HERRING STORER ACOUSTICS

AUSTRALIAN GARNET PTY LTD

LUCKY BAY GARNET MINE PROJECT

PROPOSED UPGRADES TO PROCESSING PLANT

ENVIRONMENTAL NOISE ASSESSMENT

JULY 2024

DOCUMENT CONTROL PAGE

PROCESSING PLANT UPGRADES
ENVIRONMENTAL NOISE ASSESSMENT

LUCKY BAY GARNET MINE PROJECT

Job No: 24187

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APPENDICES

1.0 INTRODUCTION

Herring Storer Acoustics was commissioned by Australian Garnet Pty Ltd to undertake noise assessment relating to noise emissions associated with the proposed upgrade to the Processing Plant at the Lucky Bay mine site, Western Australia.

The proposed upgrade will be in the form of improvements to the existing processing plant. These improvements are designed to improve product quality and water recovery and do not result in increased emissions or discharges, exceed the design capacity of the processing plant or the assessed production capacity of the Premises.

The upgrades are in the form of the following components:

- Wet Concentrator Plant (WCP)
  The existing constant density (CD) tank is being replaced with an upgraded design, which includes a new CD tank design, an upgraded cyclone pack and relocation of the current CD tank transfer pump onto the new CD tank.

- Additional Dryer and Baghouse
  The existing dryer and baghouse is undersized and constrains the dry plant capacity, which has an approved throughput of 47 tph, under the current Works Approval. The dryer and baghouse are to be replaced with a larger unit that will comply with existing Works Approval requirements.

- Attritioner Cells Upgrade
  The attritioner circuit modification involves the relocation of the existing two cells into a new structure with two cells to be installed in parallel in the same structure (i.e., a total of four versus original design of six). A new cyclone and dewatering screen will be installed on each of the new parallel attritioner feed streams.

- Dry Separation Plant Upgrades (DSP)
  The DSP is fed dried heavy metal concentrate from the dryer. The DSP includes magnetic separation and screening, and non-magnetic and magnetic (Ilmenite) stockpiling. The upgrades propose to install an additional dry plant and equipment in the form of screens, magnets and air tables into the DSP to improve product quality.

Previously, noise level measurements of the existing processing plant and mining operations have been undertaken in both near and far field locations (*HSA reference 31331-2-23207*). The resultant noise levels have been assessed for compliance against the criteria contained in the *Environmental Protection (Noise) Regulations 1997.*

The proposed upgrades will be all situated within the existing processing plant, as shown in Figure 1.1 below.

The calibrated predictive noise model for the site has been updated to include the proposed upgraded plant noise emissions.

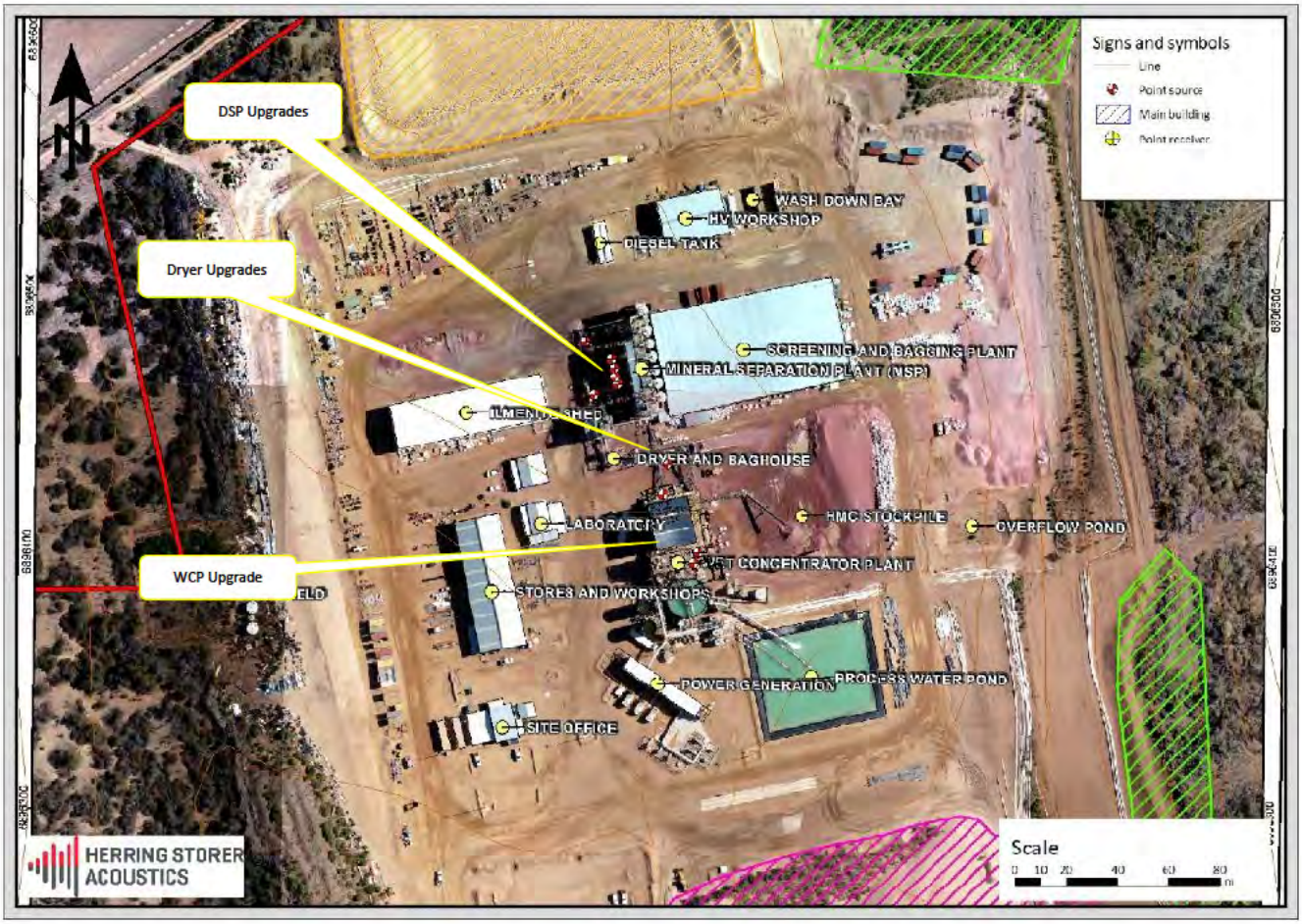


FIGURE 1.1 – AUSTRALIAN GARNET LUCKY BAY OPERATIONS – PROPOSED PROCESS PLANT UPGRADES

2.0 ACOUSTIC CRITERIA

The criteria used is in accordance with the *Environmental Protection (Noise) Regulations 1997.* These regulations stipulate maximum allowable external noise levels. For residential or noise sensitive premises, this is determined by the calculation of an influencing factor. The influencing factor is calculated for the usage of land within the two circles, having radii of 100m and 450m from the premises of concern. For commercial and industrial premises, the assigned noise levels are fixed for all hours, as listed in Table 2.1.

TABLE 2.1 – ASSIGNED OUTDOOR NOISE LEVELS

Type of premises receiving noise	Time of day	Assigned level (dB)		
		$L_{A\,10}$	$L_{A\,1}$	$L_{A\,max}$
Noise sensitive premises: highly sensitive area (i.e within 15m of a dwelling)	0700 to 1900 hours Monday to Saturday	45 + IF	55 + IF	65 + IF
	0900 to 1900 hours Sunday and public holidays	40 + IF	50 + IF	65 + IF
	1900 to 2200 hours all days	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + IF	45 + IF	55 + IF
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90

Note: The L_{A10} noise level is the noise that is exceeded for 10% of the time.
The L_{A1} noise level is the noise that is exceeded for 1% of the time.
The L_{Amax} noise level is the maximum noise level recorded.
IF = Influencing Factor

It is a requirement that noise from the site be free of annoying characteristics (tonality, modulation and impulsiveness) at other premises, defined as per Regulation 9.

Where the above characteristics are present and cannot be practicably removed, the following adjustments are made to the measured or predicted level at other premises.

TABLE 2.2 – ADJUSTMENTS FOR ANNOYING CHARACTERISTICS WHEN MUSIC IS NOT PRESENT

Where tonality is present	Where modulation is present	Where impulsiveness is present
+ 5 dB	+ 5 dB	+ 10 dB

The influencing factor at the noise sensitive premises has been determined as being zero for the nearest receptors, as they are in a rural area and not within 450m of the mine site.

3.0 METHODOLOGY/MEASURED NOISE LEVELS

To determine the noise that is received from the Australian Garnet operations, noise measurements were carried out during a previous site visit on the 3rd to the 10th of July 2023.

Two forms of noise level measurements were carried out, namely continuous and short term observed measurements.

3.1 CONTINUOUS NOISE LEVEL MEASUREMENTS

To measure the noise emissions from the operating mine site, noise monitors, capable of continuous noise level measurement were utilised.

Two noise monitoring campaigns were undertaken. For the first campaign, three noise monitors (Svan307A) were deployed on Monday 3rd July 2023 and measured noise levels through to the 10th July 2024 (approximately 1 week).

The first noise monitor was located at the highest noise area identified during the site visit, being the active mining area where the loader, trommel (screen) and generation systems were positioned. This monitor captured continuous noise levels and provided a baseline for comparison to the other far field monitors.

The other two monitoring units were placed towards the east, being the nearest noise sensitive residence, and to the south, being towards the Lucky Bay campgrounds.

Figure 3.1 details the locations of the monitors, and Figure 3.2 shows them in situ.

FIGURE 3.1 - CONTINUOUS MONITORING LOCATIONS

FIGURE 3.2 - MONITORS IN SITU

For the second noise monitoring campaign the locations of the noise monitors were changed to better represent the noise levels at the nearest noise sensitive premise.

Continuous noise monitoring has been undertaken from August 2023 (to current) at the site in three locations, with two being different location from that previous used. The updated continuous monitoring locations are as below in Figure 3.3 and include a comparable location for the residence to the east. It is noted that authority to monitor at the residence was not given, hence a logger at near to equal distance was used. For information the monitoring locations are as follows:

TABLE 3.1 – MONITORING SUMMARY

Assessment Report	Monitoring Period	Monitoring Location
31331-1-23207	17th May to 1st June 2023	Trommel Logger
		Laydown Logger
		South Logger
31331-2-23207	24th August 2023 to 1st March 2024	Hill West Logger
		Laydown Logger
		Residence Logger

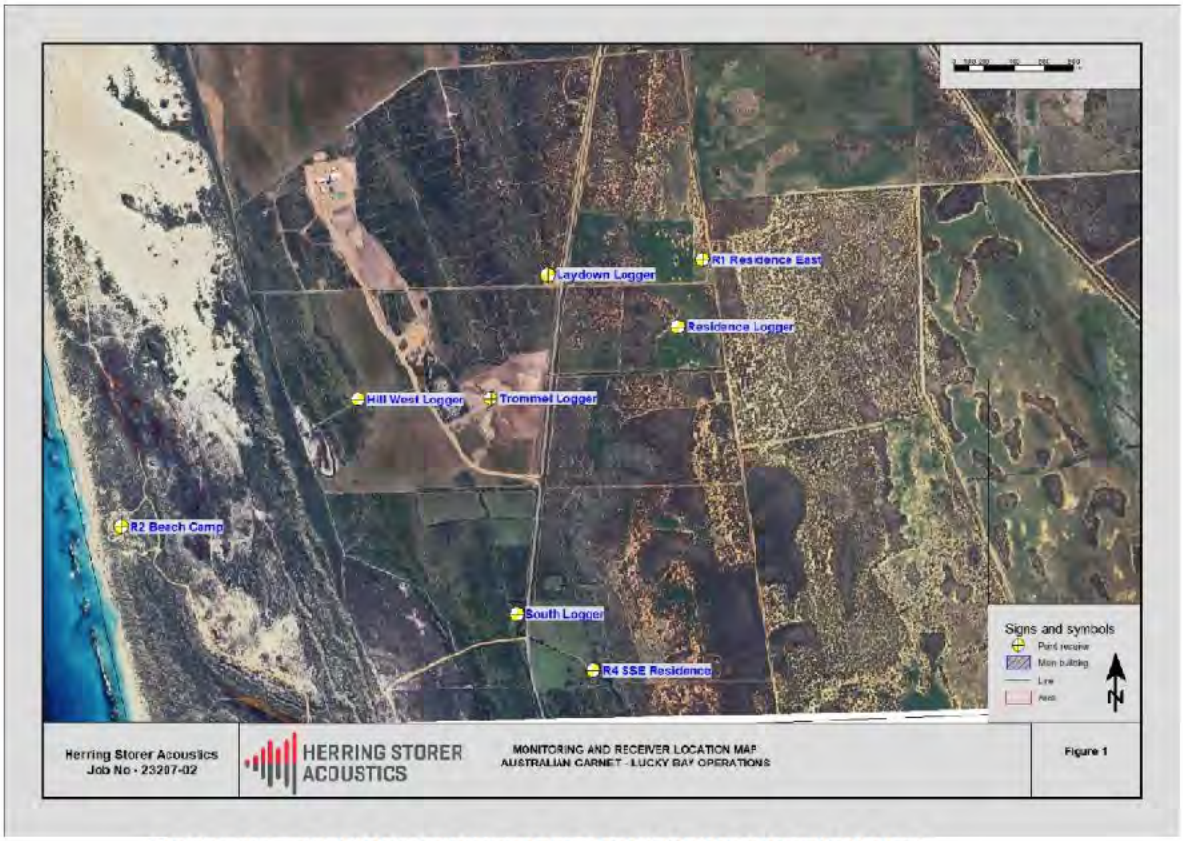


FIGURE 3.3 – PREVIOUS AND UPDATED MONITORING LOCATION MAP

The analysis included monthly monitoring data from August 2023 to February 2024.

3.2 OBSERVED HANDHELD NOISE LEVEL MEASUREMENTS

During the site visit on the 3rd and 4th July 2023, short term, observed noise level measurements were conducted.

Two types of measurements were carried out, firstly nearfield noise level measurements of the main process operating and mining areas, and far field noise levels measurements of the overall mine noise emissions.

Measurements in at the far field locations were conducted at 05:00 on Tuesday 4th July 2023 as this was a clear weather period with south-westerly winds. Observations were taken over a one hour period, with measurements conducted short term (between traffic movements) over a representative period of 15 minutes.

Confirmation noise level measurement was conducted at this location as winds at the time were in the general direction of interest. It was used for confirmation of the predicted noise levels, however, did not form the basis of the actual assessable noise level.

Measurement locations of the main processing plant are shown in Figure 3.4, with the other measurement locations for the mine site shown in Figure 3.5.

FIGURE 3.4 – MAIN PROCESSING PLANT – NOISE MEASUREMENT LOCATIONS

FIGURE 3.5 – MINESITE – NOISE MEASUREMENT LOCATIONS

4.0 OBSERVED HANDHELD NOISE LEVEL MEASUREMENTS

A summary of the noise levels for the observed measurements for the existing Processing Plant is shown in Table 5.1. It is noted that the plant was in a steady operational state throughout the measurement period.

TABLE 5.1 – MEASURED NOISE LEVELS

Measurement Location	L_{A10} (dB(A))	Comment
Process Plant Loc 1	83	Normal Operation
Process Plant Loc 2	72	Normal Operation
Process Plant Loc 3	72	Normal Operation
Process Plant Loc 4	74	Normal Operation
Process Plant Loc 5	73	Normal Operation
Process Plant Loc 6	74	Normal Operation
Process Plant Loc 7	71	Normal Operation
Process Plant Loc 8	68	Normal Operation
Process Plant Loc 9	66	Normal Operation
Process Plant Loc 10	59	Normal Operation
Process Plant Loc 11	58	Normal Operation
Process Plant Loc 12	58	Normal Operation
Process Plant Loc 13	61	Normal Operation
Process Plant Loc 14	66	Normal Operation
Process Plant Loc 15	68	Normal Operation
Process Plant Loc 16	75	Normal Operation
Process Plant Loc 17	70	Normal Operation

The above noise levels were used to calibrate the predictive noise model.

5.0 CALIBRATION

The noise modelling has been calibrated to the site measurements conducted i.e. nearfield noise levels for the processing plant, booster pumps and trommel.

Noise levels were predicted using the acoustic software SoundPlan for worst case wind conditions as per the DER 'Draft Guideline on Environmental Noise for Prescribed Premises (May 2021)' for day operation.

It is noted that 'worst case' wind conditions refer to conditions where there is a temperature inversion in conjunction with light winds in the direction from noise source to receiver, resulting in effective sound propagation to receiver locations. For the case of light westerly winds, temperature inversions are unlikely due to the warm air from the ocean.

The 'SoundPlan' software implements the CONCAWE algorithm, which has been used in this assessment.

Topographical data used for the above algorithm has been based on the proposed extraction area, as provided by the client. For the surrounding area, general ground RL's are imported into the model via Google Earth.

The sound power levels used in the acoustic modelling are calculated based on measured noise levels from this current assessment.

6.0 NOISE MODELLING

Noise immissions[1] at the nearest neighbouring residential premises, due to noise associated with the proposed processing operations, were modelled using the computer programme SoundPlan. Sound power levels used for the noise modelling were based on both manufacturer data and measured sound pressure levels of similar equipment proposed for use on site.

This acoustic assessment is required for the approval process and is being undertaken prior to the final design of the upgrade being known. Whilst the plant design is undergoing final consideration, for the purpose of the predictive noise modelling, the current design has been used as a basis for the assessment.

The design configuration for the plant is contained in Appendix A. The modelling of noise levels has been based on noise sources and sound power levels shown in Figure 4.1 and Table 4.1.

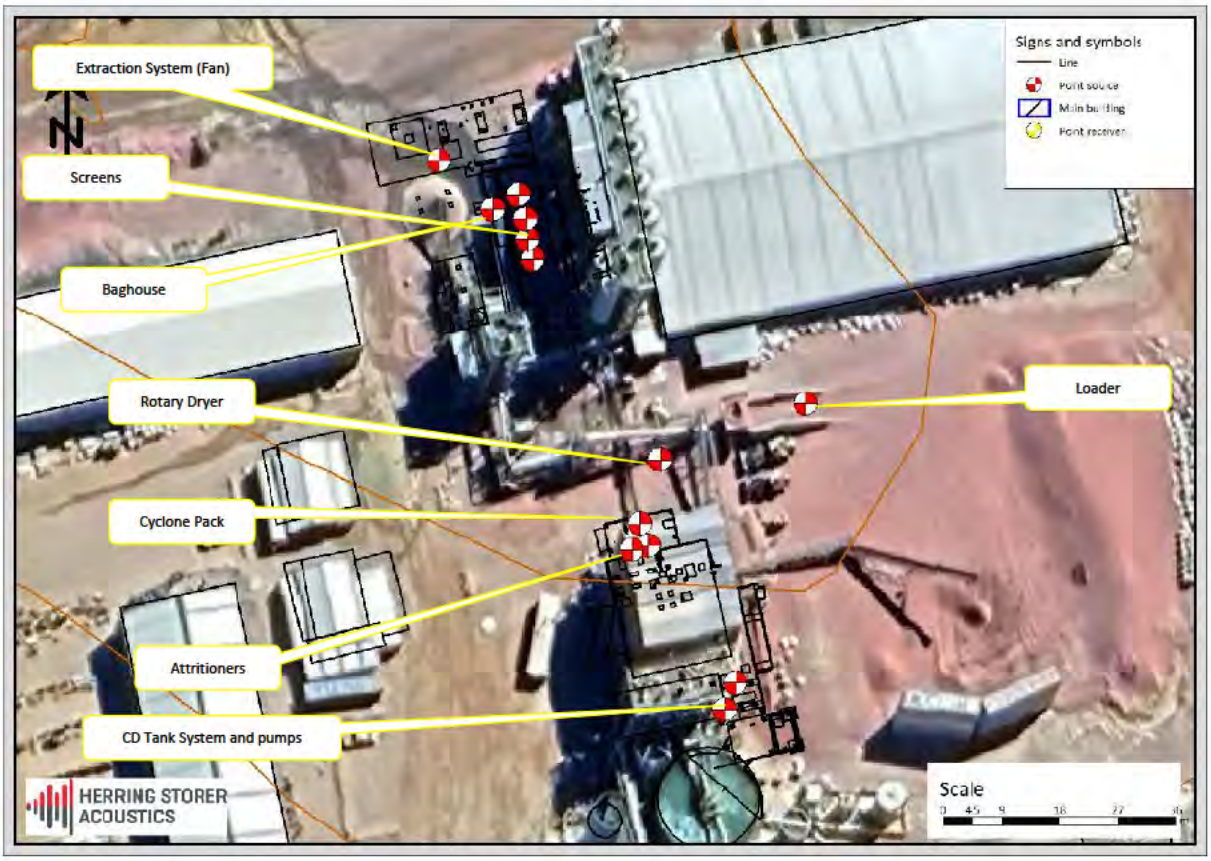


FIGURE 4.1 – PROCESS PLANT UPGRADES SOURCE LAYOUT

1 Immissions – noise received at a source
2 Emissions – noise emanating from a source and / or location

TABLE 4.1 – SOUND POWER LEVEL - NOISE SOURCES dB(A)

Noise Sources	Sound Power Level dB(A)	Process Area
Attritioners /Scrubbers	99 (2 off)	Wet Concentrator Plant
Rotary Dryer	99 (1 additional)	Dry Separation Plant
Constant Density Tank System (Cyclone Pack)	105 (1 new replacement)	Wet Concentrator Plant
CD Tank Transfer Pumps	94 (2 off)	Wet Concentrator Plant
Screen	101 (4 off))	Dry Separation Plant
Extraction System (Fan)	102 (1 off)	Dry Separation Plant
Cyclone Stacker	105 (1 additional)	Wet Concentrator Plant
Baghouse	(1 additional)	Dry Separation Plant
Front End Loader*	105	Dry Separation Plant

*existing mobile plant, however not operational during previous measurements – as outlined in Section 4.0

Note – given the noise levels of the above items, additional equipment proposed for the upgrades such as conveyors etc have an insignificant acoustic contribution.

Considering the Process Plant can operate 24 hours a day, the most stringent regulatory time period would be 22:00 to 07:00 hours, or "night". It is noted that mining does not occur during the night period, hence this assessment considers the current noise emission from the processing plant, the upgrades in isolation from the existing, and the cumulative noise emissions from the existing and the proposed upgrades.

Based on the operations undertaken, the following three scenarios have been modelled:

Scenario 1 – Night Operations – Existing Processing Plant, Booster Pumps and Trommel;
Scenario 2 – Night Operations – Proposed Upgrades Only (as per Table 4.1); and
Scenario 3 – Night Operations - All processing sources (Existing and Proposed).

Resultant noise levels for the modelling are as per Table 6.2.

TABLE 6.1 – PREDICTED NOISE LEVELS AT NOISE SENSITIVE LOCATIONS

Operating Condition	Receiving Location	Noise Level dB(A)
Scenario 1 – Night Operations- Existing Processing Plant, Booster Pumps and Trommel	R1 Residence East	24
	R2 Beach Camp	27
	R3 NW Residence	8
	R4 SSE Residence	23
Scenario 2 – Night Operations – Proposed Dry Plant Only	R1 Residence East	25
	R2 Beach Camp	18
	R3 NW Residence	13
	R4 SSE Residence	19
Night Operations - All processing sources (Existing and Proposed)	R1 Residence East	27
	R2 Beach Camp	28
	R3 NW Residence	14
	R4 SSE Residence	24

7.0 ASSESSMENT

Analysis of the most critical night operations for the predicted noise levels under worst case conditions has been undertaken with these shown in Table 7.1 below. It is noted that analysis of the noise given the distance and level, shows the noise received are not tonal. This has been previously confirmed by third octave band analysis of both monitored and measured noise levels.

TABLE 7.1 – PREDICTED NOISE LEVELS AT NOISE SENSITIVE LOCATIONS

Operating Condition	Location	Noise Level dB(A)	Assigned Noise Level dB(A)	Compliance
Night Operations - All processing sources (Existing and Proposed)	R1 Residence East	27	35	Complies
	R2 Beach Camp	28	35	Complies
	R3 NW Residence	16	35	Complies
	R4 SSE Residence	25	35	Complies

Given the assessable noise level of 28 dB(A), for the addition of the dry plant to the existing processing, the Australian Garnet operations would comply for all time periods.

8.0 CONCLUSION

Assessment of the Australian Garnet noise levels for the addition of the proposed Dry plant to the existing processing operations, show that compliance is achieved for all operating conditions for night periods, being the most stringent in terms of compliance for the processing plant.

APPENDIX A

FIGURE A1 – EXISTING PROCESSING PLANT

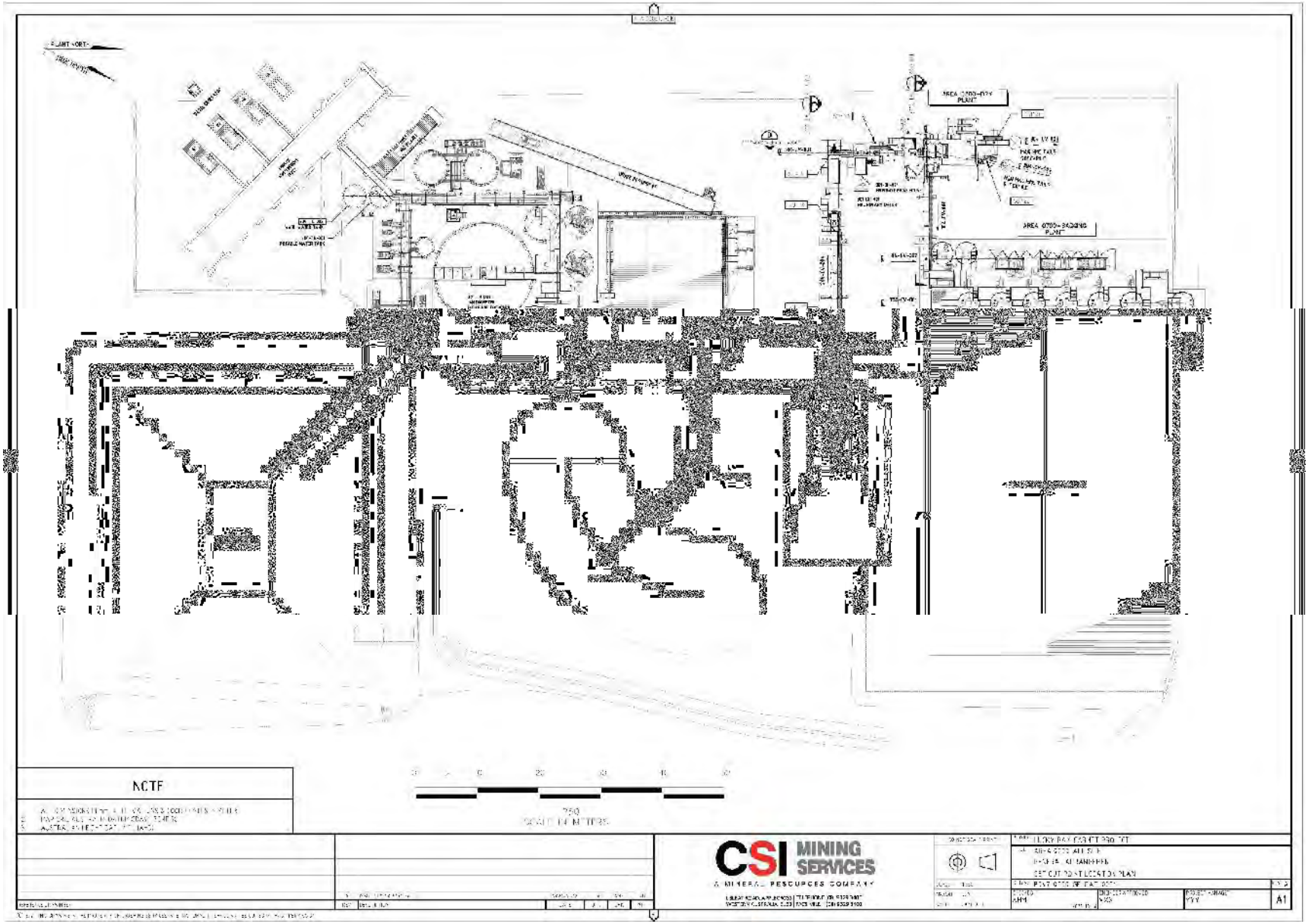


FIGURE A2– EXISTING PROCESSING PLANT AREA PLAN

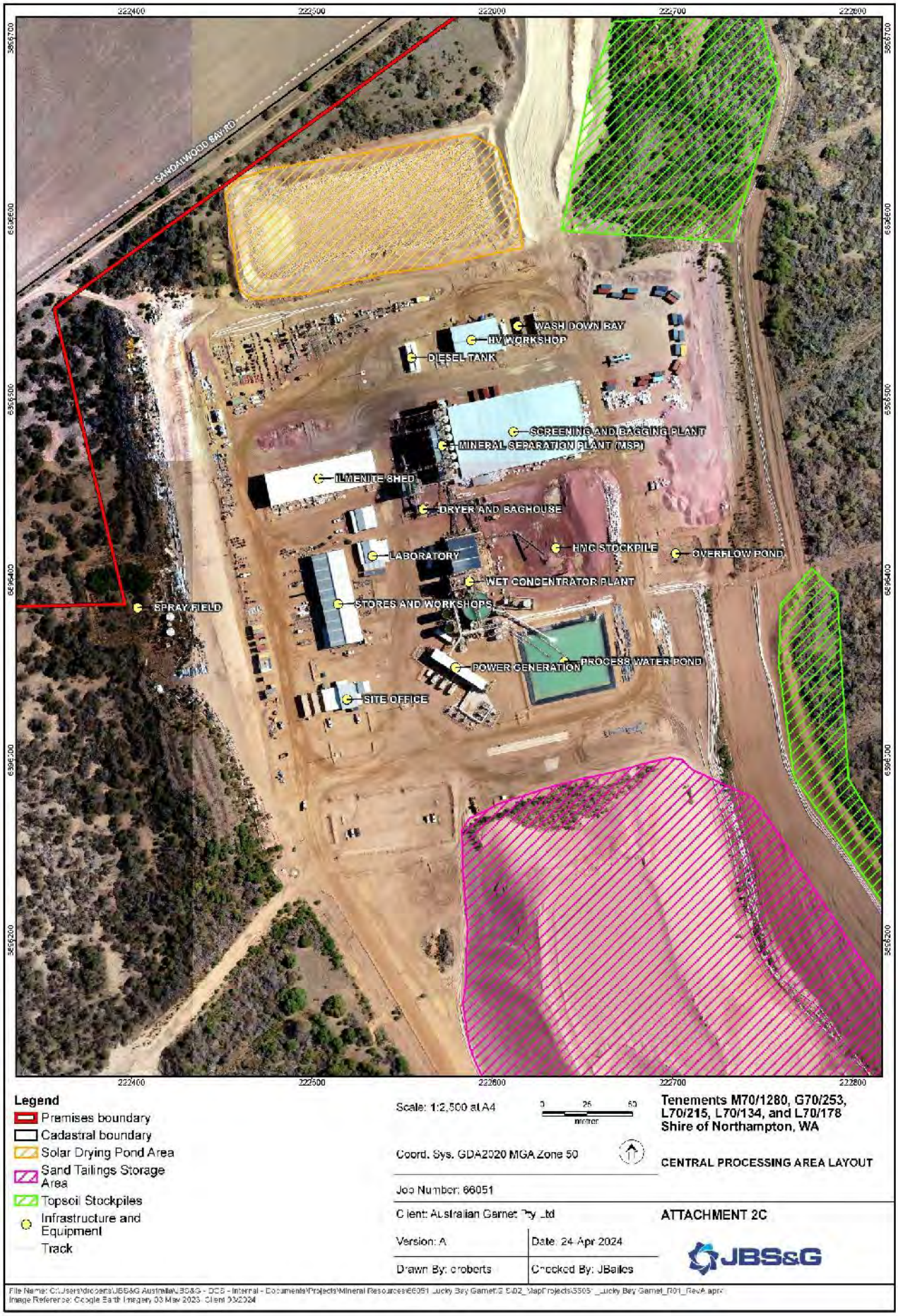


FIGURE A3 – CONSTANT DENSITY TANK UPGRADE - WCP

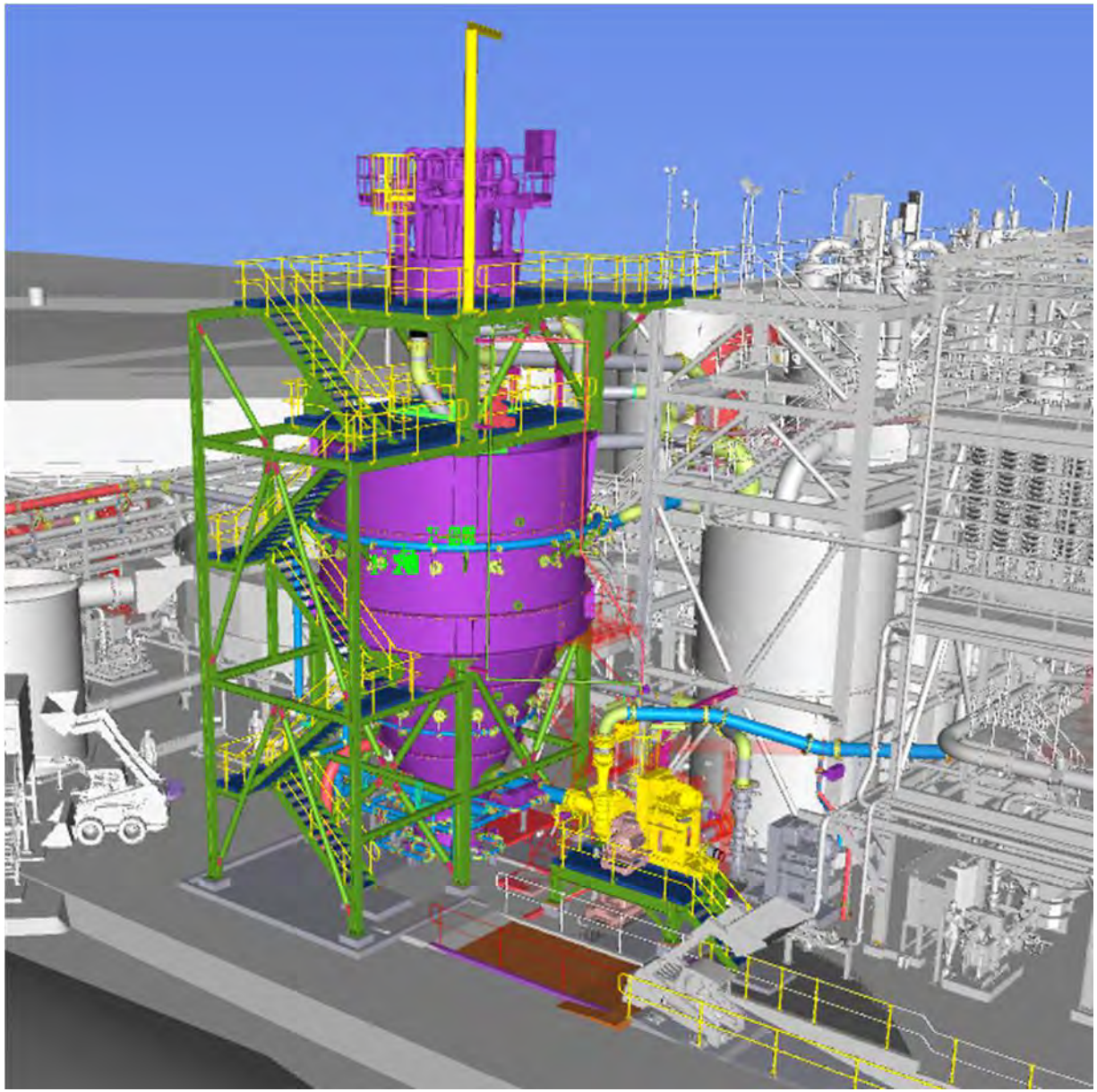


FIGURE A4 – SCREEN UPGRADE - DSP

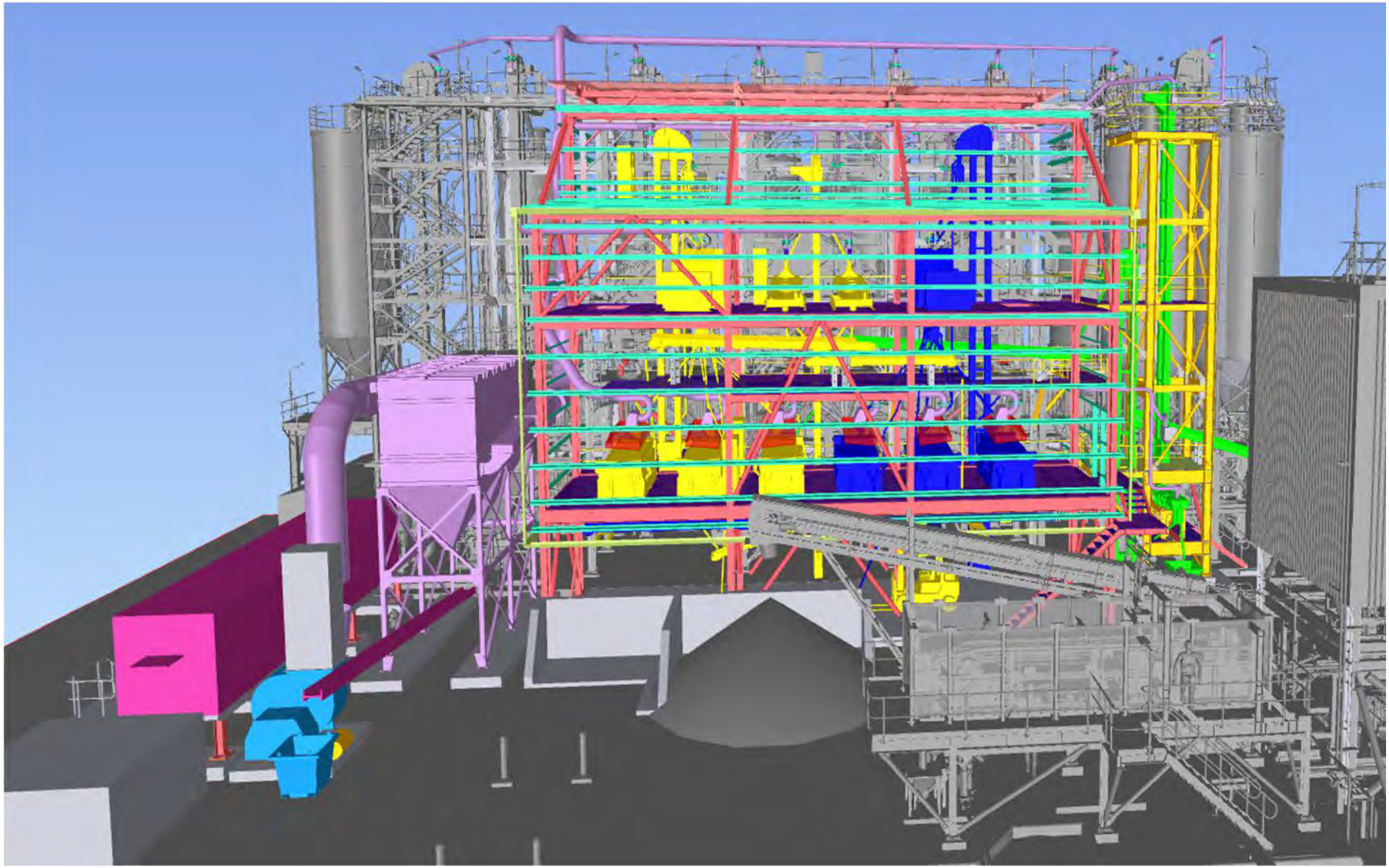


FIGURE A 5 – ATTRITIONER UPGRADE – WCP

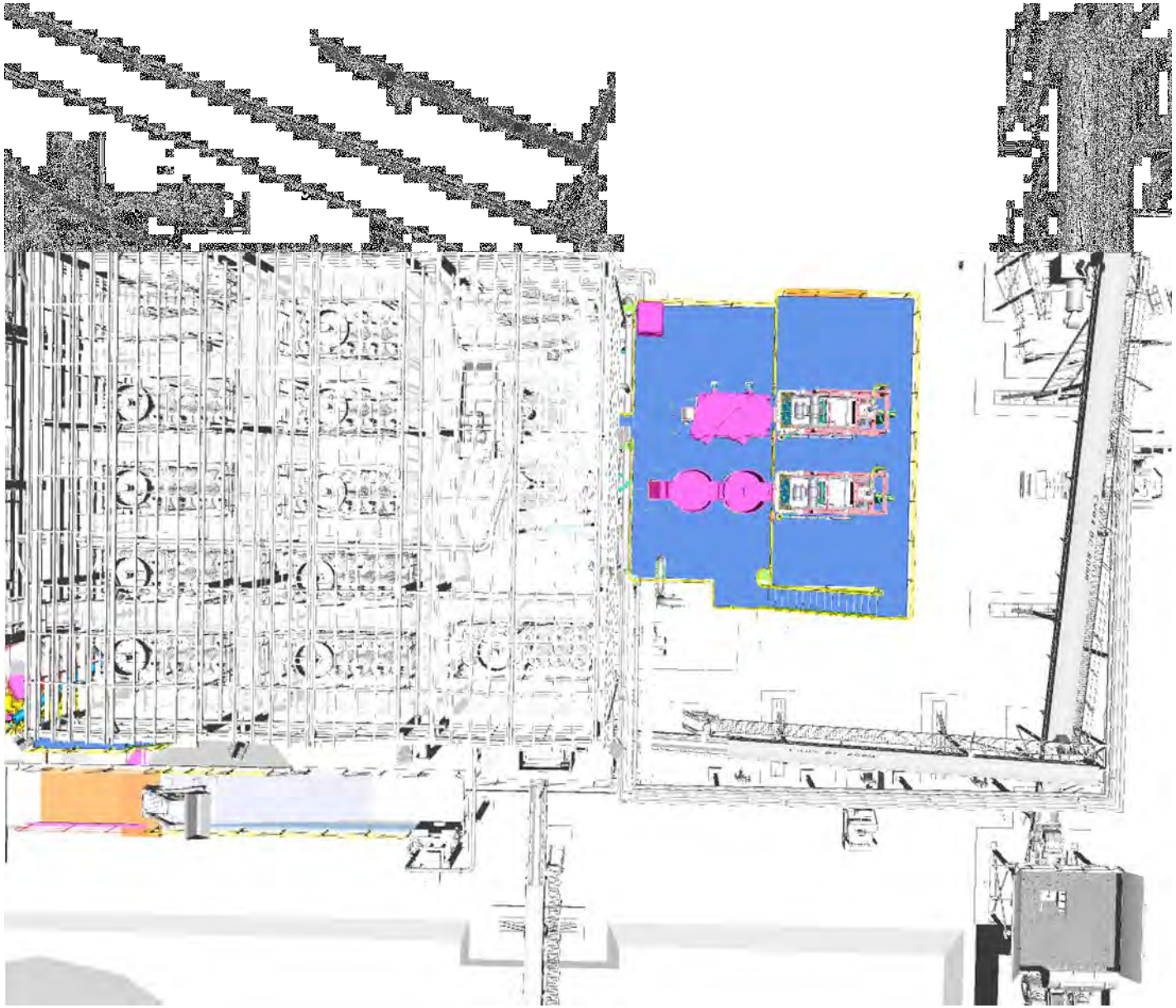


FIGURE A6 – ATTRITIONER UPGRADE – WCP

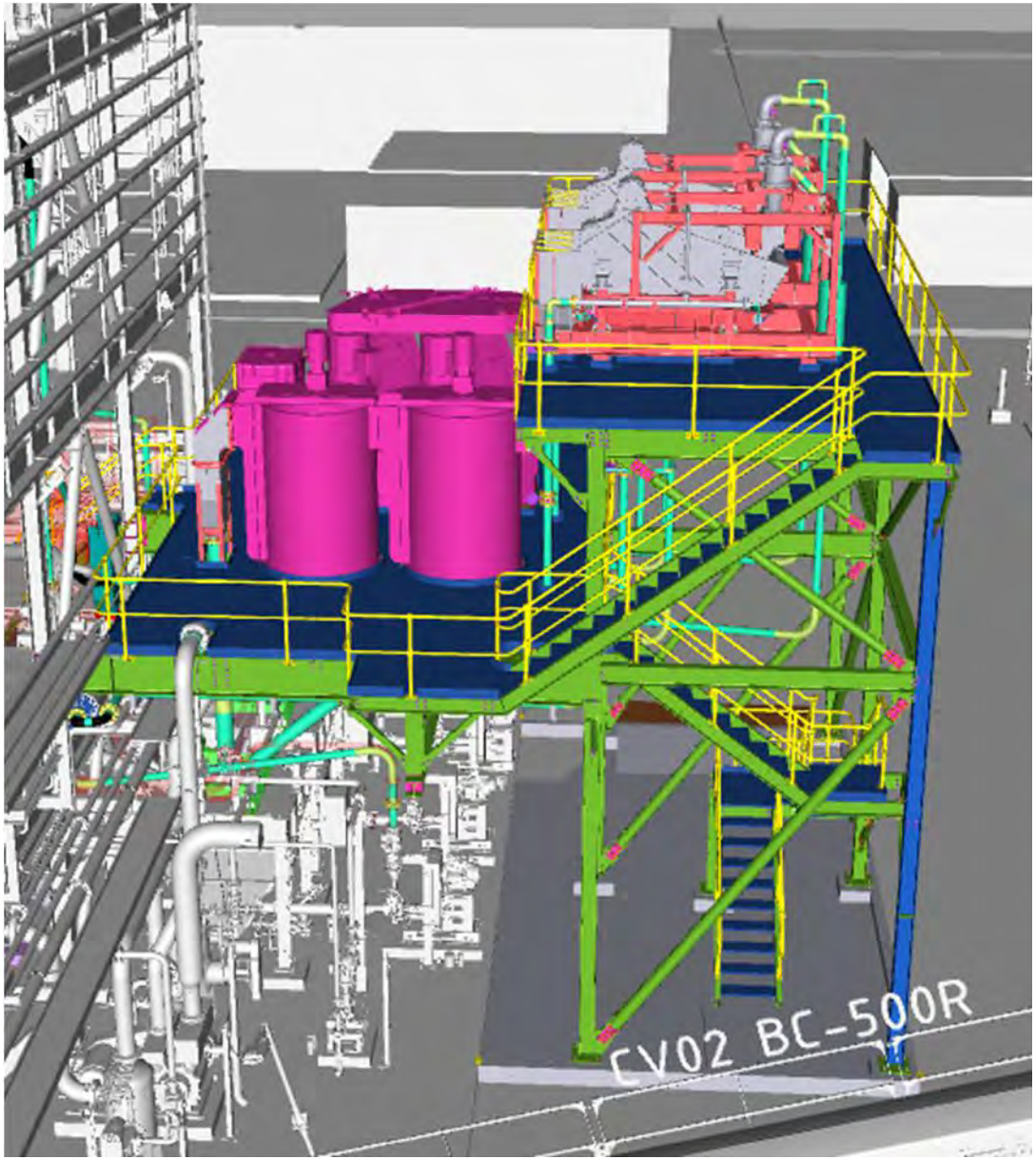
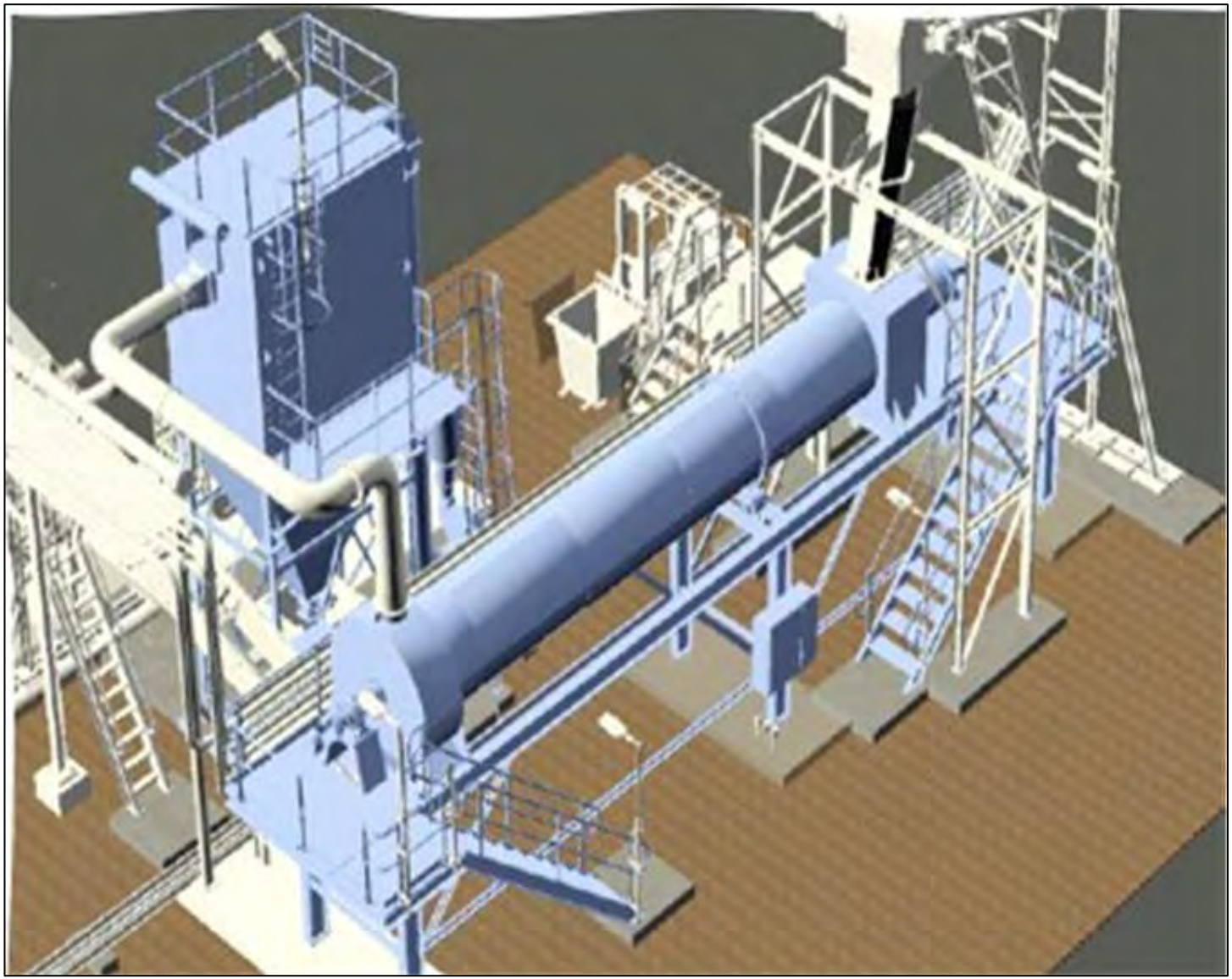
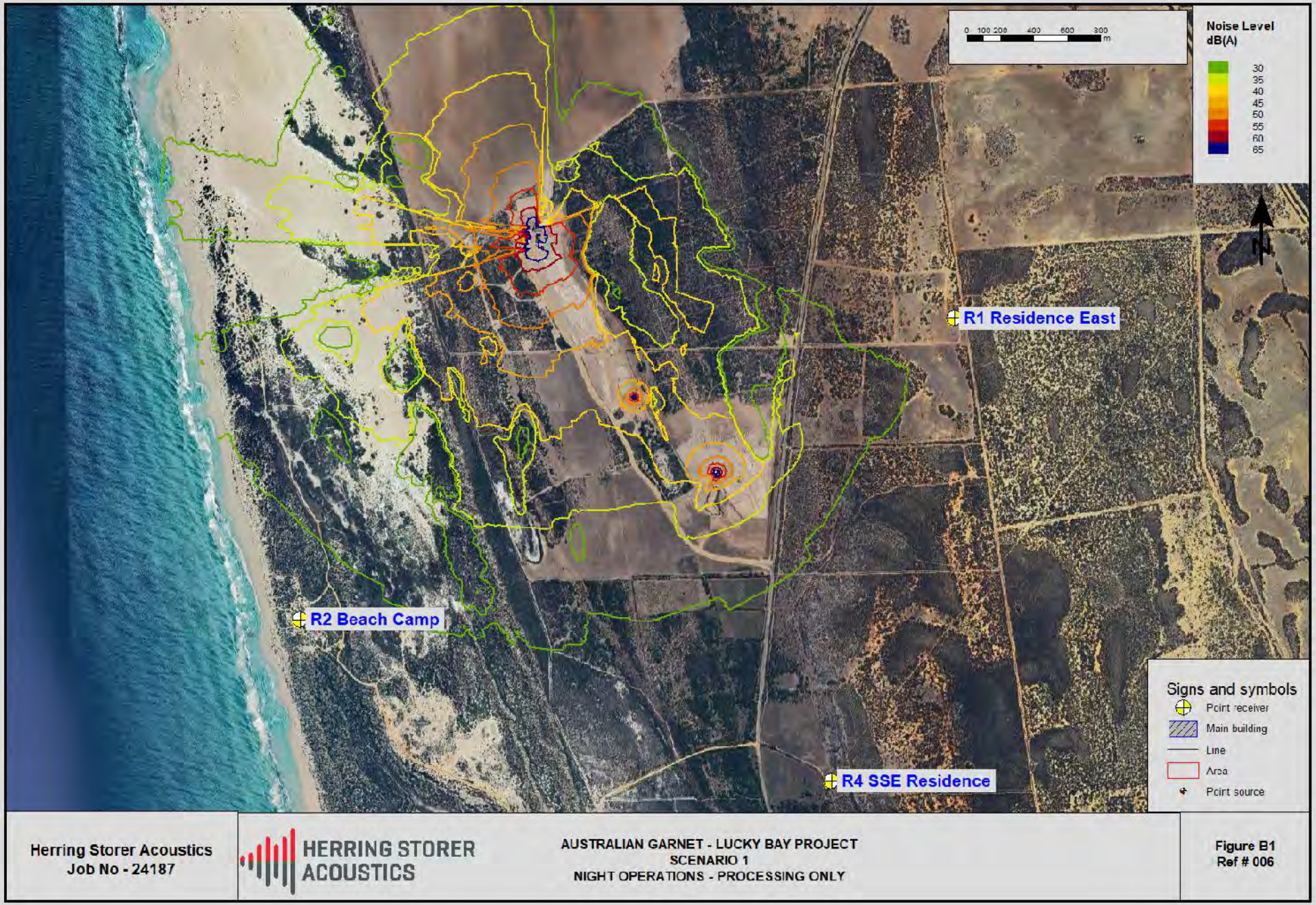


FIGURE A7 – BAGHOUSE AND DRYER UPGRADE - DSP



APPENDIX B



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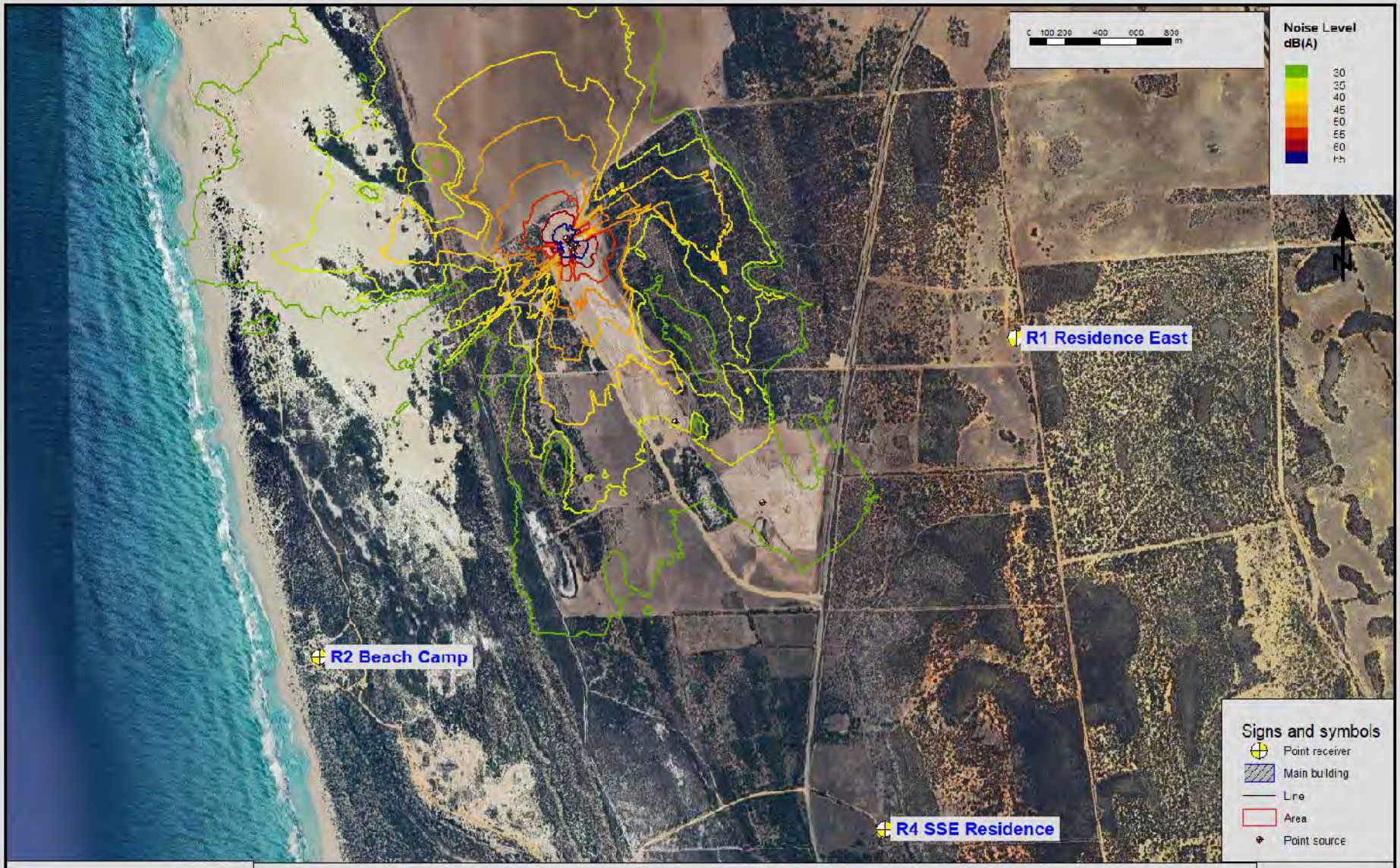
AUSTRALIAN GARNET - LUCKY BAY PROJECT
SCENARIO 1
NIGHT OPERATIONS - PROCESSING ONLY

Figure B1
Ref # 006



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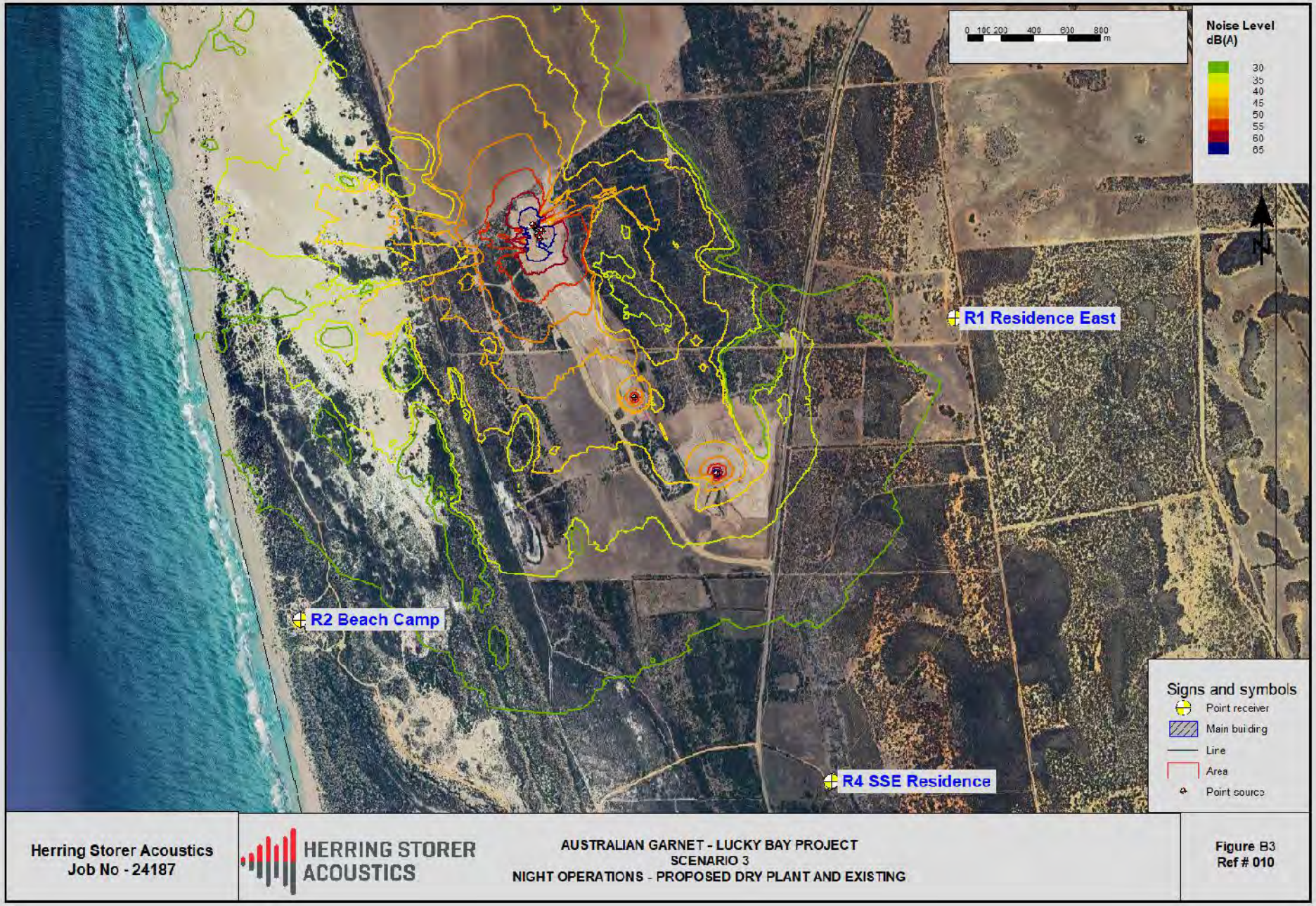
AUSTRALIAN GARNET - LUCKY BAY PROJECT
SCENARIO 2
NIGHT OPERATIONS - PROPOSED DRY PLANT ONLY

Figure B2
Ref # 009



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AUSTRALIAN GARNET - LUCKY BAY PROJECT
SCENARIO 3
NIGHT OPERATIONS - PROPOSED DRY PLANT AND EXISTING

Figure B3
Ref # 010