



FIRE ENGINEERING MEMO

TO: Phillip Rodrigues
FROM: Dan Kirk
SUBJECT: Fire Engineering Report(FER) – Members Services Fitout, Harbord Diggers
OUR REF: Harbord_Diggers_Member_Services_fitout FER rev. 2
DATE: 13 June 2019

1. INTRODUCTION

WSP have been appointed by Cerno Group to undertake fire engineering assessment on the fitout works of on the Lower Ground Floor associated with Harbord Diggers Member's Service areas.

It is understood that the completed portions of the premises comply with the base build Fire Engineering Report (FER) prepared by WSP (ref. FEG1444000_Harbord Diggers FER-Rev 4 1/08/2017). This FER is intended to address non-compliances identified within the Members Services fitout works on the Lower Ground Floor only as outlined in WSP's proposal for these works (ref. PS1140960 – Harbord Diggers Members Services Fee Proposal).

2. OVERVIEW OF NON-COMPLIANCES

The following table provides a summary of the Performance Solution, the relevant BCA DtS Clauses that are affected and the relevant BCA Performance Requirements and IFEG sub-systems applicable to each.

Table 2.1: Performance Solutions

NO.	DESCRIPTION OF NON-COMPLIANCES	BCA CLAUSE	PERFORMANCE REQUIREMENTS
1	Assess an additional five (5) doors opening into the fire-isolated passageway leading to the fire pump room (this affects the current fire engineering assessment addressed in Section 13.7.5 of the base building FER).	D1.7	DP4, DP5, EP1.6, EP2.2
2	Assess the omission of required fire hose reel coverage within the Member Services units MS4 – MS9 (fire extinguishers to be provided in lieu)	E1.4	EP1.1

The assessments to be undertaken using the methodologies and acceptance criteria in this report will demonstrate that the above Performance Solutions will meet the relevant BCA performance requirements. The Performance Solutions are subject to the implementation of the required fire safety design details as discussed in Section 3 of this report.

3. PROPOSED FIRE SAFETY MEASURES

The Harbord Diggers development shall to comply with the DtS Provisions of the BCA except where modified by the design requirements listed within the base build FER prepared by WSP (FEG1444000_Harbord Diggers FER-Rev 4 1/08/2017). The Member Services fitouts on Lower Ground shall also comply with the DtS Provisions of the BCA except where modified below as part of this fire engineering assessment:

- An automatic fire suppression system which shall include the use of fast response sprinkler heads with an RTI of $50 (m \cdot s)^{0.5}$ or less in accordance with BCA Specification E1.5 and AS 2118.1-1999.
- The doors of MS5, MS6, MS7 and MS8 tenancies that discharge into the fire-isolated corridor as indicated in Figure 1 are to be:
 - Fire rated achieving -/60/30 as a minimum;
 - Fitted with medium temperature smoke seals capable of withstanding temperatures of 200°C for 30 minutes and tested in accordance with AS 1530.7;
 - Have self-closing mechanisms fitted to them.
- A new doorway shall be installed within the corridor (as shown in Figure 1) which has an FRL of -/90/30 and is fitted with self-closing mechanisms and medium temperature smoke seals.
- No exit signs are to be installed above the doorways from retail tenancies MS5 – MS8 into the fire isolated corridor at the back of each tenancy as these are not to be used as an exit.

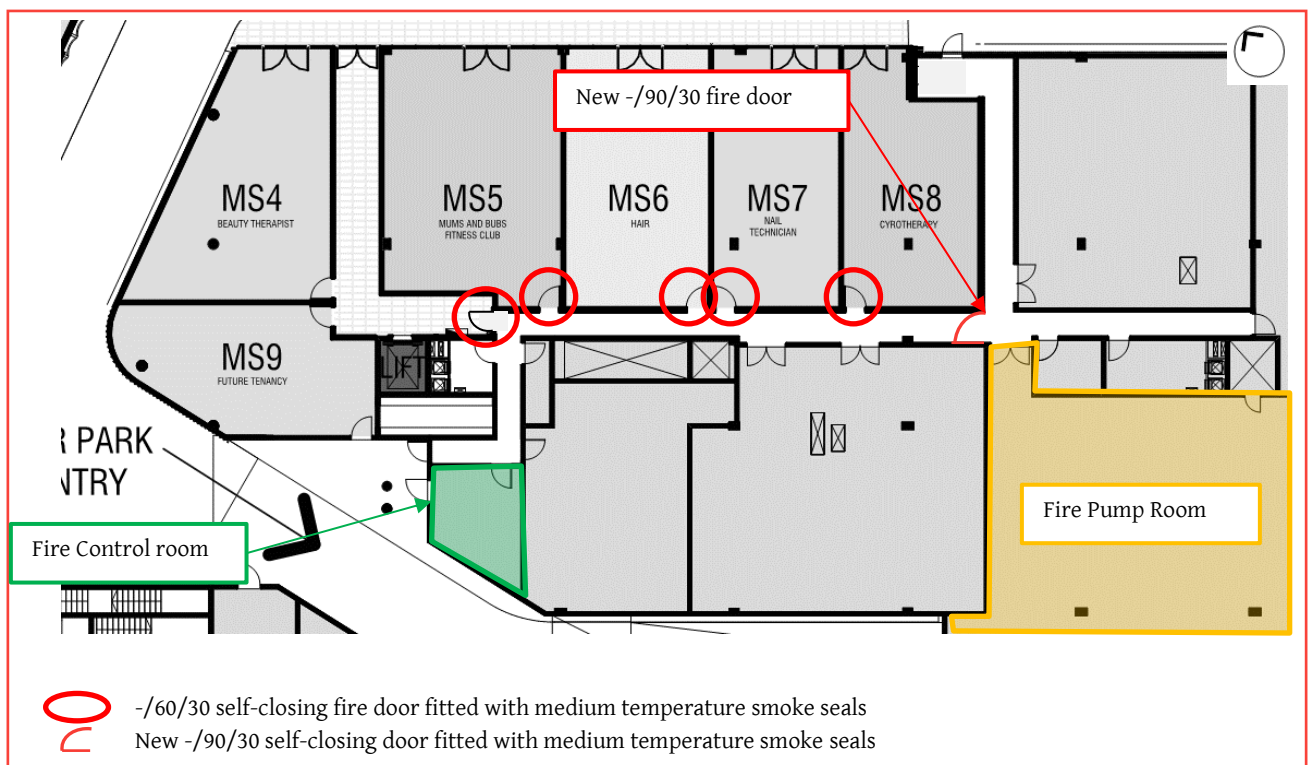


Figure 1: Access doors opening into the fire-isolated corridor on Lower Ground Floor

- As per the base building FER, the fire isolated corridor is to maintain an FRL of 90/90/90.
- The glazed façade of tenancy MS4 to MS8 are provided with drencher protection. To ensure this system functions as intended, the following management procedures shall be adhered to on site:
 - The glazed entry doorways into each of these tenancies shall be maintained in a closed position during normal operations; and
 - These doors are not to be propped open at any time except for short periods while deliveries are made within that tenancy; and
 - Laminated signage is to be fitted to the doorways stating 'DOORS TO BE KEPT CLOSED AT ALL TIMES'. This signage is to be 20 mm in height and clearly readable from inside the tenancy; and

- In the event of a delivery taking place on site, staff are to monitor the tenancy in question and immediately close the doors again should a fire alarm take place during that time after all occupants have evacuated from the space.
- Any penetrations from compartments adjacent to the fire-isolated corridor are required to be sealed (such as fire rated dampers and/or fire collars) to maintain the integrity of the compartment.
- It is understood that the existing generator within the room at the far right of Figure 1 is being removed and the room is being converted to another use. Should the generator remain on site, then access to the room is to be modified so that no doors open into it from the fire isolated corridor leading to the Fire Pump Room as per the original request by FRNSW as part of the base building FER.
- Wayfinding signage is to be provided for the brigade to locate the Fire Pump Room from both the main entry and from the Porte Cochere as illustrated in Figure 2. This signage is to be non-combustible, in a colour contrasting with the background and be a minimum of 20 mm high. The wording used may differ slightly from what is shown in Figure 2, but must be agreed to by the fire engineer prior to installation if modified.

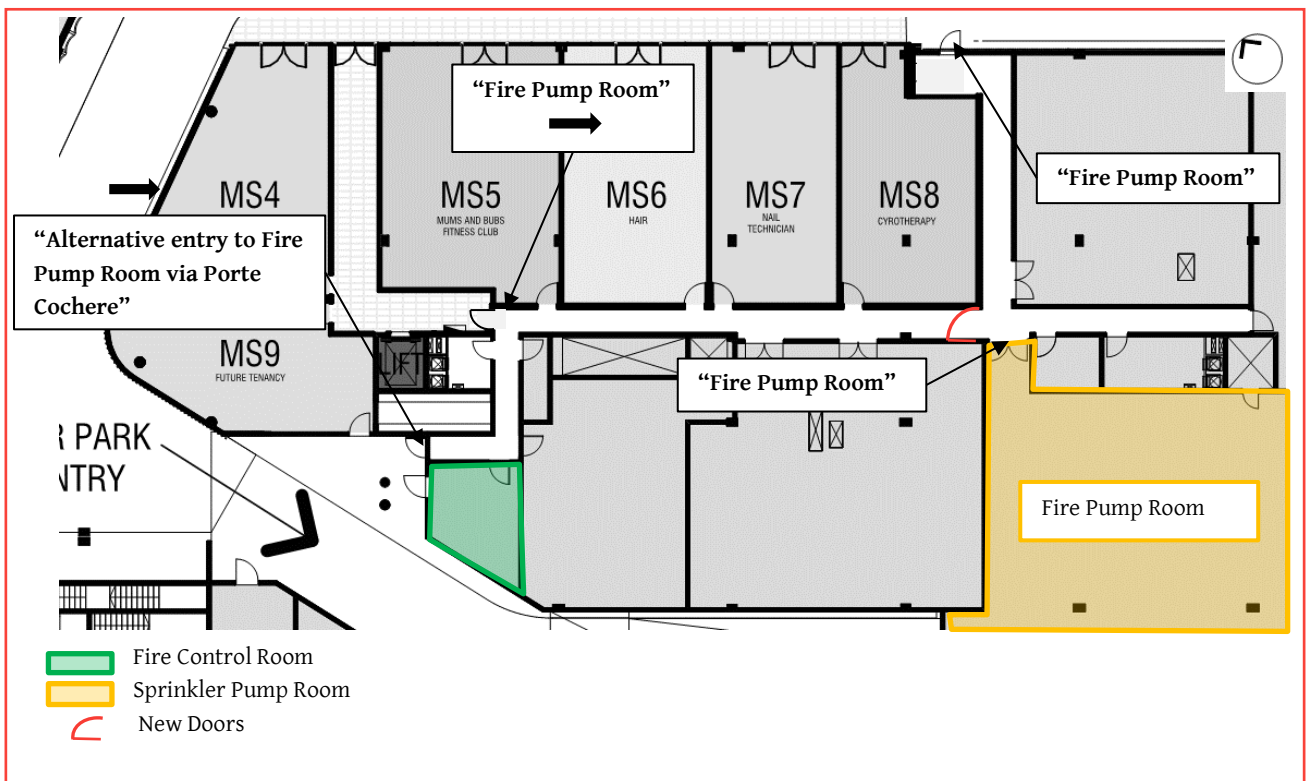


Figure 2: Signage to be provided around the fire-isolated corridor

- Additional hazard specific (4.5 kg A:B:E) portable hand-held portable fire extinguishers are to be provided in Member Services tenancies M1 and MS4 – MS9 on Lower Ground Floor in accordance with BCA Clause E1.6 and AS 2444- 2001 where fire hose reel coverage cannot be achieved from existing hose reels on site.

4. AS 1 – ADDITIONAL DOORS INTO FIRE-ISOLATED PASSAGEWAY

4.1 INTRODUCTION

The following table provides a summary of the Performance Solution, the relevant BCA DtS Clause which is affected and the relevant BCA Performance Requirements and IFEG subsystems.

Table 2: Summary of Performance Solution

DESCRIPTION OF PERFORMANCE SOLUTION	DTS CLAUSE	PERFORMANCE REQUIREMENTS	IFEG SUB-SYSTEM	BCA (A2.2)	BCA (A2.2)
Assess an additional five (5) doors opening into the fire-isolated passageway leading to the fire pump room (this affects the current fire engineering assessment addressed in Section 13.7.5 of the base building FER).	D1.7	DP4, DP5, EP1.6, EP2.2	SS-B SS-C SS-D SS-F	(1)(a)	(2)(b)(ii)
Approach and assessment method used - The approach in this solution will be qualitative in nature and will use a deterministic absolute approach.					

4.2 DESCRIPTION OF NON-COMPLIANCE WITH DTS PROVISIONS

As per BCA Clause D1.7, if more than two access doorways open into a required fire isolated exit / corridor in the same storey, than either a smoke lobby in accordance with D2.6 or pressurisation of the exit in accordance with AS 1668.1-2015 must be provided. At the back of MS5 – MS8 of Harbord Diggers, a fire isolated corridor exists which has already been justified in the base-building FER as not having pressurisation despite having >2 doors opening into it. Figure 3 shows the number of doorways which were opening into this corridor upon completion of the works in this area in mid-2018 (ten doors in total).

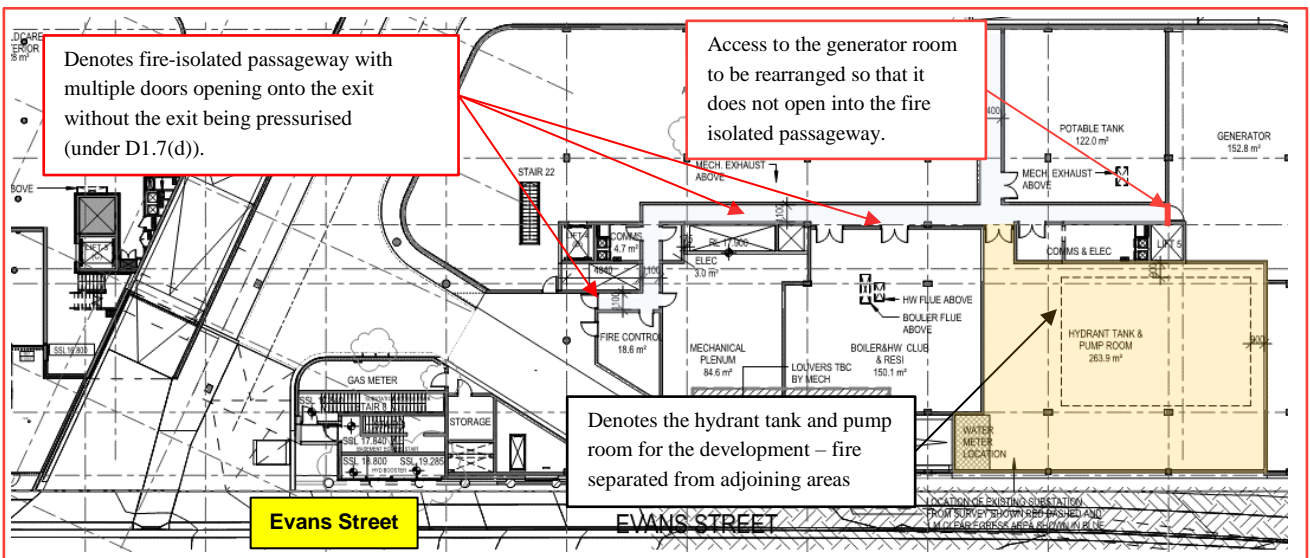


Figure 3: Fire-isolated passageway to pump room (extract from base building FER)

As part of the Member Services works, an additional five doors are being provided into this corridor from tenancies and/or lift lobbies, over and above the original ten doors. It is intended to address this issue through a performance based assessment. The location of these doors and the subject corridor can be found in Figure 4.

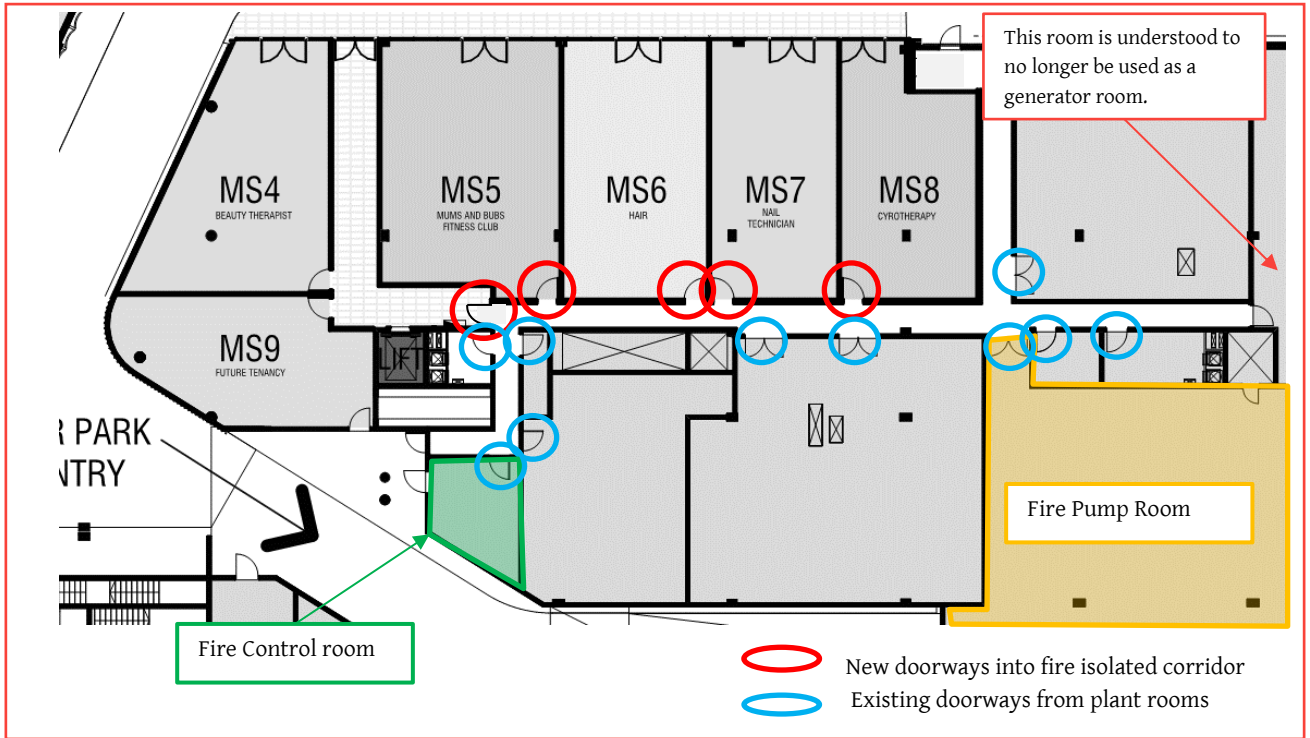


Figure 4: Access doors opening into the fire-isolated corridor on Lower Ground Floor

4.3 DISCUSSION AND INTENT OF THE BCA

4.3.1 DTS PROVISION D1.7

BCA DtS Provision D1.7 states:

- (d) If more than 2 access doorways, not from a sanitary compartment or the like, open to a required fire-isolated exit in the same storey—*
 - (i) a smoke lobby in accordance with D2.6 must be provided; or*
 - (ii) the exit must be pressurised in accordance with AS 1668.1.*

The Guide to the BCA states that the intent of D1.7(d):

'Requires the use of smoke lobby or a pressurisation system to stop the entry of smoke into the fire-isolated exit, if more than two access doorways described in D1.7(a)(i) or (ii) are provided in the same storey...'

4.4 ACCEPTANCE CRITERIA

To determine whether this Performance Solution is considered to meet the BCA Performance Requirements, it will be demonstrated that the intent of the BCA is met in that smoke shall be prevented from impacting on those using the fire-isolated exit for egress, and that the fire brigade is provided with safe access to the Fire Control Room and Fire Pump Room.

4.5 HAZARDS

The hazard associated with this non-compliance is that during a fire evacuation, the opening of multiple access doors will result in smoke spread into a fire-isolated exit which may then compromise the safety of occupants using this egress path.

4.6 PROPOSED FIRE SAFETY MEASURES

The fire safety measures listed in Section 3 form the holistic fire safety design for the development incorporating measures specific to the consideration of the Performance Solutions. Fire safety measures specific to this Performance Solution are as follows;

- An automatic fire suppression system which shall include the use of fast response sprinkler heads with an RTI of $50 \text{ (m}\cdot\text{s)}^{0.5}$ or less in accordance with BCA Specification E1.5 and AS 2118.1-1999.
- The doors of MS5, MS6, MS7 and MS8 tenancies that discharge into the fire-isolated corridor as indicated in Figure 1 are to be:
 - Fire rated achieving -/60/30 as a minimum (subject to contents of the room);
 - Fitted with medium temperature smoke seals capable of withstanding temperatures of 200°C for 30 minutes and tested in accordance with AS 1530.7;
 - Have self-closing mechanisms fitted to them.
- A new doorway shall be installed within the corridor (as shown in Figure 1) which has an FRL of -/90/30 and is fitted with self-closing mechanisms and medium temperature smoke seals.
- No exit signs are to be installed above the doorways from retail tenancies MS5 – MS8 into the fire isolated corridor at the back of each tenancy as these are not to be used as an exit.
- As per base build FER, the fire isolated corridor is to maintain an FRL of 90/90/90.
- The glazed façade of tenancy MS4 to MS8 are provided with drencher protection. To ensure this system functions as intended, the following management procedures shall be adhered to on site:
 - The glazed entry doorways into each of these tenancies shall be maintained in a closed position during normal operations; and
 - These doors are not to be propped open at any time except for short periods while deliveries are made within that tenancy; and
 - Laminated signage is to be fitted to the doorways stating 'DOORS TO BE KEPT CLOSED AT ALL TIMES'. This signage is to be 20 mm in height and clearly readable from inside the tenancy; and
 - In the event of a delivery taking place on site, staff are to monitor the tenancy in question and immediately close the doors again should a fire alarm take place during that time after all occupants have evacuated from the space.
- Any penetrations from compartments adjacent to the fire-isolated corridor are required to be sealed (such as fire rated dampers and/or fire collars) to maintain the integrity of the compartment.
- It is understood that the existing generator within the room at the far right of Figure 1 is being removed and the room is being converted to another use. Should the generator remain on site, then access to the room is to be modified so that no doors open into it from the fire isolated corridor leading to the Fire Pump Room as per the original request by FRNSW as part of the base building FER.
- Wayfinding signage is to be provided for the brigade to locate the Fire Pump Room from both the main entry and from the Porte Cochere as illustrated in Figure 2. This signage is to be non-combustible, in a colour contrasting with the background and be a minimum of 20 mm high. The wording used may differ slightly from what is shown in Figure 2, but must be agreed to by the fire engineer prior to installation if modified.

4.7 METHOD OF ANALYSIS

The proposed design is to be qualitatively evaluated by reviewing the usage of the fire isolated corridor and ensuring doorways into the corridor are fire and smoke protected such that the risk of smoke spread into the fire exit is mitigated. Additional doorways shall also be used to provide compartmentation to limit the risk posed by a tenancy door being propped open. Furthermore, wayfinding signage is to be used to aid the fire brigade to access the Fire Pump Room given an alternative route is provided to this from the Porte Cochere.

4.8 ASSESSMENT

4.8.1 PROTECTING THE FIRE ISOLATED CORRIDOR

As per the intent of the BCA Guide, compliance with D1.7(d) ensures that no smoke spreads into the fire-isolated exit to ensure tenable conditions are maintained in the fire stairs. Therefore, to minimise the risk of smoke entering the fire isolated passageway, it is necessary to fire and smoke protect the fire-isolated corridor which the fire exit is connected to. As such, the doors from MS5-MS8 and any other space or room opening onto the subject fire-isolated corridor corridors must be fire rated and self-closing, as indicated in Figure 1. The construction of the corridor itself is 90/90/90 as per the original base building FER. Any penetrations that pass into or through the fire-isolated corridor shall be suitably fire stopped to maintain the integrity of the compartment.

The key issue to be understood is that although the corridor in question is deemed to be a fire isolated corridor, it is not technically required as a primary egress route for occupants of the building. The only occupants who would be required to use this corridor to evacuate would be maintenance personnel who are working in any of the plant rooms accessed from it. The new Member Services tenancies have direct egress onto the Porte Cochere or to the street via their main entry meaning these doors will not have exit signs above them nor be used as a defined exit route. Occupants of these spaces would therefore egress via the shop front doorways. Distances from each tenancy to their main entry door is also much less than the 20 m permitted to a single exit under the BCA meaning a second exit route is not deemed necessary for compliance.

An additional self-closing fire rated door achieving -/90/30 FRL is to be installed within the fire-isolated corridor to further compartmentalise the corridor and minimise the risk of smoke migration through the space. This door is to ensure access to the Fire Pump Room can be maintained at all times. With this strategy in place, even if smoke were to migrate from a tenancy to the corridor, the Brigade will still have direct access to the Fire Pump Room from the Porte Cochere as required. Access to the Fire Control Room is available directly from outside via a separate door so use of the corridor would not be needed to gain access to the site's Fire Indicator Panel (FIP).

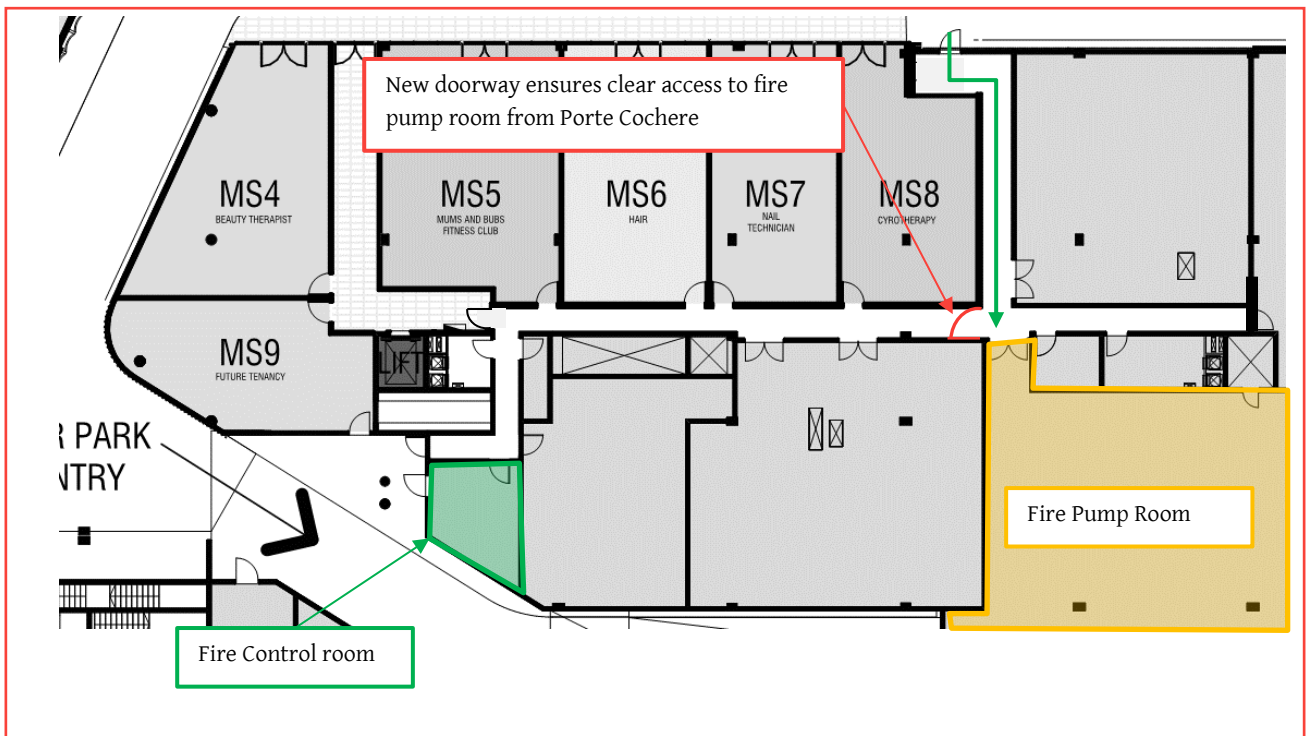


Figure 5: Additional fire door to protect Fire Pump Room

4.8.2 BENEFITS OF SMOKE SEALS

Smoke spread to into the fire-isolated corridor will be further limited by the fitting of medium temperature smoke seals to all the doors as indicated in Figure 1, thereby containing smoke within the fire-affected space and limiting smoke spread to the fire-isolated corridor and exit. The medium temperature smoke seals are required to be capable of withstanding temperatures of 200°C for 30 minutes and tested in accordance with AS 1530.7.

4.8.3 SPRINKLER PROTECTION

The Lower Ground portion of the Harbord Diggers Redevelopment building is provided with an automatic sprinkler system which shall have fast response sprinkler heads with an RTI of 50 (m·s)^{0.5} or less in accordance the existing base building FER. In the event of a fire, the sprinkler system is expected to control, if not suppress the fire. The sprinkler system acts to cool the upper smoke layer and wet adjacent combustibles and partitions helping to prevent the fire from spreading beyond the area of origin.

The provision of sprinklers in a building dramatically enhances life safety, property protection and fire brigade intervention. A fire sprinkler system will dramatically reduce the likelihood of a large fire in the building which further reduces the risk of the corridor being impacted by combustion products should a fire occur within this portion of the building.

4.8.4 WAYFINDING SIGNAGE

As noted previously, the provision of an additional fire door within the corridor will ensure that the new tenancies will not impact on Brigade access to the Fire Pump Room should a fire occur within one of them. To ensure the Brigade are made aware of the alternative route to the Fire Pump Room, additional signage is to be provided on the corridor entry doorway from street level. The wording “Alternative entry to Fire Pump Room via Porte Cochere” is proposed, although minor modifications to this are permitted if necessary, subject to WSP approving this prior to installation. In addition, a new sign noting “Fire Pump Room” shall be provided on the doorway at the other end of the corridor so this is clearly visible to people within the Porte Cochere. Further details on the signage provisions can be found in Figure 2. This signage shall be non-combustible, and in a colour contrasting with the background with a minimum height of 20 mm.

Wayfinding signage for the Fire Control Room is already covered in the base building FER, so it is not deemed necessary to provide anything further on this item. A strobe light is provided to enable immediate identification also. Access to the Fire Control Room will not be affected by the provision of extra doors to the fire isolated corridor as a doorway is already provided directly into the room from outside.

4.9 CONCLUSION

Based on the qualitative assessment carried out, the Performance Solution incorporating the fire safety measures as proposed, is at least equivalent to the DtS Provisions and therefore satisfies Performance Requirement DP4, DP5, EP1.6 and EP2.2.

5. AS 2 – OMISSION OF FIRE HOSE REELS

5.1 INTRODUCTION

The following table provides a summary of the Performance Solutions, the relevant BCA DtS Clauses which are affected and the relevant BCA Performance Requirements and IFEG subsystems.

Table 3: Summary of Performance Solution

DESCRIPTION OF PERFORMANCE SOLUTION	DTS CLAUSE	PERFORMANCE REQUIREMENTS	IFEG SUB-SYSTEM	BCA (A2.2)	BCA (A2.2)
Assess the omission of required fire hose reel coverage within the Member Services units MS4 – MS9 (fire extinguishers to be provided in lieu)	E1.4	EP1.1	SS-D	(1)(a)	(2)(b)(ii)
Approach and assessment method used - The approach in this solution will be qualitative in nature and will use a deterministic absolute approach.					

5.2 DESCRIPTION OF NON-COMPLIANCE WITH DTS PROVISIONS

As per BCA Clause E1.4 the Class 6 portion of the Lower Ground of Harbord Diggers Redevelopment (MS4 – MS9) are required to have hose reel coverage for each tenancy. Given the considerable fire compartmentation in and around these tenancies, it is proposed to omit hose reel coverage from them as otherwise each tenancy will require its own hose reel. Instead, additional hazard-specific extinguishers shall be provided in each tenancy in lieu. The tenancies of the Members Services (MS4 – MS9) which this Performance Solution applies to can be found Figure 6.

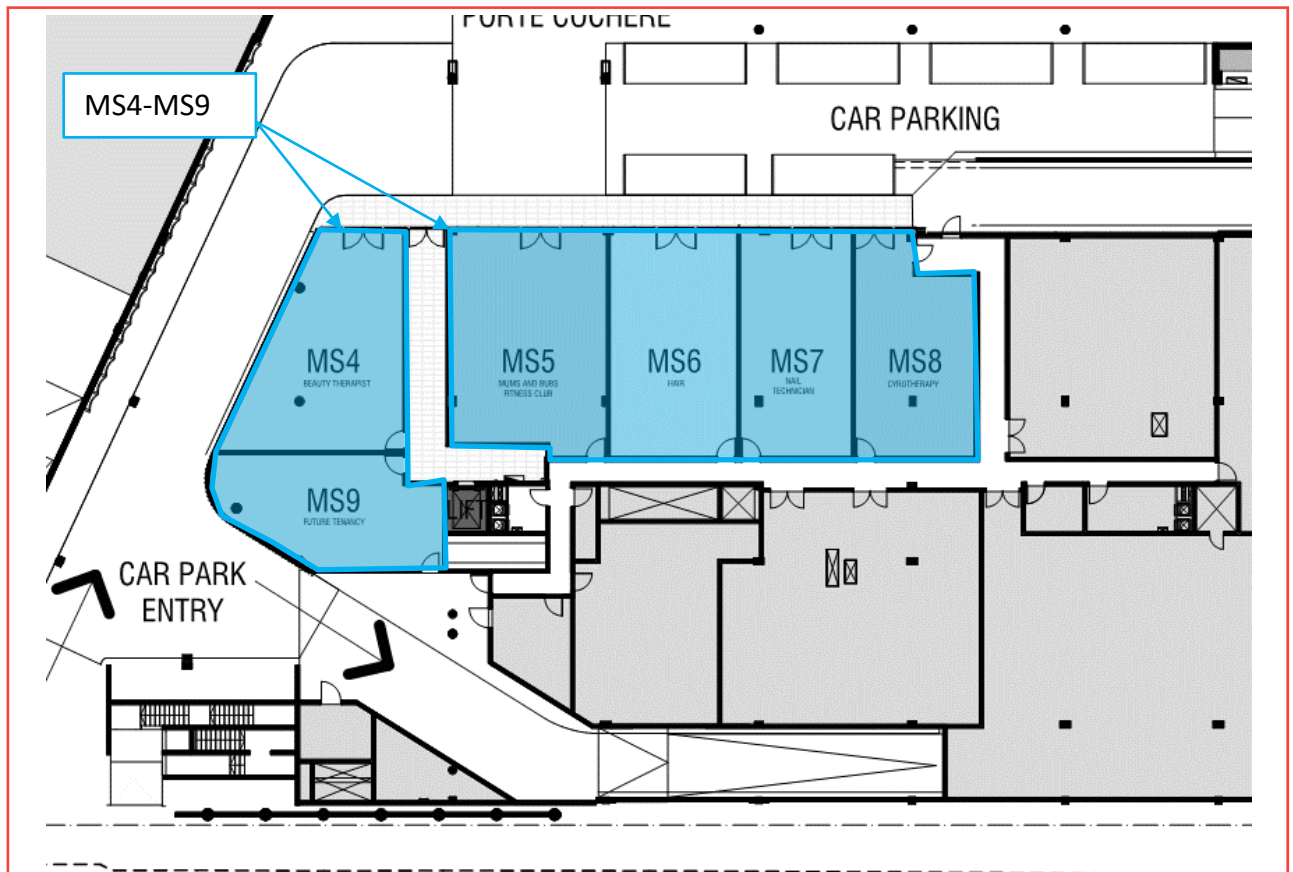


Figure 6: Location of Members Services (MS4 – MS9, Lower Ground Level)

5.3 DISCUSSION AND INTENT OF THE BCA

5.3.1 DTS PROVISION E1.4

BCA DtS Provision E1.4 states:

- (b) A fire hose reel system must be provided—*
 - (i) to serve the whole building where one or more internal fire hydrants are installed...*
- (c) the fire hose reel system must—*
 - (i) have fire hose reels installed in accordance with AS 2441 ...'*

The Guide to the BCA states that the intent is:

'To require the installation of suitable fire hose reel systems to enable, where appropriate, a building's occupants to undertake initial attack on a fire.'

5.4 ACCEPTANCE CRITERIA

To determine whether this Performance Solution is considered to meet the BCA Performance Requirements, it will be demonstrated that the intent of the BCA is met in that sufficient provision has been made for first aid fire-fighting to the Class 6 portions as outlined above.

5.5 HAZARDS

The hazard associated with the omission of fire hose reels is that first aid fire-fighting may be limited meaning occupants may be exposed to excessive risk prior to evacuation.

5.6 PROPOSED FIRE SAFETY MEASURES

The fire safety measures listed in Section 3 form the holistic fire safety design for the development incorporating measures specific to the consideration of the Performance Solutions. Fire safety measures specific to this Performance Solution are as follows;

- Additional hazard specific (4.5 kg A:B:E) portable hand-held portable fire extinguishers are to be provided in Member Services tenancies M1 and MS4 – MS9 on Lower Ground Floor in accordance with BCA Clause E1.6 and AS 2444- 2001 where fire hose reel coverage cannot be achieved from existing hose reels on site.

5.7 METHOD OF ANALYSIS

The proposed design is to be qualitatively evaluated by demonstrating that by providing hazard-specific fire extinguishers, sufficient firefighting provisions have been put in place to allow for occupants to undertake initial firefighting operation if they are required to do so.

5.8 ASSESSMENT

5.8.1 HAZARDS ASSOCIATED WITH FIRE HOSE REEL USE

It is noted that the intent of the hose reels, as discussed in the BCA Guide, is to provide a means of first aid fire-fighting, where it is appropriate for occupants to do so. However, building occupants (particularly those associated with a retail tenancy who have no affiliation with the building as would be the case in tenancies M4 – M9) are generally expected to ensure that they are not put in undue risk where they should focus on evacuating themselves rather than remaining in the building during a fire emergency to try and fight a fire with a fire hose reel. The use of fire hose reels could therefore increase the likelihood of injury or death due to the occupants remaining in the building and fighting the fire when they have not been suitably trained to do so, instead of evacuating. This is particularly relevant to small confined areas as fire conditions can change very quickly in small compartments. In the time it takes an occupant to leave the area of fire origin and return with a charged fire hose reel, conditions could have become

extremely dangerous and opening the door to a tenancy (compartment) known to contain a fire should not be encouraged.

As the fire hose reels are generally located within 4 m of an exit, their use could significantly increase the risk to other occupants in the room as they may then need to step over the hose to reach the exit. Should a hose be taken into an area / room where a fire is taking place, it could wedge the door open allowing smoke to spill directly into the adjoining spaces as first aid fire attack takes place. It is further noted that if the occupants are unable to control the fire, they may flee with the hose still wedging a door open allowing smoke and hot gases to spread into other areas of the building. This may expedite the onset of untenable conditions within that fire compartment, as well as creating significant trip hazard to themselves, other evacuating occupants and attending fire-fighters.

5.8.2 SUBSTITUTION OF EXTINGUISHERS TO FIRE HOSE REELS

To mitigate the shortfall in fire hose reel coverage to the Members Services tenancies (MS4 – MS9) it is proposed to provide portable hand held fire extinguishers. Fire extinguishers are a much more appropriate method of initial attack on a fire as they have a limited capacity of approximately 30 s of continuous use, at which point occupants should still have time to evacuate if they have not been able to extinguish a fire. This means that it is less likely for a person to continue attempting to fight a fire, which may become too large and then overwhelms them. Fire extinguishers also do not prevent doorways from closing properly or create trip hazards to the same extent as a fire hose reel unwound across a corridor / circulation egress space may do.

Fire hose reels are also quite heavy (particularly when charged with water) and require an amount of strength which many occupants may not possess, particularly elderly, young, or unwell occupants. Extinguishers are much lighter and easy to move and wield in comparison and therefore are more useful to a wider number of the buildings occupants.

In the tenancies in question, a fire isolated corridor exists at the rear of each tenancy. It is not permitted for a hose reels to be taken through a fire door given the impact they have on the compartmentation boundaries after passing through such a doorway. To achieve compliant coverage to each of these tenancies, a hose reel would need to be installed within each which is deemed excessive given their size. The provision of fire extinguishers in lieu is therefore viewed as a far more practical solution for these tenancies.

5.8.3 SPRINKLER PROTECTION

As mentioned in Section 4.8.3; the tenancies in question are all fully sprinkler protected meaning a fire occurring in this space is likely to be controlled or extinguished anyway without occupant intervention. The provision of extinguishers in lieu of hose reels is not deemed to pose any additional risk to the space as a result.

5.9 CONCLUSION

Based on the qualitative assessment carried out, the Performance Solution incorporating the fire safety measures as proposed therefore satisfies Performance Requirement EP1.1.



6. SUMMARY

Based on the Performance Solutions undertaken within this letter, it is considered that an acceptable level of life safety will be achieved within the Member Services tenancies and the surrounding areas once the design provisions detailed in Section 3 have been implemented in full.

Regards,

A handwritten signature in black ink, appearing to read 'Jonathan Wu'.

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7. REFERENCES USED IN THIS FER

- [BCA] ABCB 2019, *National Construction Code Series, Volume 1, Building Code of Australia 2019, Class 2 to Class 9 Buildings*, Australian Building Codes Board, Canberra.
- [BCA Guide] *Guide to the Building Code of Australia*, Australian Building Codes Board.
- [IFEG] ABCB 2005, *International Fire Engineering Guidelines, 2005 Edition*, Australian Building Codes Board, Canberra.