STATEMENT OF BRYCE DEREK WILKINSON

1 My full name is Bryce Derek Wilkinson. This statement responds to the following general assertions relating to Dr Shand's 2012 report:.

- Dr Shand's report is fit for purpose
- The 'standard practice' precautionary approach is correct
- The precautionary principle justifies setting the rate of accretion to zero
- Dr Shand's 'predictions' are 'sound' predictions,

Qualifications and Experience

2 I hold the degrees of BSc(Hons) (1968), MCom, with first class honours (1970), and PhD (1976) from the University of Canterbury in the fields of Chemistry (1968) and Economics (1970 and 1976).

3 I was awarded a Harkness Fellowship in the late 1970s to undertake post-doctoral research in economics at Harvard University. In 2005 I was a Visiting Scholar at Mercatus Institute, George Mason University. I was recently made a Fellow of the Law and Economics Association of New Zealand. I am on the editorial board of *Economic Affairs*, the academic journal of the UK-based Institute of Economic Affairs.

4 I am a member, and past president of, the Law and Economics Association of New Zealand, a member of the American Economic Association, the New Zealand Association of Economists, the Institute of Directors, and the Institute of Finance Professionals NZ Inc. I am a past member of the New Zealand Stock Exchange.

5 My career has been in business and government rather than in academia. Since 1997 I have been a director of Capital Economics Limited, a Wellington-based economics consultancy firm. Between 1985 and 1997 I worked in a sharebroking firm that started out as Jarden & Co and was First NZ Capital when I left it to set up Capital Economics Limited. By 1995 I was a director and shareholder of First NZ Capital and head of its economic advisory unit. I started my professional career with a position in an economics division in the Treasury in 1970. At the time that I left Treasury in 1985 I had reached the position of director of the Internal Economics I Division.

6 My career has been analytically focused, specialising in economic analysis, public

policy and finance. My PhD thesis included a focus on monetary policy, risk preferences and risk analysis relating to portfolio choice and monetary policy.

7 During my time in Treasury, relevant specialist areas that I contributed to included monetary policy, project analysis (particularly in helping teach Treasury's cost-benefit tuition courses for public servants) and the choice of discount rate for risky public sector projects,. During one period of my time in sharebroking I was head of research, overseeing the firm's research on the pricing of risky assets - bonds and shares. Later, as head of the firm's economic advisory unity, I reviewed and applied the academic theory of risk to insurance markets in the context of examining New Zealand's accident compensation arrangements.[1]

8 Since 2001, a particular professional interest has been in the economic analysis of government laws and regulations.[2] I have engaged constructively frequently during the last decade with the government officials who have been responsible for improving the attempts by government agencies to understand and utilise cost-benefit assessments of regulatory laws. These assessments lie at the core of the government's regulatory impact statement requirement. Treasury has consulted me, informally, and on occasion formally, on development work it does on improving its cost-benefit guidance to departments.

9 In recent years I have been a member of the Government's Regulatory Responsibility Taskforce, the Government's ACC Steering Group, and the Government's 2025 Taskforce. Recently I have assisted the Minister of Regulatory Reform with economic advice. For a short period in 2011 I was acting executive director of the New Zealand Business Roundtable.

10 In this evidence I draw on my experience and such expertise as I have accumulated in regulatory analysis, risk analysis and cost benefit analysis to comment on the matters referred to in paragraph 1 above.

11 I have the background experience and expertise I have outlined above. I am a trustee of the family trust that owns the property at 65 Manly Street, Paraparaumu, one of the properties which is affected by the matters being disputed.

12 That property adjourns the distinctive cuspate that has been accreting for the past

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1 See for example, chapter 6 in *Accident Compensation: Options for Reform*, a report prepared by Credit Suisse First Boston for the New Zealand Business Roundtable in 1998. As noted at the front of that report, I was the principal author of that chapter.

2 I was the author of a 251-page 2001 report *Constraining Government Regulation* that proposed, *inter alia*, a Regulatory Responsibility Act for New Zealand.

6,500 years, according to Dr Roger Shand of Coastal Systems Limited. Whilst I am an affected party, the opinions in this statement are based on my professional expertise and experience.

13 I have examined, from a risk analysis and public policy perspective, Dr Roger Shand's Coastal Systems Limited report in 2012 (The CSL Report) for the Kapiti Coast District Council (KCDC). The KCDC used this report to justify annotating, from August 2012, any LIMs requested for around 1,800 properties.

14 I have particularly considered whether the KCDC's annotations to the LIMs of the 1,800 affected properties are likely to unreasonably mislead potential buyers as to coastal erosion risks in relation to these properties by failing to distinguish between a likely risk and a remote and speculative risk and by failing to provide relevant objective information relating to the coastal hazard risk.

15 I examine the relevant matters below under the following headings:

- Professional competence in risk analysis
- Distinction between likely outcomes and remote risks
- The meaningfulness of a precautionary approach
- Reasonableness of annotations to the LIMs

16 My conclusions on these matters are, in summary, that:

- Professional expertise in behavioural risk analysis has not been demonstrated in the professional inputs going into the KCDC's LIM annotations.
- Dr Shand's 'predicted' shorelines are not predictions – as statisticians and economists understand the term – they are projections.
- Dr Shand's shorelines are inland of what he would regard to be most likely shorelines – reflecting his 'conservative' approach, but he does not know how far inland they are in this respect.
- Dr Shand's projected shorelines are not worst-case shorelines, and to call them 'worse case' only begs the questions: 'worse than what and by how much? It seems that no one knows.
- The decision to annotate LIMs with projected shorelines 100 years ahead was not informed by careful consideration of the difference between likely outcomes and remote risks.
- How seriously a projection should be taken depends on the realism of the assumptions driving those projections. It appears that neither Dr Shand nor

KCDC have attempted such an assessment. It follows that neither party knows how realistic the projections are.

- In short, the lines on the KCDC's map do not represent knowledge; at best they are speculative pessimistic conjectures.
- Furthermore, the precautionary approach relied on by the scientists and the KCDC has no standing in the professional risk analysis literature, for example as reviewed by the OECD in 2010.
- One problem is that the precautionary approach provides no guidance as to whether the costs to the community of basing LIM annotations on a shoreline that was too far inland would exceed or fall short of the costs of making the opposite error. I have found no evidence in all the material I have reviewed that any cost calculations of this nature have been made. This calls into question all the adjustments made by Dr Shand, and others, on the basis of the precautionary approach.
- A major flaw that the OECD identified is that this approach unduly focuses attention on a few unlikely, even extreme, outcomes, neglecting consideration of benefits from more likely outcomes.
- The effect of this flaw is evident from Dr Shand's presentation of his single-projection approach as 'deterministic' rather than 'probabilistic'.
- As noted by Dr Willem de Lange, the Coastal Systems Ltd reports do not quantify risk. Instead they address uncertainties, and avoid any meaningful quantification of the probabilities associated with the results. The OECD's critique explains why it is essential for a sound risk analysis that that <u>all</u> plausible risky outcomes are considered.
- The use of the precautionary approach in order to justify arbitrarily setting long-standing accretion to zero is untenable in terms of mainstream risk analysis, as explained by the OECD.
- The same flaw is evident in the KCDC's appeal to the precautionary approach in order to justify requiring Dr Shand to do his projections on the basis of only the higher of the MfE's two recommended projections for sea-level rise in the next 100 years – 60 percent higher.
- This decision alone meant that Councillors were presented with only one set of possible outcomes in August 2012, and it seems clear from the KCDC's letter of 25 August 2012 that this single set of lines deceived the KCDC itself into considering that they represented likely shorelines.

- Even the lower of the MfE's projections is highly speculative, statistically speaking, as it assumes a rate of acceleration in the rate of sea-level rise that is far higher than statistically significant rate in the long historical record.
- In my opinion, the Council's failure to assess the reliability of the projections provided by Dr Shand, prior to reaching its policy decisions, was reckless to the point of irresponsibility from an economic and public policy perspective – given the magnitude of the potential cost to the community.

Professional competence in risk analysis

17 Annotations to LIMs based on adjustments for risk raise the question of whether those adjustments have a sound basis in human behaviour in regard to risk.

18 A training in natural science is not a training in the study of optimal decision-making under uncertainty by sentient human beings. Formal training in decision-making under uncertainty is provided by such disciplines as economics, operations research and finance.

19 I cannot find any evidence in The CSL Report that Dr Shand has specialist formal training in economics, operations research or finance. Nor could I see any evidence of familiarity with the standard approaches in these disciplines to risk analysis. For example, the standard approach in economics is to assume that decision-makers seek to maximise their expected utility over the entire range of utilities that they might experience from the entire range of (dollar) costs or benefit outcomes that could result from a risky decision, taking the decision-maker's degree of risk aversion into account. Moreover, individuals may differ widely in their degree of risk aversion.

20 The CSL Report ignores this mainstream approach entirely. It even fails the very first step of identifying the entire range of possible outcomes for future shorelines. It fails to put probabilities on each of the possible shoreline outcomes. It makes no attempt to assess the likely costs and benefits to the community from each of the possible outcomes. It does not even consider the degree to which the community might have off-loaded risks to insurers. It fails to review the findings of the economics literature as to what constitutes a plausible degree of risk aversion for the individuals who are members of the local community. As a result, it has no discernible evidential basis for determining what degree of risk averting behaviour in relation to sea-level rise is consistent with maximising community welfare. It follows that it has no discernible basis for determining what humans might regard

to be a 'conservative' estimate of the future position of the shoreline. I have been unable even to ascertain a meaningful definition for the term 'conservative estimate'. In whose opinion is an estimate conservative and how conservative is it?

21 Instead of adopting a mainstream approach to risk analysis, The CSL Report simply assumes that uncertainty as to the future sea-level shoreline is best dealt with by looking only towards one extreme of the possible shoreline outcomes. From a mainstream risk analysis perspective, this is absurd. No one invests in a risky asset, be it company shares or a coastal property, by considering downside risks alone.

22 An expert in the science of natural processes should be able to help decision-makers ascertain the full range of possible outcomes from those natural processes. The same expert might be able to use his or her experience and judgment to propose an objective or subjective probability distribution for that range of outcomes that can assist decision-makers.[3] No considerations relating to risk aversion should enter the construction of such a probability distribution. Risk aversion is a matter of human behaviour with respect to the costs and benefits humans might experience as a result of the outcomes from risky situations. Expertise in the science of natural processes provides no training in itself as to matters of human behaviour. In the mainstream approach, risk aversion only enters the analysis after the costs and benefits to humans have been assessed and a decision has to be made as to how much weight to put on costs relative to benefits to reflect risk aversion.

23 One defensive interpretation of The CSL Report is that it implicitly presumes that it will be less costly for the community to make the error of projecting a shoreline that is too far inland than it would be to make the opposite error. However, this is something to be proven rather than asserted, and no proof is provided by Coastal Systems Ltd. As just observed, such calculations of human cost and benefit are outside the expertise of someone trained only in the science of natural processes.

24 I conclude that the statements in The CSL Report and in KCDC's written material that relate to the appropriate adjustment for risk have no discernible economic, commercial, or public policy basis.

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[3] See for example, Saski, Kyohei, *Statistics for Modern Decision-Making*, Wadworth Publishing Company, 1968, pp 53-54.

Distinction between likely outcomes and remote risks

25 I do not consider a speculative conjecture to be knowledge. Knowledge is something that is known; generally it can be verified. NIWA reported in 2012 that no statistically-significant acceleration in sea-level rise can yet be detected for New Zealand.[4] The historic rate of relative sea-level rise in Wellington Harbour is only 0.203m per century. Dr Shand has referred to overall accretion around the Kapiti cuspate for the last 6,500 years. These are independently verifiable facts that I would regard as knowledge relevant to a risk analysis in this case.

26 The United Nations-based International Protocol on Climate Change (IPCC) has defined a *likely* event to be one that has a probability of more than 66 percent, but not more than 90 percent.[5] It is clear in this case that Dr Shand does not see his projection lines as being likely to occur. For a start they represent an enormous acceleration in the rate of sea-level rise, as already mentioned. That acceleration is scientifically and statistically conjectural, notwithstanding the strident opinions amongst environmental lobby groups and the advocacy of some scientists.

27 Last month I examined the IPCC's September 2013 assessment of climate change matters.[6] It reported that in 2011 one study found zero acceleration in the rate of sea-level rise globally between 1900 and 2010 and another study found only a near-trivial rate of acceleration of 0.012 mm a year. Both findings were statistically significant at the 90% confidence interval. The first estimate implies that the rise in the global sea-level in the next 100 years will be the same as in the last 100 years – which the IPCC reports was 0.17m. I calculate that the second estimate implies a global sea-level rise in the next 100 years of 0.29m. This implies that even the MfE's ignored 0.5m 'base case' recommended assumption for global sea-level rise is highly speculative, statistically speaking.

28 A December 2012 version of the KCDC's annotations to the LIMs that I have seen asserted that Dr Shand's projected lines represented a 'worst case' assessment. Yet the same version inconsistently said that upper estimates may *exceed* the assumed 0.9 meter rise. Either way, the projected lines are certainly not intended to show where the shoreline is *likely* to be in 50 and 100 years, using the IPCC's terminology. A worst case scenario would be more like one that had a 1 percent probability, or less.

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4 NIWA *Sea-level variability and trends*: *Wellington Region*, prepared for the Greater Wellington Regional Council, June 2012, pp 36-37.

5 http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1s1-6.html

6 See "Who's Afraid of Sea-Level Rise?", National Business Review, 11 October 2013.

29 I have also seen Dr Shand's projected shorelines referred to as a 'worse case' scenario. But this just begs the question 'worse than what, and by how much'?

30 The CSL Report confuses conditional projections with forecasts or predictions of likely outcomes. In correspondence with Dr Shand last year he commented that he saw the terms projections and predications as synonymous. This indicates that he was not familiar with the standard distinction in statistics and economics that predictions or forecasts are assertions about what is likely to happen or going to happen – whereas projections are merely implications of assumptions that might or might not be realistic. I attach as "Exhibit 1" below a useful explanation by the Australian Bureau of Statistics of the distinction between forecasts and forecasts.

31 In my view it is clear that Dr Shand's future shorelines do not **predict** where the actual shoreline is likely to be. The Council has appeared to acknowledge this by now referring to the shorelines as 'projected'.

32 However, the KCDC's decision to include this information on LIMs clearly interpreted the lines as predictions, representing something that is likely or highly probable. This is evidenced by the KCDC's letter to me of 25 August 2012, a number of references by officers and publicly by the Mayor using the word "likely" and by use of the word "predicted" [Second para of EJT5 "…*it predicts where the shoreline is likely to be*" and EJT6 reference to appendix 2 showing *Predicted shoreline maps*]

33 Nor are the sea-level rise projections that the Ministry for the Environment recommends be used for coastal hazard assessments *predictions or forecasts*. They are instead based on scenario-based projections of possible global sea-level rise by the IPCC. The IPCC is very clear that it is producing projections, not forecasts. Its projections encompass scenarios that assume no mitigation of CO2 emissions and no defensive adaption mechanisms by local communities. Dr Shand does not give any indication that he is aware of the potential significance of these limiting assumptions.

34 It is apparent that the KCDC and the scientists have no clear idea of what level of probability should be attached to Dr Shand's projected lines. As a result the KCDC's LIM annotations fail to inform potential buyers adequately as to the reliability or otherwise of the projected lines.

35 I conclude that the KCDC did not properly inform itself as to the reliability and probability of the projections when reaching its LIM decision. Furthermore, in my

view, it is not responsible for a local authority to present the 100-year projections as if they are as reliable as the 50-year projections. The case for putting the 100-year projections into the LIMs seems to be extraordinarily weak. Finally, reliance on a single set of projections of this speculative nature is likely to mislead potential buyers and policy makers alike about likely outcomes, with otherwise avoidable adverse effects on restrictive policy decisions and on house prices.

The meaningfulness of a precautionary approach

~~36~~ Dr Shand asserts that his adoption of a precautionary approach to existing uncertainties is appropriate. However, he fails to acknowledge criticisms of this approach in the mainstream risk analysis literature, let alone respond to them.

37 In 2010 the respected Organisation of Economic Cooperation and Development (OECD), published a report on risk analysis. It included, in a chapter 3, a lengthy critique of the precautionary principle compared to the mainstream economic approach to risk analysis.[7] (The OECD is a Paris-based government-funded international organisation that specialises in economic issues relating to applied public policy.)

38 One summary conclusion was:

> This principle violates basic principles of the logic of decision-making under uncertainty; it disregards the opportunity cost of precautionary measures; it fails to take the potential benefits as well as the potential losses into consideration; not least it greatly complicates the already difficult problem of setting regulatory priorities.

39 The OECD stressed the superiority of the mainstream approach which takes into account "both the losses and probabilities of all events". Precautionary approaches disregard relevant information "by considering only the worst possible case, disregarding probabilities". … "In particular, the overestimation of low probability events has substantial [adverse] implications for public policy."

40 The OECD's critique considered that the most basic flaw of this approach was the artificial distinction it drew between situations where the level of scientific information is sufficient to permit a formal risk assessment and where it is not. It considered these situations to be differences in degree rather than in kind. It considered that a (subjective but transparent) Bayesian approach to these situations would be much better.

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7 Chapter 3 Strategic Issues in Risk Regulation and Risk Management, Prof Giandomenico Majone, European University Institute, Florence, Italy in *Risk and Regulatory Policy: Improving the Governance of Risk*, OECD 2010.

41 It follows that Dr Shand was not justified in terms of mainstream theory in setting accretion to zero on the grounds that it was not well understood. This was not a scientific decision. Nor, as the OECD report has indicated was it a sound statistical decision. There is long-standing evidence of accretion and it should not be treated as being of zero significance. To do so was not a risk assessment; if anything it was a policy decision. The same verdict applies to the KCDC's decision to adopt the MfE's higher recommendation for sea-level rise projections, but not its lower one. Relevant information about possible outcomes should not be ignored.

42 In short, the KCDC's 'precautionary approach' is not consistent with the standard text book economic treatments of decision-making under uncertainty. These treatments do not ignore the likelihood of less adverse events, which is what the KCDC's projected shorelines do. To the contrary, they seek to identify all relevant aspects of the probability distribution. They also seek to assess the consequences of each possible outcome.

43 The KCDC's approach focuses on projecting an adverse event, largely ignoring the question of the outcome. This is a serious omission. The KCDC does not seem to consider that the consequences of the projected erosion in 100 years might be minor, even miniscule, in present value terms. The long lead time creates much potential for risk to be reduced by protective and adaptive works, phased relocations, and options for risk sharing and income growth.

44 Policy 24 in the National Coastal Policy Statement, 2010, requires the KCDC to give priority to identifying coastal areas "*of high risk of being affected*". Dr Shand's report makes no such probabilistic assessment (even in relation to the 50 year projections). Yet the KCDC's unexamined assumption appears to be that the consequences will be enormous, potentially to the point of creating a 'high risk'. Mr Dahn [75] recognised the relevance of the 'high risk' aspect, but he also assumes rather than establishes a very high cost from future projected erosion. Even then he appears to consider that Dr Shand's projections are probably not a high risk because of the issue of accretion.

45 To focus the attention of potential buyers on one possible adverse outcome, which is what Dr Shand's lines do, is as unreasonable as proposing that an investor in the sharemarket should focus on how much share prices might fall, ignoring the possibility that they might go up.

46 Nothing I have seen in KCDC's evidence addresses such criticisms of attempts to apply a precautionary approach to risk assessment.

47 The apparent justification for the approach is policy 3 (precautionary approach) of the NZCPS 2010. However, that justification confuses managing coastal activities with assessing natural hazard risks. Policy 3 only applies to the former.

48 I conclude that the risk analysis in Dr Shand's report is anything but fit for purpose. The mainstream approach to risk analysis outlined by the OECD is fit for purpose.

Reliability and reasonableness

49 The CSL Report's assessment of consequences seems to be effectively non-existent. I fail to see how a competent peer review of that report informed by knowledge of mainstream risk analysis techniques could have missed the well-documented problems in the literature with the tunnel-vision precautionary approach.

50 The KCDC's LIM annotations affect around 1,800 properties with a possible market value approaching $2,000 million, prior to their being imposed. The potential implications for property values of fears of a sharp acceleration in sea-level rise, as hypothesised by Dr Shand and promulgated by the KCDC are significant. Even a 10 percent reduction in property values indicates that the community considers the amenity value of those properties has fallen by $200 million in present value terms.

51 In my opinion it is highly misleading and unprofessional to focus investors on a single 'worst case' projection line when they are considering a risky investment, particularly when important information factual relevant to assessing the likelihood of that 'worst case' projection is unreasonably withheld.

Conclusions on general assertions

52 I conclude that The CSL Report is not fit for the purpose of public policy decision-making, the precautionary approach it adopts is an incorrect approach to decision-making under uncertainty and does not justify setting the rate of accretion to zero, and that far from making sound predictions, its projected shorelines are not even predictions.

Dr Bryce D Wilkinson

Exhibit 1

The Australian Bureau of Statistics: **What is a projection?**

A projection indicates what the future changes in a population would be if the assumptions about future trends actually occur. These assumptions are often based on patterns of change which have previously occurred.

For example: Data collected about the total number of store locations for a retail chain over three years show an increase from 8 stores in first year, to 12 stores in the second year, to 18 stores in the third year. It could therefore be projected that if the chain continues to expand following the same pattern of increasing by half (50%) each year there will be 27 stores after the fourth year.

A projection is not making a prediction or forecast about what is going to happen, it is indicating what would happen if the assumptions which underpin the projection actually occur.

Comparison of Projections and Forecasts

Type of Information	The Difference	Nature of Assumptions
Projections indicate what future values for the population would be if the assumed patterns of change were to occur. They are not a prediction that the population will change in this manner.	While both involve analysis of data, the key difference between a forecast and a projection is the nature of the assertion in relation to the assumptions occurring.	A **projection** simply indicates a future value for the population if the set of underlying assumptions occur.
Forecasts speculate future values for the population with a certain level of confidence, based on current and past values as an expectation (prediction) of what will happen.		In a **forecast**, the assumptions represent expectations of actual future events.