Sault Ste. Marie Solid Waste Management
Air Quality and Odour Impact Assessment (Draft)

February 2015 – 06-6988

Note to Reader:

The attached Report (the “Report”) has been prepared by Dillon Consulting Limited. This report was prepared specifically for the City of Sault Ste. Marie Solid Waste Environmental Assessment.

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1.0 Introduction and Project Description

This document presents the findings of the air quality and odour impact assessment as part of the Environmental Assessment (EA) of the proposed expansion of the City of Sault Ste. Marie's landfill located on Fifth Line (the "Site").

The air quality impact assessment examines and evaluates the potential for impact to public health and safety as a result of air quality impacts from the landfill expansion. The air quality assessment also considers the potential for dust associated with the expansion which is considered as a disruption effect on local residents and businesses as part of the socio-economic assessment.

The air quality impact assessment concentrates on identifying and analyzing any effects on the environment arising from the proposed project. It also aims to identify and address key interactions between communities and the proposed project.

The odour assessment examines the potential for change in odour level as a result of the proposed expansion and discusses any need for mitigation to reduce levels. The results of the odour assessment will provide information for the socio-economic evaluation which considers potential for disruption to residents and businesses during operation of the expanded landfill.

Following on from this introductory section, the report takes on the following format:

- Air Quality:
  - Description of the study area;
  - Outline of methodology and approach to air quality assessment;
  - Summary of existing air quality; and
  - Evaluation of potential air quality impacts.
- Odour:
  - Outline of methodology and approach to odour assessment;
  - Summary of existing odour conditions; and
  - Evaluation of potential odour impacts.

2.0 Air Quality

2.1 Study Area

The study area for the air quality assessment is shown on **Figure 1**. This area was selected based on defining an area around the Site that would incorporate potential impacts of the Site operations (i.e., capture maximum concentrations) and also defining a boundary that would allow for consideration of the City of Sault Ste. Marie (i.e., capture potential impacts to nearest major population centre, if applicable).

2.2 Methodology and Approach

The air quality assessment for the proposed Sault Ste. Marie Landfill Expansion was completed using the following steps:

- Definition of baseline concentrations of indicator compounds based on ambient air quality data (detailed in Section 4 below);
- Review of future operational scenarios (including equipment location and estimated emissions) to select a worst-case operating scenario specific to air quality (detailed in Section 5 below);
- Prediction of off-property concentrations of air quality indicator compounds (detailed in Section 5 below);
- Comparison of the predicted concentrations and baseline conditions to relevant air quality criteria (detailed in Section 5 below).

The indicator compounds selected for the air quality assessment were those of greatest significance from typical landfill operations, namely:

- Oxides of Nitrogen (NO_X)
  - Generated from combustion of fuel in mobile and stationary equipment at the landfill.
  - Air quality criteria are based on prevention of health impacts.
- Total Suspended Particulate (TSP)
  - Generated from movement of vehicles on paved roads, movement of vehicles on unpaved roads/surfaces and material handling and movement.
  - Air quality criteria are based on visibility (dust).
- Particulate Matter with aerodynamic diameter less than 10µm (PM_{10})
  - Generated from movement of vehicles on paved roads, movement of vehicles on unpaved roads/ surfaces and material handling and movement.
  - Air quality criteria are based on prevention of health impacts.

- Particulate Matter with aerodynamic diameter less than 2.5µm ($PM_{2.5}$)
    - Generated from movement of vehicles on paved roads, movement of vehicles on unpaved roads/surfaces and material handling and movement.
    - Air quality criteria are based on prevention of health impacts.

2.3 Existing Air Quality

In order to define existing air quality (baseline conditions), a review was done of ambient air quality monitoring stations close to or within the Study Area. The Ministry of the Environment and Climate Change's (MOECC) Sault College station was selected as the preferred source of baseline conditions because of the availability of $PM_{2.5}$ and NO_X data from this site and its location within the Study Area (see **Figure 2**).

The Sault College station is located more than 6km to the south of the project site, and more than 4km east of the major industrial activity within the City of Sault Ste. Marie (see **Figure 2**). As shown in **Figure 3** below, the predominant wind directions in the area of the project site are winds from the North West, East and South East. The Sault College station should therefore provide a reasonable indication of air quality in Sault Ste. Marie, without being significantly impacted by the industrial areas located in the western area of the City.

CITY OF SAULT STE. MARIE
WASTE MANAGEMENT EA
SAULT STE. MARIE, ON

AIR QUALITY ASSESSMENT
STUDY AREA
FIGURE 1

STUDY AREA

DILLON CONSULTING

MAPPING INFORMATION
© 2014 Google Earth Pro

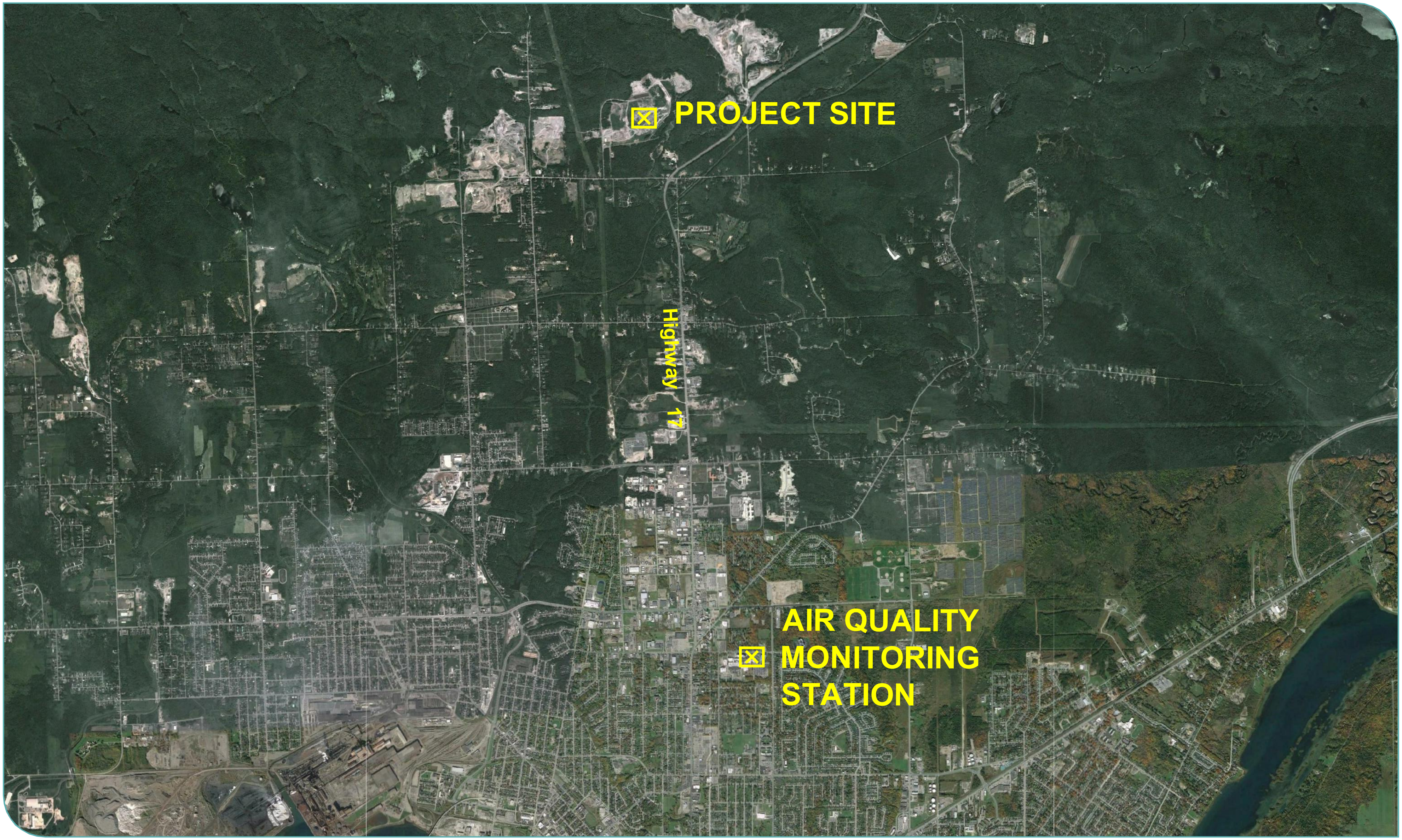
CREATED BY: JMM
CHECKED BY: RM

File Location:
v:\projects\draft\2006\06-6988 ssm landfill ea\figures\066988-05-site.dwg June, 24, 2014 2:39 PM

SCALE 1:200,000
0 1.25 2.5 5km

N W E S

PROJECT: 06 6988 STATUS: DRAFT DATE: 06/24/14



CITY OF SAULT STE. MARIE
WASTE MANAGEMENT EA
SAULT STE. MARIE, ON

LOCATION OF MOE'S SAULT COLLEGE AIR QUALITY MONITORING STATION AND PROJECT SITE
FIGURE 2

DILLON CONSULTING

MAPPING INFORMATION
© 2014 Google Earth Pro

CREATED BY: JMM
CHECKED BY: RM

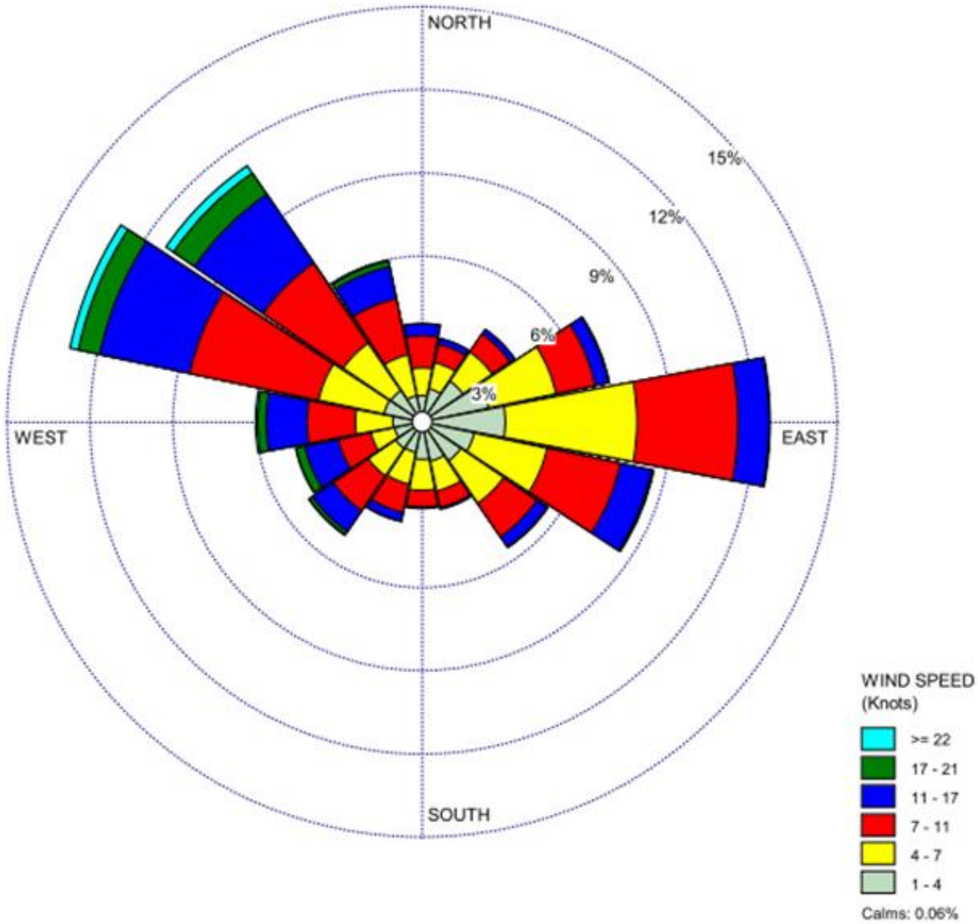
File Location:
v:\projects\draft\2006\06-6988 ssm landfill ea\figures\066988-05-site.dwg June, 24, 2014 2:39 PM

SCALE 1:60,000
0 750 1500m

N W E S

PROJECT: 06 6988 STATUS: DRAFT DATE: 06/24/14

Figure 3: Wind Rose for Project Site (2009 to 2013) [Ref: Ontario Ministry of the Environment and Climate Change]



Ambient air quality data from the Sault College station for the most recent three years of monitoring (2011 to 2013), for the selected indicator compounds, was analyzed. Based on established air quality assessment practice, the baseline air quality was defined as being the 90th percentile for each averaging period. This approach recognizes that there is variability in ambient air quality, whilst also providing a conservative value for use in air quality assessment and facility planning.

The use of the 90th percentile is conservative because these levels only occur for 10% of the time. The baseline concentrations defined for this project are shown in the T**able 1**. The table also shows the Ministry of the Environment and Climate Change Ambient Air Quality Criteria which defines the "desirable concentration" of a contaminant in air based on protection against adverse effects on health or the environment.

Table 1: Baseline Air Quality Concentrations of Indicator Compounds

Pollutant	Averaging Period	Baseline Concentrations (90th Percentile) (µg/m³)	Relevant Ambient Air Quality Criteria (µg/m³)
NO_2	1-hour	26.3	400 – Ontario AAQC[1]
NO_2	24-hour	22.6	200 – Ontario AAQC
TSP[2]	24-hour	36.5	120 – Ontario AAQC
PM_{10}[3]	24-hour	15.2	50 – Interim Ontario AAQC
$PM_{2.5}$	24-hour	9.1	30 – Canada Wide Standard

Notes:

(1) AAQC is defined as a “desirable concentration” of a contaminant in air based on protection against adverse effects on health or the environment.

(2) Regional ambient monitoring data for TSP was not available for the period 2011 to 2013. TSP was estimated assuming that $PM_{2.5}$ accounts for ~25% of TSP, which is higher than the values found from a literature survey of available data (Canadian and Ontario). The values found ranged from 18% to 24%.

(3) Regional ambient monitoring data for PM_{10} was not available. PM_{10} was estimated assuming that $PM_{2.5}$ accounts for ~60% of PM_{10}, which is based on research conducted by the MOE in Ontario (*“A Compendium of Current Knowledge on Fine Particulate Matter in Ontario”,* dated March 1999).

2.4 Air Quality Impact Assessment

The evaluation of potential effects on air quality of the project activities included the following tasks:

- Analysis of Operating Scenarios - Identification of the worst-case operating scenario for air quality;
- Emission Estimation - Estimation of emissions of indicator compounds from significant sources/activities at the landfill, including vehicles travelling into and out of the site, vehicles and equipment traveling within the site, combustion emissions from stationary and mobile equipment operating within the site, and the handling of materials within the site;
- Dispersion Modelling - Prediction of the concentrations of indicator compounds at sensitive receptors, resulting from the project emissions defined above; and
- Analysis of Potential Effects - Estimation of the cumulative concentrations of indicator compounds (based on the addition of project activities to existing conditions) and comparison of these concentrations to relevant air quality criteria.

Each of these tasks is elaborated on in the following sections.

2.4.1 Analysis of Operating Scenarios

Eight future operational scenarios representing different stages of landfill operations were considered as part of the air quality effects assessment. A brief description of the scenarios is provided in **Table 2**:

Table 2: SSM Landfill Operational Scenarios

Scenario Number	Anticipated Timeframe	Main Project Activities
1	2017	Cell 1 construction and existing landfill operations
2	2018 - 2020	Cell 1 operation and mining operations on Cell 1A
3	2020	Cell 1operation and Cell 1A construction
4	2021 - 2026	Cell 1A operation
5	2027	Cell 1A operation and Cell 2 construction
6	2032	Cell 2 operation and Cell 3 construction
7	2033 - 2036	Cell 3 operation
8	2037	Cell 3 operation and Cell 4 construction

For all the scenarios, normal landfill activities are expected to be in operation (i.e., disposal of waste at the active area). In general, the scenarios can be divided into three main categories:

- Cell construction with normal landfill operations (Scenarios 1, 3, 5, 6, 8);
- Waste mining (with normal landfill operations) (Scenario 2); and
- Normal landfill operations (Scenarios 4, 7).

The vehicles and equipment associated with normal landfill operations would be the same for all scenarios, however, the vehicles and equipment required for cell construction and waste mining would vary.

In order to determine which scenario represents the worst-case operating scenario in terms of potential for air quality effects, a screening level assessment was completed. This screening assessment considered vehicle and equipment activities at the site, as well as vehicle and equipment travel distances (unpaved roads). Vehicle activity on paved roads was not considered as part of the screening assessment, as it is considered to be the same for each scenario.

Based on the screening assessment, Scenarios 1 and 2 were determined to have the greatest potential to impact air quality. Scenarios 1, 3, 5, 6, and 8 all include cell construction activities, however, Scenario 1 represents the longest travel path for cell construction vehicles. Scenario 2 is the only scenario representative of waste mining. Scenarios 4 and 7 are representative of normal landfill operations.

Since the cell construction and waste mining activities would contribute to emissions in addition to those during normal landfill operations, the normal landfill operation Scenarios were not considered to be significant in terms of impacts.

Emissions from Scenario 2 are expected to represent the worst-case scenario, as the travel paths associated with the active waste disposal area (working face) are the greatest, waste mining activities add to emissions from mobile and stationary combustion sources, and emission sources associated with waste mining activities are located southwest of the existing waste cells, closer to the property line and receptors. This scenario was therefore used to assess the potential air quality impacts of the proposed landfill expansion.

Sample calculations for the worst-case scenario are presented in **Appendix A**.

2.4.2 Emission Estimation

Table 3 summarizes the vehicles and equipment assumed to be in operation as part of Scenario 2, as well as their operating schedule and assumed specifications. Further information on the approach to calculating emissions is included in the subsections below.

Table 3: Equipment Assumed to Be Operational at the Landfill

Vehicle / Equipment / Source	Affiliated Operation	# In Use	Operating Schedule (average hrs/day)
Dump Truck	Landfill Operations	1/day	4
Compactor	Landfill Operations	1/day	6
Bulldozer	Landfill Operations	1/day	4
Rock Truck	Landfill Operations	1/day	4
Front End Loader	Landfill Operations	1/day	5
Landfill Flare	Landfill Operations	1/day	24
Waste Trucks	Landfill Operations	6/hr	9
Public Vehicles (Public Drop Off)	Landfill Operations	21/hr	9
Yard Waste Truck	Landfill Operations	1/hr	9
Compost Screener	Composting Operations	1/day	5
Compost Turner	Composting Operations	1/day	5
Farm Tractor	Composting Operations	1/day	5
Trommel Screeners	Waste Mining	2/day	9
Stacker	Waste Mining	1/day	9
Tub Grinder	Waste Mining	1/day	9
Excavator	Waste Mining	2/day	9
Bulldozer	Waste Mining	1/day	9
Articulating Truck	Waste Mining	2/day	9

Notes:

(1) Composting operations are expected to occur primarily during the spring and fall months and waste mining operations year round. Thus, the worst-case emission scenario for the purposes of this assessment consists of the peak (i.e., period of greatest activity) composting and waste mining operations occurring at the same times of the year as the landfill. Landfill and waste mining operations will occur year-round and composting operations will not occur in winter.

(2) Engine sizes, empty/loaded weights and dimensions were assumed based on available information.

(3) Ancillary equipment (e.g., vacuum, water truck) were assumed to be insignificant contributors to the site emissions.

2.4.2.1 Combustion Emissions - On-Road Vehicles

For this assessment, on-road vehicles consisted of waste trucks. The *U.S. EPA MOBILE6.2 Source Emission Factor Model* was used to determine emission factors for indicator compounds, for on-road vehicles. Emission factors were determined assuming a maximum operating speed of 30 km/h (representative of average speed limit throughout the site). Emission factors for different seasons were determined and averaged to yield a single overall emission factor. Climate data for the area was taken from the meteorological data (2009-2013) provided by the MOECC for Sault Ste. Marie. Vehicle traffic was assumed to consist of Heavy Duty Diesel Vehicles (HDDV Class 8b).

The emission rates for on-road vehicles were calculated by multiplying the estimated travel distance per hour by the MOBILE6.2 emission factors for each indicator compound. The travel distance was calculated by multiplying the distance of the road traversed by the average number of waste trucks that enter the site per hour. The average number of waste trucks that enter the site per hour was determined based on 2013 daily waste receipt data, which is considered to be representative of the worst-case scenario (i.e., future traffic volumes are not expected to increase significantly).

The equation used as part of the calculation is presented below.

$$ER_{on\text{-}road} = MOBILE6_{EF} \times Travel\ Distance$$

where:

$MOBILE6_{EF}$ = *mobile emission factor for HDDV traveling 30 km/hr (g/mile)*
Travel Distance = round-trip distance travelled (miles)

2.4.2.2 Combustion Emissions - Off-Road Vehicles

For this assessment, off-road vehicles included the articulating truck, dump truck, tractor, compactor, bulldozers, front end loader, excavator, and other equipment that primarily operated on-site. The U.S. EPA guidance document *Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling Compression-Ignition (2010)* was used to determine combustion emission rates from off-road vehicles.

Based on the proposed timing of Scenario 2 (2018-2020), it was assumed that all non-road equipment would meet the US EPA Tier 3 emission standards (phased in 2006); therefore, Tier 3 emission factors were applied.

The equations used as part of the calculation are presented below.

$$EF_{non\text{-}road\ (NOx,\ CO,\ HC)} = EF_{ss} \times TAF \times DF$$

where:

$EF_{non\text{-}road\ (NOx,\ CO,\ HC)}$ = final emission factor used in model, after adjustments to account for transient operation and deterioration (g/hp.hr)

EF_{ss} = zero-hour, steady-state emission factor (g/hp/hr)

TAF = transient adjustment factor (unitless)

DF = deterioration factor (unitless)

$$EF_{non\text{-}road\ (PM)} = EF_{ss} \times TAF \times DF - S_{PMadj}$$

where:

S_{PMadj} = adjustment to PM emission factor to account for variations in fuel sulphur content (g/hp.hr)

2.4.2.3 Stationary Equipment Emissions

For this assessment, stationary equipment included the landfill flare, the compost screener, the stacker, the trommel screeners, the tub grinder and other stationary combustion sources. Emission rates for the operation of the landfill flare were based on information documented in the Environmental Compliance Approval (ECA) [4306-7ZHPR3] for the site.

The ECA was based on a landfill gas flowrate of 770 CFM. Based on the results of the U.S. EPA LANDGEM model for the site, an average landfill gas flowrate of 604 CFM is expected for the years 2018 to 2020. As a result, the emission rates estimated as part of the ECA are considered to be conservative and representative for this assessment.

Air emission standards documented in *U.S. EPA Title 40, Part 89 – Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines* were used to determine combustion emission rates from stationary combustion sources.

Based on the proposed timing of Scenario 2 (2018-2020), it was assumed that all stationary combustion equipment would meet the US EPA Tier 3 emission standards (phased in 2006); therefore, Tier 3 emission factors were applied.

The equation used as part of the calculation is presented below.

$$ER_{stationary} = ES_{Tier3} \times \text{Engine Power Rating}$$

where:

ES_{Tier3} = *emission standard based on Tier 3 timing (g/kW.hr)*
Engine Power Rating = power capacity of the diesel engine (kW)

2.4.2.4 Road Dust Emissions

Road dust emissions were calculated using emission factors documented in *U.S. EPA AP-42 Chapter 13.2.1 – Paved Roads and Chapter 13.2.2 – Unpaved Roads.* For this assessment, vehicles traveling on paved roads included waste trucks, yard waste vehicles, and public vehicles.

Particulate emission rates from the re-suspension of road dust on paved roads were estimated using the following equation.

$$EF_{paved} = k \times (sL)^{0.91} \times (W)^{1.02}$$

where:

EF_{paved} = *particulate emission factor (matching units of k)*
k = particle size multiplier for particle size range of interest (g/VKT)
sL = road surface silt loading (g/m^2)
W = average weight of the vehicles traveling the road (tons)

For the purposes of this assessment, sL was assumed to be 7.4%, representative of municipal landfills (from the AP-42 guidance document). In addition, the average weight of each vehicle type traveling on paved roads was determined based on a detailed assessment of 2013 daily weigh scale data.

Vehicles traveling on unpaved roads included waste trucks, the compactor, the bulldozer, the rock truck, etc. Particulate emission rates from the re-suspension of road dust on unpaved roads were estimated using following equation.

$$EF_{unpaved} = k \times (s/12)^{a} \times (W/3)^{b}$$

where:

$EF_{unpaved}$ = *particulate emission factor (lb/VMT)*
s = surface material silt content (%)
W = mean vehicle weight (tons)
k, a and b = empirical constants (unitless)

For the purposes of this assessment, s was assumed to be 6.4%, representative of municipal landfills (from the AP-42 guidance document). In addition, the average weight of waste trucks traveling on unpaved roads was determined based on a detailed assessment of 2013 daily waste scale data.

Travel distances for each vehicle were determined based on measurement of travel pathways (for vehicles that travel across the site) and/or calculated distances based on an average travel speeds and runtimes (for equipment that moves within a defined work area). For equipment associated with normal landfill and waste mining activities, it was assumed that the equipment moved at an average speed of 4.8 km/hr (3 mph), 75% of the average operating time.

2.4.2.5 Material Handling Emissions

Emissions from the handling of soil were calculated using emission factors documented in *U.S. EPA AP-42 Chapter 13.2.1 – Paved Roads and Chapter 13.2.4 – Aggregate Handling and Storage Piles.* It was assumed that the rock truck would deliver cover soil to the working face once per hour.

The particulate emission rate associated with the dumping of cover soil was estimated using following equation.

$$EF_{soil\ cover} = k \times 0.0016 \times \frac{(U/2.2)^{1.3}}{(M/2)^{1.4}}$$

where:

$EF_{soil\ cover}$ = particulate emission factor (kg/Mg)
K = particle size multiplier for particle size range of interest (unitless)
U = mean wind speed (m/s)
M = material moisture content (%)

For the purposes of this assessment, U was assumed to be 3.7 m/s, representing the average hourly wind speed as obtained from the regional MOECC surface meteorological data for dispersion modelling (1996 – 2000). In addition, the material moisture content was assumed to be 7.4%, representative of the sandy soil used at the landfills (from the AP-42 guidance document).

2.4.2.6 Material Storage Emissions

In order to understand the impact of the particulate emissions due to wind erosion from the exposed areas at the site, extreme wind erosion events which occur under high wind conditions were assessed in accordance with the US EPA AP-42, Section 13.2.5.

Using the threshold friction velocity of 1.33 m/s for Scoria (roadbed material) as described in Table 13.2.5-2 of AP-42 Section 13.2.5, which is representative of site conditions, the corresponding threshold fastest mile of wind at a reference anemometer height of 10 m is 25.1 m/s based on Equation (4) of AP-42 Section 13.2.5.

In Canada, the fastest mile of wind is not routinely recorded by Environment Canada (EC). Accordingly, a conversion factor of 1.5 is applied to the hourly wind speed recorded to derive the fastest mile of wind.

Therefore, the minimum wind speed which could result in extreme dust emissions by wind erosion is above 16.7 m/s.

After analyzing the wind speed distribution for the 2009 to 2013 MOECC surface meteorological data (Sault Ste. Marie) provided by the MOECC, wind speeds above 16.7 m/s only occurred for four hours over the five year period.

The infrequent nature of winds above the threshold value (16.7m/s) and the best management practices that are in place at the site suggest that the emissions from material storage would be insignificant.

2.4.2.7 Assumptions

The air quality effects assessment is based on the assumptions summarized in **Table 4**:

Table 4: Assumptions Used within the Air Quality Effects Assessment

Assumption	Rationale
Combustion emissions from public vehicles were considered to be negligible.	• Emissions from heavy-duty commercial vehicles and equipment are expected to be the dominant contributors to site emissions.
Non-road mobile and stationary combustion equipment will be in compliance with U.S. EPA Tier 3 emission standards.	• Based on the timeframe of Scenario 2 (2018 – 2020), it is expected that the majority of non-road equipment will comply with Tier 3 emissions standards.
Vehicle and equipment engines will not operate at 100% load all the time.	• It is expected that during a typical hour of operation, vehicle and equipment engines will operate at 100% half the time, and a reduced load (10%) the remainder of the time.
Particulate emissions from the storage and handling of waste were assumed to be negligible.	• Based on the moisture content of typical waste materials (expected to be 20-25% for landfilled waste and 35-65% for mined waste), the handling of waste materials (associated with landfill operations and waste mining) are not expected to generate significant levels of particulate. It is generally accepted that materials with a moisture content of 12% or greater have a low potential for dust (particulate matter) generation.
Dust control is provided as part of the fugitive dust management plan for the site.	• A fugitive dust management plan will be in-place at the site to control dust emissions from landfill activities. It is assumed that this plan would also carry over to waste mining activities.

2.4.3 Dispersion Modelling

The US EPA AERMOD modelling system, which is one of the Ontario MOECC's approved air dispersion models, was used to predict the off-property point of impingement (POI) concentrations for NO_x, PM_{10}, and $PM_{2.5}$. The dispersion modelling was conducted in accordance with the MOE's Publication entitled "*Air Dispersion Modelling Guideline for Ontario*", dated March 2009 (ADMGO).

The following sections detail how the AERMOD model was setup for the site to allow for the prediction of potential impacts from on-site emissions. Information is presented as follows:

- Source Parameterization – Definition of how the emission sources were defined in the AERMOD model for the site.
- Coordinate System – Description of the coordinate system used for geo-referencing of sources etc. within the dispersion modelling.
- Meteorology – Description of the source of the meteorological data used within the AERMOD model for the site.
- Terrain Data – Describes the terrain data used to develop the AERMOD model for the site.
- Receptors – Details the receptor grid that was used within the prediction of air quality impacts.
- Building Downwash – Describes how air flow around structures and buildings was treated within the dispersion model for the site.
- Deposition – Defines how deposition was treated within the modeling.
- Correlation Between NOX and NO2 – Describes how the conversion between NO and NO2 was treated within the assessment.
- Dispersion Modelling Options and Inputs – Summarizes the key inputs/options defined within the AERMOD model for the site.

2.4.3.1 Source Paramaterization

Stationary sources were modelled as volume sources and release heights and source dimensions were defined based on equipment dimensions. Vehicles travelling on-site were modelled as a series of volume sources along the road way.

For vehicle travel on roadways (paved and unpaved) volume sources were defined based on the Oklahoma guidance document entitled *"Air Dispersion Modeling Guidelines for Oklahoma Air Quality Permits,"* dated April 2011. More specifically, the following were incorporated into the model setup:

- The height of the volume (height of plume) is twice the height of the vehicle.
- The line source is represented by alternating volume sources.
- The release height of the volume source is half the height of the volume.
- The length of the volume (width of plume) was defined as the road width plus an additional factor to account for the turbulence caused by the vehicle as it travels. The Oklahoma Guidelines use a width of 6 m to characterize this turbulence.

The variable emissions options were used in AERMOD to represent different emissions scenarios (turn sources on and off based on the seasonality of their operations). Landfill and waste mining were assumed to operate between 8:00 am and 5:00 pm, on Monday through Saturday and all year. Composting was assumed to operate between 8:00 am and 5:00 pm, on Monday through Saturday and only in Spring, Summer and Fall.

2.4.3.2 Coordinate System

The coordinate system used within the modelling was the Universal Transverse Mercator (UTM) projection, as per Section 5.2.2 of the ADMGO. The Datum of the UTM projection was North American Datum of 1983 (NAD83).

2.4.3.3 Meteorology

A site-specific five year meteorological dataset was provided by the Ontario MOECC spanning the period 2009 to 2013. This dataset was processed by the MOECC to reflect local land use surrounding the project site. This pre-processed data was directly input to the AERMOD model for the site.

2.4.3.4 Terrain Data

Terrain data used in this assessment was obtained from the MOECC (7.5 minute format) and included the following tiles:

- 0215_2.DEM
- 0215_3.DEM
- 0215_4.DEM
- 0216_2.DEM
- 0216_3.DEM
- 0216_4.DEM
- 0217_2.DEM
- 0217_3.DEM
- 0217_4.DEM
- 2.4.3.5 Receptors

Receptors were chosen based on recommendations provided in Section 7.1 of the ADMGO. Specifically, a nested receptor grid, around a bounding box encircling all sources modelled, was placed as follows:

(a) 20 m spacing, within an area of 200 m by 200 m;

(b) 50 m spacing, within an area surrounding the area described in (a) with a boundary at 300 m by 300 m outside the boundary of the area described in (a);

(c) 100 m spacing, within an area surrounding the area described in (b) with a boundary at 1,000 m by 1,000 m outside the boundary of the area described in (a);

(d) 200 m spacing, within an area surrounding the area described in (c)with a boundary at 2,000 m by 2,000 m outside the boundary of the area described in (a); and

(e) 500 m spacing, within an area surrounding the area described in (d) with a boundary at 5,000 m by 5,000 m outside the boundary of the area described in (a);

(f) 1,000 m spacing within an area surrounding the area described in (e) with a boundary at 10,000 m by 10,000 m outside the boundary area described in (a).

In addition to using the nested receptor grid, receptors were placed every 20 m along the property line.

2.4.3.5 Building Downwash

Building wake effects are calculated by AERMOD for point sources using the US EPA's Building Profile Input Program (BPIP-PRIME), another pre-processor to AERMOD. The inputs into this processor include the coordinates and heights of each tier of the buildings and point sources. The single point source modeled within the assessment was the flare, which is not associated with any on-site buildings/structures that could affect dispersion characteristics. Therefore building profiles generated from the BPIP pre-processor were not input to AERMOD.

2.4.3.6 Deposition

AERMOD has the algorithms to account for wet and dry depositions of substances that would reduce ground level concentrations at POI. However, the deposition algorithms were not activated for this assessment which assumes that no particulates will be removed from the plume and therefore adds to the conservatism of the assessment presented herein.

2.4.3.7 Correlation Between NO_x and NO_2

The majority of NO_X emissions from stationary and mobile combustion engines is in the form of NO (as opposed to NO_2). The Ontario AAQC is based on concentrations of NO_2 in the atmosphere as NO_2 has a higher potential to impact health. Therefore a mechanism to convert NO_X to NO_2 was required to properly assess the impact of NO_X emissions. For this assessment, the ambient ratio method which derives a ratio of NO_2 to NO_X from representative ambient observations in the region, was applied to the model predicted maximum NO_X concentrations due to the emissions from the Facility plus the background.

Ambient NO_2 and NO_X concentrations recorded at the MOECC's Sault College station were used to calculate the ratios. For each averaging period, curves based on an exponential relationship were fit to the upper-envelope of observed NO_2/NO_X versus NO_X. These curves are presented in **Figures 4 and 5** and were used to convert the predicted NO_X concentrations to NO_2 concentrations for comparing with the AAQC.

Figure 4: Relationship between NO_2 and NO_x (Hourly Concentrations)

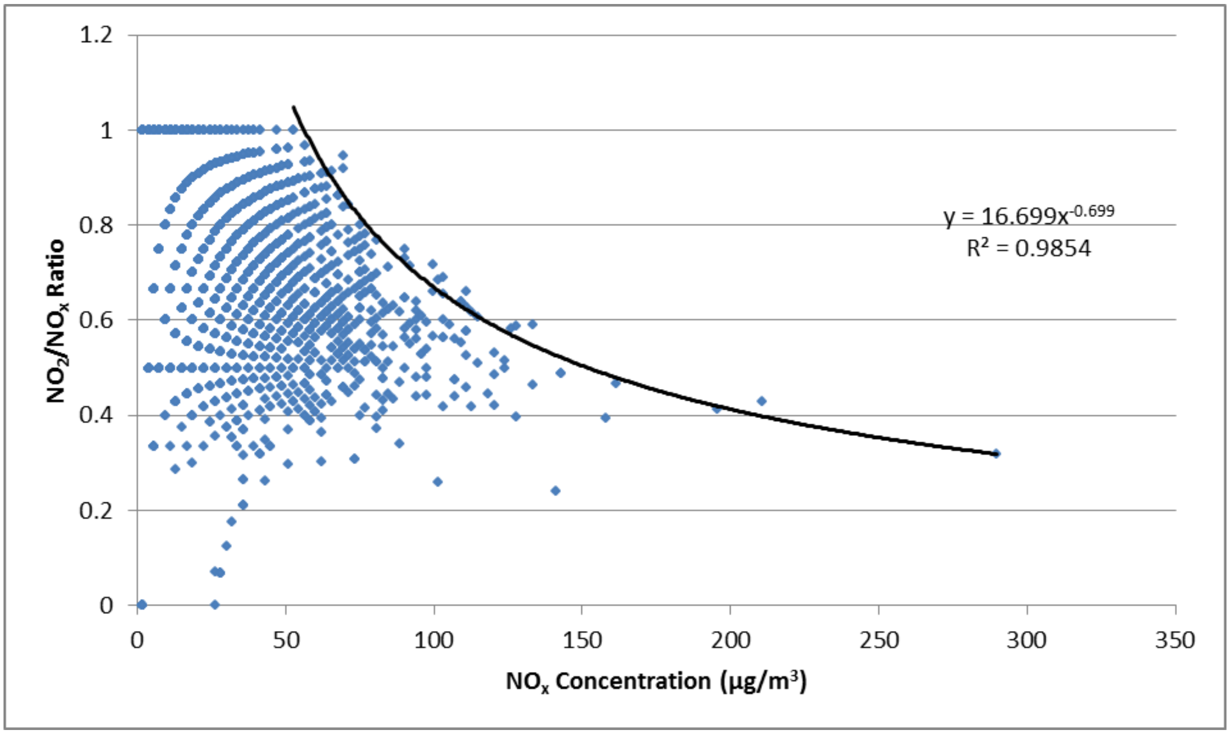
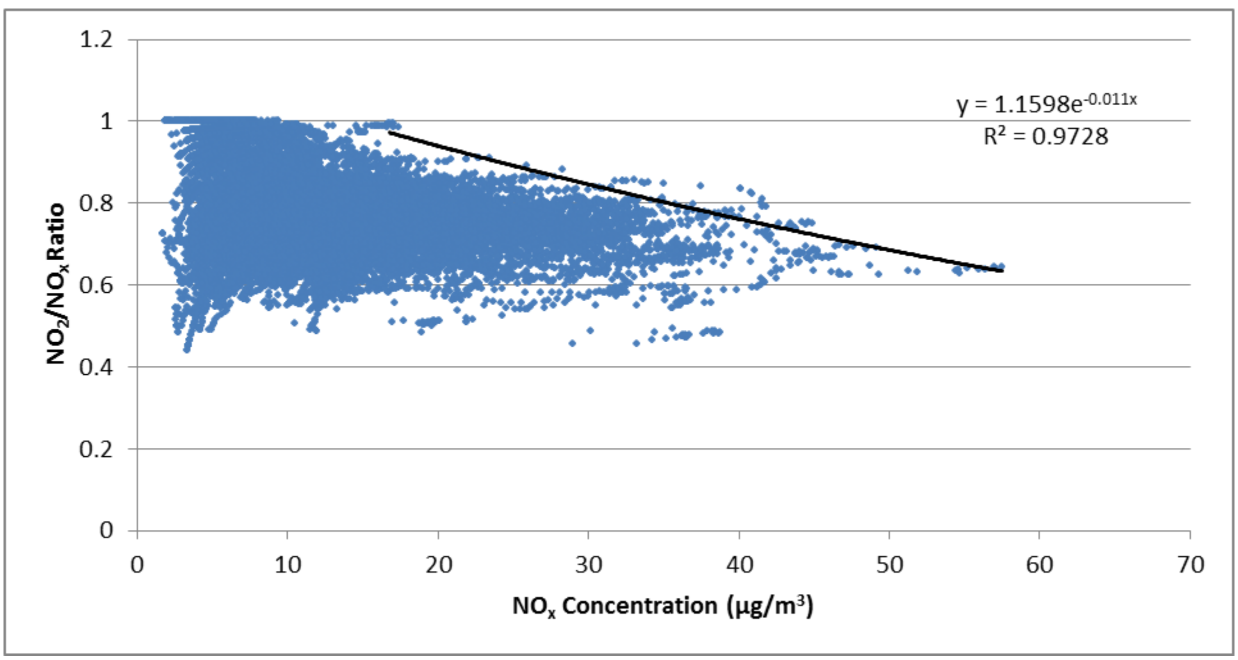


Figure 5: Relationship between NO_2 and NO_x (Dailly Concentrations)



2.4.3.8 Dispersion Modelling Options and Inputs

The regulatory default options for AERMOD were used for this assessment. Selected key options used within the modelling are summarized in **Table 5**.

Table 5: Summary of Key AERMOD Options

Modelling Parameter	Description	Used in the Assessment?
DFAULT	Specifies the regulatory default options will be used	Yes
CONC	Specifies that concentration values will be calculated	Yes
NODRYDPLT	Specifies that no dry deposition will be calculated	No
NOWETDPLT	Specifies that no wet deposition will be calculated	No
FLAT	Specifies that the non-default option of assuming flat terrain will be used	No, Elevated terrain option used
NOSTD	Specifies that the non-default option of no-stack tip downwash will be used	No
AVERTIME	Averaging periods used	1-hour, 24-hour
URBANOPT	Specifies that the urban dispersion coefficients will be used	No
URBANROUGHNESS	Specifies the urban roughness (m) if URBANOPT is used	No, used default
FLAGPOLE	Specifies that receptor heights above local ground level are allowed on the receptors	No

2.4.4 Analysis of Potential Effects

Air dispersion modelling was used to predict the maximum off property concentrations of indicator compounds. In accordance with the ADMGO, for the assessment of 24-hour ambient air quality criteria the highest 24-hour average predicted concentration was discarded in each single modelled year in order to account for meteorological anomalies. Additionally, the 8 hours with the highest 1-hour average predicted concentrations in each single meteorological year were discarded in the assessment of 1-hour average predicted concentration.

These maximum concentrations were combined with the corresponding baseline air quality concentrations to define a predicted cumulative impact, and compared to the pertinent ambient air quality criteria. The criteria used in this assessment include:

- Ontario Ministry of the Environment "Ontario's Ambient Air Quality Criteria," dated April 2012, and
- Canadian Council of Ministers of the Environment "Canada-Wide Standards for Particulate Matter (PM) and Ozone", dated June 2000.

Table 6 presents the maximum predicted pollutant concentrations, for off-property receptors. With background concentrations considered, no exceedances of relevant criteria were predicted.

Table 6: Summary of Predicted Concentrations of Air Quality Indicator Compounds

Indicator Compound	Averaging Period	Baseline Air Quality Concentration (µg/m³)	Predicted Maximum Off-Property Concentration (µg/m³)	Predicted Maximum Cumulative Air Quality Concentration (µg/m³)	Relevant Air Quality Criterion (µg/m³)
NO_X	1-hour	26.3	399.6	425.9	—
NO_X	24-hour	22.6	42.4	65.0	—
NO_2	1-hour	—	—	103.3	400
NO_2	24-hour	—	—	36.9	200
TSP	24-hour	36.5	67.3	103.8	120
PM_{10}	24-hour	15.2	20.7	35.9	50
$PM_{2.5}$	24-hour	9.1	5.0	14.1	30

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3.0 Odour

3.1 Methodology and Approach

The odour assessment of the proposed project is based on a qualitative assessment of the odour potential of operations at the Site, in the context of the Ministry of the Environment and Climate Change's recommended FIDOL (Frequency, Intensity, Duration, Offensiveness and Location) approach.

The baseline and future operations of the project were compared to determine whether significant changes in the odour profile of the site would be expected. Where significant changes may occur, an analysis has been done on the approaches to be used at the Site to reduce the potential for odour impacts.

3.2 Existing Odour Conditions

The baseline environment at the Site is characterized by an odour profile typical of the disposal of waste in a landfill. The Site maintains relationships with neighbours and staff are trained on the management of odour from the operations.

Practices in place to manage odourous emissions from the Site are documented within the Annual Design and Operations Report for the Site. A historical summary of the actions taken by the City to better manage nuisance odours is provided below:

- A formalized complaint recording procedure was adopted and complaints were analysed to assist in the determination of the source of odours and factors contributing to odour complaint incidents (e.g., weather).
- In 2003, an odour study was completed to identify the potential origin of odours generated at the Site. Based on the findings of the study, the City initiated several activities to reduce odour from suspected sources, including:
    - Changes to sludge handling;
    - Purchase and deployment of odour control granules to neutralize surface emissions; and
    - Application of clay cover to an inactive but uncompleted area (due to settlement) of the landfill in the northeast corner.
- In 2004, twenty-four (24) flares were installed in the northeast portion of the landfill. The flares were inspected on a regular basis and necessary maintenance was undertaken to ensure continuous combustion. Six (6) additional vent flares were installed in 2007, bringing the total up to thirty (30). The vent flares were effective in mitigating odour impacts from landfill gas emissions.
- In 2006, an odour control spray system was also installed along a portion of the south fence line. The system included four (4) spray nozzles mounted directly on the fence. The system ran 24/7 appropriately nine months of the year (i.e., April to November). This system was

decommissioned in 2010 when excavation activities related to the active landfill gas collection system required the removal of the fence. Throughout the construction period, a portable deodorizing system was employed to mitigate off-site odours.

- In 2010, the City completed an upgrade from a passive system to an active landfill gas collection system over a portion of the Site. The system reduced the quantity of methane released to the atmosphere and also reduced the odours generated at the Site. The active landfill gas collection system has been continuously active with the exception of occasional shutdowns required for system maintenance and repairs.
- In 2013, the City initiated programs, in a proactive approach, to manage and mitigate odours associated with the transport, management and disposal of biosolids, including:
    - The use of an odour neutralizing agent, which is applied to the biosolids at the water pollution control plants prior to delivery to the landfill site. Once the biosolids are tipped at the working face, they are mixed with other wastes and cover is applied. A hand held sprayer is also used by the vehicle operators to apply the odour neutralizing agent to the empty trailers before they leave the Site;
    - Purchase of a portable odour fogging machine, which effectively distributes an odour neutralizing agent in the form of a light mist. The fogging machine typically runs from the time the first load of biosolids arrives until after the last load has been received, tipped and covered;
    - Enhanced biosolids trailer washing to remove residual bioso ces and wheels of the trailers; and
    - Replacement of mesh tarps with impermeable waterproof tarps on the biosolids trailers.
- The City is also undertaking a Class Environmental Assessment to identify various long term biosolids management strategies. The objective of the study is to develop a sustainable and effective approach that reduces the impact of the City's landfill, more effectively manages nuisance odours in transit and at the landfill site, has wide public support and is cost effective and environmentally responsible.

In addition to the foregoing the following are included in the operating protocols for the Site:

- Minimizing the size of the active area;
- Minimizing the storage time of waste prior to disposal within the active area;
- Appropriate management of leachate;
- Use of special practices for disposal of highly odorous waste; and
- Use of daily cover.

The City continues to be committed to a process of continual improvement in it odour management protocols. Their odour management program, will continue to include the on-going review of operational practices with potential for odour generation, completion of odour studies if necessary, formal response to odour complaints, and the implementation of capital improvements to reduce the potential impacts of odour.

The Site's Odour Management Program has led to proactive relations with nearby stakeholders and improved odour management from the site.

3.3 Evaluation of the Potential for Odour Impacts

The proposed project will consist of two activities that may have the potential to result in odour impacts: typical landfill operations (within new waste cells) and waste mining.

Since the proposed activities associated with cell construction and typical landfill operations will not significantly increase the daily waste acceptance rate of the Site, nor will they adjust how waste deposition is conducted in the landfill, the odour profile (Frequency, Intensity, Duration, Offensiveness and Location) of the Site's operations is expected to remain the same. It is expected that the Site's existing odour management program would be able to effectively manage odour impacts associated with these activities.

Waste mining is proposed for the southwestern portion of the existing disposal footprint, as part of an environmental enhancement at the landfill to further mitigate the potential for groundwater impacts associated with unlined waste cells. The evaluation of alternative methods identified a preference for an expansion that included landfill mining, concluding that the shorter term odour effects and additional effort and cost to manage them was worth the opportunity to enhance groundwater management along the western site boundary. This conclusion was based on the experience of other landfill sites in North America where odour impacts were effectively managed through the implementation of best management practices. The proposed waste mining activities are expected to occur over a period of two years, up to five months each year.

The mining process will involve the excavation of waste from a currently dormant area of the landfill and transfer of this waste to a lined cell. The mining process may include:

- Screening of this waste to separate large and small factions;
- Removal of recyclables or material with residual value; and,
- Transfer of screened residual waste to a lined cell.

In order to mitigate the potential for waste mining to generate odour impacts, an Odour Management Plan (OMP) supplement will be developed specifically for this activity to support the site OMP. A preliminary version of the OMP supplement is included in Appendix B. The OMP will be finalized as the waste mining program is designed and developed, and will include input from the contractor/landfill mining team and effective best management practices that have been implemented at similar sites. The OMP will be shared with the MOECC in preparation for the waste mining activities.

Table 7 shows the linkage between some of the key planned odour management measures associated with the proposed waste mining process and the MOECC recognized FIDOL approach for assessing/managing odours.

Table 7: Summary of Odour Criteria and Proposed Management Practices

Odour Assessment Criterion	Management Practices
Frequency	• Management of operations based on meteorological conditions (e.g., shut down during calm periods or specific wind direction) • Daily inspection program used to adjust and refine mining operations • Bypass screening of waste where highly odorous material is excavated
Intensity	• Use of chemical and biological treatment to reduce significance of odour • Use of periphery odour misting system • Minimize size of active excavation • Bypass screening of waste where highly odorous material is excavated
Duration	• Cover applied to excavated area at the end of the day • Daily inspection program used to adjust and refine mining operations • Bypass screening of waste where highly odorous material is excavated
Offensiveness	• Use of chemical and biological treatment to reduce significance of odour • Use of periphery odour misting system • Minimize size of active excavation • Bypass screening of waste where highly odorous material is excavated
Location	• Management of operations based on meteorological conditions (e.g., shut down when winds blowing to nearest receptors) • Daily inspection program used to adjust and refine mining operations

In developing the waste mining program, the following will be completed:

- Draw upon the experience of other municipalities and landfill operators in setting up the waste mining process and detailed mitigation strategies;
- Complete a pilot mining program, to better characterize the type of waste, odour profile of the waste and logistical processes for screening and transfer to lined cell;
- Use findings of pilot mining program to guide the development of Standard Operating Practices (SOPs) and the OMP for full-scale waste mining;
- Engage local stakeholders to keep them abreast of the waste mining process and gather their feedback on the process;
- Train all staff on SOPs and the OMP; and
- Conduct a monitoring campaign for odours around the waste mining process.

The overall OMP for the Site will be enhanced to incorporate additional measures to mitigate potential impacts associated with the waste mining process, and will become a ‘living’ document, requiring review and update as Site conditions change. The City is committed to making continuous improvement to reduce the sources of odours at the Site and along travel routes, and effectively manage and mitigate source of odour that are inherent with typical landfill operations. Through the implementation of the odour management practices outlined above, and ongoing engagement with local stakeholders, it is expected that odours associated with the proposed landfill expansion can be effectively managed.

Appendix A

Sample Calculations

Sault Ste. Marie Landfill
Environmental Screening Process

Landfill Info

Operating Hours
- 7:30 am to 5:00 pm
- 6 days per week

Landfill Waste Projections

Year	Disposed (tonnes)
2014	75,717
2015	76,180
2016	65,910
2017	66,444
2018	66,978
2019	67,512
2020	68,046
2021	68,580
2022	68,857
2023	69,134
2024	69,412
2025	69,689
2026	69,966
2027	70,316
2028	70,667
2029	71,021
2030	71,376
2031	71,733
2032	72,091
2033	72,452
2034	72,814
2035	73,178
2036	73,544
2037	73,912
2038	74,281
2039	74,653
2040	75,026
2041	75,401
2042	75,778
2043	76,157
2044	76,538
2045	76,920
2046	77,305
2047	77,692
2048	78,080
2049	78,470
2050	0

Note:
(1) Projected waste disposal volumes assume a 0.5% annual increase.

Sault Ste. Marie Landfill
Environmental Screening Process

Landfill Equipment Information

Type of Equipment	Worst Case Operating Hours per Day	Average Operating Hours per Day	# in Operation	Weight Information	Engine Size Information	Dimensions (L x W x H)
Landfill Operations						
Sterling LT 8500 roll-off	7 hrs	4 hrs	1	60000 lb / 80000 lb	300 hp engine (diesel)	5.3 m x 2.4 m x 2.4 m
CAT 826 Compactor	7 hrs	6 hrs	1	82000 lb	341 hp engine (diesel)	7.7 m x 3.8 m x 4.0 m
CAT D-6 Bulldozer	7 hrs	4 hrs	1	36000 lb	189 hp engine (diesel)	4.1 m x 2.7 m x 3.2 m
Terex TA 27 Rock Truck	7 hrs	4 hrs	1	49000 lb / 104000 lb	365 hp engine (diesel)	9.8 m x 2.2 m x 3.6 m
Case 821 Front End Loader	7 hrs	5 hrs	1	31000 lb	186 hp engine (diesel)	7.5 m x 2.7 m x 3.3 m
Trackless MT-5	4 hrs	5 hrs per week	1	Negligible		
Kubota 1100 RTV UTV	3 hrs	6 hrs per month	1	Negligible		
MadVac litter vacuum	6 hrs	5 hrs	1	Negligible		
Composting Operations						
Sittler compost turner	6 hrs	5 hrs every third day	1		Pulled by tractor	
RotoScreen Compost Screener	6.5 hrs	5 hrs	1		225 hp engine (diesel)	4.6 m x 2.6 m x 4.1 m
Odour turbine	9 hrs	7.5 hrs	1			
John Deere Farm Tractor 5420	6 hrs	5 hrs every third day	1	7000 lb	81 hp engine (diesel)	3.8 m x 2.0 m x 2.6 m
Sterling STE flow truck/sander	7 hrs	5 hrs as needed	1	60000 lb / 80000 lb	300 hp engine (diesel)	5.3 m x 2.4 m x 2.4 m
Various front end loaders	7 hrs	5 hrs as needed	1			
Various water trucks	6 hrs	5 hrs as needed	1			
Cell Construction Operations						
Tri-axl dump truck (gravel)	9 hrs	5 trips per hour	1	60000 lb / 80000 lb	300 hp engine (diesel)	5.3 m x 2.4 m x 2.4 m
CAT D-7 Bulldozer	9 hrs	9 hrs	1	45000 lb	200 hp engine (diesel)	4.2 m x 2.6 m x 3.3 m
Cell Mining Operations						
McCloskey MCB 733 Trommel Screeners	60 min/hr	9 hrs	2	Stationary	225 hp engine (diesel)	21.1 m x 3.3 m x 4.1 m
McCloskey Stacker	60 min/hr	9 hrs	1	Stationary	90 hp engine (diesel)	15.2 m x 3.4 m x 3.4 m
Mobark 1100 Tub Grinder	60 min/hr	9 hrs	1	Stationary	600 hp engine (diesel)	17.1 m x 3.4 m x 3.9 m
CAT 345 Excavator	60 min/hr	9 hrs	2	100000 lb	345 hp engine (diesel)	11.9 m x 3.5 m x 7.6 m
CAT D-7 Bulldozer	60 min/hr	9 hrs	1	45000 lb	200 hp engine (diesel)	4.2 m x 2.6 m x 3.3 m
CAT 735 Articulating Truck	run 30 min in hour	9 hrs	2	67000 lb / 140000 lb	413 hp engine (diesel)	10.9 m x 3.4 m x 3.7 m

Sault Ste. Marie Landfill
Environmental Screening Process

Calculation Template - Emissions from Paved Roads

Based on guidance provided by USEPA AP-42 Compilation of Emission Factors Chapter 13.2.1 - Paved Roads (Jan. 2011).

13.2.1.3 Predictive Emission Factor Equations[10,29]

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k\ (sL)^{0.91} \times (W)^{1.02} \qquad (1)$$

where:
E = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see below),
sL = road surface silt loading (grams per square meter) (g/m^2), and
W = average weight (tons) of the vehicles traveling the road.

Inputs

k = particle size multiplier

Size Range	Particle Size Multiplier		
	g/VKT	g/VMT	lb/VMT
$PM_{2.5}$	0.15	0.25	0.00054
PM_{10}	0.62	1.00	0.0022
PM_{30}	3.23	5.24	0.011

sl = road surface silt loading (municipal solid waste landfill - mean) = 7.4 g/m^2

W = average weight (in tons) of vehicles travelling on the road

Vehicle Type	Weight (tons)
Waste trucks	18
Public waste	3
Yard waste	15

Length of Travel Areas

Travel Path	Length (km)
Waste trucks	1.15
Public waste	1.16
Yard waste	1.16

Vehicles per Unit Time

Vehicle	# per Hour	# per 24 Hour
Waste trucks	6	49
Public waste	21	188
Yard waste	1	5

Emission Rates

Scenario	PM Fraction	Emission Factor (g/VKT)	Distance Travelled (km)	Emission Rate (g/s)	Emission Rate (C) (g/s)
Waste trucks	$PM_{2.5}$	17.72	6.9	0.034	0.0034
	PM_{10}	73.26	6.9	0.140	0.014
	PM_{30}	381.7	6.9	0.732	0.073
Public waste	$PM_{2.5}$	2.796	24.4	0.019	0.0019
	PM_{10}	11.56	24.4	0.078	0.0078
	PM_{30}	60.20	24.4	0.407	0.041
Yard waste	$PM_{2.5}$	14.79	1.2	0.005	0.00048
	PM_{10}	61.12	1.2	0.020	0.0020
	PM_{30}	318.4	1.2	0.103	0.010

Note:
(1) Assumes dust controls (i.e.g., water spray, sweepers) with 90% control efficiency.

Sault Ste. Marie Landfill
Environmental Screening Process

Calculation Template - Emissions from Unpaved Roads

Based on guidance provided by USEPA AP-42 Compilation of Emission Factors Chapter 13.2.2 - Unpaved Roads (Nov. 2006).

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\,(s/12)^a (W/3)^b \qquad (1a)$$

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

Inputs

k, a, b, c, and d = emperical constants

Constant	Industrial Roads (Equation 1a)		
	$PM_{2.5}$	PM_{10}	PM_{30}
k (lb/VMT)	0.15	1.5	4.9
a	0.9	0.9	0.7
b	0.45	0.45	0.45
c	-	-	-
d	-	-	-

s = surface material silt content (municipal solid waste landfill - mean) = 6.4 %

W = mean weight (in tons) of vehicles travelling on the road

Vehicle Type	Weight (tons)
Mining truck	52
Waste truck	18
Soil cover truck	38
CAT 826 Compactor	41
CAT D-6 Bulldozer	18
Case 821 Front End Loader	16
John Deere Farm Tractor 5420	4
CAT 345 Excavator	50
CAT D-7 Bulldozer	23

Length of Travel Areas

Travel Path	Length (miles)
Mining truck	1.2
Waste truck	1.3
Soil cover truck	0.2
CAT 826 Compactor	2.3
CAT D-6 Bulldozer	2.3
Case 821 Front End Loader	2.3
John Deere Farm Tractor 5420	2.3
CAT 345 Excavator	2.3
CAT D-7 Bulldozer	2.3

Notes:
(1) Waste/construction equipment was assumed to have an average speed of 3 MPH.
(2) Waste/construction equipment was assumed to be in motion 75% of the time.

Vehicles per Unit Time

Vehicle	# per Hour	# per 24 Hour
Mining truck	2	18
Waste truck	6	49
Soil cover truck	1	9
CAT 826 Compactor	-	-
CAT D-6 Bulldozer	-	-
Case 821 Front End Loader	-	-
John Deere Farm Tractor 5420	-	-
CAT 345 Excavator	-	-
CAT D-7 Bulldozer	-	-

Emission Rates

Scenario	PM Fraction	Emission Factor (lb/VMT)	Distance Travelled (miles)	Emission Rate (g/s)	Emission Rate (C) (g/s)		
Mining truck	$PM_{2.5}$	0.307	2.3	0.090	0.0090	$PM_{2.5}$	0.288
	PM_{10}	3.069	2.3	0.901	0.090	PM_{10}	2.880
	PM_{30}	11.367	2.3	3.338	0.334	PM_{30}	10.667
Waste truck	$PM_{2.5}$	0.191	8.0	0.192	0.019		
	PM_{10}	1.910	8.0	1.916	0.192		
	PM_{30}	7.075	8.0	7.096	0.710		
Soil cover truck	$PM_{2.5}$	0.268	0.2	0.0063	0.00063		
	PM_{10}	2.678	0.2	0.063	0.0063		
	PM_{30}	9.921	0.2	0.232	0.023		
CAT 826 Compactor	$PM_{2.5}$	0.276	2.3	0.078	0.0039		
	PM_{10}	2.763	2.3	0.783	0.039		
	PM_{30}	10.24	2.3	2.901	0.145		
CAT D-6 Bulldozer	$PM_{2.5}$	0.191	2.3	0.054	0.0027		
	PM_{10}	1.908	2.3	0.541	0.027		
	PM_{30}	7.067	2.3	2.003	0.100		
Case 821 Front End Loader	$PM_{2.5}$	0.178	2.3	0.051	0.0051		
	PM_{10}	1.784	2.3	0.506	0.051		
	PM_{30}	6.608	2.3	1.873	0.187		
John Deere Farm Tractor 5420	$PM_{2.5}$	0.091	2.3	0.026	0.0026		
	PM_{10}	0.913	2.3	0.259	0.026		
	PM_{30}	3.382	2.3	0.959	0.096		
CAT 345 Excavator	$PM_{2.5}$	0.302	2.3	0.086	0.0043		
	PM_{10}	3.021	2.3	0.856	0.043		
	PM_{30}	11.19	2.3	3.172	0.159		
CAT D-7 Bulldozer	$PM_{2.5}$	0.211	2.3	0.060	0.0030		
	PM_{10}	2.109	2.3	0.598	0.030		
	PM_{30}	7.814	2.3	2.215	0.111		

Notes:
(1) Assumes dust controls (water spray, high moisture content, etc.) with 90% control efficiency.
(2) Assumes high moisture content of waste will result in a 95% dust control efficiency (for CAT 826 Compactor, CAT D-6 Bulldozer, CAT 345 Excavator, and CAT D-7 Bulldozer).

Sault Ste. Marie Landfill
Environmental Screening Process

Calculation Template - Emissions from Mobile Combustion Units - Road

Based on guidance provided by USEPA AP-42 MOBILE6.

Emission Factors

Pollutant	Emission Factor (g/mile)
NOx	2.117
PM	0.075
PM_{10}	0.075
$PM_{2.5}$	0.046

Note:

(1) Based on a speed of 30 km/hr.

Length of Travel Areas

Travel Path	Length (miles)
Waste trucks	2.0

Vehicles per Unit Time

Vehicle	# per Hour	# per 24 Hour
Waste trucks	6	49

Road Equipment

Equipment Type	Distance Traveled (miles)	NOx Emission Rate (g/s)	PM Emission Rate (g/s)
Landfill Operations			
Waste truck	12	0.0072	0.00026

Sault Ste. Marie Landfill
Environmental Screening Process

Calculation Template - Emissions from Mobile Combustion Units - Nonroad

Based on guidance provided by USEPA AP-42 Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling Compression-Ignition (2010).

Emission Factors

Zero-hour, steady-state emission factors for non-road CI Engines (US EPA, 2010, Table A4)

Engine Power (hp)	Technology Type	BSFC (lb/hp-hr)	Emission Factors (g/hp-hr)				S_{PMadj} (g/hr-hr)
			HC	CO	NOx	PM	
>0 to 11	Tier 3	0.408	-	-	-	-	0.096
>11 to 16	Tier 3	0.408	-	-	-	-	0.096
>16 to 25	Tier 3	0.408	-	-	-	-	0.096
>25 to 50	Tier 3	0.408	-	-	-	-	0.096
>50 to 75	Tier 3	0.408	-	-	-	-	0.096
>75 to 100	Tier 3	0.408	0.1836	2.3655	3.0	0.20	0.096
>100 to 175	Tier 3	0.367	0.1836	0.8667	2.5	0.22	0.086
>175 to 300	Tier 3	0.367	0.1836	0.7475	2.5	0.15	0.086
>300 to 600	Tier 3	0.367	0.1669	0.8425	2.5	0.15	0.086
>600 to 750	Tier 3	0.367	0.1669	1.3272	2.5	0.15	0.086
>750 except generator sets	Tier 3	0.367	-	-	-	-	0.086
Gen sets >750 to 1200	Tier 3	0.367	-	-	-	-	0.086
Gen sets >1200	Tier 3	0.367	-	-	-	-	0.086

Transient Adjustment Factors by Equipment type for nonroad CI equipment (US EPA, 2010, Table A5)

Equipment Type	Cycle	TAF Assignment	HC	CO	NOx	PM	BSFC
Bore/Drill Rigs	None	None	1.00	1.00	1.00	1.00	1.00
Excavator	Excavator	Hi LF	1.05	1.53	1.04	1.47	1.01
Cranes	None	None	1.00	1.00	1.00	1.00	1.00
Off-highway Trucks	Crawler	Hi LF	1.05	1.53	1.04	1.47	1.01
Off-highway Tractors	Crawler	Hi LF	1.05	1.53	1.04	1.47	1.01
Rubber Tire Loader	RTLoader	HI LF	1.05	1.53	1.04	1.47	1.01
Rubber Tire Dozer	Crawler	Hi LF	1.05	1.53	1.04	1.47	1.01
Tractors/Loaders/Backhoes	Backhoe	Lo LF	2.29	2.57	1.21	2.37	1.18
Other Construction Eqmt.	Crawler	HiLF	1.05	1.53	1.04	1.47	1.01
Light Comm. Air Compressor	None	None	1.00	1.00	1.00	1.00	1.00
Light Comm. Gen Set	None	None	1.00	1.00	1.00	1.00	1.00

Deterioration Factors for Nonroad Diesel Engines (US EPA, 2010, Table A6)

Pollutant	Tier 3 Relative Deterioration Factor (A) (%increate/%useful life)
HC	0.027
CO	0.151
NOx	0.008
PM	0.473

Nonroad Equipment

$$EF_{adj\,(HC\,,CO\,,NOx\,)} = EF_{ss} \times TAF \times DF$$ [Equation 1]

where:
EF_{adj} = final emission factor used in model, after adjustments to account for transient operation and deterioration (g/hp-hr)
EF_{ss} = zero-hour, steady-state emission factor (g/hp-hr)
TAF = transient adjustment factor (unitless)
DF = deterioration factor (unitless)

$$EF_{adj\,(PM\,)} = EF_{ss} \times TAF \times DF \times S_{PMadj}$$ [Equatic

where:
$S_{PM\ adj}$ = adjustment to PM emission factor to account for variations in fuel sulfur content (g/hp-hr)

Equipment Type	Power Rating (hp)	NOx Emission Factor (g/hp.hr)	NOx Emission Rate (g/s)	PM Emission Factor (g/hp.hr)	PM Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)
Landfill Operations							
CAT 826 Compactor	341	2.621	0.248	0.239	0.023	0.023	0.022
CAT D-6 Bulldozer	189	2.621	0.138	0.239	0.0125	0.0125	0.0122
Terex TA 27 Rock Truck	365	2.621	0.266	0.239	0.024	0.024	0.023
Case 821 Front End Loader	186	2.621	0.135	0.239	0.0123	0.0123	0.0120
John Deere Farm Tractor 5420	81	3.145	0.071	0.337	0.0076	0.0076	0.0074
Cell Construction Operations							
CAT D-7 Bulldozer	200	2.621	0.146	0.239	0.0133	0.0133	0.0129
Cell Mining Operations							
CAT 345 Excavator	345	2.621	0.251	0.239	0.023	0.023	0.022
CAT D-7 Bulldozer	200	2.621	0.146	0.239	0.0133	0.0133	0.0129
CAT 735 Articulating Truck	413	2.621	0.301	0.239	0.027	0.027	0.027

Notes:
(1) Based on the use of Tier 3 engines.

Sault Ste. Marie Landfill
Environmental Screening Process

Calculation Template - Emissions from Stationary Combustion Units

Based on guidance provided by USEPA Non-Road Emission Standards.

Emission Factors

Pollutant	Emission Factor 90 hp (g/kW.hr)	Emission Factor 225 hp (g/kW.hr)	Emission Factor 600 hp (g/kW.hr)
NOx	4.7	4.0	4.0
PM	0.4	0.2	0.2

Stationary Equipment

Equipment Type	Power Rating (hp)	NOx Emission Rate (g/s)	PM Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	$PM_{2.5}$ Emission Rate (g/s)
Landfill Operations					
RotoScreen Compost Screener	225	0.187	0.0093	0.0093	0.0090
Cell Mining Operations					
McCloskey MCB 733 Trommel Screeners	225	0.187	0.0093	0.0093	0.0090
McCloskey Stacker	90	0.088	0.0075	0.0075	0.0072
Mobark 1100 Tub Grinder	600	0.498	0.025	0.025	0.024

Note:
(1) All PM is assumed to be less than 1 um in size.
(2) Assumes $PM_{2.5}$ is equal to 97% of PM_{10} emission rates.

Load Factor

Equipment Type	Power Rating (hp)	NOx Emission Rate Load Factor (g/s)	PM Emission Rate Load Factor (g/s)	PM_{10} Emission Rate Load Factor (g/s)	$PM_{2.5}$ Emission Rate Load Factor (g/s)
Landfill Operations					
RotoScreen Compost Screener	225	0.140	0.0051	0.0051	0.0050
Cell Mining Operations					
McCloskey MCB 733 Trommel Screeners	225	0.140	0.0051	0.0051	0.0050
McCloskey Stacker	90	0.066	0.0041	0.0041	0.0040
Mobark 1100 Tub Grinder	600	0.373	0.014	0.014	0.013

Note:
(1) Assumes that equipment operates at full load for 50% of the time, and 10% load (idle) for 50% of the time.

Sault Ste. Marie Landfill
Environmental Screening Process

Calculation Template - Emissions from Flare Combustion

Based on guidance provided in ECA application for site (2010).

Emission Rates

Pollutant	Emission Rate (g/s)
NOx	0.349
PM	0.086

Note:
(1) Flare emissions based on a landfill gas flowrate of 770 CFM.

Calculation Template - Emissions from Material Handling and Storage

Based on guidance provided by USEPA AP-42 Compilation of Emission Factors Chapter 13.2.4 - Aggregate Handling and Storage Piles (Nov. 2006).

The quantity of particulate emissions generated by either type of drop operation, per kilogram (kg) (ton) of material transferred, may be estimated, with a rating of A, using the following empirical expression:[11]

$$E = k(0.0016)\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \text{ (kg/megagram [Mg])}$$

where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

Inputs

k = particle size multiplier

Particle Size Multiplier		
$PM_{2.5}$	**PM_{10}**	**PM_{30}**
0.053	0.35	0.74

U = mean wind speed = 3.7 m/s

M = material moisture content =

7.4 %	Sandy soil
20 %	Waste material
0.7 %	Gravel

Amount of Material Handled

Scenario	Quantity (tonnes/hr)
Soil cover	24.9
Gravel dumping	45.4

Emission Rates

Scenario	PM Fraction	Emission Factor (kg/tonne)	Emission Rate (g/s)
Soil cover	$PM_{2.5}$	0.000027	0.00018
	PM_{10}	0.00018	0.00122
	PM_{30}	0.00037	0.0026
Gravel dumping	$PM_{2.5}$	0.00072	0.0091
	PM_{10}	0.0048	0.060
	PM_{30}	0.010	0.127

Sault Ste. Marie Landfill
Environmental Screening Process

Emission Summary Table - All Sources (Scenario 2)

Source	SOURCE ID	Dimension of Source (L x W x H)	NOx Emission Rate (1-hr) (g/s)	NOx Emission Rate (24-hr) (g/s)	PM Emission Rate (1-hr) (g/s)	PM Emission Rate (24-hr) (g/s)	PM_{10} Emission Rate (1-hr) (g/s)	PM_{10} Emission Rate (24-hr) (g/s)	$PM_{2.5}$ Emission Rate (1-hr) (g/s)	$PM_{2.5}$ Emission Rate (24-hr) (g/s)
Mobile Combustion - Road										
Waste trucks	RD-1	5.3 m x 2.4 m x 2.4 m	0.0072	0.0012	0.00026	0.000043	0.00026	0.000043	0.00016	0.000026
Mobile Combustion - Nonroad										
CAT 826 Compactor	NR-1	7.7 m x 3.8 m x 4.0 m	0.137	0.023	0.012	0.0021	0.012	0.0021	0.012	0.0020
CAT D-6 Bulldozer	NR-2	4.1 m x 2.7 m x 3.2 m	0.076	0.019	0.0069	0.0017	0.0069	0.0017	0.0067	0.0017
Terex TA 27 Rock Truck	NR-3	9.8 m x 2.2 m x 3.6 m	0.146	0.024	0.013	0.0022	0.013	0.0022	0.013	0.0022
Case 821 Front End Loader	NR-4	7.5 m x 2.7 m x 3.3 m	0.074	0.012	0.0068	0.0011	0.0068	0.0011	0.0066	0.0011
John Deere Farm Tractor 5420	NR-5	3.8 m x 2.0 m x 2.6 m	0.039	0.008	0.0042	0.0009	0.0042	0.0009	0.0041	0.0008
CAT 345 Excavator	NR-6	11.9 m x 3.5 m x 7.6 m	0.276	0.104	0.025	0.009	0.025	0.009	0.024	0.009
CAT D-7 Bulldozer	NR-7	4.2 m x 2.6 m x 3.3 m	0.080	0.030	0.007	0.0027	0.0073	0.0027	0.0071	0.0027
CAT 735 Articulating Truck	NR-8	10.9 m x 3.4 m x 3.7 m	0.331	0.124	0.030	0.011	0.030	0.011	0.029	0.011
Stationary Combustion										
RotoScreen Compost Screener	SC-1	4.6 m x 2.6 m x 4.1 m	0.140	0.029	0.0051	0.0011	0.0051	0.0011	0.0050	0.0010
McCloskey MCB 733 Trommel Screeners	SC-2	21.1 m x 3.3 m x 4.1 m	0.280	0.105	0.010	0.0038	0.010	0.0038	0.010	0.0037
McCloskey Stacker	SC-3	15.2 m x 3.4 m x 3.4 m	0.066	0.025	0.0041	0.0015	0.0041	0.0015	0.0040	0.0015
Mobark 1100 Tub Grinder	SC-4	17.1 m x 3.4 m x 3.9 m	0.373	0.140	0.014	0.0051	0.014	0.0051	0.013	0.0050
Flare	SC-5	-	0.349	0.349	0.086	0.086	0.086	0.086	0.086	0.086
Road Dust - Paved Roads										
Waste trucks	PR-1		-	-	0.073	0.012	0.014	0.0023	0.0034	0.00057
Public waste	PR-2		-	-	0.041	0.015	0.0078	0.0029	0.0019	0.00071
Yard waste	PR-3		-	-	0.010	0.0038	0.0020	0.00074	0.00048	0.00018
Road Dust - Unpaved Roads										
Waste truck	UPR-1		-	-	0.710	0.118	0.192	0.032	0.019	0.0032
Mining truck	UPR-2		-	-	0.334	0.125	0.090	0.034	0.0090	0.0034
Soil cover truck	UPR-3		-	-	0.023	0.0087	0.0063	0.0024	0.00063	0.00024
CAT 826 Compactor	UPR-4		-	-	0.145	0.024	0.039	0.0065	0.0039	0.00065
CAT D-6 Bulldozer	UPR-5		-	-	0.100	0.025	0.027	0.0068	0.0027	0.0007
Case 821 Front End Loader	UPR-6		-	-	0.187	0.031	0.051	0.0084	0.0051	0.00084
John Deere Farm Tractor 5420	UPR-7		-	-	0.096	0.020	0.026	0.0054	0.0026	0.00054
CAT 345 Excavator	UPR-8		-	-	0.159	0.059	0.043	0.016	0.0043	0.0016
CAT D-7 Bulldozer	UPR-9		-	-	0.111	0.042	0.030	0.011	0.0030	0.0011
Material Handling										
Soil cover	MH-1		-	-	0.0026	0.00097	0.00122	0.00046	0.00018	0.000069
TOTAL			**2.374**	**0.993**	**2.217**	**0.615**	**0.754**	**0.258**	**0.278**	**0.142**

Appendix B

Odour Management Plan

Draft Odour Management Plan (forwarded January 9, 2015)

1.0 INTRODUCTION

This Odour Management Plan (OMP) is part of the Air Quality and Odour Impact Assessment which was completed to support an Environmental Assessment (EA) of the proposed expansion of the City of Sault Ste. Marie's landfill, located at 402 Fifth Line East in Sault Ste. Marie, Ontario (the "Site"). The OMP focuses on the activities with the potential to cause odour impacts and the existing and proposed odour management practices to mitigate them. Further information about the proposed design of the landfill and EA is included in other reports (e.g., main EA document).

1.1 PURPOSE OF THE ODOUR MANAGEMENT PLAN

The City of Sault Ste. Marie has an ongoing commitment to proper management of the landfill, in which odour management is an important part of this commitment. Proper landfill design and operating practices can reduce the potential for odour impacts.

This OMP describes mitigation measures to manage odours and reduce the potential for off-property impacts. Information on typical landfill operations and waste mining is provided as separate sections, with the following described for each:

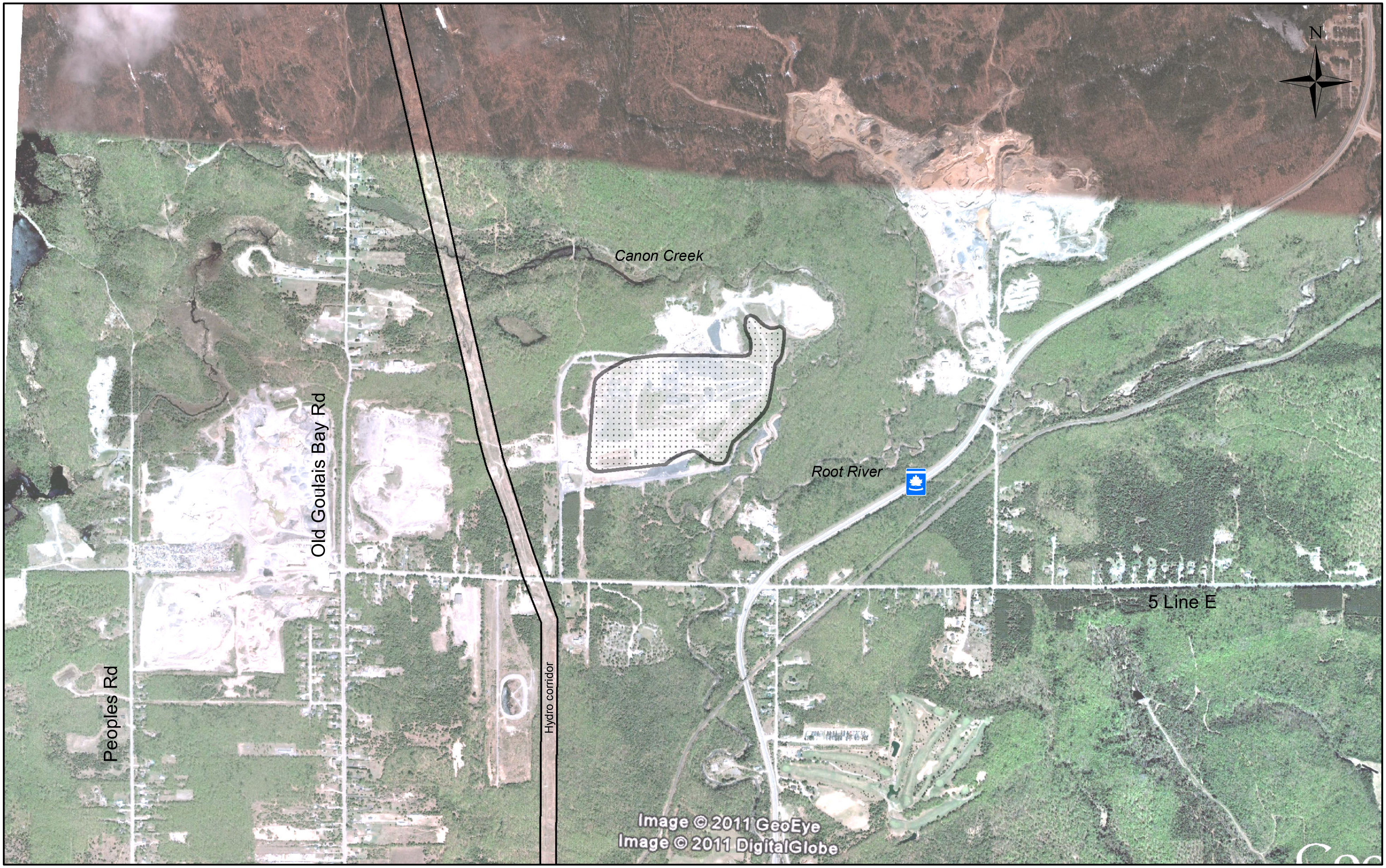
- Operational controls, and
- Administrative controls.

The OMP is intended to be a 'living document', and will be updated as required, based on Site conditions. A waste mining pilot project will be completed prior to full-scale waste mining activities to further develop and refine the OMP based on actual Site conditions.

1.2 SITE DESCRIPTION

The Site consists of an active landfill site, covering 83.6 ha of land, west of the intersection of Fifth Line East and Highway #17, in the City of Sault Ste. Marie. The Site is surrounded by woodlots to the north, woodlots and industrial land use (quarry) to the east, woodlots and residential/agricultural/recreational land use to the south, and woodlots and residential/industrial land use (quarry) to the west. The nearest sensitive odour receptor (residential land) to the Site is located along Fifth Line East, less than 500 m from the proposed work area(s). The location of the Site and surrounding land use is presented in **Figure 1**.

The proposed landfill expansion is presented to address the limited remaining landfill capacity, which has an existing estimated life of less than 10 years, based on the anticipated average disposal rate.



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Meters

DILLON CONSULTING

Legend

EXISTING LANDFILL

TRANS-CANADA HIGHWAY

Sault Ste. Marie Municipal Landfill Site

EXISTING SAULT STE. MARIE LANDFILL SITE

Project Manager:	KK
Scale:	1 : 20000
Date Issued:	FEB 2015
Location:	I:\066988\
Drawn By:	SLP
Checked By:	XXX
Project No:	06-6988
File Name:	Existing Site Figure

Figure No.

1

1.3 POTENTIAL ODOUR EMISSION SOURCES

In general, odours are a combination of many chemical compounds generated by decomposing organic wastes. The potential for odours at a landfill site is influenced by many factors, including the nature and volume of the waste, temperature, age of the waste, weather, and others.

The landfill is licensed to accept various forms of non-hazardous residential, commercial and industrial waste, including organic waste. Odours may originate from landfilling of waste, including tipping, spreading, compacting or other movement of waste, or waste mining.

The proposed waste mining process would involve the excavation of waste from a dormant area of the landfill and transfer of this waste to a lined cell. Specifically, the mining process may include:

- Screening of waste to separate large and small fractions;
- Removal of recyclables or material with residual value; and
- Transfer of screened waste to a lined cell.

2.0 TYPICAL LANDFILL OPERATIONS

This section describes existing and proposed odour management measures for typical landfill operations. Measures specific to landfill mining operations are included in a later section.

2.1 OPERATIONAL CONTROLS

This OMP builds from existing odour management practices at the landfill. In 2003, the City of Sault Ste. Marie initiated an odour management program at the Site in response to odour complaints. Since then, a number of operational changes and capital improvements have been implemented at the Site to reduce the potential for impacts from odour. These include, but are not limited to:

- Changes to sludge handling activities;
- Purchase and deployment of odour control granules to neutralize surface emissions;
- Application of clay cover to inactive but uncompleted areas of the landfill;
- Installation of passive and active flare systems to reduce the potential contribution of landfill gas to odours;
- Installation of an odour control spray system along portions of the Site perimeter and use of a portable deodorizing system during construction activities;
- Changes to biosolids management activities, including the application of an odour reduction agent at water pollution control plants prior to delivery to the Site, mixing with other wastes, and covered promptly; and
- Review and assessment of alternative approaches to waste transportation and disposal methods.

In addition to the control measures identified above, the operational measures outlined in ***Table 1*** have been implemented at the Site to mitigate potential odour concerns:

Table 1: Summary of Existing Operational Odour Control Measures for Typical Landfill Operations

Operational Control	Description
Keep working face areas and active area as small as reasonably possible	• This reduces the exposed waste area, thus minimizing the potential for odours • Also requires the use of less daily cover
Apply daily cover	• Applying daily cover reduces the potential for odourous gases to escape from the working face
Minimize the storage time of waste prior to disposal in the active area	• Minimizing the time between collection and deposition of waste can reduce odours, since the waste has less time to degrade
Employ special practices for the disposal of highly odourous wastes	• Highly odourous waste may require special handling • This waste receives priority for landfilling, and additional odour mitigation measures may be employed, such as spray odour suppressants • The City of Sault Ste. Marie has developed special practices for managing odours from biosolids, as described above
Manage leachate appropriately	• Ensuring leachate collection is functioning properly avoids the build-up of potentially odourous leachate • Leachate management controls have been in place since the 1990s and have been upgraded since then, including a leachate collector, purge wells, and forcemain from the landfill pump station to the sanitary sewer system • The Site's Certificate of Approval requires an annual assessment of leachate management controls, and the controls undergo continuous maintenance to ensure proper function
Consider meteorological conditions	• Considering meteorological conditions during landfill operations can mitigate odour impacts • For example, activities with high potential to generate odour are avoided where possible when winds are blowing in the direction of sensitive receptors
Continue to optimize operation of the landfill gas collection system	• The active landfill gas collection system has effectively mitigated off-site methane odours • The collection system has continuously operated since its installation in 2010, with the exception of shutdowns for maintenance or repair

Odour control measures implemented at the Site have resulted in a decline in odour-related complaints at the Site since 2010.

2.2 ADMINISTRATIVE CONTROLS

The administrative controls presented in ***Table 2*** have been or will be implemented at the Site to support the operational mitigation measures to control odour impacts from typical landfill operations.

Table 2: Summary of Existing and Proposed Administrative Odour Control Measures for Typical Landfill Operations

Administrative Control	Description

Complaint response procedure (existing)	• Complaints of any nature are recorded by landfill employees and resolved as soon as possible after notification
	• The telephone number for the landfill is made available for the public and is posted on a sign at the entrance to the Site
	• Complaints can also be made after-hours by phone
	• The complaint is documented and referred to the Landfill Manager for response
	• A response to the complaint is made on the same day (if practical) confirming the receipt and nature of the complaint and results of any follow-up
	• If the complaint cannot be resolved within a reasonable time period, the complainant is notified of what action will be taken and when it will be taken
	• Complaint forms are completed when a verbal complaint is received (see **Appendix A**)
	• The form is kept on file, along with copies of any correspondence or other records of discussions with the complainant
	• The form includes the following information:
	    – Date and time of the day the complaint was received
	    – Date and time the complaint incident occurred
	    – Complainant’s name, address, telephone number, and the location of the incident relative to the Site
	    – Nature of the complaint
	    – Receipt of complaint (by phone, or site visit, and which staff received the complaint)
	    – Nature and result of any investigation or follow-up
	    – Weather conditions and meteorological measurements at the time of the complaint

	• Odour complaints received by the landfill are documented and reported to the MOE as part of the landfill's annual performance report
Odour monitoring (existing)	• Landfill employees continuously monitor for odours throughout the day and report/document accordingly • Highly odourous wastes are flagged and identified by landfill employees for special management practices
Employee training (to be implemented)	• All on-site landfill employees will receive training to review the OMP and related Standard Operating Procedures (SOPs)
Routine inspections (to be implemented)	• Landfill employees will continuously monitor for odour concerns throughout the day • An Odour Inspection Form (see **Appendix B**) should be completed periodically • Any incident observed will be reported to the Landfill Manager as soon as possible, and documented on the Odour Inspection Form • The Landfill Manager will investigate the incident and apply corrective actions as necessary

3.0 WASTE MINING

This section describes existing and proposed odour management measures to mitigate potential odours from waste mining activities.

Waste mining has been employed at sites throughout Canada, the United States, and elsewhere. Based on a review of technical studies completed at representative sites, while odours from landfill mining are a potential concern, concerns can be mitigated through the implementation of best management practices and the development of a site-specific odour management plan.

The operational and administrative controls described below are proposed for the Site to reduce the potential for odour impacts from the waste mining process. These proposed controls will be re-assessed and revised accordingly based on the completion of a waste mining pilot project that will be completed at the Site.

3.1 OPERATIONAL CONTROLS

Proposal operational controls that will be implemented as part of the waste mining activities at the Site are summarized in ***Table 3***.

Table 3: Summary of Proposed Operational Odour Control Measures for Waste Mining

Operational Control	Description
Minimize the area of active excavation	• The area of active excavation would be minimized to one day's production wherever possible, and would be covered as soon as possible with soil • This would minimize exposing freshly excavated waste to the air, which could cause significant odour emissions • All reasonable precautions would be taken to prevent the movement of adjacent material when waste is being mined
Increase the slope of excavation	• A steeper than typical slope can mitigate odour emissions • The slopes of exposed waste would not be greater than 2H:1V (2 horizontal units per 1 unit vertical) unless a slope monitoring plan is approved by the MOE prior to commencement of mining • The waste sideslopes would be inspected before the start of each working day.
By-pass screening of waste where highly odourous waste may be excavated	• Some types or ages of waste may have higher odour generation potential than others • For example, older waste typically generates fewer odours than newer waste • Site operators should by-pass screening of waste with known high potential for odour generation
Avoid mining in areas of known or suspected to have perched leachate	• Encountering perched leachate during mining could cause odour emissions • Leachate impacted water encountered during mining would be pumped using tanker trucks or other methods and disposed of appropriately as soon as possible
Manage operations based on meteorological conditions	• As with typical landfill operations, site operators should consider meteorological conditions to mitigate potential off-property odour emissions • Examples include avoiding mining on hot days, mining during wet days wherever possible, and avoiding mining when winds are blowing strongly in the direction of residences or other sensitive odour receptors • Observations documented during similar waste mining projects completed by others indicated reduced odour generation by conducting waste mining activities during the colder months of the year
Use chemical and/or biological treatment to reduce the significance of odour	• The City has experience using odour neutralizing agents and an odour fogging machine at the landfill • The waste mining process would include the use of this existing equipment at the location of the mining where feasible, and use of additional chemical odour controls as

required

3.2 ADMINISTRATIVE CONTROLS

The administrative controls presented in ***Table 4*** will be implemented at the Site, in addition to those for typical landfill operations, to support the operational mitigation measures to control odour impacts from waste mining.

Table 4: Summary of Proposed Administrative Odour Control Measures for Waste Mining

Administrative Control	Description
Process-specific employee training	• Landfill employees associated with the waste mining process will receive training to review the OMP, operational controls and related Standard Operating Procedures (SOPs)
Contractor selection	• A contractor for the project will be selected that demonstrates adequate experience with similar waste mining projects, and knowledge of how to effectively manage odours • The contract for the project will incorporate requirements to strictly comply with the SOPs
Monitoring program	• The contract will include a requirement for the periodic collection and analysis of air samples
Routine inspections	• Daily inspections will be completed of the active waste mining area(s) to document Site conditions, adherence to the control measures and SOPs, and potential odour impacts

Appendix A – Complaint Form (to be added)

Appendix B – Odour Inspection Form (to be added)