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Ref | 20345-L01-2
Date | 16 January 2026

24-28 Middle Harbour Road, Lindfield – Response to NSW SES Feedback

The Proponent has received feedback from the NSW State Emergency Service (SES) following the submission of the Flood Impact and Risk Assessment (FIRA) as part of the EIS submission for the SSD (SSD-82548708). The responses are identified below and references are provided to show where they are addressed in the updated report.

We note the NSW SES's summary recommendations and the associated seven outlined principles. Our response to each of the outlined principles has been included below, also encompassing the summary recommendations. The responses include design decision context and further technical discussion to assist in closing out the remaining concern relating to the management of flood risk for the development.

Principle 1 Any proposed Emergency Management strategy should be compatible with any existing community Emergency Management strategy

NSW SES Feedback: Any proposed Emergency Management strategy for an area should be compatible with the evacuation strategies identified in the NSW State Flood Plan and the Hornsby Ku-ring-gai Local Flood Plan, where evacuation is the preferred emergency management strategy for people impacted by flooding. We also note that any proposed evacuation strategy must not require people to drive or walk through flood water.

We do not support shelter in place for this site, per condition 8c of the NSW Government Shelter-in-Place guideline for flash flooding, as the site and proposed buildings on the site would be directly exposed to high hazard flooding. Please see Principle 4 for further discussion.

Response: The proposed development design and the FIRA have been updated to support horizontal evacuation rather than shelter in place (refer Section 5 of the updated FIRA). An elevated walkway has been provided in the design which connects the building's main entrance to the flood-free area in the southwest corner of the site. From this point, evacuation to higher ground is available to the west along Middle Harbour Road. The walkway has been designed to be above the PMF level to ensure a flood-free evacuation route.

Principle 2 Decisions should be informed by understanding the full range of risks to the community

NSW SES Feedback: Decisions relating to future development should be risk-based and ensure Emergency Management risks to the community of the full range of floods are effectively understood and managed.

Flood risks up to the PMF

Risk assessment should consider the full range of flooding, including events up to the Probable Maximum Flood (PMF) and not focus only on the 1% AEP flood. For example, section 5 of the FIRA states "Duration of inundation … is expected to be less than 1 hour in 1% AEP storm event", however there is no mention of duration for events greater than the 1% AEP.

It is noted that the site itself is currently prone to flooding in a 10% AEP event with flood depths of 0.15-0.50m across the site, and depths of up to 1m during a PMF. However, the post-development modelling shows the site would become inundated with depths of up to and greater than 2 metres immediately adjacent to the site during a PMF.

We would also like to emphasise that the NSW SES has responded to multiple flood related requests in this area, including inundation of properties on Middle Harbour Road and Capper Street, and multiple sandbagging requests for property protection in the area.

Climate change

Current evidence suggests that flood events will become more frequent due to climate change. Flood impacts and risks due to climate change should be considered, beyond providing modelling for these events. The afflux models for the 0.5% AEP and 0.2% AEP (proxies for the 1% AEP event plus climate change) clearly demonstrate increases in the area inundated by floodwater under both scenarios, with flood depths adjacent to the site increasing by up to 0.30m during an 0.5% AEP event and greater than 0.30m during an 0.2% AEP event. These afflux levels are not insignificant. The climate change proxy modelling also shows that climate change would increase flood hazard by 1-2 levels in various locations adjacent to and downstream from the site.

A Climate Change Calculator has been developed to address the updated ARR climate change guidelines (Wasko et al, 2024), recommending the adjustment of the BoM 2016 IFDs to account for the warming that has occurred since the mid-point of the data used for their development (1961-1990). This results in a significant increase in existing conditions flood levels. The change in flood probabilities with climate change for the this catchment area results in the new probability of the 1 in 100 AEP to be approximately 1 in 44 AEP event for the current 2025 scenario, becoming even more frequent in the future. For the proposed development site, this could result in more frequent inundation and isolation than what is currently expected based on previous modelling.

Response: The FIRA has been updated to include mapping and discussion on the duration of inundation for the PMF event (refer Section 4.2 and Figure 4-6 of the FIRA). These results show that, across most of the site, hazard at or higher than H3 is not expected to last longer than 3 hours, with some localised areas within the proposed swale lasting up to 6 hours.

The climate change assessment undertaken in the FIRA shows flood level increases of up to 0.3 m are expected across most of the site, except within localised areas within the swales where increases of up to 0.45 m are observed in the 0.2% AEP event. The development finished floor level has been set to over 1 m higher than the applicable 1% AEP flood level at the entrance, and all surrounding balconies are protected by solid walls set to 0.3 m above the applicable 1% AEP flood level. Similarly, the driveway entrance crest is 0.3 m above the applicable 1% AEP flood level. While it is not feasible to adopt crest levels consistent with the rarer climate-change-adjusted events due to geometric and operational limitations, the selected design levels aim to balance flood resilience with the physical constraints of the site.

Principle 3 Development of the floodplain does not impact on the ability of the existing community to safely and effectively respond to a flood

NSW SES Feedback: The ability of the existing community to effectively respond (including self-evacuating) within the available timeframe on available infrastructure is to be maintained. It is not to be impacted on by the cumulative impact of new development.

During the PMF the site currently becomes inundated to depths of up to 1 metre, but under post-development conditions becomes inundated to depths of up to and greater than 2 metres. The afflux maps also indicate that the proposed development would increase flooding on adjacent sites to the north, west and south of the site during the PMF by up to and greater than 0.3m, and would introduce floodwater to properties and parts of properties that would otherwise have been dry. This proposal would therefore impact on the existing community, and we recommend removing the statement "the proposed development results in limited flood level afflux within neighbouring properties" as this does not hold true for all events up to the PMF.

Risk assessment should have regard to flood warning and evacuation demand on existing and future access/egress routes. Consideration should also be given to the impacts of localised flooding on evacuation routes. Evacuation must not require people to drive or walk through flood water. Development strategies relying on an assumption that mass rescue may be possible where evacuation fails or is not implemented are not acceptable to the NSW SES.

Response: As discussed in the response to Principle 1, the proposed development design has been updated to include an elevated walkway to allow for a flood-free evacuation route to the southwest corner of the site. This route now provides access to flood-free land to the entire site, whereas under pre-development conditions the northeastern corner of the site would have been isolated. The proposed design therefore improves upon the pre-development evacuation ability of the site.

It is acknowledged that in the PMF event there is increase in flood levels on adjacent sites to the north, west and south. However, in the north and west, the increase is contained to the rear of the adjacent properties and therefore does not result in a worsening of evacuation ability of these properties, which can still evacuate through their frontage to Russel Avenue or Middle Harbour Road. The increases in flood levels in the south of the site are contained within the road reserve, which under pre-development conditions is already subject to inundation and therefore would not serve as an evacuation route.

The statement "the proposed development results in limited flood level afflux within neighbouring properties" has been amended to "the proposed development results in limited flood level afflux within neighbouring properties and Middle Harbour Road in all modelled events up to and including the 0.2% AEP event".

Principle 4 Decisions on development within the floodplain does not increase risk to life from flooding

NSW SES Feedback: Managing risks associated with flooding requires careful consideration of development type, likely users, and their ability respond to minimise their risks. This includes consideration of:

• Isolation – There is no known safe period of isolation in a flood, the longer the period of isolation the greater the risk to occupants who are isolated.

• Secondary risks – This includes fire and medical emergencies that can impact on the safety of people isolated by floodwater. The potential risk to occupants needs to be considered and managed in decision-making.

• Consideration of human behaviour – The behaviour of individuals such as choosing not to remain isolated from their family or social network in a building on a floor above the PMF for an extended flood duration or attempting to return to a building during a flood, needs to be considered.

Shelter in Place

As noted earlier, we do not support shelter in place for this site, primarily because the site would be directly exposed to high hazard flooding. This therefore does not meet condition 8c of the NSW Government Shelter-in-Place guideline for flash flooding.

We also note that 'shelter in place' strategy is not an endorsed flood management strategy by the NSW SES for future development. Such an approach is only considered suitable for existing dwellings where the risk of staying is lower than the risk of evacuating, without increasing the number of people subject to such risks. Development strategies relying on deliberate isolation or sheltering in buildings surrounded by flood water are not equivalent, in risk management terms, to evacuation.

Elevated structures to achieve compliance with habitable floor levels, although effective for property protection, brings with it the problem that residents will be convinced that it is safe to "sit-out the flood". Unless the floor level is above the limit of all flooding i.e., above the PMF, this is not true because the water could keep rising over the floor level after residents have lost their escape route. It also does not consider how occupants may behave including the potential that they may attempt to leave too late, or access flood affected buildings when it is unsafe to do so. Unfortunately, our experience is that people change their mind about sheltering in place after they have been surrounded by flood water or when essential services such as water, power and sewer cease to function. Building stability can also be an issue, particularly in high hazard floods where all buildings are susceptible to structural failure.

The flood evacuation constraints in an area must not be used as a reason to justify new development by requiring the new development to have a suitable refuge above the PMF. Allowing such development will increase the number of people exposed to the effects of flooding and other secondary emergencies such as fires and medical emergencies. Emergency services are also exposed to greater risks than if flood-free access was available. This unnecessarily exposes emergency service personnel to flood situations which may lead to injury or death.

Basement carparking

Basement car parks have inherent risks to life and property and can often restrict safe evacuation of the occupants. This can be managed through building design, such as crest levels above a certain level (e.g. the PMF) to prevent water ingress and flooding.

Building designs which put cars or other property under the building may also encourage people to take risks to save these items, and therefore is not preferred for future development that sees an increase in the number of people exposed to the risks.

Response: As noted earlier, the proposed development design and the FIRA have been updated to support horizontal evacuation rather than shelter in place (refer Section 5 of the updated FIRA). An elevated walkway has been provided in the design which connects the building's main entrance to the flood-free area in the southwest corner of the site. From this point, evacuation to higher ground is available to the west along Middle Harbour Road. The walkway has been designed to be above the PMF level to ensure a flood-free evacuation route.

The basement car park entry has been designed with a crest at the 1% AEP plus 0.3 m freeboard to provide protection from flooding. This level has been adopted as it represents the highest practical crest elevation achievable within the site constraints while maintaining compliant vehicular access grades and avoiding adverse impacts on the overall site layout.

The behavioural risks associated with occupants attempting to access the basement during flooding are acknowledged, and the forthcoming FERP will include clear procedures and on-site signage discouraging basement entry during elevated flood risk.

Principle 5 Risks faced by the itinerant population need to be managed

NSW SES Feedback: Any Emergency Management strategy needs to consider people visiting the area or using a development.

Response: As noted earlier, the proposed development design and the FIRA have been updated to support horizontal evacuation rather than shelter in place (refer Section 5 of the updated FIRA). An elevated walkway has been provided in the design to support safe horizontal evacuation for all site users, including visitors. A detailed Flood Emergency Response Plan (FERP) will be prepared prior to Construction Certificate. This plan will outline specific operational procedures, communication protocols, responsibilities, and evacuation triggers, and will ensure the safety of both occupants and visitors during a flood event.

Principle 6 Recognise the need for effective flood warning and associated limitations

NSW SES Feedback: An effective flood warning strategy with clear and concise messaging understood by the community is key to providing the community an opportunity to respond to a flood threat in an appropriate and timely manner.

The AEP of an event will not be known until after the flooding has peaked and therefore should not be used in determining flood emergency response strategies. Instead, FERPs should include triggers and plans which apply to all events including frequent flood events and events up to and including the PMF. For this site, Severe Weather Warnings and Thunderstorm Warnings will be the most likely form of advice about the potential for flood producing storms and rainfall.

Response: The FERP for the site will incorporate a flood warning strategy that relies on clear, actionable triggers rather than the AEP of an event. We acknowledge that AEP cannot be determined until after a flood peak has occurred and therefore is not an appropriate basis for activating emergency response actions. In line with SES guidance, the FERP will instead establish practical, event-agnostic triggers and procedures that apply across the full range of potential flooding, from frequent events through to the PMF.

As recommended, the FERP will utilise Bureau of Meteorology Severe Weather Warnings and Thunderstorm Warnings as the primary sources of advice regarding the potential for flood-producing rainfall. These warnings will form the basis for early awareness, staged preparedness actions, and timely implementation of evacuation procedures as required. The plan will ensure that warnings are communicated clearly and consistently to all site users to support safe and effective flood response.

Principle 7 Ongoing community awareness of flooding is critical to assist effective emergency response

NSW SES Feedback: The flood risk at the site and actions taken to reduce risk to life should be communicated to all site users (includes increasing risk awareness, community connections, preparedness actions, appropriate signage and emergency drills) during and after the construction phase. However, it is important to note that the NSW SES is opposed to the imposition of development consent conditions requiring private flood evacuation plans rather than the application of sound land use planning and flood risk management.

Development in a floodplain will increase the need for NSW SES to undertake continuous community awareness, preparedness, and response requirements.

Response: The forthcoming FERP will outline measures to support risk awareness, including appropriate site signage, communication protocols, and preparedness actions aligned with the intended use of the development. A separate Construction FERP will also be prepared, outlining specific risk awareness requirements, site access arrangements, contractor responsibilities, and flood response procedures applicable during the construction phase to ensure the safety of workers and visitors throughout this period.

It is also acknowledged that development within the floodplain contributes to the broader community awareness and preparedness responsibilities of the NSW SES. Accordingly, the design revisions undertaken to support horizontal evacuation and reduce residual risk to life are intended to minimise the reliance on emergency services and ensure that on-site measures are proportionate, practical, and consistent with established flood risk management principles.

Principle 8 Flood Risk – Riparian Land Requirements (DCP 17.4) and (DCP24D)

Friends of Ku-ring-gai Environment Inc. (FOKE) Feedback: The site is mapped in KLEP as flood prone land. The existing dwellings are sited to avoid the Core Riparian Zone (CRZ). The SSD Application does not meet the requirements of the Ku-ring-gai Flood Prone Land policy and should be rejected.

The SSD Application fails to meet the required setbacks of 10 metres from the CRZ as measured from the centreline of the watercourse. The CRZ for category 3a should at a minimum cover the extent of any overland flow path.

All parts of the development are to be located outside the CRZ on Category 3a Riparian Land. This requirement has not been met.

Ku-ring-gai Flood Prone Land Policy aims to minimise the flood risk to life and property associated with the use of land and avoid significant adverse impacts on flood behaviour and the environment.

DCP24D.3 states 'Subsurface water management systems are to be designed to transfer subsurface water through, around or under the SSD Application to maintain the natural subsurface water regime.' It must be 'demonstrated that the natural flow regime is restored both 3 up-gradient and down-gradient of the site, without any adverse effects on surrounding property; infrastructure; groundwater dependent ecosystems; threatened species, populations, and ecological communities.' This requirement has not been met and effects to the down-gradient surrounding properties, environments and infrastructure have not been addressed.

The Flood Impact Risk Assessment highlights that issues exist with a 1% AEP (Annual Exceedance Probability) on the site. Ku-ring-gai Council has stated that with the existing Stormwater system has an inadequate capacity to convey a 5% AEP event. This issue has also been raised in the Applicant's Flood Impact Risk Assessment as a concern for flooding resulting from surcharging into draining pits in a maximum precipitation event.

Ku-ring-gai is a high rainfall area with 2022 marking significant flooded roads, bridges properties and numerous catchment areas. This part of Lindfield was heavily affected.

The typography of this site leading to the catchment area at the intersection of Trafalgar Avenue and Middle Harbour Road caused significant damage to gardens, structures and access into dwellings down gradient from this proposed development in 2022.

With the replacement of slow draining grassed areas with hard surfaces and drainage aimed at moving the water offsite, this will exacerbate the speed at which water will accumulate and move downstream in times of high precipitation. The Flood Impact Assessment fails to take into consideration the likely impact on neighbouring properties from this impact.

There is a Flood Evacuation Plan for the SSD Application, but it minimises the impact of flood or increased damage from water accumulation and speed downstream from the development site.

Due to Climate Change, Lindfield and Ku-ring-gai can only expect increased levels of rainfall. As such this development should be rejected.

Response: WMS has modelled the proposed building outline which considers the following: increased impervious areas (i.e. decreased infiltration); pipe and culvert materials (increase velocity in a concrete pipe compared with a grassed surface); and flow constriction as water is diverted at the perimeter of the property (increased velocity).

With the inclusion of these parameters, WMS has shown that up to the PMF storm event, the flood level is reduced downstream, with a reduction in flood hazard (velocity * depth). Downstream of the site, any increase in flood level or velocities are contained with the subject site or within Middle Harbour Road directly adjacent to the subject site.

Principle 9 Flood Impact Risk Assessment (FIRA) Model Verification

Conservation Programs, Heritage & Regulation (CPHR) Feedback: The FIRA has established a rainfall on grid (ROG) hydrological and hydraulic modelling to identify existing and post development flood behaviour. The FIRA ROG model has not been verified to Ku-ring-gai Council's Middle Harbour Southern Catchments Flood Study (BMT, November 2024). CPHR notes that the FIRA ROG model did not apply the verified parameters and inputs utilised in Council's model. The ROG extracted the Intensity-Frequency-Duration (IFD) rainfall depths directly from the Australian Rainfall and Runoff Data Hub without consideration to Council's adopted IFD which are based on the results of at-site rainfall analysis (refer to Table 6.3 of the Middle Harbour Southern Catchments Flood Study). As a result, the IFD rainfall depths used in the FIRA ROG are significantly lower than Council's adopted IFD.

Recommended action:

The ROG model should be reviewed to adopt the IFD rainfall depths values of the Middle Harbour Southern Catchments Flood Study (BMT, November 2024). The FIRA and maps should be updated accordingly.

Response: As a proxy to the updated climate change values, WMS have run the model with the 0.2% AEP IFD data. Comparison with the 1% AEP data, it has a difference of rainfall (mm) of approximately 2%. As such, WMS propose that the 0.2% AEP be utilised for assessment of the 1% AEP climate change data (short-term, SSP2-4.5).

The flood level difference between the 1% AEP (no climate change) and 1% AEP climate change is 0.45 m within the swale at the perimeter of the subject site, and 0.30 m adjacent to the building. As the finished floor levels were > 1.0 m above the 1% AEP (no climate change) flood levels, freeboard of 0.70 m is still provided. The balconies and driveway entrances were 0.30 m above the 1% AEP (no climate change) flood level. As there is no requirement for the driveway entrance freeboard, WMS have set the driveway at the 1% AEP climate change level. Entrances from the balconies will achieve freeboard via enclosed balconies.

Principle 10 Impacts of the Development on Adjacent Properties in Extreme Flood Events

Conservation Programs, Heritage & Regulation (CPHR) Feedback: The probable maximum flood (PMF) afflux map shows significant adverse impacts on neighbouring properties, particularly properties at 22 Middle Harbour Road, 15 Russell Avenue and 17 Russell Avenue.

Recommended action:

The design of the development is refined to reduce the adverse impacts on neighbouring properties to an acceptable level.

Response: During the 1% AEP climate change storm event, affluxes are contained within the subject site, excluding a storm portion (~50 m^2) within the rear north-east boundary of lot 22 Middle Harbour Road where flood levels increase up to 0.30 m. This is outside of the building envelopes or any existing dwellings/buildings.

During the PMF storm event, affluxes occur within three adjoining properties to the north-west: 22 Middle Harbour Road; 15 Russell Avenue; and 17 Russell Avenue. The increase in flood depth is located outside of any existing dwellings or buildings. Flood depths increase up to 1.0m in 22 Middle Harbour Road, 0.30 m in 15 Russell Avenue, and up to 0.70 m in 17 Russell Avenue.

Principle 11 Emergency Management Consideration in Significant Flood Events

Conservation Programs, Heritage & Regulation (CPHR) Feedback: CPHR notes that in the PMF event, access to the development, including access to the main entrance and basement car park, is inundated by high hazard flooding. The site is mostly impacted by flooding except the northeast part. The FIRA indicates that the recommended evacuation strategy will be 'shelter in place' which the FIRA named incorrectly "vertical evacuation".

Recommended action:

The FIRA should be updated to consider the 'Shelter in place guideline for flash flooding', published by DPHI in January 2025. The guideline provides 'shelter in place considerations', which the FIRA should address to help guide the consent authority when assessing if shelter in place is an appropriate emergency management strategy for the site.

Response: Shelter-in-place has not been identified as a viable option by the SES. As such, evacuation processes have been outlined.

Please do not hesitate to contact me if you require further clarification.

Yours sincerely,

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