

Angus Gordon's response to Dr Rob Bell's comments on Appendix 1

With great respect to Dr Bell his assessment of my Appendix 1 appears to miss the principle reason for its existence. All three appendices were included as appendices, rather than in the main text so as to indicate areas where further consideration of the factors raised was needed in order to improve the ability to undertake coastal assessments at Kapiti. And, whether the available data and scientific understanding was sufficiently comprehensive and robust to justify the construction of 50 and 100 year hazard lines for the Kapiti region; particularly where those lines had the effect of potentially causing significant adverse social and economic adverse.

Had I wished to argue with Dr Shand's analysis, which was based on the approach currently adopted in New Zealand of projecting Absolute Sea Level (ASL) rise forward (albeit slightly modified for local conditions), I would have done so in the main text. Throughout my report I consistently made the point that Dr Shand had to work with limited data, information and assumptions and hence the projection of 50 and 100 year hazard lines reflected these limitations.

Rather than provide alternative calculations based on my own "opinions" (as Dr Bell seems to assume I was seeking to do) I recognised that Dr Shand's report(s) were most useful scoping studies and that Dr Shand professionally pointed to the uncertainties of the information he had to work with. It is also noted that the directives from Central Government seem to be unhelpful to consultants and decision makers as they place emphasis on the high range scenarios of the IPCC.

It is one thing to take a conservative approach to the forward projection of sea level rise but if this results in non-conservative social and economic impacts then it is incumbent on scientists to provide guidance to the decision makers as to the likelihood of a range of outcomes and the consequences of the community choosing any one of those outcomes, rather than to just advise on high range scenarios for ASL but leaving out assessment of the range of Relative Sea Level (RSL) rise.

The potential impacts of climate change on both current and future generations need to be considered. However a balance between the possible long-term physical and societal impacts (environmental, social and economic) also needs to be recognised. Therefore scientific advice to decision makers must provide an assessment of the uncertainties as to what may actually come to pass. The IPCC's range of projections was developed for just that purpose and the IPCC is careful to note that they are "projections" not predictions. Further, while the range of projections are based on the current "consensus of opinion", only the future will tell what the real situation will be. It is therefore important that advice be provided on the full range of projections and, to the best of our ability, also on what the likelihood of occurrence is for the elements of the range.

The purpose of the Appendix on sea level rise was to highlight that there can be a significant difference between ASL rise and RSL rise. To this end I specifically

listed a number of factors that could produce differences. In particular, the information available indicated that tectonic movements in the south of the North Island were potentially important factors when seeking to determine RSL and hence shoreline response.

Interestingly while Dr Bell recognises this he does not appear to realise that the reason I have focussed on it is because I am of the opinion it is important to understand the differences in how terms are incorporated when projecting forward. For example, the current scenarios for absolute sea level projections (IPCC) suggest an exponentially accelerating trend that is particularly noticeable for the modelling and assumptions of the higher range projection, whereas the information from Beavan and Litchfield seems to indicate a more linear forward projection for tectonic effects, until the next major earthquake..

It is important to note that some components of RSL rise, such as local effects and tectonic movements, do not necessarily follow the exponential projection trend of ASL rise advocated by the IPCC and hence it is vital to analyse the various components of RSL movement separately to obtain the best estimate of their future trends, before combining them to obtain the net RSL response. Clearly coastal shorelines are ignorant of the various components; they simply responds to the net RSL change. Hence RSL (past and present) is not likely to be a simple exponential function, and nor will the shoreline response be. Clearly, shoreline response can even include step functions as a result of other factors such as earthquakes. To this end I find Dr Bells criticism on the simple example I gave of just adding ASL and tectonic influences together to give an RSL, so as to demonstrate the point of the non linearity of some components and the possible linearity of others, somewhat curious.

The opportunity exists to propose a way forward to resolving the dilemma of having a methodology for a “best approximation” or, better still a range of approximations for historical and future RSLs at Kapiti; which is what is needed. I would have thought that by looking at the entirety of my comments and the methodology I was using overall it could be seen that I was not proposing a value, rather I was demonstrating issues, and methodologies, that needed to be considered; but that may be my fault for not making it clearer.

A key matter in the case of Kapiti is that an understanding of RSL rise is vital, not only for future projections but also when calculating /understanding historical shoreline trends. Clearly, the methodology used to project recession forward should be able to incorporate, and determine, the component of shoreline recession attributable to past RSL changes (that is, back-casting). The difference between that component and the actual measured historical shoreline trend assists in uncovering other factors in the sediment budget that may be causing recession, or even accretion. For example if the historical shoreline trend, calculated from considerations of recession due to historical RSL rise is greater than the actual, measured trend, then clearly there is additional sediment being added to the system, and vica-versa. Dr Bell unfortunately does not appear to have recognised my concerns that this matter needs to be explored as fully as possible.

I wish to note, at this juncture, that historically the approach to assessing shoreline recession, used worldwide by many practitioners, has been to determine the long-term shoreline trend and then simply add additional components for the impacts of future SLR rise plus other factors, such as storm demand and slope slumping. This has been the approach used by Dr Shand at Kapiti and so is in keeping with the conventional practice. My concern, and not intended to be a criticism of Dr Shand's work, rather highlighting a matter that has become increasingly apparent, is that in a location such as Kapiti where the RSL change may be sufficiently different to the ASL rise, it is important to examine the factors contributing to RSL change in more detail. I have no reason to not believe that Dr Shand would be of the same view.

My argument is that, with what the existing information suggests is a tectonically unstable region, such as the Southern region of the North Island, historical RSL change needs to be evaluated and applied to the historical component of shoreline movements before then projecting forward to obtain potential hazard lines, otherwise there is a risk of double counting. Further, RSL change should be used rather than ASL rise for future projection of likely shoreline evolution. I purposely chose to use figures from the existing reports to demonstrate that one could achieve quite anomalous results, depending on how the information was used. I note that in my appendix I used the word "anomalous" on several occasions, to make it clear that there was a need for further consideration of the relevant factors.

I now turn to Dr Bell's statements that some of my figures were based on "misinterpretations" of the Beavan and Litchfield report; I can but disagree. Dr Bell seems to have formed his own opinions on the Bevan and Litchfield information, in which he may or may not be correct. To this end, for example, I note that Dr Bell seems to attribute to me the statements regarding the extrapolation of trends based on information collected over the over the historical period of interest, whereas the extrapolation is that of Beavan and Litchfield. Further, it was Beavan and Litchfield, not I, who indicated that the trend is likely to continue for the next 50 to 100 years, and hence I did not misinterpret their work, simply used it in a particular manner to make a point.

I also note Emeritus Professor John Hannah's comments "Our best guess at this stage is....." in quoting this I am not seeking to criticise the Professor but rather to reinforce my contention that the ability to calculate the RSL change, both past and projecting almost 100 years into the future at Kapiti, with confidence, given the current understanding, is one of scientific judgement rather than one based on hard evidence or robust scientific understanding of the processes on the Kapiti coast. This in turn demonstrates the fragility of drawing uncertain 100 year "hazard" lines that so material impact on peoples property. Clearly there is a need to scope the full range of probabilities of outcomes, not argue about singular interpretations.

I am of the view there is little point in going through Dr Bell's comments in detail as they seem predicated on his assumption that I was putting forward firm

opinions rather than simply using the available information to illustrate the weaknesses in determining the historical and future RSL at Kapiti, and hence to meaningfully estimate shoreline movements. To describe my comments as “erroneous” is incorrect and misses the point. It is therefore unhelpful.

Matters that do require comment include Dr Bell’s paragraph 5 where he states “one can’t simply add a subsidence rate from a short term cGPS record onto that of a long-term global trend to get relative sea level rise”. I would have thought it obvious, given the totality of my comments, that I was simply illustrating a point. Further I again reiterate that the long-term projections of sea level rise being advocated are actually not based on direct extrapolation of historical information but rather they are exponential functions derived using modelling and assumptions and based on scenarios. Hence they are potentially as uncertain as the use of short-term records of tectonic activity. In addition it was Beavan and Litchfield who said that they expected the current tectonic trend in the region to continue over the next 50 to 100 years.

Further relevant comment is made in Dr Bell’s paragraph 6 where he addresses SLR trends. I note Dr Bell’s statement that the “recent sea level rise in Wellington has been compounded by the subsidence from SSEs. The past decade also corresponds to the length of cGPS records, which confirms this subsidence contribution to an increased rate, but prior to that it is not known what the subsidence from SSEs was for Wellington-nor how it may trend in the future”. As Dr Bell indicates, it is not known whether the evidence collected over the past 10 years is indicative of long-term trends. However it would seem from Beavan and Litchfield’s report that it could be one possible scenario. Clearly other credible scenarios also need to be examined.

However, it would be a pity to become distracted by arguments about scientific method, and peoples differing opinions when the main aim, and focus, should be to obtain an improved understanding of the range of possible RSL change outcomes for determining shoreline movements and their impacts on the community at Kapiti. This can only happen if all those with considered opinions on the RSL issue combine to develop a way forward to improve our knowledge of this important parameter.

As a general comment on Dr Bell’s discussions on ASL, interestingly there is currently growing to be much debate in Australia, and elsewhere as to whether the global mean sea level rises obtained by satellite measurements are representative. Dr Phil Watson has pointed to this dilemma and has carried out detailed analysis of tide records, including those from New Zealand. His overall conclusions (which have been peer reviewed and published internationally) are that over the past 3 decades there has been little change in the long-term trends in sea level rise and if anything his analysis shows a possible deceleration as demonstrated by some recorded data, rather than the acceleration Dr Bell indicates the New Zealand data may be starting to show (I note Dr Bell’s words of caution regarding the indications of acceleration). I am aware that Dr Watson’s research has sparked much controversy. I am also aware that some overseas researches are beginning to publishing information that tends to agree

with Dr Watson's position. I note here that Dr Watson is not a "climate change sceptic" nor a person who denies climate change. In fact the original purpose of his research was to demonstrate the agreement between the modelling projections, the satellite information and the actual measurements. Hence his views act to strengthen the position that there remain uncertainties as to the likely impacts climate change will make on sea level rise, and hence where in the range of IPCC scenarios the future sea level will fall.

Dr Bell takes issue with my comment that implies he is of the view that current trends will continue for the next 50 to 100 years. He is correct, my expression of the point I was seeking to make was poor and for that I apologise, I have no reason to believe, from Dr Bell's comments, that he has an opinion on the likely 50 to 100 year future RSL trend for the Kapiti coast. I also recognise, from the approach taken by Dr Bell in critically appraising appendix 1 that the manner in which I have framed my discussion has misled him as to the argument I was seeking to present.

Finally, I take the opportunity to point out that I was seconded to the Antarctic Division of the Australian Department of Science in 1976 because of my concerns in projecting historical shoreline information forward. The Antarctic Division was the area most involved in climate change considerations at the time. In 1987 I presented a paper on sea level rise and its relationship to the historical shoreline trends at a number of locations where we had undertaken studies (the paper included, what today I would describe as "basic", analysis of the Fort Denison records). This paper was included as a chapter in the CSIRO's book "Greenhouse 87" and was the only chapter on the topic. I am unaware that others were looking at this issue at that time. Further, in 1991 I was lead author of Engineers Australia guidelines on managing climate change in the coastal zone and was subsequently seconded to the Australian contingent to the IPCC. I was one of the Keynote speakers at the first Australian Conference on Practical Adaptation to Climate Change, and am a keen follower of the sea level rise arguments. In other words I have had a scientific "interest" in sea level rise and its impacts on the coast for over 37 years. So I do know how to use information to make a point. Hence much of Dr Bell's comments, while interesting, actually miss the thrust of the issue I am seeking to explore; the reliability of the current data and understanding for determining 50 and 100 year hazard lines that impact on the Kapiti community.

In conclusion, based on the issues raised regarding the robustness of RSL information for the Kapiti coast, clearly NIWA should, if it hasn't already done so, advise Central Government of the fragility of the determining 50 and 100 year hazard lines for the Kapiti coast given the current state of knowledge, and the potential impact of using such uncertain information on the social and economic wellbeing of the community. The current requirement to develop those lines also places the Council in a most invidious position.