Assets | Engineering | Environment | Noise | Spatial | Waste

Rare Earths Processing Facility
Yilkari, Western Australia

Environmental Noise Impact Assessment

Prepared for Lynas Corporation Pty Ltd

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Executive Summary

Lynas Corporation Pty Ltd (Lynas) is proposing to develop a Rare Earths Processing Facility (REPF) at Lot 500 Great Eastern Highway, Yilkari WA (West of Kalgoorlie). This report summarises an environmental noise impact assessment for the proposed facility.

Aim

The aim of this study is to assess the noise impacts of the proposed REPF on surrounding noise sensitive receivers and determine noise control measures required to comply with the Environmental Protection (Noise) Regulations 1997.

Noise Model Results (no noise controls)

All noise modelling has been undertaken using worst-case operational[1] and night-time meteorological conditions in accordance with EPA's Guideline on Environmental Noise for Prescribed Premises.

Predicted received noise from the REPF complies with the night-time assigned levels for most of the sensitive receivers, including the more densely populated residential areas in the Town of Kalgoorlie Boulder (East of the facility).

The receivers that do not comply are shown in Table E 1. Noise mitigation is therefore required to reduce the received noise levels at non-compliant receivers to below the assigned level.

Table E 1 REPF Predicted Received LA10 level with no noise control

Receiver	LA10 Noise Levels		Exceedance (dB)
	Assigned (night-time)	Predicted	
R1	47	59.0	12.0
R2	49	62.4	13.4
R3	36	45.0	9.0
R4	35	42.2	7.2
R6	36	39.1	3.1
R8	37	37.4	0.4

Noise Control

Detailed analysis of the noise modelling outputs, and facility layout were used to identify opportunities for moving equipment to shielded locations, the development of low noise equipment specifications, inclusion of bunds and shielding, and engineering noise controls. The noise control measures which

[1] Worst case operational conditions is all equipment operating simultaneously.

will be implemented by the project are detailed in section 5, and can be broadly summarised as follows:

- The facility layout has been optimised to ensure pumps and drives, as far as possible, are shielded from the receivers located North and West of the facility.
- For equipment items which cannot be relocated, shielding will be applied to these items.
- Shielding walls will be applied to some top contributing noise sources.
- Equipment specifications using low noise specifications based on model outputs will be used to ensure that vendor equipment meets required noise levels.
- A 9m high bund will be located North of the plant (i.e. Gypsum Storage bund), and a 2m high colorbond fence placed on the plant facing edge of this bund.
- A 3m high bund will be located West of the plant (i.e. Iron Phosphate bund), and a 2m high colorbond fence placed on the plant facing edge of this bund.

During detailed design noise control specifications will be developed and, where possible, the requirements for shielding and walls will be optimised.

Outcomes (with noise controls)

With the noise control measures implemented, as shown in Table E 2, the REPF is predicted to comply with the assigned noise levels at all sensitive receivers.

Table E 2 REPF Predicted LA10 Received level with noise control

Receiver	LA10 Noise Levels		Exceedance (dB)
	Assigned (night-time)	Predicted	
R1	47	39.6	Nil
R2	49	43.7	Nil
R3	36	36.0	Nil
R4	35	33.7	Nil
R6	36	28.8	Nil
R8	37	27.7	Nil

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1 Introduction

Lynas Kalgoorlie Pty Ltd (Lynas) is proposing to develop a Rare Earths Processing Facility (REPF) at Lot 500 Great Eastern Highway, Yilkari WA, located West of Kalgoorlie. This report summarises the environmental noise impact assessment undertaken for the proposed facility.

1.1 Aim

The aim of this study is to assess the noise impacts of the proposed REPF on surrounding noise sensitive receivers and determine noise control measures required to comply with the Environmental Protection (Noise) Regulations 1997 (the Regulations).

1.2 Scope

The scope of this report includes an overview of the REPF model setup and model outcomes. It also includes an assessment of the projects noise impacts on surrounding sensitive receivers, and an evaluation of layout changes and noise control requirements for the plant to be compliant with the Regulations at the identified sensitive receivers.

1.3 Applicable Documents

[1] *Environmental Protection Act 1986*.
[2] Environmental Protection (Noise) Regulations 1997.
[3] Draft Guidance Note 8 Guideline on Environmental Noise for Prescribed Premises.

1.4 Project Overview

The REPF will be located approximately 2km West of the Kalgoorlie Industrial Area and approximately 6km West of Kalgoorlie Boulder Township (as shown in Figure 1-1). The locality is primarily surrounded by rural and industrial land, with sporadic caretaker and residential premises to the North, East and West of the facility.

The closest receivers are approximately 400-700m to the North of the facility, followed by receivers between 2 and 3km to the West and the more densely populated areas to the East which are between 3 and 6km from the facility.

The REPF will receive raw rare earth products from Lynas' existing Mt Weld operations, and using a series of treatment, separation and refining processes, will produce a carbonate which will be exported to Lynas Advanced Materials Plant (LAMP) in Malaysia. The major processes will include extraction, neutralisation, drying, carbonation, packaging and transportation.

Figure 1-2 presents a general layout, more detailed layouts and a process flow diagram are provided in Appendix C.

Figure 1-1 Location of proposed operations and receiver locations

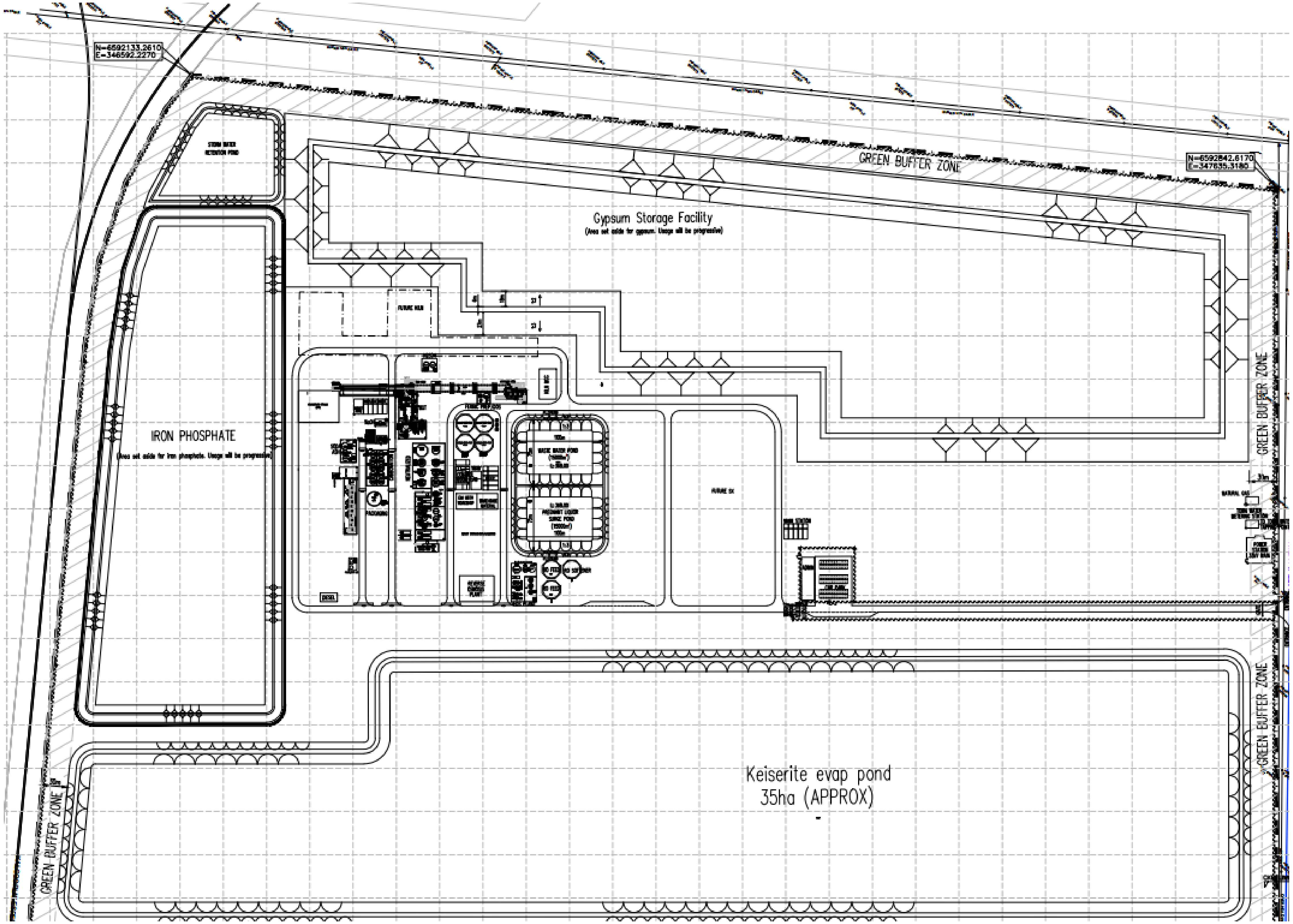

Figure 1-2 Facility Layout

2 Assessment Criteria

2.1 Environmental Protection (Noise) Regulations

Noise management in Western Australia is implemented through the Environmental Protection (Noise) Regulations 1997 (the Regulations), which operate under the Environmental Protection Act 1986.

The Regulations define maximum allowable noise levels which apply to noise received at noise sensitive premises, such as residential areas. These are determined by a combination of a base noise level plus an Influencing Factor (IF). The result is termed the "assigned level".

The assigned noise levels include L_{A1}, L_{A10} and L_{AMAX} noise parameters, defined as:

- L_{ASMAX} means an assigned level which is not to be exceeded at any time.
- L_{AS1} means an assigned level which is not to be exceeded for more than 1% of time.
- L_{AS10} means an assigned level which is not to be exceeded for more than 10% of time.

The L_{A10} noise level is most applicable noise emissions from the proposed REPF.

For noise sensitive premises, the time of day also affects the assigned noise levels. As the REPF will operate 24 hours a day, 7 days a week, noise emissions have been assessed against the most stringent night-time assigned levels (10pm-7am).

Based on the above, this noise assessment will assess the proposed REPF against the night-time L_{A10} assigned level.

2.2 Assigned Noise Levels

Table 2-1 presents the assigned noise levels defined in the Regulations.

Table 2-1 : Assigned Noise Levels as defined in the Environmental Protection (Noise) Regulations

Sensitive Receiver	Time of day	Assigned Levels (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise Sensitive Premises	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sundays and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
Boundary	all times	65	80	90

2.2.1 Influencing Factor

The Influencing Factor (IF) is based on the surrounding land use adjacent to each of the noise sensitive receivers, including the amount (%) of industrial and commercial premises as well as the number and proximity of major and secondary roads. Table 2-2 presents a summary of the IF which have been calculated for each receiver and used in this assessment.

Table 2-2 Calculated Influencing Factors

Receiver	Influencing Factor	Receiver	Influencing Factor
R1	**12**	R9	**4**
R2	**14**	R10	**4**
R3	**1**	R11	**4**
R4	**0**	R12	**1**
R5	**9**	R13	**3**
R6	**1**	R14	**2**
R7	**6**	R15	**6**
R8	**2**	R16	**0**

2.2.2 Adjustments for intrusive or dominant characteristics

Received noise levels are subject to adjustments if the noise exhibits intrusive or dominant characteristics i.e. if the noise is impulsive, tonal or modulating. These adjustments, shown in Table 2-3, are cumulative up to a maximum of 15 dB.

Section 9 of the Regulations sets out objective tests to assess whether the received noise is free of these characteristics.

Table 2-3 : Adjustments for intrusive or dominant characteristics (cumulative to maximum 15 dB)

Tonality	Modulation	Impulsiveness
+ 5dB	+5 dB	+10 dB

The area surrounding the REPF has Western Road, the Great Eastern Highway and Trans Australian Rail traffic, which contribute to the ambient noise field at the key receivers. Due to the presence of these other pre-existing sources in the background noise, and that the attenuated REPF tonal characteristics, as far as possible, will be engineered out of a number of noise sources (see Table 5-2), it is expected that tonality from the REPF will not be present at the receivers and as a result no tonal adjustment has been applied.

2.2.3 Non-Significant Contributor

The Regulations require that *"noise emitted from any premises when received at other premises must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind".*

A noise emission is taken to significantly contribute to a level of noise if the received noise exceeds a value which is **5 dB below the assigned level** at the point of reception.

The received noise at the sensitive receivers from industries to the East of the facility are expected to be below 30 dB(A) at night as a result a significant contributor penalty has not been applied.

2.3 Applicable Project Assessment Criteria

Table 2-4 presents the assigned LA10 noise levels, including influencing factors and adjustments, which have been used for this assessment.

Table 2-4 Applicable LA10 Assigned Noise Levels

Receiver	Base Assigned LA10 Noise Level	Influencing Factor (IF)	Assigned LA10 Noise Level (incl. IF)
R1	35	+12	**47**
R2	35	+14	**49**
R3	35	+1	**36**
R4	35	0	**35**
R5	35	+9	**44**
R6	35	+1	**36**
R7	35	+6	**41**
R8	35	+2	**37**
R9	35	+4	**39**
R10	35	+4	**39**
R11	35	+4	**39**
R12	35	+1	**36**
R13	35	+3	**38**
R14	35	+2	**37**
R15	35	+6	**41**
R16	35	0	**35**

3 Noise Modelling Overview

3.1 Noise Model Software

A desktop environmental noise model was created to simulate the proposed operations using the SoundPlan v8 software program. This software package calculates sound pressure levels at nominated receiver locations and produces noise contours over a defined area of interest. SoundPlan can be used to model different types of noises, such as industrial noise, traffic noise and aircraft noise.

The inputs required by the SoundPlan modelling software are noise sources, ground topographical and absorption data, meteorological data and sensitive receiver point locations. SoundPlan utilises ISO9613 for calculating the attenuation of sound during outside propagation in combination with CONCAWE[2,3].

The model has been used to predict received noise levels at noise sensitive receiver locations and to generate noise contour maps for the Yilkari and Kalgoorlie area.

3.2 Noise Model Inputs

3.2.1 Noise Sensitive Receivers

Table 3-1 and Figure 1-1 provide details of the locations of noise sensitive receivers used in this assessment.

Table 3-1 Noise Sensitive Receivers

Reference	GPS Location (UTM MGA94, Zone51)	
	Northings	Eastings
R1	347245	6592737
R2	346886	6592502
R3	345151	6591473
R4	344787	6591178
R5	351047	6593385
R6	348949	6594301
R7	349129	6594146
R8	349253	6594398

2 CONCAWE (Conservation of Clean Air and Water in Europe) was established in 1963 by a group of oil companies to carry out research on environmental issues relevant to the oil industry.

3 The propagation of noise from petroleum and petrochemical complexes to neighbouring communities, CONCAWE Report 4/81, 1981.

Reference	GPS Location (UTM MGA94, Zone51)	
	Northings	Eastings
R9	350033	6594421
R10	350079	6594445
R11	350260	6594389
R12	350297	6594337
R13	350226	6594550
R14	350316	6594465
R15	350413	6594357
R16	351690	6594330

3.2.2 Topography and Ground Absorption

Topographical information for the noise model was provided by Lynas, which is imported into the noise model to create a Digital Ground Map (DGM).

The acoustic properties of the ground surface influence the propagation of noise. Flat non-porous surfaces such as concrete, asphalt and water are more reflective whereas soft, porous surfaces such as foliage and grass are more absorptive.

A CONCAWE ground factor of G=0.8 was applied to the model. CONCAWE is a conservative algorithm and is accepted by the Department of Water and Environment Regulation (DWER).

The base case noise model does not include any bunds or berms such as the feed and waste stockpiles to the North and West of the facility.

3.2.3 Meteorological Conditions

The SoundPlan noise model has a range of different algorithms that it can use to calculate noise levels for user defined meteorological conditions. The CONCAWE algorithm has been used for this assessment, which is consistent with previous assessments.

Table 3-2 presents the worst case meteorological conditions applied to the model, which are defined in the Department of Water and Environment Regulation (DWER) “Draft Guideline on Environmental Noise for Prescribed Premises”.

Table 3-2 : Worst-Case Meteorological Conditions for Noise Propagation

Time of day	Temperature	Relative Humidity	Wind Speed	Wind Direction	Pasquil Stability Category (PSC)
Night (19:00 - 07:00)	15° Celsius	50%	3 m/s	worst case	F

Night-time meteorological conditions include the refraction effects of sound waves during propagation in the parts of the atmosphere close to the ground. Worst case conditions occur during night-time when downward refraction bends the sound waves towards the ground, increasing the noise levels at the receiver. Night-time conditions were applied to the model as this represents the worst case conditions.

3.2.4 Noise Sources

Noise source Sound Power Levels (SWLs) were determined using a mechanical equipment list, layout drawings and engineering data supplied by Lynas. The noise source levels applied to each equipment item were calculated using a combination of the equipment specifications, engineering data, acoustic literature, and equivalent equipment measured from other Lynas facilities.

Table 3-3 presents a high-level summary of the total SWL for each major area. Detailed SWL data for each piece of equipment modelled, including octave band levels, can be found in Appendix B.

Table 3-3 Area Noise Source Levels

Process Area No.	Description	Total Sound Power Level in dB(A)
31	Air	110.1
61	NaOH Dosing	99.9
62	H2SO4	104.1
64	MGO Preparation	108.6
65	Lime Slurry Preparation	114.7
66	Soda Ash Preparation	104.6
69	FESO4 Preparation & Dosing	96.2
71	Process Water	107.7
72	Cooling Tower	108.5
73	Domestic / Potable Water	107.3
75	Heat Recovery	106.7
78	HDS	113.3
79	RO Pre-treatment	110.4
210	Concentrate Handling	108.5
220	Concentrate Cracking	109.3
230	Primary Leaching	112.3
240	Neutralisation	112.2
250	Secondary Filtration, Polishing Filtration	112.1
260	Carbonation	115.3
290	WTG/WESP	114.3

3.3 Noise Model Configuration

The equipment noise sources and structures (e.g. tanks and buildings) were positioned in the noise model using layout drawings and elevation drawings provided by Lynas, as shown in Figure 3-1.

The noise sensitive receivers were also placed in the model, at locations defined in Table 3-1. The base case noise model assumes no bunds.

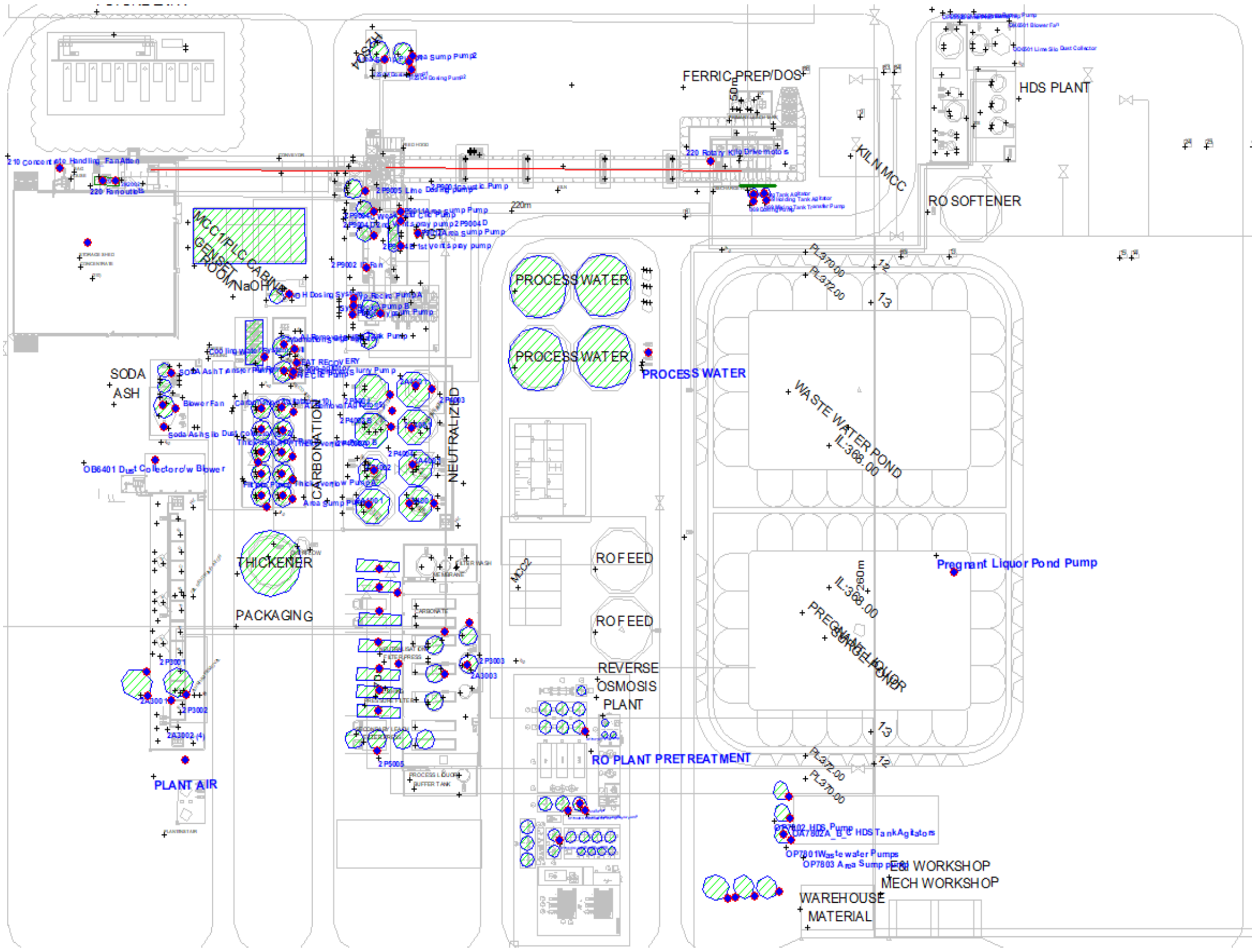

Figure 3-1 Layout of Modelled Noise Sources

4 Noise Model Results (No Noise Controls)

The following section presents the noise model results, with no noise control, including an assessment against the Regulations.

4.1 Model Results

Table 4-1 presents the worst case predicted noise levels and assessment against the Regulations. Figure 4-1 and Figure 4-2 show noise contour maps for the results.

As can be seen from the table, the received noise from the REPF complies with the night-time assigned levels at most sensitive receivers, including the more densely populated residential areas in the Town of Kalgoorlie Boulder (East of the REPF).

Six receivers R1, R2, R3, R4, R6 and R8 exceed the assigned night-time levels at receivers, with the most significant exceedances occurring at R1 (12.0 dB) and R2 (13.4 dB). As a result, noise mitigation is required to reduce received noise levels at non-compliant receivers to below the assigned level (see section 5).

Table 4-1 Noise Model Results- No Noise Controls

Receiver	LA10 Noise Levels		Exceedance (dB)
	Assigned (night-time)	Predicted	
R1	47	59.0	12.0
R2	49	62.4	13.4
R3	36	45.0	9.0
R4	35	42.2	7.2
R5	44	32.7	Nil
R6	36	39.6	3.6
R7	41	39.3	Nil
R8	37	37.7	0.7
R9	39	34.7	Nil
R10	39	33.8	Nil
R11	39	33.9	Nil
R12	36	33.5	Nil
R13	38	34.4	Nil
R14	37	33.4	Nil
R15	41	33.3	Nil
R16	35	28.8	Nil

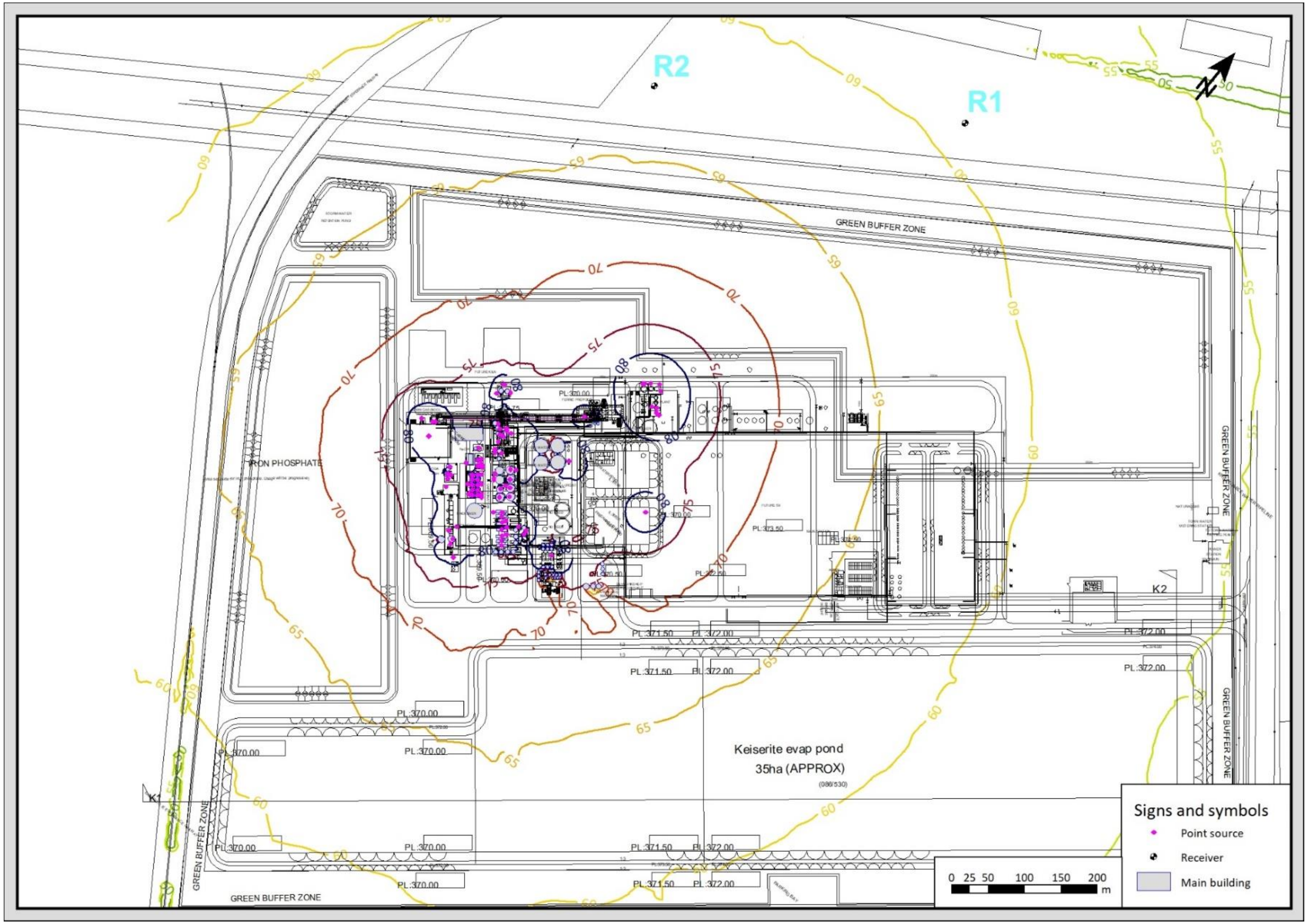

Figure 4-1 Noise Contour Map of the REPF with no noise control

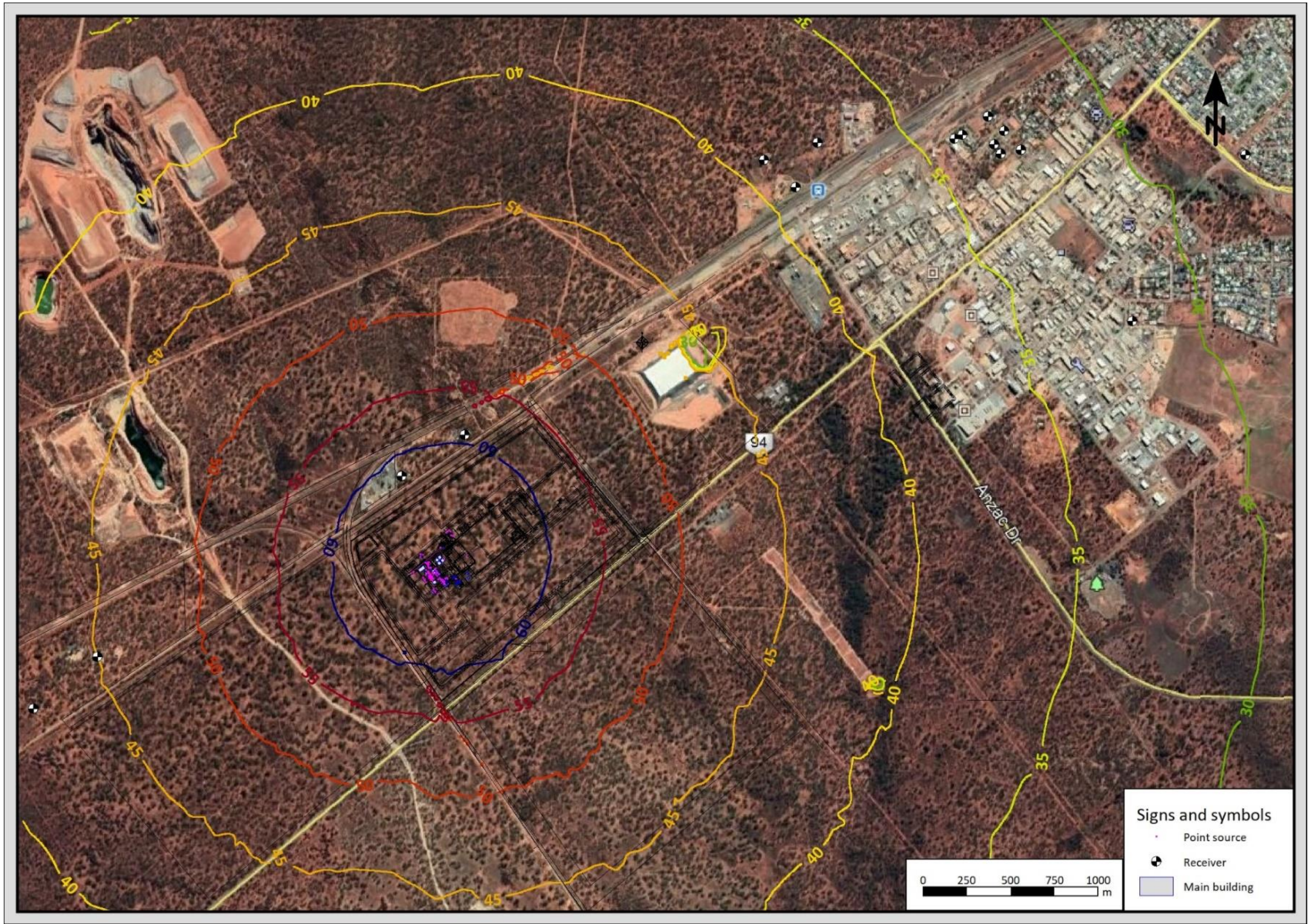

Figure 4-2 Noise Contour Map of the wider area (no noise control)

5 Noise Control and Updated Modelling Results

Noise modelling results show that noise mitigation is required to achieve the assigned levels at various receivers. The noise control methodology followed in this report uses an integrated approach, taking the following factors into account:

- Equipment noise source contribution rankings.
- Assigned noise levels.
- Investigation, selection and prioritisation of noise controls.

5.1 Noise Control Approach

Effective noise control starts with determining which noise sources are contributing significantly to the noise level at a receiver. To effectively reduce received noise levels, it is necessary to first address the most significant contributing noise sources before addressing the less significant noise sources. This is key, because without addressing the top contributors, the overall noise level will not be significantly reduced. As a result, the top contributing noise sources at each of the exceeding receivers was investigated and noise control was targeted around these noise sources. In addition to targeting the top contributors, equipment noise specifications were also considered. The advantage of including this as part of the noise control approach is that by ensuring that low noise equipment is purchased and installed results in a large number of small reductions of noise source contributions which will also result in a reduction at the receivers.

To achieve compliance therefore requires a multi-faceted noise control approach. A number of potential noise control options have been investigated to determine which controls are effective and reasonably practicable. These options included low noise equipment noise specifications, engineering noise control measures, layout changes, management measures and operational/administrative measures.

5.2 Top Contributing Equipment Items

The top 10 noise contributing equipment sources at receiver R1, R2, R4 and R6 is given in Table 5-1. The items listed in the table formed the basis of the most significant layout changes and noise controls.

Table 5-1 Top Contributing Sources

R2/R1		R4		R6	
Equipment	Received Level dB(A)	Equipment	Received Level dB(A)	Item Name	Received Level dB(A)
OP6501 Lime Prep Pump	50.7	Air	29.9	Domestic/Potable Water	29.4
OP6502A Lime Prep Pump	50.6	MGO Prep OB6401 Dust Collector c/w Blower	29.2	WGT/WESP 2K9002 - ID Fan	27.1
OP6502B Lime Prep Pump	50.6	RO Pre-treatment	29.2	RO Pre-treatment	26.6
OP7803 Area Sump Pumps	49.8	Primary Leaching Pumps 2P3002	28.3	OP7801 Waste Water Pumps	26.1
WGT/WESP 2K9002 - ID Fan	48.6	WGT/WESP 2K9002 - ID Fan	27.8	OP7803 Area Sump Pumps	26.1

R2/R1		R4		R6	
Process Water	47.2	Dilution Air Fan	27.5	OP6501 Lime Prep Pump	25.8
RO Pretreatment	47.0	OP7801 Waste Water Pumps	27.4	OP6502A Lime Prep Pump	25.7
Concentrate Cracking Dilution Air Fan	44.6	OP7803 Area Sump Pumps	27.3	Air	25.7
Rotary Kiln	44.5	OP6502A Lime Prep Pump	27.2	Process Water	25.5
Combustion Air Fan	44.3	Neutralization Surge Pump 2P4002	27.0	Agitator 2A5003	25.1

5.3 Noise Control Requirements

The noise control package which will be implemented will consist of a combination of low noise specifications, engineering changes, layout changes (see Figure 5-1 and Appendix C), implementation of bunds (Figure 5-2) and operational/administrative changes aimed at reducing the received noise levels to achieve the assigned levels. The controls being implemented are listed in Table 5-2.

During detailed design noise control specifications will be developed and, where possible, the requirements for shielding and walls will be optimised.

Table 5-2 Noise Control Requirements

Equipment	Noise Control
Pumps	All pumps, as far as possible, will be relocated to the South Eastern side of tanks
	All pumps which cannot be relocated will receive shielding or be specified to have a Sound Power Level (SWL) of ≤ 98 dBA. All pump specifications to include a requirement that their noise emissions will not contain tonal characteristics as defined in Regulation 9 sub regulation (1) of the Noise Regulations [2], or if it is not reasonably practicable to remove tonality, then the SWL must be 5 dB less than specified.
Electric drive motors	All electric drive motors which cannot be relocated will have cowlings or close-fitting acoustic enclosures.
Agitators	Large agitator motors will be specified to have a SWL ≤ 98dB(A) Small agitator motors will be specified to have a SWL ≤ 92dB(A) All agitator specifications to include a requirement that their emissions will not contain tonal characteristics as defined in Regulation 9 sub regulation (1) of the Noise Regulations [2], or if it is not reasonably practicable to remove tonality, then the SWL must be 5 dB less than specified.
Cooling Tower	Pumps will be relocated to the Eastern side of the structure. Cooling Tower fans will be specified to have a SWL of ≤ 100 dB(A) per fan.

Equipment	Noise Control
	Cooling tower specifications to include a requirement that their emissions will not contain tonal characteristics as defined in Regulation 9 sub regulation (1) of the Noise Regulations [2], or if it is not reasonably practicable to remove tonality, then the SWL must be 5 dB less than specified.
Combustion Air Fan	Shielding
Dilution Air Fan	Shielding
WTG/WESP ID Fan	Shielding
Rotary kiln drives	Shielding
Concentrate handling fan	Shielding
Filter Building	Three sided enclosure will be applied to the North, East, West and Roof.
Air	Relocated to inside a building and ensure that the building maintains its acoustic integrity during design and construction.
HDS/Lime Preparation	Relocated to the Southern end of the facility.
Bunds	A 9m high bund will be located North of the plant (Gypsum Storage bund) as shown in Figure 5-2, plus a 2m high colorbond fence located at the plant facing edge of the bund. A 3m high bund located West of the plant (Iron Phosphate bund) as shown in Figure 5-2), plus a 2m high colorbond fence located at the plant facing edge of the bund. A bund will be built underneath the kiln up to the base of the kiln (9.8m at the West end and 7.7m at the East end of the kiln). All bunds listed above which have been used in the noise control modelling will be built to the height specified in this table prior to the commencement of commissioning.

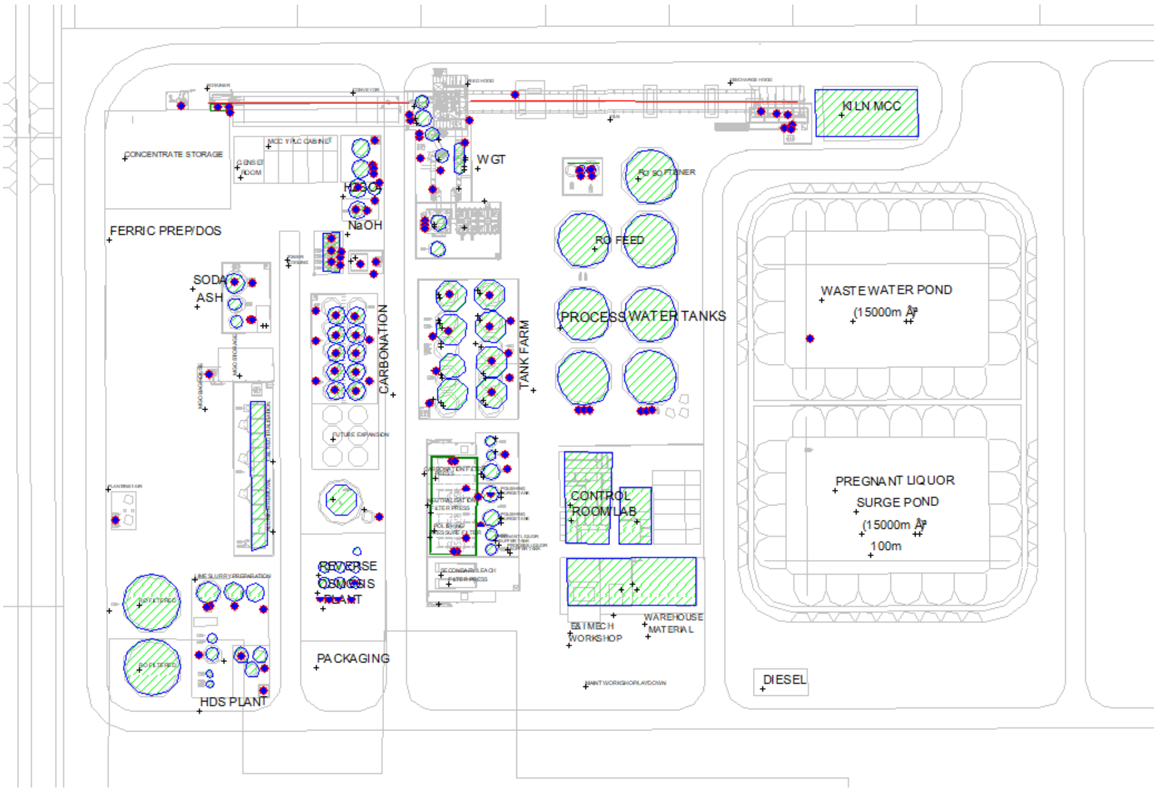

Figure 5-1 Layout of Modelled Noise Sources (after noise control)

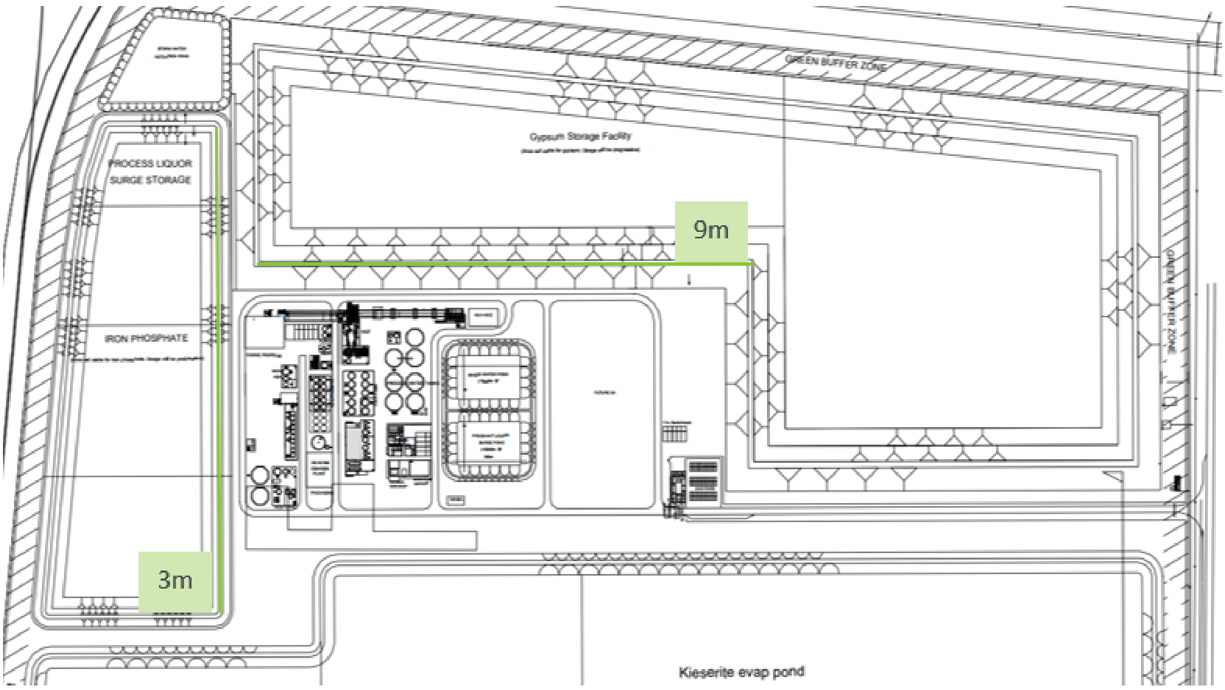

Figure 5-2 Berms to be located North (9m high) and West (3m high) of the facility

5.4 Noise Control Outcomes

Table 5-3 presents the resultant received noise levels with the noise controls implemented. As can be seen from the results, the REPF is compliant with the assigned noise levels at all sensitive receivers.

Noise contour maps for the post noise control results are presented in Figure 5-3 and Figure 5-4.

Table 5-3 Predicted Received Noise Levels AFTER Noise Control Implementation

Receiver	Before Noise Control		Exceedance (dB)
	Assigned	Predicted	
R1	46	39.6	Nil
R2	49	43.7	Nil
R3	36	36.0	Nil
R4	35	33.7	Nil
R6	36	28.8	Nil
R8	37	27.7	Nil

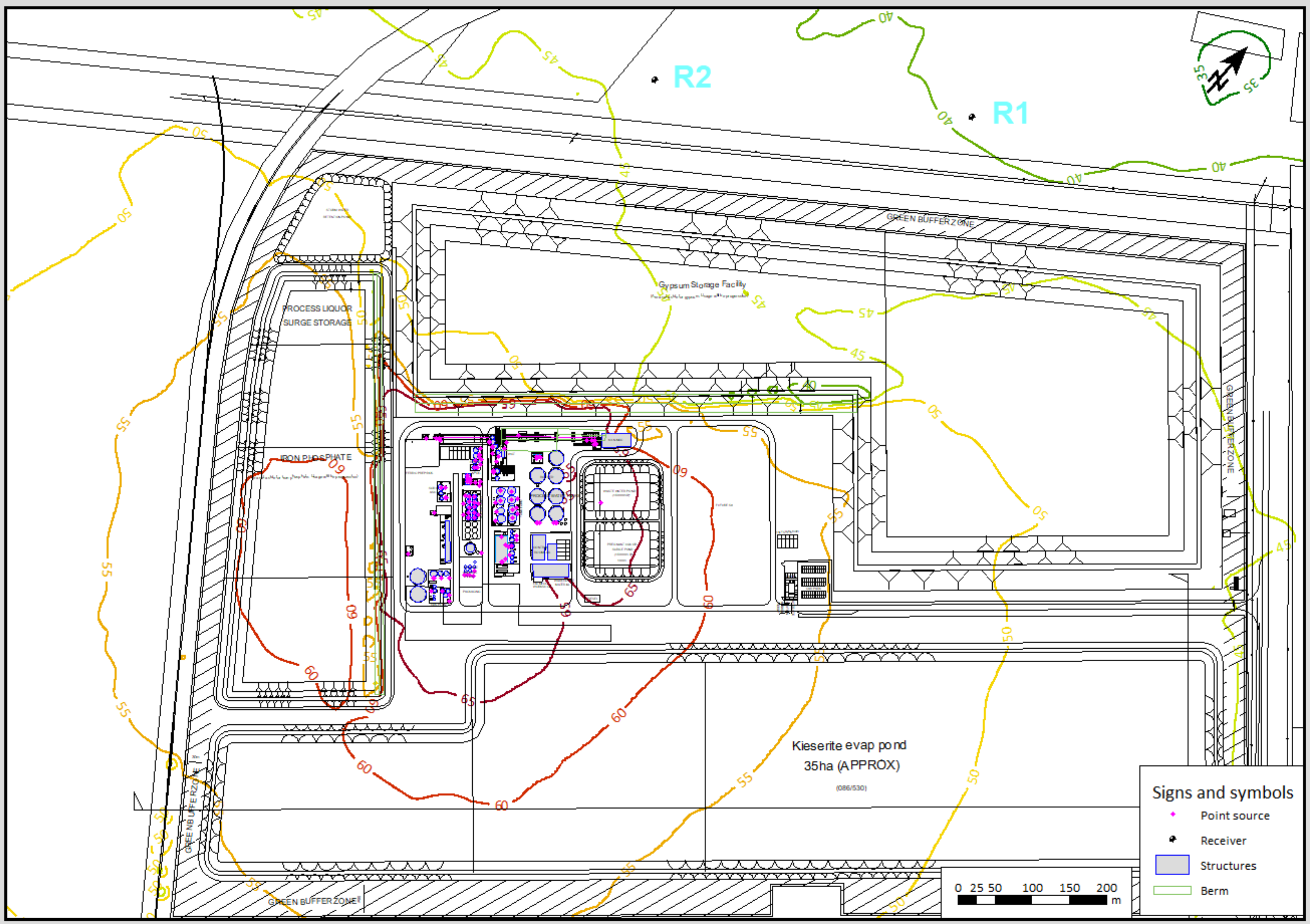

Figure 5-3 Noise Contour Map of the REPF (after noise control)

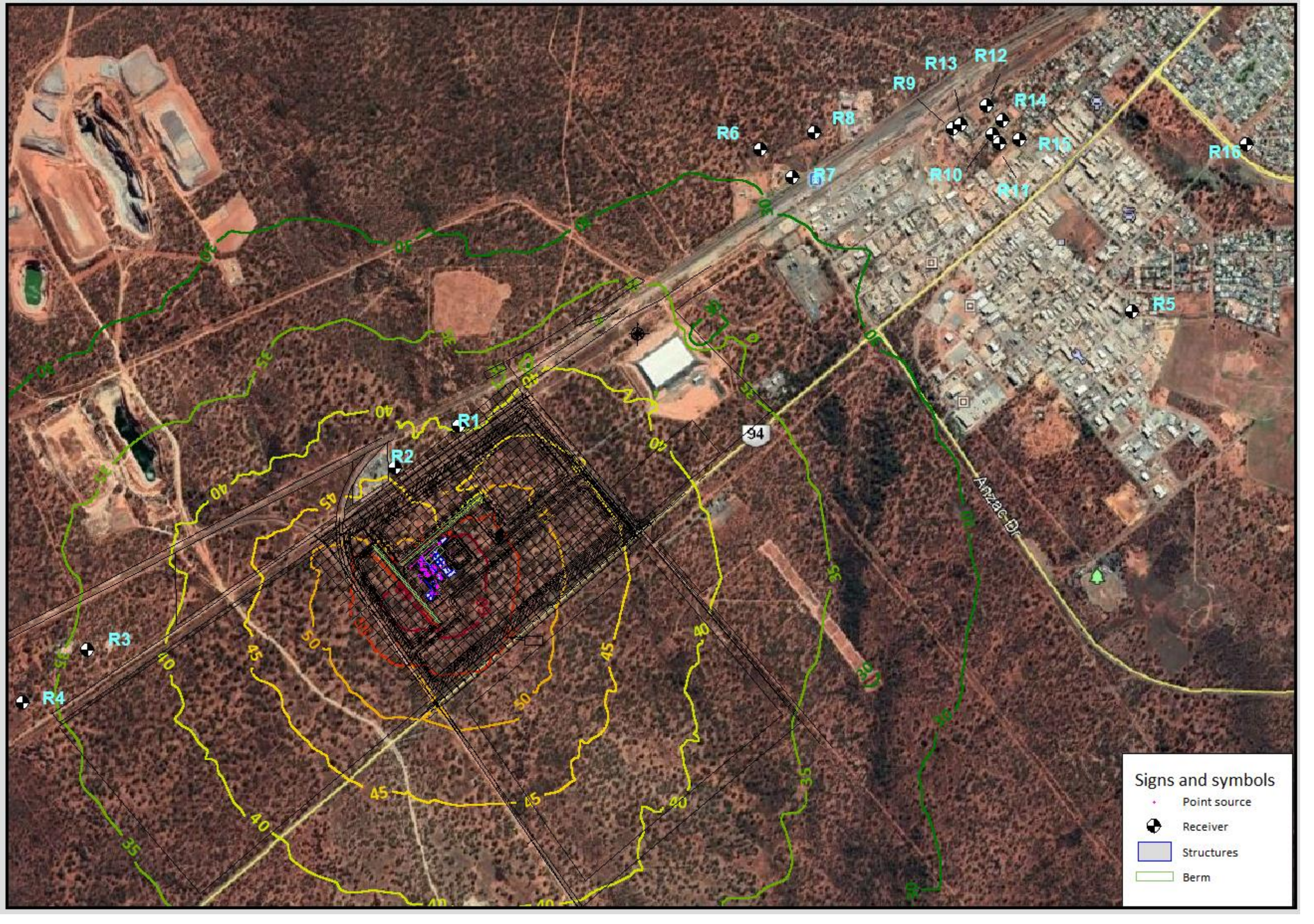

Figure 5-4 Noise Contour Map of the wider area (after noise control)

6 Conclusions

With the noise control measures outlined in section 5 implemented, the REPF is predicted to comply with the assigned noise levels at all sensitive receivers.

Appendix A Noise Legislation

Noise management in Western Australia is implemented through the Environmental Protection (Noise) Regulations 1997 (the Regulations), which operate under the Environmental Protection Act 1986. The Regulations specify maximum noise levels (assigned noise levels) which are the highest noise levels that can be received at noise-sensitive (residential), commercial and industrial premises.

Assigned noise levels are defined differently for noise sensitive premises, commercial premises, and industrial premises. For noise sensitive premises, an Influencing Factor (IF) is included in the assigned noise levels. The IF depends on the presence of major/minor roads and commercial/industrial land use zonings within circles of 100 metres and 450 metres radius from the noise receiver.

For noise sensitive residences, the time of day also affects the assigned levels. The regulations define three types of assigned noise level:

- L_{ASMAX} means an assigned level that is not to be exceeded at any time;
- L_{AS1} means an assigned level that is not to be exceeded for more than 1% of time;
- L_{AS10} means an assigned level that is not to be exceeded for more than 10% of time.

Table A1 : Assigned Noise Levels for Noise Sensitive Receivers

Type of premises receiving noise	Time of day	Assigned Levels (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
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
Industrial and utility premises in the Kwinana Industrial Area	All hours	75	85	90

Environmental Protection (Noise) Regulations 1997

Appendix B Equipment Noise Source Levels (SWLs)

Table B 1 - Modelled Equipment, Sound Power Levels (SWLs)

Area	Item	dBA									
31	Air .	**110.1**	66.3	79.4	90.5	98.2	103.8	105.3	103.6	98.5	91.3
61	NaOH Dosing System .	**99.9**	55.7	68.8	79.9	87.6	93.3	95.2	93.6	88.7	81.9
62	Area Sump Pump . 0P6002.	**96.5**	52.7	65.7	76.9	84.6	90.2	91.8	90	84.9	77.7
62	Area Sump Pump . 0P6003.	**92.3**	48.5	61.5	72.7	80.4	86	87.6	85.8	80.7	73.5
62	H_2SO_4 Dosing Pump . 0P6201 A.	**99.8**	56	69	80.2	87.9	93.5	95.1	93.3	88.2	81
62	H_2SO_4 Dosing Pump . 0P6201 B.	**99.8**	56	69	80.2	87.9	93.5	95.1	93.3	88.2	81
64	Dust Collector c/w Blower . 0B6401.	**108.6**	64.7	77.8	89	96.6	102.3	103.9	102.2	97.1	89.9
65	Lime Silo Dust Collector . 0D6501.	**108.6**	64.7	77.8	89	96.6	102.3	103.9	102.2	97.1	89.9
65	Lime Preparation Pump . 0P6501.	**108.6**	64.7	77.8	89	96.6	102.3	103.9	102.2	97.1	89.9
65	Lime Preparation Pump . 0P6502A.	**108.6**	64.7	77.8	89	96.6	102.3	103.9	102.2	97.1	89.9
65	Lime Slurry Pump . 0P6502B.	**108.6**	64.7	77.8	89	96.6	102.3	103.9	102.2	97.1	89.9
66	Blower Fan . 0K6605.	**101.5**	57.7	70.7	81.9	89.6	95.2	96.8	95.1	90	82.8
66	Soda Ash Preparation Tank Agitator . 0A6601.	**94.1**	49.7	62.7	73.9	81.6	87.4	89.4	87.8	83	76.2
66	Soda Ash Silo Dust Collector (SX2) . 0D6606.	**88.3**	43	56.1	67.2	75.2	81	83.7	82.2	77.7	71.2
66	Soda Ash Transfer Pump . 0P6601.	**99.4**	55.5	68.6	79.8	87.4	93.1	94.7	93	87.9	80.8
69	Mixing Tank Agitator . 0A6901.	**90.1**	45	58.1	69.2	77.1	82.8	85.5	83.9	79.3	72.7
69	Holding Tank Agitator . 0A6902.	**90.1**	45	58.1	69.2	77.1	82.8	85.5	83.9	79.3	72.7
69	Mixing Tank Transfer Pump . 0P6901.	**90.1**	45	58.1	69.2	77.1	82.8	85.5	83.9	79.3	72.7

69	Dosing Pump . 0P6902.	**90.1**	45	58.1	69.2	77.1	82.8	85.5	83.9	79.3	72.7
71	Process Water . .	**107.7**	63.8	76.9	88.1	95.7	101.4	102.9	101.2	96.1	88.9
72	Cooling Water pumps . .	**108.5**	64.6	77.7	88.8	96.5	102.2	103.7	102	97	89.9
73	Domestic/Potable Water . .	**107.3**	63.7	76.7	87.9	95.6	101.2	102.8	101.1	96	88.8
75	Heat Recovery . .	**106.7**	62.9	76	87.1	94.8	100.4	101.9	100.2	95	87.8
78	HDS Tank Agitator . 0A7802A /2B /2C /2D.	**103.9**	59.5	72.6	83.7	91.5	97.2	99.2	97.6	92.7	86
78	Waste Water Pump . 0P7801A / 1B 0P8201.	**108.8**	65.2	78.2	89.4	97.1	102.7	104	102.2	97	89.7
78	HDS Pump . 0P7802.	**105.7**	62.2	75.2	86.4	94	99.6	100.9	99.2	94	86.6
78	Area Sump Pump . 0P7803.	**108.8**	65.1	78.1	89.3	97	102.6	104	102.3	97.1	89.9
79	RO Pre-treatment . .	**110.4**	66.6	79.6	90.8	98.5	104.1	105.6	103.9	98.8	91.6
210	Blower Fan + Mild Steel Ducting Motor . 2DK1001.	**103.1**	84.3	89.3	96.3	99.5	95.8	91	77.2	85.5	86.3
210	Concentrate Handling _ all except fan ou . .	**107**	64.1	77.1	88.3	95.8	101.4	102.1	100.2	94.5	86.4
210	Conveyor 1 . .	**65**	40.8	51.7	65.7	71.9	78.6	79.6	77.4	69.9	61.5
220	Combustion Air Fan . 2K2001.	**104.2**	83.8	88.8	92.4	102.5	95.3	90.5	76.7	85.1	85.8
220	Conveyor 2 . .	**65**	42.7	53.6	67.6	73.8	80.5	81.5	79.3	71.8	63.4
220	Dilution Air Fan . 2K2002.	**105.1**	84.8	89.8	93.3	103.5	96.3	91.5	77.7	86	86.8
220	Rotary Kiln. 2RK2001.	**104.1**	56.6	71.1	82.3	89.7	94.9	98	98.9	95.9	89.4
230	Attrition Agitator (Duplex 2205) . 2A3001.	**99.8**	57.1	70	81.2	88.7	94.3	94.8	92.9	87.1	78.7
230	Primary Leaching Agitator . 2A3002 - C1/C2A/C3/C/4.	**105.8**	63.1	76.1	87.2	94.8	100.3	100.9	98.9	93.1	84.7
230	Primary Leaching Surge Tank Agitator . 2A3003.	**96.8**	54	67	78.2	85.7	91.3	91.8	89.9	84.1	75.7
230	Heat Exchanger Circulation Pump . 2P3001.	**104.5**	60.7	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
230	Primary Leaching Pump (Warner pump 6/4) . 2P3002.	**108.4**	65	78	89.2	96.8	102.4	103.6	101.8	96.4	88.9

230	Neutralisation Pump (Warner pump 6/4) . 2P3003.	**102.1**	59.3	72.3	83.5	91	96.6	97.1	95.2	89.4	81
240	Neutralization Surge Agitator . 2A4002.	**101.3**	58.6	71.5	82.7	90.2	95.8	96.3	94.4	88.6	80.2
240	Neutralize Slurry Pump (Warner 6/4) . 2P4001.	**104.5**	60.7	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
240	Neutralization Surge Pump (Warner pump 6/4) . 2P4002 A / B.	**106.8**	64	77	88.2	95.7	101.3	101.8	99.9	94.1	85.7
240	Neutralization Surge Pump (Warner pump 6/4) . 2P4002 A / B.	**106.8**	64	77	88.2	95.7	101.3	101.8	99.9	94.1	85.7
240	Heat Exchanger Circulation Pump (Warner 6/4) . 2P4003.	**104.5**	60.7	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
240	Area Sump Pump . 2P4004.	**90.1**	45	58.1	69.2	77.1	82.8	85.5	83.9	79.3	72.7
250	Reslurry Tank Tank Agitator . 2A5001 A/B.	**98**	55.3	68.3	79.4	87	92.5	93.1	91.1	85.3	76.9
250	Reslurry Tank Tank Agitator . 2A5001 A/B.	**98**	55.3	68.3	79.4	87	92.5	93.1	91.1	85.3	76.9
250	Tertiary Leach Tank Agitator . 2A5003.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
250	Neutralisation Filter Press . 2F5001A.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
250	Neutralisation Filter Press. 2F5001B.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
250	Tertiary Filter Press. 2F5002A.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
250	Tertiary Filter Press. 2F5002B.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
250	Reslurry Tank Tank Agitator . 2A5001 A/B.	**104.5**	60.7	73.7	84.9	92.6	98.2	99.8	98.1	93	85.8
250	Reslurry Tank Tank Agitator . 2A5001 A/B.	**104.5**	60.7	73.7	84.9	92.6	98.2	99.8	98.1	93	85.8
250	Polishing Surge Pump (Warner pump 6/4) . 2P5002.	**104.5**	60.7	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
250	Process Liquor Pump (8/6 Warner Pump) . 2P5005.	**105.1**	61.4	74.4	85.6	93.2	98.9	100.3	98.6	93.4	86.1
250	250-Remaining . .	**102.1**	58.7	71.7	82.9	90.5	96.1	97.2	95.5	90.1	82.6
260	Al Removal Slurry Pump (Warner 6/4) .	**104.5**	60.7	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
260	Al Removal Surge Agitator .	**96.8**	54	67	78.2	85.7	91.3	91.8	89.9	84.1	75.7
260	Al Removal Surge Tank Pump (Warner pum . .	**106.8**	64	77	88.2	95.7	101.3	101.8	99.9	94.1	85.7

260	Al Removal Agitator (5) . .	**102.4**	59.7	72.7	83.8	91.4	96.9	97.5	95.5	89.7	81.3
260	Area Sump Pump . .	**86.4**	43.7	56.7	67.8	75.4	80.9	81.5	79.5	73.7	65.3
260	Cabonation Surge Agitator . .	**96.8**	54	67	78.2	85.7	91.3	91.8	89.9	84.1	75.7
260	Carbonation Agitator 1 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 2 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 3 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 4 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 5 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 6 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 7 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 8 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 9 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Carbonation Agitator 10 . .	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
260	Filtrate Pump . .	**102.1**	59.3	72.3	83.5	91	96.6	97.1	95.2	89.4	81
260	Heat Exchanger Circulation Pump (Warner . .	**104.5**	60.3	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
260	Pregnant Liquor Pond Pump (Warner 6/4) . .	**111.4**	67.7	80.7	91.9	99.5	105.2	106.7	105	99.8	92.6
260	Thickener overflow pump . .	**71.6**	28.8	41.8	53	60.5	66.1	66.6	64.7	58.9	50.5
260	Thickener overflow pump_B . .	**102.1**	59.3	72.3	83.5	91	96.6	97.1	95.2	89.4	81
260	Thickener U/Flow pump . .	**71.6**	28.8	41.8	53	60.5	66.1	66.6	64.7	58.9	50.5
290	Neutralization Agitator . 2A4001 -C1/C2A/C3/C4/C5.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
290	Neutralization Agitator . 2A4001 -C1/C2A/C3/C4/C5.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
290	Neutralization Agitator . 2A4001 -C1/C2A/C3/C4/C5.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4

290	Neutralization Agitator . 2A4001 -C1/C2A/C3/C4/C5.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
290	Neutralization Agitator . 2A4001 -C1/C2A/C3/C4/C5.	**95.5**	52.7	65.7	76.9	84.4	90	90.5	88.6	82.8	74.4
290	ID Fan . 2K9002A.	**108.4**	81.9	92.6	100.3	105.7	101.4	97.4	83.2	85.7	80.5
290	Caustic Pump . 2P9001.	**104.5**	60.7	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
290	Weak Acid Feed Pump . 2P9004A.	**101.5**	57.7	70.7	81.9	89.6	95.2	96.8	95.1	90	82.8
290	1st Venturi Spray Pump . 2P9004B.	**104.5**	60.7	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
290	2nd Venturi Spray Pump . 2P9004D.	**104.5**	60.7	73.7	84.9	92.5	98.2	99.7	98	92.8	85.6
290	Lime Dosing Pump . 2P9005.	**96.5**	52.3	65.4	76.5	84.2	89.9	91.8	90.1	85.1	78.3
290	Gypsum Recirculation Pump . 2P9006A.	**105.1**	61.4	74.4	85.6	93.2	98.9	100.3	98.6	93.4	86.1
290	Gypsum Recirculation Pump . 2P9006B.	**105.1**	61.4	74.4	85.6	93.2	98.9	100.3	98.6	93.4	86.1
290	Gypsum Pump . 2P9006C.	**96.5**	52.3	65.4	76.5	84.2	89.9	91.8	90.1	85.1	78.3
290	Area Sump Pump . 2P9011.	**96.5**	52.3	65.4	76.5	84.2	89.9	91.8	90.1	85.1	78.3
290	Area Sump Pump . 2P9012.	**96.5**	52.3	65.4	76.5	84.2	89.9	91.8	90.1	85.1	78.3

Appendix C Layout Images

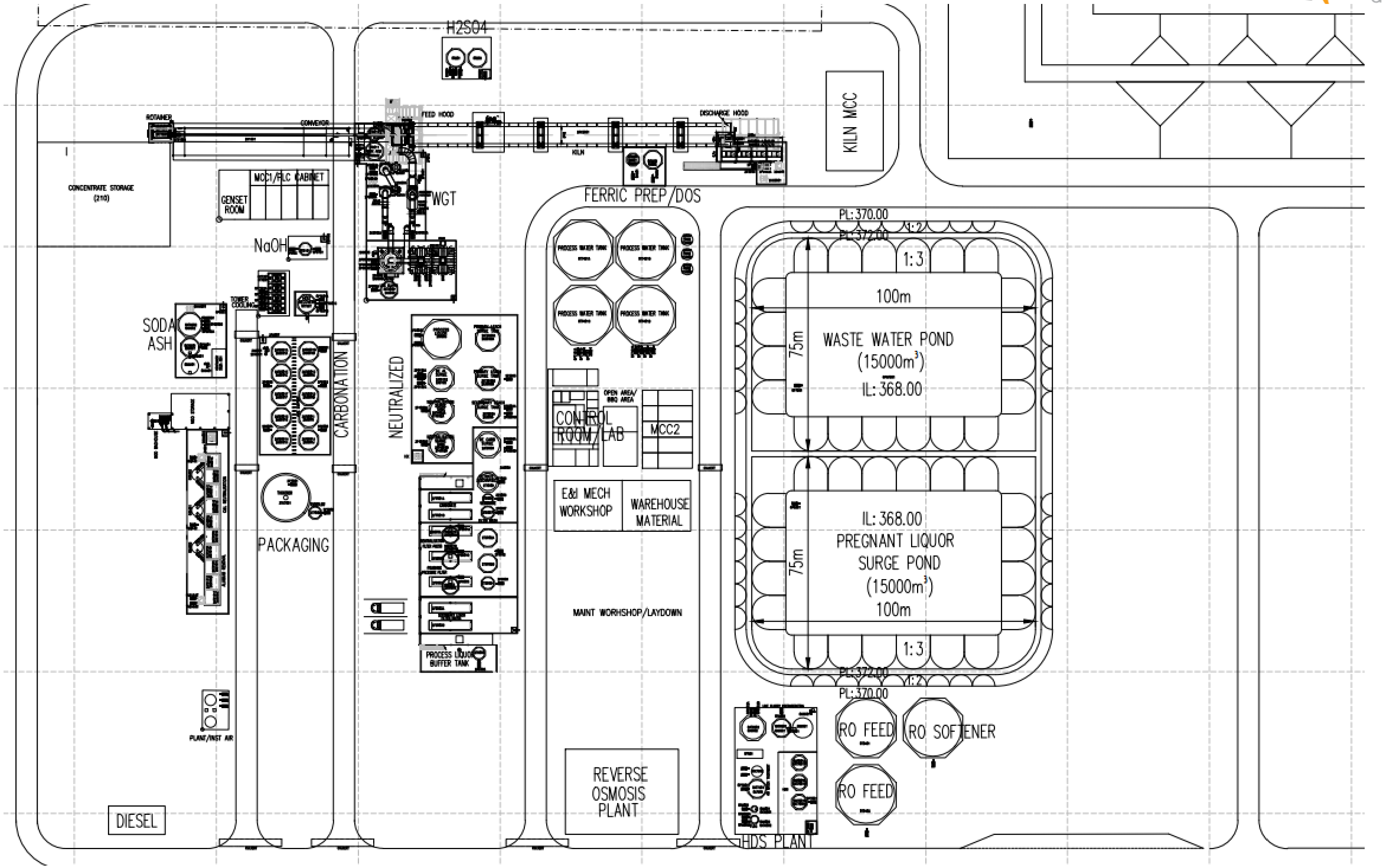

Figure C 1 REPF Layout (before layout changes)

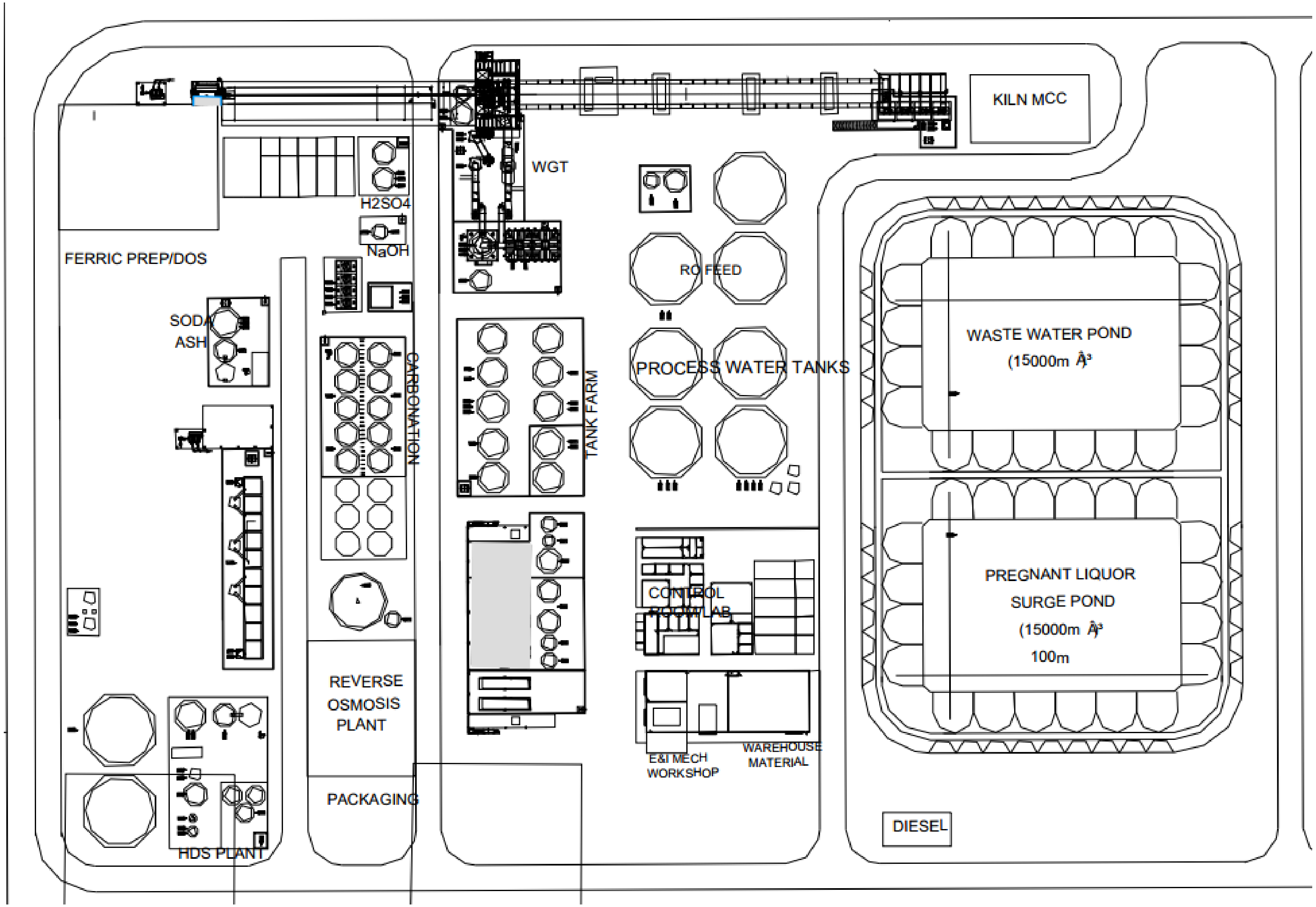

Figure C 2 REPF Layout (after layout changes)

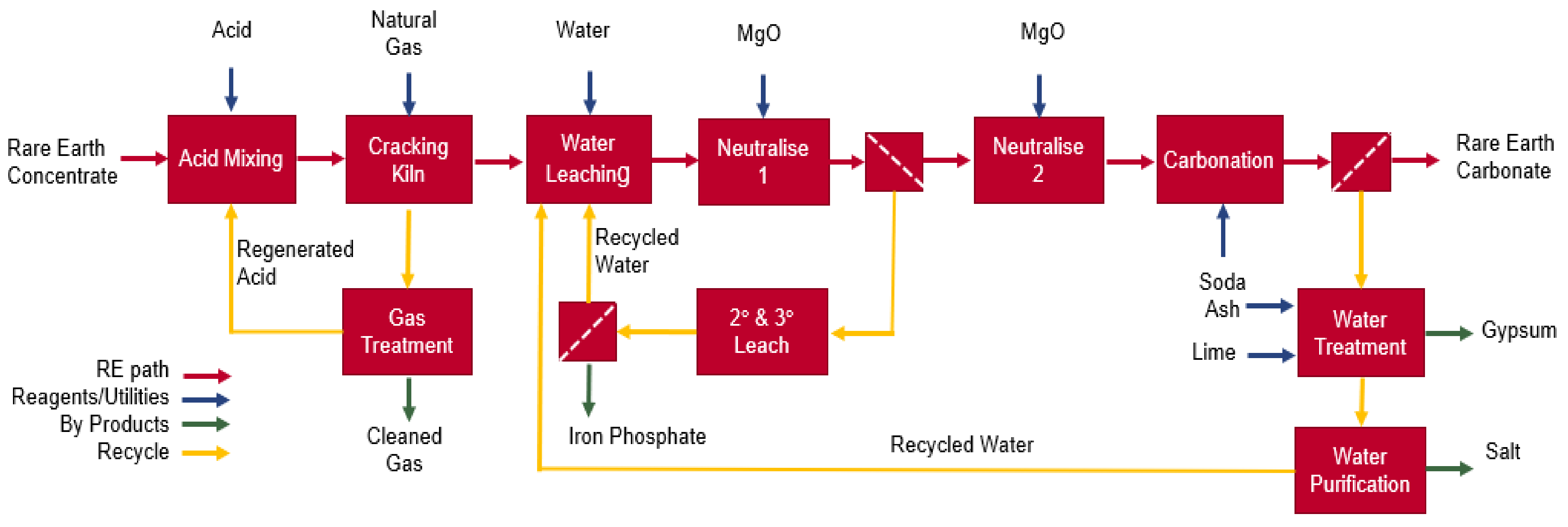

Figure C 3 REPF Simplified Process Flowchart