is considered an urban site. In general, PM and NO_2 levels are expected to be higher at an urban site than in a rural area where Upper's Quarry would be located.

TSP and PM_{10} were estimated from the station measured $PM_{2.5}$ data using factors derived from 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 US (U.S. EPA, 1996).[4]

For background estimates regarding PAHs, VOCs, and metals, nearby National Air Pollutant Surveillance (NAPS) stations were used. For PAHs, VOCs, and metals the NAPS station in Simcoe, ON (ID 62601) was used. While more distant, this station reflects a similar mix of land use patterns. Data from NAPS station in downtown Hamilton (ID 60512) is also available, however this station is in a heavily urbanized area, and influenced by significant industrial emissions. Using this data is inappropriate for a rural setting such as the subject site.

In keeping with common practice, the 90th percentile 1-hour and 24-hour concentrations, and annual average concentrations from the background monitoring data was used in the cumulative effect assessment. This represents the highest background concentration that could reasonably be expected to coincide with maximum impacts from existing operations in the area and the Upper's Quarry. **Table 1** summarizes background data on air quality in the study area.

[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.*

12 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. It is important to the cumulative effects assessment, as the criteria used in that assessment applies only to NO_2, which has a much greater toxicity than NO.

The Ozone Limiting Method (OLM) in the AERMOD model 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 ozone (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. On the other hand, if the concentration of available O_3 exceeds that of the NO contributed by the modelled roadway, then all of the NO is converted to NO_2. 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%.

13 UNCERTAINTIES

Dust emissions are highly variable, as they are potentially influenced by many factors, such as moisture level, wind speed, vehicle speeds, particle sizes, and humidity, which all factor into the estimates.. The manner in which the emissions disperse into the surrounding environment is influenced by a large number of factors. The techniques used to model emissions and dispersion cannot accurately account for all the relevant factors.

To compensate for this inaccuracy, the analysis was designed to estimate impacts under worst-case weather and considering maximum operating conditions for every day of the peak operating season (March through November, inclusive) of every year considered. Operations during the months of December through February were assessed at a lower production level. Based on these compensating features of the analysis, it can be safely assumed that the actual impacts at the site, with the assumed mitigation measures in place, will be less than what has been predicted.

14 RESULTS

The results of the dispersion modelling assessment for aggregate extraction are provided in **Table 2** through **Table 5**. The analysis shows that with appropriate controls on the haul routes, compliance with the relevant criteria can be achieved at all offsite receptors based on modelled emissions of sources.

However, with the addition of background concentrations to benzo(a)pyrene, this contaminant exceeds the AAQC even without emissions from the facility. This is due to the ambient background levels throughout most of Ontario already being above the AAQC. This is illustrated by the fact that elevated concentrations of benzo[a]pyrene (and benzene) formed the basis for the MECP Cumulative Effects Assessment (CEA) in Air Approvals policy, which came into effect on October 1, 2018. This is described in the MECP "Discussion Paper: Cumulative Effects Assessment in Air Approvals", published in November 2017."

> "The ministry analysed the monitoring data available for selected urban communities and identified benzene and benzo[a]pyrene as the two most significant carcinogens, with the highest concentrations measured at stations in the Hamilton and Sarnia areas."

Table 5.1 of the 2017 Discussion Paper shows that concentrations of benzo[a]pyrene actually exceed the AAQC at all stations examined (Toronto, 4 locations in Hamilton, Sarnia, and Simcoe).

The MECP currently has no additional restrictions on construction of new facilities that emit low levels of benzo(a)pyrene outside of Hamilton and Sarnia. Were an asphalt plant to be constructed at this location today, it would be eligible to receive an Environmental Compliance Approval, based on the predicted impacts. Furthermore, the incremental impacts due to facility emissions are low, resulting in an incremental increase of less than 2% over the annual average background levels.

The results of the analysis demonstrate that the proposed Upper's Quarry has been appropriately designed and separated from surrounding sensitive land uses and can be managed with appropriate mitigation to prevent and mitigate adverse effects.

15 RECOMMENDATIONS

The proposed Upper's Quarry 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 on the Site Plans:

- The site will operate in accordance with the Best Management Practices Plan (BMPP) for 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.

16 RECOMMENDED MANAGEMENT PRACTICES

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

- Blasting operations occurring within 300 m of a residential receptor shall have a blast area not exceeding 200 m² in area.
- Aggregate extraction, processing and shipping does not exceed 9,000 tonnes per day.
- Under dry conditions, the capacity to apply water on an hourly basis to all travelled haul routes is required.

17 CONCLUSIONS

With the implementation of the recommendations outlined in Sections 15 and 16 of this report, predicted concentrations at the nearby offsite receptors will be at or below the relevant criteria for all contaminants from source emissions. With the addition of background concentrations, predicted annual concentrations of benzo(a)pyrene exceed the AAQC guidelines. The MECP currently has no additional restrictions on construction of new facilities that emit low levels of benzo(a)pyrene outside of Hamilton and Sarnia. Were an asphalt plant to be constructed at this location today, it would be eligible to receive an Environmental Compliance Approval, based on the predicted impacts. Furthermore, the incremental impacts due to facility emissions are low, resulting in an incremental increase of less than 2% over the annual average background levels.

The proposed Upper's Quarry has been appropriately designed and separated from surrounding sensitive land uses and can be managed with appropriate mitigation to prevent and mitigate adverse effects.

18 DUST CONTROL REFERENCES

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TABLES

Table 1: Background Ambient Air Quality Data

RWDI #1603157

Upper's Quarry

Year	TSP [2]		PM_{10} [2]		Silica [3]	$PM_{2.5}$ [2]		NO_2 [2][4]				O_3 [2][4]				Benzene [5]		Benzo(a)Pyrene [56]		Naphthalene [5]	Arsenic [6]	Lead [5]	Nickel [5]	Nickel [5]
	90th Percentile 24-hour	Annual Average	90th Percentile 24-hour	Annual Average	90th Percentile 24-hour	90th Percentile 24-hour	Annual Average	90th Percentile 1-Hour		Annual Average		99th Percentile 1-Hour		Annual Average		90th Percentile 24-hour	Annual Average	90th Percentile 24-hour	Annual Average	90th Percentile 24-hour	90th Percentile 24-hour	90th Percentile 24-hour	90th Percentile 24-hour	Annual Average
	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(ppb)	(µg/m³)	(ppb)	(µg/m³)	(ppb)	(µg/m³)	(ppb)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.57	0.40	4.97E-05	2.92E-05	0.05	N/D	1.94E-03	9.11E-04	2.31E-04
2016	43	23	24	13	1.4	13	6.9	14	28	6.6	13	64	132	29.8	61.5	0.47	0.25	5.03E-05	2.77E-05	0.02	N/D	2.18E-03	4.85E-04	1.59E-04
2017	43	23	24	13	1.4	13	6.9	14	28	6.6	13	59	122	28.2	58.2	0.47	0.27	3.64E-05	1.64E-05	0.03	N/D	N/D	4.85E-04	3.24E-04
2018	47	23	26	13	1.6	14	7.0	12	24	6.0	12	61	126	28.5	58.8	0.49	0.30	3.58E-05	1.77E-05	0.04	N/D	2.82E-03	4.85E-04	2.00E-04
2019	47	23	26	13	1.6	14	7.0	12	24	6.0	12	56	116	28.4	58.7	0.38	0.24	3.01E-05	1.50E-05	0.06	N/D	N/D	4.85E-04	1.70E-04
2020	40	21	22	12	1.3	12	6.3	10	20	5.3	11	60	124	30.2	62.3	--	--	--	--	--	--	--	--	--
Average	44	23	24	13	1.5	13	6.8	12	25	6.1	12	60	124	29	59.9	0.45	0.27	4.05E-05	2.12E-05	3.97E-02	N/D	2.31E-03	5.70E-04	2.17E-04

Notes:

[1] Data from MECP Station St. Catherines (ID: 27067), located in St. Catherines, Argyle Cres. Pump Stn, ON. The station is the closest station with data for TSP, PM_{10}, Silica, $PM_{2.5}$, NO_2, and O_3.

[2] Estimated from PM2.5 measurements using published factors (Lall et al., 2004)

[3] Estimated as 6% of PM10, from published data for cities in the northeast US (U.S. EPA, 1996)

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

[5] Data from NAPS station ID 62601, located at Haldimand-Norfolk, Simcoe, ON.

[6] N/D means No Data available for background concentrations, or insufficient data for determining 90th percentile value.

Table 2: Cumulative Effects Analysis for Uppers Quarry Proposed Operating Scenario (Scenario 1)

Phase 2A - 1 Plant at Top of Rock

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 1	Residence	648758.52	4773661.47	TSP	24	18.4	15%	0	0.0%	62.4	52%	0	0.0%
				PM_{10}	24	7.7	15%	0	0.0%	32.1	64%	0	0.0%
				$PM_{2.5}$	24	1.1	5%	0	0.0%	14.3	57%	0	0.0%
				Silica	24	0.8	15%	0	0.0%	2.2	44%	0	0.0%
				NO_2	1	114.8	29%	0	0.0%	139.4	35%	0	0.0%
					24	28.3	14%	0	0.0%	28.3	14%	0	0.0%
Receptor 2	Residence	649391.00	4773733.84	TSP	24	9.2	8%	0	0.0%	53.2	44%	0	0.0%
				PM_{10}	24	3.7	7%	0	0.0%	28.1	56%	0	0.0%
				$PM_{2.5}$	24	0.6	2%	0	0.0%	13.8	55%	0	0.0%
				Silica	24	0.4	7%	0	0.0%	1.8	36%	0	0.0%
				NO_2	1	91.9	23%	0	0.0%	116.5	29%	0	0.0%
					24	16.6	8%	0	0.0%	16.6	8%	0	0.0%
Receptor 3	Residence	649561.36	4773627.17	TSP	24	7.2	6%	0	0.0%	51.2	43%	0	0.0%
				PM_{10}	24	2.7	5%	0	0.0%	27.1	54%	0	0.0%
				$PM_{2.5}$	24	0.4	2%	0	0.0%	13.6	54%	0	0.0%
				Silica	24	0.3	5%	0	0.0%	1.7	34%	0	0.0%
				NO_2	1	85.3	21%	0	0.0%	109.9	27%	0	0.0%
					24	20.0	10%	0	0.0%	20.0	10%	0	0.0%
Receptor 4	Business	649501.46	4773093.70	TSP	24	19.1	16%	0	0.0%	63.1	53%	0	0.0%
				PM_{10}	24	8.2	16%	0	0.0%	32.6	65%	0	0.0%
				$PM_{2.5}$	24	1.2	5%	0	0.0%	14.4	58%	0	0.0%
				Silica	24	0.8	16%	0	0.0%	2.3	45%	0	0.0%
				NO_2	1	108.3	27%	0	0.0%	133.0	33%	0	0.0%
					24	33.2	17%	0	0.0%	33.2	17%	0	0.0%
Receptor 5	Residence	649609.10	4772690.07	TSP	24	10.9	9%	0	0.0%	54.9	46%	0	0.0%
				PM_{10}	24	4.7	9%	0	0.0%	29.1	58%	0	0.0%
				$PM_{2.5}$	24	0.7	3%	0	0.0%	13.9	55%	0	0.0%
				Silica	24	0.5	9%	0	0.0%	1.9	39%	0	0.0%
				NO_2	1	91.0	23%	0	0.0%	115.7	29%	0	0.0%
					24	17.5	9%	0	0.0%	17.5	9%	0	0.0%
Receptor 6	Residence	649559.53	4772403.99	TSP	24	8.1	7%	0	0.0%	52.1	43%	0	0.0%
				PM_{10}	24	3.4	7%	0	0.0%	27.8	56%	0	0.0%
				$PM_{2.5}$	24	0.5	2%	0	0.0%	13.7	55%	0	0.0%
				Silica	24	0.3	7%	0	0.0%	1.8	36%	0	0.0%
				NO_2	1	83.2	21%	0	0.0%	107.8	27%	0	0.0%
					24	10.1	5%	0	0.0%	10.1	5%	0	0.0%
Receptor 7	Residence	649568.03	4772333.18	TSP	24	6.8	6%	0	0.0%	50.8	42%	0	0.0%
				PM_{10}	24	2.8	6%	0	0.0%	27.2	54%	0	0.0%
				$PM_{2.5}$	24	0.4	1%	0	0.0%	13.6	54%	0	0.0%
				Silica	24	0.3	6%	0	0.0%	1.7	35%	0	0.0%
				NO_2	1	79.1	20%	0	0.0%	103.7	26%	0	0.0%
					24	10.6	5%	0	0.0%	10.6	5%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 8	Residence (potential)	648398.27	4772829.98	TSP	24	26.2	22%	0	0.0%	70.2	58%	0	0.0%
				PM_{10}	24	10.9	22%	0	0.0%	35.3	71%	0	0.0%
				$PM_{2.5}$	24	1.5	6%	0	0.0%	14.7	59%	0	0.0%
				Silica	24	1.1	21%	0	0.0%	2.5	51%	0	0.0%
				NO_2	1	122.6	31%	0	0.0%	147.2	37%	0	0.0%
					24	32.3	16%	0	0.0%	32.3	16%	0	0.0%
Receptor 9	Business	649114.60	4773685.21	TSP	24	12.2	10%	0	0.0%	56.2	47%	0	0.0%
				PM_{10}	24	5.2	10%	0	0.0%	29.6	59%	0	0.0%
				$PM_{2.5}$	24	0.8	3%	0	0.0%	14.0	56%	0	0.0%
				Silica	24	0.5	10%	0	0.0%	2.0	39%	0	0.0%
				NO_2	1	98.1	25%	0	0.0%	122.7	31%	0	0.0%
					24	20.5	10%	0	0.0%	20.5	10%	0	0.0%
Receptor 10	Business	649107.18	4772042.78	TSP	24	6.6	6%	0	0.0%	50.6	42%	0	0.0%
				PM_{10}	24	2.8	6%	0	0.0%	27.2	54%	0	0.0%
				$PM_{2.5}$	24	0.4	2%	0	0.0%	13.6	54%	0	0.0%
				Silica	24	0.3	6%	0	0.0%	1.7	35%	0	0.0%
				NO_2	1	78.8	20%	0	0.0%	103.5	26%	0	0.0%
					24	12.6	6%	0	0.0%	12.6	6%	0	0.0%
Receptor 11	Residence	648614.94	4771698.96	TSP	24	4.0	3%	0	0.0%	48.0	40%	0	0.0%
				PM_{10}	24	1.7	3%	0	0.0%	26.1	52%	0	0.0%
				$PM_{2.5}$	24	0.2	1%	0	0.0%	13.4	54%	0	0.0%
				Silica	24	0.2	3%	0	0.0%	1.6	33%	0	0.0%
				NO_2	1	66.5	17%	0	0.0%	91.2	23%	0	0.0%
					24	9.3	5%	0	0.0%	9.3	5%	0	0.0%

Days of Valid Meteorological Data	1827
Hours of Valid Meteorological Data	43848

Relevant Criteria:

TSP	120	µg/m³ AAQC
PM_{10}	50	µg/m³ Interim AAQC
$PM_{2.5}$	25	µg/m³ Canada Wide Standard
Silica	5	µg/m³ AAQC
NO_2	400	µg/m³ 1-Hour AAQC
	200	µg/m³ 24-Hour AAQC
O_3	165	µg/m³ 1-Hour AAQC
Benzene	2.3	µg/m³ 24-Hour AAQC
Benzene	0.45	µg/m³ Annual AAQC
Benzo(a)pyrene	0.00005	µg/m³ 24-Hour AAQC
Benzo(a)pyrene	0.00001	µg/m³ Annual AAQC
Naphthalene	22.5	µg/m³ 24-Hour AAQC
Arsenic	0.3	µg/m³ 24-Hour AAQC
Lead	0.5	µg/m³ 24-Hour AAQC
Nickel	0.2	µg/m³ 24-Hour AAQC
Nickel	0.04	µg/m³ Annual AAQC

Background:

TSP	44	µg/m³ (24-hour)
PM_{10}	24	µg/m³ (24-hour)
$PM_{2.5}$	13	µg/m³ (24-hour)
Silica	1.5	µg/m³ (24-hour)
NO_2	25	µg/m³ (1-hour)
		µg/m³ (24-hour)
O_3	124	µg/m³ (1-hour)
Benzene	0.45	µg/m³ (24-hour)
Benzene	0.27	µg/m³ (Annual)
Benzo(a)pyrene	4.05E-05	µg/m³ (24-hour)
Benzo(a)pyrene	2.12E-05	µg/m³ (Annual)
Naphthalene	0.04	µg/m³ (24-hour)
Arsenic		µg/m³ (24-hour)
Lead	2.31E-03	µg/m³ (24-hour)
Nickel	5.70E-04	µg/m³ (24-hour)
Nickel	2.17E-04	µg/m³ (Annual)

Table 3: Cumulative Effects Analysis for Uppers Quarry Proposed Operating Scenario (Scenario 2)

Phase 3A and 3B - 2 Plants at Bottom of Quarry - Maximum Production With Asphalt Plant

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 1	Residence	648758.52	4773661.47	TSP	24	46.2	38%	0	0.0%	90.2	75%	0	0.0%
				PM_{10}	24	15.6	31%	0	0.0%	40.0	80%	0	0.0%
				$PM_{2.5}$	24	3.5	14%	0	0.0%	16.7	67%	0	0.0%
				Silica	24	1.5	31%	0	0.0%	3.0	60%	0	0.0%
				NO_2	1	89.6	22%	0	0.0%	114.2	29%	0	0.0%
					24	31.3	16%	0	0.0%	31.3	16%	0	0.0%
				Benzene	24	1.34E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	3.92E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.33E-06	13%	0	0.0%	4.7E-05	94%	0	0.0%
					Annual	1.58E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	3.74E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.30E-04	0%	0	0.0%	7.0E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 2	Residence	649391.00	4773733.84	TSP	24	19.8	17%	0	0.0%	63.8	53%	0	0.0%
				PM_{10}	24	7.8	16%	0	0.0%	32.2	64%	0	0.0%
				$PM_{2.5}$	24	3.3	13%	0	0.0%	16.5	66%	0	0.0%
				Silica	24	0.8	16%	0	0.0%	2.3	45%	0	0.0%
				NO_2	1	74.1	19%	0	0.0%	98.7	25%	0	0.0%
					24	22.7	11%	0	0.0%	22.7	11%	0	0.0%
				Benzene	24	1.45E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	5.04E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.12E-06	8%	0	0.0%	4.5E-05	89%	0	0.0%
					Annual	1.30E-07	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.65E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.40E-04	0%	0	0.0%	7.1E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 3	Residence	649561.36	4773627.17	TSP	24	25.7	21%	0	0.0%	69.7	58%	0	0.0%
				PM_{10}	24	10.2	20%	0	0.0%	34.6	69%	0	0.0%
				$PM_{2.5}$	24	3.0	12%	0	0.0%	16.2	65%	0	0.0%
				Silica	24	1.0	20%	0	0.0%	2.5	49%	0	0.0%
				NO_2	1	73.1	18%	0	0.0%	97.8	24%	0	0.0%
					24	23.5	12%	0	0.0%	23.5	12%	0	0.0%
				Benzene	24	1.19E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	4.90E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.39E-06	9%	0	0.0%	4.5E-05	90%	0	0.0%
					Annual	1.28E-07	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.00E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.20E-04	0%	0	0.0%	6.9E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 4	Business	649501.46	4773093.70	TSP	24	34.2	28%	0	0.0%	78.2	65%	0	0.0%
				PM_{10}	24	10.8	22%	0	0.0%	35.2	70%	0	0.0%
				$PM_{2.5}$	24	5.3	21%	0	0.0%	18.5	74%	0	0.0%
				Silica	24	1.1	22%	0	0.0%	2.5	51%	0	0.0%
				NO_2	1	79.3	20%	0	0.0%	104.0	26%	0	0.0%
					24	26.3	13%	0	0.0%	26.3	13%	0	0.0%
				Benzene	24	3.37E-02	1%	0	0.0%	4.9E-01	21%	0	0.0%
					Annual	1.05E-03	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.83E-06	14%	0	0.0%	4.7E-05	95%	0	0.0%
					Annual	2.50E-07	3%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	6.90E-03	0%	0	0.0%	4.7E-02	0%	0	0.0%
				Arsenic	24	5.00E-05	0%	0	0.0%	5.0E-05	0%	0	0.0%
				Lead	24	1.00E-04	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	3.40E-04	0%	0	0.0%	9.1E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 5	Residence	649609.10	4772690.07	TSP	24	23.8	20%	0	0.0%	67.8	57%	0	0.0%
				PM_{10}	24	9.4	19%	0	0.0%	33.8	68%	0	0.0%
				$PM_{2.5}$	24	3.7	15%	0	0.0%	16.9	68%	0	0.0%
				Silica	24	0.9	19%	0	0.0%	2.4	48%	0	0.0%
				NO_2	1	48.2	12%	0	0.0%	72.9	18%	0	0.0%
					24	16.8	8%	0	0.0%	16.8	8%	0	0.0%
				Benzene	24	2.09E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	8.82E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	5.34E-06	11%	0	0.0%	4.6E-05	92%	0	0.0%
					Annual	2.01E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.09E-03	0%	0	0.0%	4.4E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.10E-04	0%	0	0.0%	7.8E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 6	Residence	649559.53	4772403.99	TSP	24	20.1	17%	0	0.0%	64.1	53%	0	0.0%
				PM_{10}	24	8.1	16%	0	0.0%	32.5	65%	0	0.0%
				$PM_{2.5}$	24	3.3	13%	0	0.0%	16.5	66%	0	0.0%
				Silica	24	0.8	16%	0	0.0%	2.3	45%	0	0.0%
				NO_2	1	48.7	12%	0	0.0%	73.3	18%	0	0.0%
					24	18.5	9%	0	0.0%	18.5	9%	0	0.0%
				Benzene	24	1.84E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	8.26E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.28E-06	13%	0	0.0%	4.7E-05	93%	0	0.0%
					Annual	1.90E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.82E-03	0%	0	0.0%	4.5E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.90E-04	0%	0	0.0%	7.6E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 7	Residence	649568.03	4772333.18	TSP	24	18.5	15%	0	0.0%	62.5	52%	0	0.0%
				PM_{10}	24	7.7	15%	0	0.0%	32.1	64%	0	0.0%
				$PM_{2.5}$	24	3.3	13%	0	0.0%	16.5	66%	0	0.0%
				Silica	24	0.8	15%	0	0.0%	2.2	44%	0	0.0%
				NO_2	1	48.0	12%	0	0.0%	72.7	18%	0	0.0%
					24	18.7	9%	0	0.0%	18.7	9%	0	0.0%
				Benzene	24	1.90E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	7.70E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	5.88E-06	12%	0	0.0%	4.6E-05	93%	0	0.0%
					Annual	1.76E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.69E-03	0%	0	0.0%	4.4E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.00E-04	0%	0	0.0%	7.7E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 8	Residence (potential)	648398.27	4772829.98	TSP	24	52.3	44%	0	0.0%	96.3	80%	0	0.0%
				PM_{10}	24	17.9	36%	0	0.0%	42.3	85%	0	0.0%
				$PM_{2.5}$	24	6.1	24%	0	0.0%	19.3	77%	0	0.0%
				Silica	24	1.8	36%	0	0.0%	3.2	65%	0	0.0%
				NO_2	1	63.9	16%	0	0.0%	88.5	22%	0	0.0%
					24	25.8	13%	0	0.0%	25.8	13%	0	0.0%
				Benzene	24	3.44E-02	1%	0	0.0%	4.9E-01	21%	0	0.0%
					Annual	1.26E-03	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	8.72E-06	17%	0	0.0%	4.9E-05	98%	0	0.0%
					Annual	3.14E-07	3%	0	0.0%	2.2E-05	215%	n/a	n/a
				Naphthalene	24	6.79E-03	0%	0	0.0%	4.7E-02	0%	0	0.0%
				Arsenic	24	5.00E-05	0%	0	0.0%	5.0E-05	0%	0	0.0%
				Lead	24	1.00E-04	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	3.60E-04	0%	0	0.0%	9.3E-04	0%	0	0.0%
					Annual	4.20E-05	0%	0	0.0%	2.6E-04	1%	0	0.0%
Receptor 9	Business	649114.60	4773685.21	TSP	24	33.4	28%	0	0.0%	77.4	64%	0	0.0%
				PM_{10}	24	13.3	27%	0	0.0%	37.7	75%	0	0.0%
				$PM_{2.5}$	24	3.5	14%	0	0.0%	16.7	67%	0	0.0%
				Silica	24	1.4	28%	0	0.0%	2.8	57%	0	0.0%
				NO_2	1	76.5	19%	0	0.0%	101.1	25%	0	0.0%
					24	29.6	15%	0	0.0%	29.6	15%	0	0.0%
				Benzene	24	1.27E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	5.04E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.89E-06	10%	0	0.0%	4.5E-05	91%	0	0.0%
					Annual	1.59E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	3.06E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.30E-04	0%	0	0.0%	7.0E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 10	Business	649107.18	4772042.78	TSP	24	24.0	20%	0	0.0%	68.0	57%	0	0.0%
				PM_{10}	24	10.1	20%	0	0.0%	34.5	69%	0	0.0%
				$PM_{2.5}$	24	4.3	17%	0	0.0%	17.5	70%	0	0.0%
				Silica	24	1.1	21%	0	0.0%	2.5	50%	0	0.0%
				NO_2	1	72.9	18%	0	0.0%	97.6	24%	0	0.0%
					24	18.3	9%	0	0.0%	18.3	9%	0	0.0%
				Benzene	24	2.49E-02	1%	0	0.0%	4.8E-01	21%	0	0.0%
					Annual	6.02E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	7.69E-06	15%	0	0.0%	4.8E-05	96%	0	0.0%
					Annual	1.95E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	5.15E-03	0%	0	0.0%	4.5E-02	0%	0	0.0%
				Arsenic	24	4.00E-05	0%	0	0.0%	4.0E-05	0%	0	0.0%
				Lead	24	8.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.60E-04	0%	0	0.0%	8.3E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 11	Residence	648614.94	4771698.96	TSP	24	17.7	15%	0	0.0%	61.7	51%	0	0.0%
				PM_{10}	24	6.8	14%	0	0.0%	31.2	62%	0	0.0%
				$PM_{2.5}$	24	2.3	9%	0	0.0%	15.5	62%	0	0.0%
				Silica	24	0.7	13%	0	0.0%	2.1	43%	0	0.0%
				NO_2	1	74.6	19%	0	0.0%	99.2	25%	0	0.0%
					24	18.2	9%	0	0.0%	18.2	9%	0	0.0%
				Benzene	24	1.06E-02	0%	0	0.0%	4.6E-01	20%	0	0.0%
					Annual	2.38E-04	0%	0	0.0%	2.7E-01	59%	0	0.0%
				Benzo(a)pyrene	24	4.29E-06	9%	0	0.0%	4.5E-05	89%	0	0.0%
					Annual	7.78E-08	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.23E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	3.00E-05	0%	0	0.0%	2.3E-03	0%	0	0.0%
				Nickel	24	1.00E-04	0%	0	0.0%	6.7E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Days of Valid Meteorological Data	1827
Hours of Valid Meteorological Data	43848

Relevant Criteria:

TSP	120	µg/m³ AAQC
PM_{10}	50	µg/m³ Interim AAQC
$PM_{2.5}$	25	µg/m³ Canada Wide Standard
Silica	5	µg/m³ AAQC
NO_2	400	µg/m³ 1-Hour AAQC
	200	µg/m³ 24-Hour AAQC
O_3	165	µg/m³ 1-Hour AAQC
Benzene	2.3	µg/m³ 24-Hour AAQC
Benzene	0.45	µg/m³ Annual AAQC
Benzo(a)pyrene	0.00005	µg/m³ 24-Hour AAQC
Benzo(a)pyrene	0.00001	µg/m³ Annual AAQC
Naphthalene	22.5	µg/m³ 24-Hour AAQC
Arsenic	0.3	µg/m³ 24-Hour AAQC
Lead	0.5	µg/m³ 24-Hour AAQC
Nickel	0.2	µg/m³ 24-Hour AAQC
Nickel	0.04	µg/m³ Annual AAQC

Background:

TSP	44	µg/m³ (24-hour)
PM_{10}	24	µg/m³ (24-hour)
$PM_{2.5}$	13	µg/m³ (24-hour)
Silica	1.5	µg/m³ (24-hour)
NO_2	25	µg/m³ (1-hour)
		µg/m³ (24-hour)
O_3	124	µg/m³ (1-hour)
Benzene	0.45	µg/m³ (24-hour)
Benzene	0.27	µg/m³ (Annual)
Benzo(a)pyrene	4.05E-05	µg/m³ (24-hour)
Benzo(a)pyrene	2.12E-05	µg/m³ (Annual)
Naphthalene	0.04	µg/m³ (24-hour)
Arsenic		µg/m³ (24-hour)
Lead	2.31E-03	µg/m³ (24-hour)
Nickel	5.70E-04	µg/m³ (24-hour)
Nickel	2.17E-04	µg/m³ (Annual)

Table 4: Cumulative Effects Analysis for Uppers Quarry Proposed Operating Scenario (Scenario 3)

Phase 4 - 2 Plants Bottom of Quarry - Maximum Production with Asphalt Plant

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 1	Residence	648758.52	4773661.47	TSP	24	19.2	16%	0	0.0%	63.2	53%	0	0.0%
				PM_{10}	24	7.7	15%	0	0.0%	32.1	64%	0	0.0%
				$PM_{2.5}$	24	2.6	10%	0	0.0%	15.8	63%	0	0.0%
				Silica	24	0.8	15%	0	0.0%	2.2	45%	0	0.0%
				NO_2	1	77.0	19%	0	0.0%	101.6	25%	0	0.0%
					24	23.7	12%	0	0.0%	23.7	12%	0	0.0%
				Benzene	24	1.34E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	3.92E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.33E-06	13%	0	0.0%	4.7E-05	94%	0	0.0%
					Annual	1.58E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	3.74E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.30E-04	0%	0	0.0%	7.0E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 2	Residence	649391.00	4773733.84	TSP	24	21.6	18%	0	0.0%	65.6	55%	0	0.0%
				PM_{10}	24	9.8	20%	0	0.0%	34.2	68%	0	0.0%
				$PM_{2.5}$	24	3.9	15%	0	0.0%	17.1	68%	0	0.0%
				Silica	24	1.0	20%	0	0.0%	2.4	49%	0	0.0%
				NO_2	1	109.7	27%	0	0.0%	134.4	34%	0	0.0%
					24	22.1	11%	0	0.0%	22.1	11%	0	0.0%
				Benzene	24	1.45E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	5.04E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.12E-06	8%	0	0.0%	4.5E-05	89%	0	0.0%
					Annual	1.30E-07	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.65E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.40E-04	0%	0	0.0%	7.1E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 3	Residence	649561.36	4773627.17	TSP	24	20.5	17%	0	0.0%	64.5	54%	0	0.0%
				PM_{10}	24	9.1	18%	0	0.0%	33.5	67%	0	0.0%
				$PM_{2.5}$	24	3.3	13%	0	0.0%	16.5	66%	0	0.0%
				Silica	24	0.9	18%	0	0.0%	2.4	47%	0	0.0%
				NO_2	1	101.0	25%	0	0.0%	125.6	31%	0	0.0%
					24	19.2	10%	0	0.0%	19.2	10%	0	0.0%
				Benzene	24	1.19E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	4.90E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.39E-06	9%	0	0.0%	4.5E-05	90%	0	0.0%
					Annual	1.28E-07	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.00E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.20E-04	0%	0	0.0%	6.9E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 4	Business	649501.46	4773093.70	TSP	24	34.0	28%	0	0.0%	78.0	65%	0	0.0%
				PM_{10}	24	15.2	30%	0	0.0%	39.6	79%	0	0.0%
				$PM_{2.5}$	24	6.0	24%	0	0.0%	19.2	77%	0	0.0%
				Silica	24	1.5	31%	0	0.0%	3.0	60%	0	0.0%
				NO_2	1	100.8	25%	0	0.0%	125.5	31%	0	0.0%
					24	38.1	19%	0	0.0%	38.1	19%	0	0.0%
				Benzene	24	3.37E-02	1%	0	0.0%	4.9E-01	21%	0	0.0%
					Annual	1.05E-03	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.83E-06	14%	0	0.0%	4.7E-05	95%	0	0.0%
					Annual	2.50E-07	3%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	6.90E-03	0%	0	0.0%	4.7E-02	0%	0	0.0%
				Arsenic	24	5.00E-05	0%	0	0.0%	5.0E-05	0%	0	0.0%
				Lead	24	1.00E-04	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	3.40E-04	0%	0	0.0%	9.1E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 5	Residence	649609.10	4772690.07	TSP	24	41.0	34%	0	0.0%	85.0	71%	0	0.0%
				PM_{10}	24	19.0	38%	0	0.0%	43.4	87%	0	0.0%
				$PM_{2.5}$	24	5.1	20%	0	0.0%	18.3	73%	0	0.0%
				Silica	24	1.9	38%	0	0.0%	3.4	68%	0	0.0%
				NO_2	1	97.9	24%	0	0.0%	122.5	31%	0	0.0%
					24	42.1	21%	0	0.0%	42.1	21%	0	0.0%
				Benzene	24	2.09E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	8.82E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	5.34E-06	11%	0	0.0%	4.6E-05	92%	0	0.0%
					Annual	2.01E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.09E-03	0%	0	0.0%	4.4E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.10E-04	0%	0	0.0%	7.8E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 6	Residence	649559.53	4772403.99	TSP	24	28.5	24%	0	0.0%	72.5	60%	0	0.0%
				PM_{10}	24	10.8	22%	0	0.0%	35.2	70%	0	0.0%
				$PM_{2.5}$	24	3.5	14%	0	0.0%	16.7	67%	0	0.0%
				Silica	24	1.1	21%	0	0.0%	2.5	50%	0	0.0%
				NO_2	1	76.3	19%	0	0.0%	100.9	25%	0	0.0%
					24	26.5	13%	0	0.0%	26.5	13%	0	0.0%
				Benzene	24	1.84E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	8.26E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.28E-06	13%	0	0.0%	4.7E-05	93%	0	0.0%
					Annual	1.90E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.82E-03	0%	0	0.0%	4.5E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.90E-04	0%	0	0.0%	7.6E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 7	Residence	649568.03	4772333.18	TSP	24	25.6	21%	0	0.0%	69.6	58%	0	0.0%
				PM_{10}	24	9.7	19%	0	0.0%	34.1	68%	0	0.0%
				$PM_{2.5}$	24	3.5	14%	0	0.0%	16.7	67%	0	0.0%
				Silica	24	0.9	19%	0	0.0%	2.4	48%	0	0.0%
				NO_2	1	67.4	17%	0	0.0%	92.1	23%	0	0.0%
					24	23.0	11%	0	0.0%	23.0	11%	0	0.0%
				Benzene	24	1.90E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	7.70E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	5.88E-06	12%	0	0.0%	4.6E-05	93%	0	0.0%
					Annual	1.76E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.69E-03	0%	0	0.0%	4.4E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.00E-04	0%	0	0.0%	7.7E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 8	Residence (potential)	648398.27	4772829.98	TSP	24	48.0	40%	0	0.0%	92.0	77%	0	0.0%
				PM_{10}	24	19.5	39%	0	0.0%	43.9	88%	0	0.0%
				$PM_{2.5}$	24	6.6	26%	0	0.0%	19.8	79%	0	0.0%
				Silica	24	1.9	39%	0	0.0%	3.4	68%	0	0.0%
				NO_2	1	95.2	24%	0	0.0%	119.9	30%	0	0.0%
					24	37.3	19%	0	0.0%	37.3	19%	0	0.0%
				Benzene	24	3.44E-02	1%	0	0.0%	4.9E-01	21%	0	0.0%
					Annual	1.26E-03	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	8.72E-06	17%	0	0.0%	4.9E-05	98%	0	0.0%
					Annual	3.14E-07	3%	0	0.0%	2.2E-05	215%	n/a	n/a
				Naphthalene	24	6.79E-03	0%	0	0.0%	4.7E-02	0%	0	0.0%
				Arsenic	24	5.00E-05	0%	0	0.0%	5.0E-05	0%	0	0.0%
				Lead	24	1.00E-04	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	3.60E-04	0%	0	0.0%	9.3E-04	0%	0	0.0%
					Annual	4.20E-05	0%	0	0.0%	2.6E-04	1%	0	0.0%
Receptor 9	Business	649114.60	4773685.21	TSP	24	20.5	17%	0	0.0%	64.5	54%	0	0.0%
				PM_{10}	24	8.9	18%	0	0.0%	33.3	67%	0	0.0%
				$PM_{2.5}$	24	3.0	12%	0	0.0%	16.2	65%	0	0.0%
				Silica	24	0.9	18%	0	0.0%	2.4	47%	0	0.0%
				NO_2	1	106.0	27%	0	0.0%	130.7	33%	0	0.0%
					24	22.1	11%	0	0.0%	22.1	11%	0	0.0%
				Benzene	24	1.27E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	5.04E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.89E-06	10%	0	0.0%	4.5E-05	91%	0	0.0%
					Annual	1.59E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	3.06E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.30E-04	0%	0	0.0%	7.0E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 10	Business	649107.18	4772042.78	TSP	24	25.3	21%	0	0.0%	69.3	58%	0	0.0%
				PM_{10}	24	9.5	19%	0	0.0%	33.9	68%	0	0.0%
				$PM_{2.5}$	24	4.2	17%	0	0.0%	17.4	70%	0	0.0%
				Silica	24	1.0	19%	0	0.0%	2.4	48%	0	0.0%
				NO_2	1	98.9	25%	0	0.0%	123.5	31%	0	0.0%
					24	29.7	15%	0	0.0%	29.7	15%	0	0.0%
				Benzene	24	2.49E-02	1%	0	0.0%	4.8E-01	21%	0	0.0%
					Annual	6.02E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	7.69E-06	15%	0	0.0%	4.8E-05	96%	0	0.0%
					Annual	1.95E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	5.15E-03	0%	0	0.0%	4.5E-02	0%	0	0.0%
				Arsenic	24	4.00E-05	0%	0	0.0%	4.0E-05	0%	0	0.0%
				Lead	24	8.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.60E-04	0%	0	0.0%	8.3E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 11	Residence	648614.94	4771698.96	TSP	24	15.7	13%	0	0.0%	59.7	50%	0	0.0%
				PM_{10}	24	6.3	13%	0	0.0%	30.7	61%	0	0.0%
				$PM_{2.5}$	24	2.3	9%	0	0.0%	15.5	62%	0	0.0%
				Silica	24	0.6	13%	0	0.0%	2.1	42%	0	0.0%
				NO_2	1	97.9	24%	0	0.0%	122.5	31%	0	0.0%
					24	17.0	8%	0	0.0%	17.0	8%	0	0.0%
				Benzene	24	1.06E-02	0%	0	0.0%	4.6E-01	20%	0	0.0%
					Annual	2.38E-04	0%	0	0.0%	2.7E-01	59%	0	0.0%
				Benzo(a)pyrene	24	4.29E-06	9%	0	0.0%	4.5E-05	89%	0	0.0%
					Annual	7.78E-08	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.23E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	3.00E-05	0%	0	0.0%	2.3E-03	0%	0	0.0%
				Nickel	24	1.00E-04	0%	0	0.0%	6.7E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Days of Valid Meteorological Data	1827
Hours of Valid Meteorological Data	43848

Relevant Criteria:

TSP	120	µg/m³ AAQC
PM_{10}	50	µg/m³ Interim AAQC
$PM_{2.5}$	25	µg/m³ Canada Wide Standard
Silica	5	µg/m³ AAQC
NO_2	400	µg/m³ 1-Hour AAQC
	200	µg/m³ 24-Hour AAQC
O_3	165	µg/m³ 1-Hour AAQC
Benzene	2.3	µg/m³ 24-Hour AAQC
Benzene	0.45	µg/m³ Annual AAQC
Benzo(a)pyrene	0.00005	µg/m³ 24-Hour AAQC
Benzo(a)pyrene	0.00001	µg/m³ Annual AAQC
Naphthalene	22.5	µg/m³ 24-Hour AAQC
Arsenic	0.3	µg/m³ 24-Hour AAQC
Lead	0.5	µg/m³ 24-Hour AAQC
Nickel	0.2	µg/m³ 24-Hour AAQC
Nickel	0.04	µg/m³ Annual AAQC

Background:

TSP	44	µg/m³ (24-hour)
PM_{10}	24	µg/m³ (24-hour)
$PM_{2.5}$	13	µg/m³ (24-hour)
Silica	1.5	µg/m³ (24-hour)
NO_2	25	µg/m³ (1-hour)
		µg/m³ (24-hour)
O_3	124	µg/m³ (1-hour)
Benzene	0.45	µg/m³ (24-hour)
Benzene	0.27	µg/m³ (Annual)
Benzo(a)pyrene	4.05E-05	µg/m³ (24-hour)
Benzo(a)pyrene	2.12E-05	µg/m³ (Annual)
Naphthalene	0.04	µg/m³ (24-hour)
Arsenic		µg/m³ (24-hour)
Lead	2.31E-03	µg/m³ (24-hour)
Nickel	5.70E-04	µg/m³ (24-hour)
Nickel	2.17E-04	µg/m³ (Annual)

Table 5: Cumulative Effects Analysis for Uppers Quarry Proposed Operating Scenario (Scenario 4)

Extraction in Phase 5 - Plants Remain in Phase 1A and 4 - Maximum Production with Asphalt Plant

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 1	Residence	648758.52	4773661.47	TSP	24	19.7	16%	0	0.0%	63.7	53%	0	0.0%
				PM_{10}	24	7.8	16%	0	0.0%	32.2	64%	0	0.0%
				$PM_{2.5}$	24	2.6	10%	0	0.0%	15.8	63%	0	0.0%
				Silica	24	0.8	16%	0	0.0%	2.3	45%	0	0.0%
				NO_2	1	77.3	19%	0	0.0%	101.9	25%	0	0.0%
					24	24.1	12%	0	0.0%	24.1	12%	0	0.0%
				Benzene	24	1.34E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	3.92E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.33E-06	13%	0	0.0%	4.7E-05	94%	0	0.0%
					Annual	1.58E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	3.74E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.30E-04	0%	0	0.0%	7.0E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 2	Residence	649391.00	4773733.84	TSP	24	21.9	18%	0	0.0%	65.9	55%	0	0.0%
				PM_{10}	24	9.9	20%	0	0.0%	34.3	69%	0	0.0%
				$PM_{2.5}$	24	3.9	16%	0	0.0%	17.1	68%	0	0.0%
				Silica	24	1.0	20%	0	0.0%	2.5	49%	0	0.0%
				NO_2	1	111.0	28%	0	0.0%	135.7	34%	0	0.0%
					24	22.4	11%	0	0.0%	22.4	11%	0	0.0%
				Benzene	24	1.45E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	5.04E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.12E-06	8%	0	0.0%	4.5E-05	89%	0	0.0%
					Annual	1.30E-07	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.65E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.40E-04	0%	0	0.0%	7.1E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 3	Residence	649561.36	4773627.17	TSP	24	20.7	17%	0	0.0%	64.7	54%	0	0.0%
				PM_{10}	24	9.2	18%	0	0.0%	33.6	67%	0	0.0%
				$PM_{2.5}$	24	3.3	13%	0	0.0%	16.5	66%	0	0.0%
				Silica	24	0.9	18%	0	0.0%	2.4	48%	0	0.0%
				NO_2	1	101.0	25%	0	0.0%	125.6	31%	0	0.0%
					24	19.7	10%	0	0.0%	19.7	10%	0	0.0%
				Benzene	24	1.19E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	4.90E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.39E-06	9%	0	0.0%	4.5E-05	90%	0	0.0%
					Annual	1.28E-07	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.00E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.20E-04	0%	0	0.0%	6.9E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 4	Business	649501.46	4773093.70	TSP	24	34.0	28%	0	0.0%	78.0	65%	0	0.0%
				PM_{10}	24	15.2	30%	0	0.0%	39.6	79%	0	0.0%
				$PM_{2.5}$	24	6.0	24%	0	0.0%	19.2	77%	0	0.0%
				Silica	24	1.5	31%	0	0.0%	3.0	60%	0	0.0%
				NO_2	1	100.9	25%	0	0.0%	125.5	31%	0	0.0%
					24	38.1	19%	0	0.0%	38.1	19%	0	0.0%
				Benzene	24	3.37E-02	1%	0	0.0%	4.9E-01	21%	0	0.0%
					Annual	1.05E-03	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.83E-06	14%	0	0.0%	4.7E-05	95%	0	0.0%
					Annual	2.50E-07	3%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	6.90E-03	0%	0	0.0%	4.7E-02	0%	0	0.0%
				Arsenic	24	5.00E-05	0%	0	0.0%	5.0E-05	0%	0	0.0%
				Lead	24	1.00E-04	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	3.40E-04	0%	0	0.0%	9.1E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 5	Residence	649609.10	4772690.07	TSP	24	38.3	32%	0	0.0%	82.3	69%	0	0.0%
				PM_{10}	24	15.9	32%	0	0.0%	40.3	81%	0	0.0%
				$PM_{2.5}$	24	4.6	18%	0	0.0%	17.8	71%	0	0.0%
				Silica	24	1.6	32%	0	0.0%	3.1	61%	0	0.0%
				NO_2	1	97.9	24%	0	0.0%	122.6	31%	0	0.0%
					24	42.1	21%	0	0.0%	42.1	21%	0	0.0%
				Benzene	24	2.09E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	8.82E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	5.34E-06	11%	0	0.0%	4.6E-05	92%	n/a	#VALUE!
					Annual	2.01E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.09E-03	0%	0	0.0%	4.4E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.10E-04	0%	0	0.0%	7.8E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 6	Residence	649559.53	4772403.99	TSP	24	28.7	24%	0	0.0%	72.7	61%	0	0.0%
				PM_{10}	24	10.9	22%	0	0.0%	35.3	71%	0	0.0%
				$PM_{2.5}$	24	3.6	14%	0	0.0%	16.8	67%	0	0.0%
				Silica	24	1.1	21%	0	0.0%	2.5	51%	0	0.0%
				NO_2	1	76.4	19%	0	0.0%	101.0	25%	0	0.0%
					24	26.5	13%	0	0.0%	26.5	13%	0	0.0%
				Benzene	24	1.84E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	8.26E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	6.28E-06	13%	0	0.0%	4.7E-05	93%	0	0.0%
					Annual	1.90E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.82E-03	0%	0	0.0%	4.5E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.90E-04	0%	0	0.0%	7.6E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 7	Residence	649568.03	4772333.18	TSP	24	26.2	22%	0	0.0%	70.2	59%	0	0.0%
				PM_{10}	24	10.0	20%	0	0.0%	34.4	69%	0	0.0%
				$PM_{2.5}$	24	3.5	14%	0	0.0%	16.7	67%	0	0.0%
				Silica	24	1.0	20%	0	0.0%	2.4	49%	0	0.0%
				NO_2	1	67.5	17%	0	0.0%	92.1	23%	0	0.0%
					24	24.0	12%	0	0.0%	24.0	12%	0	0.0%
				Benzene	24	1.90E-02	1%	0	0.0%	4.7E-01	21%	0	0.0%
					Annual	7.70E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	5.88E-06	12%	0	0.0%	4.6E-05	93%	0	0.0%
					Annual	1.76E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	4.69E-03	0%	0	0.0%	4.4E-02	0%	0	0.0%
				Arsenic	24	3.00E-05	0%	0	0.0%	3.0E-05	0%	0	0.0%
				Lead	24	6.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.00E-04	0%	0	0.0%	7.7E-04	0%	0	0.0%
					Annual	2.80E-05	0%	0	0.0%	2.4E-04	1%	0	0.0%
Receptor 8	Residence (potential)	648398.27	4772829.98	TSP	24	47.9	40%	0	0.0%	91.9	77%	0	0.0%
				PM_{10}	24	19.4	39%	0	0.0%	43.8	88%	0	0.0%
				$PM_{2.5}$	24	6.6	26%	0	0.0%	19.8	79%	0	0.0%
				Silica	24	1.9	39%	0	0.0%	3.4	68%	0	0.0%
				NO_2	1	95.3	24%	0	0.0%	119.9	30%	0	0.0%
					24	37.3	19%	0	0.0%	37.3	19%	0	0.0%
				Benzene	24	3.44E-02	1%	0	0.0%	4.9E-01	21%	0	0.0%
					Annual	1.26E-03	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	8.72E-06	17%	0	0.0%	4.9E-05	98%	0	0.0%
					Annual	3.14E-07	3%	0	0.0%	2.2E-05	215%	n/a	n/a
				Naphthalene	24	6.79E-03	0%	0	0.0%	4.7E-02	0%	0	0.0%
				Arsenic	24	5.00E-05	0%	0	0.0%	5.0E-05	0%	0	0.0%
				Lead	24	1.00E-04	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	3.60E-04	0%	0	0.0%	9.3E-04	0%	0	0.0%
					Annual	4.20E-05	0%	0	0.0%	2.6E-04	1%	0	0.0%
Receptor 9	Business	649114.60	4773685.21	TSP	24	20.9	17%	0	0.0%	64.9	54%	0	0.0%
				PM_{10}	24	9.1	18%	0	0.0%	33.5	67%	0	0.0%
				$PM_{2.5}$	24	3.0	12%	0	0.0%	16.2	65%	0	0.0%
				Silica	24	0.9	18%	0	0.0%	2.4	48%	0	0.0%
				NO_2	1	111.0	28%	0	0.0%	135.7	34%	0	0.0%
					24	22.3	11%	0	0.0%	22.3	11%	0	0.0%
				Benzene	24	1.27E-02	1%	0	0.0%	4.7E-01	20%	0	0.0%
					Annual	5.04E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	4.89E-06	10%	0	0.0%	4.5E-05	91%	0	0.0%
					Annual	1.59E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	3.06E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	4.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	1.30E-04	0%	0	0.0%	7.0E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 10	Business	649107.18	4772042.78	TSP	24	26.7	22%	0	0.0%	70.7	59%	0	0.0%
				PM_{10}	24	10.4	21%	0	0.0%	34.8	70%	0	0.0%
				$PM_{2.5}$	24	4.3	17%	0	0.0%	17.5	70%	0	0.0%
				Silica	24	1.0	21%	0	0.0%	2.5	50%	0	0.0%
				NO_2	1	110.5	28%	0	0.0%	135.1	34%	0	0.0%
					24	31.8	16%	0	0.0%	31.8	16%	0	0.0%
				Benzene	24	2.49E-02	1%	0	0.0%	4.8E-01	21%	0	0.0%
					Annual	6.02E-04	0%	0	0.0%	2.7E-01	60%	0	0.0%
				Benzo(a)pyrene	24	7.69E-06	15%	0	0.0%	4.8E-05	96%	0	0.0%
					Annual	1.95E-07	2%	0	0.0%	2.1E-05	214%	n/a	n/a
				Naphthalene	24	5.15E-03	0%	0	0.0%	4.5E-02	0%	0	0.0%
				Arsenic	24	4.00E-05	0%	0	0.0%	4.0E-05	0%	0	0.0%
				Lead	24	8.00E-05	0%	0	0.0%	2.4E-03	0%	0	0.0%
				Nickel	24	2.60E-04	0%	0	0.0%	8.3E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%
Receptor 11	Residence	648614.94	4771698.96	TSP	24	16.1	13%	0	0.0%	60.1	50%	0	0.0%
				PM_{10}	24	6.6	13%	0	0.0%	31.0	62%	0	0.0%
				$PM_{2.5}$	24	2.3	9%	0	0.0%	15.5	62%	0	0.0%
				Silica	24	0.7	13%	0	0.0%	2.1	42%	0	0.0%
				NO_2	1	97.9	24%	0	0.0%	122.5	31%	0	0.0%
					24	17.1	9%	0	0.0%	17.1	9%	0	0.0%
				Benzene	24	1.06E-02	0%	0	0.0%	4.6E-01	20%	0	0.0%
					Annual	2.38E-04	0%	0	0.0%	2.7E-01	59%	0	0.0%
				Benzo(a)pyrene	24	4.29E-06	9%	0	0.0%	4.5E-05	89%	0	0.0%
					Annual	7.78E-08	1%	0	0.0%	2.1E-05	213%	n/a	n/a
				Naphthalene	24	3.23E-03	0%	0	0.0%	4.3E-02	0%	0	0.0%
				Arsenic	24	2.00E-05	0%	0	0.0%	2.0E-05	0%	0	0.0%
				Lead	24	3.00E-05	0%	0	0.0%	2.3E-03	0%	0	0.0%
				Nickel	24	1.00E-04	0%	0	0.0%	6.7E-04	0%	0	0.0%
					Annual	1.40E-05	0%	0	0.0%	2.3E-04	1%	0	0.0%

Days of Valid Meteorological Data	1827
Hours of Valid Meteorological Data	43848

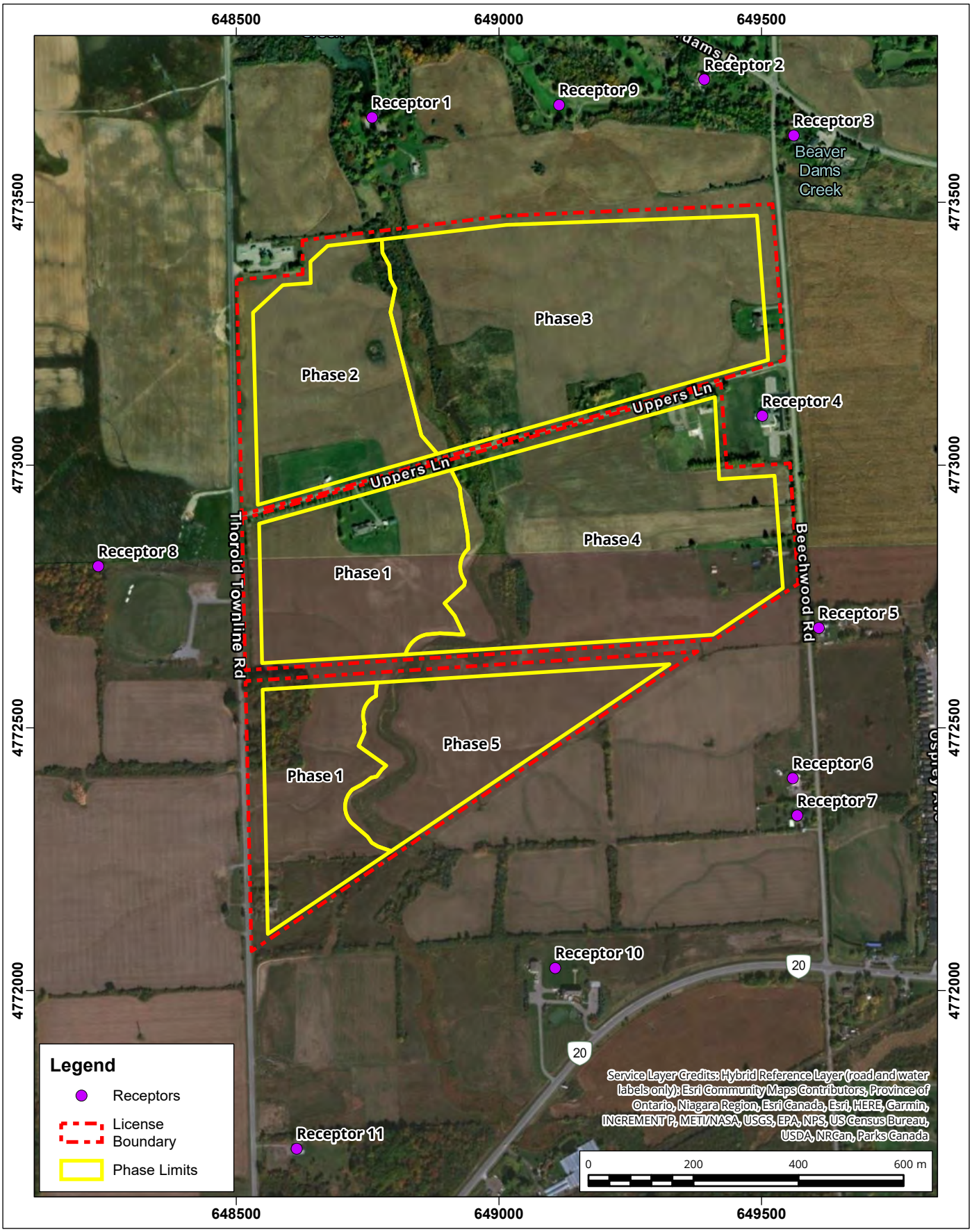
Relevant Criteria:

TSP	120	µg/m³ AAQC
PM_{10}	50	µg/m³ Interim AAQC
$PM_{2.5}$	25	µg/m³ Canada Wide Standard
Silica	5	µg/m³ AAQC
NO_2	400	µg/m³ 1-Hour AAQC
	200	µg/m³ 24-Hour AAQC
O_3	165	µg/m³ 1-Hour AAQC
Benzene	2.3	µg/m³ 24-Hour AAQC
Benzene	0.45	µg/m³ Annual AAQC
Benzo(a)pyrene	0.00005	µg/m³ 24-Hour AAQC
Benzo(a)pyrene	0.00001	µg/m³ Annual AAQC
Naphthalene	22.5	µg/m³ 24-Hour AAQC
Arsenic	0.3	µg/m³ 24-Hour AAQC
Lead	0.5	µg/m³ 24-Hour AAQC
Nickel	0.2	µg/m³ 24-Hour AAQC
Nickel	0.04	µg/m³ Annual AAQC

Background:

TSP	44	µg/m³ (24-hour)
PM_{10}	24	µg/m³ (24-hour)
$PM_{2.5}$	13	µg/m³ (24-hour)
Silica	1.5	µg/m³ (24-hour)
NO_2	25	µg/m³ (1-hour)
		µg/m³ (24-hour)
O_3	124	µg/m³ (1-hour)
Benzene	0.45	µg/m³ (24-hour)
Benzene	0.27	µg/m³ (Annual)
Benzo(a)pyrene	4.05E-05	µg/m³ (24-hour)
Benzo(a)pyrene	2.12E-05	µg/m³ (Annual)
Naphthalene	0.04	µg/m³ (24-hour)
Arsenic		µg/m³ (24-hour)
Lead	2.31E-03	µg/m³ (24-hour)
Nickel	5.70E-04	µg/m³ (24-hour)
Nickel	2.17E-04	µg/m³ (Annual)

FIGURES



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Receptor Locations

Map Projection: NAD 1983 UTM Zone 17N

Upper's Quarry - Niagara Region, Ontario

True North

Project #: 1603157

Drawn by: LJN	Figure: 1
Approx. Scale:	1:10,000
Date Revised:	Sep 3, 2021

Map Document: C:\Users\LJN\OneDrive - ROWAN WILLIAMS DAVIES & IRWIN INC\Desktop\GIS\Uppers Quarry\GIS\1603157_Uppers Quarry_210714.aprx

Scenario 1 - Phase 2A

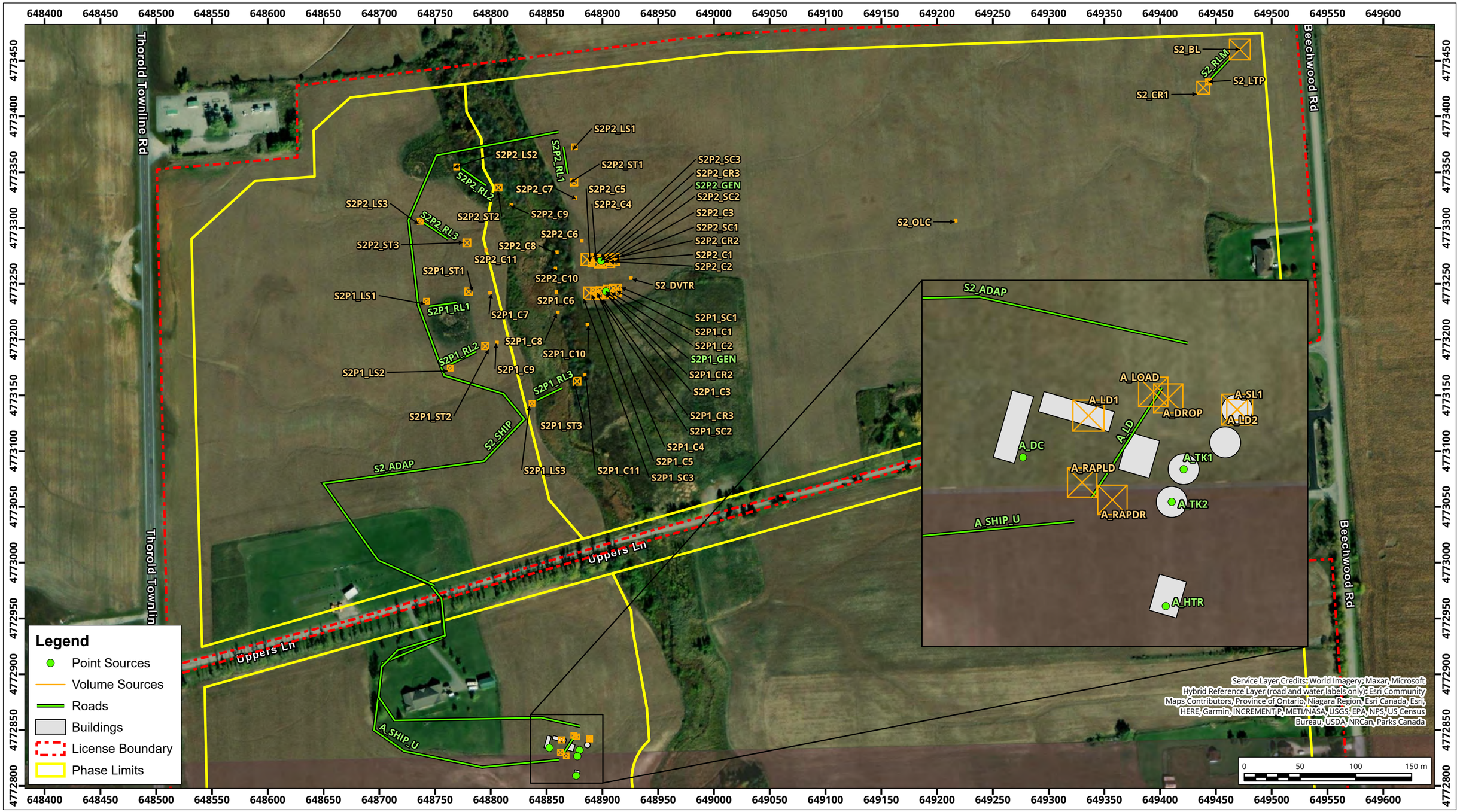
Map Projection: NAD 1983 UTM Zone 17N

Upper's Quarry - Niagara Region, Ontario

True North

Project #: 1603157

Drawn by:	LJN	Figure:	2
Approx. Scale:	1:1,600		
Date Revised:	Sep 3, 2021		



Scenario 2 - Phase 3A and 3B with Asphalt Plant in Phase 1A

Map Projection: NAD 1983 UTM Zone 17N

Upper's Quarry - Niagara Region, Ontario

True North

Project #: 1603157

Drawn by:	LJN	Figure:	3
Approx. Scale:		1:3,200	
Date Revised:		Sep 3, 2021	

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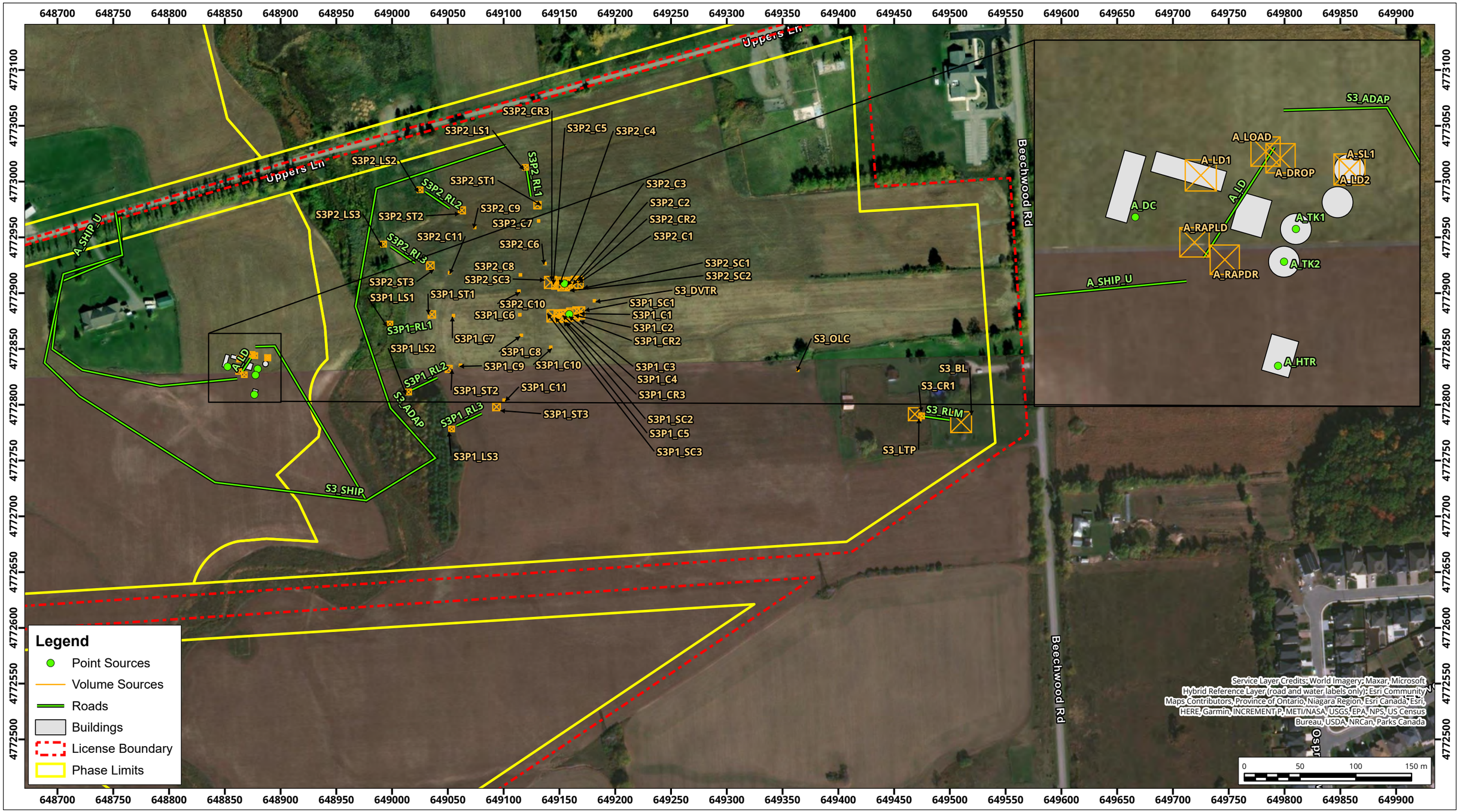


Phase 4 with Asphalt Plant in Phase 1A

Map Projection: NAD 1983 UTM Zone 17N

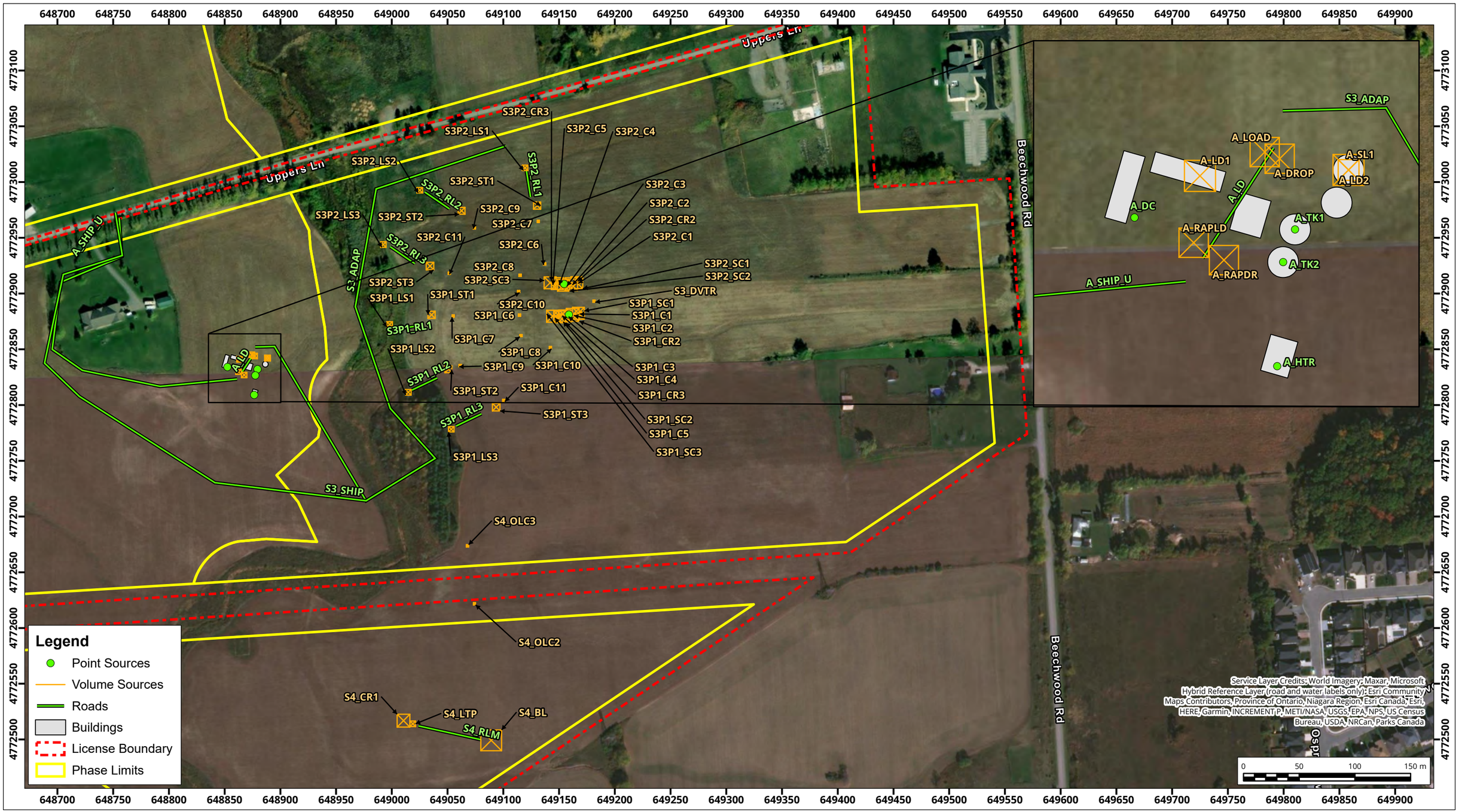
Upper's Quarry - Niagara Region, Ontario

True North

Project #: 1603157

Drawn by:	LJN	Figure:	4
Approx. Scale:	1:3,200		
Date Revised:	Sep 3, 2021		

Map Document: C:\Users\LJN\OneDrive - ROWAN WILLIAMS DAVIES & IRWIN INC\Desktop\GIS\Uppers Quarry\GIS\1603157 Uppers Quarry_210714.aprx



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Phase 5 with Processing in Phase 4 and Asphalt Plant in Phase 1A

Map Projection: NAD 1983 UTM Zone 17N

Upper's Quarry - Niagara Region, Ontario

True North

Project #: 1603157

Drawn by:	LJN	Figure:	5
Approx. Scale:	1:3,200		
Date Revised:	Sep 3, 2021		

APPENDIX A

Appendix A: Proposed Extraction Scenario Blasting Operations Emission Spreadsheet

Project # 1603157

Upper's Quarry and Asphalt Plant

WESTERN SURFACE COAL MINING - AP-42 Section 11.9
EXPLOSIVES DETONATION - AP-42 Section 13.3

Blasting operation particulate emissions: $E = 0.00022\ k * A^{1.5}$

E emission factor
k particle size multiplier (1.13, 1.0, 0.52 and 0.03 for TSP, PM_{30}, PM_{10} and $PM_{2.5}$, respectively)
A blast surface area (m^2)

Source ID	Source Description	Total Blast Area (m^2)	Explosive Type	Number of Blasts			Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied (%)	Final Controlled Emission Rate							
				Hourly	Daily	Annual	TSP (kg/blast)	PM_{10} (kg/blast)	$PM_{2.5}$ (kg/blast)	Silica (kg/blast)	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
BL	Blasting at Working Face	346	ANFO	1	1	200	1.6E+00	7.4E-01	4.2E-02	7.4E-02	4.4E-01	2.0E-01	1.2E-02	2.0E-02	0%	4.4E-01	C	2.0E-01	C	1.2E-02	C	2.0E-02	C
	Blasting - Reduced Area	200	ANFO	1	1	200	7.0E-01	3.2E-01	1.9E-02	3.2E-02	2.0E-01	9.0E-02	5.2E-03	9.0E-03	0%	2.0E-01	C	9.0E-02	C	5.2E-03	C	9.0E-03	C

Sample calculation for uncontrolled TSP emission factor for Source BL: Blasting at Working Face.

EF = 0.00022 x (1) x (346 m)^1.5 = 1.6E+00 kg TSP / blast

Sample calculation for TSP emission rate for Source BL: Blasting - Reduced Area.

$$\frac{1\ \text{blast}}{1\ \text{h}} \times \frac{1.6\text{E+00}\ \text{kg}_{TSP}}{1\ \text{blast}} \times \frac{1\ \text{h}}{3600\ \text{s}} \times \frac{1000\ \text{g}_{TSP}}{1\ \text{kg}_{TSP}} \times \frac{1\ \text{g}_{TSP\ uncontrolled}}{1\ \text{g}_{TSP}} = 4.4\text{E-01}\ \text{g}_{TSP}/\text{s}$$

Comments
Blast area assumed similar to the existing operations at WBQ
Silica emissions based on silica in native stone 10.00%

APPENDIX B

Appendix B: Proposed Extraction Scenario Processing Emissions Spreadsheet

Upper's Quarry and Asphalt Plant

Project # 1603157

Soource ID [1]	Source Description / Process Decription	AP-42 Process Description [2]	Process Code	AP-42 Chapter	Processing Rate		Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied	Final Controlled Emission Rate							
					Hourly	Daily	TSP [3]	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)	(kg/Mg)	(kg/Mg)	(kg/Mg)	(kg/Mg)	(g/s)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)		(g/s)	
Scenario 1:	**Phase 2A - 1 Plant at Top of Rock**																						
S1_LTP	Loading to Primary Crusher	Truck unloading - fragmented stone	16	11.19.2-1	250	3000	1.1E-05	8.0E-06	1.2E-06	8.0E-07	7.6E-04	5.6E-04	8.3E-05	5.6E-05		7.6E-04	E	5.6E-04	E	8.3E-05	E	5.6E-05	E
S1_CR1	Primary crusher	Primary crushing (controlled)	6	11.19.2-1	250	3000	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.4E-02	1.9E-02	3.5E-03	1.9E-03		2.4E-02	E	1.9E-02	E	3.5E-03	E	1.9E-03	E
S1_C1	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	250	3000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.6E-03	1.6E-03	4.5E-04	1.6E-04		2.6E-03	E	1.6E-03	D	4.5E-04	E	1.6E-04	E
S1_SC1	Primary screen	Screening (controlled)	2	11.19.2-1	250	3000	5.6E-04	3.7E-04	2.5E-05	3.7E-05	3.9E-02	2.6E-02	1.7E-03	2.6E-03		3.9E-02	E	2.6E-02	C	1.7E-03	E	2.6E-03	E
S1_C2	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	175	2100	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.8E-03	1.1E-03	3.2E-04	1.1E-04		1.8E-03	E	1.1E-03	D	3.2E-04	E	1.1E-04	E
S1_CR2	Secondary crusher	Secondary crushing (controlled)	7	11.19.2-1	175	2100	3.4E-04	2.7E-04	5.0E-05	2.7E-05	1.7E-02	1.3E-02	2.4E-03	1.3E-03		1.7E-02	E	1.3E-02	E	2.4E-03	E	1.3E-03	E
S1_C3	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	175	2100	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.8E-03	1.1E-03	3.2E-04	1.1E-04		1.8E-03	E	1.1E-03	D	3.2E-04	E	1.1E-04	E
S1_SC2	Secondary screen	Screening (controlled)	2	11.19.2-1	175	2100	5.6E-04	3.7E-04	2.5E-05	3.7E-05	2.7E-02	1.8E-02	1.2E-03	1.8E-03		2.7E-02	E	1.8E-02	C	1.2E-03	E	1.8E-03	E
S1_C4	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	175	2100	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.8E-03	1.1E-03	3.2E-04	1.1E-04		1.8E-03	E	1.1E-03	D	3.2E-04	E	1.1E-04	E
S1_CR3	Tertiary crusher	Secondary crushing (controlled)	7	11.19.2-1	175	2100	3.4E-04	2.7E-04	5.0E-05	2.7E-05	1.7E-02	1.3E-02	2.4E-03	1.3E-03		1.7E-02	E	1.3E-02	E	2.4E-03	E	1.3E-03	E
S1_C5	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	175	2100	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.8E-03	1.1E-03	3.2E-04	1.1E-04		1.8E-03	E	1.1E-03	D	3.2E-04	E	1.1E-04	E
S1_SC3	Tertiary screen	Screening (controlled)	2	11.19.2-1	175	2100	5.6E-04	3.7E-04	2.5E-05	3.7E-05	2.7E-02	1.8E-02	1.2E-03	1.8E-03		2.7E-02	E	1.8E-02	C	1.2E-03	E	1.8E-03	E
S1_C6	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S1_C7	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S1_C8	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S1_C9	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S1_C10	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S1_C11	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
Scenario 2:	**Phase 3A and 3B - 2 Plants at Bottom of Quarry - Maximum Production With Asphalt Plant**																						
S2_LTP	Loading to Primary Crusher	Truck unloading - fragmented stone	16	11.19.2-1	750	9000	1.1E-05	8.0E-06	1.2E-06	8.0E-07	2.3E-03	1.7E-03	2.5E-04	1.7E-04		2.3E-03	E	1.7E-03	E	2.5E-04	E	1.7E-04	E
S2_CR1	Primary crusher	Primary crushing (controlled)	6	11.19.2-1	750	9000	3.4E-04	2.7E-04	5.0E-05	2.7E-05	7.1E-02	5.6E-02	1.0E-02	5.6E-03		7.1E-02	E	5.6E-02	E	1.0E-02	E	5.6E-03	E
S2_OLC	Overland Conveyor Drop Point	Conveyor transfer point (controlled)	14	11.19.2-1	750	9000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	7.7E-03	4.8E-03	1.4E-03	4.8E-04		7.7E-03	E	4.8E-03	D	1.4E-03	E	4.8E-04	E
S2_DVTR	Feed Diverter for Secondary Plants	Conveyor transfer point (controlled)	14	11.19.2-1	750	9000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	7.7E-03	4.8E-03	1.4E-03	4.8E-04		7.7E-03	E	4.8E-03	D	1.4E-03	E	4.8E-04	E
S2P1_C1	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	375	4500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	3.9E-03	2.4E-03	6.8E-04	2.4E-04		3.9E-03	E	2.4E-03	D	6.8E-04	E	2.4E-04	E
S2P1_SC1	Primary screen	Screening (controlled)	2	11.19.2-1	375	4500	5.6E-04	3.7E-04	2.5E-05	3.7E-05	5.8E-02	3.9E-02	2.6E-03	3.9E-03		5.8E-02	E	3.9E-02	C	2.6E-03	E	3.9E-03	E
S2P1_C2	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S2P1_CR2	Secondary crusher	Secondary crushing (controlled)	7	11.19.2-1	263	3150	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.5E-02	2.0E-02	3.6E-03	2.0E-03		2.5E-02	E	2.0E-02	E	3.6E-03	E	2.0E-03	E
S2P1_C3	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S2P1_SC2	Secondary screen	Screening (controlled)	2	11.19.2-1	263	3150	5.6E-04	3.7E-04	2.5E-05	3.7E-05	4.1E-02	2.7E-02	1.8E-03	2.7E-03		4.1E-02	E	2.7E-02	C	1.8E-03	E	2.7E-03	E
S2P1_C4	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S2P1_CR3	Tertiary crusher	Secondary crushing (controlled)	7	11.19.2-1	263	3150	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.5E-02	2.0E-02	3.6E-03	2.0E-03		2.5E-02	E	2.0E-02	E	3.6E-03	E	2.0E-03	E
S2P1_C5	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S2P1_SC3	Tertiary screen	Screening (controlled)	2	11.19.2-1	263	3150	5.6E-04	3.7E-04	2.5E-05	3.7E-05	4.1E-02	2.7E-02	1.8E-03	2.7E-03		4.1E-02	E	2.7E-02	C	1.8E-03	E	2.7E-03	E
S2P1_C6	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P1_C7	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P1_C8	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P1_C9	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P1_C10	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P1_C11	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P2_C1	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	375	4500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	3.9E-03	2.4E-03	6.8E-04	2.4E-04		3.9E-03	E	2.4E-03	D	6.8E-04	E	2.4E-04	E
S2P2_SC1	Primary screen	Screening (controlled)	2	11.19.2-1	375	4500	5.6E-04	3.7E-04	2.5E-05	3.7E-05	5.8E-02	3.9E-02	2.6E-03	3.9E-03		5.8E-02	E	3.9E-02	C	2.6E-03	E	3.9E-03	E
S2P2_C2	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S2P2_CR2	Secondary crusher	Secondary crushing (controlled)	7	11.19.2-1	263	3150	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.5E-02	2.0E-02	3.6E-03	2.0E-03		2.5E-02	E	2.0E-02	E	3.6E-03	E	2.0E-03	E
S2P2_C3	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S2P2_SC2	Secondary screen	Screening (controlled)	2	11.19.2-1	263	3150	5.6E-04	3.7E-04	2.5E-05	3.7E-05	4.1E-02	2.7E-02	1.8E-03	2.7E-03		4.1E-02	E	2.7E-02	C	1.8E-03	E	2.7E-03	E
S2P2_C4	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S2P2_CR3	Tertiary crusher	Secondary crushing (controlled)	7	11.19.2-1	263	3150	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.5E-02	2.0E-02	3.6E-03	2.0E-03		2.5E-02	E	2.0E-02	E	3.6E-03	E	2.0E-03	E
S2P2_C5	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S2P2_SC3	Tertiary screen	Screening (controlled)	2	11.19.2-1	263	3150	5.6E-04	3.7E-04	2.5E-05	3.7E-05	4.1E-02	2.7E-02	1.8E-03	2.7E-03		4.1E-02	E	2.7E-02	C	1.8E-03	E	2.7E-03	E

Soource ID [1]	Source Description / Process Decription	AP-42 Process Description [2]	Process Code	AP-42 Chapter	Processing Rate		Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied	Final Controlled Emission Rate							
					Hourly	Daily	TSP [3]	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)	(kg/Mg)	(kg/Mg)	(kg/Mg)	(kg/Mg)	(g/s)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)		(g/s)	
S2P2_C6	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P2_C7	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P2_C8	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P2_C9	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P2_C10	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S2P2_C11	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
Scenario 3: Phase 4 - 2 Plants Bottom of Quarry - Maximum Production with Asphalt Plant																							
S3_LTP	Loading to Primary Crusher	Truck unloading - fragmented stone	16	11.19.2-1	750	9000	1.1E-05	8.0E-06	1.2E-06	8.0E-07	2.3E-03	1.7E-03	2.5E-04	1.7E-04		2.3E-03	E	1.7E-03	E	2.5E-04	E	1.7E-04	E
S3_CR1	Primary crusher	Primary crushing (controlled)	6	11.19.2-1	750	9000	3.4E-04	2.7E-04	5.0E-05	2.7E-05	7.1E-02	5.6E-02	1.0E-02	5.6E-03		7.1E-02	E	5.6E-02	E	1.0E-02	E	5.6E-03	E
S3_OLC	Overland Conveyor Drop Point	Conveyor transfer point (controlled)	14	11.19.2-1	750	9000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	7.7E-03	4.8E-03	1.4E-03	4.8E-04		7.7E-03	E	4.8E-03	D	1.4E-03	E	4.8E-04	E
S3_DVTR	Feed Diverter for Secondary Plants	Conveyor transfer point (controlled)	14	11.19.2-1	750	9000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	7.7E-03	4.8E-03	1.4E-03	4.8E-04		7.7E-03	E	4.8E-03	D	1.4E-03	E	4.8E-04	E
S3P1_C1	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	375	4500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	3.9E-03	2.4E-03	6.8E-04	2.4E-04		3.9E-03	E	2.4E-03	D	6.8E-04	E	2.4E-04	E
S3P1_SC1	Primary screen	Screening (controlled)	2	11.19.2-1	375	4500	5.6E-04	3.7E-04	2.5E-05	3.7E-05	5.8E-02	3.9E-02	2.6E-03	3.9E-03		5.8E-02	E	3.9E-02	C	2.6E-03	E	3.9E-03	E
S3P1_C2	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S3P1_CR2	Secondary crusher	Secondary crushing (controlled)	7	11.19.2-1	263	3150	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.5E-02	2.0E-02	3.6E-03	2.0E-03		2.5E-02	E	2.0E-02	E	3.6E-03	E	2.0E-03	E
S3P1_C3	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S3P1_SC2	Secondary screen	Screening (controlled)	2	11.19.2-1	263	3150	5.6E-04	3.7E-04	2.5E-05	3.7E-05	4.1E-02	2.7E-02	1.8E-03	2.7E-03		4.1E-02	E	2.7E-02	C	1.8E-03	E	2.7E-03	E
S3P1_C4	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S3P1_CR3	Tertiary crusher	Secondary crushing (controlled)	7	11.19.2-1	263	3150	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.5E-02	2.0E-02	3.6E-03	2.0E-03		2.5E-02	E	2.0E-02	E	3.6E-03	E	2.0E-03	E
S3P1_C5	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S3P1_SC3	Tertiary screen	Screening (controlled)	2	11.19.2-1	263	3150	5.6E-04	3.7E-04	2.5E-05	3.7E-05	4.1E-02	2.7E-02	1.8E-03	2.7E-03		4.1E-02	E	2.7E-02	C	1.8E-03	E	2.7E-03	E
S3P1_C6	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P1_C7	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P1_C8	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P1_C9	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P1_C10	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P1_C11	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P2_C1	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	375	4500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	3.9E-03	2.4E-03	6.8E-04	2.4E-04		3.9E-03	E	2.4E-03	D	6.8E-04	E	2.4E-04	E
S3P2_SC1	Primary screen	Screening (controlled)	2	11.19.2-1	375	4500	5.6E-04	3.7E-04	2.5E-05	3.7E-05	5.8E-02	3.9E-02	2.6E-03	3.9E-03		5.8E-02	E	3.9E-02	C	2.6E-03	E	3.9E-03	E
S3P2_C2	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S3P2_CR2	Secondary crusher	Secondary crushing (controlled)	7	11.19.2-1	263	3150	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.5E-02	2.0E-02	3.6E-03	2.0E-03		2.5E-02	E	2.0E-02	E	3.6E-03	E	2.0E-03	E
S3P2_C3	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S3P2_SC2	Secondary screen	Screening (controlled)	2	11.19.2-1	263	3150	5.6E-04	3.7E-04	2.5E-05	3.7E-05	4.1E-02	2.7E-02	1.8E-03	2.7E-03		4.1E-02	E	2.7E-02	C	1.8E-03	E	2.7E-03	E
S3P2_C4	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S3P2_CR3	Tertiary crusher	Secondary crushing (controlled)	7	11.19.2-1	263	3150	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.5E-02	2.0E-02	3.6E-03	2.0E-03		2.5E-02	E	2.0E-02	E	3.6E-03	E	2.0E-03	E
S3P2_C5	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	263	3150	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.7E-03	1.7E-03	4.7E-04	1.7E-04		2.7E-03	E	1.7E-03	D	4.7E-04	E	1.7E-04	E
S3P2_SC3	Tertiary screen	Screening (controlled)	2	11.19.2-1	263	3150	5.6E-04	3.7E-04	2.5E-05	3.7E-05	4.1E-02	2.7E-02	1.8E-03	2.7E-03		4.1E-02	E	2.7E-02	C	1.8E-03	E	2.7E-03	E
S3P2_C6	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P2_C7	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P2_C8	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P2_C9	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P2_C10	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
S3P2_C11	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	125	1500	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.3E-03	8.0E-04	2.3E-04	8.0E-05		1.3E-03	E	8.0E-04	D	2.3E-04	E	8.0E-05	E
Scenario 4: Extraction in Phase 5 - Plants Remain in Phase 1A and 4 - Maximum Production with Asphalt Plant																							
S4_LTP	Loading to Primary Crusher	Truck unloading - fragmented stone	16	11.19.2-1	750	9000	1.1E-05	8.0E-06	1.2E-06	8.0E-07	2.3E-03	1.7E-03	2.5E-04	1.7E-04		2.3E-03	E	1.7E-03	E	2.5E-04	E	1.7E-04	E
S4_CR1	Primary crusher	Primary crushing (controlled)	6	11.19.2-1	750	9000	3.4E-04	2.7E-04	5.0E-05	2.7E-05	7.1E-02	5.6E-02	1.0E-02	5.6E-03		7.1E-02	E	5.6E-02	E	1.0E-02	E	5.6E-03	E
S4_OLC1	Overland Conveyor Drop Point	Conveyor transfer point (controlled)	14	11.19.2-1	750	9000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	7.7E-03	4.8E-03	1.4E-03	4.8E-04		7.7E-03	E	4.8E-03	D	1.4E-03	E	4.8E-04	E
S4_OLC2	Overland Conveyor Drop Point	Conveyor transfer point (controlled)	14	11.19.2-1	750	9000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	7.7E-03	4.8E-03	1.4E-03	4.8E-04		7.7E-03	E	4.8E-03	D	1.4E-03	E	4.8E-04	E
S4_OLC3	Overland Conveyor Drop Point	Conveyor transfer point (controlled)	14	11.19.2-1	750	9000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	7.7E-03	4.8E-03	1.4E-03	4.8E-04		7.7E-03	E	4.8E-03	D	1.4E-03	E	4.8E-04	E
All other Sources Identical to Scenario 7																							
Scenario 5: Alternate Extraction Scenario - Phase 1A - 1 Plant at Top of Rock																							
S5_LTP	Loading to Primary Crusher	Truck unloading - fragmented stone	16	11.19.2-1	250	3000	1.1E-05	8.0E-06	1.2E-06	8.0E-07	7.6E-04	5.6E-04	8.3E-05	5.6E-05		7.6E-04	E	5.6E-04	E	8.3E-05	E	5.6E-05	E
S5_CR1	Primary crusher	Primary crushing (controlled)	6	11.19.2-1	250	3000	3.4E-04	2.7E-04	5.0E-05	2.7E-05	2.4E-02	1.9E-02	3.5E-03	1.9E-03		2.4E-02	E	1.9E-02	E	3.5E-03	E	1.9E-03	E
S5_C1	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	250	3000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	2.6E-03	1.6E-03	4.5E-04	1.6E-04		2.6E-03	E	1.6E-03	D	4.5E-04	E	1.6E-04	E

Soource ID [1]	Source Description / Process Decription	AP-42 Process Description [2]	Process Code	AP-42 Chapter	Processing Rate		Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied	Final Controlled Emission Rate							
					Hourly	Daily	TSP [3]	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)	(kg/Mg)	(kg/Mg)	(kg/Mg)	(kg/Mg)	(g/s)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)		(g/s)	
S5_SC1	Primary screen	Screening (controlled)	2	11.19.2-1	250	3000	5.6E-04	3.7E-04	2.5E-05	3.7E-05	3.9E-02	2.6E-02	1.7E-03	2.6E-03		3.9E-02	E	2.6E-02	C	1.7E-03	E	2.6E-03	E
S5_C2	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	175	2100	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.8E-03	1.1E-03	3.2E-04	1.1E-04		1.8E-03	E	1.1E-03	D	3.2E-04	E	1.1E-04	E
S5_CR2	Secondary crusher	Secondary crushing (controlled)	7	11.19.2-1	175	2100	3.4E-04	2.7E-04	5.0E-05	2.7E-05	1.7E-02	1.3E-02	2.4E-03	1.3E-03		1.7E-02	E	1.3E-02	E	2.4E-03	E	1.3E-03	E
S5_C3	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	175	2100	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.8E-03	1.1E-03	3.2E-04	1.1E-04		1.8E-03	E	1.1E-03	D	3.2E-04	E	1.1E-04	E
S5_SC2	Secondary screen	Screening (controlled)	2	11.19.2-1	175	2100	5.6E-04	3.7E-04	2.5E-05	3.7E-05	2.7E-02	1.8E-02	1.2E-03	1.8E-03		2.7E-02	E	1.8E-02	C	1.2E-03	E	1.8E-03	E
S5_C4	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	175	2100	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.8E-03	1.1E-03	3.2E-04	1.1E-04		1.8E-03	E	1.1E-03	D	3.2E-04	E	1.1E-04	E
S5_CR3	Tertiary crusher	Secondary crushing (controlled)	7	11.19.2-1	175	2100	3.4E-04	2.7E-04	5.0E-05	2.7E-05	1.7E-02	1.3E-02	2.4E-03	1.3E-03		1.7E-02	E	1.3E-02	E	2.4E-03	E	1.3E-03	E
S5_C5	Conveyor drop point	Conveyor transfer point (controlled)	14	11.19.2-1	175	2100	3.7E-05	2.3E-05	6.5E-06	2.3E-06	1.8E-03	1.1E-03	3.2E-04	1.1E-04		1.8E-03	E	1.1E-03	D	3.2E-04	E	1.1E-04	E
S5_SC3	Tertiary screen	Screening (controlled)	2	11.19.2-1	175	2100	5.6E-04	3.7E-04	2.5E-05	3.7E-05	2.7E-02	1.8E-02	1.2E-03	1.8E-03		2.7E-02	E	1.8E-02	C	1.2E-03	E	1.8E-03	E
S5_C6	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S5_C7	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S5_C8	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S5_C9	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S5_C10	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E
S5_C11	Conveyor drop point for stacker	Conveyor transfer point (controlled)	14	11.19.2-1	83	1000	3.7E-05	2.3E-05	6.5E-06	2.3E-06	8.6E-04	5.3E-04	1.5E-04	5.3E-05		8.6E-04	E	5.3E-04	D	1.5E-04	E	5.3E-05	E

[1] ID corresponds to process flow diagram for facility and / or material

[2] AP-42 process listed as "controlled" reflects between 70-90% control due to high moisture / water sprays, as described in AP-42 Section 11.19.2.

[3] Base AP-42 Emission Factor is based on PM_{100}, emissions have been corrected to PM_{44}.

Comments
Percentage of total material handled by each process are considered to be similar to the WBQ Quarry
The percentages are as follows: Primary crushing 100%, secondary crushing 70%, and tertiary crushing 70%.
Future percentages were assumed to be the same as existing conditions.
All processing activity (crushing, screening, etc) at the Uppers Quarry is controlled using water sprays.
For this reason, the "controlled" AP-42 emission factors were used, rather than the "uncontrolled" factors.
Silica emissions based on silica in native stone 10.0%
For simplicity, total production is split evenly across all stackers.

Sample calculation for TSP emissions from Source S1_CR1: Primary crusher

$$\frac{250\ Mg_{processed}}{1\ h} \times \frac{3.4E\text{-}04\ kg_{TSP}}{1\ Mg_{processed}} \times \frac{1\ h}{3600\ s} \times \frac{1000}{1} \times \frac{100\%\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 2.4E\text{-}02\ g_{TSP}/s$$

APPENDIX C

Appendix C: Proposed Extraction Scenario Bulk Material Handling Emissions Spreadsheet

Project # 1603157

Upper's Quarry and Asphalt Plant

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, 0.74, 0.35 and 0.053 for TSP, PM_{30}, PM_{10} and $PM_{2.5}$, respectively) [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): 3.57
(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 3.57 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)	
Scenario 1: Phase 2A - 1 Plant at Top of Rock with Asphalt Plant																								
S1_ST1	Stacker drop point	83	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	5.2E-02	2.3E-02	3.4E-03	2.3E-03		5.2E-02	B	2.3E-02	B	3.4E-03	B	2.3E-03	B
S1_LS1	Loading at processing plant for shipping	42	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	2.6E-02	1.1E-02	1.7E-03	1.1E-03		2.6E-02	B	1.1E-02	B	1.7E-03	B	1.1E-03	B
S1_ST2	Stacker drop point	83	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	5.2E-02	2.3E-02	3.4E-03	2.3E-03		5.2E-02	B	2.3E-02	B	3.4E-03	B	2.3E-03	B
S1_LS2	Loading at processing plant for shipping	42	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	2.6E-02	1.1E-02	1.7E-03	1.1E-03		2.6E-02	B	1.1E-02	B	1.7E-03	B	1.1E-03	B
S1_ST3	Stacker drop point	83	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	5.2E-02	2.3E-02	3.4E-03	2.3E-03		5.2E-02	B	2.3E-02	B	3.4E-03	B	2.3E-03	B
S1_LS3	Loading at processing plant for shipping	42	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	2.6E-02	1.1E-02	1.7E-03	1.1E-03		2.6E-02	B	1.1E-02	B	1.7E-03	B	1.1E-03	B
Scenario 2: Phase 3A and 3B - 2 Plants at Bottom of Quarry - Maximum Production with Asphalt Plant																								
S2P1_ST1	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S2P1_LS1	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S2P1_ST2	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S2P1_LS2	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S2P1_ST3	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S2P1_LS3	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S2P2_ST1	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S2P2_LS1	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S2P2_ST2	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S2P2_LS2	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S2P2_ST3	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S2P2_LS3	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
Scenario 3: Phase 4 - 2 Plants Bottom of Quarry - Maximum Production with Asphalt Plant																								
S3P1_ST1	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S3P1_LS1	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S3P1_ST2	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S3P1_LS2	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S3P1_ST3	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S3P1_LS3	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S3P2_ST1	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S3P2_LS1	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S3P2_ST2	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S3P2_LS2	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
S3P2_ST3	Stacker drop point	125	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	7.8E-02	3.4E-02	5.2E-03	3.4E-03		7.8E-02	B	3.4E-02	B	5.2E-03	B	3.4E-03	B
S3P2_LS3	Loading at processing plant for shipping	63	1500	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	3.9E-02	1.7E-02	2.6E-03	1.7E-03		3.9E-02	B	1.7E-02	B	2.6E-03	B	1.7E-03	B
Scenario 4: Extraction in Phase 5 - Plants Remain in Phase 1A and 4 - Maximum Production with Asphalt Plant																								
All sources identical to Scenario 3																								
Scenario 5: Alternate Extraction Scenario - Phase 1A - 1 Plant at Top of Rock																								
S5_ST1	Stacker drop point	83	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	5.2E-02	2.3E-02	3.4E-03	2.3E-03		5.2E-02	B	2.3E-02	B	3.4E-03	B	2.3E-03	B
S5_LS1	Loading at processing plant for shipping	42	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	2.6E-02	1.1E-02	1.7E-03	1.1E-03		2.6E-02	B	1.1E-02	B	1.7E-03	B	1.1E-03	B
S5_ST2	Stacker drop point	83	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	5.2E-02	2.3E-02	3.4E-03	2.3E-03		5.2E-02	B	2.3E-02	B	3.4E-03	B	2.3E-03	B
S5_LS2	Loading at processing plant for shipping	42	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	2.6E-02	1.1E-02	1.7E-03	1.1E-03		2.6E-02	B	1.1E-02	B	1.7E-03	B	1.1E-03	B
S5_ST3	Stacker drop point	83	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	5.2E-02	2.3E-02	3.4E-03	2.3E-03		5.2E-02	B	2.3E-02	B	3.4E-03	B	2.3E-03	B
S5_LS3	Loading at processing plant for shipping	42	1000	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	2.6E-02	1.1E-02	1.7E-03	1.1E-03		2.6E-02	B	1.1E-02	B	1.7E-03	B	1.1E-03	B
Asphalt Plant																								
A_DROP	Dropping aggregate at asphalt plant	155	3724	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	9.7E-02	4.2E-02	6.4E-03	4.2E-03		9.7E-02	B	4.2E-02	B	6.4E-03	B	4.2E-03	B
A_RAPDR	Dumping RAP to RAP pile	10	245	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	6.4E-03	2.8E-03	4.2E-04	2.8E-04		6.4E-03	B	2.8E-03	B	4.2E-04	B	2.8E-04	B
A_RAPLD	Loading RAP to asphalt plant	10	245	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	6.4E-03	2.8E-03	4.2E-04	2.8E-04		6.4E-03	B	2.8E-03	B	4.2E-04	B	2.8E-04	B

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 3.57 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)	
A_LOAD	Loading of aggregate at asphalt plant	155	3724	n	1.6%	2.1%	valid	2.2E-03	9.8E-04	1.5E-04	9.8E-05	9.7E-02	4.2E-02	6.4E-03	4.2E-03		9.7E-02	B	4.2E-02	B	6.4E-03	B	4.2E-03	B

[1] ID corresponds to process flow diagram for facility and / or material

[2] Relates to AP-42 Section 13.2.4-4

[3] k-factor for TSP (PM_{44}) scaled up logarithmically to 0.8 from published k-factor of 0.74 which refers to PM_{30}.

Comments
Shipping occurs 24 hours per day.
Silica emissions based on silica in native stone 10.0%
For simplicity, total production is split evenly across all stockpiles / loading points.

Sample calculation for uncontrolled TSP emission factor for Source S1_ST1: Stacker drop point, at a sample wind speed of 3.57 m/s

EF = 0.0016 x (0.74) x ((3.57 m/s) / 2.2)^1.3 / ((2.1%) / 2)^1.4 = 2.2E-03 kg TSP / Mg handled

Sample calculation for TSP emission rate for Source S1_ST1: Stacker drop point, at a sample wind speed of 3.57 m/s

$$\frac{83\ Mg_{handled}}{1\ h} \times \frac{2.2E\text{-}03\ kg_{TSP}}{1\ Mg_{handled}} \times \frac{1\ h}{3600\ s} \times \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \times \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 5.2E\text{-}02\ g_{TSP} / s$$

APPENDIX D

Appendix D: Proposed Operating Scenrio On-Site Mobile Equipment Emissions Spreadsheet - Fugitive Dust

Project # 1603157

Uppers Quarry and Asphalt Plant

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		Segment Length [2]	Road Surface [3]	Roadway Type [4]	Mean Vehicle Speed		Average Vehicle Weight [5]	Surface Material Moisture Content [6]	Surface Silt Content [7]	Road Surface Silt Loading [8]	Base AP-42 Factor			Base Emission Rate			Additional Control Efficiency Applied	Final Controlled Emission Rate							
		Hourly	Daily										TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$		TSP	Data Quality Rating	PM_{10}	Data Quality Rating	$PM_{2.5}$	Data Quality Rating	Silica	Data Quality Rating
		(#/h)	(#/d)	(m)			(km/h)	(mph)	(tons)	(%)	(%)	(g/m^2)	(g/VKT)	(g/VKT)	(g/VKT)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)		(g/s)	
Scenario 1: Phase 2A - 1 Plant at Top of Rock																											
S1_RLM	Loader traffic at muck pile	33	400	65	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.9E+00	8.6E-01	8.6E-02	95%	1.5E-01	B	4.3E-02	B	4.3E-03	B	4.3E-03	B
S1_RL1	Loader traffic at stockpiles	6	133	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	1.9E-01	5.5E-02	5.5E-03	95%	9.3E-03	B	2.8E-03	B	2.8E-04	B	2.8E-04	B
S1_RL2	Loader traffic at stockpiles	6	133	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	1.9E-01	5.5E-02	5.5E-03	95%	9.3E-03	B	2.8E-03	B	2.8E-04	B	2.8E-04	B
S1_RL3	Loader traffic at stockpiles	6	133	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	1.9E-01	5.5E-02	5.5E-03	95%	9.3E-03	B	2.8E-03	B	2.8E-04	B	2.8E-04	B
S1_SHIP	Shipping traffic from stockpiles	8	182	385	Unpaved	Industrial	20	12	33.0		10.0%		3.6E+03	1.1E+03	1.1E+02	2.9E+00	8.6E-01	8.6E-02	95%	1.4E-01	B	4.3E-02	B	4.3E-03	B	4.3E-03	B
Scenario 2: Phase 3A and 3B - 2 Plants at Bottom of Quarry - Maximum Production with Asphalt Plan																											
S2_RLM	Loader traffic at muck pile	100	1200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	3.4E+00	9.9E-01	9.9E-02	95%	1.7E-01	B	5.0E-02	B	5.0E-03	B	5.0E-03	B
S2P1_RL1	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S2P1_RL2	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S2P1_RL3	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S2P2_RL1	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S2P2_RL2	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S2P2_RL3	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S2_SHIP	Shipping traffic from stockpiles	23	545	745	Unpaved	Industrial	20	12	33.0		10.0%		3.6E+03	1.1E+03	1.1E+02	1.7E+01	5.0E+00	5.0E-01	95%	8.4E-01	B	2.5E-01	B	2.5E-02	B	2.5E-02	B
S2_ADAP	Aggregate Deliveries to Asphalt Plant	5	115	1075	Unpaved	Industrial	20	12	158.8		10.0%		7.3E+03	2.1E+03	2.1E+02	1.0E+01	3.1E+00	3.1E-01	95%	5.2E-01	B	1.5E-01	B	1.5E-02	B	1.5E-02	B
Scenario 3: Phase 4 - 2 Plants Bottom of Quarry - Maximum Production with Asphalt Plan																											
S3_RLM	Loader traffic at muck pile	100	1200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	3.4E+00	9.9E-01	9.9E-02	95%	1.7E-01	B	5.0E-02	B	5.0E-03	B	5.0E-03	B
S3P1_RL1	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S3P1_RL2	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S3P1_RL3	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S3P2_RL1	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S3P2_RL2	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S3P2_RL3	Loader traffic at stockpiles	8	200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.8E-01	8.3E-02	8.3E-03	95%	1.4E-02	B	4.1E-03	B	4.1E-04	B	4.1E-04	B
S3_SHIP	Shipping traffic from stockpiles	23	545	960	Unpaved	Industrial	20	12	33.0		10.0%		3.6E+03	1.1E+03	1.1E+02	2.2E+01	6.4E+00	6.4E-01	95%	1.1E+00	B	3.2E-01	B	3.2E-02	B	3.2E-02	B
S3_ADAP	Aggregate Deliveries to Asphalt Plant	5	115	640	Unpaved	Industrial	20	12	158.8		10.0%		7.3E+03	2.1E+03	2.1E+02	6.2E+00	1.8E+00	1.8E-01	95%	3.1E-01	B	9.1E-02	B	9.1E-03	B	9.1E-03	B
Scenario 4: Extraction in Phase 5 - Plants Remain in Phase 1A and 4 - Maximum Production with Asphalt Plan																											
S4_RLM	Loader traffic at muck pile	100	1200	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	3.4E+00	9.9E-01	9.9E-02	95%	1.7E-01	B	5.0E-02	B	5.0E-03	B	5.0E-03	B
All other sources identical to Scenario 7																											
Scenario 5: Alternate Extraction Scenario - Phase 1A - 1 Plant at Top of Rock																											
S1_RLM	Loader traffic at muck pile	33	400	65	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	2.9E+00	8.6E-01	8.6E-02	95%	1.5E-01	B	4.3E-02	B	4.3E-03	B	4.3E-03	B
S1_RL1	Loader traffic at stockpiles	6	133	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	1.9E-01	5.5E-02	5.5E-03	95%	9.3E-03	B	2.8E-03	B	2.8E-04	B	2.8E-04	B
S1_RL2	Loader traffic at stockpiles	6	133	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	1.9E-01	5.5E-02	5.5E-03	95%	9.3E-03	B	2.8E-03	B	2.8E-04	B	2.8E-04	B
S1_RL3	Loader traffic at stockpiles	6	133	25	Unpaved	Industrial	20	12	64.5		10.0%		4.8E+03	1.4E+03	1.4E+02	1.9E-01	5.5E-02	5.5E-03	95%	9.3E-03	B	2.8E-03	B	2.8E-04	B	2.8E-04	B
S1_SHIP	Shipping traffic from stockpiles	8	182	780	Unpaved	Industrial	20	12	33.0		10.0%		3.6E+03	1.1E+03	1.1E+02	5.9E+00	1.7E+00	1.7E-01	95%	2.9E-01	B	8.7E-02	B	8.7E-03	B	8.7E-03	B
Asphalt Plant																											
A_LD	Asphalt plant loader traffic	26	621	22	Unpaved	Industrial	20	12	59.5		10.0%		4.7E+03	1.4E+03	1.4E+02	7.4E-01	2.2E-01	2.2E-02	95%	3.7E-02	B	1.1E-02	B	1.1E-03	B	1.1E-03	B
A_SHIP_U	Asphalt plant shipping (unpaved)	12	297	186	Unpaved	Industrial	20	12	33.0		10.0%		3.6E+03	1.1E+03	1.1E+02	2.3E+00	6.7E-01	6.7E-02	95%	1.1E-01	B	3.4E-02	B	3.4E-03	B	3.4E-03	B

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	-	-	-	-	-
	TSP	3.23	-	-	-	-	-
Unpaved Roads - Industrial:	**$PM_{2.5}$**	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	TSP	4.9	0.7	0.45	-	-	B
Unpaved Roads - Public:	**$PM_{2.5}$**	0.18	1	-	0.2	0.5	C
	PM_{10}	1.8	1	-	0.2	0.5	B
	TSP	6	1	-	0.3	0.3	B

Comments
Extraction (7 am - 7 pm: Mon - Sat), processing (7 am - 7 pm: Mon - Fri/Sat), and shipping (24/7)
Quarry loaders are CAT 988 or similar (414 kW, 15 tonne bucket capacity, 51 tonne vehicle operating weight)
Asphalt plant loaders are CAT 980-982 (assumed 982M) or similar (325 kW, 12 tonne bucket capacity, 36 tonne tare weight)
Shipping traffic based on daily shipping and fleet mix of 5% tandems, 20% tri-axles, 50% tri-axle trailers, 25% tri-axle trains (33 tonne payload)
Haul trucks for aggregate delivery to Asphalt Plant are CAT 775 (assumed 775G) or similar (615 kW, 64.6 tonne payload, 111.8 tonne tare weight)
Silt content for unpaved roads taken from mean values presented in U.S EPA AP-42, Chapter 13.2.2-1
95% control applied to unpaved roads based on watering.
Silica emissions based on silica in native stone 10.0%

[1] Route ID numbers provided on site plan.
[2] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[3] Paved surfaces include asphalt, concrete, and recycled asphalt (if it forms a relatively consistent surface).
[4] Publicly accessible and dominated by light vehicles, or industrial, and dominated by heavy vehicles.
[5] The average vehicle weight reflects the average of the empty and loaded vehicle weight, for travel in both directions.
[6] Required only for publicly accessible unpaved roads.
[7] Required only for unpaved roads (public and industrial).
[8] Required only for industrial paved roads.

Sample calculation for uncontrolled TSP emission factor for Source S1_RLM: Loader traffic at muck pile

EF = 281.9 x (4.9) x [(10% / 12)]^(0.7) x [(64.4851935 tons) / 3]^(0.45) = 4835 g TSP / vehicle kilometer travelled (vkt)

Sample calculation for TSP emission rate for Source S1_RLM: Loader traffic at muck pile

$$\frac{33\ \text{vehicles}}{1\ \text{h}} \times \frac{65\ \text{m}}{} \times \frac{1\ \text{km}}{1000\ \text{m}} \times \frac{4835\ g_{TSP}}{1\ \text{vehicle km}} \times \frac{1\ \text{h}}{3600\ \text{s}} \times \frac{5\%\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 1.5\text{E-}01\ g_{TSP}/\text{s}$$

APPENDIX E

Appendix E: Proposed Operating Scenario Summary of Combustion Exhaust Emissions (Mobile and Stationary Sources)

Project # 1603157

Upper's Quarry and Asphalt Plant

Source ID	Description	Gross Power Rating (kW)	Number Of Units	Traffic Passes		Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Tailpipe Emission Factor [5]								Tailpipe Emission Rate				Tailpipe + Fugitive Emission Rate [6]			
				Hourly	Daily				TSP		PM_{10}		$PM_{2.5}$		NO_X		TSP	PM_{10}	$PM_{2.5}$	NO_X	TSP	PM_{10}	$PM_{2.5}$	NO_X
				(#/h)	(#/d)				(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)
Scenario 1:	**Phase 1A - 1 Plant at Top of Rock**																							
S1_RLM	Loader traffic at muck pile	414	1	33	400	65	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-01	4.4E-02	5.4E-03	3.5E-01
S1_GEN	Generator	1600	1	N/A	N/A	N/A	N/A	43%		0.03		0.03		0.03		0.67	5.7E-03	5.7E-03	5.7E-03	1.3E-01	5.7E-03	5.7E-03	5.7E-03	1.3E-01
S1_RL1	Loader traffic at stockpiles	414	1	6	133	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.0E-02	3.9E-03	1.4E-03	3.5E-01
S1_RL2	Loader traffic at stockpiles	414	1	6	133	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.0E-02	3.9E-03	1.4E-03	3.5E-01
S1_RL3	Loader traffic at stockpiles	414	1	6	133	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.0E-02	3.9E-03	1.4E-03	3.5E-01
S1_SHIP	Shipping traffic from stockpiles	n/a	1	8	182	385	20	n/a	0.83		0.83		0.83		7.0		6.7E-04	6.7E-04	6.7E-04	5.7E-03	1.5E-01	4.3E-02	4.9E-03	5.7E-03
Scenario 2:	**Phase 3A and 3B - 2 Plants at Bottom of Quarry - Maximum Production with Asphalt Plant**																							
S2_RLM	Loader traffic at muck pile	414	1	100	1200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.7E-01	5.1E-02	6.1E-03	3.5E-01
S2P1_GEN	Generator	1600	1	N/A	N/A	N/A	N/A	43%		0.03		0.03		0.03		0.67	5.7E-03	5.7E-03	5.7E-03	1.3E-01	5.7E-03	5.7E-03	5.7E-03	1.3E-01
S2P1_RL1	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S2P1_RL2	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S2P1_RL3	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S2P2_GEN	Generator	1600	1	N/A	N/A	N/A	N/A	43%		0.03		0.03		0.03		0.67	5.7E-03	5.7E-03	5.7E-03	1.3E-01	5.7E-03	5.7E-03	5.7E-03	1.3E-01
S2P2_RL1	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S2P2_RL2	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S2P2_RL3	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S2_SHIP	Shipping traffic from stockpiles	n/a	1	23	545	745	20	n/a	0.83		0.83		0.83		7.0		3.9E-03	3.9E-03	3.9E-03	3.3E-02	8.5E-01	2.5E-01	2.9E-02	3.3E-02
S2_ADAP	Aggregate Deliveries to Asphalt Plant	615	1	5	115	1075	20	48%		0.02		0.02		0.02		6.40	1.6E-03	1.6E-03	1.6E-03	5.2E-01	5.2E-01	1.5E-01	1.7E-02	5.2E-01
Scenario 3:	**Phase 4 - 2 Plants Bottom of Quarry - Maximum Production with Asphalt Plant**																							
S3_RLM	Loader traffic at muck pile	414	1	100	1200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.7E-01	5.1E-02	6.1E-03	3.5E-01
S3P1_GEN	Generator	1600	1	N/A	N/A	N/A	N/A	43%		0.03		0.03		0.03		0.67	5.7E-03	5.7E-03	5.7E-03	1.3E-01	5.7E-03	5.7E-03	5.7E-03	1.3E-01
S3P1_RL1	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S3P1_RL2	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S3P1_RL3	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S3P2_GEN	Generator	1600	1	N/A	N/A	N/A	N/A	43%		0.03		0.03		0.03		0.67	5.7E-03	5.7E-03	5.7E-03	1.3E-01	5.7E-03	5.7E-03	5.7E-03	1.3E-01
S3P2_RL1	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S3P2_RL2	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S3P2_RL3	Loader traffic at stockpiles	414	1	8	200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-02	5.2E-03	1.5E-03	3.5E-01
S3_SHIP	Shipping traffic from stockpiles	n/a	1	23	545	960	20	n/a	0.83		0.83		0.83		7.0		5.0E-03	5.0E-03	5.0E-03	4.2E-02	1.1E+00	3.2E-01	3.7E-02	4.2E-02
S3_ADAP	Aggregate Deliveries to Asphalt Plant	615	1	5	115	640	20	48%		0.02		0.02		0.02		6.40	1.6E-03	1.6E-03	1.6E-03	5.2E-01	3.1E-01	9.3E-02	1.1E-02	5.2E-01
Scenario 4: Extraction in Phase 5 - Plants Remain in Phase 1A and 4 - Maximum Production																								
S4_RLM	Loader traffic at muck pile	414	1	100	1200	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.7E-01	5.1E-02	6.1E-03	3.5E-01
All other sources identical to Scenario 7																								
Scenario 5:	**Phase 1A - 1 Plant at Top of Rock**																							
S1_RLM	Loader traffic at muck pile	414	1	33	400	65	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.5E-01	4.4E-02	5.4E-03	3.5E-01
S1_GEN	Generator	1600	1	N/A	N/A	N/A	N/A	43%		0.03		0.03		0.03		0.67	5.7E-03	5.7E-03	5.7E-03	1.3E-01	5.7E-03	5.7E-03	5.7E-03	1.3E-01
S1_RL1	Loader traffic at stockpiles	414	1	6	133	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.0E-02	3.9E-03	1.4E-03	3.5E-01
S1_RL2	Loader traffic at stockpiles	414	1	6	133	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.0E-02	3.9E-03	1.4E-03	3.5E-01
S1_RL3	Loader traffic at stockpiles	414	1	6	133	25	20	48%		0.02		0.02		0.02		6.40	1.1E-03	1.1E-03	1.1E-03	3.5E-01	1.0E-02	3.9E-03	1.4E-03	3.5E-01
S1_SHIP	Shipping traffic from stockpiles	n/a	1	8	182	385	20	n/a	0.83		0.83		0.83		7.0		6.7E-04	6.7E-04	6.7E-04	5.7E-03	1.5E-01	4.3E-02	4.9E-03	5.7E-03
Asphalt Plant																								
A_LD	Asphalt plant loader traffic	236	1	26	621	22	20	48%		0.02		0.02		0.02		6.40	6.3E-04	6.3E-04	6.3E-04	2.0E-01	3.7E-02	1.2E-02	1.7E-03	2.0E-01
A_SHIP_U	Asphalt plant shipping (unpaved)	n/a	1	12	297	186	20	n/a	0.83		0.83		0.83		7.0		5.3E-04	5.3E-04	5.3E-04	4.5E-03	1.1E-01	3.4E-02	3.9E-03	4.5E-03

[1] ID should reflect Source ID or Route ID, as approprite.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] 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

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Comments
Extraction (7 am - 7 pm: Mon - Sat), processing (7 am - 7 pm: Mon - Fri/Sat), and shipping (24/7).
Haul trucks are CAT 775 (assumed 775G) or similar (615 kW, 64.6 tonne payload, 111.8 tonne tare weight)
Quarry loaders are CAT 988 or similar (414 kW, 15 tonne bucket capacity, 51 tonne vehicle operating weight)
Shipping traffic based on fleet mix of 5% tandems, 20% tri-axles, 50% tri-axle trailers, 25% tri-axle trains (33 tonne payload)

Sample Calculations

S1_RLM Exhaust TSP Emissions:

$$\frac{414\ \text{kW}}{} \left| \frac{0.02\ \text{g}}{1\ \text{kW h}} \right| \frac{48\%\ \text{Load}}{} \left| \frac{1\ \text{h}}{3600\ \text{s}} \right. = 1.1\text{E-}03\ g_{TSP} / \text{s}$$

APPENDIX F

Appendix F1: Asphalt Plant Data

Project # 1603157

Upper's Quarry and Asphalt Plant

HOT MIX ASPHALT PLANTS - AP-42 Section 11.1

General Information		
Natural Gas Heating Value	1020	BTU/scf
Atmospheric Pressure	101.325	kPa
Gas Constant	8.314	L kPa / mol k
Aggregate silica content:	10	% - based on silica content at nearby Walker Brothers Quarry
Hot Mix Asphalt Production Information		
Operating Hours	24	hours/day
	275	days/year, March - November, inclusive
HMA Production	204	Mg/hour
	4900	Mg/day
	400000	Mg/year (confirmed via 20210901 e-mail from F. Kielbowich)
HMA Load Out	204	Mg/hour
	4900	Mg/day
	400000	Mg/year
HMA Load Out at Mixer	204	Mg/hour
	2900	Mg/day
	236735	Mg/year
AC Usage	10	Mg/hour
	245	Mg/day
	20000	Mg/year
RAP Usage	63	Mg/hour
	1500	Mg/day
	120000	Mg/year
Stone Usage	78	Mg/hour
	1862	Mg/day
	152000	Mg/year
Sand Usage	78	Mg/hour
	1862	Mg/day
	152000	Mg/year
Hot Mix Asphalt Silo Information		
Number of AC Tanks	2	
HMA Silo Capacity	200	tonnes each
Silo Filling Rate and	204	Mg/hour
HMA Loadout at Silo	2000	Mg/day
	163265	Mg/year
HMA Silo Height	80	feet
	24.4	m
AC Tank Diameter	17	feet
	5.2	m
HMA Temperature	350	°F

Appendix F2: Asphalt Plant Mixer Dust Collector Emissions Spreadsheet

Project # 1603157

Upper's Quarry and Asphalt Plant

HOT MIX ASPHALT PLANTS - AP-42 Section 11.1

Source ID	Source Description	Contaminant	CAS Number	Emission Factor		Data Quality		Source	Emission Rate (g/s)
				Imperial (lb/ton HMA)	Metric (kg/Mg HMA)	AP-42	MOE		
A_DC (max hourly)	Natural Gas Batch Mixer with Fabric Filter	Nitrogen Oxides	10102-44-0	2.50E-02	1.25E-02	D	Marginal	Table 11.1-5	7.1E-01
		Particulate Matter	n/a - TSP	4.20E-02	2.10E-02	A	Above-Average	Table 11.1-1	1.2E+00
		Silica	[1]	4.20E-03	2.10E-03	A	Above-Average	Scaled from PM	1.2E-01
		Benzene	71-43-2	2.80E-04	1.40E-04	D	Marginal	Table 11.1-9	7.9E-03
		Benzo(a)pyrene	50-32-8	3.1E-10	1.55E-10	E	Marginal	Table 11.1-9	8.8E-09
		Naphthalene	91-20-3	3.6E-05	1.80E-05	D	Marginal	Table 11.1-9	1.0E-03
		Arsenic	7440-38-2	4.60E-07	2.30E-07	D	Marginal	Table 11.1-11	1.3E-05
		Lead	7439-92-1	8.90E-07	4.45E-07	D	Marginal	Table 11.1-11	2.5E-05
		Nickel	7440-02-0	3.00E-06	1.50E-06	D	Marginal	Table 11.1-11	8.5E-05
A_DC (max daily)	Natural Gas Batch Mixer with Fabric Filter	Nitrogen Oxides	10102-44-0	2.50E-02	1.25E-02	D	Marginal	Table 11.1-5	7.1E-01
		Particulate Matter	n/a - TSP	4.20E-02	2.10E-02	A	Above-Average	Table 11.1-1	1.2E+00
		Silica	[1]	4.20E-03	2.10E-03	A	Above-Average	Scaled from PM	1.2E-01
		Benzene	71-43-2	2.80E-04	1.40E-04	D	Marginal	Table 11.1-9	7.9E-03
		Benzo(a)pyrene	50-32-8	3.1E-10	1.55E-10	E	Marginal	Table 11.1-9	8.8E-09
		Naphthalene	91-20-3	3.6E-05	1.80E-05	D	Marginal	Table 11.1-9	1.0E-03
		Arsenic	7440-38-2	4.60E-07	2.30E-07	D	Marginal	Table 11.1-11	1.3E-05
		Lead	7439-92-1	8.90E-07	4.45E-07	D	Marginal	Table 11.1-11	2.5E-05
		Nickel	7440-02-0	3.00E-06	1.50E-06	D	Marginal	Table 11.1-11	8.5E-05
A_DC (annual) 275 days	Natural Gas Batch Mixer with Fabric Filter	Nitrogen Oxides	10102-44-0	2.50E-02	1.25E-02	D	Marginal	Table 11.1-5	2.1E-01
		Particulate Matter	n/a - TSP	4.20E-02	2.10E-02	A	Above-Average	Table 11.1-1	3.5E-01
		Silica	[1]	4.20E-03	2.10E-03	A	Above-Average	Scaled from PM	3.5E-02
		Benzene	71-43-2	2.80E-04	1.40E-04	D	Marginal	Table 11.1-9	2.4E-03
		Benzo(a)pyrene	50-32-8	3.1E-10	1.55E-10	E	Marginal	Table 11.1-9	2.6E-09
		Naphthalene	91-20-3	3.6E-05	1.80E-05	D	Marginal	Table 11.1-9	3.0E-04
		Arsenic	7440-38-2	4.60E-07	2.30E-07	D	Marginal	Table 11.1-11	3.9E-06
		Lead	7439-92-1	8.90E-07	4.45E-07	D	Marginal	Table 11.1-11	7.5E-06
		Nickel	7440-02-0	3.00E-06	1.50E-06	D	Marginal	Table 11.1-11	2.5E-05

Sample Calculation

PM Emission Rate (max hourly)

$$\frac{2.10\text{E-}02\ \text{kg PM}}{1\ \text{Mg HMA}} \times \frac{204\ \text{Mg HMA}}{1\ \text{h}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 1.2\text{E+}00\ \text{g/s}$$

PM Emission Rate (annual)

$$\frac{2.10\text{E-}02\ \text{kg PM}}{1\ \text{Mg HMA}} \times \frac{400000\ \text{Mg HMA}}{1\ \text{year}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{year}}{275\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{hrs}} \times \frac{1\ \text{hr}}{3600\ \text{s}} = 3.5\text{E-}01\ \text{g/s}$$

Notes:

[1] Silica refers to cristabolite (14464-46-1), quartz (14808-60-7), and tridymite (15468-32-3) forms. Estimated emissions based on silica content of aggregate.

Appendix F3: Asphalt Plant Asphalt Cement Heater Emissions Spreadsheet

Project # 1603157

Upper's Quarry and Asphalt Plant

NATURAL GAS COMBUSTION - AP-42 Section 1.4

Source ID	Source Description	Contaminant	CAS Number	Emission Factor		Data Quality		Source	Emission Rate (g/s)
				(lb/10^6scf)		AP-42	MOE		
A_HTR	Natural Gas	Nitrogen Oxides	10102-44-0	1.00E+02	--	B	Above-Average	Chapter 1.4	2.6E-02
	Tank Heater	Particulate Matter	n/a - TSP	7.60E+00	--	D	Marginal	Chapter 1.4	2.0E-03

Sample Calculation

NOx Emission Rate

$$\frac{1.00E+02\ \text{lb NOx}}{1000000\ \text{scf}} \times \frac{2059\ \text{scf}}{1\ \text{h}} \times \frac{454\ \text{g}}{1\ \text{lb}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 2.6E-02\ \text{g/s}$$

Appendix F4: Asphalt Plant HMA Load Out Emissions Spreadsheet

Project # 1603157

Upper's Quarry and Asphalt Plant

HOT MIX ASPHALT PLANTS - AP-42 Section 11.1

From Table 11.1-14	Total PM	EF = 0.000181 + 0.00141(-V)e((0.0251)(T + 460) - 20.43)	8.20E-04	lb/ton HMA
	Org. PM	EF = 0.00141(-V)e((0.0251)(T + 460) - 20.43)	6.39E-04	lb/ton HMA
	TOC	EF = 0.0172(-V)e((0.0251)(T + 460) - 20.43)	7.79E-03	lb/ton HMA
	CO	EF = 0.00558(-V)e((0.0251)(T + 460) - 20.43)	2.53E-03	lb/ton HMA

Asphalt Loadout Scenarios:

Asphalt can be loaded into trucks in one of two locations: at Mixer (ASPH_LD1) or at Silo (ASPH_LD2). For the peak hourly scenario, both loadouts are assumed to be used at the maximum rate of 204 Mg of HMA per hour. For the peak daily scenario, 2000 Mg of HMA is assumed to be loaded from the Silo (based on a maximum daily silo filling rate of 2000 Mg/day. The remaining 2900 tonnes of HMA are assumed to be loaded at the Mixer. For the annual scenario, the total annual mass of HMA was divided between the Silo and the Mixer based on a ratio of 2000:2900.

Source ID	Source Description	Contaminant	CAS Number	Speciation Profile	Emission Factor		Data Quality		Source	Emission Rate (g/s)
					Imperial (lb/ton HMA)	Metric (kg/Mg HMA)	AP-42	MOE		
A_LD1 (max hourly)	HMA Load Out at Mixer	Particulate Matter	n/a - TSP	n/a	8.20E-04	4.10E-04	C	Average	Table 11.1-14	2.3E-02
		Silica	[1]	n/a	8.20E-05	4.10E-05	C	Average	Scaled from PM	2.3E-03
		TOC (used only for speciation below)	n/a	n/a	7.79E-03	3.89E-03	C	Average	Table 11.1-14	2.2E-01
		Benzene	71-43-2	0.052%	4.05E-06	2.03E-06	C	Average	Table 11.1-16	1.1E-04
		Organic PM (used only for speciation below)	n/a	n/a	6.39E-04	3.19E-04	C	Average	Table 11.1-14	1.8E-02
		Benzo(a)pyrene	50-32-8	0.0023%	1.47E-08	7.34E-09	C	Average	Table 11.1-15	4.2E-07
		Naphthalene	91-20-3	1.25%	7.98E-06	3.99E-06	C	Average	Table 11.1-15	2.3E-04
A_LD1 (max daily)	HMA Load Out at Mixer	Particulate Matter	n/a - TSP	n/a	8.20E-04	4.10E-04	C	Average	Table 11.1-14	1.4E-02
		Silica	[1]	n/a	8.20E-05	4.10E-05	C	Average	Scaled from PM	1.4E-03
		TOC (used only for speciation below)	n/a	n/a	7.79E-03	3.89E-03	C	Average	Table 11.1-14	1.3E-01
		Benzene	71-43-2	0.052%	4.05E-06	2.03E-06	C	Average	Table 11.1-16	6.8E-05
		Organic PM (used only for speciation below)	n/a	n/a	6.39E-04	3.19E-04	C	Average	Table 11.1-14	1.1E-02
		Benzo(a)pyrene	50-32-8	0.0023%	1.47E-08	7.34E-09	C	Average	Table 11.1-15	2.5E-07
		Naphthalene	91-20-3	1.25%	7.98E-06	3.99E-06	C	Average	Table 11.1-15	1.3E-04
A_LD1 (annual) 275 days	HMA Load Out at Mixer	Particulate Matter	n/a - TSP	n/a	8.20E-04	4.10E-04	C	Average	Table 11.1-14	4.1E-03
		Silica	[1]	n/a	8.20E-05	4.10E-05	C	Average	Scaled from PM	4.1E-04
		TOC (used only for speciation below)	n/a	n/a	7.79E-03	3.89E-03	C	Average	Table 11.1-14	3.9E-02
		Benzene	71-43-2	0.052%	4.05E-06	2.03E-06	C	Average	Table 11.1-16	2.0E-05
		Organic PM (used only for speciation below)	n/a	n/a	6.39E-04	3.19E-04	C	Average	Table 11.1-14	3.2E-03
		Benzo(a)pyrene	50-32-8	0.0023%	1.47E-08	7.34E-09	C	Average	Table 11.1-15	7.3E-08
		Naphthalene	91-20-3	1.25%	7.98E-06	3.99E-06	C	Average	Table 11.1-15	4.0E-05
A_LD2 (max hourly)	HMA Load Out at Silo	Particulate Matter	n/a - TSP	n/a	8.20E-04	4.10E-04	C	Average	Table 11.1-14	2.3E-02
		Silica	[1]	n/a	8.20E-05	4.10E-05	C	Average	Scaled from PM	2.3E-03
		TOC (used only for speciation below)	n/a	n/a	7.79E-03	3.89E-03	C	Average	Table 11.1-14	2.2E-01
		Benzene	71-43-2	0.052%	4.05E-06	2.03E-06	C	Average	Table 11.1-16	1.1E-04
		Organic PM (used only for speciation below)	n/a	n/a	6.39E-04	3.19E-04	C	Average	Table 11.1-14	1.8E-02
		Benzo(a)pyrene	50-32-8	0.0023%	1.47E-08	7.34E-09	C	Average	Table 11.1-15	4.2E-07
		Naphthalene	91-20-3	1.25%	7.98E-06	3.99E-06	C	Average	Table 11.1-15	2.3E-04
A_LD2 (max daily)	HMA Load Out at Silo	Particulate Matter	n/a - TSP	n/a	8.20E-04	4.10E-04	C	Average	Table 11.1-14	9.5E-03
		Silica	[1]	n/a	8.20E-05	4.10E-05	C	Average	Scaled from PM	9.5E-04
		TOC (used only for speciation below)	n/a	n/a	7.79E-03	3.89E-03	C	Average	Table 11.1-14	9.0E-02
		Benzene	71-43-2	0.052%	4.05E-06	2.03E-06	C	Average	Table 11.1-16	4.7E-05
		Organic PM (used only for speciation below)	n/a	n/a	6.39E-04	3.19E-04	C	Average	Table 11.1-14	7.4E-03
		Benzo(a)pyrene	50-32-8	0.0023%	1.47E-08	7.34E-09	C	Average	Table 11.1-15	1.7E-07
		Naphthalene	91-20-3	1.25%	7.98E-06	3.99E-06	C	Average	Table 11.1-15	9.2E-05

Source ID	Source Description	Contaminant	CAS Number	Speciation Profile	Emission Factor		Data Quality		Source	Emission Rate (g/s)
					Imperial (lb/ton HMA)	Metric (kg/Mg HMA)	AP-42	MOE		
A_LD2 (annual) 275 days	HMA Load Out at Silo	Particulate Matter	n/a - TSP	n/a	7.98E-06	3.99E-06	C	Average	Table 11.1-14	2.7E-05
		Silica	[1]	n/a	7.98E-07	3.99E-07	C	Average	Scaled from PM	2.7E-06
		TOC (used only for speciation below)	n/a	n/a	7.79E-03	3.89E-03	C	Average	Table 11.1-14	2.7E-02
		Benzene	71-43-2	0.052%	4.05E-06	2.03E-06	C	Average	Table 11.1-16	1.4E-05
		Organic PM (used only for speciation below)	n/a	n/a	6.39E-04	3.19E-04	C	Average	Table 11.1-14	2.2E-03
		Benzo(a)pyrene	50-32-8	0.0023%	1.47E-08	7.34E-09	C	Average	Table 11.1-15	5.0E-08
		Naphthalene	91-20-3	1.25%	7.98E-06	3.99E-06	C	Average	Table 11.1-15	2.7E-05

Sample Calculation - Load Out at Mixer

PM Emission Rate (hourly)

$$\frac{4.10E\text{-}04\ \text{kg PM}}{1\ \text{Mg HMA}} \times \frac{204\ \text{Mg HMA}}{1\ \text{h}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 2.3E\text{-}02\ \text{g/s}$$

Benzene Emission Factor

$$\frac{3.89E\text{-}03\ \text{kg TOC}}{1\ \text{Mg HMA}} \times \frac{0.052\%\ \text{g Benzene}}{1\ \text{g TOC}} = 2.03E\text{-}06\ \text{kg Benzene / Mg HMA}$$

Benzene Emission Rate (hourly)

$$\frac{2.03E\text{-}06\ \text{kg Benz}}{1\ \text{Mg HMA}} \times \frac{204\ \text{Mg HMA}}{1\ \text{h}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 1.1E\text{-}04\ \text{g/s}$$

PM Emission Rate (Mixer + Silo) (annual)

$$\frac{4.10E\text{-}04\ \text{kg PM}}{1\ \text{Mg HMA}} \times \frac{236735\ \text{Mg HMA}}{1\ \text{year}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{year}}{275\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{s}} \times \frac{1\ \text{hr}}{3600\ \text{s}} = 4.1E\text{-}03\ \text{g/s}$$

Notes:

[1] Silica refers to cristabolite (14464-46-1), quartz (14808-60-7), and tridymite (15468-32-3) forms. Estimated emissions based on silica content of aggregate.

Appendix F5: Asphalt Plant HMA Silo Filling Emissions Spreadsheet

Project # 1603157

Upper's Quarry and Asphalt Plant

HOT MIX ASPHALT PLANTS - AP-42 Section 11.1

From Table 11.1-14	Total PM	EF = 0.000332 + 0.00105(-V)e((0.0251)(T + 460) - 20.43)	0.000807515 lb/ton HMA
	Org. PM	EF = 0.00105(-V)e((0.0251)(T + 460) - 20.43)	0.000475515 lb/ton HMA
	TOC	EF = 0.0504(-V)e((0.0251)(T + 460) - 20.43)	0.022824716 lb/ton HMA
	CO	EF = 0.00488(-V)e((0.0251)(T + 460) - 20.43)	0.002210012 lb/ton HMA

Source ID	Source Description	Contaminant	CAS Number	Speciation Profile	Emission Factor		Data Quality		Source	Emission Rate (g/s)
					Imperial (lb/ton HMA)	Metric (kg/Mg HMA)	AP-42	MOE		
A_SL1 (max hourly)	HMA Silo Filling	Particulate Matter	n/a - TSP	n/a	8.08E-04	4.04E-04	C	Average	Table 11.1-14	2.3E-02
		Silica	[1]	n/a	8.08E-05	4.04E-05	C	Average	Scaled from PM	2.3E-03
		TOC (used only for speciation below)	n/a	n/a	2.28E-02	1.14E-02	C	Average	Table 11.1-14	6.5E-01
		Benzene	71-43-2	0.032%	7.30E-06	3.65E-06	C	Average	Table 11.1-16	2.1E-04
		Organic PM (used only for speciation below)	n/a	n/a	4.76E-04	2.38E-04	C	Average	Table 11.1-14	1.3E-02
		Benzo(a)pyrene	50-32-8	0.002%	1.09E-08	5.47E-09	C	Average	Table 11.1-15	3.1E-07
		Naphthalene	91-20-3	1.82%	8.65E-06	4.33E-06	C	Average	Table 11.1-15	2.5E-04
A_SL1 (max daily)	HMA Silo Filling	Particulate Matter	n/a - TSP	n/a	8.08E-04	4.04E-04	C	Average	Table 11.1-14	9.3E-03
		Silica	[1]	n/a	8.08E-05	4.04E-05	C	Average	Scaled from PM	9.3E-04
		TOC (used only for speciation below)	n/a	n/a	2.28E-02	1.14E-02	C	Average	Table 11.1-14	2.6E-01
		Benzene	71-43-2	0.032%	7.30E-06	3.65E-06	C	Average	Table 11.1-16	8.5E-05
		Organic PM (used only for speciation below)	n/a	n/a	4.76E-04	2.38E-04	C	Average	Table 11.1-14	5.5E-03
		Benzo(a)pyrene	50-32-8	0.002%	1.09E-08	5.47E-09	C	Average	Table 11.1-15	1.3E-07
		Naphthalene	91-20-3	1.82%	8.65E-06	4.33E-06	C	Average	Table 11.1-15	1.0E-04
A_SL1 (annual)	HMA Silo Filling	Particulate Matter	n/a - TSP	n/a	8.08E-04	4.04E-04	C	Average	Table 11.1-14	2.8E-03
		Silica	[1]	n/a	8.08E-05	4.04E-05	C	Average	Scaled from PM	2.8E-04
		TOC (used only for speciation below)	n/a	n/a	2.28E-02	1.14E-02	C	Average	Table 11.1-14	7.8E-02
		Benzene	71-43-2	0.032%	7.30E-06	3.65E-06	C	Average	Table 11.1-16	2.5E-05
		Organic PM (used only for speciation below)	n/a	n/a	4.76E-04	2.38E-04	C	Average	Table 11.1-14	1.6E-03
		Benzo(a)pyrene	50-32-8	0.002%	1.09E-08	5.47E-09	C	Average	Table 11.1-15	3.8E-08
		Naphthalene	91-20-3	1.82%	8.65E-06	4.33E-06	C	Average	Table 11.1-15	3.0E-05

Sample Calculation

PM Emission Rate

$$\frac{4.04E\text{-}04\ \text{kg PM}}{1\ \text{Mg HMA}} \times \frac{204\ \text{Mg HMA}}{1\ \text{h}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 2.3E\text{-}02\ \text{g/s}$$

Benzene Emission Factor

$$\frac{1.14E\text{-}02\ \text{kg TOC}}{1\ \text{Mg HMA}} \times \frac{0.032\%\ \text{g Benzene}}{1\ \text{g TOC}} = 3.65E\text{-}06\ \text{kg Benzene / Mg HMA}$$

Benzene Emission Rate

$$\frac{3.65E\text{-}06\ \text{kg CO}}{1\ \text{Mg HMA}} \times \frac{204\ \text{Mg HMA}}{1\ \text{h}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 2.1E\text{-}04\ \text{g/s}$$

PM Emission Rate (annual)

$$\frac{4.04E\text{-}04\ \text{kg PM}}{1\ \text{Mg HMA}} \times \frac{400000\ \text{Mg HMA}}{1\ \text{year}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{year}}{275\ \text{days}} \times \frac{1\ \text{day}}{14\ \text{hrs}} \times \frac{1\ \text{hr}}{3600\ \text{s}} = 1.2E\text{-}02\ \text{g/s}$$

Notes:

[1] Silica refers to cristabolite (14464-46-1), quartz (14808-60-7), and tridymite (15468-32-3) forms. Estimated emissions assume:

Appendix F6: Asphalt Plant Data

Project # 1603157

Upper's Quarry and Asphalt Plant

HOT MIX ASPHALT PLANTS - AP-42 Section 11.1

Asphalt Cement Tank Information		
Asphalt volatility	-0.5	% loss on heating (average value for test method)
AC Density	1	kg/L (BITUMAR MSDS)
AC Molecular Weight	105	g/mol (from AP-42 11.2.1.5)
Asphalt Cement Tanker Truck		
Tank Truck Capacity	35	tonnes/truck (typical tanker capacity)
	0.3	trucks/h
	7	trucks/d
	571	trucks/year
Asphalt Cement Tank Information		
Number of AC Tanks	2	
AC Tank Capacity	100	tonnes
	100000	L
	26420	gallons
AC Usage - Hourly (from Appendix F1)	10	tonnes/hour
	5	tonnes/hour/tank
	5000	litres/hour/tank
	1321	gallons/hour/tank
AC Usage - Daily (from Appendix F1)	245	tonnes/day (based on 24-hour production)
	122.5	tonnes/day/tank
	122500	litres/day/tank
	32365	gallons/day/tank
AC Usage - Annual (from Appendix F1)	20000	tonnes/year
	10000	tonnes/year/tank
	10000000	litres/year/tank
	2642008	gallons/year/tank
Turnovers	0.1	total turnovers per hour based on daily AC usage and tank capacity
	0.1	turnovers per hour per tank based on daily AC usage and tank capacity
	2.5	total turnovers per day based on daily AC usage and tank capacity
	1.2	turnovers per day per tank based on daily AC usage and tank capacity
	200	total turnovers per year based on annual AC usage and tank capacity
	100	turnovers per year per tank based on annual AC usage and tank capacity
AC Tank Orientation	Vertical	
AC Tank Height	25	feet (top of cone)
	7.6	m (top of cone)
	23	feet, assuming 2' for cone roof
AC Tank Working Height	18	feet, assuming 80% high level switch
AC Tank Diameter	17	feet (outer shell)
	5.2	m (outer shell)
	16	feet, assuming 6" for insulation
AC Tank Fill Rate	0.6	tonnes/min
	36000	L/h (calculated from fill rate and density)
Minimum Tank Temp.	320	ºF (based on settings at Vineland Quarry)
	160	ºC
	433	K
Maximum Tank Temp.	350	ºF (based on settings at Vineland Quarry)
	177	ºC
	450	K
Asphalt Cement Tank Hot Oil Heater Information		
Tank Heater Rating	2100000	Btu/h
	2059	scf/h on gas

Appendix F7: Asphalt Cement Storage Emissions Spreadsheet

Project # 1603157

Upper's Quarry and Asphalt Plant

AP-42 Chapter 7 emissions estimating methodologies were used to determine emissions from the hot mix asphalt storage tanks.
AP-42 Chapter 11 Section 11.1.2.5 asphalt properties were used to estimate the emissions from the asphalt storage tanks.

Working Losses:

Working losses are estimated on a "per-fill" basis in by assuming 1 turnover (fill for fixed roof tanks) per month.
The month with the higest emissions is then used to estimate working losses throughout the year, which is conservative.
Maximum set temperature was considered to calculated worse-case scenario working losses.

Working losses =	1.03	lbs/turnover (annual average)
	1.48	lbs/turnover (max hour - URT, DAV, AAV)

Table 1: Emissions from Working Losses

Source ID	Source Description	Contaminant	CAS Number	Speciation Profile	Emission Factor		Data Quality		Source	Emission Rate per Tank (g/s)	Total Emissions per Tank Working + Standing (Annual Only) (g/s)
					Imperial (lb/turnover)	Metric (kg/turnover)	AP-42	MOE			
A_TK1 A_TK2 (max hourly)	Working Losses	TOC (used only for speciation below)	n/a - TOC	n/a	1.5E+00	6.72E-01	n/a	Average	AP-42 Ch. 7	9.3E-03	--
		Benzene	71-43-2	0.032%	4.7E-04	2.15E-04	C	Average	Table 11.1-16	3.0E-06	--
		Organic PM (used only for speciation below)	n/a	24.7%	3.7E-01	1.66E-01	n/a	Average	[1]	2.3E-03	--
		Particulate Matter	n/a - TSP	100%	3.7E-01	1.66E-01	n/a	Average	[2]	2.3E-03	--
		Benzo(a)pyrene	50-32-8	0.0023%	8.4E-06	3.81E-06	n/a	Average	[3]	5.3E-08	--
A_TK1 A_TK2 (max daily)	Working Losses	TOC (used only for speciation below)	n/a - TOC	n/a	1.5E+00	6.72E-01	n/a	Average	AP-42 Ch. 7	9.3E-03	--
		Benzene	71-43-2	0.032%	4.7E-04	2.15E-04	C	Average	Table 11.1-16	3.0E-06	--
		Organic PM (used only for speciation below)	n/a	24.7%	3.7E-01	1.66E-01	n/a	Average	[1]	2.3E-03	--
		Particulate Matter	n/a - TSP	100%	3.7E-01	1.66E-01	n/a	Average	[2]	2.3E-03	--
		Benzo(a)pyrene	50-32-8	0.0023%	8.4E-06	3.81E-06	n/a	Average	[3]	5.3E-08	--
A_TK1 A_TK2 (annual) 204	Working Losses	TOC (used only for speciation below)	n/a - TOC	n/a	1.0E+00	4.67E-01	n/a	Average	AP-42 Ch. 7	2.0E-03	2.2E-03
		Benzene	71-43-2	0.032%	3.3E-04	1.50E-04	C	Average	Table 11.1-16	6.3E-07	6.9E-07
		Organic PM (used only for speciation below)	n/a	24.7%	2.5E-01	1.15E-01	n/a	Average	[1]	4.9E-04	5.3E-04
		Particulate Matter	n/a - TSP	100%	2.5E-01	1.15E-01	n/a	Average	[2]	4.9E-04	5.3E-04
		Benzo(a)pyrene	50-32-8	0.0023%	5.9E-06	2.65E-06	n/a	Average	[3]	1.1E-08	1.2E-08

Notes:
[1] Organic PM is assumed to be 24.7% of the TOC, as per Tank B on Table 4 of "Estimates of Air Emissions from Asphalt Storage Tanks and Truck Loading" by David C. Trumbore, Asphalt Technology Laboratory. Owens Corning.
[2] Organic PM is also the Total PM for this source. There are no silica emissions since all the PM is from organic vapours.
[3] Benzo(a)pyrene is assumed to represent 0.0023% of Organic PM based on U.S. EPA AP-42 Chapter 11.1 *(Table 11.1-15). Table 11.1-15 lists b* enzo(a)pyrene as being below the detection limit for the "speciation profile for silo filling and asphalt storage tank emissions", so the speciation for benzo(a)pyrene from the "speciation profile for load-out and yard emissions" was used instead.

Sample Calculation

TOC Emission Rate

$$\frac{6.72E\text{-}01\ \text{kg TOC}}{1\ \text{turnover}} \times \frac{1.2\ \text{turnovers}}{1\ \text{day - tank}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{day}}{24\ \text{hours}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 9.3E\text{-}03\ \text{g/s/tank}$$

Benzene Emission Factor

$$\frac{6.72E\text{-}01\ \text{kg TOC}}{1\ \text{turnover}} \times \frac{0.032\%\ \text{g Benzene}}{1\ \text{g TOC}} = 2.15E\text{-}04\ \text{kg Benzene / Mg HMA}$$

Benzene Emission Rate

$$\frac{2.15E\text{-}04\ \text{kg Benzene}}{1\ \text{turnover}} \times \frac{1.2\ \text{turnovers}}{1\ \text{day - tank}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{day}}{24\ \text{hours}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 3.0E\text{-}06\ \text{g/s/tank}$$

TOC Emission Rate (annual)

$$\frac{4.67E\text{-}01\ \text{kg TOC}}{1\ \text{turnover}} \times \frac{100\ \text{turnovers}}{1\ \text{year}} \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{year}}{275\ \text{days}} \times \frac{1\ \text{day}}{24\ \text{hours}} \times \frac{1\ \text{h}}{3600\ \text{s}} = 2.0E\text{-}03\ \text{g/s/tank}$$

Standing Losses:

The asphalt cement storage tank is set for a maximum temperature of 350ºF, with a minimum temperature of 320ºF.
The emissions for the tanks is calculated as total standing losses per month, which vary from month to month only because of the number of days in a month.

Standing losses for month of January from TANKS =	1.08	lb/month/tank
Days in January =	31	
Standing losses per day =	0.035	lb/day/tank
	16	g/day/tank
Standing losses (hourly) =	0.00018	g/s/tank

Table 2: Emissions from Standing Losses

Source ID	Source Description	Contaminant	CAS Number	Speciation Profile	Emission Factor		Data Quality		Source	Emission Rate per Tank (g/s)
					Imperial (lb/turnover)	Metric (kg/turnover)	AP-42	MOE		
ASPH_TK1 ASPH_TK2 (annual)	Standing Losses	TOC (used only for speciation below)	n/a	n/a	3.5E-02	1.59E-02	n/a	Average	AP-42 Ch. 7	1.8E-04
		Benzene	71-43-2	0.032%	1.1E-05	5.08E-06	C	Average	Table 11.1-16	5.9E-08
		Organic PM (used only for speciation below)	n/a	24.7%	8.6E-03	3.92E-03	n/a	Average	[1]	4.5E-05
		Particulate Matter	n/a - TSP	100%	8.6E-03	3.92E-03	n/a	Average	[2]	4.5E-05
		Benzo(a)pyrene	50-32-8	0.0023%	2.0E-07	9.02E-08	n/a	Average	[3]	1.0E-09

Notes:
[1] Organic PM is assumed to be 24.7% of the TOC, as per Tank B on Table 4 of "Estimates of Air Emissions from Asphalt Storage Tanks and Truck Loading" by David C. Trumbore, Asphalt Technology Laboratory. Owens Corning.
[2] Organic PM is also the Total PM for this source. There are no silica emissions since all the PM is from organic vapours.
[3] Benzo(a)pyrene is assumed to represent 0.0023% of Organic PM based on U.S. EPA AP-42 Chapter 11.1 *(Table 11.1-15). Table 11.1-15 lists b* enzo(a)pyrene as being below the detection limit for the "speciation profile for silo filling and asphalt storage tank emissions", so the speciation for benzo(a)pyrene from the "speciation profile for load-out and yard emissions" was used instead.

Sample Calculation

TOC Emission Rate	1.08 lb TOC	1 month	1 kg	1000 g	1 day	1 h	
	1 month	31 days	2.204 lb	1 kg	24 hours	3600 s	1.8E-04 g/s

Appendix F8: Working and Standing Losses for Annual Average Modelling

INPUTS						
Name of tank	=	A_TK				
Tank shell diameter	=	17	ft	Cone/Dome?	Cone	
Tank shell height/length	=	23	ft	Vertical/Horizontal?	Vertical	
Tank cone slope	=	0.235	ft/ft	Default =	0.0625	
Tank dome radius	=		ft	<-- Leave untouched if unknown		
Average working liquid height	=	10	ft	Number of heating cycles/day?	1	
Max working liquid height	=	19	ft	Typical Max in heating cycle (°F)	350	
Min working liquid height	=	1	ft	Typical Min in heating cycle (°F)	320	
Working volume	=	629.05	bbl	Insulated?	Fully	
Annual throughput	=	7548.57	bbl/yr	Heated?	Yes	
Breather vent pressure	=	0	psi	Default =	0.03	
Breather vent vacuum	=	0	psi	Default =	-0.03	
Nearest location	=	Detroit, Michigan				
Tank shell color/condition	=	Color:	Gray (light	Condition:	New	
Tank roof color/condition	=	Color:	Gray (light	Condition:	New	
Liquid number		Name of Liquid			Composition (wt%)	Valid temperature range (°C)
Stored liquid 1	=	Asphalt			100.00%	No information available

Appendix F8: Working and Standing Losses for Annual Average Modelling

SUMMARY		
Total Routine Loss (lb/yr) = $L_S + L_W$	=	25.10
Standing Loss (lb/yr)	=	12.71
Working Loss (lb/yr)	=	12.39
STANDING LOSS		
Standing Loss = $365 \times V_V \times W_V \times K_E \times K_S$		
Standing loss (L_S, lb/yr)	=	12.71
Vapor space volume (V_V,ft3))	=	3101.87
Stock vapour density (W_V, lb/ft3)	=	0.0003
Vapour space expansion factor (K_E, per day)	=	0.0391
Vented vapor saturation factor (K_S, dimensionless)	=	0.98
WORKING LOSS		
Working Loss = $V_Q \times K_N \times K_P \times W_V \times K_B$		
Working Loss (L_W, lb/yr)	=	12.39
Net working loss throughput (V_Q, ft^3/yr)	=	42382.08
Working loss turnover (saturation) factor (K_N, dimensionless)	=	1.00
Working loss product factor (K_P, dimensionless)	=	1.00
Vapour Density (W_V, lb/ft3)	=	0.0003
Vent setting correction factor (K_B, dimensionless)	=	1.00

Month	Throughput (ft^3/month)	Working Loss (lb/month)	Working Loss (g/s)	Standing Loss (lb/month)	Standing Loss (g/s)	Total Loss (lb/month)	Total Loss (g/s)
Max	3531.840	1.03	0.00019	1.08	0.00018	2.11	0.0004
Jan	3531.84	1.03	0.00017	1.08	0.00018	2.11	0.0004
Feb	3531.84	1.03	0.00019	0.97	0.00018	2.01	0.0004
Mar	3531.84	1.03	0.00017	1.08	0.00018	2.11	0.0004
Apr	3531.84	1.03	0.00018	1.04	0.00018	2.08	0.0004
May	3531.84	1.03	0.00017	1.08	0.00018	2.11	0.0004
Jun	3531.84	1.03	0.00018	1.04	0.00018	2.08	0.0004
Jul	3531.84	1.03	0.00017	1.08	0.00018	2.11	0.0004
Aug	3531.84	1.03	0.00017	1.08	0.00018	2.11	0.0004
Sep	3531.84	1.03	0.00018	1.04	0.00018	2.08	0.0004
Oct	3531.84	1.03	0.00017	1.08	0.00018	2.11	0.0004
Nov	3531.84	1.03	0.00018	1.04	0.00018	2.08	0.0004
Dec	3531.84	1.03	0.00017	1.08	0.00018	2.11	0.0004

Annual Average Chemical Mixture Constants			
Vapour molecular weight	=	105.00	lb/lb-mole
Vapour pressure at Avg. daily liquid surface temp	=	0.0237	psia
Vapour pressure at Max. daily liquid surface temp	=	0.0347	psia
Vapour pressure at Min. daily liquid surface temp	=	0.0160	psia

Daily			
Name	Variable	Value (Imp)	Unit
Stock Vapour Density	W_V	0.00042	lb/ft^3
Net working loss throughput	V_Q	3531.84	ft^3/yr
Working loss turnover (saturation factor)	K_N	1	dimensionless
Annual sum of increases in liquid level	ΣH_{QI}	15.56	ft/yr
Number of turnovers per year	N	0.86	dimensionless
Working loss	L_W	1.48207	lb/yr

Annual Average Chemical Mixture Calculations													
Chemical Name		P_{VA} (psi)	$P_{VA,max}$ (psi)	$P_{VA,min}$ (psi)	Relative moles	Liquid mole fraction	Partial pressure (psi)	Vapour mole fraction	Used to calculate M_v	Max partial pressure	Min partial pressure	Vapour molecular weight	Annual emission rates (g/s)
Asphalt	=	0.0237	0.0347	0.0160	1.0000	1.0000	0.0237	1.0000	105.0000	0.0347	0.0160	105.0000	3.61E-04

Appendix F9: Working Losses for Peak Hour and Peak Day Modelling

INPUTS						
Name of tank	=	A_TK_Working				
Tank shell diameter	=	17	ft	Cone/Dome?	Cone	
Tank shell height/length	=	23	ft	Vertical/Horizontal?	Vertical	
Tank cone slope	=	0.235	ft/ft	Default =	0.0625	
Tank dome radius	=		ft	<-- Leave untouched if unknown		
Average working liquid height	=	10	ft	Number of heating cycles/day?	1	
Max working liquid height	=	19	ft	Typical Max in heating cycle (°F)	350	
Min working liquid height	=	1	ft	Typical Min in heating cycle (°F)	350	
Working volume	=	629.05	bbl	Insulated?	Fully	
Annual throughput	=	7548.57	bbl/yr	Heated?	Yes	
Breather vent pressure	=	0	psi	Default =	0.03	
Breather vent vacuum	=	0	psi	Default =	-0.03	
Nearest location	=	Detroit, Michigan				
Tank shell color/condition	=	Color:	Gray (light	Condition:	New	
Tank roof color/condition	=	Color:	Gray (light	Condition:	New	
Liquid number		Name of Liquid			Composition (wt%)	Valid temperature range (°C)
Stored liquid 1	=	Asphalt			100.00%	No information available

Appendix F9: Working Losses for Peak Hour and Peak Day Modelling

SUMMARY		
Total Routine Loss (lb/yr) = $L_S + L_W$	=	17.78
Standing Loss (lb/yr)	=	0
Working Loss (lb/yr)	=	17.78
STANDING LOSS		
Standing Loss = $365 \times V_V \times W_V \times K_E \times K_S$		
Standing loss (L_S, lb/yr)	=	0.00
Vapor space volume (V_V,ft3))	=	3101.87
Stock vapour density (W_V, lb/ft3)	=	0.0004
Vapour space expansion factor (K_E, per day)	=	0.0000
Vented vapor saturation factor (K_S, dimensionless)	=	0.98
WORKING LOSS		
Working Loss = $V_Q \times K_N \times K_P \times W_V \times K_B$		
Working Loss (L_W, lb/yr)	=	17.78
Net working loss throughput (V_Q, ft^3/yr)	=	42382.08
Working loss turnover (saturation) factor (K_N, dimensionless)	=	1.00
Working loss product factor (K_P, dimensionless)	=	1.00
Vapour Density (W_V, lb/ft3)	=	0.0004
Vent setting correction factor (K_B, dimensionless)	=	1.00

Month	Throughput (ft^3/month)	Working Loss (lb/month)	Working Loss (g/s)	Standing Loss (lb/month)	Standing Loss (g/s)	Total Loss (lb/month)	Total Loss (g/s)
Max	3531.840	1.48	0.00028	0.000	0.0000	1.48	0.0003
Jan	3531.84	1.48	0.00025	0.00	0.0000	1.48	0.0003
Feb	3531.84	1.48	0.00028	0.00	0.0000	1.48	0.0003
Mar	3531.84	1.48	0.00025	0.00	0.0000	1.48	0.0003
Apr	3531.84	1.48	0.00026	0.00	0.0000	1.48	0.0003
May	3531.84	1.48	0.00025	0.00	0.0000	1.48	0.0003
Jun	3531.84	1.48	0.00026	0.00	0.0000	1.48	0.0003
Jul	3531.84	1.48	0.00025	0.00	0.0000	1.48	0.0003
Aug	3531.84	1.48	0.00025	0.00	0.0000	1.48	0.0003
Sep	3531.84	1.48	0.00026	0.00	0.0000	1.48	0.0003
Oct	3531.84	1.48	0.00025	0.00	0.0000	1.48	0.0003
Nov	3531.84	1.48	0.00026	0.00	0.0000	1.48	0.0003
Dec	3531.84	1.48	0.00025	0.00	0.0000	1.48	0.0003

Daily			
Name	Variable	Value (Imp)	Unit
Stock Vapour Density	W_V	0.00042	lb/ft^3
Net working loss throughput	V_Q	3531.84	ft^3/yr
Working loss turnover (saturation factor)	K_N	1	dimensionless
Annual sum of increases in liquid level	ΣH_{QI}	15.56	ft/yr
Number of turnovers per year	N	0.86	dimensionless
Working loss	L_W	1.48207	lb/yr

Annual Average Chemical Mixture Constants			
Vapour molecular weight	=	105.00	lb/lb-mole
Vapour pressure at Avg. daily liquid surface temp	=	0.0347	psia
Vapour pressure at Max. daily liquid surface temp	=	0.0347	psia
Vapour pressure at Min. daily liquid surface temp	=	0.0347	psia

Annual Average Chemical Mixture Calculations												
Chemical Name		P_{VA} (psi)	$P_{VA,max}$ (psi)	$P_{VA,min}$ (psi)	Relative moles	Liquid mole fraction	Partial pressure (psi)	Vapour mole fraction	Used to calculate M_v	Max partial pressure	Min partial pressure	Vapour molecular weight	Annual emission rates (g/s)
Asphalt	=	0.0347	0.0347	0.0347	1.0000	1.0000	0.0347	1.0000	105.0000	0.0347	0.0347	105.0000	2.56E-04

APPENDIX G

ALTERNATE EXTRACTION SCENARIO

In the event an agreement is reached with the City of Niagara Falls, Walker would also propose to extract:

i. Upper's Lane, between the North Extraction Area and the Mid Extraction Area; and
ii. The unopened road allowance between Lots 120 and 136, between the Mid Extraction Area and the South Extraction Area (see Figure X).

Walker owns all of the lands north and south of Upper's Lane and the unopened road allowance between Thorold Townline Road and Beechwood Road. Subject to an agreement with the City, Walker proposes to extract this portion of Upper's Lane and the unopened road allowance to maximize access to the aggregate resource and to create a more integrated operation and rehabilitation plan.

Should Agreement with the City be reached, extraction at the site can be simplified greatly. A single sinking cut would then be required, as opposed to four sinking cuts in the Proposed Extraction Scenario. Initial operations will be similar to the Proposed Extraction Scenario, with a portable plant operating at the top of rock until sufficient area has been opened to move the plant to the first bench and then the final quarry floor. Once on the quarry floor, the plant can be expanded, and will be fed by a primary crusher and conveyor which follow the working face.

In addition to aggregate extraction and processing, the site will also include the hot mix asphalt (HMA) batch plant, described under the Proposed Extraction Scenario, to be located in Phase 1A.

From an air quality perspective, impacts are expected to be similar to, or lower than, the Proposed Extraction Scenario, as there are fewer sinking cuts. Furthermore, a centralized processing plant area can be established much earlier in the life of the quarry, allowing conveyors to bring material from a primary crusher at the active face back to the main processing plant area. This prevents the need to establish multiple processing plant areas throughout the life of the quarry.

Figure G1 presents modelled source locations for the initial sinking cut and processing plant in the Alternate Extraction Scenario, as the subsequent phases of operations in the Alternate Extraction Scenario are adequately covered through the Proposed Extraction Scenario.

The emission estimation methodology, dispersion modelling methodology and assessment of background air quality are analogous to that described for the proposed extraction scenario. **Table G1** provides the results of the dispersion modelling assessment for the Alternate Extraction Scenario. The analysis shows that with appropriate controls on the haul routes, compliance with the relevant criteria can be achieved at all offsite receptors based on modelled emissions of sources.

As noted in the discussion of the Proposed Extraction Scenario, the results of the analysis demonstrate that the proposed Upper's Quarry has been appropriately designed and separated from surrounding sensitive land uses and can be managed with appropriate mitigation to prevent and mitigate adverse effects.

The recommendations and recommended management practices associated with the proposed extraction scenario also apply to this alternate extraction scenario.

Table G1: Cumulative Effects Analysis for Upper's Quarry Alternate Operating Scenario

Extraction in Phase 1A - 1 Plant at Top of Rock

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 1	Residence	648758.52	4773661.47	TSP	24	8.5	7%	0	0.0%	52.5	44%	0	0.0%
				PM_{10}	24	3.6	7%	0	0.0%	28.0	56%	0	0.0%
				$PM_{2.5}$	24	0.5	2%	0	0.0%	13.7	55%	0	0.0%
				Silica	24	0.6	13%	0	0.0%	2.1	42%	0	0.0%
				NO_2	1	115.0	29%	0	0.0%	139.6	35%	0	0.0%
					24	23.3	12%	0	0.0%	23.3	12%	0	0.0%
Receptor 2	Residence	649391.00	4773733.84	TSP	24	7.4	6%	0	0.0%	51.4	43%	0	0.0%
				PM_{10}	24	3.4	7%	0	0.0%	27.8	56%	0	0.0%
				$PM_{2.5}$	24	0.5	2%	0	0.0%	13.7	55%	0	0.0%
				Silica	24	0.5	10%	0	0.0%	2.0	39%	0	0.0%
				NO_2	1	110.7	28%	0	0.0%	135.4	34%	0	0.0%
					24	15.4	8%	0	0.0%	15.4	8%	0	0.0%
Receptor 3	Residence	649561.36	4773627.17	TSP	24	5.1	4%	0	0.0%	49.1	41%	0	0.0%
				PM_{10}	24	2.4	5%	0	0.0%	26.8	54%	0	0.0%
				$PM_{2.5}$	24	0.3	1%	0	0.0%	13.5	54%	0	0.0%
				Silica	24	0.4	7%	0	0.0%	1.8	37%	0	0.0%
				NO_2	1	104.3	26%	0	0.0%	129.0	32%	0	0.0%
					24	11.5	6%	0	0.0%	11.5	6%	0	0.0%
Receptor 4	Business	649501.46	4773093.70	TSP	24	9.5	8%	0	0.0%	53.5	45%	0	0.0%
				PM_{10}	24	3.9	8%	0	0.0%	28.3	57%	0	0.0%
				$PM_{2.5}$	24	0.6	2%	0	0.0%	13.8	55%	0	0.0%
				Silica	24	0.7	14%	0	0.0%	2.2	43%	0	0.0%
				NO_2	1	123.2	31%	0	0.0%	147.8	37%	0	0.0%
					24	27.7	14%	0	0.0%	27.7	14%	0	0.0%
Receptor 5	Residence	649609.10	4772690.07	TSP	24	12.1	10%	0	0.0%	56.1	47%	0	0.0%
				PM_{10}	24	5.5	11%	0	0.0%	29.9	60%	0	0.0%
				$PM_{2.5}$	24	0.9	4%	0	0.0%	14.1	56%	0	0.0%
				Silica	24	0.9	18%	0	0.0%	2.3	47%	0	0.0%
				NO_2	1	118.9	30%	0	0.0%	143.6	36%	0	0.0%
					24	43.5	22%	0	0.0%	43.5	22%	0	0.0%
Receptor 6	Residence	649559.53	4772403.99	TSP	24	9.2	8%	0	0.0%	53.2	44%	0	0.0%
				PM_{10}	24	4.0	8%	0	0.0%	28.4	57%	0	0.0%
				$PM_{2.5}$	24	0.6	2%	0	0.0%	13.8	55%	0	0.0%
				Silica	24	0.7	15%	0	0.0%	2.2	44%	0	0.0%
				NO_2	1	117.2	29%	0	0.0%	141.9	35%	0	0.0%
					24	30.1	15%	0	0.0%	30.1	15%	0	0.0%
Receptor 7	Residence	649568.03	4772333.18	TSP	24	9.4	8%	0	0.0%	53.4	45%	0	0.0%
				PM_{10}	24	4.1	8%	0	0.0%	28.5	57%	0	0.0%
				$PM_{2.5}$	24	0.6	2%	0	0.0%	13.8	55%	0	0.0%
				Silica	24	0.6	13%	0	0.0%	2.1	42%	0	0.0%
				NO_2	1	116.3	29%	0	0.0%	141.0	35%	0	0.0%
					24	30.6	15%	0	0.0%	30.6	15%	0	0.0%

Receptor		UTM Coordinates		Contaminant	Averaging Period	With No Background Concentration				With Additional Background Concentrations			
ID	Type	X (m)	Y (m)		(hours)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)	Maximum Predicted 24-Hour Concentration (µg/m³)	Percentage of Relevant Criteria (%)	Number of Predicted Excursions Above Criteria over 5 Years	Frequency of Predicted Excursions Above Criteria (%)
Receptor 8	Residence (potential)	648398.27	4772829.98	TSP	24	27.0	23%	0	0.0%	71.0	59%	0	0.0%
				PM_{10}	24	10.9	22%	0	0.0%	35.3	71%	0	0.0%
				$PM_{2.5}$	24	1.4	5%	0	0.0%	14.6	58%	0	0.0%
				Silica	24	2.8	57%	0	0.0%	4.3	86%	0	0.0%
				NO_2	1	129.0	32%	0	0.0%	153.7	38%	0	0.0%
					24	39.2	20%	0	0.0%	39.2	20%	0	0.0%
Receptor 9	Business	649114.60	4773685.21	TSP	24	6.1	5%	0	0.0%	50.1	42%	0	0.0%
				PM_{10}	24	2.7	5%	0	0.0%	27.1	54%	0	0.0%
				$PM_{2.5}$	24	0.4	1%	0	0.0%	13.6	54%	0	0.0%
				Silica	24	0.4	9%	0	0.0%	1.9	38%	0	0.0%
				NO_2	1	113.7	28%	0	0.0%	138.4	35%	0	0.0%
					24	13.9	7%	0	0.0%	13.9	7%	0	0.0%
Receptor 10	Business	649107.18	4772042.78	TSP	24	9.9	8%	0	0.0%	53.9	45%	0	0.0%
				PM_{10}	24	4.3	9%	0	0.0%	28.7	57%	0	0.0%
				$PM_{2.5}$	24	0.6	3%	0	0.0%	13.8	55%	0	0.0%
				Silica	24	0.7	13%	0	0.0%	2.1	42%	0	0.0%
				NO_2	1	118.2	30%	0	0.0%	142.8	36%	0	0.0%
					24	29.3	15%	0	0.0%	29.3	15%	0	0.0%
Receptor 11	Residence	648614.94	4771698.96	TSP	24	6.1	5%	0	0.0%	50.1	42%	0	0.0%
				PM_{10}	24	2.7	5%	0	0.0%	27.1	54%	0	0.0%
				$PM_{2.5}$	24	0.4	2%	0	0.0%	13.6	54%	0	0.0%
				Silica	24	0.5	9%	0	0.0%	1.9	38%	0	0.0%
				NO_2	1	114.9	29%	0	0.0%	139.5	35%	0	0.0%
					24	20.2	10%	0	0.0%	20.2	10%	0	0.0%

Days of Valid Meteorological Data	1827
Hours of Valid Meteorological Data	43848

Relevant Criteria:

TSP	120	µg/m³ AAQC
PM_{10}	50	µg/m³ Interim AAQC
$PM_{2.5}$	25	µg/m³ Canada Wide Standard
Silica	5	µg/m³ AAQC
NO_2	400	µg/m³ 1-Hour AAQC
	200	µg/m³ 24-Hour AAQC
O_3	165	µg/m³ 1-Hour AAQC
Benzene	2.3	µg/m³ 24-Hour AAQC
Benzene	0.45	µg/m³ Annual AAQC
Benzo(a)pyrene	0.00005	µg/m³ 24-Hour AAQC
Benzo(a)pyrene	0.00001	µg/m³ Annual AAQC
Naphthalene	22.5	µg/m³ 24-Hour AAQC
Arsenic	0.3	µg/m³ 24-Hour AAQC
Lead	0.5	µg/m³ 24-Hour AAQC
Nickel	0.2	µg/m³ 24-Hour AAQC
Nickel	0.04	µg/m³ Annual AAQC

Background:

TSP	44	µg/m³ (24-hour)
PM_{10}	24	µg/m³ (24-hour)
$PM_{2.5}$	13	µg/m³ (24-hour)
Silica	1.5	µg/m³ (24-hour)
NO_2	25	µg/m³ (1-hour)
		µg/m³ (24-hour)
O_3	124	µg/m³ (1-hour)
Benzene	0.45	µg/m³ (24-hour)
Benzene	0.27	µg/m³ (Annual)
Benzo(a)pyrene	4.05E-05	µg/m³ (24-hour)
Benzo(a)pyrene	2.12E-05	µg/m³ (Annual)
Naphthalene	0.04	µg/m³ (24-hour)
Arsenic		µg/m³ (24-hour)
Lead	2.31E-03	µg/m³ (24-hour)
Nickel	5.70E-04	µg/m³ (24-hour)
Nickel	2.17E-04	µg/m³ (Annual)

Phase 1A - Alternative Extraction Scenario

Map Projection: NAD 1983 UTM Zone 17N

Uppers Quarry - Niagara Region, Ontario

True North

Project #: 1603157

Drawn by:	LJN	Figure:	G1
Approx. Scale:	1:1,800		
Date Revised:	Sep 3, 2021		

Map Document: C:\Users\LJN\OneDrive - ROWAN WILLIAMS DAVIES & IRWIN INC\Desktop\GIS\Uppers Quarry\GIS\1603157_Uppers Quarry_210714.aprx

APPENDIX H

BRIAN SULLEY, B.A.SC., P.ENG.

TECHNICAL DIRECTOR - AIR QUALITY | PRINCIPAL

T: 519.823.1311 X 2373 | Brian.Sulley@rwdi.com

Brian is a Technical Director and Principal whose area of expertise includes air quality emissions and dispersion modelling, odour assessments, dust assessments, hazard modelling and chemical process quantitative risk analysis.

Brian has also served as an expert witness before the Ontario Land Tribunal (formerly the Ontario Municipal Board and Local Planning Appeal Tribunal) multiple times, as well as the Ontario Superior Court of Justice, the Toronto Local Appeal Body, and for a Hearing of Necessity under the Expropriations Act. Brian has been qualified to provide expert testimony in each of his areas of expertise.

Brian's experience includes heavy industry such as the mining, aggregates, hot mix asphalt, cement, pulp and paper, petrochemical, and automotive industries, through to institutional facilities such as hospitals and universities, as well as transportation infrastructure, including highways, rail systems and airports.

Brian's experience in chemical process quantitative risk analysis spans his work with his previous employer in the chemical process industry and with RWDI. His work in chemical process engineering provides a strong foundation for both his current role.

Brian sits involved in several industry associations, providing guidance and training to members on best practices and regulatory compliance requirements.

Brian also acts as a technical lead for our air quality modelling group, coaching and mentoring scientists and engineers across Canada at work on a range of emissions inventory, monitoring and modelling projects.

Employment History

2001 – Present
Technical Director – Air Quality, Principal, RWDI

2016 – Present
Instructor: Air and Water Quality Analysis, Environmental Building Science Program, Conestoga College

2003 – Present
Instructor: Introduction to Air Quality, Environmental Engineering Applications Program, Conestoga College

2011 – 2018
Instructor: Air Pollution Control, Environmental Control Program, Sheridan College

1999 – 2001
Process Engineering Associate, Huntsman Corporation Canada Inc.

Engineering Licenses

Licensed Professional Engineer (P.Eng.) with:

- **Professional Engineers of Ontario, 2005**
- **Association of Professional Engineers and Geoscientists of Saskatchewan, 2019**
- **Association of Professional Engineers of Nova Scotia, 2020**
- **Association of Professional Engineers and Geoscientists of Alberta, 2021**
- **Engineers and Geoscientists British Columbia, 2021**

Affiliations

A&WMA - Air & Waste Management Association

OSSGA – Ontario Stone Sand and Gravel Association

Ontario Air Practitioners Group.

Education

Bachelor of Applied Science (Environmental [Chemical] Engineering), University of Waterloo, 2000

Courses Taught

Controlling Dust from Process Equipment. Ontario Agri Business Association

Evolution of the Ontario Approvals Process. Ontario Association of Physical Plant Administrators

Emission Sources, From Boilers to Bulldozers. A&WMA Ontario Section

Emission Estimation & Data Quality, Good Emissions Data Makes for Good Decisions. A&WMA Ontario Section

Controlling Fugitive Dust. OSSGA Environmental Management Workshop

Environmental Engineering for Non-Environmental Engineers, EPIC Educational Program Innovations Center

BRIAN SULLEY, B.A.SC., P.ENG.

TECHNICAL DIRECTOR - AIR QUALITY | PRINCIPAL

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Selected Project Experience

Hearings

- Albion Hills Automotive, Palgrave, ON, (OMB File PL070637)
- Crestwood Subdivision OMB Appeal, London, ON (OMB File PL080059)
- SASE Aggregates Ltd., Uxbridge, ON (OMB File PL160852)
- Blythe Holsteins Ltd., Municipality of Thames Centre, ON (LPAT File PL161154)
- Atlantic Power Corporation, Williams Lake, BC (EAB file 2016-EMA-G05)
- James Dick Construction Limited, Township of Guelph-Eramosa, ON (LPAT File PL170688)
- Colacem Canada Inc., Township of Champlain, ON (LPAT File PL170756)
- C. H. Demill Holdings Inc., Township of Tyendinaga, ON (LPAT File MM180027)
- Halton Crushed Stone, Town of Erin, ON (LPAT File MM190008)
- Zircon Design and Development Inc., Toronto, ON Hearing of Necessity under the Expropriations Act.
- MJJJ Developments Inc., Town of Caledon, ON (LPAT File PL190106, PL190107)
- RioTrin Properties (Burnhamthorpe) Inc., Mississauga, ON (LPAT File PL190221, PL190222)
- REDECAN & REDECAN PHARM, Town of Pelham, ON (OLT File PL200426)
- Eastwood Holdings Corp., City of Vaughan, ON (OLT-22-002164, Legacy Case PL210333)
- Obico Rail Yard (GP) Inc., City of Toronto, ON Proceeding under s.13 of the Expropriations Act (OLT Case No. LC200010)
- 9205187 Canada Ltd o/a Morven Construction v. Hong Jie Xu and Yu Qing Huang, Napanee ON (Ontario Superior Court of Justice Court File No. CV-22-00000019-0000)
- Grainboys Holdings Inc., Township of Uxbridge, ON (OLT-22-002956, Legacy Case PL200240)
- Urros Investments Inc. Appeal of Refusal to Allow a Minor Variance, Toronto, ON (TLAB Case No. 22 217984 S45 05)

Federal Government

- Cliff Hill Central Heating Plant, Ottawa, ON
- Revision to NPRI Welding Emission Factors, Gatineau, PQ
- Tunney's Pasture Central Heating Plant, Ottawa, ON

Building Air Quality Design Reviews

- 81 Bay Street, Toronto, ON
- 141 Bay Street, Toronto, ON
- 280 King Street East, Toronto, ON
- 17 Prince Arthur Street, Toronto, ON

Transportation / Roadway Air Quality

- Bluewater Bridge, Sarnia, ON
- CN MacMillan Yard, Vaughan, ON
- GO Milton Expansion, ON
- Highway 400 Improvements, Barrie, ON
- Highway 417 Widening, Ottawa, ON
- Highway 69 Widening North of Parry Sound, ON
- Jebel Ali Airport, Dubai, UAE
- Metrolinx Network Expansion, ON
- North Channel Seaway Bridge, Cornwall, ON
- QEW Widening, Oakville, ON

Land-Use Planning Air Quality Assessments

- Bolton Gateway Feasibility Assessment, Bolton ON
- Active Wellness Products, London, ON
- 225 Birmingham Street Redevelopment, Toronto, ON
- 6 Cuddy Boulevard, London, ON
- Dundas & Shorncliffe, Toronto, ON
- 5507-5509 Dundas Street Redevelopment, Toronto, ON
- 328-374 Dupont Street, Toronto, ON
- 176-178 Front Street Redevelopment, Toronto, ON
- 250 Front Street East Redevelopment, Toronto, ON
- 105 Garden Avenue Development, Brantford, ON
- Hansler Rd. Development, Thorold, ON
- iPoly, St. Catharines, ON
- 6 Lloyd Avenue, Toronto, ON
- Niagara Stone Rd. Development, Niagara-on-the-Lake, ON
- Nyon Energy Park Review, Port Colborne, ON
- Portage Rd. Development, Niagara Falls, ON
- Portuguese Cheese, Toronto, ON
- 933-935 Queensway Redevelopment, Toronto, ON
- Riverside Waste Transfer Facility, Centre, Wellington, ON
- 383 Sorauren Avenue Peer Review, Toronto, ON
- Thorold Park Redevelopment, Thorold, ON
- Xinyi Glass Canada, Guelph Eramosa Township, ON
- Xinyi Glass Canada, Stratford, ON
- 771 Yonge Street Redevelopment, Toronto, ON

Environmental Protection Plans

- Pound-Maker Bioethanol, Lanigan, SK
- North West Bio-Energy Ltd, Unity, SK

Agricultural Experience

- DLM Foods Canada Inc., Elmira, ON
- Horst Farm Odour Assessment, Woolwich, ON
- New Life Mills Limited, Inkerman, ON
- New Life Mills Limited, Wyoming, ON
- Masterfeeds, Stratford, ON
- Don J. Pestell Limited, New Hamburg, ON
- Cargill, Multiple Sites, ON

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Odour Assessments

- Active Wellness Products, London, ON
- Arnprior Sewage Treatment Plant, Arnprior, ON
- Colonial Sewage Pumping Station, Waterloo, ON
- Creemore Springs Brewery Peer Review, Creemore, ON
- Guelph Composting Facility, Guelph, ON
- Guelph Wet/Dry Facility, Guelph, ON
- Elora Wastewater Treatment Plant, Elora, ON
- IGPC Ethanol, Aylmer, ON
- Kawartha Ethanol, Kawartha Lakes, ON
- Keswick Wastewater Treatment Plant, Keswick, ON
- Lush Cosmetics, Toronto, ON
- Nitta Gelatin, Toronto, ON
- Parry Sound Sewage Treatment Plant, Parry Sound, ON
- Peel Composting Facility Management Plan, Caledon, ON
- Portuguese Cheese, Toronto, ON
- Ravensview Water Pollution Control Plant, Kingston, ON
- Royal Canin Pet Foods, Puslinch, ON
- S.C. Johnson, Brantford, ON
- Symplastics Engineering Plastics, Orangeville, ON
- Trail Road Landfill, Ottawa, ON
- Zircon Design and Development Inc., Toronto, ON
- Redecan Odour Assessment, Fenwick, ON

Institutional Air Quality Assessments

- Bridgepoint Hospital, Toronto, ON
- Brock University, St Catharines, ON
- Carleton University, Ottawa, ON
- Centre for Addiction and Mental Health, Toronto, ON
- Centre Wellington Sportsplex, Fergus, ON
- Fanshaw College, London, ON
- Joseph Brant Hospital, Burlington, ON
- London Health Sciences Centre, London, ON
- Mackenzie Health Care, Multiple Sites, ON
- Milton District Hospital, Milton, ON
- North Bay Aquatic Centre, North Bay, ON
- North Bay Regional Health Centre, North Bay, ON
- St. Joseph's Health Centre, Hamilton, ON
- St. Michael's Hospital, Toronto, ON
- Stratford General Hospital, ON
- Trillium Health Care, Multiple Sites, ON
- Toronto Western Hospital, Toronto, ON
- University of Guelph, Guelph, ON
- University of Ottawa, Ottawa, ON
- Women's College Hospital, Toronto, ON
- Fanshaw College, London, ON

Air Quality Monitoring Studies

- SaskPower Boundary Dam Power Station, Estevan, SK

Industrial Facility Air Quality Assessments

- Anchor-Danly, Cambridge, ON
- Anchor-Danly, Windsor, ON
- Arcelor Mittal Hamilton East Works, Hamilton, ON
- Ar-Razi Methanol Plant, Jubail, Kingdom of Saudi Arabia
- Breeze Dried Flooring, Tilsonburg, ON
- Cooper Plating, Newmarket, ON
- Enbridge Gas Storage and Transfer Operations, ON
- Fiat Chrysler, Multiple Sites, ON
- Gateway Pet Memorial, Guelph, ON
- Gateway Pet Memorial, Ottawa, ON
- General Motors of Canada Limited, Multiple Sites, ON
- IMBC Blow Molding, Orangeville, ON
- Kuntz Electroplating, Kitchener, ON
- L.J. Barton, Hamilton, ON
- Mitten Vinyl, Paris, ON
- NOVA Chemicals, Corunna, Sarnia & St. Clair, ON
- Peel Plastics, Brampton, ON
- Pestell Pet Products, New Hamburg, ON
- Resolute Iroquois Falls Mill, Iroquois Falls, ON
- Resolute Thunder Bay Mill, Thunder Bay, ON
- Rochling Engineering Plastics, Orangeville, ON
- Sithe Energy, Mississauga and Brampton, ON
- Stelco, Hamilton & Nanticoke, ON
- TBay Tel Generators, Multiple Sites, ON
- Weston Bakeries, Multiple Sites, ON

Ready-Mix Concrete Facility Air Quality Assessments

- Dufferin Construction, Burlington, ON
- Dufferin Construction, Hamilton, ON
- Dufferin Construction, Bowmanville, ON
- Dufferin Construction, Toronto, ON
- Dufferin Construction, Scarborough, ON
- Ontario Redi-Mix, Pickering, ON
- Ontario Redi-Mix, Toronto, ON

Hot-Mix Asphalt Facility Air Quality Assessments

- AECON, Brampton, ON
- Walker Aggregates, Thorold, ON
- Ingram Asphalt, Toronto, ON
- Walker Aggregates, Vineland, ON
- Dufferin Aggregates, Mosport, ON
- Waterford Group, Port Colborne, ON
- Coco Paving, Windsor, ON

Mining Air Quality Assessments

- Vale, Sudbury, ON
- Kirkland Lake Gold, Kirkland Lake, ON
- Rubicon Minerals Phoenix Gold Mine, Red Lake, ON
- Treasury Metals Goliath Gold, Wabigoon, ON

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Fugitive Dust Monitoring Studies

- Summit Aggregates, Ayr Pit, Ayr, ON
- CBM Sunderland Pit, Sunderland, ON
- CBM Codrington Pit, Codrington, ON
- CBM Westwood Pit, Peterborough, ON
- CBM Thamesford Pit, Thamesford, ON
- CBM St. Mary's Quarry, St. Mary's ON
- CBM Osprey Quarry, Duntoon, ON
- CBM Hillsburgh Pit, Hillsburgh, ON
- CBM David Pit, North Dumfries, ON
- CBM Buckhorn Quarry, Buckhorn, ON
- CBM Bowmanville Quarry, Bowmanville, ON
- CBM Aberfoyle South Pit, Puslinch, ON
- CBM Aberfoyle North Pit, Puslinch, ON
- Waterford Group Dunnville Rock Products, Dunnville, ON
- Waterford Group Law Crushed Stone, Port Colborne, ON
- Waterford Group Norfolk Aggregates, Norfolk, ON
- Waterford Group Vinemount Quarry, Vinemount, ON
- Waterford Group Waterford Pit, Waterford, ON

Fugitive Dust Studies

- 5W Farms, Victoria Road Quarry, Victoria Road, ON
- AECON Ottawa Quarry, Ottawa, ON
- Blythe Dale Agg. Leitch Gover Pit, Thames Centre, ON
- Brampton Brick Hillsdale Plant, Hillsdale, ON
- Brampton Brick Norval Quarry Review, Brampton, ON
- Bruno's Contracting, Trout Lake Pit, Thunder Bay, ON
- Cambridge Aggregates Edworthy Pit, North Dumfries, ON
- Capital Paving, Aikensville Pit, Puslinch, ON
- Capital Paving, West Montrose Pit, West Montrose, ON
- Capital Paving, Shantz Station Pit, Maryhill, ON
- CBM Sunderland Pit Dust Control, Sunderland, ON
- C.H. Demill Melrose Quarry, Shannonville, ON
- City of Ottawa Trail Road Landfill, Ottawa, ON
- Cressy Quarry Review, Cressy, ON
- D&J Lockhart Martin Pit Expansion, Woolwich, ON
- Dufferin Aggregates Aberfoyle Pit, Puslinch, ON
- Dufferin Aggregates Acton Quarry, Acton, ON
- Dufferin Aggregates Alps Pit, North Dumfries, ON
- Dufferin Aggregates Butler Pit, North Dumfries, ON
- Dufferin Aggregates Carden Quarry, Carden, ON
- Dufferin Aggregates Cayuga Quarry, Cayuga, ON
- Dufferin Aggregates Cedar Creek Pit, North Dumfries, ON
- Dufferin Aggregates Chudyk Pit, North Dumfries, ON
- Dufferin Aggregates Flamboro Quarry, Dundas, ON
- Dufferin Aggregates Maple Yard, Maple, ON
- Dufferin Aggregates Mill Creek Pit, Puslinch, ON
- Dufferin Aggregates Milton Quarry, Milton, ON
- Dufferin Aggregates Mosport Pit, Mosport, ON
- Dufferin Aggregates Mill Creek Pit, Puslinch, ON
- Dufferin Agg. Richmond Hill Yard, Richmond Hill, ON
- Dufferin Aggregates Pickering Yard, Pickering, ON
- Duncor Portable Plant, Barrie, ON
- Duncor Emulsions, Shanty Bay, ON
- E.C. King Transfer Yard, Owen Sound, ON
- Essential Soils Solutions, Ramara, ON
- Farrish Crushing Portable Plant, Listowel, ON
- Federal Marine Terminals, Hamilton, ON
- Halton Crushed Stone, Town of Erin, ON
- Hanson Brick Burlington Review, Burlington, ON
- Highlands Group Melancthon Quarry, Melancthon, ON
- Hillway Equipment Limited, Orillia, ON
- James Dick Rockfort Quarry, Rockfort, ON
- James Dick Erin Pit Extension, Erin, ON
- James Dick Hidden Quarry, Guelph Eramosa, ON
- James Dick Reid Road Reservoir Quarry, Campbellville, ON
- Jennison Construction Clinton Pit, Clinton, ON
- Johnson Brothers McGuigan Pit, Cedar Springs, ON
- Johnson Brothers Erwin South Pit, Putnam, ON
- Kingfisher Aggregates Kingfisher Quarry, Ramara, ON
- Lafarge Cement, Bath, ON
- Lafarge Cement, Exshaw, AB
- Lafarge Goodwood Pit, Goodwood, ON
- Lippa Quarry, Skeleton Lake, ON
- Livingston Excavating & Trucking Inc., Simcoe, ON
- Lower Mattagami River Project, Mattagami, ON
- Lowndes Holdings, Mountsberg Quarry, Mountsberg, ON
- McCann Redi-Mix Durst Pit, Benmiller, ON
- NJ Excavating Martin Pit, Woolwich, ON
- SASE Aggregates, Uxbridge, ON
- Staples Himsworth Quarry, Himsworth, ON
- Thames Valley Agg., Banner Rd. Pit, Thamesford, ON
- Thames Valley Aggregates, Golding Pit, Putnam, ON
- The Murray Group, Cole Pit, Inverhaugh, ON
- The Murray Group, Devin Pit, Inverhaugh, ON
- Trent Valley Sand & Gravel Norfolk Quary, Norfolk, ON
- Try Aggregates Byron Pit Review, London, ON
- Preston Sand & Gravel Roszell Pit, Puslinch, ON
- Preston Sand & Gravel Henning Pit, North Dumfries, ON
- VicDom Sand and Gravel, Uxbridge, ON
- VicDom Sand and Gravel, Sunderland, ON
- VicDom Sand and Gravel, Utica, ON
- Walker Aggregates Walker Brothers Quarry, Thorold, ON
- Walker Aggregates Severn Pines Quarry, Orillia, ON
- Walker Aggregates Duntroon Quarry, Duntroon, ON
- Walker Aggregates Uppers Lane Quarry, Niagara Falls, ON
- Walker Aggregates Vineland Quarry, Vineland, ON
- Waterford Group Vinemount Quarry, Vinemount, ON
- Waterford Group Law Crushed Stone, Port Colborne, ON
- Wilson Quarry, Monck, ON

BRIAN SULLEY, B.A.SC., P.ENG.

TECHNICAL DIRECTOR - AIR QUALITY | PRINCIPAL

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Air Pollution Control Technologies

- Flue Gas Desulphurization Technology and Design Review, Moa Nickel, Cuba
- City of Guelph Waste Resource Innovation Centre Biofilter Replacement, Guelph, ON

Chemical Engineering Experience

- Process Design, Optimization and Control Relating to the Chemical Process Industry
- Two years in the process-engineering group of Huntsman Corporation Canada Inc.

Hazard Modelling / Chemical Process Quantitative Risk Analysis

- Quantitative Hazard Assessment Sulphur Dioxide Storage and Transfer Systems, Huntsman Corporation Canada Inc., Guelph, ON
- Quantitative Hazard Assessment Hydrogen Chloride Storage and Transfer Systems, Huntsman Corporation Canada Inc., Guelph, ON
- Quantitative Hazard Assessment Ethylene Oxide Storage and Transfer Systems, Huntsman Corporation Canada Inc., Guelph, ON
- Peer Review of Cytec Canada Risk Assessment, Niagara Falls, ON
- Edmonton Air Quality Assessment, Edmonton, AB
- Madoc Co-Operative Association, Madoc, ON
- Screening Level Risk Assessment of a Propane Facility, St. George, ON
- RioTrin Grand Park Redevelopment Hazard Consequence Modelling, Mississauga, ON
- CN MacMillan Yard Accidental Release Hazard Modelling, Vaughan, ON