

**Before Independent Hearing Commissioners appointed by Wellington
City Council**

In the matter of the Resource Management Act 1991 (**RMA**)

And

In the matter of hearing of submissions on the Proposed Wellington City District
Plan

Between

**Argosy Property No 1 Limited, Fabric Property Limited,
Oyster Management Limited and Precinct Properties New
Zealand Limited**

and

Wellington City Council

Statement of coastal hazard evidence of Samuel Casey Morgan
on behalf of Argosy Property No 1 Limited (submitter 383), Fabric
Property Limited (submitter 425), Oyster Management Limited
(submitter 404) and Precinct Properties New Zealand Limited
(submitter 139)

Hearing Stream 5

Dated 18 July 2023

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MAY IT PLEASE THE COMMISSIONERS

INTRODUCTION

1. I have been engaged by Argosy Property No 1 Limited (**Argosy**), Fabric Property Limited (**Fabric**), Oyster Management Limited (**Oyster**), and Precinct Properties New Zealand Limited (**Precinct**) to provide expert evidence on behalf of all four **Office Companies**, who have made submissions on the Proposed Wellington City District Plan (**Proposed Plan**). In this hearing, my evidence refers to the Natural Hazards and Coastal Environment chapters of the Proposed Plan.
2. I hold a Master of Science degree (Hons) in Marine Science, specialising in the geosciences, from the University of Auckland.
3. I have approximately 19 years' experience in the fields of coastal science and management. I am currently employed as a Technical Principal - Coastal Adaptation at WSP in Gisborne, although I am involved in projects across New Zealand. Within in this role, I utilise my background in coastal processes to develop adaptation responses to coastal hazards and future climate change.
4. I am currently Deputy Chair of the New Zealand Coastal Society Committee and hold a General Environmental Practitioner Certification in the fields of coastal processes and coastal management under the Environment Institute of Australia and New Zealand scheme.
5. In 2008, I started at the Rodney District Council in an operational role undertaking the maintenance and development of coastal assets within the district. Prior to this, I was involved in research and teaching at the University of Auckland and University of Wollongong, as well as research at the Elkhorn Slough Estuarine Research Centre in California.
6. Between 2009 and 2011, I worked for Davis Coastal Consultants on a range of coastal management and engineering projects. Following this, I was employed by Auckland Council as a Senior Coastal Specialist from August 2011 to January 2016, and then with AR & Associates, as an Associate - Coastal Scientist between 2016 and early 2018.

7. I joined 4Sight Consulting Limited in 2018 as Principal Coastal Consultant, and during my time there, managed a range of coastal management projects and provided coastal science inputs. Undertaking and reviewing site specific coastal hazard assessments was a regular part of this role. I also undertook coastal hazard assessments at Whitianga and Cooks Beach to develop management strategies on behalf of Thames Coromandel District Council.
8. In my current role I am involved in undertaking coastal hazard assessments for the Dunedin coastline and Wainui Beach on behalf of Gisborne District Council.

CODE OF CONDUCT

9. I have read and am familiar with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2023, and agree to comply with it. My qualifications as an expert are set out above. Other than where I state that I am relying on the advice of another person, I confirm that the issues addressed in this statement of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

SCOPE

10. My evidence will provide a high level assessment of coastal hazard occurrence and risk around Wellington and associated implications in relation to the Proposed Plan.
11. In preparing my evidence, I have reviewed:
 - (a) The Proposed Plan.
 - (b) The report on Natural Hazards and Coastal Hazards prepared under s 42a Resource Management Act 1991.
 - (c) NIWA, 2021 (a). Coastal hazards and sea-level rise in Wellington City. Supporting the 2020-2021 district plan process. Prepared for Wellington City Council. August 2021.
 - (d) NIWA 2021 (b). Update on sea-level rise projections for Wellington City. Supporting the 2020–2021. District Plan process. Prepared for Wellington City Council. March 2021.

- (e) Burbidge DR, Gusman AR, Power WL, Wang X, Lukovic B. 2021. Wellington City probabilistic tsunami hazard map. Lower Hutt (NZ): GNS Science. 24p Consultancy Report 2021/91.
- (f) Ministry for the Environment. Coastal hazards and climate change: Guidance for local government (2017).
- (g) Statement of evidence of Connon James Andrews on behalf of Wellington City Council (Coastal Inundation) Date: 13 June 2023.
- (h) Statement of evidence of David Ross Burbidge behalf of Wellington City Council (Tsunami) Date: 18 May 2023
- (i) Statement of evidence James Gary Beban behalf of Wellington City Council (Tsunami) Date: 30 June 2023

COASTAL INUNDATION

12. Present day flooding as a result of coastal inundation events is often associated with a range of tide and storm variables as can be seen in Figure 1 below. This figure (taken from NIWA 2021 (a)) demonstrates the different variables that contribute to an estimation of extreme water levels and therefore inundation.
13. To assess the likelihood of a storm resulting in inundation the different variables are calculated by numerical models and calibrated against field measurements such as tide gauges. The probability of these all occurring at the same time is determined through statistical analysis.
14. With predicted sea-level rise the frequency of flooding to impact existing areas of development is expected to increase. In the Wellington region, this is compounded by ground subsidence which is in the order of 3mm/yr or 30cm per century across the region.
15. These values are then translated into the local survey datum and then plotted against contour information so that the extent and depth of inundation is able to be understood.
16. It is also worth noting that due to the coincidence of peak coastal inundation levels with high tide cycles these types of events are often predictable, albeit the effects may only be realised for a number of hours either side of peak high tide.

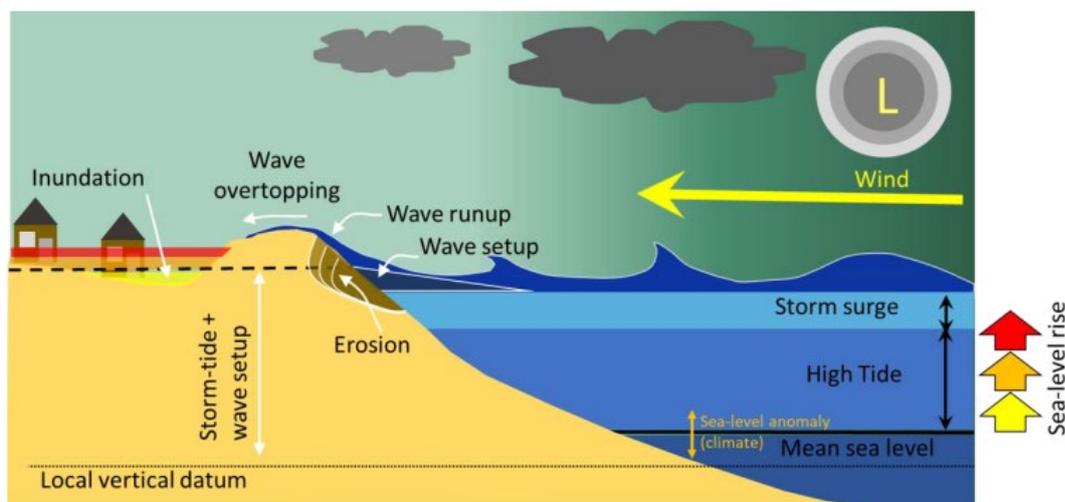


Figure 1: Components of coastal inundation (NIWA 2021(a)).

17. This means that the risk from coastal inundation will fluctuate across an area with changing land level and corresponding waters depths. Matters such as infrastructure and community vulnerability become important considerations over an inundation event.
18. In the case of the City Centre the depth of water and flows will vary across the area extent mapped with the changing topography and water ingress pathways between buildings. However, it is fair to assume that in general the deepest and strongest water flows will occur closest to the waterfront margins.
19. The mapped coastal inundation hazard overlays presented within the Proposed Plan are representative of a 1:100yr event (High) and 1:100yr event plus 1.43m (Medium) allowance for sea level rise (**SLR**). These include an allowance for wave set-up with some increased allowance for extreme weather conditions on the exposed coasts based on more dynamic modelling of wave set up. The mapped extent represents a combination of these variables occurring at high tide.
20. For the inner harbour areas NIWA took a more simplistic modelling approach because there is a lower energy setting. This type of coastal environment is likely to have much lower range of wave set-up and run-up components due to its sheltered nature. Brief analysis of this information indicates that much of the City Centre area will subject to inundation under storm conditions.
21. NIWA undertook a wave run-up analysis for the exposed areas of the coast within the investigations but this was not included in the Proposed Plan maps.

As I understand it this is because of the complex nature of the coastline and nature of wave run-up conditions made it difficult to assign return periods accurately.

22. However, events of a lesser magnitude are already known to impact the South Coast (Lyall to Owhiro Bay) and cause damage to homes and infrastructure. This part of the Wellington coast is more susceptible to such events due to its exposure to large southerly swell events.
23. Because of the frequency and consequences of current inundation events impacting homes and infrastructure, it appears that this coastline is at a greater **risk** to coastal inundation than the more sheltered parts of the coastline like the City Centre.
24. It is my opinion that as there is greater risk presented along the South Coast more stringent planning controls should be applied to this coastline. However, the Proposed Plan currently assigns the same high hazard ranking to respective parts of the South Coast and the City Centre. I consider that the coastal hazard risk for the City Centre is significantly less than the South Coast and amendment is required to the hazard ranking table. I address this further below in the amendments proposed to the hazard table.



Figure 2: Damage from coastal inundation at Owhiro Bay in June 2013 (Source: . https://en.wikipedia.org/wiki/2013_New_Zealand_winter_storm)

TSUNAMI

25. Tsunami events are typically generated by the displacement of water associated with events such as earthquakes and volcanoes. Depending on the scale and location of the event a long period wave (or series of waves) can be produced and impact coastlines.
26. GNS Science undertook an investigation into the probability of different sized tsunami events impacting the Wellington Coast. The focus was on events in the order of 1:100, 1:500 and 1:1000 return periods.¹
27. Once the size of these respective events was determined, the extent of ingress was determined from a baseline water level of MHWS. It is unclear if the likelihood of a tsunami occurring at the same time as a spring high tide peak was modelled by GNS Science.
28. In examination of Tsunami Hazard maps I have identified a discrepancy between the mapped hazard extent and what is described in Table 246 of the Proposed Plan. The mapped value for the High Tsunami hazard is the 1:100yr event plus 1m sea-level rise which is different to 1:100year event (with no sea level rise) described in the table below.
29. David Burbidge in his evidence noted that the High Hazard area shown in the Proposed Plan maps related to the figure contained within the GNS report of the 1:100yr plus 1m SLR event extent, but he didn't comment on the difference between the maps and the table.
30. The extent of the 1:100yr return period vs the 1:100yr return period plus 1m SLR event can be seen in the map presented in Appendix A. It is apparent the greater extent of the 1:100yr return period plus 1m SLR impacts significantly more properties.

¹ Return periods refers to the statically estimated time it would be expected to see an event of a certain magnitude to occur again. Annual Exceedance Probability is a different way of expressing the same statistical analysis.

Table 246: coastal hazard ranking for Wellington City Council

Coastal Hazard Overlay	Respective Hazard Ranking
Tsunami – 1:100 year scenario inundation extent	High
Existing Coastal Inundation Extent with a 1:100 year storm	
Tsunami – 1:500 year scenario inundation extent	Medium
Coastal Inundation Extent – with 1.49m Sea Level Rise Scenario and 1:100 year storm	
Tsunami 1:1000 year scenario inundation extent	Low

PROPOSED COASTAL HAZARD RANKINGS

31. The Introduction supporting the Hazard Rankings references the need to manage risk from coastal hazards under guidance from the New Zealand Coastal Policy Statement (NZCPS). There does appear to be some confusion over the direction from the NZCPS with a focus on a 1:100yr return period hazard events rather than consideration of coastal hazard impacts over at least the next 100 years.
32. Policy 25 of the NZCPS provides for subdivision, use and development in areas potentially affected by coastal hazards over at least the next 100 years. It includes to avoid redevelopment, or change in land use, that would increase the risk of adverse effects from coastal hazards. The NZCPS defines ‘risk’ as follows: “Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence (AS/NZS ISO 31000:2009 Risk management – Principles and guidelines, November 2009).”
33. The Ministry for the Environment’s *Coastal hazards and climate change: Guidance for local government* (2017) also discusses the identification of hazards and developing an understanding the hazard risk (being likelihood vs. consequence) over the next 100 years. To my knowledge neither specifically state that a 1:100 year return period event is considered to be a high hazard area.
34. By focusing on the 1:100 year return period the Proposed Plan has essentially ignored those areas which are currently affected by coastal hazards during storm events and that in the future will be impacted potentially numerous times a

year under relatively calm conditions and sea-level rise. For example, in Paragraph 22 above I discuss the example of increased coastal risk as a result of more frequent inundation occurrences along the South Coast. However, details around the frequency and degree of wave run-up events impacting this area are difficult to predict. I recommend further consideration is given to the mechanism and planning response to address hazard sensitive areas such as this.

35. In addition, the Proposed Plan does not take into account protection mechanisms that may be installed (such as sea walls), and that it is more likely that these will be considered in areas of significant existing investment to avoid inundation, including in the City Centre.
36. Accordingly, some areas such as the South Coast will have increasing amounts of consequence with increased frequency (i.e. risk) when compared to the areas in the City Centre, the majority of which will only be impacted during extreme weather events. The Proposed Plan's approach to assessing coastal hazards does not address the different risk profiles of these areas.
37. Since the Council Officers' and experts' assessments have focussed on the likelihood of hazards only, there appears to be no robust assessment of the risk from coastal hazard as defined within the NZCPS and what the implications of the different hazards acting upon different parts of the coast might be.
38. This could possibly lead to disproportionate planning regulations being applied to areas that have a low coastal hazard risk profile in comparison to those areas with a high coastal hazard risk profile. It could also lead to a misconception of the "risk" to the land subject to the hazard overlays.
39. Recognising the current level of information available pertaining to coastal hazard risk profiles around Wellington, I would recommend that the present-day coastal inundation extent with 1% AEP storm surge event and tsunami with 1% AEP event be used as the baseline for the planning framework until further information is available.
40. Upon comparison of the 1:100yr storm surge coastal inundation + SLR and the 1:100yr tsunami + SLR extent it appears the extent of water ingress is similar. I accept that a tsunami may have more "driving force" behind it but it seems fair to assume that the risk posed from such events will be similar in nature. Therefore,

it would seem rational to assign them the same hazard rating. Further, it is important to note that degree of SLR has not yet occurred and there is some uncertainty of the degree to which SLR will be realised, particularly beyond 50yrs. This scenario would be “medium” in the interim table below.

41. I consider that more detailed risk assessments which consider the likelihood and consequence of hazards across the district are necessary to inform the Proposed Plan. This should involve an assessment of types and degree of development and infrastructure subject to coastal hazards. Consideration should be given to the community dynamics in order to assess aspects such as values and vulnerability (for example, the “fixed” position of the Wellington City Centre and adaptation strategy proposed). Guidance for such investigations is provided by the Ministry for the Environment.
42. For these reasons it is my opinion that the current hazard rankings are inconsistent and at a coarse level. Accordingly, I have proposed the amended coastal hazard rankings table below as an interim measure until more detailed risk assessments can be undertaken. A definition of what the hazard rankings actually mean may also be useful to avoid misinterpretation of the plan for processes outside of its intended purpose.

Coastal Hazard Overlay	Respective Hazard Ranking
Existing coastal inundation extent with a 1% AEP event	High
Tsunami present day 1:100yr scenario extent	
Future coastal inundation Extent with 1% AEP storm event and 1.43m sea level rise	Medium
Tsunami 1:100yr scenario with 1m allowance for sea level rise	
Future coastal inundation Extent with 1% AEP storm event and 1.73m sea level rise	Low
Tsunami 1:1000yr scenario inundation extent	

OTHER MATTERS

43. Provision for those areas impacted by coastal erosion have not been dealt with under the Proposed Plan, and I understand this is outside the scope of Argosy, Fabric, Oyster and Precinct's submissions. However, I note the NIWA report (2021a) has recommended a 30m horizontal offset as a means of addressing the degree of erosion potential under a 1% AEP (1:100yr) storm event. A similar approach was adopted under the Auckland Unitary Plan, with site specific coastal hazard assessments required for works requiring resource consent. Coastal erosion susceptibility is also area specific, and this also needs to be taken into account.
44. The Ministry for the Environment guidance (2017) recommended that regional and district authorities work with communities to develop adaptation plans for the management of coastal hazards. An adaptation plan for Makara Beach has been developed using these guidelines but it is unclear how the plan has been incorporated into the coastal hazard provisions of the Proposed Plan.
45. In the past the implementation of these plans has been problematic due to the lack of legislative weight placed upon them through the resource consenting process because they are not part of the relevant regional or district plan. I can speak to examples of this from Auckland, Waikato and Gisborne regions.
46. Therefore, I recommend that reference within the Coastal Hazards chapter is given to recognising the value and giving some weight to the Makara Plan and any future adaptation plans developed in Wellington.
47. Site-specific coastal hazard assessments are commonly used in other district and regional plans across the country to enable hazard rankings (or other similar mechanisms) to be set aside if a site-specific assessment has been undertaken that demonstrates that the hazard ranking is not appropriate. An example of such an approach is contained within Chapter E36.9 of the Auckland Unitary Plan. I would recommend that such assessment be included within the objectives and policies and include that such work be undertaken by a suitably qualified and experienced professional following appropriate standard guidelines.

CONCLUSION

48. There are apparent inconsistencies and omissions in the current proposed coastal hazard rankings within the Proposed Wellington City District Plan.
49. This is in part due to the lack of understanding of the approach to assessing coastal hazard risk as defined within the NZCPS.
50. I consider that the Council needs to undertake a detailed assessment of coastal hazard risk in Wellington in accordance with the NZCPS. However, I have proposed an interim hazard ranking table until a more thorough assessment of coastal hazard risk can be undertaken.

DATED this 18 July 2023



Samuel Casey Morgan



LEGEND

- CR2021_91_Tsunami Hazard_Present_100yr
- CR2021_91_Tsunami Hazard_SLR1m_100yr

PROJECT

Coastal Hazard Provision
Assessment



PROJECT NUMBER

2-S8E00.52

SCALE

0 250 500 m

