IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of applications by the HAWKES BAY REGIONAL COUNCIL for RWSS Tukituki Catchment Proposal

STATEMENT OF EVIDENCE OF SARA GERARD

1. Executive Summary - Evidence 16 October 2013

In my opinion, the proposed Ruataniwha Water Storage Scheme (RWSS) scheme, the Dam and reservoir, and the extensive distribution of headrace and pipes and associated infrastructure bridges and maintenance roads has a major impact on the natural physical and ecological processes in the catchment, the natural and landscape character, and visual amenity of the Tukituki Catchment.

The proposed 83m high dam and the redistribution of water will have degrees of effect on the braided rivers of the Makaroro, Waipawa Tukituki River and coastline landscape around the Tukituki River Mouth. The proposed Makaroro on-river dam will have significant adverse effects on the moderately high natural landscape values of this braided river valley and gorge.

The photomontage of the proposed RWSS dam provided by the applicant Mr Gavin Lister’s Landscape Assessment Appendix 3.4 does not show full extent of the dam by not showing the gorge portion of the dam, and omits the associated dam infrastructure. In my opinion the photomontage is a misrepresentation of the visual and landscape effects of the dam.

In my opinion the RWSS Reservoir will have very low visual amenity. I believe the photomontages prepared in the Applicant’s Landscape Assessment report showing an attractive lake of high water level, omitting dead standing trees, is a misrepresentation of a purpose built irrigation reservoir.

I believe the RWSS scheme is an over engineered solution to catchment management. The RWSS will have a significant adverse actual effect on natural character and landscape patterns. In my opinion smaller off-river tributary catchment water storage would provide significantly less conveyance infrastructure and be able to integrate with the terrace and plain landform and natural drainage patterns.
The Tukituki catchment has a diversity of distinctive landscapes with a number of landscapes types areas that will be affected by the RWSS through change in land use from irrigation and change in river flows, geomorphology and water quality.

There are notable areas of undulating terrain in the catchment above the Ruataniwha Plains under the RWSS Production Land Use Zone map. Potential removal of Totara in this landscape type is an adverse landscape effect of irrigation.

On the Ruataniwha Plains there is a change in landscape pattern occurring already with irrigation. The longer the irrigators the greater the removal of trees, the more monocultural the character of the landscape becomes. The extent of monoculture has an adverse effect on biodiversity in the landscape. I consider limits need to be placed on the size of travelling irrigators.

Given that the engineered RWSS is based on one large in-river dam distributing water from one tributary catchment, the Makaroro, stretching canals and pipes with pumped water over the plains and over rivers to other tributary catchments. This water conveyance pattern has adverse effect on the landscape as well as the natural intrinsic values of the catchment being incoherent to natural drainage and ecological patterns.

Further reduction in river water quality and biodiversity through landuse intensification by dairy farm conversion will, in my opinion, adversely affect natural intrinsic value and mauri of the river and the visual amenity and natural character of the river landscape.

The proposed RWSS Makaroro River dam will reduce the amount of sediment in the river system which will eventually be pushed out the Tukituki River mouth during storm events. The dam will potentially have a long term effect on physical coastal processes and increasing the potential of coastal erosion, effecting visual landscape character and visual amenity of the coastline into the future.

In my opinion as well as protecting and enhancing water quality and the natural intrinsic values within the Tukituki catchment, the Plan Change 6 should address managing landscape change and weaving biodiversity resilience into production landscapes.

I consider visual amenity, landscape and natural character of gas drilling activities should be addressed under Plan Change 6.
Table of Contents

1 Executive Summary 1
2 Introduction 4
3 Scope of Evidence 7
4 Involvement of Project 7
5 Relevant Statutory Documents 8
6 RWSS Project Description and Assessment of Effects 8
   Dam assessment, findings and summary 19
   Reservoir assessment summary 27
   RWSS Distribution Conclusion 32
   RWSS Discussion and Summary 33
7: Plan Change 6 Assessment of Effects 34
8: Gas Drilling and Plan Change 6 51
2. INTRODUCTION

Qualifications and experience

My full name is Sara Frances Gerard. I am the Principal Landscape Architect of Gerard Land Design.

I hold a Bachelor of Science degree, majoring in Geography, from the University of Canterbury 1982 and a Post Graduate Diploma in Landscape Architecture from Lincoln College (now Lincoln University) in 1985.

As a Landscape Architect and have been in practice since 1986. I have been a corporate member of the New Zealand Institute of Landscape Architects Inc (NZILA) for 22 years.

I have a broad range of landscape planning and design experience obtained from project work for central and local government, government corporations and private companies. I have prepared numerous landscape assessments for private resource consent applications at Council level and recent years presented at hearings before the Wellington City, Hastings District, Gisborne District and the Hawke’s Bay Regional Councils.

I have twenty eight years’ experience as a Landscape Architect, much of which has been rural based. I have been involved with a range of Local and Central Government Agencies and Corporate Companies and as a director of a practice specialising in Landscape Architecture, Sara Gerard & Associates 1991-2003 and Gerard Design from 2012 to present day.

Central Government Agencies I have worked for include Lands and Survey, Ministry of Works and Development, Ministry of Forestry. In Britain I worked Ministry of Agriculture, Fisheries and Food (United Kingdom) undertaking work associated with Agricultural Schemes to reduce the “grain mountains” at the time. This involved research into the Set-aside Scheme and the Landscape Assessment for the South Downs where farmers were paid to reduce areas of cultivation under the ESA -Environmentally Sensitive Area Scheme.

I was the principal of Sara Gerard & Associates which Landscape architectural worked specialised in the rural sector. As well as forestry, agricultural, conservation and rural subdivision projects, I worked the waterway enhancement projects for the Christchurch City Council, land
stabilisation work for Timaru Port Company and public areas for Electricorp Waitaki on lake projects.

During 2003-2005 I was employed by the Hawke Bay Regional Council Land Management division as an Environmental Enhancement Officer where I had the role of managing 12 Hawke’s Bay regionally significant wetlands, one being the Tukituki Estuary and the Coastal Care Programme. I was part of the multi-disciplinary team in the development of the Te Karamu Catchment Enhancement Strategy. 2007-2012

I was employed by Opus International Consultants and during this time worked with New Zealand Transport Agency on highway and bridge projects, Gisborne District Council as an expert in coastal processes and Central Hawke’s Bay District Council for wetland sewage treatment.

I was brought up on a mixed farm on the Rangitata River Terraces on the edge of the Canterbury Plains. The property is now farmed by my sister’s family. The Rangitata Diversion race flowed through our property, as well as an intake and spillway to feed the secondary Sheppard’s Bush race. I have had the experience first-hand of growing up with a head race and the schemes infrastructure.

Coming from Canterbury I have witnessed the landscape changes that have occurred with the growth of the dairy sector from a previously primarily dry land farming regimes of cropping and sheep, deer and beef cattle farming. Through my farming background, professional and social life, and now that I live in rural Hawke’s Bay and that I have kept myself informed by reading and listening to farming media, I have a good understanding of farming regimes and the communities.

I am familiar with Tukituki Catchment through my work in Land Management in the Hawke’s Bay Regional Council. For two years I managed the Tukituki Estuary Management Plan. I worked alongside HBRC Land Managers working on land management in the catchment and have an understanding of the erosion and the water quality issues in this catchment.

I am familiar with the Ruataniwha Plains area. I visited the site of the upper reservoir 2nd October 2013, and wished to visit the dam site however was prohibited. With an extension granted by the Board (Minute No 11) I
subsequently visited to the Dam site 16 October 2013. On this visit I also carried out a site visit to the head water of the Papanui Stream. On the 2nd October it was raining and the river was in flood.

It is normal practice for regionally significant projects for the landscape architect involved to present the project to the local branch of the Institute of Landscape Architects. To my knowledge this did not occur.

I have stated in my Gerard Land Design submission that I am opposed to the magnitude of the on-river Ruataniwha Dam proposal. On that basis I have an interest in the outcome and I regard that I may not be sufficiently independent to be an expert. I am representing myself as a locally based landscape architect that has experience in catchment work and production landscapes in New Zealand and in Britain.

This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.
3. **Scope of evidence**

3.1 For the purpose of this evidence I define **Landscape** as the expression of the cumulative effects of physical, ecological and cultural processes.

3.2 I have read the statement of evidence of Mr Gavin Lister. My statement will provide assessment to address landscape issues in regard to:

- Ruataniwha Water Storage Scheme Project Description and assessment of effects
- The Tukituki Catchment and Plan Change 6, Landscape characterisation and assessment of effects.
- Plan Change 6 Gas land use activity and assessment of effects.

4. **Involvement in project**

I have undertaken to present evidence to address matters towards issues relating to the effects on natural character, landscape character and visual amenity values. I believe such a nationally significant project requires checks and balances in all aspects and this should include landscape effects.

I have attended two Water Symposiaums held by HBRC and kept myself informed through the process via the HBRC webpage, Landwise field day, media, and in conversation.
5. Relevant Statutory, Policy and other documents

Resource Management Act

6. Ruataniwha Water Storage Scheme (RWSS Project Description and Landscape Assessment of Effects)

In my evidence I outline my understanding of the proposal and in my presentation to follow will assess whether the proposal is consistent with the intentions of the RMA.

In my evidence, I address the proposal in regard to natural character, and landscape and visual amenity.

6.1 The Makaroro River (RWSS) Dam

The dam will be 83 m height at the river’s deepest point. The Application Design of the proposal allows for “irrigation and flushing flows to be drawn from multiple levels within the reservoir through an intake tower into a penstock located in a tunnel beneath the dam. This is an area of potential optimisation as discussed in Section 3. A hydro power station located at the toe of the dam will harness energy before releasing the water into a tailrace canal excavated to the true right of the existing river. A concrete lined spillway will take flood flows through the right abutment and discharge into a stilling basin that joins the tailrace. The discharge point to the river from the spillway is located to avoid a potentially unstable rock mass above the left bank downstream of the dam.”

T&T Ref: 27690 Issue B.
Figure 1: RWSS Application Design

Figure 2: RWSS Feasibility Design

Source: RWSS K1 Project Description Tokin & Taylor (May 2013a) Part B

Appendix A Dam and Reservoir Drawings
My Lister compares the Opuha rock fill dam as similar construction as to the proposed RWSS Application Design.

The proposed RWSS Dam is to be 83m while the Opuha is 47m high. The Opuha Dam is located on river flats at the start of a gorge in catchment as part of the Southern Alps with Mount Misery at 2294m shown below.

![Figure 3: Opuha Dam, South Canterbury](image)

Source: Opuha Water Ltd

The proposed RWSS dam is located in a river valley in foothills, with the northern Ruahines with the highest peak being 1234m high.
Figure 4 Appendix 3.4 Mr Gavin Lister’s Landscape Assessment

Alternative primary spillway site

Figure 5: Photo S Gerard 16 Oct 2013. 16 October assessment.

Photo showing gorge with indicative locations of proposed dam and spillways but not including construction form of spillways and tail race, the auxiliary spillway to take flood flows roads, hydro power station, buildings, spoil disposal, power transmission lines or vegetation clearance. Without these features it is hard to interpret the scale of the dam. The full height and the
extent of required infrastructure was omitted in the Applicants photomontage of the dam. I consider with these omissions this photomontage is a misrepresentation of the visual and landscape effects of the proposed dam.

Figure 6: Gorge at proposed RWSS dam site. Photo  S Gerard  16 Oct 2013

**Landscape Character Assessment - of existing proposed dam site and surrounding area.**

Landform: Low greywacke foothills as disjointed hummocks and knobs forma dendritic shaped valley, with many side gullies. I do not regard the hills to be “bold”. Terraces have formed both sides of the braided river valley. As the river meanders around the rock bluffs the river cuts through as a gorge. At the locality of the dam site the river flows down through a steep deep rock faced gorge, with the river about 30m down from the top of the terrace.

Figure 7: True right proposed dam abutment. Photo  S Gerard  16 Oct 2013
The knobbly hill forming the true right abutment of the dam, with the intake weir for the primary spillway about position of arrow on left. The location for an alternative intake weir for a primary spillway is roughly around the position of the blue arrow on the right.

**Figure 8:** Looking downstream over the terrace, river gorge and "potentially unstable" greywacke knob. Note two landslips on hills in distance (see Figures 14 & 15) Photo  S Gerard  16 Oct 2013

"An area of dilated, potentially unstable rock is identified on the left bank wall of the gorge extending from the downstream toe of the embankment a further 200 to 250m downstream."4.2  K1 Project Description, Tokin & Taylor

**Figure 9:** True left proposed dam abutment. Hummocky hill forming the left abutment of the proposed dam is positioned roughly around the position of the black arrow. To the back of this hummock is the proposed auxiliary spillway (blue arrow). Photo  S Gerard  16 Oct 2013
Figure 10. Looking north over river terrace to river upstream. With terrace of true left bank and steeper erodible hill faces on true right side of river valley. Photo  S Gerard  16 Oct 2013

Figure 11: South end of landslip. Photo  S Gerard  16 Oct 2013

Described by Tokin & Taylor in the K1 Project Description as a “90 m high landslide located on the right bank of the reservoir approximately 0.5 km upstream of the dam could remobilise during reservoir filling or be triggered by the maximum design earthquake.
Tokin and Taylor state: “Optimisation in respect of this landslide would entail further site investigation, design and analysis to review of the scale of movement and likelihood of wave generation relative to freeboard requirements.
Figure 12: Part of Landslip upstream from dam.

Photo S Gerard 16 Oct 2013

Figure 13: Valley slope upstream with continuation of the landslip.

Photo S Gerard 16 Oct 2013

Figure 14:

One of three large landslips downstream of dam site (see Figure 8).

Downstream of the proposed dam site three more earthquake derived landslips are notable landscape features on valley slopes above the river (the largest one is most southern is further downstream, which was observed using aerial photography by Peter Scott.)

Figure 15

Large landslips as features on the Makaroro River gorge landscape.

Source: Peter Scott

The shore and valley slopes of the proposed reservoir may be affected by future earthquakes causing further landslips. The reservoir will be filled (and constantly refilled after that) potentially remobilising slopes. Eroding slopes will be exposed to a fluctuating level and fluctuating weight of water and exposed to saturation and drying, the removal of vegetation and effected by a degree of wave action. With these processes the proposed reservoir shores, notably those from true right 0.5km upstream of the dam on true right shores, are likely to be affected by slipping and erosion and become a raw dynamic feature on the reservoir landscape. The extent of area of this raw dynamic feature has the potential to be a significant adverse effect on the amenity and landscape character of the reservoir.

The 20m wide planted area above these erodible slopes around the shoreline are likely to erode back in time and do little in mitigating the adverse effects of the extent of erosion.
Vegetation: To the west of the valley the indigenous forest on the terraces and hills slopes above and most of the gullies has been cleared for pastoral dry stock farming. A few remnants of mature trees still stand, some being in the gully where the spoil disposal area is proposed below the dam. To the east side of the river the land is managed under Smedley Station and is more extensively grazed with significant areas of mature podocarp forest on the terraces and up into the gullies most notable being the Donovan Gully.

**Figure 16**: Makaroro River gorge with notable mature podocarp trees. There tree will be submerged. Photo  S Gerard  16 Oct 2013

**Figure 17**: Terrace in foreground looking towards Donavan Gully with notable mature podocarp corridors from the river gorge up side streams to the hills. The mature forest has significant landscape ecological values. These forest areas are to be submerged by the reservoir
Figure 18: River terrace with notable mature podocarp forest which will be submerged by the reservoir.

There would be a significant adverse effect on the Mokaroro and Waipawa River landscapes if the dam breached from an earthquake, or during construction as what occurred with the Opuha Dam. A dam failure during the dam operation would have significant landscape effects along the path of the wave of water.

Figure 19.

The partially completed Opuha dam failed 6 February 1997, releasing about 13 million cubic metres of water into the Opuha Riverbed.

Opuha Gorge, 5 km downstream of Opuha Dam, swept clean of vegetation, soil and water recorders.

Photo Source: Philip Lees 1 and David Thomson 2 Emergency Management, Opuha Dam collapse, Waitangi Day 1997
Dam Assessment Findings and Discussion

The photomontage of the proposed RWSS dam provided by the applicant Mr Gavin Lister’s Landscape Assessment Appendix 3.4 does not show full extent of the dam by not showing the gorge portion of the dam, and omits the associated dam infrastructure. In my opinion the photomontage is a misrepresentation of the visual and landscape effects of the dam.

The Ruataniwha Dam, if built, would be the biggest irrigation dam in the country. When the reservoir is drawn down to its lowest operating levels, it will be a novel stark unnatural landscape. The dam itself will be an iconic engineering “man over nature” feature in the landscape. For these reasons I consider people will want to visit the dam site.

The dam is surrounded by unstable earthquake affected landform yet it is very unlikely any natural landslip or blockage in a river system would create a dam of this height relative to the enclosing landform. The dam height therefore is out of proportion to its small abutment landforms and to the hills that form its reservoir, especially so to the east. The effect will create a large elevated large water body of man-made, unnatural character.

In my opinion the reservoir above the dam will not have the qualities of being “picturesque” or a “serpentine lake” and “contained by bold hills”. as described by Mr Lister.

By destroying and submerging a significant area of braided river and significant river edge habitat of mature podocarp forest, the proposed dam will have significant adverse effects on the moderately high natural landscape values.

6.2 The Dam Reservoir

Exiting Landscape and Natural character

Braided river and terraced landscape, surrounded by steeper hills, with remnant of mature beech and podocarp forest with significant habitat values contributing to a natural character, pastoral grassland and Pinus radiata plantations providing a rural landscape character. There is a low degree of built structures and the attractive sunny valley setting provides high visual amenity for visitors and recreationalists.
Adverse effect on Landscape Ecology.

In terms of ecological effects I refer to Kessels & Associates Ltd and Alan Forbes documents.

The total area affected by flooding, the dam structure and spoil disposal is approximately 450.18 ha. A total of 185.18 ha of ecologically significant indigenous vegetation and habitats would be flooded by the proposed reservoir, or covered over by associated infrastructure including the dam structure, new access tracks and soil disposal sites. This comprises of: 80.71 ha of mature and secondary indigenous forest (including a number of trees which would be in excess of 300 years old); 2.69 ha of treeland; 22.70 ha of secondary indigenous scrub; 73.97 ha of gravel river bed; and 5.11 ha of wetland or seep zones. One At Risk plant species was found – red mistletoe.

Kessels noted “Nationally Vulnerable New Zealand bush falcon, and one adult banded dotterel with a chick. Nationally ‘At Risk’ species detected were pied stilt, New Zealand pipit, black shag and North Island fernbird. Long-tailed bats were found throughout the proposed reservoir. When viewed in this landscape these species provide indicators of ecological health.”
In addition to measures to avoid, remedy or directly mitigate for potentially affected flora and fauna, three key Mitigation and Offset packages are recommended. These are:

A Ruataniwha Reservoir Restoration Buffer and Catchment Enhancement Zone:
The objectives of this package are to:
• Recreate 46 ha of riparian margin with indigenous vegetation, which will provide habitats and ecological linkages for a wide range of fauna and flora.
• Restore and enhance at least 100 ha of marginal farmland and existing forest, scrub, treeland, shrubland and wetland remnants within the sub-catchment above the dam to quickly improve existing habitat for flora and fauna, reinforce ecological linkages.

Alan Forbes in his report Tukituki Catchment Terrestrial Ecology Characterisation commissioned by HBRC December 2011 also describes the effects of the reservoir on the ecological landscape in pages 89 to 93 in his report. He explains the generic assessment of effects from changes in river flows and/or river morphology to river and terrestrial bird values. He then follows with the proposed Ruatanwha Augmentation Scheme as an example of the potential effects during the construction phase and post construction phase.

Forbes states “Flooding of considerable areas of native forest will occur when the dam is completed. This is in an area of significant native riparian vegetation (providing natural character), which provides for an ecological landscape corridor for native birds, as well as important nesting and feeding habitats”.

Forbes states “no matter how much area is planted, this will take many years before it is able to support the same number of birds, and the impact of the loss of old native trees is difficult to determine reliably”.

AEE recommendations as minimum requirements

I consider as a minimum the proposed conditions of consent would need to adhere and commit to the recommendations within the Aquatic and Terrestrial Ecology, Landscape and Recreational Assessment reports and cultural requirements as an outcome of the consultation process.
Minimal requirements in the consent should include the implementation of “Integrated Mitigation and Offset Approach and through a Reservoir Filling and Edge Rehabilitation Plan - to be progressively implemented upon commencement of construction of the Scheme, which incorporates most of the recommendations into a coordinated plan”.

I note also there are landscape recommendations relating to the reservoir and its surroundings are incorporated in a ‘Project A: Ruataniwha Reservoir Restoration Buffer and Catchment Enhancement Zone’ and other recommendations are included in the ‘Ruataniwha Water Storage Scheme Construction Environmental Management Plan’, (May 2013). Section 4.9 contains methods for revegetation of earthworks and section 4.10 contains methods to reduce visual impacts of the proposed earthworks. These should be at least a minimum requirement as a condition.

Mr Lister’s landscape assessment states “While there will be some potential adverse amenity effects resulting from the seasonal bare zone around the reservoir margins, a range of measures is proposed to mitigate such effects”.

The above should not be a recommendation rather it should be an integral part of the project and implemented as a cost within the project. In my opinion setting up a Trust is inappropriate. The cost of managing and implementing mitigation requirements should be under the construction contract and a 35 year management plan managed through a maintenance contract(s), as an integral part of the project operation. The maintenance needs to be budgeted and monitored for, the same as most large infrastructural projects (e.g. highway projects) under the RMA process.
**Fluctuating Water Levels.**

In my opinion the bare zone on the reservoir will be a significant adverse landscape effect. The Ruataniwha reservoir is a dendritic shaped water body. The dendritic nature of the reservoir gives it much greater edge effect than say an oblong water body. With the fluctuating function of the reservoir this edge effect will mean the thinner branches of the water body may be completely bare during summer months.

Accurate reservoir surface and cross sections are required so to assess the seasonal water levels and the extent of the bare zone. Further information is required –

a) Longitudinal cross section(s) showing length of the reservoir to the dam horizontal

b) Representative reservoir horizontal cross sections for the length of the dam, say at every 750 m.

c) A reservoir cross section (showing the seasonal reservoir operating levels) for site of public access, jetty, showing level of the car park and road access.

d) The volume/height/surface area relationship.

The only reservoir drawings I have found supplied by the applicant showing reservoir fluctuations are perspective drawings and these are not clear enough for assessment. The quality from this set of drawings is very poor, being difficult to read, assess and to reproduce for the purpose of evidence.

In my opinion there will be extensive areas of bare zone, especially in late summer and autumn creating a water body that has very low visual amenity and natural character.

I intend to produce the above data I require to present some reservoir surface area plans and cross sections during my presentation to the board.

**Dust**

Dust is considered to be an adverse effect by Tonkin Taylor and they recommend shelter belts as a means of mitigation for neighbours. The
potential dust clouds are an adverse effect on the visual amenity and landscape character.

When the reservoir is drawn down the 20m planted buffer around the reservoir edge and shelter belts will do very little in mitigating dust clouds during strong winds.

**Drowned Dead Trees**

The proposal has not allowed for tree removal for the reservoir footprint. Large mature native podocarp and beech forest trees will be drowned. When the reservoir is operating at lower level during the summer months these significant areas of dead trees will be visible, with the dead canopy tops standing out of the water. Not only would these trees be an eyesore they will be a perceived hazard. They will look morbid; significantly reduce visual amenity and landscape character. These trees will be standing for some time, especially the totara.

![Figure 21: Example of mature Podocarp trees to be drowned. Exiting dead trees have been killed by bed aggregation following cyclone Alison. Photo S Gerard 2 Oct 2013](image-url)
Figure 22: Trees in foreground - example of mature podocarp trees to be drowned and left standing. Photo: S Gerard 2 Oct 2013

Water plumage

Water plumage is an engineered solution to get water movement within the Lake body to improve water quality. Typically water plumage areas are roped off with signs so to inform any water user there is a hazard. This perceived hazard will lower the natural values and visual amenity.

Sediment training banks and other sediment flushing devices

Tonkin &Taylor state “Sediment focussing by in-reservoir works to manage sediment storage within the reservoir and Hydraulic flushing of fine sediments via low outlets would need to be provided for at the detailed design stage.

These can consist of training banks and similar structures to enhance flushing of sediment from live storage to dead storage, and for access up-river. Closure (not included in the Application Design)"

These are further man-made structures in the reservoir having an adverse effect on natural and landscape character and visual amenity.
Reservoir Assessment Summary

The dam and reservoir will have major adverse effects on the natural and landscape character and visual amenity of the area.

In my opinion the accumulation of the adverse effects of reservoir features would create a landscape that is very low in natural character and visual amenity. This would have a significant effect on the recreational values of the proposed reservoir water body. The landscape character would be one of a dam reservoir, with a large man-made fluctuating bare zone being most dominant, especially over the late summer and autumn months. I believe the photomontages prepared in the Applicant’s Landscape Assessment report showing the reservoir as an attractive lake, omitting dead standing trees is a misrepresentation.

I consider mitigation recommended should be a requirement of the consent holder and part of the development cost of the project involving a 35 year management plan, budgeted and monitored under maintenance contracts.
6.3 Downstream of the Makaroro and Waipawa Rivers

The section of the river from the dam toe to the Waipawa River confluence, a section of 12.3 km will have significant impact in terms of river geomorphology, flow regime and water quality. Natural patterns of floods and freshes have the function of removing weeds, such as lupin, broom and gorse that are a serious threat to the braided river bird habitat. Without natural freshes shingle islands will stabilise and deep channelization of the river bed will start to occur. The mauri of the river will change. The construction phase is likely to cause the most alteration to habitat and flow regimes. Additionally the construction of the hydro power station will reduce flow rate variability within this section of the river.

Alan Forbes page 89-93 provided an assessment of effects of changes in water flows. In 5.2.1 he explains the changes in the physical and chemical, and water temperature through storage of water in reservoir. The landscape effects downstream from changes in the physical, chemical and temperature of the water causing marked effects on water quality and the landscape ecology of the braided river downstream, adversely effecting its natural character.

6.4 Primary Distribution System Headrace Canal Zones

Proposed RWSS Infrastructure

Tokin & Taylor describe “The alignment of the headrace canal is constrained by the topography of the area and follows the base of hilly ground to maintain head whilst minimising earthworks. The elevation of the intake site (approximately 260 m RL) determines the maximum elevation of the canal. Based on the Application Design intake discussed in the preceding section, the primary distribution system headrace canal water elevation (hydraulic grade) adopted for assessing alignments is 258.2 m RL at the hydraulic jump location immediately downstream of the radial gate structure.

All of Zone A is proposed to be piped. A siphon under the Waipawa River about 300 m downstream from the upstream water intake connects the Zone A piped system to the primary distribution system headrace canal within Zone B.

The primary distribution system headrace canal supplies all of the Zone B and part of Zone C secondary system via a canal south from the intake past Ongaonga and through several siphons under the Kahakahuri and Ongaonga streams. The
canal then transitions to the primary distribution system pipeline near Ashcott Road. The primary distribution system pipeline then services the remainder of Zone C and all of Zone D. The canal end point at this location avoids a bridge over Ashcott road, the gas pipeline and a major storm water crossing under an appreciable but unnamed tributary of the Tukipo River. Supply to the areas east and south of the headrace is provided by the secondary distribution system pipelines which are required to cross the Vector gas pipeline to supply the southern area of Zone C and all of Zone D.

6.5 The Head Race

Propose RWSS Head race description:

Ruataniwha Water Storage Scheme Project Description T&T Ref. 27690 Issue B describes

Canal Cross sections and liners :2H:1V slopes have been adopted for cut and fill profiles from the canal crest to existing ground level outside of the primary distribution system headrace canal. The cut batter slope and fill embankment heights have been restricted to a maximum of 15 m, to reduce the likelihood of potential slope stability issues.

Allowance is made for some landscape fill/cut to waste, rather than a balanced cut to fill. This is because the rate for cut to waste/landscape fill is generally considerably cheaper than balanced cut to engineered fill. This approach is often quicker too. (with greater impact on landscape)

Based on preliminary understanding of the geology along the primary system canal alignment, substantial sections of the trapezoidal channel may require a liner to minimise canal leakage and demonstrate efficient water use consistent with current industry. The alignment of the headrace canal is constrained by the topography of the area and follows the base of hilly ground to maintain head whilst minimising earthworks. The elevation of the intake site (approximately 260 m RL) determines the maximum elevation of the canal.

The length of primary distribution system may reduce as a result of optimisation during detailed design. The optimisation process may also result in the length of headrace canal reducing with a corresponding increase in the length of primary pipeline.
The route alignment will be optimised within the corridor defined in the Notice of Requirement during detailed design in consultation with landowners. The batter slopes of the canals will be optimised to balance the earthworks quantities where possible.”

In my opinion the RWSS scheme requiring this degree of distribution is excessive man-made modification to the catchment landscape.

The Mr Lister has indicated similarities of the proposed RWSS head race with the Rangitata Diversion Race. Such feature this will require much deliberation in the design as he has demonstrated and through the Outline Plan. It would be a significant man made infrastructural feature on the landscape, that will affect people’s daily lives. For instance our family was brought up with a fear of water as our mother was very fearful of the race with young children. The race had swift deep water and steep banks and people and stock did drown in it. Therefore proximity to residential houses, location of bridges will need to be carefully worked through.

I have noted one house has the proposed race close to two sides of the house. Even if the property owner agrees, in my opinion this should not occur.

For health and safety of people and stock I suggest areas where the bank profile allows entry and exit.

Any cut into the light gravelly soils will remain in a lighter tone than the rest of the landscape and will be a visual feature.

With careful design the head race has an opportunity to provide landscape values broader than just conveyance of irrigation water. The race could be designed so to support recreation and wildlife habitat.

The head race has many differences to the existing irrigation races in the area. They are small, gravity feed, following more natural drainage patterns, requiring little cut and fill.

The alignment and gravelly embankments of the RWSS headrace, roughly parallel and visible from SH 50, will be a noticeable engineered feature on the rural landscape.
Large distribution underground pipe is proposed for Zone A, a portion of Zone C to Zone D, and is being considered as an alternative design option for Zone M. In my opinion day-lighted water conveyance has significant environmental advantages over piped water. The open channels, sediment ponds have more environmental values than piped water as explained in the graphs below.

![Costs of 'natural treatment'](image1)

![Costs of piping](image2)

![Values realised for natural channels](image3)

![Values realised for piping](image4)

**Figure 23:** Christchurch City Council Diagrams describing the values of open water conveyance in the landscape in comparison with piping.
I am concerned diverting large amounts of river water into pipes does not require a Resource Consent. I consider there should be community discussion on the merits of piped water versus open channels for water conveyance. This process should provide an engineering, economic and environmental cost analysis over 35 years of the options and the assessment in the environmental effects.

Piping the water is taking water out of the landscape and ecosystem.

**6.7 Concern with the “mixing of waters”**.

Given that the RWSS is based on one large in-river dam distributing water from one tributary catchment, the Makaroro, to other tributary catchments. This practice is incoherent to natural and intrinsic drainage patterns and may have unforeseen ecological effects.

**6.8 Primary Distribution System - Zone M**

Tokin & Taylor describes: “The Application Design involves using the Papanui Stream (Old Waipawa River) channel to convey water. An alternative piped option may be considered during detailed design. The former Waipawa River alignment followed what is now referred to as the Old Waipawa River Bed before former joining the Papanui Stream, and then entering the current Tukituki River 25 km downstream of the proposed intake. The Bishop’s Stopbank was constructed some one hundred years ago to enable the diversion of the Waipawa River into the Tukituki River along the present river alignment to facilitate land development adjacent to the former river bed”.

I have not had time to assess landscape, natural and visual amenity of this part of the proposal. I consider this diversion may be an opportunity to undo past damage to the natural river system.

I believe the option of piping the water would be a more than minor adverse effect on the landscape and would undermine the environmental benefits the Applicant is stating for the diversion proposal.
Effects on the Coastline Landscape:

The natural dominant means of supply of sediment to the coast sediment form the Tukituki River is during major flood events such as cyclones. The proposed RWSS Makaroro River dam will reduce the amount of sediment in the river system which will eventually be pushed out the Tukituki River mouth during storm events. The dam will potentially have a long term effect on physical coastal processes and increasing the potential of coastal erosion, effecting visual landscape character and visual amenity of the coastline into the future. Not having enough sediment in the coastal system will have a potential adverse effect on the coastal landscape through increased coastal erosion.

Discussion: Mitigation by extraction - trucking sediment form length of the river bed directly u stream from the Tukituki estuary to beaches both sides of the river mouth is regarded by the HBRC as an appropriate mitigation. When I consider effects on the natural physical coastal processes, predicted sea level rise higher storm wave surges with climate change, I would hope extent of modification of the proposed dam on sediment flow through the catchment to the coastline, and the degree of mitigation, is being appropriately considered by experts in physical coastal processes.

6.9 RWSS Conclusion

In my opinion, the proposed RWSS scheme, the Dam and reservoir, and the extensive distribution of headrace and pipes and associated infrastructure bridges and maintenance roads has a major impact on the natural physical and ecological processes in the catchment, natural and landscape character and visual amenity of the Tukituki Catchment.

The Makaroro on-river dam, of a magnitude of 83m in height, would have a significant adverse actual effect on natural catchment processes and patterns. In my opinion smaller off-river tributary catchment water storage would provide significantly less conveyance infrastructure and be able to integrate with the terrace and plain landform and natural catchment drainage patterns.

In my opinion the RWSS Reservoir will have very low visual amenity. With the degree of bare zone due to fluctuating water levels, dust, water plumage, sediment training devices, dead trees standing in the water, the reservoir landscape will be unnatural and unpleasant in character, with elements of danger. In my opinion people would not go there for recreation.
In my opinion the on – river dam option, where there is a block in the natural process of alluvial flows in a braided river system, is a significant adverse landscape effect.

In my reading of the environmental reasons in the Tonkin and Taylor feasibility studies for water storage in the Tukituki Catchment, the environmental justification for the Makaroro Site to me is not clear. The decision looked to be one based on the economies of scale.

With such a large dam proposed extensive water distribution network is required. In my opinion the extensive proposed RWSS distribution system planned with a pattern and scale that requires the crossing of rivers, from one sub catchment to the next, and the extensive piping and pumping of water, is an over engineered solution on the landscape.

In my opinion, while maybe more expensive to build for the amount of water storage provided, water storage as off-river sites located within different tributaries catchments around the Tukituki catchment, with water distributed downstream by gravity, would have greater environmental values and reduced operating costs and risk to downstream users. This means of water storage and distribution would follow natural and existing drainage patterns and integrate, if not enhance the landscape.

I consider upper catchment management through managing water retention by off-river water storage, recreating wetlands, soil management, revegetation in gullies and appropriate land use regimes and practices would be a preferable approach than have a very large and extensive engineered RWSS solution adversely affecting the catchment landscape from the hills to the sea.
7. **Plan Change 6- Assessment of Effects**

7.1 **Landscape Context the wider the Tukituki Catchment**

The proposed 83m high dam and the redistribution of water will have degrees of effect on the wider catchment, braided rivers of the Makaroro, Waipawa and Tukituki River to the sea.

The Tukituki River is highly valued for its landscape, and is advertised by local business as the “Jewel of Hawke’s Bay”.

The rivers in the catchment are highly valued for their Trout fisheries and have significant mahinga kai and cultural values to Maori. Alan Forbes writes in his Tukituki Catchment Terrestrial Ecology Characterisation 2011” “Braided riverbeds are a rare habitat type internationally, and although a number exist in the South Island, they are not common in the North Island. The riverbed of the Tukituki River is renowned for its wildlife values, having been listed as “high” during the SSWI surveys.

The wading and wetland birds are a feature of the braided river within a braided river landscape as the flamingo is to Lake Nakuru. Bird species such as the banded dotterel and the pied stilt are useful visual indicators of ecological health in the braided river landscape.

The Tukituki catchment has a diversity of distinctive landscapes. The landscape types are a response to the topography, climate especially rainfall, indigenous vegetation and habitat, and cultural patterns of land use, infrastructure and man-made features. The broad landscape types correspond to the Catchment Units Alan Forbes developed in his report, derived using Land Environment of New Zealand data (at Level IV).
Figure 24 For the purpose of this landscape assessment Tukituki “Catchment Units”
The RWSS project involves Landscape Types (Catchment units)- A, C D and E

Landscape Type A
The Upper catchment of the steeper bush clad Ruahine Ranges predominantly in Conservation Land. The catchment is drained by a large number of streams and rivers, the most substantial being the Tukituki, Waipawa and the Makaroro, with the Makaroro being most northern of the three. The geology is predominantly greywacke. The climate is characteristically cool and cloudy with high rainfall and heavy rain at times. Most of the rain comes from the west, contributing to a significant “rain shadow” effect extending from the under the ranges across to the upper and central Tukituki Catchment. The rain shadow influences the composition and character of the native forest. Landslides are common in this steep landscape.

Landscape Type C:
This landscape features three terrace landforms known as the “Remnant High Terraces” represented as gently undulating and strongly undulating
plains and hills, and intermediate terrace form by river terraces and low terraces as post alluvial fans terraced by rivers. Earth quake fault lines have also shaped the landscape by folding and dissecting the landform. The proposed Makaroro River Dam site, the reservoir as well as areas within the RWSS Production Use Area come within this terrace landscape type.

Figure 25: Landscape Type C looking towards the Makaroro catchment. From Hardy Road S Gerard 2 Oct 2013

Figure 25a: View from Hardy Road looking towards confluence of Waipawa and Makaroro Rivers. S Gerard 2 Oct 2013

Figure 26: View from Hardy Road over the terrace Totara studded Landscape Type C to the Ruataniwha Plains below. S Gerard 2 Oct 2013
The catchment unit experiences strong rain shadow effects due to its location relative to the Ruahine Range. Land cover is predominantly exotic grassland. However indigenous vegetation, notably remnant podocarp of varying degrees of density and degrees of fragmentation is a notable visual and ecologically important component of this landscape.

Figure 27a and b: Examples of the terrace Totara studded Landscape Type C to the. Photo: S Gerard 2 Oct 2013

The catchment unit has a range of farming regimes including sheep, cattle, deer, dairying and farm forestry. Some dairying properties are operating in this area without irrigation.

Figure 28. Typical Farm dam in Landscape Type C
Photo: From Hardy Road S Gerard 2 Oct 2013
Farm dams provide landscape values such as water retention and storage, habitat and ecological connectivity and visual amenity. It is possible to irrigate undulating terrain in Catchment Unit C with travelling irrigators. Removal of indigenous fragmented podocarp species in this landscape type is a potential adverse landscape effect of this activity. There are notable areas of indigenous vegetation in the Catchment C area under the RWSS Production Land Use Zone.

![Figure 29. A travelling irrigator operating on an undulating terrace landform in the Landscape Type C.](image)

Photo: S Gerard 2 Oct 2013

**Landscape Type D.**

The landscape is characterised by flat plains and the gently undulating plains of the Ruataniwha Plains, the Hatuma Basin and the flat land to the North east of Waipukurua, around the confluence of the Waipawa and Tukituki Rivers. Forbes describes “These landforms have alluvial origins. Intermediate terraces of around 10,000 years make up the majority of the Ruataniwha Plains, along with a lesser proportion of Low terraces, which generally follow the course of the existing water courses.”

Landuse is predominantly pastoral farming sheep, beef cattle and deer, with some small areas of orchards forestry and other crops.
**Figure 30.** Typical sheep farming landscape character in Landscape Type C. Photo: S Gerard 2 Oct 2013

**Figure 31.** Typical cattle/ grazing unit landscape character in Landscape Type C. Photo: S Gerard 2 Oct 2013

**Figure 32.** Deer grazing unit landscape character in Landscape Type C. Photo: S Gerard 2 Oct 2013
Forbes describes “The plains feature warm temperatures and moderate to low annual water deficit and strong winds predominantly from the westerly quarter”. Shelter belts reduce evapo-transpiration rates of crops and pasture and provide shelter and shade for stock. As a consequence the landscape has evolved as a patchwork pattern of paddocks with shelter belts and amenity tree plantings around homesteads.

The braided rivers are an important landscape feature of the plains. Indigenous vegetation on the alluvial plains of treelands of kanuka and kowhai, broadleaved and podocarp species are very sparse. These landscapes are very vulnerable to adverse change to landscape natural using overhead travelling irrigators.

![Image of landscape](image.jpg)

**Figure 33.** Remnant podocarp, kanuka and kowhai in Landscape Type C. Low terrace, left bank Makaroro River, Makaroro Road near Highway 50. Photo: S Gerard 2 Oct 2013

In my opinion there need to be limits placed on the size of travelling irrigators. The use of overhead irrigators will potentially change the landscape pattern through removal of trees and the increase of scale of the paddocks. The wider the irrigator the greater the degree of change towards creating a monocultural landscape. The circular pivot irrigator changes the cultivation from geometric to a circular pattern, which on a large scale such as on the northern end of Butler Road, changes the landscape character significantly. The greater the length of the irrigator, the greater the effect on biodiversity of flora and fauna (including invertebrate, some of which are important for food production).
This scale of landuse activity does not provide for biodiversity and ecological connectivity. In my opinion there are adverse affect in the landscape pattern created by long irrigators that extend from a regular sized paddock typical to the surrounding landscape. In my opinion there should be a limit on the size so that the values of trees in the plains landscape can still be realised.

Figure 34. Long travelling pivot irrigator.-Butler Road
Photo: S Gerard 2 Oct 2013

Figure 35. Pattern of Fields using pivot irrigators dominating the landscape pattern on the plains- North end Butler Road
Source: Google Earth
Figure 36. Pattern in field using circular pivot irrigator- Butler Road. Looking east. Photo: S Gerard 2 Oct 2013

Figure 37. Pastoral landuse pattern Butler Road- 1 km south of Pivot irrigators looking east, Photo: S Gerard 2 Oct 2013

Figure 38. Pattern in field using Pivot irrigator- Butler Road looking west Photo: S Gerard 2 Oct 2013
Figure 39. Pastoral Landuse pattern Butler Road- 1 km south of Pivot irrigators looking west, Photo: S Gerard 2 Oct 2013

Figure 40 From Highway 50, Removal of shelter belts in preparation for irrigation Photo: S Gerard 2 Oct 2013

Figure 41 From Highway 50, Removal of shelter belts in preparation for irrigation Photo: S Gerard 2 Oct 2013
The braided rivers are an important landscape feature of the plains. Indigenous vegetation on the alluvial plains of treelands of kanuka and kowhai, broadleaved and podocarp species are very sparse. These landscape are very vulnerable to farming intensification and the used of overhead travelling irrigators.

Further intensification of grazing regimes (particularly dairying), will result in further reduction in water quality and biodiversity. Further reduction in water quality will adversely affect natural intrinsic values and mauri of the rivers and spring feed streams on the plains and the subsequent adverse effects of the river landscape character.
Given that the RWSS is based on one large in-river dam distributing water from one tributary catchment, the Makaroro, to other tributary catchments. This practice has adverse effect on natural intrinsic values of the catchment, being incoherent to natural drainage patterns and may have unforeseen ecological effects such as modifications in physical, chemical and temperature attributes of the water on invertebrates. The scheme is a much engineered “man over nature” approach to catchment planning and landscape.
Landscape Type F

The landscape character of this Catchment Unit is one of undulating hills, flat plains and flat flood plains within valley floors. Relevant drainage features are the old Waipawa River bed, and the Papanui Stream and the Tukituki River to the Tukituki River Mouth as the lowest point of the catchment.

Forbes describes “The climate is one of characteristically mild temperatures, moderate solar radiation, low annual water deficits and low monthly water balance ratios.”

Land cover is around 85% exotic pasture grassland and 5% pine plantations. Small concentration of cropping land is present northeast of Otane, east of Havelock North and around Haumoana.

A podocarp –broadleaved forest composition dominated by kahikatea, totara and matai is characteristic of the alluvial terraces of the rivers, while a very mixed podocarp is on the faces and gullies of the mudstone hills. Cabbage tree treeland is characteristic on former forested sites”.

Tokin a & Taylor describes:” The Application Design involves using the Papanui Stream (Old Waipawa River) channel to convey water. An alternative piped option may be considered during detailed design.

The former Waipawa River alignment followed what is now referred to as the Old Waipawa River Bed before former joining the Papanui Stream, and then entering the current Tukituki River 25 km downstream of the proposed intake. The Bishop’s Stopbank was constructed some one hundred years ago to enable the diversion of the Waipawa River into the Tukituki River along the present river alignment to facilitate land development adjacent to the former river bed”.

I consider this diversion may be an opportunity to undo past damage to the natural river system. However I believe the option of piping the water would be a more than minor adverse effect by removing water from the landscape and ecosystem.
The Tukituki River

Photo 48: Algae blooms in the Tukituki River
Source: Baybuzz blog digs slime Published: April 20, 2009 by frog

The Tukituki River is vulnerable to low summer flows and high nutrient levels resulting in algae growth. This algae growth is often thick and brown smothering the braided gravels and rocks near and in the water channel. The slime adversely affects the visual amenity, natural and landscape values of the river. Further reduction in water quality and biodiversity through land intensification of landuse by dairy farm conversion in my opinion will adversely affect natural intrinsic value and mauri of the river and the visual amenity and character of the river landscape.

Photo 49: Michael Bisset examines a slimy rock below the Opuha Dam, which anglers say is the source of a toxic algae bloom of phormidium.
Source: The Timaru Herald 26/01/2011
The Tukituki River Estuary:

The estuary is an important the patch/component in the braided river systems for many fish and bird species. The river mouth has an estuarine wetland planting and supports habitat for indicator birds such as oystercatchers and pied stilt. Water quality is important not only for the natural environment it is also a valued area for mahinga kai and passive recreation in the area.

**Figure 50** Fishing and White baiting at Tukituki River mouth Photo: S Gerard 2 Oct 2013

**Figure 51:** Recreation in the Tukituki River. Source: Internet. Christine Scott

Effects on the Coastline Landscape:

As the natural flow of gravels along the Makaroro braided river system has been blocked, the RWSS proposal requires beach nourishment of 3,400 m3/year comprising of 1700 m3/year of river sediment. This will be placed within the Coastal Marine Area directly along the barrier beach between Richmond Road and School Road extension and an additional 1,700 m3/year to the south along the spit. The sediment would be extracted from upstream of Black Bridge or other locations in the Tukituki/Waipawa Rivers.
The natural dominant means of supply of sediment to the coast sediment form the Tukituki River is during major flood events such as cyclones. The proposed RWSS Makaroro River dam will reduce the amount of sediment in the river system which will eventually be pushed out the Tukituki River mouth during storm events. The dam will potentially have a long term effect on physical coastal processes and increasing the potential of coastal erosion, effecting visual landscape character and visual amenity of the coastline into the future. Not having enough sediment in the coastal system will have a potential adverse effect on the coastal landscape through increased coastal erosion.

Discussion: Mitigation by extraction - trucking sediment form length of the river bed directly upstream stream from the Tukituki estuary to beaches both sides of the river mouth is regarded by the HBRC as an appropriate mitigation. When I consider effects on the natural physical coastal processes, predicted sea level rise higher storm wave surges with climate change, I would hope extent of modification of the proposed dam on sediment flow through the catchment to the coastline, and the degree of mitigation, is being appropriately considered by experts in physical coastal processes.

7.2 Conclusion

The proposed 83m high dam and the redistribution of water will have degrees of effect on the wider catchment, braided rivers of the Makaroro, Waipawa and Tukituki River to the sea.

The Tukituki catchment has a diversity of distinctive landscapes. The landscape types are a response to the topography, climate especially rainfall, indigenous vegetation and habitat, and cultural patterns of land use, infrastructure and man-made features. Relevant landscapes that will be affected by the RWSS through change in land use from irrigation and change in river flows and potential effects on water quality are as follows:

- the lower areas of the terraced Totara clad hills coming down from the ranges (Landscape Type C),
- the Ruataniwha and a portion of the Takapau Plains, the flat land to the North east of Waipukurua, around the confluence of the Waipawa and Tukituki Rivers (Landscape Type D), and
areas of the lower catchment; the old Waipawa River bed, and the Papanui Stream and the lower Tukituki River to the Tukituki River Mouth and associated plains and hills (Landscape Type F).

Findings in the assessment were as follows:
In the lower terraces of Landscape Type C undulating terrain is presently being irrigated. With potential removal of Totara in this landscape type is a potential adverse landscape effect of this activity. There are notable areas of this landscape type under the RWSS Production Land Use Zone map.

While the Landuse is predominantly pastoral farming sheep, beef cattle and deer in the plains Landscape Type D there is a change in landscape pattern occurring already with irrigation. The longer the irrigator, the greater the removal of trees within the landscape, the more monocultural the character of the landscape and the greater the adverse effect on biodiversity. I consider limits need to be placed on the size of travelling irrigators.

Given that the engineered RWSS is based on one large in-river dam distributing water from one tributary catchment, the Makaroro, stretching canals and pipes over the plains and over rivers to other tributary catchments. This practice has adverse effect on natural intrinsic values of the catchment and is incoherent to natural drainage and ecological patterns.

The dam will potentially have a long term effect on physical coastal processes and increasing the potential of coastal erosion, effecting visual landscape character and visual amenity of the coastline into the future.

Further reduction in water quality and biodiversity through land intensification of landuse by dairy farm conversion in my opinion will adversely affect natural intrinsic value and mauri of the river and the visual amenity and character of the river landscape.

**Discussion**

In my opinion as well as protecting and enhancing water quality and the natural intrinsic values within the Tuki Tuki catchment, the Plan Change 6 should address managing landscape change and weaving biodiversity resilience in production landscapes.
8. GAS DRILLING AND PLAN CHANGE 6

Like dairy conversions, Hydraulic fracturing for proposed gas production is a land based activity likely to occur in the Tukituki Catchment in the near future.

There is potential for gas drilling to occur in the Landscape Types (Catchment Units) C, E and F in Figure 6.

As with RWSS water is available for future dairy conversions through pipes and canals, this water could also come available for water tankers to be supply gas hydraulic fracturing sites within the catchment (and beyond)

I suggest the Proposed Plan Change through the EPA process provides the appropriate process, time and forum for assessing this foreseen land use within a catchment.

I consider visual amenity, landscape and natural character of gas drilling activities should be addressed under Plan Change 6 and other Local Authority Plan Changes.

Sara Gerard

22 October 2013

References
Alan Forbes, MWH, Tukituki Catchment Terrestrial Ecology Characterisation Prepared for HBRC December 2011 EMT 11/13 HBRC Plan Number 4294