Fire Safety Engineering Design Review for DA Submission

42-44 Boorea Street, Lidcombe NSW (DP 740385)

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1. General

Scientific Fire Services (SFS) has undertaken a preliminary review and high-level assessment of the architectural drawings and concepts for the proposed multi-level warehouse/processing facility and associated office development located at 42-44 Boorea Road, Lidcombe NSW. The following provides a summary of the fire safety risk engineering aspects and 'in-principle' support for the proposed design.

2. The Project

The project is a new industrial development located at 42-44 Boorea Street, Lidcombe NSW. The principal site access is via a shared carriageway from Boorea Street as depicted below.

The layout of the site comprises a total of five (5) storeys consisting of Class 5 (office), Class 7a (carpark), and Class 7b/8 warehouse/processing occupancies.

The subject building has a total floor area/volume in excess of 18,000m^2 and 108,000m^3 respectively and is therefore required to be designed and constructed in accordance with the provisions commensurate with Type A fire resisting construction and the *Large Isolated Building* (LIB) provisions prescribed in Volume One of the Building Code of Australia (BCA 2019 – Amendment 1).

Figure 2.1 to Figure 2.3 illustrates the general configuration/layout of the proposed development.

Figure 2.1: Arial View 1

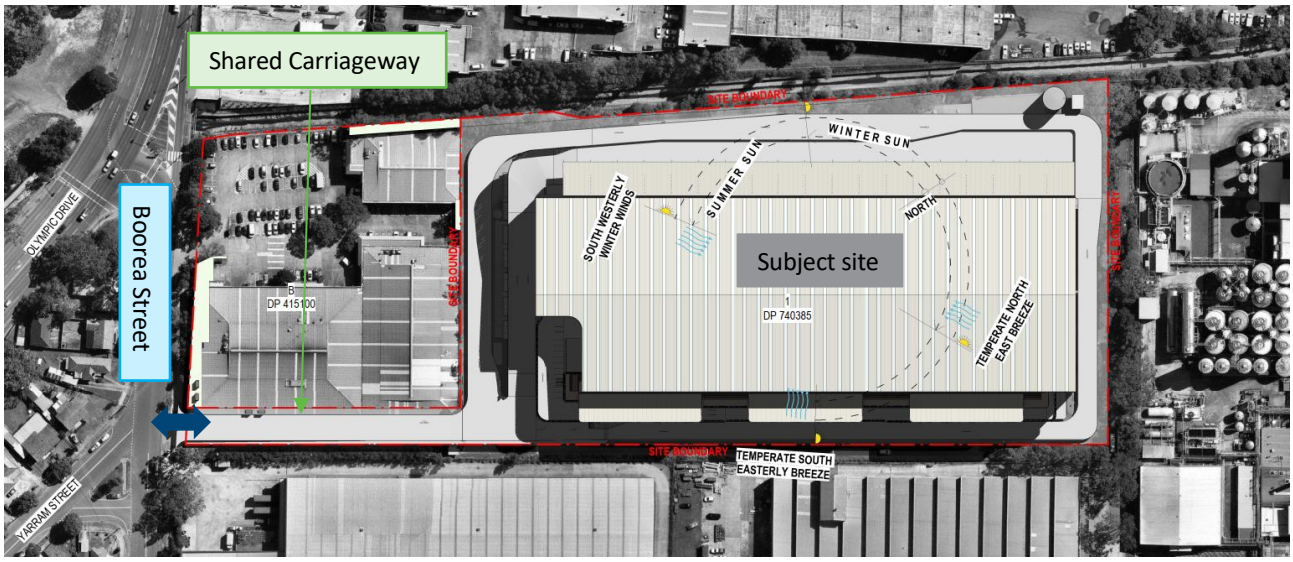

Figure 2.2: Arial View 2

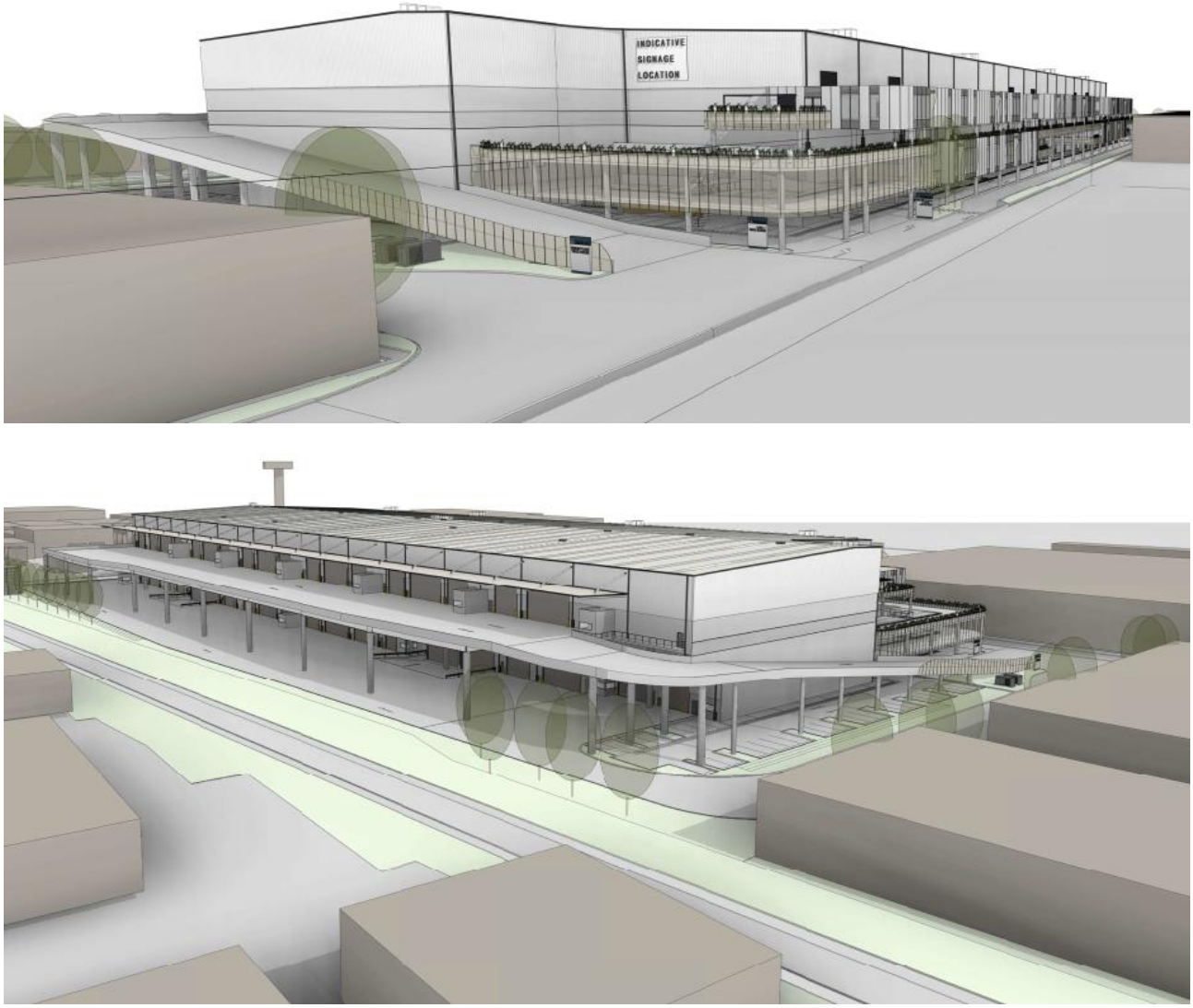

Figure 2.3: 3D Perspective View – Overall Development

Outlined below is a BCA summary of the overall building detail.

Table 2.1: BCA description of building

Building Summary	Industrial Development
Building Classification	Class 5 (Office), Class 7a (Carpark), Class 7b (Warehouse) & Class 8 (Processing)
Number of Storeys Contained	Five (5)
Rise in Storeys	Five (5)
Type of Construction Required	Type A (*Large Isolated Building*)
Effective Height	11.5m

3. Purpose

The preliminary fire safety engineering review was undertaken to determine 'in-principle' whether the design will achieve compliance with the Performance Requirements of the Building Code of Australia (BCA) (ABCB, 2019 Amendment 1). The design review relates to the fire-resisting construction, egress provisions and fire protection services proposed for the entire development.

The design issues specific to the subject building (refer to Appendix A) will be formally assessed through the application of the fire safety risk engineering process in accordance with the Australian Fire Engineering Guidelines (AFEG) (ABCB, 2021). It is the expectation that a suitable fire *Performance Solution* will be developed and supported through robust fire engineering methodologies of the current design proposal.

In the context of fire resistance, the fire resistance of the building is proposed to be designed and constructed in order to achieve a uniform method of construction and minimum fire resistance to all building elements requiring a Fire Resistance Level (FRL) pursuant to Type A fire resisting construction (as defined by Part C from Volume One of the BCA 2019 Amendment 1). The fire *Performance Solution* will further review the method of construction for the roof covering. This has been further outlined in Section 3.1 of this statement.

In the context of perimeter vehicular access/open space provisions, the subject building is deemed to be a LIB, it is proposed to review and rationalise the perimeter vehicular access provisions around the proposed development. This has been further outlined in Section 3.1 of this statement.

In the context of occupant egress, egress travel distances from all warehouse areas have been identified to exceed the maximum prescribed distance to a point of choice, to the nearest exit and between alternative exits. In order to reduce the impact of the identified design issue, measures including a rationalised level of automatic smoke exhaust, automatic sprinkler protection, reliance on the warehouse tenancy volume will all assist in controlling and/or supressing a potential fire. Further to the distance of travel throughout the development, the building also has a series of required fire isolated and non-fire isolated stairways which enable occupants to evacuate to a road or open space. The discharge location of these stairways is not in accordance with the prescriptive provisions of the BCA as the code does not allow stairways to discharge internally within the building and furthermore, does not allow openings in the external wall of the same building situated within 6m of a stairwell discharge location. This has been detailed in Section 3.2.

In the context of fire services and equipment, the building shall be served by the standard suite of fire safety measures which are commensurate with a building of this size and nature. This shall generally include automatic sprinkler protection, automatic smoke exhaust, fire hydrants, fire hose reels, emergency lighting, exit signage, portable fire extinguishers. As part of the fire strategy, it is proposed to rationalise the fire hydrant location/coverage requirements (i.e. fire hydrants without radiant heat shield protection, fire hydrants to be situated underneath awning structures and the fire hydrant booster assembly to not be positioned in a compliant location). With respect to the provision for fire hose reels, it is proposed to adopt 50m fire hose reels within the warehouse areas only. The location of the sprinkler booster assembly has been identified not to be located at the principal main entry/site boundary and furthermore not be within direct line of sight of the main entry to the building and each tenancy. Based on the size/geometry of the building, it is proposed to rationalise the smoke hazard management system allowing a rationalised automatic smoke exhaust system to the warehouse units. The size and scale of the building requires the building to be afforded with a Fire Control Centre (FCC) however in this instance, it is proposed to provide a main Fire Indicator Panel in an acoustically separated enclosure in a common area on the site with the provision for MIMIC/Sub FIP panels within the individual warehouse units. Finally, and where permissible, the mounting of exit signage and in particular, exit sign heights within the warehouse portions only are proposed to be located greater than 2.7m above the finished floor level. This has been further outlined in Section 3.3.

3.1 Fire Resistance and Perimeter Vehicular Access

3.1.1 Fire Resistance

The deign issues relating to the rationalisation of FRL and permitting the use of combustible skylights within the roof covering shall be addressed through both a qualitative and quantitative methodology with the view of establishing a minimum (and uniform) fire-resisting construction is to maintain an adequate level of structural stability and also to minimise potential fire spread. Rationalisation of FRL shall consider key hazards which will include the following:

- The potential for structural collapse and fire spread within the building;
- The proposed FRL to the building elements may potentially have an impact on the life safety and occupants and Fire Brigade Intervention;
- The potential for structural adequacy to negatively impact on occupant evacuation and fire brigade operations;
- Potential for fire spread from the roof to another fire compartment/adjacent building on another allotment.

The assessment methodology will include a combined qualitative 'risk' & quantitative 'deterministic' evaluation. The qualitative 'risk' aspect of the evaluation shall consider the proposed building arrangement in relation to the research outcomes for buildings of similar nature whilst the more in-depth quantitative aspect of the analysis shall consider multiple fire/evacuation scenarios demonstrating that occupants can safely evacuate the building, firefighting personnel can safety access the building during an emergency all prior to any structural fire safety compromise of the building structure. Quantitative radiant heat flux calculations will also be performed in order to demonstrate that the potential risk of fire spread to adjacent fire source features will be mitigated by the location/distance of the combustible skylights forming part of the roof covering. The preliminary assessment conducted by Scientific Fire Services indicates that the fire resistance provisions can readily meet the relevant *Performance Requirements* of CP1 and CP2.

3.1.2 Perimeter Vehicular Access

The design issues relating to the identified vehicular access provisions shall be addressed through a qualitative methodology with consideration given towards the effectiveness and efficacy surrounding the following:

- Operational firefighting ability and any potential impacts on operational functions undertaken during firefighting operations;
- Potential firefighter impacts as a direct result of the function and use of the building, likely fire load and potential fire intensity and hazard in association with the active and passive fire mitigation systems;
- Fire appliance and other emergency vehicle access around the entire site including the ability to ensure emergency vehicles do not obstruct appliance manoeuvrability and access around the site.

The assessment methodology shall consider the Standard Operational Guideline's (SOG's) of firefighting personnel which is expected to be obtained following direct consultation with the FRNSW specific to the provisions for sliding gate/s within the perimeter vehicular access road. The design issues shall be substantiated and supported based on typical fire brigade operational procedures. The provision of additional measures which may include additional wayfinding signage/mud-maps as well as the ability for the attending fire crews to unlock and open the gate without forced entry will also be assessed through a qualitative assessment methodology. The preliminary assessment conducted by Scientific Fire Services indicates that the perimeter vehicular access provisions can readily meet the relevant *Performance Requirement* of CP9.

3.2 Occupant Egress

3.2.1 Exit Travel Distance/Distance Between Alternative Exits

Preliminary review of the project information highlights a number of egress related design issues which include egress travel distance to a point of choice, to the nearest exit and between alternative exits to all be exceeded from the prescribed maximum distances in the BCA.

The design issues associated with the occupant egress will be evaluated by way of an overall holistic assessment that will be developed with consideration of all occupants from the warehouse portions of the building. The design issues will be addressed through a deterministic and absolute approach demonstrating occupant (and fire brigade) life safety for acceptable durations of time. The exit travel distance and distance between alternative exits will be addressed with consideration to the fire safety systems installed within the building to ensure tenability limits are not breached during the evacuation process or firefighting operations.

The identified design shall be supported through computational modelling (i.e. CFD modelling and Pathfinder Evacuation Modelling) which shall suitably assess credible fire scenarios, the overall evacuation times of occupants and also the impact on attending fire brigade personnel upon arrival on site. The assessment will ensure that occupants would have adequate times to evacuate and also attending personnel to commence water application activities before being exposed to untenable conditions.

The preliminary assessment conducted by Scientific Fire Services indicates that the proposed design solution relative to occupant egress can readily meet the relevant *Performance Requirements* DP4 and EP2.2 from the BCA

3.2.2 Stairway Discharge Locations

Additionally, the building also has a series of required fire isolated and non-fire isolated stairways which enable occupants to evacuate to a road or open space. The discharge location of these stairways is not in accordance with the prescriptive provisions of the BCA as the code does not allow stairways to discharge internally within the building and furthermore, does not allow openings in the external wall of the same building situated within 6m of a stairwell discharge location.

With respect to the stairway discharge locations and proximity of external wall openings to the stairwell discharge locations, additional protection measures such as drencher protection, fire rated construction, fire shutters or the like will be adopted to safeguard occupants as they evacuate to a road or open space at the stairwell discharge level.

The preliminary assessment conducted by Scientific Fire Services indicates that the proposed design solution relative to occupant egress can readily meet the relevant *Performance Requirements* DP4, DP5 and EP2.2 from the BCA.

3.3 Fire Services & Equipment

Scientific Fire Services understand that the deviations from the prescriptive provisions of the BCA that have been identified with respect to fire services & equipment for the proposed building design shall generally be designed to achieve compliance with the relevant DtS provisions unless where noted herein. From a compliance perspective, the proposed design shall meet the relevant *Performance Requirements* of the BCA.

3.3.1 Fire Hydrant System and Fire Hydrant Booster Assembly Location

The preliminary review of the project information notes that based on the presence of awnings structure serving the building that the fire hydrants in several locations are likely to be situated beneath these covered areas. In order to support this design approach, a qualitative risk-based assessment shall be undertaken specific to the benefits of sprinkler protection, the provision of full back hydrants that provide protection to hydrants under the awnings and also the concessions outlined in the latest AS2419.1:2017 for sprinkler protected building.

Furthermore, it is proposed to rationalise the fire hydrant booster assembly locations. The evaluation shall give consideration to the potential risks associated with the proposed fire hydrant booster assembly location (i.e. not being at the site boundary and not within direct line of sight of the main entry to the building and each tenancy) and the proposed fire safety measures which shall assist attending Fire Brigade personnel in locating the fire booster assembly. The identified measures shall include block plans, additional signage denote the booster location on site, the adoption of a red strobe light to clear denote to attending fire brigade personnel the location of the fire hydrant booster assembly.

Finally, it is proposed to review the provision for fire hydrants located beneath awning structures to be considered as “external fire hydrants” for the purposes of fire hydrant coverage. A qualitative assessment methodology focusing on the sprinkler protected awning structure and naturally ventilated environment will be emphasised in order to address the design issue.

The overall strategy and approach shall be also presented and consulted with Fire & Rescue NSW specific to the impact of fire crews and their ability to safely access the subject hydrants to undertake their operations. The preliminary assessment undertaken by Scientific Fire Services suggests that the identified design issue for the hydrant systems can readily meet the relevant *Performance Requirement* EP1.3 from the BCA.

3.3.2 Fire Hose Reels to Warehouse Areas

The preliminary review of the proposed design specific to the identified adoption of 50m fire hose reels within the warehouse areas (only) shall be assessed through a qualitative risk-based assessment. The design issue shall be assessed with respect to the type and suitability of the occupancy. Additionally, the presence of multiple exits in alternative directions shall be considered in relation to the FHR locations with respect to an initial fire attack by occupants. The assessment shall also consider the provision of additional measures which primarily shall include training to be afforded to staff to be comfortable with utilising the fire hose reels where appropriate to do so. The preliminary assessment undertaken by Scientific Fire Services suggests that the identified design issue for the proposed fire hose reels can readily meet the relevant *Performance Requirement* EP1.1 from the BCA.

3.3.3 Sprinkler Booster Location

The preliminary review of the design has identified that the proposed location of the sprinkler booster not being situated at the main entry to the site, not at the site boundary and not within direct line of sight of the main/principal building entry and each tenancy. The methodology to be adopted to address the design issue relative to the location of the sprinkler booster assembly shall be based upon a qualitative evaluation. The evaluation shall give consideration to the potential risks associated with the proposed sprinkler booster assembly location and the proposed fire safety measures

which shall assist attending Fire Brigade personnel in locating the respective booster assemblies. The identified measures shall include block plans, additional signage denote the booster location on site, the adoption of a red strobe light to clear denote to attending fire brigade personnel the location of the sprinkler booster and also to ensure that the booster is parallel to the access road to ensure suitable fire brigade operations. The preliminary assessment undertaken by Scientific Fire Services suggests that the identified design issue for the sprinkler booster can readily meet the relevant *Performance Requirement* EP1.4 from the BCA.

3.3.4 Fire Control Centre

The preliminary review of the design has identified that the subject site contains a floor area of more than 18,000m^2 and therefore is required to be provided with a Fire Control Centre to serve the site. In this instance, a Fire Indictor Panel (FIP) shall be located in a separate enclosure and the provision for MIMIC panels/sub FIP panels to be situated within the main office entry locations to each warehouse tenancy. The methodology to be adopted to address the design issue shall be based upon a qualitative evaluation. The evaluation shall give consideration to the potential risks associated with being able to identify the location of the indicating equipment and therefore, it is proposed to assist attending Fire Brigade personnel by providing suitable signage and the adoption of a red strobe light to assist with its location. Furthermore, acceptance of the design shall satisfy fire-fighting Standard Operational Guideline's (SOG's) when identifying (i.e.: locating) and accessing the Fire Indicator Panel and introduces an equivalent level of operational and functional use (including necessary equipment adjacent to the FIP) when compared to a similar DtS compliant solution. The preliminary assessment undertaken by Scientific Fire Services suggests that the identified design issue for the fire control centre can readily meet the relevant *Performance Requirement* EP1.6 from the BCA.

3.3.5 Smoke Hazard Management

The preliminary assessment of the building has identified that the smoke hazard management provisions are required based on building size and scale. As the warehouse units are not significantly large, it is proposed to provide an engineered smoke control system (fit for purpose) and sized suitably for the building's area, geometry and volume. The methodology to be adopted to address the egress and smoke hazard management provision will be a quantitatively assessed through an ASET vs RSET assessment through computational modelling (i.e. CFD modelling and Pathfinder Evacuation Modelling) ensuring occupants within the building have the ability to evacuate to a road or open space before being exposed to untenable conditions. Furthermore, the same quantitative analysis will ensure that the rationalisation of a smoke hazard management to ensure fire-fighters have the ability to access the building within a timeframe which enables the commencement of water application activities before being exposed to untenable conditions. The design shall rely upon the overall building area/volume, occupant characteristics, the provision of a rationalised automatic smoke exhaust capacity. Preliminary fire (and evacuation) modelling has been undertaken and the preliminary smoke hazard management and systems sequencing shall consider the following as a preliminary trial concept design:

3.3.5.1 Smoke Hazard Management System Design

- Dedicated smoke exhaust shall be provided to each warehouse tenancy:
  - Each tenancy shall be provided with a minimum smoke exhaust capacity of 30m^3/s;
  - Each tenancy shall be provided with a minimum of two (2) smoke exhaust inlet points to ensure adequate distribution of smoke extraction. Smoke exhaust inlet points to be located along Gridline I and Gridline E;
- Smoke hazard management system shall be activated by fire detection and alarm system in accordance with AS1670.1:2018 (smoke detectors based on 15m x 15m grid);
  - To mitigate false alarms, a minimum of two (2) smoke detectors within the warehouse tenancy of fire origin must activate prior to the initiation of the BOWS and the smoke exhaust system;
- Make-up air provisions shall be provided via the roller shutter doors along Gridline A;
  - Perforation through the roller shutter doors must achieve a minimum free area of 12m^2.

3.3.5.2 General Fire Alarm Activation

- GFA for the warehouse tenancy of fire origin shall be activated by a minimum of two (2) smoke detectors to mitigate potential false alarms;
- GFA for the remainder of the building shall be activate by the fire sprinkler system.

The preliminary assessment undertaken by Scientific Fire Services suggests that the identified design issues for the smoke hazard management system can readily meet the relevant *Performance Requirement* EP2.2 from the BCA.

3.3.6 Exit Signage Heights

The preliminary review of the design based on the overall size of the respective warehouse portions along with its intended use has recognised the impact on the required exit sign heights. These shall be addressed quantitatively analysing the fire and evacuation modelling outcomes to determine the effective height of the signs that can be adopted whilst affording occupants suitable wayfinding. In this instance, an ASET vs RSET assessment shall be undertaken demonstrating that the smoke layer height is maintained above the top of the exit sign (e.g. mounted between 3.6m-

4.5m above the finished floor level measured to the top of the exit signage for at least the time taken for occupants to evacuate the warehouse portion of the building). Furthermore, the proposed mounting height the exit signs shall be deemed acceptable with respect to occupant visibility via an analysis of the viewing angle and distance. The preliminary assessment undertaken by Scientific Fire Services suggests that the identified design issues for the exit signage heights can readily meet the relevant *Performance Requirement* EP4.2 form the BCA.

4. Statement of Endorsement

The fire and life safety related design issues will be addressed through the performance-based path of compliance. Scientific Fire Services can confirm that the proposed design will achieve fire safety design compliance to the Performance Requirements of CP1, CP2, CP9, DP4, DP5, EP1.1, EP1.3, EP1.4, EP2.2 & EP4.2 of the BCA (ABCB, 2019).

The formulation of the Performance Based Design Brief (formerly Fire Engineering Brief) represents the next step in the approvals process. Scientific Fire Services shall commence the process of developing this document and will provide a formal comprehensive Performance Based Design Brief submission. As part of the process, a Fire Engineering Brief Questionnaire (FEBQ) document shall be prepared in accordance with the Fire and Rescue NSW pro forma and formally submitted as part of the referrals process.

Finally, and in order to ensure that the client can obtain a Construction Certificate for the proposed building works, Scientific Fire Services will prepare a Fire Safety Engineering Report (FSER) incorporating stakeholder conditions, comments and advice to the satisfaction of the Principle Certifying Authority (PCA).

On the basis of the review of the proposed design issues identified herein, Scientific Fire Services can confirm that the documentation in relation to the subject development will achieve fire safety design compliance to the relevant Performance Requirements of the National Construction Code Series – Volume 1 – Amendment 1, Building Code of Australia (BCA).

I trust the above is satisfactory for your current purposes. Should you have any queries, please do not hesitate to contact me on (02) 9221 3658 or email to parkan.behayeddin@scifire.com.au

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Appendix A. Preliminary List of Design Issues

No.	Identified Design Issue	BCA DtS Clause	Performance Requirement
1	It is proposed to permit building elements serving the subject building to achieve a minimum FRL of 120 minutes throughout the building in lieu of up to 240 minutes pursuant to Type A fire resisting construction.	Clause C1.1 inter alia Specification C1.1 Clause C2.7 Clause C2.8 Clause C2.9	CP1 and CP2
2	It is proposed to permit the use of skylights deemed to be combustible as a roof covering at the topmost level (only) of the building. Note: All external walls must be fully designed and constructed to strictly be non-combustible.	Clause C1.1 inter alia Clause 3.5 from Specification C1.1	CP2
3	Perimeter vehicular access for emergency vehicles does not satisfy the provisions of the BCA to the following areas: • Unobstructed access has not been provided due to the presence of a sliding gate.	Clause C2.3 inter alia Clause C2.4	CP9
4	Warehouse Portions: The travel distance to and distance between exits does not satisfy the deemed-to-satisfy provisions of the BCA in the following areas: • *All levels* - Travel distance to a point of choice exceeds 20m (i.e. up to 30m); and • *All levels* - Travel distance to nearest exit exceeds 40m (i.e. up to 60m); and • *All levels*– Travel distance between alternative exits exceeds 60m (i.e. up to 100m).	Clause D1.4 & Clause D1.5	DP4 & EP2.2
5	It is proposed to review the discharge location of the required fire isolated stairways (i.e. FS1, FS2, and FS3) being internally within the building. Furthermore, it is proposed to review the discharge location of the required fire isolated stairways (FS5, FS6 and FS7) being with the confines of the building and within 20m of a road or open space. In all aforementioned instances, the path of travel from the discharge location to a road or open space requires passing by openings within 6m in the external walls of the same building.	Clause D1.7(b) & Clause D1.7(c)	DP5 & EP2.2
6	It is proposed to permit fire hydrants to be located beneath sprinkler protected awning structures and proposed to be treated as external hydrants with respect to coverage. Furthermore, it is proposed to permit the fire hydrant booster assembly to not be located at the site boundary and not within direct line of sight of the main/principle building entrance to the building and each tenancy. Finally, it is proposed to permit external fire hydrant outlets serving the building to not be provided compliant radiant heat shield protection. This item will be required to be addressed against the Performance Requirements of the BCA and in consultation with Fire and Rescue NSW.	Clause E1.3 & AS2419.1:2005	EP1.3

No.	Identified Design Issue	BCA DtS Clause	Performance Requirement
7	It is proposed to review fire hose reel shortfalls throughout the warehouse portions of the building. In this instance, it is proposed to permit 50m fire hose reels to be utilised to provide full fire hose reel coverage to the warehouse portions of the building.	Clause E1.4 & AS2441-2005	EP1.1
8	It is proposed to permit the sprinkler booster assembly to not be located at the main entry to the site, not at the site boundary and not within direct line of sight of the main/principle building entrance to the building and each tenancy. This item will be required to be addressed against the Performance Requirements of the BCA and in consultation with Fire and Rescue NSW.	Clause E1.5 & AS2118.1-2017	EP1.4
9	It is proposed to omit the requirement for a Fire Control Centre (FCC) for the subject site having floor area of more than 18,000m^2. In this instance, a Fire Indictor Panel (FIP) shall be located in a separate enclosure and the provision for MIMIC panels/sub FIP panels to be situated within the main office entry locations to each warehouse tenancy. This item will be required to be addressed against the Performance Requirements of the BCA and in consultation with Fire and Rescue NSW.	Clause E1.8 inter alia Specification E1.8	EP1.6
10	It is proposed to provide an engineered smoke hazard management system specific to the layout/geometry of the proposed building. In this instance, it is proposed to design a smoke hazard management strategy as per follows: • Rationalise the overall smoke clearance/exhaust capacity serving the building; and • Omit the requirement for any smoke baffles; and • Rationalise the requirement for a smoke detection system forming part of the smoke hazard management system. Note: Pending outcomes from fire/smoke evacuation and Fire Brigade Intervention timeline analysis, a smoke hazard management system will be proposed which will either be: • A manually operated smoke clearance system dedicated for FRNSW use only; or • An engineered automatic smoke exhaust system specific to satisfy occupant and firefighter tenability limits. This item will be required to be addressed against the Performance Requirements of the BCA and in consultation with Fire and Rescue NSW.	Clause E2.2 and Specification E2.2b	EP2.2
11	It is proposed that the intermediate illuminated exit signs within the warehouse portions of the building to be mounted greater than 2.7m AFFL. Exit signs will required to be located no more than 2.7m AFFL at PA doorways within the perimeter of the building and within all Class 5 office portions.	Clause E4.5 & AS2293.1-2005	EP4.2

Appendix B. Architectural Drawings

Drawing No.	Title	Date / Revision
DA000	Cover Page	H
DA010	3D – 1	H
DA011	3D – 2	H
DA012	3D – 3	H
DA013	3D – 4	H
DA050	Site Analysis Plan & Summary	F
DA100	Ground Floor	J
DA101	Ground Floor Mezz Plan	E
DA102	Level 1 Office Access	E
DA103	Level 1	I
DA104	Roof Plan	E
DA200	Elevations	F
DA300	Sections	H
DA301	Sections	D