



Moyne Planning Scheme Amendment C69
Expert Witness Statement of Robert
Campbell Swan

Flooding

15 August 2022

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1. Name and Address

Mr Robert Campbell Swan

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2. Position

Principal Engineer, Flooding and Stormwater

3. Area of Expertise

My area of expertise is hydrology and hydraulics, particularly the areas relating to the flow of and characteristics of surface water and flood dynamics.

Specifically, I:

- a) Have been the project manager, project director and technical director for more than 50 flood studies undertaken across Victoria.
- b) Contributed to the development of Melbourne Water's flood mapping technical specifications.
- c) Provided land development advice with regard to drainage and stormwater for numerous clients across the Melbourne metropolitan region.
- d) Developed drainage strategies for redevelopment areas around Victoria including Warrnambool West, Dennington, Benalla and Shepparton.
- e) Developed flood planning layers used in various Planning Schemes, including City of Manningham, Moorabool Shire Council, Southern Grampians Shire and others.
- f) Provided peer review for Melbourne Water on flood modelling for major infrastructure projects.
- g) Was the Project Director and Technical lead for the Translation of the Port Fairy Coastal Hazard Assessment Project (August 2019) and the Flood Summary Report (August 2021).
- h) Am a Level 3 Flood Specialist for the Victorian State Emergency Services expert hydrology panel to provide flood advice and analysis during flood related emergencies.

My qualifications are detailed in Appendix A

4. Instructions

My instructions were provided by Harwood Andrews and consisted of two letters, dated 6 July 2022 and 4 August 2022. The 6 July letter instructed me to:

- Prepare an expert witness statement to be filed on a date to be confirmed (with a draft provided in advance of that date) which:
 - outlines the history and nature of your involvement in relation to Amendment C69 (including background work supporting Amendment C69) prior to the preparation of your witness statement;
 - outlines the methodology and processes you adopted in preparing the *Translation of Port Fairy Coastal Hazard Assessment* (18 August 2019) and the *Flood Summary Report* (11 August 2021);
 - confirms whether you adopt the findings and recommendation of the *Translation of Port Fairy Coastal Hazard Assessment* (18 August 2019) and the *Flood Summary Report* (11 August 2021 and, if necessary, outlines any departures from findings recommendations, inaccuracies or any change circumstances or assumptions;
 - provides your expert hydrological opinion on whether the Amendment addresses relevant coastal and riverine flooding hazards acceptably or whether you recommend a different response, including any further changes to the Amendment documents.
 - addresses submissions to Amendment C69 relevant to your area of expertise;
 - contains a summary of key issues, opinions and recommendations;

The letter of 4 August provided these additional instructions:

- consider and provide in your expert witness statement your opinion on the contents of the memorandum from Water Technology to Myers Planning Group dated 19 May 2022 regarding 169A Princes Highway Port Fairy; and
- if directed by the Panel, arrange and attend a conclave with hydrological experts called by other parties.

A full copy of my instructions is provided in Appendix B. An updated version of the Water Technology memorandum to Myers Planning Group was provided by Harwood Andrews on 12 August. My instructions were to assess the updated version of the memorandum.

5. Documents Examined

I have examined the number of documents as part of my evidence. This has included:

- Port Fairy Local Floodplain Development Plan (2019)
- Translation of Port Fairy Coastal Hazard Assessment (18 August 2019)
- Flood Summary Report (August 2021)
- Port Fairy Local Floodplain Development Plan (December 2021)
- Updated LSIO and FO maps, resulting from the flood summary report

- Submissions to the Panel
- Extract from Councils Meetings Minutes (1 March 2022)
- Water Technology Memorandum to Myers Planning Group, 169A Princes Highway, Port Fairy, dated 18 July 2022

6. Involvement with Amendment C69

My involvement with Amendment C69 began as the project director of the Translation of the Port Fairy Flood Mapping Project, which was undertaken whilst I was the National Technical Director, Flooding at the consulting firm Cardno. This project was to provide additional detailed dynamic flood modelling of combined ocean and riverine flood events at Port Fairy that were not completed as part of the Port Fairy Coastal Hazard Vulnerability Assessment. There was also an extension of the modelled area, west of the Port Fairy Township. This project began in 2016 and the primary work on the project, as per the project brief completed in early 2017.

The initial project scope was expanded as a result of discussions with the Glenelg Hopkins Catchment Management Authority (GHCMA), who asked for additional model runs to be completed. The project was finalised in 2019 and, to my understanding provided the flood maps initially proposed as part of Amendment C69. At that time, it was expected by Council that flooding driven primarily by coastal factors would be considered separately to riverine flooding and that a key outcome of the assessment was to define areas around the township that may be subject to future coastal inundation, such that these would not be included when planning the township boundaries.

Between 2019 and 2020, I was involved in various discussions with Council and the GHCMA regarding the appropriate design floods that could be adopted at Port Fairy. This ultimately led to the Flood Summary Report, completed under my direction by Hydrology and Risk Consulting, with additional modelling completed by Cardno. This project included modelling of a number of additional combinations of sea level rise, ocean storm events and riverine flows and form the underlying data for the updated planning maps that are proposed for this amendment. Part of this analysis was providing mapping of potential Land Subject to Inundation Overlay and Floodway Overlay controls, using the guidelines provided by the GHCMA.

I was involved in discussions as part of these projects regarding the appropriate choice of overlay controls and flood event combinations. I was not involved in the drafting of the 2019 or 2021 Port Fairy Local Floodplain Development Plans. The decisions regarding the choice of flood planning overlay were ultimately those of the GHCMA.

7. Flood Modelling History at Port Fairy

There are four main flood mapping studies that have been completed at Port Fairy, these being:

- Port Fairy Regional Flood Study, 2008, undertaken by Water Technology
 - Port Fairy Regional Flood Study – Sea Level Rise Modelling, 2010, undertaken by Water Technology

- Port Fairy Coastal Hazard Vulnerability Assessment, Water Research Laboratory of the University of NSW, 2013
- Translation of Port Fairy Coastal Hazard Assessment, Cardno, 2019
- Flood Summary Report (additional Scenario Modelling), HARC, 2021

The Flood Summary Report (HARC, 2021) provides a summary of each of these projects and the methods used to derive the flood extents. It is important to note that each study, moving forward in time, has built on the outcomes of the previous projects. I have extracted the summary of each report from HARC 2021 and provided some additional commentary in the sections below.

7.1 Port Fairy Regional Flood Study, 2008

The Port Fairy Flood study was delivered in 2008 by Water Technology. The aim of the study was to assess riverine flood impacts associated with the Moyne River more widely and provide flood information in and around Port Fairy. The study did not undertake any modelling of the offshore wind and wave conditions at Port Fairy to identify ocean boundary levels as this was outside the scope of works.

Whilst the study did investigate the consequences of rising sea level on flood risk associated with the Moyne estuary (including Belfast Lough), it used ocean boundary level estimates that did not account for the dynamic nature of tidal influence on flood levels. The study did not account for the difference offshore wind and wave conditions in that exist between the Moyne River entrance and the Southwest passage and the influence of these factors in producing different ocean boundary levels between these locations. As a consequence, the study applied the same ocean boundary level for both the Moyne River entrance and the Southwest Passage.

The design riverine and pluvial flooding hydrographs from this project have been adopted by all the following assessments of flooding at Port Fairy.

7.1.1 Port Fairy Regional Flood Study – Sea Level Rise Addendum Modelling, 2010

The Sea Level Rise Addendum Modelling updated some aspects of the model to consider the impact of sea level rise at Port Fairy. There was some consideration of joint flood events in the riverine and ocean boundaries, but for the peak 1% ocean storm events, no flow in the Moyne River was assumed.

This modelling also did not consider the the difference offshore wind and wave conditions in that exist between the Moyne River entrance and the Southwest passage.

7.2 Port Fairy Coastal Hazard Vulnerability Assessment

The Port Fairy Coastal Hazard Vulnerability Assessment (PFCHVA) was undertaken by the Water Research Laboratory (WRL) of the University of NSW, as part of the Future Coasts program, led by the Victorian Department of Sustainability and Environment and the Department of Planning and Community Development. The main objective was to provide

Moyne Shire Council and other land and asset managers with information to assist in planning and establishing effective adaptive management options in response to present day coastal erosion and flooding risks and the projected impacts of climate change.

A main difference when compared to the previous assessments of coastal processes at Port Fairy was the consideration of coastlines coastline recession (erosion) risk and pure coastal flooding (locations subject to coastal/storm tide flood risk only) as well as flood risk in the Moyne River estuary (subject to coastal/storm tide flood risk and riverine flood risk). The assessment included all coastline from Cape Reamur to Cape Killarney.

The hydraulic model used in the Port Fairy regional Flood Model was updated and extended by WRL, but maintained the same riverine inputs. The ocean inputs were significantly modified to include the effect of nearshore waves, wind, wave setup, coastal erosion and wave overtopping. The PFCHVA provides the most contemporary and definitive guide to the factors influencing coastal inundation at Port Fairy.

Due to time and budget constraints, the modelling completed as part of the PFCHVA used dynamic tides for the 0.8m SLR cases. Bathtub models, which tend to overestimate flood extents, were adopted for the 1.2mSLR case. The combination of riverine and ocean flood events only considered 1% AEP ocean flooding with more frequent riverine flooding.

The PFCHVA provides the best understanding of coastal process that contribute to flooding.

7.3 Translation of Port Fairy Coastal Hazard Assessment

This project was to expand the dynamic modelling of storm tide and riverine flood events to more combinations than were considered in the PFCHVA. The assessment used data derived in the PFCHVA to update various ocean boundary conditions, with riverine flooding inputs identical to those in the Port Fairy Regional Flood Model. With the exception of minor flow inputs west of Port Fairy (outside of areas that contribute to flooding in and around the township boundary) no new flow or tide information was developed as part of this project.

There also was an extension to the model area, west of the Port Fairy township. This was to ensure the dynamic behaviour of flooding in the Port Fairy west wetland system was appropriately captured. The bathtub assessment for the 1.2m SLR case adopted in the PFCHVA in this area created flood extents that were significantly higher than those resulting from the dynamic modelling.

The project was converted from the MIKEFLOOD modelling system to the SOBEK modelling system, as there was an issue that prevented the MIKEFLOOD model from running. The project found that there was no significant variance in predicted flood levels through Port Fairy as a result of this change. The updated SOBEK model included the reinstated open channel between the Princes Highway and Osmonds Lane to better reflect the existing conditions. Some other minor model fixes were also included.

The aim of the project was to provide the best available information for understanding the likely change in Port Fairy's flood risk profile for the purpose of climate change adaptation planning. The project initially included combinations of events that were primarily driven by higher ocean

conditions, but additionally include a coincident 1% AEP riverine and 1% AEP ocean flood combination for a range of sea level rise cases, at the request of the GHCMA. This was because the GHCMA wanted a single set of flood overlays to cover both riverine and ocean flood events, as opposed to various schedules to the overlay.

7.4 Flood Summary Report

The peer review of the of the Port Fairy Translation project recommended that flood overlays at Port Fairy be defined by a combination of ocean and riverine flood scenarios. I note that the original intention of the Port Fairy Translation project was not to provide a unified flood overlay, but rather to defines areas in and around the township that may be subject to inundation as a result of sea level rise and ocean storm events, such that any expansion to the township area would not introduce future issues with regard to inundation, consistent with the Victorian Coastal Strategy.

The Flood Summary Report ran a number of additional combinations of boundary conditions with minor modifications to the model used in the Translation project, addressing the peer review comments. The additional model runs were to enable the development of a set of flood overlays that included consideration of both riverine dominant flood behaviour and ocean dominant flood behaviour. To develop the proposed overlays an envelope approach was adopted, where the highest flood level at any location created the flood extent from either ocean dominant or river dominant conditions.

The Flood Summary Report details the changes to the previously exhibited overlays. As expected, the updated overlays generally increased in area, as the contribution from the 1% AEP riverine flood was considered. A mapping issues was also identified where an offset had been inadvertently incorporated into the previous exhibited maps and this was rectified as part of the project.

The development of single overlays was a key consideration of the GHCMA for this planning process. The adoption of the 1.2m SLR case was recommended for the LSIO layer, with the development of a local floodplain development plan to provide the planning certainty and adaptive management of flooding risks in the township. The conclusions noted that the local floodplain development plan may adopt different controls for existing township areas compared to developing areas.

7.5 Study Methodology

All the flood mapping projects at Port Fairy have adopted contemporary practice for flood modelling of ocean and riverine flood events. The Flood Summary Report provides a summary of the technical approaches to modelling the combination of flood and riverine events used in general engineering practice. The modelling methodology and analysis of the model outcomes used in the Translation of the Port Fairy Coastal Hazard Vulnerability Assessment and the Flood Summary Report is consistent with the technical approaches widely used in Victoria. I note that the decision to adopt any particular combination of events is a policy based decision, not a modelling based decision. The modelling is intended to inform the policy decisions by providing an understanding of the relative flood risks between various options.

8. Adoption of Findings

The Translation of the Port Fairy Coastal Hazard Vulnerability Project provided data to assist in the development of planning overlays and policies related to coastal inundation at Port Fairy. These are found at Section 5 of that report. The modelling completed as part of that report was slightly revised as part of the Flood Summary Report work, but the results for the events modelled were effectively unchanged. From section 5 of the report, the key planning considerations to be considered by Moyne Shire Council and the GHCMA were:

“... These maps can provide guidance for decision makers in developing appropriate planning controls for coastal inundation and coastal erosion.

Stage 2 of the project provides for the synthesis of the outputs provide by this report into planning scheme changes at both a policy and overlay level. There are differences between coastal inundation and riverine flooding that can be important when adopting a risk based approach to planning controls. This means that it is likely that schedules will be required to the Land Subject to Inundation Overlay and Floodway Overlay that appropriately consider the special conditions associated with coastal inundation, especially where that inundation is transient. Key aspects to consider are:

- > The time of inundation is important in coastal flooding, especially for areas where the depth of water is low. This is because storm tides are predictable and warnings can be provided, meaning that there are design response that can limit floodplain risk to people and property.*
- > The appropriateness of freeboard limits for different areas, such as those fronting the open coast along Ocean Drive, and those along the tidal estuary.*
- > How to manage swash zones with regard to property protection.*

The 1% AEP flood on the Moyne River is the dominant flood mechanism for many areas surrounding the Port Fairy township, particularly inland of the coastal fringe. Planning for the town's future expansion should include consideration of both the ocean and riverine flood mechanisms.” (Section 5.1, page 7)

In the report conclusions for the Translation project, it is stated that:

“...The report should be read in conjunction with the Port Fairy Coastal Hazard Assessment, as the data used to generate the mapped outputs in this document are primarily derived from that project.

The maps and information provided in this report will enable Stage 2 of the project to be commenced utilising a risk based approach to develop appropriate planning controls....” (Section 6, page 7)

I adopt these statements into my evidence as well as the general report findings, noting that the flood summary report updated some of the specific model outcomes.

The Flood Summary Report (2021) provided additional analysis of the flood behaviour at Port fairy and adopted a combination flood approach as requested by the GHCMA. Section 4.4 of that report recommended the following approach to developing planning policy and overlays:

“...it is recommended to adopt the 1.2m sea level rise case adopting an envelope of the maximum flood extent from the 1% River and 5% Ocean AEP events and the 5% River and 1% Ocean AEP events as the planning flood extent defined by the LSIO.

This is consistent with the approach recommended by the NSW OEH guideline. It is the recommended approach for the following reasons:

- *The approach provides a reasonable upper limit for inundation as a result of sea level rise, in combination with a riverine flood event.*
- *For areas that are not currently developed, the approach will provide an indication of areas that will be subject to inundation under future climatic conditions.*
- *The resultant mapping provides an appropriate extent for triggering the consideration of present day and future flood risk in floodplain development decisions. It does not necessarily restrict the setting of floor levels to account for the estimated maximum 1%AEP flood level for the adopted future sea level scenario across the entire extent of the floodplain.*
- *Moyne Shire and GHCMa should consider a Local Floodplain Development Plan to define an adaptive approach to planning requirements for existing and new land parcels in the LSIO and FO areas. Such a progressive approach will be consistent with the new Marine and Coastal Strategy.*
- *The level of the maximum 0.8m SLR cases plus a 300mm freeboard level is unlikely to provide protection against flood levels likely to occur in the area when sea level rise exceeds the 0.8m threshold, noting that the latest IPCC report (Sept. 2019) for the Oceans and Cryosphere has revised upward the projected global average increase in sea level to 1.1 metres by 2100.*

The floodway overlay has been determined from the same envelope of flood scenarios as the LSIO. The revised floodway overlay map has been delineated according to the GHCMa guidelines (GHCMa, 2013) and requires that the area have a depth of 0.5m or more and/or a velocity by depth product of 0.4 metres squared per second or more.” (Section 4.4, page 26-27)

The conclusions of the flood summary report were:

“The assessment undertaken as part of this project has included review of the historical flood and coastal studies at Port Fairy and included additional analysis of potential flooding for the purpose of developing planning control maps that account for the likely change in risk as sea level rises. It is concluded that:

- *The 2008 Port Fairy Regional Flood Study provides the best estimation of catchment inflows at Port Fairy. However, the adoption of static tide levels may increase flood levels in Belfast Lough.*
- *Both regional flood study reports do not take into account the elevated sea state along the south facing coastline, particularly the South Beach/Ocean Drive/Southwest Passage areas.*
- *The Port Fairy Coastal Hazard Vulnerability Assessment remains the definitive assessment of coastal process at Port Fairy. The project adopts the riverine inputs from the regional*

flood study and appropriately accounts for additional coastal processes such as wave overtopping and setup.

- *The Translation of the Port Fairy Coastal Hazard Assessment project is effectively an extension to the PFCHVA. It includes some improvements to the model to account for mitigation works in Reedy Creek and extension of the model westward along the coastline, but did not generate additional ocean information. The modelling ensured that all scenarios envisaged in the PFCHVA were modelled using dynamic ocean boundaries and wave overtopping, which are important to flood levels in Belfast Lough and at Ocean Drive.*
- *Additional assessment was undertaken in this project to provide an envelope of flooding from both river and ocean dominated events to ensure the drivers of flood risk are fully understood.*
- *The adoption of the 1.2m SLR 1%/5% envelope flooding is recommended for the planning scheme LSIO layer. This approach is consistent with that recommended by the NSW OEH guideline for coastal flood risk modelling for the purpose of delineating flood controls in planning schemes*
- *A mapping shift of the model results of 10m south and west from those presented in previous studies is required to better match the topography of the land. This shift has been applied to all datasets provided as part of this project, including the proposed overlays.*

It is recommended that the GHCMA and Council consider the following items for the development of planning controls in Port Fairy.

- *The development of a local floodplain development plan to define the floor level and other planning controls for both existing and developing areas of Port Fairy, noting that these controls may be different.*
- *Future township expansion is not recommended in areas that are inside the 2100 flood envelope.”*

(Section 6, page 34)

I adopt the findings and recommendations of this project into my evidence, with one amendment to the report. At Section 4 of the Flood Summary Report, it is stated that:

“...no planning scheme overlay in Victoria includes consideration of climate change for the derivation of flood planning zones or layers (UFZ, FO, LSIO and SBO) where the source of flooding is from riverine or pluvial sources only. Consideration of climate change risk factors have generally only been considered in the adoption of flood related planning controls in the coastal floodplain setting.”

Since the writing of that report, the City of Melbourne has proposed amendment C384melb for the Melbourne Planning Scheme. Schedule 3 to the Land Subject to Inundation Overlay includes the following provisions:

To identify land in areas that may be inundated by the combined effects of the 1% Annual Exceedance Probability (AEP) flood event incorporating an 18.5% increase in rainfall intensity due to climate change by the year 2100. (Section 1)

The mapping which forms the basis of the Land Subject to Inundation Overlay identifies areas that would be subject to inundation by the combined effects of the 1% Annual Exceedance Probability (AEP) flood event incorporating an 18.5% increase in rainfall intensity due to climate change by the year 2100. For Moonee Ponds Creek and the Lower Yarra River a boundary condition inclusive of a starting water surface level of a 10% Annual Exceedance Probability (AEP) tidal level plus a 0.8 metre sea level rise in 2100 has been included in the modelling. This information is contained in the background documents listed in the Schedule to Clause 72.08 which is the source of mapping for this overlay. (Section 2)

It is understood that if the 0.8m sea level rise storm tide inundation level is above the riverine flood level, Melbourne Water already applies the higher of the two levels. I note that Melbourne Water applies a 600mm freeboard above the modelled flood level to form the NFPL for development.

9. Does the Amendment address relevant coastal and riverine flooding hazards acceptably?

In my view, the amendment provides an acceptable framework to identify coastal and riverine hazards in and around the Port Fairy Township. The adoption of a planning overlay related to flooding is indicative that consideration of flood related risks should be part of the decision-making process around the development on that land.

The decision on adoption of planning overlays using either the 1.2m SLR 1% AEP or 0.8m SLR event with the 5% AEP riverine flows in the estuarine area is a complex one. Ultimately, the decision on which extent is appropriate is based on a balance between the planning horizon and the expected asset life. It is acknowledged that with such a long planning horizon, the adoption of the higher SLR scenario may be too conservative or apply conditions that plan for risks that may begin to occur in 2100 or beyond for buildings or works with a design life that ends before this time period.

At Port Fairy, adopting the higher planning level (SLR 1.2) provides for a reasonable control on the expansion of the township. The flood extent through Belfast Lough and in the river surrounds is not significantly greater than for the 0.8m SLR. The township also has many areas of land that are not constrained by flooding, from either riverine or coastal sources. Although the current assessment indicates that a SLR of 1.2m is unlikely by 2100, adoption of this level ensures that redevelopment or rezoning of land below this level will be appropriately managed for future generations.

A further consideration is that the effects of sea level rise will continue beyond 2100, under the most likely emissions scenarios. Figure 1 shows the expected sea level rise and confidence limits for the SSP5-8.5 scenario at Portland. Figure 2 shows the expected range in time when sea level rise will exceed 1.2m based on current predictions for a range of climate scenarios. The SSP number indicates the emissions scenario, with higher numbers indicating higher global emissions. SSP8.5 is widely adopted by planning authorities as the relevant scenario for



planning purposes across a range of climate factors. This scenario represents a business-as-usual approach to emissions.

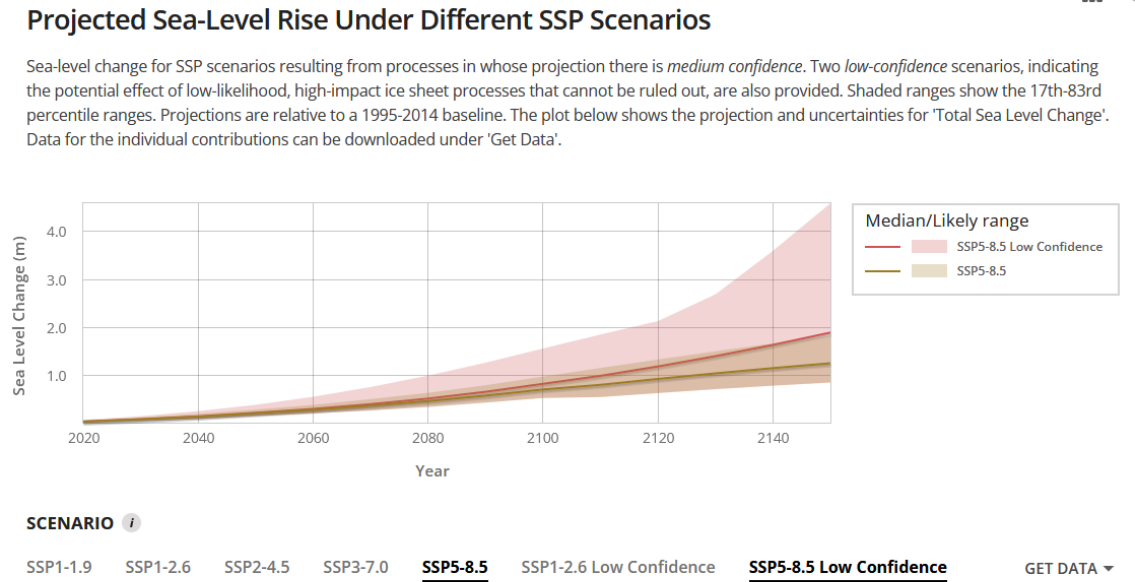


Figure 1 Sea level rise at Portland for SSP5-8.5 scenarios (<https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool>)

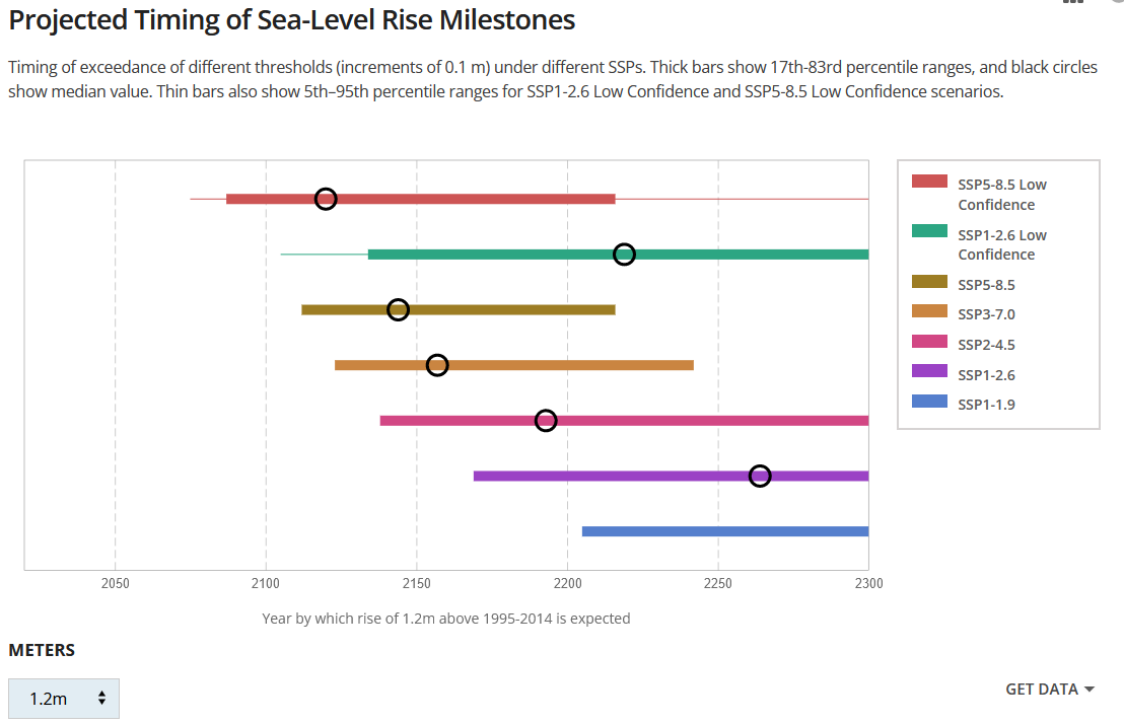


Figure 2 - Expected time of Sea level rise exceeding 1.2m at Portland (<https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool>)

Figure 1 indicates that sea level rise is expected to continue beyond 2100 under the climate scenario represented by SSP5-8.5. Sea level rise is not expected to decrease under any climate scenario, although some very low emissions scenarios show very gradual increases. The low confidence scenarios for SSP1.5-2.6 and SSP8.5 indicate the potential effect of low likelihood, high impact ice sheet process that cannot be ruled out. The most likely time of exceedance of the 1.2m threshold is indicated by the black circle, with the thick bars indicating the 17-83rd percentile timings. In a worst-case scenario, 1.2m SLR could occur at 2070, and assuming that the global emission reductions agreed to at the Paris Climate Conference are met (represented by the SSP2-4.5), this level of rise could occur by 2140 (or earlier).

It should be noted that the baseline sea level in the charts shown above is taken from a period between 1995 and 2014. The baseline sea level used in the flood modelling at Port Fairy was relative to 1990. Since 1993, Victoria's sea level has risen approximately 3mm per year.

The GHCMa expressed a preference for LSIO and FO extents that encompassed both riverine and ocean dominant flooding. This envelope approach has been adopted at Port Fairy, noting that in Belfast Lough, flood levels are generally higher under the riverine dominant scenario, although there is some convergence as sea level rise approaches 1.2 m. The overlays do not include consideration of the impacts of climate change on pluvial and riverine flooding. Australian Rainfall and Runoff indicates that at 2100, rainfall intensities are expected to increase at Port Fairy by approximately 19%. An increase in rainfall intensity has not been included in the development of the combined overlays, but would increase flood levels through the Moyne River system, regardless of the sea level conditions.

9.1 Draft Local Floodplain Development Plan

The effect of an overlay is to require further consideration of the specific risk mapped by the overlay extent. Under the proposed LSIO and FO, the draft Local Floodplain Development Plan (LFDP) provides the decision making framework for development in and around Port Fairy with regard to flooding. For clarity, when referring to the LFDP, it should be assumed that I am referring to the December 2021 version. I have reviewed this plan, noting that it was recommended in both the Port Fairy Translation Project and the Flood Summary Report that the Local Floodplain Development Plan provide for adaptive management of flood risk.

I have identified a minor technical correction in the plan:

- In Sections 1, the plan correctly refers to the sea level rise cases as being relative to 1990. In Section 2, the plan refers to the baseline as being between 1995 and 2015, which is not correct.

The plan nominates the Nominal Flood Protection Level (NFPL) as the 1% AEP flood estimate with an allowance for 1.2m of sea level rise. However, the plan also notes that the floodplain management authority can advise that the NFPL is another level for a specific development. At section 4.5, the LFDP explicitly states that the application of the NFPL must be adaptable.

I have considered the adoption of the NFPL by comparing it with the approach adopted by Melbourne Water. Melbourne Water sets the NFPL for the Yarra River Estuary as the higher of

the 1% AEP riverine flood level (which includes a sea level rise of 0.8m, a 10% AEP storm surge level and an 19% increase in rainfall intensity above present day levels) or the 1% AEP tidal surge event (assuming 0.8m sea level rise) plus 600mm freeboard allowance.

To put that into context at Port Fairy, I have calculated the NFPL for a property on Belfast Lough, adopting the results shown in the Port Fairy Flood Summary Report (Table 3) using Melbourne Water's approach and the approach adopted in the LFDP. There is no direct comparison for the Melbourne Water approach as a higher riverine flow was not modelled. However, it is reasonable to assume that it would be higher than the 1% riverine, 10% ocean case with 0.8m of sea level rise. The difference in flood level in Belfast Lough between the 5% and 10% riverine flow cases with a 1% AEP tidal boundary is 0.24m. For the purposes of the calculation, I have adopted an indicative level of 2.78m AHD in the Lough for the Melbourne Water flood level (this is half the increase in level between the 5% and 10% AEP riverine flow cases added to the 1% riverine, 10% ocean, 0.8m SLR level). Table 1 shows the NFPL's calculated for a property adjacent to the Lough.

Table 1 - Calculation of Nominal Flood Protection Level

NFPL Calculation	NFPL at Belfast Lough (mAHD)
Port Fairy LFDP (1.2m SLR, max 1% flood envelope, no freeboard)	3.34 mAHD
Melbourne Water (0.8m SLR, 600mm Freeboard)	3.38 mAHD

It can be seen that the although the Melbourne Water approach adopts a nominal 0.8m sea level rise, the application of freeboard results in an almost identical NFPL. The advantage of the approach in these overlays, compared to the Melbourne Water approach, is that all areas below the NFPL are treated equally under the provisions. In the Melbourne Water approach, a property with a ground level of 2.8mAHD would have no flood or floor level constraints (as it is outside the flood overlay), whilst a neighbour that had a ground level of 2.75mAHD would be required to build floors above the NFPL.

I have considered the various sections of the LFDP, including the performance criteria, and have the following comments:

- Sections 1 to 4 of the document provide a clear overview of the flood behaviour at Port Fairy and the purpose and intent of the plan
- Section 5 provides clear guidance on application requirements under the overlays.
- Section 6 provides the performance criteria for assessment of applications:
 - Section 6.2 allows for subdivision of land below the NFPL in both the FO and LSIO provided specific criteria can be met.
 - Consideration could be given to modifying the constraints associated with the LSIO for subdivision of land, where that subdivision proposes an appropriate response to future flood risk assuming a 1.2m sea level rise case.
 - Clarification may be required to ensure that new roads can be constructed such that the access criteria at dot point 3 are met.

- Where access to new subdivided land is along existing council roads, there may need to be some consideration of amending the access requirements.
- Section 6.3 for new or replacement dwellings appear reasonable, noting that the NFPL can be specified by the GHCMA in circumstances where a development may offer an alternative flood mitigation arrangement.
- Section 6.4 relates to extensions to existing buildings.
 - At dot point 2, I would add the words in bold to the provision “**where possible**, be aligned with the longest wall parallel to the dominant direction of floodwater flow” as a specific extension may not be able to achieve this outcome given various site constraints.
 - The table at dot point 4 is not consistent with the earlier discussions in the LFDP regarding the NFPL level being the 1% AEP flood level (with 1.2m sea level rise). The last 2 columns headed “For existing floor levels above the adopted 1% AEP flood level” should be removed. The implication in the table is that only large extensions can be built at the NFPL, which would be lower than the existing floor level.
 - It would be prudent to change the reference to the 1% AEP flood level in the first two columns of the table to the NFPL.
- Sections 6.5 to 6.10 appear reasonable.
- Section 7 appears reasonable.

I do have concerns regarding the application of an aspect of the LFDP in the existing townships areas under Sections 6.3 of the plan. Specifically, this relates to the access criteria which may be along existing council owned roads that are not in the control of the applicant. For example, there are a number of properties along Griffiths Street which are partially impacted by flooding, but would have no access that meets the requirements of Section 6.3. This provision would effectively remove the ability of those properties to replace the existing building and could effectively increase the potential flood damage and flood risk to occupants at these locations.

With the exception noted above, the LFDP appears to provide reasonable flexibility for applicants to provide innovative responses to flood related issues. I note that although the LFDP nominates the NFPL, it allows for the GHCMA to vary that level in response to the specific application, if necessary. The NFPL adopted is effectively equivalent to that that would be calculated using the approach adopted by Melbourne Water, noting that this nominally uses a 0.8m sea level rise.

10. Response to Submissions

I have read all submissions identified by Council in Section 9 and 10 of their Table of Submissions to Amendment C69moyn, (dated Feb 2022). Section 9 of this document identifies the key issues raised by submitters with regard to the application of the FO and LSIO as part of the amendment, while Section 10 identifies issues relating to the proposed LFDP. I have also reviewed the Council Officers response in the document.

I have responded to the key concerns listed in the Council document individually, where they are within my area of expertise. Where a submission has raised a specific issue with the

technical application of the flood model at a site, I have responded to that submission individually.

10.1 Negative Impact on Insurance

(Submissions 6a, 21a, 27, 35, 39a, 42a, 50, 51a, 52a, 55, 58, 58a, 74, 75, 90, 101, 118, 123, 125)

I agree with the Council Officers response. I would also add that insurance companies are already undertaking their own studies and have access to a range of information regarding flood and inundation risk. The application of the overlay simply identifies a risk to be planned for and this may reduce future insurance premiums, compared to a case where there is no consideration of the flood risk.

10.2 The application of the FO and LSIO are too severe on existing and future residents, each property should be assessed individually

(Submissions 6a, 20, 21a, 27, 33, 33a, 39a, 42a, 48, 51a, 52a, 55, 58, 58a, 60, 72a, 74, 75, 77a, 90, 96, 101, 105, 111)

The proposed overlays are intended to manage the risk of inundation into the future in a non-stationary climate. The resolution of the model is such that the effect on properties is assessed at the individual level. The inclusion of overlays means that each site can be compared on its merits at the time of application.

10.3 The flood provisions will/may inhibit further subdivision, extension of existing structure and additional development of affected properties

(Submissions 6a, 20, 21a, 27, 33, 33a, 39a, 42a, 48, 51a, 52a, 55, 58, 58a, 60, 72a, 74, 75, 77a, 90, 96, 101, 105, 111)

This is the effect of any planning overlay. In this case, the LFDP provides guidance as to what can be undertaken on individual sites. I have proposed some amendments to the LFDP, particularly around site access, that may enable some additional development on impacted properties, whilst maintaining the intention of the LFDP.

The limiting of subdivision to areas that are unlikely to be impacted by inundation in the future is an appropriate response at Port Fairy, where there is flood free land available to meet the expansionary needs of the township.

10.4 The modelling is theoretical, the impacts suggested may not happen

(Submissions 6a, 20, 21a, 27, 33, 33a, 39a, 42a, 48, 51a, 52a, 55, 58, 58a, 60, 72a, 74, 75, 77a, 90, 96, 101, 105, 111)

This statement is correct. All modelling is theoretical and the specific impacts described in the report result from a combination of rare events that may not occur in the real world. However, the modelling provides an indication of future risks that should be planned for prior to their occurrence, even if that occurrence is very rare. This precautionary approach has been adopted at Port Fairy.

10.5 Other councils are not proposing these more severe controls

(Submissions 6a, 20, 21a, 27, 33, 33a, 39a, 42a, 48, 51a, 52a, 55, 58, 58a, 60, 72a, 74, 75, 77a, 90, 96, 101, 105, 111)

The provisions of the State Planning Policy dealing with coastal inundation (13.01-2S) states require that authorities should:

Plan for sea level rise of not less than 0.8 metres by 2100 and allow for the combined effects of tides, storm surges, coastal processes and local conditions such as topography and geology when assessing risks and coastal impacts associated with climate change.

I note that the provision includes the use of the words “not less than 0.8m” in its wording. As described above in section 9.1 of my evidence, the adoption of a 0.8m sea level rise provision, with an allowance for freeboard, provides an identical practical outcome for the nominal flood protection level. However, it is considered that site access provisions will be shown as more constrained under 1.2m sea level rise conditions than 0.8 sea level rise conditions. In my view, site access provisions should have further considerations in the LFDP, such that they do not unreasonably sterilise land, especially where the access is along a council road.

The planning controls proposed by the City of Melbourne in Amendment C384melb are arguably more severe than those adopted for Port Fairy, considering that they include a provision for an increase in rainfall intensity of 19%, leading to significantly higher riverine flows.

10.6 Untested assumptions underpinning the restrictions on floodplain development

(Submission 9)

The submission is correct in that flooding is rare in and around Port Fairy and that the township will not typically be impacted by flash flooding in the Moyne River. However, the submission appears to indicate that the studies indicate frequent flooding in Port Fairy. This is not correct in my view. The lack of evidence of frequent flooding simply indicates that flooding at Port Fairy is rare, and is significantly buffered by Belfast Lough. The impact of rising sea level is to reduce the storage capacity of Belfast Lough, thereby increasing the flood height for an equivalent inflow.

The adoption of a risk level is a policy decision made by Council and the floodplain management authority based on a number of factors. Submission 76 and 76a by the GHCMa provides guidance on their position regarding the risk at Port Fairy.

The overlays do not assume that design solutions for safe development of the floodplain do not exist. Should flood mitigation works be proposed, either as part of a development or at a more regional scale, the overlays can be amended to reflect the current flood state. The overlays ensure that these design solutions are assessed with appropriate rigour.

10.7 The existing overlays adequately reflect the current and ongoing needs of Port Fairy, based on past experience.

(Submissions 58, 58a, 90, 96, 101, 105, 114)

The science is clear that the climate is changing and that those changes will impact inundation and sea levels at Port Fairy. As such, history provides some guidance as to the flood behaviour at Port Fairy, but the assumption that the climate conditions are stationary cannot be supported. The overlays have been developed based on a specific future scenario to manage the future climate risk.

10.8 Changes to the flood provisions should be applied incrementally

(Submission 60)

I agree with the Council response. Submission 60 also indicates that their site at 92 Griffiths Street is subject to a greater extent of Floodway Overlay than neighbouring properties. The overlay is simply an indication that the land may be subject to inundation, limited by the resolution of the model and the availability of topographic data. The exact extent at any property can be determined by survey and would be undertaken as part of any planning application.

10.9 The Amendment does not take into consideration the potential for flood mitigation works which would reduce flood levels on developable land.

(Submission 6a, 20, 39a, 58a, 123, 125, 126)

The overlay controls cannot take into account future works that may modify the flood behaviour. The overlays ensure that any proposed flood mitigation works that may be considered meet the requirements of the LFDP, including that there is no adverse impacts on neighbouring properties. There is nothing in the LFDP, FO or LSIO that prevents flood mitigation works from occurring or the GHCMa providing a lower NFPL based on some future mitigation works.

10.10 The LSIO and FO proposed for the area in the vicinity of Companion Lagoon and Reedy Creek to the south of Hamilton –Port Fairy Road be reviewed to consider the accuracy of data relating to locality specific flood risk.

(Submission 122)

The modelling of flooding into Companion Lagoon formed part of the extension of the Port Fairy Regional Flood Model. The area shown as inundated is from backflow up Reedy Creek from the wider Moyne floodplain to the east. This area is outside the area impacted by sea level rise considerations and is driven by riverine flows only. The maps show the same flooded area under all sea level rise conditions.

10.11 Submission 80 – 103 Princes Highway Flood Extent

The submission at 103 Princes Highway provides information on a proposed development. The development has had flood modelling completed, but I have no information on the development of that flood model or its conditions. As a matter of good practice, I would not adjust flood overlays until the development was in place and certified plans had been received. The submission also details that the properties to the north of 103 Princes Highway do not have the FO applied. I am unsure why this has occurred. The modelling identified that area as inside the FO. However, the final FO and LSIO extents were created by the GHCMA and Council and may not exactly reflect the results of the modelling.

11. Review of Water Technology Memo

I have read the Water Technology memorandum dated 18 July 2022. My views on the memorandum are:

1. At section 1, the memo indicates that the work completed by WRL on the expected ocean boundaries for Port Fairy is overly conservative. No justification is given for this view. The Port Fairy Coastal Hazard Vulnerability Assessment was extensively peer-reviewed during its development, including by external parties. WRL are highly experienced in the application and development of coastal hazard studies, including writing guidelines for the NSW government on approaches to modelling and assessing climate change in estuaries.
2. The assumption that the differences between the modelling systems are due to misrepresentations in the Cardno model as a result of the conversion between MikeFlood and Sobek is not supported. In my view, it is more likely that any differences are related to modelling assumptions associated with the Gipps Street Bridge. The Cardno modelling adopted bridge losses that were conservative. The characterisation that one choice of bridge parameters compared to another is incorrect is not supported. The losses through the bridge can be impacted by a number of factors.
3. I note that the peak flood level modelled by Water Technology is not from the same event combination as identified in the Flood Summary Report.
4. I agree that the differences between the existing and proposed models are the relevant consideration.
5. The proposed development creates lots that appear to be inundated post the development. Typically, the creation of fully inundated lots would not be supported by policy.
6. The discussion on the potential climate future is reasonable, however it should be noted that the actual global emission reductions represented by the SSP2-4.5 scenario are not yet realised. Planning for a worse scenario is a risk minimisation measure, that can be

amended in the future if the emissions reductions goals are realised. We note that even under the SSP2-4.5 case, sea level rise will progress to 1.2m, although later in time.

7. It is agreed that the typical planning control across Australia is typically no more than a 0.9 sea level rise, once freeboard controls are adopted, the NFPL may well be consistent with the 1.2m sea level rise case.
8. The LFDP allows for subdivision in the FO provided specific triggers are met.
9. The adoption of the FO as exhibited was at the direction of the GHCMA. The FO extent is derived from their FO delineation guidelines, consistent with other locations with the GHCMA boundary.
10. Planning Practice Note 12 did not specifically include inundation from the coast. However, in practice planning overlays have been developed including the consideration of ocean inundation in Victoria. These include the adoption of 1% ocean AEP tailwater levels by Melbourne Water that are effectively translated into the overlay provisions.
11. Melbourne Water does not routinely apply the Floodway Overlay, in contrast to Catchment Management Authorities. For example, there are very few areas of the Yarra River floodplain, where depths are in excess of 1 metre, that are covered by the FO. Melbourne Water's view has been that the LSIO provides sufficient planning control to refuse development in flood storage and fast flowing areas.
12. The peak flood levels in Belfast Lough are caused by the river dominated flood event. The application of the FO would be consistent with Belfast Lough being an important flood storage area in this river dominated flood event.
13. I do not agree that the setting of the NFPL to the 1.2mSLR without an allowance for freeboard is not consistent with good practice. Adopting this level provides an inherent freeboard above the 0.8m sea level rise cases (between 500 and 700mm).
14. I do agree that there is potential that the adoption of the FO may lead to a conservative assessment of flood risk at Port Fairy and limit development on land that may not be subject to the identified risk for some time. Amendments to the LFDP may be able to provide an alternate decision pathway for development, noting that subdivision is allowed under the FO in the LFDP.

12. Conclusions

Based on my investigations, it is my opinion that:

- The modelling undertaken to inform the derivation of flood overlays at Port Fairy is based upon the best available information for both riverine and ocean inundation.
- The adoption of a 1.2m sea level rise case for the derivation of flood overlays is reasonable, especially when considering the planning of future township boundaries and the location of proposed higher density subdivisions.
- Sea level rise is expected to continue to rise to above 1.2m, under most emission reduction scenarios. The time at which sea level rise reaches 1.2m is dependent on the global response to GHG emission reductions.
- With some amendments, the Local Floodplain Development Plan provides a reasonable response to flood planning at Port Fairy. There are specific amendments that should be considered are detailed in Section 9.1 above.
- It is recommended that the access provisions to sites in the LFDP be reconsidered, such that the access provisions do not effectively sterilise land from redevelopment that is otherwise consistent with the requirements of the LFDP.
- The nominal flood protection level at Port Fairy adopting the 1.2m SLR case with no freeboard is consistent with a 0.8m sea level rise case plus 600mm freeboard. The adoption of the 1.2m envelope ensures that there are no boundary areas that are exempt from flood controls.
- The flood planning controls at Port Fairy do not include consideration of an increase in rainfall intensity of 19% under climate change conditions.
- The adoption of the SSP5-8.5 climate case is consistent with climate change impact assessment and planning in Victoria.
- The FO extents have been developed based on the GHCMA guidelines. These are considered conservative under present day conditions. It is noted that future flood conditions are being adopted in planning schemes elsewhere in Victoria, such as C384melb.
- Ultimately, the decision to adopt any particular flood level or sea level rise case is policy driven decision that is made based on the risk appetite of the community and the relevant planning authorities.

Overall, it is my opinion that the flood overlays developed for Port Fairy are based on sound modelling practice and are representative of future flood conditions. They can be considered conservative and should be revisited once global emission pathways are better established. The flood extents can always be reduced in the future as part of revisions to the flood extents as new information becomes available.

13. Declaration

I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

A handwritten signature in black ink, appearing to read 'R. Campbell Swan', with a long horizontal flourish extending to the right.

Robert Campbell Swan

15 August 2022

Appendix A CV of Robert Campbell Swan



Rob Swan

Principal Flood & Stormwater Engineer

Rob has over twenty years' experience in the areas of hydrology and hydraulics, flood analysis, water quality and environmental assessment. He has significant project management experience and has worked on a number of large multi-disciplinary infrastructure projects. Prior to joining HARC, Rob was Cardno's National Technical Director for Water.

Rob is an expert in floodplain management and the simulation and modelling of large flood events. He is a member of the Victorian State Emergency Service Expert Hydrologist Panel and has performed in an operational capacity in emergency flood response. Rob has significant experience in the intersection of the planning system and flood analysis and their interaction to provide community benefit and appropriate management of natural assets.

Qualifications

Bachelor of Engineering,
2000

Diploma of Project
Management, 2016

Affiliations

Fellow of the Institute of
Engineers Australia
(FIEAust)

Expertise

One and two-dimensional numerical model development and application for the study of flooding and water quality

Flood Emergency Response and Planning

Drainage Scheme Development and Application

Planning Scheme Amendments

Hydraulic and hydrologic investigations of urban and rural floodplains

Water quality investigations of shallow lakes and Water Sensitive Urban Design

Floodplain management and planning

Expert Witness Services and Planning Panels

Employment History

Hydrology and Risk Consulting (HARC), Australia

February 2021 – current

Cardno / Lawson and Treloar, Australia

January 2003 – December 2020

Melbourne Water Corporation, Australia

November 2000 – December 2002

Recent Project Experience

Floodplain Management and Modelling

Rob has extensive experience developing, calibrating and using flood models for strategic and statutory planning, infrastructure investigations and design. He has worked in this sector for a range of private and government projects, including on major infrastructure projects.

- **Melbourne Water Flood Planning Panel** (2014 – 2020) – Rob was the project director and key client liaison for projects undertaken as part of this panel arrangement. This included more than 20 individual projects with a total value in excess of \$2.5M. The projects were varied and included flood mapping, advice on pump station and infrastructure design, expert witness advice and development of planning layers. Flood mapping projects were completed across Melbourne, including areas such as Pakenham, Hume, Riddles Creek and Nunawading,
- **Clifton Springs and Drysdale Flood Mapping and Mitigation Project** (2020) – Rob was the project director for this project undertaken on behalf of the City of Greater Geelong. The project included mapping and analysis of both historical and expected flooding in the Clifton Springs and Drysdale on the Bellarine Peninsula. The project was expanded to include an assessment of potential integrated water cycle management options in the catchment.

- **City of Manningham Flood Mapping and Planning** (2011-2018) – Rob was the project director and manager for the City of Manningham flood mapping projects and the following flood planning layer development project. Rob ensured that the project delivered high quality mapping outcomes that were suitable for use by Melbourne Water and Council. Rob acted as the expert witness for the Panel hearing and provided advice to reduce the number of objectors prior to the panel hearing.
- **Benalla Rural City Flood Information** (2016-2020) - Rob was the lead for the Rural City of Benalla for a number of projects, including the detailed investigation of large scale flood mitigation options. This included presenting to three community forums with over 300 total attendees and providing summary documents to Council for distribution to residents. The outcome of this work was the Benalla Flood Information Portal, which provides advice on flood risk to all residents of Benalla. Rob led this follow up project and launched the portal alongside Council and VicSES in late 2017.
- **SES Expert Hydrologist 2012 Broken Creek Flood Event** - Rob provided hydrological and hydraulic analysis as part of the incident response to flooding on the Broken Creek. His work included public meetings and liaison, flood impact prediction, hydrological assessment and flood impact assessment. Rob is a current member of SES's expert hydrology panel.
- **Port Fairy Coastal Hazard Mapping Project** (2016-2020) – Rob was the project director and key technical lead for this project which expanded the assessment of coastal inundation at Port Fairy from a static analysis to a fully dynamic assessment for a number of riverine and coastal event combinations. The project will define the future development boundaries for the township of Port Fairy.
- **Bellarine Coastal Hazard Vulnerability Assessment** (2012-2016) - The Bellarine Peninsula - Corio Bay LCHA study area includes the entire Bellarine Peninsula and the northern side of Corio Bay, from Point Wilson in the north, to Breamlea in the south. The study provided a comprehensive understanding of the extent of coastal hazards and their impacts on the coastal environments within the study area. It assessed coastal inundation, while considering the effects of climate change, as well as combined incidence of catchment flooding and coastal inundation. Rob was the technical lead for the inundation modelling portions of the project, including the consideration of ocean storm surge and tidal flood events.

Major Infrastructure Projects

- **North East Link Project Early Works (DP48)** (2019-2020) – Rob was the project lead for design Package 48 of the North East Link Early Works Project. This project included the flood analysis of the proposed early works design at Borlase Reserve and the design of temporary drainage works for the realignment of Banyule Creek. The design package was delivered under significant time constraints to meet the project construction requirements.
- **North East Link Early Works Construction** (2020) Rob managed the response to flooding for the construction phase of the North East Link Early Works program. This included assessment of flood impacts from temporary works and the development of construction flood management plans, based around the trigger levels and actions.
- **Melbourne Metro Project Stations and Tunnels** (2018–20) Rob was a technical adviser to the Stations and Tunnels design team and provided technical review for flood mapping and analysis of the flooding associated with the city stations and tunnel portals. This included mapping of urban flooding through the CBD and in the Arden Street precinct. Analysis was also required of the major riverine flooding associated with the Yarra and Maribyrnong Rivers and Moonee Ponds Creek.
- **Western Distributor Tender Design** (2016-17) - Rob was the design lead for flooding for the Western Distributor Tender Design. The project is a \$5.5 Billion tunnel and freeway upgrade and included crossings of 4 major waterways. The analysis of a new bridge crossing of the Maribyrnong River included consideration of PMP and climate change flooding and the navigational requirements of commercial and recreational craft on the river.
- **Second Bridge Crossing, Murray River at Echuca** (2012-2017) Rob provided design and technical advice to VicRoads on the required bridge and culvert requirements for the proposed second crossing of the Murray and Campaspe Rivers at Echuca. This advice included flood impact assessment, mitigation sizing, preliminary costing, water quality and

quantity assessment and community consultation. Rob prepared the technical reports and provided expert advice to the Planning Panel considering the application.

Urban Planning, Development and Integrated Water Cycle Management

- **Shepparton East Growth Area** (2019) – Project Director for the drainage, IWM and flood strategy for the Shepparton East Growth Area. The project was undertaken for the VPA to provide appropriate engineering inputs into future land use planning.
- **Benalla West Drainage Strategy** (2019) – Project Director for the Benalla West Drainage Strategy, which defines the future strategy for the next 30 years of development in Benalla. This include consideration of flood behaviour and conceptual drainage design.
- **East Village Bentleigh Development Drainage Strategy** (2018) – Project director for the development of the future drainage strategy for the East Village development at Bentleigh, including consideration of the main drainage flood impacts, development of the required drainage strategy and integration of water sensitive urban design drainage elements into the comprehensive development plan.
- **Sandown Racecourse Flood Management Strategy** (2020) – on behalf of the Melbourne Racing Club, Rob developed the flood management and drainage strategy to facilitate the future redevelopment of Sandown Racecourse. The proposed strategy incorporates the naturalisation of Mile Creek, significant flood storage and optimises the availability of open space throughout the site.

Water Balance, Water Quality and WSUD

- **Cannon Hills Development and Golf Course, Brisbane** (2018 - 2020) – Rob was the technical director and project lead for the assessment of this development which included water harvesting from a tidal creek for irrigation purposes. Rob assessed the complex interactions between surface hydrology, tidal levels and irrigation demands to optimise the availability of water for irrigation, whilst ensuring appropriate turnover to minimise blue green algal growth and ensuring that fish refuges remained wet at all times.
- **Melbourne Desalination Plant Outfall** (2013/14) – Rob was a project lead for the investigation and modelling of the saline plume discharge from the Melbourne Desalination plant. This modelling determined the area of environmental impact that was used to define the operating licence for the plant. Subsequent testing has indicated that the highly detailed 3D model was very accurate in its estimation of the area of impact.
- **Sanctuary Lakes Algal Bloom Modelling** (2004-5) – Rob was the project lead for the analysis of the expansion of the 60 hectare lake to 120 hectares. The analysis used modelling to assess the performance of the lakes under a range of scenarios and incorporated the use of a process driven water quality model to quantify potential algal growth. Since the modelling was completed, there has not been an algal bloom in the lakes system.
- **Johnstone Park Raingarden Geelong** (2017) – Rob was the project director for this project which incorporated a tiered raingarden and a 250KL stormwater reuse tank in the heritage listed Johnstone Park. The design required heritage approvals and was created to be sympathetic to the original park design.

Awards

- 2011 Harold Davies Award for Technical Excellence, Runner-up

Publications

Swan, R, Guest, R, Sommerville, H, and Haywood, J. (2018) *ARR 2016 – Adopting a Practical Methodology for Catchment Scale Urban Flood Mapping Projects*. Proceedings of the 2018 Floodplain Management Australia National Conference, May 29 to June 1, 2018

Veldema, A and Swan, R (2016) *Adaptive Floodplain Planning - from modelling to implementation*. Proceedings of the 4th National Conference of Stormwater Australia, August-September 2016

- Veldema, A and Swan, R** (2015) *Transforming Flood Mapping Outputs to Decision Making Inputs*. Proceedings of the 36th National Hydrology and Water Resources Symposium, December 2015
- Swan, R, Provis, D and Bicknell, P** (2015) *Ocean Inundation, climate change and policy planning – is the Flood approach suitable?*, Proceedings of the 36th National Hydrology and Water Resources Symposium, December 2015
- Swan, R, and Thompson, A** (2013) *Representing flood mechanisms in the Koo Wee Rup Flood Protection District*, Presented at the 8th Victorian Flood Conference, February 2013
- Thompson, A and Swan, R**, (2013) *Flood Mapping without Drainage Asset Data*, Presented at the 8th Victorian Flood Conference, February 2013
- Swan, R, and Thomson, R** (2011) *Direct Rainfall - Verifying the technique across two States*, Proceedings of the 34th IAHR World Congress and the 33rd National Hydrology and Water Resources Symposium and the 10th National Conference on Hydraulics in Water Engineering, June 2011
- Swan, R.** (2010) *Direct Rainfall - Loss Modelling Approaches*, Presented at the 7th Victorian Floodplain Management Conference, October 2010
- Swan, R and Provis, D.** (2010) *Ocean versus River - Coastal Interfaces, Climate Change and Flood Analysis*, Presented at the 7th Victorian Flood Conference, October 2010
- Swan, R, Watkinson, R and Wong, M.** (2007a) *Dealing with Hydrological Uncertainty: A New Modelling Approach*, Presented at the 5th Victorian Floodplain Management Conference, October 2007
- Swan, R, Howells, L, Bonello, D, Watkinson, R, Robertson, J.** (2005) *Flood Studies and Extreme Events - Modelling, Mitigation and Assessment at Fairfield, Victoria*, Presented at the 4th Victorian Floodplain Management Conference, October 2005
- Swan, R.** (2004) *Application of Australian Runoff Quality Draft Chapter 6 - A 'model' approach?*, Proceedings of the 6th International Conference on WSUD - Cities as Catchments (WSUD 2004), December 2004
- Swan, R. and Collins, N.** (2004) *Integrated High Order Water Quality and Hydrodynamic Analysis - An Essential Tool for Lake Management*, Proceedings of the 8th National Conference on Hydraulics in Water Engineering, July 2004



Appendix B Instructions

Our ref: 1GFT 22001863
Contact: Greg Tobin
Direct Line: 03 5225 5252
Direct Email: gtobin@ha.legal

6 July 2022

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HARC
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Geelong VIC 3220

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Subject to legal professional privilege

Dear Rob,

Moyne Planning Scheme Amendment C69

1. We act for Moyne Shire Council (**Council**) in relation to proposed Amendment C69 to the Moyne Planning Scheme (**Amendment C69**). Council is the planning authority for the Amendment.
2. Amendment C69 applies to all land within the Port Fairy township and surrounds.
3. Amendment C69 proposes to implement the recommendations of the *Port Fairy Coastal and Structure Plan 2018 (Structure Plan)* by:
 - making changes to zone and overlay controls applicable to Port Fairy;
 - revising the Local Planning Policy Framework; and
 - updating operational provisions.
4. The proposed changes to the zone and overlay controls, include:
 - introducing new schedules to the Land Subject to Inundation Overlay (**LSIO**) and Floodway Overlay (**FO**) to identified areas subject to coastal and inundation and a 1.2m seal level rise;
 - simplifying existing Design and Development Overlays (**DDO**);
 - rezoning land identified in Growth Area A on the Structure Plan to Neighbourhood Residential Zone – Schedule 1 (**NRZ1**);
 - rezoning land in the General Residential Zone (**GRZ**) and Mixed Use Zone to NRZ1;
 - rezoning land identified for commercial expansion of the town centre from GRZ to Commercial 1 Zone;
 - rezoning land outside the settlement boundary shown on the Structure Plan around Belfast Lough to Rural Conservation Zone; and
 - extending the Erosion Management Overlay (EMO) which applies to Port Fairy West to areas along the primary coastal dune in South Beach and East Beach.
5. We understand that you were the author of the *Translation of Port Fairy Coastal Hazard Assessment* (18 August 2019) and the *Flood Summary Report* (11 August 2021) which support the new schedules to the LSIO and FO.
6. Amendment C69 documentation and relevant Council reports are contained in your brief of documents.
7. Amendment C69 was exhibited in mid-2020. Following a review of the 86 submissions received, Council placed Amendment C69 on hold to enable further flood modelling to be undertaken to ensure that Amendment C69 is

based on robust and thorough information. In late 2021- early 2022, Council conducted further community consultation in respect of the further flood study. See below for further detail.

8. On 1 March 2022, at the Ordinary Council Meeting, Council:
 - (a) considered all submissions received during the exhibition period and further community consultation;
 - (b) resolved to abandon the parts of Amendment C69 relating to the application of the Parking Overlay to the Port Fairy town centre¹ and the application of the Environmental Significance Overlay to the Wannon Water Port Fairy Water Reclamation Plant²; and
 - (c) resolved to refer remaining submissions to a Planning Panel.
9. A Planning Panel has been appointed and comprises Kathy Mitchell (Chair), Adam Terrill and Geoff Underwood.
10. Key dates are as follows:
 - a Directions hearing in the **week of 8 August 2022**;
 - expert evidence is likely to be required to be circulated **no earlier than 22 August 2022**; and
 - a hearing in the **week of 5 September 2022**.

Instructions

11. We have been instructed to brief you to provide a fee proposal to:
 1. Review this letter, the attached brief of documents and relevant policies and provisions of the Moyne Planning Scheme;
 2. Prepare an expert witness statement to be filed on a date to be confirmed (with a draft provided in advance of that date) which:
 - (a) outlines the history and nature of your involvement in relation to Amendment C69 (including background work supporting Amendment C69) prior to the preparation of your witness statement;
 - (b) outlines the methodology and processes you adopted in preparing the *Translation of Port Fairy Coastal Hazard Assessment* (18 August 2019) and the *Flood Summary Report* (11 August 2021);
 - (c) confirms whether you adopt the findings and recommendation of the *Translation of Port Fairy Coastal Hazard Assessment* (18 August 2019) and the *Flood Summary Report* (11 August 2021) and, if necessary, outlines any departments from findings recommendations, inaccuracies or any change circumstances or assumptions;
 - (d) provides your expert hydrological opinion on whether the Amendment addresses relevant coastal and riverine flooding hazards acceptably or whether you recommend a different response, including any further changes to the Amendment documents.
 - (e) addresses submissions to Amendment C69 relevant to your area of expertise;
 - (f) contains a summary of key issues, opinions and recommendations;

¹ Council noted that the *Port Fairy Car Parking Strategy 2017* found that existing supply to be adequate for the populating and that other mechanisms could be used to address higher demand in peak tourist periods.

² As part of Council's ongoing strategy work program, Council officers propose to further consider the interface e requirements for Port Fairy's industrial areas, including the reclamations plant.

3. If instructed:
 - (a) attend a meeting/video-conference(s) to discuss the above matters;
 - (b) consider and advise on:
 - any relevant expert witness statement circulated on behalf of other parties; and
 - any changes to Amendment C69 proposed by other parties.
 - (c) present your expert evidence at the hearing.
12. If you are instructed to provide expert evidence, we would appreciate a draft of your expert evidence in advance of the required circulation date.
13. Your written statement of evidence must be prepared in accordance with [Planning Panel's Guide to expert evidence](#).

Further Background

Processing Amendment C69

14. On 4 March 2020, the Minister for Planning authorised the preparation of Amendment C69.
15. Amendment C69 was exhibited between 14 May and 28 July 2020. Eighty-six submissions were received during exhibition. In summary, submissions both supported and objected to the proposed flood provisions, residential rezonings, application of the EMO and simplification of the DDOs. Some submissions opposed the application of the PO. Some submissions requested changes to the text/maps in the Planning Scheme ordinance and maps.
16. Following a review of submissions, Council placed Amendment C69 on hold to commission additional flood modelling. Hydrology and Risk Consulting Pty Ltd were appointed to undertake the additional flood modelling, which was completed in August 2021. A copy of the Flood Summary Report 2021 is contained in your brief.
17. Public consultation in relation to the updated flood modelling was undertaken between 16 December 2021 and 31 January 2022. In response to the consultation, 65 submissions were received (in addition to the 85 submissions received in response exhibition). Of the 65 submissions, 2 were late and 23 supplemented submissions received to the exhibition of Amendment C69. A total of 128 submissions have been received in response to exhibition and the subsequent consultation. Submissions to the consultation raised similar concerns as submission to exhibition.
18. As set out above, Council abandoned part of Amendment C69 and referred remaining submissions to a Planning Panel at its meeting on 1 March 2022. A copy of the Council report is contained in your brief. The report contains a detailed summary of submissions and the officer response.
19. Further information on Amendment C69 can be found online [here](#).

Amendment C75 (Amendment C75) and application under section 96a of the PE Act (Permit Application)

20. Amendment C75 and the Permit Application relate to land at the land at 169a and 183 Princes Highway, Port Fairy and together seek to facilitate a residential subdivision and development.
21. Amendment C75 proposes to rezone the Subject Land from Farming Zone and General Residential Zone to the Neighbourhood Residential Zone and apply the Development Plan Overlay – Schedule 5. A draft development plan has also been prepared.
22. The Permit Application proposes to subdivide the Subject Land into 75 residential lots, undertake earthworks (cut and fill), construct 10 dwellings on Proposed Lot 20, create or alter access to a road in a road in the Transport Zone 2 (formerly Road Zone, Category 1) and create or remove easements.
23. Council is the Planning Authority for Amendment C75 made at the request of Myers Planning Group Pty Ltd on behalf of Rivers Run Estate Pty Ltd.

24. Amendment C75 and the Permit Application were exhibited between 16 December 2021 and 31 January 2022. Council has received 89 submissions, which raised various issues.
25. Following a preliminary review of submissions, Amendment C75 and the Permit Application has been put on hold while officers seek further information from Rivers Run Estate Pty Ltd.
26. Previously Council was intending for Amendment C69 and Amendment C75 to be heard together at a Panel hearing. However, the timeframes no longer coincide.
27. Further information regarding Amendment C75 and the Permit Application, including a copy of submission can be found online [here](#).

Brief of documents

We have provided you with an electronic brief of documents (index attached and brief available via link [here](#)).

Your fees

We request that you send your fee proposal to our client care of Harwood Andrews by email, marked for the attention of Allison Tansley (atansley@ha.legal).

We confirm that you should not commence any substantive work on this matter until you have received confirmation from Harwood Andrews that your fee proposal has been approved.

Our client will remain responsible for your fees. We require that any tax invoices be addressed to our client, whose contact details are as follows:

Moyne Shire Council
c/o Allison Tansley
Harwood Andrews
Email: atansley@ha.legal

Legal professional privilege

Your professional opinion is sought in the context of us providing legal advice to our client about this matter. Consequently, your advice by virtue of your being engaged by us, attracts legal professional privilege.

To ensure that legal professional privilege is maintained, please keep our engagement of you confidential until your expert witness report is filed and served, at which time legal professional privilege will be deemed to be waived.

Next steps

If you have any questions or require any further information, please contact Allison Tansley on 03 9611 0197.

Yours faithfully,



Greg Tobin
HARWOOD ANDREWS

Encl. Index to brief of documents

Index to Brief of Documents

A. Amendment C69 Exhibited Amendment Documents	
1.	Explanatory Report
2.	Instruction Sheet
3.	<p>Proposed ordinance:</p> <ul style="list-style-type: none"> (a) Clause 21.06 (Environment) (b) Clause 21.09 (Local areas) (c) Clause 21.11(Reference documents) (d) Clause 32.09 (NRZ) (e) Schedule 1 to Clause 32.09 (NRZ) (f) Schedule 1 to Clause 35.06 (RCZ) (g) Schedule 2 to Clause 35.06 (RCZ) (h) Schedule 7 to Clause 42.01 (ESO) (i) Schedule 1 to Clause 43.02 (DDO) (j) Schedule 2 to Clause 43.02 (DDO) (k) Schedule 3 to Clause 43.02 (DDO) (l) Schedule 4 to Clause 43.02 (DDO) (m) Schedule 5 to Clause 43.02 (DDO) (n) Schedule 6 to Clause 43.02 (DDO) (o) Schedule 7 to Clause 43.02 (DDO) (p) Schedule 4 to Clause 43.04 (DPO) (q) Schedule 2 to Clause 44.03 (LSIO) (r) Schedule 3 to Clause 44.03 (LSIO) (s) Schedule 2 to Clause 44.04 (FO) (t) Schedule 4 to Clause 44.04 (FO) (u) Clause 45.09 (Parking Overlay) (v) Schedule 1 to Clause 45.09 (Parking Overlay) (w) Schedule to Clause 66.04 (Referral of permit applications under local provisions) (x) Schedule to Clause 72.03 (What does this Planning Scheme consist of?) (y) Schedule to Clause 72.04 (Documents Incorporated in this Planning Scheme)
4.	Map sheets
5.	<p>Incorporated Documents:</p> <ul style="list-style-type: none"> (a) Port Fairy Local Floodplain Development Plan 2019 (b) Guidelines – Fencing in Flood-Prone Areas (July 2015)
6.	<p>Supporting documents/clauses and schedules in tracked changes:</p> <ul style="list-style-type: none"> (a) Clause 21.06 (Environment) (b) Clause 21.09 (Local areas) (c) Clause 21.11(Reference documents) (d) Schedule to Clause 66.04 (Referral of permit applications under local provisions) (e) Schedule to Clause 72.03 (What does this Planning Scheme consist of?) (f) Schedule to Clause 72.04 (Documents Incorporated in this Planning Scheme) (g) Port Fairy Coastal and Structure Plan (August 2018) (h) Translation of Part Fair Coastal Hazard Assessment (18 August 2019) (i) Port Fairy Car Parking Strategy (17 March 2017)
B. Updated modelling and maps the subject of community consultation	
7.	Flood Summary Report (August 2021)

8.	Port Fairy Local Floodplain Development Plan (December 2021)
9.	Updated LSIO and FO maps
C. Submissions in response to exhibition and further consultation	
10.	Redacted submissions
D. Council Meeting Minutes & Agendas	
11.	<p>Ordinary Council Meeting on 1 March 2022:</p> <p>(a) Agenda (extract)</p> <p>(b) Attachments (extract)</p> <p>(c) Minutes (extract)</p>

Our ref: 1GFT 22001863
Contact: Greg Tobin
Direct Line: 03 5225 5252
Direct Email: gtobin@ha.legal

4 August 2022

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Subject to legal professional privilege

Dear Rob,

Moyne Planning Scheme Amendment C69

1. We continue to act for Moyne Shire Council (**Council**) in relation to proposed Amendment C69 to the Moyne Planning Scheme (**Amendment C69**).
2. This letter supplements our letter dated 6 July 2022 requesting a fee proposal to prepare expert evidence in relation to hydrological matters.
3. We are now instructed to request that, in addition to the scope of your instructions in our letter dated 6 July 2022, you:
 - (a) consider and provide in your expert witness statement your opinion on the contents of the memorandum from Water Technology to Myers Planning Group dated 19 May 2022 regarding 169A Princes Highway Port Fairy; and
 - (b) if directed by the Panel, arrange and attend a conclave with hydrological experts called by other parties.
4. We have provided you with an updated electronic brief of documents (index attached and brief available via link [HERE](#)).
5. Subject to the Panel Directions following the Directions Hearing on 5 August 2022, expert evidence is likely to be due on **19 August 2022**.
6. We remind you that:
 - (a) Your expert witness statement must comply with [Planning Panels Guide to expert evidence \(DOCX, 81.8 KB\), April 2019](#) and provide a summary of key issues, opinions and recommendations.
 - (b) Your advice by virtue of your being engaged by us, attracts legal professional privilege. To ensure that legal professional privilege is maintained, keep our engagement of you confidential until your expert witness report is filed and served, at which time legal professional privilege will be deemed to be waived.
7. If you have any questions or require any further information, please contact Allison Tansley on 03 9611 0197.

Yours faithfully,

A handwritten signature in black ink, consisting of a stylized 'G' followed by a horizontal line that curves upwards at the end.

Greg Tobin
HARWOOD ANDREWS

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E. Other	
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