BEFORE THE HEARINGS COMMITTEE

IN THE MATTER	**of hearings on submissions concerning the proposed One Plan notified by the Manawatu-Wanganui Regional Council**

SECTION 42A REPORT OF ALLAN DAVID COOK
ON BEHALF OF HORIZONS REGIONAL COUNCIL

My qualifications/experience

1. My name is Allan David Cook. I am the Group Manager - Operations for Horizons Regional Council (HRC). I am responsible for managing Council's river and drainage engineering functions.

2. I hold a New Zealand Certificate in Engineering (Civil) and a Diploma in Business Studies (Local Government Management). I am a Registered Engineering Associate.

3. I have in excess of 35 years of experience in river engineering throughout the Manawatu-Wanganui Region at a practical, technical and managerial level.

4. I have carried out many investigations of river behaviour, have designed and supervised the construction of river engineering works, have managed many river scheme capital works and maintenance programmes, and have participated in the development and review of many river management plans. I have developed and led the public consultation programmes for a number of significant flood protection projects throughout the Manawatu-Wanganui Region.

Scope of evidence

5. My evidence will relate to my involvement in addressing the loss of flood channel capacity in some major flood protection schemes, as a direct result of the deposition of silts and gravels derived from upper catchment erosion.

6. In particular I will refer to my experience following the widespread and extreme storm event of February 2004 that impacted on most of the Region's large river systems. I will refer to the substantial costs to be incurred by the Region's communities in mitigating the effects of the silt deposition through short-term measures.

7. I will also refer to the inevitable increased risk to property, life and infrastructure in the event that longer-term sustainable solutions cannot be identified.

1. INTRODUCTION

8. River engineers are acutely aware that in designing flood protection schemes on flood plains they are interfering with the natural erosion/deposition processes that have created those flood plains. Those natural processes were occurring long before land

development created a need for flood protection schemes and will continue indefinitely, irrespective of any human intervention.

9. The containment of flood flows within narrow flood channels will obviously result in a more rapid aggradation of land between the flood defences than occurred on the previously unconstrained flood plain. Accordingly the designers of flood protection schemes have always understood that the service level of their works would either progressively decline with time or alternatively, the defences would need to be progressively upgraded to maintain original design standards.

10. However the construction of the flood protection schemes within New Zealand has followed reasonably closely upon the clearance and intensive development of the respective upper catchments, and the effect of that development on the rate of upper catchment erosion and resulting flood plain building may not in all cases have been fully understood.

11. Optimally, communities should not have developed on flood plains to the extent that major flood protection works have become necessary. The reality is however that many major communities in New Zealand have developed in highly flood-prone areas and there is now no practicable option other than to provide a level of protection for them.

2. DISCUSSION

12. Horizons Regional Council manages nine flood protection schemes throughout the Manawatu-Wanganui Region. Two primary flood protection methods are employed. In five schemes, flood control is achieved through peak flow reduction by the storage of flood water in detention dams. In all other schemes, control is achieved through the use of conventional stopbank structures and associated flood spillways and ponding areas.

13. Flood protection assets owned and maintained by the schemes are valued at $93 million and include 437 km of stopbanks and 52 detention dams.

14. The schemes are designed to varying protection standards, with rural standards ranging from 5% Annual Exceedance Probability (AEP) to 1% AEP. Large urban areas are typically protected to the 1% AEP standard; however in the case of Palmerston North City, a very high standard of 0.2% AEP has been agreed.

15. For some years, measures have been in place to address progressive loss of flood capacity in certain flood protection schemes. For example a 20-year programme of stopbank upgrade work on the Rangitikei scheme was commenced in 1990. That programme was designed in response to a measured average annual increase of 30 mm in the mean bed level of the stopbanked section of the lower river. Within the detention dam schemes, large volumes of silt have been removed periodically from the ponding areas of certain dams where storage capacity has been compromised. On the Oroua River, stopbanks were raised in 1975 in response to capacity loss resulting from silt and gravel deposition, and other measures were implemented to minimise the aggradation problem. Very large volumes of silt gravel were removed from the Oroua River in the vicinity of Kopane following the substantial loss of capacity during the 1999 flood.

16. However the real extent and magnitude of the aggradation problem became much more apparent following the February 2004 floods. That extreme storm event extended across a large proportion of the Region, and produced peak flood flows that exceeded the design parameters for a number of schemes.

17. Extensive investigations have been undertaken on our major river systems since the 2004 flood to accurately determine post-flood channel capacities; to determine the present standard of protection provided; and to facilitate design work for upgrade options. Some startling results have been obtained.

18. On the Oroua River, it has been found that the standard of flood protection, originally designed to 1% AEP, is presently as low as 10% AEP through the Kopane aggradation reach. It has been found that on average, 15,000 m^3 of gravel and 15,000 m^3 of silts have been deposited each year in that 15 km reach over a period of 20 years up until the 2004 flood. Furthermore it has been assessed that an additional '20-year's worth' of silt (300,000 m^3) was deposited on the flood berms in the one flood event in 2004.

19. Of even greater concern is the extremely disturbed state of the upper Oroua catchment following the 2004 storm and the likelihood that will result in accelerated erosion and increased silt deposition on the flood plain for some years to come. Indeed observations of silt deposition on recently lowered and levelled flood berms, following post-2004 moderate floods, would suggest present deposition rates could be double the long-term average. Silt drops in some localised areas have been as great as 500 mm in a single flood event. Channel re-surveys scheduled over the next 10 years or so will confirm whether or not there has been a significant increase in berm aggradation rates.

20. Future management proposals for the Oroua River include provision for the perpetual removal of silt at an average annual rate of 15,000 m^3 from the aggradation reach. That will cost an estimated $100,000 per year. While that is a costly proposition, it is preferable to continually raising stopbanks and thereby increasing the risk of catastrophic failure. There are good engineering and economic reasons for not continuing to raise stopbanks. The scheme may possibly be able to afford the level of silt removal work currently proposed; however, if presently indicated elevated levels of deposition are maintained for an extended period of time, then there will be no choice but to accept a progressive loss of capacity; increased risk of flooding; and increased risks to property, life and infrastructure.

21. On the Manawatu River main stem, the silt deposition problem extends over the 32 km reach between Longburn and the Moutoa Sluicegates. Silt deposited in that reach over the past 10 years has totalled 1.6 million m^3. The estimated cost to remove material at the rate of deposition is $800,000 per year. Those costs are unaffordable by a community that is already burdened with very high capital works costs to reinstate basic flood protection to an appropriate standard. At the present time, the silt problem is being addressed by way of a 20-year aggradation allowance incorporated in the design for stopbank upgrades. The annual cost of that provision is less than that for silt removal but nevertheless very substantial. Beyond 20 years, the aggradation allowance will have been absorbed and the design standard of flood protection will progressively decline unless silt removal measures are implemented. Again it is likely that engineering considerations will preclude the further raising of stopbanks.

22. On the Rangitikei River, investigations following the 2004 flood confirmed a long term average of approximately 30 mm per year of silt deposition through the lower aggradation reach. That aggradation has a very real and direct impact on the performance of the flood protection scheme. As in the Manawatu scheme, a 20-year aggradation allowance has been included in the design of upgrade works to reinstate the standard of protection previously enjoyed. The works will cost the small community involved in excess of $6 million over the next 20 years.

23. The silt management measures proposed in each of the three river systems referred to above should be regarded as no more than short-term measures. In particular, the inclusion of an aggradation allowance in the design for flood protection on the Rangitikei and Manawatu Rivers is only ‘buying time’ while a more sustainable solution is found. I

am convinced that ultimately the sustainability of the flood protection schemes concerned will hinge on our ability to achieve a long-term reduction in the rate of erosion in the catchments concerned. It is possible that the removal of sand and silt from the active channel and flood berms may become more economically viable in the future; however it would make more sense to use the limited time available to focus on more environmentally friendly and more sustainable methods of river management.

24. I acknowledge that a significant proportion of the silts and also the gravels that are causing problems on the flood plains are derived from lateral channel erosion, and in some instances from bed degradation in the mid-catchments. Unfortunately there is no way at present of quantifying the relative proportions; however it is my view that in the Oroua River at least, more than 50% of the silts are derived from accelerated erosion in the upper catchment. That assessment is largely based on the high proportion of sand in the aggradation zone deposits, and the very visible, active and extensive erosion of sandy soil types in the upper catchment. Furthermore an erosion protection scheme on the middle reaches of the river limits the opportunity for lateral channel erosion.

25. I am less certain as to the source of silt deposited in the Lower Manawatu River main stem. As for the Oroua River, there is an erosion protection scheme on the lower and middle reaches of the Pohangina River that limits the opportunity for lateral erosion, and there is known to be little transportation of sand through the Manawatu Gorge in flood events. It is therefore my view that a very significant proportion of the problem material is silts/sands derived from accelerated erosion in the upper Pohangina and Oroua Rivers, and to a lesser extent silts emanating from the upper Manawatu catchment.

3. CONCLUSION

26. The consultant engineer (AC Consulting Ltd) who undertook the post-2004 flood investigations on the Rangitikei River referred to reports that there had been a 30% increase in the area affected by landslides in the mid to upper Rangitikei catchment following the flood. The consultant concluded that there would be a proportionate increase in the sediment supply. Inevitably that will result in a significant contribution to the aggradation problem in the lower river. The best scenario is that the slug of material emanating from that substantial upper catchment disturbance will be smoothed as it travels downstream, and that the presently understood long-term average rate of bed level increase in the lower river will be maintained. However another and more likely scenario is that the sediment supply to the lower river will be elevated for some years,

and that the 20 years of aggradation allowance built into the scheme will be absorbed over a much shorter period.

27. Assuming that a significant proportion of the silt and sandy material that is compromising the effectiveness and increasing the cost of flood protection schemes on the floodplains of the Region's major rivers is derived from other than natural erosion processes in the upper river catchments, any initiative that has the potential to reduce that erosion and minimise sediment loadings in the river systems should be applauded.

28. As a river engineer and manager, I recognise the very real limitations of engineered solutions to flooding problems and consider sustainable catchment management essential.

Allan Cook
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