Australia Pacific LNG Project
Supplemental information to the EIS

Noise Assessment – Gas Fields

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Savery & Associates Pty Ltd
ABN 62 079 417 379
Acoustic, Vibration and Environmental Consultants

Supplementary information- Noise Assessment Australia Pacific LNG Upstream Project

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Prepared for:

WorleyParsons Infrastructure & Environment

PO Box 15081

City East Brisbane Qld 4002

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P.O Box 265 The Gap QLD 4061 Australia. Ph: + 617 33006288
www.savery.com.au jsavery@savery.com.au

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SAVERY & ASSOCIATES PTY LTD
Suite 4 The Gap Village, 1000 Waterworks Rd
PO Box 265
The Gap, QLD. 4061

Telephone: (07) 3300 6288
Facsimile: (07) 3300 0574

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Contents

1.0 Introduction

Savery & Associates Pty Ltd was commissioned by WorleyParsons to prepare supplementary reporting for the Australia Pacific LNG upstream project to address significant alterations and refinements to the proposed base-case technology and field development plan as described below.

The sites for eight gas processing facilities (GPFs) expected within the first 5 years of development have been confirmed, enabling the site-specific noise impacts of these facilities to be assessed.

It is proposed to utilise mains-powered electric drives for gas compressors. This change will facilitate and optimise the effective acoustic enclosure of compressors and drivers.

Ultra-low noise fans will be utilised for process gas cooling for sites that are in (relatively) close proximity to residential locations.

In the short term it is proposed that two GPF sites will utilise temporary electricity supply from portable gas turbine generators, the noise impacts of which have not previously been quantified.

Low level ground flares will be utilised to achieve reduced spread of noise (and light) compared to the previous elevated stack flare designs.

Well head compression will likely be utilised as gas wells mature to achieve higher pressure gain at the well-head compared with the well-head pumping that will be utilised in the early life of a gas well.

The noise modelling discussed in this report is based upon noise source data provided by relevant manufacturers and suppliers and upon best estimates of sound power levels determined from the supplied data.

2.0 Noise limits

2.1 Planning for Noise Control

The Queensland Ecoaccess guideline Planning for Noise Control (the Guideline) is the government approved and endorsed planning guideline for environmental noise assessment.

The Guideline preamble indicates that it is intended to manage three aspects of the acoustic environment that may be affected by new industrial developments, commercial premises or mining operations, namely:

- the control and prevention of 'background noise creep' (the gradual cumulative increase in minimum noise levels generated by continuously operating machinery);
- the containment of variable noise levels and short term noise events to an 'acceptable level' above the background noise levels (for example, noise associated with a short term but periodic noise such as a process pressure relief valve); and
- the setting of noise limits for transient noise events to avoid 'sleep disturbance' (for example, a temporary release of compressed air or a process alarm).

Application of the Guideline methodology to sites in the gas field areas results in a night planning noise limit of $L_{Aeq\ 1hour\ adj}$ 28 dB(A) for CSG plant noise received at residential locations, based upon the prevention of background creep and upon a minimum deemed rating background noise level of 25 dB(A. Since the GPF plant normally operates at constant throughput on a 24/7 basis, compliance with the night noise limit ensures compliance with noise limits at other times.

The Guideline correctly points out that the rated background noise level of an industrial noise is 3 dB lower than the equivalent continuous noise level(L_{Aeq}) of the same industrial noise. By not allowing an increase in the deemed rated background noise level, i.e. no increase in the rated background noise level of 25 dB(A), the planning noise level for the new development (in terms of the L_{Aeq} acoustic parameter) is 25+3 = 28 dB(A).

The adjustment (designated by the 'adj' subscript) is applied to tonal and/or impulsive characteristics of a noise and is intended to counter-act any increase in the perceived subjective loudness of the noise resulting from the tonal or impulsive characteristics of the noise.

The adjustment for tonal and/or impulsive characteristics is the sum of correction factors K_1 and K_2, summarised in Table 1 in accordance the Guideline, or with AS1055

Acoustics–Description and measurement of environmental noise Part 1: General procedures.

Table 1: Adjustments for audible characteristics 'adj' = K1 + K2

Audible characteristic	Criterion at receptor	Correction
Tonality	Subjectively just detectable	K1 = 2-3dB
	Subjectively prominent (clearly audible) and objectively measurable by one-third octave band analysis as per Australian Standard AS1055.1 Clause 6.6.3	K1 = 5-6 dB
Impulsivity	Subjectively detectable and objectively measureable as per Australian Standard AS1055.1 Clause 6.6.4	K2 = 2dB

2.2 Accounting for Contributions from Multiple Sources

The total noise contribution from all CSG noise sources (e.g. GPF, GTG, WTF and well heads) received at a receptor is not to exceed 28dBA $L_{Aeq,adj,1hour}$ at night.

As the GPF is normally the largest noise source, the permissible noise contribution from other sources (e.g. well head drive(s)) will be dependent on both the GPF contribution at a receptor, and the tonal adjustment that is necessary considering the audible characteristics of the GPF and the other sources combined.

The total adjusted level at the sensitive receptor ($L_{Aeq,adj,1hour}$)is calculated as the unadjusted energy summation of the sound pressure contributions from all individual components ($L_{Aeq,i}$), then adjusted for expected tonal or impulsive characteristics of the cumulative contribution as per the following equation:-.

$$L_{Aeq,adj,1\ hour} = \left\{ \sum_{i=1}^{n} 10^{\left(LAeq,\frac{i}{10}\right)} \right\} + \text{adj}$$

Simple examples of the possible combinations of GPF noise level, tonal adjustment and noise level from other sources that would comply with the 28dBA $L_{Aeq,adj,1hour}$ night limit are illustrated in Table 2. This data illustrates how the presence of tonal noise characteristics received at a receptor, and the presence of other minor noise sources (e.g. well heads) translates to a more stringent component noise limit for a GPF (or vice versa).

For design purposes it is recommended that a tonal adjustment of not less than 2dBA be allowed, relating to just audible tonal characteristics that are generally anticipated for well-attenuated plant that is compliant with the design limit. The implication of this assumption is that GPFs should generally be designed to achieve a contribution not exceeding 25dBA L_{Aeq} (unadjusted) at a dwelling, allowing contributions from other sources, such as well heads of up to 19dBA L_{Aeq}(unadjusted).

In the instance of a temporary GTG, a tonal adjustment of 5dBA should be allowed.

Table 2: Example multiple contributions to achieve 28dBA $L_{Aeq,adj,1hour}$ Total at a Sensitive Receptor

GPF + GTG noise component ($L_{Aeq,1hr}$ dBA)	contribution from other sources (e.g. well head(s)) ($L_{Aeq,1hr}$ dBA)	Unadjusted Total ($L_{Aeq,1hr}$ dBA)	Tonal Adjustment (all sources) (dB)	Adjusted Total ($L_{Aeq,adj,1hr}$ dBA)
28	<15	28 & 15=28	0	28+0=28
27	20	27 & 20=28	0	28+0=28
26	24	26 & 24=28	0	28+0=28
25	25	25 & 25=28	0	28+0=28
26	<13	26 & 13=26	+2	26+2=28
25	19	25 & 19=26	+2	26+2=28
24	22	24 & 22=26	+2	26+2=28
23	23	23 & 23=26	+2	26+2=28
23	<10	23 & 10=23	+5	23+5=28
22	16	22 & 16=23	+5	23+5=28
21	19	21 & 19=23	+5	23+5=28
20	20	20 & 20=23	+5	23+5=28

3.0 Plant Description

3.1 Gas Processing Facility Sites

The GPF compression sites and capacities considered in this report are listed in Table 3.

Table 3 Field compression facility sites and capacities

Gas field	Capacity TJ
Talinga North	100
Orana	150
Condabri South	150
Condabri Central	150
Condabri North	100
Combabula	225
Pine Hills	150
Reedy Creek	150

The location of the gas fields is shown schematically in Figure 1.

3.2 GPF Components

The GPFs were based upon a 37.5 TJ/day module comprising a single 11MW electric drive motor, gearbox, high and low pressure compressor and four variable speed electric drive low-noise fans in two vertical axis fan-cooler housings as illustrated in Figure 2 and Figure 3.

For the larger facilities the number of plant items was increased in proportion to the TJ rating of the site (e.g. 100 TJ required three trains and twelve air-cooler fans, 150 TJ required four trains and sixteen air-cooler fans).

The GPF site layouts were based upon the Worley Parsons Option D plant layouts with the Option C layout also assessed for the Reedy Creek site.

The noise source data was supplied from the following sources:

- Low noise air-cooler data – Howden low-noise SX Howden cooling fans
- Electric motor – estimated from noise engineering correlations
- gearbox and compressors – WorleyParsons

Noise data for industry best-practice low-noise fans has been utilised for all GPF sites for the purpose of illustrating the feasibility of GPF compliance with noise constraints. For some sites a lower-specification fan may be considered whilst still enabling compliance with noise emission targets.

The sound power levels and attenuation spectra for noise control devices/materials used in the noise prediction modelling are presented in Table 5 of Appendix B.

Compressors and drive motors have been modelled as fully-enclosed utilising the transmission loss and internal absorption spectra detailed in Table 6 of Appendix B. The enclosure will necessarily require ventilation attenuators, and modelling assumes that these attenuators will be sized such as not to de-rate the modelled enclosure transmission loss performance. No details on the required air-flow to compressor enclosures were available at the time of reporting.

No noise emission data was available for control valves for the project. This modelling analysis assumes that any pipe-radiated noise from pipes and control valves that are external to the compressor enclosures are lagged if necessary to achieve negligible contribution to compressor plant noise levels.

3.3 Temporary Gas Turbine Power Generation

Noise emissions from the Combabula and Condabri Central GPF sites have been assessed with the option of on-site power generation for the limited period (~ 2 years) of GPF operation anticipated before mains power supply is available.

For the Condabri Central GPF power generation noise has been assessed based upon the portable 23MW GE TM2500 unit, shown in Figure 4 and Figure 5. For the Combabula GPF the operation of two such units has been assessed at the GPF site.

The sound power levels of the GE TM2500 were calculated from near-field noise levels provided by GE Rentals. As exhaust noise data was unavailable from GE, the attenuated exhaust noise component has been calculated from the unattenuated turbine exhaust noise and an estimate of the silencer insertion loss.

3.4 Well Head Compression

A very limited specification of the power draw and pumped flow characteristics of a well-head compressor has been supplied by Frick Rotary Compression Systems.

At the time of reporting only a drive power capacity was available for the purposes of noise estimation for well head compression.

3.5 Ground Flares

The sound power data for sub-sonic ground flare burners has been obtained from Zeeco.

4.0 Noise modelling methodology

A topographical noise model of each gas field area was constructed using ISO 9613-2 (1996), Acoustics - Attenuation of sound during propagation outdoors, Part 2: General method of calculation, as implemented in SoundPLAN software. The method predicts A-weighted sound pressure levels under meteorological conditions favourable to sound propagation from noise sources (that is, mild temperature inversion with slight downwind). The stated overall model accuracy is ± 3dBA.

The graphical noise contours generated by the model represent the envelope of results for noise propagation in all directions (that is, summary of typical worst-case noise propagation in all directions).

Where predictions are presented in the form of distance versus level curves, the curves represent the predicted level in the down-wind direction.

The detailed calculation of sound propagation from the source to the receiver locations is calculated with specific algorithms for the following physical effects:

- geometrical divergence
- atmospheric absorption (in accordance with ISO 9613 Part 1)
- ground effect (hard ground reflects sound, soft ground absorbs sound)
- reflection from surfaces (typical 1dBA reflection loss for buildings)
- screening by obstacles (horizontal and vertical diffraction),
- dense vegetation (none included).

Noise contours were modelled 1.5m above local ground level.

The ground under GPF sites is assumed to be hard-packed and acoustically reflective. Otherwise, all terrain is assumed to be acoustically soft.

At night and in the early morning it is common in winter for sound refraction by the atmosphere to result in ground-ward curvature of noise propagation paths from a source, resulting in increased sound pressure levels remote from the source. A downward refracting atmosphere is a result of the net dependence of a vertically increasing speed of sound through the atmosphere, upon the vertical profiles of temperature, windspeed, and air turbulence.

The meteorological conditions modelled by ISO9613-2 defined in the standard are:-

- downwind speed between approx. 1m/s and 5m/s, measured at a height of 3m to 11m above ground, or
- a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear calm nights
- 10°C ambient temperature and 70% relative humidity

These conditions are typical of worst-case night-time winter conditions in the study area.

A refracted radius of curvature of 5km is utilised by the ISO9613-2 standard for the purpose of calculating atmospheric absorption, which can be directly related to an average effective atmospheric sound speed gradient of 0.07m/s per metre resulting from the combined effect of vertical gradients of windspeed, atmospheric turbulence and atmospheric temperature up to a height of approximately 100m above ground level.

No allowance has been made for noise absorption provided by vegetation or forested areas as generally there is not anticipated to be a significant vegetated tree canopy close to either the GPF or residential dwellings relevant to sound propagation over longer distances by curved atmospheric propagation paths.

The ISO9613-2 model enables prediction of sound pressure levels averaged over short-term timescales of the order of 15 minutes to one hour, intrinsically 'smoothing' short-term transient fluctuations in atmospheric propagation. The ISO9613-2 timescale parameter C_{Met} should be set to zero.

5.0 Operational impact assessment

5.1 Noise modelling results

The predicted noise contour maps for the eight GPF sites are summarised in Table 4 and included in Appendix C.

Table 4 Noise Prediction Maps - GPFs

Gas field	Capacity TJ	Reference
Talinga North	100	Figure 6
Orana	150	Figure 7
Condabri South	150	Figure 8
Condabri Central (Mains power) Condabri Central (GTG power)	150	Figure 9 Figure 10
Condabri North Condabri North + transient 50TJ stack flare Condabri North + transient 50TJ ground flare Condabri North + 15 minute average of 120 second 50TJ ground flare	100	Figure 11 Figure 12 Figure 13 Figure 14
Combabula (Mains power) Combabula (GTG power)	225	Figure 15 Figure 16
Pine Hills	150	Figure 17
Reedy Creek	150	Figure 18

5.2 Low-noise GPFs

A tonal adjustment of +2 has been used for the scenarios with the GPF without the temporary gas-turbine generator facility (TM2500), based on the predicted noise spectrum at the noise sensitive receptors. From the predicted noise levels and the source sound power levels, the gearbox of the compressor train may generate a significant tonal component in the 125Hz octave frequency band.

At all sites the adoption of best practice noise controls on GPFs will enable the GPF noise contribution to be well within the 28dBA $L_{Aeq,adj,1hr=}$ noise limit. The most constrained site (Condabri North) indicates an unadjusted GPF component as low as 19dBA being achievable. Referring to the example cumulative noise information in Table 2 it is concluded that the low-noise GPF option is sufficiently quiet to ensure a realistic noise 'allowance' in instances where well pumps are located near dwellings.

5.3 Temporary Gas Turbine Power Generation

A tonal adjustment of +5 has been used for the scenarios with the GPF with the temporary trailer mounted gas-turbine generator facility (TM2500), based on the predicted noise spectrum at the noise sensitive receptors. Source level data suggests that the trailer mounted gas-turbine generator is significantly tonal within the 250Hz octave frequency band.

The noise modelling results for simultaneous operation of the GPF and one TM2500 GTG at Condabri Central (Figure 10) indicate that additional noise controls would be necessary to achieve compliance at the nearest receptors. Including a 5dB tonal adjustment, the assessed level at the nearest receptor south-east of the site is $L_{Aeq,adj}$ 33dBA. A noise reduction from the GTG of at least 5dBA (at the receptor) is required to achieve compliance. This reduction is believed to be achievable on the basis that the noise emissions for the trailer-mounted GE TM2500 have been optimised for portability but not for low-noise emission.

The noise modelling results for simultaneous operation of the GPF and two TM2500 GTGs at Combabula (Figure 16) indicate an assessed level at the nearest receptor south-east of the site is $L_{Aeq,adj}$ 25dBA. Reasonable scope remains for the cumulative result with gas well-head drives to comply with the 28dBA $L_{Aeq,adj,1hour}$ limit.

It is expected that this result would be improved by adoption of the same GTG noise control upgrades that will be necessary for GTG deployment at Condabri Central.

5.4 Well Head Compression

At this stage product data for proposed well head compressors is limited to an approximate power range of 47- 56kW (63-75hp) only.

As the motive power required is comparable to that of Oil-lift hydra-packs (50kW) and twin microturbines (2 x 30kW) it can be concluded that the requisite drive engine (reciprocating or microturbine) can be attenuated at least as effectively as the existing known well-head drive systems. It is also expected that the rotary compression device, which will not be large, can also be well attenuated.

On this basis it is reasonable to expect that the well head compression does not present a greater noise control challenge than the existing known well-head drivers.

5.5 Ground Flares

All GPF sites will be equipped with a flare to manage temporary gas delivery oversupply during the transient shut down of a compression train.

Flare noise modelling results are presented for Condabri North for illustrative purposes as this site features the nearest sensitive receptors to any GPF site.

Noise modelling results are presented for the transient maximum levels (L_{Amax}) from a flare equivalent to 50TJ plant capacity for the option of a traditional 25m high stack flare (Figure 12), and the proposed multi-burner ground flare (Figure 13) surrounded by 17m high radiation shields. The ground flare achieves a significantly reduced noise footprint compared to the traditional stack flare, with predicted maximum instantaneous levels at the nearest receptor of around L_{Amax} 36dBA.

The frequency and duration of flaring is expected to be substantially reduced compared to existing GPF's for two key reasons:-

- compression train shutdowns in traditional GPFs were primarily caused by reciprocating driver shutdowns. The proposed electric compression drives are expected by Origin to greatly reduce the non-scheduled compression train outages
- new GPFs will utilise rapid-acting well-head telemetry control systems to immediately reduce the supply of gas from well heads in the event of a compression train shut-down. The expected duration of flaring is estimated by Origin to be of the order of 60-120 seconds.

Qualitatively a ground flare operation would be perceived as similar to (and may not be distinguishable from) a distant jet aircraft flyover event. The absence of a clearly visible flare will further decrease the likelihood that noise associated with a brief flaring event would be identified as a flare event, or judged as intrusive.

Providing the duration of flaring can be limited to not greater than 120 seconds, the shielded sub-sonic ground flare is predicted to comply with a design limit of $L_{Aeq,adj,15min}$ 28 dBA. This prediction is presented in Figure 14. No tonal adjustment would be applicable to the flare sound characteristic.

6.0 Conclusions

At all sites the adoption of best practice noise controls on GPFs will enable the GPF noise contribution to be well within the 28dBA $L_{Aeq,adj,1hr}$ noise limit. The most constrained site (Condabri North) indicates an unadjusted GPF component as low as 19dBA being achievable. It is concluded that the low-noise GPF option is sufficiently quiet to ensure a realistic noise 'allowance' in instances where well pumps are located near dwellings.

The noise modelling results for simultaneous operation of the GPF and one TM2500 GTG at Condabri Central indicates that additional noise controls would be necessary to achieve compliance at the nearest receptors. A noise reduction from the GTG of at least 5dBA (at receptor) is required to achieve compliance. This reduction is believed to be achievable on the basis that the noise emissions for the trailer-mounted GE TM2500 have been optimised for portability but not for low-noise emission.

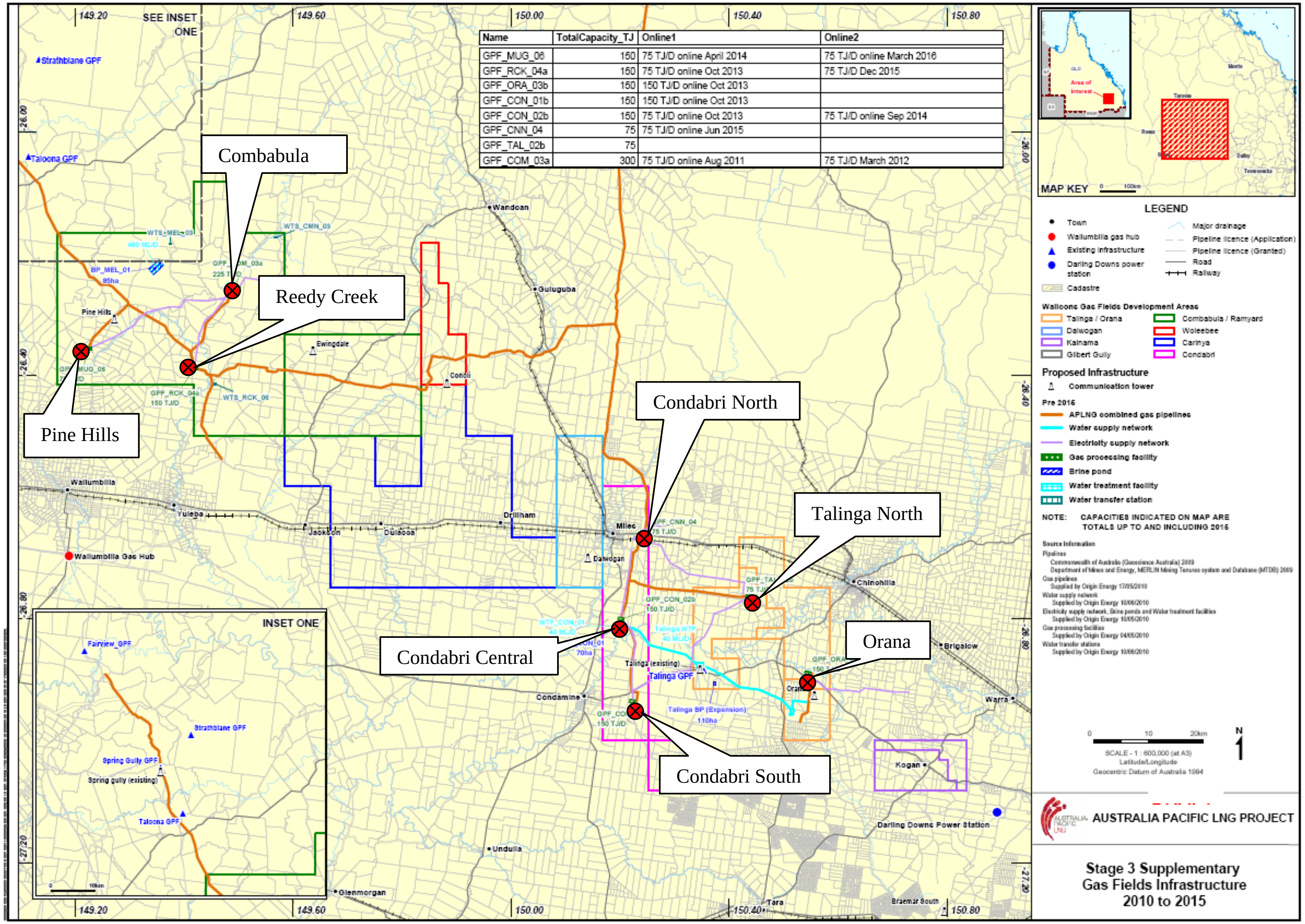
The noise modelling results for simultaneous operation of the GPF and two TM2500 GTGs at Combabula indicate an assessed level at the nearest receptor south-east of the site is $L_{Aeq,adj}$ 25dBA. It is expected that this result would be improved by adoption of the same GTG noise control upgrades that will be necessary for GTG deployment at Condabri Central.

As the motive power for well head compression is comparable to that of Oil-lift hydra-packs and twin microturbines it can be concluded that the requisite drive engine (reciprocating or microturbine) can be attenuated at least as effectively as the existing known well-head drive systems. It is also expected that the rotary compression device, which will not be large, can also be well attenuated. On this basis it is expected that future well head compression does not present a greater noise control challenge than the existing known well-head drivers.

The proposed ground flare for GPFs achieves a significantly reduced noise footprint compared to the traditional stack flare, with substantially reduced flaring duration and frequency expected compared to existing GPF's due to reliability improvements and control system improvements.

Providing the duration of flaring can be limited to not greater than 120 seconds, the shielded sub-sonic ground flare is predicted to comply with a design limit of $L_{Aeq,adj,15min}$ 28 dBA

Appendix A - Figures



Name	TotalCapacity_TJ	Online1	Online2
GPF_MUG_06	150	75 TJ/D online April 2014	75 TJ/D online March 2016
GPF_RCK_04a	150	75 TJ/D online Oct 2013	75 TJ/D Dec 2015
GPF_ORA_03b	150	150 TJ/D online Oct 2013	
GPF_CON_01b	150	150 TJ/D online Oct 2013	
GPF_CON_02b	150	75 TJ/D online Oct 2013	75 TJ/D online Sep 2014
GPF_CNN_04	75	75 TJ/D online Jun 2015	
GPF_TAL_02b	75		
GPF_COM_03a	300	75 TJ/D online Aug 2011	75 TJ/D March 2012

Figure 1: GPF locations

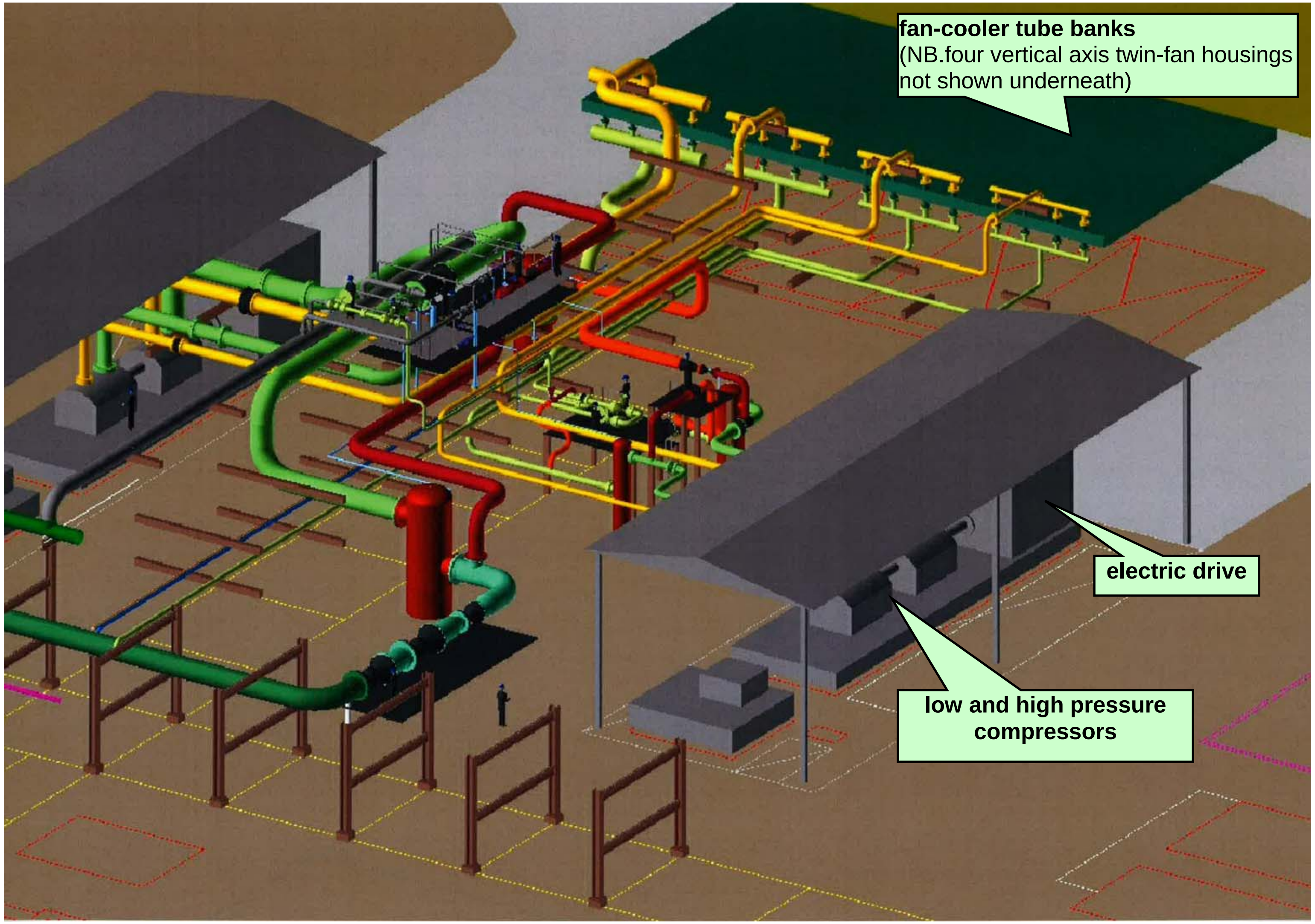


Figure 2: Two 37.5 TJ gas processing facility modules (compressor enclosures not shown)

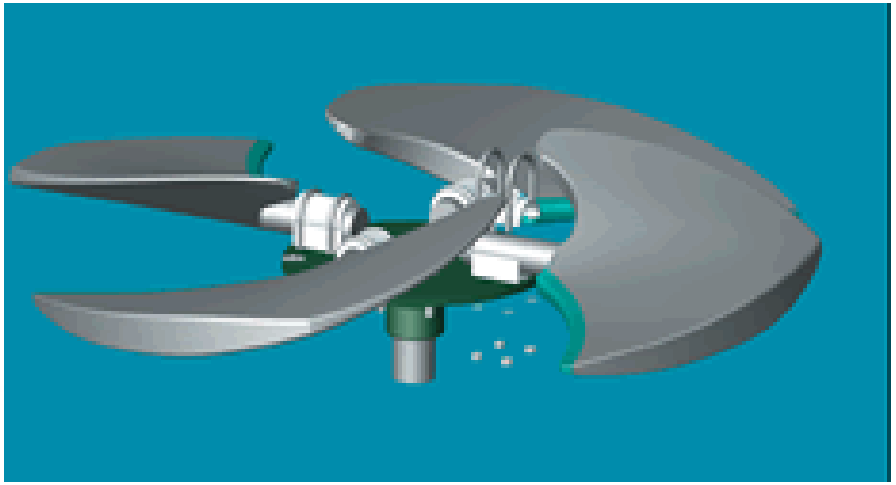


Figure 3: Vertical axis fan-cooler housing (left) and Low-noise fan blades (right)

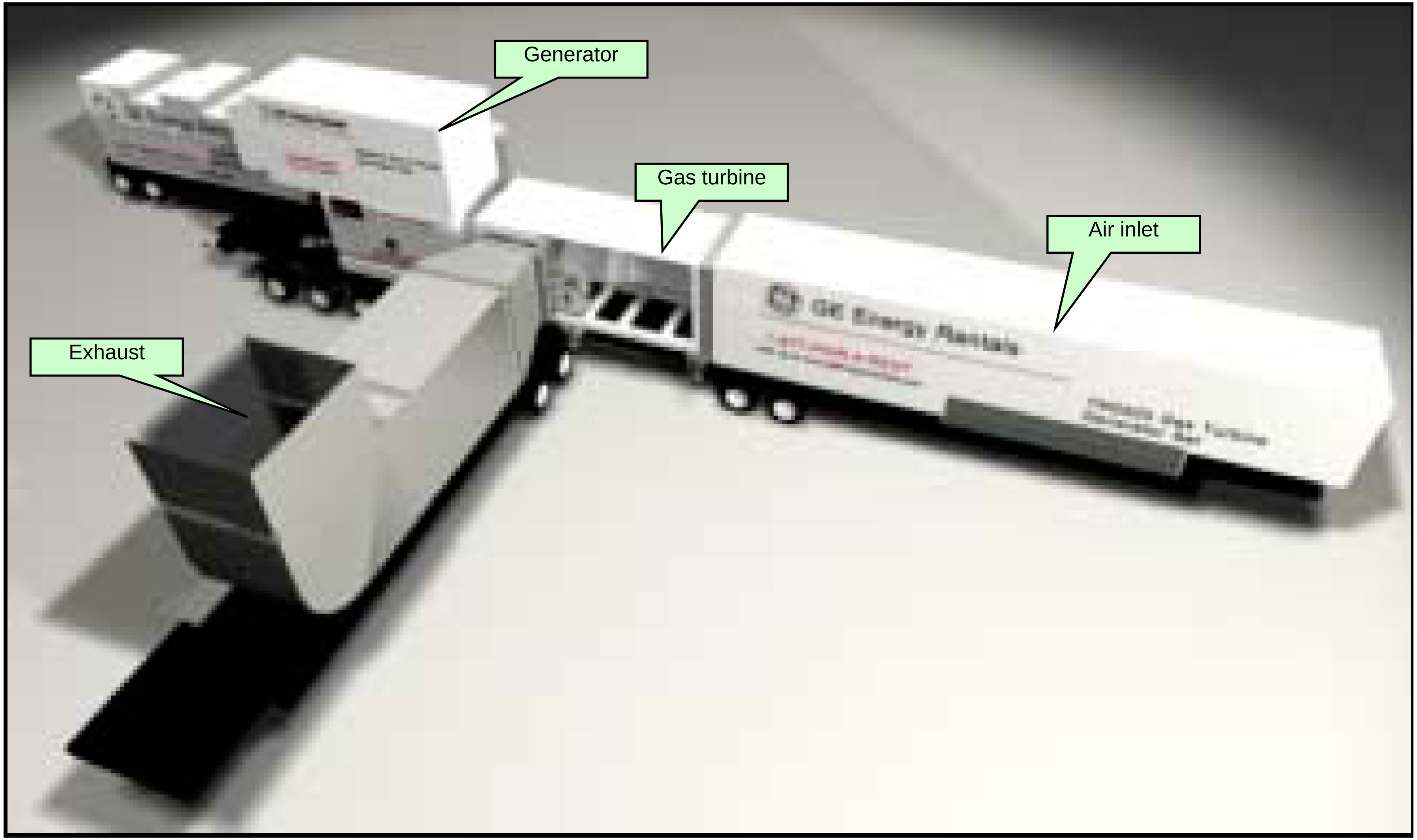


Figure 4: GE TM2500 Gas Turbine Generator

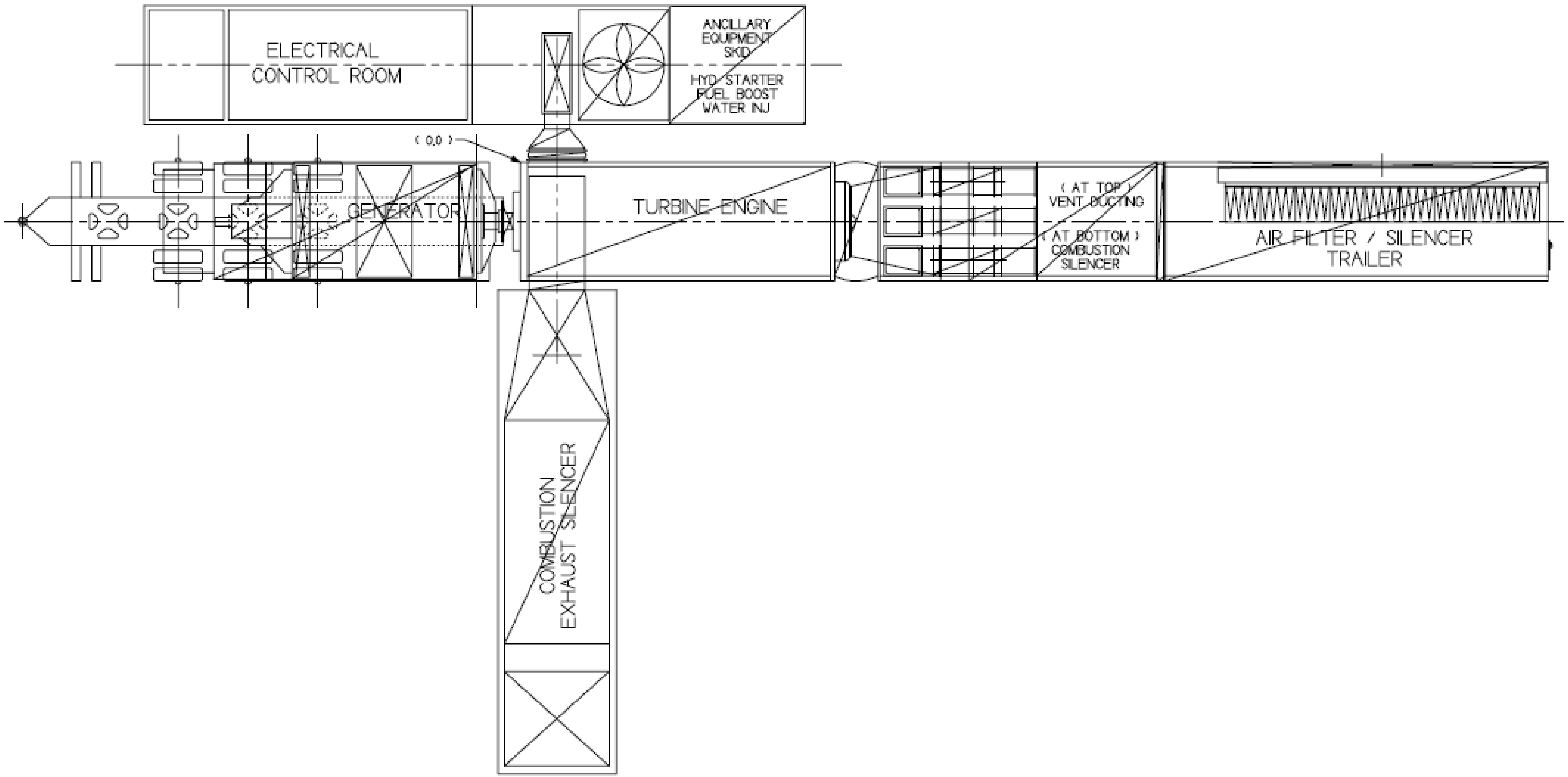


Figure 5: Layout – GE TM2500

Appendix B – Source noise data

Table 5: GPF sound power data

Source items	Octave Sound Power Data - dBA									
	31.5	63	125	250	500	1k	2k	4k	8k	Overall - dBA
GPFs										
Howden SX Fan Duty A		62.1	76.9	79	84.3	85.1	78.6	71.4	57.8	89.1
Howden SX Fan Duty B		63.6	77.9	80.1	84.8	85.3	79.9	72.6	59.6	89.7
11MW Electric Motor		76.2	88.3	95.8	101.2	104.4	105.6	102.4	93.3	110.0
LP Compressor		65.5	79	83.1	91.6	100.5	105.9	102	93.3	108.4
HP Compressor		60.8	74.3	78.5	86.9	95.9	101.2	97.3	88.6	103.8
Compressor Gearbox		86	95.1	97.6	100	100.2	101.4	99.2	96.1	107.5
Mobile GE TM2500 gas turbine-generator										
TM2500 Auxiliaries	61.3	72.5	84.9	88.5	89.2	88.0	87.2	83.4	77.8	95.2
TM2500 Generator	73.4	83.6	102.7	110.2	94.6	96.8	98.0	92.8	89.7	111.5
TM2500 Discharge Duct	62.1	72.0	84.4	85.5	83.5	84.8	86.8	85.3	83.8	93.5
TM2500 Turbine	74.2	85.4	96.5	97.0	97.4	99.6	101.8	101.6	100.5	108.1
TM2500 Combustion Silencer	66.6	76.9	81.5	85.0	86.9	86.1	89.0	87.0	81.4	94.5
TM2500 Air Inlet End	69.8	79.1	81.5	84.7	85.4	84.7	84.3	89.9	84.8	94.3
TM2500 Unattenuated Combustion Exhaust	93	106	119	130	138	138	139	138	117	144
TM2500 Attenuated Combustion Exhaust	82	92	96	99	103	95	109	114	98	116
Flares										
12TJ stack flare (Spring Gully)	76	82	91	107	107	110	112	105	81	116
50TJ stack flare (scaled from 12TJ stack flare)	82	88	97	113	113	116	118	111	87	123
Zeeco sonic flow 0.67kg/s ground flare burner	86	99	109	109	115	114	115	118	118	124
Zeeco subsonic 0.52kg/s ground flare burner	86	95	100	108	108	107	106	109	115	118
Zeeco subsonic 21 x 0.52kg/s ground flare burner (11kg/s total)	99	108	113	121	121	120	119	122	128	131

Table 6: Noise Control Data

Items	Octave Data - dB								
	31.5	63	125	250	500	1k	2k	4k	8k
GPFs									
Enclosure internal absorption coefficient (ceiling & walls)	0.1	0.15	0.45	0.8	1.0	0.9	0.85	0.7	0.6
Enclosure transmission loss – 100mm metal clad sandwich panel	14	18	22	26	36	44	46	50	47
Mobile GE TM2500 gas turbine-generator									
Exhaust attenuator insertion loss	8	12	20	28	32	40	27	20	16

Appendix C – Noise contour maps

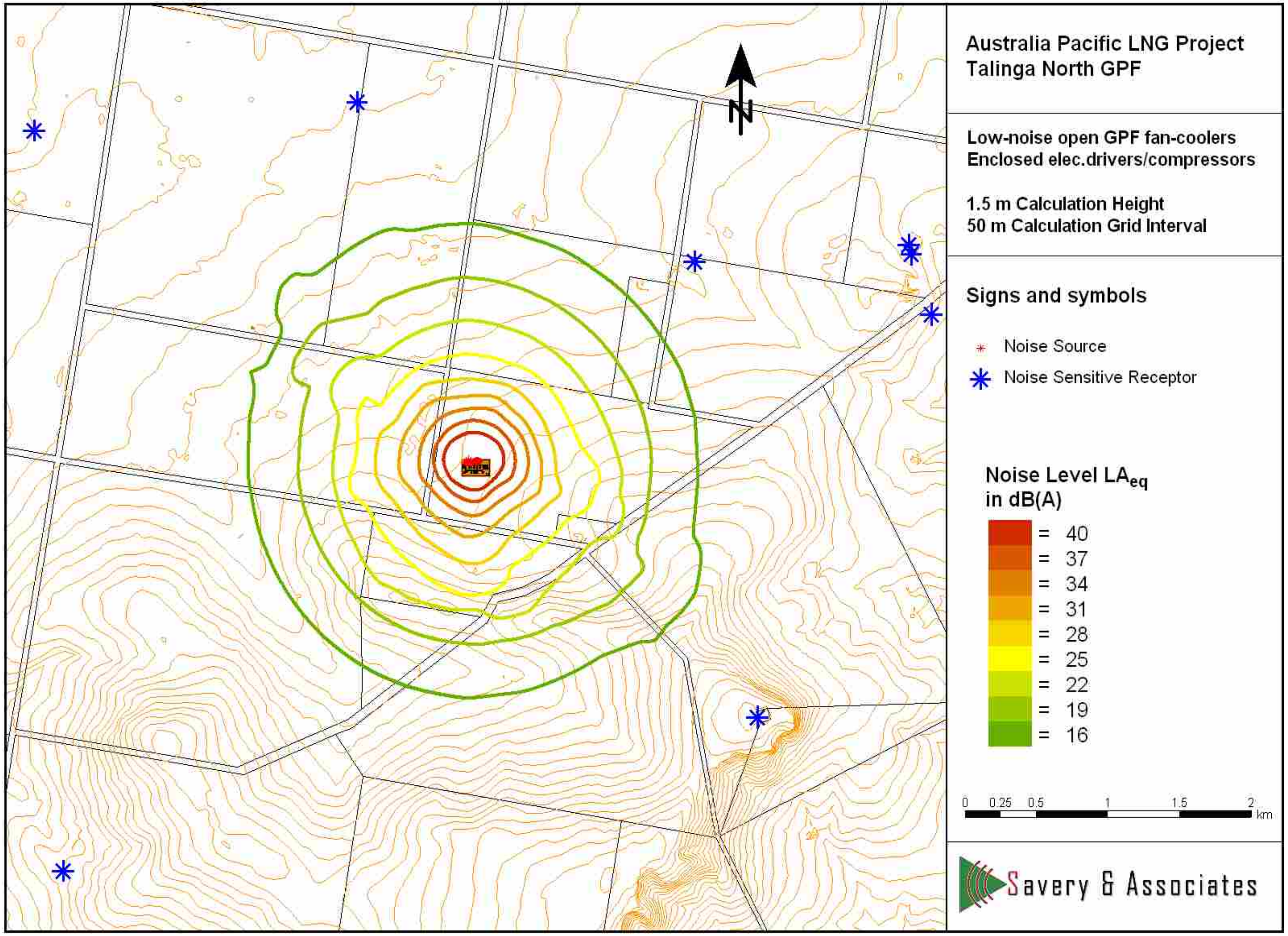


Figure 6: Talinga North GPF (Mains Power)

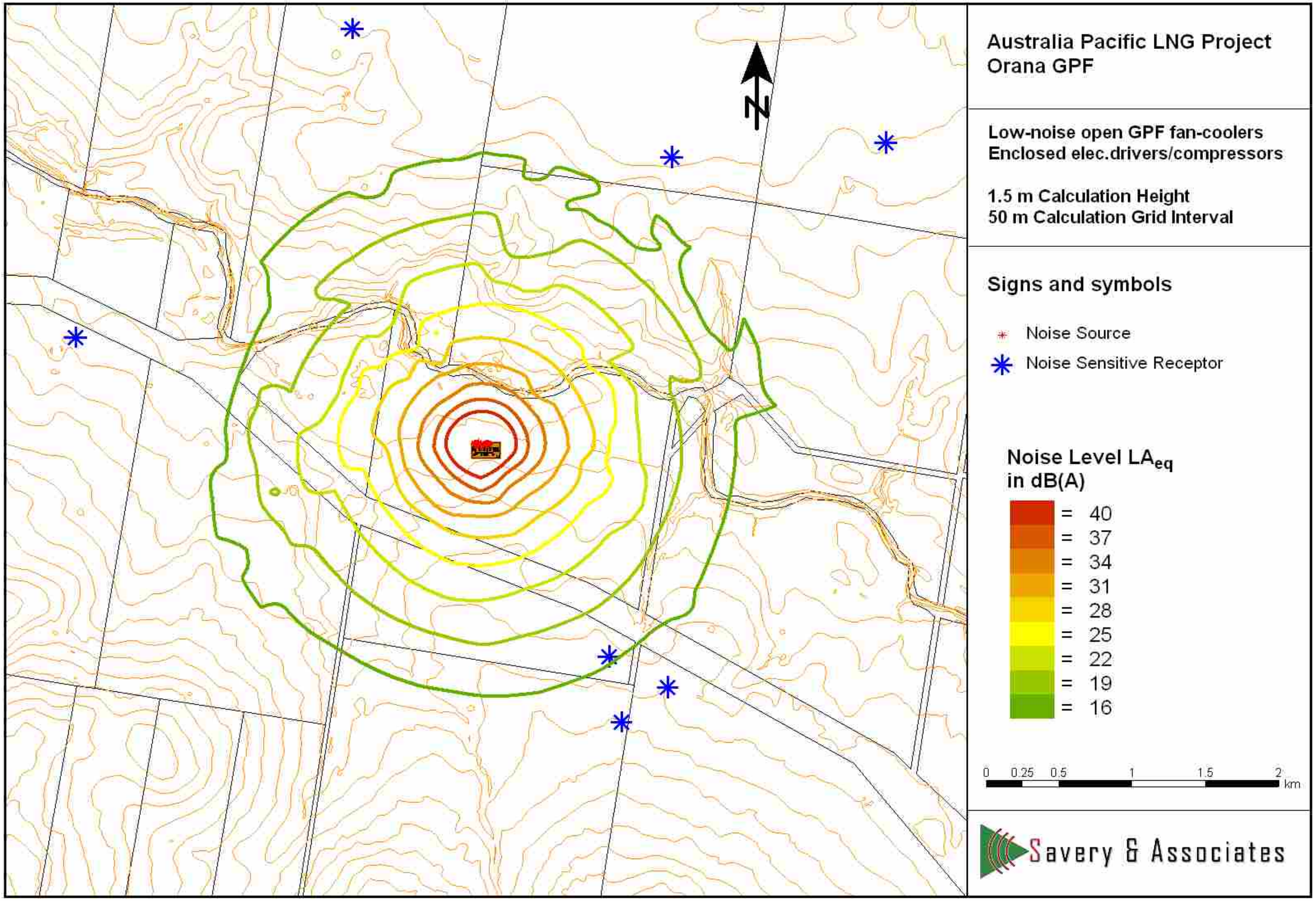


Figure 7: Orana GPF (Mains Power)

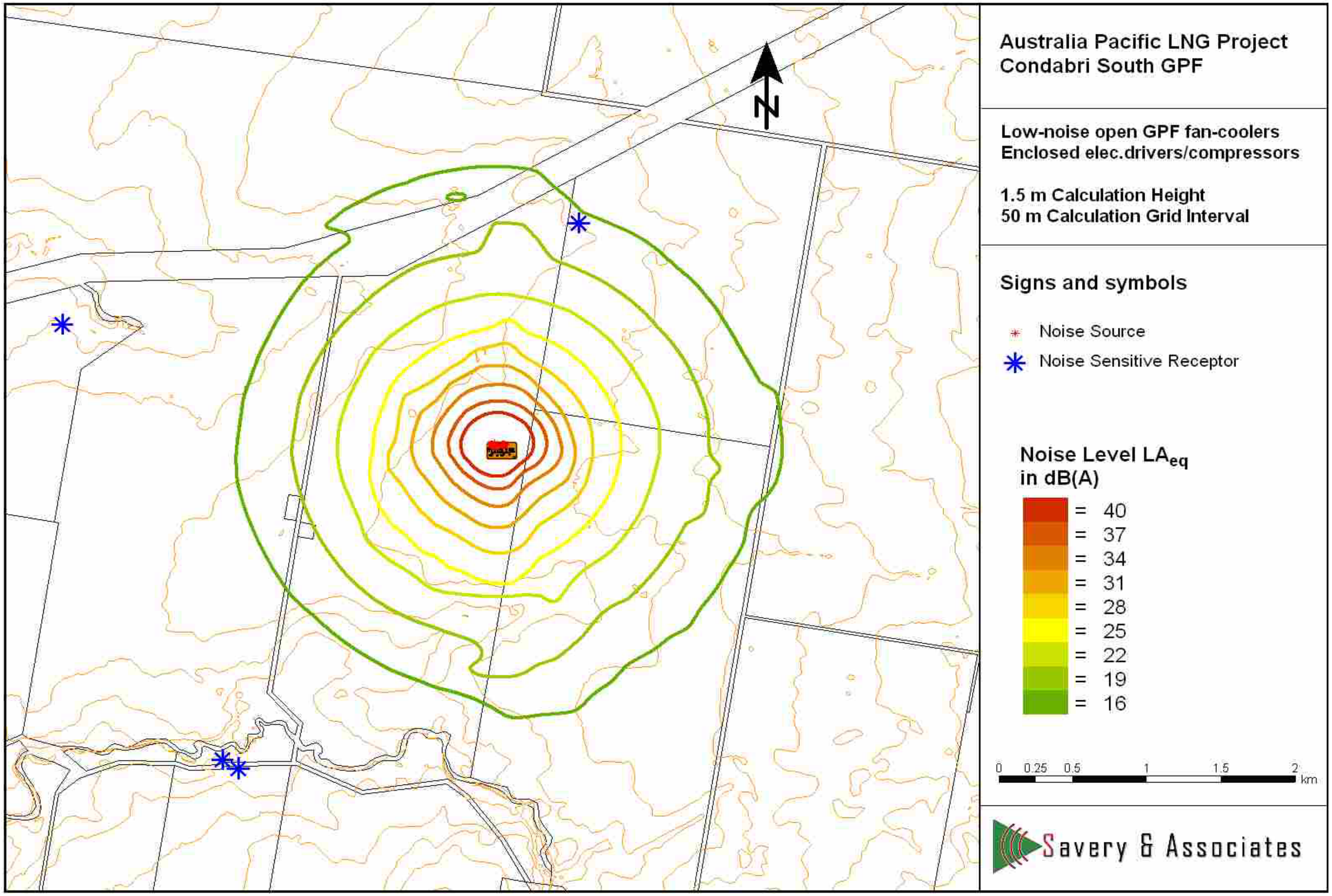


Figure 8: Condabri South GPF (Mains Power)

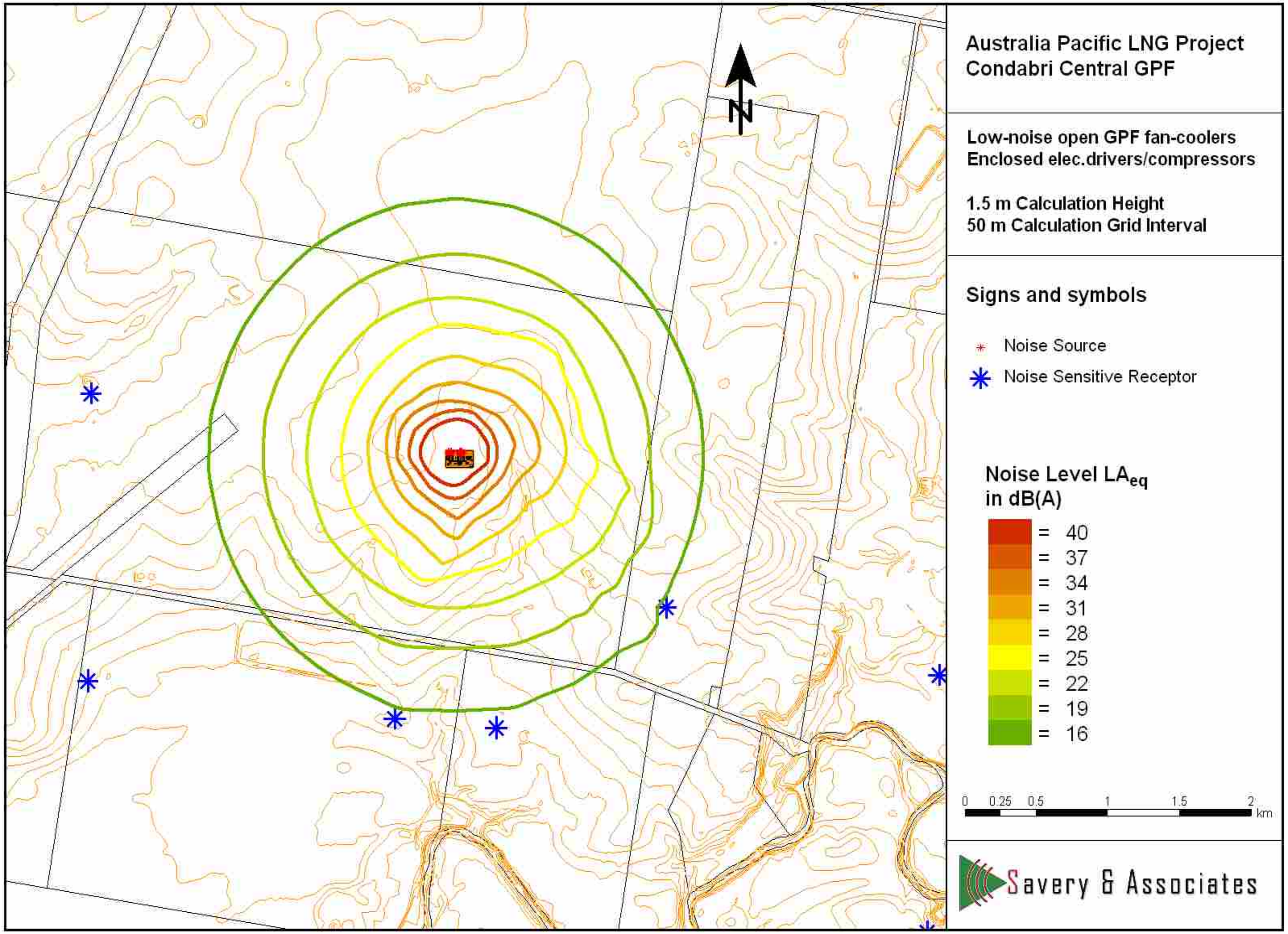


Figure 9: Condabri Central GPF (Mains Power)

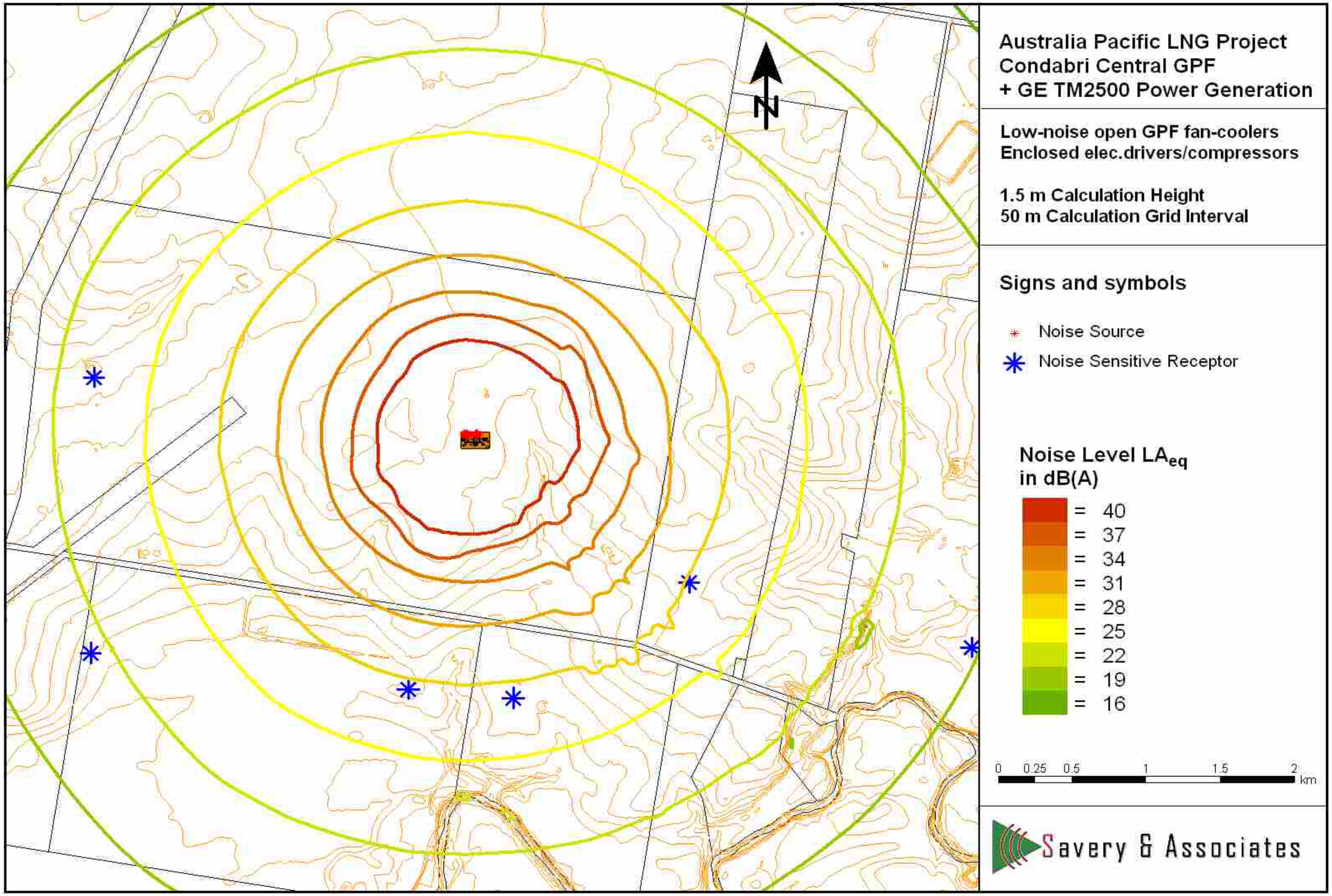


Figure 10: Condabri Central GPF – Including GE TM2500

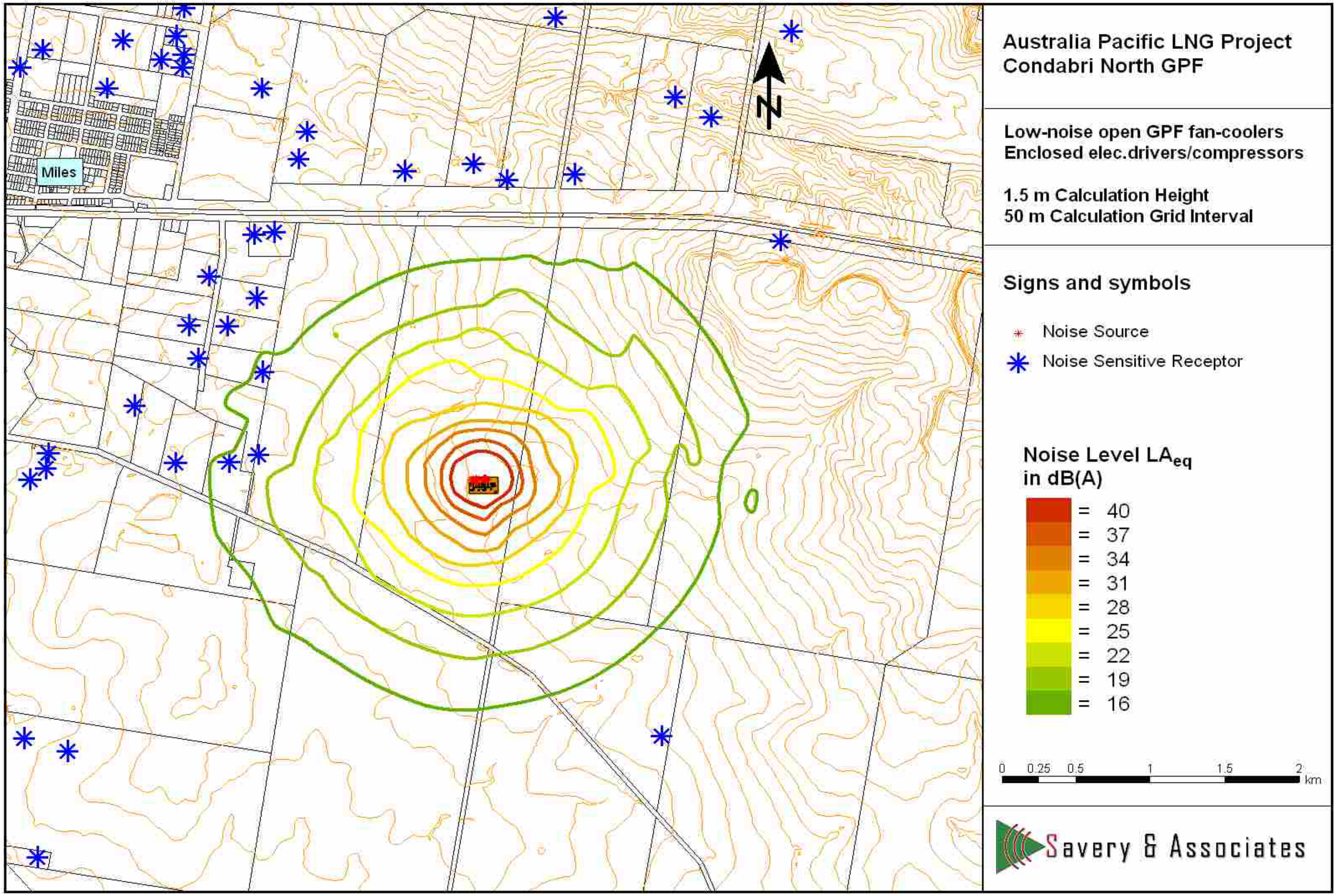


Figure 11: Condabri North GPF (Mains Power)

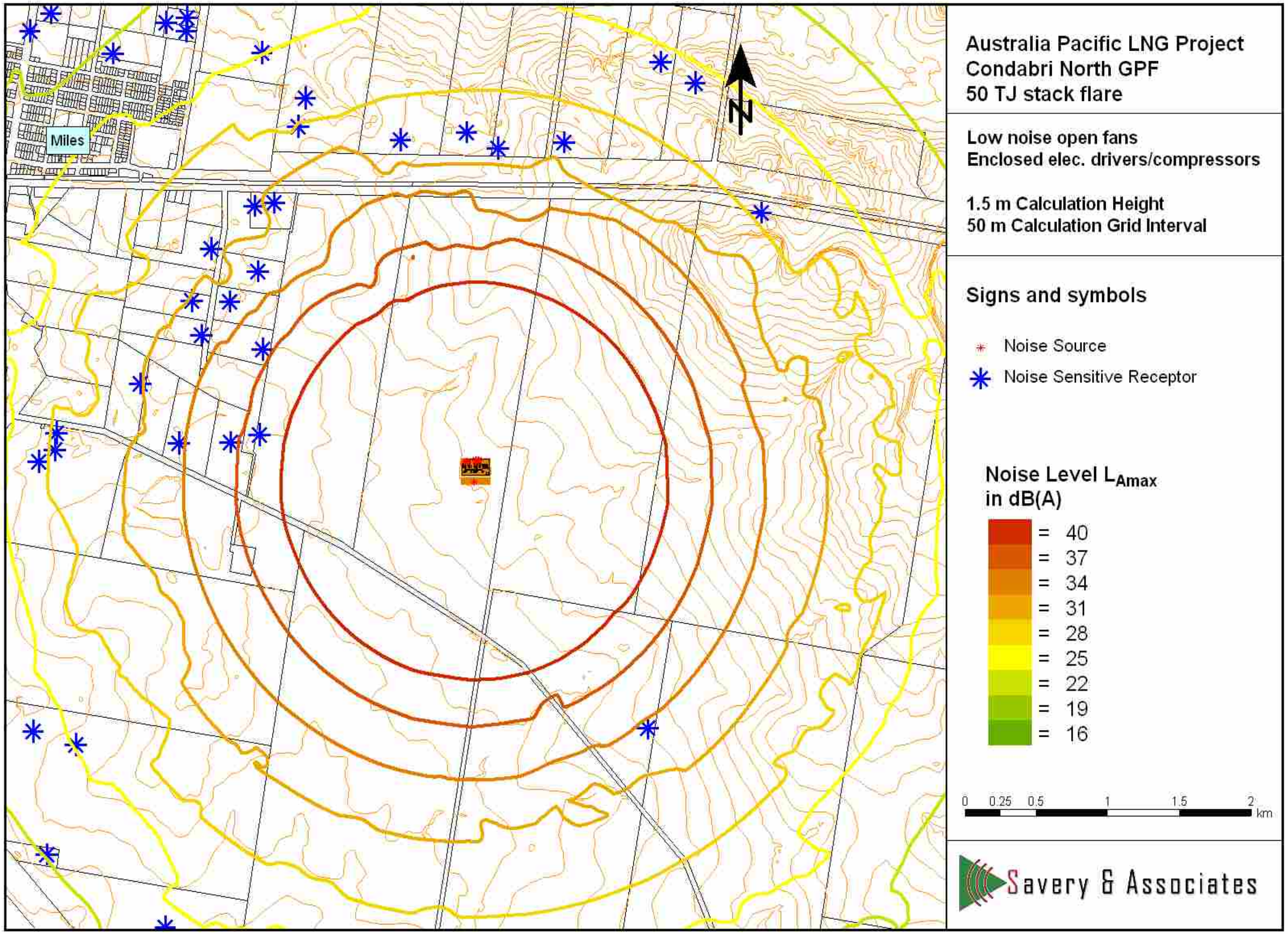


Figure 12: Condabri North GPF + Transient 50TJ Stack Flare

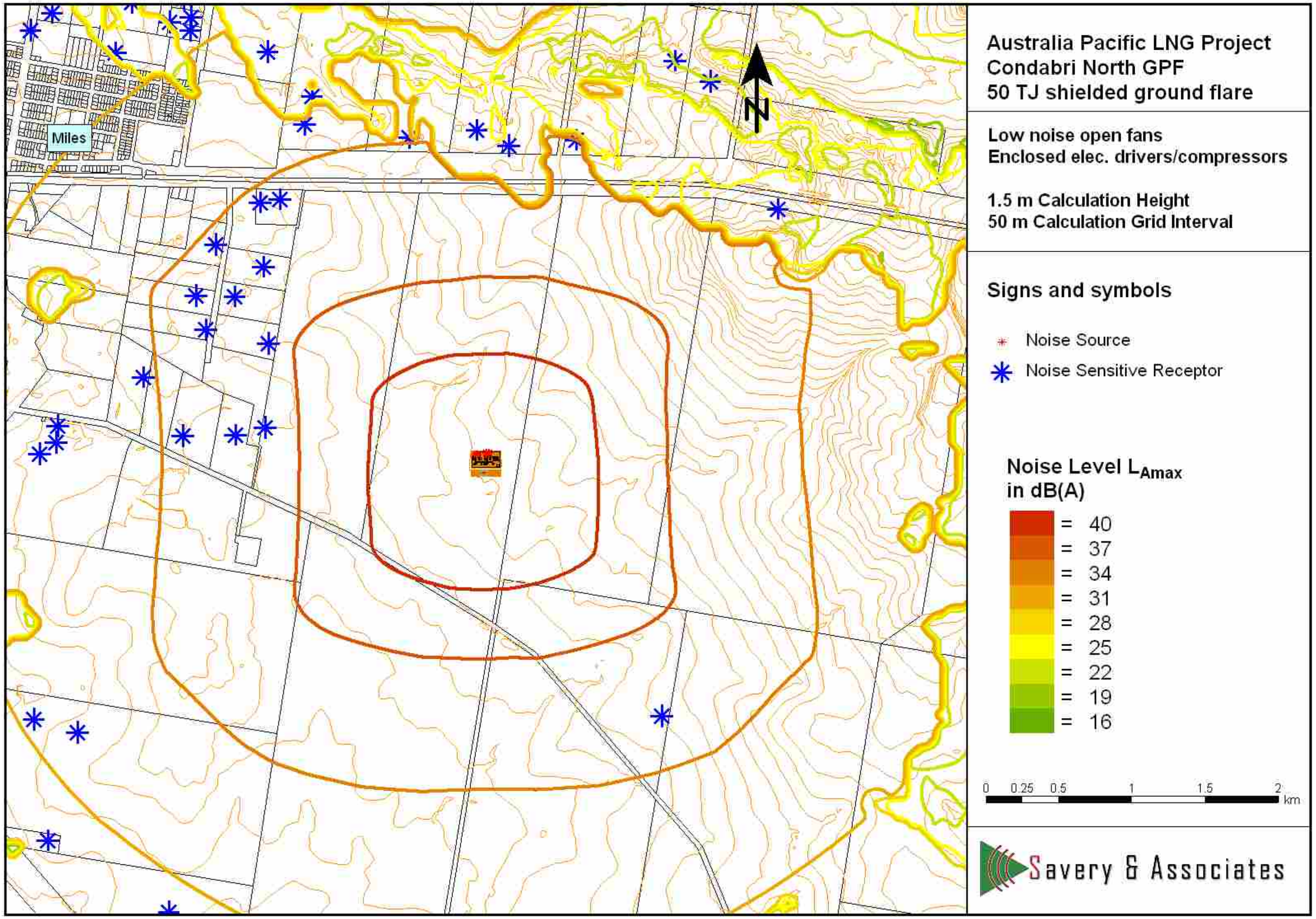


Figure 13: Condabri North GPF + Transient Shielded Sub-sonic 50TJ Ground Flare

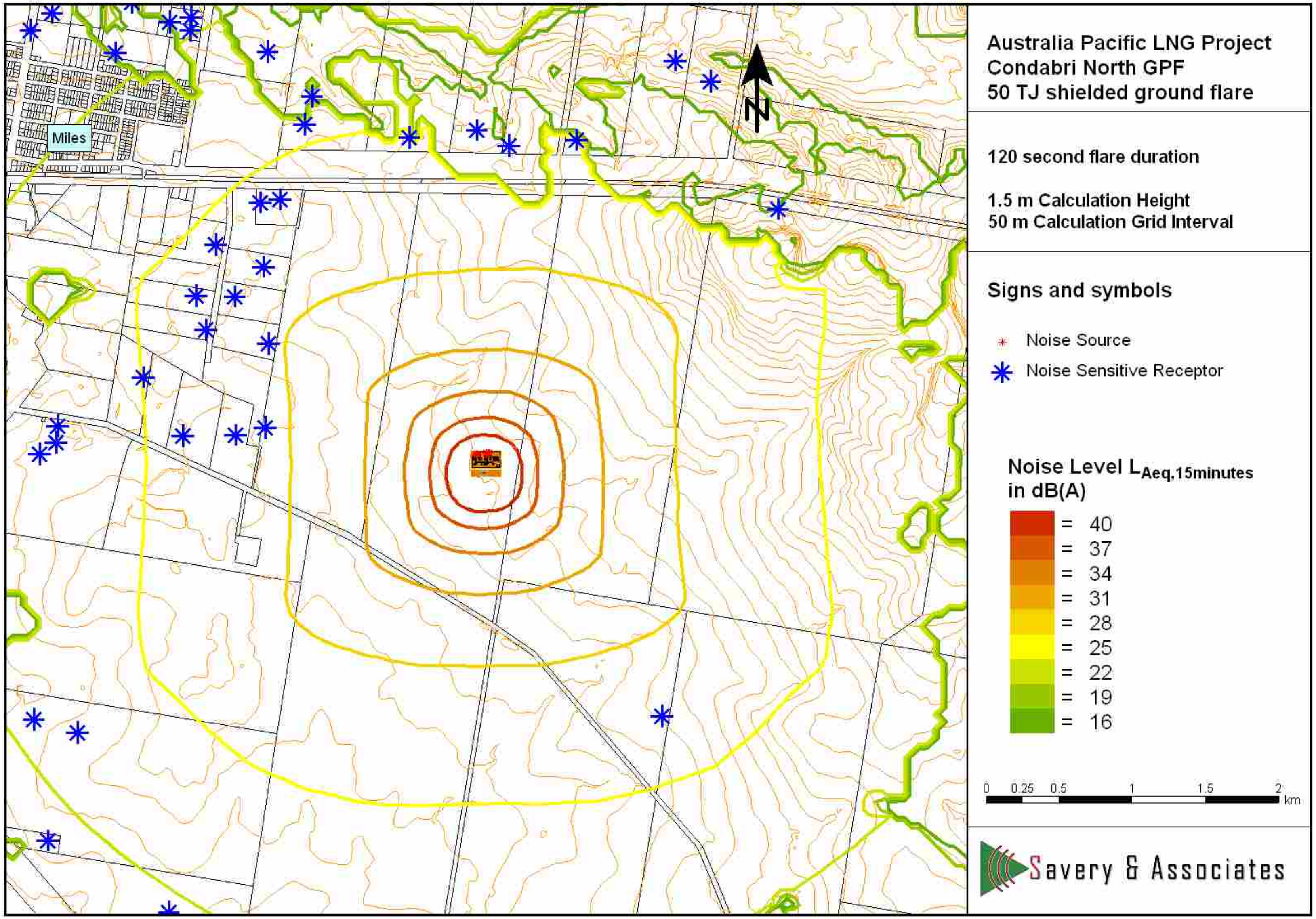


Figure 14: Condabri North GPF + 15 minute L_{Aeq} average of 120 second duration Transient 50TJ Ground Flare

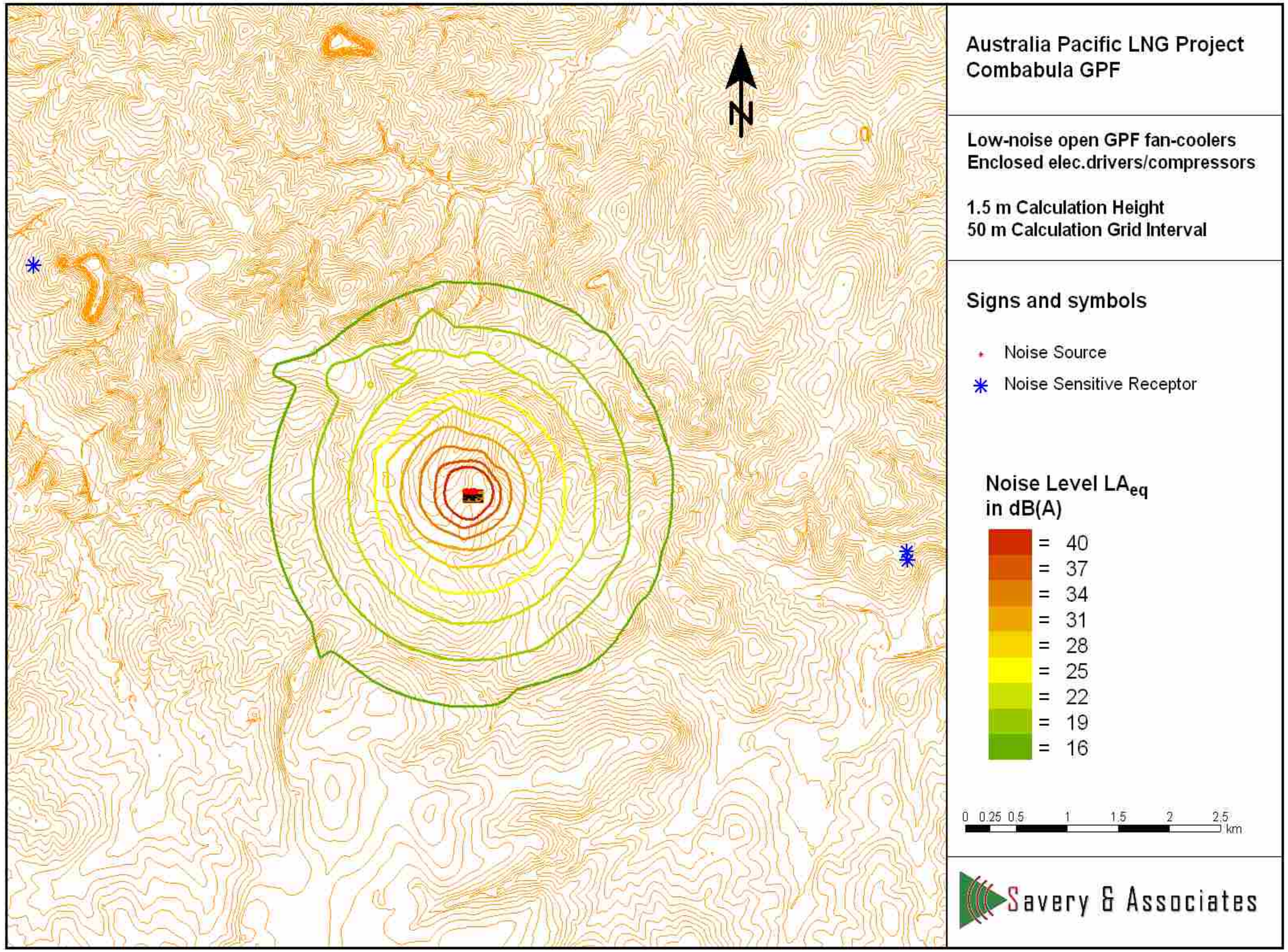


Figure 15: Combabula GPF (Mains Power)

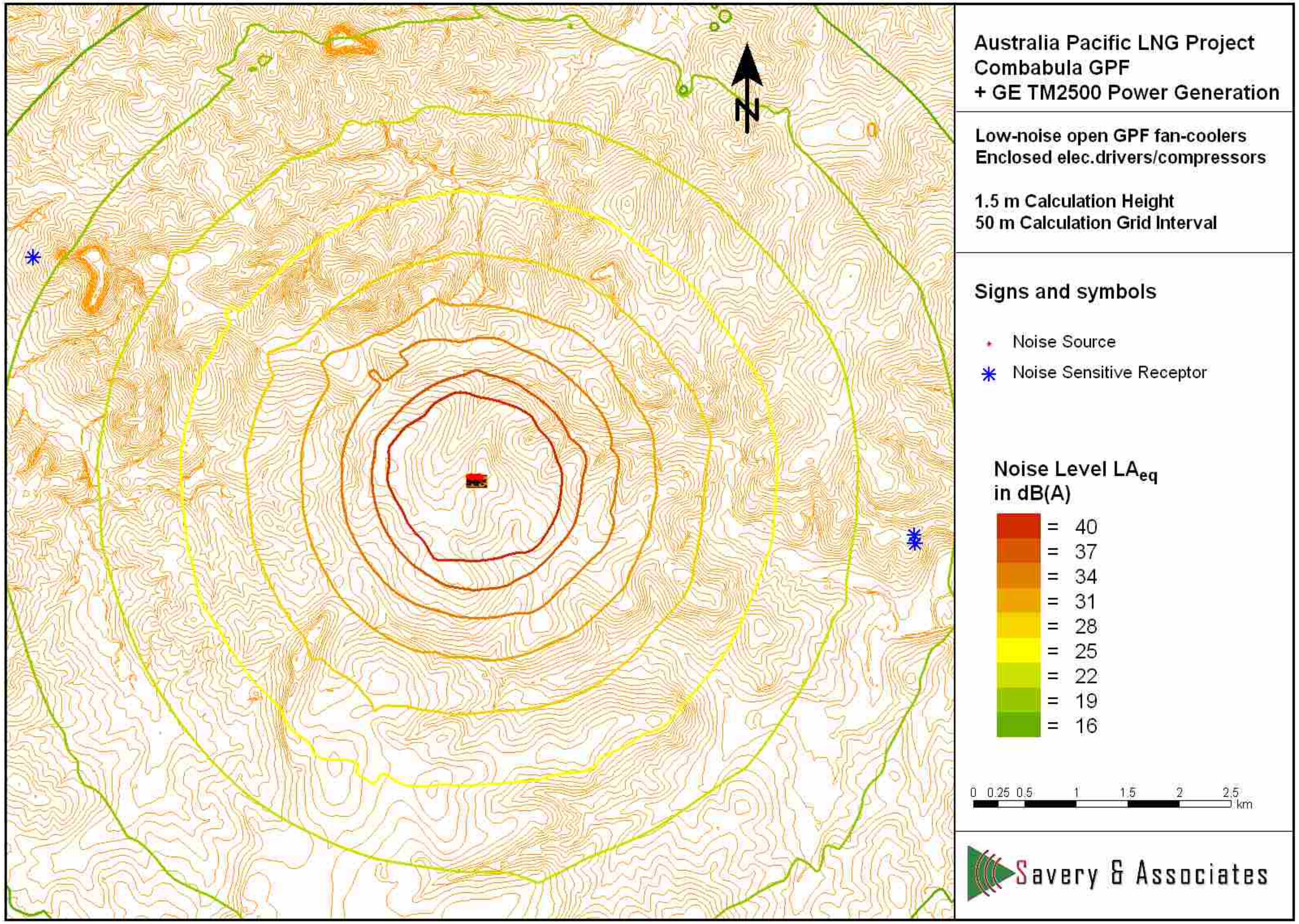


Figure 16: Combabula GPF – Including GE TM2500

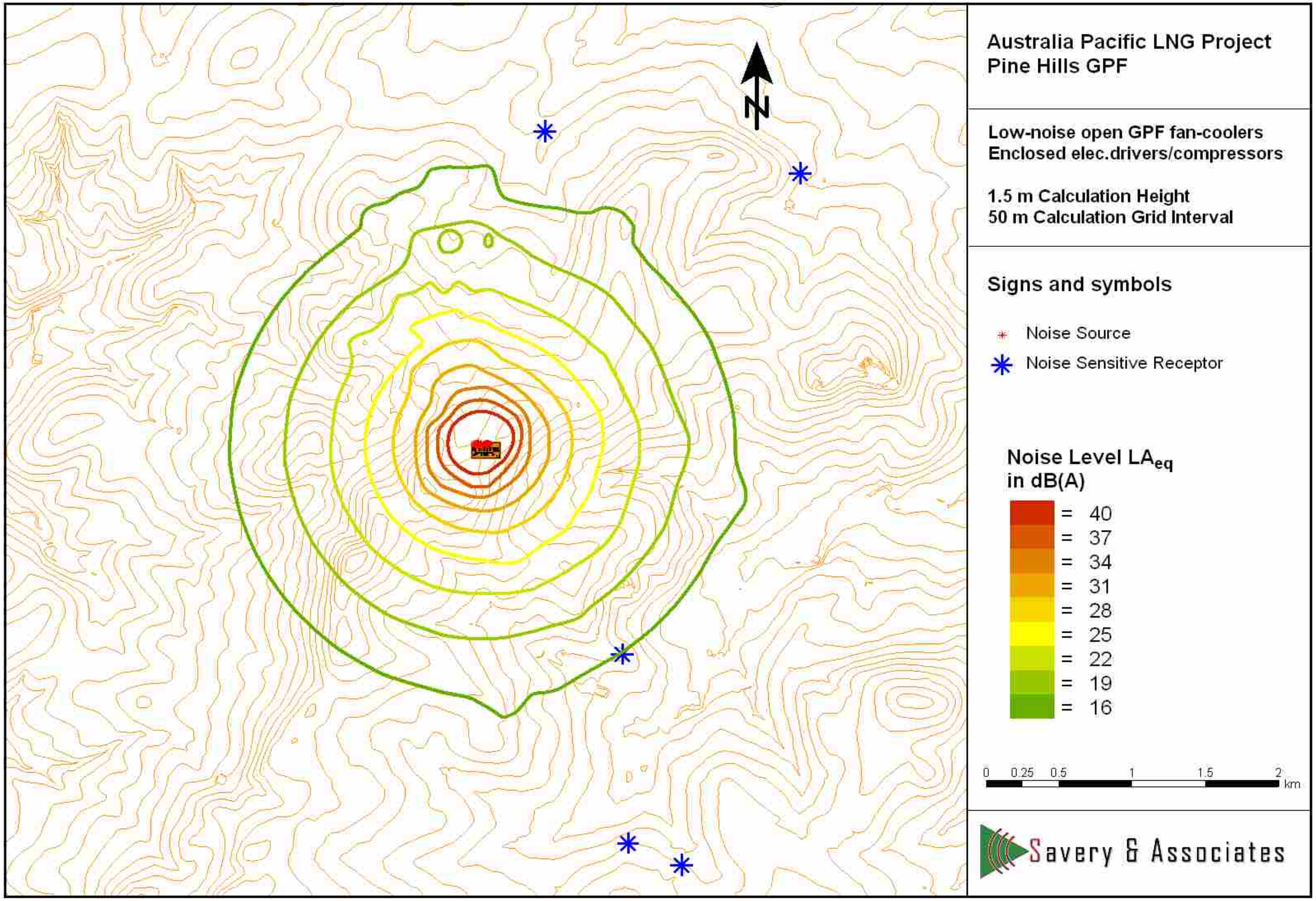


Figure 17: Pine Hills GPF (Mains Power)

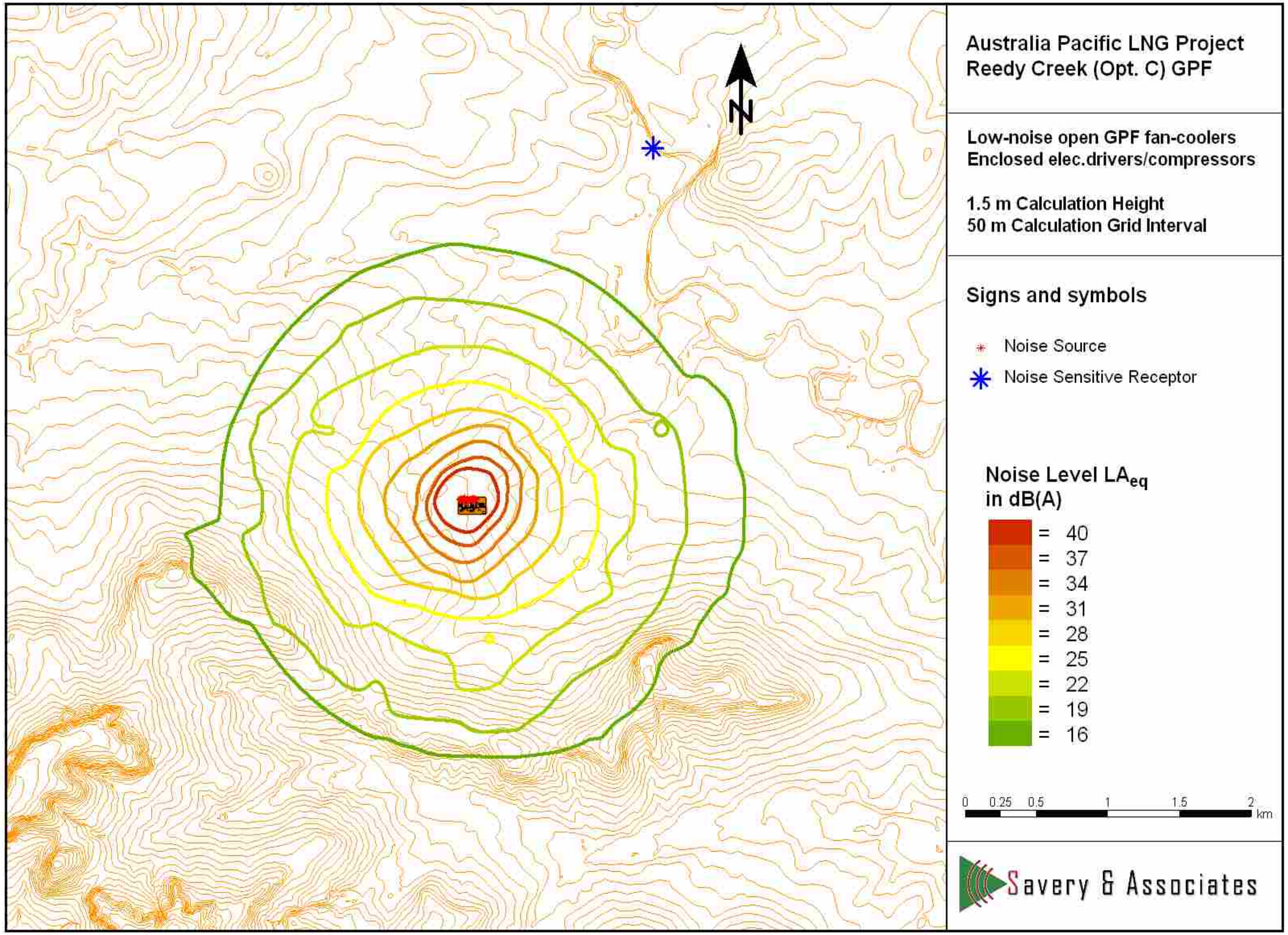


Figure 18: Reedy Creek (Option C) GPF (Mains Power)