

23 August 2024

Marcus Peck
 C/o Office of the Coordinator General
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Dear Marcus

Alpha HPA Response to Information Request Special Industry and Linear Infrastructure Facility

We write on behalf of Alpha HPA (the Applicant) in response to the information request issued on 15 August 2024 requesting further information on the Amended State Development Area Approval for Special Industry and Linear Infrastructure Facility at 53 Reid Road, Yarwun.

Reference is made to the meeting undertaken with the Office of the Coordinator General and the Department of Environment, Science and Innovation (DESI) on the 15 August 2024. We note that as per the submitted Application and the meeting, a separate application to Amend the EA Permit will be submitted to DESI for assessment highlighting the conditions sought under the Permit to be changed.

The following provides a full response to the information request to allow for the application to progress. We look forward to receiving draft conditions to allow for this approved Project to progress to Stage 2.

Request Item	Response
Chemical Storage and Risk Planning	
Hazardous Chemicals	
<p>As part of the change application, the plant layout for Stage 2 has been substantially changed, appearing to lead to development of a new product (involving new inputs and processes). Insufficient detail of the new inputs, processes, products, and impacts of the site operations has been provided, causing concern for appropriate management of any hazardous chemicals on site. Further information is required to properly evaluate the risks and mitigation measures associated with the proposed development.</p> <p>The proponent is requested to provide additional information to clearly define any new types (including chemical name and UN number), maximum quantities to be produced and stored, locations and processes involving chemicals and chemical reactions, including labelling of all hazardous chemicals.</p> <p>Note: This may include block flow diagrams, process flow diagrams, detailed plant layouts and the hazardous chemicals manifest.</p>	<p>The process changes since the previous SDA assessment and approval are minor, as shown in the simplified block diagram (Attachment A) one new production process has been added for a new product – Alumina Trihydrate (ATH). This new production process takes some of the crystalliser product that was going to HPA production and undergoes a slightly different reaction process followed by filtration and drying. There are no new hazardous chemicals required for this process and no increase in stored quantities of the existing hazardous chemicals.</p> <p>No additional hazardous chemicals will be stored on site than what was included in the current SDA Approval and the previous QRA. The total storage capacity of ammonium nitrate solution has remained the same and the risk associated with an ammonia release has actually been lowered by reducing the maximum capacity of the largest storage vessel from 100 tonnes to 40 tonnes.</p> <p>The reason for the layout of the plant having to change from the previous approval is that the footprint of a lot of the equipment has increased in size as more information has been received from vendors.</p> <p>Reference is made to Attachment B containing an amended Quantitative Risk Assessment (QRA) prepared by Sherpa Consulting. The</p>

Request Item	Response
	<p>addendum has updated the QRA to include the changes proposed to Stage 2 (no changes proposed to Stage 1 PPF that have not already been previously assessed) to reflect the changes to the inventory and location of hazardous materials.</p> <p>The report has made clear comparisons between what was originally approved and what changes are currently proposed.</p> <p>The QRA Addendum contains:</p> <ul style="list-style-type: none"> • Updated hazardous material inventories for the Project. • Updated assessment of the Project against State Code 21. • Overall cumulative individual fatality risk • Cumulative societal risk • Updated site plan. <p>We consider this report and associated conclusions provide sufficient information to address this item.</p>
Updated QRA	
<p>A key input into a quantitative risk assessment is the location of hazardous chemicals onsite. The quantitative risk assessment has not been updated as part of this change application, despite the core amendments sought to the SDA approval being the rearranging of structures and containers onsite.</p> <p>Further information is required to properly understand the risks associated with the proposed development.</p> <p>The proponent is requested to update the quantitative risk assessment with the new locations of hazardous chemical products and storage to provide a more accurate risk assessment.</p>	<p>Reference is made to Attachment B containing an amended QRA prepared by Sherpa Consulting. The addendum has updated the QRA to include the changes to the PPF and Stage 2 to reflect the changes to the inventory and location of hazardous materials.</p>
SDAP V3.0 State Code 21 Hazardous Chemical Facilities	
<p>Appendix F of the application material contains an assessment against SDAP State Code 21. However, a number of responses are tabled as 'will comply', with limited supporting evidence. Further detail is required to justify the compliance of the proposed development against State Code 21.</p> <p>The proponent is requested to update their assessment against SDAP V3.0 State Code 21 (Hazardous Chemical Facilities) to reflect the proposed plant design and layout and types and quantities of hazardous chemicals. This will</p>	<p>Reference is made to Attachment B containing an amended QRA prepared by Sherpa Consulting.</p> <p>The approved QRA under the SDA Approval was approved under State Code 21 Version 2.6 which was current at the time. Since then, a new State Code 21 version 3.0 has been adopted. In version 2.6, the State Code Performance Outcomes were assessed on a risk basis, with version 3.0 deleting a number of fatality risk criteria and replacing these with consequence based criteria.</p>

Request Item	Response
<p>require inputs from the updated QRA and provision of technical detail to show compliance with State Code 21 in areas where 'will comply' is currently listed, or where there is reliance on the previous QRA.</p>	<p>Changes have been made to Stage 2 layout and inventories during detailed design. The changes are the result of the detailed design with the footprint of the equipment increasing in size due to more information from the vendors. Key changes to the proposal include:</p> <ul style="list-style-type: none"> • Concentrated ammonium nitrate solution (ANS) has moved slightly south (Figure 2.1, Attachment B). • Anhydrous ammonia storage has moved slightly south (Figure 2.1, Attachment B). • Solvent extraction process area bund has been reoriented (Figure 2.1, Attachment B). • No additional hazardous chemicals will be stored on site than what was included in the current SDA Approval and the previous QRA (Table 2.2, Attachment B). • The total storage capacity of ANS has remained the same (Table 2.2, Attachment B). <p>The assessment concluded (Section 3, Attachment B) that the development does not fully comply with the Performance Outcomes of the updated State Code 21 version 3.0 – however it is clearly noted that the outcome of this assessment does not result from the change in inventories or layout, the outcome would be the same for the approved layout / inventories when assessed.</p> <p>Figure 2.2 within Attachment B clearly demonstrates that there is no increase in ammonia or ANS inventory and the locations of storage has moved marginally to what was originally approved.</p> <p>Specifically, the total storage capacity of ANS has remained the same and the risk associated with an ammonia release has actually been lowered by reducing the maximum capacity of the largest storage vessel from 100 tonnes to 40 tonnes.</p> <p>Reference is made to Attachment B, section 3.2.3 where discussion has been provided demonstrating that while the Project does not comply with some Performance Outcomes of the State Code 21, the Project clearly demonstrates compliance with the Purpose Statement of State Code 21. The discussion has been included below:</p> <p><i>The State Code 21 v3.0 purpose statement requires that the development is 'designed so far as reasonably practicable, to ensure</i></p> <p><i>1) human health and safety, and the</i></p>

Request Item	Response
	<p><i>built environment are protected from off-site risks resulting from physical or chemical hazards'. The design features adopted to in relation to the scenarios that do not meet the POs to reduce the risk so far as reasonably practicable (SFARP)is provided below:</i></p> <p><i>Ammonia storage:</i></p> <ul style="list-style-type: none"> • <i>Total ammonia storage quantity has been minimised to an operationally practical quantity and the largest single inventory reduced so far as reasonably practicable (maximum single storage vessel size reduced from approximately 120m3 in preliminary design to 51m3 in current design).</i> • <i>Storage vessels will be procured from reputable fabricators and subject to QA processes, testing prior to commissioning and subject to planned inspection programme over their operational life.</i> • <i>Emergency response planning and equipment provided (eg dilution of ammonia vapours with water).</i> <p><i>Ammonium nitrate solution storage:</i></p> <ul style="list-style-type: none"> • <i>Total storage quantity has been minimised to an operationally practical quantity</i> • <i>Instrumentation will be provided to detect any excursions in process parameters (eg temperature and pH) and initiate the appropriate mitigation response (eg shutdown heat, dilution / quench of tank contents). The required functionality and reliability will be determined during detailed engineering including Safety Integrity Level (SIL) assessment.</i> • <i>Any combustibles in the vicinity of ANS will be minimised to reduce the risk of external heat source initiating decomposition.</i> <p><i>The project design process includes the standard hazard assessment studies including HAZID, HAZOP that will confirm scenarios and associated controls required to reduce the risk SFARP.</i></p> <p><i>In addition, the facility will be determined as a Major Hazard Facility (MHF) due to the quantities of hazardous chemicals and as such will be subject to significant regulatory oversight. This include initial assessment to obtain an MHF licence to commence operations and periodic verification that that the risk levels remain at a levels that have been reduced SFARP.</i></p>

Request Item	Response
	<p>On the basis of the above justification, we consider that there is no conflict with the Project meeting the Purpose or intent of the State Code 21.</p>
<p>DESI</p>	
<p>General Comment</p>	
<ul style="list-style-type: none"> We note that each of the Technical Assessments submitted (noise, air quality, plume rise and site based water) have assessed the changes to the whole of Project - Stage 1 and Stage 2. This application seeks to change the SDA Conditions of Approval and that a Major Amendment to the EA Permit will be lodged under separate cover to DESI for their Assessment to change the applicable conditions of the EA that will result as part of this change. Alpha HPA will accept a condition noting that an EA Amendment will need to be lodged to the DESI prior to commencement of use for Stage 2. We further note that there is no proposed increase in thresholds being applied for as part of this change. To further clarify we will not be seeking to change Condition G1 of the EA Permit as listed below. <p style="text-align: right;">Permit Environmental authority P-EA-100167564</p> <p>Conditions of environmental authority</p> <p>Schedule G: General</p> <p>General</p> <p>G1 Activities authorised under this environmental authority must be conducted in accordance with the following annual limitations:</p> <ul style="list-style-type: none"> a) manufacture of up to 11,000 tonnes (t) of high purity aluminium products (such as high purity alumina, aluminium precursor salts, boehmite); and b) manufacture of up to 136,000t of ammonium nitrate; and c) manufacture of up to 5,000t of fertiliser. <p>G2 All reasonable and practicable measures must be taken to prevent or minimise environmental harm caused by the activities.</p> <p>G3 This environmental authority does not authorise a relevant act unless a condition of the environmental authority specifically authorises that relevant act to occur.</p>	
<p>Air</p>	
<p>Due to changes in project scope, impacts to air quality were not able to be evaluated. The proponent is requested to provide documentation and plans that identify the following:</p> <ul style="list-style-type: none"> a. Sensitive and commercial receptors relevant to air quality; b. Expected releases and emissions as a result of the proposed activity during normal operation and unplanned events; c. Release locations (including GDA2020, latitude and longitude, decimal degrees); d. Release details (where relevant) e.g. quantity/m3, velocity, stack height. 	<p>Reference is made to Attachment G of the submitted SDA Changed Approval Application Package containing the Air Quality Impact Assessment. The following provides DESI with the location of each of the requested items contained within this report.</p> <ul style="list-style-type: none"> a. Sensitive and Commercial Receptors; <ul style="list-style-type: none"> Please refer to Section 4.4 and Table 24 of Air Quality Impact Assessment discusses sensitive receptors. The Project is located in an Industrial designation under the SDA commercial receptors where not required to be assessed as part of the originating EA.

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<p>e. Assessment against and consideration of the Air Quality Objectives within the Environmental (Air) Policy 2019;</p> <p>f. Air modelling demonstrating impact on the nearest sensitive receptors.</p>	<p>b. Expected releases and emissions as a result of the proposed activity during normal operation and unplanned events;</p> <ul style="list-style-type: none"> • Please refer to Tables 26 to 29 of the Air Quality Impact Assessment. <p>c. Release locations (GDA2020, latitude and longitude, decimal degrees);</p> <ul style="list-style-type: none"> • Please refer to Table 36 of the Air Quality Impact Assessment / Table 3 and Table 4 of Plume Rise Assessment – (in UTM). <p>d. Release details if relevant e.g. quantity/m3, velocity, stack height.</p> <ul style="list-style-type: none"> • Please refer to Table 36 of the Air Quality Impact Assessment. <p>e. Assessment against and consideration of the Air Quality Objectives within the Environmental (Air) Policy 2019;</p> <ul style="list-style-type: none"> • Please refer to Table 3 of the Air Quality Impact Assessment – consideration of objectives. • Please refer to Section 11 of Air Quality Impact Assessment including Table 38 to Table 40 – assessment against objectives. <p>f. Air modelling to show the impact on the nearest sensitive receptors.</p> <ul style="list-style-type: none"> • Please refer to Section 11 of Air Quality Impact Assessment.
Greenhouse Gas Emissions	
<p>Information on greenhouse gas emissions was not provided as part of the application material.</p> <p>The proponent is requested to provide information in relation to greenhouse gas (GHG) emissions to assess the likely impact of each relevant activity on the environmental values, including details of:</p> <p>a. any emissions or releases likely to be generated by each relevant activity, and</p> <p>b. mitigation measures to be implemented to prevent or minimise adverse impacts.</p>	<p>As discussed in the meeting on the 15 August 2024 with DESI. An Amendment to the EA Permit will be submitted to DESI under separate cover. Greenhouse Gas Emissions will be considered as part of the EA Amendment Application.</p>
Noise	
<p>Due to changes in project scope, noise impacts were not able to be evaluated.</p> <p>The proponent is requested to provide documentation and plans that identify the following:</p> <p>a. sensitive and commercial receptors relevant to noise impacts</p>	<p>Reference is made to Attachment I of the submitted SDA Change Approval Application Package containing the Preliminary Noise Impact Assessment. The following provides DESI with the location of each of the requested items contained within this report.</p>

Request Item	Response
<p>b. list of noise sources produced by the proposed development</p> <p>c. expected levels of noise production</p> <p>d. noise mitigation measures</p> <p>e. assessment against and consideration of the Environmental (Noise) Policy 2019</p> <p>f. background noise levels taken in line with the latest version of the Department of Environment and Science' Noise Measurement Manual, and noise modelling.</p>	<p>a. Sensitive and Commercial receptors;</p> <ul style="list-style-type: none"> • Please refer to Section 2.3 of Preliminary Noise Impact Assessment. The Project is located in an Industrial designation under the SDA. The nearest noise sensitive receptors comprise residential buildings; the closest of which is 4km away. Existing commercial receptors are located much farther away from the Project than identified residential buildings, and also receive a more lenient noise criterion. Accordingly, where the assessment has considered the impacts to existing residential buildings, the exclusion of commercial buildings is not expected to change acoustic outcomes. <p>b. List of noise sources;</p> <ul style="list-style-type: none"> • Please refer to Appendix B of Preliminary Noise Impact Assessment. <p>c. Expected levels of noise production;</p> <ul style="list-style-type: none"> • Please refer to Section 5 Preliminary Noise Impact Assessment. <p>d. Noise mitigation measures;</p> <ul style="list-style-type: none"> • Please refer to Section 5.2 Preliminary Noise Impact Assessment. <p>e. Assessment against and consideration of the Environmental (Noise) Policy 2019;</p> <ul style="list-style-type: none"> • Please refer to Section 5.2 Preliminary Noise Impact Assessment. The Environmental (Noise) Policy 2019 was considered in the earlier versions of this assessments (circa 2021 and 2022), and assisted DESI in developing the current EA noise limits. These current EA noise limits are reproduced in Section 3.0 Noise Criteria, and continue to be adopted in this assessment. <p>f. Background noise levels taken in line with the latest version of the Department of Environment and Science' Noise Measurement Manual;</p> <ul style="list-style-type: none"> • Measurements of noise from other existing facilities located within the Gladstone State Development Area (GSDA), and background noise levels at nearby sensitive receptors, have not been undertaken, as the nominated criteria are not dependent on these pre-existing background noise levels. Note also that the current EA noise limits are not dependant on the background noise levels and measurements.

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	<p>g. Noise modelling.</p> <ul style="list-style-type: none"> Please refer to Section 4 Preliminary Noise Impact Assessment.
Waste	
<p>Due to changes in project scope, waste impacts were not able to be evaluated.</p> <p>The proponent is requested to provide documentation and plans that identify the following:</p> <ol style="list-style-type: none"> types of wastes produced application of waste management hierarchy, and waste storage and disposal. 	<p>Please refer to Section 3.4.6 of SDA Amended Approval Report for details on waste.</p> <p>Please also note that no changes are being proposed to the EA conditions relating to waste. This will be detailed in the submitted Amendment to the EA.</p>
Water	
<p>Due to changes in project scope, water impacts were not able to be evaluated.</p> <p>The proponent is requested to provide documentation and plans that identify the following:</p> <ol style="list-style-type: none"> any proposed release locations and monitoring locations in GDA 2022 with latitude and longitude proposed release criteria with consideration of local water quality objectives (Curtis Island, Calliope River and Boyne River Basins Environmental Values and Water Quality Objectives); as prescribed under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019, and any proposed treatment methods for stormwater or wastewater. 	<p>Reference is made to Attachment J of the submitted SDA Change Approval Application Package containing the Site Based Water Management Plan (SBWMP). The following provides DESI with the location of each of the requested items contained within this report.</p> <ol style="list-style-type: none"> any proposed release locations and monitoring locations (provide in GDA 2022, latitude and longitude); <ul style="list-style-type: none"> Please refer to Section 6.0 of SBWMP. Numerical coordinates. proposed release criteria with consideration of local water quality objectives (<u>Curtis Island, Calliope River and Boyne River Basins Environmental Values and Water Quality Objectives</u>); as prescribed under the <u>Environmental Protection (Water and Wetland Biodiversity) Policy 2019</u>; <ul style="list-style-type: none"> Please refer to the Executive Summary. Please refer to Table A, B, C and D of Section 5.5. any proposed treatment methods for stormwater or wastewater, etc. <ul style="list-style-type: none"> Please refer to Section 5.5 which discusses the proposed site water management systems.
Surface Water Releases and Waste Water Releases	
<p>Due to changes in project scope, impacts generated by surface water and wastewater releases were not able to be evaluated.</p>	<p>Reference is made to Attachment J of the submitted SDA Change Approval Application Package containing the SBWMP. The following provides DESI with the location of each of the requested items contained within this report.</p>

Request Item	Response
<p>The proponent is requested to provide documentation and plans that identify the following</p> <ol style="list-style-type: none"> onsite and neighbouring waterways (including Gladstone Harbour) any nearby wetlands groundwater, and consideration of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019. 	<ol style="list-style-type: none"> Onsite and neighbouring waterways including: Gladstone Harbour; <ul style="list-style-type: none"> Please refer to Section 4.11 of SDA Change Report and SBWMP Section 4.1 discusses Gladstone Harbour. Any nearby wetlands; <ul style="list-style-type: none"> Please refer to Section 3.2.1 of SBWMP. Groundwater; <ul style="list-style-type: none"> The Project is not located within the wetland protection area. Consideration of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019. <ul style="list-style-type: none"> The Project is not located within the wetland protection area.
<p>Flares</p>	
<p>Due to changes in project scope, it is unclear whether flares are included as part of the proposed development.</p> <p>The proponent is requested to confirm whether a flare is included in the design. If there is a flare proposed, the proponent is requested to identify (in documentation and plans) the type of flare proposed, any visual amenity mitigation measures for the flare, combustion temperature and design details including height.</p>	<p>Reference is made to Attachment H of the submitted SDA Change Approval Application Package containing the Plume Rise Impact Assessment. The following provides DESI with the location of each of the requested items contained within this report.</p> <ol style="list-style-type: none"> Please refer to Section 4.3.3, Table 5, Table 8.
<p>Proposal Plans</p>	
<p>While site details have been provided, additional context is required to understand how the site components will be located. The proponent is requested to provide a single plan that clearly identify the following:</p> <ol style="list-style-type: none"> Manufacturing areas/tanks Storage tanks Stormwater infrastructure Access tracks/roads Any other infrastructure of importance Overall design/production capacity of the plant, and Details of secondary and/or tertiary containment on site. 	<p>Reference is made to Attachment C of the submitted SDA Change Approval Application Package containing the Development Plans. The submitted plans clearly show</p> <ol style="list-style-type: none"> All manufacturing areas/tanks Storage tanks Stormwater infrastructure Access tracks/roads All proposed site infrastructure Design and production capacity and containment on site has been detailed within the technical assessment submitted.
<p>Landscape Plan</p>	
	<p>Please refer to Attachment C containing an updated Landscape Plan. This plan has been amended as part of the Operational Works Approval currently being assessed by GRC. To</p>

Request Item	Response
	ensure consistency, the updated plan has been submitted herein for assessment.

We trust this information is sufficient for the purpose of this assessment. Should the Office of the Coordinator General require any further information or clarification, please contact the undersigned.

Yours faithfully
For AECOM Australia Pty Ltd



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Attachment A

Attachment B

TECHNICAL NOTE

HIGH PURITY ALUMINA (HPA) PLANT

QRA ADDENDUM UPDATED INVENTORIES

ALPHA HPA

Rev	Date	Description	Prepared	Checked	Approved	Method of issue
A	14-Aug-2024	Draft for review	J Polich RPEQ 24537	-	-	Email PDF
0	15-Aug-2024	Final	J Polich RPEQ 24537	-	-	Email PDF
1	23-Aug-2024	Final	J Polich RPEQ 24537	-	J Polich RPEQ 24537	Email PDF

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1. INTRODUCTION

1.1. Background

Alpha HPA Limited (Alpha) is proposing to develop a commercial scale High Purity Alumina (HPA) plant in Yarwun, Queensland (Qld) in the Gladstone State Development Area which is zoned for industrial purposes. Alpha submitted a Development Application (DA) in 2020 and received approval for the project. The application was accompanied by a hazard assessment report in the form of a Quantitative Risk Assessment (QRA) to demonstrate compliance with Qld State Code 21 (Ref [1]) which was prepared by Sherpa Consulting Pty Ltd (Sherpa).

Alpha modified the approval in 2021 to include a Precursor Production Facility (PPF) which is a small scale version (Stage 1) of the full facility. The PPF has been constructed, is operational and will remain in use as a trial facility once the full scale facility (Stage 2) is operational. An update to the QRA was also prepared to cover the PPF in November 2021 (Ref [2]).

Alpha has made some minor changes to the layout and inventories in the proposed Stage 2 facility which requires another modification to the approval. There are no changes proposed for the PPF.

The hazard assessment prepared at the time of the approval adopted the performance outcomes (POs) in version 2.6 of State Code 21 which was current at that time. In 2022, version 3 of State Code 21 was released (effective from 18 Feb 2022) which substantially changed the POs relating to offsite risk. In v2.6 of State Code 21, POs were assessed on a risk basis, with v3.0 deleting a number of fatality risk criteria and replacing these with consequence based criteria which are significantly more onerous. The regulator has requested that a comparison with the current version of State Code 21 (version 3) be provided as part of the change application.

Alpha has requested that Sherpa update the QRA to reflect the changes and also include a comparison to the most recent version of State Code 21.

1.2. Scope

This technical note provides:

- Updated cumulative risks including the Stage 2 facility accounting for the proposed changes in inventory and location of hazardous materials, and the PPF.
- A comparison of worst case incident scenarios against version 3 of State Code 21 Performance Outcomes 1 to 5 (PO1 to PO5). Note that no other requirements of State Code 21 are covered apart from PO1 to PO5 inclusive.

Apart from the changes noted in the following sections all methodology and assumptions are the same as previous QRA reports and are not reproduced.

2. PROJECT DESCRIPTION

2.1. Changes

Some changes have been made to the Stage 2 layout and inventories as detailed design has progressed. Figure 2.1 shows the updated site layout. Changes in stage 2 layout accounted for in the QRA are:

- Concentrated ammonium nitrate solution (ANS) has moved slightly south.
- Anhydrous ammonia storage has moved slightly south.
- Solvent extraction process area bund has been reoriented.

Refer to Figure 2.2 for a comparison between the current design and previous layouts used in QRA supporting the planning application.

2.2. Hazardous material inventories

Table 2.1 shows the hazardous materials included in the QRA model accounting for inventory changes. Figure 2.2 shows a comparison between the current and previous inventories used in QRA supporting the planning application.

Note that as per previous reports all other materials used in the process have localised impacts and do not contribute to offsite risk and are not included in the risk model.

Specifically there are no incident scenarios associated with dilute ANS included in the QRA as no decomposition mechanisms (eg due to overheating, contamination) have been identified.

Table 2.1: Materials in QRA model

Chemical	Stage 2		PPF	
	Mass (tonnes)	Basis	Mass (tonnes)	Basis
Anhydrous liquid NH ₃	120	3 x 51 m ³ storage vessels	26	Storage vessel filled by road tanker
Ammonium Nitrate (as concentrated > 80% AN solution)	750 (as pure AN)	4 x 88m ³ tanks and 1 x 237m ³ tank	-	No concentrated AN, dilute ANS only with no mechanism for decomposition. Not modelled
Solvent / Organic	1200 (total organic)	SX organic Combustible below flashpoint Contained in 11 mixer and settler tanks including reagent supply and storage tanks	5	Shellsol D80, combustible below flashpoint
LPG	-	Not required, piped gas	2	Storage vessel and road tanker filling

Figure 2.1: Site layout

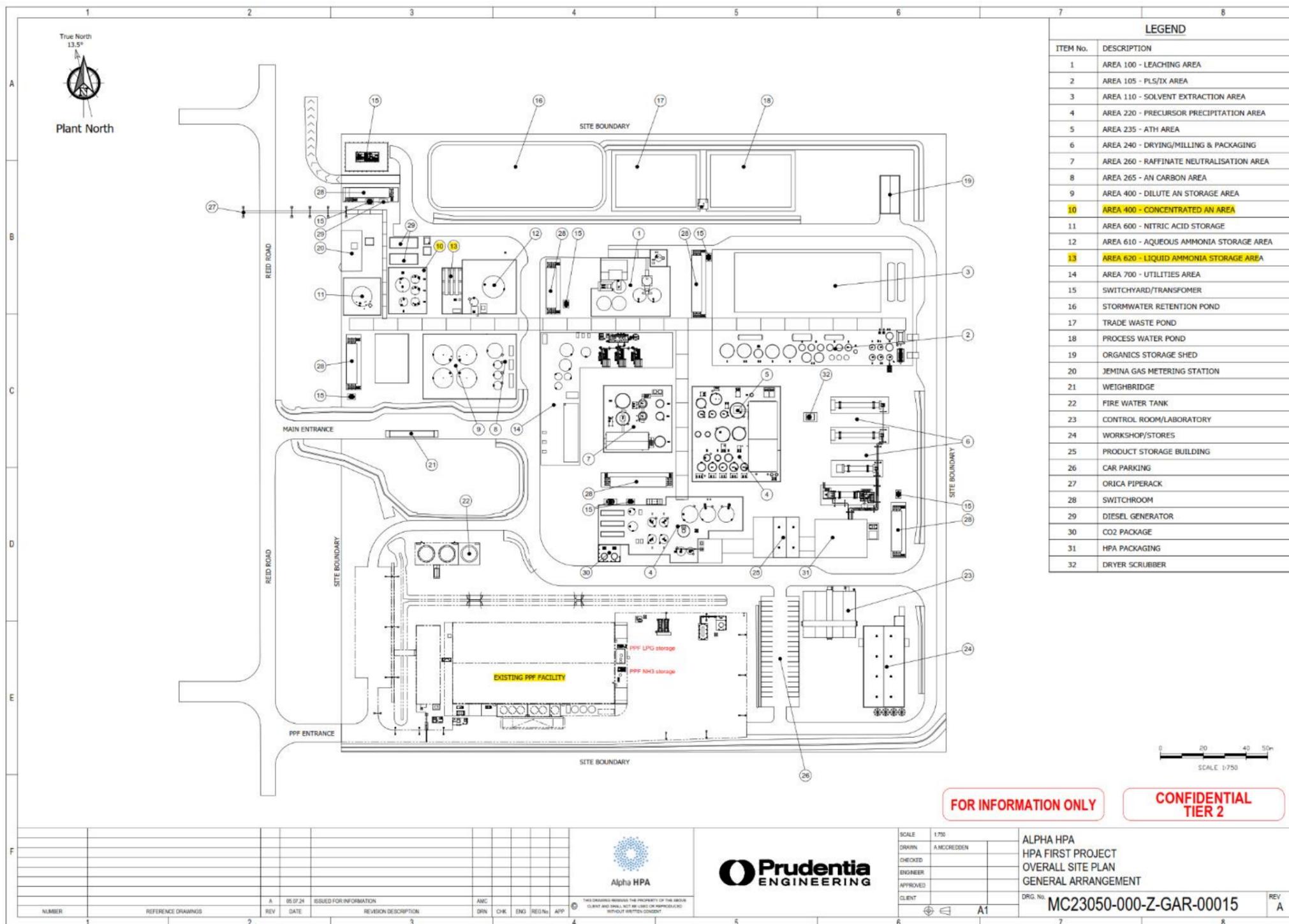
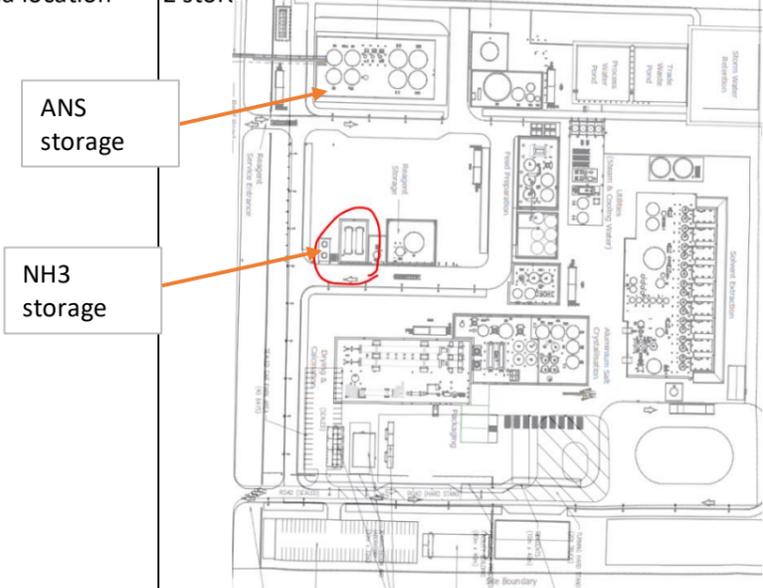
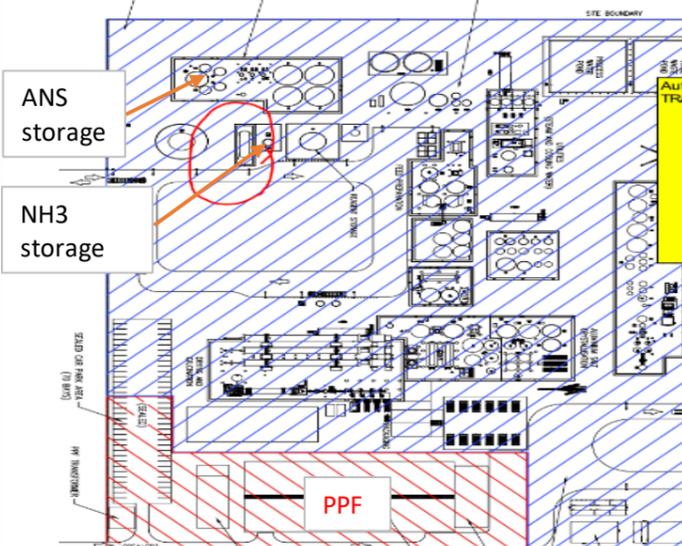
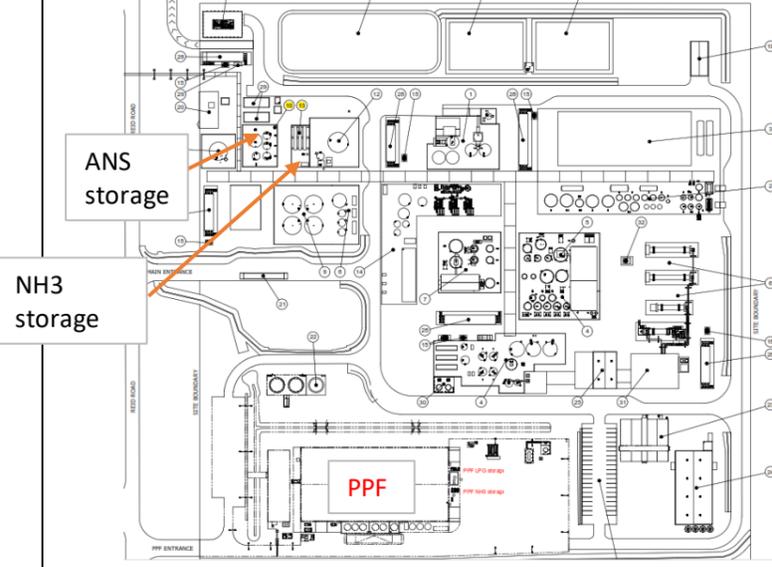


Figure 2.2: Comparison of QRA basis

Stage 2 Full scale plant:	Original Stage 2 QRA submitted with DA Oct 2020	Updated Stage 2 with PPF for QRA Addendum August 2021	Updated Stage 2 with PPF tech note 21874-TN-001 Aug 2024
Ammonia inventory	200 tonnes	100 tonnes	120 tonnes
ANS inventory	870 tonnes largest single inventory 240m3	870 tonnes largest single inventory 240m3	750 tonnes as 100% AN ~ 870 tonnes as AN solution 4 x 88m3 tanks and 1 x 237m3 tank
Ammonia location	2 storage vessels 	1 storage vessel 	3 x 51 m3 storage vessels 
Precursor plant (PPF)	Not included	Included	Included
Ammonia inventory	n/a	26 tonnes	26 tonnes
LPG	n/a	2 tonnes	2 tonnes

3. RESULTS AND DISCUSSION

3.1. Comparison against State Code 21 v2.6

3.1.1. Individual fatality risk

The individual fatality risk results for the overall site including the PPF and Stage 2 are shown in Figure 3.1 and also compared to the previous risk results (Ref [2]).

There is minimal difference to the previous risk results and all criteria in State Code 21 v2.6 are met. .

3.1.2. Societal risk results

The societal risk results for the overall site including the PPF and Stage 2 is shown in Figure 3.2. The FN curve is fully within the tolerable/ ALARP region or negligible region and does not extend into the intolerable region. There is no material change from the results presented in the previous QRA.

3.2. Comparison against State Code 21 v3.0

3.2.1. Changes in State Code 21 v3.0

State Code 21 v3.0 provides the following purpose statement which identifies the overall intent of the code:

The development is designed and sited, so far as reasonably practicable, to ensure:

- 1. human health and safety, and the built environment are protected from off-site risks resulting from physical or chemical hazards;*
- 2. hazardous chemical facilities are protected from:*
 - a. off-site hazard scenarios at existing hazardous chemical facilities;*
 - b. natural hazards.*

State Code 21 v3.0 eliminates risk criteria for human health risks to some land uses (which were included in v2.6) and replaces them with consequence criteria (expressed as a 'dangerous dose').

To assess whether proposed developments achieve the purpose statement, Performance Outcomes (POs) are defined. PO1 to PO5 relate to hazard assessment of offsite effects from the proposal and are reproduced in Table 3.1 with dangerous dose definitions in Table 3.2.

Proposed developments comply with State Code 21 if:

- all POs are achieved, or
- where POs are not met, the approval authority (SARA) determines, on balance, that the development complies with the purpose statement.

Table 3.1: State code 21 v3.0 PO1 to PO5

ID	Off-site land use or land zoned for this land use	Performance outcome
PO1	Vulnerable (schools, hospitals etc)	PO1 The hazardous chemical facility does not create a dangerous dose to human health.
PO2	Sensitive (includes residential)	PO2 The hazardous chemical facility does not create a dangerous dose to human health.
PO3	Commercial or community activity	PO3 The hazardous chemical facility does not create a dangerous dose to human health.
PO4	Open space	PO4 The hazardous chemical facility, does not create: <ul style="list-style-type: none"> a. a dangerous dose to human health; or b. where (a) cannot be achieved, an individual fatality risk level of 10×10^{-6}/year and the societal risk criteria in Figure 2.1 (of State Code 21 which is reproduced in Figure 3.2)
PO5	Industrial	PO5 The hazardous chemical facility, does not create either of the following: <ul style="list-style-type: none"> a. a dangerous dose to the built environment; and b. an individual fatality risk level of 50×10^{-6}/year.

Table 3.2: State code 21 v3.0 dangerous dose definitions

Dangerous dose	Consequence level criteria		
	Heat radiation	Explosion overpressure	Toxic effects
To human health	4.7 kW/m ²	7 kPa	AEGL-2 (60 mins) for ammonia this is 160 ppm
To the built environment	12.6 kW/m ²	14 kPa	-

3.2.2. Consequence assessment

Consequence modelling showing the distances to the ‘dangerous dose’ as per Table 3.2 is provided in APPENDIX A for a toxic release from the largest ammonia inventory and a decomposition in the largest ANS inventory.

Note that the modelling is ‘worst case’ as it is based on the maximum inventory, includes worst case environmental conditions and does not include the effect of any mitigation measures such as emergency response.

Also note that:

- the only change in consequence modelling outcomes since previous QRAs is that the worst case extent of the ammonia dispersion for a vessel rupture scenario has reduced as the inventory of the single largest vessel has reduced from 100 tonnes to 40 tonnes.
- The most recent version of Gexcon Riskcurves (v12.3) has also been used which has some minor changes to dispersion model compared to v11 used in previous studies.

The nearest non industrial land use is in Gladstone central business area approximately 7 km south east of the Alpha site.

- A dangerous dose to human health (7kPa) from the largest ANS decomposition event extends approximately 700 m hence does not affect any non-industrial land uses.
- A dangerous dose to the built environment (14kPa) from the largest ANS decomposition event extends approximately 400 m hence reaches the neighbouring Orica plant to the west and the Water Treatment Plant (WTP) to the north.
- The AEGL2 (60 mins) from a worst case rupture scenario of a 51 m³ (40 tonne) ammonia vessel extends approximately 3.6 km during typical day time conditions (stability class D, wind speed 1.5m/s) which does not reach non-industrial land uses
- The AEGL2 (60 mins) from a worst case rupture scenario of a 51 m³ (40 tonne) ammonia vessel extends approximately 10 km during worst case night time conditions (stability class F, wind speed 2m/s). This may reach non industrial land uses if the wind direction is towards Gladstone. As per the QRA the wind direction is predominantly from the southeast, ie away from Gladstone.

3.2.3. Assessment results against State Code 21 v3.0

The assessment against State Code 21 v3.0 PO1 to PO5 is summarised in Table 3.4. The development does not fully comply. Note that this outcome does not result from the change in inventories or layout, the outcome would be the same for previously assessed layout / inventories when assessed State Code 21 v3.0.

- Complies: Human health criteria for PO4 and PO5 are fully met on a risk basis. Societal risk is in the ALARP region as per Figure 3.2 hence meets the PO4 societal risk criterion.
- Does not comply: Human health criteria PO1 to PO3 (consequence basis) are not met for a worst case scenario of ammonia tank rupture (which is a very low frequency scenario) under a low likelihood combination of worst case F2 night time meteorological condition, combined with a wind direction from the north

west. For other meteorological combinations the dangerous dose is not exceeded in non-industrial land uses.

- Does not comply: A worst case ANS explosion will result in overpressure of 14kPa at neighbouring industrial facilities (built environment).

The State Code 21 v3.0 purpose statement requires that the development is '*designed so far as reasonably practicable, to ensure 1) human health and safety, and the built environment are protected from off-site risks resulting from physical or chemical hazards*'. The design features adopted to in relation to the scenarios that do not meet the POs to reduce the risk so far as reasonably practicable (SFARP) is provided below:

Ammonia storage:

- Total ammonia storage quantity has been minimised to an operationally practical quantity and the largest single inventory reduced so far as reasonably practicable (maximum single storage vessel size reduced from approximately 120m³ in preliminary design to 51m³ in current design).
- Storage vessels will be procured from reputable fabricators and subject to QA processes, testing prior to commissioning and subject to planned inspection programme over their operational life.
- Emergency response planning and equipment provided (eg dilution of ammonia vapours with water).

Ammonium nitrate solution storage:

- Total storage quantity has been minimised to an operationally practical quantity
- Instrumentation will be provided to detect any excursions in process parameters (eg temperature and pH) and initiate the appropriate mitigation response (eg shutdown heat, dilution / quench of tank contents). The required functionality and reliability will be determined during detailed engineering including Safety Integrity Level (SIL) assessment.
- Any combustibles in the vicinity of ANS will be minimised to reduce the risk of external heat source initiating decomposition.

The project design process includes the standard hazard assessment studies including HAZID, HAZOP that will confirm scenarios and associated controls required to reduce the risk SFARP.

In addition, the facility will be determined as a Major Hazard Facility (MHF) due to the quantities of hazardous chemicals and as such will be subject to significant regulatory oversight. This include initial assessment to obtain an MHF licence to commence operations and periodic verification that that the risk levels remain at a levels that have been reduced SFARP.

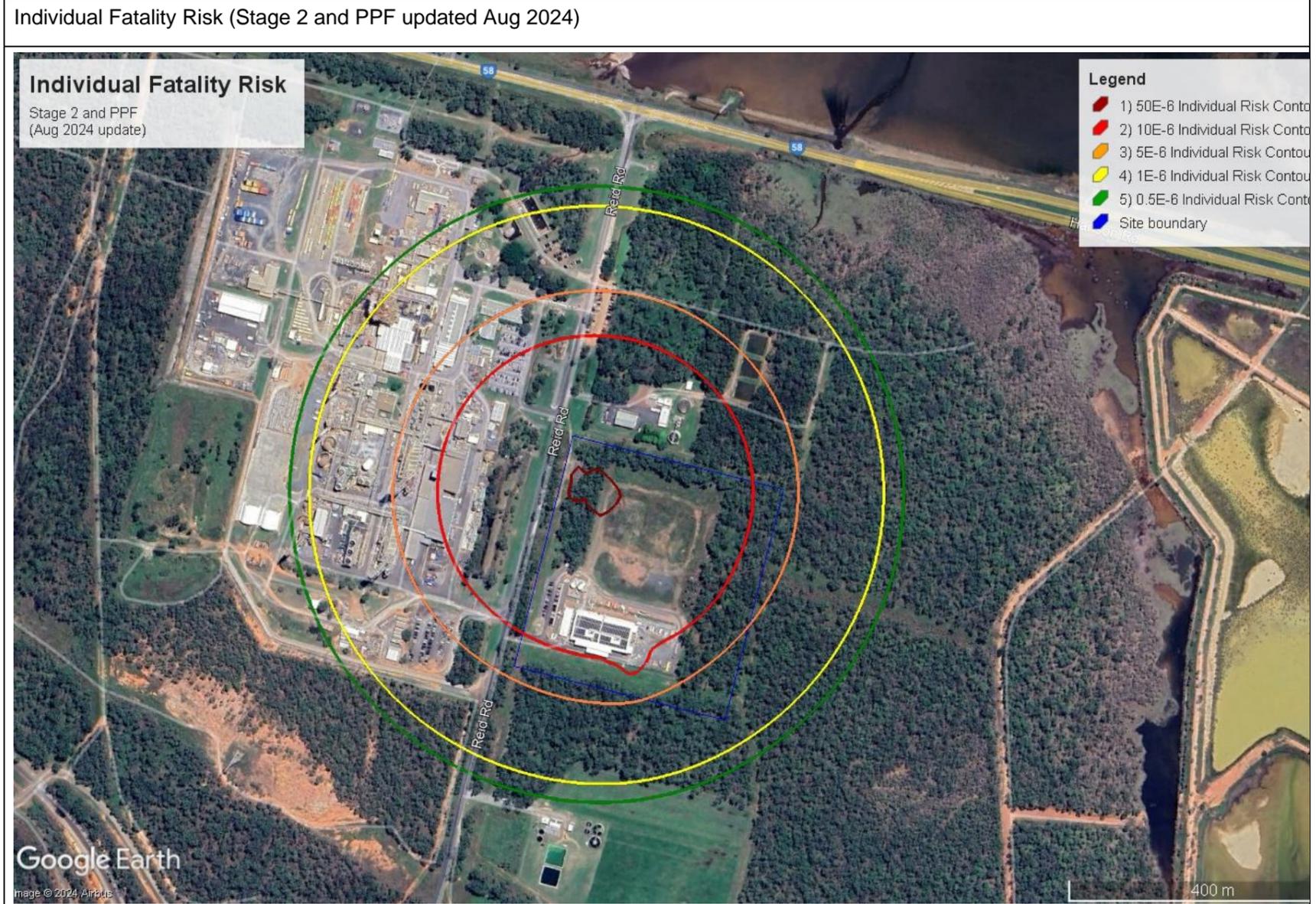
Table 3.3: Assessment against individual fatality risk criteria for PO1 (AO1.1 to 1.5) compliance State Code 21 v2.6 (as applicable at planning application and approval stage)

Description	Risk criteria adopted (per year)	Complies with criteria? (Figure 3.1)	Comments
<p>AO1.1 Any off-site impact from a hazard scenario shall not exceed, at the boundary of any vulnerable land use or zone:</p> <ol style="list-style-type: none"> 1. a dangerous dose to human health; or 2. if the above criteria cannot be achieved: <ol style="list-style-type: none"> a. an individual fatality risk level of 0.5×10^{-6}/year 	0.5×10^{-6}	Yes	Offsite Criteria met as no vulnerable land uses
<p>AO1.2 Any off-site impact from a hazard scenario shall not exceed, at the boundary of any sensitive land use or zone:</p> <ol style="list-style-type: none"> 1. a dangerous dose to human health; or 2. if the above criteria cannot be achieved: <ol style="list-style-type: none"> a. an individual fatality risk level of 1×10^{-6}/year 	1×10^{-6}	Yes	Offsite Criteria met no sensitive land uses
<p>AO1.3 Any off-site impact from a hazard scenario shall not exceed, at the boundary of any commercial or community activity land use or zone:</p> <ol style="list-style-type: none"> 1. a dangerous dose to human health; or 2. if the above criteria cannot be achieved: <ol style="list-style-type: none"> a. an individual fatality risk level of 5×10^{-6}/year 	5×10^{-6}	Yes	Offsite Criteria met no commercial or community activity land uses
<p>AO1.4 Any off-site impact from a hazard scenario shall not exceed, at the boundary of any open space land use or zone:</p> <ol style="list-style-type: none"> 1. a dangerous dose to human health; or 2. if the above criteria cannot be achieved: <ol style="list-style-type: none"> a. an individual fatality risk level of 10×10^{-6}/year 	10×10^{-6}	Yes	Offsite Criteria met no open space land uses
<p>AO1.5 Any off-site impact from a hazard scenario shall not exceed, at the boundary of any industrial land use or zone:</p> <ol style="list-style-type: none"> 1. a dangerous dose to the built environment; or 2. an individual fatality risk level of 50×10^{-6}/year 	50×10^{-6}	Yes	Contour within site boundary (onsite) Criteria met

Table 3.4: Assessment against individual fatality risk criteria for PO1 to PO5 compliance State Code 21 v3

Material	Scenario	PO met at relevant land use?					
		PO1 Vulnerable	PO2 Sensitive	PO3 Commercial	PO4 Open space	PO5 Industrial	
		Human health	Human health	Human health	Human health	Human health	Built environment
Ammonia	Worst case: 51m ³ tank rupture forming ammonia cloud	No Dangerous dose (AEGL2) reached in Gladstone town area (Night time F conditions only)	No Dangerous dose (AEGL2) reached in Gladstone town area (Night time F conditions only)	No Dangerous dose (AEGL2) reached in Gladstone town area (Night time F conditions only)	Yes 10 x10 ⁻⁶ per year contour does not extend to any open space areas	Yes Cumulative risk below 50 x10 ⁻⁶ per year offsite, contour within site boundary.	n/a
AN solution	Decomposition of largest single inventory (237m ³)	Yes Dangerous dose (7kPa) not reached	Yes Dangerous dose (7kPa) not reached	Yes Dangerous dose (7kPa) not reached	Yes Dangerous dose (7kPa) not reached	Yes Cumulative risk below 50 x10 ⁻⁶ per year	No 14kPa extends approximately 400m and reaches Orica to the west and the WTP to the north

Figure 3.1: Overall cumulative individual fatality risk



Individual fatality risk contours – PPF and Stage 2 ammonia bullet location changed, reduced ammonia inventory (2021) (Ref [2])

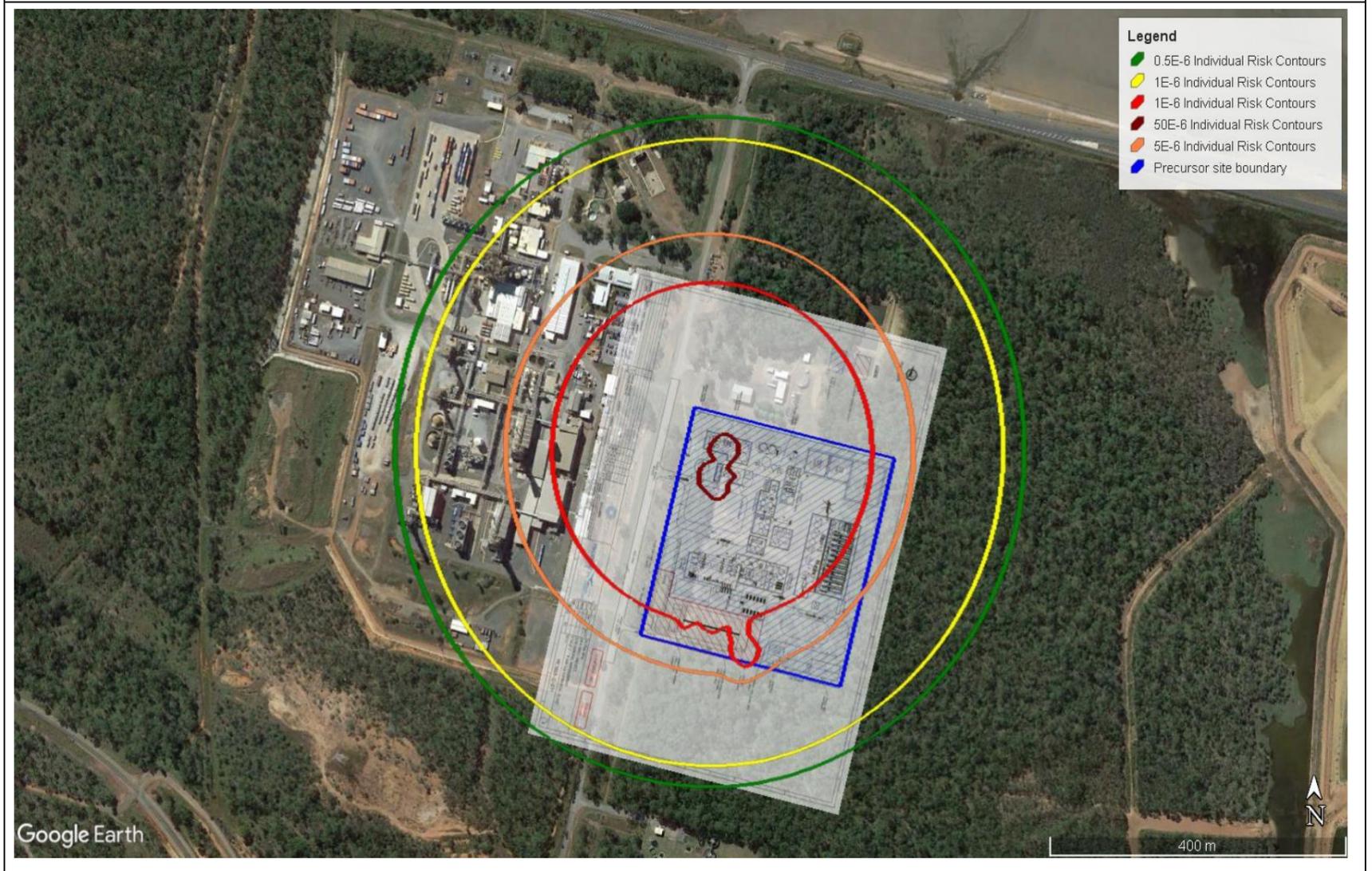
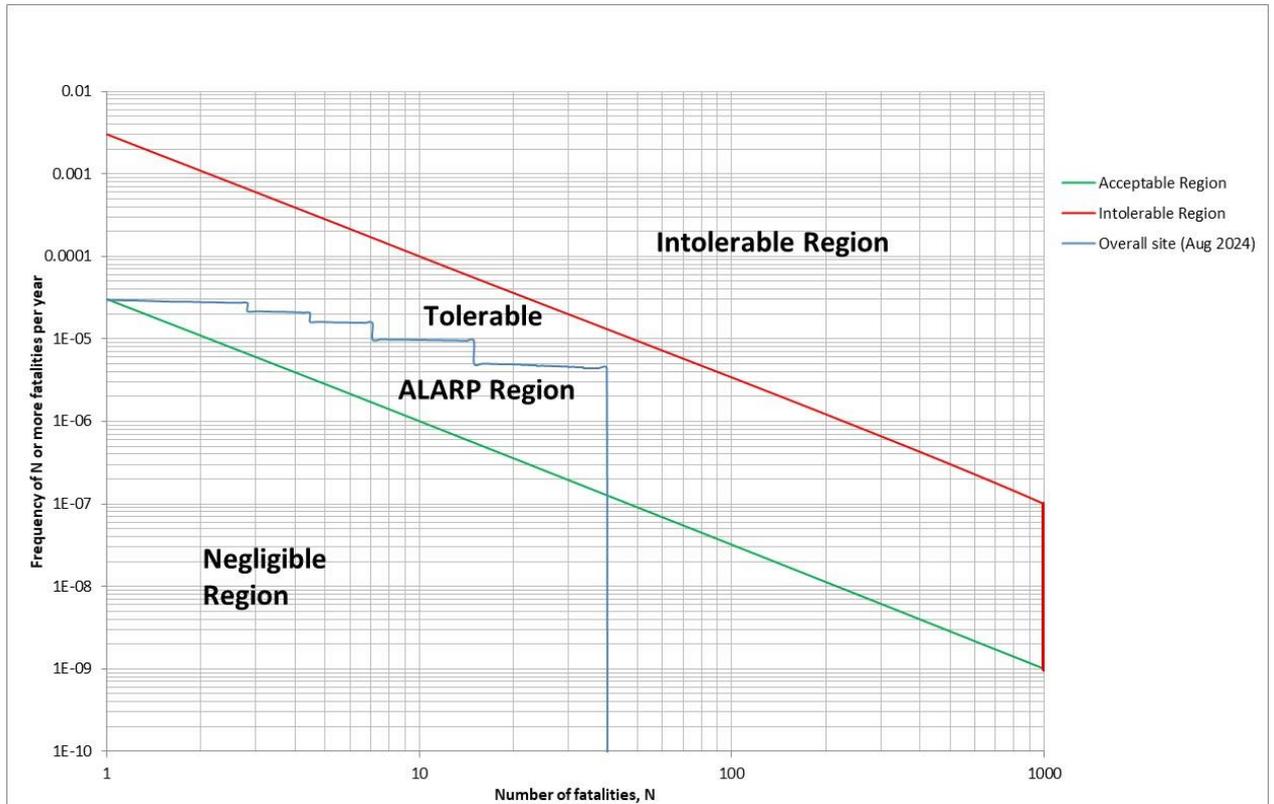


Figure 3.2: Cumulative societal risk results (Stage 2 and PPF updated Aug 2024)



4. REFERENCES

- [1] Sherpa Consulting Pty Ltd, "Qualitative Risk Assessment - Proposed High Purity Alumina Project," 2020.
- [2] S. C. P. Ltd, "TECHNICAL NOTE QRA ADDENDUM PRECURSOR PRODUCTION FACILITY (PPF) doc ref 21438-TN-003," Rev B Nov 2021.
- [3] A. W. Cox, F. P. Lees and A. M. L., Classification of Hazardous Locations, Institution of Chemical Engineers, 1990.

APPENDIX A. CONSEQUENCE RESULTS

A1. ANS largest inventory

Scenario ID	Area	Scenario Description	Material	Max storage quantity (te)	proportion AN	Theoretical Mass Avail for Explosion (te)	Equivalenc e	Efficien cy	NEQ (kg)	Distance *m)	
										14 kPa	7kPa
AN1-02	AN Storage and concentration	240m3 tank ANS explosion	ANS	328.8	0.885	291	0.353	0.6	61631	414	710

A2. Ammonia 51m³ vessel rupture

Modelset: Instantaneous Ammonia rupture Set							
Model: Liquefied Gas LOC Scenario Instantaneous Release							
version: v2024.08.9943f73 (12/08/2024)							
Reference: EFFECTS User manual "Combined models"							
Parameters							
Inputs	A2.5 Day	B2.7 Day	C2.4 Day	D1.9 Day	D1.9 Night	E1.9 Night	F2 Night
Process Conditions							
Chemical name	AMMONIA (DIP AMMONIA (DIP AMMONIA (AMMONIA (DI AMMONIA (I AMMONIA (I AMMONIA (DIPPR)						
Initial temperature in vessel (°C)	23	23	23	23	23	23	23
Pressure inside vessel determination	Use vapour pres Use vapour pres Use vapour Use vapour pr Use vapour p Use vapour p Use vapour pressure						
Burst pressure vessel (bar)	25	25	25	25	25	25	25
Calculation Method							
Outcome / phenomena	Toxic cloud	Toxic cloud	Toxic cloud	Toxic cloud	Toxic cloud	Toxic cloud	Toxic cloud
Vessel volume (m3)	51	51	51	51	51	51	51
Filling degree (%)	100	100	100	100	100	100	100
Reporting							
Contour maximum distances							
Lethality contours distance [m]	A2.5 Day	B2.7 Day	C2.4 Day	D1.9 Day	D1.9 Night	E1.9 Night	F2 Night
1 % lethality contour (Combine Toxic cloud)	162	254	338	358	356	437	778
Concentration contours distance [m]							
A2.5 Day	B2.7 Day	C2.4 Day	D1.9 Day	D1.9 Night	E1.9 Night	F2 Night	
AEGL-2 [3600] at 1.5m (Toxic Cloud Instant)	1485	2360	3302	3604	3612	6763	10742
Other information							
Main program	RISKCURVES 12.3.0.24041						

Results outside model validity range. Can be regarded as indicative and are provided for completeness only. In reality the wind and environmental conditions would change over the area which would tend to result in a wider and shorter effect area than predicted by this type of modelling

State code 21: Hazardous chemical facilities

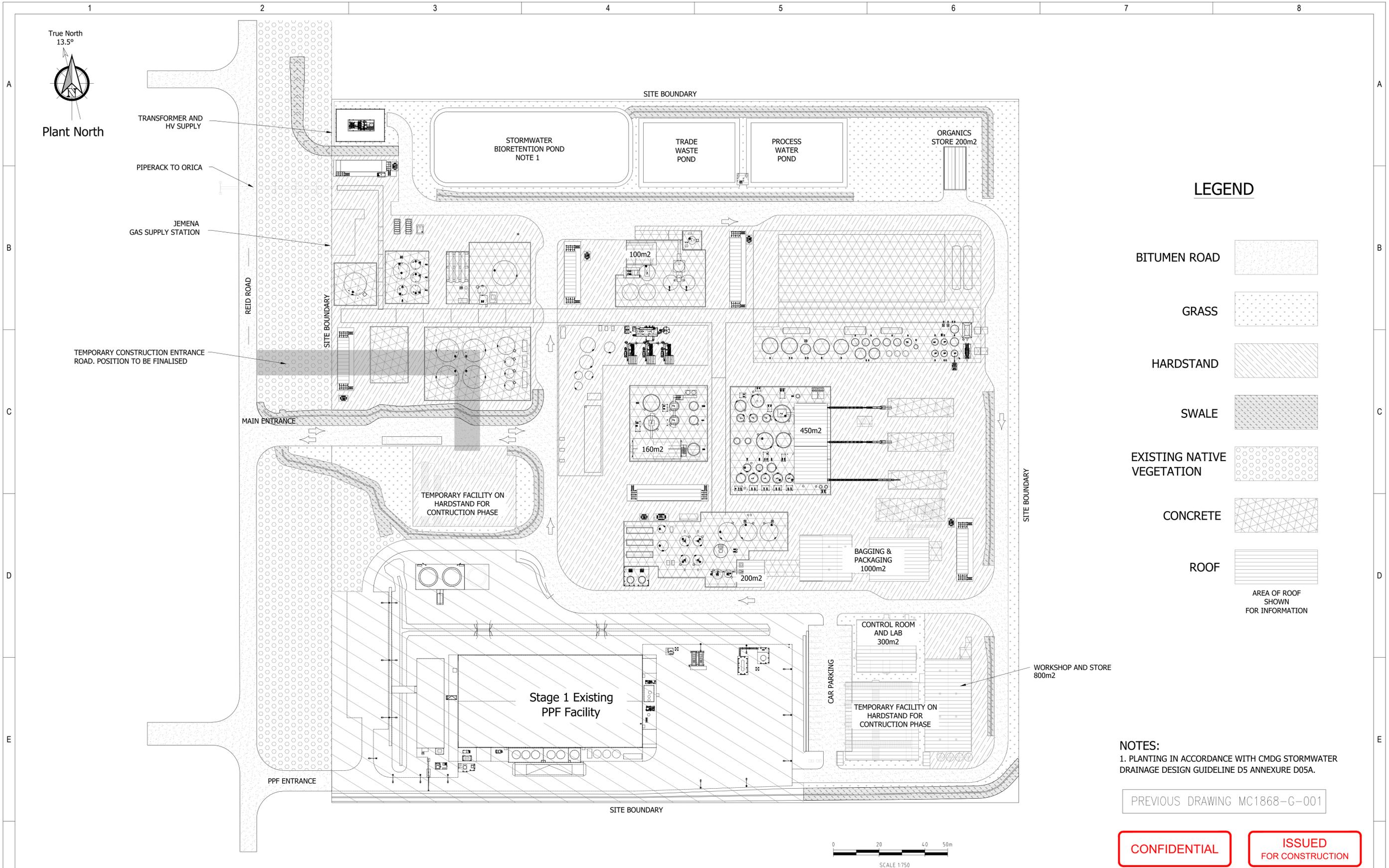
Planning guideline – State code 21: Hazardous chemical facilities provides direction on how to address this code.

Table 21.1: Material change of use

Performance outcomes	Response
Off-site impacts—vulnerable land use or land zoned for a vulnerable land use	
PO1 The hazardous chemical facility does not create a dangerous dose to human health .	Refer to Sherpa QRA Addendum for assessment against the PO.
Off-site impacts—sensitive land use or land zoned for a sensitive land use	
PO2 The hazardous chemical facility does not create a dangerous dose to human health .	Refer to Sherpa QRA Addendum for assessment against the PO.
Off-site impacts—commercial or community activity land use or land zoned for a commercial or community activity land use	
PO3 The hazardous chemical facility does not create a dangerous dose to human health .	Refer to Sherpa QRA Addendum for assessment against the PO.
Off-site impacts—open space land use or land zoned for an open space land use	
PO4 The hazardous chemical facility, does not create: a. a dangerous dose to human health ; or b. where (a) cannot be achieved, an individual fatality risk level of 10×10^{-6} /year and the societal risk criteria in figure 21.1.	Refer to Sherpa QRA Addendum for assessment against the PO.
Off-site impacts—industrial land use or land zoned for an industrial land use	
PO5 The hazardous chemical facility, does not create either of the following: a. a dangerous dose to the built environment ; and b. an individual fatality risk level of 50×10^{-6} /year.	Refer to Sherpa QRA Addendum for assessment against the PO.
Storage and handling areas	
PO6 Storage and handling areas for fire risk hazardous chemicals are provided with a 24-hour monitored fire detection system that has the ability to detect a fire in its early stages and notify an emergency responder at all times.	Complies Storage and handling areas for fire risk hazardous chemicals will be provided within a 24 hour monitored fire detection system that has the ability to detect a fire in its early stages.
PO7 Storage and handling areas for packages of liquid or solid fire risk hazardous chemicals are provided with a spill containment system with a working volume capable of containing a minimum of 100 percent of all packages (prescribed hazardous chemicals and/or non-hazardous	Complies Storage and handling areas for packages of liquids or solid fire risk hazardous chemicals will be provided within a spill containment system.

chemicals) within the area plus the output of any fixed firefighting system provided for the area over a minimum of 90 minutes.	
<p>PO8 Storage and handling areas for liquid or solid fire risk hazardous chemicals in tanks are provided with a spill containment system with a working volume capable of containing a minimum of:</p> <ol style="list-style-type: none"> 110 percent of the largest tank within a spill compound or 25 percent of the aggregate where multiple tanks are located within a spill compound, whichever is the greater; and the output of any fixed firefighting system provided for any bulk tank within a spill compound over a minimum of 90 minutes. 	<p>Complies</p> <p>Storage and handling areas for packages of liquids or solid fire risk hazardous chemicals will be provided within a spill containment system with a minimum capacity of:</p> <ol style="list-style-type: none"> 110 percent of the largest tank within a spill compound or 25 percent of the aggregate where multiple tanks are located within a spill compound, whichever is the greater; and the output of any fixed firefighting system provided for any bulk tank within a spill compound over a minimum of 90 minutes.
<p>PO9 Storage and handling areas for prescribed hazardous chemicals that, if in contact with each other, may react to produce a fire, explosion or other harmful reaction, or a flammable, toxic or corrosive vapour are designed to prevent contact between the prescribed hazardous chemicals.</p>	<p>Complies</p> <p>Storage and handling areas for packages of liquids or solid fire risk hazardous chemicals will be provided within a spill containment system.</p>
<p>PO10 Development is designed and sited to mitigate impacts on storage and handling areas from natural hazard including, but not limited to:</p> <ol style="list-style-type: none"> flood; bushfire; erosion; storm tide inundation; landslide; earthquake; wind action. 	<p>Complies</p> <p>The project complies with PO 10 through the following considerations:</p> <ul style="list-style-type: none"> • Flooding - reference is made to Attachment J which demonstrates flood mitigation measures to ensure compliance is achieved. • Bushfire Prone Area - reference is made to the approved Site Based Management Plan which demonstrates mitigation measures to ensure compliance is achieved. • Erosion Prone Area/Storm Tide Inundation Area - the Project area is not impacted by erosion prone area or storm tide inundation mapping. • Landslide Hazard Area – the Project area is not mapped as a landslide hazard area.
All development	
<p>PO11 Development is designed and sited to mitigate the risks from hazard scenarios occurring at existing hazardous chemical facilities.</p>	<p>Complies</p> <p>The plant is being designed in accordance with the relevant Australia Standards.</p>

Attachment C



NUMBER	REFERENCE DRAWINGS	REV	DATE	REVISION DESCRIPTION	DRN	CHK	ENG	REG No.	APP
		1	02.08.24	SITE LAYOUT REVISED	AMC	DO	DO		TC
		0	27.06.24	ISSUED FOR CONSTRUCTION	AMC	DO	DO		TC
		C	24.05.24	SITE LAYOUT UPDATED	AMC	JH	JH		TC
		B	29.04.24	SITE LAYOUT UPDATED	AMC	JH	JH		TC
		A	19.02.24	ISSUED FOR INFORMATION	AMC	JH	JH		TC
MC23050-000-Z-GAR-001	GENERAL LAYOUT STAGE 1 & 2								

SCALE	1:750
DRAWN	A.MCCREDDEN 08.11.23
CHECKED	J. HEPBURN 19.02.24
ENGINEER	J. HEPBURN 19.02.24
APPROVED	T. CHOW 19.02.24
CLIENT	

ALPHA HPA	Prudentia ENGINEERING	SCALE 1:750	DRG. No. MC23050-000-Z-GAR-00004	REV 1
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