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ACOUSTIC ASSESSMENT FOR THE HIGHLAND LINE PIT LANARK HIGHLAND TOWNSHIP LANARK COUNTY ONTARIO

Prepared for

Thomas Cavanagh Construction Limited

Prepared by

Freefield Ltd.

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ACOUSTIC ASSESSMENT FOR THE HIGHLAND LINE PIT LANARK HIGHLAND TOWNSHIP, LANARK COUNTY, ONTARIO

Executive Summary

Thomas Cavanagh Construction Limited (Cavanagh) is applying to the Ministry of Northern Development, Mines, Natural Resources and Forestry, MNDMNRF, for a license under the Aggregate Resources Act, ARA, for the Highland Line Pit, Class A, Sand Pit (below water), to be located at Part of Lot 5, Concession 10, Lanark Highland Township, Lanark County, Ontario, as shown in Figures 1 and 2.

The North American Industry Classification System (NAICS) code of the facility is 212323.

The MNDMNRF license application requires the submission of an Acoustic Assessment Report of the proposed operation. Freefield Ltd. has been retained by Cavanagh to complete this acoustic assessment.

The acoustic assessment has been carried out according to the applicable Ministry of Environment, Conservation and Parks (MECP) Noise Assessment Guidelines, including NPC-300, published August 2013. The assessment considers the impact on nearby noise sensitive lands, including existing residences and vacant land zoned for potential noise sensitive use, of noise generated by all on-site equipment operations, including extraction operations by loaders or excavators, aggregate processing operations by a crushing plant, screening plant and wash plant, loading operations by loaders, site preparation and maintenance by an excavator and truck movements used for the shipping of product off-site on a 24-hour basis. The site is not a significant source of vibration hence an assessment of vibrations is not required.

Noise impacts have been predicted and compared to the MECP sound level limits as set out in NPC-300. Where applicable, noise mitigation measures such as barriers and limits to operations have been designed to ensure all operations comply with the applicable sound level limits.

Assessment methodology is provided in Section 1. A detailed description of the facility and its operations is provided in Section 2. Noise sources associated with operations at the pit are summarized in Section 3. Noise sensitive receptors are described in Section 1 and Section 4, with Section 5, 6 and 7 detailing applicable assessment criteria, an assessment of noise impacts and recommended mitigation measures.

ACOUSTIC ASSESSMENT FOR THE HIGHLAND LINE PIT LANARK HIGHLAND TOWNSHIP, LANARK COUNTY, ONTARIO

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ACOUSTIC ASSESSMENT FOR THE HIGHLAND LINE PIT LANARK HIGHLAND TOWNSHIP, LANARK COUNTY, ONTARIO

1.0 Introduction

Thomas Cavanagh Construction Limited (Cavanagh) is applying to the Ministry of Northern Development, Mines, Natural Resources and Forestry, MNDMNRF, for a license under the Aggregate Resources Act, ARA, for the Highland Line Pit, Class A, Sand Pit (below water), to be located at Part of Lot 5, Concession 10, Lanark Highland Township, Lanark County, Ontario, as shown in Figures 1 and 2 (the facility).

The North American Industry Classification System (NAICS) code of the facility is 212323.

This report describes an assessment, carried out by Freefield Ltd., of the potential impact of noise from operations at the facility on nearby noise sensitive receptors in accordance with MECP guidelines for stationary noise sources. [1, 2]

This report has been prepared in accordance with the MECP Document NPC-233, *Information to be Submitted for Approval of Stationary Sources of Sound*, October 1995. Noise from the facility is assessed according to MECP Documents: NPC-300, *Stationary and Transportation Sources – Approval and Planning*, August 2013.[1] This report follows the recommended format contained in, *Sample Application Package, Basic Comprehensive Certificate of Approval (Air and Noise)*, July 2009.[2]

The noise assessment methodology is summarised below.

- Identification of noise sensitive receptors in the vicinity of the facility. Potential noise sensitive receptors include residences, motels, places of worship, schools, hospitals and vacant land zoned for potential noise sensitive use.

- Determination of the MECP sound level limits[1] which apply at each of the noise sensitive receptors.

- Identification of the sources of noise that will arise from the facilities operations. In the current study, the strengths of the various noise sources were obtained from noise measurements of the proposed equipment in operation at the Cavanagh Pine Grove Pit carried out in October 2019 and from a database of noise measurements of similar operations at other aggregate operations in Ontario by Freefield Ltd.

- Based on the strengths of the individual noise sources, noise levels due to the facilities operations are predicted at nearby noise sensitive receptors using a prediction procedure[6] which is favoured by the MECP. The MECP methodology requires that compliance be assessed under predictable "worst case" conditions for normal operations.

- Assessment of compliance of the noise due to the facilities operations with MECP sound level limits. Where appropriate mitigation measures are recommended such that compliance, with MECP sound level limits, is achieved at all receptors.

Note that this assessment considers all significant noise sources in operation on the site. The site is not a significant source of vibration; hence, an assessment of vibrations is not required.

Surrounding Lands, Acoustic Environment and Noise Sensitive Receptors

The facility is located in a predominantly rural area, on the south sides of Highland Line Road, approximately 2.8 km west of Country Road 12, in Lanark Highland Township, Lanark, Ontario.

The site is bisected by Anderson Lane into an east and west extraction area. The extraction areas consist of an unexcavated sand deposit. The site rises in a southerly direction from Highland Line Road to a ridge approximately 20 m high located in the southern portion of each extraction area. The land surrounding the facility consists of undulating topography with moderate changes in elevation, plus minus 20 m.

Note that directions in this report are referenced to site north as shown in Figure 1.

The legal description of the land occupied by the facility is as follows:

Part of Lot 5,
Concession 10,
Lanark Highland Township,
Lanark County, Ontario

A location plan showing the site with respect to the surrounding area is provided in Figure 1. A site layout plan, showing the sites detailed arrangement and elevation contours, is provided in Figure 2. A land use zoning map is provided in Appendix 1.

The site is zoned Mineral Aggregate Reserve – Holding Zone (MAR-h) and Rural (RU) as shown on the Zoning Map, Appendix 1. It is noted, while the proposed licensed area will be located fully within Part of Lot 5 the property boundary incorporates an area to the south located on Part of Lot 4, as shown on Figure 1, 2 and Appendix 1.

To the north of the site the land is zoned Rural (RU) with areas of Limited Services Rural (LSR) and Mineral Aggregate Resources Reserve – Holding Zone (MAR-h) and Environmental Protection (Organic Soils) zoned land. An existing pit lies immediately north of the site on the northern side of Highland Line Road with a number of existing residences, and vacant lots zoned

for potential noise sensitive use, located in this direction with access via McDonalds Corner Road, 10th Concession Road, 11th Concession Road Dalhousie, Camerons Place and Highland Line Road. The closest existing residences and potential future residences, on vacant land zoned RU and LSR, in this direction have been selected as noise sensitive receptors in the following assessment.

To the east of the site the land is zoned Mineral Aggregate Resources Pit (MXP) and Limited Services Rural (LSR). An existing licensed pit on land zoned MXP and a small number of residences and seasonal hunt camps, fronting Barbers Lake with access via Leo Jay Road, exist in this direction. The closest existing residences and seasonal hunt camps in this direction have been selected as noise sensitive receptors in the following assessment.

To the south of the site the land is zoned Rural (RU) and Limited Services Rural (LSR). An existing residence and a vacant lot zoned for potential noise sensitive use lie in this direction with access via Anderson Lane and Concession Road 11 Dalhousie respectively. The closest existing residence and vacant lot zoned for potential noise sensitive use in this direction have been selected as noise sensitive receptors in the following assessment.

To the west of the site the land is zoned Rural (RU) with pockets of Mineral Aggregate Resources Reserve – Holding Zone (MAR-h). A small number of residences exist in this direction fronting Highland Line Road. In addition, Wheelers Pancake House and Sugar Camp (camp) lie in this direction, while primarily a restaurant and day camp for school tours, also provides opportunities for accommodation in the historic farmhouse. As such the closest existing residence and camp in this direction have been selected as noise sensitive receptors in the following assessment.

Where receptors have been located on vacant land zoned for potential noise sensitive use i.e. a possible future residence located on land zoned rural, the location selected for assessment is consistent with the existing pattern of development in the area.

The noise sensitive noise sensitive receptors, which have been selected for detailed analysis, are shown in Figure 1. These were selected as being the receptors most likely impacted by noise from the facilities operations. Other noise sensitive receptors are at greater distances and will be less affected by noise from the facility.

Table 1 lists the noise sensitive receptors selected for analysis.

2.0 Facility Description

The proposed Highland Line Pit will produce various grades of sand and aggregate with an annual production limit of 1,000,000 tonnes per year.

The site is divided into an east extraction area (Extraction Area 1) and west extraction area (Extraction Area 2) by Anderson Lane as shown on Figure 1 and 2.

Excavated raw material will be extracted in each extraction area by excavators and loaders which transport the raw material to a screening plant located near the lift face. After screening processed sand is stockpiled using conveyors and stackers. A loader or excavator then loads the processed sand from stockpiles onto highway trucks which are used to deliver the product off-site. The screening plant has a maximum throughput capacity of 200 tonnes per hour.

At certain times a wash plant may be used in place of the mobile screening plant to process raw material. The wash plant has a maximum throughput capacity of 200 tonnes per hour.

The larger stones and rocks which are separated by the screening plant or wash plant will be stockpiled before being transferred to a mobile crushing plant which is brought to site as needed. After crushing, processed aggregate will be stockpiled using conveyors and stackers. A loader or excavator then loads the processed aggregate from stockpiles onto highway trucks which are used to deliver the product off-site.

Additional material may be brought on site as needed, stored and processed, before being shipped off site.

Extraction of the pit will take place in a number of lifts up to 20 m in height, possibly in benches.

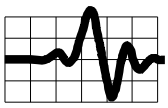
The existing ground elevation and pit floor of the first lift down in each extraction area will be at an approximate elevation of 188 mASL. The ground water table lies at an approximate elevation of 186 mASL.

Extraction will commence in the north of each extraction area in the area adjacent to Highland Line Road near the site entries as shown on Figure 2 and proceed to the setback limits in a south, east and west direction in each extraction area.

Access for shipping processed sand and aggregate, in each extraction area, is from the site entrances off Highland Line Road as shown in Figure 2.

The following equipment will be operated on-site and is included in this assessment as significant sources of noise:

- One mobile screening plant, with associated conveyors and stackers,
- One wash plant, with associated conveyors, stackers and diesel generator,
- One mobile crushing plant, brought to site occasionally, when required,



- Up to six loaders or excavators,
- Highway trucks used to ship the product off site,
- Portable equipment for site preparation and rehabilitation, including excavators, hydraulic shovels, dozers and scrapers.

A description of each operation follows:

Mobile Screening Plant

A mobile screening plant (mobile screener) will be brought to site as needed and located near the extraction face. The mobile screener consists of a hopper (feed bin), screen deck, diesel engine, magnetic separator and conveyors. Overburden, soil, sand and aggregate are fed through the screening plant to produce various grades of product before being stockpiled, using stackers and conveyors, and processed for shipping off site. Oversized aggregates separated in the screening process are stockpiled before being taken to the mobile crushing plant for further processing. Typically, two loaders and two excavators are used to extract material from the lift face to feed the screening plant and fill trucks from the stockpiles for shipment off-site.

The mobile screening plant operates only during daytime hours (07:00 – 19:00).

Wash Plant

A wash plant is used to process extracted sand and separate it into various grades of aggregate. The major components of the wash plant include a hopper (feed bin), dry screen deck, a wet screen deck, a classifier, two double screw material washers, a dewatering derrick and conveyors and stackers. Typically, associated operations include loaders used to supply raw material to the plant and to load trucks from stockpiles for delivery off-site and a diesel generator used to provide power to the plant.

The wash plant operates only during daytime hours (07:00 – 19:00).

Mobile Crushing Plant

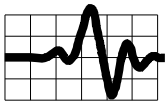
A mobile crushing plant (crusher) is brought to site as needed and located in each extraction area in location shown on Figure 2. The plant consists of a hopper (feed bin), primary and secondary crushing units, a diesel engine, vibrating screens, a magnetic separator and conveyors. Typically, associated operations include one loader and excavator.

The mobile crushing plant operates only during daytime hours (07:00 – 19:00).

Loaders and Excavators

Typically, loaders and excavators are required on-site for the following:

- Extracting raw material from the extraction face,
- Loading extracted material onto trucks for delivery to the mobile crushing plant,
- Loading sand from stockpiles into the hoppers to feed the mobile screening plant,
- Loading processed sand and aggregate on to trucks for shipping off-site,
- Generally pushing around rock and aggregate to maintain the site in a safe state,



- Removing overburden and site preparation,

Loading and excavating activities may take place on a twenty-four-hour basis (24 hour).

Highway Trucks

Highway trucks are used for shipping processed sand and aggregate off site and as needed to deliver oversized material separated in the screening process to stockpiles located near the mobile crushing plant in each extraction area. Based on the annual tonnage it is assumed 15 loads per hour are shipped from the screening plant, wash plant and / or mobile crushing plant during periods of maximum capacity during the daytime period of operation in each extraction area. During the evening and nighttime period, it is assumed 5 loads per hour are shipped during periods of maximum capacity in Extraction Area 1 and 10 loads per hour are shipped during periods of maximum capacity in Extraction Area 2. The speed limit for trucks on site is 30 km/h. The use of jake brakes (compression assisted brakes) is forbidden on site.

Trucks used for shipping and delivery of product and the associated on-site truck movements take place on a twenty-four-hour basis (24 hours).

Portable equipment for site preparations and rehabilitation

Portable construction equipment will be used occasionally for site preparation (e.g. land clearing and construction of berms) and rehabilitation. This equipment would typically include excavators, hydraulic shovels, dozers and scrapers. To minimize the impact of noise during site preparation and rehabilitation, the construction equipment used, excavators, bulldozers, etc., will comply with MECP Publication NPC-115,[5] Construction Equipment, August 1978. This publication gives noise standards to be met by construction equipment in Ontario.

Site preparation and rehabilitation activities will take place only during daytime hours (07:00 – 19:00).

Hours of Operation

Daytime Operations (07:00 – 19:00) - During the daytime period, all significant noise sources are assumed to be in operation and include the following:

- One Mobile Screening Plant,
- One Wash Plant,
- One Mobile Crushing plant,
- Up to six loaders or excavators,
- On-site truck movements used to deliver material to the mobile crushing plant and ship processed product off-site.

Evening and Nighttime Operations (19:00 – 07:00) – During the evening and nighttime period the following significant noise sources may be in operation:

- Up to two loaders or excavators,
- On-site truck movements used to ship processed aggregate product off-site.

3.0 Noise Source Summary

The following noise sources have been used to model noise generated by operations at the Highland Line Pit. In brackets are the shortened names of the noise sources as used in the acoustic model. The characteristics of these sources, as used in acoustic modelling, are summarized in Table 2.

- One Mobile Screening Plant (Source: Screener),
- One Wash Plant (Source: Washplant),
- One diesel generator used to provide power to the wash plant (Source: Generator),
- One Mobile Crushing Plant (Source: Crusher),
- Three Loaders (Source: Loader_1, Loader_2 and Loader_3)
- Three Excavators (Source: Excavator_1, Excavator _2 and Excavator _3)
- On-site truck movements (Source: IHR_1 and IHR_2).

The noise modelling considers various scenarios relating to different areas of operation as described in Section 6.0. For each scenario, the locations of the noise sources are selected for worst case noise impacts.

The strengths of the noise sources, i.e. the sound powers shown in Table 2 and used in this analysis, are taken from noise measurements of the mobile screening plant in operation at the Cavanagh Pine Grove Pit in October 2019, the wash plant in operation at Cavanagh Lanark Quarry in August 2020 and from a database of noise measurements by Freefield Ltd. of similar operations made at other aggregate operations in Ontario.

A Brüel & Kjær Type 2270 sound level meter was used for all noise measurements. Field calibrations, using a Brüel & Kjær 4231 field calibrator, and battery checks were carried out before and after each measurement series. In no case did the field calibration vary by more than 0.1 dB over a series of measurements. In addition, the sound level meters, and the field calibrator are laboratory calibrated on an annual basis. Copies of the relevant calibration certificates are included in Appendix 3.

The weather conditions during the measurements were suitable for outdoor noise measurements (variable winds of less than 20 km/h, skies generally clear with relatively low humidity). A windshield was used during noise measurements.

Noise from the highway trucks, and associated on-site haul routes, are estimated using the moving point source method and modelled as a loop indicating the worst-case on-site truck movements.

Insignificant noise sources:

Conveyors, stackers and noise from employee or service vehicles have been assessed as insignificant noise sources in this analysis.

Refer to Figures 3, 5, 7, 9, 11, 13, 15, 17 and 19 for locations of sources for the worst-case modes of operation analysed.

4.0 Point of Reception Summary

A total of thirteen nearby noise sensitive receptors have been selected for detailed noise evaluation.

These existing and potential future residences on vacant land zoned for potential noise sensitive use are those closest to the proposed pit in all directions and represent the worst-case noise impacts in comparison to other nearby or more distant noise sensitive receptors.

The thirteen points of reception selected for analysis, POR 1 to POR 13, are shown in Figure 1 and listed in Table 1.

As per MECP Guideline NPC-300, two points of reception (POR) have been selected at each noise sensitive receptor for which worst case sound levels have been calculated.

> POW – Plane of window (POW) points of reception are located on the dwelling or noise sensitive building, typically 2 m above ground for single storey dwellings and 4.5 m above ground for two storey dwellings.
>
> OPR – Outdoor Point of Reception, an area on the property of the residence. For large properties, the OPR point of reception can be up to 30 m from the dwelling at a height of 1.5 m above ground.

Where receptors have been located on vacant land zoned for potential noise sensitive use i.e. a possible future residence located on land zoned rural, the location selected for assessment are consistent with the existing pattern of development in the area.

Noise prediction results are summarized in Table 6 by point of reception. Figures 4, 6, 8, 10, 12, 14, 16, 18 and 20 show predicted results as noise contours for Scenario 1 through Scenario 9.

Detailed prediction results are contained in Appendix 2, with Tables A2.7.1 to A2.7.9 providing a summary of predicted noise impacts at each point of reception (POR) for the individual sources.

5.0 Assessment Criteria, Performance Limits

Sound level limits, as specified in the MECP guideline NPC-300 [1], depend on the acoustical classification of the area as Class 1, 2, 3 or 4.

> **Class 1 area** 'an area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the activities of people, usually road traffic, often referred to as urban hum.'
>
> **Class 2 area** 'an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 areas: sound levels characteristic of Class 1 during daytime (07:00 to 19:00 or to 23:00 hours); and low evening and night background sound level defined by natural environment and infrequent human activity starting as early as 19:00 hours (19:00 or 23:00 to 07:00 hours).'
>
> **Class 3 area** 'a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as: a small community; agricultural area; a rural resort area such as a cottage or resort area; or, a wilderness area. '
>
> **Class 4 area** 'an area or specific site that would otherwise be defined as Class 1 or 2 and which: is an area intended for development with new noise sensitive land use(s) that are not yet built; is in proximity to existing, lawfully established stationary source(s); and, has formal confirmation from the land use planning authority with the Class 4 area classification which is determined during the land use planning process. Additionally, areas with existing noise sensitive land use(s) cannot be classified as Class 4 areas.'

Due to the relatively low levels of road traffic along Highland Line Road and other nearby roads the area in which all receptors are located is classified as Class 3 Area.

The applicable outdoor sound level limit at a point of reception is the higher of the applicable exclusion limit value, presented in Tables 3 and Table 4, or the background sound level for that point of reception. Background sound level means the sound level that is present in the environment produced by noise sources other than the source under assessment.

A background noise assessment was not carried out, hence, the levels given in the Tables 3 and 4 are taken as the sound level limits at all points of reception for the purpose of this assessment according to their location in a Class 3 Area.

The applicable sound level limits for each point of reception are set out in Table 5.

Sound levels are assessed in terms of the 1-hour equivalent sound level, L_{eq}, effectively the average sound level over each hour. All sound levels are A-weighted, A-weighting being a frequency weighting with represents sensitivity of human hearing to sounds of differing frequencies.

6.0 Impact Assessment

Noise levels have been predicted at the noise sensitive receptors using "predictable worst case" assumptions under normal operations and using ISO 9613-2 sound propagation methodology[6] as implemented in the sound prediction software Cadna-A, Version 2021. The "predictable worst case" is interpreted as meaning the greatest noise impact anticipated under normal operating conditions. The ISO methodology provides a conservative (i.e. high) estimate of the noise level at a receptor taking into account adverse wind and meteorological conditions.

The estimation method includes the following:

- Distance attenuation is based on spherical spreading.
- Atmospheric attenuation.
- Ground attenuations, as appropriate.
- Barrier attenuation, as appropriate.

In order to consider cases of worst noise impacts, nine operational scenarios have been modeled. In general, the worst impacts are those which occur when all equipment is operating concurrently.

The following six worst case scenarios are presented in this report and form the basis for the recommended mitigation measures and assessment of compliance to MECP criteria:

Scenario 1: *Worst Case, **Extraction Area 1** – Crushing Plant and Screening Plant in operation concurrently with extraction occurring closest to POR 1, 2, 3, 4 & 12 (Day only) – Figure 3 and 4.*

Scenario 2: *Worst Case, **Extraction Area 1** - Crushing Plant and Screening Plant in operation concurrently with extraction occurring closest to POR 5 (Day only) – Figure 5 and 6.*

Scenario 3: *Worst Case, **Extraction Area 2** - Crushing Plant and Screening Plant in operation concurrently with extraction occurring closest to POR 6 & 7 (Day only) – Figure 7 and 8.*

Scenario 4: *Worst Case, **Extraction Area 2** - Crushing Plant and Screening Plant in operation concurrently with extraction occurring closest to POR 8 & 13 (Day only) – Figure 9 and 10.*

Scenario 5: *Worst Case, **Extraction Area 1** – Crushing Plant and Wash Plant in operation concurrently with extraction occurring closest to POR 1, 2, 3, 4 & 12 (Day only) – Figure 11 and 12.*

Scenario 6: *Worst Case, **Extraction Area 1** - Crushing Plant and Wash Plant in operation concurrently with extraction occurring closest to POR 5 (Day only) – Figure 13 and 14.*

Scenario 7: *Worst Case, **Extraction Area 2** - Crushing Plant and Wash Plant in operation concurrently with extraction occurring closest to POR 6 & 7 (Day only) – Figure 15 and 16.*

Scenario 8: *Worst Case, **Extraction Area 2** - Crushing Plant and Wash Plant in operation concurrently with extraction occurring closest to POR 8 & 13 (Day only) – Figure 17 and 18.*

Scenario 9: *Worst Case, **Extraction Area 1 & 2** - Loading and hauling operations only (Day, evening or night) – Figure 19 and 20.*

In Table 6 estimated noise levels at the nearest receptors for the worst case, among all scenarios, are compared with the applicable sound level limits. More detailed estimates, for all sources and scenarios, are contained in the Point of Reception Noise Impact Tables in Appendix 2, Tables A2.7.1 to A2.7.9 and Table A2.8.

It can be seen that the sound level limits are met at all noise sensitive points of reception, POR 1 to POR 13, for worst case operating conditions during the proposed daytime period of operation 7 am to 7 pm (07:00 to 19:00) and evening and nighttime period of operation 7 pm to 7 am (19:00 to 07:00).

Details of acoustic modeling are provided in Appendix 2. Figures 4, 6, 8, 10, 12, 14, 16, 18 and 20 show predicted noise contours for each mode of operation analyzed.

Statement of Compliance

It is concluded that, with the recommended mitigation measures detailed in section 7.0, noise impacts from operations at the Highland Line Pit will be in compliance with MECP Environmental Noise Guidelines[1] for the proposed daytime period of operation 7 am to 7 pm (07:00 to 19:00) and evening and nighttime period of operation (19:00 to 07:00).

7.0 Mitigation Measures (Site Plan Recommendations)

Noise mitigation measures for the Highland Line Pit operations are detailed below.

The predicted noise impacts in Tables A2.7.1 to A2.7.9 are based on the implementation of the following mitigation measures:

7.1 Noise Barriers and Berms:

7.1.1 Noise barriers and berms are to be provided as per Table 7 and Figure 21, 22, 23, 24 and 25.

7.1.2 Noise barriers and berms are to be solid, having no gaps, and are to have a surface density of no less than 20 kg/m2. Examples of suitable barriers or berms are as follow:

7.1.2.1 Lift face or existing terrain;
7.1.2.2 Earth, gravel or aggregate berms or stockpiles;
7.1.2.3 Concrete or brick walls;
7.1.2.4 Commercial noise barriers;
7.1.2.5 Shipping containers or buildings,
7.1.2.6 A portable barrier such as a truck trailer equipped with movable flaps to block the space between the ground and the bottom of the trailer and increase height if required.

7.1.3 Noise barriers shielding portable equipment may be progressively established to provide shielding from location of operation to the identified noise sensitive point of reception (POR).

7.2 Mobile Screening Plant

7.2.1 The operation of the mobile screening plant (screener) may take place only during the daytime period (07:00 to 19:00) and shall comply with the following:

7.2.1.1 The screener is to be located on the pit floor at a maximum elevation of 188 mASL.
7.2.1.2 Noise barriers are to be provided as per Table 7 and Figure 22.

7.3 Wash Plant

7.3.1 The operation of the wash plant and associated diesel generator may take place only during the daytime period (07:00 to 19:00) and shall comply with the following:

7.3.1.1 The wash plant is to be located on the pit floor at a maximum elevation of 188 mASL in locations shown in Figure 2.
7.3.1.2 Noise barriers are to be provided as per Table 7 and Figure 23.
7.3.1.3 The maximum outdoor sound power of the generator, if used to provide power to the wash plant, must not exceed the levels given in Table 2. To achieve these ratings the generator will likely need to be housed inside an enclosure and fitted with an exhaust silencer that meets the minimum insertion loss requirements listed in Table 8. The silencer is to be located inside the enclosures or as close as possible to the location where the exhaust exits the enclosures with the duct material between the silencer and the generator constructed of 16-gauge weather resistant metal. The silencers shall have a high transmission loss casing.
7.3.1.4 Item 7.2.1.3 above does not apply if hydro is used to provide power to the plant.

7.4 Mobile Crushing Plant

7.4.1 The operation of the mobile crushing plant (crusher) may take place only during the daytime period (07:00 to 19:00) and shall comply with the following:

7.4.1.1 The crusher is to be located on the pit floor at a maximum elevation of 188 mASL in locations shown in Figure 2.

7.4.1.2 Noise barriers are to be provided as per Table 7 and Figure 24 and 25.

7.5 Loaders and Excavators

7.5.1 The operation of the loaders and excavators may take place during the daytime, evening and nighttime period (24 hours) anywhere in the extraction area.

7.6 Highway Trucks

7.6.1 The loading and shipping of product using highway trucks may take place during the daytime, evening and nighttime period (24 hours) and shall comply with the following:

7.6.1.1 When operating on-site, highway trucks shall not exceed 30 km/h and shall not use compression braking (Jake Brakes).

7.7 Portable construction equipment

7.7.1 Portable construction equipment used for site preparation (e.g. land clearing and construction of berms) and rehabilitation shall comply with MECP Publication NPC-115, Construction Equipment, August 1978. (This publication gives noise standards to be met by construction equipment in Ontario.) Site preparation and rehabilitation activities shall take place only during daytime hours (07:00 – 19:00).

7.8 New Process

7.8.1 If a new process is introduced to the site, then this process shall be assessed by a qualified acoustical consultant prior to commissioning. Noise mitigation measures shall be reviewed, and altered if necessary, to ensure that MECP sound level limits are met at all points of reception.

8.0 Conclusions

An acoustic assessment of operations at the Proposed Highland Line Pit has been conducted according to MECP noise assessment procedures. Operations include extraction by loaders or excavators, aggregate processing operations by a mobile screening plant, a wash plant and a mobile crushing plant, loading processed sand and aggregate from stockpiles using loaders or excavators, and delivery and shipping of product using highway trucks.

It has been found that noise levels from the operations at nearby receptors are in compliance with MECP sound level limits as set out in publication NPC-300[1], provided that the noise mitigation measures described in Section 7.0 of this report are followed.

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Member, Canadian Acoustical Society, Member, Australian Acoustical Society, Associate Member, INCE-USA

Hugh Williamson, Ph.D., P.Eng.
Member, Canadian Acoustical Society

References

1. Ministry of Environment, Conservation and Parks Publication NPC-300, *Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning*, August 2013, adopted by the MECP on 22 October 2013.

2. Ministry of Environment, Conservation and Parks, *Sample Application Package, Basic Comprehensive Certificate of Approval (Air and Noise)*, July 2009.

3. Ministry of Environment, Conservation and Parks Publication NPC-206, *Sound Levels due to Road Traffic,* October 1995.

4. Ministry of Environment, Conservation and Parks, Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT), 1989.

5. Ministry of Environment, Conservation and Parks, STAMSON Software, Version 5.03, 1996. (Software implementation of reference 4).

6. International Standards Organization, *Acoustics - Attenuation of Sound during Propagation Outdoors, Part 2: General Method of Calculation*, ISO 9613-2: 1996(E).

TABLES

Table 1: Point of Reception Summary Table*

Point of Reception	Location*
POR 1	Residence 626 Highland Line Road (2 storey)
POR 2	Hunting Camp 273 Leo Jay Road (1 storey)
POR 3	Residence 255 Leo Jay Road (2 storey)
POR 4	Residence 229 Leo Jay Road (1 storey) (also represents houses further east on Leo Jay Road)
POR 5	Residence 137 Anderson Lane (2 storey)
POR 6	Vacant Lot to the South via Concession Road 11 Dalhousie (2 storey)
POR 7	Wheelers Pancake House and Sugar Camp 1001 Highland Line Road (2 storey)
POR 8	Residence 1025 Highland Line Road (1.5 storey)
POR 9	Residence 804 Concession Road 11 Dalhousie (2 storey) (Also represents residence at 811 Concession Road 11)
POR 10	Residence 805 Concession Road 10 Dalhousie (2 storey) (Also represents residence at 811 Concession Road 11 Dalhousie)
POR 11	Residence 102 Camerons Road (2 storey)
POR 12	Vacant Lot 610 Highland Line Road (2 storey)
POR 13	Vacant Lot to the North Concession Road 11 Dalhousie (2 storey)

* For assessment purposes, points of reception, (POR), have been taken as upper floor windows (2 m above grade for single storey and 4.5 m above grade to represent two storey residences) and Outdoor Point of Reception (30 m from residence, 1.5 m above grade) in acoustic calculations. POR's located on vacant land have been assessed at 2 stories in height.

Table 2: Noise Source Summary Table

Source ID	Source Description	Sound Power (dBA)	Source Location Ht. above ground* (m)	Sound Character-istics	Noise Control Measures
Screener	Mobile Screening Plant	111.0	3.0	Steady, no significant tonality, non-directional	Refer Section 7.0
Wash Plant	Wash Plant	109.9	4.3	Steady, non-tonal, non-directional	As noted in section 7.0
Generator	Generator	108.5**	4	Steady, non-tonal, non-directional	As noted in section 7.0
Crusher	Mobile Crushing Plant	120.0	3.0	Steady, no significant tonality, non-directional	Refer Section 7.0
Loader_1 Loader_2 Loader_3	Loaders used for loading trucks or feeding the screener or crusher (CAT982M or similar)	103	2.5	Steady, moving, no significant tonality, non-directional	Refer Section 7.0
Excavator_1 Excavator _2 Excavator_3	Excavators for extraction or loading the screener or crusher (CAT345DL or similar)	103.2	2.5	Steady, moving, no significant tonality, non-directional	Refer Section 7.0
IHR_1 IHR_2	On-site truck movements for shipping	110.1	2.5	Steady, moving, no significant tonality, non-directional	Refer Section 7.0

*Height measured from finished grade at location of equipment operation.
**Includes attenuation provided by silencer as noted in Table 8.

Table 3: MECP Exclusion Limit Values for One-Hour Equivalent Sound Level (Leq, dBA) at Outdoor Points of Reception

Time of Day	Class 1 Area	Class 2 Area	Class 3 Area	Class 4 Area
07:00 – 19:00	50	50	**45**	55
19:00 – 23:00	50	45	**40**	55

Table 4: MECP Exclusion Limit Values for One-Hour Equivalent Sound Level (Leq, dBA) at Plane of Window of Noise Sensitive Spaces

Time of Day	Class 1 Area	Class 2 Area	Class 3 Area	Class 4 Area
07:00 – 19:00	50	50	**45**	60
19:00 – 23:00	50	50	**40**	60
23:00 – 07:00	45	45	**40**	55

Table 5: Applicable One Hour Sound Level Limits for the Daytime Period (07:00 – 19:00)

Receptor & Point of Reception POW = Plane of Widow OPR = Outdoor Point of Reception	Sound Level Limit 1-hour LAEQ dBA (Daytime Period, 07:00 – 19:00)	Sound Level Limit 1-hour LAEQ dBA (Evening Period, 19:00 – 23:00)	Sound Level Limit 1-hour LAEQ dBA (Nighttime Period, 23:00 – 07:00)
POR_1_POW	45	40	40
POR_1_OPR	45	40	-
POR_2_POW	45	40	40
POR_2_OPR	45	40	-
POR_3_POW	45	40	40
POR_3_OPR	45	40	-
POR_4_POW	45	40	40
POR_4_OPR	45	40	-
POR_5_POW	45	40	40
POR_5_OPR	45	40	-
POR_6_POW	45	40	40
POR_6_OPR	45	40	-
POR_7_POW	45	40	40
POR_7_OPR	45	40	-
POR_8_POW	45	40	40
POR_8_OPR	45	40	-
POR_9_POW	45	40	40
POR_9_OPR	45	40	-
POR_10_POW	45	40	40
POR_10_OPR	45	40	-
POR_11_POW	45	40	40
POR_11_OPR	45	40	-
POR_12_POW	45	40	40
POR_12_OPR	45	40	-
POR_13_POW	45	40	40
POR_13_OPR	45	40	-

Table 6: Acoustic Assessment Summary Table, Worst Case, Daytime Period of Operation, 7 am to 7 pm (07:00 - 19:00) and Evening and Nighttime Period (19:00 – 07:00)

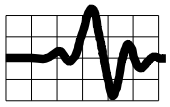
Point of Reception ID	Location	Scenario 1 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 2 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 3 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 4 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 5 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 6 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 7 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 8 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Performance Limit* Daytime Period (dBA)	Scenario 9 Estimated Sound Level Evening / Nighttime Period (Worst Case) (dBA)	Performance Limit* Evening / Nighttime Period (dBA)	Compliance with Performance Limit (Yes/No)
POR 1	POW	43	42	41	41	44	44	44	44	45	37	40	Yes
	OPR	42	41	39	39	43	43	44	44	45	37	40	Yes
POR 2	POW	41	41	41	40	41	41	42	42	45	35	40	Yes
	OPR	42	43	40	40	43	43	42	42	45	37	40	Yes
POR 3	POW	39	44	41	41	40	43	41	41	45	36	40	Yes
	OPR	36	42	40	40	36	41	40	40	45	33	40	Yes
POR 4	POW	37	42	40	40	37	41	40	40	45	34	40	Yes
	OPR	37	42	39	39	37	41	40	40	45	33	40	Yes
POR 5	POW	44	42	42	42	45	44	44	44	45	40	40	Yes
	OPR	42	41	40	40	42	42	42	42	45	38	40	Yes
POR 6	POW	33	31	40	40	33	33	40	40	45	29	40	Yes
	OPR	31	30	38	39	32	31	39	39	45	28	40	Yes
POR 7	POW	39	39	42	42	39	39	42	42	45	29	40	Yes
	OPR	32	32	38	38	33	33	38	38	45	25	40	Yes
POR 8	POW	41	42	44	44	41	42	44	44	45	34	40	Yes
	OPR	41	41	43	43	41	41	43	43	45	33	40	Yes
POR 9	POW	34	33	35	35	34	34	36	36	45	25	40	Yes
	OPR	33	33	35	35	33	33	35	35	45	24	40	Yes
POR 10	POW	26	17	3	2	27	26	25	25	45	21	40	Yes
	OPR	25	16	14	6	26	25	25	25	45	20	40	Yes
POR 11	POW	32	30	-**	-**	33	32	28	28	45	24	40	Yes

Point of Reception ID	Location	Scenario 1 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 2 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 3 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 4 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 5 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 6 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 7 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Scenario 8 Estimated Sound Level Daytime Period (Worst Case) (dBA)	Performance Limit* Daytime Period (dBA)	Scenario 9 Estimated Sound Level Evening / Nighttime Period (Worst Case) (dBA)	Performance Limit* Evening / Nighttime Period (dBA)	Compliance with Performance Limit (Yes/No)
	OPR	31	31	-**	-**	32	32	28	28	45	23	40	Yes
POR 12	POW	42	41	43	42	44	43	45	44	45	36	40	Yes
	OPR	41	40	42	42	43	43	44	44	45	35	40	Yes
POR 13	POW	38	38	41	40	38	38	41	41	45	29	40	Yes
	OPR	37	37	40	40	37	37	40	40	45	28	40	Yes

*Performance limits are based on 1-hour equivalent sound levels, Leq.
**Noise impacts insignificant.

Table 7: Recommended Noise Barriers

Barrier	Minimum Height (m / mASL)	Minimum Length (m)	Maximum Distance from Source (m)	Location	Required to shield Line of Sight from Identified Source ID	Required to shield Line of Sight to Identified Receptor/s	Description
Barrier_1 (Site berm)	196 mASL	Up to 100 m	-	As per: Figure 21	Mobile Screening Plant and extraction operations occurring in Extraction Area 1 East of Line AA	POR_12*	New barrier (berm / lift face): Required to shield noise impacts to the identified receptors when operating in Extraction Area 1 East of Line AA (Onlyrequired following development of a new noise sensitive development at POR 12)
Barrier_2 (Site berm)	196 mASL	Up to 400 m	-	As per: Figure 21	Mobile Screening Plant and extraction operations occurring in Extraction Area 1 East of Line AA	POR_1 POR_2 POR_3 POR_4	New barrier (berm / lift face): Required to shield noise impacts to the identified receptors when operating in Extraction Area 1 East of Line AA
Barrier_3 (Site berm)	3 m	Up to 285 m	-	As per: Figure 21	Mobile Screening Plant and extraction operations occurring in Extraction Area 1 South of Line BB	POR_5	New barrier (berm): Required to shield noise impacts at the identified receptor when operating in Extraction Area 1 South of Line BB
Barrier_SP1 (Stockpile)	4 m	10 m	20 m	As per: Figure 22	Screener when operating in Extraction Area 1	POR_1 POR_2 POR_3 POR_5	New barrier (stockpile): Required to be maintained to shield noise impacts at the identified receptors when operating greater than 20 m from a lift face or site berm that otherwise shields in the direction of the identified receptors
Barrier_WP1 (Stockpile)	7 m	20 m	25 m	As per: Figure 23	Wash Plant and associated generator when operating in Extraction Area 1	POR_2	New barrier (stockpile): Required to be maintained to shield noise impacts at the identified receptor



Barrier	Minimum Height (m / mASL)	Minimum Length (m)	Maximum Distance from Source (m)	Location	Required to shield Line of Sight from Identified Source ID	Required to shield Line of Sight to Identified Receptor/s	Description
Barrier_WP2 (Stockpile)	6 m	30 m	25 m	As per: Figure 23	Wash Plant and associated generator when operating in Extraction Area 1	POR_5	New barrier (stockpile): Required to be maintained to shield noise impacts at the identified receptor
Barrier_CP1 (Stockpile)	10 m	47 m (55 m)*	20 m	As per: Figure 24	Crusher when operating in Extraction Area 1	POR_1 POR_2 POR_3 POR_5 POR_12*	New barrier (stockpile): Required to be maintained to shield noise impacts at the identified receptor
Barrier_CP2 (Stockpile)	6 m	20 m	25 m	As per: Figure 25	Crusher when operating in Extraction Area 2	POR_8	New barrier (stockpile): Required to be maintained to shield noise impacts at the identified receptor
Barrier_CP3 (Stockpile)	6 m	30 m	25 m	As per: Figure 25	Crusher when operating in Extraction Area 2	POR_1 POR_2 POR_3 POR_4 POR_5	New barrier (stockpile): Required to be maintained to shield noise impacts at the identified receptor

*Shielding of receptors representing vacant lots only required following development of a new noise sensitive development.

Table 8: Minimum Insertion Loss for Generator Exhaust Silencer

Name	Octave Band Centre Frequency, Hz Minimum Dynamic Insertion Loss (dB)								Rw
	63	125	250	500	1000	2000	4000	8000	
Silencer to be installed at the generator exhaust[2] (Source: Generator)	10	30	38	30	25	20	20	20	24

Notes:

1. Octave Band Centre Frequency, Hz, with minimum dynamic insertion loss in dB or dBA units re 10-12 Watts. Alternative levels at each frequency band permissible providing the overall insertion loss meets the overall insertion loss (Rw) as noted above and is not tonal in character.
2. Insertion loss based on Silex Silencer Model JB 6. Refer manufacturers data Appendix 4.

FIGURES

Figure 1: Scaled Area Location Plan showing Receptor Locations

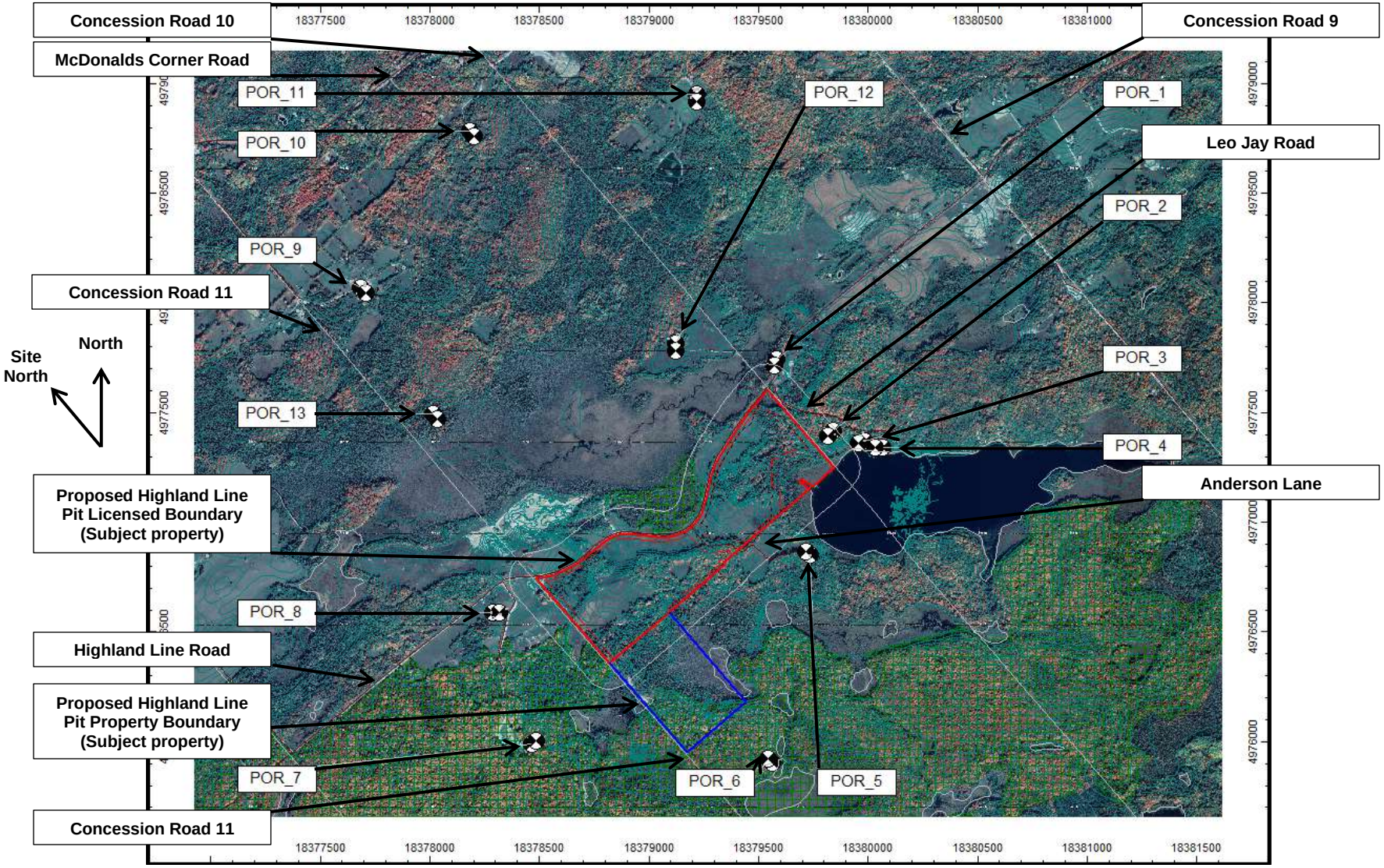


Figure 2: **Detail Site Layout & Surface Elevation Contours** (elevation contours based on Land Information Ontario (LIO), Provincial Digital Elevation Model, at 2-meter intervals)

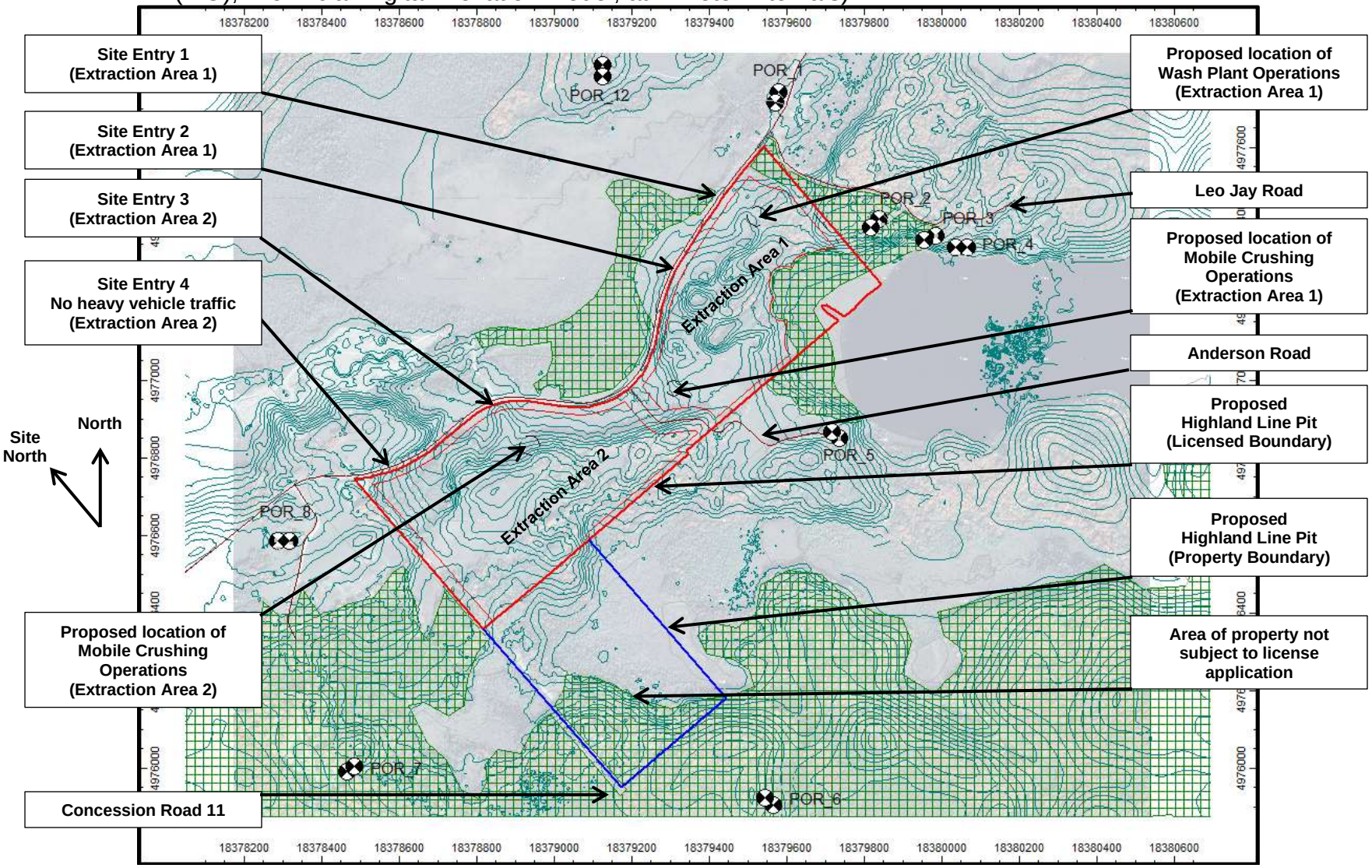


Figure 3: Scenario 1: Worst Case, Extraction Area 1 – Crushing Plant and Screening Plant in operation concurrently with extraction occurring closest to POR 1, 2, 3, 4 & 12 (Day only)

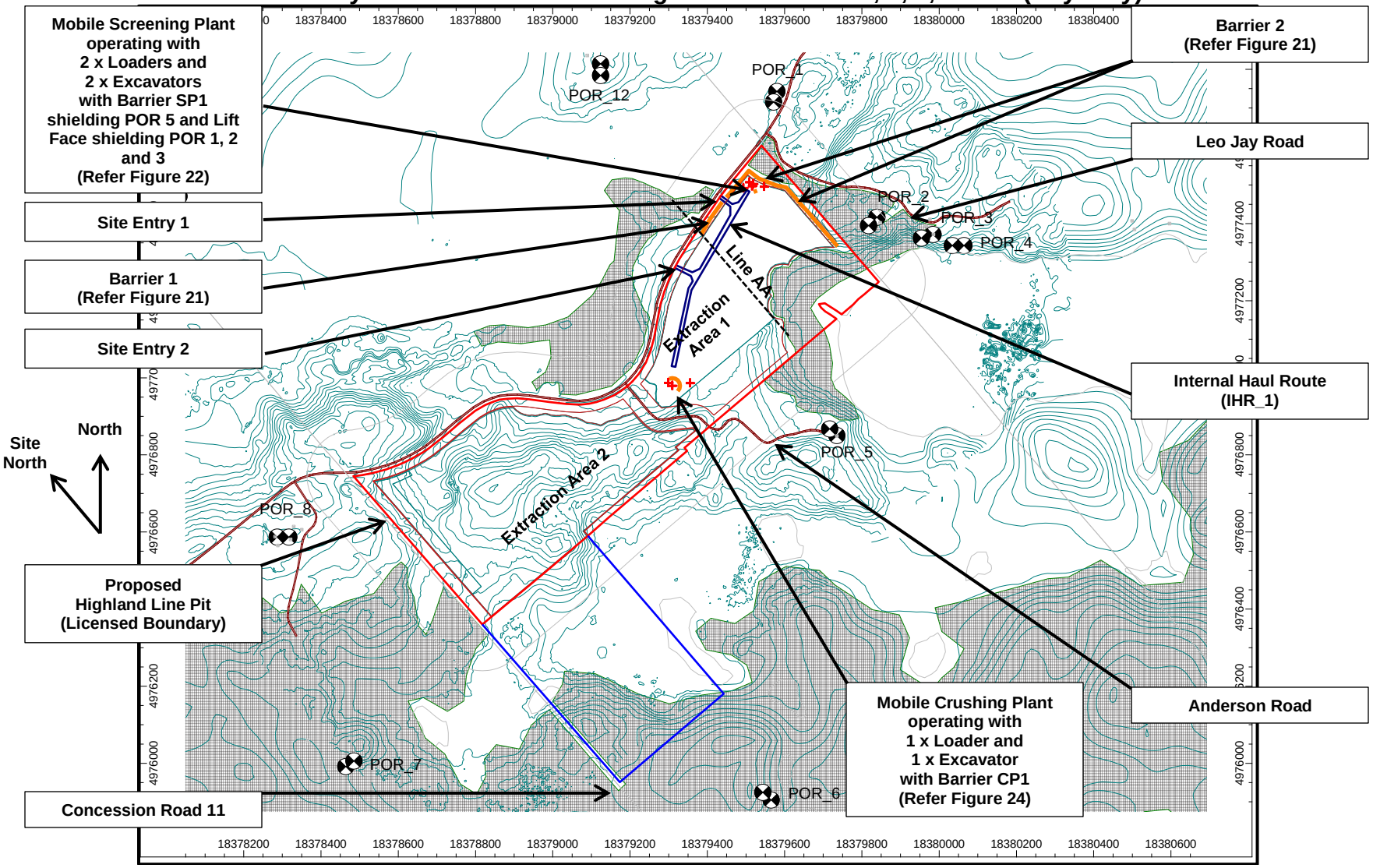


Figure 4: Prediction Results, Scenario 1 - Day only (07:00 to 19:00): Noise Contours, (Noise levels at 4.5 m)

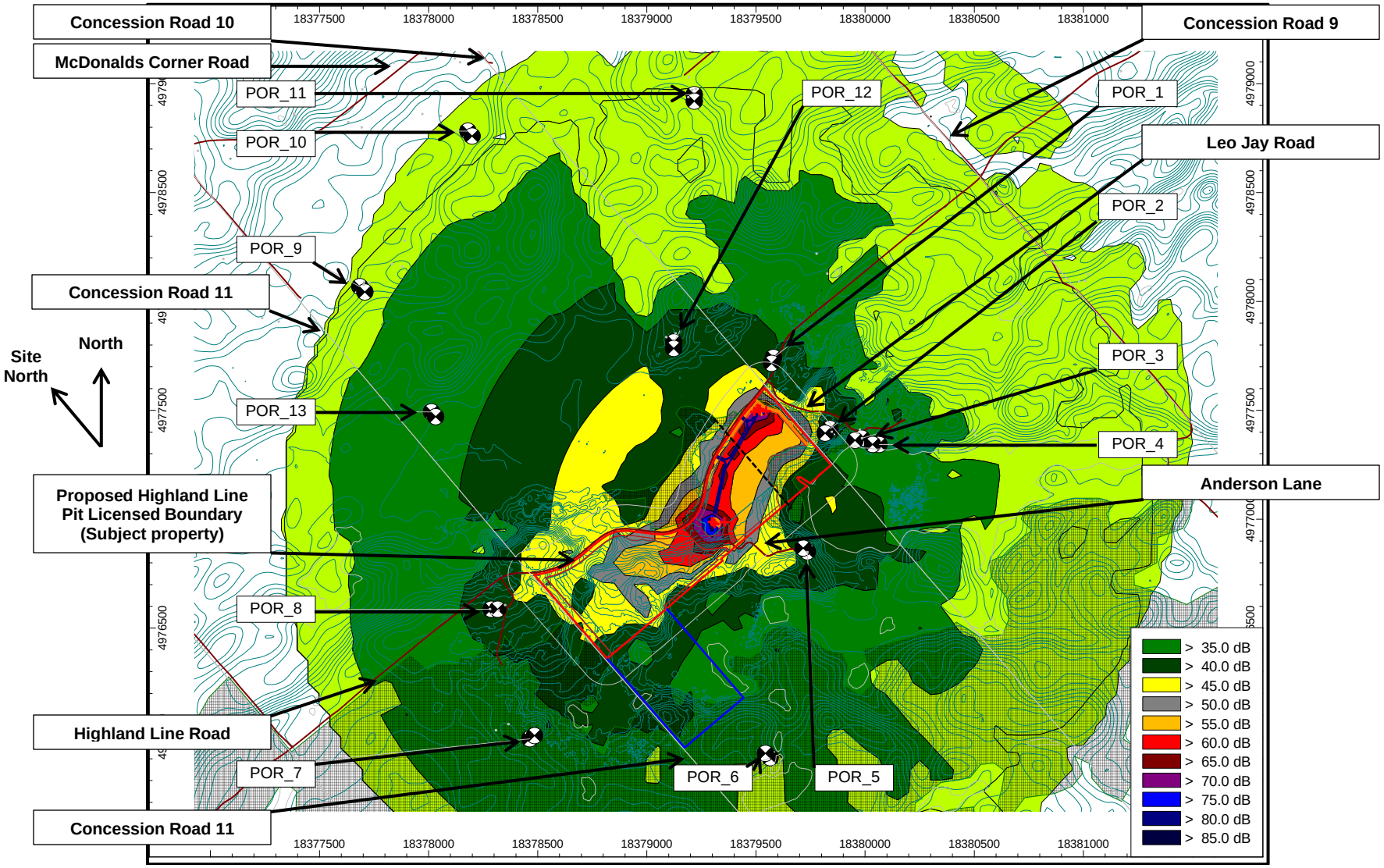


Figure 5: Scenario 2: Worst Case, Extraction Area 1 - Crushing Plant and Screening Plant in operation concurrently with extraction occurring closest to POR 5 – (Day only)

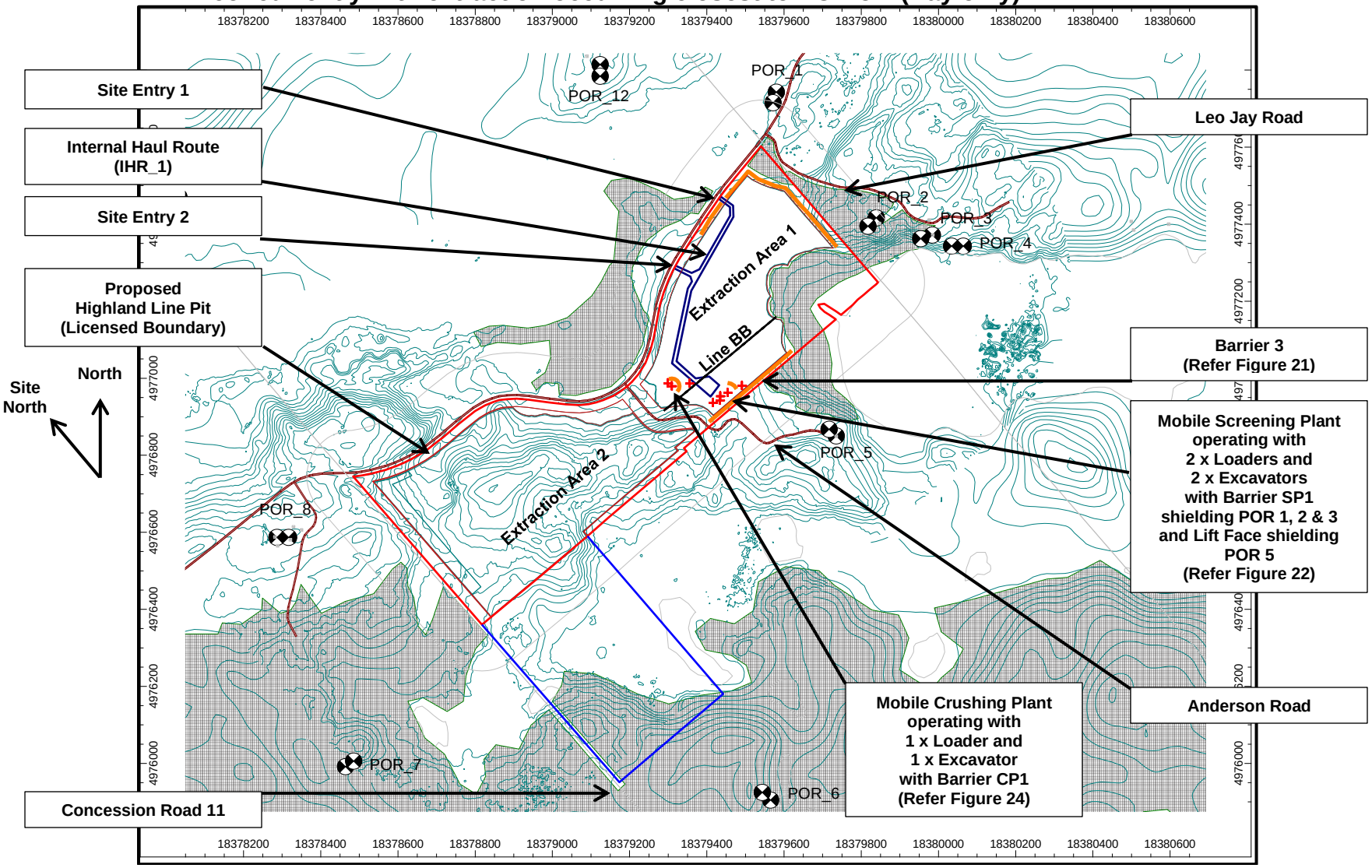


Figure 6: Prediction Results, Scenario 2 - Day only (07:00 to 19:00): Noise Contours, (Noise levels at 4.5 m)

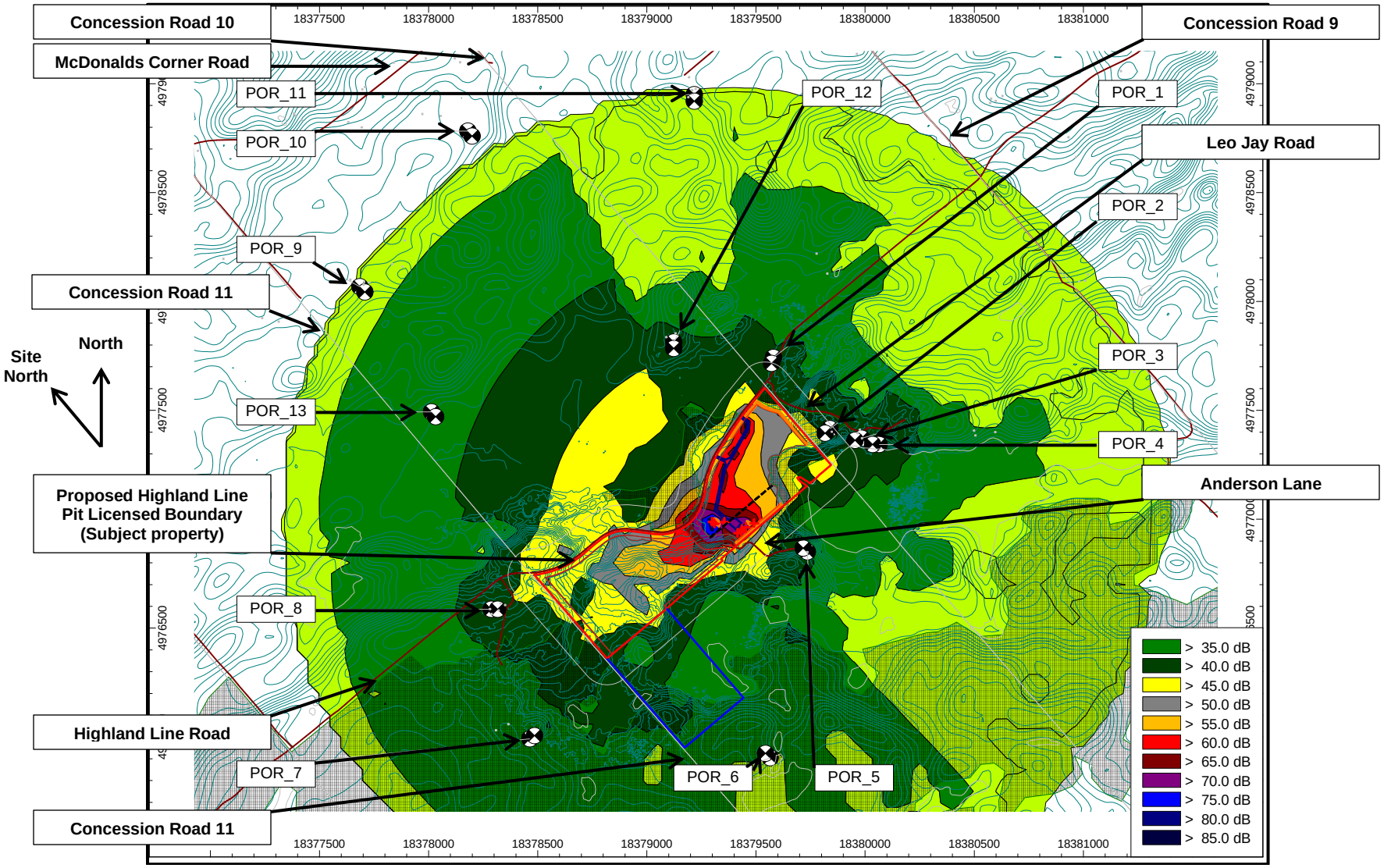


Figure 7: Scenario 3: Worst Case, Extraction Area 2 - Crushing Plant and Screening Plant in operation concurrently with extraction occurring closest to POR 6 & 7 – (Day only)

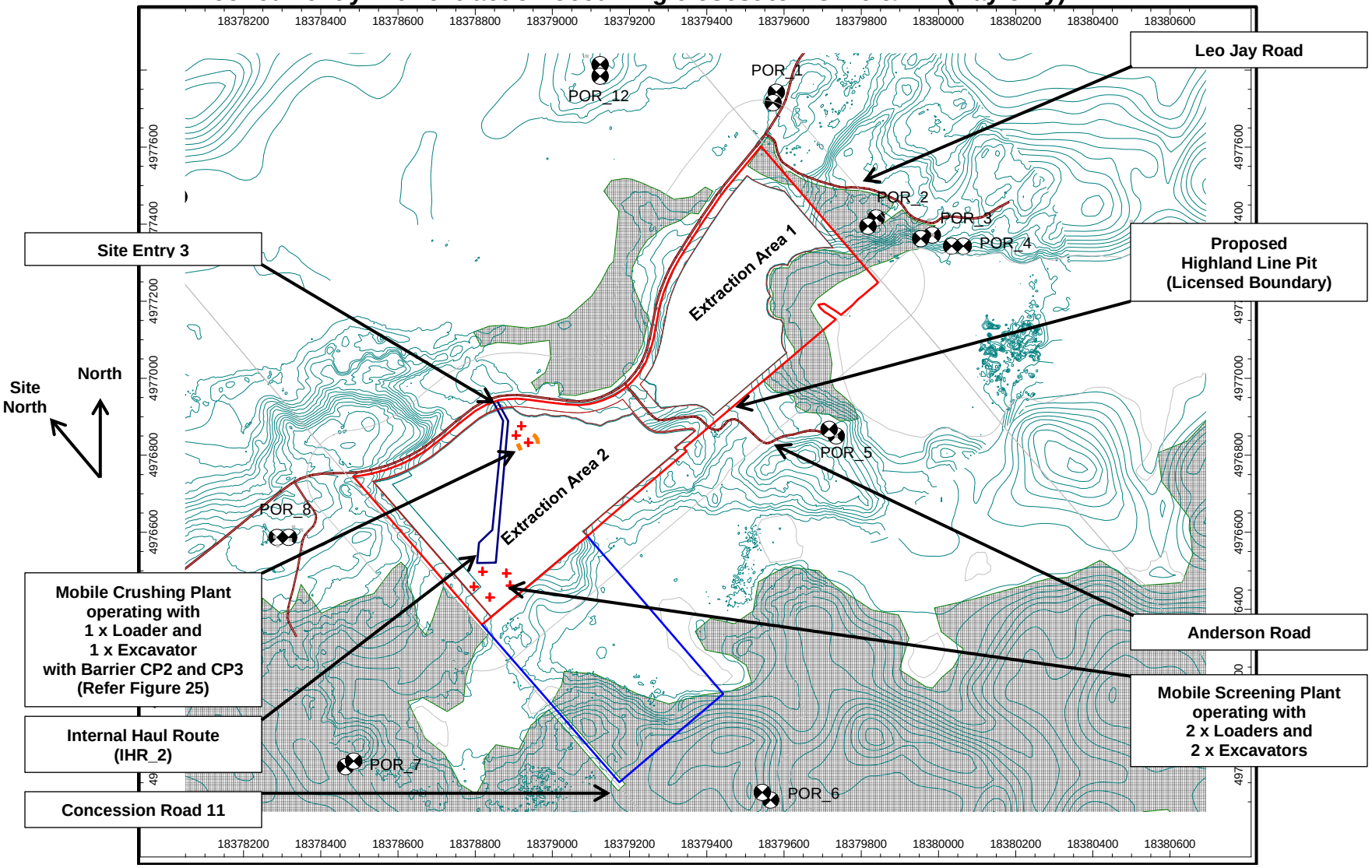


Figure 8: Prediction Results, Scenario 3 - Day only (07:00 to 19:00): Noise Contours, (Noise levels at 4.5 m)

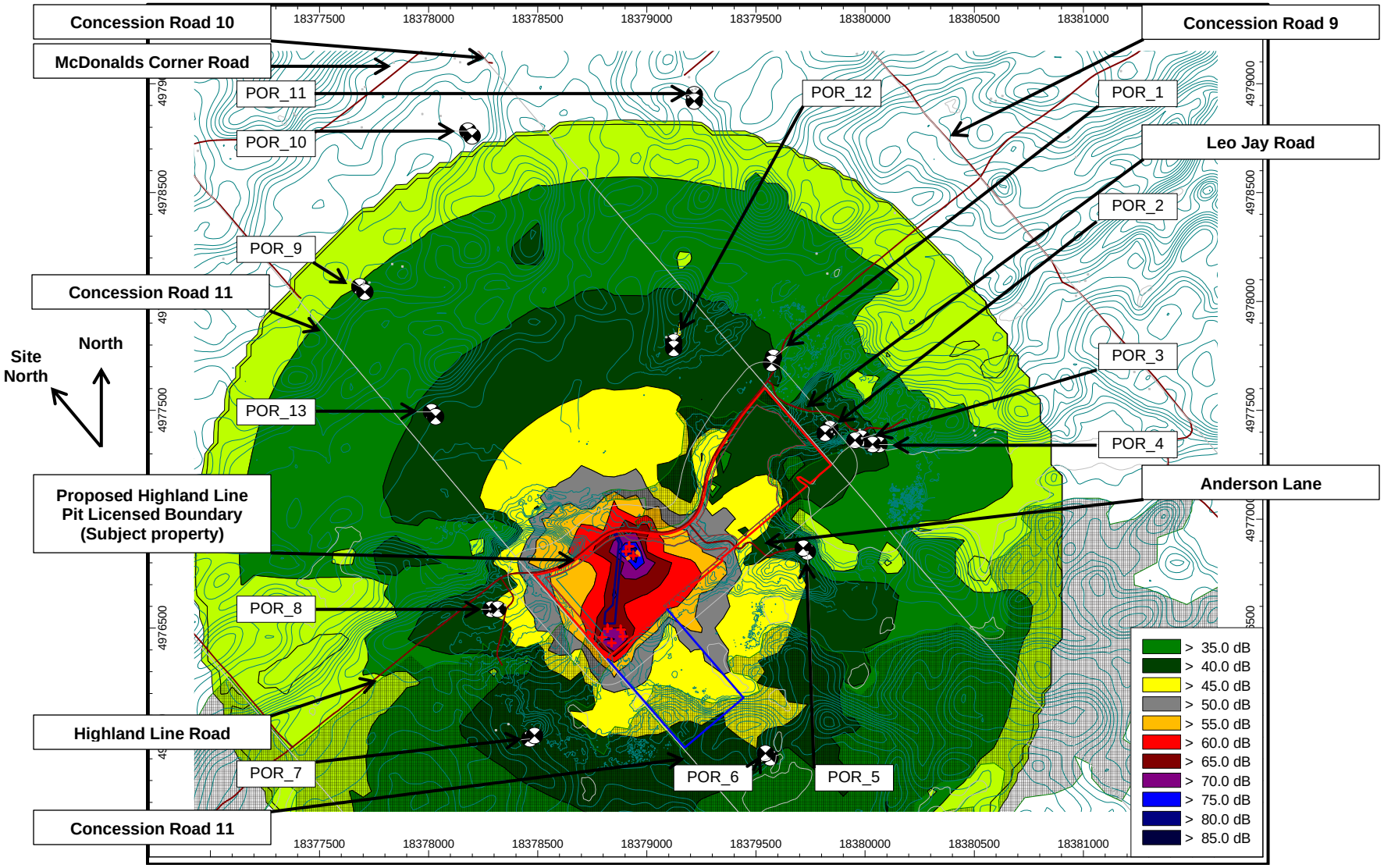


Figure 9: Scenario 4: Worst Case, Extraction Area 2 - Crushing Plant and Screening Plant in operation concurrently with extraction occurring closest to POR 8 & 13 (Day only)

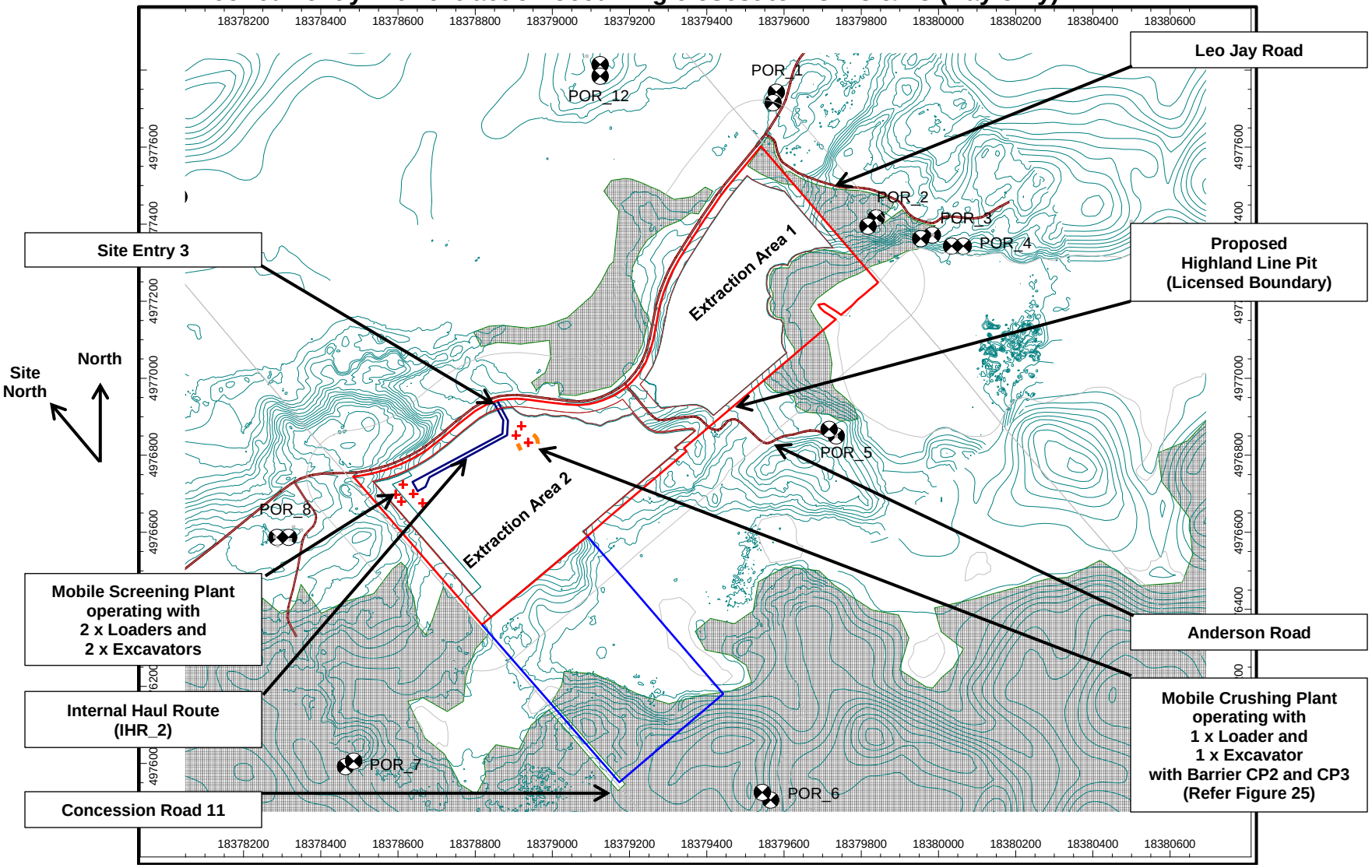


Figure 10: Prediction Results, Scenario 4 - Day only (07:00 to 19:00): Noise Contours, (Noise levels at 4.5 m)

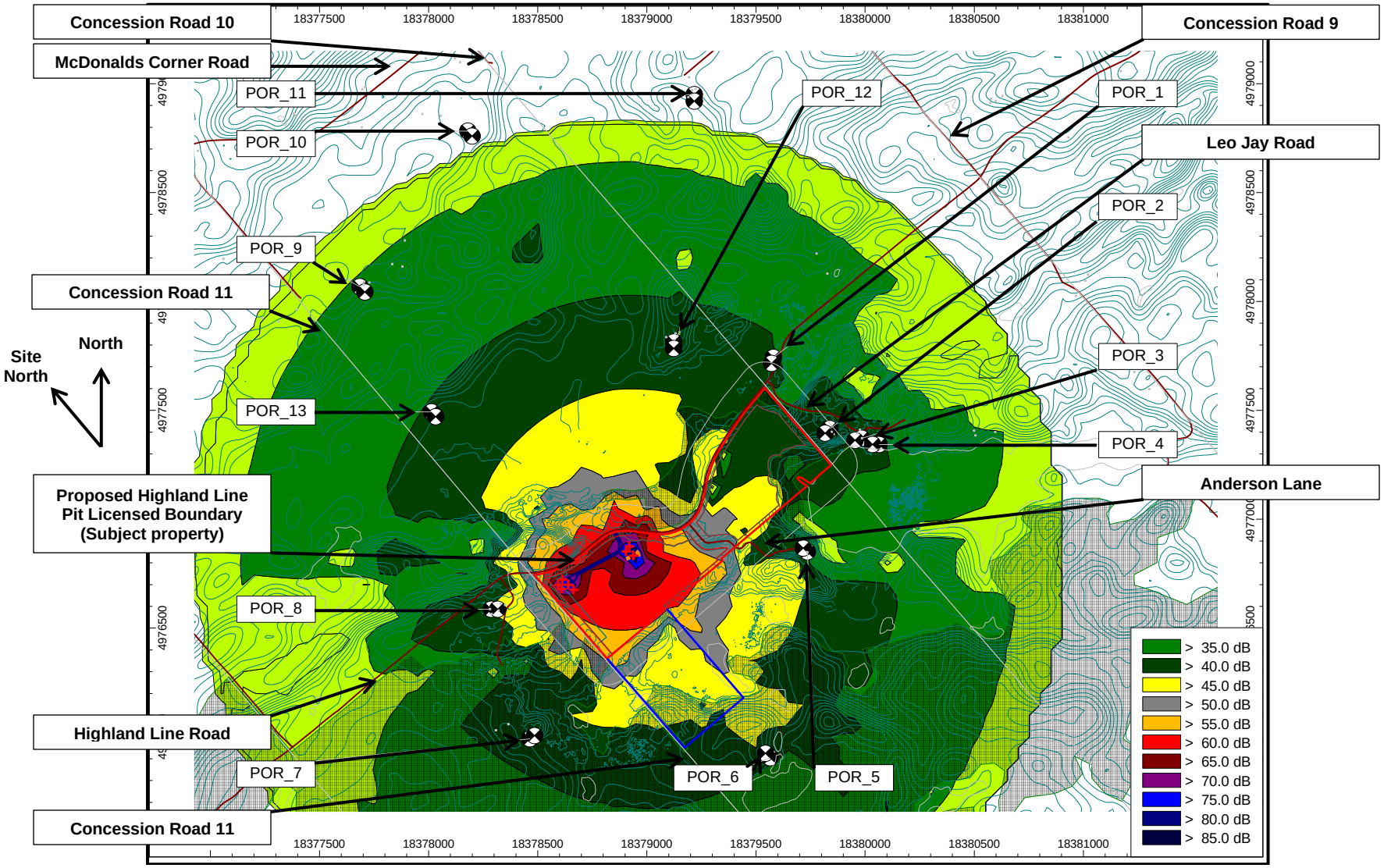


Figure 11: Scenario 5: Worst Case, Extraction Area 1 – Crushing Plant and Wash Plant in operation concurrently with extraction occurring closest to POR 1, 2, 3, 4 & 12 (Day only)

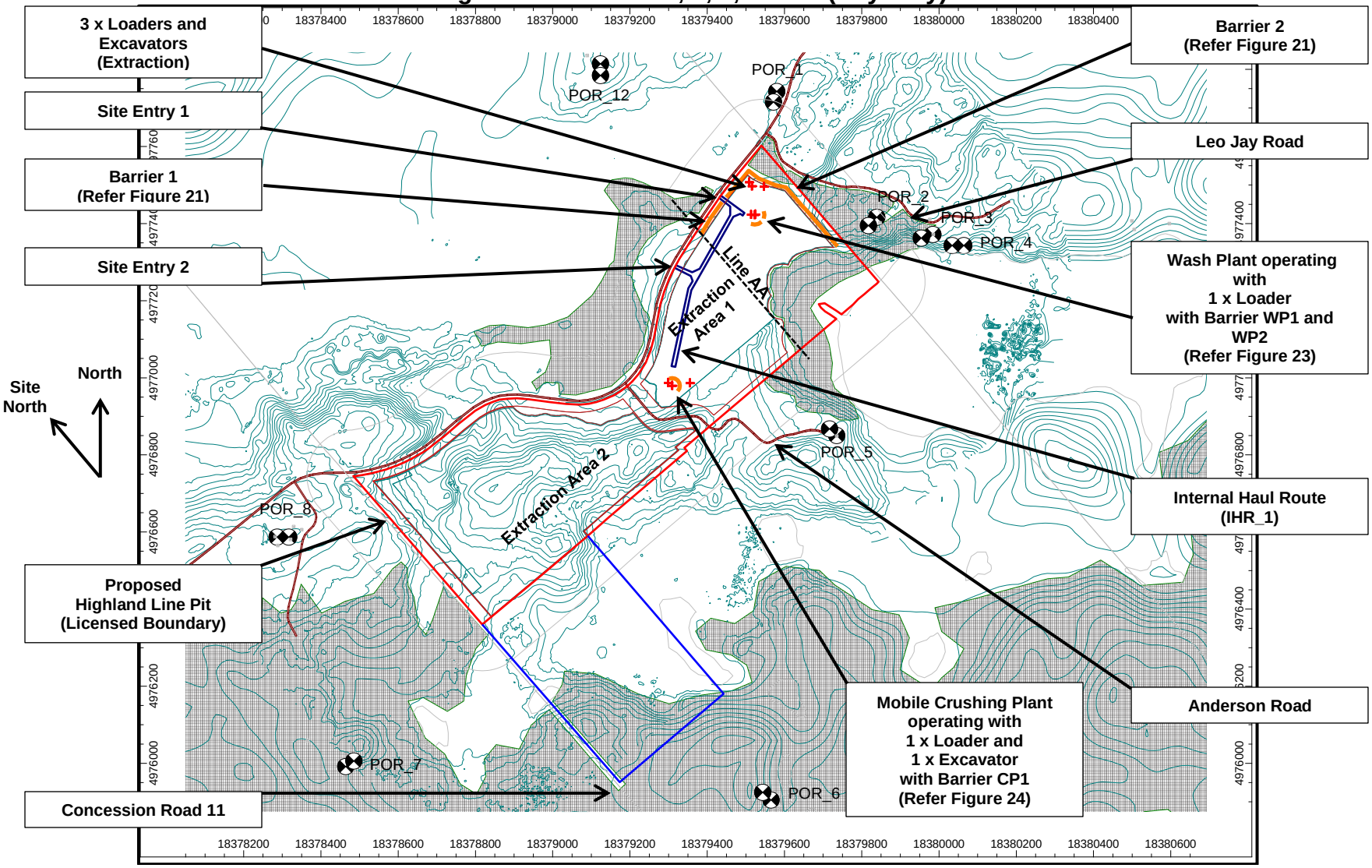


Figure 12: Prediction Results, Scenario 5 - Day only (07:00 to 19:00): Noise Contours, (Noise levels at 4.5 m)

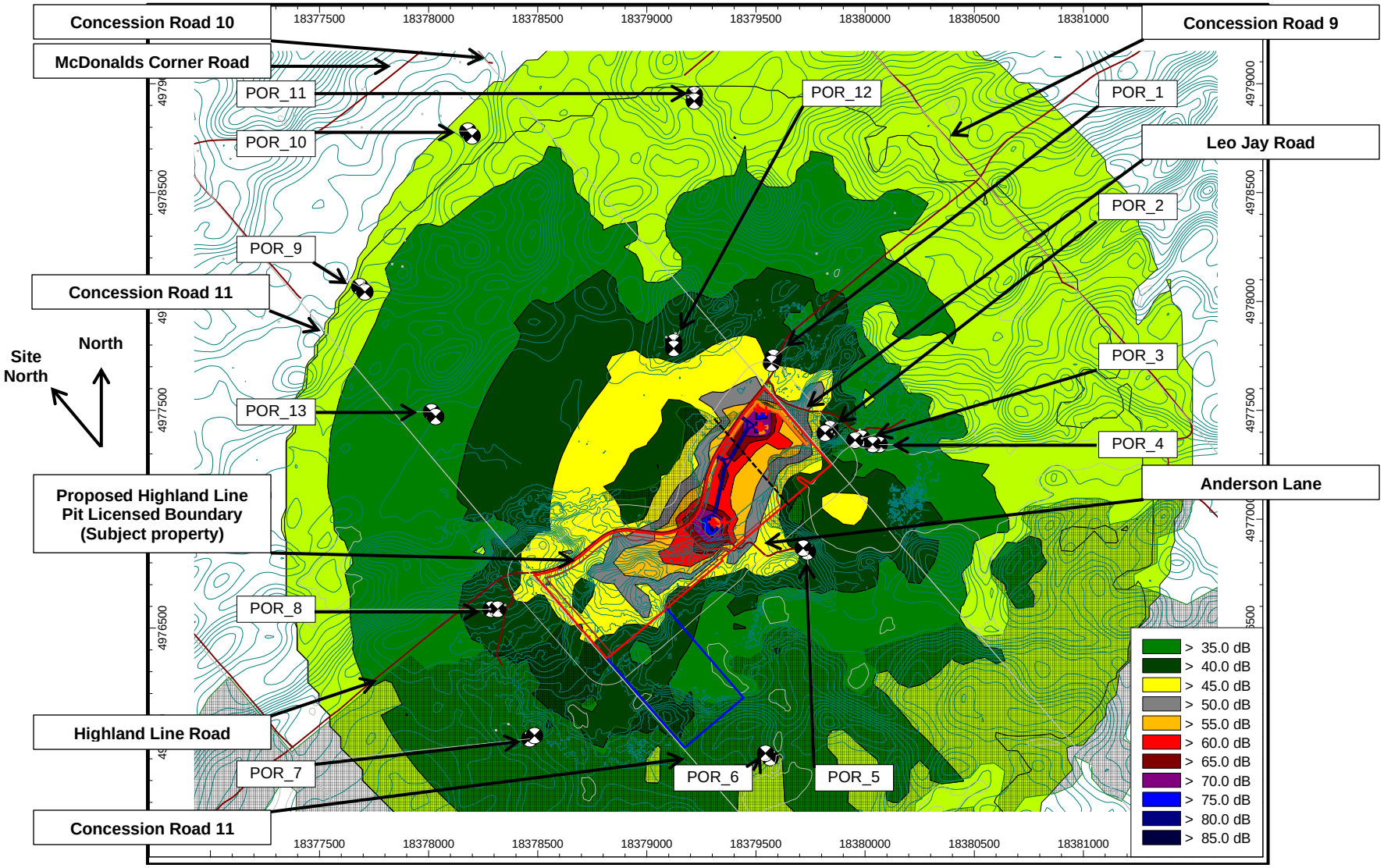


Figure 13: Scenario 6: Worst Case, Extraction Area 1 - Crushing Plant and Wash Plant in operation concurrently with extraction occurring closest to POR 5 – (Day only)

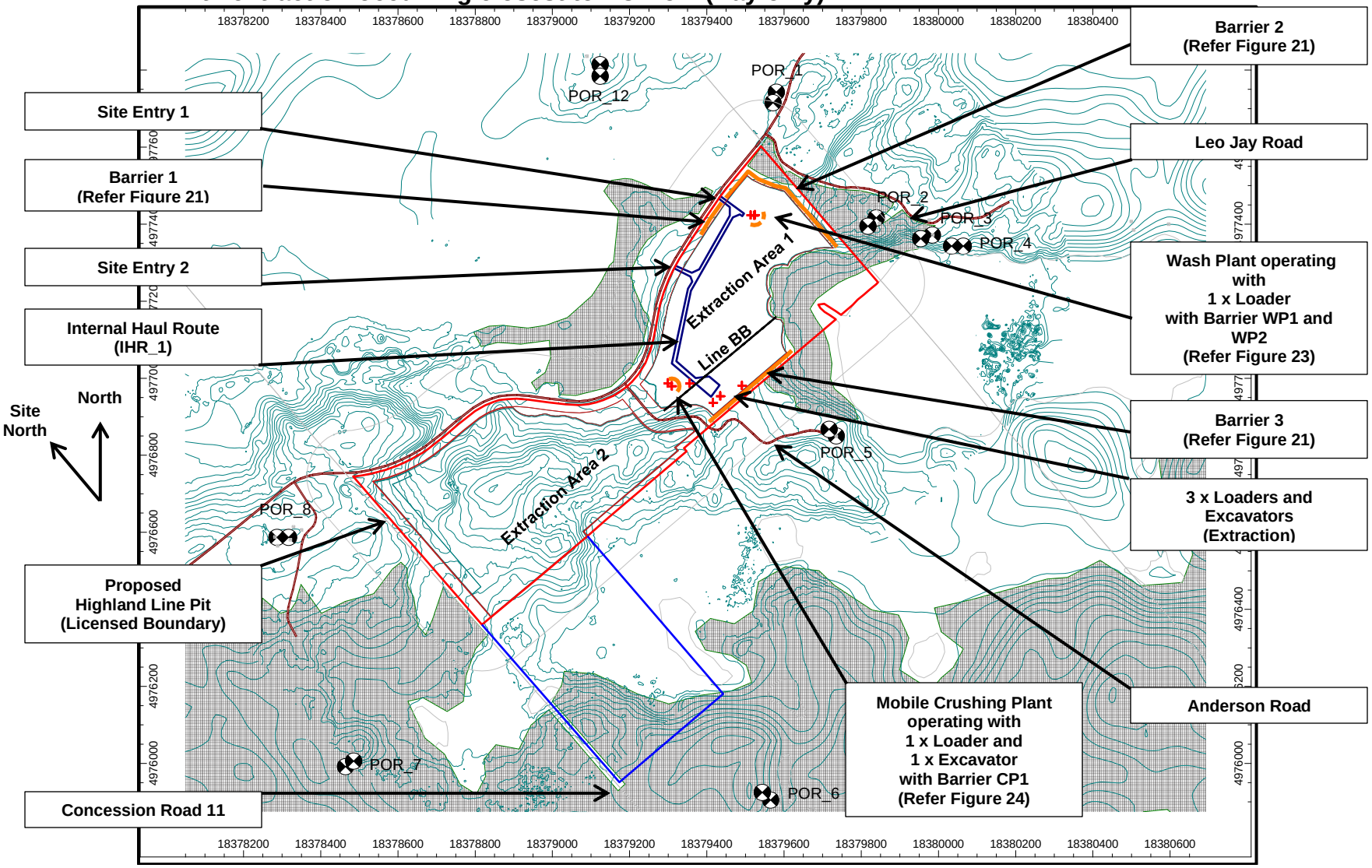


Figure 14: Prediction Results, Scenario 6 - Day only (07:00 to 19:00): Noise Contours, (Noise levels at 4.5 m)

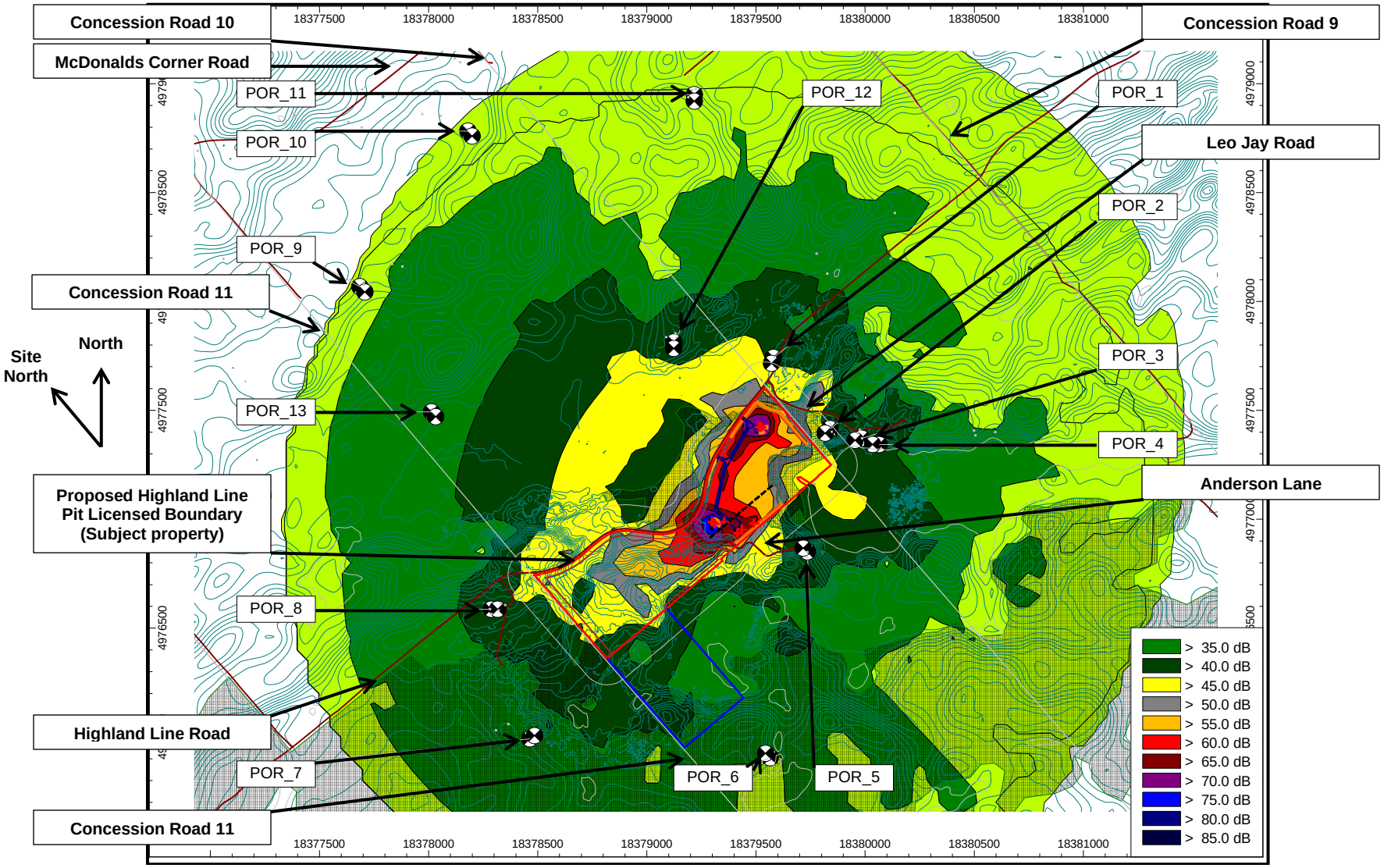


Figure 15: Scenario 7: Worst Case, Extraction Area 2 - Crushing Plant and Wash Plant in operation concurrently with extraction occurring closest to POR 6 & 7 – (Day only)

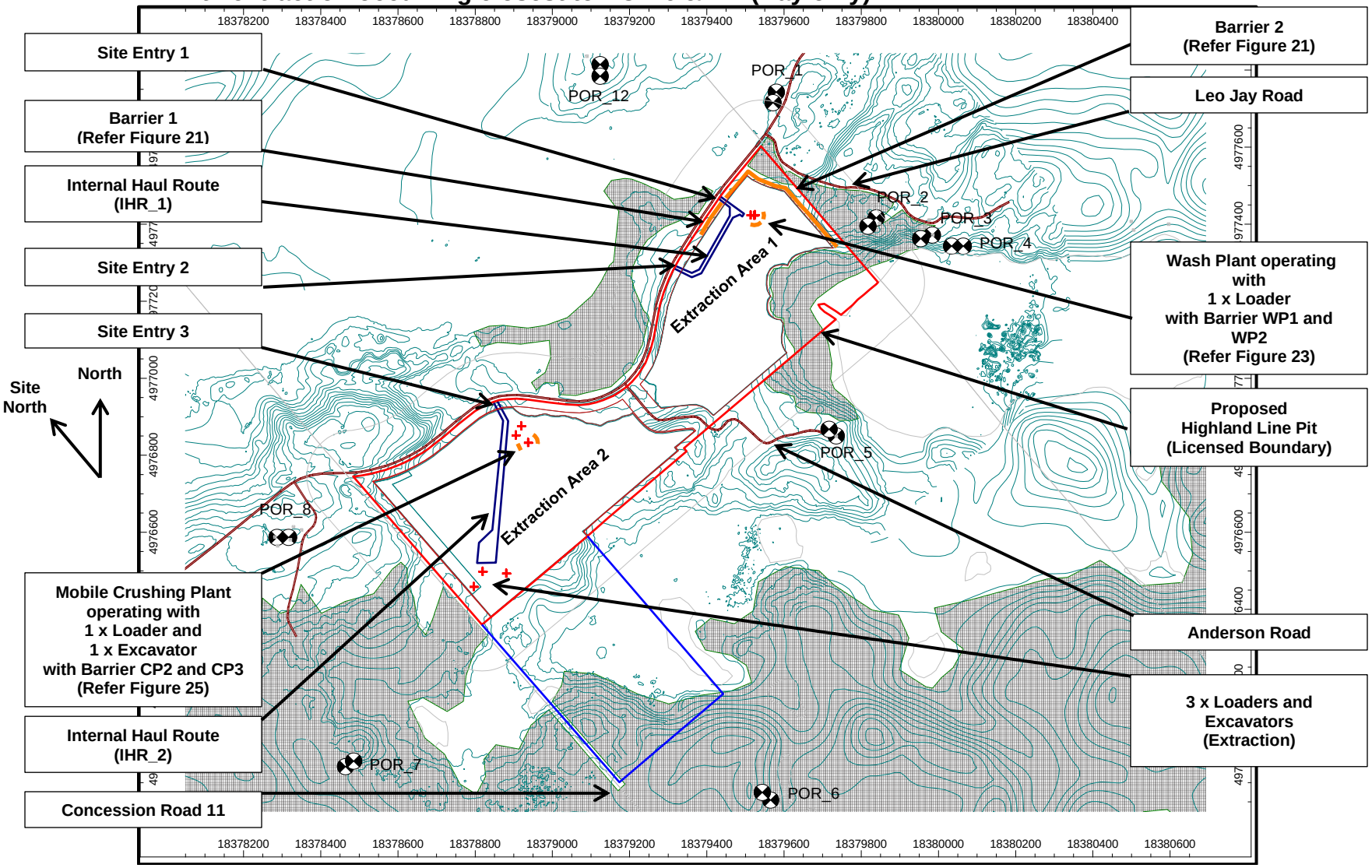


Figure 16: Prediction Results, Scenario 7 - Day only (07:00 to 19:00): Noise Contours, (Noise levels at 4.5 m)

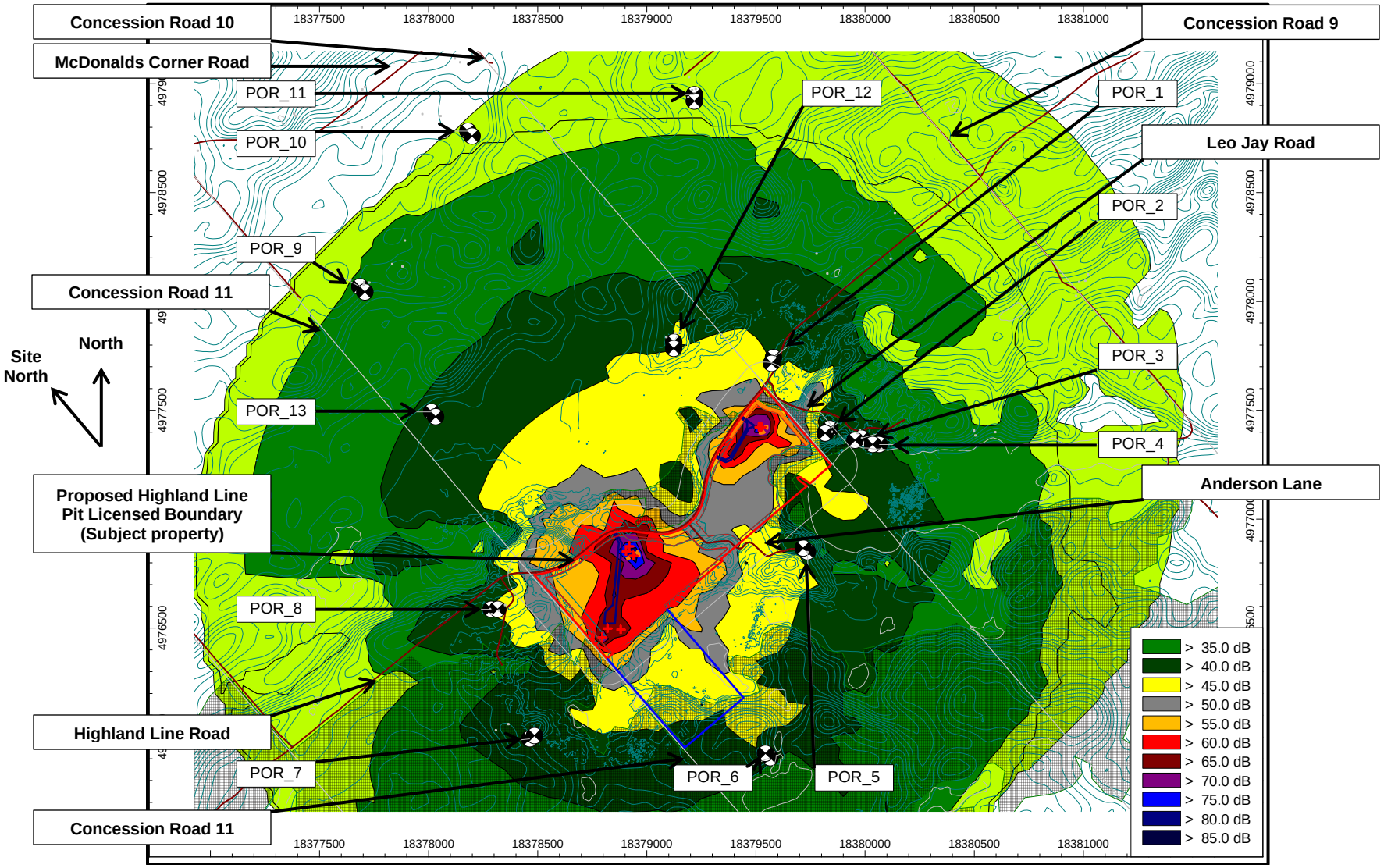


Figure 17: Scenario 8: Worst Case, Extraction Area 2 - Crushing Plant and Wash Plant in operation concurrently with extraction occurring closest to POR 8 & 13 (Day only)

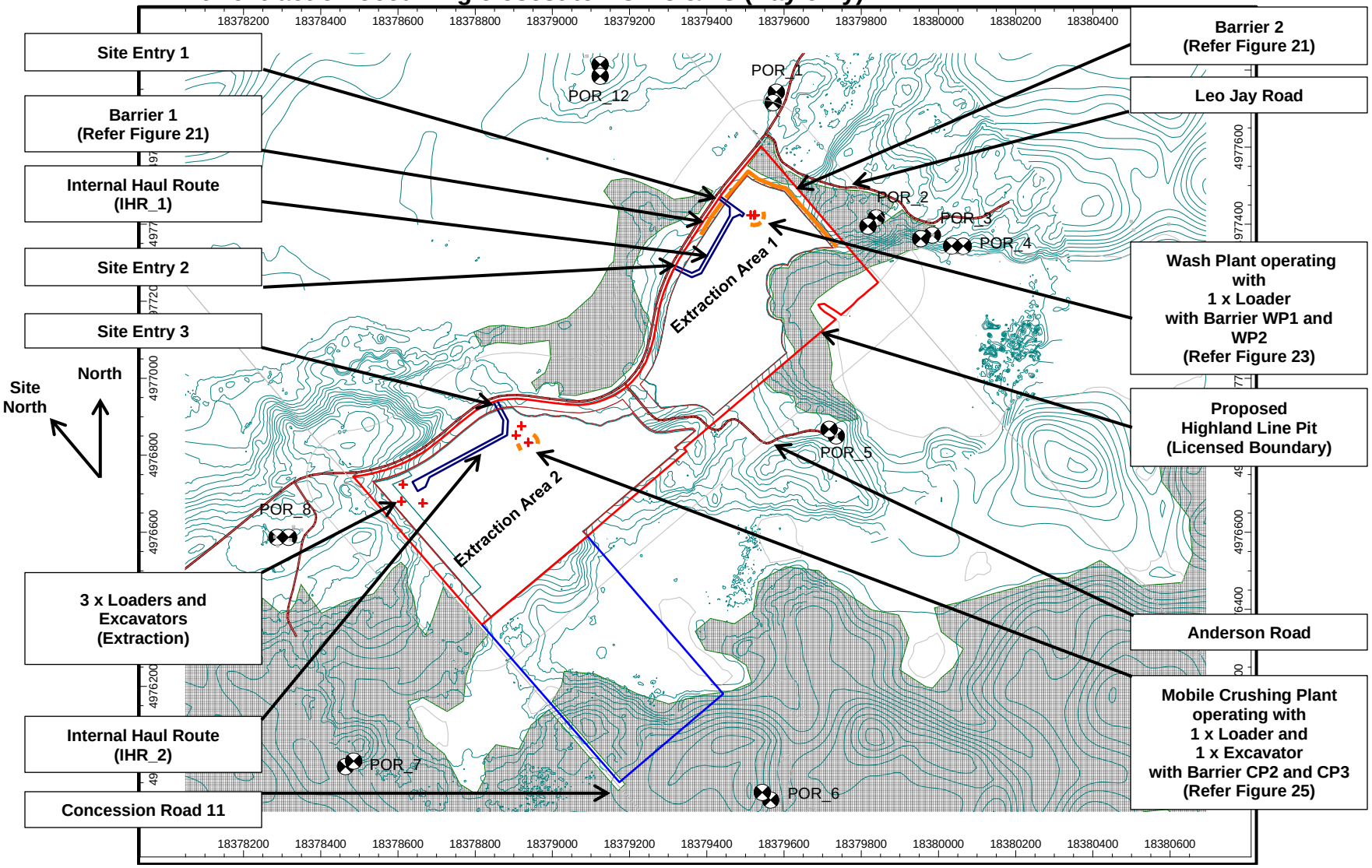


Figure 18: Prediction Results, Scenario 8 - Day only (07:00 to 19:00): Noise Contours, (Noise levels at 4.5 m)

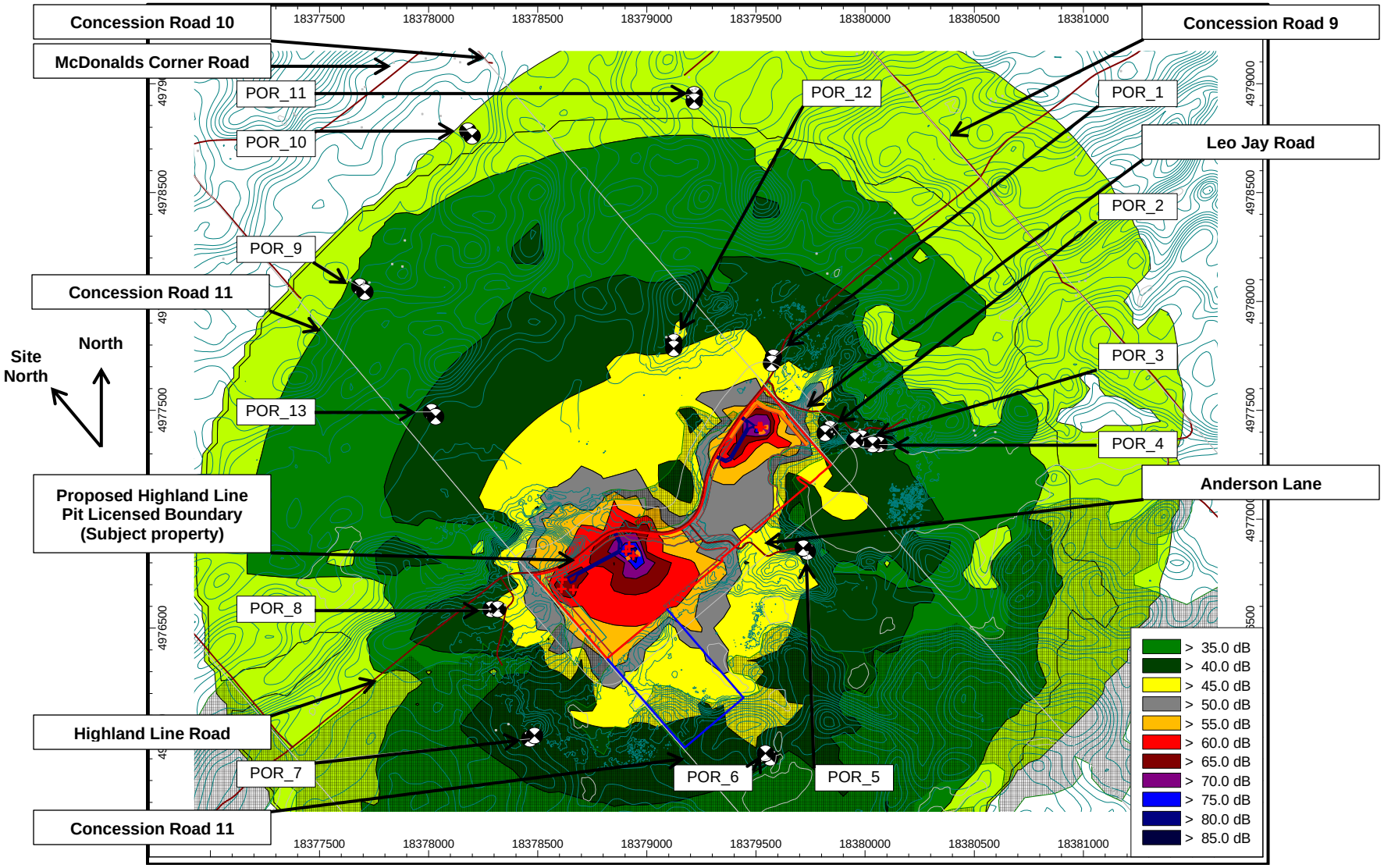


Figure 19: Scenario 9: Worst Case, Extraction Area 1 & 2 - Loading and hauling operations only (Evening or Night)

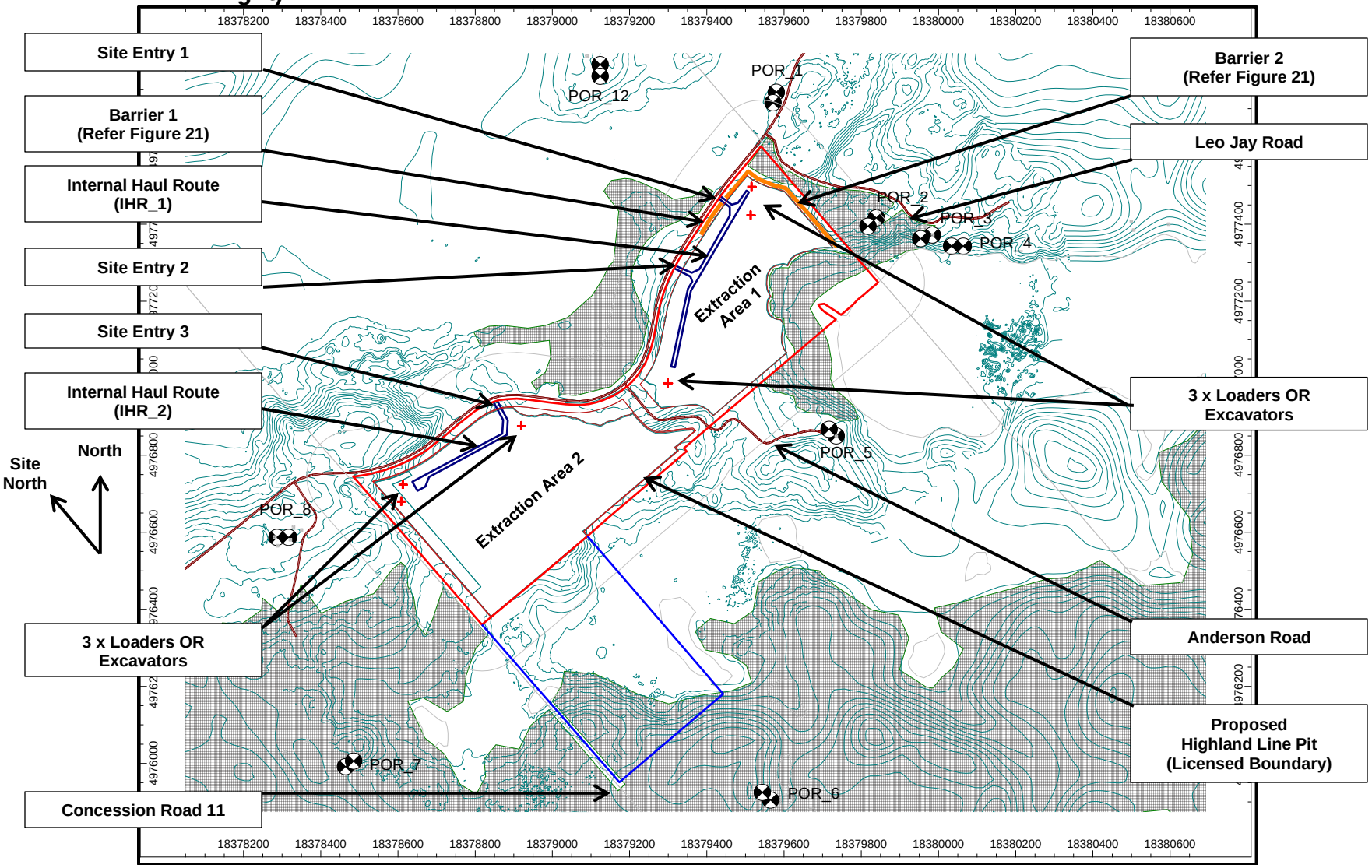


Figure 20: Prediction Results, Scenario 9 – Evening or Night (19:00 to 07:00): Noise Contours, (Noise levels at 4.5 m)

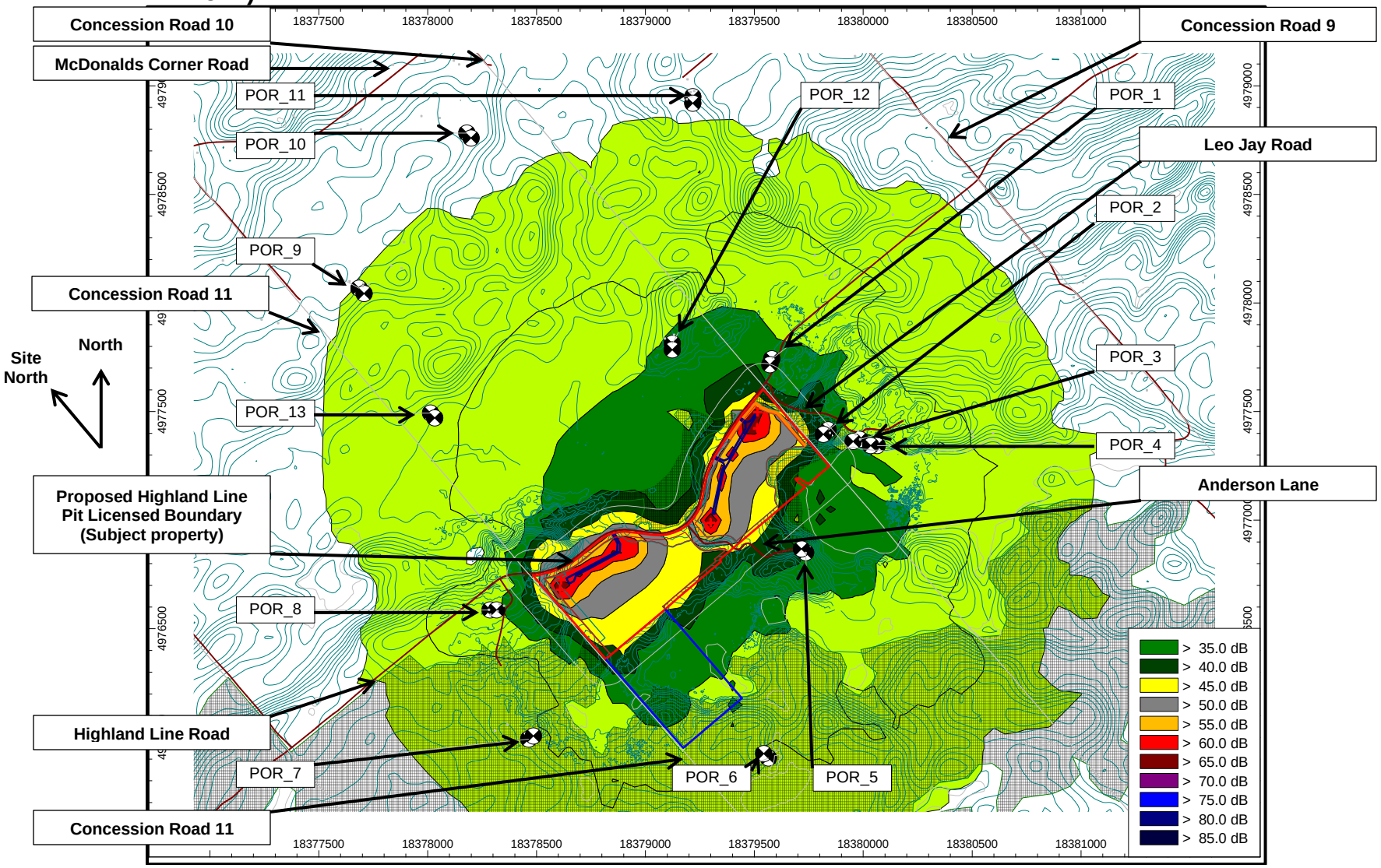


Figure 21: Detail site plan showing location of site berms and barrier requirements

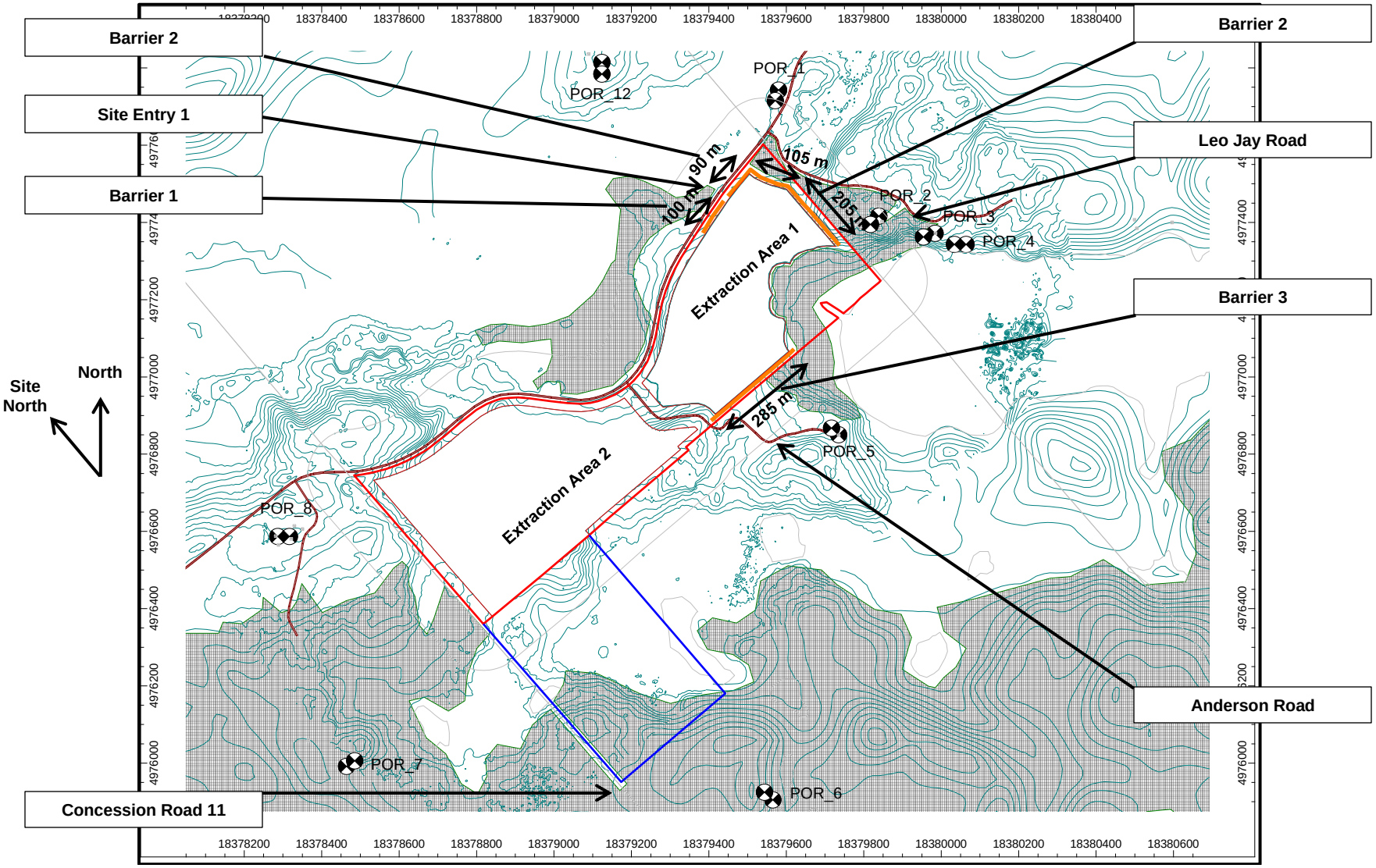


Figure 22: Detail plan at Mobile Screening Plant showing location of noise barriers (stockpiles) when operating in Extraction Area 1

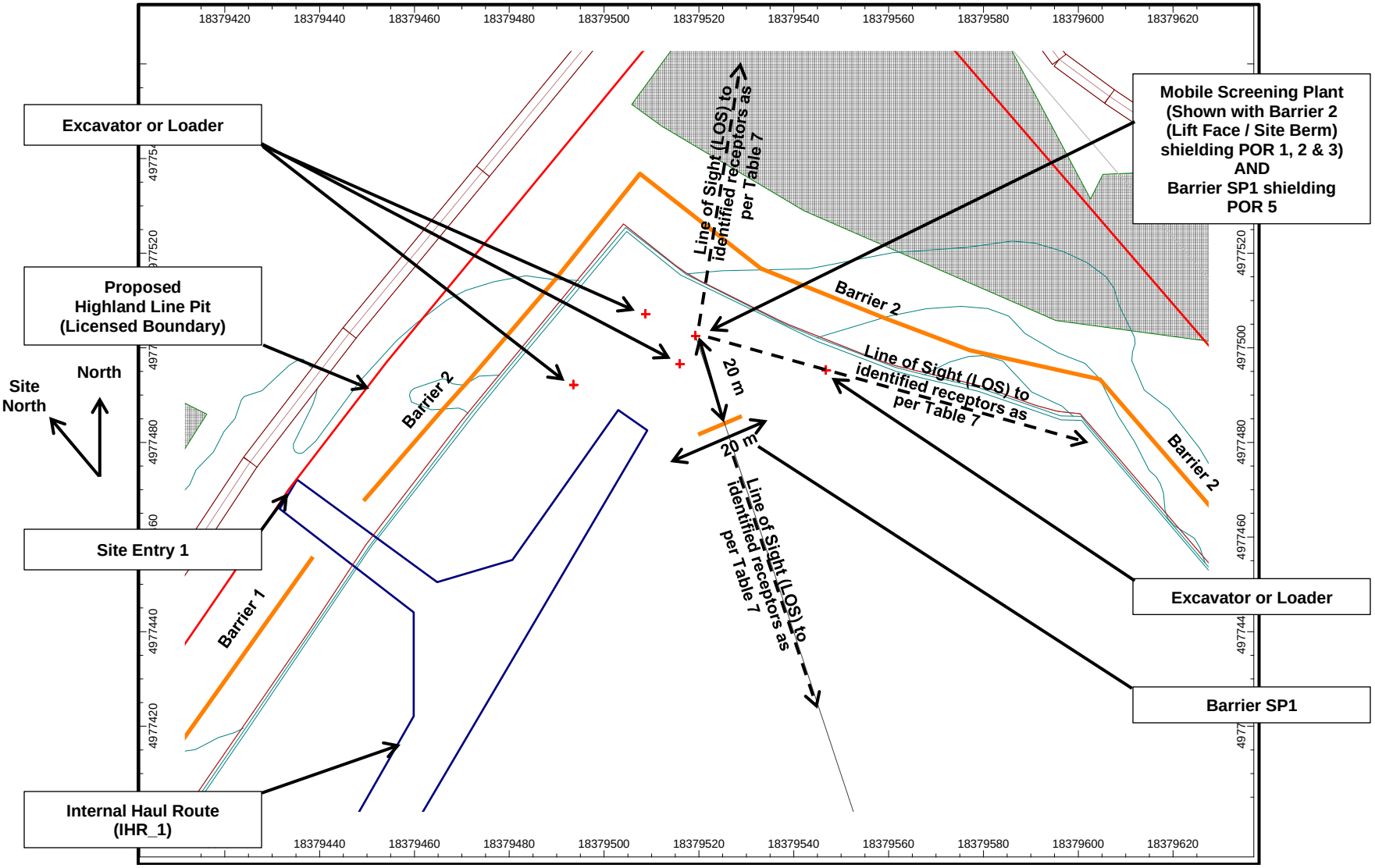


Figure 23: Detail plan at Wash Plant showing location of noise barriers (stockpiles) when operation in Extraction Area 1

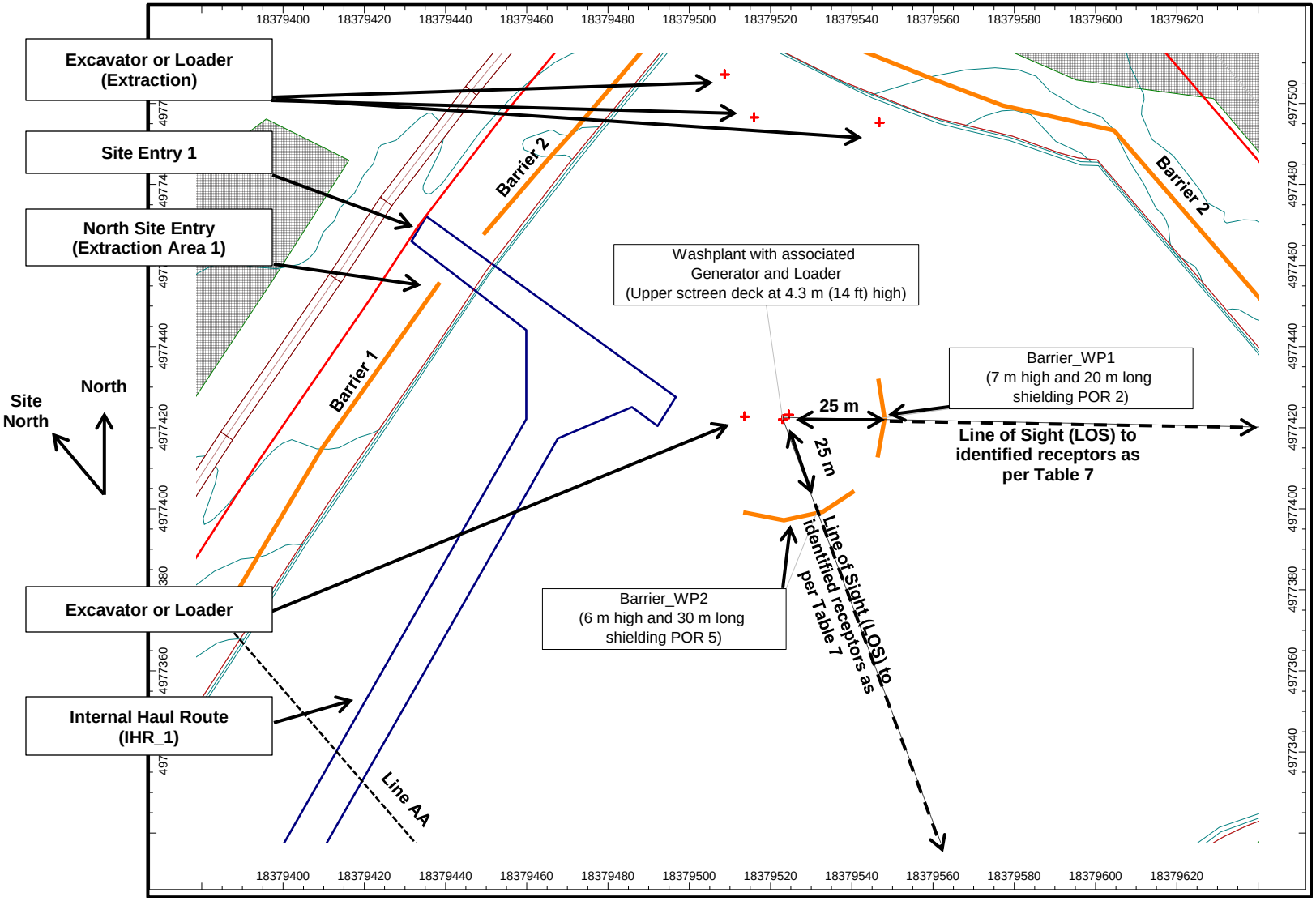


Figure 24: Detail plan at Mobile Crushing Plant showing location of noise barrier (stockpile) when operating in Extraction Area 1

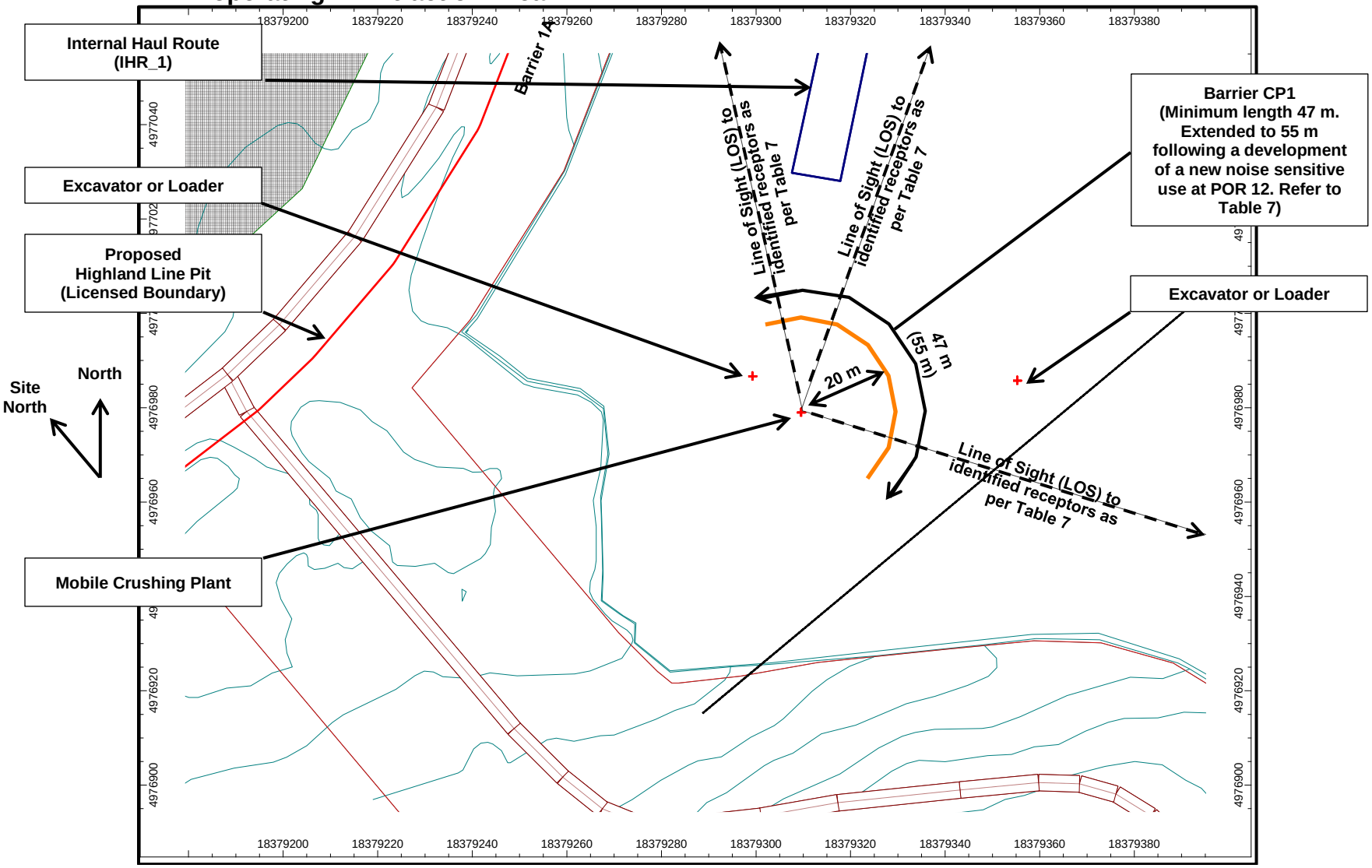
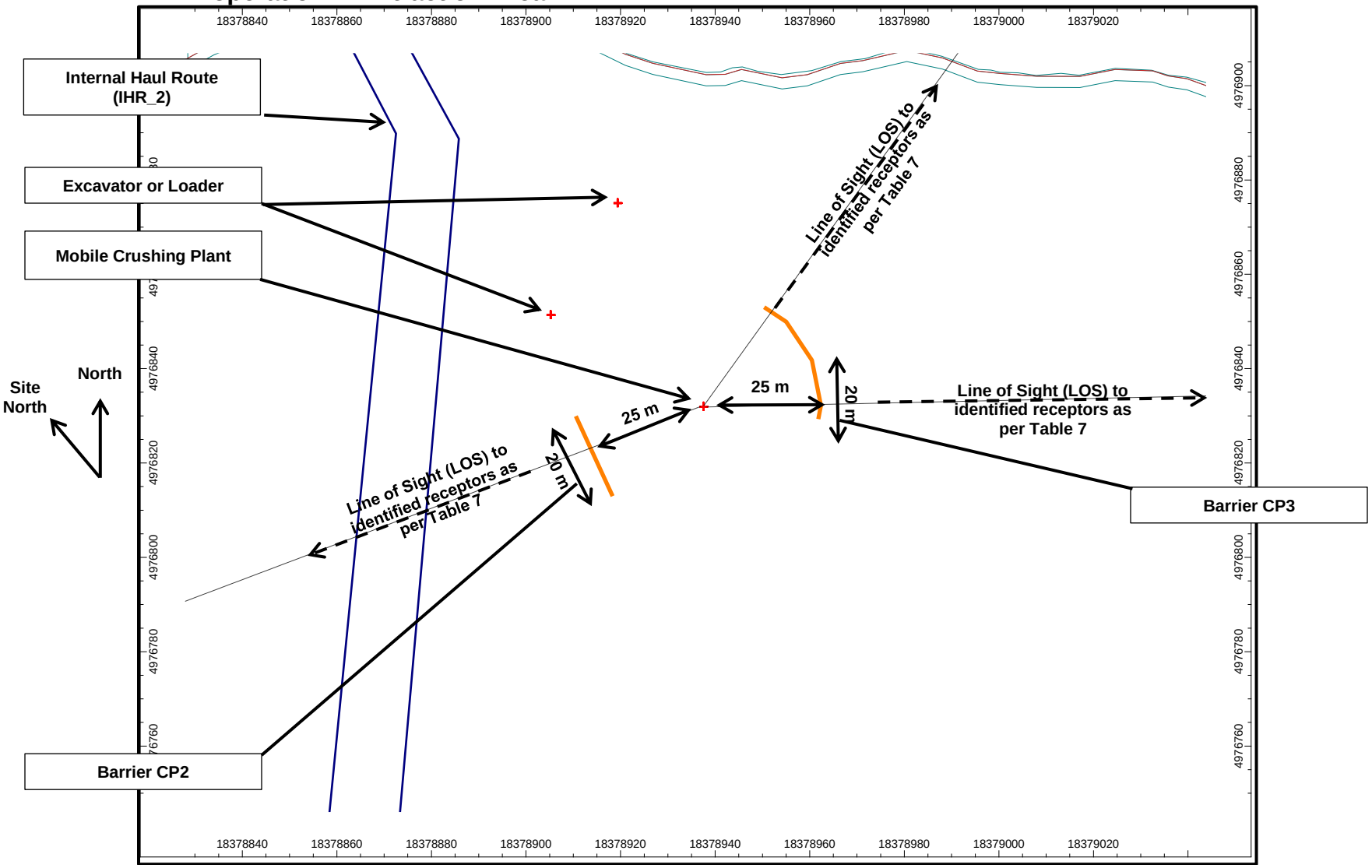


Figure 25: Detail plan at Mobile Crushing Plant showing location of noise barriers (stockpiles) when operation in Extraction Area 2



Appendix 1

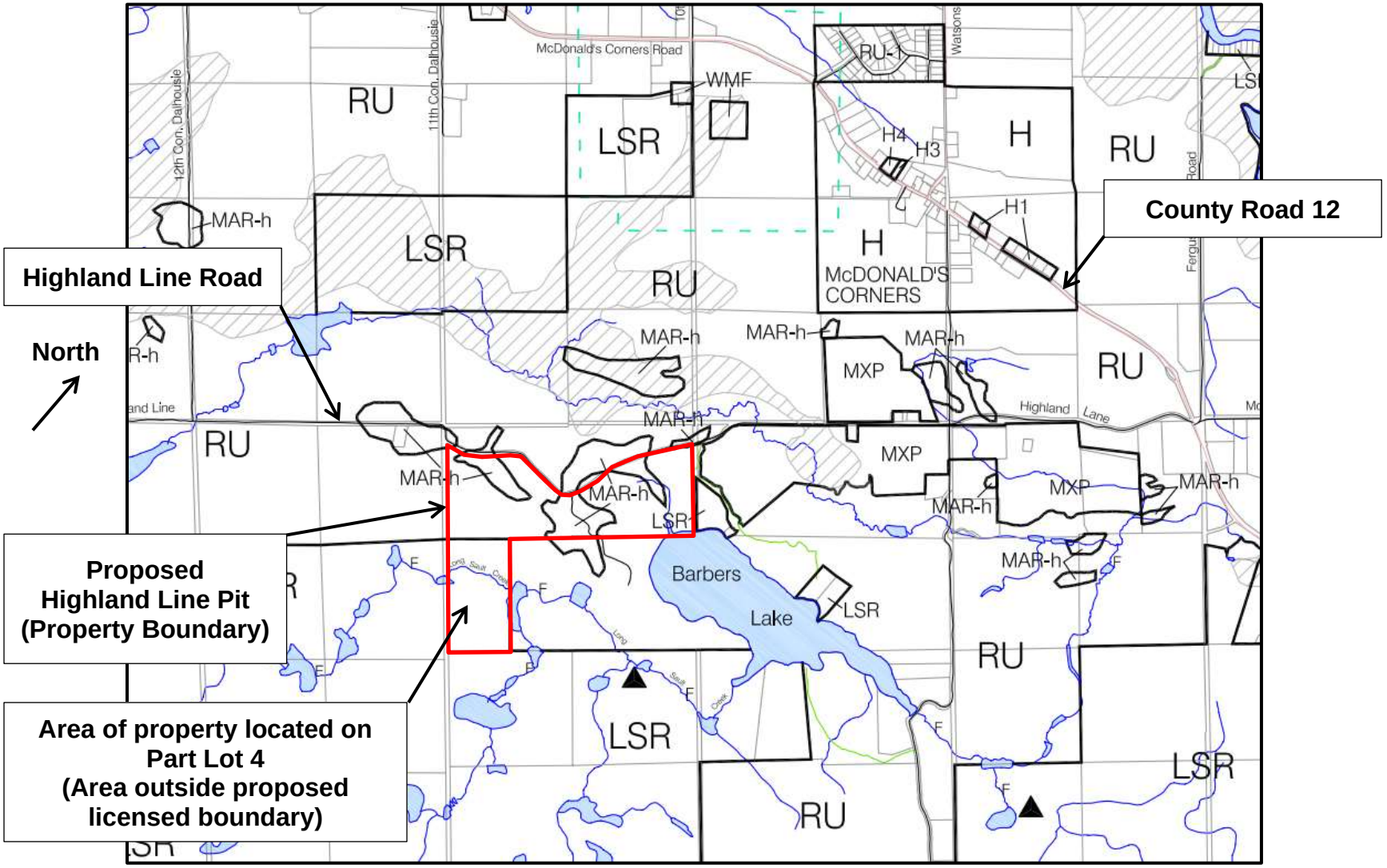
Zoning Plan and Land Use Designations

Contents:

- **Zoning Map**: Zoning By-law for the Township of Lanark Highlands, Dalhousie and North Sherbrooke, Schedule A2, By-law no. 2003-451 (source: Township of Lanark Highlands)

Legend:

Zoning Map: Zoning By-law for the Township of Lanark Highlands, Dalhousie and North Sherbrooke, Schedule A2, By-law no. 2003-451 (source: Township of Lanark Highlands)



Appendix 2

Acoustic Modelling Details

Modeling Notes:

1. Acoustic model developed uses Cadna-A software, Version 2021.
2. Sound propagation is modeled according to ISO 9613-2: 1996(E).
3. The whole of the extraction area is modelled with an absorption coefficient of 0.35 representative of exposed earth. The surrounding area is modeled with an absorption coefficient of 1.0 indicative of a Class 3 Area.
4. MECP favoured conservative modelling assumptions are used, that is, 'no subtraction of negative ground attenuation' and 'no negative path differences'.

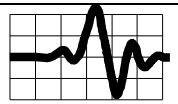
Contents:

Table A2.1 Point of Reception Location Table

Name	ID	Height	Coordinates		
			X	Y	Z
		(m)	(m)	(m)	(m)
POR_1_POW	POR_1_POW	4.5	18379580.1	4977742.3	196.6
POR_1_OPR	POR_1_OPR	1.5	18379571.9	4977715.2	193.5
POR_2_POW	POR_2_POW	2.0	18379839.3	4977415.9	202.3
POR_2_OPR	POR_2_OPR	1.5	18379817.4	4977394.7	203.4
POR_3_POW	POR_3_POW	4.5	18379984.5	4977371.5	202.5
POR_3_OPR	POR_3_OPR	1.5	18379954.5	4977361.9	193.4
POR_4_POW	POR_4_POW	2.0	18380064.5	4977342.7	192.2
POR_4_OPR	POR_4_OPR	1.5	18380034.5	4977342.7	191.8
POR_5_POW	POR_5_POW	4.5	18379735.4	4976850.1	202.5
POR_5_OPR	POR_5_OPR	1.5	18379716.7	4976867.3	197.5
POR_6_POW	POR_6_POW	4.5	18379565.3	4975904.7	208.5
POR_6_OPR	POR_6_OPR	1.5	18379543.8	4975924.4	208.0
POR_7_POW	POR_7_POW	4.5	18378464.3	4975991.3	212.5
POR_7_OPR	POR_7_OPR	1.5	18378485.6	4976005.7	210.1
POR_8_POW	POR_8_POW	3.0	18378286.9	4976586.7	217.0
POR_8_OPR	POR_8_OPR	1.5	18378316.9	4976586.7	215.5
POR_9_POW	POR_9_POW	4.5	18377685.2	4978067.5	211.8
POR_9_OPR	POR_9_OPR	1.5	18377708.6	4978043.4	206.9
POR_10_POW	POR_10_POW	4.5	18378180.5	4978781.9	211.9
POR_10_OPR	POR_10_OPR	1.5	18378199.5	4978759.0	208.6
POR_11_POW	POR_11_POW	4.5	18379217.5	4978949.3	209.3
POR_11_OPR	POR_11_OPR	1.5	18379217.5	4978919.3	204.6
POR_12_POW	POR_12_POW	4.5	18379123.8	4977813.8	203.6
POR_12_OPR	POR_12_OPR	1.5	18379123.8	4977783.8	199.6
POR_13_POW	POR_13_POW	4.5	18378013.4	4977492.9	195.2
POR_13_OPR	POR_13_OPR	1.5	18378032.9	4977470.5	191.5

Table A2.2 Point Sources

ID	Result. PWL			Lw / Li	Noise Source Library File	Operating Time			Direct.	Attenuation	Height	Coordinates		
	Day	Evening	Night	Type	Value	Day	Evening	Night				X	Y	Z
	(dBA)	(dBA)	(dBA)			(min/hr)	(min/hr)	(min/hr)			(m)	(m)	(m)	(m)
Crusher_S1_2_5_6	120.0	120.0	120.0	Lw	Crusher_KPI_JCI	60.0	0.0	0.0	(none)	-	3.0	18379309.5	4976979.0	191.0
Crusher_S3_4_7_8	120.0	120.0	120.0	Lw	Crusher_KPI_JCI	60.0	0.0	0.0	(none)	-	3.0	18378937.5	4976831.9	191.0
Screener_S1	111.0	111.0	111.0	Lw	Powerscreen_Chiefton_1700	60.0	0.0	0.0	(none)	-	3.0	18379519.2	4977502.5	191.0
Screener_S2	111.0	111.0	111.0	Lw	Powerscreen_Chiefton_1700	60.0	0.0	0.0	(none)	-	3.0	18379453.9	4976961.8	191.0
Screener_S3	111.0	111.0	111.0	Lw	Powerscreen_Chiefton_1700	60.0	0.0	0.0	(none)	-	3.0	18378838.0	4976430.7	191.0
Screener_S4	111.0	111.0	111.0	Lw	Powerscreen_Chiefton_1700	60.0	0.0	0.0	(none)	-	3.0	18378640.0	4976699.1	191.0
Washplant	109.9	109.9	109.9	Lw	Washplant	60.0	0.0	0.0	(none)	-	4.3	18379523.0	4977422.0	192.3
Generator	108.5	108.5	108.5	Lw	Generator_600kW	60.0	0.0	0.0	Chimney (VDI 3733)	Silex_Silencer_Model_JB_6	4.0	18379524.5	4977423.2	192.0
Excavator_1_S1_2_5_6	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18379355.3	4976985.7	190.5
Excavator_1_S3_4_7_8_9	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18378919.4	4976875.1	190.5
Excavator_2_S1_5	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18379546.8	4977495.2	190.5
Excavator_2_S2_6	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18379491.0	4976980.3	190.5
Excavator_2_S3_7	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18378796.7	4976458.1	200.5
Excavator_2_S4_8_9	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18378608.6	4976679.5	200.5
Excavator_3_S1_5_9	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18379516.0	4977496.5	190.5
Excavator_3_S2_6	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18379416.1	4976935.9	190.5
Excavator_3_S3_7	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18378819.4	4976497.7	190.5
Excavator_3_S4_8	103.2	103.2	103.2	Lw	Excavator	60	60	60	(none)	-	2.5	18378664.5	4976674.7	190.5
Loader_1__S1_2_5_6_9	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18379299.2	4976986.7	190.5
Loader_1_S3_4_7_8	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18378905.2	4976851.4	190.5
Loader_2_S1_5	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18379508.7	4977507.1	190.5
Loader_2_S2_6	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18379434.9	4976953.0	190.5
Loader_2_S3_7	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18378880.5	4976492.7	190.5



ID	Result. PWL			Lw / Li	Noise Source Library File	Operating Time			Direct.	Attenuation	Height	Coordinates		
	Day	Evening	Night	Type	Value	Day	Evening	Night				X	Y	Z
	(dBA)	(dBA)	(dBA)			(min/hr)	(min/hr)	(min/hr)			(m)	(m)	(m)	(m)
Loader_2_S4_8_9	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18378612.7	4976723.1	190.5
Loader_3_S1	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18379493.5	4977492.1	190.5
Loader_3_S2	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18379434.0	4976942.1	190.5
Loader_3_S3	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18378890.4	4976461.7	190.5
Loader_3_S4	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18378594.4	4976697.7	200.5
Loader_3_S5_6_7_8_9	103.0	103.0	103.0	Lw	Loader	60	60	60	(none)	-	2.5	18379513.6	4977422.7	190.5

Table A2.3 Line Sources

ID	Result. PWL			Lw / Li	Noise Source Library File	Direct.	Moving Pt. Src			
	Day	Evening	Night	Type	Value		Number			Speed
	(dBA)	(dBA)	(dBA)				Day	Evening	Night	(km/h)
IHR_1_S1	107.9	103.1	103.1	PWL-Pt	HWYTruck_Slow58	(none)	15.0	5.0	5.0	30.0
IHR_1_S2	108.4	103.6	103.6	PWL-Pt	HWYTruck_Slow58	(none)	15.0	5.0	5.0	30.0
IHR_1_S5	107.6	102.9	102.9	PWL-Pt	HWYTruck_Slow58	(none)	15.0	5.0	5.0	30.0
IHR_1_S6	108.6	103.8	103.8	PWL-Pt	HWYTruck_Slow58	(none)	15.0	5.0	5.0	30.0
IHR_1_S7_8	105.2	100.5	100.5	PWL-Pt	HWYTruck_Slow58	(none)	15.0	5.0	5.0	30.0
IHR_1_S9	103.1	103.1	103.1	PWL-Pt	HWYTruck_Slow58	(none)	5.0	5.0	5.0	30.0
IHR_2_S3_7	106.7	105.0	105.0	PWL-Pt	HWYTruck_Slow58	(none)	15.0	10.0	10.0	30.0
IHR_2_S4_8	105.9	104.1	104.1	PWL-Pt	HWYTruck_Slow58	(none)	15.0	10.0	10.0	30.0
IHR_2_S9	104.1	104.1	104.1	PWL-Pt	HWYTruck_Slow58	(none)	10.0	10.0	10.0	30.0

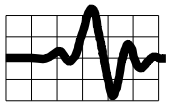


Table A2.4 Noise Barriers

ID	Height
	(m)
Barrier_1	196 mASL
Barrier_2	196 mASL
Barrier_3	3.0
Barrier_SP1	4.0
Barrier_SP1	4.0
Barrier_CP1	10.0
Barrier_CP2	6.0
Barrier_CP3	6.0
Barrier_WP1	7.0
Barrier_WP2	6.0

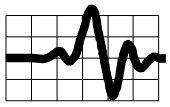


Table A2.5 Noise Source Library

ID	Type	Spectra (dB)											Source
		31.5	63	125	250	500	1000	2000	4000	8000	A	lin	
Powerscreen_Chiefton_1700	Lw	106.9	110.7	112.9	110.6	104.8	105.2	104.9	101.0	92.0	111.0	117.7	Measured 21 Oct 2019, Cavanaugh Pine Grove Pit
Washplant	Lw	112.8	116.6	117.9	105.6	103.6	104.0	103.3	99.9	88.2	109.9	121.4	Measured Lanark Quarry 14 Oct 2020 72 at 73 m
Generator_600kW	Lw	65.3	97.8	112.9	120.6	122.2	123.3	125.3	121.5	109.7	129.7	130.0	Manufacturers Data - Cummins600DQPAA-Open Exhaust
Crusher_KPI_JCI	Lw	115.5	123.3	122.3	118.8	114.9	116.5	111.7	105.9	96.4	120.0	127.7	Measured 18 March 2019, KNL Construction Site
Loader	Lw	107.3	109.5	107.1	101.8	99.4	97.6	95.9	90.1	82.9	103.0	113.6	Meas. Howe-Ross Pit 20-05-13 72dBA at 14m
Excavator	Lw	100.0	110.2	109.0	100.8	98.5	98.0	95.2	92.6	87.7	103.2	113.5	Meas. OTR 23rd August 2017 at 13.0m
HWYTruck_Slow58	Lw	115.9	112.7	110.2	101.6	101.4	105.0	104.2	97.6	103.5	110.1	119.0	Brockville McDowell Study, 2003

Table A2.6 Noise Measurement Data

ID	Type	Spectra (dB)											Source*
		31.5	63	125	250	500	1000	2000	4000	8000	A	lin	
Meas_Washplant	Li	74.9	78.7	80.0	67.7	65.7	66.1	65.4	62.0	50.3	72.0	83.5	Measured Lanark Quarry 14 Oct 2020 72 at 73 m
Meas_Powerscreen_Chiefton_1700	Li	66.2	70.0	72.2	69.9	64.1	64.5	64.2	60.3	51.3	70.3	77.0	Measured 21 Oct 2019, Cavanaugh Pine Grove Pit
Meas_Crusher_KPI_JCI	Li	67.3	77.0	71.3	72.5	65.4	70.0	65.1	57.7	48.1	72.9	80.2	Measured 18 March 2019, KNL Construction Site@50m
Meas_Loader	Li	76.3	78.5	76.1	70.8	68.4	66.6	64.9	59.1	51.9	72.0	82.6	Meas. Howe-Ross Pit 20-05-13 72dBA at 14m
Meas_Excavator_CAT345DL	Li	69.6	79.8	78.6	70.4	68.1	67.6	64.8	62.2	57.3	72.8	83.1	Meas. OTR 23rd August 2017 at 13.0m
Meas_HWYTruck_Slow58	Li	67.5	64.3	61.8	53.2	53.0	56.6	55.8	49.2	55.1	61.7	70.6	adj. 90m source Brockville McDowell Study, 2003

Table A2.7.1 Point of Reception Impacts by Source for Scenario 1*

Source	Daytime Period (07:00 – 19:00)																									
	POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW	POR_13_OPR
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
Crusher_S1_2_5_6	38.0	31.9	37.5	37.6	34.3	33.0	33.1	33.1	40.0	38.8	30.1	28.9	37.9	31.3	41.0	40.3	33.1	32.1			29.0	28.7	38.1	37.0	37.3	36.5
IHR_1_S1	36.4	36.4	30.7	35.5	35.3	31.3	33.6	33.5	36.9	33.6	22.6	20.6	21.4	16.7	20.3	19.6	17.9	17.3	17.6	16.0	20.0	19.0	31.7	31.2	20.4	19.8
Screener_S1	35.6	35.9	33.1	35.3	29.2	24.2	21.8	20.5	36.6	33.9	26.1	23.9	24.6	21.9	26.3	25.3	23.0	21.6	23.2	21.8	25.9	24.8	36.1	35.2	26.0	24.8
Loader_3_S1	33.3	32.9	26.6	28.8	22.2	18.1	15.9	14.8	33.2	29.5	19.4	17.4	18.0	15.2	19.0	18.5	15.5	14.6	13.6	12.7	18.3	14.1	25.7	25.5	18.3	17.4
Loader_2_S1_5	29.9	30.2	25.7	28.3	22.4	18.4	16.1	15.0	33.1	29.5	19.3	17.3	17.9	15.2	19.1	18.6	15.6	14.8	14.3	13.3	18.7	14.8	26.3	25.9	18.5	17.6
Excavator_3_S1_5_9	29.8	30.2	27.0	29.1	22.8	18.9	16.6	15.5	30.9	28.1	19.4	17.5	17.9	15.7	19.5	18.9	16.2	15.3	16.3	15.5	19.1	17.2	28.8	28.3	19.1	18.3
Excavator_1_S1_2_5_6	27.8	27.4	27.6	31.2	27.3	24.6	21.3	21.9	21.5	18.7	9.1	8.5	21.0	14.7	15.5	14.8	16.5	15.8			16.7	16.0	26.3	25.9	20.4	19.7
Excavator_2_S1_5	26.4	27.3	26.0	29.3	22.1	17.8	15.5	14.8	33.3	29.9	19.4	17.6	17.9	15.8	19.4	18.8	16.5	15.7	16.3	15.5	17.4	16.0	30.5	30.1	19.5	18.7
Loader_1__S1_2_5_6_9	18.9	14.2	21.0	21.2	22.0	21.0	17.7	17.7	25.0	23.8	14.5	13.4	21.1	16.0	24.1	23.2	16.5	15.6			16.6	15.8	26.2	25.7	20.5	19.8
Total	42.9	41.7	40.5	42.4	39.2	36.3	36.8	36.7	44.4	42.0	33.0	31.4	38.5	32.4	41.3	40.7	34.0	33.1	26.0	24.8	32.2	31.3	41.9	41.1	38.1	37.2

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.7.2 Point of Reception Impacts by Source for Scenario 2*

Source	Daytime Period (07:00 – 19:00)																									
	POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW	POR_13_OPR
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
Crusher_S1_2_5_6	38.0	31.9	37.5	37.6	38.2	36.9	37.0	37.0	37.2	36.7	30.1	28.9	37.9	31.3	41.0	40.3	33.1	32.1			29.0	28.7	38.1	37.0	37.3	36.5
IHR_1_S2	36.4	36.4	31.5	36.1	37.1	33.0	35.2	34.4	37.9	36.0	22.6	20.7	22.0	16.2	22.1	21.5	18.0	17.6	16.9	15.5	20.1	19.3	31.4	30.8	21.5	20.9
Screener_S2	34.9	34.1	35.4	35.7	36.2	36.1	34.8	35.3	32.7	33.1	15.8	15.0	25.9	15.7	29.7	27.3						22.2	32.8	32.3	26.4	25.4
Excavator_2_S2_6	28.1	27.7	29.0	32.8	33.8	32.8	28.2	28.4	23.2	24.0	8.2	7.5	20.5	12.6	22.0	19.2					16.7	16.0	25.8	25.4	19.5	18.7
Excavator_1_S1_2_5_6	27.8	27.4	27.6	31.2	32.4	30.5	30.6	30.3	32.1	31.0	15.3	14.2	21.0	14.7	15.5	14.8	16.5	15.8			16.7	16.0	26.3	25.9	20.4	19.7
Loader_2_S2_6	27.7	27.2	28.1	28.3	28.7	28.4	27.4	28.0	26.2	26.4	10.2	9.5	16.6	8.3	22.1	17.9						15.7	25.8	25.3	19.7	18.9
Loader_3_S2	27.6	27.0	28.0	28.2	30.1	29.2	27.2	27.4	24.9	24.7	8.6	8.0	15.0	7.3	19.1	15.0						15.6	25.7	25.2	19.7	18.9
Excavator_3_S2_6	27.4	27.0	27.8	28.0	28.3	28.1	27.1	28.3	25.9	25.6	9.9	9.2	11.5	5.9	15.4	12.3						15.7	25.6	25.2	19.8	19.1
Loader_1__S1_2_5_6_9	18.9	14.2	21.0	21.2	22.0	21.0	21.0	21.1	23.1	22.3	14.5	13.4	21.1	16.0	24.1	23.2	16.5	15.6			16.6	15.8	26.2	25.7	20.5	19.8
Total	42.2	40.5	41.4	42.8	43.5	42.1	41.7	41.7	42.2	41.3	31.2	30.0	38.5	31.8	41.6	40.7	33.4	32.5	16.9	15.5	30.2	30.8	40.8	40.0	38.2	37.3

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.7.3 Point of Reception Impacts by Source for Scenario 3*

Source	Daytime Period (07:00 – 19:00)																								
	POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW	POR_13_OPR
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
Crusher_S3_4_7_8	40.1	38.2	39.6	39.2	40.0	39.4	38.9	38.8	40.7	38.6	39.4	37.9	41.4	37.6	43.7	42.1	34.6	33.8					41.4	40.9	40.0	39.3
Screener_S3	26.9	26.0	27.5	26.6	27.3	26.7	25.9	25.8	26.4	25.6	23.0	21.1	15.8	15.4	24.0	24.0		22.2					31.9	29.9	28.2	27.3
Excavator_2_S3_7	24.2	19.5	24.4	23.1	20.5	19.9	19.4	19.3	24.5	23.8	24.3	22.7	22.7	17.7	23.8	23.4	16.9	16.1					25.1	23.4	21.8	21.1
Excavator_1_S3_4_7_8_9	23.2	22.6	22.9	22.4	23.0	21.8	21.9	21.8	27.1	26.2	22.2	20.9	24.2	21.1	29.0	28.7	18.2	17.4					24.5	24.0	23.4	22.7
Loader_1_S3_4_7_8	23.2	22.5	22.5	22.1	22.8	21.4	21.6	21.6	25.6	21.7	22.3	20.9	24.4	20.8	29.3	28.9	18.2	17.4					24.6	24.0	23.4	22.8
IHR_2_S3_7	22.9	22.5	25.9	25.3	24.5	22.7	22.3	22.2	27.8	27.3	22.2	19.1	25.5	19.8	30.7	29.9	18.0	17.4	2.6	14.1			28.2	24.5	23.7	23.3
Loader_2_S3_7	20.7	19.9	21.2	20.5	21.2	20.4	19.8	19.7	22.0	23.6	17.0	15.2	19.0	15.2	25.4	24.5	16.6	15.8					25.6	23.7	21.5	20.7
Excavator_3_S3_7	20.5	19.8	21.0	20.3	20.8	20.2	19.7	19.6	24.9	24.2	21.3	19.0	12.0	11.4	21.3	20.7	17.0	16.2					25.4	23.8	21.8	21.1
Loader_3_S3	20.5	19.8	21.1	20.3	20.8	20.3	19.5	19.5	16.9	16.9	13.7	12.4	18.3	15.3	24.6	23.6		15.7					25.4	20.5	21.2	20.5
Total	40.7	39.0	40.5	40.0	40.7	40.0	39.6	39.4	41.6	39.8	40.0	38.4	41.8	38.0	44.4	42.9	35.1	34.6	2.6	14.1	-80.2	-80.2	42.5	41.7	40.7	40.1

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.7.4 Point of Reception Impacts by Source for Scenario 4*

Source	Daytime Period (07:00 – 19:00)																								
	POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW	POR_13_OPR
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
Crusher_S3_4_7_8	40.1	38.2	39.6	39.2	40.0	39.4	38.9	38.8	40.7	38.6	39.4	37.9	41.4	37.6	43.7	42.1	34.6	33.8					41.4	40.9	40.0	39.3
Screener_S4	27.6	26.7	27.4	26.4	31.5	26.4	26.1	25.9	30.9	30.2	28.5	26.8	15.6	11.6	27.7	27.7	20.7	20.3					29.1	28.3	20.6	20.1
Excavator_2_S4_8_9	24.4	22.8	24.0	22.7	24.3	22.6	22.8	22.1	23.6	23.0	21.7	20.4	13.4	9.2	23.4	23.8	18.5	17.8					26.0	24.4	21.4	20.8
Loader_3_S4	24.4	22.4	23.9	22.4	24.3	22.3	22.6	21.8	23.6	22.8	22.2	20.1	14.2	8.5	23.7	23.9	16.9	15.9					22.0	21.3	18.3	17.9
Excavator_1_S3_4_7_8_9	23.2	22.6	22.9	22.4	23.0	21.8	21.9	21.8	27.1	26.2	22.2	20.9	24.2	21.1	29.0	28.7	18.2	17.4					24.5	24.0	23.4	22.7
Loader_1_S3_4_7_8	23.2	22.5	22.5	22.1	22.8	21.4	21.6	21.6	25.6	21.7	22.3	20.9	24.4	20.8	29.3	28.9	18.2	17.4					24.6	24.0	23.4	22.8
IHR_2_S4_8	22.0	21.7	21.8	21.4	25.7	21.4	21.1	21.1	26.5	25.9	22.0	19.9	24.6	18.2	30.6	30.0	17.3	16.8	1.8	6.4			23.6	23.3	22.2	21.1
Excavator_3_S4_8	20.8	20.1	20.8	20.1	20.5	19.9	19.5	19.5	24.2	23.5	22.1	20.5	12.2	8.2	21.6	21.8	17.8	17.0					22.2	21.6	18.8	18.3
Loader_2_S4_8_9	19.4	19.8	20.4	19.4	24.5	19.5	19.1	19.0	23.8	23.0	21.4	19.9	7.8	5.6	19.9	20.3	5.8	5.8					13.7	13.9	8.6	8.7
Total	40.8	39.1	40.4	39.9	41.2	40.0	39.6	39.4	41.9	40.0	40.2	38.7	41.7	37.8	44.4	43.0	35.3	34.5	1.8	6.4	-80.2	-80.2	42.1	41.5	40.4	39.8

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.7.5 Point of Reception Impacts by Source for Scenario 5*

Source	Daytime Period (07:00 – 19:00)																								
	POR 1 POW	POR 1 OPR	POR 2 POW	POR 2 OPR	POR 3 POW	POR 3 OPR	POR 4 POW	POR 4 OPR	POR 5 POW	POR 5 OPR	POR 6 POW	POR 6 OPR	POR 7 POW	POR 7 OPR	POR 8 POW	POR 8 OPR	POR 9 POW	POR 9 OPR	POR 10 POW	POR 10 OPR	POR 11 POW	POR 11 OPR	POR 12 POW	POR 12 OPR	POR 13 POW	POR 13 OPR
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
Crusher_S1_2_5_6	38.0	31.9	37.5	37.6	34.3	33.0	33.1	33.1	40.0	38.8	30.1	28.9	37.9	31.3	41.0	40.3	33.1	32.1			29.0	28.7	38.1	37.0	37.3	36.5
Washplant	37.7	37.9	34.2	36.5	29.0	23.9	23.1	22.2	36.3	33.9	26.5	24.6	24.9	23.4	26.5	26.0	23.1	22.3	23.3	22.5	25.9	25.1	37.0	37.2	26.1	25.3
Generator	36.6	36.7	26.7	30.7	19.2	10.7	9.4	8.3	36.1	32.3	21.4	18.2	19.1	16.8	21.5	21.4	16.1	15.9	16.4	16.2	20.5	20.4	36.9	37.3	21.0	20.8
IHR_1_S5	36.3	36.3	30.6	34.7	36.0	30.9	34.1	34.1	36.8	33.5	22.5	20.5	21.2	16.5	19.9	19.2	17.7	17.1	17.3	15.9	19.6	18.8	31.6	31.2	20.1	19.5
Loader_3_S5_6_7_8_9	30.9	30.7	25.4	28.2	20.1	15.7	13.7	13.4	29.6	26.1	19.4	15.4	18.4	15.7	19.9	19.2	16.7	15.9	17.0	16.1	19.4	18.6	31.1	30.5	19.8	19.0
Loader_2_S1_5	29.9	30.2	25.7	28.3	22.4	18.4	16.1	15.0	33.1	29.5	19.3	17.3	17.9	15.2	19.1	18.6	15.6	14.8	14.3	13.3	18.7	14.8	26.3	25.9	18.5	17.6
Excavator_3_S1_5_9	29.8	30.2	27.0	29.1	22.8	18.9	16.6	15.5	33.1	29.7	19.4	17.5	17.9	15.7	19.5	18.9	16.2	15.3	16.3	15.5	19.1	17.2	28.8	28.3	19.1	18.3
Excavator_1_S1_2_5_6	27.8	27.4	27.6	31.2	27.3	24.6	21.3	21.9	21.5	18.7	9.1	8.5	21.0	14.7	15.5	14.8	16.5	15.8			16.7	16.0	26.3	25.9	20.4	19.7
Excavator_2_S1_5	26.4	27.3	26.0	29.3	22.1	17.8	15.5	14.8	33.3	29.9	19.4	17.2	17.9	15.8	19.4	18.8	16.5	15.7	16.3	15.5	17.4	16.0	30.5	30.1	19.5	18.7
Loader_1__S1_2_5_6_9	18.9	14.2	21.0	21.2	22.0	21.0	17.7	17.7	25.0	23.8	14.5	13.4	21.1	16.0	24.1	23.2	16.5	15.6			16.6	15.8	26.2	25.7	20.5	19.8
Total	44.0	43.2	40.9	42.7	39.5	36.1	37.1	37.1	44.9	42.4	33.3	31.7	38.5	32.7	41.4	40.7	34.1	33.2	26.7	25.9	32.5	31.8	43.5	43.2	38.2	37.4

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.7.6 Point of Reception Impacts by Source for Scenario 6*

Source	Daytime Period (07:00 – 19:00)																								
	POR 1 POW	POR 1 OPR	POR 2 POW	POR 2 OPR	POR 3 POW	POR 3 OPR	POR 4 POW	POR 4 OPR	POR 5 POW	POR 5 OPR	POR 6 POW	POR 6 OPR	POR 7 POW	POR 7 OPR	POR 8 POW	POR 8 OPR	POR 9 POW	POR 9 OPR	POR 10 POW	POR 10 OPR	POR 11 POW	POR 11 OPR	POR 12 POW	POR 12 OPR	POR 13 POW	POR 13 OPR
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
Crusher_S1_2_5_6	38.0	31.9	37.5	37.6	38.2	36.9	37.0	37.0	37.2	36.7	30.1	28.9	37.9	31.3	41.0	40.3	33.1	32.1			29.0	28.7	38.1	37.0	37.3	36.5
Washplant	37.7	37.9	34.2	36.5	29.0	23.9	23.1	22.2	36.3	33.9	26.5	24.6	24.9	23.4	26.5	26.0	23.1	22.3	23.3	22.5	25.9	25.1	37.0	37.2	26.1	25.3
Generator	36.6	36.7	26.7	30.7	19.2	10.7	9.4	8.3	36.1	32.3	21.4	18.2	19.1	16.8	21.5	21.4	16.1	15.9	16.4	16.2	20.5	20.4	36.9	37.3	21.0	20.8
IHR_1_S6	36.6	36.6	31.6	35.8	36.9	33.0	35.1	35.1	37.9	36.1	22.7	20.8	22.1	16.4	22.3	21.7	18.5	18.0	17.2	15.8	20.3	19.5	32.2	31.8	21.6	21.0
Loader_3_S5_6_7_8_9	30.9	30.7	25.4	28.2	20.1	15.7	13.7	13.4	29.6	26.1	19.4	15.4	18.4	15.7	19.9	19.2	16.7	15.9	17.0	16.1	19.4	18.6	31.1	30.5	19.8	19.0
Excavator_2_S2_6	28.1	27.7	29.0	32.8	33.8	32.8	28.2	28.4	23.2	24.0	8.2	7.5	20.5	12.6	22.5	21.8					16.7	16.0	25.8	25.4	19.5	18.7
Excavator_1_S1_2_5_6	27.8	27.4	27.6	31.2	32.4	30.5	30.6	30.3	32.1	31.0	15.3	14.2	21.0	14.7	15.5	14.8	16.5	15.8			16.7	16.0	26.3	25.9	20.4	19.7
Loader_2_S2_6	27.7	27.2	28.1	31.7	33.1	31.8	31.2	30.9	26.2	26.4	10.2	9.5	16.6	8.3	22.1	17.9						15.7	25.8	25.3	19.7	18.9
Excavator_3_S2_6	27.4	27.0	27.8	31.5	32.6	31.5	27.1	30.6	25.9	25.6	9.9	9.2	11.5	5.9	15.4	12.3						15.7	25.6	25.2	19.8	19.1
Loader_1__S1_2_5_6_9	18.9	14.2	21.0	21.2	22.0	21.0	21.0	21.1	23.1	22.3	14.5	13.4	21.1	16.0	24.1	23.2	16.5	15.6			16.6	15.8	26.2	25.7	20.5	19.8
Total	44.0	43.1	41.2	43.4	43.1	41.2	40.9	41.1	43.7	42.0	32.9	31.3	38.6	32.5	41.5	40.8	33.9	33.1	25.5	24.7	32.1	31.8	43.3	43.0	38.2	37.4

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.7.7 Point of Reception Impacts by Source for Scenario 7*

Source	Daytime Period (07:00 – 19:00)																									
	POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW	POR_13_OPR
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
Crusher_S3_4_7_8	40.1	38.2	39.6	39.2	40.0	39.4	38.9	38.8	40.7	38.6	39.4	37.9	41.4	37.6	43.7	42.1	34.6	33.8					41.4	40.9	40.0	39.3
Washplant	37.7	37.9	34.2	36.5	29.0	23.9	23.1	22.2	36.3	33.9	26.5	24.6	24.9	23.5	26.5	26.0	23.1	22.3	23.3	22.5	25.9	25.1	37.0	37.2	26.1	25.3
Generator	36.6	36.7	26.7	30.7	19.2	10.7	9.4	8.3	36.1	32.3	21.4	18.2	19.1	17.0	21.5	21.4	16.1	15.9	16.4	16.2	20.5	20.4	36.9	37.3	21.0	20.8
IHR_1_S7_8	35.4	35.5	27.8	31.6	31.6	25.3	29.6	29.7	35.8	33.3	19.9	18.0	17.3	13.7	18.1	17.5	15.7	15.1	15.0	14.5	17.6	16.7	30.6	30.3	18.8	18.2
Loader_3_S5_6_7_8_9	30.9	30.7	25.4	28.2	20.1	15.7	13.7	13.4	29.6	26.1	19.4	15.4	18.4	16.2	19.9	19.2	16.7	15.9	17.0	16.1	19.4	18.6	31.1	30.5	19.8	19.0
Excavator_2_S3_7	24.2	19.5	24.4	23.1	20.5	19.9	19.4	19.3	24.5	23.8	24.3	22.7	22.7	17.7	23.8	23.4	16.9	16.1					25.1	23.4	21.8	21.1
Excavator_1_S3_4_7_8_9	23.2	22.6	22.9	22.4	23.0	21.8	21.9	21.8	27.1	26.2	22.2	20.9	24.2	21.1	29.0	28.7	18.2	17.4					24.5	24.0	23.4	22.7
Loader_1_S3_4_7_8	23.2	22.5	22.5	22.1	22.8	21.4	21.6	21.6	25.6	21.7	22.3	20.9	24.4	20.8	29.3	28.9	18.2	17.4					24.6	24.0	23.4	22.8
IHR_2_S3_7	22.9	22.5	25.9	25.3	24.5	22.7	22.3	22.2	27.8	27.3	22.2	19.1	25.5	19.8	30.7	29.9	18.0	17.4	2.6	14.1			28.2	24.5	23.7	23.3
Loader_2_S3_7	20.7	19.9	21.2	20.5	21.2	20.4	19.8	19.7	22.0	23.6	17.0	15.2	19.0	15.2	25.4	24.5	16.6	15.8					25.6	23.7	21.5	20.7
Excavator_3_S3_7	20.5	19.8	21.0	20.3	20.8	20.2	19.7	19.6	24.9	24.2	21.3	19.0	12.0	11.4	21.3	20.7	17.0	16.2					25.4	23.8	21.8	21.1
Total	44.2	43.6	41.6	42.3	41.3	40.0	39.9	39.7	44.3	42.0	40.2	38.6	41.9	38.1	44.4	43.0	35.5	34.7	25.3	25.0	28.1	27.5	44.5	44.2	40.7	40.1

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.7.8 Point of Reception Impacts by Source for Scenario 8*

Source	Daytime Period (07:00 – 19:00)																									
	POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW	POR_13_OPR
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
Crusher_S3_4_7_8	40.1	38.2	39.6	39.2	40.0	39.4	38.9	38.8	40.7	38.6	39.4	37.9	41.4	37.6	43.7	42.1	34.6	33.8					41.4	40.9	40.0	39.3
Washplant	37.7	37.9	34.2	36.5	29.0	23.9	23.1	22.2	36.3	33.9	26.5	24.6	24.9	23.5	26.5	26.0	23.1	22.3	23.3	22.5	25.9	25.1	37.0	37.2	26.1	25.3
Generator	36.6	36.7	26.7	30.7	19.2	10.7	9.4	8.3	36.1	32.3	21.4	18.2	19.1	17.0	21.5	21.4	16.1	15.9	16.4	16.2	20.5	20.4	36.9	37.3	21.0	20.8
IHR_1_S7_8	35.4	35.5	27.8	31.6	31.6	25.3	29.6	29.7	35.8	33.3	19.9	18.0	17.3	13.7	18.1	17.5	15.7	15.1	15.0	14.5	17.6	16.7	30.6	30.3	18.8	18.2
Loader_3_S5_6_7_8_9	30.9	30.7	25.4	28.2	20.1	15.7	13.7	13.4	29.6	26.1	19.4	15.4	18.4	16.2	19.9	19.2	16.7	15.9	17.0	16.1	19.4	18.6	31.1	30.5	19.8	19.0
Excavator_2_S4_8_9	24.4	22.8	24.0	22.7	24.3	22.6	22.8	22.1	23.6	23.0	21.7	20.4	13.4	9.2	23.4	23.8	18.5	17.8					26.0	24.4	21.4	20.8
Excavator_1_S3_4_7_8_9	23.2	22.6	22.9	22.4	23.0	21.8	21.9	21.8	27.1	26.2	22.2	20.9	24.2	21.1	29.0	28.7	18.2	17.4					24.5	24.0	23.4	22.7
Loader_1_S3_4_7_8	23.2	22.5	22.5	22.1	22.8	21.4	21.6	21.6	25.6	21.7	22.3	20.9	24.4	20.8	29.3	28.9	18.2	17.4					24.6	24.0	23.4	22.8
IHR_2_S4_8	22.0	21.7	21.8	21.4	25.7	21.4	21.1	21.1	26.5	25.9	22.0	19.9	24.6	18.2	30.6	30.0	17.3	16.8	1.8	6.4			23.6	23.3	22.2	21.1
Excavator_3_S4_8	20.8	20.1	20.8	20.1	20.5	19.9	19.5	19.5	24.2	23.5	22.1	20.5	12.2	8.2	21.6	21.8	17.8	17.0					22.2	21.6	18.8	18.3
Loader_2_S4_8_9	19.4	19.8	20.4	19.4	24.5	19.5	19.1	19.0	23.8	23.0	21.4	19.9	7.8	5.6	19.9	20.3	5.8	5.8					13.7	13.9	8.6	8.7
Total	44.2	43.6	41.6	42.3	41.4	40.0	39.9	39.7	44.3	41.9	40.2	38.7	41.8	38.1	44.3	43.0	35.5	34.7	25.3	24.7	28.1	27.5	44.4	44.2	40.6	40.0

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.7.9 Point of Reception Impacts by Source for Scenario 9*

Source	Evening and Nighttime Period (19:00 – 07:00)																							
	POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
IHR_1_S9	31.6	31.7	26.0	30.7	30.6	26.6	28.8	28.7	32.8	31.0	17.7	15.9	16.2	13.3	15.5	14.8	13.1	12.5	12.8	11.3	15.2	14.2	26.9	26.4	15.6
Loader_3_S5_6_7_8_9	30.9	30.7	28.7	31.1	23.6	18.1	16.3	15.4	34.2	29.7	19.9	17.8	18.4	16.2	19.9	19.2	16.7	15.9	17.0	16.1	19.4	18.6	31.1	30.5	19.8
Excavator_3_S1_5_9	29.8	30.2	27.0	29.1	22.8	18.9	16.6	15.5	33.1	29.7	19.4	17.5	17.9	16.0	19.5	18.9	16.2	15.3	16.3	15.5	19.1	17.2	28.8	28.3	19.1
Loader_1__S1_2_5_6_9	27.7	27.1	26.9	30.4	31.9	29.7	30.0	29.5	33.0	31.8	14.5	13.4	21.1	17.8	24.1	23.3	16.5	15.6			16.6	15.8	26.2	25.7	20.5
Excavator_2_S4_8_9	24.4	22.8	24.0	22.7	24.3	22.6	22.8	22.1	23.6	23.0	21.7	20.4	13.4	9.2	23.4	23.8	18.5	17.8					26.0	24.4	21.4
Excavator_1_S3_4_7_8_9	23.2	22.6	22.9	22.4	23.0	21.8	21.9	21.8	27.1	26.2	22.2	20.9	24.2	21.1	29.0	28.7	18.2	17.4					24.5	24.0	23.4
IHR_2_S9	20.2	19.8	19.9	19.5	23.9	19.5	19.4	19.2	24.7	24.3	20.2	18.2	22.8	16.4	28.8	28.2	15.5	14.9	-0.6	4.5			21.8	21.6	20.4
Loader_2_S4_8_9	19.4	19.8	20.4	19.4	24.5	19.5	19.1	19.0	23.8	23.0	21.4	19.9	7.8	5.6	19.9	20.3	5.8	5.8					13.7	13.9	8.6
Total	36.9	36.8	34.5	36.9	36.1	33.1	33.7	33.4	39.9	37.6	29.2	27.6	28.9	25.4	33.7	33.3	25.2	24.4	20.5	19.7	23.9	22.8	35.8	35.2	29.0

* Values at first floor window height (W) at 4.5 m or 2 m and Outdoor Point of Reception (OPR) at 1.5 m are given above as these where the most critical points at each receptor.

Table A2.8 Distance Source to Point of Reception

Source	Coordinates		POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW	POR_13_OPR
	X (m)		1837 9580 .07	1837 9571 .88	1837 9839 .3	1837 9817 .37	1837 9984 .46	1837 9954 .46	1838 0064 .47	1838 0034 .47	1837 9735 .39	1837 9716 .72	1837 9565 .25	1837 9543 .8	1837 8464 .29	1837 8485 .55	1837 8286 .86	1837 8316 .86	1837 7685 .16	1837 7708 .64	1837 8180 .46	1837 8199 .52	1837 9217 .49	1837 9217 .49	1837 9123 .79	1837 9123 .79	1837 8013 .41	1837 8032 .89
		Y (m)	4977 742. 32	4977 715. 22	4977 415. 89	4977 394. 72	4977 371. 54	4977 361. 94	4977 342. 74	4977 342. 74	4976 850. 07	4976 867. 27	4975 904. 68	4975 924. 38	4975 991. 28	4976 005. 73	4976 586. 73	4976 586. 73	4978 067. 51	4978 043. 38	4978 781. 85	4978 759. 04	4978 949. 27	4978 919. 27	4977 813. 76	4977 783. 76	4977 492. 92	4977 470. 48
			m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
Crusher_S1_2_5_6	1837 9309 .54	4976 978. 97	810	782	687	656	781	750	838	811	445	422	1104	1080	1300	1275	1095	1067	1955	1922	2127	2098	1972	1942	855	826	1394	1368
Crusher_S3_4_7_8	1837 8937 .53	4976 831. 94	1114	1087	1074	1044	1178	1147	1237	1210	798	780	1120	1091	965	942	695	667	1759	1726	2092	2064	2136	2106	999	970	1136	1107
Screener_S1	1837 9519 .24	4977 502. 51	247	219	332	317	483	457	568	539	687	665	1598	1578	1843	1819	1535	1511	1919	1890	1852	1822	1478	1449	503	485	1506	1487
Screener_S2	1837 9453 .94	4976 961. 84	791	763	596	565	670	641	720	694	303	279	1063	1041	1386	1361	1226	1197	2086	2053	2221	2192	2001	1972	914	886	1535	1509
Screener_S3	1837 8838 .02	4976 430. 73	1507	1479	1405	1374	1483	1454	1528	1504	991	981	898	869	577	552	573	544	2002	1969	2441	2414	2547	2517	1412	1383	1345	1315
Screener_S4	1837 8640 .03	4976 699. 08	1404	1379	1397	1367	1503	1472	1563	1536	1106	1090	1219	1190	729	710	371	342	1669	1635	2133	2107	2323	2294	1215	1188	1011	982
Washplant	1837 9523	4977 422	325	297	316	296	464	436	547	518	610	588	1518	1498	1780	1756	1492	1467	1948	1918	1911	1881	1558	1528	559	539	1511	1491
Generator	1837 9524 .5	4977 423. 15	324	296	315	294	463	434	546	516	611	588	1519	1499	1782	1757	1494	1469	1949	1919	1911	1882	1557	1527	560	539	1513	1492
Excavator_1_S1_2_5_6	1837 9355 .25	4976 985. 73	789	761	648	617	738	708	794	767	404	380	1101	1078	1335	1310	1140	1112	1990	1957	2146	2117	1968	1938	860	831	1434	1408
Excavator_1_S3_4_7_8_9	1837 8919 .39	4976 875. 07	1090	1064	1067	1037	1175	1144	1237	1209	816	797	1166	1137	994	972	695	668	1716	1683	2045	2017	2096	2066	961	931	1097	1068
Excavator_2_S1_5	1837 9546 .79	4977 495. 21	249	221	303	289	455	429	540	511	672	651	1591	1571	1853	1829	1553	1529	1948	1918	1877	1847	1491	1462	530	512	1533	1514
Excavator_2_S2_6	1837 9491 .02	4976 980. 28	767	739	558	528	630	600	678	653	277	252	1078	1057	1426	1400	1267	1238	2108	2075	2228	2198	1988	1958	911	883	1564	1538
Excavator_2_S3_7	1837 8796 .71	4976 458. 1	1504	1477	1416	1385	1498	1469	1546	1521	1017	1007	947	918	573	549	526	497	1956	1923	2404	2377	2526	2497	1395	1365	1298	1268
Excavator_2_S4_8_9	1837 8608 .55	4976 679. 46	1440	1414	1434	1405	1540	1509	1600	1573	1140	1124	1231	1202	703	685	335	306	1667	1634	2146	2119	2350	2321	1246	1219	1008	978
Excavator_3_S1_5_9	1837 9515 .95	4977 496. 51	254	226	333	318	485	459	570	541	683	660	1593	1572	1836	1812	1529	1505	1918	1888	1854	1824	1483	1454	504	486	1503	1483
Excavator_3_S2_6	1837 9416 .12	4976 935. 86	823	795	640	610	716	687	765	740	331	308	1042	1020	1341	1316	1182	1153	2068	2035	2221	2192	2023	1993	925	897	1509	1483
Excavator_3_S3_7	1837 8819 .42	4976 497. 67	1459	1431	1372	1342	1456	1427	1505	1480	981	970	953	924	619	595	540	510	1937	1903	2372	2345	2484	2454	1351	1322	1281	1251

Source	Coordinates		POR_1_POW	POR_1_OPR	POR_2_POW	POR_2_OPR	POR_3_POW	POR_3_OPR	POR_4_POW	POR_4_OPR	POR_5_POW	POR_5_OPR	POR_6_POW	POR_6_OPR	POR_7_POW	POR_7_OPR	POR_8_POW	POR_8_OPR	POR_9_POW	POR_9_OPR	POR_10_POW	POR_10_OPR	POR_11_POW	POR_11_OPR	POR_12_POW	POR_12_OPR	POR_13_POW	POR_13_OPR
	X (m)		1837958 0.07	1837957 1.88	1837983 9.3	1837981 7.37	1837998 4.46	1837995 4.46	1838006 4.47	1838003 4.47	1837973 5.39	1837971 6.72	1837956 5.25	1837954 3.8	1837846 4.29	1837848 5.55	1837828 6.86	1837831 6.86	1837768 5.16	1837770 8.64	1837818 0.52	1837821 7.49	1837921 7.49	1837921 7.49	1837912 3.79	1837912 3.79	1837801 3.41	1837803 2.89
		Y (m)	4977742.32	4977715.22	4977415.89	4977394.72	4977371.54	4977361.94	4977342.74	4977342.74	4976850.07	4976867.27	4975904.68	4975924.38	4975991.28	4976005.73	4976586.73	4976586.73	4978067.51	4978043.38	4978781.85	4978759.04	4978949.27	4978919.27	4977813.76	4977783.76	4977492.92	4977470.48
			m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
Excavator_3_S4_8	1837866 4.54	4976674.71	1406	1381	1389	1359	1493	1462	1551	1524	1085	1070	1185	1156	712	693	388	359	1703	1669	2162	2136	2341	2312	1228	1200	1046	1016
Loader_1__S1_2_5_6_9	1837929 9.24	4976986.65	806	778	690	660	786	755	844	817	457	434	1114	1090	1299	1274	1089	1061	1943	1910	2115	2086	1964	1934	846	816	1382	1356
Loader_1_S3_4_7_8	1837890 5.23	4976851.35	1118	1091	1091	1062	1198	1167	1259	1232	830	812	1154	1126	967	944	673	645	1723	1689	2062	2034	2121	2091	987	958	1099	1070
Loader_2_S1_5	1837950 8.72	4977507.08	246	218	343	328	495	469	580	551	695	673	1603	1583	1841	1817	1530	1506	1908	1878	1841	1811	1471	1442	492	474	1495	1476
Loader_2_S2_6	1837943 4.91	4976952.97	803	774	615	584	691	661	740	715	318	295	1056	1034	1366	1341	1205	1177	2075	2042	2218	2188	2008	1978	915	887	1521	1494
Loader_2_S3_7	1837888 0.45	4976492.73	1432	1404	1331	1301	1411	1382	1458	1433	927	916	903	874	652	627	601	571	1977	1944	2394	2366	2480	2450	1343	1314	1324	1294
Loader_2_S4_8_9	1837861 2.65	4976723.09	1405	1380	1409	1379	1517	1486	1579	1551	1130	1113	1256	1227	747	729	353	326	1633	1600	2104	2077	2307	2278	1205	1177	976	946
Loader_3_S1	1837949 3.51	4977492.14	265	236	354	338	506	479	590	561	686	664	1589	1569	1820	1796	1509	1485	1898	1868	1841	1811	1483	1454	490	471	1480	1461
Loader_3_S2	1837943 4	4976942.1	813	785	623	593	698	669	747	722	315	292	1046	1024	1358	1333	1201	1172	2080	2047	2226	2197	2019	1989	925	897	1524	1497
Loader_3_S3	1837889 0.39	4976461.66	1455	1427	1346	1315	1423	1394	1468	1444	930	921	875	846	635	610	616	587	2008	1974	2426	2399	2509	2479	1372	1343	1354	1324
Loader_3_S4	1837859 4.36	4976697.66	1436	1411	1437	1408	1545	1514	1605	1578	1151	1135	1254	1224	718	700	327	299	1644	1611	2125	2099	2336	2307	1235	1208	985	955
Loader_3_S5_6_7_8_9	1837951 3.6	4977422.68	326	298	326	305	474	445	557	527	614	591	1519	1499	1775	1751	1484	1460	1939	1909	1904	1874	1555	1526	552	531	1502	1481

Table A2.9 Sample Calculations – Scenario 1

Receiver
Name: POR_1
ID: POR_1_POW
X: 18379580.07 m
Y: 4977742.32 m
Z: 196.59 m

Point Source, ISO 9613, Name: "Excavator_2", ID: "Excavator_2_S1_5"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
1	18379546.79	4977495.21	190.50	0	DEN	32	60.6	0.0	0.0	0.0	0.0	58.9	0.0	-3.5	1.9	0.0	6.2	0.0	0.0	-2.9
1	18379546.79	4977495.21	190.50	0	DEN	63	84.0	0.0	0.0	0.0	0.0	58.9	0.0	-3.5	1.9	0.0	7.2	0.0	0.0	19.4
1	18379546.79	4977495.21	190.50	0	DEN	125	92.9	0.0	0.0	0.0	0.0	58.9	0.1	4.8	2.9	0.0	4.0	0.0	0.0	22.2
1	18379546.79	4977495.21	190.50	0	DEN	250	92.2	0.0	0.0	0.0	0.0	58.9	0.3	5.9	3.8	0.0	4.9	0.0	0.0	18.4
1	18379546.79	4977495.21	190.50	0	DEN	500	95.3	0.0	0.0	0.0	0.0	58.9	0.5	0.7	4.8	0.0	12.5	0.0	0.0	17.9
1	18379546.79	4977495.21	190.50	0	DEN	1000	98.0	0.0	0.0	0.0	0.0	58.9	0.9	-0.1	5.7	0.0	15.9	0.0	0.0	16.6
1	18379546.79	4977495.21	190.50	0	DEN	2000	96.4	0.0	0.0	0.0	0.0	58.9	2.4	-0.1	7.7	0.0	18.7	0.0	0.0	8.7
1	18379546.79	4977495.21	190.50	0	DEN	4000	93.6	0.0	0.0	0.0	0.0	58.9	8.2	-0.1	8.6	0.0	20.0	0.0	0.0	-2.0
1	18379546.79	4977495.21	190.50	0	DEN	8000	86.6	0.0	0.0	0.0	0.0	58.9	29.2	-0.1	11.5	0.0	20.0	0.0	0.0	-32.9

Point Source, ISO 9613, Name: "Loader_2", ID: "Loader_2_S1_5"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
2	18379508.72	4977507.08	190.50	0	DEN	32	67.9	0.0	0.0	0.0	0.0	58.8	0.0	-3.4	1.0	0.0	5.5	0.0	0.0	6.0
2	18379508.72	4977507.08	190.50	0	DEN	63	83.3	0.0	0.0	0.0	0.0	58.8	0.0	-3.4	1.0	0.0	6.2	0.0	0.0	20.7
2	18379508.72	4977507.08	190.50	0	DEN	125	91.0	0.0	0.0	0.0	0.0	58.8	0.1	4.6	1.5	0.0	2.6	0.0	0.0	23.4
2	18379508.72	4977507.08	190.50	0	DEN	250	93.2	0.0	0.0	0.0	0.0	58.8	0.3	5.6	2.0	0.0	3.2	0.0	0.0	23.4
2	18379508.72	4977507.08	190.50	0	DEN	500	96.2	0.0	0.0	0.0	0.0	58.8	0.5	0.5	2.5	0.0	10.3	0.0	0.0	23.6
2	18379508.72	4977507.08	190.50	0	DEN	1000	97.6	0.0	0.0	0.0	0.0	58.8	0.9	-0.1	3.0	0.0	13.2	0.0	0.0	21.8
2	18379508.72	4977507.08	190.50	0	DEN	2000	97.1	0.0	0.0	0.0	0.0	58.8	2.4	-0.2	4.0	0.0	15.9	0.0	0.0	16.2
2	18379508.72	4977507.08	190.50	0	DEN	4000	91.1	0.0	0.0	0.0	0.0	58.8	8.1	-0.2	4.5	0.0	18.8	0.0	0.0	1.2
2	18379508.72	4977507.08	190.50	0	DEN	8000	81.8	0.0	0.0	0.0	0.0	58.8	28.7	-0.2	5.9	0.0	20.0	0.0	0.0	-31.5

Point Source, ISO 9613, Name: "Excavator_3", ID: "Excavator_3_S1_5_9"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
3	18379515.95	4977496.51	190.50	0	DEN	32	60.6	0.0	0.0	0.0	0.0	59.1	0.0	-3.5	1.4	0.0	5.3	0.0	0.0	-1.7
3	18379515.95	4977496.51	190.50	0	DEN	63	84.0	0.0	0.0	0.0	0.0	59.1	0.0	-3.5	1.4	0.0	5.8	0.0	0.0	21.1
3	18379515.95	4977496.51	190.50	0	DEN	125	92.9	0.0	0.0	0.0	0.0	59.1	0.1	4.4	2.1	0.0	2.3	0.0	0.0	24.9
3	18379515.95	4977496.51	190.50	0	DEN	250	92.2	0.0	0.0	0.0	0.0	59.1	0.3	5.1	2.8	0.0	2.9	0.0	0.0	22.0
3	18379515.95	4977496.51	190.50	0	DEN	500	95.3	0.0	0.0	0.0	0.0	59.1	0.5	0.4	3.5	0.0	9.4	0.0	0.0	22.3
3	18379515.95	4977496.51	190.50	0	DEN	1000	98.0	0.0	0.0	0.0	0.0	59.1	0.9	-0.3	4.3	0.0	12.1	0.0	0.0	21.9
3	18379515.95	4977496.51	190.50	0	DEN	2000	96.4	0.0	0.0	0.0	0.0	59.1	2.5	-0.3	5.7	0.0	14.7	0.0	0.0	14.8
3	18379515.95	4977496.51	190.50	0	DEN	4000	93.6	0.0	0.0	0.0	0.0	59.1	8.3	-0.3	6.4	0.0	17.5	0.0	0.0	2.6
3	18379515.95	4977496.51	190.50	0	DEN	8000	86.6	0.0	0.0	0.0	0.0	59.1	29.7	-0.3	8.5	0.0	20.0	0.0	0.0	-30.4

Point Source, ISO 9613, Name: "Loader_3", ID: "Loader_3_S1"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
4	18379493.51	4977492.14	190.50	0	DEN	32	67.9	0.0	0.0	0.0	0.0	59.5	0.0	-3.6	0.6	0.0	4.9	0.0	0.0	6.6
4	18379493.51	4977492.14	190.50	0	DEN	63	83.3	0.0	0.0	0.0	0.0	59.5	0.0	-3.6	0.6	0.0	5.1	0.0	0.0	21.7
4	18379493.51	4977492.14	190.50	0	DEN	125	91.0	0.0	0.0	0.0	0.0	59.5	0.1	4.0	0.8	0.0	1.6	0.0	0.0	25.1
4	18379493.51	4977492.14	190.50	0	DEN	250	93.2	0.0	0.0	0.0	0.0	59.5	0.3	4.3	1.1	0.0	2.0	0.0	0.0	26.1
4	18379493.51	4977492.14	190.50	0	DEN	500	96.2	0.0	0.0	0.0	0.0	59.5	0.5	0.1	1.4	0.0	7.2	0.0	0.0	27.5
4	18379493.51	4977492.14	190.50	0	DEN	1000	97.6	0.0	0.0	0.0	0.0	59.5	1.0	-0.5	1.7	0.0	8.9	0.0	0.0	27.1
4	18379493.51	4977492.14	190.50	0	DEN	2000	97.1	0.0	0.0	0.0	0.0	59.5	2.6	-0.5	2.2	0.0	11.0	0.0	0.0	22.3
4	18379493.51	4977492.14	190.50	0	DEN	4000	91.1	0.0	0.0	0.0	0.0	59.5	8.7	-0.5	2.5	0.0	13.4	0.0	0.0	7.5
4	18379493.51	4977492.14	190.50	0	DEN	8000	81.8	0.0	0.0	0.0	0.0	59.5	31.0	-0.5	3.3	0.0	16.1	0.0	0.0	-27.6

Point Source, ISO 9613, Name: "Screener", ID: "Screener_S1"																				
Nr.	X	Y	Z	Refl.	DEN	Freq.	Lw	l/a	Optime	K0	Di	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	Lr
	(m)	(m)	(m)			(Hz)	dB(A)	dB	dB	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)
6	18379519.24	4977502.51	191.00	0	D	32	67.5	0.0	0.0	0.0	0.0	58.9	0.0	-3.3	1.5	0.0	5.5	0.0	0.0	4.9
6	18379519.24	4977502.51	191.00	0	D	63	84.5	0.0	0.0	0.0	0.0	58.9	0.0	-3.3	1.5	0.0	6.1	0.0	0.0	21.3
6	18379519.24	4977502.51	191.00	0	D	125	96.8	0.0	0.0	0.0	0.0	58.9	0.1	4.9	2.2	0.0	2.2	0.0	0.0	28.5
6	18379519.24	4977502.51	191.00	0	D	250	102.0	0.0	0.0	0.0	0.0	58.9	0.3	4.7	3.0	0.0	3.9	0.0	0.0	31.2

Appendix 3

Instrument Calibration Certificates

www.pylonelectronics.com

Pylon Electronics Inc.
147 Colonnade Road
Ottawa, ON K2E 7L9

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CERTIFICATE OF CALIBRATION

Description	**SOUND LEVEL CALIBRATOR**	**Work Order**	**N0833134**
Model Number	**4231**	**Serial Number**	**2730374**
Instrument Id	**N/A**	**Cal Procedure**	**33K3-4-2871-1**
Manufacturer	**BRUEL & KJAER**	**Cal Date**	**30 Jan 2020**
Customer Name	**FREEFIELD LTD.**	**Recall Cycle**	**52 Weeks**
		Next Cal Date	**30 Jan 2021**
		Purchase Order	**Credit Card**

Calibration Environment: Temperature **23.0 °C** Relative Humidity **35.2 %RH**

Received Condition: **Within Tolerance**

Completed Condition: **Within Tolerance**

Remarks: **Optimized sound level.**

Standards Used to Establish Traceability

Instrument Type	Model	Asset #	Cal Due Date
4145 BRUEL&KJAER 1" MICROPHONE	4145	240-054	4 Dec 2020
1/2" MICROPHONE	4166	240-709	18 Jun 2020
PISTONPHONE	4220	354-017	1 Apr 2020
FFT SIGNAL ANALYZER SYSTEM	3550	354-759	10 Oct 2020
MICROPHONE PREAMP	2639T	355-164	27 Feb 2020

Pylon certifies that, at the time of calibration, the above listed instrument meets or exceeds all of the specifications defined on the Test Data Sheet (TDS), unless otherwise indicated. The Certificate received and completed conditions and the TDS specifications are based on the procedure(s) and/or specification(s) referenced on the TDS unless otherwise indicated. Any statement of compliance is made without taking measurement uncertainty into account and is based on the instrument's performance against the test limits documented on the test data sheet.

The above listed instrument has been calibrated using standards that are traceable to the International System of Units (SI) through a National Metrological Institute (such as NRC or NIST). Pylon's quality system meets the requirements of ISO/IEC 17025:2005. Unless otherwise specified, Pylon maintains a minimum of a 4:1 ratio between the equipment under test and the measurement system.

Test data As Found and Final (as left) results are the same unless reported otherwise. Certificate remarks identify if adjustments were performed.

pylcert

Metrologist : *062* Quality Assurance: *301* Date of Issue: **30 Jan 2020** F093 Rev 15

HALIFAX MONTREAL OTTAWA TORONTO EDMONTON CALGARY

PYLON

Calibration Test Data

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Description:	**SOUND LEVEL CALIBRATOR**	Work order:	**N0833134**
Model:	**4231**	Serial:	**2730374**
Customer ID.:	**N/A**	Procedure:	**33K3-4-2871-1**
Manufacturer:	**BRUEL & KJAER**	Proc. Rev.:	**30-Oct-2006**
Customer:	**FREEFIELD LTD.**	Cal Date:	**30-Jan-2020**

TEST REF.	TEST DESCRIPTION	RESULTS MIN	AS FOUND	FINAL	MAX
4.1	**Sound Level Calibration:**				
	Nominal dB_{SPL}	dB_{SPL}	dB_{SPL}	dB_{SPL}	dB_{SPL}
	94.0	93.80	94.15	94.02	94.20
	(+20 dB Button) 114.0	113.80	114.13	114.01	114.20
4.2	**Frequency Calibration:**				
	Nominal (Hz)	Hz	Hz		Hz
	1 k	999.0	1000.0		1001.0
4.3	**Distortion Calibration :**				
	Measured Value	-	0.37 %		1.00 %
	ADDITIONAL TEST:				
	AUTO SHUT OFF	Pass / Fail	Pass		

www.pylonelectronics.com

Pylon Electronics Inc.
147 Colonnade Road
Ottawa, ON K2E 7L9

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CERTIFICATE OF CALIBRATION

Description	**SOUND ANALYZER**	**Work Order**	**N0833130**
Model Number	**2270**	**Serial Number**	**3008643**
Instrument Id	**N/A**	**Cal Procedure**	**BE1713-32**
Manufacturer	**BRUEL & KJAER**	**Cal Date**	**30 Jan 2020**
Customer Name	**FREEFIELD LTD.**	**Recall Cycle**	**52 Weeks**
		Next Cal Date	**30 Jan 2021**
		Purchase Order	**Credit Card**

Calibration Environment: Temperature **23.0 °C** Relative Humidity **35.2 %RH**

Received Condition: **Within Tolerance**

Completed Condition: **Within Tolerance**

Remarks: **Unit calibrated with Preamp ZC 0032 S/N 23073 AND MIC 4189 S/N 2985656**

Standards Used to Establish Traceability

Instrument Type	Model	Asset #	Cal Due Date
SOUND LEVEL CALIBRATOR	4231	240-1151	17 Sep 2020
PISTONPHONE	4220	354-017	1 Apr 2020

Pylon certifies that, at the time of calibration, the above listed instrument meets or exceeds all of the specifications defined on the Test Data Sheet (TDS), unless otherwise indicated. The Certificate received and completed conditions and the TDS specifications are based on the procedure(s) and/or specification(s) referenced on the TDS unless otherwise indicated. Any statement of compliance is made without taking measurement uncertainty into account and is based on the instrument's performance against the test limits documented on the test data sheet.

The above listed instrument has been calibrated using standards that are traceable to the International System of Units (SI) through a National Metrological Institute (such as NRC or NIST). Pylon's quality system meets the requirements of ISO/IEC 17025:2005. Unless otherwise specified, Pylon maintains a minimum of a 4:1 ratio between the equipment under test and the measurement system.

Test data As Found and Final (as left) results are the same unless reported otherwise. Certificate remarks identify if adjustments were performed.

pylcert1

Metrologist : *062* Quality Assurance: *301* Date of Issue: **30 Jan 2020** FQ83 Rev 15

HALIFAX MONTREAL OTTAWA TORONTO EDMONTON CALGARY

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PYLON

Calibration Test Data

Description:	**SOUND ANALYZER**	Work order:	**N0833130**
Model:	**2270**	Serial:	**3008643**
Customer ID.:	**N/A**	Procedure:	**BE1713-32**
Manufacturer:	**BRUEL & KJAER**	Proc. Rev.:	**23-Feb-2016**
Customer:	**FREEFIELD LTD.**	Cal Date:	**30-Jan-2020**

TEST REF.	TEST DESCRIPTION	RESULTS MIN	AS FOUND	FINAL	MAX
P. 52	**SOUND LEVEL CALIBRATION**				
	CONNECT TI TO SOUND CALIBRATOR MODEL 4231,				
	SWITCH ON THE CALIBRATOR, PRESS "START" ON TI,				
	NOTE THAT TI INDICATING "DETECTING LEVEL"	Pass / Fail	Pass		
	WHILE TI SEARCHING FOR SIGNAL & SIGNAL IS				
	STABILISING, THE "TRAFFIC LIGHT" INDICATES				
	SHORT GREEN FLASH EVERY SECOND	Pass / Fail	Pass		
	WHEN SIGNAL IS STABLE, THE GREEN LIGHT IS				
	STABLE	Pass / Fail	Pass		
	WHEN CALIBRATION IS COMPLETED SUCCESSFULLY				
	THE TRAFFIC LIGHT INDICATES A SHORT YELLOW				
	FLASH EVERY 5 SECONDS	Pass / Fail	Pass		
	Nominal SPL with 4189 Microphone attached	dB	dB		dB
	93.8 dB	92.8	93.8		94.8
	CALIBRATION COMPLETED	Pass / Fail	Pass		

Appendix 4

Manufacturers Data

Contents:

- Manufacturers Data for Cummins 600kW diesel generator used to provide power to the wash plant
- Manufacturers Data for Silex Silencer Model JB 6.

Manufacturers Data for Cummins 600kW diesel generator.

Sound data

600DQPAA 60 Hz

Sound pressure level @ 7 meters, dB(A)

See notes 1-8 listed below

Configuration		Measurement location number								Average
		1	2	3	4	5	6	7	8	
Standard - unhoused	Infinite exhaust	86.70	91.40	89.80	93.30	91.10	93.10	93.20	92.10	91.70
F200 weather	Mounted muffler	93.50	89.30	83.60	89.10	89.10	89.70	81.10	87.20	89.10
F201 – quiet site II first stage	Mounted muffler	87.30	78.60	77.60	77.40	78.60	77.70	74.10	78.00	80.70
F202 – quiet site II second stage	Mounted muffler	72.60	72.10	75.20	72.70	77.80	75.90	72.50	75.30	74.70

Sound power level, dB(A)

See notes 2-6, 9 and 10 listed below

Configuration		Octave band center frequency (Hz)								Overall sound power level
		31.5	63	125	250	500	1000	2000	4000	8000	
Standard - unhoused	Infinite exhaust	66.00	93.80	105.10	109.10	112.40	112.90	114.40	110.90	111.80	120.20
F200 weather	Mounted muffler	73.10	94.00	104.20	109.50	109.70	111.00	111.50	109.90	109.10	118.30
F201 – quiet site II first stage	Mounted muffler	73.50	93.20	103.10	104.80	102.10	101.70	105.50	101.30	100.40	111.70
F202 – quiet site II second stage	Mounted muffler	66.10	93.30	102.90	97.50	92.50	98.10	98.80	94.00	88.40	106.70

Exhaust sound power level, dB(A)

Open exhaust (no muffler rated load)	RPM	Applied load	Octave band center frequency (Hz)									Overall sound power level
			31.5	63	125	250	500	1000	2000	4000	8000	
	1800	600KW	84.90	97.40	112.50	120.20	121.80	122.90	124.90	121.10	109.30	129.70

Note:

1. Position 1 faces the generator front. The positions proceed around the generator set in a counter-clockwise direction in 45° increments. All positions are at 7 m (23 ft) from the surface of the generator set and 1.2 m (48 in) from floor level.
2. Sound levels are subject to instrumentation, measurement, installation and manufacturing variability.
3. Sound data with remote-cooled generator sets are based on rated loads without cooling fan noise.
4. Sound levels for aluminium enclosure are approximately 2 dB(A)s higher than listen sound levels for steel enclosures.
5. Sound data for generator set with infinite exhaust do not include exhaust noise.
6. Data is based on full rated load with standard radiator-cooling fan package.
7. Sound pressure levels are measured per ANSI S1.13 and ANSI S12.18, as applicable.
8. Reference sound pressure is 20 µPa.
9. Sound power levels per ISO 3744 and ISO 8528-10, as applicable.
10. Reference power = 1 pw (10^{-12} W).
11. Exhaust sound power levels are per ISO 6798, as applicable.

Cummins Inc. Data and specification subject to change without notice MSP-1206 (10/17)

Manufacturers Data for Silex Silencer Model JB 6.

www.silex.com JB

CRITICAL CYLINDRICAL SILENCERS

25 to 32 dBA Noise Reduction

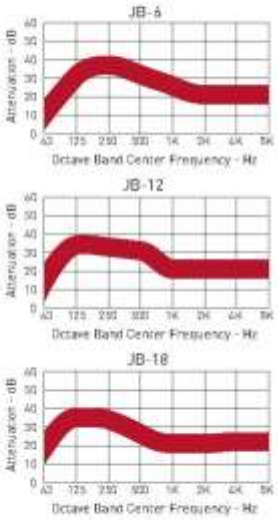
SILENCER SELECTION

For immediate assistance to select the appropriate silencer that best suits your application's acoustical and backpressure requirements contact Silex Innovations. Or, use our exclusive silencer sizing and selection program, found at www.silex.com.

PERFORMANCE & MATERIALS

The critical grade series are reactive silencers with good acoustical performance. All of the silencers are manufactured from light to heavy gauge steel and finished with high temperature black paint. A drain is included as a standard component on the silencer.

TYPICAL ATTENUATION CURVE

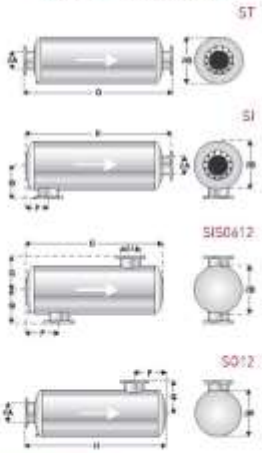


DIMENSIONS

Model	ØA in(mm)	ØB in(mm)	C in(mm)	D in(mm)	F** in(mm)	G in(mm)	H in(mm)	Wgt lb(kg)
JB-1.5	1.5	9(229)	24(610)	30(762)	4(102)	7.5(191)	27(686)	23(10)
JB-2	2	9(229)	24(610)	30(762)	4.5(114)	7.5(191)	27(686)	24(11)
JB-2.5	2.5	10(254)	28(711)	34(864)	5(127)	8(203)	31(787)	34(15)
JB-3	3	12(305)	32(813)	38(966)	5.5(140)	9(229)	35(889)	44(21)
JB-3.5	3.5	14(356)	36(914)	42(1067)	6(152)	10(254)	39(991)	65(29)
JB-4	4	14(356)	40(1016)	48(1219)	6(152)	11(279)	44(1118)	77(35)
JB-5	5	16(406)	49(1245)	57(1448)	7(178)	12(305)	53(1346)	107(49)
JB-6	6	18(457)	55(1397)	63(1600)	8(203)	13(330)	59(1499)	135(61)
JB-8	8	22(559)	66(1676)	74(1880)	9.5(241)	15(381)	70(1778)	208(94)
JB-10	10	26(660)	81(2057)	89(2261)	11.5(292)	17(432)	85(2159)	370(168)
JB-12	12	30(762)	94(2388)	102(2591)	13(330)	19(483)	98(2489)	505(229)
JB-14	14	36(914)	99(2515)	109(2769)	15.5(394)	23(584)	104(2642)	642(291)
JB-16	16	40(1016)	109(2769)	119(3023)	16.5(419)	25(635)	114(2896)	971(440)
JB-18	18	45(1143)	117(2972)	127(3226)	18(457)	27.5(699)	122(3099)	1167(529)
JB-20	20	50(1270)	127(3226)	137(3480)	20.5(521)	30(762)	132(3353)	1669(757)
JB-22	22	54(1372)	139(3531)	149(3785)	22.5(572)	32(813)	144(3658)	1972(894)
JB-24	24	60(1524)	152(3861)	162(4115)	24(610)	35(889)	157(3988)	2384(1081)
JB-26	26	64(1626)	173(4394)	183(4648)	25.5(648)	37(940)	178(4521)	2854(1295)
JB-28	28	68(1727)	190(4826)	200(5080)	26.5(673)	39(991)	195(4953)	3278(1487)
JB-30	30	72(1829)	206(5232)	216(5486)	28(711)	41(1041)	211(5359)	3777(1713)

**For F dimension other than that specified, please contact Silex Innovations.
Available in sizes up to 48" inlet.

TYPICAL ORIENTATIONS



OPTIONS

- Aluminized steel, 304L or 316L stainless steel
- Dual inlet or custom inlet / outlet configurations
- Thermal insulation blankets to suit all configurations
- Mounting brackets, gussets and lifting lugs

Metric dimensions rounded to nearest mm. Dimensions and weight are nominal and may vary slightly in production models. On silencers 4" and larger the inlet and outlet are flanged, manufactured from minimum ¼" thick plate and drilled to ANSI class 150.
The default material used is aluminized steel, however WGP reserves the right to substitute to carbon steel due to material availability, gauge and size limitations.

Corporate Headquarters
1560 Williams Drive
Stoughton, WI 53589
Tel: 608-719-1800

Silex INNOVATIONS

silex.com

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RESUMÉ: Dr. HUGH WILLIAMSON, P.Eng.

QUALIFICATIONS:

Ph.D. Mechanical Engineering, University of New South Wales, 1972

B.Sc. Mechanical Engineering, (with Distinction), University of Alberta, 1967

Member, Professional Engineers, Ontario

Member, Canadian Acoustical Association

KEY COMPETENCIES:

- Environmental noise and vibration assessments, Environmental Compliance Approval (ECA). Noise assessment for land use planning
- Architectural and building acoustics, acoustics of office spaces, meeting rooms, auditoriums and studios, noise and vibration control of building mechanical services.
- Industrial noise and vibration assessment and control.
- Transportation noise and vibration.

PROFESSIONAL EXPERIENCE:

Hugh Williamson is a professional engineer with many years of experience in the measurement, analysis and control of noise and vibration. Freefield Ltd. was incorporated in 2017 and provides consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. Clients include architects, engineering firms, industrial firms and government departments. Prior to joining Freefield Ltd. Hugh Williamson founded and directed Hugh Williamson Associates Inc. which specialized in consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. His career included extensive periods in industry as well as university level research and teaching. He is a former Director of the Acoustics and Vibration Unit at the Australian Defence Force Academy. He has published over 50 engineering and scientific papers and has been an invited speaker on noise and vibration at national and international conferences. He has more than 25 years of experience as a consultant.

CLIENT LIST:

Hugh Williamson has provided consulting services to large and small clients including: National Research Council, J. L. Richards & Associates, Barry Padolsky Associates, Atkinson Schroeter Design Group, R. W. Tomlinson Limited, Geo. Tackaberry Construction, Miller Paving, City of Ottawa.

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Phone: 613-747-0983, Email: hugh@freefieldacoustics.com, http://www.freefieldacoustics.com

RESUMÉ: MICHAEL WELLS

QUALIFICATIONS:

Registered Architect of NSW, Registration Number: 8111

B. Architecture (Hons), University of Sydney, 2002

B.Sc. Architecture, University of Sydney, 1999

Member, Canadian Acoustical Association

Member, Australian Acoustical Society

Associate Member, INCE-USA

KEY COMPETENCIES:

- Environmental noise and vibration assessments, Environmental Compliance Approval (ECA). Noise assessment for land use planning.
- Architectural and building acoustics, acoustics of office spaces, meeting rooms, auditoriums and studios, noise and vibration control of building mechanical services.
- Industrial noise and vibration assessment and control.
- Transportation noise and vibration.
- Design services including sketch design, design development (development / permit applications), contract documents, tendering and contract administration.

PROFESSIONAL EXPERIENCE:

Michael Wells is a professional Architect registered in NSW, Australia, with many years of experience in the measurement, analysis and control of noise and vibration. Michael Wells is a founding Director of Freefield Ltd. which was incorporated in 2017, and provides consulting services in architectural, building, industrial, transportation and environmental acoustics and vibration. Clients include architects, engineering firms, industrial firms and government departments. Prior to establishing Freefield Ltd., his career included working for Hugh Williamson Associates Inc. specializing in acoustics, noise and vibration consulting services, and, the founding of Michael Wells Architect in Sydney, Australia, specializing in the design of institutional, commercial and residential projects. He is the former Director of Architectural Workshops Australia and Vision Blue Pty Ltd. He has more than 15 years of experience as a consultant.

CLIENT LIST:

Michael Wells has provided consulting services to large and small clients including: National Research Council, R. W. Tomlinson, G. Tackaberry & Sons Construction, Miller Paving, J. L. Richards & Associates, Barry Padolsky Associates, Atkinson Schroeter Design Group and Industry Canada.