

## OIA request (Sean Rush)

### Questions:

1. we're slow slip events discussed in the context of vertical land movement affecting relative sea level and planning as part of the drafting or peer review process for the 2017 MfE document?
2. if so, why were their effects omitted from the 2017 document and the 2022 update?
3. if not, can a reason why be provided?

### Responses:

- 1) Slow-slip events (which occur mainly in the south-eastern part of North Island) were considered for the 2017 MfE coastal guidance, but only in the context of providing more information on longer-term average or secular<sup>1</sup> rates of vertical land movement (VLM) for planning purposes. They were discussed with contributing author Emeritus Professor John Hannah and with the late Dr John Beavan and Dr Nicola Litchfield (GNS Science). Earlier in 2012, due to the paucity of information on coastal VLM rates, NIWA engaged these two GNS researchers to produce a summary report on VLM (Beavan & Litchfield, 2012), to improve our understanding of relative sea-level rise (RSLR). The focus was on understanding and estimating contemporary secular VLM rates from continuous GNSS monitoring at stations near to or at the coast (including slow-slip events), but also the report covered the long-term geological context in terms of abrupt land elevation changes from major earthquakes. The 2017 MfE coastal guidance relied on this report for the content in sections 5.2.1 and 5.1 and reproduced Figures 20-21 of the 2017 guidance, as there was no other nationwide summary of VLM at the time to estimate RSLR. Even with this updated information, the coverage around New Zealand was very sparse and even now, only the 4 main ports have co-located tide gauges and GNSS stations.<sup>2</sup>
- 2) For practitioners managing risks from coastal hazards and sea-level rise, the focus of the guidance is to provide estimates of the average inter-seismic VLM rates, where possible, along the coast to better estimate RSLR projections regionally (or more latterly locally). Slow-slip events can produce short-term changes to the underlying VLM rate (eg, Denys et al, 2020). Slow-slip events (which mainly affect the lower North Island) are one of several processes that can affect the local or regional VLM rate over time around New Zealand, which also can include deep-basin sedimentation, local subsidence from historic reclamations, or in other areas uplift process. Due to the transient nature and occurrence, spatial variability, and incomplete understanding of slow-slip events, they were not covered in detail in the guidance to be specifically assessed by the user in deriving RSLR projections. Rather, slow-slip events, to the temporal and spatial extents they occurred, are inherent in the monitored secular VLM rates and graphs presented in the guidance.

Recent research continues to highlight the lack of information that slow-slip events and other processes have on intermediate-term VLM rates across multiple decades (King et al, 2024; Naish et al, in 2<sup>nd</sup> review). The former reference concluded from the Pāuatahanui marsh study that the “record shows that sustained subsidence should be factored into projections of future sea level for the region and its consequences”.

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<sup>1</sup> Refers to the average underlying trend in between perturbations such as earthquake events

<sup>2</sup> Action 3.23 of the National Adaptation Plan includes a LINZ workstream to upgrade the GNSS stations at the 4 main port sites and up to six additional co-located GNSS stations at other tide-gauge locations around NZ

Across New Zealand's coastline, uncertainties in secular VLM rates (and even how to factor in future slow-slip events), along with the deepening uncertainty of future sea-level rise projections, are best catered for using an adaptive planning strategy for adapting to the rising coastal risk. An essential component in such a strategy, using dynamic adaptive pathways planning (DAPP), is an ongoing monitoring and review system to adjust the adaptation strategy, when necessary, according to a set of pre-agreed monitored indicators, which will usually include sea-level rise and the secular VLM rate. The 2017 coastal guidance and the 2022 interim guidance are underpinned by the DAPP approach, within an adaptive planning strategy, to work with such uncertainties on rates of change, across a range of possible futures (including secular VLM rates).

3) See response under 2)

### References

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