

WAIPARA RIVER WORKING PARTY

Monday July 13 2009

Working Paper Number: FIVE

- Plant and animal pests, Willows, Gravel
Extraction, Water Quality

Summary

This paper addresses four management issues as follows:

- Plant and animal pests
- Willows
- Gravel Extraction
- Water Quality

Specific plant and animal pests are managed under the Canterbury Regional Pest Management Strategy. The Strategy sets out a framework for the effective and efficient management or eradication of specified animals and pests in the region. The Working Party needs to consider whether those plants and animals not specified in the Strategy need to be managed in the river. The paper looks at resources that are available for managing pests, such as the Weedbusters programme and suggests that areas/issues be identified where co-ordinated pest and weed control may have significant long term gains.

The paper goes on to look at the issue of willows providing a background on the use of willows in Canterbury rivers. The paper then identifies and discusses the adverse effects of willow trees in the bed of the river. The relevant planning documents and rules are considered in determining whether the removal of willows is a permitted activity. The paper then goes on to explore how willows could potentially be managed in the river.

Gravel extraction is another issue identified in the river. This report identifies the number of resource consents approved for gravel abstraction and the volume of material that may potentially be extracted under these consents. The report looks at the potential effects of gravel extraction in the river and whether the level of abstraction is sustainable in the long-term.

Lastly the paper considers the issue of water quality describing the characteristics of water quality and how these can be affected by environmental conditions. The main uses of water in the river are identified and the relevant planning documents are set out. The paper goes on to discuss the impact of cattle in the river and possible mechanisms that could be put in place to discourage this practice.

1 INTRODUCTION

- 1.1 This report covers four issues. Firstly, the working paper addresses the issue of plant and animal pests and identifies the relevant planning documents that seek to manage this issue. The paper then goes on to look at the issue of willows in the river, and in particular the effects of willow trees in the fairway. A couple of management issues discussed. The third issue addresses gravel extraction in the river. The paper identifies the levels of abstraction that are consented to by way of resource consent and also identifies the potential effects that abstraction may have on the river system. The paper refers to a report prepared for Environment Canterbury that provides a status on the gravel resources in the Waipara River and management implications. Lastly, the working paper takes a look at water quality issues and how these can potentially be managed.

2 PLANT AND ANIMAL PESTS

- 2.1 In terms of the Canterbury Regional Pest Management Strategy 2005-2015, a pest is defined as '*an organism specified as a pest in a pest management strategy*'. The Strategy provides a framework for efficient and effective management or eradication of specified animals and plants in the Canterbury region. The organisms covered by the strategy are capable of having significant effects on economic well-being, spill-over effects on neighbouring properties or are capable of having significant adverse effects on conservation or other values that are not necessarily shared by land occupiers.
- 2.2 The Strategy identifies the animals and plants that are classified as pests and also identifies other organisms that are to be controlled under the strategy in targeted high value environmental areas. There are also other organisms that are not formally included in the Strategy but are to be monitored through a Surveillance Project undertaken by Environment Canterbury.
- 2.3 Those pests that are listed in the strategy and are of most relevance in terms of the Waipara River are:
- Nasella tussock (*Nassella trichotoma*)
 - Rabbit (*Oryctolagus cuniculus*)
 - Broom (*Cytisus scoparius*)
 - Gorse (*Ulex europaeus*)
 - Old Mans Beard (*Clematis vitalba*)
- 2.4 Naturally there are a number of other plants and animal pests that occur in the Waipara River that are not included in the Pest Management Strategy. The Working Party will need to determine whether the approach taken to pest management is targeted to those pests listed in the Strategy or if a wider target group is appropriate. In considering their options, the Working Party should note that under the Strategy, landowners are responsible for carrying out specified control of plants and animals declared as pests and that there are regulatory procedures in place for those land occupiers that do not comply with the Strategy rules.
- 2.5 In many instances, particularly with respect to the Waipara River environment, the land has low economic value and landowners are reluctant to use the resources available to them in order to eradicate pests. As yet, it would appear that Environment Canterbury has not applied any pressure in regard to this problem. However, in some particular instances, Environment Canterbury will carry out or facilitate pest control where there is a wider community benefit.

- 2.6 A potential information and management resource available for the management of plant pests, is the Weedbusters programme. Weedbusters is an inter-agency weeds awareness and education programme designed to protect New Zealand against the spread of invasive weeds. The agency produces a guide to recognising and controlling invasive weeds. The agency is of the view that there is working solution in that everyone can help in the fight against invasive weeds by learning to:
- Recognise weeds
 - Prevent weeds establishing
 - Controlling weeds
- 2.7 With respect to the Waipara River, it may be useful to undertake a mapping exercise to identify areas/issues where coordinated pest and weed control will have significant long term gains. For instance identifying areas that can easily be managed now but have the potential to cause problems long term if left. Pest control strategies could be developed for those areas outlining priorities, responsibilities, funding requirements and work programmes.

RECOMMENDATION ONE

THAT THE WORKING PARTY RECOMMEND TO ENVIRONMENT CANTERBURY, THE HURUNUI DISTRICT COUNCIL AND THE DEPARTMENT OF CONSERVATION THAT THEY WORK COLLABORATIVELY ON IDENTIFYING AREAS/ISSUES WHERE COORDINATED PLANT AND ANIMAL PEST CONTROL WILL HAVE LONG TERM GAINS AND DEVELOP PEST CONTROL STRATEGIES FOR THESE AREAS/ISSUES OUTLINING PRIORITIES, RESPONSIBILITIES, FUNDING REQUIREMENTS AND WORK PROGRAMMES.

RECOMMENDATION TWO

THAT THE WORKING PARTY RECOMMEND TO ENVIRONMENT CANTERBURY, THE HURUNUI DISTRICT COUNCIL AND THE DEPARTMENT OF CONSERVATION THAT THEY LIAISE WITH PRIVATE LANDOWNERS IN CARRYING OUT COORDINATED PEST CONTROL THROUGH ACTIVE LIASON WITH THE FARMING COMMUNITY.

3 WILLOWS

- 3.1 Willows were initially introduced into many Canterbury rivers as a means of bank stabilisation. The historical removal of indigenous forest from floodplains and riverbanks to enable pastoral agriculture had the unwanted side effect of accelerating bank erosion rates. The response has been to plant willows along thousands of kilometre of riverbank to replace the trees whose roots formerly resisted bank erosion.
- 3.2 Some willow species such as grey willow (*Salix cinerea*) and crack willow (*Salix fragilis*) spread rapidly by stem fragments carried by water movement. Grey willow also spreads by seed or suckering from the roots. Crack willow is the predominant willow species in the Waipara River although grey willow was also observed on the field trips.
- 3.3 Whilst river engineers are generally of the view that willow trees are beneficial in terms of bank stabilisation and the control of flood flows, dense infestations of willow can have an adverse effect on the river environment. These adverse effects include:
- The choking of river channels and obstruction of flood flows;
 - The loss of braided riverbed landscapes and habitats;
 - Increasing habitats more suitable for pests;

- Impeding pest control operations; and
 - Reducing summer flows due to the high evapotranspiration rate of willows up to the order of a 28l/s reduction.
 - Loss of biodiversity as willows replace native species
- 3.4 Vegetation, and in particular willows, are becoming increasingly well established in the river corridor and it appears that the Waipara's flood flows are unable to keep the riverbed clear. Bare gravels are being replaced by vegetated floodplains and islands. Encroachment by vegetation is converting it to a narrower, anastomosing river rather than a braided river. An anastomosing river is one that has several stable channels that flow between more or less permanent islands, as distinct from a braided river in which the braids and gravel bars are unstable and impermanent and change position with each flood.
- 3.5 A technical report prepared for Environment Canterbury by Dr D M Mosley (2003) titled, *'Waipara River: Instream values and flow regime'* identifies that in many places the channel width has been reduced by 50-70% during the last 50 years. Dr Mosley notes that to maintain the existing river form would require that floods be maintained or increased in size, frequency and duration, although the present trend may be to re-establish a more natural, pre-settlement river.
- 3.6 Colonisation of the riverbed by vegetation, such as willows can also potentially result in increased predation on nesting birds. Vegetation improves the cover for predators and reduces the area of bare gravels required by some bird species for nesting.
- 3.7 Some members of the Amberley Beach community consider that willow infestation in the river is one of the potential causes of erosion at Amberley Beach. This is attributed to the willow roots holding up the gravels and sediments in the river and thereby preventing free flowing bedload in the river. Amberley Beach is currently eroding at a rate of two metres per year and is subject to an ongoing renourishment programme. Submissions received on the Long Term Community Plan requested that the Council remove willows within the river.
- 3.8 In terms of the relevant legislature, the removal of willow trees within the Waipara River will be subject to the requirements of both the Transitional Regional Plan (TRP) and the Proposed Natural Resources Management Plan (NRRP).
- 3.9 The relevant chapter in the TRP refers to the North Canterbury Catchment Board Bylaw 1. Paragraph 30 of the bylaw states that:
- 'Except with the precedent consent in writing of the Board (Environment Canterbury) no person shall plant willows or other trees and no person in occupation of any land shall cause or suffer willows or other trees to be planted in any watercourse under the control of the Board or on or within a distance of 24 feet from the banks of such watercourse or in any place where they will obstruct or be likely to obstruct the free flow of flood-waters in any existing channel.'*
- 3.10 The Proposed Natural Resources Regional Plan Chapter 6: Beds and margins of lakes and rivers, Rule BLR5 Disturbance of vegetation and harvesting practices states that:
- 'The disturbance, removal, damage or destroying of any plant or part of any plant in, on, over or under the bed of a lake or river, including any associated disturbance of the bed, and depositions of plant material on the bed is:*
- (a) *a permitted activity provided the activity complies with all the conditions of this rule.*

3.11 The conditions of the rule require that:

- 1) *The activity shall not be undertaken within the beds of any natural state or high naturalness of water bodies listed in schedule WQN5; unless the activity is classed as a permitted activity.*
- 2) *The activity and any associated equipment, materials or debris shall not obstruct or alter the passage of water in a manner that causes:*
 - (a) any increase in the risk or potential for flooding of surrounding lands;*
 - (b) any destabilising of lawfully established flood control structures or flood control vegetation or any other lawfully established structures within the bed of a lake or river;*
 - (c) any increase in erosion of the river or lake bed; or*
 - (d) Drainage of the bed.*
- 3) *No vegetation used for flood control, or bank stabilisation shall be disturbed, removed, damaged or destroyed except by or on behalf of the person or agency responsible for maintaining that vegetation for flood control purposes.*
- 4) *The activity shall not restrict access to flood control structures or flood control vegetation for the purposes of their repair or maintenance.*
- 5) *The activity shall not obstruct the passage of fish both upstream and downstream, or be undertaken within any significant salmon spawning sites listed in Schedule WQN14.*
- 6) *A discharge of sediment into water shall not:*
 - (a) for more than a total of 60 minutes in any consecutive 24 hour period;*
 - (i) change the colour by more than five Munsell Units; or*
 - (ii) decrease the clarity by more than 20 percent; or*
 - (b) increase the embeddedness of the bed substrate by more than ten percent.*

3.12 With respect to condition 1, the Waipara River is not listed in schedule WQN5. If the removal of willow trees within the bed of the Waipara River can meet the remaining conditions, it would appear to be a permitted activity. This would also appear to be in accord with the requirements of the TRP which requires that trees are not planted in any place where they will obstruct or be likely to obstruct the free flow of flood-waters in any existing channel. Whilst the willow trees in the bed have not technically been 'planted' as they have established themselves, they are considered to obstruct the free flow of flood-waters.

3.13 There was some discussion on the field trip as to why Environment Canterbury do not impose conditions on resource consents for gravel extraction to remove willow trees within the fairway of the river. The Resource Management Act 1991 notes that the power to impose conditions on a planning consent is not unlimited. To be valid at law, a condition must:

- (i) Be for a resource management purpose, not for an ulterior one;
- (ii) Fairly and reasonably relate to the development authorised by the consent to which the condition is attached; and
- (iii) Not be so unreasonable that a reasonable planning authority, duly appreciating its statutory duties, could not have approved it.

3.14 In general, conditions on resource consents can be imposed to mitigate the effects of the activity being carried out. Given that the willows growing in the bed/fairway of the river are not a direct result of gravel extraction it would be difficult to put conditions on requiring these to be removed. However, as observed on the field trip the extraction of gravel around willow tree 'islands' in the river tended to create a greater contrast between the level of surrounding river

bed and the height of the islands. Whether this has an impact on flood flows or sediment deposition is a matter for the scientists. However, it might be useful to discuss these concerns with resource consent processing staff at Environment Canterbury to see whether conditions could be imposed on consents.

- 3.15 Another method used for the control of willows in other river catchments has been through the establishment of a river rating district. There are about 60 such schemes in place for rivers in Canterbury. One example in the district is the formation of a working group for the Kowai River. The working group is driving a proposal to form a river rating district on the river's north branch. This would see people whose land adjoins the river contributing an annual rate of \$44 per \$100,000 of capital valuation, towards clearing and maintenance of trees along the river.
- 3.16 In the Kowai River example, Environment Canterbury and the Hurunui District Council have agreed to pay 25% of the annual costs. Landowners are currently being asked their opinion on the scheme via a postal vote. It is noted that overall, the financial input is expected to save ratepayer money as each time the river floods, significant damage is caused to roads and bridges.
- 3.17 Preliminary discussions with Environment Canterbury have indicated that the likely cost of establishing a river rating district, could be in the vicinity of \$10,000. In addition, a river rating district is generally only considered appropriate where there is a high potential risk of flooding. For instance, in the above example, there is a high flood risk for the Leithfield Township. The risk of flooding in the Waipara River may not be considered high enough to warrant the establishment of a river rating district.

RECOMMENDATION THREE

THAT THE WORKING PARTY RECOMMEND TO ENVIRONMENT CANTERBURY AND THE HURUNUI DISTRICT COUNCIL THAT THEY WORK COLLABORATIVELY TO REDUCE INFESTATIONS OF WILLOWS WITHIN THE FAIRWAY OF THE WAIPARA RIVER.

RECOMMENDATION FOUR

THAT THE WORKING PARTY RECOMMEND THAT ENVIRONMENT CANTERBURY CONSIDER PLACING CONDITIONS ON GRAVEL EXTRACTION CONSENTS REQUIRING ALL WILLOWS LOCATED IN THE RIVER BED WITHIN THE PROPOSED EXTRACTION AREA BE REMOVED.

4 GRAVEL EXTRACTION

- 4.1 Gravel extraction is an important tool for the management of aggrading rivers (with rising riverbeds). Riverbed gravels can be removed to maintain or increase flood capacity, correct undesirable river alignments, reduce bank erosion, and prevent course change onto the adjoining floodplain. A managed gravel extraction regime can reduce river management costs, and improve flood control effectiveness. On the other hand, excessive gravel extraction, or extraction from degrading rivers (with falling beds), can pose an undermining threat to flood protection and erosion control works.
- 4.2 The input, movement and deposition of gravel in riverbeds is episodic and is affected by factors such as catchment erosive potential, channel and bank condition, and flood size and frequency. The correct management of gravel extraction can therefore be difficult, requiring an ongoing

monitoring and review programme, and the ability to target gravel extraction in terms of location, quantity and timing.

- 4.3 In terms of legislation controlling gravel extraction activities, in July 2004, Environment Canterbury notified Variation 1 to the Proposed Natural Resources Regional Plan (Proposed NRRP). This introduced Chapter 6, which includes rules for activities in the beds of rivers. When the Proposed NRRP becomes operative, in its current form, gravel extraction takes under 50m³ and 100m³ (up to 300m³ per year) will be a permitted activity (this varies for specific rivers). Gravel extraction over the permitted amount will remain discretionary.
- 4.4 With respect to the operative Hurunui District Plan, gravel extraction from riverbeds currently requires resource consent. However, Proposed Plan Change 7 will see gravel extraction from riverbeds become a permitted activity provided that:
- (a) The activity is the subject of a current resource consent issued by the Regional Council;
 - (b) The duration of extraction at any one site does not exceed 60 days per annum
 - (c) Operations are limited to the hours of 7am – 6pm Monday to Friday, and 8am – 1pm Saturday;
 - (d) Any associated heavy vehicle movements do not exceed 36 per day
 - (e) There is no direct access to the site from a State Highway
 - (f) 48 hours notice of the commencement of works is to be given to the Council; and
 - (g) The operation noise emissions of each piece of plant proposed to be operated within 500 metres of an existing dwelling or educational facility are to be provided to the Council prior to work commencing.
- 4.5 Proposed Plan Change 7 (Quarrying and Mining) was first publicly notified on 12 March 2005 and was re-notified on 9 August 2008. The recommendations of the hearings panel, which amended the proposed change, were adopted by Council on 30 April 2009 and publicly notified on 9 May 2009. No appeals have been received within the specified time period. The Council will shortly publicly notify the date on which the proposed plan change will become operative.
- 4.6 Council records indicate that the Hurunui District Council has granted three resource consents for gravel extraction within the Waipara River. These activities are located around the end of Webbs Road and generally within the vicinity of the State Highway 1 Bridge. Environment Canterbury has approved seven resource consents for gravel extraction with a total volume of approximately 79,000m³ per annum. Gravel extraction consents are currently monitored by Environment Canterbury.
- 4.7 The effects of gravel extraction are wide-ranging, some positive and some negative. These effects include:
- Effects on recreational activities
 - Ecological effects
 - Effects on community infrastructure
 - Effects on coastal processes
 - Effects on ground water quality
- 4.8 Recreational activities can be affected by gravel extraction. Recreation is restricted at gravel extraction sites by noise and safety concerns, e.g. no picnicking or swimming. Where extraction occurs in flowing water, the water becomes dirty from disturbed sediment deterring swimmers and detracting from amenity values of the river. Extraction can also change the riverbed area either improving or deteriorating the areas for recreational activities.

- 4.9 The ecological effects of gravel abstraction activities can be wide ranging, depending upon the extraction method and the environment being quarried. Gravel can be extracted intensively from confined areas, or extensively over large areas, and over short or long timeframes. It can also be taken anywhere from the 'wet' flowing channel, from dry or 'wet' pits on the river fairway, from 'skimming' or 'scalping' the fairway, or through to excavating higher floodplain areas inundated only on extreme events.
- 4.10 Gravel extraction can result in the following ecological effects:
- (a) Bed degradation through changes in river gradient (velocity), decreased bed stability and more confined channels. Increased bed degradation generally leads to an overall reduction in ecological productiveness of systems.
 - (b) Increased fine sediment loads, decreased clarity, and sedimentation. Fine sediments such as sand and silt generate a range of adverse effects that degrade aquatic communities and recreational activities and aesthetics.
 - (c) Changes in channel morphology. These can greatly affect optimal habitat for a wide range of flora and fauna and activities.
 - (d) Removal or disturbance of ecologically important 'roughness' elements. 'Roughness' elements such as stable rock clusters and boulders or woody debris act as 'refugia' and recolonisation sources for plants and animals and also provide productive habitat and food production 'hot spots'
 - (e) Riparian zone features can be destroyed. Riparian vegetation features can provide important habitat features that are required to sustain productive ecological communities through provision of shade, habitat stability, and terrestrial food and energy inputs.
 - (f) Provide a bio-security risk through the spread of invasive organisms, terrestrial plants, aquatic weeds, nuisance and invasive algae, pest fish, etc..
- 4.11 Community infrastructure such as road and rail bridges and water supply or irrigation intake structures, can be threatened by river bed aggrade or degrade. In the case of excessive degrade, bridge abutments could be undermined and pile exposure above bed level could increase, with a resultant increase in the risk of undermining due to scour, or damage during earthquake.
- 4.12 Sediment supply to the Canterbury coast is derived from numerous sources such as, but not exclusively, rivers, eroding cliffs, eroding beaches themselves and longshore transport from other parts of the coast. Whether a beach is stable, accretionary or erosional, is dependant on the balance between the quantity of sediment entering the coastal system and the quantity of material being lost from the system. Any reduction in the supply of sediment to the coast could cause a change in this balance, either initiating erosion or exacerbating erosion on an already erosional beach.
- 4.13 The effects of fluvial extraction on coastal stability may not be immediately obvious. It may take some time, possible years or even decades, for any bedload deficit to the coast to manifest itself by way of a change in erosion rates.
- 4.14 The difficulty arises when trying to quantify the potential impacts of gravel extraction on coastal erosion. Generally this must be done using a sediment budgeting approach but unfortunately, quantities of the various components which go into constructing coastal sediment budgets are still not known to any certainty.

- 4.15 As mentioned earlier, Amberley Beach is currently eroding at a rate of 2 metres per year. To determine whether the potential level of extraction from the river, is resulting in less gravel and material being transported down the river during flood flows and subsequently resulting in less gravels being deposited on the beach, would require a coastal sediment budget analysis to be undertaken. Given that the quantities of the various components which go into constructing coastal sediment budgets are still not known to any certainty, this may difficult at this time.
- 4.16 In terms of mitigation, it is noted that a condition of resource consent CRC030497 requires that *'the consent holder shall supply a minimum of 500 cubic metres per year of suitable material to be made available to the Hurunui District Council for the purposes of beach renourishment as authorised by resource consent CRC030971'*.
- 4.17 Gravel extraction can also have an effect on groundwater quality. If gravel extraction occurs from the bed of a river above a shallow, unconfined aquifer, there will be a reduction in the depth of gravel above the aquifer. With a reduction in gravel depth between the bed of the river and the underlying aquifer, the potential exists for leakage from the river into the shallow groundwater system. Leakage of river flow into groundwater may also result in any contamination within the river flow to filter downwards into the groundwater system.
- 4.18 A report prepared for Environment Canterbury in 2006, *'Waipara River report status of gravel resources and management implications'* provides a review of the changing bed profile in the river and extraction records to assess the available gravel supply. The report concludes that there is likely to be a sustainable gravel supply of around 2,000m³/y. The report notes that the current rate of gravel extraction (average of 14,900m³/y from 1994 to 2005) is well in excess of what can be sustainably taken without lowering the river bed levels. A copy of the report is attached as Appendix A to this working paper.
- 4.19 The report recommends that a monitoring programme to record river bed levels for use in assessing bed status and changes should be commenced. In addition, to decide whether further gravel extractions from the Waipara River should occur in the future (and if so where from and in what quantity) an assessment of the required and existing flood capacity and minimum bed levels to protect infrastructure is required. This assessment would yield design bed levels against which river management decisions could be made.

RECOMMENDATION FIVE

THAT THE WORKING PARTY RECOMMEND TO ENVIRONMENT CANTERBURY THAT A MONITORING PROGRAMME TO RECORD RIVER BED LEVELS FOR USE IN ASSESING BED STATUS AND CHANGES BE COMMENCED.

RECOMMENDATION SIX

THAT THE WORKING PARTY RECOMMEND TO ENVIRONMENT CANTERBURY THAT AN ASSESSMENT OF THE REQUIRED AND EXISTING FLOOD CAPACITY AND MINIMUM BED LEVELS TO PROTECT INFRASTRUCTURE IS PROVIDED.

5 WATER QUALITY

- 5.1 Water quality refers to the physical, chemical and biological characteristics of water. The quality of water determines its suitability for a variety of uses including drinking water, mahinga kai, swimming and other forms of recreation, stock watering and irrigation.
- 5.2 Water quality is about more than just the presence or absence of substances in the water. For aquatic plants and animals, the water itself is only one part of a range of factors that impact on their habitat. Things like the state of the stream bed and banks, depth and velocity of flow. And the nature and quality of adjacent vegetation are all important. When we think about water quality in its broadest sense we need to take into account all of these things.
- 5.3 The Waipara River is not used as a source for a public water supply. However, the Council does have a well located in close proximity to the river and identifies a water intake zone over part of the river adjoining the Waipara Township. Given that the river is not used a drinking water supply, the main use for water in the Waipara River is for recreational values, mahinga kai, irrigation and stock watering.
- 5.4 Water quality can be affected by the following issues:
- Microbiological contamination
 - Nutrient enrichment
 - Suspended sediments
 - Chemical contamination
 - Physical changes
- 5.5 It is noted that the primary sources of microbiological contamination in water used for recreation include sewage, urban stormwater, agricultural runoff, livestock and wildlife. The effect of these contaminant sources on bathing water quality is largely dependent on weather conditions (rainfall, wind direction and intensity) and the nature of the receiving waters in terms of available dilution and mixing. Water-borne illnesses are a constant threat to public health. Illnesses vary from mild gastro-enteritis (stomach bug) to those with potentially fatal effects. Most water-borne diseases are caused by organisms originating in the gut of animals and humans, which has been transferred to water via faeces.
- 5.6 Nutrient enrichment occurs when there are high levels of nitrogen and phosphorus in the water. This can influence the amount and growth of algae and water weeds in surface waters. Algal blooms and water weeds change the aquatic habitat, with adverse effects on some species and positive effects on other, e.g. improving the productivity of a fishery.
- 5.7 New Zealand rivers carry more silt and mud than anywhere else in the world. Fine sediments reaching the coastal environment affect the fish and can potentially smother life on the seabed. The sediment load also affects the appearance of the water and can have impacts on recreational activities in the river, such as swimming.
- 5.8 Chemical contaminants include: hydrocarbons (e.g. oil spills), pesticides, inorganic substances (e.g. metals), hazardous substances (e.g. copper, chromium, arsenic, boron). Hazardous substances in water will have a negative effect on aquatic life and habitat, and on uses (e.g. drinking water, aquaculture, irrigation).
- 5.9 Water quality can also be affected by low environment flows. Low flows can result raised water temperature which can affect aquatic life directly by changing metabolism, growth and

behaviour and indirectly by controlling concentrations of dissolved gases, oxygen and pH levels. The water abstraction rate in the Waipara River is approximately 1,500l/s. The minimum flows for the river are set by Environment Canterbury.

- 5.10 On the field trip the Working Party heard from a farmer using the riverbed to occasionally graze sheep. Evidence suggests that stock in riverbeds have a negative effect on water quality. Stock can cause erosion and sedimentation of the river, their effluent causes nutrient enrichment, selective feeding can lead to a loss of biodiversity and can damage sites of cultural significance.
- 5.11 The research on this is largely focussed on deer and cattle as they are commonly identified as having a large impact on water ways due to their behaviour patterns. The effect of sheep in river beds is not as well researched as they are not commonly identified as being of high concern.
- 5.12 In terms of the Proposed Natural Resources Regional Plan (NRRP), the grazing of stock in the riverbed is essentially a permitted activity, provided that it does not have a significant effect on the quality of water in the river.
- 5.13 Having said that, there are some areas where stock is not allowed in riverbeds to protect areas which have particular values (e.g. areas of high contact recreation, fish habitats and drinking water intakes). There are three areas identified in the Waipara River as being high recreational contact areas. These are located at Stringers Bridge, Boys Brigade Camp and Greenwoods Bridge. The stock prohibition area includes a 1km buffer upstream from the recreational contact area. The following map identifies the stock grazing prohibition areas in blue.



- 5.14 In terms of water quality in the Waipara River, Environment Canterbury is currently undertaking a substantial amount of monitoring as part of their ongoing water monitoring programme. Monitoring is undertaken at five points on the river at Laidmore Road, Stringers Bridge, Waipara Boys Brigade Camp, Mt Cass Road and Greenwoods Bridge (Teviotdale). Environment Canterbury's water quality scientists believe that the Waipara River is one of the most well studied rivers in terms of overall water quality and invertebrate numbers. Environment

Canterbury has produced a number of technical reports on the Waipara River, although the raw data in these reports is not always easy for an outsider to find and interpret.

- 5.15 One of the technical reports titled '*Waipara River: Instream values and flow regime*' (February 2003) identifies the water quality in the Waipara River as being better in many respects than that of other Canterbury rivers that rise in the hill country. The report notes that water temperatures at Stringers Road and Teviotdale Bridge often exceed 20 degrees Celsius and periodically exceeds 25 degrees Celsius and that it is likely that higher temperatures are experienced in the semi-braided reach from Stringers Road to the Omihi Stream confluence. The report concludes that the concentrations of dissolved organic nitrogen and dissolved reactive phosphorus in the river are such that the Waipara is classified as eutrophic; bacteriological water quality is better than the guideline for contact recreation for much of the time, but shows some signs of contamination by livestock.
- 5.16 If the Working Party was of the view to encourage the removal of stock grazing in the Waipara River, there are a number of funds available for land owners and community groups for biodiversity projects such as the fencing and planting of riparian margins. This includes Environment Canterbury's Environment and Enhancement Fund (EEF) which is a contestable fund that provides grants of up to \$5,000 to individuals and groups working to protect and enhance Canterbury's biodiversity.
- 5.17 The Mainpower Hurunui Natural Environment Fund is another fund which seeks to encourage and assist with voluntary work that benefits the natural environment. The focus is on work that improves, benefits, enhances, restores or reinstates indigenous natural resources – in particular, land, vegetation, wetlands or bird habitat. The fund is open only to residents and ratepayers of the Hurunui District – individuals or groups – for work relating to either private or public land. It is a contestable fund, in which there is \$10,000.00. Of that sum, \$7,000 is earmarked for projects that are protecting existing areas, and \$3,000 for projects creating new areas.

RECOMMENDATION SEVEN

THAT THE WORKING PARTY RECOMMEND TO ENVIRONMENT CANTERBURY THAT SUITABLE MONITORING PROGRAMMES ARE ESTABLISHED, PARTICULARLY IN HIGH RISK AREAS AND THAT THE WATER QUALITY MONITORING DATA IS EASILY ACCESSIBLE TO THE GENERAL PUBLIC.

RECOMMENDATION EIGHT

THAT THE WORKING PARTY RECOMMEND TO ENVIRONMENT CANTERBURY AND THE HURUNUI DISTRICT COUNCIL THAT THEY PROMOTE THE EXCLUSION OF STOCK FROM THE WAIPARA RIVER AND ITS TRIBUTARIES AND WHERE APPROPRIATE ADVOCATE FENCING AND RESTORATION/REVEGETATION WORK AND STOCK WATER RETICULATION.

RECOMMENDATION NINE

THAT THE WORKING PARTY RECOMMEND TO ENVIRONMENT CANTERBURY AND THE HURUNUI DISTRICT COUNCIL TO PROMOTE ENVIRONMENT CANTERBURY'S ENVIRONMENT ENHANCEMENT FUND (EEF) AND THE MAINPOWER HURUNUI NATURAL ENVIRONMENT FUND AS A MEANS OF SUBSIDISING FENCING AND PLANTING COSTS IN ENHANCEMENT PROJECTS IN THE WAIPARA RIVER.

Environment Canterbury

Waipara River Report Status of Gravel Resources and Management Implications

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1. Introduction

As part of Environment Canterbury's wider "Regional Gravel Management Investigation" MWH have been commissioned to prepare reports on the Status of Gravel Resources and Management Implications for ten "Priority One" rivers within the Canterbury Region.

The Waipara River in North Canterbury is one of the ten "Priority One" rivers. Investigation of the Waipara River's gravel resources is important because:

- River gravels are used extensively throughout Canterbury (including from the Waipara River) as a construction material for roads, buildings and other infrastructure.
- Gravel aggradation in the Waipara River is a crucial aspect of flood management. Allowing gravel to accumulate in the channel has the effect of reducing the channel capacity and increases the likelihood of a flood escaping the main channel.
- Extracting too much gravel risks damage to infrastructure such as stopbank collapse and bridge pier undermining. These types of events are hazardous to life and property.

This report provides an initial overview of the Waipara River before reviewing its changing bed profile and gravel extraction records to assess the available gravel supply. On the basis of the assessed available gravel supply recommendations are made as to the river's future gravel resource management.

2. Waipara River Description

The Waipara River runs for around 71km (North Branch) from its headwaters in the Okuku range where it drains seaward from elevations of around 700m. The catchment area of the Waipara River is 737km².

For the upper parts of the river the river drains hill country formed predominantly by greywacke and argillite.

The lower river reaches cross glacial outwash deposits of the Burnham and Windwhistle formations.

The Waipara River catchment includes the town of Waipara and the intensively farmed vineyard areas surrounding Waipara. Other habitation is generally limited to isolated dwellings. State Highway 1 and the main trunk railway cross the Waipara River about 15 river kilometres from the sea.

3. River Processes

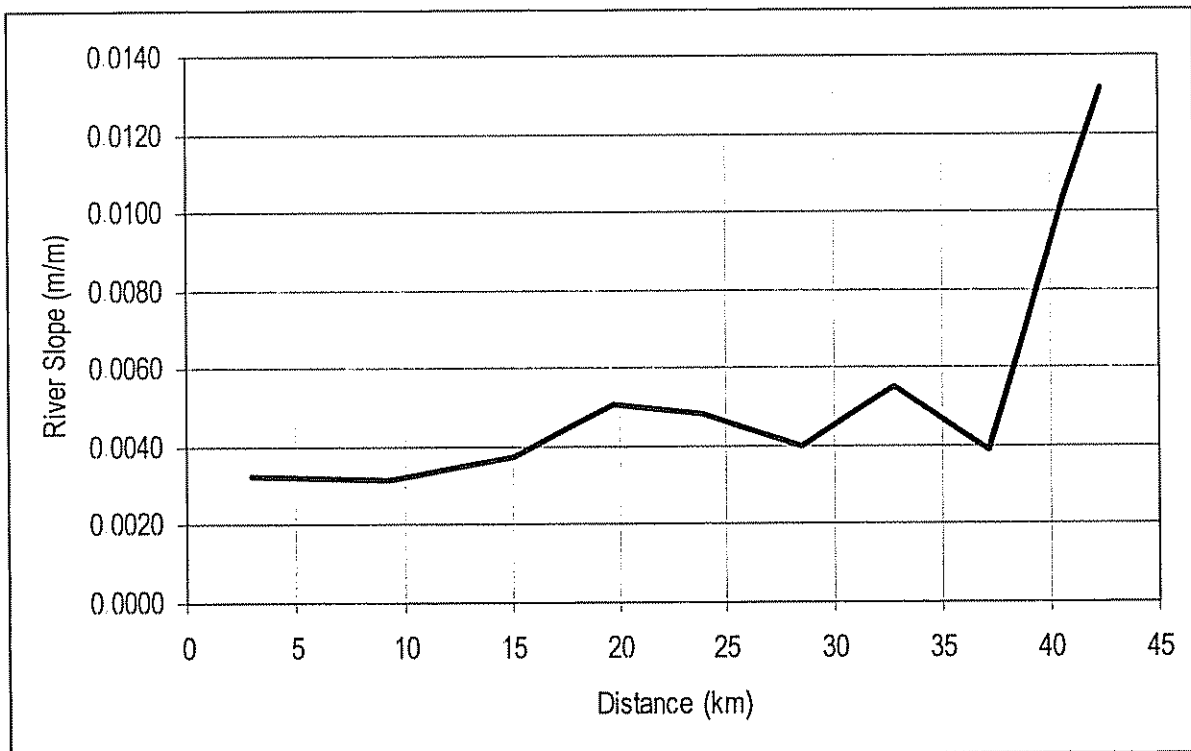
3.1 Flooding

The Waipara River does not have a formal river control scheme. Any works on this river will be localised works built in an ad-hoc manner according to individual farmer's requirements to provide protection to his property. The river is entrenched by more than 20m throughout almost all of its length and therefore has few flooding problems.

3.2 Bed Profile

The river drops in slope from 0.013m/m immediately below the confluence of the north and south branches to 0.0035m/m at the coast (refer Figure 3.1).

Figure 3.1: Waipara River Slope



As a result of the profile there is some potential for aggradation, however, the river is likely to be degrading through the landscape as it is entrenched for most of the length of the reach being investigated. This means that it is unlikely that the river bed levels are rising despite the drop in slope. Therefore it is unlikely to have a natural long-term supply in these areas.

One site where there could be a potential supply is on the lower reach at the coast. On this reach the river could behave in a similar manner to the Ashley River in which case there could be a supply of about 50% of that of the Ashley. To confirm whether there is any aggradation on the river, cross-sections need to be installed upon the river.

Any gravel extraction that caused degradation could undermine any river control works installed on this river by local farmers and also bridges and other works on the river. In this case these types of work would be to give lateral bank erosion so any degradation would directly affect the ability of these works to function. These areas would need to be assessed before any extraction could take place.

4. Gravel Extraction

Environment Canterbury monitor gravel extraction from the Waipara River by requiring extractors to submit returns indicating how much, when and where gravel is taken. The Waipara River gravel returns for the period from 1994 to June 2005 have been made available to us.

Our analysis of the returns data has been to determine the patterns of where and when gravel has been extracted from the Waipara River over the 11.5 years of record. Table 4.1 extends the record to 12 years (by extending the 2005 returns out to a full year).

Table 4.1: Gravel Returns by Year for the Makikihi River and Tributaries

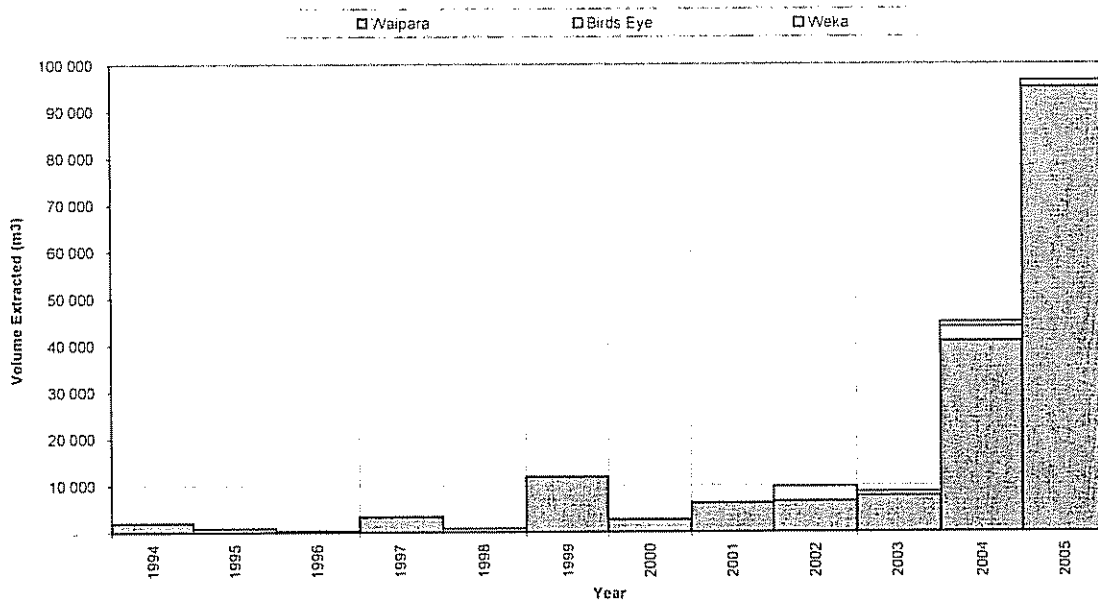
Year	Waipara	Birds Eye	Weka
1994	2,146	-	-
1995	1,000	-	-
1996	400	-	-
1997	3,369	-	90
1998	900	-	-
1999	11,900	-	-
2000	2,660	-	180
2001	6,250	-	60
2002	6,700	3,000	-
2003	7,790	-	863
2004	40,811	3,000	1,026
2005	94,968	-	1,432
Total	178,894	6,000	3,651

¹ Returns for year 2005 to June have been doubled to estimate full year extractions

For the Waipara River the total volume of gravel extracted over the period of record was 179,000m³, at an average rate of 14,900m³/yr.

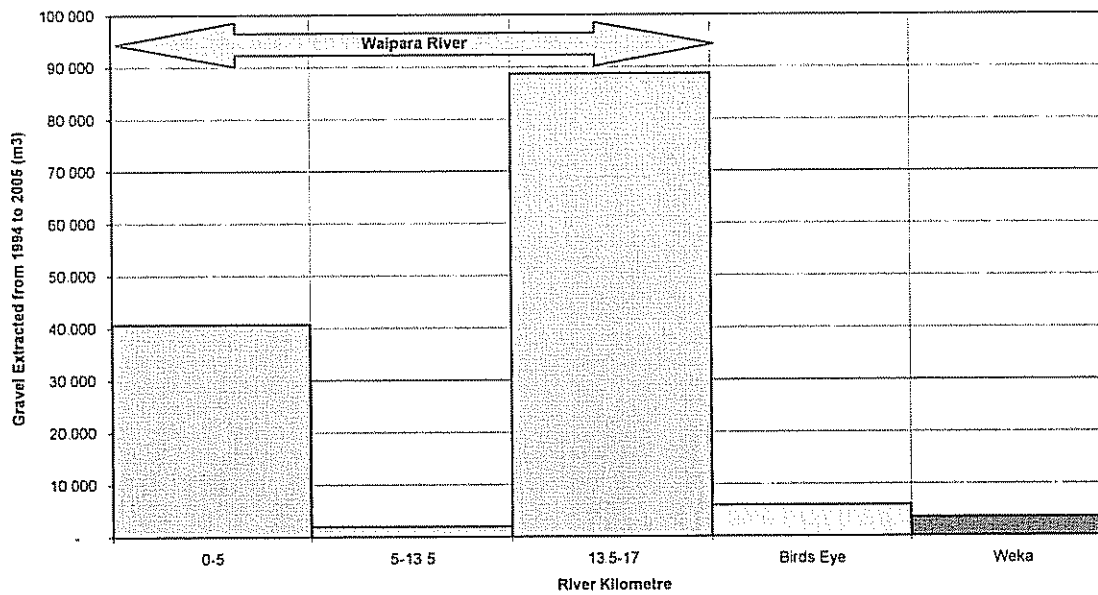
The temporal distribution of the extractions has not been even over the 14 years of return records. Figure 4.1 shows very low rates of extraction up to 1998, followed by a relatively big year in 1999 and an increasing trend to 2003 and a huge increase in the rate of extraction in 2004 and 2005.

Figure 4.1: Waipara River Gravel Extraction by Year 1994 - 2005



The spatial distribution of the gravel extraction shows most of the gravel is taken within 5km of the coast and between 13.5 and 17km from the coast

Figure 4.2: Waipara River Gravel Extraction – Spatial distribution



5. River Bed Changes

No conclusions are possible for the Waipara River bed levels. The monitoring undertaken by Environment Canterbury consists of two surveys of three cross-section locations and does not provide a sufficient basis to analysis

6. Gravel Supply

In the absence of enough riverbed monitoring surveys to work with, the gravel supply assessment for the Waipara River is based on the Ashley River assessment.

The Waipara River and the Ashley River share a number of commonalities. Both rivers:

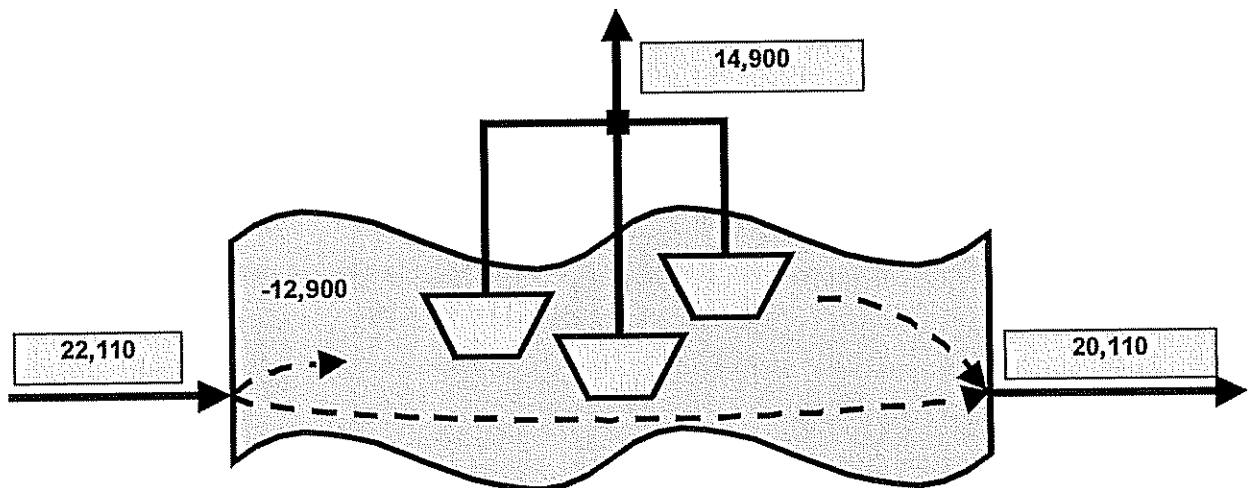
- Are located in North Canterbury. Their mouths are within 15km of each other.
- Have headwaters draining the Okuku Range (typified by Argillite and Greywacke). The Ashley headwaters also drain the Puketeraki Range which shares a similar geology.
- Flow to the sea across glacial outwash deposits.
- Have similar average bed slopes of around 0.004 within 25km of the coast.

The key difference between the two rivers which we have used to assess the Waipara gravel supply is the relative catchment areas. The Waipara catchment area is 737km² and the Ashley catchment is 1,302km². With other factors affecting the gravel supply being generally similar, the available gravel supply in the Waipara River should be around 55 percent (based on prorating catchment areas) of that in the Ashley River.

Our work on the Ashley River (see References) concluded that there is a sustainable gravel supply of around 3,600m³/yr in that river. It follows that the Waipara River's sustainable gravel supply is around 2,000m³/yr.

Figure 6.1 shows what *may* be happening in the Waipara River on the basis of the observations and assessments of the Ashley River and the relative catchment areas of the two rivers. The grey coloured boxes show the river bedloads, the light green box shows the gravel extraction (average 1994 to 2005) and the pale blue box shows the rate of gravel volume change in the river reach.

Figure 6.1: Waipara River - Schematic Representation of Change in Gravel Volumes



7. Discussion and Recommendations

The indicative gravel budget based on the Ashley River assessment shows that there is likely to be a sustainable gravel supply of around 2,000m³/yr in the Waipara River

It is likely that the current rate of gravel extraction (average of 14,900m³/yr from 1994 to 2005) is well in excess of what can be sustainably taken without lowering the river bed levels

There is no design bed level or bed level survey information to draw conclusions about possible local extractions

A monitoring programme to record river bed levels for use in assessing bed status and changes should be commenced

To decide whether gravel extractions from the Waipara River should occur in the future (and if so where from and in what quantity) an assessment of the required and existing flood capacity and minimum bed levels to protect infrastructure is required. This assessment would yield design bed levels against which river management decisions could be made

8. References

MWH (2005), "Ashley River Report Status of Gravel Resources and Management Implications", Report for Environment Canterbury.