

BEFORE THE MANAWATU-WHANGANUI REGIONAL COUNCIL HEARINGS PANEL

IN THE MATTER OF the Proposed One Plan of the Council

STATEMENT OF EVIDENCE — GARY JOHN WILLIAMS ON BEHALF OF WELLINGTON FISH & GAME COUNCIL

INTRODUCTION & QUALIFICATIONS

1. My name is Gary John Williams. I practice as a consulting engineer specialising in the field of water and soil engineering. I hold the qualifications of Bachelor of Engineering, Bachelor of Science and Master of Commerce. I am a member of the Institution of Professional Engineers New Zealand. I have worked for the Water and Soil Division of the Ministry of Works and catchment authorities in New Zealand, as well as overseas.
2. Since 1987 I have practiced as a self-employed private consultant. I provide advice, investigation, design and construction supervision services to regional and district councils, government departments, commercial firms and private individuals, as well as providing expert evidence.
3. Over the last 35 years I have had extensive experience on many rivers throughout New Zealand, covering all aspects of river management and flood mitigation, including comprehensive investigations, design work, construction supervision, and reviews, and I have undertaken bridge waterway investigations on many bridges and culverts.
4. In recent years, as a consultant, I have carried out comprehensive investigations of river behaviour and river management practices, and undertaken final design and construction supervision for major works on many rivers, including the Waitara, Whanganui, Manawatu, Ngaruroro, Ruamahanga, Waikanae, Otaki and Hutt rivers. I have carried out many investigations of flood hazards, from large rivers to small streams and urban waterways, as well as reviews of flood hazard assessments and flood mitigation schemes.
5. I have carried out a number of studies for the Ministry for the Environment [MfE], as part of the government review of the management of flooding in New Zealand, including asset management, hazard identification, infrastructure exposure and

training. I have just completed a study for the Ministry of Agriculture & Forestry on the implications of a changing climate for drainage schemes.

6. I have been commissioned by the Wellington Fish and Game Council to provide expert engineering advice, and prepare this evidence on the Beds of Rivers and Lakes provisions of the One Plan, and the Environmental Code of Practice for River Works.
7. In this evidence I will provide comment on river management in New Zealand and overseas, with particular reference to the impacts on the natural character of rivers and their margins. This will include an historical perspective on river and catchment management in New Zealand, and examples from the Horizons region and elsewhere in New Zealand
8. The main findings of my evidence are as follows:
 - River management in New Zealand, as generally practiced at present, has a single focus, on the protection of land and assets. This narrow perspective is detrimental to the efficient and effective achievement of this protection aim, while giving rise to practices that unduly, and unnecessarily, impact on other values of amenity and ecological well-being.
 - The risks from natural hazards remain relatively high in New Zealand, despite the management schemes and hazard mitigation measures in place. The vulnerability and difficulties in maintaining existing standards will be increased if the projections about climate change even partly eventuate. River management also requires a long term commitment, with continual interventions and repair or re-instatement after flood damage.
 - The Resource Management Act [RMA], as a regulatory framework, has not significantly changed the focus of river management or the practices used. Regional plans can be used to give effect to a wide range of objectives based on cultural, social, environmental and economic values. However, the implementing rules have to be leading and proactive to achieve better outcomes and enhancement, rather than being focused on 'bottom lines' and preventing further deterioration or loss.
 - The preservation of the natural character of rivers and their margins is a matter of national importance under the RMA. Despite this, there has been very little, if any, consideration of natural character or monitoring of impacts on natural character – at central or regional government levels.
 - Defining natural character is not straightforward, as it arises from the dynamic interplay of riparian, catchment and climatic influences. It is also reach specific, where these influences remain relatively similar. However, a methodology for a reach-by-reach determination of natural character, and for a more detailed characterisation of channels, could be developed for New Zealand rivers.

- For the POP to be effective in terms of natural character, and for the environmental code of practice (referred to in the Plan) to be useful for multiple objective planning, an explanation and definition of natural character should be added into the Plan.
- Studies on the natural character of rivers should be undertaken, as part of the research effort of the council that backs up its planning and other statutory functions.

RIVER MANAGEMENT

9. There are a large number of river management schemes in New Zealand, which vary greatly in the type of measures used, the extent and complexity of the schemes, and their comprehensiveness. Most schemes, and all the larger schemes, were implemented or upgraded under the Soil Conservation and Rivers Control Act (1941) and amendments. There were substantial contributions from central government to the costs of these schemes, and over time the schemes became more integrated and comprehensive, with an emphasis on a catchment-wide management of all aspects of the utilisation and conservation of water and soil resources.
10. The involvement of central government ceased in the late 1980s, with all responsibilities for scheme maintenance and river management being devolved to regional councils. Scheme funding shifted to the regions and local beneficiaries, under new acts of Parliament [Rating Powers Act (1988) and most recently the Local Government Act (2004)]. Since then, there have been very few new schemes, and in general regional councils have concentrated their river management efforts within existing schemes.
11. In recent years, there has been a trend towards the more integrated and comprehensive approaches of the 1970s and early 1980s. There has been a renewal of interest in water and soil conservation farm plans, with some incentive funding, but now with a more holistic and wider perspective.
12. The river management practices developed under the earlier regime of a National Authority and regional Catchment Boards have not changed much in the last two decades. At times, practices have become less effective and more impacting on the river environment, due to losses of institutional knowledge, and an inadequate passing on of knowledge and practices with staff changes. There are no formal guidelines or published documents on the principles and practices of river management, as applied in New Zealand. Books and manuals that were published in the past have not been updated or re-issued.

13. The Resource Management Act (1991) has changed the context in which river management works are undertaken, and through this act conditions have been applied to avoid or mitigate environmental effects. The authorisation of scheme works and other river works through the RMA has developed and changed over time. In general, there has been a shift from individual consents for works, to global consents for schemes or activities (such as the extraction of gravel bed material from rivers) to plan authorisations.
14. This RMA control over river works has affected the extent and timing of works, and general procedures around the use of machinery in waterways. It has, though, been more about preventing further environmental deterioration, or maintaining “bottom lines”, and has had little impact on general practices and the approaches taken to the protection of river banks and land from erosion, and the mitigation of flooding. As a regulatory procedure, it has not been effective in bringing about alternative or better practices that enhance the river environment and add to the diversity and amenity values of waterways.
15. In response to the procedures and requirements of the RMA, there have, however, been some initiatives in terms of environmental impacts, such as the development of environmental codes of practice for river works. This has provided guidelines to field operators on how to undertake works while minimising or avoiding adverse environmental effects.
16. Horizons has such a code of practice, as do other regional councils, and they provide a formal reference document, as well as an operational manual. Regional plans can then refer to these codes, and incorporate them into the environmental mitigation procedures of plans.
17. The codes are, however, focused on specific types of works and how best to undertake them in terms of environmental impacts. They do not, generally, consider cumulative effects and how they should be managed, although the extent and intensity of works along reaches of rivers can be incorporated into these codes. Often the environmental effects arise from the intensity or extent of activities (in space and over time) and the disruption or loadings they cause. For example, the disruptive impact of fine sediment deposits in gravel bed rivers arises from the duration and extent of the deposits, and period of time before they are broken up by flood events.
18. The codes are not manuals or guidelines for the management of rivers for multiple objectives, including ecological and amenity values, aquatic and margin habitats, or social and recreational benefits. The focus is on works that protect land from

erosion and flooding, and the type of works used within schemes in particular, and not on an overall enhancement of waterway values.

19. The RMA consent procedures and codes of practice do shift attitudes and widen the perspective of practitioners, but this regulatory framework is not really encouraging of enhancement practices, or of a multi-objective approach to river management. Where the RMA can be used to promote better practices and a wider perspective is in regional plans, and the objectives and policies of those plans. The rules of plans must, though, effectively implement the policies, and not simply prevent further environmental losses or degradation of landscapes and waterways. From my experience with many regional councils around New Zealand, the plan objectives are too often lost through a concentration on specific details in the rules, and the defining of particular requirements. I will note some examples of this with reference to the One Plan later.
20. In my opinion, river management in New Zealand suffers from too narrow a concentration on flood mitigation schemes and the protection of land, assets and people from the hazards of erosion and flooding. A wider perspective with more appreciation of the system dynamics, inter-relationships and linkages of catchment and waterway processes would improve the effectiveness of hazard mitigation measures, while giving rise to better environmental outcomes.
21. When the RMA was enacted, and the National Water & Soil Conservation Authority disbanded (along with its servicing agency in the Ministry of Works & Development), there was a perception, or assumption, that the major works of river management and flood mitigation had been completed. It was thought, at least by some people in government, that the major expenditure on these matters was over, and the costs of scheme maintenance and the mitigation of natural hazards would in the future be relatively minor.
22. In reality, the major expenditure is the on-going river management, and not the construction of the flood containing stopbanks or other control structures, and continual expenditure is required to repair protection measures and maintain a given standard of protection from flooding and erosion losses. River management requires continual active intervention, especially in New Zealand, given the high energy and activity level of our rivers, and our reliance on vegetative techniques and in-channel works.
23. Despite the measures put in place by schemes, and the on-going expenditure by regional councils, infrastructure authorities and other organisations or individual landowners, the risks from natural hazards remain relatively high in New Zealand. There are significant residual risks of flooding and erosion damage even within

major scheme areas, while many river management schemes provide a relatively low standard of protection.

24. The dynamic nature of river processes and the natural migration trends of rivers means that any river management requires a long term commitment, with annual maintenance works, damage repairs after flood events and major reinstatement after large flood events. The natural channel form of rivers and their rates of sediment transport change significantly during periods of more frequent and intense floods, compared to more quiescent periods, and there are longer term oscillations in the NZ climate that give rise to distinctly different flood patterns. These longer term changes have to be taken into account in any management of river systems.
25. The 2004 flood events demonstrated the changes generated by large floods, and the vulnerability of land, assets and people, even within major scheme areas. River channels were blown apart by these events, with major changes in channel form and very large sediment movements, for example on the lower Kiwitea and Oroua rivers. Along the Rangitikei River there were large breakouts from the confined channel form of the management scheme, with wide embayments formed beyond the pre-existing channel. The pronounced hooks in the channel form from this flood re-working, with sharp cross-overs from one side to the other, has given rise to a channel condition that is very difficult to manage. Large floods in the Mangatainoka River have also demonstrated the mobility of this river channel, and the large changes in channel form that can occur in flood events, giving rise to continual and substantial river management interventions.
26. I could give many more examples, from throughout New Zealand, of the highly changeable nature of most of our rivers, and the constant intervention that is required to maintain even relatively low standards of protection from flooding and erosion losses. River management is very much an on-going job, and the measures generally used in New Zealand (of edge vegetation and in-channel works) have direct impacts on the river environment.
27. The projected changes in the climate (globally and hence locally) indicate that our difficulties in protecting assets and people from flooding and erosion will get worse. Even if the present projections only partly come to pass, the risk exposure would be substantially worse, with increasing vulnerability and greater difficulties in maintaining protection measures. Unfortunately, the projections seem to get worse, with more pronounced changes, every time they are updated, not better.
28. Given the increasing pressures on protection systems that are already vulnerable, or provide relatively low standards of protection, more comprehensive and integrated

approaches should be used. Strategies over a wider range and with a broader scope, including catchment-wide measures and on-farm practices, would be more effective in enhancing resilience and reducing risk exposure, while giving rise to better utilisation of water and land resources.

NATURAL CHARACTER

29. Preserving the natural character of rivers and their margins is a 'matter of national importance' under the RMA – section 6(a) *“The preservation of the natural character of the coastal environment, wetlands, lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development.”*
30. Despite being a matter of national importance, very little consideration has been given to the natural character of rivers, anywhere in the country. There has been no lead or guidance from central government about what is meant by natural character, or any apparent monitoring of this matter by the Ministry for the Environment. I have worked for many different authorities, including nearly all regional councils and many government departments, on river management and hazard mitigation, since the RMA was enacted, and the matter of the natural character of rivers has hardly been mentioned. This has included reviews I have undertaken for the MfE on the management of catchment and river schemes by regional councils, and on the management of flooding and erosion hazards in general.
31. There are, undoubtedly, difficulties in defining the natural character of rivers, which are very dynamic and changeable natural systems, highly responsive to the many influences of climate and landscape, and the human modification of these influences.
32. There has been much international debate, and more than a little controversy, about what is natural character and what does river restoration mean. If a river is to be restored to its natural state, what is this state, and how do people then continue to live on floodplains and beside rivers?
33. There have also been many river restoration failures, often because a preconceived idea about river naturalness has been imposed on river reaches that have a quite different character. The classic example is the development of a sinuous meandering channel, as a river restoration project, on a river that is naturally

braiding or semi-braiding. The first major flood then destroys the carefully re-established "natural river".

34. The natural character of a river reach, in its physical expression, depends on the intensity of the flow forces, the supply of sediments to the reach, and the resistance of the channel bed and banks. It is more a matter of the processes at work than a specific state or channel condition. Thus, river reaches that have been modified by catchment and riparian changes can still have a natural character, through the expression of the processes at work. The channel dynamic and form will be different, but the difference will be the same as occurs along rivers naturally, as the formative influences change in strength or intensity.
35. The natural character of a river changes along the river, from the headwaters to the sea, and when characterising a river this is done by reaches. It is a given reach that can be characterised, not a river. The nature, character and responses of a river change from reach to reach, as the forces and processes at work change, and a given character can only be defined for a reach where there is a similarity of river processes along it.
36. The ecology of a river reach depends on the physical character and conditions, but there is a complex inter-play between the biology of flora and fauna along waterways and their physical nature, while the physical processes and ecological relationships of aquatic and terrestrial habitats form an inter-dependent and inter-connected system. Most noticeable are the interactive effects of vegetation in rivers, with river margins providing diverse vegetative habitats, and vegetation affecting the channel form through island colonisation and channel splitting. The primary energy input of a forest stream is the leaf litter, while the primary energy input to an open river channel is from in-stream algae and macrophytes. This gives rise to very different eco-systems, which in turn impact on the channel form.
37. I have undertaken many studies of river characteristics and the processes of sediment transport and channel formation, on many different types of rivers in New Zealand. In general, the aim has been to determine the natural form and dynamic along reaches, and hence define appropriate river corridors of an active channel and margin buffer zones.
38. In these studies, the natural channel width and meander character of a river reach is determined from aerial photographs taken over time, and empirical relationships based on influencing factors (of dominant flood flow, grade and bed material size) and wave forms. An appropriate channel type (of meandering, semi-braided, fully braided etc) is then selected for the natural conditions of the reach, and design channels or fairways drawn up. The associated width of vegetation buffers zones

along the river margins are also determined from the width and type of channel. The combination of the design channel or fairway and vegetation buffer zones gives an overall river corridor, within which the river can naturally move and migrate.

39. This river corridor provides sufficient space for the river, to change and move according to its natural dynamic. Allowances have to be made for the changes in channel form and increase in width during periods of high flood intensity, as compared to more quiescent periods. The buffer zones absorb the erosion and deposition processes of the river, without an encroachment onto productive land or threat to valuable assets, and allow a slow re-establishment of lost vegetation over time as the river naturally moves on and attacks other areas of the buffer.
40. The river corridor, therefore, defines a suitable area for the river, and the outer boundary beyond which productive uses can be made of the land alongside the river reach. This definition of a river corridor is reach specific, as the natural character and processes of the river are reach specific. It then allows the river to move and change in a way that expresses its natural character.
41. I have undertaken these river characterisation and corridor definition studies on a range of rivers in the Horizons region, including the Whanganui River, the lower Manawatu River, the scheme lengths of the Oroua and Pohangina rivers, reaches of the Ohau and Mangatainkoa rivers, and the Kiwitea Stream after the 2004 floods. These rivers have reaches of very different character and trends, but there is always a natural form, and management guided by the natural forms and channel widths of rivers will be both more effective and less disruptive of the river environment.
42. This work on the natural character of rivers and the definition of river corridors that relate to the natural form and behaviour of reaches, has been incorporated into scheme reviews and used to guide river management practices along these rivers. The main aim has been to provide a wider corridor, with more space for vegetation buffers, which can be managed over time as erosion and deposition occurs. Implementation does, though, require the establishment of the buffer zones, as consistent and continuous dense vegetation, fenced off from the adjacent (farm) land.
43. It has also been used to re-establish river channels to a natural meander or channel form and shape after severe damage and break outs in large or extreme flood events. The design channel and margins for the Kiwitea Stream is a case in point. On the Rangitikei River, the natural meander form was used to align diversion channels where very large embayments with a sharp hook form were developed by the floods of 2004. This, though, highlights the different behaviour and natural form of rivers in large to very large floods, and the severe bank erosion and break

outs that occur because of a constraining of the river channel over periods of more usual floods. When considering the natural character of rivers, and what width is necessary to allow this natural character to be expressed, these changes over time as the pattern of floods varies with climatic oscillations have to be taken into account.

44. After central government support was withdrawn from catchment and river management in New Zealand, I undertook a number of studies on the effectiveness of different approaches to river management and of different types of measures. In one series of studies of management practices in the Wairarapa, I compared a range of strategies from a full retreat back from the river with land retirement, to heavy control approaches that confine and restrict channel movement. The economic, social and environmental impacts of these different approaches were considered and evaluated, and this demonstrated the effectiveness of intermediate options on all criteria. This was an example of how all-round benefits could be achieved by a more comprehensive approach based on the natural form and processes of rivers. To achieve the benefits, however, there would be substantial establishment and re-forming costs, and a lack of capital funding has seriously inhibited the implementation of such multi-purpose intermediate approaches.
45. Within a broad determination of river character and space requirements, there can be a more detailed characterisation in terms of active channel forms, of islands and braids, and runs, riffles and pools. There have been many studies of channel forms and hence reach character and response trends overseas, for instance in Australia, the United Kingdom, the USA and Canada. This has led to characterising methodologies, and the mapping of river systems in terms of natural character. Manuals have also been drawn up for river management based on river type and local conditions, where a range of different measures and their respective impacts are described.
46. There have been very few formal studies of the channel forming processes of rivers in New Zealand, and there are no standard methodologies for river characterisation in this country. At present I am undertaking a detailed study of channel forms along the Waingawa River in the Wairarapa, for Greater Wellington Regional Council. The aim is to determine an appropriate environmental indicator from the run, riffle and pool forms, and a measure of environmental impact from the changes in their frequency or relationships over time.
47. This characterisation at a more detailed level is useful when considering the management measures used within the active channels of rivers. Given the broad definition of a river corridor, in terms of channel type and width and the extent of vegetation buffer zones, there are different ways of managing rivers. The adequacy

of a river corridor is also related to the type and intensity of management interventions in the active channel, or of the buffer zones. As well, the amount of management intervention will depend on how well established the buffer vegetation is, and what type or degree of structural strengthening is present along the channel or fairway edges.

48. There are, thus, ways of characterising river reaches and their natural character in terms of formative influences and the system processes of rivers. This can be used to define river management zones, as well as being an indicator of the overall environmental condition of a river reach. A more detailed characterisation can be useful in determining whether the natural character of a reach is being maintained, enhanced or degraded.
49. A formal determination of the natural character of rivers and their margins, in a manner understood by all parties, would provide a useful environmental indicator, while assisting river management to be more effective and take a wider view. It would also allow some real effect to be given to the requirement of the RMA about natural character.
50. This determination could be in terms of the physical features of river reaches, of geo-morphological setting and channel form, or in terms of a range of criteria and aspects of natural character. In Tasmania, a recent study has set up a system for characterising river reaches, through a river condition index based on four aspects: physical form, riparian vegetation, hydrologic regime and aquatic life.
51. A better understanding of natural character with a (standardised) method of characterising river reaches, and hence their nature and response trends, would also inform decisions about river restoration. We would know better how to alter the natural character of a reach to achieve a desired outcome, and what would be the likely results of restoration efforts.

COMMENTS

52. The POP defines water management zones, but they are by river, over long reaches. The values considered for these reaches do include a range of cultural, social, environmental and economic values, however, they are very broad. It is more like a check list of what to consider, than a characterisation of the reaches and their values.
53. Under 'Ecological Values' there is 'Natural State' and 'Sites of Significance' (aquatic and riparian). These categories are really indicators of what remains (from some reference state?). It is reaches which retain significant areas of riparian or aquatic

diversity, or remain in a 'natural state'. To have natural character, a river reach does not have to be in some presumed 'natural state'. This is the same confusion that arises in river restoration, of some presumed 'natural state' to restore a reach to, without having regard to its natural character, and the nature of the dynamic processes at work along the reach. A river reach can only be 'restored' to what suits the existing or present nature of the reach, given its riparian and catchment conditions and the influences of the prevailing climate. Conversely, a river retains its natural character whatever the changes in catchment or climatic influences, albeit a different natural character than it had previously.

54. Retaining natural character is a matter of providing sufficient space for the river to express the character it has along any given reach, given the vegetation present and the colonising and growth character of that vegetation. It relates to the dynamics of the river system, and changes over time, and over geological eras. It is not the retaining of a fixed state, or a conversion to some supposed 'natural state'.
55. The climate and vegetation cover of New Zealand during the last glacial period (prior to 10,000 years ago) was very different to today, and the rivers of that landscape were correspondingly different. When the climate warmed up, the land was re-afforested, and over time the forests became increasingly diverse. Similarly, the waterways and rivers of this climate and landscape changed and became more diversified.
56. There is a close relationship between the 'life supporting capacity' of a waterway and its natural character. Both are influenced by the catchment landscape and climate, and changes in geology, soils, erosion/deposition intensity, vegetation cover, altitude and topography will affect both. However, the life supporting capacity can be directly affected by the quality of the water, and the presence of toxic chemicals and high nutrient loadings, and by changes in water yields and low flow rates. Conversely, maintaining low flows and a high water quality may have little ecological benefit if the natural character of the waterway is severely constrained and distorted by narrow canalisation and a lack of channel features.
57. A well-balanced improvement to our waterways, which is effective in enhancing environmental values, along with social and economic values, will require as much attention to the natural character of waterways, as to their water quality and low flows. Unfortunately, a consideration of the natural character of rivers and their margins has only been conspicuous by its absence.
58. I believe that the single purpose focus of river management on the protection of land and assets has been detrimental to the effective achievement of this aim, as well as unduly impacting on other values of amenity and ecological health.

59. A methodology for formalising the characterisation of river reaches in New Zealand could be drawn up. It has been done in other countries, on rivers that are similar to New Zealand, as well as for very different types of rivers. This defining of natural character can be done at a broad level, in terms of both processes (the system dynamic) or channel form (the physical expression). It could also be done at a more detailed level of channel features, where the number or frequency of well-formed pools, which always have a riffle entry, may be a good proxy for natural channel form. These flat water features are easily recognised by river users and managers alike. They can also be identified from high resolution aerial photographs – by people with a practised eye for this photographic interpretation.
60. Environmental codes of practice could then be based around the natural character of reaches and how they respond to different works or measures, instead of being focused on the works themselves. This would provide a wider perspective to the operators who work in the river, and assist in re-orienting river management to be a multi-purpose activity. It would, as well, make this document better suited to the planning functions of resource management. Conditions around natural character could then refer to the document, and they would be more clearly understood by the consent holders.
61. A manual about river management and river works, based on an understanding of the geo-morphological processes of rivers, was proposed for similar reasons. To date, such a manual has not been produced in New Zealand. At present, the only project in this regard is a collation of information and documents from practitioners, which is being co-ordinated by NIWA.
62. Policy 6-27 of the POP lists matters to consider when managing rivers and lake beds. It first refers back to the values in Schedule D, discussed above. Items (d) and (e) refer to habitat diversity, including morphological diversity, and natural character. They are phrased in terms of avoiding further reductions and managing effects, and not in terms of a proactive protection or enhancement.
63. Natural character is formed by morphological processes, but it is not the same as morphological diversity. There is an overall character beyond the channel features themselves or the diversity of features. Some features are also indicative of a degraded channel and constrained character, while continual machine activity and intervention in the active channel can increase the diversity of features and forms, because of the disruption it causes to channel forming processes.
64. For these items of the policy to be meaningful there has to be a clear explanation of natural character and morphological diversity, and an understanding of what is to be achieved to ‘preserve the natural character of rivers and their margins’.

65. The rule to maintain the 'life supporting capacity' of waterways, of the conditions for permitted activities, cover some relevant matters. However, the wording is typically very specific and lacking in both flexibility (for different types of river reaches) and effectiveness in protecting the life supporting capacity of waterways. Whether 5 days is a long time or a short time for the discharge of sediments depends on the nature of the reach. Similarly, whether channel straightening of 2 times the width in 2 km, and repeatable within a year, will adversely affect the natural character of the waterway depends very much on its character. Without a means of defining river reaches in terms of their river type or natural character, there is no way of knowing whether the permitted activity will have only minor effects or very substantial adverse effects. Should, then, these types of works, such as channel straightening or channel works within the low flow area, be general permitted activities.
66. Thus, for the POP to be effective in terms of natural character, and for the code of practice to be useful for multiple objective planning, some explanation and definition of natural character should be included in the Plan. More effort is also required on the formulation of a suitable methodology for the classification of river reaches by type and natural character. This would be best done at different levels to suit different purposes, from a broad characterisation down to pool counts and vegetation surveys along river reaches.
67. The POP includes policies on gravel extraction from the beds of rivers and their margins, and gives lists of average annual allocable volumes of gravel by river or reach. The term used is 'waterbodies', but it is not just the waterbody or the area covered by water that is important in determining the effects of gravel extraction. A more appropriate term would be 'waterways and their margins', which reflects the wording used in relation to natural character – and other matters in the RMA.
68. There are complex issues relating to the extraction of gravel bed material from rivers, and I have undertaken many investigations and reviews about gravel extraction on rivers throughout New Zealand. Unless there is a natural deposition sink for the gravel bed load of a river, as does occur in some rivers near the coast, extraction will generally have a degradational effect, and involve, in essence, a mining of the river bed. The transport of gravel bed material down rivers is also flood related and very episodic, and this gives rise to pulses or waves of bed material moving down river channels.
69. The One Plan does allow allocations and provides some policy guidelines. However, to achieve river management and flood mitigation benefits the extractions have to be well directed and carefully managed. Extraction operations

can very easily become distorting and disruptive, and longer term cumulative effects can be seriously detrimental. The effect of gravel extraction on erosion and deposition activity, and on the natural character of the river, is very much dependent on the approach or method used.

(Gary Williams)

Dated: 16 September 2009