ARUP

Mace Group

Manning Base Hospital

Appendix B: Preliminary Hazard Analysis- REF Works

Reference: PHA_MBSREF

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Arup Australia Pty Ltd | ABN 76 625 912 665

Arup Australia Pty Ltd
Wurundjeri Woiwurrung Country
Sky Park One Melbourne Quarter
699 Collins Street
Docklands VIC 3008
Australia
arup.com

ARUP

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			Prepared by	**Checked by**	**Approved by**
		Name	Nick McEniry Jas Calder	Luke Pascoe Joel M Smith	
		Signature			
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		Name	Nick McEniry Jas Calder	Luke Pascoe Joel M Smith	Nigel Cann
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			Prepared by	**Checked by**	**Approved by**
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Executive Summary

The *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP) is used in New South Wales to regulate the planning approval process for developments in hazardous and offensive industries, and potentially hazardous and potentially offensive industries.

This report applies the *Applying SEPP 33* guidance document to define the thresholds for storage quantities of dangerous goods (DG) at Manning Base Hospital.

This assessment concludes that the proposed LPG tank and storage of oxidising substances i.e. liquid oxygen storage and nitrous oxide within cylinders, exceed the screening threshold. Therefore, a preliminary hazard analysis (PHA) is undertaken to determine the risk to off-site and on-site populations.

This PHA performed applies to the early stages of development at Manning Hospital known as 'REF' works. This document exists as Appendix B, part of the PHA performed for the main works at the hospital.

The PHA identified the following requirements:

- 2 x 250 L cabinets be used for storage of Class 3 flammable liquids in place of the 400 L cabinet which is non-compliant with Clause 4.9.6 (b) of AS 1940 *The storage and handling of flammable and combustible liquids* and;
- Remove Class 8 corrosive liquids and Class 4.2 spontaneously combustible materials from storage with the Class 3 flammable liquids.
- During detailed design maintain;
    - The required separation distance between the Special Care cylinder storage and bulk oxygen storage; and
    - The separation distance from the cylinder store above minor quantities (not the Special Care store) to on-site protected places.

If the above recommendations are met then the following outcomes are achieved:

- Off-site Populations:
    - The separation distances of dangerous goods stores to off-site populations are compliant to the relevant Australian Standards. Therefore, Arup deems there to be **there are no major offsite consequences and societal risk is negligible** based on the analysis conducted and the information obtained from Mace Group as outlined in this document.
- On-site Populations:
    - Arup expects compliance to appropriate Australian Standards is achievable based on the information provided, as outlined in this report. During detailed design, ensure the separation distances outlined in Section B.6 are complied with. Arup deems there to be **negligible risk to onsite populations** based on the assessed dangerous goods and the information provided by Mace Group, provided compliance with relevant Australian Standards is achieved.

B.1 Introduction

B.1.1 PHA Introduction

Manning Base Hospital is located at 26 York St, Taree NSW as shown in Figure 1.

Figure 1: Satellite view of Manning Base Hospital

The Manning Base Hospital redevelopment early works ('REF works') includes:

- A new bulk oxygen vessel enclosure and medical gas cylinder storage enclosure will be built and installed; and
- The existing bulk oxygen vessel and medical gas cylinder manifold supplies (oxygen, nitrogen, tool air), both for storage and pipework, will be demolished.

The bulk medical gas supply will include:

- Bulk liquid oxygen vessel to be upgraded from a 7 kL vessel to a 15 kL vessel (refilled approximately every 2 weeks).
- The backup supply, which is currently supplied by cylinder stores, has been proposed to be replaced with a 3 kL bulk liquid oxygen backup vessel.

Arup's Manning Hospital Stage 2: Scheme Design Report (MEP-RPT-002 issued 29 July 2022) outlines that the new building will relocate the existing cylinder stores (including the nitrous oxide cylinders and oxygen cylinders), decommission the current medical gas pipework, and install new medical gas pipework connecting into the new and existing buildings. The medical gas schematic (ARP-MG-02-DWG-00-01 and ARP-MG-02-DWG-00-03) indicates that there will be two banks of 15 G-sized cylinders each of nitrous oxide (1,500 L total water capacity).

Medical gas sizing calculations done on 28 July 2022 by Arup's Design Team outlines that two G-sized oxygen cylinders (360 L aggregate water capacity) and two G-sized medical air cylinders (283 L aggregate water capacity) will be provided.

Page 1 of the Scheme Design Reports indicates that the existing gases system will be replaced with the new system as outlined above. This new system will service the new and existing buildings.

As a result of the storage and use of dangerous goods for the hospital's operation, the development application is required to be assessed against the Resilience and Hazards SEPP as a "potentially

hazardous industry". As the quantity thresholds outlined in *Applying SEPP33* are exceeded, a Preliminary Hazard Analysis (PHA) is conducted. This document outlines the PHA process.

The screening is performed based on the quantities in the existing dangerous goods manifest (see Addendum A) and Arup's Scheme Design Report 100% Building Services & VT issued 29 July 2022[1] and the Manning Hospital Concept and Master Planning Report issued 2 March 2022.

This PHA considers:

- Existing dangerous goods including LPG tanks, flammable liquids, and diesel generator; and
- New oxygen and medical gas cylinder store.

Arup assumes that the existing dangerous goods are constructed and operated in compliance with appropriate Australian Standards. Any new developments will be assessed according to the appropriate Australian Standards.

In Addendum B, the development stages involved in the REF works are shown in drawings. This includes notably, the various stages of oxygen and medical gas rooms demolition and construction.

[1] Doc ref: MEP-RPT-002

B.2 Response to SEARs

Item 16 of the SEARs specifies that a SEPP (Resilience and Hazards) assessment is required to be undertaken as part of the Significant State Development Application. Should the development be deemed "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with the *Applying SEPP 33* guideline, the Hazardous Industry Planning Advisory Paper No. 6 'Hazard Analysis' (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011). If the development is adjacent to or on land in a pipeline corridor, consultation must be sought with operator.

The SEARs requirements and the relevant section where the response to these requirements can be found, is represented in Table 1.

Table 1: SEARs Requirements

Item	SEARs Requirement	Relevant Section in Report
16.1 – Hazards and Risks	Where there are dangerous goods and hazardous materials associated with the development provide a preliminary risk screening in accordance with Chapter 3 of SEPP (Resilience and Hazards) 2021.	Section B.5
16.2 – Hazards and Risks	Where required by SEPP (Resilience and Hazards) 2021, provide a Preliminary Hazard Analysis prepared in accordance with Hazardous Industry Planning Advisory Paper No.6 – Guidelines for Hazard Analysis and Multi-Level Risk Assessment.	Section B.6
16.3 – Hazards and Risks	If the development is adjacent to or on land in a pipeline corridor, report on consultation outcomes with the operator of the pipeline, and prepare a hazard analysis.	Section B.7

B.3 Resilience and Hazards SEPP

The New South Wales State Environmental Planning Policy (Resilience and Hazard) 2021 (Resilience and Hazard SEPP) commenced on 1 March 2022.

The screening process is used to assess whether a development is “potentially hazardous” or “potentially offensive”. Hence, the Hazardous and Offensive Development Application Guidelines Applying SEPP 33 (2011) [1] remain relevant. Applying SEPP 33 outlines the screening process used to assess whether the Resilience and Hazard SEPP applies (in the context of potentially hazardous or potentially offensive industry).

Any references to SEPP 33, particularly in extracts from Applying SEPP 33, should be taken as references to the Resilience and Hazards SEPP.

B.4 Resilience and Hazards SEPP Screening Process

Applying SEPP 33 describes the process to be followed when assessing whether a development application is to be considered potentially hazardous. Figure 1 of *Applying SEPP 33* (The SEPP 33 Process) is reproduced below in Figure 2.

Figure 1: The SEPP 33 Process

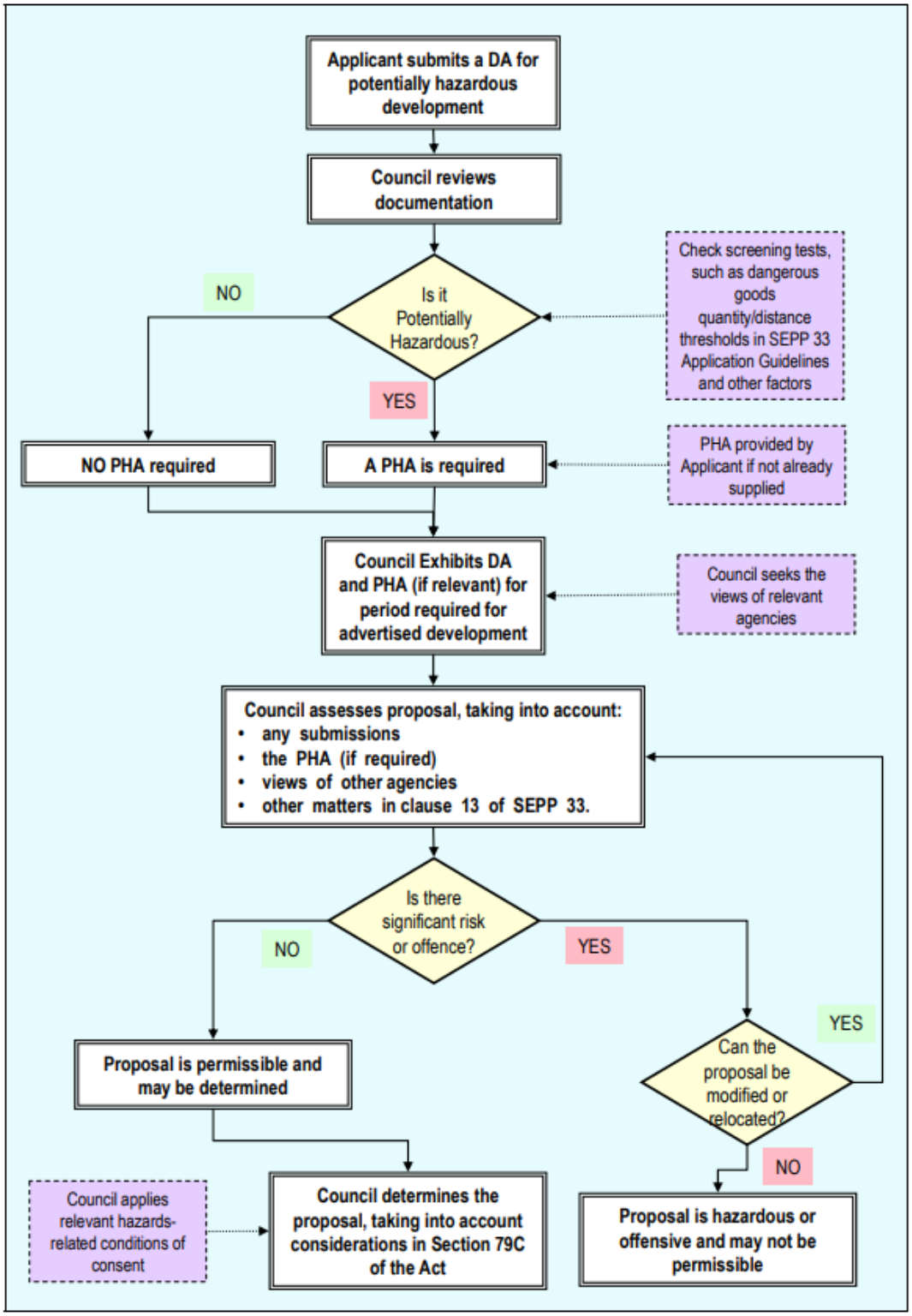


Figure 2: The Resilience and Hazards SEPP Process (extract from *Applying SEPP 33* [1])

The screening method used to determine whether a development is potentially hazardous varies based on the Class of dangerous good being assessed. Table 2 lists the table and figure references in *Applying SEPP 33* for the respective screening methods for each Class of dangerous good.

Table 2: Screening Method References in *Applying SEPP 33* [1]

Class	Description	Method to Assess Quantity (*Applying SEPP 33* references)	Method to Assess Transportation (*Applying SEPP 33* references)
1.1	Explosives – substances and articles which have a mass explosion hazard	Figure 5 (if > 100 kg)	Table 2
1.2	Explosives – substances and articles which have a projection hazard but not a mass explosion hazard	Table 3	Table 2
1.3	Explosives – substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both but not a mass explosion hazard	Table 3	Table 2
2.1	Flammable gases - pressurised (excluding LPG)	Figure 6 (if > 100 kg)	Table 2
2.1	Flammable gases - liquefied (pressure) (excluding LPG)	Figure 7 (if > 500 kg)	Table 2
2.1	Flammable gases - LPG (above and below ground)	Table 3	Table 2
2.3	Toxic gases	Table 3	Table 2
3PGI	Flammable liquids	Figure 8 (if > 2 tonne)	Table 2
3PGII	Flammable liquids	Figure 9 (if > 5 tonne)	Table 2
3PGIII	Flammable liquids	Figure 9 (if > 5 tonne)	Table 2
4	Flammable solids	Table 3	Table 2
5	Oxidisers, organic peroxides	Table 3	Table 2
6	Toxic substances	Table 3	Table 2
7	Radioactive material	Table 3	Table 2
8	Corrosive substances	Table 3	Table 2

Classes 1.4, 1.5, 1.6, 2.2 and 9 are excluded from the risk screening as they are considered to not be potentially hazardous with respect to off-site risk [1]. Combustible liquids such as diesel are not considered dangerous goods and are also excluded.

B.4.1 PHA Process

Applying SEPP 33 outlines that the NSW Department of Planning and Environment's *Multi-level Risk Assessment* [4] guideline is relevant and should be referred to when preparing PHAs. This guideline outlines three levels of analysis built around consequence-based screening and rapid risk Classification. *Multi-level Risk Assessment* describes the three approaches as follows:

- *Level 1 is an essentially qualitative approach based on comprehensive hazard identification to demonstrate that the activity does not pose a significant risk.*
- *Level 2 supplements the qualitative analysis by sufficiently quantifying the main risk contributors to show that risk criteria will not be exceeded.*
- *Level 3 is a full quantitative analysis.*

This report uses the Level 1 qualitative analysis.

A Level 1 assessment is adopted as Arup deems there to be no major off-site consequences, and societal risk is considered negligible based on the types and quantity of dangerous goods at Manning Hospital used and handled in the REF works.

A qualitative assessment (Level 1) may suffice provided all or most of the following conditions are met:

- *Screening and risk classification and prioritisation indicate there are no major off-site consequences and societal risk is negligible;*
- *The necessary technical and management safeguards are well understood and readily implemented; and*
- *There are no sensitive surrounding land uses.*

B.5 Screening Results

The screening was undertaken with reliance on the dangerous goods quantities listed in the existing dangerous goods manifest (see Addendum A), Arup's Design Report 100% Building Services and VT issued 29 July 2022[2] and Arup's Concept and Master Planning Report (Issue 2) issued 2 March 2022.

Table 3 presents the results of the screening assessment. The column labelled "minimum quantity per load" is extracted from Table 2 in *Applying SEPP 33*. *Applying SEPP 33* states that "if quantities are below this level, the potential risk is unlikely to be significant unless the number of traffic movements is high".

Applying SEPP 33 uses the Australian Dangerous Goods Code (ADGC) Edition 7.7 categorisation system.

The values represented in Table 3 are aggregate and reflect the dangerous good quantities for the entire site, not just those in the redevelopment, at the conclusion of the REF works.

Table 3: Screening Results

Class	Quantity *(kg or L)*	Quantity threshold *(kg or L)*	Threshold exceeded?	Minimum quantity per load (tonne)	Maximum peak weekly vehicle movements Exceeded? (If minimum quantity exceeded)	Transportation threshold exceeded?
2.1 (LPG)	30,000	10,000	Yes	2	No	No
3	393.5	2000	No	1	No	No
4.2	3	1000	No	2	No	No
5.1[2]	19,500	5000	Yes	2	No	No
8	5[2]	5000	No	2	No	No

2 The total quantity of Class 5.1 materials includes the liquid oxygen and nitrous oxide (Class 2.2/5.1)

The quantity of Classes 2.1 (LPG) and 5.1 (oxidising) **exceeds the screening threshold**. Therefore, **a PHA is required**.

The results of the PHA are presented in Section B.6.

In Addendum B, the changes in the dangerous goods storage involved in the REF works are summarised.

[2] Doc ref: MEP-RPT-002

B.6 Risk Classification and Prioritisation

The quantity of DG Classes 2.1 and 5.1 exceeds the screening threshold. The primary contributors to these quantities are the liquid oxygen (Class 5.1) and LPG (Class 2.1).

As threshold are exceeded in screening, as outlined in Appendix 5 of *Applying SEPP 33*, the *Multi-level Risk Assessment* guidance material is used to determine the type of analysis.

Page 12 of *Multi-level Risk Assessment* outlines that a qualitative analysis can be considered sufficient only if there are no harmful consequences extending significantly beyond the site boundary. Compliance with the following standards limits the consequences extending significantly beyond the site boundary:

- AS/NZS 1596-2014 *The storage and handling of LP Gas*
- AS 1894-1997 *The storage and handling of non-flammable cryogenic and refrigerated liquids*
- AS 1940-2017 *The storage and handling of flammable and combustible liquids*
- AS 4332-2004 *The storage and handling of gases in cylinders*

Based on the above, there is potential for offsite risk for some of the dangerous goods stored/ proposed to be stored on site, this will be assessed qualitatively.

To complete the classification process, the following matters are reviewed to assess the potential impacts off-site:

- Likelihood of container/ tank failure;
- Consequence of container/ tank failure;
- Off-site populations and;
- Risk of fatality

The impacts to on-site populations are also assessed.

B.6.1 Bulk Flammable Gases

There are existing aboveground LPG tanks (4 x 7,500 L) that have a total capacity of 30,000 L. It is assumed that Manning Hospital originally conducted a PHA in its initial development. Thus, for the existing LPG tanks there are no major offsite consequences and societal risk is negligible as originally screened in the PHA.

B.6.2 Cylinder Storage

The existing cylinder stores of medical air, oxygen (back-up supply to the liquid oxygen tank) and nitrous oxide to the east of the hospital are proposed to be upgraded and relocated to the loading dock. Drawings ARP-MG0-3-DWG-01-01 and ARP-MG-03-DWG-02-01 show four-cylinder stores: tool air and nitrous oxide cylinders (provided in the loading dock) and medical air and oxygen for Special Care (located on Level 2)

The existing back-up oxygen cylinder store is proposed to be replaced by a liquid oxygen tank, see Section B.6.4 of this report for details around the separation and construction of this store.

The proposed cylinder store gases and quantities include:

- 1,500 L (water aggregate) of nitrous oxide: Two primary-secondary banks of 15 G-sized cylinders each (Source: Section 5.3.5.4 of Manning Hospital Stage 2 Scheme Design Report);
- 1,500 L (water aggregate) of surgical tool air: Two primary-secondary banks of 15 G-sized cylinders each (Source: Section 5.3.5.5 of Manning Hospital Stage 2 Scheme Design Report). Note: Manning Hospital Stage 2 Scheme Design Report does not illustrate the location for these cylinder banks. It is assumed they will be located within the medical air cylinder store, as the report only specifies that the medical air cylinders will be stored in the special care store to the right of the LPG tank; and
- The medical air facilities include:
    - Medical air for the new IPU building will be generated by a new, standalone oil free compressor plant (oil free and no cylinders therefore no dangerous goods considerations) in the Level 7 plant room;
    - A new special care emergency medical air and oxygen cylinder supply to be provided on Level 2. Medical gas sizing calculations done on 28 July 2022 by Arup's Design Team outlines that two G-sized oxygen cylinders (360 L aggregate water capacity) and two G-sized medical air cylinders (283 L aggregate water capacity) will be provided.

Due to the proximity of the cylinders containing tool air and nitrous oxide, these stores are not considered minor storage . Therefore, the store must achieve compliance with Section 4: Construction and Location of Stores of AS 4332:2004 *The storage and handling of gases in cylinders.*

B.6.2.1 Likelihood of Container Failure

As the construction of the gas storage cylinders must comply with AS 4332, however, the failure rate of the cylinders is not a determining factor for the assessment of off-site risk.

B.6.2.2 Consequence of Container Failure

The cylinders of medical air and surgical tool air do not pose a specific hazardous substance risk, only a mechanical one (risk of cylinder rupture).

Regarding the nitrous oxide cylinders, leaks of this gas could have a twofold effect on the immediate environment around the storage location. A leak, leading to an accumulation of gas, could cause a potentially dangerous environment where the release of nitrous oxide could cause:

- Loss of coordination;
- Feeling of giddiness;
- Loss of consciousness; or
- Death (in exceptionally large doses).

Additionally, releases of nitrous oxide can reduce the amount of available oxygen in the atmosphere and lead to low oxygen environment. As the storage facilities where these cylinders are stored is outside, there is negligible off-site risk as the likelihood of high concentrations of the leaked gas accumulating is not likely. This is because any release of the gas into the atmosphere will be quickly diluted meaning that the exposure to, or low oxygen environments caused will be minimal if present at all. Provided the ventilation requirements in Section 4 of AS 4332 are met, the risk of an oxygen depleted environment is negligible.

Additionally, as nitrous oxide is a Schedule 4 medicine, a lockable open wire mesh cage or similar storage area is required. This would mean that inadvertent exposure to a large dose is unlikely, as only trained personnel, who understand this risk should have access to the storage facilities.

B.6.2.3 Off-Site Populations

The hospital is surrounded on all sides by residential areas. The future location of the gas cylinder storage is within the loading dock on York St, approximately 23 m from the closest residential dwelling.

B.6.2.4 Off-Site Risk of Fatality

AS 4332, Table 4.1, dictates the minimum separation distances for Class 2.2/5.1. As the cylinder goods are in a store that contains more than 2000 L of gases in cylinders by aggregate (not the Special Care store), the separation distances will be specific to that volume.

The minimum separation to protected places and the boundary of the premises shall be 5 m and 1 m, respectively. Based on the drawing ARP-MG-03-DWG-01-01 this will be achieved.

As this separation distance is achieved, Arup considers there to be no major offsite consequences and societal risk is negligible, therefore, a qualitative analysis is deemed appropriate.

B.6.2.5 On-Site Risk

AS 4332 specifies the required separation distances of cylinder stores from protected places and other sensitive receptors, as it relates to quantities above minor storage.

To minimise on-site risk as low as reasonably practicable, the requirements in AS 4332 must be met. These include relevant clauses from AS 4332 and AS 1596 summarised in Table 4.

Table 4: On-site separation distances (Source Table 4.1 of AS 4332 and Clause 6.2.5 AS 1596)

Items from which separation is required	Minimum distance		Achieved?
	Class 2.2	Class 2.2/5/1	
Protected places	5 m	5 m	Yes, drawing ARP-MG-03-DWG-01-01 complies with separation distances
On-site protected places	3 m	3 m	Yes, drawing sketch ARP-MG-03-DWG-01-01 shows no on-site protected place within 3 m of the cylinder stores
Stores for other dangerous goods, combustible liquids or combustible materials[3]	3 m	5 m	Yes, the distance between the cylinder store and bulk oxygen tanks is approximately 9 m (due to the protective enclosure) based on drawing ARP-MG-03-DWG-02-01
Filling/decanting points for packages of dangerous goods or combustible liquids, or dangerous goods or combustible liquids in bulk	3 m	5 m	Yes, to be specified in detailed design that the LPG filling operation cannot be within 5 m of this store
Stores of LPG	6 m for oxidising agents		Yes, the distance is 20.99 m according to BVN-AR-EW-10A

If separation distances cannot be achieved from a *protected place*, a screen wall that is rated to a Fire Resistance Level (FRL) of at least 240/240/240 can be used, as separation distances are measured around fire rated walls. Fire walls must extend at least one (1) m above the highest cylinder in the store.

The separation distance to the bulk oxygen storage area is approximately 9 m, measured around the protective enclosure based on the drawing ARP-MG-03-DWG-02-01.

The protective enclosure to be built around the tanks, shall be constructed to achieve FRL 240/240/240. Moreover, the height of the bund shall be such that the 5 m required distance is achieved when measured from the top of the internal perimeter of the bund to the edge of the cylinder store.

[3] Where these other dangerous goods are required to be kept within a bund, specified minimum distances shall be measured from the top internal perimeter of the bund

Ventilation must comply with Clause 4.3 of AS4332. As this cylinder store is outside, natural ventilation is proposed. To comply with Clause 4.3.3 the following requirements shall be met.

To comply with natural ventilation requirements, the store shall have one of the following:

- Two opposing external sides that are open from floor to ceiling (see Figure 3 (a));
- One external side that is open, provided that the length of the open side is at least twice the distance of that wall from the opposite side (see Figure 3 (b)); or
- Vents in at least one pair of opposing external sides (see Figure 3 (c)), provides that –
    - The distance between the opposing external sides does not exceed 10m;
    - In every 2 m length of the opposing external walls, there are at least two vents; one positioned immediately above the floor and the other positioned immediately below the ceiling;
    - The total area of the vents per meter length of wall shall be at least 0.1 m^2 and
    - Vents shall be evenly distributed.

The openings of a natural ventilated system may be covered by one of the following:

- Wire mesh or grill;
- Louvres;
- For open, external walls only, chequered brickwork, vent bricks, slotted roller doors or equivalent; or
- Fire dampers, where required.

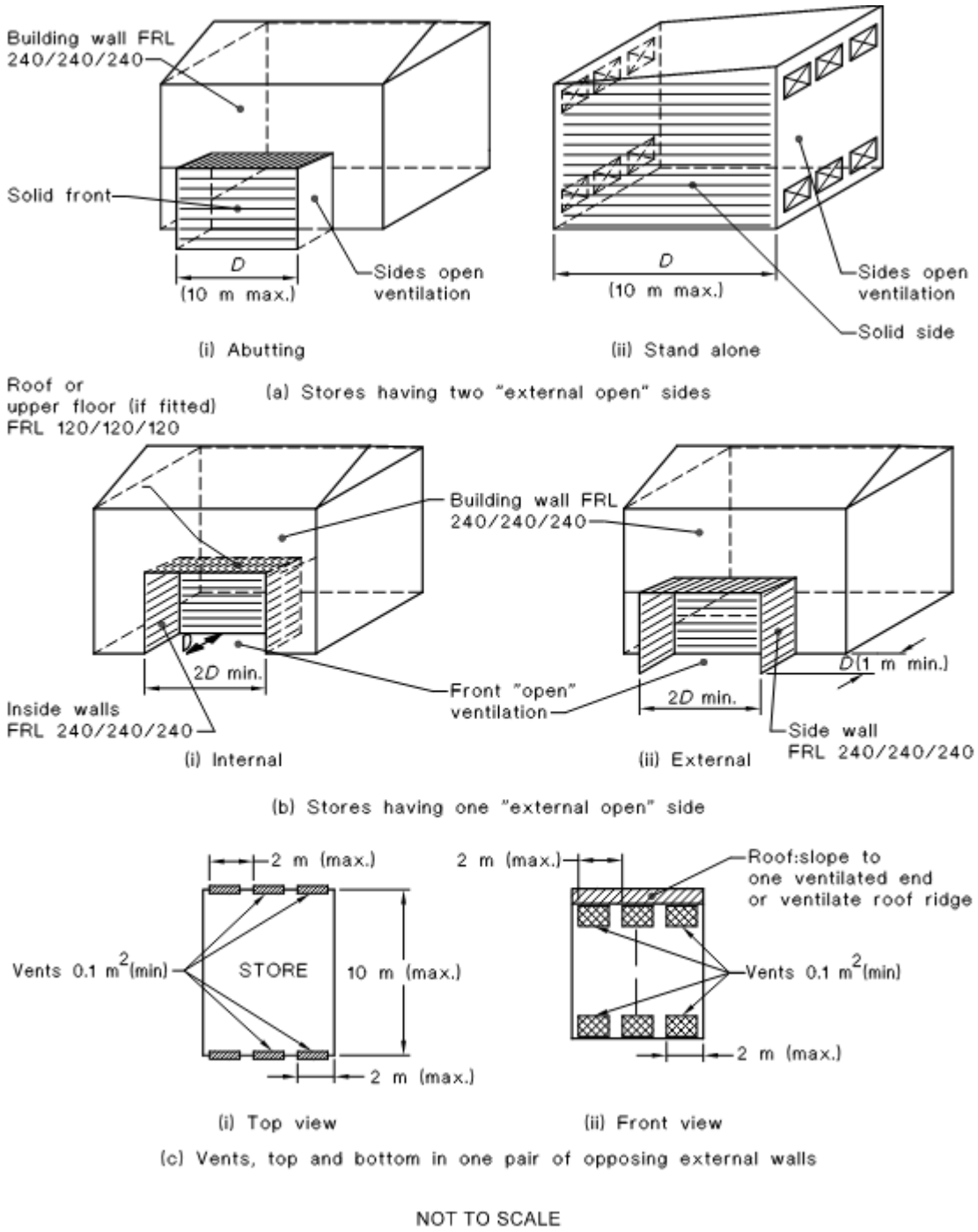


Figure 3: Schematic of naturally ventilated stores (Source: Figure 4.1 of AS4332)

Regarding segregation within the store, as only Classes 2.2 and 2.2/5.1 are stored, no internal segregation is required in the store.

B.6.3 Flammable Liquids

The existing manifest shows that 393.5 L of Class 3 DG will be stored in a chemical storage cabinet. In accordance with Clause 4.9.6(b) of AS 1940:2017 *The storage and handling of flammable and combustible liquids*, cabinets having a capacity greater than 250 L shall not be installed in hospitals.

While the maximum quantity of flammable liquids is below the Resilience and Hazards SEPP requirement, the PHA needs to consider all dangerous goods on-site and how they will impact other dangerous goods.

B.6.3.1 Likelihood of Container Failure

As the flammable liquids will be stored in flammable goods cabinets, the construction of the cabinets must comply with AS 1940:2017, therefore, the failure rate of the packaged flammable liquids is considered negligible.

B.6.3.2 Consequence of Container Failure

In the event that one of the packages leaks into the cabinet it would form a pool within the cabinet. This flammable liquid can be ignited from an ignition source. The liquid may also vaporise creating an explosive atmosphere in the vicinity of the cabinet.

B.6.3.3 Off-Site Populations

The hospital is surrounded on all sides by residential areas. While the future location of the cabinets is not known, the following Section B.6.3.4 will outline the required separation distances to off-site locations to ensure the flammable liquids do not pose an unacceptable risk to off-site populations.

B.6.3.4 Off-Site Risk of Fatality

As the stores exceed the minor storage threshold as outlined in AS 1940 and the store contains material from PG II and PG III, the separation distance from protected places is unrestricted, as each aggregate of cabinets may only be 250 L, provided that each 250 L cabinet is separated by at least 10 m.

It is recommended that 2 x 250 L cabinets be used in place of a 400 L cabinet which is non-compliant with Clause 4.9.6 (b) to achieve an *Applying SEPP33* assessment of no major offsite consequences and societal risk being negligible.

B.6.3.5 On-Site Risk

As noted in Section B.6.3.4 one 400 L cabinet is utilised for the storage of Class 3 flammable liquids, in Addendum A it is noted that small quantities of Class 8 corrosive liquids and Class 4.2 spontaneously combustible materials are also stored in this cabinet. This storage configuration is not permitted.

Cabinets greater than 250 L shall not be installed in hospitals in accordance with Clause 4.9.6(b). Note, the existing manifest did outline a cabinet capacity of 400 L, this is not permitted in accordance with the above Clause. The assessment of on-site risk is predicated on the implementation of 2 x 250 L cabinets as recommended in B.6.3.4.

The aggregate capacity of cabinets on floors above ground shall be 250 L per 250 m^2 of floor area. Each aggregate capacity shall be separated by at least 10 m.

There shall be no ignition sources outside each cabinet within 3 m measured laterally and from the floor level to a height of 1m above any opening in the cabinet, including the door, or a distance determined in accordance with AS/NZS 60079.10.1.

Where these cabinets are stored internally within the building, the required separation distances from on-site protected places are the same as protected places as outlined in Clause 4.3.1(b) of AS1940. In this case, as the maximum storage capacity of a cabinet within a hospital is 250 L, this separation is unrestricted.

The construction of stores inside the building containing flammable goods above minor storage, must comply with Clause 4.4 of AS1940, this includes:

- Separating walls shall be constructed of a material having an FRL of at least 240/240/240. The failure of any component with an FRL of less than 240/240/240 shall not jeopardize the stability of any fire wall;
- The floor of the store shall be of reinforced concrete having an FRL of at least 180/180/180;
- The roof of the store shall be of a material having an FRL of at least 180/180/180

Each package store shall be provided with adequate natural or mechanical ventilation in accordance with Clause 4.5.

Regarding the storage of drums in cabinets (as they are listed in the existing manifest), in accordance with Clause 4.9.8, drums shall not be stacked more than two high if they are greater than 60 L capacity and only one drum of more than 60 L capacity should be kept in a horizontal (decanting) position at any time.

B.6.4 Oxidising Substances

The existing primary bulk liquid oxygen tank will be upgraded to a 15,000 L (refilled approximately every 2 weeks) and relocated to the loading dock. The proposed back-up solution is a 3,000 L vessel (replacing cylinders). These vessels are contained within the same area as shown in drawing ARP-MG-03-DWG-01-01.

B.6.4.1 Likelihood of Tank Failure

The UK HSE *Failure Rate and Event Data for use in Risk Assessments* [5] gives a catastrophic[4] tank failure rate of 2.2 x 10^{-5} per year for single walled Liquid Oxygen (LOX) Refrigerated Vessels. For major leaks[5], the rate is 1 x 10^{-4} per year and for minor failure 8 x 10^{-5} per year.

These failure rates are considered acceptable risks as set out by HIPAP 4, as they are low relative to other known and tolerated risks.

B.6.4.2 Consequence of Tank Failure

In the event of tank failure, a pool of vaporising liquid oxygen will form within the secondary containment bunding around the vessel. This cloud will produce a cool layer of oxygen moving in the downwind direction. The consequence from this release is the potential for producing an oxygen enriched atmosphere (above 23% oxygen concentration in air). This could potentially increase the combustibility of combustible materials such as used boxes or cartons, wastepaper, firewood, tyres, or the like, and fuel existing fires. However, as the tanks are located outside, the oxygen will dilute

[4] Catastrophic failure: Sudden and total failure from which recovery is impossible.

[5] Major leak: Leak hole sizes between 25-50 mm for pressure vessels

into the atmosphere very quickly, resulting in no major offsite consequences and societal risk being negligible.

B.6.4.3 Off-Site Populations

The hospital is surrounded on all sides by residential areas. The 15 kL and 3 kL vessel is proposed to be stored outside, in the location of the existing mortuary. From the perimeter of the bund, it is 14 m to the site boundary according to the drawing ARP-MG-03-DWG-01-01. This meets minimum property boundary separation requirements (see Table 5).

B.6.4.4 Off-Site Risk of Fatality

Oxygen is non-toxic and non-combustible. However, it is a strong oxidiser, so it can increase the ability for other materials such as diesel to burn. Additionally, contact with liquid oxygen can cause frostbite on exposed skin and eye damage.

AS 1894:1997 *The storage and handling of non-flammable cryogenic and refrigerated liquids* Table 4.1 dictates the minimum separation distances for liquid oxygen, relating to off-site risks.

Table 5: Separation distances from liquid oxygen tanks (Source: Table 4.1 of AS1894)

Items from which separation is required	Minimum distance	Achieved?
Property boundary	4 m	Yes, the distance to the property boundary is 14 m according to the drawing ARP-MG-03-DWG-01-01
Street, road boundary or car park, other than authorised vehicles[6]		Yes, the distance to the street is more than 14 m according to the drawing ARP-MG-03-DWG-01-01. The loading dock is not used as a carpark
Areas where open flames, smoking or sources of ignition are permitted[7]		Yes, as long as a no smoking sign is installed in the vicinity of the storage tanks
Fixed installations of gases in cylinders[8]		Yes, the drawing ARP-MG-03-DWG-02-01 shows a separation distance of approximately 9m, measured around the protective enclosure.
Other dangerous goods stores of other Classes or subsidiary risks		Yes, the drawings ARP-MG-03-DWG-01-01 and ARP-HS-03-DWG-00-01 shows the underground LPG tank and 5 kL diesel tank is greater than 4 m away
Stores of LPG	6 m for oxidising agents	Yes, the distance is 20.99 m according to BVN-AR-EW-10A

Note: Combustible materials refers to such things as used boxes or cartons, wastepaper, firewood, tyres, or the like, but not to materials in structures such as timber in a fence or building walls. This separation is measured horizontally. The vertical separation distance required to the specific locations is 7.2 m. The vertical separation is measured over the top of the protective enclosure. A roof having an FRL of 240/240/240 is necessary when the vertical separation distance cannot be achieved otherwise. However, this separation distance may be halved if the combustible material is slow burning e.g., coal or heavy timber.

[6] Note, this separation distance may be measured around a screen wall. The separation distance is measured horizontally. The vertical separation distance shall be at least 1.6 m and is measured over the top of the protective enclosure.

[7] Electrical equipment complying with the requirements of Clause 4.10 is not considered an ignition source.

[8] Separation may be achieved by the use of a non-combustible splash guard that is as high as any pipework connected to the vessel or extends at least 500 mm above the uppermost point of any cylinder, whichever is the higher. Cylinders shall be kept at least 50 mm above the ground

While AS 1894 specifies a separation distance of 4 m between the bulk oxygen and cylinder store, AS 4332 required 5 m separation between these two stores. The greater distance of 5 m as specified in AS 4332 is used.

The protective enclosure to be built around the tanks, shall be constructed to achieve a FRL of 240/240/240 and the height of the bund shall be that the 5 m is achieved when measured from the top of the internal perimeter of the bund to the edge of the cylinder store.

Implementing the above requirements results in no major offsite consequences and societal risk being negligible, as separation distances in compliance with AS 1894 is deemed sufficient .

B.6.4.5 On-Site Risk

AS 1894 Table 4.1 specifies the minimum separation distances for liquid oxygen from protected places and sensitive receptors.

Table 6: On-site separation distances (Source: Table 4.1 of AS1894)

Items from which separation is required	Minimum distance	Achieved?
Building or structure with non-combustible exterior, or sprinklered building of other construction	4 m	Yes
Property boundary Street, road boundary or car park, other than authorised vehicles[9] Areas where open flames, smoking or sources of ignition are permitted[10] Fixed installations of gases in cylinders[11] Other dangerous goods stores of other Classes or subsidiary risks	4 m	Yes See Table 4. All separation distances are achieved, as seen in drawings ARP-MG-03-DWG-01-01, ARP-MG-03-DWG-02-01 and ARP-HS-03-DWG-00-01
Medium or high voltage electrical equipment greater than 415 volts e.g., substation Building or structure with combustible exterior Openings in walls of adjacent buildings or structures[12]	5 m	Yes, the separation to the existing generator is 5 m according to the drawing ARP-MG-03-DWG-01-01
Areas where personnel can congregate e.g., offices[13] Compressor or ventilator air intakes	7 m	Yes, it has been confirmed by Arup's Design Team that within a radius of 7 m there shall be no areas including in the existing inpatients building where personnel can congregate.
Places of public assembly[14] Areas of buildings where patients are confined to bed[15] Solid combustible material	12 m	Yes, it has been confirmed by Arup's Design Team that within a radius of 12m there shall be no areas including in the existing inpatients building where patients can be confined to bed. Emergency evacuation assembly points are considered public assembly points, therefore in the emergency response plan, the assembly points must be 12 m away minimum. Yes, combustible material shall not be placed within 12 m of the tanks. This includes the surrounding trees. Trees that are within 12 m of the tanks shall be removed. Due to the redevelopment, its assumed this will be achieved as clearing will be required for the LPG tank.

[9] Note, this separation distance may be measured around a screen wall. The separation distance is measured horizontally. The vertical separation distance shall be at least 2.4m, and is measured over the top of the protective enclosure.

[10] Electrical equipment complying with the requirements of Clause 4.10 is not considered an ignition source.

[11] Separation may be achieved by the use of a non-combustible splash guard that is as high as any pipework connected to the vessel or extends at least 500 mm above the uppermost point of any cylinder, whichever is the higher. Cylinders shall be kept at least 50 mm above the ground

B.6.5 Combustible Liquids

A 5,000 L diesel tank is integral to the existing generator, right of the loading dock on York St.

Regarding the diesel storage on-site, it is Classified as a C1 combustible material. C1 combustible liquids are not a dangerous good under UN Classification. Diesel however, is defined as dangerous goods under workplace legislation and AS1940 sets out requirements specifically for C1 combustibles.

It is assumed that Manning Hospital originally conducted a PHA in its initial development. Thus, for the existing diesel tank there are no major offsite consequences and societal risk is negligible as originally screened in the PHA.

B.6.6 Controlling the Risk

Based on the preceding analysis, when all requirements are implemented, Arup considers there to be no major offsite consequences and societal risk is negligible, as per *Applying SEPP33*.

It is concluded that compliance with appropriate Australian Standards will provide adequate risk management for the facility.

[12] This separation distance may be measured around a screen wall. This separation is measured horizontally, the vertical separation distances is 3 m. A roof achieving an FRL of 240/240/240 is necessary when the vertical separation distance cannot be achieved otherwise.

[13] This separation distance may be measured around a screen wall. This separation is measured horizontally, the vertical separation distances is 4.2 m. A roof achieving an FRL of 240/240/240 is necessary when the vertical separation distance cannot be achieved otherwise.

[14] This separation distance may be measured around a screen wall. This separation is measured horizontally, the vertical separation distances is 7.2 m. A roof achieving an FRL of 240/240/240 is necessary when the vertical separation distance cannot be achieved otherwise.

[15] This separation distance may be measured around a screen wall. This separation is measured horizontally, the vertical separation distances is 7.2 m. A roof achieving an FRL of 240/240/240 is necessary when the vertical separation distance cannot be achieved otherwise.

B.7 Pipeline Corridor Consultation

A Dial Before You Dig query was conducted on 13th July 2023. No service operator has communicated the existence of any transmission or high-pressure pipelines within the site boundary of Manning Base Hospital. Therefore, no consultation with pipeline operators is required. Note, these results are valid for 28 days from date of enquiry.

B.8 Dangerous Goods Requirements

The requirements for storage of dangerous goods are defined in guidance materials and standards. The applicable Australian Standards for the Manning Base Hospital REF works include:

- AS/NZS 1596-2014 The storage and handling of LP Gas;
- AS 1894-1997 The storage and handling of non-flammable cryogenic and refrigerated liquids;
- AS 1940-2017 The storage and handling of flammable and combustible liquids, and;
- AS 4332-2004 The storage and handling of gases in cylinders.

The requirements for flammable gases, Class 2.2 cylinder storage, flammable liquids, oxidising substances and combustible liquids can be found in Section B.6 of this report.

B.9 Recommendations

Arup's recommendation is to ensure compliance with the requirements outlined in Section B.6 of the report including notably required separation and segregation distances. Overall, Arup foresees no issues with compliance to appropriate Australian Standards.

In order to achieve compliance, Arup recommends;

- Using 2 x 250 L cabinets be used in place of the 400 L cabinet which is non-compliant with Clause 4.9.6 (b) of AS 1940 *The storage and handling of flammable and combustible liquids* and;
- Remove Class 8 corrosive liquids and Class 4.2 spontaneously combustible materials from storage with the Class 3 flammable liquids.

During detailed design, ensure the separation distances outlined in Section B.6 are complied with. These include:

- The required separation distance between the Special Care cylinder storage and bulk oxygen storage; and
- The separation distance from the cylinder store above minor quantities (not the Special Care store) to on-site protected places.

Arup also recommends that the requirements for the areas yet to be full designed in this report are complied with, to ensure that the necessary standards are met.

It is also recommended that Fire and Rescue NSW be informed, if appropriate thresholds are exceeded, of the volumes of dangerous goods being stored on site.

B.10 Conclusions

The Resilience and Hazards SEPP screening process identified two dangerous goods classes in the dangerous goods manifest exceeding the *Applying SEPP33* thresholds.

This led to a Preliminary Hazard Analysis (PHA) in accordance with *Applying SEPP33* which identified that minimum separation distances for site boundaries, protected places and between dangerous goods stores are met.

The analysis also identified that the storage cabinets for Class 3 flammable liquids exceeded the maximum cabinet volume (250 L) and the non-compliant storage of Class 8 and Class 4.2 materials with the Class 3 flammable liquids. These issues can be resolved by following the recommendations given in Section B.9.

If the recommendations in Section B.9 are met then the following outcomes are achieved:

- Off-site Populations:
    - The separation distances of dangerous goods stores to off-site populations are compliant to the relevant Australian Standards. Therefore, Arup deems there to be **there are no major offsite consequences and societal risk is negligible** based on the analysis conducted and the information obtained from Mace Group as outlined in this document.
- On-site Populations:
    - Arup expects compliance to appropriate Australian Standards is achievable based on the information provided, as outlined in this report. During detailed design, ensure the separation distances outlined in Section B.6 are complied with. Arup deems there to be **negligible risk to onsite populations** based on the assessed dangerous goods, provided compliance with relevant Australian Standards is achieved and the information provided by Mace Group.

B.11 References

[1] NSW Department of Planning and Environment, “Resilience and Hazards SEPP | Fact sheet - March 2022,” March 2022. [Online]. Available: https://www.planning.nsw.gov.au/-/media/Files/DPE/Factsheets-and-faqs/Policy-and-legislation/SEPP-2021/Fact-Sheet---Resilience-and-Hazards-SEPP.pdf?la=en.

[2] NSW Department of Planning, “Applying SEPP 33,” January 2011. [Online]. Available: https://www.planning.nsw.gov.au/~/media/Files/DPE/Guidelines/hazardous-and-offensive-development-application-guidelines-applying-sepp-33-2011-01.ashx?la=en.

[3] NSW Department of Planning, “Hazardous Industry Planning Advisory Paper No. 6 Hazard Analysis”. January 2011. [Online]. Available: https://www.planning.nsw.gov.au/-/media/Files/DPE/Other/hazardous-industry-planning-advisory-paper-no-6-hazard-analysis-2011-01.pdf?la=en

[4] NSW Department of Planning, “Assessment Guideline Multi-Level Risk Assessment”. May 2011. [Online]. Available: https://www.planning.nsw.gov.au/-/media/Files/DPE/Guidelines/assessment-guideline-multi-level-risk-assessment-2011-05.pdf?la=en

[5] HSE, “Failure Rate and Event Data for use within Risk Assessments”, November 2017. [Online]. Available: https://www.hse.gov.uk/landuseplanning/failure-rates.pdf

Addendum A

Existing Dangerous Goods Manifest

DANGEROUS GOODS & COMBUSTIBLE MATERIAL MANIFEST

GENERAL INFORMATION

Occupier: Manning Health Campus, Hunter New England Local Health District.

Address of Premises: 26 York Street Taree NSW 2430

EMERGENCY CONTACTS

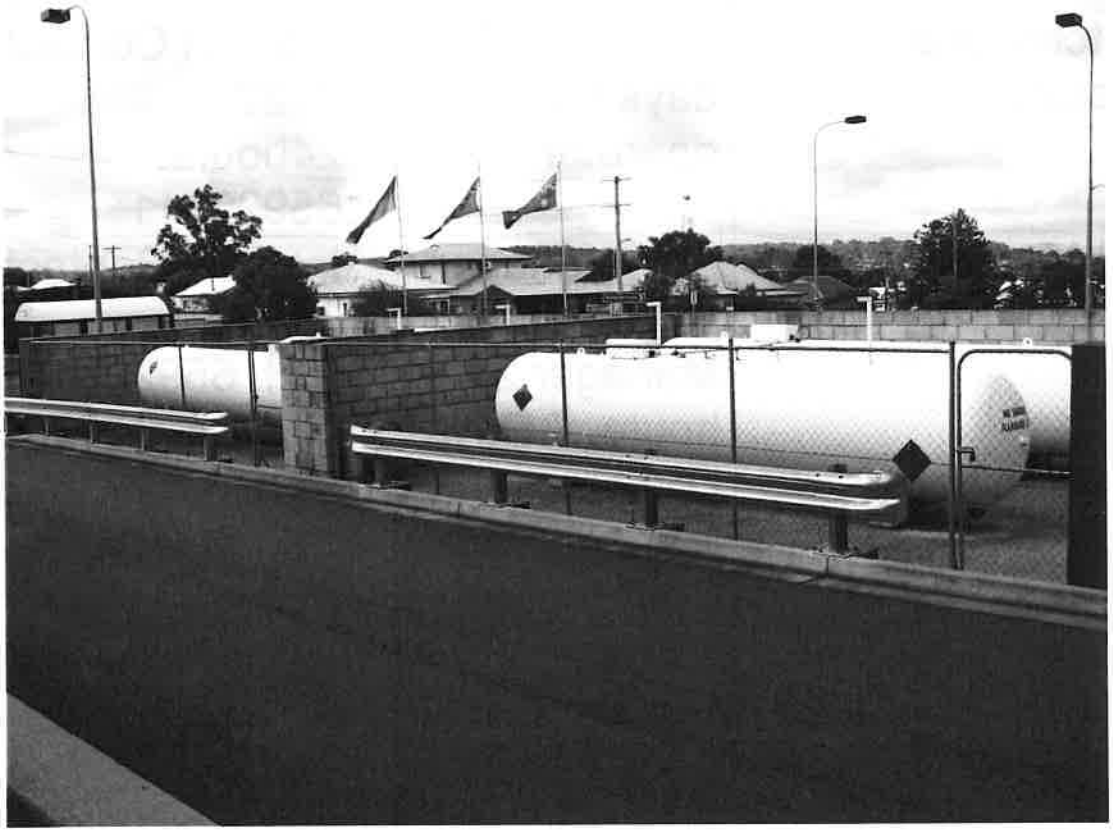
NAME	POSITION	TELEPHONE
Switchboard Operator	24 hours, 7 days telephone operator	Internal Contact: 2222 24hours: 65929111
Bed Manager	Bed Manager / After Hours Manager 24 hours, 7 Days	Internal Contact: 29014 B/H: 65929014 Mob 0423782827
Ross Moylan	Disaster Management Coordinator	MOB: 0427101527

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION

Location: MAP REFERENCE LPG 1-4
Above Ground tanks

Identifier LPG	*Type of Storage Location*	*Maximum Storage Capacity*				
	Above ground Tanks 4 x 7500Litre Tanks	TOTAL 30.000 litre Likely 6,000 litre maximum working volume per tank.				
UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1075	**Petroleum Gases Liquefied**	**2.1**	**N/A**	**N/A**	**24,000**	**Litre**



Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION

Location: MAP REFERENCE O-1

Identifier O-1e	*Type of Storage Location*	*Maximum Storage Capacity*
	Above ground Tank	**7,000 litre**

UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1073	**Liquid Oxygen**	**2.0**	**5**	**N/A**	**5,000 Lt**	**Litres Liquid**

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION

Location: REFERENCE O- 2

Identifier	*Type of Storage Location*	*Maximum Storage Capacity*				
O-2	**Caged Cylinders**	**30 cylinders**				
UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1072	**Medical EP Grade Oxygen**	**2.2**	**5.1**	**N/A**	**248,800**	**Litres Vapour**

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION

Location: MAP REFERENCE MED AIR 1

Identifier	*Type of Storage Location*	*Maximum Storage Capacity*
MED AIR 1	**Caged Cylinders- Non Flammable Non Toxic**	**16 cylinders**

UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1002	**Medical Dry Air**	**2.2**	**5.1**	**N/A**	**102,600**	**Litres Vapour**

Identifier	*Type of Storage Location*	*Store Location Class*	*Maximum Storage Capacity*
MED AIR 1	**Caged Cylinders- Non Flammable Non Toxic**	**2.2**	**19 cylinders**

UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1070	**Nitrous Oxide**	**2.2**	**5.1**	**N/A**	**251,000**	**Litres Vapour**

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION

Location: MAP REFERENCE MED AIR 2

Identifier	*Type of Storage Location*	*Maximum Storage Capacity*
MED AIR 2	**8 Pack Cylinders- Within Plant Room Non Flammable Non Toxic**	**8 cylinders**

UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1002	**Medical Dry Air**	**2.2**	**5.1**	**N/A**	**51,300**	**Litres Vapour**

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION

Location: MAP REFERENCE O-3

Identifier	*Type of Storage Location*	*Maximum Storage Capacity*
O-3	**Caged Portable Cylinders- Non Flammable Non Toxic**	**60 cylinders**

UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1072, 1070, 1002,	**Medical EP Grade Oxygen- C,D,E Oxygen, Air, Nitrous Oxide**	**2.2**	**5.1**	**N/A**	**106,000**	**Litres Vapour**

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION
Location: MAP REFERENCE DG-1
Pathology Storage

Identifier	*Type of Storage Location*	*Maximum Storage Capacity*
DG-1	**Flammable Storage Cabinet**	**400 Litres**

UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1170	**ALCOHOL 95%**	**3**	**N/A**	**II**	**90L**	**10L DRUM**
1230	**METHANOL AR**	**3**	**N/A**	**II**	**40L**	**20 L DRUM**
1307	**XYLENE**	**3**	**N/A**	**II**	**2.5L**	**2.5L**
1362	**CHARCOAL, ACTIVATED**	**4.2**	**N/A**	**III**	**3Kg**	**3Kg BUCKET**
1789	**HYDROCHLORIC ACID**	**8**	**N/A**	**II**	**2.5L**	**2.5L BOTTLE**
1866	**FAST MOUNT**	**3**	**N/A**	**II**	**1L**	**100ML**
2052	**HISTOLINE**	**3**	**N/A**	**III**	**80L**	**10L**
2789	**ACETIC ACID, GLACIAL,AR**	**8**	**N/A**	**II**	**2.5L**	**2.5L BOTTLE**

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION

Location: MAP REFERENCE DG-3
Waste Storage Area

Identifier	*Type of Storage Location*	*Maximum Storage Capacity*
DG-3	**Flammable Storage Cabinet**	**250 Litres**

UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
2052	**HISTOLINE**	**3**	**N/A**	**III**	**180L**	**10L DRUM**

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

SUBSTANCE, QUANTITIY & LOCATION

Location: MAP REFERENCE D1
Emergency Diesel Generator

Identifier	*Type of Storage Location*	*Maximum Storage Capacity*
D1	**Diesel fuel storage**	**5000 Litres**

UN Number	*Product or Common Name*	*Class*	*Sub Risk*	*PG (I, II, III)*	*Typical Quantity*	*Unit, e.g. L. Kg.*
1202	**DIESEL FUEL**	**C1**	**N/A**	**III**	**5000**	**Litres**

Developed 10/01/2006, Reviewed 8/04/2010, Reviewed 12/04/2011, Reviewed 5/09/2012. Reviewed 13/06/2017. Reviewed 16/07/2019.

Addendum B

REF Works Drawings

MANNING BASE HOSPITAL

Combined Services
REF Drawings

Sheets List (REF)		
Sheet Number	Sheet Name	Current Revision
ARP-MEP-REF-10A-XX-00	Staging Diagram Construction Cover Sheet	A
ARP-MEP-REF-10A-XX-51	Staging Diagram Construction Stage - 1	A
ARP-MEP-REF-10A-XX-52	Staging Diagram Construction Stage - 2	A
ARP-MEP-REF-10A-XX-53	Staging Diagram Construction Stage - 3	A

ISSUE	DATE	FOR
A	30/06/23	For Information

CONSULTANT
ARUP
Level 5 Barrack Place, 151 Clarence St
Sydney, NSW, 2000
Tel +61(0)29320 9320 Fax +61(0)29320 9321
www.arup.com

CONSULTANT
ARCADIA
TEL +61 2 85712900

CONSULTANT
Blackett Maguire + Goldsmith
TEL +61 2 92117774

CONSULTANT
EMF Griffiths
TEL +61 7 55932075

CONSULTANT
Enstruct
TEL +61 2 89041444

ARCHITECTS
BVN
TEL +61 2 8297 7200

PROJECT MANAGER
MACE
TEL +61 2 91268010

CLIENT
NSW GOVERNMENT Health Infrastructure

PROJECT

MANNING BASE HOSPITAL
26 York Street, Taree, NSW 2430

BVN PROJECT NUMBER

2101013

DRAWING KEY

GRAPHIC SCALE

SCALE
@A1

STATUS
Design Development

DRAWN BY:	MOC	DESIGNED BY:	MOC
CHECKED BY:	EC	APPROVED BY:	EC

DRAWING

Staging Diagram Construction Cover Sheet

ISSUE

ARP-MEP-REF-10A-XX-00 A

ALL SERVICES WITHIN MORTUARY BUILDING DEMOLISHED

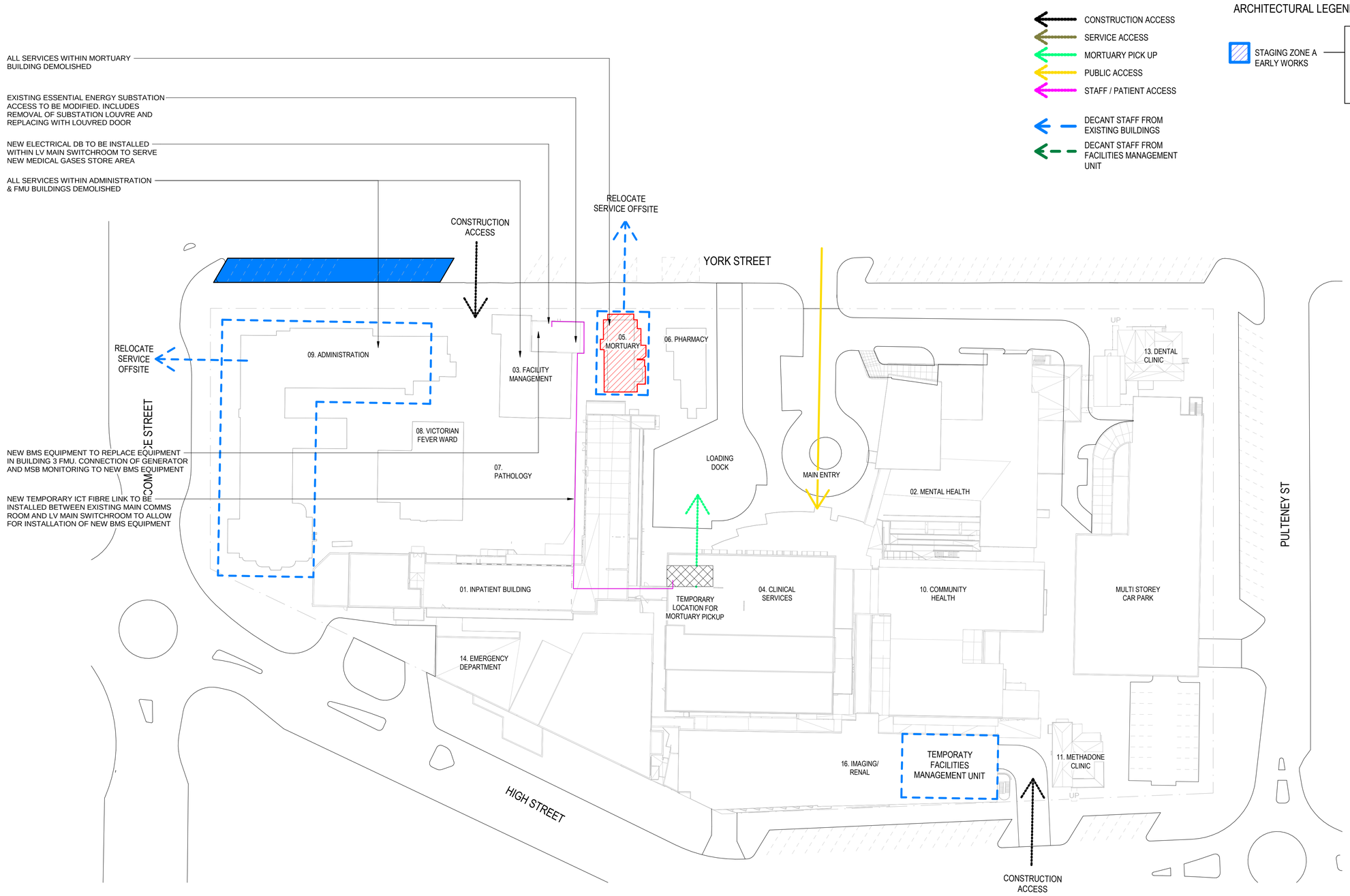
EXISTING ESSENTIAL ENERGY SUBSTATION ACCESS TO BE MODIFIED. INCLUDES REMOVAL OF SUBSTATION LOUVRE AND REPLACING WITH LOUVRED DOOR

NEW ELECTRICAL DB TO BE INSTALLED WITHIN LV MAIN SWITCHROOM TO SERVE NEW MEDICAL GASES STORE AREA

ALL SERVICES WITHIN ADMINISTRATION & FMU BUILDINGS DEMOLISHED

NEW BMS EQUIPMENT TO REPLACE EQUIPMENT IN BUILDING 3 FMU. CONNECTION OF GENERATOR AND MSB MONITORING TO NEW BMS EQUIPMENT

NEW TEMPORARY ICT FIBRE LINK TO BE INSTALLED BETWEEN EXISTING MAIN COMMS ROOM AND LV MAIN SWITCHROOM TO ALLOW FOR INSTALLATION OF NEW BMS EQUIPMENT



ARCHITECTURAL LEGEND

- CONSTRUCTION ACCESS
- SERVICE ACCESS
- MORTUARY PICK UP
- PUBLIC ACCESS
- STAFF / PATIENT ACCESS
- DECANT STAFF FROM EXISTING BUILDINGS
- DECANT STAFF FROM FACILITIES MANAGEMENT UNIT

STAGING ZONE A EARLY WORKS

- STAGE 1
- STAGE 2
- STAGE 3
- DEMOLITION

GENERAL NOTES:

1. DRAWING NOT TO BE USED FOR CONSTRUCTION
2. ALL DRAWINGS TO BE PRINTED IN COLOUR
3. EARLY WORKS DRAWINGS TO BE READ IN CONJUNCTION WITH ALL OTHER DOCUMENTATION INCLUDED ARCHITECTURAL STAGING PLANS AND MAIN WORKS SERVICES PACKAGES

SHEET NOTES:

4. THIS PACKAGE OF DOCUMENTATION IS INTENDED TO BE USED ONLY FOR THE PURPOSES OF THE REVIEW OF ENVIRONMENTAL FACTORS. FOR MORE DETAILS PLEASE REFER TO THE SERVICES EARLY WORKS PACKAGE

ISSUE	DATE	FOR
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CONSULTANT
ARUP
Level 5 Barrack Place, 151 Clarence St
Sydney, NSW, 2000
Tel +61(0)29320 9320 Fax +61(0)29320 9321
www.arup.com

CONSULTANT
ARCADIA
TEL +61 2 85712900

CONSULTANT
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EMF Griffiths
TEL +61 7 55932075

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Enstruct
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ARCHITECTS
BVN
TEL +61 2 8297 7200

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BVN PROJECT NUMBER

2101013

DRAWING KEY

TRUE NORTH | PROJECT NORTH

GRAPHIC SCALE

0 2000 5000

SCALE
1 : 500@A1

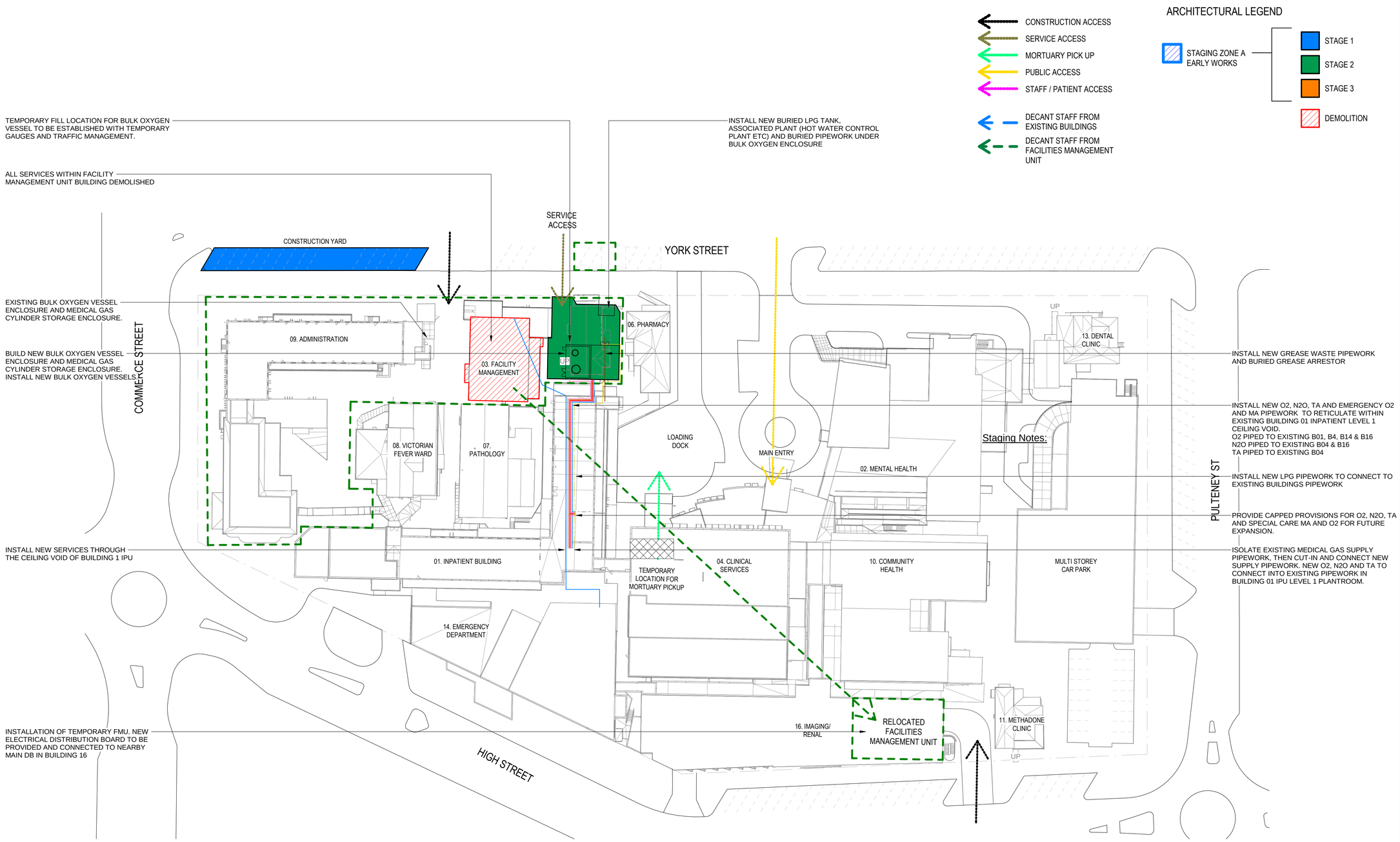
STATUS
Design Development

DRAWN BY:	MOC	DESIGNED BY:	MOC
CHECKED BY:	EC	APPROVED BY:	EC

DRAWING

Staging Diagram Construction Stage - 1

ARP-MEP-REF-10A-XX-51 | ISSUE A



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ARUP
Level 5 Barrack Place, 151 Clarence St
Sydney, NSW, 2000
Tel +61(0)2/9320 9320 Fax +61(0)2/9320 9321
www.arup.com

CONSULTANT
ARCADIA
TEL +61 2 85712900

CONSULTANT
Blackett Maguire + Goldsmith
TEL +61 2 92117774

CONSULTANT
EMF Griffiths
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ARCHITECTS
BVN
TEL +61 2 8297 7200

PROJECT MANAGER
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CLIENT
NSW GOVERNMENT Health Infrastructure

PROJECT
MANNING BASE HOSPITAL
26 York Street, Taree, NSW 2430

BVN PROJECT NUMBER
2101013

DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
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SCALE
1 : 500@A1

STATUS
Design Development

DRAWN BY:	MOC	DESIGNED BY:	MOC
CHECKED BY:	EC	APPROVED BY:	EC

DRAWING
Staging Diagram Construction Stage - 2

ISSUE
ARP-MEP-REF-10A-XX-52 A

GENERAL NOTES:

1. DRAWING NOT TO BE USED FOR CONSTRUCTION
2. ALL DRAWINGS TO BE PRINTED IN COLOUR
3. EARLY WORKS DRAWINGS TO BE READ IN CONJUNCTION WITH ALL OTHER DOCUMENTATION INCLUDED ARCHITECTURAL STAGING PLANS AND MAIN WORKS SERVICES PACKAGES

SHEET NOTES:

4. THIS PACKAGE OF DOCUMENTATION IS INTENDED TO BE USED ONLY FOR THE PURPOSES OF THE REVIEW OF ENVIRONMENTAL FACTORS. FOR MORE DETAILS PLEASE REFER TO THE SERVICES EARLY WORKS PACKAGE

ARCHITECTURAL LEGEND

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- SERVICE ACCESS
- MORTUARY PICK UP
- PUBLIC ACCESS
- STAFF / PATIENT ACCESS
- DECANT STAFF FROM EXISTING BUILDINGS
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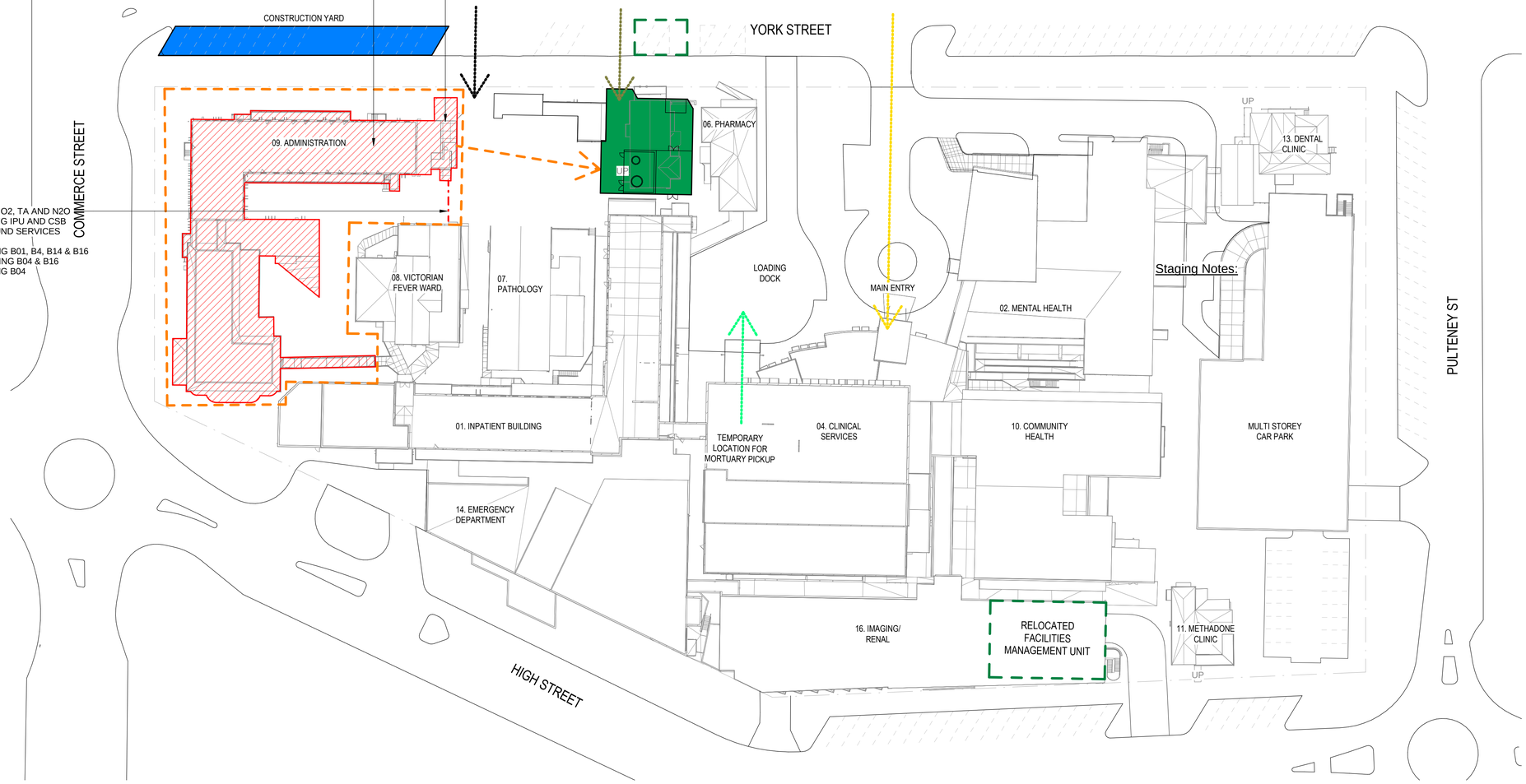
- STAGING ZONE A EARLY WORKS
- STAGE 1
- STAGE 2
- STAGE 3
- DEMOLITION

DEMOLISH EXISTING BULK OXYGEN STORE AND MEDICAL GAS CYLINDER MANIFOLD SUPPLIES (O2, N2O, TA) STORAGE.

ALL SERVICES WITHIN ADMINISTRATION BUILDING DEMOLISHED

DEMOLISH EXISTING O2, TA AND N2O PIPEWORK SERVICING IPU AND CSB WITHIN UNDERGROUND SERVICES TRENCH.
O2 PIPED TO EXISTING B01, B4, B14 & B16
N2O PIPED TO EXISTING B04 & B16
TA PIPED TO EXISTING B04



Staging Notes:

ISSUE	DATE	FOR
A	30/06/23	For Information

CONSULTANT
ARUP
Level 5 Barrack Place, 151 Clarence St
Sydney, NSW, 2000
Tel +61(0)29320 9320 Fax +61(0)29320 9321
www.arup.com

CONSULTANT
ARCADIA
TEL +61 2 85712900

CONSULTANT
Blackett Maguire + Goldsmith
TEL +61 2 92117774

CONSULTANT
EMF Griffiths
TEL +61 7 55932075

CONSULTANT
Enstruct
TEL +61 2 89041444

ARCHITECTS
BVN
TEL +61 2 8297 7200

PROJECT MANAGER
MACE
TEL +61 2 91268010

CLIENT
NSW GOVERNMENT Health Infrastructure

PROJECT
MANNING BASE HOSPITAL
26 York Street, Taree, NSW 2430

BVN PROJECT NUMBER
2101013

DRAWING KEY

TRUE NORTH | PROJECT NORTH

GRAPHIC SCALE
0 2000 5000

SCALE
1 : 500@A1

STATUS
Design Development

DRAWN BY:	MOC	DESIGNED BY:	MOC
CHECKED BY:	EC	APPROVED BY:	EC

DRAWING
Staging Diagram Construction Stage - 3

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