

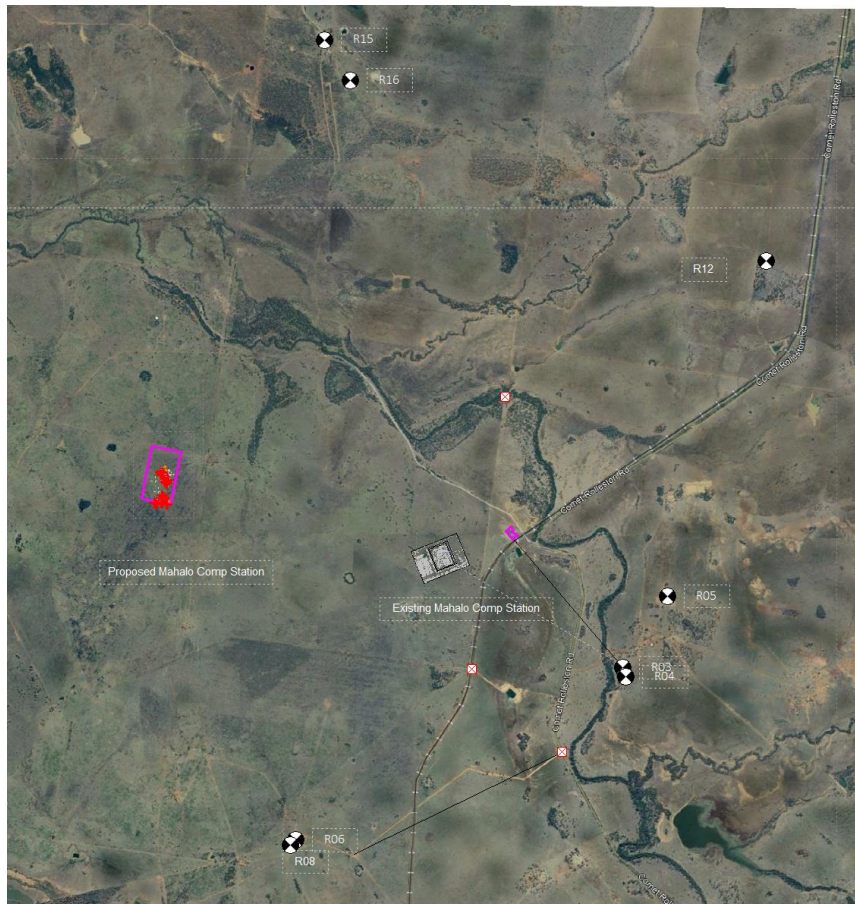


Noise Impact Assessment
Santos Limited
Mahalo Compressor Station Preliminary Assessment
Revision 4

Prepared for:
William Inonda, Senior Environmental Advisor
Santos Limited

Prepared by:
Patching Associates Acoustical Engineering Pty. Ltd.
Consultants in Acoustics, Noise Control and Vibration

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Professional Authentication

Project Role: Engineer of Record	Project Role: Validating Responsible Member
Date: 2025-06-03	Date: 2025-06-03
Patching Associates Acoustical Engineering Ltd.	Patching Associates Acoustical Engineering Ltd.
Name: Justin Caskey, P.Eng. RPEQ#31520	Name: Justin Caskey, P.Eng. RPEQ#31520

Prepared by:

Technical Lead: Sumita Biswas, Ph.D.
Project Engineer: Justin Caskey, P.Eng.



Executive Summary

Santos Limited retained Patching Associates Acoustical Engineering Ltd. to conduct a Noise Impact Assessment (NIA) for the operation phase of the Mahalo Compressor Station (Subject Facility) located approximately 41 km north of Rolleston QLD, Australia. This NIA was conducted in accordance with the requirements of the Environmental Protection (Noise) Policy 2019 (EPP noise) for Rolleston where applicable and the Environmental Authority **P-EA-100178150** (the **EA**).

In this Noise Impact Assessment (NIA), Santos has selected an alternative location to the west of the original site to relocate the equipment and evaluate its impact on the surrounding receivers. A new location was investigated after the original location failed to meet the objectives of EPP noise and the EA at all sensitive receivers. Additionally, a new compressor of a different make and model is proposed to replace the originally selected one. Furthermore, a water treatment plant has been included on the south side of the facility, as indicated in a previous model for another similar facility (Document ID: 005344-NIA-001).

The purpose of this assessment is to understand the extent of noise emissions from the compressor facility including the flare and suggest best practice control/management measures if the emissions do not meet the EA conditions. Moreover, a second operating condition with no-wind has been included in this report. The target level is to achieve 28dBA at the nearest sensitive receiver including background noise. Seven operating scenarios were included in this study:

- S1E: Maximum Flare Elevated
- S1G: **Maximum Flare Ground**
- S2A: **Normal Operation no Enclosures**
- S2B: Normal Operation with Enclosures
- S3AG: **Upset without Enclosures Ground Flare**
- S3BE: Upset with Enclosures Elevated Flare
- S3BG: Upset with Enclosures Ground Flare

The table below summarizes overall Sound Pressure Levels (SPL) predictions from the model. The Facility SPL is the overall SPL from all the facilities in the study area for the seven operating scenarios. The Permissible Sound Level (PSL) is the permissible or targeted sound level for the given receiver.

Overall Sound Pressure Levels, As Proposed

Receiver	Scenario S1E			Scenario S1G			Scenario S2A		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	29.5	30.8	No	14.2	25.3	Yes	20.4	26.3	Yes
R04	29.2	30.6	No	14.0	25.3	Yes	20.0	26.2	Yes
R05	33.8	34.3	No	13.8	25.3	Yes	21.2	26.5	Yes
R06	34.4	34.9	No	23.3	27.2	Yes	23.8	27.5	Yes
R08	33.7	34.2	No	23.2	27.2	Yes	23.4	27.3	Yes
R12	29.6	30.9	No	8.2	25.1	Yes	19.1	26.0	Yes
R15	23.4	27.3	Yes	16.2	25.5	Yes	15.9	25.5	Yes
R16	30.1	31.3	No	18.5	25.9	Yes	21.7	26.7	Yes



*Assumes ambient baseline noise level of 25 dBA.

Overall Sound Pressure Levels, As Proposed

Receiver	Scenario S2B			Scenario S3BE		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	9.3	25.1	Yes	14.5	25.4	Yes
R04	9.1	25.1	Yes	14.3	25.4	Yes
R05	11.7	25.2	Yes	18.4	25.9	Yes
R06	13.4	25.3	Yes	19.3	26.0	Yes
R08	12.3	25.2	Yes	18.6	25.9	Yes
R12	9.8	25.1	Yes	14.6	25.4	Yes
R15	5.9	25.1	Yes	9.0	25.1	Yes
R16	10.2	25.1	Yes	15.3	25.4	Yes

*Assumes ambient baseline noise level of 25 dBA.

Overall Sound Pressure Levels, As Proposed

Receiver	Scenario S3BG			Scenario S3AG		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	9.6	25.1	Yes	17.1	25.7	Yes
R04	9.5	25.1	Yes	16.5	25.6	Yes
R05	10.0	25.1	Yes	19.1	26.0	Yes
R06	14.5	25.4	Yes	23.2	27.2	Yes
R08	14.3	25.4	Yes	23.0	27.1	Yes
R12	9.1	25.1	Yes	20.7	26.4	Yes
R15	7.8	25.1	Yes	14.7	25.4	Yes
R16	11.1	25.2	Yes	17.7	25.7	Yes

*Assumes ambient baseline noise level of 25 dBA.

Overall Sound Pressure Levels, As Proposed (No wind condition)

Receiver	Scenario S1E			Scenario S1G			Scenario S2A		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	21.3	26.5	Yes	5.8	25.1	Yes	12.7	25.2	Yes
R04	21.0	26.5	Yes	5.6	25.0	Yes	12.3	25.2	Yes
R05	25.5	28.3	No	5.3	25.0	Yes	13.5	25.3	Yes
R06	27.0	29.1	No	15.6	25.5	Yes	16.8	25.6	Yes
R08	26.1	28.6	No	15.4	25.5	Yes	16.3	25.5	Yes
R12	20.7	26.4	Yes	-0.8	25.0	Yes	10.8	25.2	Yes
R15	15.2	25.4	Yes	8.0	25.1	Yes	8.4	25.1	Yes
R16	22.2	26.8	Yes	10.4	25.1	Yes	14.2	25.3	Yes

*Assumes ambient baseline of 25 dBA.



Overall Sound Pressure Levels, As Proposed (No wind condition)

Receiver	Scenario S2B			Scenario S3BE		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	2.4	25.0	Yes	6.6	25.1	Yes
R04	2.2	25.0	Yes	6.4	25.1	Yes
R05	4.6	25.0	Yes	10.3	25.1	Yes
R06	6.9	25.1	Yes	12.1	25.2	Yes
R08	5.9	25.1	Yes	11.2	25.2	Yes
R12	2.5	25.0	Yes	6.0	25.1	Yes
R15	-0.6	25.0	Yes	1.4	25.0	Yes
R16	3.4	25.0	Yes	7.6	25.1	Yes

*Assumes ambient baseline noise level of 25 dBA.

Overall Sound Pressure Levels, As Proposed (No wind condition)

Receiver	Scenario S3BG			Scenario S3AG		
	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL	Facility SPL (dBA)	Total SPL* (dBA)	Meet the PSL
R03	2.3	25.0	Yes	9.4	25.1	Yes
R04	2.1	25.0	Yes	8.7	25.1	Yes
R05	2.8	25.0	Yes	11.3	25.2	Yes
R06	7.4	25.1	Yes	16.1	25.5	Yes
R08	7.1	25.1	Yes	15.9	25.5	Yes
R12	1.8	25.0	Yes	12.4	25.2	Yes
R15	0.6	25.0	Yes	7.1	25.1	Yes
R16	4.0	25.0	Yes	10.3	25.1	Yes

*Assumes ambient baseline noise level of 25 dBA.

The above results indicate that the Cumulative SPL is expected to exceed the PSL at some of the receivers in the study area for the maximum flaring event and meet the PSL for all other scenarios. The most impacted receiver is R06 located approximately 5440m SSE from the subject facility. Additional noise control is not required for the subject facility to comply with the requirements at the Sensitive Receivers.

The results also indicate that- a) ground flare is necessary; b) compressor enclosures are not required.



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Acronyms

Acronym	Description
ASL	Ambient Sound Level
dB	Decibel
dBA	A-Weighted Decibel
dBC	C-Weighted Decibel
dBZ	Z-Weighted Decibel or Linear Decibel
DIL	Dynamic Insertion Loss
ISO	International Organization for Standardization
L_{eq}	Energy Equivalent Sound Level
LFN	Low Frequency Noise
NIA	Noise Impact Assessment
NC	Noise Control
NR	Noise Reduction
PSL	Permissible Sound Level
PWL	Sound Power Level
SPL	Sound Pressure Level
TL	Transmission Loss
UTM	Universal Transverse Mercator



Introduction

Santos Limited retained Patching Associates Acoustical Engineering Ltd. to conduct a Noise Impact Assessment (NIA) for the operation phase of the Mahalo Compressor Station (Subject Facility) located approximately 41 km north of Rolleston QLD, Australia. This NIA was conducted in accordance with the requirements of the Environmental Protection (Noise) Policy 2019 (EPP noise) for Rolleston where applicable and the Environmental Authority **P-EA-100178150** (the **EA**).

In this Noise Impact Assessment (NIA), Santos has selected an alternative location to the west of the original site to relocate the equipment and evaluate its impact on the surrounding receivers. A new location was investigated after the original location failed to meet the objectives of EPP noise and the EA at all sensitive receivers. Additionally, a new compressor of a different make and model is proposed to replace the originally selected one. Furthermore, a water treatment plant has been included on the south side of the facility, as indicated in a previous model for another similar facility (Document ID: 005344-NIA-001).

The scope of this assessment is to understand the extent of noise emissions from the compressor facility including the flare and suggest best practice control/management measures if the emissions do not meet the EA conditions. Additionally, a second operating condition with no-wind has been included in this report. The target level is to achieve 28dBA at the nearest sensitive receiver including background noise. The target is to achieve a sound pressure level of 28dBA at the nearest sensitive receiver including background noise. Six running scenarios were included in this study:

- S1E: Maximum Flare Elevated
- S1G: Maximum Flare Ground
- S2A: Normal Operation no Enclosure
- S2B: Normal Operation Enclosure
- S3AG: Upset with no Enclosures Ground Flare
- S3BE: Upset Enclosure Elevated Flare
- S3BG: Upset Enclosure Ground Flare

Study Area

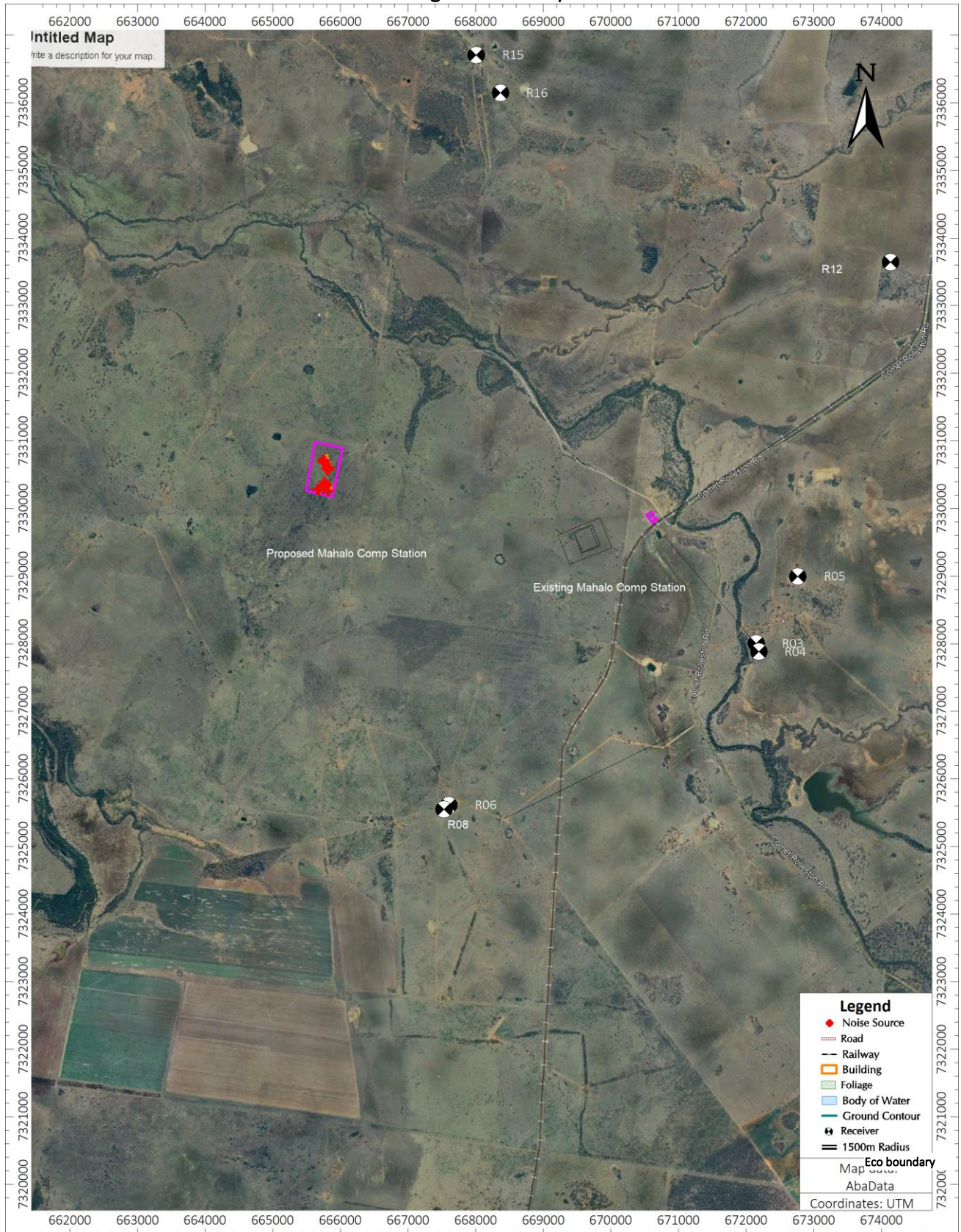
The subject facility is located approximately 40 km north from north of Rolleston QLD, Australia at 148.630811 Longitude and -24.127293 Latitude.

In this study, there exist eight (8) potentially sensitive receivers in the study area. The locations of these receivers were obtained from Santos supplied data. The nearby proposed water treatment plant (WTP) and substation were incorporated into this assessment. The terrain cover is mainly flat grassland.

Figure 1 shows a map of the study area. The locations of these receivers were obtained from information supplied by Santos.



Figure 1 – Study Area





Noise Criteria

The noise criteria were set out by the client according to the environmental authority for the area at the residential locations.

The criteria (Permissible Sound Level, PSL) for the assessment is to maintain facility sound pressure levels at or below 25 dBA at the residential sensitive receivers (28 dBA overall with an ambient of 25 dBA), based on the extract below obtained from the environmental authority P-EA-100178150. This assessment considered continuous steady state noise and does not include potential adjustments for impulsiveness, tonality, or low frequency noise. PAAE measured the sound pressure level at the fence line of a facility similar to Mahalo (ACS-03, Document ID:006612-NIA-000 ACS-03 Arcadia Valley NIA-DRAFT) in August 2024. Sound pressure level data were recorded for ten consecutive nights and analyzed from that site. The analysis result indicates that no tonal components were present at the facility. Since the Mahalo compressor station has equipment similar to that of ACS-03, tonality has not been considered in this study.

The ambient 25dBA referring to the EA background (10 pm to 6 am) suggests this is the baseline environmental noise level expected during nighttime hours. If the standard specifies compliance during these hours, it implies that noise levels will not exceed the Permissible limit during the remaining hours as well.

3 SCHEDULE C - NOISE

(C1) Notwithstanding condition (A18), emission of noise from the petroleum activity(ies) at levels less than those specified in *Schedule C, Table 1—Noise nuisance limits at a sensitive receptor* are not considered to be environmental nuisance.

Schedule C, Table 1—Noise nuisance limits at a sensitive receptor

Time period	Metric	<u>Short term noise event</u>	<u>Medium term noise event</u>	<u>Long term noise event</u>
7:00am—6:00pm	<u>L_{Aeq,adj,15 min}</u>	45 dBA	43 dBA	40 dBA
6:00pm—10:00pm	L _{Aeq,adj,15 min}	40 dBA	38 dBA	35 dBA
10:00pm—6:00am	L _{Aeq,adj,15 min}	28 dBA	28 dBA	28 dBA
	<u>Max L_{pA, 15 mins}</u>	55 dBA	55 dBA	55 dBA
6:00am—7:00am	L _{Aeq,adj,15 min}	40 dBA	38 dBA	35 dBA

1. The noise limits in Table 1 have been set based on the following deemed background noise levels (L_{ABG}):

7:00am—6:00 pm: 35 dBA
6:00pm—10:00 pm: 30 dBA
10:00pm—6:00 am: 25 dBA
6:00am—7:00 am: 30 dBA

This study does not consider occupational health and safety noise levels.



Major Equipment

Table 1A gives details of the major equipment modeled for Mahalo Compressor Station. The details were obtained from the client. See [Appendix C](#) for a plot plan showing the subject facility equipment layout.

Table 1A List of All Subject Facility Equipment with Equipment Details

Equipment Name	Number of Units	Equipment Details
Elevated Flare	1	<ul style="list-style-type: none"> 50 TJ flare, 37' high, sound power level estimated based on operating measurement of ACS-02 flare at 10 TJ as well as sound emissions data obtained from the manufacturer see Appendix B.
Ground Flare	1	<ul style="list-style-type: none"> The noise model for the flare is based on the sound power level from Zeeco, 6 flares, stack height of 1.49 m. (Ref: 005389-LTR-003)The flare wall height is 8m.
TEG Dehydration Packages	1	<ul style="list-style-type: none"> Noise emissions were obtained from a previous noise model for the ACS-02 facility provided by Santos (Santos Document number 5158-650-STU-0001).
Main Compressor Packages #1, #2, #3	3	<p>For each unit:</p> <ul style="list-style-type: none"> Compressor: Ariel JDG/4, reciprocating, Engine: Caterpillar 3612, 1,000 RPM, 4125 HP. The Sound power level is scaled up according to the Power rating change from Caterpillar 3608. For 3608, it is assumed that the engine exhaust silencer, engine air intake, building walls and vents will have a design similar to the ACS-03. Noise emissions of CAT 3608 were obtained from ACS-03 facility during field measurement by PAAE staff in 2024. A photo of the unit is provided in Appendix B. Noise emission of the compressor and driver engine without any enclosure was derived from theoretical calculation Cooling Unit: AXH 168-2ZF, 24.5 HP, 14' fan diameter. AXH 132-2ZF, two (2) 30kW motors Enclosure: Insulated metal building with perforated liner
Transformer #3, #4	2	<ul style="list-style-type: none"> Noise emissions were obtained from a previous noise model for the ACS-02 facility provided by the client (Santos Document number 5158-650-STU-0001).
HV VSD Transformer #1, #2, #3	3	<ul style="list-style-type: none"> Noise emissions were obtained from a previous study on similar equipment.
Gas Engine Generator Set	3	<ul style="list-style-type: none"> Noise emissions were obtained from measurement carried out by Patching at ACS-02 facilities Engine: caterpillar G3512E, 984 kW, Unknown make and model of muffler. A photo of the unit is provided in Appendix B to support design/procurement of the new units. Typical resistive load bank. Noise emissions were obtained from a previous study on the equipment by PAAE staff.
Diesel Engine Generator Set	1	<ul style="list-style-type: none"> For emergency use only and excluded from the analysis
Compressor Air Package	1	<ul style="list-style-type: none"> Assumed electric motor driven compressor, <300 HP, 3600RPM Located in a typical building, with doors and windows open
Modeled Operating Scenarios		
Scenario S1E		<ul style="list-style-type: none"> Elevated flare with maximum Flaring (ESD) -Full capacity flare rate of 50MMSCFD, all other equipment shut down, including the water treatment plant, only flare operating, maximum duration 5 min.
Scenario S1G		<ul style="list-style-type: none"> Ground flare with maximum flaring (ESD) -Full capacity flare rate of 50MMSCFM, all other equipment shut down, including the water treatment plant, maximum duration 5 min.
Scenario S2A		<ul style="list-style-type: none"> Normal Maximum Operation - Main compressor units operating without building, typical fans, no flaring.
Scenario S2B		<ul style="list-style-type: none"> Normal Maximum Operation - Main compressor units operating with building, typical fans, no flaring.
Scenario S3AG		<ul style="list-style-type: none"> Machine Trip - One flare firing (ground flare), main compressor units operating without buildings, typical fans, one compressor shut down and balance of the plant running



Equipment Name	Number of Units	Equipment Details
Scenario S3BE		• Machine Trip - 3MMSCFD flaring (elevated flare), Main compressor units operating with building, typical fans, one compressor shut down and balance of the plant running.
Scenario S3BG		• Machine Trip - One flare firing (ground flare), main compressor units operating with buildings, typical fans, one compressor shut down and balance of the plant running.

Table 1B lists the adjacent facilities that are included in the NIA. The facility information was obtained from the client and previous study carried out by PAAE (5344-NIA-000, Santos D 1724-650-REP-0001 dated 26-11-2019) Detailed equipment description is outlined in Appendix B.

Table 1B: Adjacent Facility Water Treatment Plant Equipment Details

Equipment Name	Operation	Equipment Details
Water Treatment Plant	Various	<ul style="list-style-type: none">• Pumps• Blowers• Small scale compressors• See Appendix B for equipment details• Pre-treatment plant excluded

Method

The method used in the NIA follows the requirements set forth in the regulations.

- The study area and facility physical layouts were determined from drawings obtained by the client and satellite images.
- The Sound Power Levels (PWLs) were determined for the major facility noise sources through theoretical calculations, manufacturer’s data, and previous study on similar units. See [Appendix D](#) for a list of all the calculated PWLs.
- It is assumed that the facility operating conditions do not change significantly between the daytime and the nighttime period. As such, the NIA analysis focuses solely on the nighttime period, as the permissible sound level is more stringent during the nighttime than during the daytime.
- Sound propagation calculations were undertaken using the noise modeling software package CadnaA to determine the facility SPL at the receivers. All calculations were undertaken in linear octave bands.
- The resulting SPL were compared to the PSL to determine if the subject facility complies with the regulations. Where the Facility SPL exceed the PSL, then noise control recommendations are designed to bring the facility SPL down to meet the PSL for all the receivers in the study area.

Environmental conditions are modelled using the same weather conditions and modelling parameters from the Subject Facility, that of 3 m/s wind in “worst case direction”, which allows down-wind from each source to each receiver.



Modeling Parameters

Table 2 lists the major parameters used in the noise model. These parameters meet the guideline set forth in EPP (Noise) 2019. The modeled conditions produce results representative of meteorological conditions favoring sound propagation (e.g., downwind or mild temperature inversion conditions) during the summer nighttime.

These conditions do not occur all the time at the receiver and the resulting SPL are expected to be lower than those predicted for most of the time. Therefore, the environmental conditions modelled represent “close-to-worst-case” sound propagation conditions.

Table 2: Modeling Parameters

Parameter	Value	Description
Modeling software	CadnaA by Datakustik Version 2025 MR1	Advanced noise propagation model considering geometric spreading, atmospheric sound absorption, ground impedance, site topography and geometry, vegetation and environmental conditions. CadnaA models calculate the contributing level of each noise source at the receiver location in octave bands as well as calculating the overall facility sound level.
Standard adopted	Concawe	Specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources.
Wind Condition	3 m/s Downwind Factor D	Concawe uses a slight downwind condition from each noise source to each receiver. Wind speed is measured at a height of 3 m to 11 m above ground. The Pasquill Stability factor considered is D
Ground Factor	0.0 for water bodies and roads 0.3 within all facility limits 0.6 everywhere else	The ground factor G is a property of the ground material, with value ranging from 0 to 1. The typical values below were determined from several standards and values, including ISO 9613, Commission Directive EU 2015/996, and Nord 2000. G = 0.0 is suitable for asphalt, concrete, pavement, water G = 0.3 is suitable for compacted dense ground, gravel road, hard soil G = 0.6 is suitable for sand, compacted field and gravel, roadside dirt G = 0.8 is suitable for cultivated land, such as farmland G = 1.0 is suitable for uncultivated land, such as forest floor and loose ground
Order of Reflection	3	The model calculates reflection effects from the reflective surfaces included in the model.
Foliage	Not Included	Not included based on conservative considerations due to the presence of human dwellings in the study area.
Temperature	0°C	Represents typical winter night-time temperature.
Relative Humidity	100%	Represents typical winter night-time relative humidity.
Topography	Included	Topographical data obtained from Queensland Spatial. Resolution: 10m.



Results

Overall Sound Pressure Levels

Tables 3A-3F summarize the overall Sound Pressure Levels (SPL) predictions from the model for each receiver in the study area for the three running scenarios. The Facility SPL is the overall SPL from all the facilities in the study area. The Cumulative SPL includes the contribution of the Facility SPL and the Ambient Sound Pressure Levels (ASL).

Table 3A: Overall Sound Pressure Levels - As Proposed (Scenario S1E)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBc-dBA
R03	6970 m ESE	28.0	25.0	29.5	30.8	No	3.1
R04	7060 m ESE	28.0	25.0	29.2	30.6	No	3.1
R05	7250 m ESE	28.0	25.0	33.8	34.3	No	3.1
R06	5440 m SSE	28.0	25.0	34.4	34.9	No	2.8
R08	5480 m SSE	28.0	25.0	33.7	34.2	No	2.8
R12	8910 m ENE	28.0	25.0	29.6	30.9	No	3.4
R15	6410 m NNE	28.0	25.0	23.4	27.3	Yes	3.4
R16	6040 m NNE	28.0	25.0	30.1	31.3	No	3.2

Table 3B: Overall Sound Pressure Levels - As Proposed (Scenario S1G)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBc-dBA
R03	6970 m ESE	28.0	25.0	14.2	25.3	Yes	3.6
R04	7060 m ESE	28.0	25.0	14.0	25.3	Yes	3.7
R05	7250 m ESE	28.0	25.0	13.8	25.3	Yes	3.6
R06	5440 m SSE	28.0	25.0	23.3	27.2	Yes	3.4
R08	5480 m SSE	28.0	25.0	23.2	27.2	Yes	3.4
R12	8910 m ENE	28.0	25.0	8.2	25.1	Yes	3.9
R15	6410 m NNE	28.0	25.0	16.2	25.5	Yes	3.6
R16	6040 m NNE	28.0	25.0	18.5	25.9	Yes	3.5

Table 3C: Overall Sound Pressure Levels - As Proposed (Scenario S2A)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBc-dBA
R03	6970 m ESE	28.0	25.0	20.4	26.3	Yes	8.7
R04	7060 m ESE	28.0	25.0	20.0	26.2	Yes	8.9
R05	7250 m ESE	28.0	25.0	21.2	26.5	Yes	8.2
R06	5440 m SSE	28.0	25.0	23.8	27.5	Yes	7.6
R08	5480 m SSE	28.0	25.0	23.4	27.3	Yes	7.8
R12	8910 m ENE	28.0	25.0	19.1	26.0	Yes	9.4
R15	6410 m NNE	28.0	25.0	15.9	25.5	Yes	10.9
R16	6040 m NNE	28.0	25.0	21.7	26.7	Yes	8.5



Table 3D: Overall Sound Pressure Levels - As Proposed (Scenario S2B)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	9.3	25.1	Yes	15.0
R04	7060 m ESE	28.0	25.0	9.1	25.1	Yes	15.1
R05	7250 m ESE	28.0	25.0	11.7	25.2	Yes	14.5
R06	5440 m SSE	28.0	25.0	13.4	25.3	Yes	14.3
R08	5480 m SSE	28.0	25.0	12.3	25.2	Yes	14.7
R12	8910 m ENE	28.0	25.0	9.8	25.1	Yes	15.0
R15	6410 m NNE	28.0	25.0	5.9	25.1	Yes	16.7
R16	6040 m NNE	28.0	25.0	10.2	25.1	Yes	15.1

Table 3E: Overall Sound Pressure Levels - As Proposed (Scenario S3BE)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	14.5	25.4	Yes	8.5
R04	7060 m ESE	28.0	25.0	14.3	25.4	Yes	8.5
R05	7250 m ESE	28.0	25.0	18.4	25.9	Yes	6.1
R06	5440 m SSE	28.0	25.0	19.3	26.0	Yes	7.1
R08	5480 m SSE	28.0	25.0	18.6	25.9	Yes	7.4
R12	8910 m ENE	28.0	25.0	14.6	25.4	Yes	8.4
R15	6410 m NNE	28.0	25.0	9.0	25.1	Yes	12.2
R16	6040 m NNE	28.0	25.0	15.3	25.4	Yes	9.2

Table 3F: Overall Sound Pressure Levels - As Proposed (Scenario S3BG)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	9.6	25.1	Yes	13.6
R04	7060 m ESE	28.0	25.0	9.5	25.1	Yes	13.6
R05	7250 m ESE	28.0	25.0	10.0	25.1	Yes	13.8
R06	5440 m SSE	28.0	25.0	14.5	25.4	Yes	11.7
R08	5480 m SSE	28.0	25.0	14.3	25.4	Yes	11.7
R12	8910 m ENE	28.0	25.0	9.1	25.1	Yes	14.6
R15	6410 m NNE	28.0	25.0	7.8	25.1	Yes	14.2
R16	6040 m NNE	28.0	25.0	11.1	25.2	Yes	13.5



Table 3G: Overall Sound Pressure Levels - As Proposed (Scenario S3AG)

Receiver	Approximate Distance & Direction from the Subject Facility	PSL (dBA)	ASL (dBA)	Facility SPL (dBA)	Cumulative SPL (dBA)	Meet the PSL	dBC-dBA
R03	6970 m ESE	28.0	25.0	17.1	25.7	Yes	9.8
R04	7060 m ESE	28.0	25.0	16.5	25.6	Yes	10.1
R05	7250 m ESE	28.0	25.0	19.1	26.0	Yes	8.5
R06	5440 m SSE	28.0	25.0	23.2	27.2	Yes	7.2
R08	5480 m SSE	28.0	25.0	23.0	27.1	Yes	7.2
R12	8910 m ENE	28.0	25.0	20.7	26.4	Yes	8.9
R15	6410 m NNE	28.0	25.0	14.7	25.4	Yes	10.7
R16	6040 m NNE	28.0	25.0	17.7	25.7	Yes	10.1

The above results indicate that the Cumulative SPL is expected to exceed the PSL at some of the receivers in the study area for the maximum flaring and meet the PSL for all other scenarios. In this study duration of 1E, 1G scenarios are less than 15 min, scenario 2A and 2B are continuous operation, scenario 3AG, 3BE, 3AG are less than 15 min long. The most impacted receiver is R06 approximately 5440m SSE from the subject facility. Additional noise control is not required for the subject facility to comply with the requirements at the Sensitive Receiver.

It is noted that dBC-dBA values are commonly used to indicate contribution of low frequency noise (LFN), the higher the difference, the greater contribution from low frequency noise, at levels exceeding 15-20 dB evaluation is required for the adjustments due to the low frequency noise contents. At results indicate the potential for low frequency noise impacts at the sensitive receivers, which will be evaluated in the event of a valid complaint.

Figures 2A-2G show the noise map of the area with Facility SPL contours for the seven operating scenarios, that is, the facility noise emissions contours excluding the ASL.



Figure 2A: Noise Contour Map – As Proposed – Facility SPL (Scenario S1E)

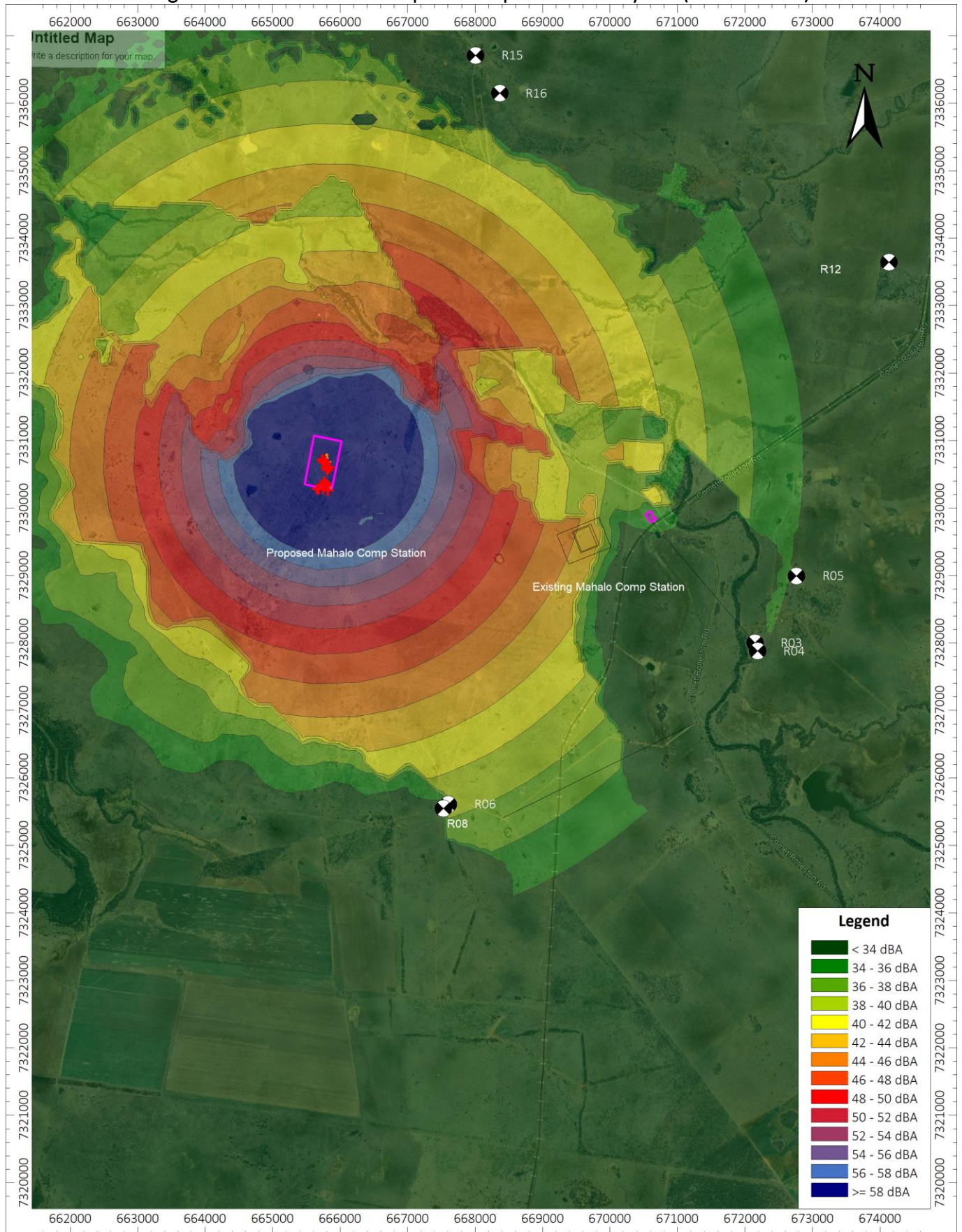




Figure 2B: Noise Contour Map – As Proposed – Facility SPL (Scenario S1G)

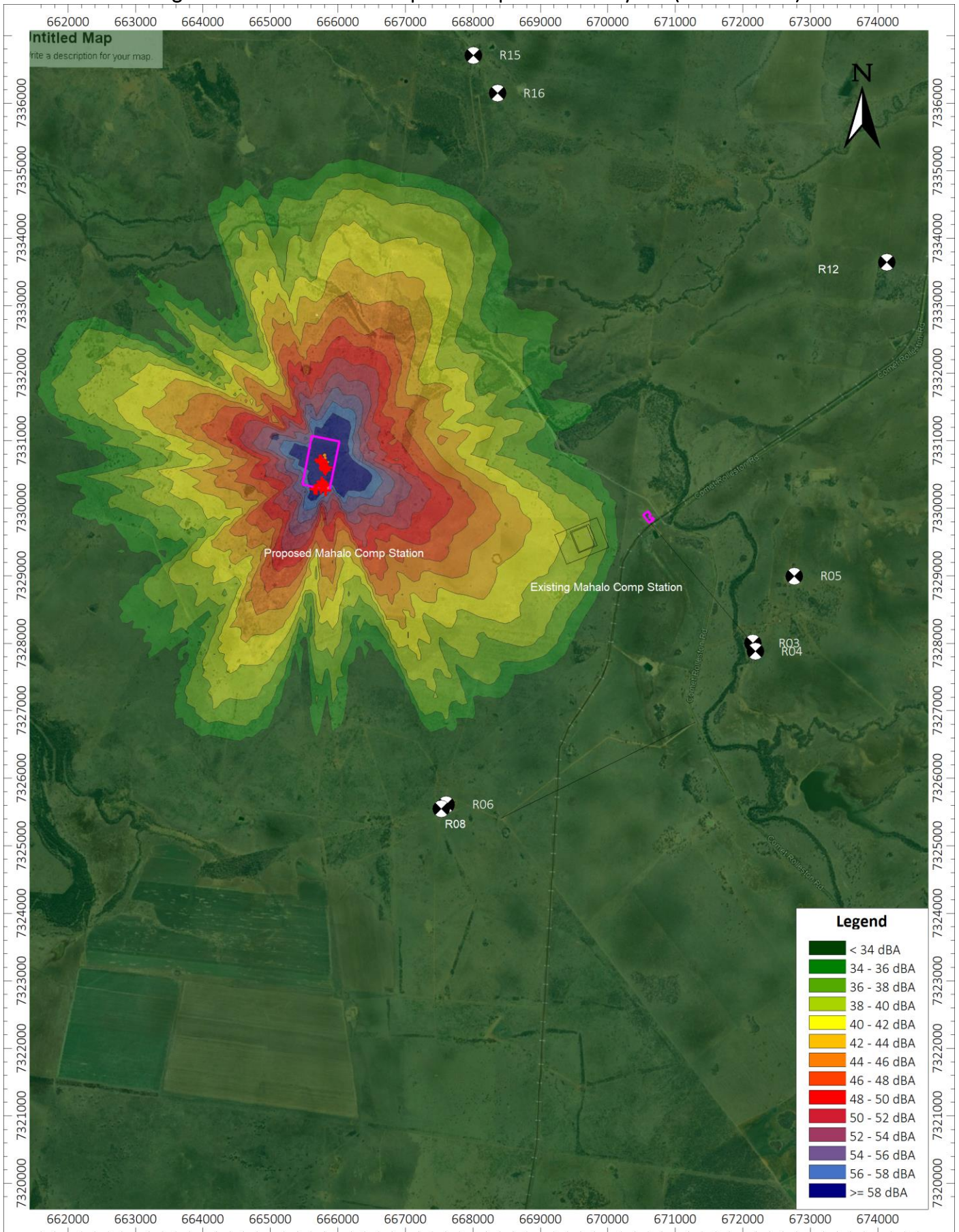




Figure 2C: Noise Contour Map – As Proposed – Facility SPL (Scenario S2A)

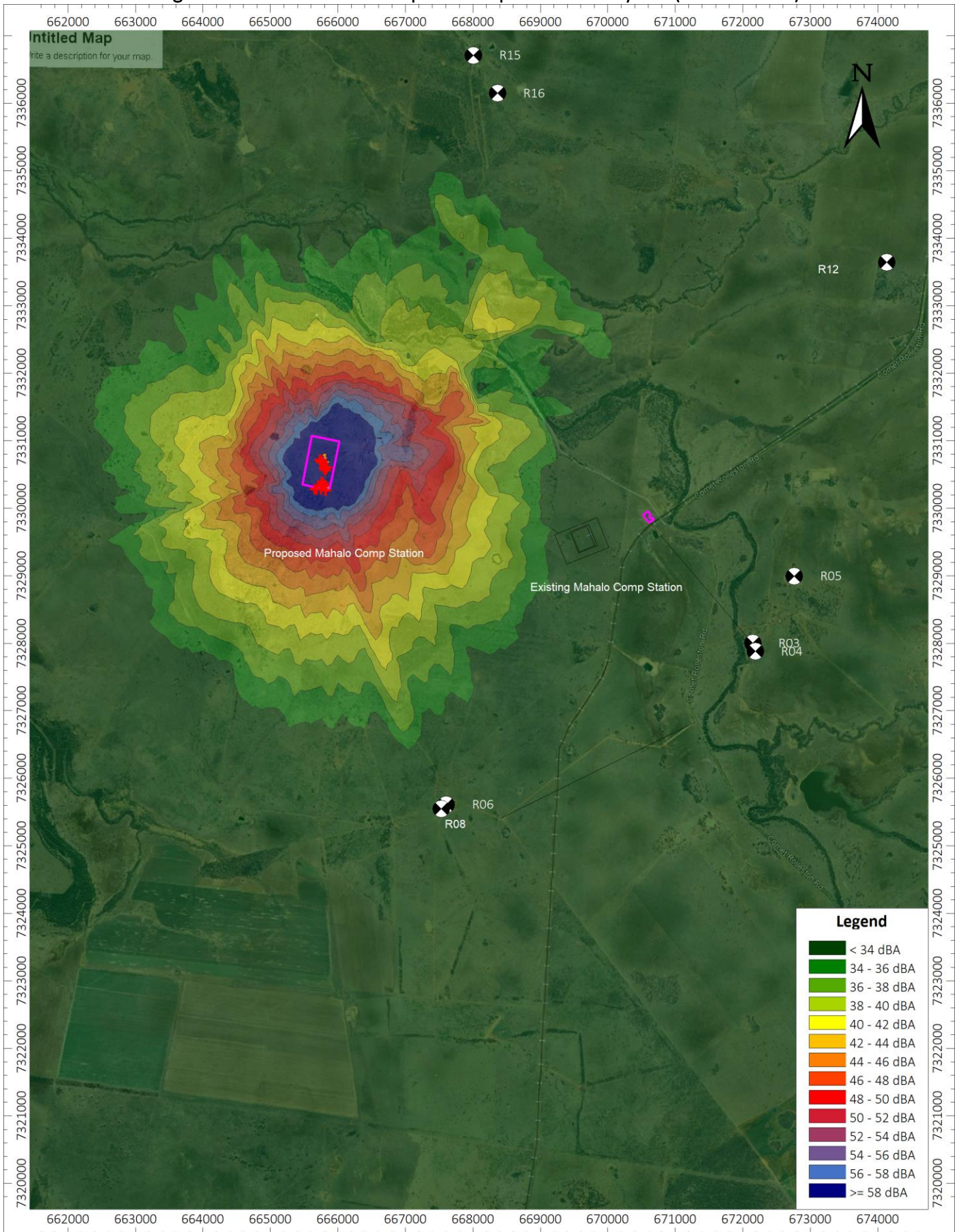




Figure 2D: Noise Contour Map – As Proposed – Facility SPL (Scenario S2B)

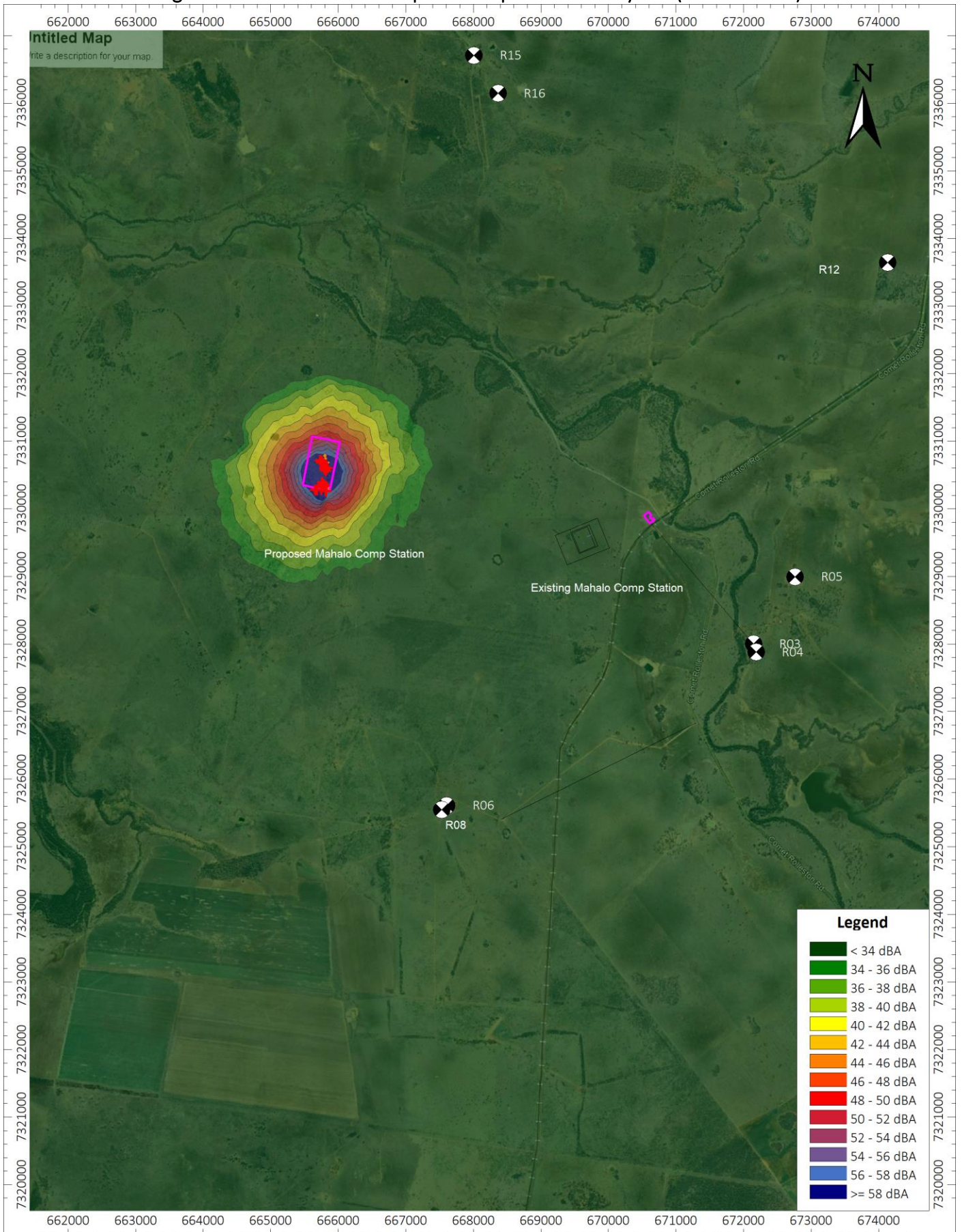




Figure 2E: Noise Contour Map – As Proposed – Facility SPL (Scenario S3BE)

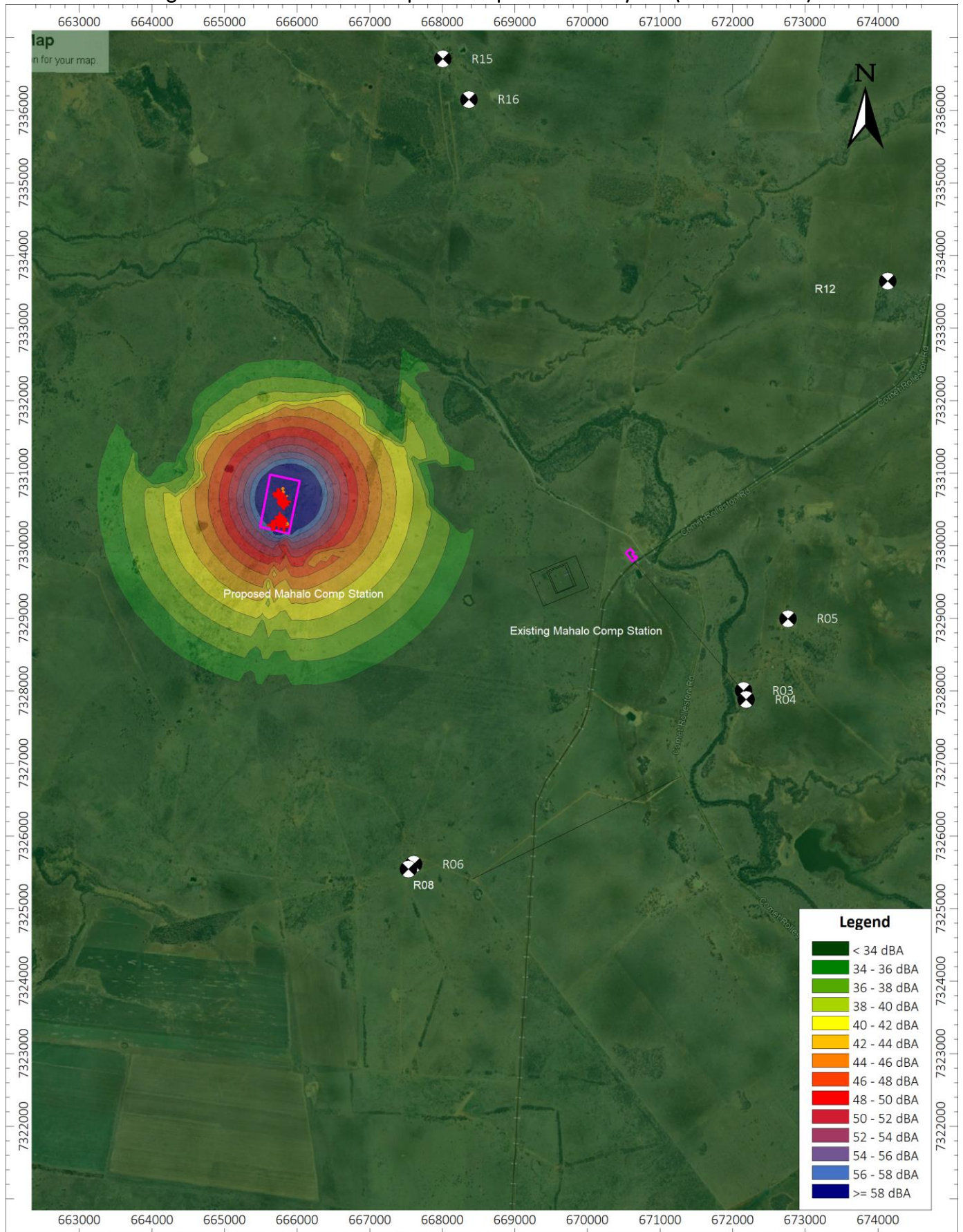




Figure 2F: Noise Contour Map – As Proposed – Facility SPL (Scenario S3BG)

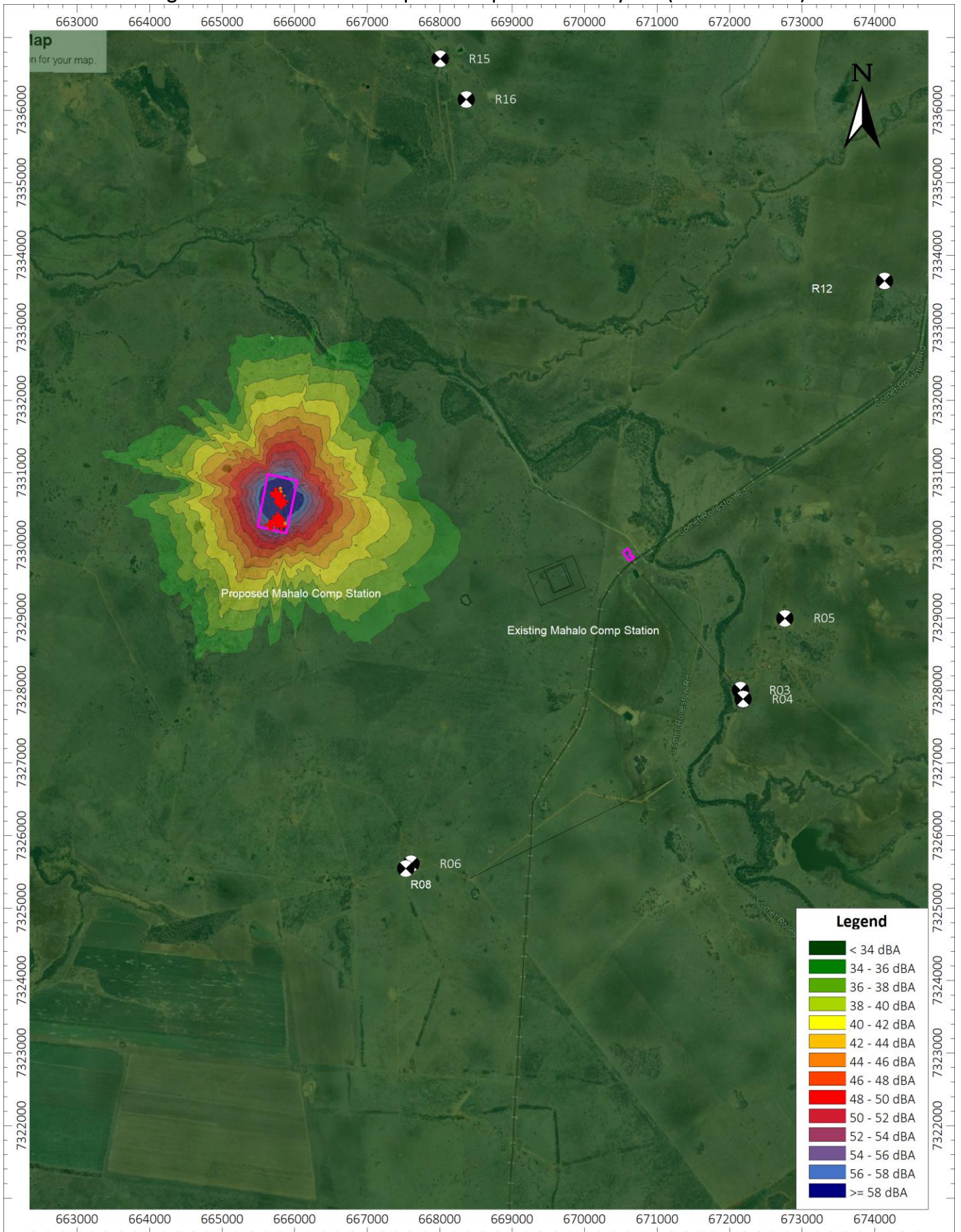
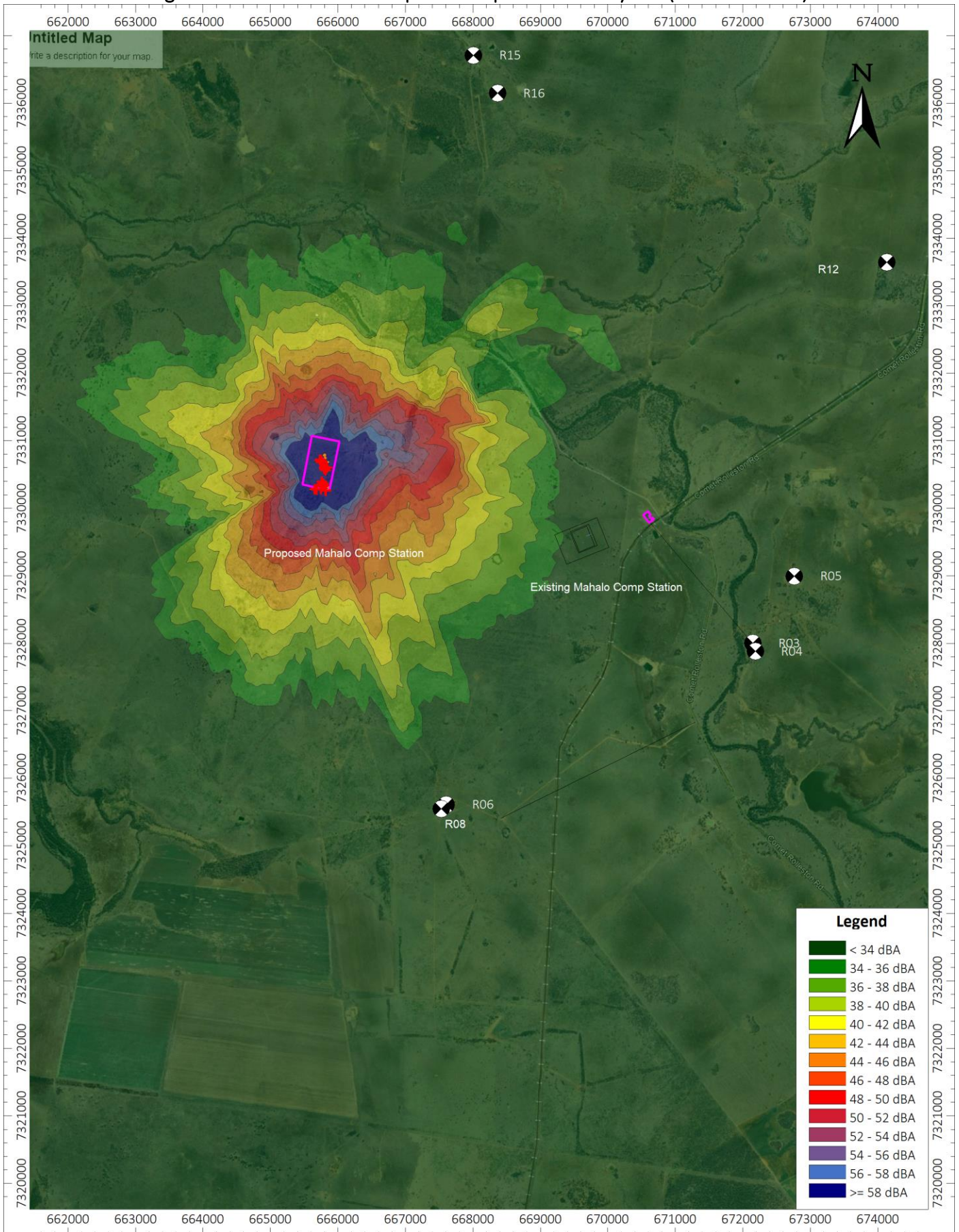




Figure 2G: Noise Contour Map – As Proposed – Facility SPL (Scenario S3AG)





Source Order Ranking

Tables 4A-4G list the top one or ten dominant noise sources received at the most impacted receiver R06 from the subject facility. See [Appendix E](#) for the complete source order ranking table.

Table 4A: Source Order Ranking - Receiver R06 (Scenario S1E)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Mahalo Flare Maximum flaring (Flare Rate of 50MMSCFM)	34.4	2.8
	Facility SPL	34.4	2.8
	ASL	25.0	-
	Cumulative SPL	34.9	-
	PSL	28.0	-

Table 4B: Source Order Ranking - Receiver R06(Scenario S1G)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Flare 5	16.6	3.4
002	Flare 3	16.2	3.5
003	Flare 1	15.8	3.4
004	Flare 2	15.3	3.5
005	Flare 4	14.8	3.5
011+	Flare 6	14.2	3.5
	Facility SPL	23.3	3.5
	ASL	25.0	-
	Cumulative SPL	27.3	-
	PSL	28.0	-

Table 4C: Source Order Ranking - Receiver R06 (Scenario S2A)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	CAT 3608 Compressor Engine unit no enclosure	21.1	5.7
002	CAT 3608 Compressor Engine unit no enclosure	16.4	7.5
003	CAT 3608 Compressor Engine unit no enclosure	15.9	7.4
004	CAT 3608 Compressor Casing No enclosure	8.9	10.0
005	CAT 3608 Compressor Casing No enclosure	7.9	10.3
006	CAT 3608 Compressor Casing No enclosure	6.5	10.7
007	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
008	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
009	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
010	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
011+	Cumulative Remaining 113 Noise Sources	7.7	15.6
	Facility SPL	23.8	7.7
	ASL	25.0	-
	Cumulative SPL	27.5	-
	PSL	28.0	-



Table 4D: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Compressor 21-1319 (4) Bldg Wall	4.2	15.2
002	Compressor 21-1319 (4) Bldg Wall	3.4	15.2
003	Compressor 21-1319 (4) Bldg Wall	3.3	15.2
004	Compressor 21-1319 (4) Bldg Skid	2.5	13.2
005	Compressor 21-1319 (4) Bldg Skid	2.0	12.9
006	Compressor 21-1319 (4) Exhaust Muffler	1.6	11.0
007	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.1
008	Compressor 21-1319 (4) Exhaust Muffler	0.9	11.5
009	Compressor 21-1319 (4) Bldg Skid	-1.4	13.8
010	Compressor 21-1319 (4)C Cooler Inlet	-4.5	14.9
011+	Cumulative Remaining 143 Noise Sources	8.0	15.5
	Facility SPL	13.4	14.4
	ASL	25.0	-
	Cumulative SPL	25.3	-
	PSL	28.0	-

Table 4E: Source Order Ranking - Receiver R06 (Scenario S3BE)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Mahalo Flare Normal flaring	18.7	2.8
002	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
003	Compressor 21-1319 (4) Bldg Wall	1.0	15.2
004	Compressor 21-1319 (4) Exhaust Muffler	0.8	11.4
005	Compressor 21-1319 (4) Bldg Wall	0.1	15.3
006	Compressor 21-1319 (4) Bldg Skid	-4.1	13.8
007	Compressor 21-1319 (4) Bldg Skid	-5.0	13.5
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Bldg Door ClosedEast2/west	-7.0	14.3
011+	Cumulative Remaining 118 Noise Sources	6.5	15.7
	Facility SPL	19.3	7.2
	ASL	25.0	-
	Cumulative SPL	26.0	-
	PSL	28.0	-

Table 4F: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Flare 1	11.7	3.5
002	Compressor 21-1319 (4) Bldg Wall	3.5	15.2
003	Compressor 21-1319 (4) Bldg Wall	2.7	15.2
004	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
005	Compressor 21-1319 (4) Exhaust Muffler	0.7	11.5
006	Compressor 21-1319 (4) Bldg Skid	-1.6	13.8



Table 4F: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
007	Compressor 21-1319 (4) Bldg Skid	-2.4	13.5
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Exhaust Muffler	-7.1	12.6
011+	Cumulative Remaining 122 Noise Sources	6.9	15.7
	Facility SPL	14.5	11.8
	ASL	25.0	-
	Cumulative SPL	25.4	-
	PSL	28.0	-

Table 4G: Source Order Ranking - Receiver R06 (Scenario S3AG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	CAT 3608 Compressor Engine unit no enclosure	21.2	5.7
002	CAT 3608 Compressor Engine unit no enclosure	16.0	7.4
003	Flare 1	11.7	3.4
004	CAT 3608 Compressor Casing No enclosure	9.0	10.0
005	CAT 3608 Compressor Casing No enclosure	6.5	10.7
006	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
007	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Exhaust Muffler	-7.1	12.6
011+	Cumulative Remaining 102 Noise Sources	6.8	15.8
	Facility SPL	23.2	7.2
	ASL	25.0	-
	Cumulative SPL	27.2	-
	PSL	28.0	-

The above results indicate that for the nearest potentially sensitive receiver R06 the dominant noise stems from the flare and Compressor units. A full order ranking list is outlined in the [Appendix E](#) for each of the six running scenarios. Noise control should be aimed at attenuating the dominant noise sources.

For general technical details on sound pressure levels and analysis, as well as for a best practice approach, see [Appendix G](#).



Conclusion

The results indicate that, as proposed, the Cumulative SPL is expected to exceed the PSL at some of the receivers in the study area for the maximum flaring event scenario. The most impacted receiver is at the receiver is R06, located approximately 5440m SSE from the subject facility.

The above results indicate that for the nearest potentially sensitive receiver, R06 the dominant noise stems from the flare and Compressor units.

Additional noise control is not required for the subject facility to comply with the requirements at the sensitive receiver.



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International Organization for Standardization (ISO) 1996. *Standard 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation*, Geneva Switzerland.

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Queensland Globe: <https://qldglobe.information.qld.gov.au/>

Queensland Spatial: <http://qldspatial.information.qld.gov.au/catalogue/>



Appendix A: Glossary



Table A: Glossary

Term	Description
A-weighted sound pressure level (dBA)	The sound pressure level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear at levels typical of rural backgrounds in mid frequencies.
Bands (full octave or 1/3 octave)	A series of electronic filters separate sound into discrete frequency bands, making it possible to know how sound energy is distributed as a function of frequency. Each octave band has a center frequency that is double the center frequency of the octave band preceding it. The 1/3 octave band analysis provides a finer breakdown of sound distribution as a function of frequency.
C-weighted sound pressure level (dBC)	The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dBA). The C-weighted sound pressure level (i.e., measured with the C-weighting) is more sensitive to sounds at low frequencies than the A-weighted sound level and is sometimes used to assess the low-frequency content of complex sound environments.
Daytime	Defined as the hours from 07:00 to 22:00.
Energy equivalent sound pressure level (Leq)	The average weighted sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measured over a time interval. The time interval used should be specified in brackets following the Leq—e.g., Leq (9) is a 9-hour Leq. If a sound level is constant over the measurement period, the Leq will equal the constant sound level.
Facility SPL	The overall sound pressure level from all the facilities in the study area
Heavily Travelled Road	Generally includes highways and any other road where the average traffic count is at least 10 vehicles/hour over the night-time period. It is acknowledged that highways are sometimes lightly travelled during the night-time period, which is usually the period of greatest concern.
Night-time	Defined as the hours from 22:00 to 07:00.
Noise	Generally associated with the unwanted portion of sound.
Noise Impact Assessment (NIA)	An NIA identifies the expected sound level emanating from a facility as measured 15 m from the nearest or most impacted permanently or seasonally occupied dwelling. It also identifies what the permissible sound level is and how it was calculated.
Permanent facility	A facility that is in operation for more than two months.
Permissible Sound Level (SPL)	The maximum SPL that a facility must not exceed at receivers.
Receiver	The location of the residences existing in the NIA study area for which the SPL is determined.
Representative conditions	Those conditions typical for an area and/or the nature of a complaint. For ASLs, these are conditions that portray the typical activities for the area, not the quietest time. For CSLs, these do not constitute absolute worst-case conditions or the exact conditions the complainant has highlighted if those conditions are not easily duplicated. Sound levels must be taken only when representative conditions exist; this may necessitate a survey of extensive duration (two or more consecutive nights).
Sound Power Level (PWL)	The sound power level emitted. The decibel equivalent of the rate of energy (or power) emitted in the form of noise. The sound power level is given by: $PWL = 10 \times \text{LOG}_{10} \left(\frac{\text{Sound as Power}}{W_0} \right)$ Where $W_0 = 10^{-12}$ watts (or 1 pW)
Sound Pressure Level (SPL)	The sound level received. The decibel equivalent of the pressure of sound waves at a specific location, which is measured with a microphone. The sound pressure level is given by: $SPL = 10 \times \text{LOG}_{10} \left(\frac{\text{Sound as Pressure}}{P_0} \right)$ Where $P_0 = 2 \times 10^{-5}$ Pa (or 20 μ Pa)
Subject facility	The ventilation facility which is the object of the NIA.
Tonal component	A pronounced peak clearly obvious within the sound level spectrum.



Appendix B: Equipment Details from Manufacturer



Figure B1: Generator from ACS-02 Site.



Figure B2: Compressor from ACS-03 Site.



Figure B3: Engine Exhaust Muffler (Maxim) from ACS-03 Site.



Table B: Water Treatment Plant Equipment Details

Equipment Name	Operation	ID	Equipment Details
P-1101 UF Feed Pump#1	Proposed 15/15min	-	Pump: Xylem e1610205B <ul style="list-style-type: none"> • Flow Rate: 156m³/h • Motor: 30 kW @ 2955 RPM estimated 71dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1102 UF Feed Pump#2	Proposed 15/15min	-	Pump: Xylem e1610205B <ul style="list-style-type: none"> • Flow Rate: 156m³/h • Motor: 30 kW @ 2955 RPM estimated 71dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
1724 KX-1003 Membrane Aeration Blower Skid 1	Proposed 02/15min	-	Blower: Pedro Gill CAPS Blower Fitted with Intake Acoustic Box, Sound Enclosure, Inlet and Discharge Silencer <ul style="list-style-type: none"> • Flow Rate: 242 Nm³/h at 80 kPa (g) @0C • Motor: 11 kW @ 1460-3000 RPM estimated 80dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
1724 KX-1004 Membrane Aeration Blower skid 2	Proposed 02/15min	-	Blower: Pedro Gill CAPS Blower Fitted with Intake Acoustic Box, Sound Enclosure, Inlet and Discharge Silencer <ul style="list-style-type: none"> • Flow Rate: 242 Nm³/h at 80 kPa (g) @0C • Motor: 11 kW @ 1460-3000 RPM estimated 80dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1301 RO Feed Pump #1	Proposed 15/15min	504899-MA-02	<ul style="list-style-type: none"> • Pump: Xylem E1610-2.5B • Flow Rate: 94m³/h • Motor: 18.5 kW @ 2940 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1301 RO Feed Pump #2	Proposed 15/15min	504899-MA-02	Pump: Xylem E1610-2.5B <ul style="list-style-type: none"> • Flow Rate: 94m³/h • Motor: 18.5 kW @ 2940 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1411 Train # 1 RO Stage 1HP Pump	Proposed 15/15min	-	Pump: Xylem MPB 65.2/5 <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 90 kW @ 2975 RPM estimated 77dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1421 Train # 2 RO Stage 1 HP Pump	Proposed 15/15min	-	Pump: Xylem MPB 65.2/5 <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 90 kW @ 2975 RPM estimated 77dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1412 Train # 1 RO Stage 2 Feed Pump	Proposed 15/15min	-	Pump: FEDCO MS-70 <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 55 kW @ 2970 RPM estimated 74dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only



Equipment Name	Operation	ID	Equipment Details
P-1422 Train # 1 RO Stage 2 Feed Pump	Proposed 15/15min	-	Pump: FEDCO MS-70 <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 55 kW @ 2970 RPM estimated 74dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1413 Train # 1 RO Stage 3 Feed Pump	Proposed 15/15min	-	Pump <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 22 kW @ 2950 RPM estimated 74dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1423 Train # 2 RO Stage 3 Feed Pump	Proposed 15/15min	-	Pump <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 22 kW @ 2950 RPM estimated 74dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1511 RO Permeate Recycle Pump	Proposed 15/15min	504899- MA-5	Pump <ul style="list-style-type: none"> • Flow 130m³/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1512 Flush / Backwash Pump	Proposed 02/15min	504899- MA-4	Pump <ul style="list-style-type: none"> • Flow Rate: 80m³/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1513 Flush / Backwash Pump	Proposed 02/15min	504899- MA-4	Pump <ul style="list-style-type: none"> • Flow Rate: 80m³/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1521 Backwash Waste Sump Pump	Proposed 0/15min infrequent operation and buried	-	Pump <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 15 kW @ 2935 RPM estimated 73dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1522 Backwash Waste Sump Pump	Proposed 0/15min infrequent operation and buried	-	Pump <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 15 kW @ 2935 RPM estimated 73dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1531 CIP Pump	Proposed 15/15min	504899- MA-03	Pump <ul style="list-style-type: none"> • Flow Rate: 45m³/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
P-1532 CIP Pump	Proposed 15/15min	504899- MA-03	Pump <ul style="list-style-type: none"> • Flow Rate: 45m³/h • Motor: 11 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only



Equipment Name	Operation	ID	Equipment Details
Combined Dosing Kit	Proposed 15/15min	-	<p>Multiple Pumps modelled as single source</p> <ul style="list-style-type: none"> • Flow Rate: unknown • Multiple Motors combined to: 15 kW @ 2935 RPM estimated 70dBA @ 1m • Cooling: N/A • Enclosure: enclosed, with roof
KX-1001 Air Compressor #1	Proposed 15/15min	-	<p>Compressor: Caps Australia -CR11-13-500</p> <ul style="list-style-type: none"> • Flow Rate: 1.1 m3/min discharge @ 750-850 kPa • Motor: 11 kW @ 2935 RPM estimated 65dBA @ 1m from PAAE database • Cooling: N/A • Enclosure: not enclosed, roof only
DX1001 Desiccant Dryer	Proposed 15/15min	-	<p>Adsorption Dryer DPS 10</p> <ul style="list-style-type: none"> • Flow Rate: 110m3/h • Motor: Operating pressure 4-16bar • Valve noise estimated 70dBA sound power • Cooling: N/A • Enclosure: not enclosed,
P-0003 Rain Water Pump	Proposed 0/15min infrequent operation	-	<p>Pump</p> <ul style="list-style-type: none"> • Flow Rate: unknown • Motor: 7.5 kW @ 2935 RPM estimated 69dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Irrigation Pump #1 and #2	Proposed 15/15min	-	<p>CRN 155-3-2_3*400V</p> <ul style="list-style-type: none"> • Pump: Grundfos • Flow Rate: 38 lps • Motor: 37 kW estimated 67dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Irrigation pump #3 and #4	Proposed 15/15min	-	<p>CRN 45-4-2_3*400V</p> <ul style="list-style-type: none"> • Pump: Grundfos • Flow Rate: 13.5 lps • Motor: 15 kW estimated 60dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Irrigation pump #6	Proposed 0/15min infrequent operation	-	<p>CRN 32-4-3*400V</p> <ul style="list-style-type: none"> • Pump: Grundfos • Flow Rate: 7 lps • Motor: 7.5 kW estimated 60dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Irrigation Booster Pump	Proposed 15/15min	-	<p>NBG 150-125-315/290_3*400V</p> <ul style="list-style-type: none"> • Pump: Grundfos • Flow Rate: 45 lps • Motor: 22 kW estimated 66dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Truck Fill Pump #7 & #8	Proposed 15/15min	-	<p>CRN95-2-2_3*400V</p> <ul style="list-style-type: none"> • Pump: Grundfos • Flow Rate: 18 lps • Motor: 11 kW estimated 60dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,



Equipment Name	Operation	ID	Equipment Details
Dam Transfer pump	Proposed 15/15min	-	<p>NBG 150-125-315/290_3*400V</p> <ul style="list-style-type: none"> • Pump: Grundfos • Flow Rate: 45 lps • Motor: 22 kW estimated 66dBA @ 1m • Cooling: N/A • Enclosure: not enclosed,
Air Conditioning	Proposed 15/15min	-	<ul style="list-style-type: none"> • Fujitsu – AOTG30KMTA 3 off • Capacity: Cooling 2.9-10.5, Heating: 2.2-11.2 • Compressor: Hermetic x1 • Motor: (W): 2200 • Sound Power: 67dB linear
Pre-Treatment Plant			
Clarifying Feed Pump	15/15min Duty / Standby		<p>Xylem Pump</p> <ul style="list-style-type: none"> • Feed Pump Centrifugal e1610 4A 4kW • Flow Rate: 115m³/h at 2.39kW • Motor: 4 kW @ 1443 RPM estimated 57dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
Effluent Pump	15/15min Duty / Standby		<p>Pump</p> <ul style="list-style-type: none"> • Feed Pump Centrifugal e1610 4A 4kW • Flow Rate: 115m³/h • Motor: 4 kW @ 1443 RPM estimated 57dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
Sludge Pump	15/15min Duty		<p>Pump</p> <ul style="list-style-type: none"> • Sludge Pump Monoflo NOV E14AF81RMA • Flow Rate: 6m³/h • Motor: 3 kW @ 425 RPM estimated 51dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
Clarifier	15/15min Duty		<ul style="list-style-type: none"> • Flocculator Tank Mixer (two) 0.37kW @1305RPM 43dBA at 1m • Scraper driver – 0.18kW @1320RPM • Shear mixer driver – 11 kW @ 1445 RPM estimated 61dBA @ 1m • Rapid mixer driver – 0.55 kW @ 1445 RPM estimated 44dBA @ 1m
Containerized Dewatering Plant	15/15min Duty		<ul style="list-style-type: none"> • Rotamat Screw Press RoS Q - <70dBA • Rotamat Screw Conveyor - <70dBA • Sludge Feed Pump – BN 10-6L, 9m³/h – Seepex Cavity Pump 2.2kW RPM 1449 Motor, Pump speed 349RPM • Sludge Feed Pump – BN 1-6L, 500l/h – Seepex Cavity Pump 0.55kW RPM 1375 Motor, Pump speed 300RPM <p>Enclosed isolated</p> <ul style="list-style-type: none"> • TECO AirCon Unit TSO27HFAMJBB outside Sound power 62dBA
Bentonite Slurry Mixer	15/15min Duty		<p>Vertical Mixer</p> <ul style="list-style-type: none"> • Mixtec – Vertical Mixer • Mixer: 1.24m dia • Motor: 2.2 kW @ 1445 RPM estimated 53dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only



Equipment Name	Operation	ID	Equipment Details
Bentonite Batching and Dosing Skid	15/15min Duty		<ul style="list-style-type: none"> • Feeder (Aug Feeder) – 0.37kW at 1405 RPM 50dBA at 1m • Hopper Motor (Agitator) – 0.37kW at 1405RPM 50dBA at 1m • Feed Bucket Elevator – 0.55kW at 1405RPM 48dBA at 1m • Makeup Tank Mixer – 3.0 kW at 1456 at 70dBA • Slurry Tank Mixer – 2.2kW at 1450 at 0dBA at 1m • Dosing Pump – 0.75kW, 1415RPM, 47dBA at 1m
Dosing Skid Ferric Chloride Ferric Sulphate Dosing Pump	15/15min Duty/Standby		Dosing Skid <ul style="list-style-type: none"> • IXOM Dosing Skid • Dosing Pumps Grundfos DDA30-4 FCM • Dosing Pump – 0.02kW – 15L/h • Enclosed in Dosing Cabinet on Skid • Not acoustically significant
Utility Water Pump Pumps Hydro MPC-E 2 CRNE15-4 5.5kw	15/15min Duty/Standby		<ul style="list-style-type: none"> • Grunfos Pump • Pump CRNE15-4 Pump • Flow Rate: • Motor: 5.5 kW @ 1443 RPM estimated 57dBA @ 1m • Cooling: N/A • Enclosure: not enclosed, roof only
Hypochlorite Chemical Unloading & Dosing Skid	15/15min Duty/Standby		<ul style="list-style-type: none"> • IBC unloading Pump – 0.55 kW @ 1445 RPM estimated 44dBA @ 1m Dosing Pump Grundfos DDA30-4 FCM Enclosed in dosing cabinet on skid, 0.02kW not acoustically significant
Filtration Pump	15/15min Duty / Standby		Gorman RVPP, 0.75kW at 1415RPM, 47dBA at 1m
Generator DE200E	Intermittent operation only not modelled		<ul style="list-style-type: none"> • 97dBA Sound Power with 62dBA at 15m



Appendix C: Subject Facility Plot Plan



Appendix D: Sound Power Levels



The Sound Power Levels (PWL) were determined for all of the facility major noise sources. The PWL in linear octave band are presented in the table below. For each proposed noise source, the PWL was obtained from theory, manufacturer’s data, and previous study on similar sources.

Table D-1: Source Octave Band Sound Power Levels

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
Mahalo Flare Maximum flaring((Elevated)	Theory	115	115	123	132	140	138	135	132	129	142	144
Mahalo Flare Normal flaring(Elevated)	Theory	105	105	113	122	130	127	125	122	119	132	133
CAT 3612 Compressor Casing No enclosure	Previous Study	115	111	116	115	113	116	121	118	111	125	125
CAT 3612 Engine Unit no enclosure	Previous Study	110	115	117	116	117	117	115	111	105	121	124
Mahalo Comp Air Bldg Open Area (Doors Open)	Theory	96	95	99	101	102	103	106	103	94	110	111
Compressor 21-1319 (4) Exhaust Pipe	Previous Study	95	103	91	85	87	93	105	106	87	109	109
Compressor 21-1319 (4) Exhaust Muffler	Previous Study	101	110	100	96	96	101	99	96	81	105	111
Compressor 21-1319 (4) Bldg Skid	Previous Study	107	110	112	110	101	95	89	87	83	105	116
Load bank Air Intake	Field	91	95	103	99	98	97	92	85	81	101	107
Compressor 21-1319 (4) Bldg Wall	Previous Study	109	108	113	103	97	94	89	86	80	101	115
Compressor 21-1319 (4) Air Intake Pipe	Previous Study	101	102	99	95	87	86	90	97	85	100	106
Load bank Cooler Discharge	Field	88	92	99	97	95	94	89	82	74	98	103
Mahalo Generator Bldg Door ClosedEast2/west		92	95	105	100	92	87	78	71	65	95	107
Mahalo Generator Bldg Door ClosedEast2/west	Theory	92	95	105	100	92	87	78	71	65	95	107
Mahalo Generator Cooler Inlet	Theory	96	97	95	96	88	90	87	78	67	94	102
Mahalo Generator Cooler DischargeTop	Theory	112	108	98	92	85	87	89	80	73	94	111
Mahalo Water plant	Theory	97	88	84	85	87	89	86	83	85	93	98
Compressor 21-1319 (4)C Cooler Inlet	Previous Study	101	98	98	93	87	81	81	88	72	93	103
Mahalo Generator Exhaust Muffler	Theory	92	98	100	94	88	88	86	80	70	93	103
Mahalo Comp Air Bldg Wall and Roof	Theory	106	99	96	94	94	82	84	73	64	93	105
Mahalo Substation	Theory	88	94	97	93	92	87	82	77	70	93	101
Mahalo Generator Bldg Door Closed North	Theory	93	97	105	95	84	75	69	62	52	91	106



Table D-1: Source Octave Band Sound Power Levels

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
Mahalo Generator Bldg Wall East/West	Theory	92	96	104	94	84	75	68	62	51	90	105
Mahalo Generator Air Intake Pipe West	Theory	97	96	102	90	81	76	79	82	75	90	103
Mahalo Generator Cooler HousingTop	Theory	90	92	90	95	81	82	76	65	57	89	98
Compressor 21-1319 (4) Exhaust Tip1.0	Previous Study	92	95	91	85	80	79	80	81	69	87	98
Mahalo Generator Bldg WallTop	Theory	97	94	95	90	84	75	73	64	56	86	99
Compressor 21-1319 (4) Exhaust Tip	Previous Study	95	98	94	88	83	82	82	83	70	89	100
Compressor 21-1319 (4)C Cooler Discharge	Previous Study	98	95	94	87	82	76	74	76	63	85	99
Mahalo Generator Bldg Door ClosedEast	Theory	85	87	91	89	81	76	66	57	50	84	95
Compressor 21-1319 (4)C Cooler Housing	Previous Study	94	93	94	88	80	74	68	71	60	84	98
Compressor 21-1319 (4) Bldg Door Closed E1	Previous Study	88	88	89	81	79	77	75	72	71	83	93
Mahalo Generator Bldg Fan Louver OpenSouth	Theory	94	93	96	83	76	74	71	70	72	83	98
Mahalo Generator Air IntakeNorth top	Theory	94	93	91	84	80	69	68	60	57	81	96
Mahalo Generator Exhaust Tip	Theory	96	94	86	78	75	71	73	67	54	79	96
Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	Previous Study	90	89	84	73	73	72	68	66	64	77	92
Mahalo TEG Dehydration Package Unit 1	Theory	85	74	73	69	70	71	66	63	61	74	83
Mahalo TEG Dehydration Package Unit 2	Theory	85	74	73	69	70	71	66	63	61	74	83
Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	Previous Study	85	85	84	74	69	64	62	61	54	73	88
Mahalo Transformer #3	Theory	61	67	70	66	65	60	55	50	43	66	74
Mahalo Transformer #4	Theory	61	67	70	66	65	60	55	50	43	66	74
Mahalo HV VSD Transformer #1	Theory	61	67	70	66	65	60	55	50	43	66	74
Mahalo HV VSD Transformer #2	Theory	61	67	70	66	65	60	55	50	43	66	74
Mahalo HV VSD Transformer #3	Theory	61	67	70	66	65	60	55	50	43	66	74



Table D-2: Source Octave Band Sound Power Levels (WTP)

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
P-1411 Train # 1 RO Stage 1 HP Pump	Previous Study	82	83	88	88	91	86	85	80	77	92	95
P-1421 Train # 2 RO Stage 1 HP Pump	Previous Study	82	83	88	88	91	86	85	80	77	92	95
P-1412 Train # 1 RO Stage 2 Feed Pump	Previous Study	79	80	84	85	87	83	81	76	74	89	92
P-1422 Train # 2 RO Stage 2 Feed Pump	Previous Study	79	80	84	85	87	83	81	76	74	89	92
P-1413 Train # 1 RO Stage 3 Feed Pump	Previous Study	83	77	76	76	81	83	84	78	73	89	89
P-1423 Train # 2 RO Stage 3 Feed Pump	Previous Study	83	77	76	76	81	83	84	78	73	89	89
KX-1003 Membrane Aeration Blower Skid 1	Previous Study	82	83	78	90	82	83	79	78	69	88	93
KX-1004 Membrane Aeration Blower Skid 1	Previous Study	82	83	78	90	82	83	79	78	69	88	93
P-1101 UF Feed Pump #1	Previous Study	84	76	76	76	79	79	81	76	74	85	87
P-1102 UF Feed Pump #2	Previous Study	84	76	76	76	79	79	81	76	74	85	87
Combined Dosing Skid	Previous Study	82	75	75	74	80	81	79	73	70	85	87
P-1511 RO Permeate Recycle Pump	Previous Study	81	74	74	74	79	80	78	72	69	84	86
P-1531 CIP Pump	Previous Study	79	72	72	72	79	80	78	72	67	84	85
P-1532 CIP Pump	Previous Study	79	72	72	72	79	80	78	72	67	84	85
P-1301 RO Feed Pump # 1	Previous Study	82	74	73	73	77	77	79	74	72	84	85
P-1302 RO Feed Pump # 2	Previous Study	82	74	73	73	77	77	79	74	72	84	85
Irrigation Pumps #1 - CRN155 PW	Previous Study	83	81	77	79	76	75	75	71	74	81	87
Irrigation Pumps #2 - CRN155 PW	Previous Study	83	81	77	79	76	75	75	71	74	81	87
KX-1001 Air Compressor # 1	Previous Study	82	85	82	83	78	73	71	61	49	80	89
Irrigation Pumps Booster NBG150	Previous Study	77	70	69	69	73	74	76	70	68	80	81
Dam Transfer NBG150	Previous Study	77	70	69	69	73	74	76	70	68	80	81
Pre Tx Dewatering Bldg Open Area (Doors Open)	Previous Study	82	83	80	85	73	72	69	69	66	80	88
Pre Tx Dewatering Bld Ext Motor	Previous Study	73	66	65	65	70	72	69	65	67	76	78



Table D-2: Source Octave Band Sound Power Levels (WTP)

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
P-1512 Flush / Backwash Pump	Previous Study	72	65	65	65	71	71	69	64	60	75	77
P-1513 Flush / Backwash Pump	Previous Study	72	65	65	65	71	71	69	64	60	75	77
Pre Tx Clarifier - Shear Mixer	Previous Study	71	64	63	63	68	70	66	63	65	74	75
Pre Tx Dewatering Bldg Wall and Roof	Previous Study	91	86	77	80	68	61	57	54	51	73	91
Truck Pumps #7 CRN 95	Previous Study	68	62	62	62	69	69	68	62	56	73	75
Truck Pumps #8 CRN 95	Previous Study	68	62	62	62	69	69	68	62	56	73	75
Pre Tx Clarifying Feed Pump	Previous Study	70	63	62	62	67	69	66	63	65	73	75
Irrigation Pumps #3 CRN 45 AW	Previous Study	74	64	63	67	70	69	64	62	60	73	76
Irrigation Pumps #4 CRN 45 AW	Previous Study	74	64	63	67	70	69	64	62	60	73	76
Desiccant Dryer DX1001	Manufacturer	43	42	40	46	52	60	64	65	64	70	69
Pre Tx Utility Water Pump	Previous Study	66	60	59	59	63	66	62	59	61	69	71
Pre Tx Effluent Pump	Previous Study	64	57	56	56	60	63	59	56	58	67	68
Pre Tx Sludge pump	Previous Study	62	55	54	54	59	61	58	55	57	65	67
Pre Tx Bentonite Slurry Mixer	Previous Study	62	55	54	54	59	61	57	54	56	65	66
Pre Tx Dewatering Bld Ext AirCon	Previous Study	82	72	70	65	60	54	47	44	42	62	80
Pre Tx Bentonite-Skid Feeder	Previous Study	59	52	51	51	56	58	54	51	53	62	63
Pre Tx Bentonite Skid Hopper	Previous Study	59	52	51	51	56	58	54	51	53	62	63
5344-Futjisu ASTG30KMTA #1	Manufacturer	54	57	61	63	58	55	51	46	41	60	67
5344-Futjisu ASTG30KMTA #2	Manufacturer	54	57	61	63	58	55	51	46	41	60	67
5344-Futjisu ASTG30KMTA #3	Manufacturer	54	57	61	63	58	55	51	46	41	60	67
Pre Tx Bentonite Skid Make up mixer	Previous Study	57	50	49	49	54	56	53	50	52	60	62
Pre Tx Bentonite Skid Feed Bucket	Previous Study	57	50	49	49	54	56	52	49	51	60	61
Pre Tx Clarifier - Scraper	Previous Study	56	50	49	49	53	56	52	49	51	60	61



Table D-2: Source Octave Band Sound Power Levels (WTP)

Noise Source	Data Source	Linear Octave Band Centre Frequency (dB)									Overall (dBA)	Overall (dBC)
		31.5	63	125	250	500	1000	2000	4000	8000		
Pre Tx Filtration Pump	Previous Study	56	49	48	48	53	55	51	48	50	59	60
Pre Tx Bentonite Skid Dosing Pump	Previous Study	56	49	48	48	53	55	51	48	50	59	60
Pre Tx Clarifier - Flocculator Tan Mixer (2)	Previous Study	55	48	47	47	52	54	50	47	49	58	59
Pre Tx Bentonite Skid Slurry mixer	Previous Study	55	48	47	47	52	54	50	47	49	58	59
Pre Tx Hypochlorite IBC unloading	Previous Study	53	46	45	45	50	52	48	45	47	56	57
Pre Tx Clarifier - Rapid Mixer	Previous Study	53	46	45	45	50	52	48	45	47	56	57



Appendix E: Source Order Ranking



Table E1: Source Order Ranking - Receiver R06 (Scenario S1E)

Rank	Noise Source	SPL (dBA)	dBc-dBA
001	Mahalo Flare Maximum flaring (50MM)	34.4	2.8
	Facility SPL	34.4	2.8
	ASL	25.0	-
	Cumulative SPL	34.9	-
	PSL	28.0	-

Table E2: Source Order Ranking - Receiver R06 (Scenario S1G)

Rank	Noise Source	SPL (dBA)	dBc-dBA
001	Flare 5	16.6	3.4
002	Flare 3	16.2	3.5
003	Flare 1	15.8	3.4
004	Flare 2	15.3	3.5
005	Flare 4	14.8	3.5
006	Flare 6	14.2	3.5
	Facility SPL	23.3	3.4
	ASL	25.0	-
	Cumulative SPL	27.3	-
	PSL	28.0	-



Table E3: Source Order Ranking - Receiver R06 (Scenario S2A)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	CAT 3608 Compressor Engine unit no enclosure	21.1	5.7
002	CAT 3608 Compressor Engine unit no enclosure	16.4	7.5
003	CAT 3608 Compressor Engine unit no enclosure	15.9	7.4
004	CAT 3608 Compressor Casing No enclosure	8.9	10.0
005	CAT 3608 Compressor Casing No enclosure	7.9	10.3
006	CAT 3608 Compressor Casing No enclosure	6.5	10.7
007	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
008	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
009	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
010	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
011	Compressor 21-1319 (4) Exhaust Pipe	-6.6	11.6
012	Compressor 21-1319 (4) Exhaust Pipe	-7.0	12.0
013	Mahalo Generator Bldg Door ClosedEast2/west	-7.1	14.3
014	Mahalo Generator Exhaust Muffler	-7.1	12.6
015	Mahalo Generator Exhaust Muffler	-7.2	12.6
015	Mahalo Generator Exhaust Muffler	-7.2	12.6
017	Compressor 21-1319 (4)C Cooler Inlet	-7.4	14.9
018	Compressor 21-1319 (4)C Cooler Inlet	-7.5	15.0
019	Mahalo Generator Cooler Inlet	-8.1	12.0
020	Compressor 21-1319 (4) Air Intake Pipe	-8.4	15.1
021	Compressor 21-1319 (4) Air Intake Pipe	-8.5	15.2
022	Mahalo Generator Bldg Door ClosedNorth	-8.6	15.9
023	P-1411 Train # 1 RO Stage 1 HP Pump	-8.8	5.2
023	Compressor 21-1319 (4)C Cooler Housing	-9.1	15.1
025	Compressor 21-1319 (4)C Cooler Housing	-9.2	15.1
026	Mahalo Generator Cooler DischargeTop	-9.2	22.0
027	Mahalo Generator Cooler DischargeTop	-9.2	21.9
027	Mahalo Generator Cooler DischargeTop	-9.2	21.9
029	Mahalo Generator Bldg WallEast/West	-9.3	15.9
030	Compressor 21-1319 (4) Air Intake Pipe	-10.0	16.3
031	Compressor 21-1319 (4)C Cooler Housing	-10.2	15.5
032	Mahalo Generator Bldg Door ClosedEast2/west	-10.3	14.4
033	Mahalo Generator Cooler Inlet	-10.5	13.4
034	Mahalo Generator Bldg Door ClosedEast2/west	-10.7	14.5
035	Mahalo Generator Cooler Inlet	-10.9	13.6
036	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.9	4.8
037	Mahalo Generator Cooler HousingTop	-11.1	11.6
038	Mahalo Generator Air Intake PipeWest	-11.3	16.9
039	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
040	P-1421 Train # 2 RO Stage 1 HP Pump	-11.3	6.1
041	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
042	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
042	Compressor 21-1319 (4)C Cooler Housing	-11.4	15.6
044	Mahalo Generator Cooler HousingTop	-11.4	11.8
045	Compressor 21-1319 (4)C Cooler Housing	-11.5	15.6
046	Mahalo Generator Cooler HousingTop	-11.5	11.9
047	Compressor 21-1319 (4)C Cooler Housing	-11.6	15.7



Table E3: Source Order Ranking - Receiver R06 (Scenario S2A)

Rank	Noise Source	SPL (dBA)	dBC-dBA
048	Mahalo Generator Bldg Door ClosedNorth	-11.6	16.0
049	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.9	5.1
050	Mahalo Generator Bldg Door ClosedNorth	-12.0	16.1
051	Mahalo Generator Bldg WallTop	-12.2	15.3
052	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
053	Mahalo Generator Bldg WallEast/West	-12.3	16.0
054	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
055	Compressor 21-1319 (4)C Cooler Discharge	-12.4	15.6
056	Compressor 21-1319 (4) Exhaust Tip	-12.5	14.9
056	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
058	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
058	Mahalo Generator Bldg WallEast/West	-12.7	16.1
060	Mahalo Generator Bldg WallTop	-13.5	15.9
061	Mahalo Generator Bldg WallTop	-13.6	16.0
062	Mahalo Generator Air IntakeNorth top	-14.3	15.7
063	Mahalo Generator Air IntakeNorth top	-14.4	15.7
064	Mahalo Generator Air IntakeNorth top	-14.4	15.7
065	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.7	3.9
066	Load bank Air Intake	-14.8	12.4
067	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.9	4.0
068	Compressor 21-1319 (4)C Cooler Inlet	-15.2	18.4
069	Compressor 21-1319 (4)C Cooler Inlet	-15.9	17.2
070	Compressor 21-1319 (4)C Cooler Inlet	-16.0	17.3
071	Compressor 21-1319 (4)C Cooler Inlet	-16.1	17.2
072	KX-1003 Membrane Aeration Blower Skid 1	-16.6	7.5
073	Combined Dosing Skid	-16.6	4.3
074	KX-1004 Membrane Aeration Blower Skid 1	-16.7	7.6
075	Mahalo Generator Air Intake PipeWest	-16.8	17.3
076	Load bank Air Intake	-17.3	12.5
077	Load bank Air Intake	-17.4	12.5
078	Mahalo Generator Air Intake PipeWest	-17.4	17.4
079	Mahalo Generator Bldg Fan Louver OpenSouth	-17.4	17.5
080	P-1101 UF Feed Pump #1	-17.9	5.7
081	P-1102 UF Feed Pump #2	-17.9	5.7
082	Load bank Cooler Discharge	-18.2	11.7
083	Compressor 21-1319 (4) Air Intake E	-18.7	24.3
084	Compressor 21-1319 (4) Air Intake E	-18.7	24.3
085	KX-1001 Air Compressor # 1	-19.4	10.2
086	Mahalo Generator Bldg Door ClosedEast	-19.4	14.2
087	P-1301 RO Feed Pump # 1	-19.9	5.6
088	P-1302 RO Feed Pump # 2	-19.9	5.6
089	Mahalo Generator Bldg Fan Louver OpenSouth	-20.5	17.8
090	Load bank Cooler Discharge	-20.5	11.9
091	Mahalo Comp Air Bldg Open Area (Doors Closed)	-20.5	5.3
092	Irrigation Pumps #2 - CRN155 PW	-20.6	8.5
093	P-1511 RO Permeate Recycle Pump	-20.6	5.7
094	Irrigation Pumps #1 - CRN155 PW	-20.7	8.6
095	Mahalo Generator Bldg Fan Louver OpenSouth	-20.8	17.9



Table E3: Source Order Ranking - Receiver R06 (Scenario S2A)

Rank	Noise Source	SPL (dBA)	dBC-dBA
096	Load bank Cooler Discharge	-20.9	11.9
097	Mahalo Generator Exhaust Tip	-21.1	19.2
098	Mahalo Generator Exhaust Tip	-21.1	19.2
099	Mahalo Generator Exhaust Tip	-21.1	19.2
100	Mahalo Comp Air Bldg Wall and Roof	-21.3	14.6
101	Compressor 21-1319 (4) Air Intake E	-22.0	26.3
102	Mahalo Generator Bldg Door ClosedEast	-22.6	14.6
103	Mahalo Generator Bldg Door ClosedEast	-23.1	14.6
104	P-1531 CIP Pump	-23.2	6.0
105	P-1532 CIP Pump	-23.4	6.1
106	Irrigation Pumps Booster NBG150	-23.4	5.2
107	Dam Transfer NBG150	-23.5	5.2
108	Irrigation Pumps #4 CRN 45 AW	-26.8	5.2
109	Irrigation Pumps #3 CRN 45 AW	-26.8	5.2
110	Mahalo TEG Dehydration Package Unit 1	-27.5	12.3
111	P-1512 Flush / Backwash Pump	-28.5	5.3
112	P-1513 Flush / Backwash Pump	-28.7	5.5
113	Truck Pumps #7 CRN 95	-29.9	4.3
113	Truck Pumps #8 CRN 95	-29.9	4.3
115	Mahalo HV VSD Transformer #1	-35.8	10.3
116	5344-Futjisu ASTG30KMTA #1	-36.3	7.7
116	5344-Futjisu ASTG30KMTA #2	-36.3	7.7
116	5344-Futjisu ASTG30KMTA #3	-36.3	7.7
119	Mahalo Transformer #4	-38.8	11.9
120	Mahalo Transformer #3	-39.5	12.1
121	Mahalo HV VSD Transformer #2	-43.6	12.8
122	Mahalo HV VSD Transformer #3	-43.8	12.9
123	Desiccant Dryer DX1001	-44.2	1.5
	Facility SPL	23.8	7.6
	ASL	25.0	-
	Cumulative SPL	27.5	-
	PSL	28.0	-

Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Compressor 21-1319 (4) Bldg Wall	4.2	15.2
002	Compressor 21-1319 (4) Bldg Wall	3.4	15.2
003	Compressor 21-1319 (4) Bldg Wall	3.3	15.2
004	Compressor 21-1319 (4) Bldg Skid	2.5	13.2
005	Compressor 21-1319 (4) Bldg Skid	2.0	12.9
006	Compressor 21-1319 (4) Exhaust Muffler	1.6	11.0
007	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.1
008	Compressor 21-1319 (4) Exhaust Muffler	0.9	11.5
009	Compressor 21-1319 (4) Bldg Skid	-1.4	13.8



Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
010	Compressor 21-1319 (4)C Cooler Inlet	-4.5	14.9
011	Compressor 21-1319 (4) Exhaust Pipe	-6.1	11.4
012	Compressor 21-1319 (4) Exhaust Pipe	-6.2	11.4
013	Compressor 21-1319 (4) Exhaust Pipe	-6.2	11.4
013	Mahalo Generator Exhaust Muffler	-7.0	12.6
015	Mahalo Generator Exhaust Muffler	-7.0	12.6
016	Mahalo Generator Exhaust Muffler	-7.0	12.6
017	Compressor 21-1319 (4)C Cooler Inlet	-7.3	14.9
018	Mahalo Generator Bldg Door ClosedEast2/west	-7.5	14.3
019	P-1411 Train # 1 RO Stage 1 HP Pump	-8.1	5.1
020	Compressor 21-1319 (4) Air Intake Pipe	-8.2	15.1
020	Mahalo Generator Cooler Inlet	-8.6	12.5
022	Mahalo Generator Bldg Door ClosedNorth	-8.9	16.0
023	Compressor 21-1319 (4)C Cooler Housing	-9.0	15.1
024	Compressor 21-1319 (4)C Cooler Housing	-9.0	15.1
025	Mahalo Generator Cooler DischargeTop	-9.1	22.1
026	Mahalo Generator Cooler DischargeTop	-9.1	22.0
026	Mahalo Generator Cooler DischargeTop	-9.1	22.0
028	Mahalo Generator Bldg WallEast/West	-9.6	16.0
029	Compressor 21-1319 (4) Air Intake Pipe	-9.9	16.4
030	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.2	4.7
031	P-1421 Train # 2 RO Stage 1 HP Pump	-10.3	5.9
032	Mahalo Generator Bldg Door ClosedEast2/west	-10.5	14.5
033	Mahalo Generator Cooler Inlet	-10.7	13.7
034	Mahalo Generator Bldg Door ClosedEast2/west	-10.7	14.6
035	Mahalo Generator Cooler Inlet	-10.8	13.7
036	Compressor 21-1319 (4)C Cooler Housing	-11.0	15.4
037	Compressor 21-1319 (4)C Cooler Discharge	-11.1	15.6
038	Compressor 21-1319 (4)C Cooler Discharge	-11.1	15.6
039	Mahalo Generator Cooler HousingTop	-11.2	11.7
039	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.2	5.0
041	Compressor 21-1319 (4)C Cooler Housing	-11.3	15.6
042	Compressor 21-1319 (4)C Cooler Housing	-11.4	15.6
043	Mahalo Generator Cooler HousingTop	-11.4	11.9
044	Compressor 21-1319 (4)C Cooler Housing	-11.4	15.7
045	Mahalo Generator Cooler HousingTop	-11.4	11.9
046	Mahalo Generator Air Intake PipeWest	-11.6	17.0
046	Mahalo Generator Bldg Door ClosedNorth	-11.7	16.1
048	Mahalo Generator Bldg Door ClosedNorth	-12.0	16.1
049	Compressor 21-1319 (4)C Cooler Discharge	-12.2	15.6
050	Compressor 21-1319 (4)C Cooler Discharge	-12.2	15.6
051	Compressor 21-1319 (4)C Cooler Discharge	-12.2	15.6
052	Compressor 21-1319 (4)C Cooler Discharge	-12.2	15.6
053	Compressor 21-1319 (4) Exhaust Tip	-12.4	14.9
054	Compressor 21-1319 (4) Exhaust Tip	-12.4	14.9
054	Mahalo Generator Bldg WallTop	-12.4	15.6
056	Compressor 21-1319 (4) Exhaust Tip	-12.4	14.9
057	Mahalo Generator Bldg WallEast/West	-12.4	16.1



Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
058	Compressor 21-1319 (4)C Cooler Inlet	-12.6	16.7
059	Mahalo Generator Bldg WallEast/West	-12.7	16.1
060	Mahalo Generator Bldg WallTop	-13.5	16.0
061	Mahalo Generator Bldg WallTop	-13.6	16.1
062	Compressor 21-1319 (4)C Cooler Inlet	-13.8	16.5
063	Compressor 21-1319 (4)C Cooler Inlet	-13.8	16.6
063	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.0	3.9
065	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.0	3.9
066	Mahalo Generator Air IntakeNorth top	-14.2	15.8
067	Mahalo Generator Air IntakeNorth top	-14.2	15.7
068	Mahalo Generator Air IntakeNorth top	-14.2	15.7
069	Compressor 21-1319 (4) Bldg Door Closed E1	-14.9	12.7
070	Compressor 21-1319 (4) Bldg Door Closed E1	-15.0	12.8
071	Compressor 21-1319 (4) Bldg Door Closed E1	-15.0	12.8
072	Load bank Air Intake	-15.7	12.4
073	Combined Dosing Skid	-15.9	4.3
074	KX-1003 Membrane Aeration Blower Skid 1	-16.0	7.4
075	KX-1004 Membrane Aeration Blower Skid 1	-16.2	7.5
076	Load bank Air Intake	-16.7	12.5
077	Mahalo Generator Air Intake PipeWest	-16.9	17.4
078	Mahalo Generator Air Intake PipeWest	-17.0	17.4
079	P-1101 UF Feed Pump #1	-17.1	5.6
079	P-1102 UF Feed Pump #2	-17.1	5.6
081	Load bank Air Intake	-17.2	12.5
082	Compressor 21-1319 (4) Air Intake Pipe	-17.7	19.6
083	Mahalo Generator Bldg Fan Louver OpenSouth	-17.7	17.6
083	Compressor 21-1319 (4) Air Intake E	-18.4	24.3
085	KX-1001 Air Compressor # 1	-18.9	10.1
085	Load bank Cooler Discharge	-19.0	11.8
087	Compressor 21-1319 (4) Bldg Door Closed E2	-19.1	15.5
088	Compressor 21-1319 (4)C Cooler Inlet	-19.3	19.5
089	Compressor 21-1319 (4) Bldg Door Closed W	-19.5	15.8
089	Compressor 21-1319 (4) Bldg Door Closed W	-19.6	15.8
089	Mahalo Generator Bldg Door ClosedEast	-19.8	14.4
089	P-1511 RO Permeate Recycle Pump	-20.0	5.7
093	Irrigation Pumps #1 - CRN155 PW	-20.1	8.5
093	Compressor 21-1319 (4) Bldg Door Closed E2	-20.2	16.1
095	Load bank Cooler Discharge	-20.2	11.9
095	Irrigation Pumps #2 - CRN155 PW	-20.3	8.7
097	Load bank Cooler Discharge	-20.4	11.8
097	Mahalo Generator Bldg Fan Louver OpenSouth	-20.6	17.9
097	Mahalo Generator Bldg Fan Louver OpenSouth	-20.8	18.0
097	Mahalo Generator Exhaust Tip	-20.9	19.2
101	Mahalo Generator Exhaust Tip	-20.9	19.2
102	Mahalo Generator Exhaust Tip	-20.9	19.2
103	Mahalo Comp Air Bldg Open Area (Doors Closed)	-21.0	5.9
104	Mahalo Comp Air Bldg Wall and Roof	-21.1	14.9
105	P-1531 CIP Pump	-21.9	5.6



Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
106	P-1532 CIP Pump	-22.1	5.7
107	Compressor 21-1319 (4) Air Intake E	-22.2	26.6
108	P-1301 RO Feed Pump # 1	-22.3	7.4
109	P-1302 RO Feed Pump # 2	-22.3	7.4
110	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.6	16.4
111	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.6	16.4
112	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.6	16.4
113	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.6	16.4
114	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.6	16.4
115	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.6	16.4
116	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.6	16.4
117	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.6	16.4
118	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.6	16.4
119	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.6	16.4
120	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.6	16.4
121	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.6	16.4
122	Irrigation Pumps Booster NBG150	-22.6	5.2
123	Mahalo Generator Bldg Door ClosedEast	-22.8	14.6
124	Mahalo Generator Bldg Door ClosedEast	-23.1	14.7
125	Dam Transfer NBG150	-23.1	5.2
126	Compressor 21-1319 (4) Bldg Door Closed N	-23.9	16.4
127	Compressor 21-1319 (4) Bldg Door Closed N	-23.9	16.3
128	Compressor 21-1319 (4) Bldg Door Closed E2	-25.0	17.4
129	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-25.2	20.3
130	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-25.2	20.3
131	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-25.2	20.3
131	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-25.2	20.3
133	Irrigation Pumps #4 CRN 45 AW	-26.1	5.1
134	Irrigation Pumps #3 CRN 45 AW	-26.2	5.1
135	Mahalo TEG Dehydration Package Unit 1	-26.8	11.9
136	P-1512 Flush / Backwash Pump	-27.9	5.3
137	P-1513 Flush / Backwash Pump	-28.1	5.4
138	Truck Pumps #7 CRN 95	-28.6	3.9
139	Truck Pumps #8 CRN 95	-28.6	3.9
139	Compressor 21-1319 (4) Bldg Door Closed W	-28.7	17.9
139	Compressor 21-1319 (4) Air Intake E	-29.9	27.9
142	Compressor 21-1319 (4) Bldg Door Closed N	-31.6	17.9
143	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-33.9	22.7
144	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-34.0	22.7
145	5344-Futjisu ASTG30KMTA #1	-35.8	7.6
146	5344-Futjisu ASTG30KMTA #2	-35.8	7.6
147	5344-Futjisu ASTG30KMTA #3	-35.8	7.6
148	Mahalo Transformer #4	-39.2	12.1
149	Mahalo Transformer #3	-39.9	12.3
150	Mahalo HV VSD Transformer #1	-43.4	12.8
151	Mahalo HV VSD Transformer #2	-43.6	12.8
152	Desiccant Dryer DX1001	-43.7	1.5
153	Mahalo HV VSD Transformer #3	-43.8	12.9



Table E4: Source Order Ranking - Receiver R06 (Scenario S2B)

Rank	Noise Source	SPL (dBA)	dBC-dBA
	Facility SPL	13.4	14.3
	ASL	25.0	-
	Cumulative SPL	25.3	-
	PSL	28.0	-

Table E5: Source Order Ranking - Receiver R06 (Scenario S3BE)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Mahalo Flare Normal flaring	18.7	2.8
002	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
003	Compressor 21-1319 (4) Bldg Wall	1.0	15.2
004	Compressor 21-1319 (4) Exhaust Muffler	0.8	11.4
005	Compressor 21-1319 (4) Bldg Wall	0.1	15.3
006	Compressor 21-1319 (4) Bldg Skid	-4.1	13.8
007	Compressor 21-1319 (4) Bldg Skid	-5.0	13.5
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Bldg Door ClosedEast2/west	-7.0	14.3
011	Mahalo Generator Exhaust Muffler	-7.1	12.6
012	Mahalo Generator Exhaust Muffler	-7.1	12.6
012	Mahalo Generator Exhaust Muffler	-7.1	12.6
014	Mahalo Generator Cooler Inlet	-8.0	12.0
014	P-1411 Train # 1 RO Stage 1 HP Pump	-8.2	5.1
016	Compressor 21-1319 (4) Air Intake Pipe	-8.3	15.2
016	Mahalo Generator Bldg Door ClosedNorth	-8.6	15.9
018	Mahalo Water plant	-8.7	7.5
019	Mahalo Generator Cooler DischargeTop	-9.2	21.9
020	Mahalo Generator Cooler DischargeTop	-9.2	22.0
021	Mahalo Generator Cooler DischargeTop	-9.2	22.0
022	Mahalo Generator Bldg WallEast/West	-9.3	15.9
023	Compressor 21-1319 (4)C Cooler Inlet	-10.0	14.9
024	Mahalo Generator Bldg Door ClosedEast2/west	-10.4	14.4
025	P-1421 Train # 2 RO Stage 1 HP Pump	-10.5	5.9
026	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.6	4.8
027	Mahalo Generator Bldg Door ClosedEast2/west	-10.6	14.5
028	Mahalo Generator Cooler Inlet	-10.8	13.5
029	Mahalo Generator Cooler Inlet	-10.8	13.6
030	Mahalo Generator Cooler HousingTop	-11.1	11.6
031	Mahalo Generator Air Intake PipeWest	-11.2	16.9
032	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.3	5.0
033	Mahalo Generator Cooler HousingTop	-11.5	11.9
034	Mahalo Generator Cooler HousingTop	-11.6	11.9
035	Compressor 21-1319 (4)C Cooler Housing	-11.7	15.1
036	Mahalo Generator Bldg Door ClosedNorth	-11.8	16.0
037	Mahalo Generator Bldg Door ClosedNorth	-11.9	16.1



Table E5: Source Order Ranking - Receiver R06 (Scenario S3BE)

Rank	Noise Source	SPL (dBA)	dBC-dBA
038	Mahalo Generator Bldg WallTop	-12.2	15.3
039	Mahalo Generator Bldg WallEast/West	-12.5	16.0
040	Compressor 21-1319 (4) Exhaust Tip	-12.5	14.9
041	Load bank Air Intake	-12.6	12.5
042	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
043	Mahalo Generator Bldg WallEast/West	-12.6	16.1
044	Compressor 21-1319 (4)C Cooler Housing	-12.8	15.5
045	Mahalo Generator Bldg WallTop	-13.6	16.0
046	Mahalo Generator Bldg WallTop	-13.6	16.0
047	Compressor 21-1319 (4)C Cooler Discharge	-13.8	15.6
048	Compressor 21-1319 (4)C Cooler Discharge	-13.9	15.6
048	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.0	3.8
050	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.1	3.8
051	Compressor 21-1319 (4)C Cooler Housing	-14.1	15.7
052	Compressor 21-1319 (4)C Cooler Housing	-14.1	15.7
053	Mahalo Generator Air IntakeNorth top	-14.3	15.7
054	Mahalo Generator Air IntakeNorth top	-14.3	15.7
055	Mahalo Generator Air IntakeNorth top	-14.3	15.7
056	Compressor 21-1319 (4)C Cooler Discharge	-14.9	15.6
056	Compressor 21-1319 (4)C Cooler Discharge	-14.9	15.6
058	Compressor 21-1319 (4) Bldg Door Closed E1	-15.4	13.0
059	Compressor 21-1319 (4) Bldg Door Closed E1	-15.4	13.0
060	Load bank Cooler Discharge	-15.5	11.7
061	Combined Dosing Skid	-15.9	4.3
062	Compressor 21-1319 (4)C Cooler Inlet	-16.0	17.2
063	KX-1003 Membrane Aeration Blower Skid 1	-16.1	7.4
064	KX-1004 Membrane Aeration Blower Skid 1	-16.3	7.5
065	P-1101 UF Feed Pump #1	-17.2	5.6
066	P-1102 UF Feed Pump #2	-17.2	5.6
067	Mahalo Generator Air Intake PipeWest	-17.3	17.4
068	Mahalo Generator Air Intake PipeWest	-17.3	17.4
069	Mahalo Generator Bldg Fan Louver OpenSouth	-17.4	17.5
070	Compressor 21-1319 (4) Air Intake Pipe	-17.9	19.6
070	Compressor 21-1319 (4)C Cooler Inlet	-18.5	17.2
072	Compressor 21-1319 (4) Air Intake E	-18.6	24.3
073	Compressor 21-1319 (4)C Cooler Inlet	-18.7	17.2
074	KX-1001 Air Compressor # 1	-19.0	10.1
074	Mahalo Generator Bldg Door ClosedEast	-19.3	14.2
076	P-1302 RO Feed Pump # 2	-19.5	5.6
076	Compressor 21-1319 (4) Bldg Door Closed W	-19.8	15.8
078	P-1511 RO Permeate Recycle Pump	-20.1	5.7
079	Irrigation Pumps #1 - CRN155 PW	-20.2	8.6
079	Irrigation Pumps #2 - CRN155 PW	-20.2	8.6
081	Mahalo Generator Bldg Fan Louver OpenSouth	-20.6	17.8
081	Mahalo Generator Bldg Fan Louver OpenSouth	-20.8	17.9
081	Mahalo Generator Exhaust Tip	-21.0	19.2
081	Mahalo Generator Exhaust Tip	-21.1	19.2
085	Mahalo Generator Exhaust Tip	-21.1	19.2



Table E5: Source Order Ranking - Receiver R06 (Scenario S3BE)

Rank	Noise Source	SPL (dBA)	dBC-dBA
085	Mahalo Comp Air Bldg Wall and Roof	-22.0	15.3
087	P-1531 CIP Pump	-22.1	5.7
088	P-1532 CIP Pump	-22.2	5.8
089	P-1301 RO Feed Pump # 1	-22.3	7.2
090	Mahalo Comp Air Bldg Open Area (Doors Closed)	-22.4	6.2
091	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.7	16.4
092	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.7	16.4
093	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.7	16.4
094	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.7	16.4
095	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.7	16.4
096	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.7	16.4
097	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.7	16.4
098	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.7	16.4
099	Mahalo Generator Bldg Door ClosedEast	-22.8	14.5
100	Irrigation Pumps Booster NBG150	-23.0	5.2
101	Mahalo Generator Bldg Door ClosedEast	-23.0	14.6
102	Dam Transfer NBG150	-23.1	5.2
103	Compressor 21-1319 (4) Bldg Door Closed N	-24.0	16.3
104	Compressor 21-1319 (4) Bldg Door Closed N	-24.0	16.4
105	Compressor 21-1319 (4) Bldg Door Closed E2	-25.2	17.3
106	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-25.4	20.3
107	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-25.4	20.3
108	Irrigation Pumps #4 CRN 45 AW	-26.2	5.1
109	Irrigation Pumps #3 CRN 45 AW	-26.2	5.1
110	Compressor 21-1319 (4) Bldg Door Closed E2	-26.6	17.6
111	Mahalo TEG Dehydration Package Unit 1	-27.4	12.2
112	P-1512 Flush / Backwash Pump	-28.0	5.3
113	P-1513 Flush / Backwash Pump	-28.2	5.4
114	Compressor 21-1319 (4) Bldg Door Closed W	-28.8	17.9
115	Truck Pumps #7 CRN 95	-29.5	4.3
117	Truck Pumps #8 CRN 95	-29.5	4.3
118	Compressor 21-1319 (4) Air Intake E	-30.0	27.9
119	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-34.0	22.6
120	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-34.1	22.6
121	5344-Futjisu ASTG30KMTA #3	-35.9	7.6
122	5344-Futjisu ASTG30KMTA #1	-35.9	7.6
122	5344-Futjisu ASTG30KMTA #2	-35.9	7.6
122	Mahalo HV VSD Transformer #1	-36.1	10.5
125	Mahalo Transformer #4	-38.7	11.9
126	Mahalo Transformer #3	-39.5	12.2
127	Mahalo HV VSD Transformer #2	-43.6	12.8
128	Desiccant Dryer DX1001	-43.7	1.5
	Facility SPL	19.3	7.1
	ASL	25.0	-
	Cumulative SPL	26.0	-
	PSL	28.0	-



Table E6: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	Flare 1	11.7	3.5
002	Compressor 21-1319 (4) Bldg Wall	3.5	15.2
003	Compressor 21-1319 (4) Bldg Wall	2.7	15.2
004	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
005	Compressor 21-1319 (4) Exhaust Muffler	0.7	11.5
006	Compressor 21-1319 (4) Bldg Skid	-1.6	13.8
007	Compressor 21-1319 (4) Bldg Skid	-2.4	13.5
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Exhaust Muffler	-7.1	12.6
011	Mahalo Generator Exhaust Muffler	-7.1	12.6
012	Mahalo Generator Exhaust Muffler	-7.2	12.6
013	Mahalo Generator Bldg Door ClosedEast2/west	-7.2	14.3
014	Compressor 21-1319 (4)C Cooler Inlet	-7.4	14.9
015	Mahalo Generator Cooler Inlet	-8.1	12.0
016	P-1411 Train # 1 RO Stage 1 HP Pump	-8.4	5.1
016	Compressor 21-1319 (4) Air Intake Pipe	-8.4	15.1
018	Mahalo Generator Bldg Door ClosedNorth	-8.7	15.9
019	Compressor 21-1319 (4)C Cooler Housing	-9.1	15.1
019	Mahalo Generator Cooler DischargeTop	-9.2	21.9
021	Mahalo Generator Cooler DischargeTop	-9.2	22.0
022	Mahalo Generator Cooler DischargeTop	-9.2	21.9
023	Mahalo Generator Bldg WallEast/West	-9.4	15.9
023	Load bank Air Intake	-9.9	12.5
025	Load bank Air Intake	-9.9	12.5
026	Mahalo Generator Bldg Door ClosedEast2/west	-10.2	14.5
026	Compressor 21-1319 (4)C Cooler Housing	-10.2	15.5
028	Mahalo Generator Cooler Inlet	-10.3	13.4
029	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.4	4.7
030	Mahalo Generator Bldg Door ClosedEast2/west	-10.5	14.5
031	P-1421 Train # 2 RO Stage 1 HP Pump	-10.6	5.9
032	Mahalo Generator Cooler Inlet	-10.8	13.5
033	Mahalo Generator Cooler HousingTop	-11.1	11.6
034	Compressor 21-1319 (4)C Cooler Discharge	-11.2	15.6
035	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
036	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.4	5.0
037	Mahalo Generator Air Intake PipeWest	-11.4	16.9
038	Mahalo Generator Cooler HousingTop	-11.4	11.8
038	Mahalo Generator Bldg Door ClosedNorth	-11.5	16.1
040	Mahalo Generator Cooler HousingTop	-11.6	11.9
041	Compressor 21-1319 (4)C Cooler Housing	-11.6	15.7
042	Compressor 21-1319 (4)C Cooler Housing	-11.7	15.7
043	Mahalo Generator Bldg Door ClosedNorth	-11.8	16.0
044	Mahalo Generator Bldg WallEast/West	-12.2	16.0
045	Mahalo Generator Bldg WallTop	-12.2	15.3
046	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
047	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6



Table E6: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
048	Mahalo Generator Bldg WallEast/West	-12.5	16.0
049	Compressor 21-1319 (4) Exhaust Tip	-12.5	14.9
050	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
051	Mahalo Generator Bldg WallTop	-13.3	15.9
052	Compressor 21-1319 (4)C Cooler Inlet	-13.4	17.2
053	Mahalo Generator Bldg WallTop	-13.6	16.0
053	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.2	3.9
055	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.2	3.8
056	Mahalo Generator Air IntakeNorth top	-14.3	15.7
057	Mahalo Generator Air IntakeNorth top	-14.3	15.7
058	Mahalo Generator Air IntakeNorth top	-14.4	15.7
059	Compressor 21-1319 (4) Bldg Door Closed E1	-15.1	12.8
060	Compressor 21-1319 (4) Bldg Door Closed E1	-15.4	13.0
061	Combined Dosing Skid	-16.0	4.3
062	Compressor 21-1319 (4)C Cooler Inlet	-16.2	17.2
063	Compressor 21-1319 (4)C Cooler Inlet	-16.2	17.2
064	KX-1003 Membrane Aeration Blower Skid 1	-16.2	7.5
065	Mahalo Generator Air Intake PipeWest	-16.2	17.3
066	KX-1004 Membrane Aeration Blower Skid 1	-16.3	7.5
067	P-1101 UF Feed Pump #1	-17.3	5.6
068	P-1102 UF Feed Pump #2	-17.3	5.6
069	Mahalo Generator Air Intake PipeWest	-17.3	17.4
070	Mahalo Generator Bldg Fan Louver OpenSouth	-17.5	17.5
071	Compressor 21-1319 (4) Air Intake Pipe	-17.9	19.6
072	Compressor 21-1319 (4) Air Intake E	-18.6	24.4
073	KX-1001 Air Compressor # 1	-19.0	10.1
074	Load bank Cooler Discharge	-19.1	11.8
075	Load bank Cooler Discharge	-19.1	11.8
076	Mahalo Generator Bldg Door ClosedEast	-19.5	14.3
077	P-1301 RO Feed Pump # 1	-19.5	5.6
078	P-1302 RO Feed Pump # 2	-19.5	5.6
079	Compressor 21-1319 (4) Bldg Door Closed W	-19.8	15.8
079	P-1511 RO Permeate Recycle Pump	-20.1	5.7
081	Irrigation Pumps #1 - CRN155 PW	-20.2	8.5
081	Irrigation Pumps #2 - CRN155 PW	-20.2	8.5
081	Load bank Cooler Discharge	-20.3	11.9
081	Load bank Cooler Discharge	-20.3	11.8
085	Mahalo Generator Bldg Fan Louver OpenSouth	-20.3	17.9
085	Mahalo Generator Bldg Fan Louver OpenSouth	-20.6	17.8
087	Mahalo Generator Exhaust Tip	-21.1	19.2
088	Mahalo Generator Exhaust Tip	-21.1	19.2
089	Mahalo Generator Exhaust Tip	-21.1	19.2
090	Mahalo Comp Air Bldg Wall and Roof	-22.1	15.2
091	P-1531 CIP Pump	-22.3	5.7
091	Mahalo Comp Air Bldg Open Area (Doors Closed)	-22.4	6.2
093	P-1532 CIP Pump	-22.5	5.8
093	Mahalo Generator Bldg Door ClosedEast	-22.5	14.6
095	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.7	16.4



Table E6: Source Order Ranking - Receiver R06 (Scenario S3BG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
096	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.7	16.4
097	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.7	16.4
098	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.7	16.4
099	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High1	-22.8	16.4
100	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High2	-22.8	16.4
101	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High3	-22.8	16.4
102	Compressor 21-1319 (4) Bldg Fan Louver Open Discharge High4	-22.8	16.4
103	Mahalo Generator Bldg Door ClosedEast	-22.8	14.5
104	Irrigation Pumps Booster NBG150	-23.0	5.2
105	Dam Transfer NBG150	-23.3	5.3
106	Compressor 21-1319 (4) Bldg Door Closed N	-24.0	16.3
107	Compressor 21-1319 (4) Bldg Door Closed N	-24.1	16.3
108	Compressor 21-1319 (4) Bldg Door Closed E2	-24.9	17.3
109	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-25.4	20.4
110	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-25.4	20.4
111	Irrigation Pumps #4 CRN 45 AW	-26.2	5.1
112	Irrigation Pumps #3 CRN 45 AW	-26.3	5.1
113	Compressor 21-1319 (4) Bldg Door Closed E2	-26.4	17.6
114	Mahalo TEG Dehydration Package Unit 1	-27.5	12.3
115	P-1512 Flush / Backwash Pump	-28.0	5.3
115	P-1513 Flush / Backwash Pump	-28.3	5.4
117	Compressor 21-1319 (4) Bldg Door Closed W	-28.8	17.9
118	Truck Pumps #7 CRN 95	-29.5	4.3
119	Truck Pumps #8 CRN 95	-29.5	4.3
120	Compressor 21-1319 (4) Air Intake E	-30.0	27.9
121	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low E	-34.1	22.6
121	Compressor 21-1319 (4) Bldg Fan Louver Open Intake Low W	-34.1	22.6
121	Mahalo HV VSD Transformer #1	-35.9	10.4
122	5344-Futjisu ASTG30KMTA #1	-35.9	7.6
123	5344-Futjisu ASTG30KMTA #2	-35.9	7.6
124	5344-Futjisu ASTG30KMTA #3	-35.9	7.6
124	Mahalo TEG Dehydration Package Unit 2	-36.6	19.2
124	Mahalo Transformer #4	-38.8	11.9
127	Mahalo Transformer #3	-39.5	12.1
128	Mahalo HV VSD Transformer #2	-43.6	12.8
129	Desiccant Dryer DX1001	-43.7	1.5
130	Mahalo HV VSD Transformer #3	-43.8	12.9
131	Flare 1	11.7	3.5
132	Compressor 21-1319 (4) Bldg Wall	3.5	15.2
	Facility SPL	14.5	11.7
	ASL	25.0	-
	Cumulative SPL	25.4	-
	PSL	28.0	-



Table E7: Source Order Ranking - Receiver R06 (Scenario S3AG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
001	CAT 3608 Compressor Engine unit no enclosure	21.2	5.7
002	CAT 3608 Compressor Engine unit no enclosure	16.0	7.4
003	Flare 1	11.7	3.4
004	CAT 3608 Compressor Casing No enclosure	9.0	10.0
005	CAT 3608 Compressor Casing No enclosure	6.5	10.7
006	Compressor 21-1319 (4) Exhaust Muffler	1.4	11.0
007	Compressor 21-1319 (4) Exhaust Muffler	1.3	11.0
008	Compressor 21-1319 (4) Exhaust Pipe	-6.4	11.5
009	Compressor 21-1319 (4) Exhaust Pipe	-6.5	11.5
010	Mahalo Generator Exhaust Muffler	-7.1	12.6
011	Mahalo Generator Exhaust Muffler	-7.1	12.6
012	Mahalo Generator Exhaust Muffler	-7.1	12.6
013	Mahalo Generator Bldg Door ClosedEast2/west	-7.3	14.3
014	Compressor 21-1319 (4)C Cooler Inlet	-7.4	14.9
015	Mahalo Generator Cooler Inlet	-8.2	12.1
016	Compressor 21-1319 (4) Air Intake Pipe	-8.4	15.1
017	Compressor 21-1319 (4) Air Intake Pipe	-8.4	15.1
018	Mahalo Generator Bldg Door ClosedNorth	-8.8	15.9
019	P-1411 Train # 1 RO Stage 1 HP Pump	-8.8	5.2
020	Compressor 21-1319 (4)C Cooler Housing	-9.1	15.1
021	Mahalo Generator Cooler DischargeTop	-9.1	21.9
022	Mahalo Generator Cooler DischargeTop	-9.2	21.9
023	Mahalo Generator Cooler DischargeTop	-9.2	22.0
024	Mahalo Generator Bldg WallEast/West	-9.5	15.9
025	Mahalo Generator Bldg Door ClosedEast2/west	-10.1	14.5
026	Mahalo Generator Cooler Inlet	-10.1	13.3
027	Mahalo Generator Bldg Door ClosedEast2/west	-10.1	14.4
028	Compressor 21-1319 (4)C Cooler Housing	-10.2	15.5
029	Mahalo Generator Cooler Inlet	-10.3	13.3
030	P-1412 Train # 1 RO Stage 2 Feed Pump	-10.9	4.8
031	Mahalo Generator Cooler HousingTop	-11.1	11.7
032	Compressor 21-1319 (4)C Cooler Discharge	-11.2	15.6
033	P-1421 Train # 2 RO Stage 1 HP Pump	-11.2	6.1
034	Compressor 21-1319 (4)C Cooler Discharge	-11.3	15.6
035	Mahalo Generator Cooler HousingTop	-11.3	11.7
036	Mahalo Generator Bldg Door ClosedNorth	-11.4	16.1
036	Mahalo Generator Cooler HousingTop	-11.4	11.8
038	Mahalo Generator Bldg Door ClosedNorth	-11.4	16.0
038	Mahalo Generator Air Intake PipeWest	-11.5	17.0
040	Compressor 21-1319 (4)C Cooler Housing	-11.5	15.7
040	Compressor 21-1319 (4)C Cooler Housing	-11.5	15.7
042	P-1422 Train # 2 RO Stage 2 Feed Pump	-11.8	5.1
043	Mahalo Generator Bldg WallEast/West	-12.0	16.1
044	Mahalo Generator Bldg WallEast/West	-12.1	16.0
045	Mahalo Generator Bldg WallTop	-12.2	15.3
045	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
047	Compressor 21-1319 (4)C Cooler Discharge	-12.3	15.6
047	Compressor 21-1319 (4) Exhaust Tip	-12.5	14.9



Table E7: Source Order Ranking - Receiver R06 (Scenario S3AG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
049	Compressor 21-1319 (4) Exhaust Tip	-12.6	14.9
050	Mahalo Generator Bldg WallTop	-13.2	15.9
051	Mahalo Generator Bldg WallTop	-13.3	15.9
052	Compressor 21-1319 (4)C Cooler Inlet	-13.4	17.2
053	Mahalo Generator Air IntakeNorth top	-14.3	15.7
054	Mahalo Generator Air IntakeNorth top	-14.3	15.7
055	Mahalo Generator Air IntakeNorth top	-14.3	15.7
056	P-1413 Train # 1 RO Stage 3 Feed Pump	-14.6	3.9
057	Load bank Air Intake	-14.7	12.4
058	Load bank Air Intake	-14.8	12.4
059	P-1423 Train # 2 RO Stage 3 Feed Pump	-14.9	4.0
060	Mahalo Generator Air Intake PipeWest	-15.9	17.3
061	Compressor 21-1319 (4)C Cooler Inlet	-15.9	17.3
062	Compressor 21-1319 (4)C Cooler Inlet	-16.0	17.2
063	Mahalo Generator Air Intake PipeWest	-16.3	17.3
064	Combined Dosing Skid	-16.5	4.3
065	KX-1003 Membrane Aeration Blower Skid 1	-16.5	7.5
066	KX-1004 Membrane Aeration Blower Skid 1	-16.7	7.6
067	Load bank Air Intake	-17.0	12.5
068	Mahalo Generator Bldg Fan Louver OpenSouth	-17.6	17.5
069	P-1101 UF Feed Pump #1	-17.9	5.7
070	P-1102 UF Feed Pump #2	-17.9	5.7
071	Load bank Cooler Discharge	-18.1	11.7
071	Load bank Cooler Discharge	-18.2	11.7
073	Compressor 21-1319 (4) Air Intake E	-18.6	24.3
074	Compressor 21-1319 (4) Air Intake E	-18.7	24.3
075	KX-1001 Air Compressor # 1	-19.3	10.1
076	Mahalo Generator Bldg Door ClosedEast	-19.6	14.3
076	P-1301 RO Feed Pump # 1	-19.9	5.6
078	P-1302 RO Feed Pump # 2	-19.9	5.6
079	Mahalo Generator Bldg Fan Louver OpenSouth	-20.2	17.9
080	Mahalo Generator Bldg Fan Louver OpenSouth	-20.2	17.8
081	Load bank Cooler Discharge	-20.4	11.8
082	Irrigation Pumps #1 - CRN155 PW	-20.5	8.6
082	P-1511 RO Permeate Recycle Pump	-20.5	5.7
084	Mahalo Comp Air Bldg Open Area (Doors Closed)	-20.5	5.3
084	Irrigation Pumps #2 - CRN155 PW	-20.7	8.7
086	Mahalo Generator Exhaust Tip	-21.0	19.2
087	Mahalo Generator Exhaust Tip	-21.1	19.2
087	Mahalo Generator Exhaust Tip	-21.1	19.2
087	Mahalo Comp Air Bldg Wall and Roof	-21.3	14.6
090	Mahalo Generator Bldg Door ClosedEast	-22.5	14.6
091	Mahalo Generator Bldg Door ClosedEast	-22.5	14.6
092	P-1531 CIP Pump	-23.1	6.0
093	P-1532 CIP Pump	-23.3	6.1
094	Irrigation Pumps Booster NBG150	-23.4	5.2
094	Dam Transfer NBG150	-23.5	5.3
095	Irrigation Pumps #3 CRN 45 AW	-26.8	5.2



Table E7: Source Order Ranking - Receiver R06 (Scenario S3AG)

Rank	Noise Source	SPL (dBA)	dBC-dBA
096	Irrigation Pumps #4 CRN 45 AW	-26.9	5.2
097	Mahalo TEG Dehydration Package Unit 1	-27.4	12.2
098	P-1512 Flush / Backwash Pump	-28.5	5.3
099	P-1513 Flush / Backwash Pump	-28.7	5.4
100	Truck Pumps #7 CRN 95	-29.8	4.3
101	Truck Pumps #8 CRN 95	-29.8	4.3
102	Mahalo HV VSD Transformer #1	-36.0	10.4
103	5344-Futjisu ASTG30KMTA #1	-36.3	7.7
104	5344-Futjisu ASTG30KMTA #2	-36.3	7.7
105	5344-Futjisu ASTG30KMTA #3	-36.3	7.7
106	Mahalo TEG Dehydration Package Unit 2	-36.5	19.1
107	Mahalo Transformer #4	-38.8	11.9
108	Mahalo Transformer #3	-39.5	12.2
109	Mahalo HV VSD Transformer #2	-43.6	12.8
110	Mahalo HV VSD Transformer #3	-43.7	12.8
111	Desiccant Dryer DX1001	-44.2	1.5
112	CAT 3608 Compressor Engine unit no enclosure	21.2	5.7
	Facility SPL	23.2	7.2
	ASL	25.0	-
	Cumulative SPL	27.2	-
	PSL	28.0	-



Appendix F: Noise Control Acoustic Specifications



Summary

The table below lists the noise control items designed to bring the subject facility in compliance with the regulations.

Noise Control Recommendations

Item	Noise Source	Noise Control
1	Cooler	1.AXH 168-2ZF, 24.5 HP, 14' fan diameter, 2.AXH 132-2ZF, two (2) 30kW motors
2	Engine Air Intake	Air intake AFS3-20S1 Size 20 inches, critical grade
3	Engine exhaust silencer	Exhaust silencer MSA77-22C2-D40-142-8A21222 Size: 20.0 inches, Super Extreme grade, attenuation: 45-60 dbA



Appendix G: Technical Details and Best Practices Approach



Technical Details

Sound is the phenomena of vibrations transmitted through air, or other medium such as water or a building structure. The range of pressure amplitudes, intensities, and frequencies of the sound energy is very wide, and many specialized fields have developed using different ranges of these variables, such as room acoustics and medical ultrasound.

Due to the wide range of intensities, which are perceived as sound, standard engineering units become inconvenient. Sound levels are commonly measured on a logarithmic scale, with the level (in decibels, or dB) being proportional to ten times the common logarithm of the sound energy or intensity. Normal human hearing covers a range of about twelve to fourteen orders of magnitude in energy, from the threshold of hearing to the threshold of pain. On the decibel scale, the threshold of hearing is set as zero, written as 0 dB, while the threshold of pain varies between 120 to 140 dB. The most usual measure of sound is the sound pressure level (SPL), with 0 dB SPL set at $2.0 \times 10^{-5} \text{ N/m}^2$ (also written $20 \mu\text{Pa}$), which corresponds to a sound intensity of $10^{-12} \text{ Watts/m}^2$ (or 1 pWatt/m², written 1 pW/m²).

Normal human hearing spans a frequency range from about 20 Hertz (Hz, or cycles per second) to about 20,000 Hz (written 20 kHz). However, the sensitivity of human hearing is not the same at all frequencies. To accommodate the variation in sensitivity, various frequency-weighting scales have been developed. The most common is the A-weighting scale, which is based on the sensitivity of human hearing at moderate levels; this scale reflects the low sensitivity to sounds of very high or very low frequencies. Sound levels measured on the A-weighted scale are written in A-weighted decibels, commonly shown as dBA or dB(A).

Human hearing becomes more sensitive to lower frequency sounds as the level of the sound increases. For this purpose, the C-weighting scale was developed to assess reaction to higher levels sounds. Although the C-weighting scale, or the sound level in dBC, is seldom used on its own, the levels in dBC and dBA are often used together to assess the significance of the low-frequency components of sound. In some cases, a limit is placed on the dBC level at a location in order to limit the amount of low-frequency noise.

When sound is measured using the A-weighting scale, the reading is often called the “Noise level”, to confirm that human sensitivity and reactions are being addressed. A table of some common noise sources and their associated noise levels are shown in the table below.

When the A-weighting scale is not used, the measurement is said to have a “linear” weighting, or to be unweighted, and may be called a “linear” level. As the linear reading is an accurate measurement of the physical (sound) pressure, the term “Sound Pressure Level”, or SPL, is usually (but not universally) reserved for unweighted measurements.

Noise is usually defined as “unwanted sound”, which indicates that it is not just the physical sound that is important, but also the human reaction to the sound that leads to the perception of sound as noise. It implies a judgment of the quality or quantity of sound experienced. As a human reaction to sound is involved, noise levels are usually given in A-weighted decibels (dBA). However, use of the C-weighting scale, usually in combination with the dBA level, is becoming more common as well. An alternate definition of noise is “sound made by somebody else”, which emphasizes that the ability to control the level of the sound alters the perception of noise.



Noise Levels of Familiar Sources

Source or Environment	Noise Level (dBA)
High Pressure Steam Venting to Atmosphere (3 m)	121
Steam Boiler (2 m)	90-95
Drilling Rig (10 m)	80-90
Pneumatic Drill (15 m)	85
Pump Jack (10 m)	68-72
Truck (15 m)	65-70
Business Office	65
Conversational Speech (1 m)	60
Light Auto Traffic (30 m)	50
Living Room	40
Library	35
Soft Whisper (5 m)	20-35

The single number A-weighted level is often inadequate for engineering purposes, although it does supply a good estimate of people's reaction to a noise environment. As noise sources, control measures, and materials differ in the frequency dependence of their noise responses or production, sound is measured with a narrower frequency bandwidth; the specific methodology varies with the application. For most work, the acoustic frequency range is divided into frequency bands where the center frequency of each band is twice the frequency of the next lower band; these are called "Octave" bands, as their frequency relation is called an "Octave" in music, where the field of acoustics has its roots. For more detailed work, the octave bands, and certain standard octave and 1/3 octave bands have been specified by international agreements.

Where the noise at the receiver is steady, it is easy to assess the noise level. However, both the production of noise at the source and the transmission of noise can vary with time; most noise levels are not constant, either because of the motion of the noise source (as in traffic noise), because the noise source itself varies, or because the transmission of sound to the receiver location is not steady as over long distances. This is almost always the case for environmental noise studies. Several single number descriptors have been developed and are used to assess noise in these conditions.

The most common is the measurement of the "equivalent continuous" sound level, or L_{eq} , which is the level of a hypothetical source of a constant level which would give the same total sound energy as is measured during the sampling period. This is the "energy" average noise level. Typical sampling periods are one hour, night-time (9 hours) or one day (24 hours); the sampling period used must be reported when using this unit.

The greatest value of the L_{eq} is that the contributions of different sources to the total noise level can be assessed, or in a case where a new noise source is to be added to an existing environment, the total noise level from new and old sources can be easily calculated. It is also sensitive to short term high noise levels.

Statistical noise levels are sometimes used to assess an unsteady noise environment. They indicate the levels that are exceeded a fixed percentage of the measurement time period measured. For example, the 10th percentile level, written L_{10} , is the levels exceeded 10% of the time; this level is a good measure of frequent noisy occurrences such as steady road traffic. The 90% level, L_{90} , is the level exceeded 90% of the time, and is the background level, or noise floor. A steady noise source will modify the background level, while an intermittent noise source such as road or rail traffic will affect the short-term levels only.



One disadvantage with the L_{eq} measure, when used alone, is that nearby loud sources (e.g. dogs barking, or birds singing) can confuse the assessment of the situation when it is the noise from a distant plant that is the concern. For this reason, the equivalent level and the statistical levels can be used together to better understand the noise environment. One such indication is the difference between the L_{eq} and the L_{90} levels. A large difference between the L_{eq} and L_{90} , greater than 10 dB, indicates the intrusion of short-term noise events on the general background level. A small difference, less than 5 dB, indicates a very steady noise environment. If the L_{eq} value exceeds the L_{10} value this indicates the presence of significant short-term loud events.

For most noise measurement, instruments are adjusted so that the time response of the instrument is similar to the response of the human ear; this is the “Fast” setting. Measurement with the “Fast” setting therefore assesses the sound environment according to the way humans would hear it and react to it. Where the noise level varies substantially and an average level is wanted without the complexity of and L_{eq} or statistical measurement, the “Slow” setting is used on the sound level meter. The “Slow” setting is also typically used in industrial settings where hearing damage is a concern. Where the noise level changes very rapidly, for example due to impacts or detonations, the “Fast” and “Slow” settings do not respond quickly enough to assess the maximum levels, and the “Impulse” meter setting is used.

The Sound Power Level (abbreviated L_w , SWL or PWL) is the decibel equivalent of the total energy emitted from a source in the form of noise. The reference level for the sound power is 10^{-12} Watts, or 1 piconWatt (abbreviated pW). The sound power level is given by:

$$L_w, \text{ SWL, PWL} = 10 \times \log_{10} (\text{Emitted Power} / 1 \text{ pW}) \text{ dB}$$

Therefore, a source emitting 1 Watt of power in the form of sound would have a sound power level of 120 dB. Sound power levels can be expressed in terms of frequency bands, an overall linear-weighted level or A-weighted, as is the case for sound pressure levels. However, sound power levels are inherent to the source of noise, whereas the sound pressure level is dependent on the source, but also on the distance from the source and other environmental factors.

Note that according to the acoustical literature (E.g. Noise Control Engineering from Bies and Hansen), the subjective effect of changes in SPL is as follows:

- A 3-dB change is “just perceptible”.
- A 5-dB change is “clearly noticeable”.
- A 10-dB change is “twice as loud or half as loud”.
- A 20-dB change is “much louder or much quieter”.