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Penrith Lakes Scheme

Flood Planning Advice Report

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Peter Cochrane

30 March 2023



Acknowledgement of Country

The Department of Planning and Environment acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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Penrith Lakes Scheme

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Contents

Acknowledgement of Country	2
Contents	3
Defined terms	4
1 Introduction	5
2 Background	5
2.1 Site and locality.....	5
2.2 SEPP Amendments.....	7
2.3 Related matters	9
2.4 2022 Flood Inquiry.....	10
2.5 Flood Advisory Panel advice request	10
3 The Panel’s consideration	11
3.1 Material considered by the Panel	11
3.2 The Panel’s meetings.....	12
3.3 Key issues.....	12
3.3.1 Flood modelling, hazard and behaviour.....	12
3.3.2 Flood evacuation.....	16
3.3.3 Flood risk mitigation measures.....	22
4 Conclusions and recommendations	26
Appendix A – Material	29

Defined terms

Term	Definition
AEP	Annual Exceedance Probability
Bureau	Bureau of Meteorology
Council	Penrith City Council
Costin Roe Desktop Assessment	<i>Desktop Flood Assessment</i> , prepared by Costin Roe Consulting, dated 10 February 2021
DCP	Development Control Plan
Department	Department of Planning and Environment
FEM	<i>Hawkesbury-Nepean Valley Flood Evacuation Model Report</i> , July 2022
Flood Inquiry	NSW Flood Inquiry (July 2022)
INSW	Infrastructure NSW
LGA	Local Government Area
Material	Material considered by the Flood Advisory Panel, summarised at Section 3.1 of this report
Molino Stewart discussion paper	<i>Flood and Bushfire Emergency Response Discussion Paper</i> (prepared by Molino Stewart, undated)
Panel	Flood Advisory Panel
Penrith Lakes SEPP	<i>State Environmental Planning Policy (Penrith Lakes Scheme) 1989</i>
PLUS	Department's Planning and Land Use Strategy team
PLUS Request	PLUS request for advice from the Flood Advisory Panel with respect to Penrith Lakes (20 December 2022)
PMF	Probable Maximum Flood
Proponents	Southbank – Western Sydney Lakes Golf Course – Western Sydney Lakes Landers Inn – Western Sydney Lakes Film Production Precinct – Lakeside Studios Heliport – Sydney Helicopters
SES	NSW State Emergency Service
Site	The development of Penrith Lakes at Castlereagh
TAG	Flood Technical Advisory Group
TAR	Flood Technical Advisory Report
TfNSW	Transport for NSW
Water Technology Report	<i>Flood Level Assessment</i> , prepared by Water Technology Pty Ltd, dated 12 May 2022
Western Parkland City SEPP	<i>State Environmental Planning Policy (Precincts – Western Parkland City) 2021</i>
WSL	Western Sydney Lakes

1 Introduction

1. On 20 December 2022, the NSW Department of Planning and Environment's (**Department**) Planning and Land Use Strategy (**PLUS**) team requested flood related advice (**PLUS Request**) from the Flood Advisory Panel (**Panel**). The PLUS Request related to several planning proposals to zone or rezone land under *State Environmental Planning Policy (Precincts – Western Parkland City)* (**Western Parkland City SEPP**) within the Penrith Lakes Scheme (the **Site**) in the Penrith Local Government Area (**LGA**).
2. In 2021, a draft amendment to the Western Parkland City SEPP was exhibited seeking to increase employment, recreational and tourism opportunities at the Site. The draft Western Parkland City SEPP proposed additional land uses at specific locations within the Site, including:
 - Film Production Precinct
 - Private golf course
 - Office premises (relocation of existing offices)
 - Tourism and commercial uses of a local heritage item (Landers Inn)
 - A heliport.
3. Following exhibition, Western Sydney Lakes (**WSL**) (formerly Penrith Lakes Development Corporation) submitted a request for the Department to include the 'Southbank' proposal as part of the draft Western Parkland City SEPP amendment. Southbank seeks to rezone 80 hectares of unzoned land to employment, tourism and parkland zones, as stage 1 of developing a 320 hectare parcel of land identified as a Lot 4 within the Site.
4. PLUS also requested the Panel provide advice on the future development potential of the remaining 240 hectares of 'Lot 4', marked for 'future urban' and parkland for public use (PLUS Request, p1). In this regard, PLUS requested the Panel advise on "*whether filling of land in Lot 4, to either 1 in 100 year flood level or the 1 in 500 year flood level, or a combination of both, would be suitable for further investigation in order to support additional capacity for urban development on Lot 4*" (PLUS Request, pp6-7).
5. The Department's Deputy Secretary Monica Gibson (Chair), and independent members Dianne Leeson and Peter Cochrane have been appointed to constitute the Panel with respect to this request.

2 Background

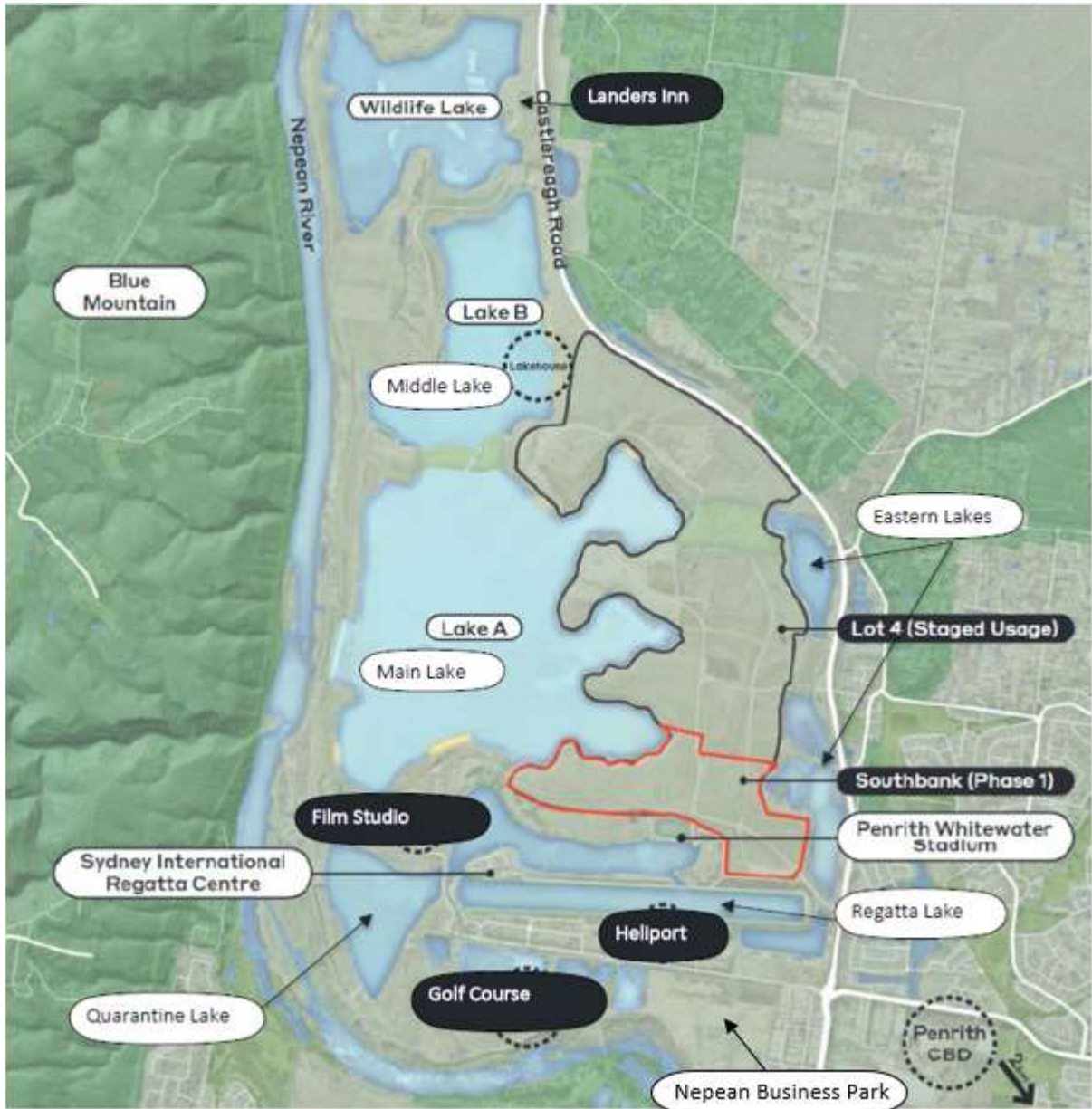
2.1 Site and locality

6. The Site is located entirely within the suburb of Castlereagh within the Penrith City Council LGA, north of the Penrith City CBD. The Site is 1,940 hectares in area and is bordered by Nepean River to the west and south and Castlereagh Road to the east.
7. The Site is a former quarry and is in the process of being rehabilitated by WSL. It has been undergoing redevelopment into a regional lake system and park for public recreation, ponds and wetlands providing water treatment and wildlife habitat.

8. The Site contains 750 hectares of man-made, freshwater lakes including six main lakes with two of these lakes part of the Sydney International Regatta Centre and Penrith Whitewater Stadium. Other existing development includes an Environmental Education Centre, Penrith Motorcycle Rider Training Centre and WSL offices.

Figure 1: Site Context

(Source: Penrith Lakes Phase 1 Urban Design Framework)



9. It is the NSW Government's long-term intention to secure the dedication of the lakes and parklands for public use. The overall vision for the Site is to be a signature piece of regional open space in the Western Parkland City, with a strong world-class sporting and recreational identity. The NSW Government is committed to making the Site a destination to play, relax, work and visit.

2.2 SEPP Amendments

10. Since 1989, development on land within the Penrith Lakes Scheme has been governed by *State Environmental Planning Policy (Penrith Lakes Scheme) 1989* (**Penrith Lakes SEPP**). In 2017, an amendment to the Penrith Lakes SEPP rezoned some land within the Site for tourism, employment and residential uses.
11. The Site is now governed by the Western Parkland City SEPP. In 2021, the draft Western Parkland City SEPP amendment was exhibited to zone 'unzoned' land and to allow additional permitted uses on land already zoned Tourism at the southern portion of the Site, to increase employment, recreational and tourism opportunities. The amendments sought to permit the following additional land uses at specific locations within the Site:
 - **Film Production Precinct:**
 - land is currently zoned *Tourism*
 - proposed amendment to include a new Additional Permitted Use, enabling *Film Production* as a permissible use and specifically listing ancillary uses that would comprise this new cultural and tourist facility such as *Light Industry, High Technology Industry, Tourist and Visitor Accommodation, Educational Establishment, Food and Drink Premises* and *Office Premises*
 - the proposal comprises up to 10 production stages/sheds, three construction mills that would be used for creating set designs and costumes, filming pool tanks, short/long-term accommodation, film school/academy, office spaces, ancillary food and drink premises, audience holding areas, car parking and security facilities.
 - **Golf course (private):**
 - land is currently unzoned
 - the proposal seeks to zone the land *Tourism* to permit *recreational facilities (outdoor)* that would allow a new private golf course and associated facilities, including club house, driving range and car parking to the south of Old Castlereagh Road.
 - **Office premises:**
 - the land identified as the new WSL office space is currently zoned *Tourism*, under which offices are a prohibited use
 - the proposal includes the relocation of the existing WSL offices from the proposed heliport site to a 1 hectare parcel of land to the southwest of the Main Lake, fronting Old Castlereagh Road
 - this site is located on the northern part of the Film Production Precinct.
 - **Landers Inn:**
 - the Landers Inn site is currently unzoned and contains an existing 19th Century inn and sandstone barn, which is a local heritage item and is currently used for residential purposes
 - the proposal seeks to rezone this land to *Tourism* to allow the possible repurposing as tourist accommodation or commercial premises
 - the proposal would list the site as a local heritage item under the SEPP.
 - **A heliport:**
 - this site is currently zoned *Tourism* and is occupied by an approved helipad operation
 - proposed amendment to include an Additional Permitted Use, enabling *Heliports* as a permissible use
 - the proposed operation will include private tourism flights, charter flights, film and photography as well as assisting public emergency services such as the Rural Fire Service and State Emergency Service.

12. The draft Western Parkland City SEPP amendment included changes to existing flood management provisions to ensure flood evacuation is considered for any land use within the Site that requires development consent. The Consultation Paper exhibited with the SEPP amendment identifies these provisions would be supported by a Flood Response Guideline for the Site, which is being drafted by the Department separate to the SEPP amendment. The Flood Response Guideline is intended to specify an early flood warning and site non-attendance/evacuation system for the Site.
13. The Department has undertaken separate targeted consultation of the draft Early Flood Evacuation Guideline (Department, May 2022), which could support the proposed SEPP amendment.
14. Following the exhibition of the draft Western Parkland City SEPP amendment, WSL submitted a request, dated 22 May 2022, to zone 80 hectares of unzoned land to employment, tourism and parkland. The proposal known as 'Southbank' will facilitate public open space and community uses, foreshore embellishment, a new business park, a retail and commercial precinct, outdoor recreational areas, hotel and tourist accommodation, a Farmer's Market and supporting infrastructure. Southbank is a phase 1 rezoning proposal, with the remaining 240 hectares of land identified as Lot 4, to be subject to future rezoning proposals. For the purpose of the TAG and Panel processes, Southbank has been considered in its totality. Options for the staging of separate uses were not put to the Panel and have therefore not been specifically considered.
15. Information received from PLUS on 27 January 2023 provided the following capacity breakdown (in terms of the number of vehicles) for each of the proposed SEPP amendment uses (Table 1). The Panel notes these numbers are indicative and have been calculated by PLUS.

Table 1 – Anticipated vehicle capacity (SEPP Amendments)

Land use proposal	Number of carparking spaces
Office (relocation of existing premises)	24 existing (approx.); DCP requires 1 space per 40 sq.m.
Film Production Precinct	2,580 spaces
Heliport	40 spaces
Golf Course	200 spaces
Landers Inn Heritage Listing	End use is not defined, no assumptions made for carparking
Total	2,844 to support SEPP amendment proposals 2,820 additional spaces (minus 24 existing)

(Note: the source of these numbers is the DPE email dated 27 February 2023, and have been calculated by DPE for indicative purposes only)

16. The information provided by PLUS on 27 January 2023 also included information extracted from the Proponent's Transport Impact Assessment submitted with the Southbank proposal. This information (included as Table 2 below) includes the anticipated number of parking rates for each component of the Southbank proposal, depending on which parking rates are applied (either the Western Sydney Aerotropolis DCP or the Penrith Lakes DCP).

Table 2 – Anticipated vehicle capacity (Southbank Proposal)

Land use proposal	Number of spaces at full build out (Western Sydney Aerotropolis DCP)	Number of spaces at full build out (Penrith Lakes DCP)
Farmers market	750	750
Wave park	625	625
Golf driving range	625	625
High tech business park	458	915
Hotel	90	450
Serviced apartments	54	270
Cultural centre	7	185
Retail	1,164	1,940
Commercial	477	1,191
Total	4,250 additional spaces	6,951 additional spaces

(Source: Transport Impact Assessment (prepared by Pentelic Advisory, dated 16 May 2022, p69)

17. The Panel understands that the Department has been working in collaboration with WSL, Penrith City Council and other Government agencies on a detailed vision and master plan for the Site. The intention of this work is to provide a framework through which site-specific issues can be identified and resolved where possible and provide the basis for seeking funding to realise the State Government’s long-term vision for the Site. The master planning and visioning work has been placed on hold pending the outcome of the Panel’s advice.

2.3 Related matters

18. On 31 March 2022, the Land and Environment Court approved the subdivision of the south-eastern corner of the Site to facilitate the Nepean Business Park. The development consent comprised subdividing the southeast corner of the Site into four environmental lots, 93 Community title lots and one community association lot, including associated earthworks, road works and landscaping.
19. The approval of the Nepean Business Park development application included a Flood Emergency Response Plan, which identifies management actions and requires each future business to establish, implement and maintain a Flood Emergency Response Plan, consistent with the approved overarching Flood Emergency Response Plan, enforceable through a mechanism such as a DA condition or covenant on title.
20. The approved Flood Emergency Response Plan establishes a coordinated response to evacuation through the creation of a Community Association. The Community Association is responsible for maintaining and implementing the Flood Emergency Response Plan for the Nepean Business Park.

21. Further to the approval of the Nepean Business Park, on 3 August 2022, the Independent Planning Commission approved the construction and operation of a helipad facility on the Site, adjacent to the existing WLS offices.

2.4 2022 Flood Inquiry

22. The O’Kane/Fuller 2022 Flood Inquiry (**Flood Inquiry**) was commissioned in March 2022 to understand major flood events experienced in NSW in February, March and July 2022 and to make recommendations for future improvements to planning for, and responses to, flood events.
23. The Flood Inquiry made recommendations relating to planning on flood prone land and the importance of NSW taking a greater proactive, risk-based approach to flooding and land-use decisions.
24. Part of this risk-based approach included the recommendation that new flood-planning levels be developed for high-risk catchments in NSW, which are to be determined by the yet to be established NSW Reconstruction Authority. As an interim measure, to allow existing planning proposals to progress while the NSW Reconstruction Authority is set up, the Department has constituted Flood Advisory Panels (Panels) to provide advice on the flood risk associated with certain ‘high-risk’ planning proposals, in the context of the recommendations of the Flood Inquiry.

2.5 Flood Advisory Panel advice request

25. PLUS has requested the Panel provide advice and recommendations on how to proceed with the draft Western Parkland City SEPP amendment, considering the flood and evacuation matters, with possible options being:
- *Do not proceed with any of the development proposals*
 - *Do not proceed with any of the development proposals until the flood related issues have been addressed*
 - *Proceed with certain aspects of the development proposals, such the office site relocation amendment only, with the remaining amendments including Southbank proposal placed on hold until all the flood-related issues have been addressed and advise how these matters should be addressed*
 - *Where proposals may be able to proceed to determination, seek further information to address flood related matters including addressing SES’ significant concerns with the draft guideline*
(PLUS Request, p6).
26. In addition, PLUS has requested the Panel provide advice on future development on ‘Lot 4 Future Urban Area’, with possible options being:
- *Considering the flood and evacuation issues of the site, no future urban development is recommended to proceed.*
 - *Considering the flood and evacuation issues of the site, only low impact development should be investigated subject to resolving NSW SES’ concerns regarding early evacuation of the site.*
 - *Considering the flood and evacuation issues of the site the overall development capacity of Penrith Lakes and the necessary actions/works required to achieve this capacity.*
(PLUS Request, p6)

27. As part of the consideration of the above options, PLUS has requested the Panel advise on whether filling 'Lot 4 Future Urban Area' to either the 1% Annual Exceedance Probability (AEP) flood level or 0.2% AEP flood level, or a combination of both, would be suitable for further investigation in order to support additional capacity for urban development on Lot 4.

3 The Panel's consideration

3.1 Material considered by the Panel

28. In this review, the Panel has considered the following material (**Material**):
- NSW Flood Inquiry report
 - Material provided by the Proponents, including correspondence, responses to questions on notice, presentation material and photographs
 - Material provided by Council, including correspondence and presentation material
 - Material provided by PLUS, including exhibition documentation, correspondence, responses to questions on notice and presentation material
 - Key reports, including:
 - Penrith Lakes SEPP Amendment 2021 Consultation Paper (plus attachments)
 - WLC - Penrith Lakes Rezoning Request Letter (plus attachments)
 - Flood Level Assessment, prepared by Water Technology Pty Ltd
 - Flood and Bushfire Emergency Response Discussion Paper, prepared by Molino Stewart
 - Desktop Flood Assessment, prepared by Costin Roe Consulting
 - Hawkesbury-Nepean Flood Studies, including:
 - *Hawkesbury-Nepean Valley Regional Flood Study* (INSW, WMA Water, July 2019)
 - *Climate Change and Flooding Effects on the Hawkesbury-Nepean* (WMA Water, September 2021).
 - draft *Hawkesbury-Nepean Flood Study - Interim Results* (INSW, April 2022)
 - *Hawkesbury-Nepean Valley Flood Risk Management Strategy* (INSW, July 2022)
 - *Hawkesbury-Nepean Valley Flood Evacuation Model Report* (INSW, July 2022) (**FEM**)
29. A detailed list of the Material is provided in Appendix A.
30. In addition, a Technical Advisory Group (**TAG**) was established to provide technical advice, in response to Panel's requests on specific flood-related risks of the various proposals, having regard to the recent Flood Inquiry and its recommendations as accepted by government (either absolutely or in principle).
31. The TAG consists of independent experts in the fields of climate change, hydrology and natural hazards and risks, as well as representatives from the NSW State Emergency Service (**SES**), Infrastructure NSW and Transport for NSW (**TfNSW**).
32. The TAG was requested to advise whether the proposals adopt a tolerable, risk-based flood planning level considering the Material.
33. The TAG provided its advice in a Technical Advice Report, dated 21 February 2023. In considering the TAG advice, the Panel noted concerns that the TAG advice is conservative. However, based on the information available, and in the context of the Flood Inquiry recommendations and the government's endorsement of those recommendations in principle, the Panel are satisfied this approach is appropriate to apply across the Site.

34. As indicated above, the Panel also considered the conclusions of the FEM. The FEM was developed through an expert-led interagency government process to assess cumulative regional road network capacity during a flood evacuation based on the SES’s Flood Plan arrangements. The FEM simulates the SES evacuation timeline and arrangements under a range of assumptions. It provides the NSW Government with a repeatable process to quantify existing and ongoing risk associated with the cumulative impact of growth and climate change on road evacuation capacity in the Hawkesbury Nepean Valley.

3.2 The Panel’s meetings

35. As part of formulating its advice, the Panel met with various organisations as set out in Table 1. The Panel also extended an invitation to the Proponent for the Heliport proposal, but they were not available to attend and did not take up the Panel’s offer to accept a submission in writing.

Table 2 – Panel’s Key Stakeholder Meetings

Meeting	Date
Site Inspection	31 January 2023
Department (PLUS)	19 January 2023
WSL	2 February 2023 and 20 February 2023
Council	1 March 2023
Film Precinct Proponent	3 March 2023

3.3 Key issues

3.3.1 Flood modelling, hazard and behaviour

Proponent comments

36. The Proponent for the Southbank proposal commissioned and provided the Panel with the following documents that consider flooding:
- *Flood Level Assessment*, prepared by Water Technology Pty Ltd, dated 12 May 2022 (**Water Technology Flood Assessment**)
 - *Flood and Bushfire Emergency Response Discussion Paper*, prepared by Molino Stewart, undated (**Molino Stewart Discussion Paper**)
37. The Proponent for the Film Production Precinct proposal commissioned and provided the Panel with a *Desktop Flood Assessment*, prepared by Costin Roe Consulting, dated 10 February 2021 (**Costin Roe Desktop Assessment**).
38. While not specifically undertaken for the golf course, Landers Inn or heliport proposals, the Panel notes that the modelling undertaken for Southbank and the Film Production Precinct is relevant to these proposals.

39. The submitted documents indicate the Southbank proposal is immune from inundation in flood events up to and including the 0.5% AEP level (Water Technology Flood Assessment, p2). However, Southbank becomes inundated during a 0.2% AEP event and is fully inundated during a 0.1% AEP event, with flood levels of up to 6.5m across the Site during a PMF (Molino Stewart Discussion Paper, p4-9).
40. The Desktop Flood Assessment found the Film Production Precinct will have large proportions of the precinct which are not affected by the 1% AEP event but becomes fully inundated in a 0.2% AEP event. However, the Desktop Flood Assessment notes the precinct becomes landlocked in events between 5% AEP and 2% AEP levels (Costin Roe Desktop Assessment, p4).

Council comments

41. At its meeting with the Panel, the Council noted the flood risk at Penrith Lakes has always been a consideration in planning for the area. Council indicated Penrith Lakes is flood free up to the 1% AEP event, but there are residual risks above that to consider. Council is of the view that, under the existing policy framework, the 1% AEP event plus freeboard is an appropriate flood planning level for the Site.
42. However, Council also noted there is a considerable body of work underway in terms of floodplain management, particularly in the Hawkesbury-Nepean Valley. Council raised frustrations that much of this work is yet to be finalised or publicly exhibited, which results in significant uncertainty for Council, the community, landowners and developers. Council are of the view that policy amendments in line with the Flood Inquiry recommendations should be directed by the State Government and clarity should be provided as soon as possible.

PLUS comments

43. The PLUS Request notes the Site is within the Hawkesbury-Nepean Valley and is at risk of flooding from the Hawkesbury-Nepean River and that:
 - parts of the Site become isolated by flood waters between the 5% AEP and 2% AEP event
 - 27 hectares of the Site is impacted by the 1% AEP event
 - the development sites are fully inundated by up to 6.5m in depth during the PMF. (PLUS Request, p3)

TAG comments

44. The TAG found that the submitted modelling did not consider a full range of scenarios, instead focusing heavily on the 1% AEP event, and did not make use of all the existing flood data available for the area.
45. The TAG noted that flood risk assessments were also not provided across all proposals for the 1% AEP, 0.2% AEP or the PMF events. The submitted documents only describe the range of flood levels, but do not assess the flood behaviour impacts (hydrology and hydraulics) on the proposed developments or cumulative impacts of how the developments might alter the flood behaviour.

46. The TAG noted that the submitted flooding modelling relied primarily on Council's *Nepean River Flood Study* (November 2018). However, the TAG advised that more recent flood data, such as the *Hawkesbury-Nepean River Flood Review* (March 2021) and the interim results from the draft *Hawkesbury-Nepean River Flood Study* (April 2022) had become available to enable the TAG's consideration of, and advice on, the flood risk across the Penrith Lakes precinct in other flood scenarios.
47. Further, the TAG found that there was no evidence in the submitted documentation that climate change impacts have been considered in assessing risk. The TAG noted that when factoring in climate change and interim results from the draft *Hawkesbury-Nepean River Flood Study* (April 2022), all analysis submitted by the Proponents is likely to underestimate the flood risk to the proposals.
48. The TAG notes the Hawkesbury-Nepean floodplain experiences a 'bathtub' effect, with floodwaters backing up and rising rapidly. This results in deep and widespread flooding in the valley, with the potential for parts of the Site to be inundated for up to 40 hours in a 1% AEP event.
49. Taking into account the submitted models and also the other available studies (identified in paragraphs 46 and 47), the TAG noted the following existing flood impacts on individual proposal sites:
- **Southbank:** road access is cut by floodwaters in a 1% AEP event. Site becomes largely inundated in the 0.2% AEP event, with the majority of the site inundated in the PMF.
 - **Film Production Precinct and WSL office relocation:** becomes a flood island in events greater than the 5% AEP event and, once isolated, the surrounding floodwater can be highly hazardous with ratings of H5-H6. Part of the site is affected by the 1% AEP event, with up to 1.27m depths in 0.2% AEP event, and 6.52m depths in the PMF.
 - **Heliport:** impacted by flooding in the 1% AEP event. Evacuation routes inundated in 1% AEP event, creating a low flood island, though trafficable in the 2% AEP. Complete inundation in the 0.1% AEP event.
 - **Golf course:** impacted by flooding in the 1% AEP event. Evacuation routes inundated in 1% AEP event, though trafficable in the 2% AEP event. Complete inundation in the PMF.
 - **Landers Inn:** complete inundation in the 2% AEP event, with evacuation routes inundated in the 5% AEP event. Hazard category of H5 in the 1% AEP event.
50. The TAG found that the Proponent-led flood studies did not include sufficient information regarding flood hazard across all of the planning proposal sites, and therefore a hazard analysis across all of the sites could not be undertaken by the TAG. The TAG further found there was insufficient analysis provided on how each of the proposals would impact the behaviour of flood waters through conveyance and storage.
51. The TAG found that the flood hazard in Penrith Lakes is primarily driven by flood depth and that the assumptions made in the Desktop Flood Assessment (Costin Roe, 2021) submitted for the Film Production Precinct underestimate the rate of rise and does not account for its actual variability.
52. The TAG concluded that the retail and commercial uses and the hotel and tourist accommodation uses in the Film Production Precinct and Southbank significantly increase the number of people occupying the site, increasing the risk to life from flood events. The TAG also raised concerns that occupants or tourist accommodation uses are potentially more vulnerable because they would be occupying the site day and night and are likely to lack local knowledge and awareness of flood emergency management arrangements.

53. The TAG noted that the Site is surrounded by levees that will be subject to significant flood flows. The TAG advised that a geotechnical assessment should be undertaken to ascertain the stability of the levees and future buildings under the potential flood flows in events up to and including the PMF.

Panel advice on flood modelling, hazard and behaviour

54. The Panel have reviewed the Material available for the various development proposals with respect to flood modelling, hazard and behaviour. The Panel have considered the Material in the context of the Flood Inquiry recommendations, which found that continuing to use the 1% AEP flood planning level may no longer be adequate, unless accompanied by a comprehensive risk-based assessment (Flood Inquiry, p289).
55. The Panel notes that the Proponent-led flood modelling relied primarily on Council's *Nepean River Flood Study* (November 2018). However, it is acknowledged that information available to the Panel and the TAG, such as the Flood Inquiry, the FEM and updated flood data calibrated to recent events was not available to Proponents at the time of preparing the submitted documents.
56. Notwithstanding, the Panel agrees with the TAG that the Proponent's flood modelling does not include the full range of flood events and notes it would be beneficial to model the 0.02% AEP event, consistent with the Flood Inquiry recommendation 18. The Panel advises that amended flood reports should be provided that includes data from more recent flood events, and adequately accounts for climate change.
57. The Panel accepts the findings of the TAG that the submitted documents do not include sufficient analysis of hazard risk, which the Panel understands to include a combination of depth, velocity and rate of rise. The Panel also agrees that the submitted documents do not adequately consider the impacts of climate change on flood risk or cumulative impacts and how the developments and proposed earthworks would impact the behaviour of flood waters through conveyance and storage.
58. The Panel understands that INSW is nearing completion of a 'new' *Hawkesbury-Nepean Flood Study*, which incorporates learnings from the February 2020, March 2021, March 2022 and July 2022 floods. Interim results (April 2022) have been made available to councils and other stakeholders on request and indicate future flood levels within the Hawkesbury-Nepean catchment are likely to rise, when calibrated against recent flood events. The draft results indicate increases in the order of approximately 0.3m for the 1% AEP level, 0.5m for the 0.2% AEP level and up to 3.9m for the PMF level.
59. While the Panel notes the draft *Hawkesbury-Nepean Flood Study* has not yet been completed, or publicly exhibited, the Panel concludes from the Material before it that modelling that considers climate change impacts and is calibrated to the most recent flood events is likely to result in higher flood levels across the Site. Therefore, the Panel advises that the current, Proponent-led models of flood levels for the Site are likely to underestimate the level of risk.
60. The Panel also notes the submitted Material did not address flash flooding or its potential impact on future development or evacuation.
61. The Panel recommends further flood modelling be undertaken across the Site for the full range of events identified by the Flood Inquiry, which accounts for climate change impacts and includes all available data from recent flood events. The new modelling should consider cumulative impacts of proposed developments and earthworks and flash flooding.

3.3.2 Flood evacuation

Proponent comments

62. WSL submitted the Molino Stewart discussion paper for the Southbank proposal.
63. The Molino Stewart discussion paper indicates that, for Penrith Lakes, there are two key evacuation roads – the M4 Motorway taking Emu Plains, Penrith, Penrith North and Penrith Lakes vehicles east or west, and The Northern Road which heads south towards the Great Western Highway and the M4 (Molino Stewart, p18).
64. The Molino Stewart discussion paper also references the SES’s Timeline Evacuation Model, which estimates evacuation time and capacity by calculating the time it takes for all vehicles in an area to leave at a rate of 600 vehicles per hour per lane of evacuation route (Molino Stewart, p16). Under current technology, the Bureau can provide forecasts, with reasonable confidence, of 6 hours in advance at Penrith for floods less than 23m AHD and 8 hours for larger floods. The Molino Stewart discussion paper indicates this means that any area around Penrith which is affected by flooding below 23m AHD must be able to evacuate within approximately 6 hours (Molino Stewart, p16). At its meeting with the Panel on 2 February 2023, WSL indicated that, for a 1% AEP event, the flood level is 22m AHD (based on their modelling).
65. The Molino Stewart discussion paper notes the challenge for Southbank is to ensure that any development is able to evacuate early so not to block the evacuation of other population centres evacuating via The Northern Road at the same time (Molino Stewart, p17).
66. The Molino Stewart discussion paper notes that, during a 1% AEP event, water would flow back up Boundary Creek and flow across Andrews Road, cutting off this evacuation route to the east towards The Northern Road (Molino Stewart, p4).
67. In order to address evacuation for Southbank, the Molino Stewart discussion paper indicates the landform proposed for future urban development on Southbank and the remainder of Lot 4 has been contoured so a road layout can be provided to ensure every building can be on a road that has a continuous rising road access to a spine road along a ridge which will have a rising gradient across the subdivision, leading to a northern exit point. From the northern exit there would be a rising gradient southbound along Castlereagh Road to Cranebrook Road to access The Northern Road. This arrangement is demonstrated at Figure 8 of the Molino Stewart discussion paper (Molino Stewart, p17-18).
68. However, the Molino Stewart discussion paper acknowledges that people evacuating from Southbank via McCarthy’s Lane to Castlereagh Road would not have rising road access for vehicles but could be provided with an overland pedestrian escape route (Molino Stewart, p18).
69. The Molino Stewart discussion paper also references the FEM, noting it would appear that development within the Penrith Lakes area would need to be limited in scale and be provided with primary vehicular evacuation routes as a continually rising route north onto Castlereagh Road and Cranebrook Road (Molino Stewart, p18).
70. At its meetings with the Panel on 2 and 20 February 2023, WSL also discussed the FEM and raised concerns with several of its assumptions which resulted in conclusions that limit the available evacuation capacity for the Site. These include concerns regarding:

- *background traffic allowance*: question the assumption of 600 evacuating vehicles per hour
 - *evacuation destinations*: a significant portion of the workforce would evacuate to the west rather than the south and east, which would impact the capacity constraints
 - *early voluntary evacuation*: the FEM doesn't take into account that behaviourally, people would leave work early or that there would be low work attendance on days when flooding is possible
 - *infill dwellings in the Hawkesbury*: the FEM notes infill development will occur in areas that are of a higher risk than sites such as Penrith Lakes, occupying evacuation capacity and preventing developments in lower risk areas from progressing
 - the FEM has been prepared based on residential uses in Penrith Lakes, whereas there are no residential uses proposed
 - the FEM is based on 100% site occupancy, but the commercial uses will result in the site being closed approximately two thirds of the time (generally overnight)
71. Further, WSL noted the following infrastructure upgrades that would improve evacuation capacity for the Site and the region:
- duplication of the Windsor evacuation route
 - an additional lane on The Northern Road
 - alternative connections between The Northern Road and the M4 via Kent Road
 - contraflow
 - Mulgoa / Castlereagh Road corridor upgrade
 - Castlereagh Connection corridor.

Council comments

72. At its meeting with the Panel on 1 March 2023, Council noted the strategic importance of the development of Site for the community, and that solutions need to be found noting the non-residential nature of the proposals.
73. Council agreed with WSL, noting that the Site is proposed for non-residential uses, and in terms of evacuation, residential and non-residential development have different risk profiles and should be viewed differently.
74. Council is of the view that, for non-residential uses at this Site, there is sufficient notice to prevent occupants from attending the Site in the event that flooding is possible. The Council further noted it supports being able to enshrine early evacuation measures into future uses, potentially through measures such as covenants.
75. Further, Council also raised concerns regarding the assumptions used in the FEM, noting they appear overly conservative, based on dated information and did not take into account infrastructure upgrades that will be rolled out over the life of the development proposals on the Site.

PLUS comments

76. At its meeting with the Panel on 19 January 2023, PLUS noted the number of vehicles within the Site was a critical factor in considering evacuation needs and capacity. To ensure that the number of vehicles needing evacuation does not exceed the capacity of the regional road evacuation routes, a vehicle cap would be required in the form of maximum parking rates (PLUS referral, p5).

77. PLUS noted that operating under current warning timeframes, the FEM noted an additional 1,000 vehicles for the Site could be evacuated without impinging on the evacuation capacity of nearby areas. However, PLUS noted this advice predated the Land and Environment Court approval of the Nepean Business Park. As part of its Flood Emergency Response Plan, the Nepean Business Park will have a vehicle cap of 1,000 vehicles when flood triggers are reached. As such, PLUS no longer considers there to be any additional evacuation capacity for Site with current warning timeframes (PLUS referral, p4-5).
78. PLUS noted that no concept designs or details were submitted with the rezoning requests. However, PLUS provided an indicative summary of vehicle numbers for each proposal based on land use assumptions. These vehicle number summaries are included as Tables 1 and 2 of this report and indicate that, from PLUS's calculations, if all proposed developments were to proceed, the total number of additional vehicles on site would range from approximately 7,070 to 9,771 (depending on which DCP is applied) (PLUS Email, dated 27 January 2023).
79. PLUS advised that with the adoption of an early warning system, an additional 3,500 vehicles could be evacuated from the Site (at the southern end) without impacting the evacuation capacity of nearby areas. It is noted that of that 3,500 number, the Nepean Business Park has already been approved, which could result in the evacuation of up to 1,000 vehicles in accordance with the Flood Emergency Response Plan. To ensure that the number of evacuating vehicles does not exceed the capacity of the regional road evacuation routes, the PLUS Request indicates a vehicle cap would be required in the form of maximum parking rates (PLUS Request, p5).

TAG comments

80. The TAG also noted that, with current warning timeframes, 1,000 vehicles evacuating the Site (at the southern end) could be accommodated in the existing road network without adversely impacting the evacuation capacity of nearby areas. However, with the recent approval of the Nepean Business Park, 2.3 the TAG considered that neither Southbank nor the Film Production Precinct can be accommodated within this existing evacuation capacity.
81. The TAG noted the 3,500 vehicles scenario would be feasible if an early warning system was established. However, the TAG advised that there are inherent risks associated with an early warning evacuation system as proposed, particularly relating to the expected level of compliance with this system. The TAG's concerns with the early warning system are summarised at paragraphs 117 to 119 below.
82. With respect to WSL concerns with the assumptions used in the FEM, the TAG noted that the data and assumptions used in the FEM, whilst conservative, are based on the best available evidence.
83. In response to the Proponent's comments that a significant proportion of occupants at this Site are likely to evacuate to the west, the TAG confirmed that a westward evacuation option was explored in the FEM. The FEM modelled scenarios including evacuation along the primary routes of the M4/Great Western Highway or Old Bathurst Road up to the Blue Mountains. While this made some difference to the evacuation capacity of the Emu Plains sector, it was not considered to be an effective strategy for evacuating large numbers of people to the west.

84. The TAG recommends that the proposed Southbank (Phase 1) and Film Production Precinct proposals do not proceed in their current form because the scale of these developments would have a significant impact on evacuation from the Penrith Lakes precinct and the capacity of the regional flood road evacuation network. The TAG is of the view that the proposed mitigation measures – including the early warning system and the earthworks are not adequate at this stage for solving the evacuation capacity issues.
85. However, the TAG noted that the Golf Course, WSL office relocation, Landers Inn and Heliport would have minimal impacts on the evacuation capacity.

Panel advice on flood evacuation

86. The Panel have considered the flood evacuation material in the context of the Flood Inquiry recommendations, which found that future development should not occur in areas where satisfactory arrangements for evacuation cannot be implemented (Flood Inquiry, p280).
87. The Panel considers the flood evacuation issues for these Planning Proposals relates to two matters:
- Evacuation from within the Site – future road design and providing for rising egress to key evacuation routes, and
 - Evacuation capacity in the regional road network – ensures vehicles evacuating the Site will not adversely impact regional evacuating traffic
88. The Panel notes the Site is at a critical point in the flood evacuation network of the Hawkesbury-Nepean Valley. This is due to vehicles from the Richmond/Windsor floodplain having to evacuate south when the routes across South Creek are cut, resulting in a convergence with evacuation traffic from the Penrith area.
89. The Panel notes the FEM modelled the evacuation of 1,000, 3,500 and 10,400 vehicles from the Site under a range of flood event scenarios and under a range of assumptions. These scenarios were compared with the 2041 base case for the Hawkesbury-Nepean Valley, assuming current committed and permissible development.
90. The Panel has considered the FEM findings, that with current warning timeframes, an additional 1,000 vehicles evacuating the Site (from the southern end) can be accommodated in the existing road network without adversely impacting the evacuation capacity of nearby areas.
91. The Panel notes the concerns raised by WSL and Council with respect to the assumptions in the FEM. However, the Panel acknowledges that the FEM is based on substantial evidence, is supported by government and is a key piece of material to consider with respect to evacuation capacity constraints for this Site.
92. Regardless of the issues raised about the FEM assumptions and the specific numbers, the Panel accepts that there are significant capacity constraints on the existing road network.
93. The Panel has noted that there are no residential components proposed in these planning proposals and that, in terms of evacuation, residential and non-residential development have different risk profiles. However, the Panel advises, irrespective of the nature of the developments, that evacuation capacity is a major limiting factor to future development at this site, particularly with the recent approval of the Nepean Business Park. The Panel also acknowledges complexity and cost of improving regional evacuation capacity and the challenges in coordinating infrastructure upgrades between Proponents, Council and the State Government.

94. From the information provided by PLUS (Table 1), the Panel considers the golf course (200 expected spaces), the office relocation (24 existing spaces, minor increase expected), the heliport (40 spaces) and the heritage listing of Landers Inn (no end use defined) are lower intensity uses that would have an acceptable impact on the existing evacuation capacity at the southern end of the Site.
95. The Panel confirms that this finding is based on the information currently available. For example, the golf course proposal before the Panel includes a golf course, clubhouse, driving range and carparking facility. The Panel has not considered this use to include function or conference facilities that could significantly increase parking rates.
96. In terms of the office relocation site, the Panel notes that it is on land that is identified by the TAG as becoming a flood island during events greater than the 5% AEP. However, the Panel has considered that the office is an existing use at the Site, will present a minor increase in occupancy, is a single use office by an organisation that has management responsibilities across the Site and is a discrete use that can be evacuated with relative ease. Therefore, the Panel is of the view that the office relocation will have an acceptable impact on evacuation capacity.
97. Further to this, the Landers Inn proposal before the Panel seeks to rezone the land to Tourism to allow the possible repurposing of the heritage building for commercial or tourist uses. The Panel notes that the Landers Inn site is to the north of the Penrith Lakes Scheme area, which is some distance from the evacuation capacity impacts identified for the southern end of the Site. While the Panel agrees that some commercial tourism uses could be supported at the Landers Inn site, the Panel strongly advises against an intensification of uses that would require extended occupation, including residential and tourist accommodation uses that would further impact on evacuation capability.
98. With the recent approval of the Nepean Business Park at the southern end of the Site, the Panel agrees that the cumulative numbers of the Southbank and the Film Production Precinct proposals are greater than what can be accommodated within the existing evacuation capacity.
99. Without certainty around committed network upgrades, the Panel accepts the TAG findings that the cumulative intensity of the Southbank and Film Production Precinct proposals would bring a larger number of people and vehicles to the Site than can evacuate safely, resulting in risks to life. Further, the Panel notes any congestion caused by these additional vehicles would increase the risks to life for existing developments in other areas of the floodplain and Hawkesbury-Nepean catchment. Therefore, the Panel does not support the Southbank and Film Production Precinct proposals in their current form.
100. The Panel notes the Southbank and Film Production Precinct proposals comprise several components, but there were no concept designs or future development details submitted with the rezoning requests. Options for the staging of separate uses were not put to the Panel and have therefore not been specifically considered. To this end, the Panel has considered both proposals holistically, in terms of their potential cumulative intensity at the site.

101. The Southbank proposal includes the zoning of unzoned land to employment, tourism, and parkland to facilitate public open space and community uses, foreshore embellishment, a new business park, a retail and commercial precinct, outdoor recreational areas, hotel and tourist accommodation, a Farmer's Market and supporting infrastructure. The Panel notes that these uses do not necessarily rely on each other, and it may be appropriate to consider some of the lower intensity or temporary uses individually, that could be effectively cancelled or closed and evacuated well in advance of flood events (i.e. a weekly farmers market). The Panel advises that the consideration of the lower intensity individual uses under current circumstances could be undertaken by PLUS if the cumulative assessment of flood evacuation is completed and the recommendations in paragraphs 103 and 104 are adopted.
102. The Film Production Precinct proposal seeks to enable *Film Production* as a permissible use on that site and to specifically list ancillary uses that would comprise this new cultural and tourist facility. Based on the limited information before the Panel, the Panel has not considered the individual components of the Film Production Precinct (from a flood risk perspective) because all uses appear to be tied together as ancillary uses and do not appear to be intended to be delivered independently.
103. On the basis of the Panel's views outlined in the paragraphs above, with respect to the Southbank and Film Production Precinct proposals, the Panel recommends a staged approach could be taken that limits the vehicles for these proposals to 3,500, subject to the implementation of an effective early evacuation warning system and appropriate location of services (see discussion under section 3.3.3 below).
104. The Panel advises that any additional development potential explored in the future must be supported by additional modelling work, earthworks designed to the satisfaction of the Department and Council, the provision of internal roads with rising egress to Castlereagh Road and necessary road network upgrades. This should also include additional traffic analysis to determine whether any additional exits from the Site onto Castlereagh Road adversely impact on the level of service of key intersections between the Site and The Northern Road evacuation route.
105. As discussed in Section 3.3.1 above, the Panel notes the Material did not address flashing flooding or its potential impact on regional evacuation capacity and advises that the additional modelling should identify whether key evacuation routes or internal roads that are critical to effective evacuation are impacted by flash flooding.
106. In summary, the Panel considers the golf course, office relocation and heliport to be lower intensity uses, and the Landers Inn proposal to be sufficiently separated from the evacuation constraints that apply to the southern portion of the Site. The Panel considers that these proposals would have an acceptable impact on the existing evacuation capacity and therefore supports those SEPP amendments.
107. The Panel considers the Southbank and Film Production Precinct proposals to be higher intensity proposals (cumulatively) and does not support them in their current form. The Panel advice does not preclude certain elements of the Southbank proposal from proceeding (see paragraph 101), subject to a vehicle cap being imposed until the relevant recommendations of this report have been fulfilled.

3.3.3 Flood risk mitigation measures

Proponent comments:

108. There appear to be two flood risk mitigation measures proposed by WSL, including an early evacuation system and site earthworks.
109. At its meeting with the Panel, WSL identified that it would support the SEPP amendment proposed by the Department with respect to a requirement that flood evacuation is considered for all development that requires development consent. WSL also support the early warning system proposed to be implemented in the draft *Penrith Lakes Early Flood Evacuation Guideline* (Department, May 2022) under preparation by the Department. WSL noted that the SES and the Bureau have a legislated responsibility to manage flood warnings and evacuation alerts and that those responsibilities would continue for future developments at Penrith Lakes. The Proponents did not propose a holistic early evacuation system or indicate how such a system could be maintained and implemented in perpetuity.
110. WSL also propose earthworks to reprofile Southbank and the remainder of Lot 4 to be above the 1% AEP event plus 1.0m freeboard (in accordance with the current DCP requirements for Penrith Lakes), with an option to fill up to the 0.2% AEP event.
111. The earthworks proposed for the Southbank site include cut of 481,010m³ and fill of 106,550m³, resulting in the net removal of 374,460m³ of fill from the site to reach the 1 in 100 plus freeboard level. The proposed earthworks will remove a localised high point and introduce a gentle grade down to the lake north of the site.

Council comments:

112. At its meeting with the Panel on 1 March 2023, Council discussed the draft *Penrith Lakes Early Flood Evacuation Guideline* (Department, May 2022) and notes it would require a system to be put in place to manage evacuation at this Site. Council indicated it is open to considering such a system and agree with the SEPP amendment that early evacuation measures could be enshrined in future uses and enforced via covenants.
113. Council noted their support for the 1% AEP (plus freeboard) flood planning level as an appropriate flood planning level for the Site and did not raise concerns about the proposed earthworks.

PLUS comments

114. At its meeting with the Panel on 19 January 2023, PLUS acknowledged the Southbank proposal includes areas to be reprofiled to be above the 1% AEP event. Despite the mitigation measures, PLUS notes the entire Site will be inundated, with significant water depths across the Site during a PMF event.
115. Whilst not proposed, PLUS noted the Site is not suitable for occupants to Shelter-in-Place due to the expected duration of flood events. Continuation of electricity, water and sewer services as well as access to medical services become a concern in extended Shelter-in-Place scenarios and place people at undue risk.

TAG comments:

116. The TAG found the two mitigation measures proposed for the Site, being an early warning evacuation system and the reprofiling of the Southbank site utilising fill, were inadequate to mitigate the flood risk for the Site.
117. The TAG noted the early warning evacuation system proposes triggers for an early evacuation of the Site prior to other areas in the region. This ensures the Site can be evacuated, and traffic cleared before other areas in the region evacuate. The success of this system relies on the Penrith Lakes area evacuating at a much lower flood level trigger than the remainder of the floodplain to ensure cars in this location do not contribute to evacuation congestion.
118. The TAG raised concerns about the effectiveness of such an early evacuation system because the system:
- relies on accurate forecasting, which presents scientific and technological challenges
 - necessitates very early flood warnings, which lead to a high likelihood of false alarms and increased complacency and non-compliance over time if the Site is closed and inundation does not eventuate
 - is contingent on private flood emergency management plans and for each development to have an early warning service provider and a trained warden available to undertake the site evacuation at all times the site is occupied.
119. The TAG also noted that the Department's *Early Flood Evacuation Guideline – Bespoke Trigger* (prepared by WMA Water, dated February 2023), does not consider shelter-of-last resort if a person becomes trapped onsite and faced with hazardous floodwater. Therefore, the proposed risk assessment process is inconsistent with that required under the *National Emergency Risk Assessment Guidelines* (Australian Institute for Disaster Resilience, 2020).
120. Regarding the proposed earthworks as a way to mitigate flood risk, the TAG identified that the Proponent's documentation did not fully consider cumulative impacts of the cut and fill, nor the wider impacts resulting from additional building infrastructure within the floodplain. The TAG recommends these cumulative impacts be investigated further.
121. The TAG noted the proposed reprofiling of the Southbank site could impact localised flood behaviour and, by removing the localised high point, this measure removes a level of flood protection afforded to existing higher areas of the site. Further, the TAG Advises that the proposed reprofiling would only address the risk to property and would not eliminate the evacuation constraints.
122. The TAG also noted that the site is surrounded by levees that will be subject to significant flood flows and advises a geotechnical assessment be undertaken to ascertain the stability of the levees and future buildings under the potential flood flows in events up to and including the PMF.
123. The TAG considered whether filling the land on Lot 4 to either a 1% AEP or 0.2% AEP level would be suitable for further investigation. The TAG advised that these measures are unlikely to resolve flood-related capacity issues constraining urban development on the site. The TAG advised that some land in Lot 4 above the 0.2% AEP level could be suitable for urban development commensurate with flood risk, however this would need to be considered carefully in terms of regional flood evacuation network capacity.

Panel advice on mitigation measures

124. The Panel has considered the proposed flood risk mitigation measures, including the implementation of an early warning evacuation system and reprofiling Lot 4 (including the Southbank site) to above the 1% AEP event.
125. The Panel notes the Western City Parkland SEPP requires development in the Penrith Lakes Scheme to ensure it is provided with safe and effective evacuation of the land and the surrounding area. In the context of the evacuation capacity issues experienced by the regional road network of the Hawkesbury-Nepean catchment, the Panel notes the Department commissioned the draft *Penrith Lakes Early Flood Evacuation Guideline* (Department, May 2022) to ensure that full evacuation and closure of the proposed Penrith Lakes site occurs before the evacuation of the wider Richmond-Windsor-Penrith area.
126. The Panel acknowledges that an additional 3,500 vehicles evacuating the Site could be feasible if an effective early warning system was established. However, the Panel notes the concerns raised by TAG with respect to the governance of any early warning system and the inherent challenges in a system involving private flood emergency management plans, amongst multiple landowners, with a high likelihood of false alarms and uncertain levels of compliance.
127. However, the Panel also notes Council's support for such a system and the approach set by the recent Land and Environment Court approval of the Nepean Business Park. The Nepean Business Park approval implements a Flood Emergency Response Plan to be created through a Community Association, which includes the appointment of a Chief Flood Warden responsible for maintaining and implementing the Flood Emergency Response Plan and actioning the four alert levels. The alert levels are based on warnings and alerts issued by the Bureau 2.3. However, the Panel notes the particular circumstances of the Nepean Business Park approval, and subsequently the Flood Emergency Response Plan, relate to a specific development application rather than a planning proposal as is considered here.
128. The Panel has recommended that further flood modelling be undertaken for the full range of events identified by the Flood Inquiry, that accounts for climate change impacts and includes all available data from recent flood events. Further to that recommendation, the Panel also recommends a staged approach be taken that initially limits the vehicles for all urban development at the Site to 3,500, subject to the implementation of a satisfactory early evacuation warning system. This advice recognises that the risk profile for the proposed commercial, tourism and recreational uses is lower than residential uses, in terms of site occupation and use, and therefore further consideration of measures that can prevent occupants from entering the Site or allowing them to leave early enough in the event of flooding is warranted. The staging of the development would need to be commensurate with the evacuating road capacity that is existing and committed at the time.
129. The Panel notes recent improvements to emergency warning systems include the Government's updated '*Hazards Near Me*' app, which provides information and advice on what to do to stay safe. Further consideration is required as to how these systems can be incorporated into any emergency management strategy for the region.
130. With respect to the proposed earthworks, the Panel notes that any reprofiling of the Site must be considered in terms of the cumulative impacts of the cut and fill, potential loss of flood storage or conveyance, and the impact of future development on flood behaviour.

131. The Panel found that there is not sufficient information before it to determine the appropriateness of the earthworks at this stage. However, these works could be further explored for the Southbank and future Lot 4 development, subject to the satisfaction of conditions such as being designed to the satisfaction of the Department and Council, providing internal roads with rising egress to Castlereagh Road and consideration of cumulative impacts of such work in the context of the further modelling recommended by the Panel. The Panel also recommends any consideration of the proposed earthworks takes into account the implications of gradients and parkland amenity adjacent to the lakes. While this is not specific to the flood related remit of the Panel, the Panel notes it is important for any future master planning and landscape design to have regard to revised flood levels.
132. The Panel also supports the TAG recommendation, that geotechnical assessments be undertaken to ascertain the stability of the levees and future buildings under the potential flood flows in events up to and including the PMF.
133. In consideration of the proposed mitigation measures, the Panel acknowledges the advice of the TAG that the modelling and subsequent mitigation measures do not appropriately account for climate change and therefore the effectiveness of the mitigation measures need to be reconsidered in the context of the recommended further modelling that explicitly takes this into account.

4 Conclusions and recommendations

135. The Panel has undertaken a review of the development proposals as requested by PLUS (see Section 3 above). In doing so, the Panel has considered the available Material (see section 3.1 above), including additional submissions by the Proponents, Council and PLUS. The Panel also met with Council, PLUS and the Proponents for the Southbank and Film Production Precinct proposals, in addition to carefully considering the advice of the TAG.
136. The Panel acknowledges the strategic importance of the Site as an opportunity for additional public recreational space and employment for Western Sydney. Further, the Panel acknowledges the NSW Government's long-standing commitment to redeveloping the Site.
137. In its consideration of the TAG advice, the Panel notes that the advice is a compilation of advice from independent experts and representatives of the SES, Infrastructure NSW and TfNSW. The Panel is aware of concerns that the TAG advice is conservative. However, based on the information available, and in the context of the Flood Inquiry recommendations and the government's endorsement of those recommendations in principle, the Panel are satisfied this approach is appropriate to apply across the Site.
138. The Panel notes significant infrastructure investment is required to ensure safe evacuation can occur during a significant flood event, and that evacuation capacity should be considered in terms of cumulative impacts from these development proposals and other approved developments that rely on the Castlereagh Road, Andrews Road, The Northern Road network.
139. The Panel understands that the development potential of the Site is directly linked to evacuation capacity and that significant investment is likely to be required if the full potential of the Site is to be realised. In making informed decisions for this Site, the strategic and economic benefits of developing the wider region must be balanced with the infrastructure costs. In doing that, consideration should also be given to the cumulative impacts (benefits and costs) of developments in the high-risk areas to the north of Penrith Lakes that also rely on the same evacuation network.
140. The Panel recognises that there are significant challenges to be resolved with respect to flood-related matters, particularly for the higher intensity uses proposed for the Southbank and Film Production Precinct sites. This is due to the size and occupancy created by some specific uses, such as the commercial and film production precincts as well as the cumulative effect of these and many smaller uses across the site, such as the farmers market, driving range and wave park. However, the Panel supports the progression of the proposed uses of lower intensity, such as the golf course, Landers Inn, office relocation and the heliport, that do not significantly impact the available evacuation capacity, for the reasons explained in this report.
141. In order to progress the higher intensity uses proposed for Southbank and the Film Production Precinct, the Panel recommends new modelling be undertaken that:
- considers the range of events recommended by the Flood Inquiry
 - considers impacts of climate change
 - is calibrated with the most recent flood events, and
 - includes hazard mapping for each event.

142. The Panel also advises that a cumulative impact assessment of flood behaviour, taking into account future development proposals and any reprofiling of the Site, should be undertaken. The Panel also recommends additional traffic analysis to determine whether the proposed north exit from the Site adversely impacts on the service levels of key intersections between the Site and The Northern Road evacuation route against the proposed uses, a range of density scenarios, and a range of infrastructure scenarios, including one where no infrastructure upgrades occur.
143. Once additional modelling has been completed, a risk-based assessment should be undertaken in accordance with the recommendations of the Flood Inquiry to determine what uses may be appropriate to proceed at particular levels across the Site. The Panel advises that any future development will need to be determined with respect to the ability for safe evacuation, and ensure the uses do not include residential accommodation services, either temporary or permanent. The evacuation capacity should be considered on the basis of the existing road network and committed infrastructure funding (by Council and/or the State Government), to the satisfaction of the Department.
144. With respect to the mooted early evacuation warning system, the Panel notes Council's support for such a system and the approach set by the recent Land and Environment Court approval of the Nepean Business Park. The Nepean Business Park approval implements a Flood Emergency Response Plan to be created through a Community Association, which includes the appointment of a Chief Flood Warden responsible for maintaining and implementing the Flood Emergency Response Plan and actioning the four alert levels. The alert levels are based on warnings and alerts issued by the Bureau. The Panel advises there is not sufficient information before the Panel with respect to governance and management arrangements to support an early evacuation warning system for the Site at this stage. The Panel strongly recommends any proposed early warning system be reviewed and endorsed by relevant emergency agencies and TfNSW prior to finalisation of any rezoning for higher intensity uses.
145. Any development in addition to the golf course (as proposed), the heliport, the office relocation and Landers Inn should be subject to the implementation of a satisfactory early evacuation warning system and an initial overall Site capacity cap of 3,500 (including vehicles associated with the existing development and supported lower intensity uses), consistent with the findings in the FEM. Additional development potential could be explored in the future if it is supported by additional modelling as recommended by the Panel, any proposed earthworks that are designed to the satisfaction of the Department and Council, the provision of internal roads with rising egress to Castlereagh Road and necessary road network and related infrastructure upgrades.
146. In summary, in response to the PLUS Request, the Panel advises that certain aspects of the development proposals could proceed, which include the office relocation, golf course, Heliport, and Landers Inn.
147. Progression of the remaining SEPP amendments, including the proposals for Southbank and the Film Production Precinct should be subject to addressing the flood-related issues, including:
- additional flood modelling that accounts for greater precipitation and flooding as a result of climate change, is calibrated with the most recent flood events and includes hazard mapping for each event
 - a cumulative impact assessment of flood behaviour taking account of future developments and any proposed reprofiling of the Site

- analysis of cumulative traffic impacts, taking into account traffic volumes, choke points and converging traffic from surrounding areas, such as the Richmond/Windsor floodplain and Penrith
- consideration of flash flooding and any associated impacts on evacuation timing and routes
- provisions to implement development controls for resilient building design
- a detailed analysis of development caps, infrastructure schedule, staging plan, cost estimates and funding agreements to enable supporting infrastructure that is critical to emergency management and the evacuation capacity of the Site and its impact on regional evacuation capacity
- a geotechnical assessment be undertaken to ascertain the stability of the levees and future buildings under the potential flood flows in events up to and including the PMF.

148. The Panel recommends that, given the flood and evacuation issues at the Site, other low intensity development proposals could be investigated, subject to resolving SES's concerns regarding early evacuation of the site. The Panel notes that further consideration of Lot 4 would need to include future infrastructure upgrades to improve the evacuation capacity on the regional road network, reflect the revised modelling as recommended above, ensuring internal roads are above the flood planning level and with rising egress, and the exclusion of residential development.
149. If resultant flood impacts are considered, the Panel does not preclude earthworks from being used as a mitigation measure but advises that consideration must be given to the cumulative, off-site impacts on the catchment and flood behaviour from such works. In summary, the Panel does not preclude further investigation of fill to either the 1% AEP or the 0.2% AEP flood levels, or a combination of both, in order to support additional capacity for urban development on Lot 4.
150. Finally, the Panel confirms that in order for the development potential of this key strategic site to be realised, it will be essential to secure and deliver significant investments in infrastructure that will require close collaboration between state and local government and private entities.

Panel note: we thank all the organisations and people who contributed to our deliberations and consideration of these issues and pay particular thanks to the Secretariat staff who so ably and tirelessly supported the Panel's work.



Monica Gibson (Chair)
DPE Executive Panel Member



Dianne Leeson
Panel Member



Peter Cochrane
Panel Member

Appendix A – Material

Name	Author	Date
Site Context	DPE	Nil
Penrith Lakes SEPP Amendment 2021 Consultation Paper	DPE	August 2021
Location of Proposed Amendments	DPE	Nil
Exhibited Requests for Rezoning	Multiple	Multiple
Penrith Lakes Resozning Request Letter	PLDC	27.05.22
Sustainability Vision	Atelier Ten	April 2022
Penrith Lakes Connecting with Country Framework	Bangawarra	May 2022
Bulk Earthworks Plan	J. Wyndham Prince	04.05.22
Stormwater Quality Management	J. Wyndham Prince	April 2022
Infrastructure Servicing Report	J. Wyndham Prince	May 2022
Flood Assessment	Water Technology Pty Ltd	12.05.22
Environmental Noise Assessment	Resonate	10.05.22
Penrith Lakes Phase 1 Urban Design Framework	Ethos Urban	May 2022
Transport Impact Assessment Report	Pentelic Advisory	16.05.22
Cultural Heritage Report	TKD Architects	April 2022
Strategic Bushfire Study	Blackash	19.04.22
Flood and Bushfire Emergency Response	Molino Stewart	Nil
Ecology Assessment	Biosis	17.05.22
Ecology Strategic Plan	Biosis	26.05.22
Land Use Suitability Statement	ERM	28.04.22
Geotechnical Assessment	PSM	14.04.22
SES Submission	SES	25.09.21
SES Letter - Evacuation Constraints for Penrith Lakes	SES	18.02.22
Transport for NSW Submission	TfNSW	23.09.21
Transport for NSW Submission	TfNSW	27.05.20
Transport for NSW Clarification	TfNSW	26.11.21
Nepean Business Park FERP	Molino Stewart	March 2022
Penrith Lakes Scheme Early Flood Evacuation Guideline	DPE	May 2022
SES Penrith Lakes Scheme Evacuation Guideline	SES	04.08.22
GHD Penrith Lakes Traffic & Transport Investigation	GHD	25.05.22
Penrith Lakes Advisor Panel Referral Letter	DPE	20.12.22
Early Warning and Site Closure System	WMA Water	March 2023
Flood Emergency Management Plan	WMA Water	March 2023
WMA Water Report excerpt	WMA Water	DPE IN 27.01.23
Northern Lot 4 Two Year Plans	J. Wyndham Prince	DPE IN 27.01.23
Partial Lot 4 Tow Year Plans	PLDC	DPE IN 27.01.23
Partial Lot 4 Tow Year Plans_Sections	J. Wyndham Prince	DPE IN 27.01.23
PLUS Questions on Notice Response	DPE	DPE IN 27.01.23
Summary of available flood information	DPE	DPE IN 27.01.23
Heliport Response to Stakeholder Agenda	Sydney Helicopters Pty Ltd	07.03.23

Lakeside Studio Case Study	Lakeside Studio	Nil
Castlereagh Connection Advocacy document	Penrith City Council	COUNCIL IN 01.03.23
Penrith Council's Shelter in Place submission Council Report	Penrith City Council	COUNCIL IN 01.03.23
Penrith Council's Shelter in Place submission	Penrith City Council	COUNCIL IN 01.03.23