



NEPEAN RIVER FLOODPLAIN RISK MANAGEMENT STUDY & PLAN INCLUDING NARELLAN CREEK

APPENDIX K – PUBLIC EXHIBITION RESPONSES

Final Report (13 November 2022)



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APPENDIX K – PUBLIC EXHIBITION RESPONSES

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| Contact | | Submission | | | Response | |
|---------------|-------------------------------|-----------------|-----------------------|---|--|--|
| Submission No | Submitted on behalf of Group? | Submission Date | Nature of Submission? | Document Referenced | Submission Details | Council Comments/ Response |
| 1 | Local Resident | 8/08/2022 | Submission Form | Nepean River | The customer is suggesting that the risk of flooding at the Nepean River is far greater due to flood behaviour and climate change impacts. According to him - dredging of the Nepean River would substantially reduce the flood risk to property damage within the Camden area. In addition, the customer is suggesting to establish a Voluntary House Raising Scheme as part of the Floodplain Risk Management Plan that would allow residents to reduce the risk of damage to their property and possessions. | Dredging - Dredging of river channels does not prevent flooding during extreme river flows. It however impacts negatively through channel bed modification, habitat degradation, remobilization of contaminants, and increases in suspended sediment concentrations. It can disturb the natural balance of rivers which can lead to increased erosion, changes in the river geomorphology, destroying natural habitat, and impacts on flora and fauna. VHR Scheme - Voluntary House raising has been investigated as part of this study and 108 properties that are impacted in the 5% AEP event have been identified as suitable for VHR. This option is in the FRMP and Council is currently investigating the opportunity to establish a VHR scheme. |
| 2 | Local Resident | 18/08/2022 | Email | Flood Risk Management Policy and Nepean River Floodplain Risk Management Study and Plan | The customer attached notes from the NSW Flood Report re the Lismore Floods (Attach 1, 2, 3). Also, the customer found the below areas confusing and inconclusive. • Concessional development in the case of commercial and residential (low, medium or high density) development, • Concessional development in the case of other development and • Concessional development in the case of development within the Camden Heritage Conservation Precinct: a) All Commercial and Industrial, Low, Medium and High-Density Residential developments (as categorised in this policy) located only within the Camden Heritage Conservation Precinct shown in Figure 3 of the Appendix 1. The customer would like to know whether Council intend to clear up and fix the large scale destruction of the river bank and the loss of big healthy trees which were holding the river bank. Along with preservation of any trees and river bank that are in danger of further collapse (see above photos). Many facilities well used by the public are still closed in Camden ie: The Llewellyn Davis Walk Way and the Equestrian Centre to name a few. No more building on Flood Plains. There are 3 attachments with this Submission | The 2022 NSW Independent Flood Inquiry is a comprehensive document that details investigations that were commissioned by the NSW Government into the 2022 flood events, with a particular focus on the hardest hit regions of the Northern Rivers. The recommendations that have come out of this report are primarily for: a) The NSW Government/Bureau of Meteorology/SES to begin changing the way that floods are predicted, monitored and communicated [pre-flood]. b) The NSW Government/SES to begin changing the way that floods are responded to [during flood]. c) The NSW Government to begin changing the way that flood recovery takes place. This includes the establishment of the NSWRA, similar to the successful QRA [post-flood]. The recommendations from this report are strategic in nature and will take time to manifest in policies and directions from the NSW State Government that Council will be directed to consider or adopt. The current flood studies, floodplain risk management studies and plans and the flood policy have been developed in accordance with the current NSW Flood Prone Land Policy. It is not the responsibility of Council to respond directly to the outcomes and recommendations of the 2022 NSW Independent Flood Inquiry. The Nepean River Floodplain Risk Management Study and Plan was prepared prior to the release of the 2022 NSW Independent Flood Inquiry report. As mentioned in Section 16, the Floodplain Risk Management Study and Plan "should be regarded as a dynamic plan requiring review and modification over time. The catalysts for change include new floods and enhanced collection of flood data, legislative change, alterations in the availability of funding and reviews of Council planning policies. Notwithstanding these catalysts for review, a review every five years or so is warranted to ensure the ongoing relevance of the Plan". The outcomes of the 2022 NSW Independent Flood Inquiry report will be reviewed by Council during future updates to the Plan. The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future. Damage to the river banks is part of a natural process that occurs to rivers and creeks in flood and it is generally not feasible to interfere with natural river movements. Funding for rehabilitation may be available in some instances and Council does get involved to repair damage located near public infrastructure assets such as our bridges and the Nepean Cycleway. |
| 3 | | 18/08/2022 | SUBMISSION FORM | Flood Risk Management Policy and Nepean River Floodplain Risk Management Study and Plan | 02_Submission 3 | The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future. |
| 4 | Local Resident | 22/08/2022 | SUBMISSION FORM | Flood Risk Management Policy and Nepean River Floodplain Risk Management Study and Plan | 02_Submission 4 | >No Climate Change Policy - Council has adopted Climate Change requirements through the Nepean River Floodplain Risk Management Study and Plan and included in the new Flood Risk Management Policy. >Impact of the 2022 NSW Independent Flood Inquiry on the Policy – The 2022 NSW Independent Flood Inquiry is a comprehensive document that details investigations that were commissioned by the NSW Government into the 2022 flood events, with a particular focus on the hardest hit regions of the Northern Rivers. The recommendations that have come out of this report are primarily for: a) The NSW Government/Bureau of Meteorology/SES to begin changing the way that floods are predicted, monitored and communicated [pre-flood]. b) The NSW Government/SES to begin changing the way that floods are responded to [during flood]. c) The NSW Government to begin changing the way that flood recovery takes place. This includes the establishment of the NSWRA, similar to the successful QRA [post-flood]. The recommendations from this report are strategic in nature and will take time to manifest in policies and directions from the NSW State Government that Council will be directed to consider or adopt. The current flood studies, floodplain risk management studies and plans and the flood policy have been developed in accordance with the current NSW Flood Prone Land Policy. It is not the responsibility of Council to respond directly to the outcomes and recommendations of the 2022 NSW Independent Flood Inquiry. The Nepean River Floodplain Risk Management Study and Plan was prepared prior to the release of the 2022 NSW Independent Flood Inquiry report. As mentioned in Section 16, the Floodplain Risk Management Study and Plan "should be regarded as a dynamic plan requiring review and modification over time. The catalysts for change include new floods and enhanced collection of flood data, legislative change, alterations in the availability of funding and reviews of Council planning policies. Notwithstanding these catalysts for review, a review every five years or so is warranted to ensure the ongoing relevance of the Plan". The outcomes of the 2022 NSW Independent Flood Inquiry report will be reviewed by Council during future updates to the Plan. >Different format and focus to other Council's Flood Risk Management Policies - The policy has been documented based on the outcomes of the Floodplain Risk Management Study and Plans as required by the Floodplain Development Manual. Current best practice approach has been adopted to developing this policy. The policy is documented to best suit Camden Council's requirements. >Rather than relying on existing planning instruments, the Policy introduces specific controls and unique definitions - The policy has been documented based on the outcomes of the Floodplain Risk Management Study and Plans as required by the Floodplain Development Manual. Definitions have been introduced based on the policy requirements. Need to include how we are updating the Policy. >There is no justification for using a 10% rainfall increase in the climate change modelling - Detailed analysis was undertaken to derive the 10% increase in climate change. This is provided in the attached climate change discussion paper. This approach is based on current best practice and will be further investigated by Council when latest data and information is available. >The models use ARR 2016 and not ARR 2019 – The flood modelling was undertaken prior to the release of the new ARR 2016/2019 guidelines. An ARR 2016 assessment was undertaken and the results are documented in Appendix C of the report. Council has updated the Upper South Creek Flood Study to the new ARR2019 guidelines and intends to undertake an ARR2019 assessment for the Nepean River Floodplain Risk Management Study and Plan as well based on State government funding availability. Also the updates in ARR 2019 will not make any significant changes to the results. |
| | | | | | | >The projected increase of the 1% AEP will exceed the current FPL within the Policy's life. Yet there is no policy for managing or communicating the problem - The Policy will be reviewed and updated every 5 years. This will be considered in the next review based on the latest available information. >Both Nepean River Catchment matrices do not require consideration of cumulative development in all instances - Submission related to Floodplain Risk Management Policy to be addressed in the other excel sheet. >Congestion and blockage of evacuation routes - The Nepean River Floodplain Risk Management Study and Plan has identified the current flood evacuation and emergency response. New developments will be required to provide an emergency response plan. This will assist SES and also ensure they do not burden the current evacuation routes and SES resources. >Concessions for areas subject to frequent flooding at low water levels (i.e. 5% AEP) - The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future. >The Camden Local Planning Panel requested precinct-specific design control for the HCA - Same as above >Concessional status of the HCA and the apparent disregard for equity and flood risk management - Same as above >The use of unique land use descriptions is inconsistent with the definitions in the Camden Local Environment Plan - It is unclear which land use description is being referred to. To Council's knowledge, the descriptions are consistent with the Camden Local Environment Plan. >Lack of discussion of special flood considerations in areas between the FPL and the PMF - The study was undertaken in accordance with the 2007 Planning Circular and Guideline on Development Controls on Low Flood Risk Area, Ministerial Direction No. 4.3, which had restricted Councils in NSW from applying residential development controls on land between the 1% AEP flood extent and the PMF extent. The new 2021 flood prone land package reverses the effects of this and Council is currently undertaking investigations on flood considerations for these areas and updating the LEP. >Adoption of the Nepean River Floodplain Risk Management Study & Plan Including Narellan Creek recommendations - The Nepean River Floodplain Risk Management Study & Plan recommendations have been adopted including the 500mm freeboard requirements and emergency management plan. |
| 5 | Local Resident | 23/08/2022 | Email | Nepean River | 02_Submission 5 | The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future. |
| 6 | Local Resident | 22/08/2022 | SUBMISSION FORM | Nepean River | The current flood regulations are a the 2005 version. Council states it is updating flood development regulations, this date is quoted 2018, this leaves out the recent three large floods, 2021 - 2020, and forgets historic information held by Camden Museum. Councils present intention stated in the 2018 development proposal, is to increase the size of buildings and density of people in the flood plain, this is in direct opposition to recent NSW Government regulations, brought about by three large flood events in a short time frame. One proposal is to have a very large shopping centre in a historic floodway 1873, 71.40 metres and 1964 69.75 metres. The frontage to Edward Street 67.40 is four metres below 1873 and 2.25 below 1964. The rear of the site is 63.50 metres, the same height as the Cowpasture Bridge There are huge areas of hard surface in place since these events, and more to come. Council should not be allowing greater density of buildings and more people living and working in Camden. | The Study commenced in 2016 and hence the various assessments were undertaken for the duration of the study until 2021. Since then the 2021/2022 flood events have occurred. Council has undertaken an in-house comparison of the recent March 2022 floods. This is provided in Appendix K. Actual flood marks were compared with the Nepean River Floodplain Risk Management Study and Plan 5yr and 20yr flood extent when Cowpasture Bridge gauge was at 12.3m. This showed that the study flood extents mapped are consistent with the actual flood extent observed. The recent 2022 Flood Inquiry Report is not a regulation. |

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| 7 | Local Resident | 25/08/2022 | Email | Flood Risk Management Policy and Nepean River Floodplain Risk Management Study and Plan | 02_Submission 7 | <p>>(1) The 2022 NSW Independent Flood Inquiry is a comprehensive document that details investigations that were commissioned by the NSW Government into the 2022 flood events, with a particular focus on the hardest hit regions of the Northern Rivers. The recommendations that have come out of this report are primarily for:</p> <p>a) The NSW Government/Bureau of Meteorology/SES to begin changing the way that floods are predicted, monitored and communicated [pre-flood].</p> <p>b) The NSW Government/SES to begin changing the way that floods are responded to [during flood].</p> <p>c) The NSW Government to begin changing the way that flood recovery takes place. This includes the establishment of the NSWRA, similar to the successful QRA [post-flood].</p> <p>The recommendations from this report are strategic in nature and will take time to manifest in policies and directions from the NSW State Government that Council will be directed to consider or adopt. The current flood studies, floodplain risk management studies and plans and the flood policy have been developed in accordance with the current NSW Flood Prone Land Policy. It is not the responsibility of Council to respond directly to the outcomes and recommendations of the 2022 NSW Independent Flood Inquiry.</p> <p>The Nepean River Floodplain Risk Management Study and Plan was prepared prior to the release of the 2022 NSW Independent Flood Inquiry report. As mentioned in Section 16, the Floodplain Risk Management Study and Plan "should be regarded as a dynamic plan requiring review and modification over time. The catalysts for change include new floods and enhanced collection of flood data, legislative change, alterations in the availability of funding and reviews of Council planning policies. Notwithstanding these catalysts for review, a review every five years or so is warranted to ensure the ongoing relevance of the Plan". The outcomes of the 2022 NSW Independent Flood Inquiry report will be reviewed by Council during future updates to the Plan.</p> <p>>(2a) - Refer to response to item (1)</p> <p>>(2b) -The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future.</p> <p>>(2c) - The Study commenced in 2016 and hence the various assessments were undertaken for the duration of the study until 2021. Since then the 2021/2022 flood events have occurred. Council has undertaken an in-house comparison of the recent March 2022 floods. This is provided in Appendix K. Actual flood marks were compared with the Nepean River Floodplain Risk Management Study and Plan 5yr and 20yr flood extent when Cowpasture Biridge gauge was at 12.3m. This showed that the study flood extents mapped are consistent with the actual flood extent observed. The intention of the public exhibition was the gain community feedback and gather community knowledge. Various submissions have been received by Council and are now being investigated and addressed.</p> <p>>(2d(i)) - The potential flood impact from climate change is explained in Table 9.6 of the report . Detailed analysis was undertaken to derive the 10% increase in climate change. This is provided in the attached climate change discussion paper. This approach is based on current best practice and will be further investigated by Council when latest data and information is available.</p> <p>>(2d(ii)) - Climate change flood mapping have been provided (Appendix B).</p> |
| 8 | Local Resident | 26/08/2022 | Email | | 02_Submission 8 | <p>>(1) - The 2022 NSW Independent Flood Inquiry is a comprehensive document that details investigations that were commissioned by the NSW Government into the 2022 flood events, with a particular focus on the hardest hit regions of the Northern Rivers. The recommendations that have come out of this report are primarily for:</p> <p>a) The NSW Government/Bureau of Meteorology/SES to begin changing the way that floods are predicted, monitored and communicated [pre-flood].</p> <p>b) The NSW Government/SES to begin changing the way that floods are responded to [during flood].</p> <p>c) The NSW Government to begin changing the way that flood recovery takes place. This includes the establishment of the NSWRA, similar to the successful QRA [post-flood].</p> <p>The recommendations from this report are strategic in nature and will take time to manifest in policies and directions from the NSW State Government that Council will be directed to consider or adopt. The current flood studies, floodplain risk management studies and plans and the flood policy have been developed in accordance with the current NSW Flood Prone Land Policy. It is not the responsibility of Council to respond directly to the outcomes and recommendations of the 2022 NSW Independent Flood Inquiry.</p> <p>The Nepean River Floodplain Risk Management Study and Plan was prepared prior to the release of the 2022 NSW Independent Flood Inquiry report. As mentioned in Section 16, the Floodplain Risk Management Study and Plan "should be regarded as a dynamic plan requiring review and modification over time. The catalysts for change include new floods and enhanced collection of flood data, legislative change, alterations in the availability of funding and reviews of Council planning policies. Notwithstanding these catalysts for review, a review every five years or so is warranted to ensure the ongoing relevance of the Plan". The outcomes of the 2022 NSW Independent Flood Inquiry report will be reviewed by Council during future updates to the Plan.</p> <p>>(2) -The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future.</p> <p>>(3) - Noted and agreed. Please refer to response to item (2).</p> <p>>(4) - Refer to item (2)</p> <p>>(5) Detailed analysis was undertaken to derive the 10% increase in climate change. This is provided in the attached climate change discussion paper. This approach is based on current best practice and will be further investigated by Council when latest data and information is available.</p> <p>>(6) - The Policy has been developed based on the outcomes of the Floodplain Risk Management Study and Plan. The Floodplain Risk Management Study and Plan was developed in consultation with the Floodplain Risk Management Committee (as required by the Floodplain Development Manual) which has public representation. The intention of the public exhibition was to gain community feedback and gather community knowledge. Various submissions have been received by Council and are now being investigated and addressed.</p> |
| 9 | President, Camden Residents' Action Group Inc | 26/08/2022 | Email | Flood Risk Management Policy and Nepean River Floodplain Risk Management Study and Plan | CRAG's submission | <p>>(1) to (16) - The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future.</p> <p>>(17) - The concerns regarding the Nepean River FRMSP not being up-to-date is noted. The Study commenced in 2016 and hence the various assessments were undertaken for the duration of the study until 2021. Since then the 2021/2022 flood events have occurred. Council has undertaken an in-house comparison of the recent March 2022 floods. This is provided in Appendix K Actual flood marks were compared with the Nepean River Floodplain Risk Management Study and Plan 5yr and 20yr flood extent when Cowpasture Biridge gauge was at 12.3m. This showed that the study flood extents mapped are consistent with the actual flood extent observed.</p> <p>>(18) & (19) - The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future.</p> <p>>(20) Detailed analysis was undertaken to derive the 10% increase in climate change. This is provided in the attached climate discussion paper. This approach is based on current best practice and will be further investigated by Council when latest data and information is available.</p> <p>>(21) - This has been captured for Greenfield development is Zone B.</p> <p>>(22) - Climate change flood mapping have been provided (Appendix B).</p> <p>>(23) - Climate Change considerations are for new developments and transport in Zone B.</p> <p>>(24) - Refer to response to item (20).</p> <p>>(25) - This feedback is noted. The policy has incorporated the outcomes of the studies. Individually the documents provide a summary. However, we note that an overarching summary introducing the public exhibition would have assisted community to understand the two documents and how they relate, Council will take this feedback for future studies.</p> |
| | | | | | | <p>>(0) - The Policy has been developed based on the outcomes of the Floodplain Risk Management Study and Plan. The Floodplain Risk Management Study and Plan was developed in consultation with the Floodplain Risk Management Committee (as required by the Floodplain Development Manual) which has public representation, council officers and technical staff. The intention of the public exhibition was to gain community feedback and gather community knowledge. Various submissions have been received by Council and are now being investigated and addressed.</p> <p>>(1) & (28) - Refer to response to item (17). At the commencement of Nepean River Flood Study a community consultation was undertaken, and this information was used to validate the Flood Study results and current Nepean River Floodplain Risk Management Study and Plan is based on Nepean River Flood Study. The Nepean River Floodplain Risk Management Study and Plan was validated for June 2016 flood event and current March 2022 flood event (inhouse).</p> |
| 10 | Local Resident | 26/08/2022 | Email | Nepean River Floodplain Risk Management Study and Plan | 02_Submission 10 | <p>>Evacuation routes - The feedback has been noted. Evacuation Routes have been assessed and as mentioned in Section 10.3.1, many roads experience loss of access in the 20% AEP event. New developments will be required to provide an emergency response plan. This will assist SES and also ensure they do not burden the current evacuation routes and SES resources.</p> <p>>Evacuation Centres - Camden township gets flooded and hence not suitable for evacuation. Evacuation centres have been identified on land that is flood free and mostly accessible.</p> <p>>Flood mitigation measures - While levees at several locations have been considered only two have been listed and prioritised as High in the Plan. Both these levees provide benefits for flood events up to 1% AEP events. Further investigations on the suitability of the levees are yet to be undertaken. Voluntary purchase is being considered by Council but needs further investigation and State government funding.</p> <p>>HCA - The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future.</p> |

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| 11 | Local Resident | 26/08/2022 | Email | Flood Risk Management Policy and Nepean River Floodplain Risk Management Study and Plan | 02_Submission 11 | <p>1) The Study commenced in 2016 and hence the various assessments were undertaken for the duration of the study until 2021. Since then the 2021/2022 flood events have occurred. Council has undertaken an in-house comparison of the recent March 2022 floods. This is provided in Appendix K. Actual flood marks were compared with the Nepean River Floodplain Risk Management Study and Plan 5yr and 20yr flood extent when Cowpasture Birdge gauge was at 12.3m. This showed that the study flood extents mapped are consistent with the actual flood extent observed.</p> <p>2) The Policy has been developed based on the outcomes of the Floodplain Risk Management Study and Plan. The Floodplain Risk Management Study and Plan was developed in consultation with the Floodplain Risk Management Committee (as required by the Floodplain Development Manual) which has public representation. The intention of the public exhibition was to gain community feedback and gather community knowledge. Various submissions have been received by Council and are now being investigated and addressed.</p> <p>3) The 2022 NSW Independent Flood Inquiry is a comprehensive document that details investigations that were commissioned by the NSW Government into the 2022 flood events, with a particular focus on the hardest hit regions of the Northern Rivers. The recommendations that have come out of this report are primarily for:</p> <p>a) The NSW Government/Bureau of Meteorology/SES to begin changing the way that floods are predicted, monitored and communicated [pre-flood].</p> <p>b) The NSW Government/SES to begin changing the way that floods are responded to [during flood].</p> <p>c) The NSW Government to begin changing the way that flood recovery takes place. This includes the establishment of the NSWRA, similar to the successful QRA [post-flood].</p> <p>The recommendations from this report are strategic in nature and will take time to manifest in policies and directions from the NSW State Government that Council will be directed to consider or adopt. The current flood studies, floodplain risk management studies and plans and the flood policy have been developed in accordance with the current NSW Flood Prone Land Policy. It is not the responsibility of Council to respond directly to the outcomes and recommendations of the 2022 NSW Independent Flood Inquiry.</p> <p>The Nepean River Floodplain Risk Management Study and Plan was prepared prior to the release of the 2022 NSW Independent Flood Inquiry report. As mentioned in Section 16, the Floodplain Risk Management Study and Plan "should be regarded as a dynamic plan requiring review and modification over time. The catalysts for change include new floods and enhanced collection of flood data, legislative change, alterations in the availability of funding and reviews of Council planning policies. Notwithstanding these catalysts for review, a review every five years or so is warranted to ensure the ongoing relevance of the Plan". The outcomes of the 2022 NSW Independent Flood Inquiry report will be reviewed by Council during future updates to the Plan.</p> <p>4)The concessional development in Heritage Conservation Precinct was included inline with the Camden Town Centre Urban Design Framework adopted by Council in 2018 to support the proposed development and to allow rebuilding to reduce flood risk and damage to existing development. Based on the responses received from the community with regards to concessional development in the Heritage Concessional Precinct, Council has decided to withdraw this from the FRM Policy. Council will consider it at a later stage after further investigations are undertaken including cumulative impact assessment, and evacuation modelling to address overburden of SES by increasing the people in the floodplain due to concessional development in the floodplain. Council will also consider 2022 NSW Independent Flood Inquiry report Recommendation 19 and any other relevant recommendations in future.</p> |
| 12 | Local Resident | 26/08/2022 | Email | issue of raw sewage being discharged into the Equestrian Park and the subsequent impact / Nepean River Catchment | | <p>1) Why is this being done (raw sewage discharge into public land)?</p> <p>2) Why have the public not been informed or given the change to debate the matter?</p> <p>3)Where are the issues around this to be dealt with in the floodplain management documents?</p> <p>4)Is this the reason that the Equestrian Park has been closed to the public for time well beyond what the drying out of pathways etc require?</p> <p>5)What are the remediation plans to date? What is the time scale for same?</p> <p>The existing sewer system within the BEP includes a rising main to the Sydney Water sewer system as a standard gravity flow main is not feasible due to the topography of the site. This is an existing sewer system for BEP and not a new connection. Our draft Flood Risk management Policy requires that all electrical equipment be located above FPL in order to minimise the risk of electrical failure of such equipment.</p> <p>The Equestrian Park and some other public places are closed for safety of the public because of either the places are wet or damaged assets are under repair. These public places will be re-opened once repairs are complete and they are suitable for public use.</p> |

Climate Change Discussion Paper

NEPEAN RIVER FLOODPLAIN RISK MANAGEMENT STUDY

NEPEAN RIVER FLOOD PLANNING LEVEL DISCUSSION PAPER

14 FEBRUARY 2020

SUMMARY

In the case of a 10% increase in the 100 yr ARI rainfall intensities, it has been assessed that 100 yr ARI flood levels on the Nepean River floodplain would increase by between 0.6 m – 1.5 m depending on location. Given the magnitude of the increase in flood levels arising from a 10% increase in rainfall on the Nepean River floodplain, the concern that arises is that under a changing climate a standard 0.5 m freeboard could be reduced to 0.0 m well within the planning horizon.

The impact of a 10% increase in the (ARR1987) 100 yr ARI rainfall intensity is a 15% increase in the 100 yr ARI peak flow at the upstream boundary of the study area (at Menangle).

The impact of adopting the 10 ARR2016 storm burst areal temporal patterns and rainfall intensities in combination with the rainfall losses adopted in the 1995 and 2015 flood studies is to lower the 100 yr ARI (median) peak flow (at Wallacia Weir) by 13%. This equates to an 8.8% change in rainfall.

Flood Levels estimated using ARR1987 are conservative

If the reduction in 100 yr ARI peak flow due to ARR2019 data is accepted, then the ramification is that adopting the 100 yr ARI flood levels based on ARR1987 would provide a significant off-set against the impacts of a 10% increase in 100 yr ARI rainfall.

Assuming that:

- the change in 100 yr ARI flood levels due to a change in peak flows from 6,807 m³/s to 7,800 m³/s at Wallacia is similar to the assessed impact of a peak flow increase from 8,313 m³/s to 9,256 m³/s at Menangle; and
- a linear response in raised flood levels to changes in rainfall intensity;

then adopting a freeboard of 0.6 m in Zone A and 0.7 m in Zone B would give a planning horizon of beyond the year 2100 under RCP4.5 and between years 2070 and 2090 under RCP8.5.

Flood Levels estimated using ARR1987 are not conservative

While hydrological modelling using ARR2019 data estimates reduced peak flows, the analysis of the recorded data at Wallacia Weir using the ARR2019 procedure FLIKE found that the 100 yr ARI peak flows estimated for the period 1917-2012 is close to the 100 yr ARI peak flow estimated using ARR1987 data. If this is the case, then the current adopted 100 yr ARI flood levels do not include any allowance for climate change.

The potential ramifications for the planning horizon when adopting a flood planning level with allowances of 0% and 10% increase in 100 yr ARI rainfall intensities is explored in **Table 2**.

To achieve a planning horizon of beyond the year 2100 under RCP4.5 and between years 2070 and 2090 under RCP8.5 would require the inclusion of a 10% rainfall increase in either the benchmark flood level (with a further 0.5 m freeboard) or a 10% rainfall increase in the freeboard ie. the freeboard above the current adopted 100 yr ARI flood level would vary from 1.1 m to 2.0 m depending on location.

Allowing for Climate Change Only

The third approach could be to adopt freeboards equal to the differences between the 2015 flood levels with 0% and 10% rainfall increase across the Nepean River floodplain. The FPL would then vary from 0.6 m – 1.5 m above the current adopted 100 yr ARI flood level depending on location. The planning horizon for these FPLs would be the year 2100 under RCP4.5 and the year 2055 under RCP8.5. The aim of this approach would be to monitor research on changes in rainfall intensities over the next 10 years to ascertain if changes are tracking closer to the RCP4.5 estimates or to the RCP8.5 estimates and if appropriate to adjust the approach to setting FPLs at that time.

1. BACKGROUND

1.1 Climate Change

As outlined by Babister et al, 2016¹:

The Australian Rainfall and Runoff (ARR) revision projects have produced a large number of spatial design inputs that practitioners need to access in order to undertake design flood estimation. These inputs will be updated as improvements in terms of data record and methodology are made or anomalies are addressed. The ARR data hub www.data.arr.org.au was created to provide a one stop shop for practitioners to access current inputs in a simple easy manner.

The online data hub has the advantage of documenting the version of the data used and allowing improved reproducibility of past results. This new approach represents a significant shift in practice with practitioners accessing data at the start of a study and software vendors not embedding datasets within their software platform.

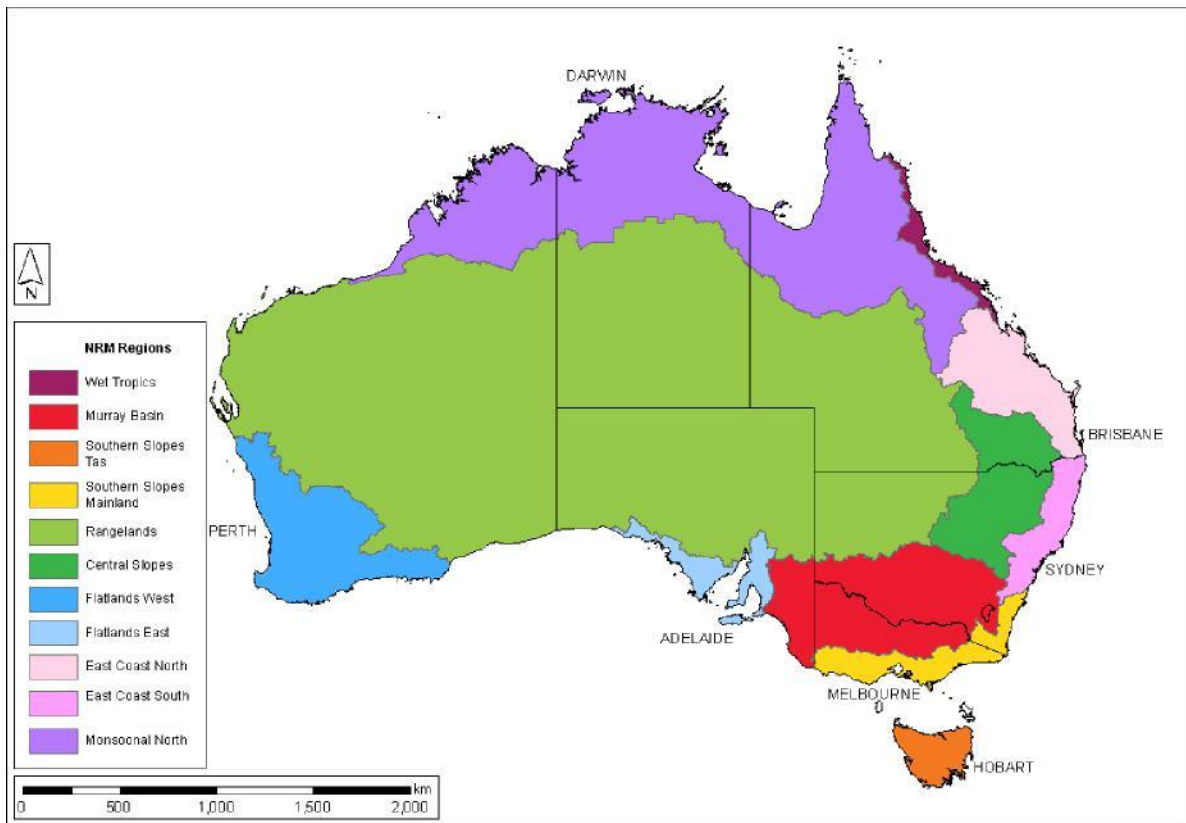
As outlined in ARR, 2019:

Book 1 Chapter 6 uses output from the Climate Futures web tool developed by the CSIRO. Climate change projections are focussed on Natural Resource Management (NRM) 'clusters'(see Fig.1). Projected changes from Global Climate Models (GCMs) can be explored for 14 20-year periods and the four Representative Concentration Pathways (RCPs) for greenhouse gas and aerosol concentrations that were used to drive the GCMs.

¹ Babister, M., Trim, A., Testoni, I. and Rettalick, M. (2016) "The Australian Rainfall & Runoff Datahub", Proceedings, 37th Hydrology and Water Resources Symposium, 28 November - 2 December 2016, Queenstown, New Zealand.

The RCPs are designated as 2.6, 4.5, 6.0 and 8.5, and are named according to radiative forcing values ($W m^{-2}$) in the year 2100 relative to pre-industrial values. Use of RCPs 4.5 and 8.5 (low and high concentrations, respectively) is recommended for impact assessment.

The ARR Datahub provides a table of temperature increases and percentage increase in rainfall for a set of forecast years and RCP 4.5, 6 and 8.5 emissions schemes (CSIRO and BoM, 2015)². ARR recommends the use of RCP4.5 and RCP 8.5 values. These values for the East Coast South Cluster which includes Sydney are tabulated below.



**Figure 1 Locations of Natural Resource Management Clusters
(After ARR Book 1, Chapter 6, Figure 1.6.1)**

Interim Climate Change Factors for NRM East Coast South (Design Rainfall Increase in %)

| Year | RCP4.5 | RCP8.5 |
|------|--------|--------|
| 2030 | 4.3% | 4.9% |
| 2040 | 5.3% | 6.8% |
| 2050 | 6.4% | 9.0% |
| 2060 | 7.5% | 11.5% |
| 2070 | 8.5% | 14.2% |
| 2080 | 9.2% | 16.9% |
| 2090 | 9.5% | 19.7% |

² CSIRO and Bureau of Meteorology (2015), "Climate Change in Australia, Projections for Australia's NRM Regions". *Technical Report*, CSIRO and Bureau of Meteorology, Australia. Retrieved from www.climatechangeinaustralia.gov.au/en [<http://www.climatechangeinaustralia.gov.au/en>].

1.2 South Creek

As part of assessments undertaken for land holdings in the South Creek catchment, a comparison of 100 yr ARI peak flows at Node 1.17 in the South Creek XP-RAFTS model (located north of Elizabeth Drive) assessed using ARR1987 and ARR2019 data was undertaken. The estimated peak flows at Node 1.17 are summarised in **Table 1**.

Table 1 Summary of Estimated Peak Flows in South Creek at Node 1.17

| Event | Storm Burst | | | |
|------------|-------------|------|-------|---|
| | 2 hr | 9 hr | 36 hr | |
| 2 yr ARI | 13.6 | 151 | 305 | ARR1987 - Worley Parsons, 2015 Model |
| 100 yr ARI | 360 | 774 | 956 | ARR1987 - Worley Parsons, 2015 Model |
| 1% AEP | 558 | 727 | 563 | ARR2019 - Modified Worley Parsons, 2015 Model |

It was noted that the indicative peak flow under ARR2019 is lower (by around 24%) than estimated under ARR1987 and the critical storm burst duration reduces from 36 hours to 9 hours.

The indicative ARR2019 peak flows were obtained by modifying the 2015 Worley Parsons model by adopting a global storm (not catchment dependent storms) and a uniform initial burst loss across the catchment. An areal reduction factor was not applied to the rainfall intensities obtained from the ARR Data Hub.

In the case of South Creek, a 24% reduction in the 100 yr ARI peak flow would

- offset the impact of adopting RCP4.5 rainfall intensities (and still yield an overall lower peak flow in the year 2100); or
- offset the impact of adopting RCP8.5 rainfall intensities such that the peak flow would be around the same value in the year 2100 as currently adopted.

1.3 Nepean River

The 2015 Nepean River Flood Study³ assessed the impact of a 10% and 20% increase in 100 yr ARI rainfall intensities on 100 yr ARI flood levels on the Nepean River floodplain. In the case of a 10% increase in the 100 yr ARI rainfall intensities it was assessed that 100 yr ARI flood levels would increase by between 0.6 – 1.5 m depending on location.

The freeboard which is routinely adopted by Council's when setting flood planning levels is 0.5 m.

Given the magnitude of the increase in flood levels arising from a 10% increase in rainfall on the Nepean River floodplain, the concern that arises is that under a changing climate a standard 0.5 m freeboard could be reduced to 0.0 m well within the planning horizon. This issue is explored in **Table 2**.

³ Worley Parsons (2015) *Nepean River Flood Study*

The issue which then arises is, if a 10% increase in rainfall intensities is included in the benchmark flood level then under a changing climate, when would the freeboard reduce to 0.0 m. This issue is also explored in **Table 2**.

Table 2 Timeframes in which a 0.5 m Freeboard may reduce to 0.0 m under a Changing Climate

How long would floor levels be protected 0% CC allowance + 0.5 m freeboard?

| | Zone A | | | Zone B | | |
|---------------------------------|--------|------|------|--------|------|------|
| Freeboard | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| FL Rise due to 0% increase | 0 | 0 | 0 | 0 | 0 | 0 |
| FPL | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| FL Rise due to 10% increase | 0.25 | 0.50 | 0.75 | 0.75 | 1.00 | 1.50 |
| Rainfall increase to exceed FPL | >20% | 10% | 6.9% | 6.9% | 4.6% | 3.0% |
| Year when reached under RCP4.5 | >>2100 | 2100 | 2055 | 2055 | 2034 | 2022 |
| Year when reached under RCP8.5 | 2090 | 2053 | 2040 | 2040 | 2028 | 2020 |

How long would floor levels be protected with 10% CC allowance + 0.5 m freeboard?

| | Zone A | | | Zone B | | |
|---------------------------------|---------|--------|---------|---------|--------|-------|
| Freeboard | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| FL Rise due to 10% increase | 0.25 | 0.5 | 0.75 | 0.75 | 1.0 | 1.5 |
| FPL | 0.75 | 1.0 | 1.25 | 1.25 | 1.5 | 2.0 |
| Rainfall increase to exceed FPL | >>20% | 25% | 21% | 21% | 17% | 14% |
| Year when reached under RCP4.5 | >>>2100 | >>2100 | >>>2100 | >>>2100 | >>2100 | >2100 |
| Additional years protected | | | >45 | >45 | >66 | >68 |
| Year when reached under RCP8.5 | >2100 | 2105 | 2092 | 2092 | 2080 | 2070 |
| Additional years protected | >10 | 52 | 52 | 52 | 52 | 50 |

2. OBJECTIVE

The objective of this assessment is to establish if the reduction in 100 yr ARI peak flows in South Creek estimated using ARR2019 is also present in the Nepean River catchment and the possible ramifications for flood planning levels on the Nepean River floodplain.

3. NEPEAN RIVER

3.1 Nepean River at Menangle

A comparison of the 1% AEP peak flows estimated at Menangle using RORB and reported in the 2015 Nepean River Flood Study are summarized in **Table 3**. It is of interest to note that the percentage increase in peak flows is greater than the increase in rainfall intensity.

Table 3 1% AEP Peak Flows at Menangle

| Rainfall Losses | | 36 hour Temporal Pattern | | Peak Flow (m ³ /s) | Rainfall Increase | Peak Flow Increase |
|-----------------|-----------|--------------------------|---------|-------------------------------|-------------------|--------------------|
| IL (mm) | CL (mm/h) | Number | Source | Median | | |
| 60 | 0.5 | 1 | ARR1987 | 8,313 | 0% | |
| 60 | 0.5 | 1 | ARR1987 | 9,526 | 10% | 15% |
| 60 | 0.5 | 1 | ARR1987 | 10,516 | 20% | 27% |
| 60 | 0.5 | 10 | ARR2016 | | | |
| 45 | 3.9 | 10 | ARR2016 | | | |

3.2 Nepean River at Wallacia

The streamflow records at Station 212202 (Nepean River @ Wallacia Weir) reported in the 2015 Nepean River Flood Study (Worley Parsons, 2015) were re-analysed using the FFA procedure released under ARR2016.

Peak-Over-Threshold (POT) Gauged Series Analysis

A POT series consists of all floods with peak discharges above a selected threshold value regardless of the number of such floods occurring each year however there should not be more than 3 or 4 floods above the threshold each year (ARR, 2016). The POT series reported by (Worley Parsons, 2015) based on a threshold of 400 m³/s was found to have no more than 3 flood events occurred above the threshold in any one year.

The POT series includes 57 events which exceeded the threshold of 400 m³/s over the period 1917 - 2012, at a ratio of 0.6 to 1. When fitting a Log Pearson III (LP III) distribution it is recommended that the ratio of floods to number of years of record be 1:1 (Jayasuriya and Mein, 1985⁴). It is noted that the selected data does not meet this criterion.

TUFLOW FLIKE analyses were undertaken of the following cases, using the LP III probability model:

- Case 0: Period from 1860 to 2012 with a flow threshold of 400 m³/s;
- Case 1: Period from 1917 to 2012 with a flow threshold of 400 m³/s;
- Case 2: Case 1 plus 3 exceedances of 3,940 m³/s in the preceding 58 years.

⁴ Jayasuriya, M.D.A. and Mein, R.G. (1985), Frequency analysis using the partial series. Hydrology and Water Resources Symposium 1985, Inst. Engrs Aust., Natl Conf. Publ. No. 85/2, pp: 81-85

Results

The results of the FLIKE FFA analysis are given in **Table 4**.

Table 4 2019 FFA for Nepean River at Wallacia Weir (Stn 212202)

| | AEP (1 in X) | | | | | |
|--------|--------------|-------|-------|-------|-------|--------|
| | 2 | 5 | 10 | 20 | 50 | 100 |
| Case 0 | 830 | 1,694 | 2,756 | 4,384 | 7,931 | 12,288 |
| Case 1 | 779 | 1,440 | 2,175 | 3,213 | 5,273 | 7,588 |
| Case 2 | 789 | 1,496 | 2,301 | 3,463 | 5,824 | 8,537 |

A comparison of the peak flows estimated at Wallacia Weir using RORB and the 1% AEP flows estimated by flood frequency analysis are summarized in **Table 5**.

Table 5 Comparison of 1% AEP Nepean River Peak Flows estimated at Wallacia Weir

| Rainfall Losses | | 36 hour Temporal Pattern | | Peak Flow (m ³ /s) | Difference to ARR1987 |
|-----------------|-----------|--------------------------|---------|-------------------------------|-----------------------|
| IL (mm) | CL (mm/h) | Number | Source | Median | |
| 60 | 0.5 | 1 | ARR1987 | 7,800 | |
| 60 | 0.5 | 10 | ARR2016 | 6,807 | -13% |
| 45 | 3.9 | 10 | ARR2016 | 5,324 | -32% |
| FFA | | Period of Record | | | |
| 1995 | | 1917-1993 | | 6,400 | -18% |
| 2015 | | 1860 – 2012 | | 8,635 | 11% |
| | | 1917 – 2012 | | 5,101 | -35% |
| 2019 | | 1860 – 2012 | | 12,288 | 58% |
| | | 1917 – 2012 | | 7,588 | -3% |
| | | 1917 – 2012 | | 8,537 | 9% |

3.3 Discussion

In the case of a 10% increase in the 100 yr ARI rainfall intensities it was assessed that 100 yr ARI flood levels on the Nepean River floodplain would increase by between 0.6 m – 2.0 m depending on location. Given the increase in flood levels arising from a 10% increase in rainfall on the Nepean River floodplain the concern that arises is that under a changing climate the freeboard could be reduced to 0.0 m well within the planning horizon.

The impact of a 10% increase in the (ARR1987) 100 yr ARI rainfall intensity is a 15% increase in the 100 yr ARI peak flow at the upstream boundary of the study area (at Menangle).

The impact of adopting the 10 ARR2016 storm burst areal temporal patterns and rainfall intensities in combination with the rainfall losses adopted in the 1995 and 2015 flood studies is to lower the 100 yr ARI (median) peak flow (at Wallacia Weir) by 13%. This equates to an 8.8% change in rainfall.

Flood Levels estimated using ARR1987 are conservative

If the reduction in 100 yr ARI peak flow due to ARR2019 data is accepted, then the ramification is that adopting the 100 yr ARI flood levels based on ARR1987 would provide a significant off-set against the impacts of a 10% increase in 100 yr ARI rainfall.

Assuming that:

- the change in 100 yr ARI flood levels due to a change in peak flows from 6,807 m³/s to 7,800 m³/s at Wallacia is similar to the assessed impact of a peak flow increase from 8,313 m³/s to 9,256 m³/s at Menangle; and
- a linear response in raised flood levels to changes in rainfall intensity;

then adopting a freeboard of 0.6 m in Zone A and 0.7 m in Zone B would give a planning horizon of beyond the year 2100 under RCP4.5 and between years 2070 and 2090 under RCP8.5.

Flood Levels estimated using ARR1987 are not conservative

While hydrological modelling using ARR2019 data estimates reduced peak flows, the analysis of the recorded data at Wallacia Weir using the ARR2019 procedure FLIKE found that the 100 yr ARI peak flows estimated for the period 1917-2012 is close to the 1100 yr ARI peak flow estimated using ARR1987 data. If this is the case, then the current adopted 100 yr ARI flood levels do not include any allowance for climate change.

The potential ramifications for the planning horizon when adopting a flood planning level with allowances of 0% and 10% increase in 100 yr ARI rainfall intensities is explored in **Table 2**.

To achieve a planning horizon of beyond the year 2100 under RCP4.5 and between years 2070 and 2090 under RCP8.5 would require the inclusion of a 10% rainfall increase in either the benchmark flood level (with a further 0.5 m freeboard) or a 10% rainfall increase in the freeboard ie. The freeboard above the current adopted 100 yr ARI flood level would vary from 1.1 m to 2.0 m depending on location.

Allowing for Climate Change Only

The third approach could be to adopt freeboards equal to the differences between the 2015 flood levels with 0% and 10% rainfall increase across the Nepean River floodplain. The FPL would then vary from 0.6 m – 1.5 m above the current adopted 100 yr ARI flood level depending on location. The planning horizon for these FPLs would be the year 2100 under RCP4.5 and the year 2055 under RCP8.5. The aim of this approach would be to monitor research on changes in rainfall intensities over the next 10 years to ascertain if changes are tracking closer to the RCP4.5 estimates or to the RCP8.5 estimates and if appropriate to adjust the approach to setting FPLs at that time.

The comparison of the actual flood level and the flood mapping from Nepean River FRMSP Draft Study

Date of photos captured: Tuesday 8th March 2022

Gauge Location: Cowpasture Bridge

Gauge level at peak: 12.3m

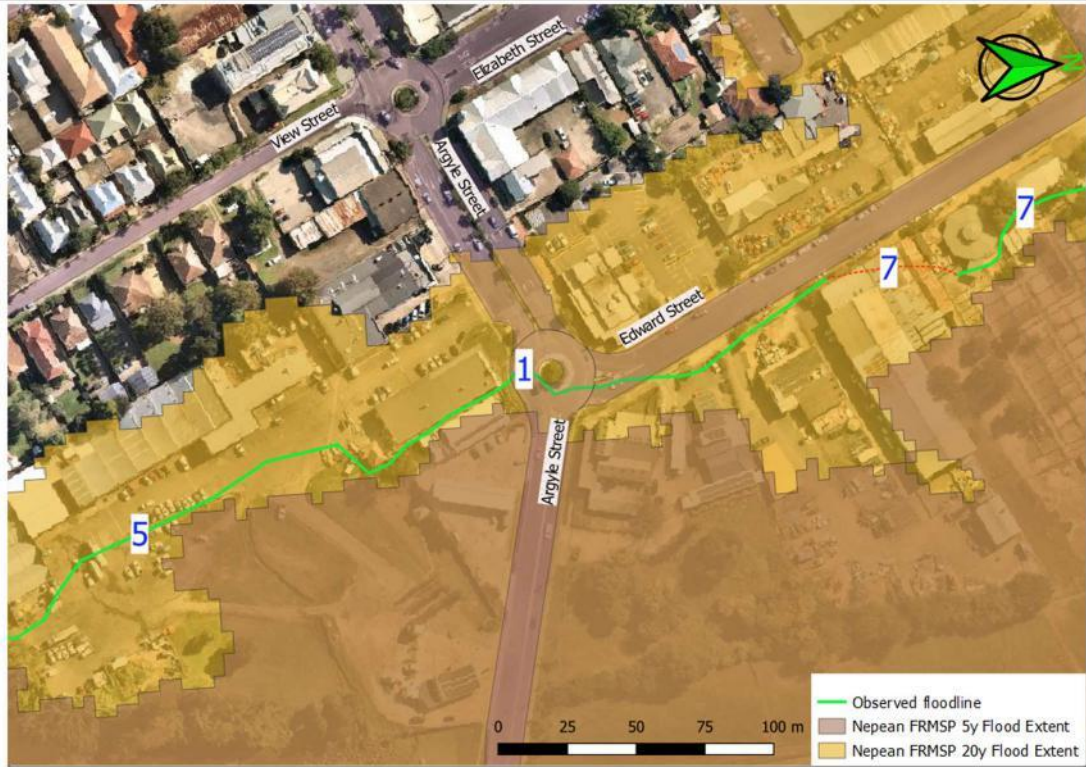
Photos Courtesy: Brett Atkins ([Capture Camden](#))

Based on historical flood data, the Cowpasture Bride Gauge level of 12.3m corresponds to approximately an event closer and lower to 6.5 year.

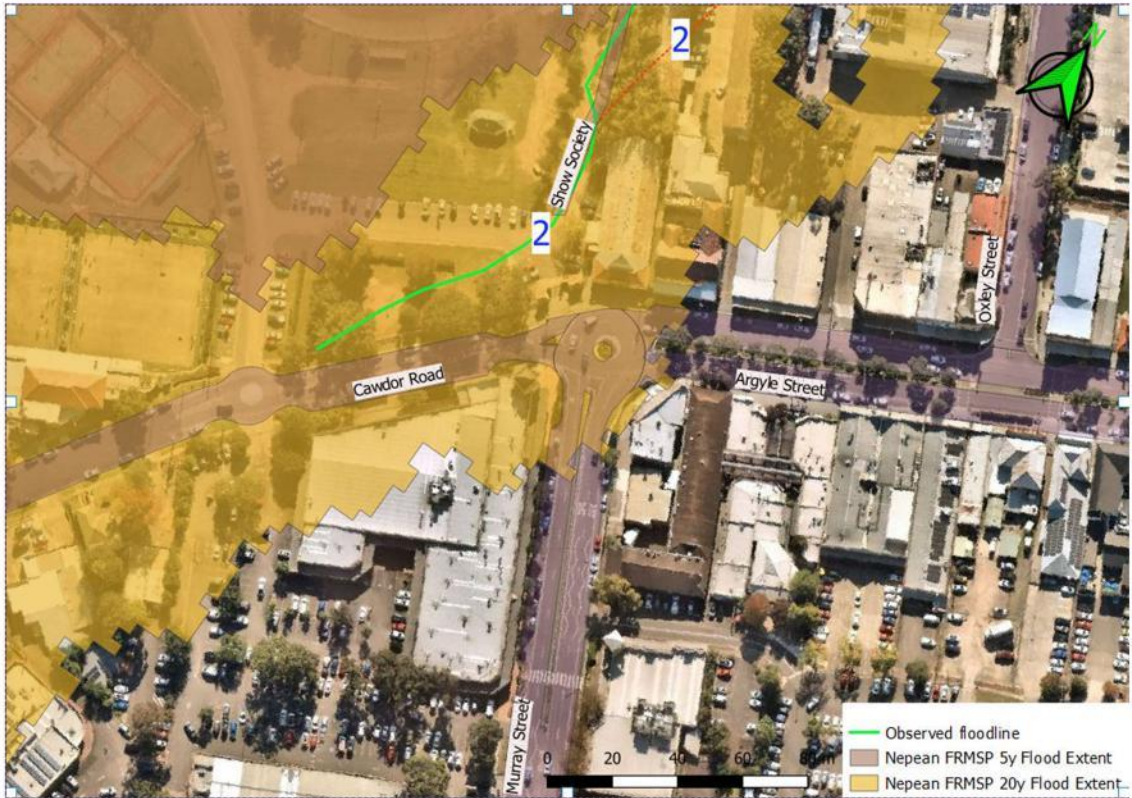
The comparison of flood extents from March 2022 flood photos and the Nepean River FRMSP flood mapping shows that the flood extents are consistent with the flood event indicated from the gauge justifying the validity and the accuracy of the Nepean River FRMSP flood mapping.



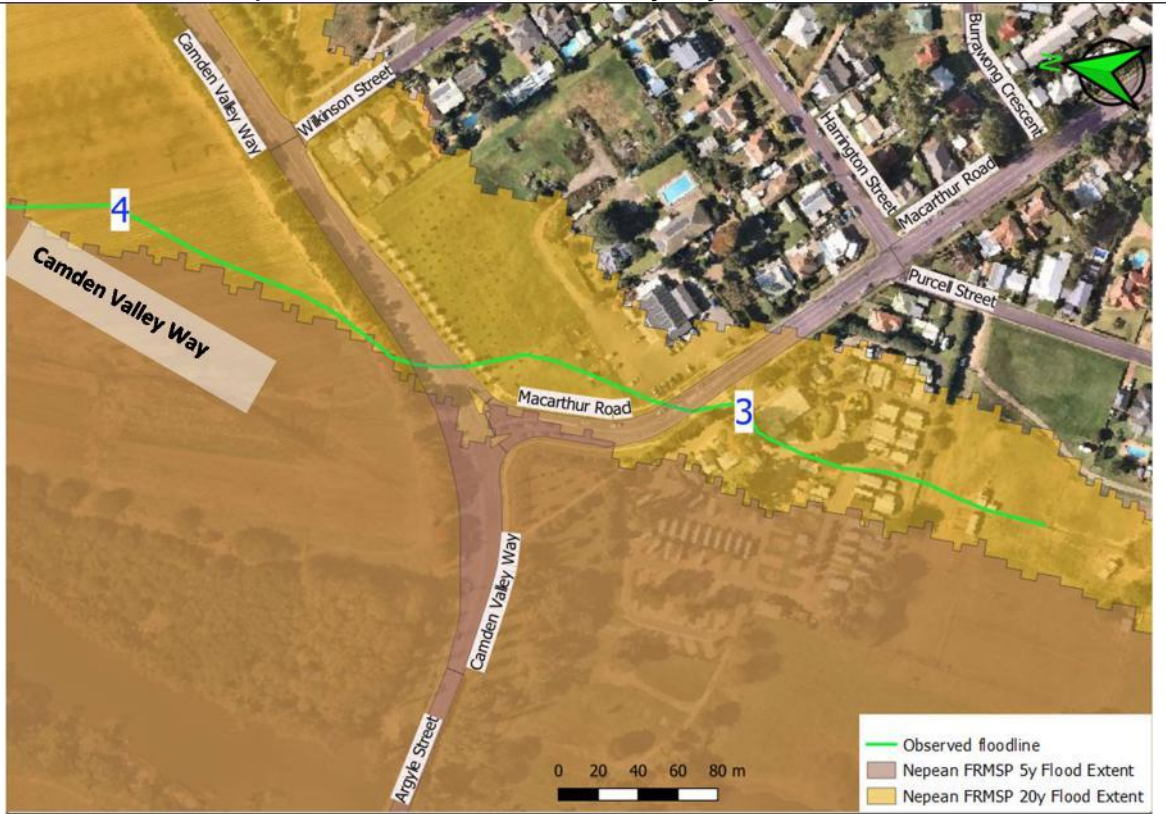
1. Argyle St entrance to Camden



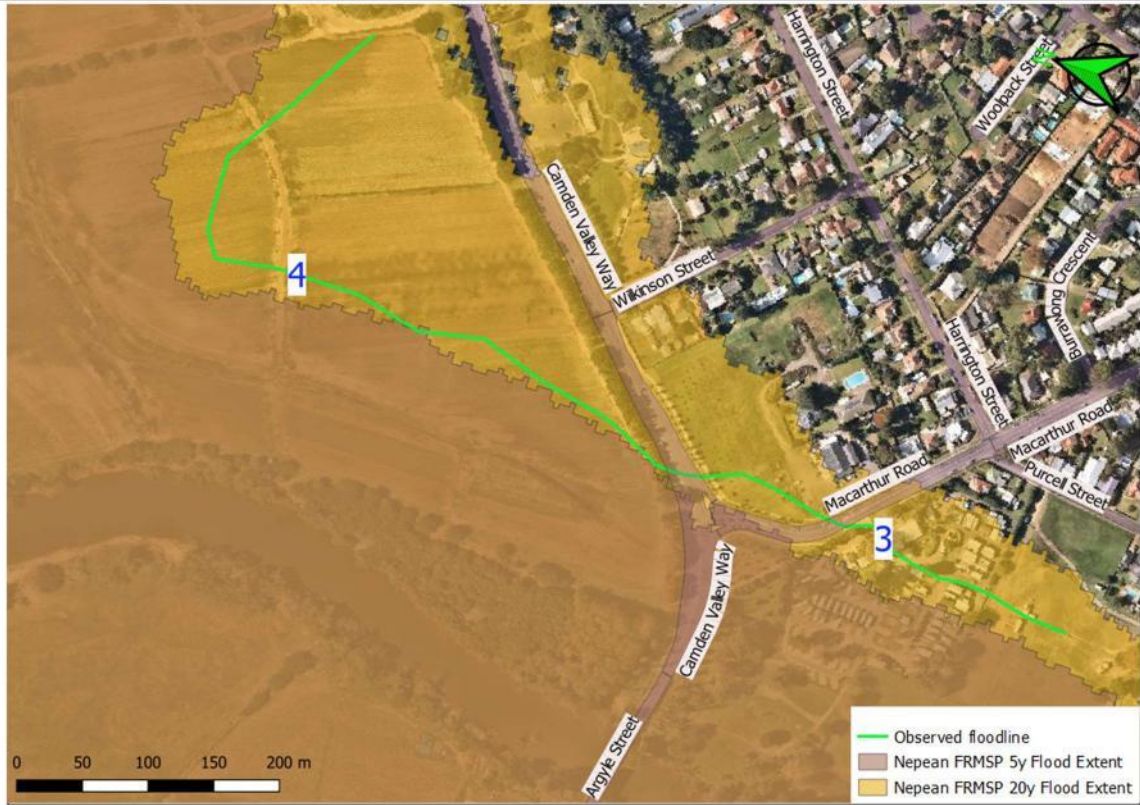
2. Camden Show Hall and Showgrounds



3. Poplar Caravan Park & Camden Valley Way entrance to Camden



4. River with Cowpasture Bridge completely underwater



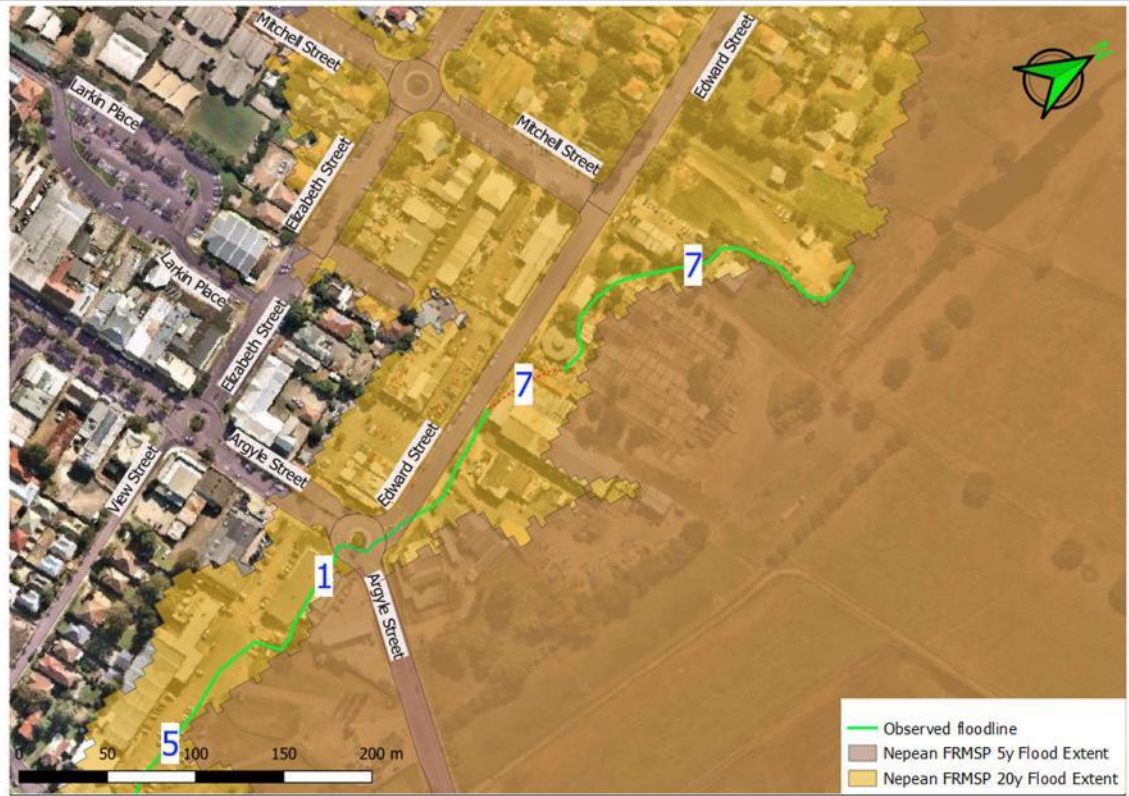
5. Floodwaters surrounding Camden Township



6. Floodwaters surrounding Camden Township



7. A view over Edward Street



8. Looking up Mitchell St with Woolworths and the Camden Pools in the foreground Top of Form

