Core Engineering Group • Fire • Risk • Emergency Management

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10 December 2025 | SSDA Issue | Report No. F201262_Masterplan_FSS_17

Fire Safety Strategy

Aspect Estate - Masterplan

Lots 1, 2 & 5 DP1285305 & Lots 6 & 7 DP1291562 Mamre Road, Kemps Creek

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Report Details

Project: Aspect Estate
Lots 1, 2 & 5 DP1285305 & Lots 6 & 7 DP1291562 Mamre Road, Kemps Creek
Document: Fire Safety Strategy
Report No.: F201262_Masterplan_FSS_17

Report Revision History

REV	DATE ISSUED	COMMENT	PREPARED BY	REVIEWED BY
01	09/01/2020	Draft Issue for comment	**Anson Lo** *BEng (Aerospace) (Hons)*	**Graham Morris** *MEng (Structural and Fire Safety)* *MIEAust, CPEng, NER (Fire Safety)*
02	02/06/2020	Revised for DA		
03	01/10/2020	Revised for updated masterplan for SSD DA		
04	16/10/2020	Revised for updated plans and comments		
05	28/01/2022	Revised for updated plans	**Christie Tran** *BEng (Mechanical)* *MEng (Fire Protection)*	
06	11/03/2022	Revised for updated plans (Mod 2)		
07	27/05/2022	Revised for updated plans (Mod 2)	**Dean Watt** *BEng (Chemical)(Hons)* *MEng (Fire Safety)*	
08	17/06/2022	Revised for updated plans (Mod 2)		
09	29/06/2022	Revised for design team comments		
10	29/07/2022	Revised for updated plans & renaming convention to Mod 3.		
11	19/08/2022	Revised for updated Lot and DP numbers		
12	01/02/2023	Revised for updated plans (Mod 5)		
13	13/09/2023	Revised for updated plans and revised naming convention to Mod 6		
14	06/11/2023	Revised for updated lot numbering		

REV	DATE ISSUED	COMMENT	PREPARED BY	REVIEWED BY
15	21/02/2024	Revised for changes to Mod 6		
16	02/04/2024	Revised for changes to Mod 6 (minor amendment to building footprint)		
17	10/12/2025	Revised for changes to Mod 12	**Ben Windsor** *BEng (Mech)*	**Dean Watt** *BEng (Chemical)(Hons)* *MEng (Fire Safety)*

DOCUMENT REVISION HISTORY

The following table summarises the changes incorporated in each revision of this report.

Report Revision History

REV	DATE ISSUED	COMMENT
05	28/01/2022	Updated issue to incorporate the following changes ('Mod 1'): • Relocation of Access Road 2 to the area located between Warehouse/Lot 1 and 2, and modifications to perimeter vehicular access. • Minor adjustment of Lots 1, 2 and 3. • Removal of café.
06	11/03/2022	Updated issue to incorporate the following changes ('Mod 2'): • Reconfiguration of the estate layout including reduction in overall lot/warehouses from 11 to 9. • New warehouse footprints and subsequent impact on fire services infrastructure and perimeter vehicular access paths. • Smoke hazard management strategy changed from manual smoke clearance system to a rationalised automatic smoke exhaust system (refer Section 8).
07	27/05/2022	Updated issue to incorporate the following changes ('Mod 2'): • Minor increase to the floor area of Warehouse 7, and a minor reduction to the floor area of Warehouse 9. • Addition of café to Warehouse 7.
08	17/06/2022	Updated issue to incorporate the following changes ('Mod 2'): • Change to allocation of carparking spaces serving Warehouse 8.
09	29/06/2022	Updated issue to incorporate minor comments from the design team regarding: • Lot 8 floor areas. • Figure referencing.
10	29/07/2022	Updated issue to incorporate the following changes: • Renaming from 'Mod 2' to 'Mod 3'. • Amended floor areas and estate plan. • Access Roads 1 and 3 revert back to a road width of 26.4 m. • Removal of one office serving Warehouse 8.
11	19/08/2022	Updated issue to reference Lots 1-5 and DP1285305 for the proposed development.
12	01/02/2023	Updated issue to incorporate the following changes ('Mod 5'): • Amended Lot 8 design.

REV	DATE ISSUED	COMMENT
13	13/09/2023	Updated issue to incorporate the following changes: • Renaming from 'Mod 5' to 'Mod 6'. • Update to be consistent with NCC 2022 (previously NCC 2019 Amdt 1). • Amended Lot 8 design. • Addressing minor design team comments.
14	06/11/2023	Revised for updated lot numbering.
15	21/02/2024	Revised to depict changes to Lot 8, including reverting to a speculative development.
16	02/04/2024	Revised to depict the minor changes to Lot 8, primarily relating to a change in the building footprint (and external areas to accommodate this change).
17	10/12/2025	Updated issue to incorporate the following changes in building description and associated markups: • Renaming from to Mod 12. • Removal of Warehouse 5. • Updated layout and extent of Warehouse 4.

EXECUTIVE SUMMARY

CORE Engineering Group has been engaged by Mirvac to develop a Fire Safety Strategy (FSS) for the construction of warehouse facilities at Aspect Estate on Lots 1, 2 & 5 DP1285305 & Lots 6 & 7 DP1291562 Mamre Road, Kemps Creek. Specifically, this report relates to the overall estate concept masterplan, including 9 warehouse buildings and the associated site infrastructure.

This FSS provides an overview of the design, construction and management requirements considered necessary to achieve an acceptable level of life safety within the building.

A fully prescriptive approach of complying with the Building Code of Australia 2022 (BCA) [1] Deemed-to-Satisfy (DtS) provisions for occupant egress, fire resisting construction, fire services, and fire brigade intervention is unlikely to satisfy the desired architectural and client aspirations.

As such, Performance Solutions have been proposed to account for the following items which can satisfy the Performance Requirements of the BCA rather than the DtS Provisions:

- C3D5 – Rationalised perimeter vehicular access path (over adjoining lease boundaries).
- D2D5 – Extended travel distances to the nearest exit within the warehouse buildings.
- D2D6 – Extended travel distances between alternative exits within the warehouse buildings.
- D2D15 – Egress paths on adjacent lots.
- E1D2 – External hydrants positioned beneath awnings & holistic hydrant design to AS2419.1:2021 despite buildings exceeding a volume of 108,000 m³.
- E1D4 – Location of sprinkler boosters.
- E2D10 – Rationalised automatic smoke exhaust system.

This FSS provides a holistic summary of the fire and life safety measures anticipated to be necessary in developing the above listed Performance Solutions. These measures include passive and active fire protection systems, egress provisions, occupant first aid firefighting, fire brigade intervention, and future building management provisions.

The complete fire engineering analysis will be included within the Fire Engineering Report (FER), undertaken in accordance with the Australian Fire Engineering Guidelines (AFEG), and as such is not documented herein.

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1 INTRODUCTION

1.1 OVERVIEW

This Fire Safety Strategy has been undertaken to nominate proposed Performance Solutions for assessing compliance with the nominated Performance Requirements of the Building Code of Australia 2022 (BCA) [1] in accordance with the methodologies defined in the Australian Fire Engineering Guideline AFEG [3].

In order to develop and assess the nominated non-compliances the following flowchart process is to be adopted.

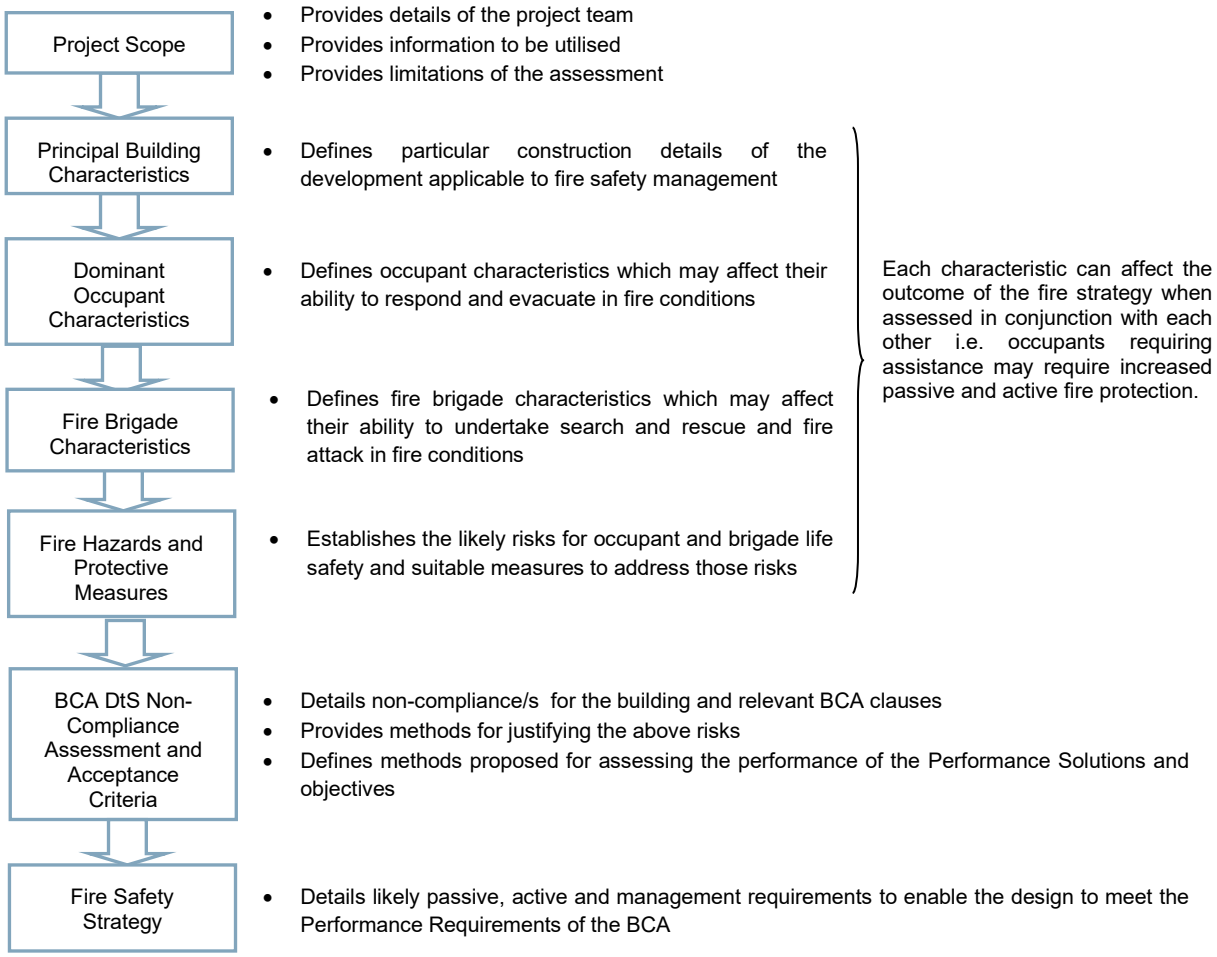


Figure 1-1: Fire Safety Strategy Process

The scope of the FSS is to detail the nominated departures that do not prescriptively meet the Deemed-to-Satisfy (DtS) Provisions of the BCA, assess these in regard to the appropriate Performance Requirements, and provide methodologies for establishing a workable and safe FSS to be verified further through the Performance Based Design Brief Process.

1.2 FIRE SAFETY OBJECTIVES

The objective of this Fire Engineering Assessment is to develop a Fire Safety System, which satisfies the performance requirements of the NCC whilst maintaining an acceptable level of life safety, protection of adjacent property and adequate provisions for Fire Brigade intervention. At a community level, fire safety objectives are met if the relevant legislation and regulations are complied with. As stated in the NCC, "*A Building Solution will comply with the NCC if it satisfies the Performance Requirements*". In addition to this, certain non-regulatory objectives exist as detailed below.

1.2.1 Building regulatory objectives

The following items are a summary of the fire and life safety objectives of the NCC:

- **Life safety of occupants -** the occupants must be able to leave the building (or remain in a safe refuge) without being subject to hazardous or untenable conditions. The objective of the Fire Engineering Assessment is to demonstrate that the proposed building design and fire safety systems would minimise the risk of exposing building occupants to hazardous or untenable conditions in an event of a fire.
- **Life safety of fire fighters -** fire fighters must be given a reasonable time to rescue any remaining occupants before hazardous conditions or building collapse occurs. The objective of the Fire Engineering Assessment is to demonstrate that the proposed building design and fire safety systems would facilitate fire brigade intervention and minimise the risk of exposing fire fighters to hazardous or untenable conditions in an event of a fire.
- **Protection of adjoining buildings** - structures must not collapse onto adjacent property and fire spread by radiation should not occur. The objective of the Fire Engineering Assessment is to demonstrate that the proposed building design and fire safety systems would minimise the risk of fire spreading from one building to another.

1.2.2 Fire Brigade objectives

The overall philosophical Fire Brigade objectives throughout Australia are to protect life, property and the environment from fire according to the Fire Brigade Intervention Model (FBIM) [6] as per the Fire Services State and Territory Acts and Regulations.

Over and above the requirements of the NCC, the Fire Brigade has functions with regard to property and environmental protection and considerations regarding occupational health and safety for its employees.

1.2.3 Non-prescribed objectives

Fire Engineering has an overarching benefit to many facets of the built environment where non-prescribed objectives can have an influence on the Fire Safety Strategy adopted. Although not assessed within, the following can be considered if requested.

- **Business continuity -** will the loss of a particular facility due to fire / smoke damage result in excessive financial impact on the client? For example, is the facility critical to business continuity?
- **Public perception -** should a fire occur within the facility is there likely to be questionable public perception about the safety and operation of the facility?
- **Environmental protection -** fires of excessive sizes can have significant effects on the environment which may require a detailed risk assessment to minimise such outcomes.
- **Heritage salvation -** buildings can have a heritage value for both cultural and educational purposes which can be destroyed by insufficient fire protection.
- **Risk mitigation / insurance limitations -** are there specific limitations on insurance with respect to risk mitigation and fire safety design? i.e. Does the relevant insurer have concerns with respect to open voids through the building?
- **Future proofing (isolation of systems) -** what flexibility is required in the overall design to allow for future development or changes in building layout?
- **Occupational Health and Safety (OHS) requirements -** buildings may have specific fire safety requirements pertaining to OHS requirements.

1.3 REGULATORY FRAMEWORK OF THE FIRE ENGINEERING ASSESSMENT

1.3.1 National Construction Code

One of the goals of the NCC is the achievement and maintenance of acceptable standards of safety from fire for the benefit of the community. This goal extends no further than is necessary in the public interest and is considered to be cost effective and not needlessly onerous in its application.

Section A2G1 of the NCC [1] outlines how compliance with the Performance Requirements can be achieved, being satisfied by one of the following:

(a) A Performance Solution which demonstrates–

  (i) Compliance with all relevant Performance Requirements; or

  (ii) The solution is at least equivalent to the Deemed-to-Satisfy Provisions; or

(b) A Deemed-to-Satisfy Solution; or

(c) a combination of (1) and (2).

Section A2G2 of the NCC provides several different methods for assessing that a Performance Solution complies with the Performance Requirements, through one or a combination of the following Assessment Methods:

(a) Evidence of suitability that shows the use of a material, product, form of construction or design meets the relevant Performance Requirements.

(b) A Verification Method including the following:

  (i) the Verification Methods in the NCC; or

  (ii) other Verification Methods, accepted by the appropriate authority that show compliance with the relevant Performance Requirements.

(c) Expert Judgement.

(d) Comparison with the Deemed-to-Satisfy Provisions.

Where a Performance Requirement is satisfied entirely by a Performance Solution, the following method must be used to determine the Performance Requirements relevant to the Performance Solution:

(a) Identify the relevant Performance Requirement from the Sections or Part to which the Performance Solution applies.

(b) Identify Performance Requirements from other Sections of Parts that are relevant to any aspects of the Performance Solution proposed or that are affected by the application of the Performance Solution.

Under Section A2G4, the following method must be used to determine the relevant Performance Requirements when using a Performance Solution in combination with a Deemed-to-Satisfy Solution: These methods are summarised as follows:

(a) Identify the relevant Deemed-to-Satisfy Provisions of each Section or Part that are to be the subject of the Performance Solution.

(b) Identify the Performance Requirements from the same Section or Part that are relevant to the identified Deemed-to-Satisfy Provisions.

  (i) Identify Performance Requirements from the other Sections and Parts that are relevant to any aspects of the Performance Solution proposed or that are affected by the application of the Deemed-to-Satisfy Provisions that are the subject of the Performance Solution.

Where a Performance Solution is proposed to satisfy the Performance Requirements, Provision A2G2(4) of NCC 2022 requires that the following steps be undertaken:

(a) Prepare a performance-based design brief in consultation with relevant stakeholders

(b) Carry out analysis, using one or more of the Assessment Methods listed in (2) (refer to Section 1.3.1 of this report), as proposed by the performance based design brief.

(c) Evaluate results from (b) against the acceptance criteria in the performance based design brief

(d) Prepare a final report that include –

  i. All Performance Requirements and/or Deemed-to-satisfy Provisions identified through A2G2(3) or A2G4(3) as applicable; and

  ii. Identification of the assessment methods used; and

  iii. Details of steps (a) to (c)

  iv. Confirmation that the Performance Requirement has been met; and

  v. Details of conditions or limitations, if any exist, regarding the Performance Solution

The definition of a Performance Based Design Brief in the NCC is *"the process and the associated report that defines the scope of work for the performance-based analysis, the technical basis for the analysis, and the criteria for acceptance of any relevant Performance Solution as agreed by stakeholders".*

1.3.2 Australian Fire Engineering Guidelines

The AFEG [3] document has been developed for use in fire safety design and assessment of buildings, and reflects international best practice. The document is intended to provide guidance for fire engineers as they work to develop and assess strategies that provide acceptable levels of safety.

The document is particularly useful in providing guidance in the design and assessment of Performance Solutions against the Performance Requirements of the NCC. The prescribed methodology set out in the AFEG will be generally adopted in the FER.

2 PROJECT SCOPE

2.1 OVERVIEW

CORE Engineering Group has been engaged by Mirvac to develop a Fire Safety Strategy (FSS) for the construction of warehouse facilities at Aspect Estate on Lots 1, 2 & 5 DP1285305 & Lots 6 & 7 DP1291562 Mamre Road, Kemps Creek. Specifically, this report relates to the overall estate concept masterplan, including 9 warehouse buildings and the associated site infrastructure.

The purpose of this FSS is to outline the fire engineering principles to be considered in ensuring that built form proposed is capable of meeting the Performance Requirements of the BCA and thus permitting development approval.

The complete fire engineering analysis will be included within the FER, and as such is not documented herein. This document does however outline the construction and management requirements considered necessary to achieve an acceptable level of life safety within the building as a result of the Performance Solution and to satisfy the Performance Requirements of the BCA.

2.2 RELEVANT STAKEHOLDERS

This Performance Solution has been developed collaboratively with the relevant stakeholders as identified below:

Table 2-1: Relevant Stakeholders

ROLE	NAME	ORGANISATION
Development Director	Susan Paul Stephen Foster	Mirvac
Project Manager	Ash McGowan Ali Altajjar	RP Infrastructure
BCA Consultant	Dean Goldsmith	Blackett Maguire + Goldsmith
Architect	Richard Prince	SBA Architects
Fire Safety Engineer	Dean Watt	CORE Engineering Group
Registered Certifier – Fire Safety	Graham Morris	

It should be noted that at times some parties may have a vested interest in the outcome of the Fire Engineering assessment. Such parties can include local fire brigades, insurers, Environmental Protection Authority (EPA), project control groups, end users and community representatives. Although not always a legislative requirement, the design team should give due consideration to their inclusion in the Fire Engineering process. Where not required by legislation it is the client's decision to involve such parties, especially local fire brigade, to ensure a transparent and adequate fire safety solution for all. Where we are not notified of the inclusion of such parties it is assumed the client / representative has given due consideration to the above.

2.3 SOURCES OF INFORMATION

The following sources of information have been provided by the design team:

- SSDA-Mod 12 Estate Masterplan – 25229 (Rev C), dated 5 November 2025.

2.4 LIMITATIONS AND ASSUMPTIONS

In this instance the FSS is developed based on applicable limitations and assumptions for the development which are listed as follows:

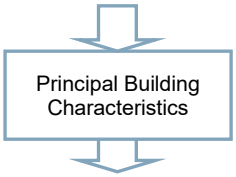
- The report is specifically limited to the project described in Section 3.
- The report is based on the information provided by the team as listed above in Section 2.3.
- This document represents the opinions of CORE Engineering Group based on the information known at the time of preparation of this document. Opinions, findings, and recommendations detailed in this

document are based on our understanding and interpretation of current statutory and regulatory obligations and standards and should not be construed as legal opinions.

- This report does not constitute a fire engineering report (FER) that addresses the Performance Requirements of the BCA. Any recommendations herein are subject to detailed fire engineering analysis, and the relevant approval process.
- This document has been prepared as a guidance document only, and any parties relying on this for pricing should be cognisant that the recommendations are preliminary and subject to detailed analysis and authority approvals.
- The assessment is limited to the objectives of the BCA and does not consider property damage such as building and contents damage caused by fire, potential increased insurance liability, and loss of business continuity.
- Malicious acts or arson with respect to fire ignition and safety systems are limited in nature and are outside the objectives of the BCA. Such acts can potentially overwhelm fire safety systems and therefore further strategies such as security, housekeeping, and management procedures may better mitigate such risks.
- This report is prepared in good faith and with due care for information purposes only, and should not be relied upon as providing any warranty or guarantee that ignition or a fire will not occur.
- Where parties nominated in Section 2.2 have not been consulted or legislatively are not required to be, this report does not take into account, nor warrant, that fire safety requirements specific to their needs have been complied with.

3 PRINCIPAL BUILDING CHARACTERISTICS

3.1 OVERVIEW



Building characteristics are assessed as part of the fire engineering assessment due to the following:

1. The location can affect the time for fire brigade intervention and potential external fire exposure issues.
2. The structure will impact on the ability to resist a developing fire and support condition to allow occupants to escape the building and the fire brigade to undertake firefighting to the degree necessary.
3. The floor area determines the potential fire size and area required to be evacuated in the event of a fire.
4. BCA details such as Type of Construction, Class and Height will dictate passive and active fire safety systems.

3.2 SITE LOCATION

The development site is located in Kemps Creek, approximately 40 km west of Sydney's central business district. The Kemps Creek site consisting of eight lots is located on Mamre Road, Lots 1-5 on DP1285305. The internal roads within the estate are yet to be named.

Figure 3-1: Site Location

Figure 3-2: Estate Masterplan

The building site influences the likely fire brigade intervention times and given the close proximity to the nearest fire station is expected to facilitate a relatively convenient and expedient fire brigade response. Furthermore, being located in an outer suburb of a major city, the development is provided with the services and facilities expected in an urban setting. The two nearest fire brigade stations provided with permanent staff are St Marys and Bonnyrigg Heights approximately 10 km and 11 km from the site respectively when considering actual driving directions.

3.3 SITE LAYOUT

This development site consists of 8 warehouses as illustrated in Figure 3-2. All constructed facilities will be leased to third party businesses. This report addresses fire safety strategies for the entire site.

The total area of the estate is approximately 558,000 m². The majority of the warehouses exceed 18,000 m² with the largest being 64,900 m² (total GFA). There are two buildings (total GFA) less than 18,000 m², being Lots 6, and 7. The ridge height of the warehouses is generally 13.7 m (being 16 m for Lot 1 and 14.6 m for Lot 9). Lots 1 and 6 have the potential to be split into two tenancies, with a dedicated office space provided to serve each tenancy. The remaining buildings are initially proposed as a single tenant building with a single ancillary two-storey office. Each allotment has carparks located within the tenancies. The floor area of the proposed buildings on each lots are shown in Figure 3-3.

WAREHOUSE 1	
Site Area	61,217 m²
Offices	900 m²
Warehouse	32,686 m²
Dock Office	300 m²
Total GFA	33,886 m²
Carpark Provided	141

WAREHOUSE 2	
Site Area	40,172 m²
Offices	1,500 m²
Warehouse	22,595 m²
Dock Office	200 m²
Total GFA	24,295 m²
Carpark Provided	150

WAREHOUSE 3	
Site Area	42,755 m²
Offices	700 m²
Warehouse	20,735 m²
Dock Office	100 m²
Total GFA	21,535 m²
Carpark Provided	89

WAREHOUSE 4	
Site Area	69,755 m²
Offices	700 m²
Warehouse	30,095 m²
Dock Office	200 m²
Total GFA	30,995 m²
Carpark Provided	128

WAREHOUSE 6	
Site Area	19,569 m²
Offices	1,000 m²
Warehouse	8,574 m²
Total GFA	9,574 m²
Carpark Provided	71

WAREHOUSE 7	
Site Area	27,120 m²
Offices	750 m²
Warehouse	14,358 m²
Dock Office	100 m²
Cafe	125 m²
Total GFA	15,333 m²
Carpark Provided	84

WAREHOUSE 8	
Site Area	75,710 m²
Office	2,000 m²
Warehouse	39,800 m²
Dock Office	370 m²
Store	460 m²
Total GFA	42,630 m²
Carpark 1 Provided	164
Carpark 2 Provided	33

WAREHOUSE 9	
Site Area	113,163 m²
Offices	1350 m²
Warehouse	64,900 m²
Dock Office	266 m²
Total GFA	66,516 m²
Carpark Provided	266

Figure 3-3: Schedule of Building Floor Areas

3.4 BUILDING STRUCTURE

The warehouses shall be constructed as a steel portal frame structure with dado panel walls and a metal sheet roof. All materials and elements should achieve the requisite Fire Resistance Levels (FRL) and fire hazard properties associated with the relevant type of construction (generally Type C construction).

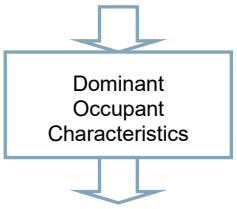
3.5 BCA ASSESSMENT SUMMARY

Table 3-1: BCA Building Characteristics

CHARACTERISTIC	DESCRIPTION (Relevant to all buildings)
Classification	Class 7b (Warehouse) and Class 5 (Office)
Construction Type	Type C (Large-Isolated Building)
Rise in Storeys	Two (2)
Effective Height	Less than 12 m
Floor Area and Volume	Greater than 18,000 m² and/or 108,000 m³ (except for buildings 6 and 7 which are under 18,000 m² but exceed 108,000 m³)

4 DOMINANT OCCUPANT CHARACTERISTICS

4.1 OVERVIEW



The occupant characteristics are assessed within the Fire Safety Strategy due to the following:

1. Population numbers can dictate the time required to evacuate the building and the required life safety systems to be provided due to evacuation times.
2. Physical and mental attributes affect the occupants' capacity to respond to various fire cues and react accordingly.
3. Familiarity of occupants can affect the time taken to evacuate the building and subsequent active / passive requirements.

4.2 OCCUPANT NUMBERS AND DISTRIBUTION

The BCA assumes the following occupant densities per an area's function and use according to Provision D2D18 [1]:

- Warehouse: 30 m² per person
- Office: 10 m² per person

In the absence of specific occupant numbers provided by the tenant, the population estimated from Provision D2D18 of the NCC DtS Provisions will be utilised in the analysis, therefore providing a conservative population in the warehouse parts.

It is noted that these numbers provide conservative inputs to the fire engineering analysis and do not form the requirements for amenities and the like.

4.3 OCCUPANT ATTRIBUTES

Occupants in the building may be of mixed age, although the elderly and children are not expected to be present. The population is therefore expected to be that of the general working public and be adults between the ages of 16 to 70. Due to the nature of the work conducted the majority of occupants are assumed to be able bodied people, however there may be a small number of less mobile or visually impaired occupants in the office portion of the building.

All occupants are expected to be awake and alert adults or in the direct company of an adult, capable of entering the leaving the building under their own volition. Occupants in all of these areas are not expected to be adversely impaired by drugs, alcohol, fatigue or other adverse conditions to degrees greater than in other warehouse and office buildings.

4.4 OCCUPANT FAMILIARITY

The majority of occupants within the building are expected to be staff and therefore the population in general are likely to react favourably in an emergency situation.

- Staff, Maintenance and Security can be expected to have a good familiarity with the building and the fire safety systems provided and may be trained in emergency procedures; and
- Clients / Visitors may or may not be familiar with the layout of the building and may require assistance in locating the exits; and
- External Maintenance Contractors are expected to have a reasonable familiarity with the building as they would have to undergo site specific induction prior to commencement of work on site; and
- FRNSW are not expected to have any familiarity of the building layout, however are assumed to obtain the required information from the site block plans and tactical fire plans available prior to entering the building.

4.5 EMERGENCY TRAINING

Occupants should be familiar with escape procedures through fire drills and designated fire wardens being appointed to mitigate risks under Workplace Health and Safety legislation (AS3745:2010). Clear escape routes should be maintained with doors unlocked, and no obstructions or rubbish to hinder evacuation.

Staff and visitors are not expected to have fire suppression training and such training is not relied upon for this building population; however staff are expected to possibly attempt to extinguish a fire or limit fire spread by removing objects in the vicinity of the fire in order to defend their belongings.

5 FIRE BRIGADE CHARACTERISTICS

5.1 OVERVIEW

Fire brigade characteristics are assessed within the FSS as brigade characteristics can dictate the time required for fire brigade intervention including search and rescue, and fire attack.

5.2 FIRE BRIGADE ASSESSMENT

Figure 5-1 to Figure 5-3 illustrate the site plan with respect to the fire services provided to each building on the development site. These include:

- Vehicular perimeter access
- Fire sprinkler tank, pump room and sprinkler booster
- Fire Control Centre (FCC) / FIP
- Fire hydrant booster

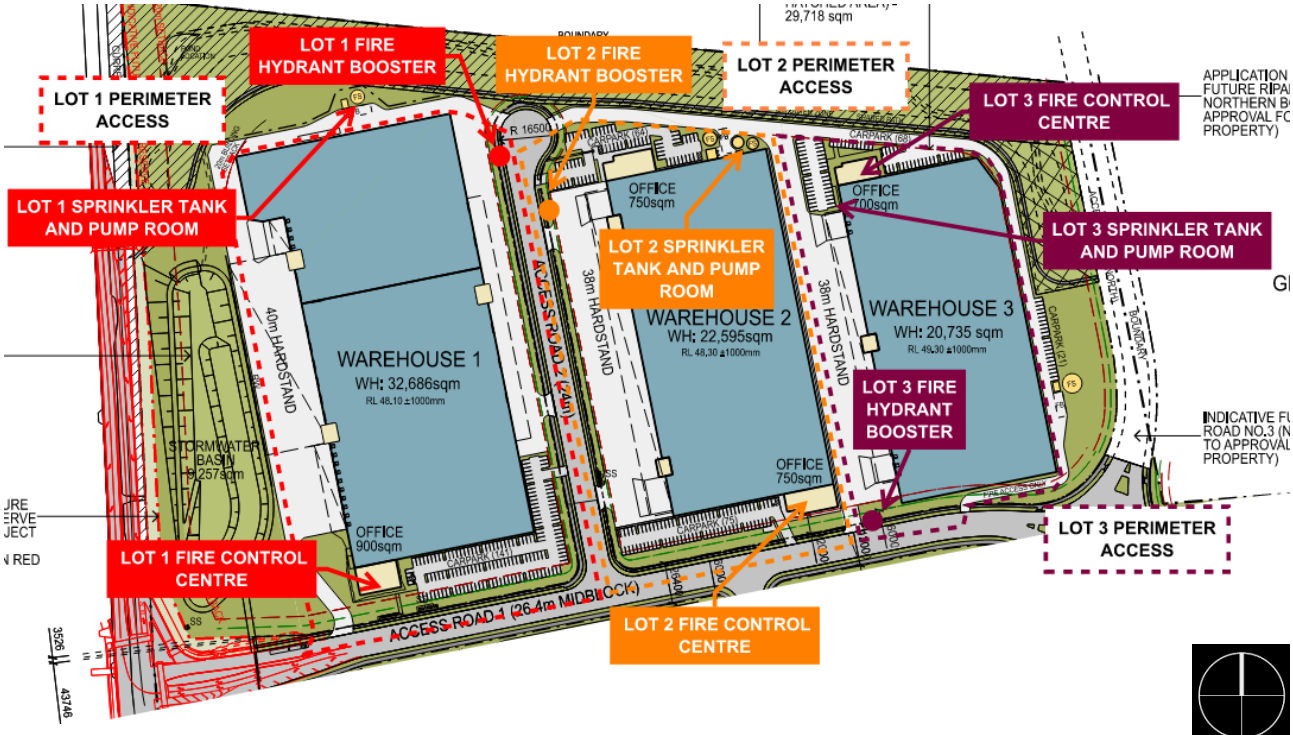


Figure 5-1: Fire Brigade Access and Site Facilities – Northern Side

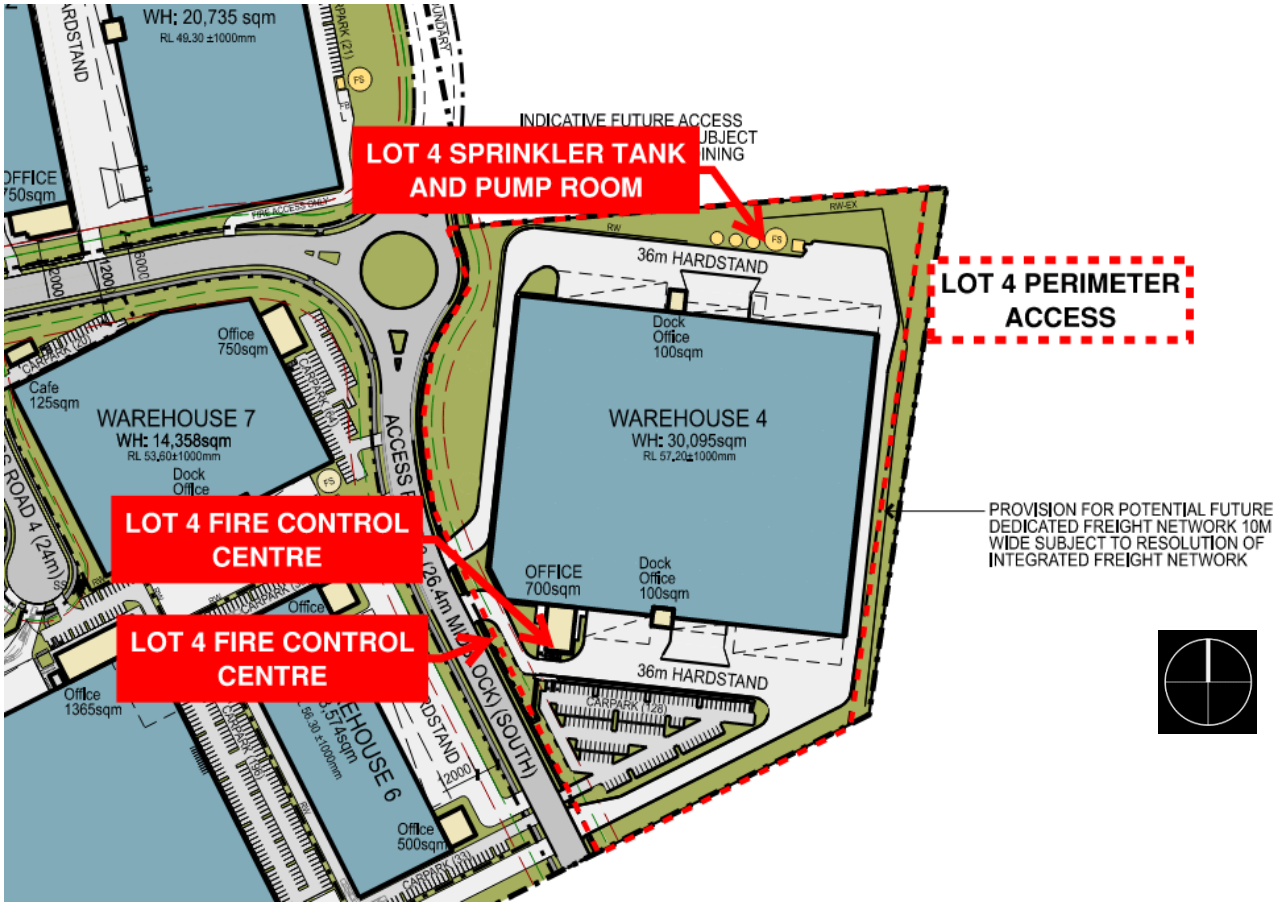


Figure 5-2: Fire Brigade Access and Site Facilities – South-Eastern Side

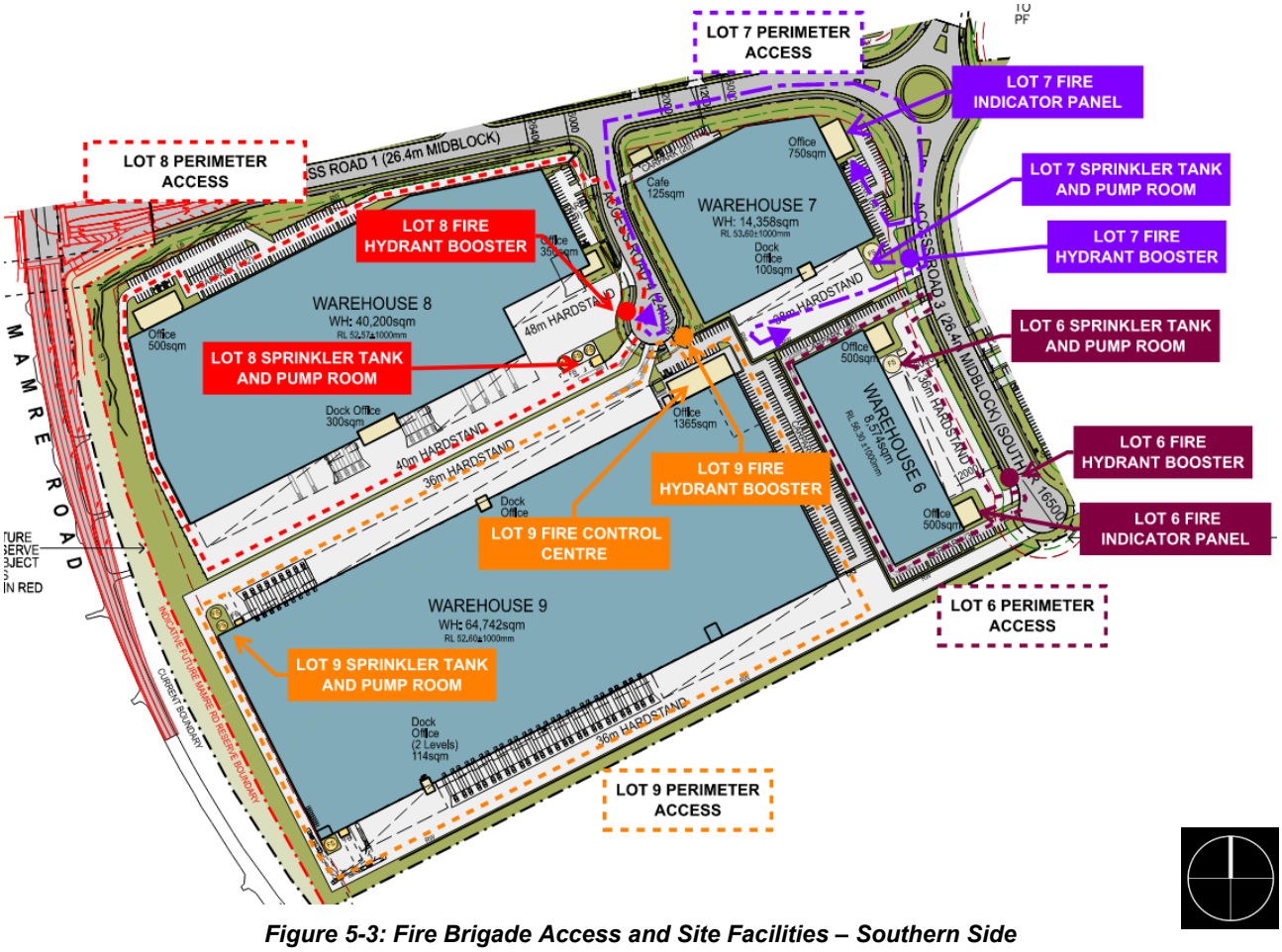


Figure 5-3: Fire Brigade Access and Site Facilities – Southern Side

The building is located within the Fire and Rescue New South Wales (FRNSW) jurisdictional turnout area. The closest two fire stations to the site that are provided with permanent staff are located in St Marys and Bonnyrigg Heights approximately 10 km and 11 km.

6 FIRE HAZARDS AND PROTECTIVE MEASURES

6.1 OVERVIEW

The fire hazard analysis forms the basis for the review of non-compliances within the building. In assessing expected and statistically validated hazards, preventative and protective measures are developed commensurate with those expected risks. The following section reviews applicable hazards and recommends possible measures to address those risks. Furthermore, the hazards identified can form a justified basis for selected scenarios.

6.2 FIRE HAZARDS

Subsequent to a review of the relevant documentation, the identified fire hazards specific to this building are summarised below.

6.2.1 Combustible External Cladding

As the buildings require Type C construction, there is no restriction on combustible materials within the external walls of the buildings. Regardless, should the design propose any combustible elements, a detailed review and risk assessment is recommended.

6.2.2 Photovoltaic Cells

No PV cells have been identified at this stage, however it is anticipated that these will be incorporated in the design. The following general design guidance is provided in order to limit any electrical exposure to evacuating occupants or attending fire fighters.

Where solar panels are proposed, the following general design guidance is provided in order to limit any electrical exposure to evacuating occupants or attending fire fighters.

An A4 block plan shall be provided at all FDCIE and shall include the following (relevant to the building):

- The location of the panels.
- The location of all associated isolation switches, AC & DC isolated for the shut-off of generated electricity.
- A statement of whether the system automatically isolates on fire trip.
- A statement in 8 mm font stating (or similar):
  - “Photovoltaic (PV) panels present. PV panels are mechanically fixed to the roof as depicted”.

6.2.3 Insulated Sandwich Panels

Where insulated sandwich panels are proposed within the facility (typically temperature-controlled areas or clean rooms), these shall be installed in accordance with the Code of Practice, IPCA Ltd Code of Practice (CoP) Version 4.3 dated 2017.

- ISPs must have a Group 1 Certificate when tested to AS ISO 9705 2003, or Class 1 to FM 4881 (relevant to PIR) and their fire performance is to be in accordance with the CoP.
- Certification should be provided from the accredited installer (e.g. a Code Compliant Company with the Code of Practice) that the panels (All EPS must meet AS 1366.3 1992, use only 100% FR bead) and the installation complies with the requirements of the CoP.
- The use of ISP’s should be identified in accordance with the requirements of the CoP e.g. labels (see Annexure B of CoP for examples) being placed on all doors leading into the rooms that have utilised ISP Systems;
- The key diagram required by the CoP is to be located at the fire indicator panel. The key diagrams shall indicate the locations and specification of all ISPs in the building and can assist firefighters when making operational decisions.

6.2.4 Dangerous Goods

Should the storage of Dangerous Goods be proposed, this must be in accordance with the relevant workplace health and safety regulations which will apply governing storage allowances (quantity) and requirements. The presence of DGs can also impact on the fire safety strategy and therefore must be reviewed in the context of fire spread, occupant evacuation and fire brigade intervention.

6.2.5 Automatic Storage and Retrieval Systems

There are various automated racking systems in the market for storage facilities as a general trend towards efficiency in distribution facilities. With the efficiency comes additional fire hazards to be considered. While automated racking systems have not been proposed in these facilities at this stage, the following potential hazards will need further consideration if such a system is proposed:

- The dense storage arrangement restricts access to maintenance personnel only, with subsequent egress being typically complex in nature.
- The restricted access limits the ability for firefighters by conventional means to access the racking arrangement to suppress a fire and/or confirm a fire is extinguished.
- The live electrical system can create additional hazards for attending firefighters.
- The automated nature (moving parts) can contribute to fire spread and result in multiple sprinkler heads operating.

Should an automated system be design, this is likely to alter the fire safety strategy and so detailed consideration of the inherent risks to fire spread, occupant evacuation and fire brigade intervention is required.

6.3 PREVENTATIVE AND PROTECTIVE MEASURES

6.3.1 Fire Initiation and Development and Control (Sub-System A)

To minimise the risk of fires initiating and growing to a size which may impact on the building occupants, fire safety systems are to be utilised within the building as listed in the following sections. The following general advice may also be provided to limit the likelihood of fire initiation and development.

- Flammable materials should be stored away from ignition sources where possible.
- Scheduled maintenance of all electrical equipment / switchboards
- Adhere to safe operating procedures for ‘hot work’ (e.g. welding).
- No smoking policy

6.3.2 Smoke Development and Spread and Control (Sub-System B)

It is recognised that smoke is one of the most serious threats to life safety in the event of a fire. Whilst the automatic smoke exhaust system for this facility shall be rationalised, the following are anticipated:

- Large smoke reservoir due to volume of each building.
- Automatic smoke exhaust system initiated upon sprinkler activation, achieving a capacity of 1 volume air change per hour.

6.3.3 Fire Spread and Impact and Control (Sub-System C)

To limit the extent and impact of fire spread through the buildings, the following are to be implemented in the building.

- Type C construction
- Fire sprinkler system, as documented in Sub System D
- The distances from the nearest fire source feature (site boundary) are greater than 3 m on all sides.
- Automatic shutdown of automated equipment (if any)

6.3.4 Fire Detection, Warning and Suppression (Sub-System D)

The following active systems are to be used within the buildings to facilitate occupant warning and suppress a potential fire.

- Occupant warning system
- Storage / suppression mode sprinkler system at warehouse roof level and under the super awning
- Sprinkler system throughout all other areas
- Fire hose reels
- Fire extinguishers

6.3.5 Occupant Evacuation and Control (Sub-System E)

The buildings are to be provided with the following systems to assist in the evacuation of occupants:

- Emergency lighting
- Exit signage
- Exits direct to outside
- Multiple exits located on all four sides of each building

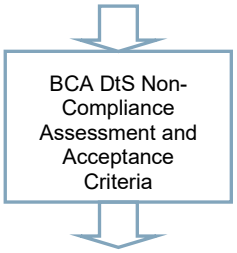
6.3.6 Fire Services Intervention (Sub-System F)

The building is to be provided with the following systems to assist in fire brigade intervention:

- Fire hydrant system, using external hydrants where possible
- Automatic link to fire brigade
- Perimeter vehicular perimeter access in a forward motion with minor non-conformances.
- Fire hydrant booster for each Lot
- FCC for each Lot
- Sprinkler tank, pump and booster for each building
- Local fire brigades in close vicinity supported by full time staff

7 BCA DTS NON-COMPLIANCE ASSESSMENT

7.1 OVERVIEW



In this instance the BCA DtS non-compliances have been formulated based on the regulatory review as provided by the principal certifying authority. Where not listed herein the building is required to achieve compliance with relevant DtS provisions or if existing, comply with relevant codes, reports and / or Standards approved at the time of consideration.

The following table lists the departures from the DtS provisions of the BCA for the proposed building and the analysis methodology proposed for the Fire Engineering assessment, which is to be generally in accordance with the AFEG [3].

7.2 BCA DTS NON-COMPLIANCE ASSESSMENT

Table 7-1: Summary of Performance Solutions

BCA DTS PROVISIONS	DETAILS OF PERFORMANCE BASED SOLUTION
Vehicular Perimeter Access **BCA DtS Provisions** Provision C3D5: Requirements for open spaces and vehicular access **Performance Requirements** C1P9	**Relevant BCA DtS Provisions** Provision C3D5(2): Vehicular access must be provided for emergency vehicles to enable travel in a forward direction around the entire building. The access path must be minimum 6 m wide and have no part of its pathway be greater than 18 m from the building. **DtS Variation** The following non-conformances are present: • The eastern part of the Lot 2 perimeter access path is on Lot 3. • The perimeter access path of Lot 7 is discontinuous at the southern corner. • In various locations for Lots 1-9, the perimeter vehicular access paths are greater than 18 m from the external wall of the subject building. **Performance Solution** For Lot 2 , the Performance Solution shall rely upon the access path over the adjoining lots being maintained clear and unobstructed, primarily via a restriction on use easement registered with the Department for Lands and Property Information. For Lot 7, the Performance Solution shall rely upon staging afforded at all corners of the building, and sufficient turnaround area (without reversing) where the pathway is discontinuous. For the distance greater than 18 m, the Performance Solution shall rely upon the fact that staging locations are available at the corners of the warehouses for firefighting and pedestrian access and smaller emergency vehicles can provide firefighters access to the building in areas of non-conformance.
Extended Travel Distances **BCA DtS Provisions** Provision D2D5: Exit travel distances Provision D2D6: Distance between alternative exits	**Relevant BCA DtS Provisions** Provision D2D5: Travel distances to the nearest exit must not exceed 40 metres. Provision D2D6: Travel distances between alternative exits must not exceed 60 metres. Provision E2D10: A Large Isolated Building which exceeds 108,000 m³ in volume must be provided with an automatic smoke exhaust system in accordance with Specification 21. **DtS Variation** • Distances up to 70 m to the nearest exit and 140 m between alternative exit are anticipated typically. • Due to the size of Lot 1, distances up to 85 m to the nearest exit and 170 m between alternative exits are anticipated (noting up to an additional 45 m is required to traverse beneath the awnings to open space).

BCA DTS PROVISIONS	DETAILS OF PERFORMANCE BASED SOLUTION
Provision E2D10: General requirements **Performance Requirements** D1P4, E2P2	• Due to the size of Lot 4, distances up to 100 m to the nearest exit and 200 m between alternative exits are anticipated. • Due to the size of Lot 8, distances up to 90 m to the nearest exit and 180 m between alternative exits are anticipated. • Due to the size of Lot 9, distances up to 95 m to the nearest exit and 190 m between alternative exits are anticipated. • A rationalised automatic smoke exhaust system is proposed with a capacity of 1 volume air change per hour. **Performance Solution** The Performance Solution relies upon: • The volume of the warehouse enclosures providing a large smoke reservoir hence longer time is available for occupant egress before the smoke descends. • The automatic smoke exhaust system is initiated upon sprinkler activation. • The population density inside the warehouse is expected to be low where the occupants are likely to be awake and able-bodied to evacuate while the tenability within the warehouse is maintained.
Egress Paths on Adjacent Lots **BCA DtS Provisions** Provision D2D15: Discharge from exits **Performance Requirements** D1P4	**Relevant BCA DtS Provisions** Provision D2D15: If a required exit leads to an open space, the path of travel to the road must have an unobstructed width throughout of not less than the minimum width of the required exit or 1 m, whichever is greater. **DtS Variation** Egress from some buildings will necessitate passing through adjacent lots. **Performance Solution** The Performance Solution shall rely upon the access path over the affected adjoining lot being maintained clear and unobstructed, primarily via a restriction on use easement registered with the Department for Lands and Property Information.
Fire Hydrants **BCA DtS Provisions** Provision E1D2: Fire hydrants **Performance Requirements** E1P3	**Relevant BCA DtS Provisions** Provision E1D2: Fire hydrants shall be installed in accordance with AS2419.1:2021. AS2419.1:2021 requires the following: • Hydrants beneath awnings are to be considered as internal hydrants. • Internal hydrants must be located not more than 4 m from a required exit. **DtS Variation** The scope of AS2419.1:2021 does not include buildings with a total volume of more than 108,000 m³. However, the standard shall be applied, with additional measures to buildings which exceed 108,000 m³. • The hydrants under awnings are to be designed as external hydrants. • The provision of additional internal hydrants not within 4 m of an exit. **Performance Solution** The Performance Solution is proposed to rely on the following: • Sprinkler protection is provided throughout the buildings, including beneath the awnings. • Hydrants located beneath the on-grade dock awnings shall have all the requirements of and be treated as external hydrants. • Fall-back hydrants shall be provided on the respective hardstands to provide full coverage to hydrants under awnings.

BCA DTS PROVISIONS	DETAILS OF PERFORMANCE BASED SOLUTION
	• Each internal hydrant is located within 70 m of an external hydrant (including those located under awnings), such that there are multiple routes to reach the fire base and the appropriate internal hydrant within the vicinity.
Sprinkler Booster Locations **BCA DtS Provisions** Provision E1D4: Sprinklers **Performance Requirements** E1P4	**Relevant BCA DtS Provisions** Provision E1D4; Specification 17: An automatic sprinkler system must comply with AS2118.1. AS2118.1:2017 (Clause 4.14.1) and AS2419.1:2021 (Clause 7.3): A sprinkler booster must be located within sight of the principal pedestrian entrance to the building. **DtS Variation** The location of the sprinkler booster of each Lot is not within sight of the main entrance of each Lot and therefore does not comply with the provisions above. **Performance Solution** The sprinkler booster shall be positioned such that it is accessible directly via the perimeter access path, having a dedicated hardstand in accordance with FRNSW guidelines that does not obstruct the perimeter access path.

8 PROPOSED FIRE SAFETY STRATEGY

8.1 OVERVIEW

The FSS outlined below has been proposed to satisfy the fire and life safety objectives specified for this project by the relevant stakeholders. In addition, the FSS is required to adequately address the specific fire and life safety hazards identified for the proposed development, and as such have been generally derived from the preventative and protective measures outlined within the BCA, and fire engineering literature and research. Where items of non-compliance have not been identified by the design team in the concept design phase, it is expected that those items will be DtS solutions.

This section provides guidance for the design and application of fire safety measures. It highlights specific design considerations for a range of fire safety measures that will undergo analysis as part of the FER to ascertain whether the relevant Performance Requirements of the BCA are satisfied. Design guidance (general informative details and specific requirements) for a range of specific fire safety measures is provided. This list is not exhaustive and the use of other fire safety measures including new technologies will require additional review.

8.2 PASSIVE FIRE PROTECTION

8.2.1 Type of Construction Required

Each building shall be built in accordance with the NCC DtS provisions for Type C fire-resisting construction, as a large-isolated building.

In practice, this means external wall that is less than 1.5 m from any fire-source feature shall achieve an FRL 90/90/90. External wall that are 1.5 m to less than 3 m from a fire-source feature shall achieve an FRL of 60/60/60. Fire walls in Type C construction shall achieve an FRL of 90/90/90.

From review of the masterplan, it does not appear that any external walls are prescriptively required to achieve an FRL.

Where the internal fit-out drives Type B construction requirements (i.e. due to the presence of mezzanine levels), the following requirements are applicable:

- External columns within 18 m of a fire source feature require an FRL of 240/--/--.
- Internal columns (other than those supporting only the roof) require an FRL of 240/--/--.
  - A Performance Solution may be feasible to rationalise the columns supporting a mezzanine to a nil FRL, subject to an understanding of the structural collapse mechanisms in a fire event to ensure that failure of a supporting column does not initiate the progressive collapse of the mezzanine. Additionally, storage height restrictions may be applicable.
- Elements in the external walls must be non-combustible.
- Ancillary elements such as signage must comply with specific requirements. Specifically, signage must:
  - Achieve a Group number of 1 or 2.
  - Not extend beyond one storey.
  - Not extend beyond one fire compartment.
  - Be separated vertically from other signs.

8.2.2 Combustibility of External Wall

As the buildings require Type C construction, there is no prescriptive requirement for materials in the external wall build-up to be non-combustible. However, given the global scrutiny on combustible façade materials, and to facilitate tenant fit-outs that may drive Type B construction, it is recommended to specify non-combustible cladding materials.

8.3 VEHICULAR PERIMETER ACCESS

The vehicular perimeter access pathway should be provided around the whole of the building. These should be designed and constructed with an all-weather surface capable of supporting all FRNSW appliances in accordance with NCC Provision C3D4 and the FRNSW Fire Safety Guideline '*Access for Emergency Vehicles*

And Emergency Service Personnel', available at http://www.fire.nsw.gov.au, with the following exceptions permitted:

- Perimeter access on the eastern side of Lot 2 is over the adjoining Lot 3.
- Perimeter access on the southern corner of Lot 7 is discontinuous.
- Parts of the perimeter vehicular access around the warehouses is in excess of 18 m from the external wall of the buildings.

To facilitate the perimeter access non-conformances, the following measures should be provided as part of the Performance Solution:

- A restriction on use easement (Section 88B instrument) should be registered with the Department for Lands and Property Information (or alternatively, via a lease agreement) on the Warehouse 3 hardstand for the benefit of Warehouse 2 to maintain the access path clear of stored goods and accessible by the fire brigade at all times.
- Gates in the security line between lots should be provided enabling access to the egress doors and fire hydrants from the hardstand.[1]
- All gates, security fencing, and boom gates should be readily openable by the fire authorities. This can be achieved through one, or a combination of, the following [8]:
  - Any vehicle access gate that is required to be locked should be secured with a non-hardened metal chain and lock.
  - All locks fitted to vehicle access gates and security devices are to be keyed alike, and a copy of the key deposited with the two nearest FRNSW fire brigade stations or kept with the site security if 24/7 security is provided for the site.
  - Any electrically operated vehicle access gate or security device should incorporate either mechanical override, fail-safe open mode, or activated by site security so that fire appliances can access the site in the event of fire.
- The load-bearing capacity and vehicle swept path of the vehicular access paths and carparks must be compatible with fire brigade vehicle requirements.

8.4 EGRESS PROVISIONS

8.4.1 Evacuation Strategy

Activation of any sprinkler heads or detectors should initiate the evacuation of all areas of the building. Dedicated fire wardens from the warehouse and office areas should ensure that all clients, visitors, and staff are promptly evacuated.

8.4.2 Travel Distances

In the warehouse, the travel distances to the nearest exit and between alternative exits must be compliant with the NCC DtS requirements with the following exceptions identified.

- Travel distances within warehouse areas are likely to extend up to 70 m to the nearest exit and the 140 m between exits in lieu of 40 m and 60 m respectively. These maximum distances also typically enable hydrant coverage to be achieved via external hydrants only.
- These distances may be extended by the additional distance under the awnings (~15 m) prior to reaching open space.
- Due to the size of Lot 1, distances up to 85 m to the nearest exit and 170 m between alternative exits are anticipated (noting up to an additional 45m is required to traverse beneath the awnings to open space).
- Due to the size of Lot 4, distances up to 100 m to the nearest exit and 200 m between alternative exits are anticipated (noting this includes 30 m of travel beneath the awnings).
- Due to the side of Lot 8, distances up to 95 m to the nearest exit and 185 m between alternative exits are anticipated (noting this includes 20 m of travel underneath the awnings).
- Due to the side of Lot 9, distances up to 90 m to the nearest exit and 180 m between alternative exits are anticipated (noting this includes 20 m of travel underneath the awnings).

It is anticipated that these distances can be addressed through a Performance Solution involving detailed computational smoke modelling and evacuation analysis.

1 Egress to the road is expected to be provided solely within the lease boundary, however should egress be required over the adjoining hardstand (as for the perimeter access), a Performance Solution is also possible for this.

Exits from some buildings involve travel over adjoining lots. Although non-compliant, this can be assessed via a Performance Solution reliant on the Section 88B instrument as for the perimeter access. The width of the egress path must be no less than 1 m wide.

8.4.3 Door Hardware, Operation and Mechanisms

All exit doors and doors in a path of travel to an exit are required to be DtS compliant throughout the building. This includes the swing of doors, the applied latching and locking mechanisms and the force required on mechanism used to open doors.

8.5 FIRE FIGHTING EQUIPMENT

8.5.1 Fire Hydrants

A dedicated fire hydrant system is proposed for each lot, in accordance with NCC Provision E1D2 and AS2419.1:2021. The following additional guidance is provided:

- As far as possible, the hydrant system should consist of external hydrants.
- All points on the floor shall be within 100 m of an external hydrant.
  - Further, guidance within Appendix C of AS2419.1:2021 notes that all points on the floor within a Class 7b or Class 8 large-isolated building shall be within 90 m of an exit. This may be referenced by FRNSW and thus presents as an approval risk, however the precedent is that this limitation has not yet been enforced at this time.
- Where the size and design of a building requires the provision of internal fire hydrants to achieve floor coverage, each internal hydrant is to be located within 70 m of an external hydrant (including those located under awnings), such that there are multiple routes to reach the fire base and the appropriate internal hydrant within the vicinity.
- Hydrants located beneath the warehouse can be considered external for coverage purposes, by way of a Performance Solution.
  - The hydrants under the awning must be designed with all requirements of external hydrants, other than that heat shields are not required.
- However, hydrant coverage of the area beneath the awnings shall be based on additional external hydrants (i.e. fallback hydrants) located within 10 m either side of the awing. Where complete coverage from external hydrants is not possible for the super awning, coverage is to be supplemented by:
  - The hydrants located below the awning being treated as internal hydrants (i.e. 40 m of coverage); and
  - External hydrants located outside of the awning must be within 50 m of the nearest hydrant below the awning. For progressive movement, the next internal hydrant required for coverage must be within 25 m of this hydrant.
- Each system must incorporate a ring main with isolation valves that are external to the building and numbered with the corresponding numbers indicated on the block plan at the booster assembly.
- All hose connections in the system are to be fitted in accordance with FRNSW Technical information sheet – FRNSW compatible hose connections (available at firesafety.fire.nsw.gov.au). These couplings should be tested as part of the system when the commissioning tests are undertaken.
- At a minimum, system capacity must be capable of allowing 3 hydrants to operate simultaneously (i.e. 30 L/s). The presence of additional hazards due to fit-out (i.e. mezzanines, Dangerous Goods, and battery storage within this facility) presents an approval risk with FRNSW and may drive the requirement to consider additional flow capacity.
- Each hydrant booster assembly is proposed to be located at the entrance to the respective lot, within sight of the main building entry. Each booster must also be located greater than 10 m from any substation, and located outside the exclusion zone of the building as per Appendix C of AS2419.1:2021.
- ASRS advice is provided in Appendix C.3 regarding:
  - Facilitating brigade access.
  - Providing hydrant coverage.
  - Power isolation, return to base functions, and manual operation of cranes.
  - Increasing water supply capabilities for the sprinkler and hydrant systems for up to 4 hours.

Note: external hydrants are not required to be provided with radiant heat shields, per the concessions provided within AS2419.1:2021.

Note2: Hydrants located beneath awnings that are no greater than 3 m deep are prescriptively considered to be external hydrants for the purposes of providing hydrant coverage.

8.5.2 Fire Hose Reels

Fire hose reel shall be provided throughout the building in accordance with Provision E1D3 of the BCA and AS2441:2005.

All points on the floor should be within reach of a 4 m hose stream issuing from a nozzle at the end of the hose laid on the floor with a hose length not exceeding 36 m (i.e. a maximum of 40 m from the hydrant location).

However, it is possible to present a Performance Solution to enable the installation of 50 m fire hose reels – generally to enable hose reels located around the building perimeter only, or to limit the installation of hose reels in cold stores. Additional requirements to permit the use of 50 m hose reels are as follows:

- 50 m fire hose reels must be tested and certified to AS/NZS1221.
- The pressure and flow at the nozzle of the 50 m hose reel is to achieve compliance with the pressure and flow requirements of AS2441.1-2005.
- Coverage is to be achieved with no more than two bends in the hose.
- Staff training in the use of the 50 m length fire hose reels is to occur at least every 12 months to maintain occupant familiarity with the increased weight and length of the extended hose reels.

8.5.3 Fire Sprinkler System

A fire sprinkler system shall be provided throughout the building in accordance with the relevant regulatory requirements. Each lot should have an independent system with dedicated fire pump, water supply tanks and booster assemblies.

- In the offices and beneath the warehouse awnings the system shall comply with NCC Specification 17 and AS2118.1:2017.
- In the warehouse a storage system shall be provided in accordance with NCC Specification 17 and AS2118.1:2017. Sprinkler activation temperature must be no greater than 101°C and have a Response Time Index (RTI) of less than $50m^{1/2}s^{1/2}$ (i.e. fast response type).

Upon sprinkler activation the automatic smoke exhaust system and building occupant warning alarm shall be initiated, as well as the direct brigade notification.

At the fire sprinkler booster, a dedicated hardstand for fire brigade appliances is required. As per FRNSW Guideline For Emergency Vehicle Access [8] this hardstand should be designed to be 18 m long by 6 m wide, whilst allowing other fire brigade appliances to pass.

- A Performance Solution is possible assess the location of the sprinkler booster in the indicated locations, being an approval risk subject to FRNSW review.

8.5.4 Portable Fire Extinguishers

Portable fire extinguishers are to be provided throughout the building in accordance with Provision E1D14 of the NCC and selected, located, and distributed in accordance with AS2444:2001.

8.5.5 Fire Control Centre

Lots 1, 2, 3, 4, 8 and 9 shall be provided with a within a compliant Fire Control Centre (FCC) at the main entry.

- The FCC serving Warehouse 8 is proposed to be provided within an acoustically separated enclosure, adjacent to the pump room.

In each instance, the Main FIP must be installed in accordance with Specification 20 and AS1670.1:2018 and have the following capabilities:

- Smoke exhaust fan controls shall be provided at the FIP which shall include clear signalling of the operational status of the fans.
- Where two tenancies are proposed in the same building , a mimic panel or sub-FIP may be required . This is subject to consultation with FRNSW and can also facilitate specific functional requirements of tenants (i.e. should an alarm occur during operational hours of 1 tenancy and not the other). It may also be possible to house the FCC centrally at the pump room in an acoustically sealed enclosure.

8.6 SMOKE HAZARD MANAGEMENT

8.6.1 Smoke Detection System

A smoke detection system for occupant warning is unlikely to be required throughout the warehouses due to their large volume.

- In the event of future subdivisions of warehouse buildings into smaller tenancies, there might arise a need for smoke detection due to the reduced smoke reservoir volumes.
- In the event of travel distances in excess of the DtS Provisions being present in the building offices, detection will likely be required throughout each affected office in accordance with AS1670.1:2018.

8.6.2 Smoke Hazard Management System

A rationalised automatic smoke hazard management system shall be provided to each warehouse, designed to achieve the following minimum requirements.

- System capacity must be capable of an exhaust rate equal to one enclosure air change per hour, and be initiated upon activation of the sprinkler system.
- Adequate make-up air should be provided at low level to facilitate the exhaust system's designed operational capacity, whilst ensuring the inlet velocity does not exceed 2.5 m/s. The make-up air should be provided at a low level by:
  - Permanently open natural ventilation louvers; and/or
  - Perforated roller shutters; and/or
  - Mechanically operated louvers that open upon activation of the fans. All motors and cables to automatic louvers, vents or supply fans must be fire rated to operate at 200°C for a period of 60 minutes.
- On/Auto/Off switches should be located at the FIP.
- Signs and a mechanical block plan alerting the fire brigade to the operation of the system must be provided.
- Fire rated fans and fire rated cabling should be designed to operate at 200°C for a period no less than 60 minutes.
- The fans shall be served by essential power and the mechanical services board serving the fans be located in a fire-rated enclosure (FRL of 120/120/120) if located within the building.

8.6.3 Building Occupant Warning System

A building occupant warning system should be provided throughout all parts of each building. The system should be in accordance with the prescriptive requirements of Specification 17 and Clause 7 of Specification 20 of NCC 2022, and AS1670.1:2018.

- The occupant warning alarm should be sounded throughout all areas of the building upon activation of the smoke detection (where provided) and/or sprinkler systems.

8.7 VISIBILITY IN AN EMERGENCY

Emergency lighting is to be provided throughout the building in accordance with DtS Provisions E4D2 and E4D4 of the NCC 2022 and AS2293.1:2018.

Exit signage is to be provided throughout the building in accordance with the DtS Provisions E4D5, E4D6, E4D8 of the NCC 2022 and AS2293.1:2018.

Whether through adjudication by the authority having jurisdiction (AHJ) or via a Performance Solution, it is anticipated that the directional signage at the end of the racking aisles and above block storage areas can be installed at a height greater than 2.7 m. Should a Performance Solution be desired, it shall consider the following:

- Exit signs and directional signs shall be "Jumbo size" to increase the visibility to occupants.
- The final height and location of the directional exit signs shall be determined through the fire engineering analysis.

8.8 BUILDING MANAGEMENT PROCEDURES

The ongoing management of the building is as important in maintaining a high level of life safety as the provisions recommended during the design phase of the building.

8.8.1 Maintenance of Fire Safety Equipment

The fire safety systems should be tested and maintained in accordance with Australian Standard AS1851 or suitable alternative testing and maintenance regime.

8.8.2 Evacuation Plan

An emergency management plan should be developed for the site in accordance with AS3745:2010.

9 ACRONYMS

ACRONYM	EXPANSION
ABCB	Australian Building Codes Board
AFEG	Australian Fire Engineering Guidelines
AFSS	Annual Fire Safety Statement
ASET	Available Safe Egress Time
BCA	Building Code of Australia
CFD	Computational Fluid Dynamics
DtS	Deemed-to-Satisfy
EPA	Environmental Protection Authority
FCC	Fire Control Centre
FER	Fire Engineering Report
FIP	Fire Indicator Panel
FRL	Fire Resistance Level
FRNSW	Fire Rescue NSW
FSS	Fire Safety Strategy
GFA	Gross Floor Area
IFEG	International Fire Engineering Guidelines
NCC	National Construction Code
NFPA	National Fire Protection Association
OHS	Occupational Health and Safety
RSET	Required Safe Egress Time
RTI	Response Time Index

10 REFERENCES

1. ABCB, “Building Code of Australia, Volume One 2022”, CanPrint Communications, Canberra 2020.
2. ABCB, “Guide to the BCA 2022”, CanPrint Communications, Canberra 2020.
3. ABCB, “Australian Fire Engineering Guidelines”, ABCB, Canberra, 2021.
4. ABCB, “International Fire Engineering Guidelines”, ABCB, Canberra, 2005.
5. BS 9999: Code of practice for fire safety in the design, management and use of buildings, October 2008.
6. “Fire Brigade Intervention Model V2.2”, Australasian Fire Authorities Council, October 2004.
7. Fire & Rescue NSW, “Annual report 2015/16”, 31 October 2016.
8. Fire & Rescue NSW “Fire Safety Guideline: Access for Emergency Vehicles and Emergency Service Personnel”, 24 May 2019
9. Flynn, Jennifer, “U.S. Structure Fires in Eating and Drinking Properties”, National Fire Protection Association, Quincy Massachusetts, February 2007.
10. FM Global Data Sheet 8-9, Storage of Class 1, 2, 3, 4 and Plastic Commodities, September 2010.
11. Marty Ahrens, (2001) “U.S. Fire Problem Overview Report”, NFPA, Quincy, MA.
12. National Fire Protection Association, ‘Fire Protection Handbook’, 19th edition, Volumes I and II, 2003.
13. PD 7974-6:2004., “Human factors: Life safety strategies – Occupant evacuation, behaviour and condition (Sub-system 6)”, British Standard, 1 July 2004.
14. Society of Fire Protection Engineers “Engineering Guide to Human Behaviour in Fire”, Review Draft August 2002, The SFPE Engineering Guide to Human Behaviour in Fire, June 2002.
15. Society of Fire Protection Engineers, ‘Handbook of Fire Protection Engineers’, 3rd Edition, 2002.
16. Technical Report FCRC-TR 96-02: Building Fire Scenarios – An analysis of Fire Incident Statistics, Fire Code Reform Research Program, March 1996
17. Technical Standard, “NFPA 92B: Standard for Smoke Management Systems in Malls, Atria and Large Spaces”, National Fire Protection Association (NFPA), 2009.
18. The Chartered Institute of Building Services Engineers, ‘CIBSE Guide E, “Fire engineering’, 2nd Edition, September 2003.