Core Engineering Group • Fire • Risk • Emergency Management

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# Fire Safety Strategy

## Elizabeth Enterprise Park - Stage 1 Masterplan

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**Report Details**

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Document: Fire Safety Strategy
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**Report Revision History**

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| 01 | 26/07/21 | Draft Issue for comment | **Julien Christopher**<br>*B Eng (Mechanical) (Hons)* | **Dean Watt**<br>*B Eng (Chemical) (Hons)*<br>*M Eng (Fire Safety)* | **Graham Morris**<br>*M Eng (Structural and Fire Safety)*<br>*CPEng MIEAust NER*<br>*Registered Certifier – Fire Safety (3200)*<br>  |
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# EXECUTIVE SUMMARY

CORE Engineering Group has been engaged by Mirvac to develop a Fire Safety Strategy (FSS) for the construction of Elizabeth Enterprise Park on Elizabeth Road, Badgerys Creek NSW. Specifically, this report relates to the Stage 1 masterplan, including seven warehouse buildings with ancillary offices, in addition to a café 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 National Construction Code 2022 (NCC) [1] Deemed-to-Satisfy (DtS) provisions for occupant egress, fire resisting construction, fire services, and fire brigade intervention would not satisfy the desired architectural and client aspirations.

The following items are proposed to comply with the Performance Requirements via a Performance Solution as opposed to a DtS Solution:

- C3D5: Requirements for open spaces and vehicular access
- D2D5: Exit travel distances
- D2D6: Distance between alternative exits
- E1D2: Fire Hydrants
- E1D4: Sprinklers
- E2D10: Buildings not more than 25m in effective height: large isolated buildings subject to C3D4

With the exception of the items identified above, all other aspects of the building design are to conform to the DtS Provisions of the NCC.

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 Engineering Report has been undertaken to nominate proposed Performance Solutions for assessing compliance with the nominated Performance Requirements of the NCC [1] in accordance with the methodologies defined in the AFEG [4] and provide a workable and safe Fire Safety Strategy through a trial design. In order to develop and assess the nominated non-compliances the following flowchart process is to be adopted.

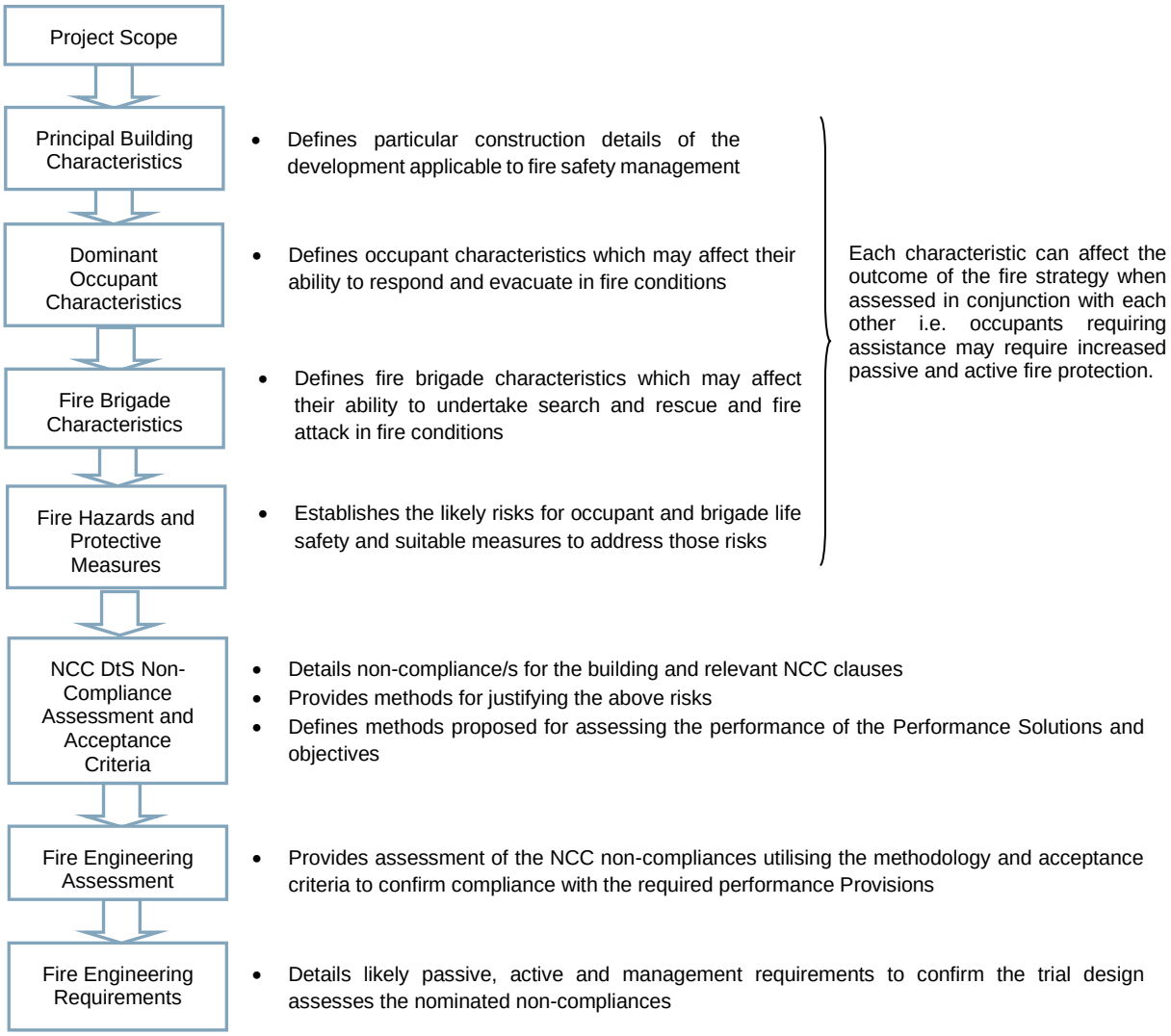



**Figure 1-1: Fire Engineering Report Process**

## 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) [7] 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 Verifications 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 1.3.2 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 [4] document has been developed for use in fire safety design and assessment of buildings and reflects Australian 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 generally be adopted in the Fire Engineering Report.

# 2 PROJECT SCOPE

## 2.1 OVERVIEW


CORE Engineering Group has been engaged to develop a FSS for the construction of Elizabeth Enterprise Park - Stage 1 Masterplan at Lot 100 DP1283398 Elizabeth Drive, Badgerys Creek NSW 2555. The purpose of this FSS is to outline the fire engineering principles that will be utilised in ensuring that the prescriptive DtS non-compliances identified in the NCC report are resolved in order to conform to the building regulations and permit 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 NCC.

## 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 Managers | Stephen Foster<br>Meighan Woods | Mirvac |
| Principal Certifying Authority | Dean Goldsmith | Blackett Maguire + Goldsmith |
| Architect | Alex Lai | SBA Architects |
| Fire Safety Engineer | Julien Christopher<br>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:

- Architectural plan provided by SBA Architects, as indicated in Table 2-2.
- Draft BCA Reports Provided by Blackett Maguire + Goldsmith for Warehouses 2 & 6. Project No 210322, Rev 0, Dated 09/08/21.

**Table 2-2: Drawings**

| DRAWING NO. | DESCRIPTION | ISSUE | DATE |
|---|---|---|---|
| MP02 | SSDA Masterplan – Stage 1 | M | 19/02/25 |
| MP07 | Fire Protection Plan | G | 19/02/25 |

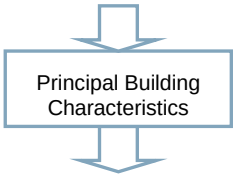
## 2.4 LIMITATIONS AND ASSUMPTIONS

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.
- Building and occupant characteristics are as per Section 3 and 4 respectively of this report. Variations to these assumptions may affect the FSS and FER, and therefore should be reviewed by a suitably qualified Fire Engineer should they differ.
- As per any building design, DtS or otherwise, the report is limited to the fire hazards and fuel loads as prescribed in the IFEG [3]. The report does not provide guidance in respect to areas which are used for Dangerous Goods (DG) storage, processing of flammable liquids, explosive materials, multiple fire ignitions, or sabotage of fire safety systems.
- The development complies with the fire safety DtS provisions of the NCC [10] with all aspects in regards to fire and life safety unless otherwise stated in this report. Where not specifically mentioned, the design is expected to meet the NCC DtS requirements of all relevant codes and legislation at the time of construction and/or at the time of issue of this report.
- The assessment is limited to the objectives of the NCC 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 NCC. 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.
- The FSS and FER is only applicable to the completed building. This report is not suitable, unless approved otherwise, to the building in a staged handover.
- 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 fire fighting 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. NCC 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 Badgerys Creek, approximately 41 km west of Sydney's central business district. The Elizabeth Enterprise Park (Stage 1) is located on Lot 100 DP1283398 and is bounded by Elizabeth Drive to the south (Figure 3-1).


**Figure 3-1: Site Location**

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 Bonnyrigg and Busby approximately 10.8 km and 15.3 km from the site respectively when considering actual driving directions.

## 3.3 SITE LAYOUT

Stage 1 of the development has a total area of approximately 566,828 m² and consists of multiple lots, as illustrated in Figure 3-2 above. This report addresses fire safety strategies for the Stage 1 works specifically, which involves the construction of the following:

- 7 Warehouse facilities inclusive of ancillary main office and dock office facilities to each warehouse tenancy.
- Café located to the south-east of the site. It is noted that this building is proposed to be DtS compliant, with no requirement for fire services, and shall therefore not be considered in the scope of this report.
- Construction of a pedestrian/cycle path to the south-east of the site which shall be available for public access.
- Substation lot to the north-west

All warehouses on the estate shall be classified as a large-isolated building of Type C construction with a proposed ridge height of 13.7 m. It is also noted that Warehouses 6 and 7 are the only warehouses to exceed 18,000 m² when considering total floor area.

Warehouses 2, 4, 6, 7and 8 have the potential to be split into multiple tenancies, with the remaining warehouses initially proposed as single tenant buildings. All warehouse facilities within the estate shall be provided with a two-storey ancillary office to serve each tenancy, a one storey office serving each loading dock (apart from Warehouse 4) and dedicated carparking. All constructed facilities (aside from the substation) will be leased to third party businesses.

The total floor area of the proposed warehouses on each lot are shown in Figure 3-2 and Figure 3-3 below.

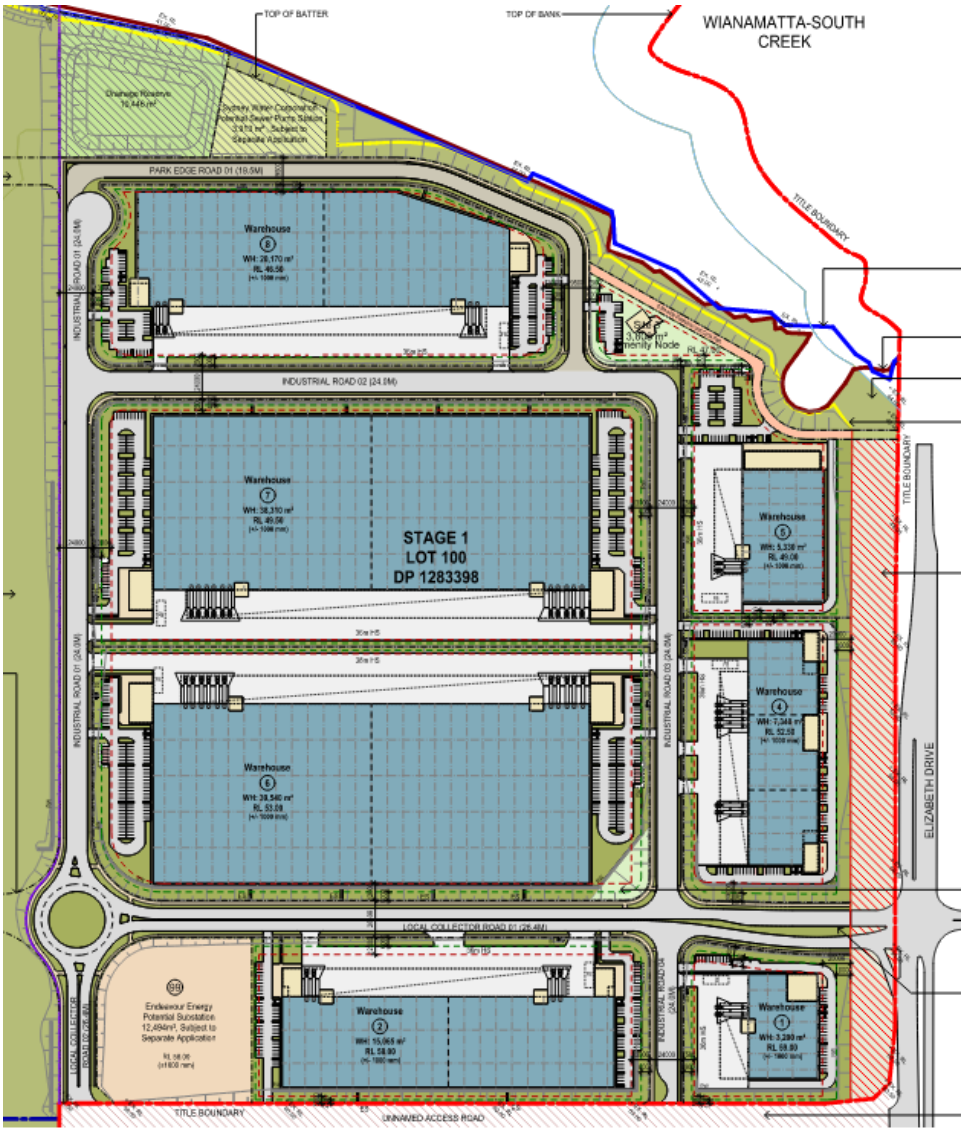
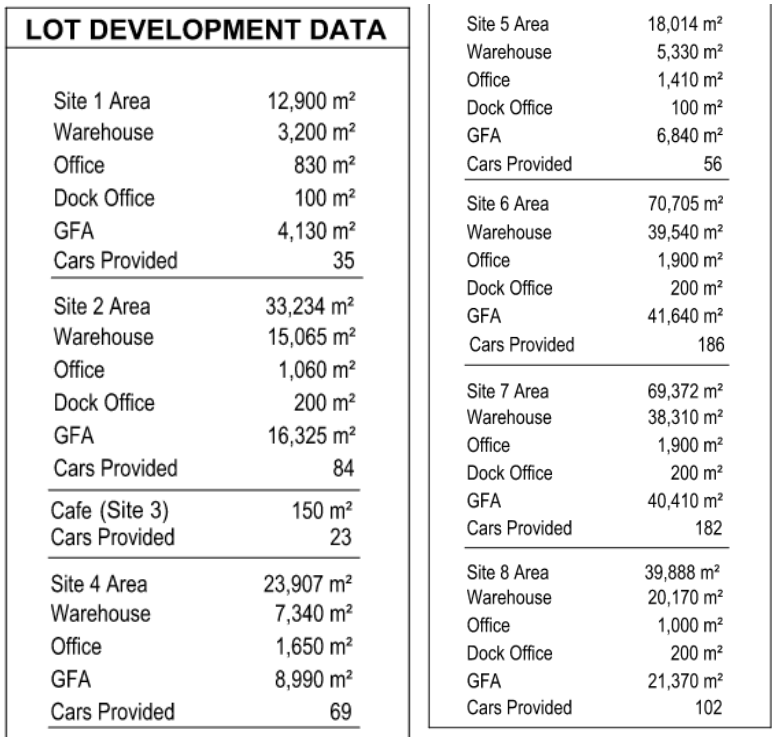



**Figure 3-2: Estate Masterplan (Stage 1)**



**LOT DEVELOPMENT DATA**

| | |
|---|---|
| Site 1 Area | 12,900 m² |
| Warehouse | 3,200 m² |
| Office | 830 m² |
| Dock Office | 100 m² |
| GFA | 4,130 m² |
| Cars Provided | 35 |
| Site 2 Area | 33,234 m² |
| Warehouse | 15,065 m² |
| Office | 1,060 m² |
| Dock Office | 200 m² |
| GFA | 16,325 m² |
| Cars Provided | 84 |
| Cafe (Site 3) | 150 m² |
| Cars Provided | 23 |
| Site 4 Area | 23,907 m² |
| Warehouse | 7,340 m² |
| Office | 1,650 m² |
| GFA | 8,990 m² |
| Cars Provided | 69 |
| Site 5 Area | 18,014 m² |
| Warehouse | 5,330 m² |
| Office | 1,410 m² |
| Dock Office | 100 m² |
| GFA | 6,840 m² |
| Cars Provided | 56 |
| Site 6 Area | 70,705 m² |
| Warehouse | 39,540 m² |
| Office | 1,900 m² |
| Dock Office | 200 m² |
| GFA | 41,640 m² |
| Cars Provided | 186 |
| Site 7 Area | 69,372 m² |
| Warehouse | 38,310 m² |
| Office | 1,900 m² |
| Dock Office | 200 m² |
| GFA | 40,410 m² |
| Cars Provided | 182 |
| Site 8 Area | 39,888 m² |
| Warehouse | 20,170 m² |
| Office | 1,000 m² |
| Dock Office | 200 m² |
| GFA | 21,370 m² |
| Cars Provided | 102 |

**Figure 3-3: Building Floor Areas (Not Including Substation)**

## 3.4 BUILDING STRUCTURE

The warehouses shall be constructed as steel portal frame structures 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 Type C construction.

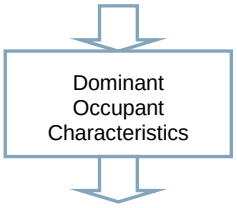
## 3.5 NCC ASSESSMENT SUMMARY

**Table 3-1: NCC Building Characteristics**

| CHARACTERISTIC | DESCRIPTION |
|---|---|
| **Classification** | Class 7b (Warehouse) and Class 5 (Office)<br>Class 6 (Retail) to Café only |
| **Construction Type** | Type C (Large-Isolated Building) |
| **Rise in Storeys** | Two (2) |
| **Effective Height** | Less than 12 m |
| **Floor Area/Volume** | Greater than 18,000 m² and/or 108,000 m³ (apart from Warehouses 1 and 5) |

# 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

DtS Provision D2D18 provides a means of estimating the population of an area based on the use of that area and its size. The following occupant densities are considered applicable to each area in this building:

- 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 DtS Provision D2D18 will be utilised in the analysis, therefore providing a conservative population in the warehouse parts.

It is noted that these numbers are only listed at this stage to 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 generally 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 expected nature of the work conducted the majority of occupants are assumed to be able bodied people with a small number of less mobile occupants requiring assistance during an evacuation. All occupants within the warehouse parts are expected to be mobile occupants.

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.

- ***Staff and Security*** are expected to be mobile with normal hearing and visual abilities, and occupants in this group are considered to take and implement decisions independently, and require minimal assistance during evacuation in a fire emergency. This occupant group is expected to be awake and fully conscious at all times when inside the building. Occupants in the warehousing areas are expected to be mobile with normal hearing and visual abilities given the nature of work likely to be undertaken; and
- ***Clients / Visitors*** are expected to be mobile with normal hearing and visual abilities, this occupant group are expected to be capable of making and implementing decisions independently however may require assistance in locating the nearest and safest egress path in an emergency.

## 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 and /or Visitors*** may or may not be familiar with the layout of the building and may require assistance in locating the exits.

## 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

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

The following figures illustrate the site plan with respect to the fire services provided on the site. These include:

- Perimeter access provided around each building.
- Fire sprinkler tank, pump room and sprinkler booster locations for each building.
- Indicative location of fire detection control and indicating equipment.
- Indicative location of fire hydrant booster for each building.

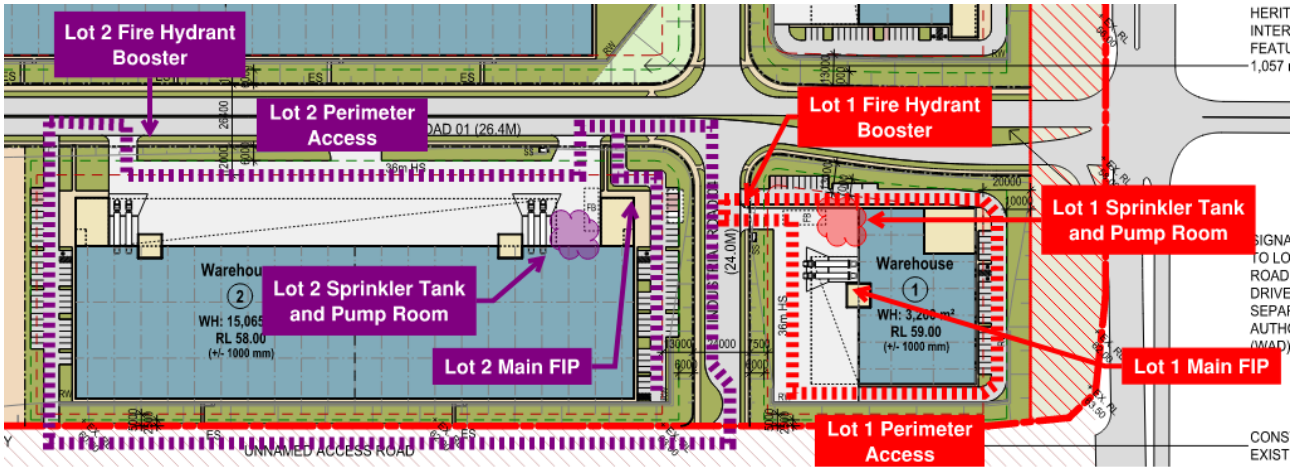



**Figure 5-1: Fire Brigade Access and Site Facilities (Lots 1 and 2)**

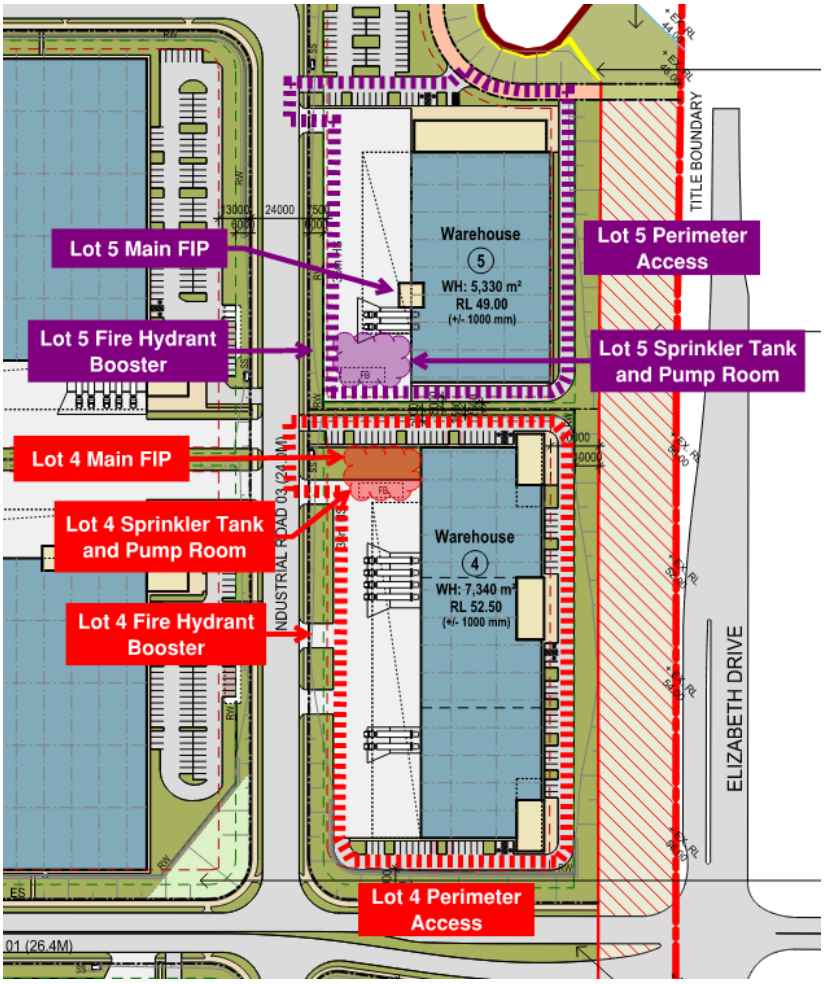



**Figure 5-2: Fire Brigade Access and Site Facilities (Lots 4 and 5)**

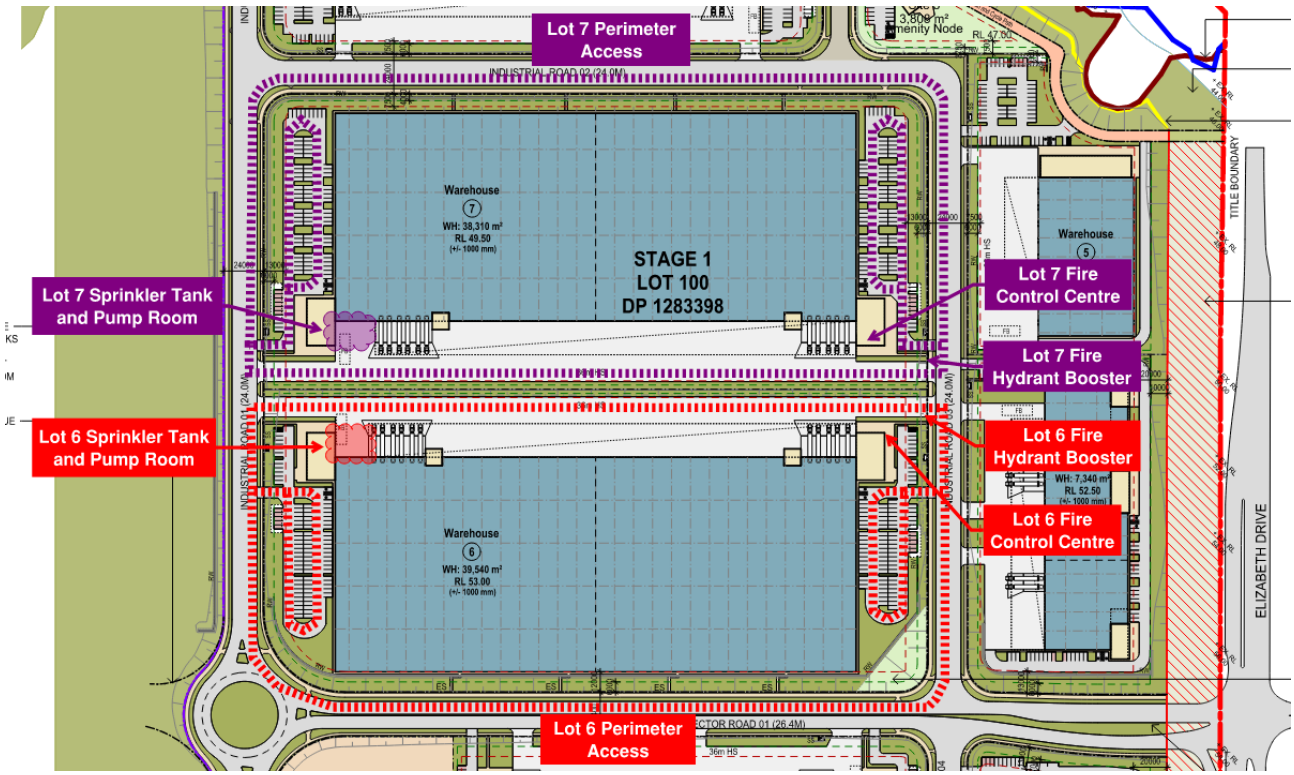



**Figure 5-3: Fire Brigade Access and Site Facilities (Lots 6 and 7)**

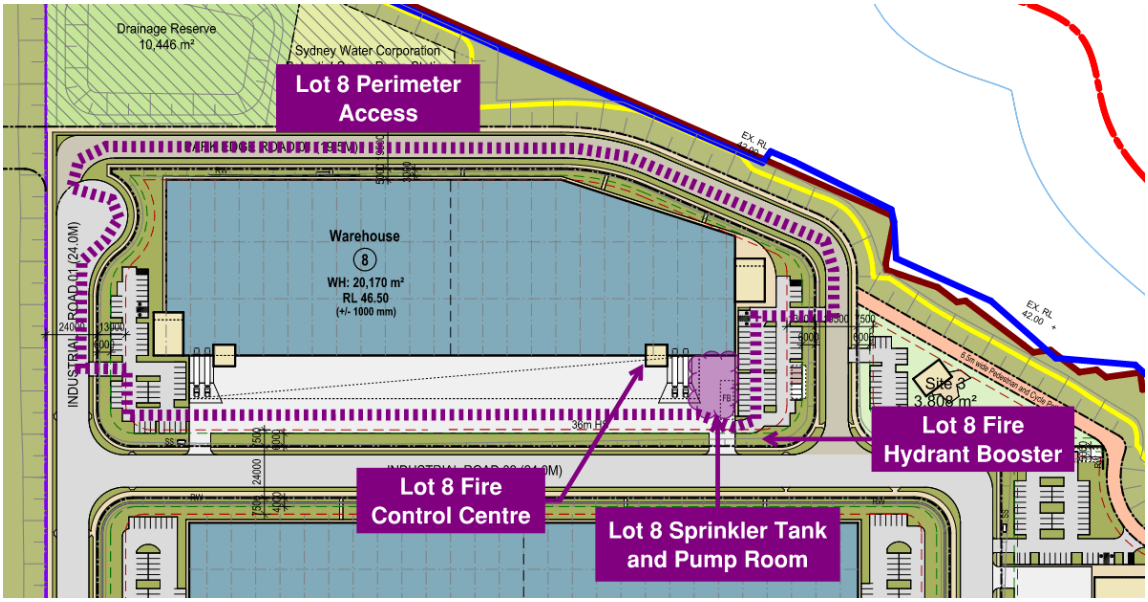



**Figure 5-4: Fire Brigade Access and Site Facilities (Lot 8)**

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 Bonnyrigg and Busby approximately 10.8 km and 15.3 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.

- Signage must be clearly displayed at the FIP identifying the presence and location of the alternative electrical generation system and be constructed of all-weather fade resistant material with lettering not less than 25mm high with a contrasting-coloured background.
- A block plan showing the location of all associated isolation switches, AC and DC isolators for the shut-off of generated electricity should be displayed at the FIP. Isolation switches are to be accessible at Ground level.
- If the alternative electrical generation system automatically isolates on fire trip, this shall be clearly depicted on the block plan at the FIP.

### 6.2.3 Substations

Where substations are proposed for each site, they must be located greater than 10 m from both hydrant/sprinkler booster assemblies to ensure compliance with AS2419.1:2021.

Furthermore, it is proposed to locate a substation lot to the north-west of the site, which has the potential to serve the entire estate. The size and location of the substation presents additional electrical hazards that must be considered. In order to minimise the risk of any electrical exposure to attending fire fighters, the location of fire brigade infrastructure for Warehouse 2 is to be located remote from the substation.

### 6.2.4 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 shall either have a non-combustible core or 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, except that EPS-FR or EPS panels shall not be used.
- 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.

### 6.2.5 Electrical Vehicle Charging Stations

Provisions have been made to accommodate for future installation of EV charging stations. The primary risks to be considered as a result are:

- Potential for battery packs to experience thermal runaway due to overcharging or fully discharging
- Potential for battery packs to burn for prolonged periods.
- Potential for the reignition of extinguished battery packs.
- Production of hazardous gases such as H-F.

AFAC Guideline [5] highlights the appropriate recommendations/considerations that shall be implemented as part of the proposed design. Hence, the following measures have been considered in the design:

- Where possible, charging stations should be open air to permit the free venting of smoke and heat.
    - Note that dedicated canopies serving EV charging stations are considered acceptable, subject to canopies being located greater than 6 m from the building and greater than 3 m from any fire source feature (i.e. site boundary) serving the estate.
- Parking bays that include charging station provisions should be greater than 10 m from any fire services infrastructure serving the estate (including fire hydrants).
- All charging stations and adjoining car spaces should be provided with compliant fire hydrant coverage.
- Where charging stations are installed, these locations are to be nominated on a block plan, to be provided at all FDCIE for the subject site.

According to the AFAC Guidance Page 4, the above measures are considered commensurate to the hazard and risk(s) associated with the proposed External EV chargers.

### 6.2.6 Dangerous Goods

At this stage of the project, no tenants have been identified and as such, Dangerous Goods requirements have not been identified as being present within the facility.

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.

### 6.2.7 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

The following measures are anticipated within the building to limit fire spread and the exposure to occupants and fire brigade. These are categorised in accordance with the sub-systems listed in the IFEG.

### 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 these warehouses are not proposed to be fitted with an automatic smoke exhaust system, the following are anticipated:

- Large smoke reservoir due to volume of each building.
- Rationalised automatic smoke exhaust system to each warehouse (apart from Warehouses 1 and 5).

### 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 6 m on all sides.

### 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
- Sprinkler system throughout
- 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 leading directly to open space.
- Multiple exits located on all four sides of each building.

### 6.3.6 Fire Services Intervention (Sub-System F)

The buildings are to be provided with the following systems to assist in fire brigade intervention:

- Fire hydrant system
- Automatic link to fire brigade.
- Vehicular perimeter access.
- Fire control centre / FIP depending on size of building
- Local fire brigades in close vicinity supported by full time staff.

# 7 NCC DTS NON-COMPLIANCE ASSESSMENT

## 7.1 OVERVIEW


In this instance the NCC 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 NCC for the proposed building and the analysis methodology proposed for the Fire Engineering assessment, which is to be generally in accordance with the AFEG [4].

## 7.2 NCC DTS NON-COMPLIANCE ASSESSMENT

**Table 7-1: Summary of Performance Solutions**

| NCC DTS PROVISIONS | DETAILS OF PERFORMANCE BASED SOLUTION |
|---|---|
| ***Vehicular Perimeter Access***<br><br>**NCC DtS Provisions**<br><br>DtS Provision C3D5: Requirements for open spaces and vehicular access<br><br>**Performance Requirements**<br>C1P9 | **Relevant NCC DtS Provisions**<br>DtS Provision C3D5: Each building must be provided with continuous vehicular access with a minimum unobstructed width 6 m where the furthest distance from the external wall of the building and the path is not more than 18 m for emergency vehicle access.<br>**DtS Variation**<br>The following non-conformances have been identified within the precinct:<br>• In various locations for Lots 1-8, the perimeter vehicular access paths are greater than 18 m from the external wall of the subject building.<br>**Performance Solution**<br>The Performance Solution for each building shall rely upon the following:<br>• Travel is provided around the facility in a forward motion.<br>• Staging is available in proximity to all 4 corners of each building.<br>• Entry to alternative carparks around the facility provide access for smaller emergency vehicles and brigade personnel. |
| ***Extended Travel Distances and Smoke Hazard Management***<br><br>**NCC DtS Provisions**<br><br>DtS Provision D2D5: Exit travel distances.<br><br>DtS Provision D2D6: Distance between alternative exits<br><br>DtS Provision E2D10: Buildings | **Relevant NCC DtS Provisions**<br>DtS Provision D2D5: In a Class 7b building, the maximum travel distance must not exceed 40 m when 2 or more exits are available.<br>DtS Provision D2D6: The distances between alternative exits must not exceed 60 m.<br>DtS Provision E2D10: Automatic smoke exhaust must be provided in Class 7b buildings which exceed 18,000 m² in floor area or 108,000 m³ in volume.<br>**DtS Variation**<br>The following non-conformances have been identified within the precinct:<br>• Distances up to 45 m to the nearest exit and 90 m between alternative exits are anticipated for Warehouses 1, 4 & 5.<br>• Distances up to 60 m to the nearest exit and 120 m between alternative exits are anticipated for Warehouses 2 & 8.<br>• Due to the size of Warehouses 6 & 7, distances up to 85 m to the nearest exit and 170 m between alternative exits are anticipated.<br>• It is proposed that all buildings apart from Warehouses 1 & 5, are to be provided with a rationalised automatic smoke exhaust system, with the following non-conformances identified: |

| NCC DTS PROVISIONS | DETAILS OF PERFORMANCE BASED SOLUTION |
|---|---|
| not more than 25m in effective height: large isolated buildings subject to C3D4<br><br>**Performance Requirements**<br>D1P4, E2P2 | • The system shall achieve an exhaust rate of one enclosure air change per hour in lieu of that required by Specification 21.<br>• Smoke zones exceed 2,000 $m^2$.<br>• The system shall initiate on sprinkler activation in lieu of smoke detection.<br>• No exhaust system is proposed for ancillary offices.<br>*Note 2: Warehouses 1 & 5 appear to be below 18,000 $m^2$ in floor area and 108,000 $m^3$ in volume, therefore not prescriptively requiring automatic smoke exhaust.*<br>**Performance Solution**<br>The Performance Solution for each building shall rely upon the following:<br>• The volume of each warehouse provides a large smoke reservoir hence longer time is available for occupant egress before the smoke descends.<br>• Sprinkler protection is afforded throughout the facilities.<br>• The population density inside the warehouses 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.<br>• A rationalised automatic smoke exhaust system shall be provided to all buildings apart from Warehouses 1 and 5, achieving an exhaust rate of one enclosure air change per hour. The system shall initiate on sprinkler activation. |
| ***Fire Hydrants***<br><br>**NCC DtS Provisions**<br><br>DtS Provision E1D2: Fire hydrant<br><br>**Performance Requirements**<br>E1P3 | **Relevant NCC DtS Provisions**<br>DtS Provision E1D2: requires that a fire hydrant system is provided and installed in accordance with AS2419.1:2021, which in turn requires hydrants located beneath the building footprint to be treated as internal hydrants. Furthermore, the scope of the standard is limited to buildings with a volume less than 108,000 $m^3$. No guidance is provided for the location of internal hydrants.<br>**DtS Variation**<br>The following non-conformances have been identified within the precinct:<br>• A hydrant system in accordance with AS2419.1:2021 is proposed for all buildings, despite the volume of all buildings apart Warehouses 1 and 5 exceeding 108,000 $m^3$.<br>• Hydrants located beneath warehouse awnings shall be treated as external hydrants, thereby allowing two hose lengths for coverage.<br>• Additional internal hydrants are required to achieve coverage of Warehouses 6 and 7.<br>*Note 2: Warehouses 1 & 5 appear to be below 108,000 $m^3$ in volume, therefore are within the scope of AS2419.1:2021.*<br>**Performance Solution**<br>The Performance Solution for each building shall rely upon the following:<br>• The hydrants located beneath the awnings are to have all the requirements of an external hydrant per AS2419.1, except that they are located under the building footprint.<br>• Fall-back hydrants are to be provided on the respective hardstands to provide coverage under the awnings.<br>• Sprinkler protection is afforded throughout the facility.<br>• The required number of hydrants operating simultaneously shall be assessed on a performance basis but shall not be less than 3.<br>• All external hydrants located within 50 m of hardstand.<br>• Additional internal hydrants shall be located no greater than 50 m from an external hydrant and 25 m from an internal hydrant. |

| NCC DTS PROVISIONS | DETAILS OF PERFORMANCE BASED SOLUTION |
|---|---|
| ***Sprinkler Booster Locations***<br><br>**NCC DtS Provisions**<br><br>DtS Provision E1D4: Sprinklers<br><br>**Performance Requirements**<br>E1P4 | **Relevant NCC DtS Provisions**<br>DtS Provision E1D4: An automatic fire sprinkler system must comply with AS 2118.1, which in turn requires that the fire brigade booster assembly shall conform to the requirements of AS2419.1 where fire brigade assemblies are to be located within sight of the main entrance to the building.<br>**DtS Variation**<br>The sprinkler booster locations do not comply with the provisions of AS 2419.1:2021.<br>**Performance Solution**<br>Sprinkler boosters shall be positioned such that they are accessible directly via the perimeter access path and have a dedicated hardstand in accordance with FRNSW guidelines. |

# 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 NCC, 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 NCC 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 FIRE RESISTING CONSTRUCTION

### 8.2.1 Type of Construction Required

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

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

### 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, 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 each building. All paths indicated in Section 5 (Figure 5-1 to Figure 5-4) should be designed and constructed with an all-weather surface capable of supporting all FRNSW appliances in accordance with DtS Provision C3D5 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:

- The perimeter access path serving each building is greater than 18 m from the building at the following locations:
  - North-eastern part of Warehouse 1 (Figure 8-1)
  - South-eastern and north-eastern parts of Warehouse 2 (Figure 8-1)
  - North-eastern part of Warehouse 4 (Figure 8-2)
  - North-eastern part of Warehouse 5 (Figure 8-2)
  - Western, north-eastern and south-eastern parts of Warehouse 6 (Figure 8-3)
  - Eastern, north-western and south-western parts of Warehouse 7 (Figure 8-3)
  - North-eastern and southern parts of Warehouse 8 (Figure 8-4)

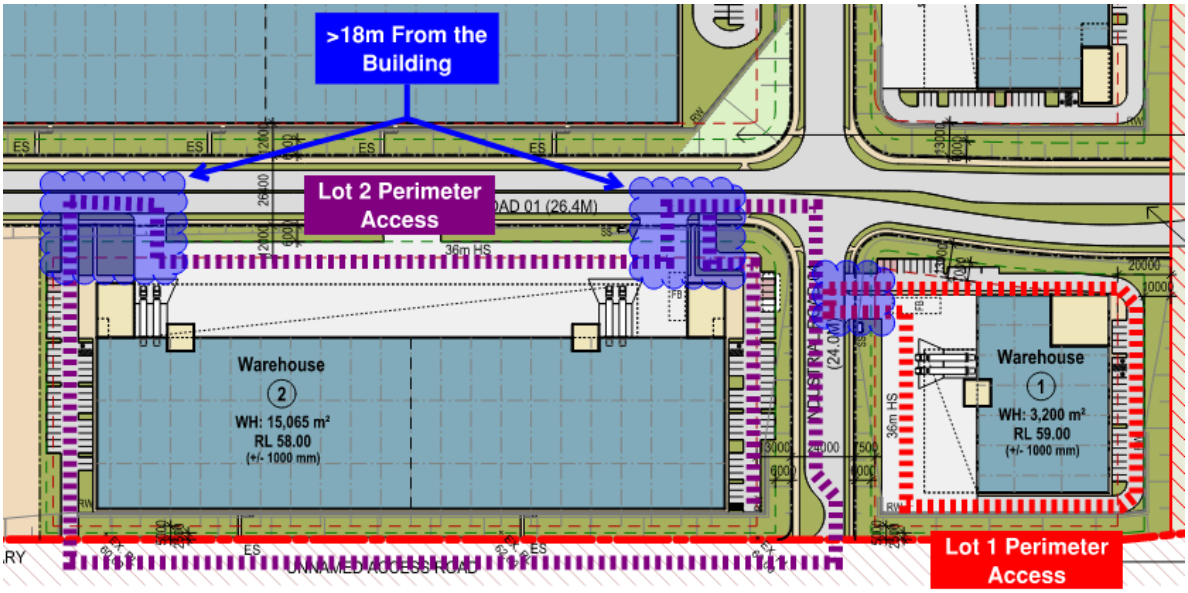



**Figure 8-1: Location of Non-Conformant Perimeter Access – Warehouses 1 & 2**

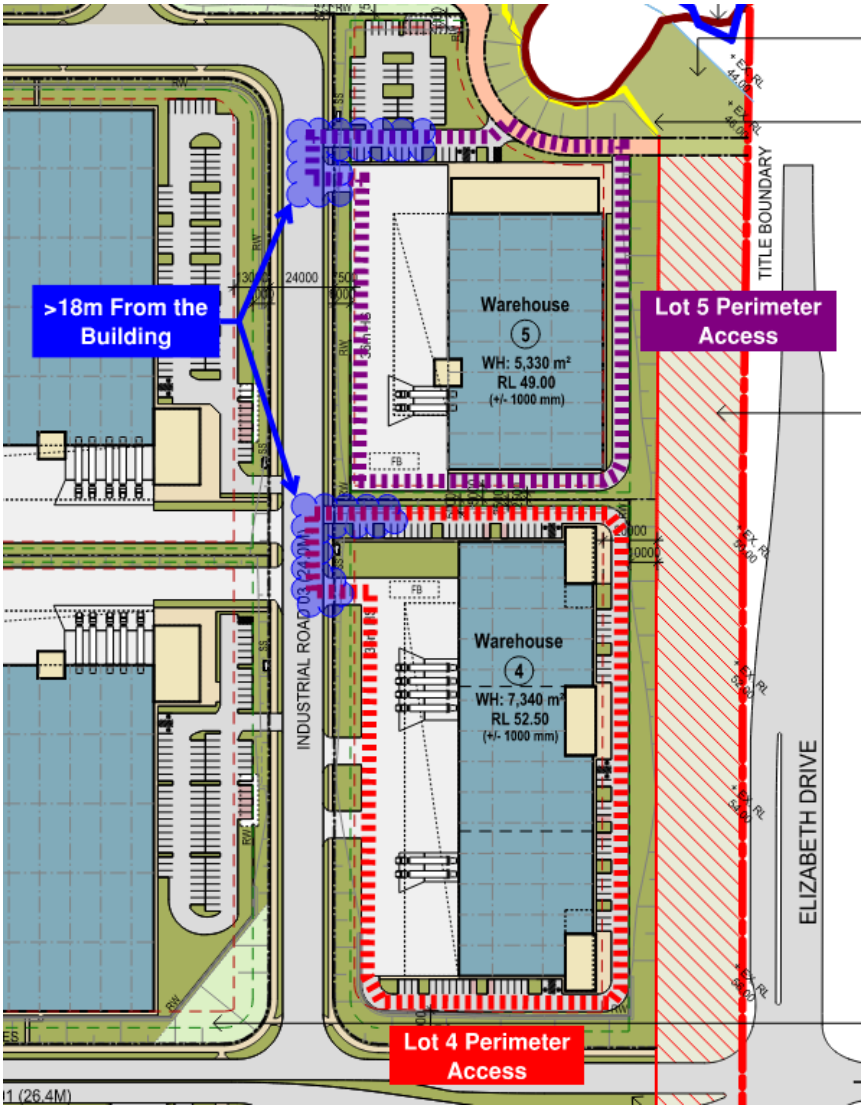



**Figure 8-2: Location of Non-Conformant Perimeter Access – Warehouses 4 & 5**

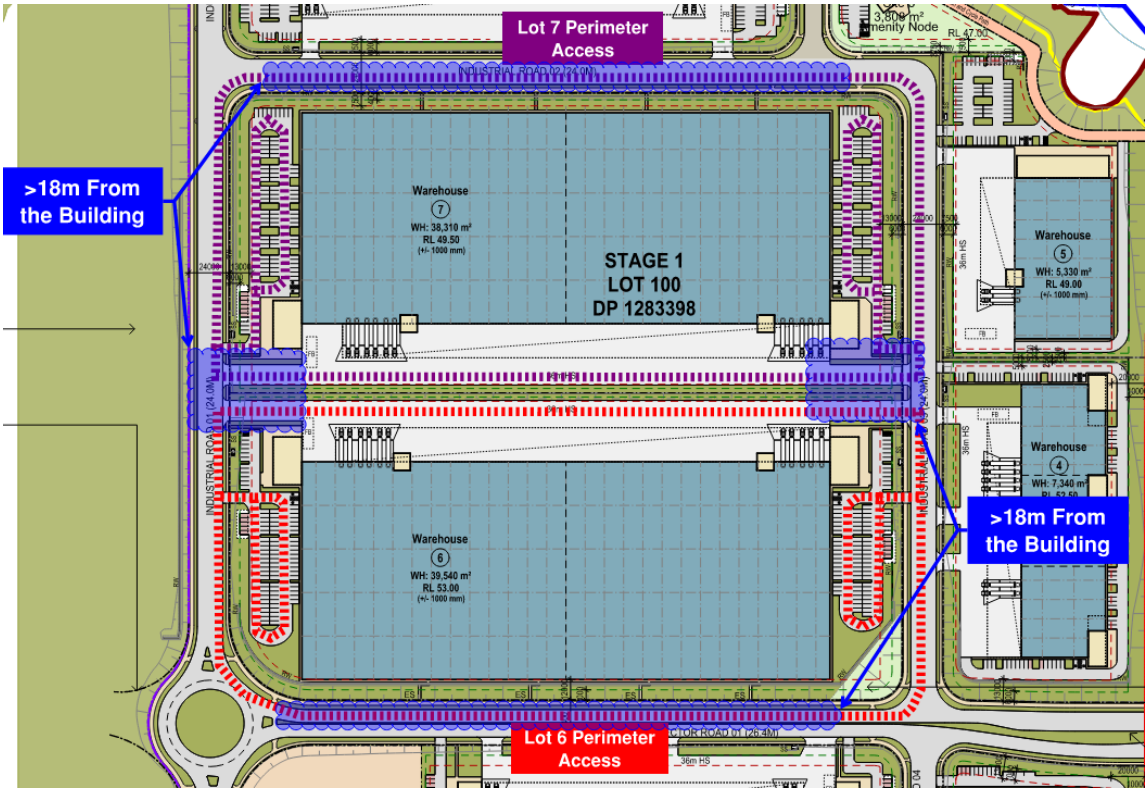



**Figure 8-3: Location of Non-Conformant Perimeter Access – Warehouses 6 & 7**

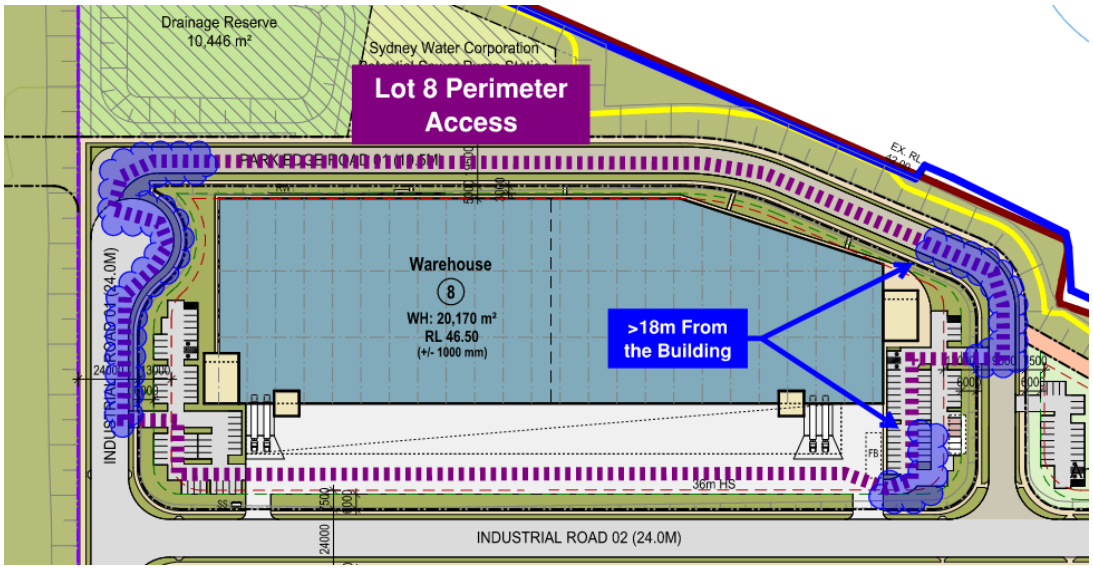



**Figure 8-4: Location of Non-Conformant Perimeter Access – Warehouse 8**

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

- Gates in the security line around Warehouses 2, 6, 7 and 8 should be provided (as per Section 5), enabling access to the egress doors and fire hydrants from the hardstand.
- 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 [9]:
  - 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 (as depicted in Section 5) must be compatible with fire brigade vehicle requirements in accordance with FRNSW Guideline.
  - This includes the south-eastern perimeter path of Warehouse 5, where travel over the “shared bike path” is required.

## 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 respective 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 (Warehouse)

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

The following non-conformances have been identified within the precinct (Figure 8-5):

- Distances up to 45 m to the nearest exit and 90 m between alternative exits are anticipated for Warehouses 1, 4 & 5.
- Distances up to 60 m to the nearest exit and 120 m between alternative exits are anticipated for Warehouses 2 & 8.
- Due to the size of Warehouses 6 & 7, distances up to 85 m to the nearest exit and 170 m between alternative exits are anticipated.

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

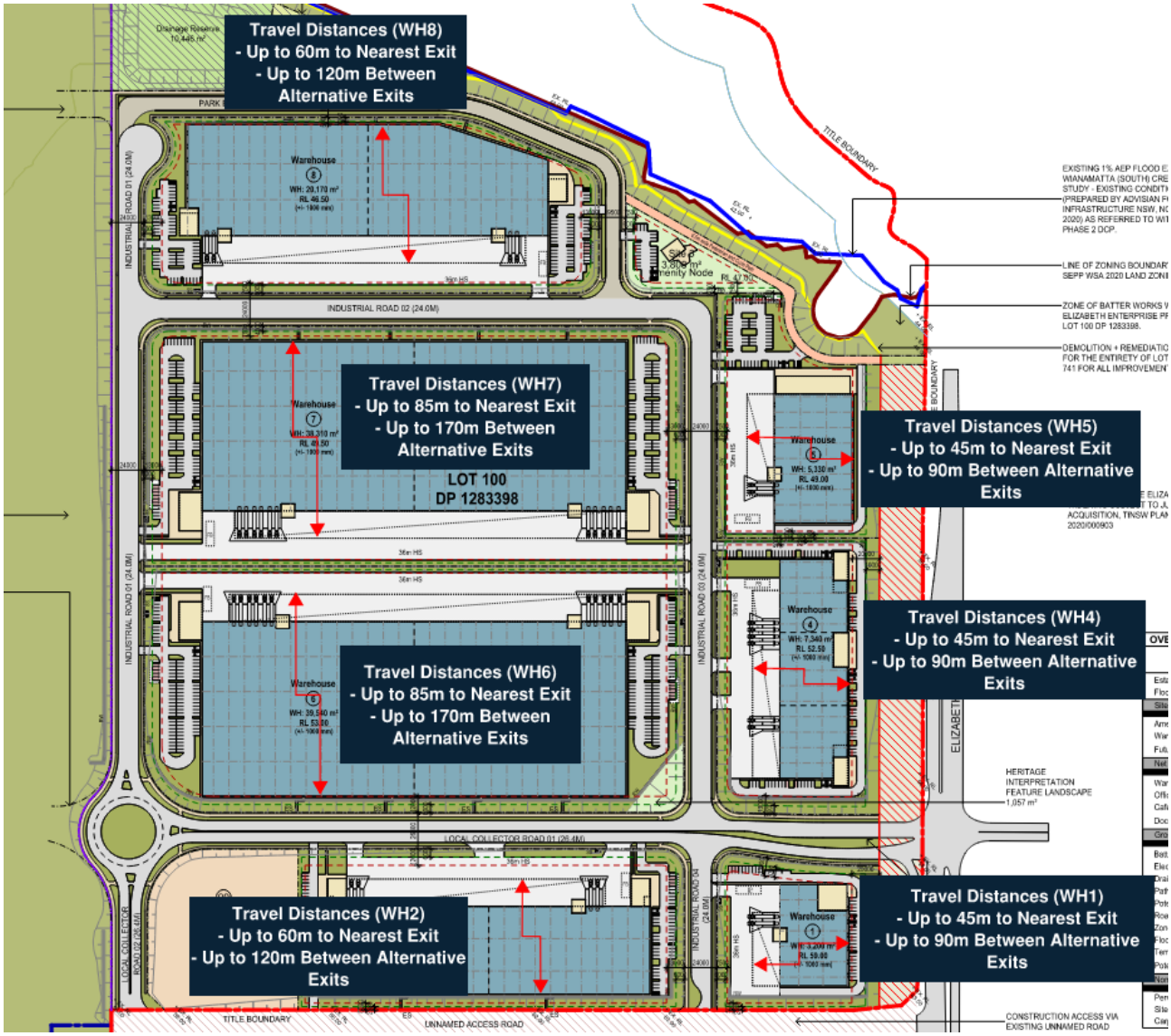



**Figure 8-5: Location of DtS Non-Compliant Travel Distances within Precinct**

### 8.4.3 Travel Distances (Office)

Travel distances on Level 1 offices are required to be provided in accordance with the DtS Provisions of the NCC, being:

- Up to 20 m to a single exit; or
- Up to 20 m to a point of choice, where a pathway is available between alternative exits.

If required, office travel distances can be addressed through a Performance Solution reliant on smoke detection provided throughout office in accordance with Section 8.6.1. Note that the Performance Solution can support no greater than 30 m to a single exit/point of choice.

Alternatively, the office stairs can be coordinated to ensure that DtS travel distances are achieved, thereby not requiring smoke detection to be provided.

### 8.4.4 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 separate hydrant system is required to be provided in accordance with NCC Provision E1D2 for all sites.

Given that all buildings (with the exception of Warehouses 1 and 5) shall exceed 108,000 $m^3$ in volume, they are not within the scope of AS2419.1:2021. However, an AS2419.1:2021 compliant system is expected to be appropriate, to be addressed as a Performance Solution in consultation with FRNSW, contingent on the following factors:

- All warehouse buildings inclusive of awnings and offices are fully sprinkler protected in accordance with AS2118.1:2017.
- The fire hydrant infrastructure (i.e. hydrant booster) is located within the exclusion zone, being 1.5 times the height of the building. Therefore, the building structural design is to be verified to fail inwards and away from the infrastructure in this location.
- The hydrant system is designed for at least 3x hydrants operating simultaneously, which in conjunction with the sprinkler system and nature of the stored commodity, is anticipated to be appropriate for the likely fire size.
- Items in Appendix C of AS2419.1:2021 to be considered and implemented by the design team.

For all warehouses, hydrants may be located below awnings (Figure 8-6). It is proposed that these hydrants are fully designed and utilised as external hydrants for coverage purposes which is contrary to AS2419.1:2021 which instead considers these internal hydrants. A Performance Solution is proposed to address this, on the basis that:

- The hydrants below awnings are full designed as external hydrants e.g. dual outlet, having external hydrant hydraulic performance.
- Fall back hydrants located remote from the building footprint are provided. These hydrants are to be located so that full coverage of the awning is achieved.
- The location of the fallback hydrants are to be shown on the hydrant block plan at the hydrant booster assembly and fire pump room.

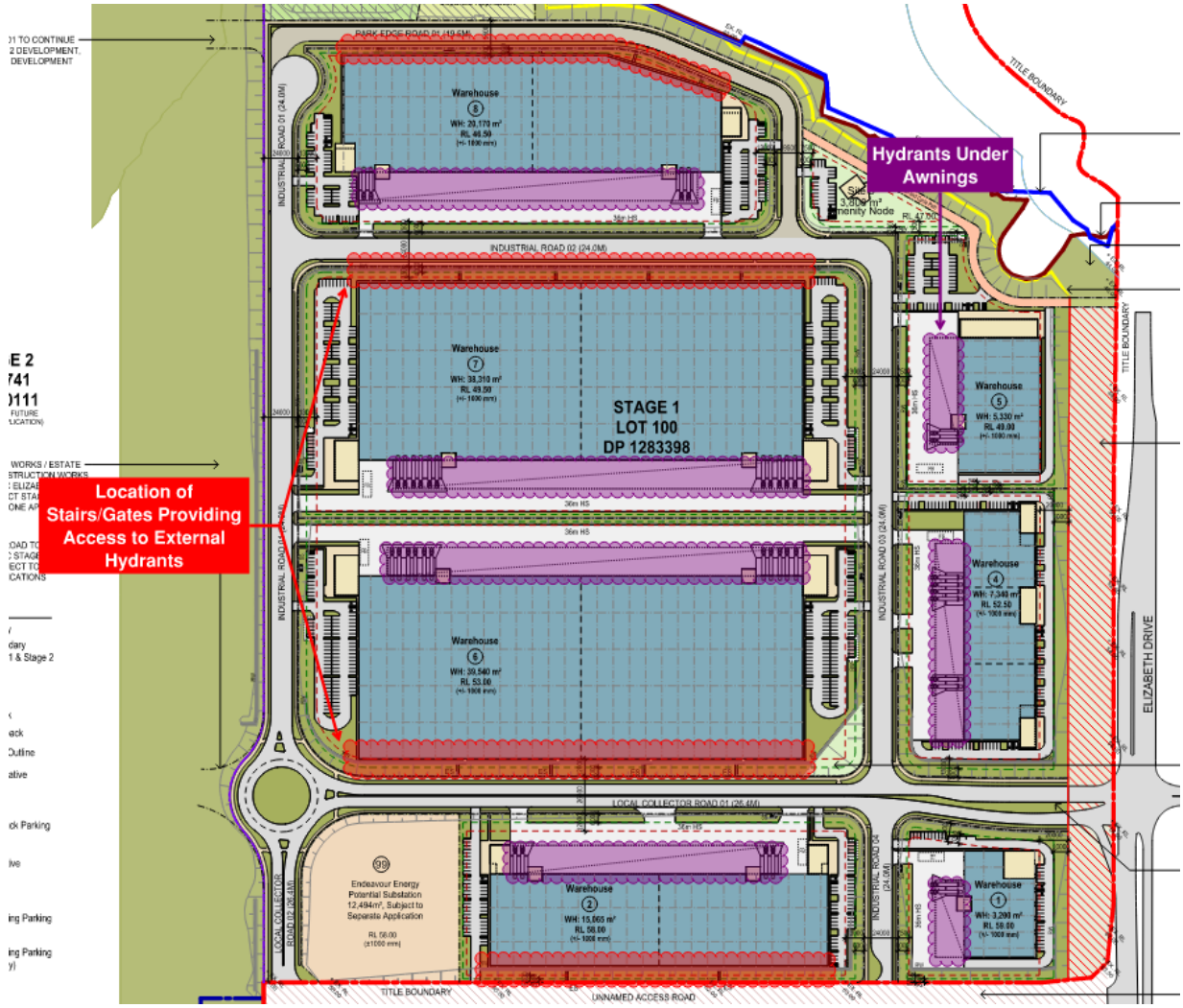



**Figure 8-6: Indicative Arrangement of Fallback Hydrants and Location of Stairs/Gates to External Hydrants**

The hydrants system shall achieve the following requirements:

- As far as possible, the hydrant system serving the warehouse enclosures should consist of external hydrant points, designed to achieve full building coverage using external hydrants (or hydrants under the awnings) only.
- If additional internal hydrants are required, this can be assessed as Performance Solution for Warehouses 6 and 7, reliant on the following measures to allow progressive movement of firefighters towards the central parts of the building:.
  - When working from an external hydrant, the next additional hydrant should be located into the building not more than 50 m from the external hydrant.
  - When working from an internal hydrant (either from within a fire isolated exit or passageway, within 4 m of an exit or another additional hydrant), the next additional hydrant should be located not more than 25 m from that hydrant.
  - 25 m and 50 m distances have been recommended to make allowance for shorter-than-standard hoses (repairs etc.) and unknown variables in the building layout and fixtures etc.
- On the basis that the building is sprinkler protected throughout, hydrant connection points need not be provided with radiant heat shield construction per the requirements of AS2419.1:2021 (i.e. FRL 90/90/90 2 m either side, and 3 m above the hydrant connection point).
- Ring main isolation valves are to be located external to the building, accessible directly at ground level, 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.
- The maximum distance between an external hydrant and the nearest hardstand shall not exceed 50 m. Where necessary, stairs/gates shall be provided such that this distance is achieved. This expected to be applicable to Warehouses 2, 6, 7 and 8 with the general location of these stairs/gates shown in Figure 8-6 above.
- The hydrant booster assemblies are located at the site boundary, adjacent to the principal vehicular access point to the site.

### 8.5.2 Fire Hose Reels

Fire hose reel shall be provided throughout the building in accordance with DtS Provision E1D3 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, should it be desired, 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 50m 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 each 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 sprinkler system shall be provided in accordance with NCC Specification 17, with the sprinkler head location, spacing and design capacity in accordance with AS2118.1:2017. Sprinkler activation temperature must be no greater than 101°C and have a Response Time Index (RTI) of less than 50 $m^{1/2}s^{1/2}$ (i.e. fast response type).
- The fire services infrastructure (i.e. sprinkler tank, booster and pump room) is located immediately adjacent to the building served. AS2419.1:2021 recommends that the fire services infrastructure is located outside of the exclusion zone, being 1.5 times the height of the building. Therefore, confirmation required from structural engineer that the external wall within the vicinity of the fire services infrastructure will collapse inwards.
- Upon sprinkler activation the building occupant warning alarm shall initiate throughout the building and the direct brigade notification activated. Furthermore, the automatic smoke exhaust system shall initiate within the relevant tenancy where sprinkler activation occurs.

A Performance Solution is feasible to address the proposed location of sprinkler infrastructure for each building. At each fire sprinkler booster, a dedicated hardstand for fire brigade appliances is required. As per FRNSW Guideline for Emergency Vehicle Access [9] this hardstand should be designed to be 18 m long by 6 m wide, whilst not obstructing the passage of other fire brigade appliances.

### 8.5.4 Portable Fire Extinguishers

Portable fire extinguishers are to be provided throughout each building in accordance with Table E1D14 and selected, located, and distributed in accordance with AS2444:2001.

### 8.5.5 Fire Control Centre

All warehouses shall be provided with a Main Fire Indicator Panel (FIP) at the ground floor entry. It is noted that Warehouses 6, 7 and 8 require a compliant Fire Control Centre (FCC), due to the buildings having a floor area greater than 18,000 $m^2$.

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

- The FIP panel must be capable of isolating, resetting, and determining the fire location within the building.
- A red strobe shall be installed at the entry door to the FIP to alert arriving fire brigade of the fire alarm origin and FIP location.
- Smoke exhaust fan controls shall be provided at the FIP. If a separate fire fan control panel is provided it shall include a display to indicate the operation or otherwise of the fans.
    - The panel shall include clear signaling of the operational status of the fans. A local fire fan control panel shall include override controls of smoke exhaust and supply fans.
- A mimic panel or sub-FIP may be required in the second office where there are multiple tenancies in the same building. This is subject to consultation with FRNSW and can also facilitate specific functional requirement 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 Automatic Smoke Exhaust System

The large floor area and volume of both Warehouses 2 and 6 will necessitate the provision of a smoke exhaust system under the DtS Provisions. A Performance Solution is proposed to address the following non-conformances:

- The smoke exhaust rate will be one (1) enclosure air change per hour in lieu of that required by Specification 21.
- The entire warehouse floor plate will comprise of a single smoke reservoir.
- The smoke exhaust system shall be activated from sprinklers only in lieu of smoke detection.
- No exhaust system is proposed for ancillary offices.

Rationalisation of the smoke exhaust system shall be considered holistically in conjunction with the extended travel distances, to be assessed through detailed CFD analysis.

The smoke exhaust system should be designed to achieve the following additional requirements:

- Adequate make-up air should be provided at low level to facilitate the exhaust system's designed operational capacity. 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.
- Override controls should be located at the FIP.
- It is recommended that multiple fans be provided and be evenly distributed to otherwise comply with the requirements of Specification 21 of the NCC.
- The exhaust system is to be served by essential power and treated as emergency equipment operating in the emergency mode.

*Note: Due to the size of Warehouses 1 and 5, a smoke hazard management system is not expected to be prescriptively required within these facilities.*

### 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 the NCC 2022 and AS1670.1:2018.

- The occupant warning alarm should be sounded throughout all areas of the building upon activation of the sprinkler system.

## 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 NOMENCLATURE

| ACRONYM | EXPANSION |
|---|---|
| ABCB | Australian Building Codes Board |
| AFSS | Annual Fire Safety Statement |
| 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 |
| IFEG | International Fire Engineering Guidelines |
| NCC | National Construction Code |
| NFPA | National Fire Protection Association |
| OHS | Occupational Health and Safety |
| RTI | Response Time Index |

# 10 REFERENCES

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