From:	Will Nicolson
To:	Natasha Pritchard
Cc:	Tony Jack
Subject:	RE: Pioneer Energy Limited - audit of further information - RM18.004
Date:	Monday, 13 September 2021 11:48:51 a.m.
Attachments:	image001.png image002.png image003.jpg image004.jpg image005.png image006.png image007.png image008.jpg Cultural Impact Assessment of Pioneere Generations Hydro Schemes in Otago.pdf Letter P Mulvihill to KTKO.pdf Iwi Meeting 5-8-05.doc Teviot galaxiid study.pdf

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Hi Natasha,

Please find the CIA attached. You'll see that it provides a good amount of context for mahika kai values in the lake and downstream river, and an assessment of the 2006 consents replacement proposal on these values.

In summary, there appear to have been no concerns raised by the CIA with regards to effects of that proposal (subsequent consents of which are still in effect and remain unchanged other than the drawdown amendment), with a focus more on the effects of introduction/movement of certain species (e.g. koaro and longfin eel) on roundhead galaxias and koura as mahika kai species, which is beyond the scope of day-to-day operation of the hydro scheme.

As a result of the CIA and subsequent consultation with iwi, proposed mitigation with regards to mahika kai and waahi tapu included (see attachment 2 – Letter P Mulvihill to KTKO & Attachment 3 – Iwi Meeting 5-8-05):

- Commission study of roundhead galaxias in the catchment (see attachment 4)
- Commission a study of the kōura population (not yet located but can probably be provided if necessary, however Ross has indicated previously no anticipated effects on this species due to the present proposal. Also likely to be somewhere in Council archives)
- Develop an accidental discovery protocol with regards to waahi taoka (not attached but believe it was implemented, and beyond the scope of the present application)

Regards,
Will

Will Nicolson

Scientist/Resource Management Planner

Landpro

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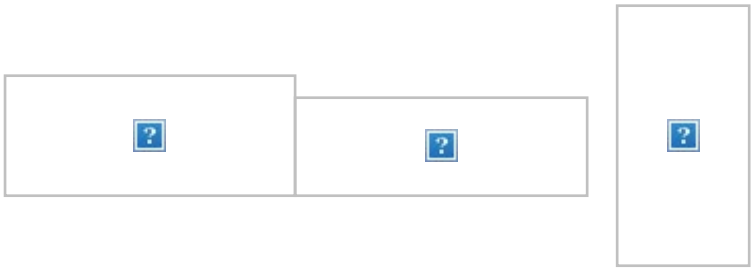

From: Natasha Pritchard <natasha.pritchard@orc.govt.nz>
Sent: Monday, 13 September 2021 9:37 AM
To: Will Nicolson <will@landpro.co.nz>
Cc: Tony Jack <tony.jack@pioneerenergy.co.nz>
Subject: RE: Pioneer Energy Limited - audit of further information - RM18.004

Hi Will,

Thank you for attaching the s42A for the original application that reference the CIA.

Tony, if you have any luck tracking the CIA down that would be appreciated. I have also approached Aukaha and our records team to see if they can find a hard copy to scan in. Kay would like to sight this before completing her report.

Much appreciated,
Natasha

From: Will Nicolson <will@landpro.co.nz>
Sent: Friday, 10 September 2021 10:57 a.m.
To: Natasha Pritchard <natasha.pritchard@orc.govt.nz>
Cc: Tony Jack <tony.jack@pioneerenergy.co.nz>; Ross Dungey <ross.d.consult@gmail.com>
Subject: RE: Pioneer Energy Limited - audit of further information - RM18.004

Hi Natasha,

Thanks for the update. I don't have a copy of the CIA either, I was just referencing Section 6.6 of the s42A report (attached, in case you don't have that either). Tony – maybe you can help?

Cheers,
Will

From: Natasha Pritchard <natasha.pritchard@orc.govt.nz>
Sent: Friday, 10 September 2021 9:54 AM
To: Will Nicolson <will@landpro.co.nz>
Cc: Tony Jack <tony.jack@pioneerenergy.co.nz>; Ross Dungey <ross.d.consult@gmail.com>
Subject: FW: Pioneer Energy Limited - audit of further information - RM18.004

Kia ora Will,

Thank you for providing this further clarification on the proposal. We will take this into consideration when drafting the s95. I am planning to have the draft finalised early next week

and then peer reviewed and legally reviewed. I am hopeful that a draft can be with you by the beginning of the following week.

Can you please provide a copy of the CIA prepared for the original consent application referenced in your responses below? I have not been able to find a copy on our document management system.

Much appreciated,
Natasha

From: Will Nicolson <will@landpro.co.nz>
Sent: Thursday, 9 September 2021 10:01 a.m.
To: Natasha Pritchard <natasha.pritchard@orc.govt.nz>
Subject: RE: Pioneer Energy Limited - audit of further information - RM18.004

Sorry, attachment referred to in our responses now provided!

Cheers,
Will

From: Will Nicolson
Sent: Thursday, 9 September 2021 9:59 AM
To: Natasha Pritchard <natasha.pritchard@orc.govt.nz>
Cc: Tony Jack <tony.jack@pioneerenergy.co.nz>; Ross Dungey <ross.d.consult@gmail.com>
Subject: RE: Pioneer Energy Limited - audit of further information - RM18.004

Hi Natasha,

We have provided responses to your further queries below in green.

Based on the information that has been provided for the application to date, there should be enough to move forward with what I assume will be a s95B limited notification decision. If possible, I would appreciate if you could proceed with the draft s95 recommendation for our review so that we can keep this application progressing.

Regards,
Will

Will Nicolson

Scientist/Resource Management Planner

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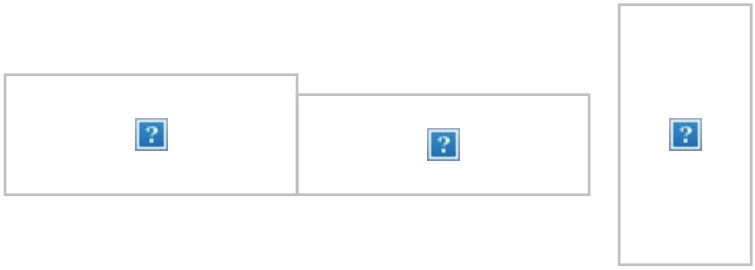

From: Natasha Pritchard <natasha.pritchard@orc.govt.nz>
Sent: Tuesday, 7 September 2021 11:53 AM
To: Will Nicolson <will@landpro.co.nz>
Cc: Tony Jack <tony.jack@pioneerenergy.co.nz>; Ross Dungey <ross.d.consult@gmail.com>
Subject: Pioneer Energy Limited - audit of further information - RM18.004

Kia ora Will,

Thank you for providing further information on recreational values and effects associated with the Pioneer variation application for Lake Onslow (RM18.004). As outlined in my last email, Council has had this audited by Dr Kay Booth. I have attached her updated audit report that includes consideration of the further information provided on 2 September. The report does identify a few outstanding gaps. The focus is on the key risk areas/adverse effects. Can you please provide further detail and/or clarify the below. The reasons and further detail for these additional requests are outlined in the audit report. Please let me know if you require further explanation.

Firstly, it would be helpful to clarify and confirm the change/s sought for this proposal; noting that the covering comments to the further information indicate that the maximum drawdown rate is not likely to exceed 0.3 mm/week. A worst case scenario is presented. Is this one that is sought to be consented so that the effects assessment is limited to this scenario? Council is required to assess the activity on the basis of the proposal in front of us; being the maximum rate of drawdown sought (0.4 m/week) and including the maximum rate this could be drawn down. Please advise if any changes/further amendments are sought to the proposal e.g. if the applicant is seeking to reduce the maximum drawdown rate from that currently proposed and/or whether the proposal includes specific criteria that limits how the drawdown will occur (i.e. on an even basis over the period of a week). While it is unlikely that the full 0.4 m/week drawdown would be reached during normal operation of the dam/lake, when the lake is very low there is a possibility that the proposed 0.4 m/week limit *would* be reached. The applicant has already reduced the proposed drawdown rate from 0.5 m/week to 0.4 m/week, and does not propose to further reduce the rate sought.

In addition to the above:

1. Finalise the Recreation Assessment Report prepared by Ross Dungey. The audit report (Q5) provides suggestions on updated technical sources that can be considered, qualitative data collection and assessments to be undertaken. It is recommended that the

report identify the recreational values associated with the Teviot River. We appreciate that there were limitations in preparing this report during L4 and L3 lockdown. Hopefully the alert level changes in the South Island from midnight tonight will enable this to be completed in a timely manner. We also note that parts of the above can be completed by desktop assessment/phone calls. The applicant will not be conducting any more work on the recreation assessment report at this stage. It's unlikely that the addition of some interviews and additional literature reviews will change the notification decision or inhibit council's ability to sufficiently assess the existing environment and potential effects of the proposal.

2. Clarify how the proposed change to the drawdown relates to the speed of a lake level drop based on the maximum drawdown rate sought and the other consented limitations (maximum discharge rate and lake levels).
    a. How quickly could the lake level drop by 0.4 m within a week? This will depend on the lake level at any given time, with increasing drawdown rates as the lake level lowers. As the maximum rate of take remains unchanged the maximum rate of change of water level also remains unchanged. The max outflow is set to 6m^3/s for both the existing and proposed scenarios, and the maximum rate of vertical water level change is also the same. The only difference being that it could be sustained for twice as long under the proposed amendment. For example:
        - When the lake is full and the outflow is 6m^3/s the current 200mm limit will be reached in 4.4 days at a maximum rate of 45.5mm/day. At the same flow rate the time taken to lower the lake 400mm will in fact be 8.8d days at a maximum rate of 45.5mm/day.
        - When the lake is down 1m and the outflow is 6m^3/s the current 200mm limit will be reached in 3.6 days at a maximum rate of 55.63 mm/day. At the same flow rate the time taken to lower the lake 400mm will be 7.2 days at a maximum rate of 55.63 mm/day
        - When the lake is down 2m and the outflow is 6m^3/s the current 200mm limit will be reached in 2.87 days at a maximum rate of 69.6 mm/day. At the same flow rate the time taken to lower the lake 400mm will be 5.75 days at a maximum rate of 69.6 mm/day

      The above scenarios are calculated on the assumption that there is no natural inflow above the dam. This is extremely conservative but given the variable nature of natural inflows it is not feasible to establish a defined inflow for calculations. Ultimately, the above scenarios of the theoretical maximum instantaneous drawdown rate are provided to reinforce that there is absolutely no change in the maximum instantaneous drawdown rate as a result of the proposal.

    b. It would be helpful to have any differences that are a factor of the lake level/discharge rate explained. The consented baseline of 6 m^3/s remains unchanged. As explained above, the only difference is that the maximum discharge rate can theoretically be sustained for longer, however in practice the applicant is unlikely to ever fully utilise the discharge rate – particularly given the fact that downstream generation infrastructure in the Teviot River have a maximum take of 6 m^3/s, and there is significant natural inflow (approx. 1/3 of the total Teviot River catchment) between the Onslow dam and the first generation unit at Horseshoe Bend. Therefore, it is unlikely that the full 6 m^3/s discharge from Lake Onslow will

actually be fully exercised as this would result in spill at Horseshoe Bend and wasted generation potential. Attached is a record of discharge rates at the Onslow dam for the past ~6 years, showing that the maximum discharge rate tends to be around 4 m^3/s but is typically less than 3 m^3. This pattern of discharge is unlikely to significantly change due to the proposal, and it is considered that this is largely outside the scope of the proposal as the applicant is not amending the discharge maximum.

c. What is the time lag between Pioneer managing the discharge/lake level to facilitate a higher drawdown and the drop in lake levels occurring. i.e. is this minutes/hours/days? The maximum discharge rate from Lake Onslow dictates the short term drawdown rate and as the discharge rate is remaining unchanged, one would expect to see the same drawdown trend as with the 0.2 m/week scenario, only for a longer duration – as explained in 2a above. It is not possible to rapidly lower the lake irrespective of the weekly drawdown limitation. Change in lake level is gradual and uniform.

d. What opportunity is there for providing a warning to any recreational users/user groups before the increased drawdown occurs? This would be unnecessary, as there is no expected "danger" to lake users due to the increase drawdown rate. As explained above, the increased rate is spread across a long time period – for example ~70 mm/day when the lake is ~2 m below dam crest. It is highly unlikely that a reduction of 70 mm over a full day would endanger anyone or significantly increase risk of boat stranding. Bearing in mind that if a user of the lake was to spend 6 hours on the water fishing the change in lake level over the that time would be less than 20mm, which is arguably imperceptible in the context of a large water body. Once again, the instantaneous drawdown rate will not change, only the weekly rate.

e. It would be helpful for the speed of drawdown and time lag able to be compared with a 0.2 m drop (current consented maximum). This is discussed sufficiently in our response to 2a above. No other consented maxima are proposed to be changed. There is no time lag in the response of the lake to changes in discharge as variation in lake level is immediate but uniformly gradual, if not imperceptible over the short term.

2. Taking into consideration the answer to question 2, is the risk of boat stranding increased by the proposed change? Is there any mitigation proposed to address this potential increased effect? Based on our prior responses, the proposal is not expected to increase risk of boat stranding. As such, no mitigation for this is proposed or considered necessary.
3. Taking into consideration the answer to question 2, is foot access affected by the proposed change such that the opportunity to fish is impaired? This has been sufficiently addressed in our previous s92 response, dated 2 September 2021. Foot access is not expected to be changed due to the proposal to the point where the opportunity to fish will be significantly impaired.
4. There is still no clarity on use of the area or potential use of the area for mahika kai gathering. Without holding expertise, this will need to come from consultation with rūnaka/Aukaha. If this results in them being unable to confirm at this point the answers to the below that is useful to know. We consider that there has been sufficient information provided as part of the application with regards to mahika kai and potential effects on this cultural value, at least to the extent that a s95 decision can be made. We note that Kai Tahu ki Otago Ltd undertook a Cultural Impact Assessment (VIA) as part of the

replacement application for PEL's Onslow and Teviot consents (including 2001.475 & 476) in 2006. The proposal is not changing any aspects of these consents other than the drawdown rate, and upon initial review of the corresponding s42A report it does not appear that drawdown rate of the lake was a topic of concern for Kai Tahu at the time.

a. Is the area used for mahika kai gathering? This is largely beyond the scope of the change proposal, as the ability to gather mahika kai is unchanged in terms of the minimum, maximum and discharge operating limits of Lake Onslow.
b. Does the area hold any value for mahika kai gathering even if the opportunity is not currently taken up? Again, there is nothing to suggest that the proposal will alter the ability to gather mahika kai as the operating limits of Lake Onslow or the Teviot River will not change.

Please let me know if you have any questions regarding the above.

Kind regards,
Natasha

Natasha Pritchard
PRINCIPAL CONSENTS PLANNER

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Cultural Impact Assessment of Pioneer Generation's Hydro Electricity Power Schemes in Central Otago, New Zealand.

Contents

1.0 Introduction

The Treaty of Waitangi was signed by the Otago Chiefs and Crown representatives on the 13th of June 1840 at Otakou. There is no reason to believe that at the time the signatories and their respective constituents did not enter into the agreement with good will and honourable intent. Article two of the Treaty is of particular relevance to Pioneer Generation's hydro-electric power schemes in Central Otago. When construction of the schemes took place [except the Horseshoe Bend scheme in the Teviot River] little thought was paid to any adverse effects and impacts the schemes may have upon the cultural and mahika kai (southern dialect for mahinga kai) values of Kai Tahu. Article Two talks about lands, estates, forests, fisheries (English version) and taonga (Maori version) (NZGO, 2001). These are broad, over-arching general terms. When taken in the context of Pioneer Generation Ltd's hydro electric power schemes they could be defined more definitively as the fisheries, their habitats, other wildlife, cultural materials, and places where one can go to enjoy these values. Fisheries can include those that are harvested for food, (e.g. eel and wai-koura, i.e. mahika kai) and those that are valued for their intrinsic value or rarity (e.g. southern flathead galaxiid, i.e. taonga species). When considering aquatic habitats one should also think of the water fowl and other bird life that these habitats support. The Ngai Tahu Claims Settlement Act 1998 lists many taonga species including paradise shelduck that are commonly observed in Central Otago. The rivers, lakes and stream margins that were associated with the power schemes were not and are not devoid of plants important to Kai Tahu. The flax's and bull rushes etc. are excellent materials for craftwork and the construction of mokihi. Watercress, which was introduced to New Zealand during the 1850s (Druett, 1983) is common in many areas and has become an important cultural food. Place names also play an important role for Kai Tahu. The naming of places after resources collected or after a particular event allowed Kai Tahu to build up an intimate knowledge of Te Waipounamu. Many of these place names have been lost or are no longer used.

Section 8 of the RMA (1991) stated that the principles of the Treaty of Waitangi should be taken into account. One of these principles, that of active protection of Maori values to the fullest extent practicable, develops more specifically what Article Two of the Treaty was stating. In 1996 the Runanga of Otago published a natural resource management plan

(KTKO, 1996). One purpose for the plan was to better define the natural resource values important to Kai Tahu so organisations such as Pioneer Generation Ltd. who operate within the natural environment can address these concerns. Te Runanga o Ngai Tahu published a Freshwater Policy Statement (TRONT, 1999) with the purpose of providing a foundation for freshwater management planning. In close consultation with Iwi, Regional and District Councils have developed a plethora of plans and statements which further define Kai Tahu environmental values and how they should be taken into account.

With such a wealth of material outlining and describing Kai Tahu's freshwater environmental values and objectives it should be relatively easy for organisations wishing to undertake activities in the natural environment to address issues.

Kai Tahu are able to point to their experiences that show that almost all Kai Tahu experiences with dams, and hydro generation, to date have been negative. In particular:

- wähi tapu and wähi taoka areas have been inundated and lost. As a result, named and active associations are broken and Kai Tahu's cultural relationship with the area is weakened and damaged,
- previously valuable mahika kai areas have been similarly destroyed, and in instances access to existing resources has also been adversely affected.
- fish movement within river systems has been disrupted; both of juveniles into the system and of mature adults attempting to leave the system. The success of recent attempts to mitigate these effects on fish passage is unknown.
- the character of the area is irrevocably altered;
- the "minimum" flows are not considered adequate for the maintenance of the river's mauri;
- dam construction can have serious environmental implications and can damage fishery and other mahika kai interests, sometimes irrevocably;
- dams have interrupted the continuity of flow from the mountains to the sea which conflicts with the Käi Tahu philosophy of "Ki Uta, Ki Tai"; and

Kai Tahu are committed to:

- supporting abundant mahika kai resources, particularly in important wetlands, side braids, backwaters, tributaries and the Matau itself;
- protecting the quality of the waters of the Matau catchment;
- protecting archaeological sites;
- protecting other wahi tapu / wahi taoka;
- protecting cultural landscapes;
- developing more appropriate flow regimes;
- ensuring variability in river levels;
- providing a sufficient buffer, or safety margin, to mitigate against the adverse effects of changing land uses on the waters of the Matau;
- undertaking the restoration, enhancement and creation of wetland areas, to act both as flow moderators and kohaka for mahika kai species;
- enhancing access throughout the river system; and
- addressing issues relating to changing landuses in the catchment, in particular the increase in dairying.

The approach to impact identification in this Assessment is to identify a number of general adverse effects before proceeding to identify site specific issues and the outcomes sought by Kai Tahu. The Assessment does not identify any mitigation measures as these will be determined through discussions between Pioneer Generation and Kai Tahu.

Kai Tahu want to see the following adverse effects avoided:

- Any deterioration to the quality of water in the mainstem and the tributaries;
- Unnatural changes to the sediment flow and patterns of deposition in the main river channel and at the coastal area;
- Any encroachment of adjacent landuses onto riverbeds;
- The residual flow regime in the mainstem resulting in extended periods of low flows with limited flow fluctuations;
- A residual flow regime that fails to recognise Kai Tahu's property interests;
- Any further dewatering or loss of tributaries, wetlands, side braids, springs, backwaters, adjacent to or surrounding mahika kai sites throughout the lower catchment;

- Any desecration of urupa;
- Any further loss of archaeological sites;
- Any further loss of access to sites of significance, especially remaining mahika kai sites;
- Any further loss of mahika kai habitats and mahika kai species;
- Any loss of wähi tapu and wähi taoka; and
- Changes in water temperature at key mahika kai sites affecting mahika kai species.

One of the outcomes sought by Kai Tahu, is the development and implementation, in consultation with Kai Tahu, of a comprehensive monitoring programme that monitors:

- the effect of changes to the operating ranges of the lakes on features and sites of significance to Kai Tahu;
- The effects on mahika kai habitats and species;
- the impacts of the flow regime on aquatic weeds in key locations that are agreed with Kai Tahu;
- the effects of landuse change on mahika kai values;
- the recruitment of migratory fish species within the catchment;
- Sediment movement and deposition;
- the following impacts on the native fishery:
    - their success in recolonising habitats in the residual river
    - competition between natives and introduced

Kai Tahu also requires a binding commitment that Pioneer Generation Ltd and its successors will undertake remedial action should monitoring show that an adverse effect is being experienced.

The report also identifies a number of other recommendations requiring Pioneer Generation Ltd to:

- comply with Kai Tahu policies with respect to the protection of waahi tapu, waahi taoka and koiwi Tangata;
- promote and support a holistic integrated management plan for catchments, with Kai Tahu as an active participant;

- consult with Kai Tahu before agreeing to stock the catchment with introduced species as a means of mitigation;
- develop a cooperative agreement with kaitiaki Runanga and TRONT for ongoing participation in management, monitoring and the development of remedial initiatives;
- identify opportunities for Kai Tahu participation in any employment, monitoring or mitigation opportunities generated e.g.
    - enhancement and restoration initiatives
    - monitoring
    - research

(Te Runanga of Arowhenua, Te Runanga o Waihao, Te Runanga o Moeraki, Te Runanga o Ngai Tahu (June 2002), "**Cultural Impact Assessment - Project Aqua**".)

2.0 Kai Tahu Values

2.1 Place Names

As Kai Tahu moved throughout the whole of Te Wai Pounamu their presence was preserved in the naming of places. Such names take their source from the earliest people, creation traditions, incidents, mahinga kai resources, weather and tupuna. Place names also provide us with descriptions of the character of the environment and give us an insight to the values and uses of sites and resources. The long history of occupation and travel within the Otago Region has left many sites that are of significance. It has also enabled Kai Tahu to accumulate an extensive amount of knowledge of the water resources of catchments and the associated water based food resources. Many of the place names in the Otago Region are interwoven in the tribal myths and legends. Collectively myths, legends and place names were the medium by which Maori described and passed on both the nature of the resource and an assessment of its status.

A lot of these placenames have been lost or are no longer used. With a loss of these placenames there is also a loss of manawhenua and kaitiakitanga status for Kai Tahu. It would be considered appropriate to begin to reuse these placenames throughout the systems used by Pioneer.

2.2 Mauri

Mauri can be a difficult term to understand or define. The mauri of a river is intact and flourishing when all its parts are interconnected, life within the river will be bountiful and all things will be balanced. A scientist might refer to this as an intact natural ecosystem. When a river is challenged by introduced plants or animals, pollution from farms or cities, inappropriate 'flood control engineering', water extraction, or damming, life within the river becomes compromised and as such the mauri is degraded.

Land catchment through which a river passes should be in its natural undeveloped state. This is especially important for riparian zones where water flowing into a river is cleansed of silt and nutrients. Excessive development (of the land, riparian and water margins) and introductions of introduced and weed species are indications of degraded mauri. An indication that the mauri of a river is intact is where a river and its tributaries are free running

from source to sea with no water abstractions, damming, diversions, or channelisation. Life within a river should not include introduced species such as fish or weed. In developed catchments, for example, where land has been developed for agriculture or plantation forestry, new species have been introduced, or irrigation abstractions and hydro-electric power development has occurred, a river system should be an intact ecosystem in exceptionally good order for its mauri to be considered only partially affected.

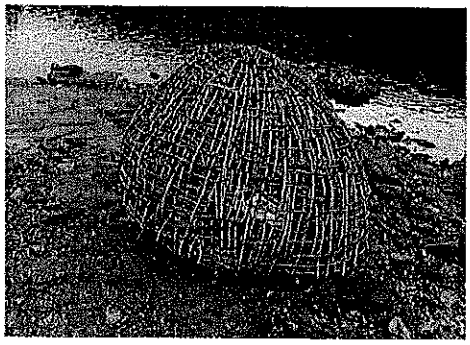
2.3 Awa/Ngai Wai

This is also linked to the issues outlined in the mahika kai section above.

As a result of the many cultural activities associated with water, Kai Tahu consider water a highly valuable resource, one which is often referred to as a taoka. Minimum flows and lake level ranges should be set and quantity and timing of water release should recognise the healthy functioning of ecosystems. Ramping of river flows has the serious potential to adversly affect Kai Tahu values. Wetlands and riparian zones should be protected. Kai Tahu are concerned that many of the regions waterways are experiencing markedly reduced flows through damming and diversion of water to powerhouses. Setting realistic minimum flows that maintain habitats of fisheries, waterfowl and flora is an important objective.

Due to low water levels in some lakes and reservoirs visual aesthetics and dust have become an issue.

2.4 Mahika Kai



Wai-koura pot constructed the traditional way using supplejack

As this assessment is focusing on the hydro generation activities of Pioneer Generation Ltd. it will focus on identification of the effects of these activities on the waterways, the riparian margins and the wider catchment. Strictly speaking, the term 'mahika kai' are the places where food is gathered or hunted. However, the term is sometimes used to refer to the species being harvested. In the contemporary setting, Kai Tahu travel to many different places or mahika kai to hunt and fish. These activities include duck hunting, eeling, collecting wai-koura, and whitebaiting. They can be carried out as individuals, parent child or entire family groups. Sometimes other associated activities will be undertaken. These could include collecting flax and other materials for craft work, constructing mokihi and practicing earlier/older methods (e.g. supplejack hinaki for eeling), swimming, wananga, and scientific research and practice. All of these and others are modern presentations and developments of earlier Kai Tahu activities associated with mahika kai and are important expressions of Kai Tahu culture and customs.

Factors that can be used to judge the quality of mahika kai are air, land, and species.

Hydro-electric power development can impact on these factors and are concluded upon separately.

Air

Kai Tahu are concerned that developments can cause various air pollutants including visual, gaseous and particulate that can adversely effect the environment. Developments or

discharges should not cause unpleasant odors, dust, or visual effects within or adjacent to mahika kai, waahi tapu or taoka.

Land

The land not only provides access to and along waterways but also forms an integral part of the water catchment. Damming of rivers and raising lake levels has flooded important Nohoanga sites. Without accompanying planning and land designation, shores of hydro lakes can move onto private land impeding access to the waterbody. Privatisation of lake edges can also lead to the legal grassing of stock along lake edges resulting in habitat destruction, sedimentation, erosion and pollution. Land management and use within a catchment can significantly reduce discharge (e.g. plantation forestry compared to tussock) or increase the maximum and minimum flows (e.g. exotic pasture compared to tussock).

Land issues associated with hydro activities have the potential to impact significantly upon Kai Tahu values. Transmission towers and cabling cross-vast areas of inland Otago are not only visually intrusive but also impact upon the mauri of the area. With the development of hydro activities, infrastructure such as access roads and buildings are required to be developed. These have the potential to impact upon Kai Tahu values. With the construction of roads a loss of flora and fauna, species habitat and the possible destruction of archaeological sites occurs. Many of the roads in Otago have been built over old Maori Trails. This is mostly due to the fact that early Maori trails followed the most accessible routes. This may also be true with the roading that is required to allow hydro activity to take place. Some archaeological sites may have already been lost during the construction of the current roading infrastructure.

Species

Kai Tahu is concerned with the wellbeing of native species of plants and animals.

The development of HydroElectric schemes has seen a parallel in the development of surrounding lands. Land that once was considered by farmers and others as unproductive yet by Kai Tahu as holding many cultural values is now able to be irrigated and developed and thus has lost many of the cultural values that where once associated with it. Land development has resulted in the clearance of native tussocks and scrub from many riparian zones and the

slopes of steep gorges. The clearance of tussock has meant a loss of habitat for native species such as weka and other species that are now considered to be endangered.

Assemblages of native plants have developed over millions of years and Kai Tahu suggests that these plant communities are optimal for these sensitive environments and result in higher water quality and quantity. Many of New Zealand's native fish species are diadromous and migrate either within catchments or to and from the sea. Local extinction of species in areas upstream of barriers to migration are common. Longfin eel, a species of particular importance to Kai Tahu have been adversely affected by the construction of dams and weirs. Other species are non-diadromous and spend all their lives within a stream reach. Consequently these species are especially susceptible to the adverse effects of land management, diversions, water abstraction and channelisation. Another adverse impact upon native non-diadromous fish species is the introduction of exotic species such as brown trout which both competitively exclude the native species but may also prey upon them.

Not withstanding the negative effects that exotic species present, Kai Tahu also have an interest in the changed assemblages where introductions of exotic species has occurred. In some areas, introduced species have added to the mahika kai species. Brown trout, although clearly having some adverse effects are an exceedingly abundant freshwater fish species available throughout the region for capture. Black swan and mallard are common on lakes, wetlands and rivers and add to the other water foul species that can be hunted. Watercress has become a favourite water plant to collect and makes a pleasant companion with wild pork.

Consequently, Kai Tahu consider the entire suite of species that are present in any particular area or mahika kai important. Kai Tahu seek to manage the (fauna and flora) community recognising both native and exotic species and the benefits each can provide while protecting biodiversity and native ecosystems.

2.5 Kaitiakitanga

Kai Tahu aspire to have their values recognised and integrated into natural resource management. Involving Kai Tahu within resource management processes is an important objective. These are integral functions of kaitiakitanga and were expected to be provided for as agreed to in the Treaty of Waitangi.

As a result of being isolated from the natural resource management process for many decades, newly established Kai Tahu political structures, Ngai Tahu Claims Settlement Act, and provisions in other Acts e.g. Resource Management Act (1991), Kai Tahu are in a process of developing their natural resource management skills and functions. Kai Tahu identify in the Kai Tahu ki Otago Natural Resource Management Plan a number of areas that they wish to be involved with including resource consent processes and monitoring.

2.6 Waahi Tapu/Waahi Toaka

For Kai Tahu, the term waahi tapu or waahi taonga refers to places that hold the respect of the people in accordance to tikanga (custom) or history. Whilst some sites are significant to the iwi some are important to the hapu and whanau who visited, lived at, or had special affiliations to that area. Some waahi tapu/ waahi taonga were only visited by tohunga (specialists) who performed rituals such as waitohi (blessings) or karakia (incantations).

Urupa are the best modern day example of waahi tapu, but in addition to many urupa within the Otago Region, physical resources such as Aoraki, other landforms, springs, remaining areas of indigenous vegetation are other examples.

3.0 Assessment Method – Effects upon Kai Tahu Values

3.1 Place Names

Kai Tahu retains Manawhenua and Kaitiakitanga status,

1. Where names given to particular areas are retained and promoted
2. Where Kai Tahu placenames that have not been used are once again reinstated.

3.2 Mauri

The mauri of a river is intact when:

1. A river, including its tributaries, lakes and surrounding catchment is in its natural state.
2. Developments such as pastoral farming, plantation forestry, urbanisation or industrialisation have no impact upon a river, its tributaries, lakes, riparian zones, wetlands, flow patterns or water quality which remain in a natural state.

3.3 Awa/Ngai Wai

1. Water within a river catchment is free running from source to the sea.
2. Where instream developments occur minimum flows and lake level ranges are set and quantity and timing of water release recognises the healthy functioning of ecosystems.
3. Controls on water flow patterns may change, in a positive way, the character of mahika kai.
4. Water quality is not adversely impacted upon by point source or non-point source discharges from, for example, agriculture, forestry, urban or industrial developments.

3.4 Mahika Kai

Mahika kai criteria can be divided into specific resource types: air, land, and species. Mahika kai will be of high quality and intact when the following outcomes are achieved,

Air

1. Developments or discharges do not produce air pollutants including visual, gaseous and particulate that can adversely effect the environment.
2. Developments and discharges are not causing unpleasant odors, dust, or visual effects within or adjacent to mahika kai.

Land

1. The land water margin of the water catchment and wetlands are intact and protected.
2. Developments such as pastoral farming, plantation forestry, urbanisation or industrialisation have only minor impacts upon a river, its tributaries, lakes, riparian zones, wetlands, flow patterns or water quality which remain in a natural state.
3. Land developments may change, in a positive way, the character of mahika kai.
4. Access to mahika kai is not adversely effected by land developments such as pastoral farming, plantation forestry, urbanisation or industrialisation. Preferably, outcomes of development enhance access to mahika kai.

Species

1. Populations of native species are protected or enhanced by developments associated with mahika kai.
2. Introductions of exotic species occurs only where adverse impacts upon native species is minimal and the exotic species enhance the suit of species available to Kai Tahu fishers and hunters.
3. Active management and habitat protection of sensitive or rare native species occurs when developments potentially impact upon these species.
4. Were the passage of migrating species has been impacted upon by developments, e.g. dams preventing eel migration, effective mechanisms are in place which circumvent the barrier.

3.5 Kaitiakitanga

Kaitaikitanga is being provided for when:

1. Kai Tahu are actively involved in all aspects of natural resource management.
2. Kai Tahu values are being accepted and expressed in the management of natural resources.

3.6 Waahi Tapu/Waahi Toaka

Kai Tahu retains Manawhenua and Kaitiakitanga status,

1. Where before any land disturbance occurs an archaeological assessment is undertaken.
2. Where disturbance has already occurred an assessment is undertaken to ascertain any sites that have been disturbed, destroyed or unearthed.

Loss of Manawhenua and Kaitiakitanga status occurs when,

1. Access to places and values that are culturally important have been impeded.
2. The special relationship Kai Tahu has with the landscape features and landforms is degraded by developments.
3.

3.7 Effects Upon Cultural Values

Kai Tahu believes that it is the responsibility of the kaitiaki Runanga to assess the impact of an activity upon cultural values. This report has used the following table to show the impact of the activity based on the above assessment criteria information received, and site inspections.

EXAMPLE

ISSUE - KAI TAHU VALUES	Impact/Recommendations
Place Names	Significant
Mauri	Significant
Awa/Nga Wai	Major
Mahika Kai Air/Land/Species	Uncertain
Kaitiakitanga	Major
Place Name	Minor
Waahi Tapu/Waahi Taoka	Significant

Uncertain – Results from site inspections and information provided have shown uncertain effects upon cultural values, further investigations are required to ascertain the impact upon cultural values.

Minor - Results from site inspections and information provided have shown minor effects upon Cultural values.

Significant – Results from monitoring and site inspections have shown that impacts are detectable and will be significantly affecting cultural values. These impacts need to be addressed.

Major – Results from site inspections and information received have shown that the activity is impacting upon Kai Tahu values and action is required to remedy this immediately.

Please Note.

Where the impact of an activity is not known due to a lack of information it is assumed that the impact is major until information is received.

4.0 Invertebrate Assessment Method

Where possible an assessment of invertebrate fauna was made by selecting stones from riffles and runs in an ad-hoc manner. Each stone was inspected for species present and an indication of abundance (rare, common, abundant). Quality of the stream bed was assessed visually, noting composition (cobbles, pebbles, sand, mud) and presence of deposits and woody debris. Eroding or non-eroding banks were noted including obvious damage by cattle or other stock. Nature of the riparian zones was assessed visually. Presence of fish including wai-koura was assessed by quietly walking a length of bank and searching for fish. The Atlas of New Zealand Freshwater Fishes (Richardson, 2000) and the Department of Conservation's publication Freshwater Fish of the Otago Region (Allibone, 1997) were also used to help indicate what species may be potentially found at each location. These data were then used to characterise each location. Sampling was limited at some locations on account of water depth and access difficulties.

4. Teviot Power Scheme

4.1 General Description

The Teviot River finds its source on the Lammerlaw Range. Forking to the south, the South Branch and other tributaries rise almost to the peak of Lammerlaw Top (1210 m). The North Branch drains the northern Lammerlaw peaks all about 850 m above mean sea level, and it is here, at the extreme north and extremity of the catchment that the Teviot and Taieri Rivers meet. Each draining a perched alpine wetland. The river has a maximum length of about 50 km, flows east to west, and drains into the Clutha River/Mata-Au on the north bank opposite Roxburgh. Its catchment is bounded to the east by the Taieri River catchment and to the north and south tributaries of the Clutha River/Mata-Au catchment.

Overall, the gradient of the river is a moderate 1:44. For a number of reasons which will become apparent, the catchment can be divided into three relatively distinct regions. Lower reaches of the Teviot River from the Clutha River/Mata-Au to the Marslin Dam (Ref Map 1, 2 & 3) includes 3·25 km of main stem, nine tributaries and a catchment area of about 7·5 km^2. This reach of the Teviot River was very steep with an average gradient of 1:20 and land elevations ranged from 100 to 532 m. The river channel was intrenched in a deep V shaped gorge and resembled a series of waterfalls, cascades and pools with huge boulders, rocks and few smaller cobbles and gravel. Native scrub, willows, broom, gorse and briar dominated the steep slopes either side of the river. More gently sloping land beyond the gorge was completely developed for pastoral farming.

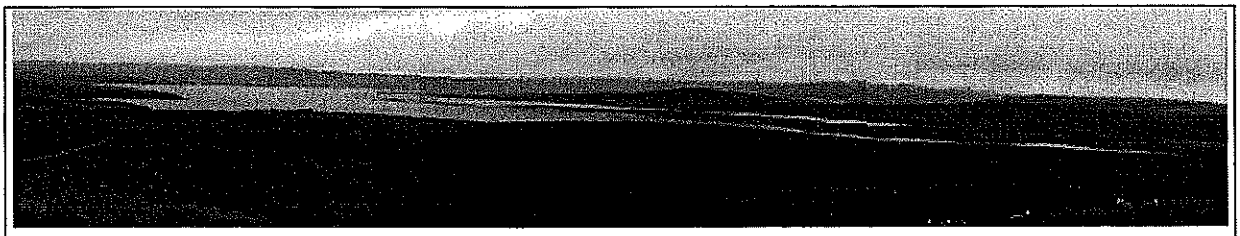
The mid region, between the Marslin and Onslow Dams, encompassed a catchment area of about 135 km^2 and included 26·75 km of mainstem, 68 tributaries, and elevations ranged between 374 m and 1124 m. Gradient of the mainstem was a moderate 1:87. Land use in this region appeared to be mostly developed for pastoral farming but there were also significant areas of plantation forestry. A little upstream of midway between the Marslin and Onslow dams in this section of the Teviot River is the Horseshoe Bend power scheme. Willows, gorse, broom and other exotic weeds with native scrub and tussock dominated the Teviot River margins downstream of Horseshoe Bend. Upstream of this point Pioneer Generation Ltd. operates an active management weed control programme which maintains weed free

riparian margins by periodically killing all weed species either by physically cutting down or spraying weed with weed killer.

Upstream of the Onslow Dam the upper catchment encompassed 174 km^2 of relatively smoothly contoured high country with perched swamps and a large basin area which formed Dismal Swamp, now Lake Onslow. Elevations range from 683 m to 1210 m and mean gradient of the river was 1:34. However, many reaches of the river and its tributaries have very low gradients especially where they flow through the remains of Dismal Swamp, Lake Onslow and other upland moss swamp areas. Native snow tussock was still the dominant flora in this part of the catchment and little development other than summer grazing, over sowing with exotic pasture grasses, and fertilisation had occurred.

The Lammerlaw range receives rain falls in southwesterly conditions but on many occasions are partially shielded from rain. Heavy local rainfalls can occur and snow may cover the entire Teviot catchment at times during winter. The area lies below the Otago winter snow line. Generally the area is prone to hot dry summers and cold winters (Pioneer Generation Ltd., 2001).

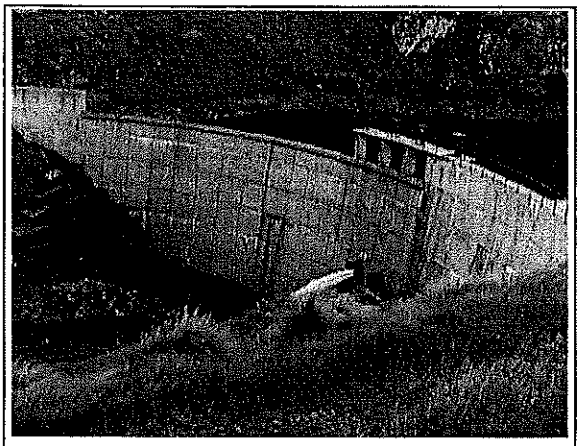
Over the last two centuries the Teviot River has been dammed and the water used for mining operations, irrigation and the production of hydro electricity. The Teviot hydro electric power and irrigation scheme includes four dams in the Teviot River, three diversions, five power generation stations, and three abstractions to irrigation systems (Ref Map 3). Lake Onslow at the head of the river was created in 1890 by damming Dismal Swamp. In 1924 a new dam, 17 m high and 70 m wide was built increasing the size of Lake Onslow to about 6 km long with an area of 950 ha. The crest of the old dam is five metres below the crest of the new dam. Lake level varies throughout the year with the lowest level over the past 20 years being the crest of the old dam, i.e. maximum range of five metres. Maximum drawdown rate is 0·2 m



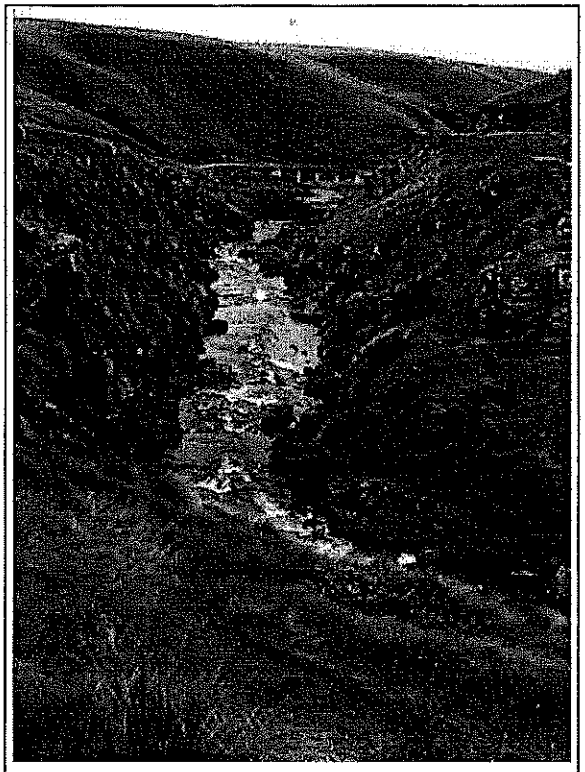
Lake Onslow viewed from a point high on the access road looking eastwards

per week.

The Lake Onslow Dam is designed to pass flood waters over the dam crest. During normal operating ranges the lake level is below the crest and flows pass through pipes in the dam wall.



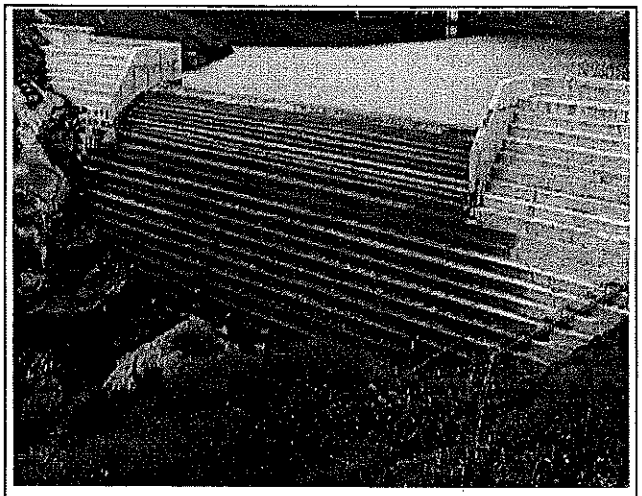
Lake Onslow Dam



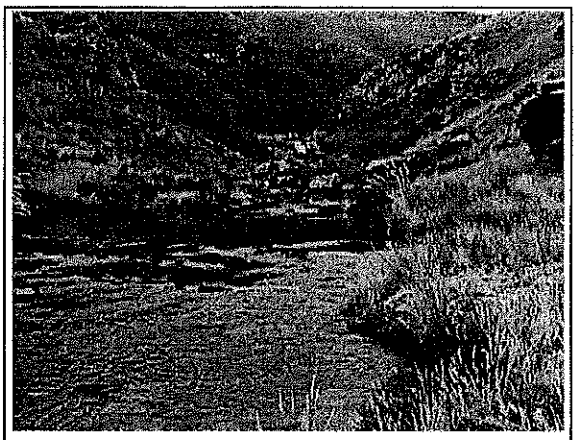
Teviot River downstream of Lake Onslow Dam

Pioneer Generation Ltd. have placed closing limits on the discharge valves so the minimum flow is approximately 0·42 cumecs with a full dam, which drops to 0·26 cumecs when storage level is at the crest of the old dam. During some dry periods the minimum outflow is greater than the inflows into the lake therefore storage supports the flow in the river and maintains it at a higher level than would occur naturally. The maximum rate at which water is passed through the dam is 6 cumecs. This includes a very small quantity used to generate power to charge batteries which operate the motorised valves on the dam.

From Lake Onslow Dam water passes down the Teviot River main channel to the Horseshoe Bend reservoir. Water is diverted from the Horseshoe bend dam through a tunnel and pipe to a powerhouse and re-enters the river about 2·5 km below the dam. A minimum flow of 0·315 cumecs is passed through the Horseshoe Bend Dam into the Teviot River.



Horseshoe Bend Dam

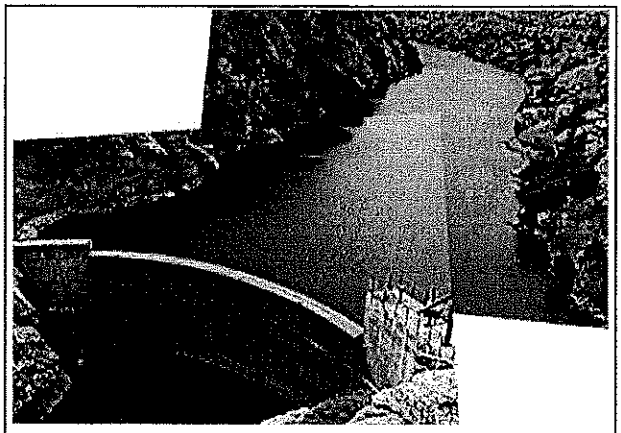


Teviot River looking upstream from Horseshoe Bend Dam power house

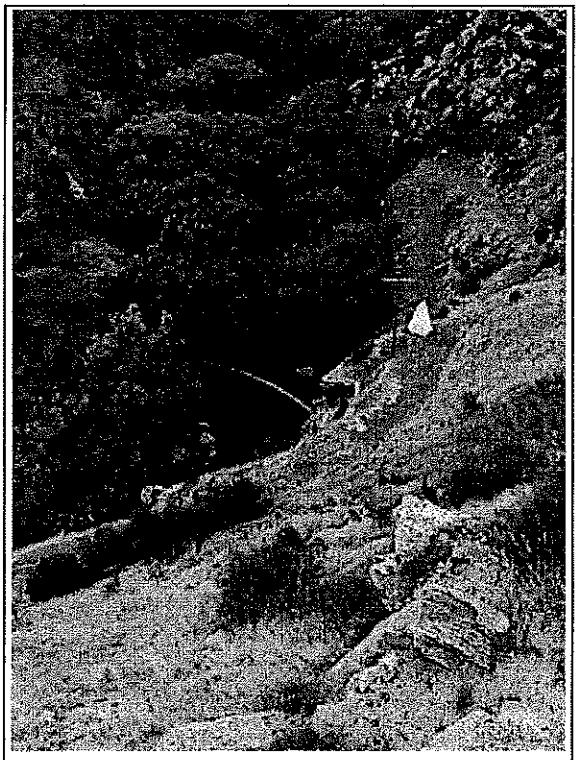
Teviot River downstream of Horseshoe Bend power house

From the Lake Onslow Dam to the Marslin Dam, a distance of about 23 km the Teviot River has 'normal' flows (0·26 to 6·0 cumecs) except for a small distance between the Horseshoe Bend Dam and power house where the flow is reduced to 0·315 cumecs.

At the Marslin Dam all water is diverted through a pipeline and race to the Michelle, George, Teviot Bridge and Ellis power houses. There is no minimum flow provided for below the Marslin Dam, however, as a consequence of the porous nature of the underlying substrate a residual flow passes under the dam resulting in a small flow which continues in the Teviot River.



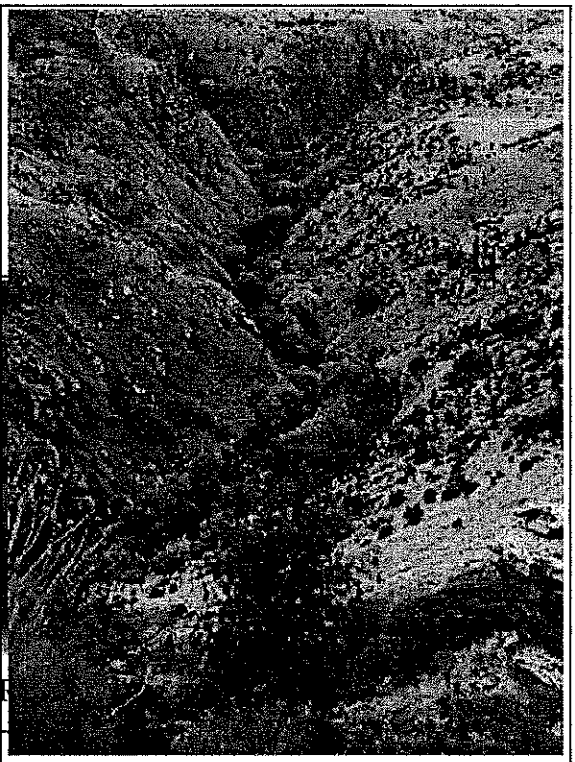
Marslin Dam



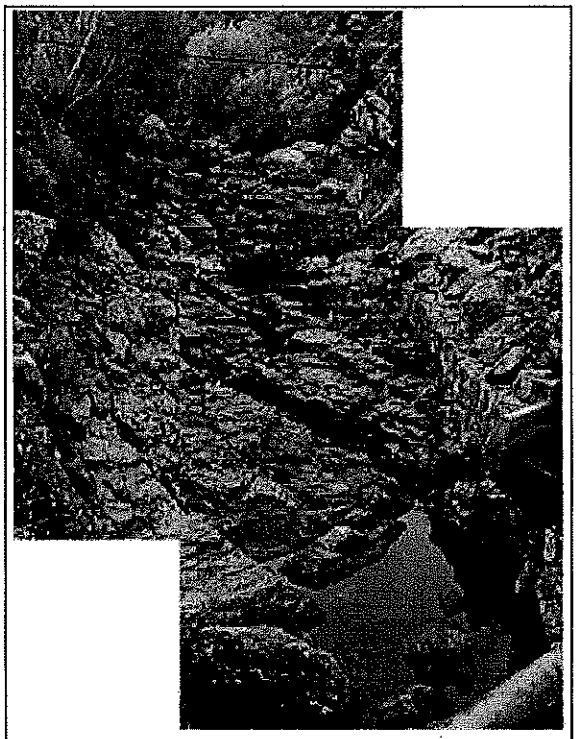
TIC intake weir

The Teviot Irrigation Company (TIC) weir is located 1·5 km downstream from the Marslin Dam and diverts all water from the Teviot River through a tunnel and race to the hydro system above the George, Teviot Bridge and Ellis power houses. As with the Marslin Dam, no minimum flow is provided by the TIC weir but the porous nature of the substrate results in a residual flow to continuing down the Teviot River.

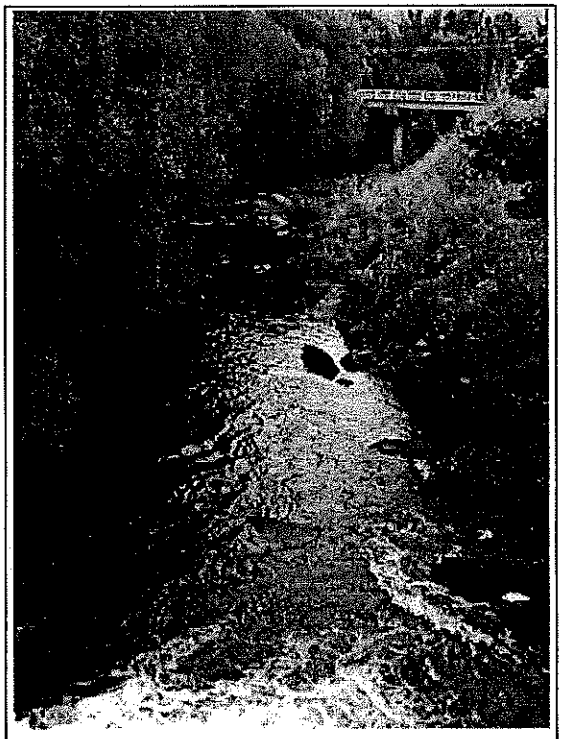
Horseshoe Bend



Teviot River below TIC intake weir



Teviot River upstream of Teviot Bridge and Ellis powerhouses



Teviot River downstream of Teviot Bridge and Ellis powerhouses

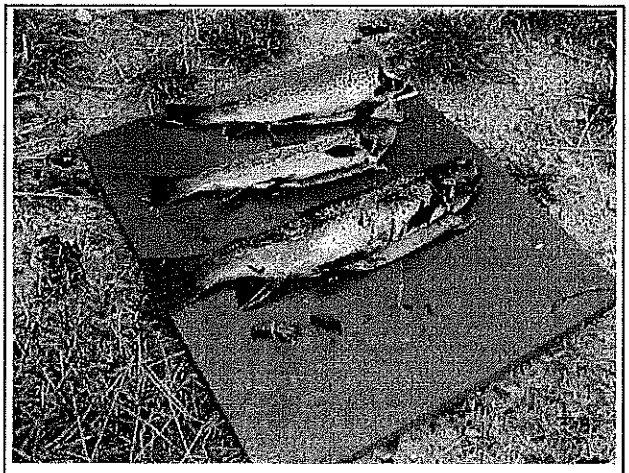
At three locations (below the Michelle power house, prior to and below the George power house) water is abstracted for irrigation by the Teviot Irrigation Company.

Flow is restored to the Teviot River by discharges from the Teviot Bridge and Ellis power houses which are located side by side on the true left bank. From this location the river has only a few hundred metres to flow until it reaches the Clutha River/Mata-Au. Flow is reduced, however, by the irrigation water abstractions taken from the hydro-electric system by the Teviot Irrigation Company.

4.2 Mahika Kai and other Species

Populations of mallard, grey duck, New Zealand shoveller, paradise shelduck, pukeko, black swan, Canada geese, red and black billed gull, black backed gull, feral goose, black and little shag, black bird, thrush, starling, sparrow, pied stilt, oystercatcher, spur winged plover, grey teal, white faced heron, Australasian harrier, New Zealand falcon, king fisher, silver eye, fantail, and welcome swallow are sustained by the catchment or frequent the area.

No fish were observed in the Teviot River during the visit. However, a fisherman met on the inspection day was happy to present his catch that were caught a short distance downstream of Horseshoe Bend power house. His catch included three brown trout, one of which had several small wai-koura in its gut.



Brown Trout captured by an angler from a reach of the Teviot River (Note: small wai-koura were found in the gut of the larger fish)

Common bully were observed in great abundance along shallow shore margins of Lake Onslow. Sign of wai-koura burrows were also very common in Lake Onslow. A fisherman who regularly uses the lake described the wai-koura fishery as exceptional.

Glova et al (2000) surveyed freshwater fish at 39 sites downstream of the Roxburgh Dam in the Clutha River/Mata-Au main stream and tributaries. Table 1 shows in order of abundance the number of fish caught. Brown trout were by far the most abundant species. Longfin eel was the most abundant native species and second most abundant overall. Focusing on native species, wai-koura, common bully, shortfin eel, and upland bully were all very common. Koaro, roundhead galaxiid, giant kokopu, and inanga were common. All the aforementioned native species are diadromous (migrate) except wai-koura and roundhead galaxiid. Allibone (1997) reported rainbow trout, brown trout, common bully and roundhead galaxias were present in the Teviot River and Lake Onslow catchment.

Table 1. Summary of numbers of fish caught below Roxburgh Dam. * indicates native species. (NIWA Freshwater Fish database).

Fish Species	Number caught	Fish Species	Number caught
Brown trout	246	Common smelt*	7
Longfin eel*	157	Rainbow trout	7
Perch	48	Black flounder*	5
Wai-koura*	46	Torrentfish*	4
Common bully*	41	Dusky galaxias*	4
Shortfin eel*	33	Lamprey*	3

Upland bully*	33	Flathead galaxias*	2
Chinock salmon	33	Brook char	2
Koaro*	17	Mullet*	1
Roundhead galaxiid*	11	Giant Bully*	1
Giant kokopu*	11	Bluegulled bully*	1
Inanga*	10	Redfin bully*	1

Most small streams and rivers flowing into the Clutha River/Mata-Au main stem appear to support greater numbers of fish in contrast to the Clutha River/Mata-Au main stem (Table 2). This suggests that smaller streams provide a diversity of habitat types that are more suited to both native and exotic fish species. Of the 23 rivers surveyed, the Teviot River had the fifth highest fish abundance.

Table 2. Average number of fish caught in streams and Clutha River/Mata-Au main stem (data source Glova et al, 2000b)

Tributary	**Total fish m^{-2}**	**Tributary**	**Total fish m^{-2}**
Bullrush Stream	1.60	Back Stream	.15
Rae's Junction Creek	.80	Coal Creek	.13
Benger Burn	.33	Blackcleugh Burn	.11
Ruby creek	.22	Bullock Creek	.10
Teviot River	**.21**	Greenfield Rd Trib	.10
Cranleigh	.20	Crook Burn	.07
Minzion Burn	.18	Clutha River/Mata-au main stem	.06
Beaumount River	.18	Four Mile Creek	.05
Saddle Creek	.17	Pomahaka River	.03
Lowburn River	.16	Waitahuna River	.02
Tuapeka River	.15	Talla Burn	.00
Bowlers Creek	.15		

Stark and Strickland (1997) carried out an intensive study of the Teviot River from Lake Onslow dam to the river's confluence with the Clutha River/Mata-Au. They found brown trout, particularly juveniles, were the most common fish and were most abundant in tributaries and in the margins of the main river below Lake Onslow. Present hydro-electric structures on the Teviot River prevent upstream migration of brown trout except between the various dams. The presence of trout fry indicates natural reproduction occurs within the system. Lake

Onslow has a brown trout fishery notable for high catch rates, although fish are of a moderate size (Stark and Strickland, 1997).

Common bullies were found only in the extreme upper reaches, Lake Onslow and immediately below the Onslow dam. Their absence from all other sample sites downstream indicates that those found are a landlocked population, rather than anadromous. Because of the steep nature of the Teviot River downstream of where common bullies were present, it seems unlikely that they would have populated this far upstream naturally (i.e. even if the existing dams had not been present). If common bullies had been able to penetrate this far upstream, koaro (which are even better climbers) should be also have done so and formed landlocked populations. However, despite the presence of suitable habitat koaro have never been recorded in this catchment. It seems most likely therefore, that common bullies were introduced into Lake Onslow after the introduction of brown trout in 1915 as a food source for trout (Stark and Strickland, 1997).

Longfin eels were found only in the first kilometre upstream from the river's confluence (Stark and Strickland, 1997). This species is the most aggressive migrant of all New Zealand freshwater fish (McDowell, 1990). Anecdotal evidence suggests that eels are able to penetrate the Teviot beyond Marslin dam. Because longfin eels are extremely long-lived, presence of very low densities, or an occasional sighting suggests limited recruitment. While the TIC weir and Marslin dam no doubt limit natural recruitment of longfin eels, the absence of these structures is unlikely to significantly increase eel density upstream. Their low density, even well downstream of these structures, suggests that the physical nature of the Teviot River is too severe for the presence of more than an occasional longfin eel (Stark and Strickland, 1997).

Roundhead galaxias were caught in two tributaries where trout were precluded by downstream waterfalls (Stark and Strickland, 1997). This species is a non-diadromous species of the Galaxiidae family that is found only in Otago. It is known from just 13 streams, 11 in the Taieri River catchment and two in the Clutha River/Mata-Au system (Richardson, 2000). They are of particular scientific interest and as a function of their rarity can be classified as taoka species.

Wai-koura were caught in the two roundhead galaxiid tributaries and two others which were populated by trout. The range and abundance of wai-koura in the Teviot system is probably much greater than the limited scientific evidence suggests. The trout caught in the mainstem on the inspection day had recently consumed young wai-koura. This indicates patchy distribution of wai-koura in the mainstem. Anecdotal reports from fishermen suggest the Lake Onslow wai-koura population is abundant with many large individuals.

It appears that apart from the extreme lower reaches of the Teviot River, only longfin eel was able to access the upper reaches of the catchment and only in very small numbers. Roundhead galaxias and wai-koura which are non migratory species probably populated all the catchment, especially tributaries and reaches with easier gradients and more stable flows.

Sampling from the Teviot River catchment including Lake Onslow has revealed a total of 87 different kinds (taxa) of macroinvertebrate (Stark and Strickland, 1997). Caddisflies (22 kinds) were represented in the greatest variety, with true flies (17), Crustacea (9), beetles (8), stoneflies (6), and mayflies (6) also represented by a reasonable variety of different taxa. In general, species richness (defined as number of taxa per sample) was higher in the smaller tributaries than in the mainstem. The poorest variety of macroinvertebrates was associated with bedrock substrates, steep streambed slopes, and torrential water velocities. The presence of a great variety of taxa, and high densities of macroinvertebrates in tributaries is likely to provide good juvenile rearing habitat for trout and a source of macroinvertebrate colonists for the Teviot River mainstem (Stark and Strickland, 1997). Stark and Strickland (1997) noted that macroinvertebrate densities in the Teviot catchment appeared to be within normal limits for New Zealand streams and no species that could be considered 'rare or endangered' were recorded.

4.3 Assessment

Positive Effects

Hydro-electric development has added one large lake and three small reservoirs to the system, and maintains reasonable minimum flows and moderates maximum flows in most of the catchment from Lake Onslow to the Marslin dam. In the absence of this development the common bully population would certainly not be present. Brown trout and wai-koura

populations would be almost insignificant in comparison to their post hydro development size and range.

In the absence of koaro and possibly eels, roundhead galaxias (which are relatively rare and found in only a few locations in the upper Taieri River) maintain small populations in some tributaries draining into Lake Onslow. The rugged nature of the river along the lower 6 km has excluded koaro and significantly limited longfin eel from the catchment. Koaro are far better climbers than trout and if they gained access to the upper catchment would certainly compromise the continued existence of roundhead galaxias which are presently protected from trout by waterfalls. Larger numbers of eels could also be a confounding problem and if they gained access to Lake Onslow could have a deleterious affect upon the wai-koura population. TIC weir and Marlin dam are therefore providing an additional and substantial barrier to koaro and eels maintaining the security of roundhead galaxias and wai-koura.

Negative Effects

Lake Onslow, originally a moss swamp, converted into a small lake by a mining dam and then increased significantly by the later hydro development now supports large populations of brown trout, wai-koura and common bully. These three species, an exotic predator and two indigenous species appear to cohabit the lake, maintaining abundant populations.

Due to the conversion of Lake Onslow, from swamp to hydro lake, the loss of mahika kai, habitat, and the destruction of flora and fauna that is associated with swamps impact upon Kai Tahu values has been substantial. The loss of Dismal Swamp is considered to be a major loss for Kai Tahu.

Place Names

Due to the current environment that has seen Kai Tahu excluded from traditional areas of mahika kai gathering as well as waahi tapu/ waahi toaka sites many of the traditional names have been lost or are no longer used. With a loss of these placenames there is also a loss of manawhenua and kaitiakitanga status for Kai Tahu. It would be considered vitally important to begin to reuse the traditional Kai Tahu names for these systems, especially where these names have not been lost to begin to allow Kai Tahu to re-establish their Manawhenua and Kaitiakitanga status.

With the development of new Hydro dams and lakes it is vitally important to retain the traditional Kai Tahu names for the areas affected.

Awa/Nga Wai

The Teviot River is not free running from source to the sea. Pioneer Generation Ltd. have three dams in the river and use the water from a forth owned by Teviot Irrigation Company. In the upper catchment there is a significant lake, Lake Onslow. Prior to development, in this area there were small tributaries drawing water from rolling high country tussock lands and swamps. The lake has a normal operating range of about five metres which is moderate for hydro storage lakes. Minimum and maximum (non-flood) controls govern the flow in about two thirds of the Teviot River. Water flows in the lower catchment are reduced to almost nil and no minimum flow is provided. Water quality is not impacted upon by Pioneer Generation Ltd's developments. Flow control in two thirds of the Teviot River probably has a moderating effect that may also increase the productivity of the mahika kai.

Kai Tahu expresses in the Otago Regional Plan: Water Incorporating Decisions on Submissions Received 7th July 2000, the values associated with the Teviot River, these are as follows,

Roxburgh sub-region									
Water body	**MA 1**	**MA 2**	**MA 3**	**MA 4**	**MB 1**	**MB 2**	**MB 3**	**MB 4**	**MB 5**
Teviot River					✓				

Code	**Access/Customary Use Interests:**
MB1	**Mahika kai** – places where food is procured or produced. Examples in the case of water-borne mahika kai include eels, whitebait, kanakana (lamprey), kokopu (galaxiid species), koura (freshwater crayfish), freshwater mussels, indigenous waterfowl, watercress and raupo.

Mauri

The Teviot River catchment as a whole is not in its natural state. Four dams or weirs are located in the main stem. Each forms a reservoir, the largest being Lake Onslow which is of

significant size. Flow rates and patterns are controlled and parts of the lower Teviot River are essentially de-watered. Land development in the catchment is not intensive with some pastoral development and plantation in the mid catchment and large tracts of tussock remain in the upper catchment. The lower catchment is steep and relatively undeveloped but gorse, broom, willow and other weed species have invaded. As a consequence of the development impacts the mauri of the Teviot River system is no long intact and has been significantly impacted upon.

Mahika Kai

Air

Pioneer Generation Ltd's dams and powerhouses are relatively small, do not produce any discharges to air and only cause visual impacts. Power lines are relatively inconspicuous. Therefore, it is reasonable to conclude that visual impacts upon mahika kai are negligible.

Land

Land use in much of the mid and lower catchment has been developed for pastoral grassing and plantation forestry. Upper catchment predominantly remains in tussock grassland. Forestry development will reduce water flows in the Teviot River. Although grassing is extensive, the riparian zones and wetlands are not protected from periodic intensive grassing and damage from stock. Riparian zones in the lower gorge are steep and undeveloped. Present land management practices probably only impact upon the Teviot River, lakes and reservoirs in a minor way. However, with pastoral intensification, ploughing of tussock and conversion of significant areas to forestry, mahika kai will be adversely affected if riparian zones and wetlands are not protected.

Species

Wai-koura and brown trout are the most important mahika kai species in the catchment. The formation of Lake Onslow has allowed the wai-koura population to expand its range and size significantly in contrast to the small tributary populations. Although not a native species, brown trout have been introduced to the catchment and the population in Lake Onslow is so abundant that the Fish and Game Council often liberalises fish regulations to allow a full year open season and no size or bag limit. Common bully, a native species exotic to the Teviot River system has also been introduced to Lake Onslow and its abundant populations probably

help to sustain the large trout population. Remnant populations of roundhead galaxias are present in some tributaries with reaches free from trout. Introduction of koaro which has good climbing ability would have serious deleterious affects upon roundhead galaxias. Both roundhead galaxias and wai-koura may be adversely affected if longfin eel, which has exceptional climbing abilities, was allowed to enter the catchment. Mallard, paradise shelduck black swan and Canada geese have benefited by Lake Onslow and are species important to hunters.

Kaitiakitanga

Effective processes and systems have not been developed that involve Kai Tahu in the management of natural resources in the Teviot River catchment including hydro-electric developments except the resource consent process for the Horseshoe Bend scheme. Kai Tahu values have not been accepted or expressed in the management of the area including the hydro-electric developments. Consequently it is clear that kaitiakitanga is not being provided for.

Waahi Tapu/Waahi Taoka

A Desktop review of archaeological sites has shown that the area surrounding Lake Onslow and Lake Onslow itself contains numerous sites of importance. The existence of these sites points to an extensive (rather then intensive) use of the area for the collection of mahika kai, flora and fauna and archaeological evidence also points to the collection and use of Orthoquartzite from the Teviot area. The finds range from flakes to a shelter area without rock art to fragments of koura, mussel shells and Moa bones and includes many oven sites as well.

It is beyond the scope of this impact assessment to undertake a full archaeological study of the area. It however is recommended that an assessment is undertaken to ascertain current cultural areas of significance and to look for sites that may have become exposed destroyed or new sites.

ISSUE - KAI TAHU VALUES	Impact
Place Names	Significant - To help re-establish Kai Tahu

	status as manawhenua and kaitiakitaka information developed by Pioneer should contain duel names or where possible traditional Kai Tahu names should be used. In the development of future hydro dams/schemes etc the use traditional Kai Tahu names is vitally important.
Awa/Ngai Wai	Significant – Minimum flows need to be investigated in consultation with Kai Tahu. De-watering of stretches of the Teviot river need to be remedied.
Mauri	Major – Discussions with Kai Tahu need to occur to investigate how the mauri of the river may be restored.
Mahika Kai Air/Land/Species	Major - Research should be carried out to ascertain the full range and distribution of roundhead galaxias in the Teviot River catchment. Potential sites for re-introduction of roundhead galaxias should be identified, trout removed, trout barriers constructed, roundhead galaxias introduced and monitored. The wai-koura population in Lake Onslow should be surveyed.
Kaitiakitanga	Significant – To help re-establish the Kaitiakitanga status of Kai Tahu due consideration should be given to the issues raised in this report.
Waahi Tapu/Waahi Taoka	Major - Given the extensive nature of waahi tapu/waahi toaka sites in the Lake

	Onslow/Teviot region, Pioneer should investigate the commissioning of an archaeological assessment.

5 Fraser River Hydro Electric Power Scheme

5.1 General Description

The Fraser River finds its source among extensive high country between the Obelisk and Old Woman Ranges with an elevation of about 1600 m. It flows firstly northwards then east around the northern end of the Obelisk Range, then southward along the Earnscleugh flats to its confluence with the Clutha River/Mata-Au opposite Alexandra at an elevation of about 150 m. The river has a maximum length of about 50 km and a median gradient of 1:35.

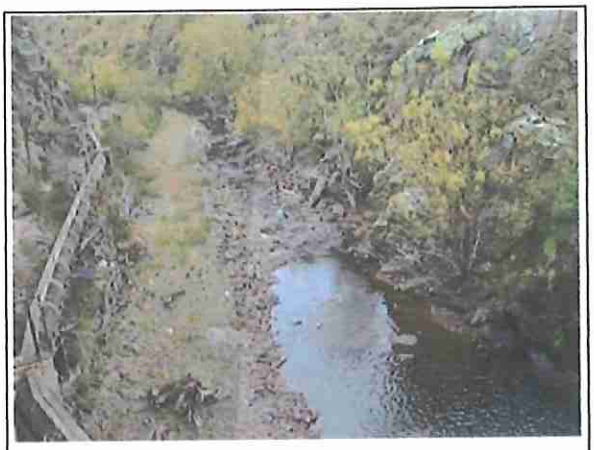
Fraser Dam and Reservoir

Fraser River Weir

The Fraser Dam and reservoir is located about mid-catchment and is the main supply for the hydro-electric system. The dam is a concrete arch type, 35 m high and the reservoir has an area of 46 ha. About 6 km downsteam from the Fraser Dam is a 10 m high intake weir. From this weir water flows through a 5 km long pipeline to a power house located on the true right bank of the Fraser River where the river flows onto the Earnscleugh flats (Refer to Map 4).

Upstream of the Fraser Dam the Fraser River catchment encompasses 122 km^2 which represents about 60% of the total catchment. Two other major tributary systems flow into the Fraser River upstream of the weir and provide significant volumes of water to the lower Fraser River and hydro-electric generation scheme. The Hawks Burn is the larger (45 km^2), and Fish Creek (10 km^2) the smaller. Average annual rain fall in the upper Fraser catchment is slightly higher (1040 mm) than the remaining area (Hawks Burn, Fish Creek and Fraser River from the dam to the weir; 83 km^2) which receives about 750 mm.

Fraser weir reservoir



Fraser River downstream of weir

Water flows at the weir generally follow a typical pattern with peak flows in October reaching about 8·5 cumecs and lowest flows in July dropping to about 1·25 cumecs. The spring snowmelt and stronger westerly winds period results in increased flows (about 3 to 8 cumecs) during the four month period from September to December. From January to June flows stabilise at about 2 cumecs. July and August are periods of lowest rainfall in central Otago and rain that does fall, generally falls as snow and is locked up on the hillsides. This results in two months of very low flows which drop to about 1·25 cumecs.

No minimum flow is provided by the weir but a residual flow results from water passing through the porous surrounding and basement substrate. In addition, water flow in the Fraser River often exceeds electricity generation requirements overtopping the weir resulting in a small sustained flow between the weir and power house discharge. At times, however, and especially during long periods of dry weather, the river between the weir and power house discharge becomes a series of pools and subterranean flow.

A feature of the Fraser hydro-electric scheme is that it is a combined hydro and irrigation scheme. The Fraser dam is owned and operated by the Earnscleugh Irrigation Company and although Pioneer Generation Ltd. use the water as it passes down the river, the purpose of the storage facility is to provide water for irrigation of Earnscleugh Flat properties. Water for this purpose is abstracted from the Fraser River immediately downstream of the power house. For many decades the lower Fraser River (downstream of the power house and irrigation intake) often ran dry as a consequence of this abstraction. Recently, water diverted from the Clyde

dam is discharged opposite the irrigation intake and maintains minimum flows of 1 cumec in the lower Fraser River.

Fraser River and Power House

Land use in the upper catchment upstream of the Fraser Dam is developed primarily for extensive pastoral grasing. Native tussock still dominates the landscape. However, areas have been burnt, oversown with exotic pasture grasses and fertilised. Mid catchment area from the powerhouse upstream to the Fraser Dam is developed for intensive pastoral grasing. The main stem of the Fraser River in this area is located in a steep sided gorge which remains relatively undeveloped except for the invasion of gorse, broom, willow and other weed species. Downstream of the power house, land use in the lower catchment has been developed for intensive pastoral grasing, orchards, vineyards and life style blocks.

5.2 Mahika Kai and other Species

No fish were observed in the river on the day of the inspection. Allibone (1997) reported brown trout were present in the Fraser River and tributaries upstream of the Fraser Dam reservoir. Rainbow trout, brown trout, perch and longfin eel are all reported from the lower Fraser River and tributaries. Unfortunately there is no information for the mid catchment between the weir and Fraser dam, or the Hawks Burn catchment except one survey of the Fraser Weir reservoir where no fish were caught.

No water fowl were observed during the inspection. However, the reservoir formed by the weir potentially provided protected sheltered water for daytime resting locations. Fraser Dam reservoir is large and therefore potentially provides a variety of habitats suitable for various water fowl including, mallard, Canada goose and paradise shelduck.

5.3 Assessment

Positive Effects

Mahika kai has been increased and diversified by the formation of two reservoirs. The Fraser Dam reservoir is of significant size (46 ha) with several access points. This reservoir could become an important mahika kai if longfin eel were able to gain access.

Negative Effects

Both the weir and Fraser Dam reservoir present significant barriers to the migration of diadromous native species including eels, kanakana, and koaro. The reservoirs formed behind the weir and dam have flooded reaches of the Fraser River and changed the habitat characteristics from stream to lake type. No minimum flow is provided in the lower Fraser River between the weir and power house and consequently the river becomes a series of isolated pools at various times of the year.

Place Names

As with the Teviot Power Scheme many traditional names in and around the Fraser/Earnscleugh region have been lost or are no longer used.

Herries Beattie (1944) (pg 28) recorded some early place names in and around the Earnscleugh. These included:

> "The Earnscleugh River bore the name O-te- whata, after a man whose name means "the storehouse" while the district around Conroys Creek and up to prospect Hill was O-rei-haki (named after a person "rei" means bone ornament ; "haki" is crooked)"

While these locations may not be completely acurate or interpreted correctly it provides evidence of the use of the area by Kai Tahu. The use of the traditional placenames is vitally important as it reinforces Kai Tahu as manawhenua and Kaitiakitanga.

Mauri

The Fraser River catchment as a whole is not in its natural state. One dam and a weir are located in the main stem. Each forms a reservoir, the largest being the Fraser Dam which is of significant size. Flow rates and patterns are controlled and parts of the lower Fraser River that

is essentially de-watered at times. Land development in the catchment includes pastoral development, orchards and vineyards. Between the Fraser Dam and Earnscleugh flats the river is in a steep and relatively undeveloped gorge but gorse, broom, willow and other weed species have invaded. As a consequence the development impacts the mauri of the Fraser River as the main stem is no longer intact.

Awa/Nga Wai

The Fraser River is not free running from source to the sea. Pioneer Generation Ltd have one weir in the river and use the water from the Fraser Dam which is owned by the Earnscleugh Irrigation Company. The Fraser Dam forms a significant reservoir in the upper catchment. Water flows in the mid catchment are reduced, at times, to almost nil and no minimum flow is provided. Water quality is not impacted upon by Pioneer Generation Ltd's developments. Mahika kai has been increased by the formation of the Fraser Dam reservoir and the small reservoir formed by the weir.

Kai Tahu expresses in the Otago Regional Plan: Water Incorporating Decisions on Submissions Received 7th July 2000, the values associated with the Fraser River, these are as follows,

Central Otago sub-region									
Water body	**MA1**	**MA2**	**MA3**	**MA4**	**MB1**	**MB2**	**MB3**	**MB4**	**MB5**
Fraser River				✓					

Code	**Mana Interests:**
MA4	**Waahi taoka** – treasured resource; values, sites and resources that are valued and reinforce the special relationship Kai Tahu have with Otago's water resources.

Mahika Kai

Air

Pioneer Generation Ltd's weir and power house are relatively small, do not produce any discharges to air and only cause minor visual impacts. Power lines are also relatively

inconspicuous. Therefore, it is reasonable to conclude that visual impacts upon mahika kai are negligible.

Land

Upper catchment predominantly remains in tussock grassland. Land use in much of the mid and lower catchment has been developed for pastoral grassing. Slopes in the lower gorge are steep and undeveloped although willows, broom, briar and other weed species have invaded. There appeared to be no specific protection (e.g. fencing) of riparian zones to prevent damage from stock trampling etc. Present land management practices probably only impact upon the Fraser River and reservoirs in a minor way. However, with further pastoral intensification and ploughing of tussock, mahika kai will be adversely affected if riparian zones and wetlands are not protected. Further conversion of tussock grasslands to pasture may alter and reduce water flows in the Fraser River.

Species

Only brown trout have been recorded in the upper catchment and no information is available describing the fisheries in the Fraser Dam reservoir. Rainbow trout, brown trout, perch and longfin eel are all reported from the lower Fraser River and tributaries. A good description of the fishery in the lower catchment results from the combined data from many surveys. Few surveys have occurred in the mid and upper catchment including the reservoirs. However, the data that is available suggests that brown trout populations will be present throughout the catchment. Little is known of native fish including galaxias species, eels and wai-koura. Longfin eel are probably locally extinct as a result of the long term presence of the Fraser Dam and weir which present significant barriers to migration. Down stream in the Clutha River/Mata-au, the Roxburgh Dam has almost certainly influenced the presence of longfin eel. Water fowl are also important mahika kai species and little is known of species, population sizes and locations.

Kaitiakitanga

Effective processes and systems have not been developed that involve Kai Tahu in the management of natural resources in the Fraser River catchment including hydro-electric developments. Kai Tahu values have not been accepted or expressed in the management of

the area including the hydro-electric developments. Consequently it is clear that kaitiakitanga is not being provided for.

Waahi Tapu/Waahi Taoka

A desktop review of archaeological sites has shown several site in close proximity to the Fraser River Hydro Scheme, with many sites existing in the surrounding landscape. These sites include ovens with moa bones, a grey argillite adze and many findspots. The existence of the site surrounding the Fraser River allows for the cultural landscape to be determined. This landscape points to one of seasonal use, hikoi passing through, and the gathering of Mahika Kai.

It is beyond the scope of this impact assessment to undertake a full archaeological study of the area. It however is recommended that an assessment is undertaken to ascertain current cultural areas of significance and to look for sites that may have become exposed or new sites.

Effects Upon Cultural Values

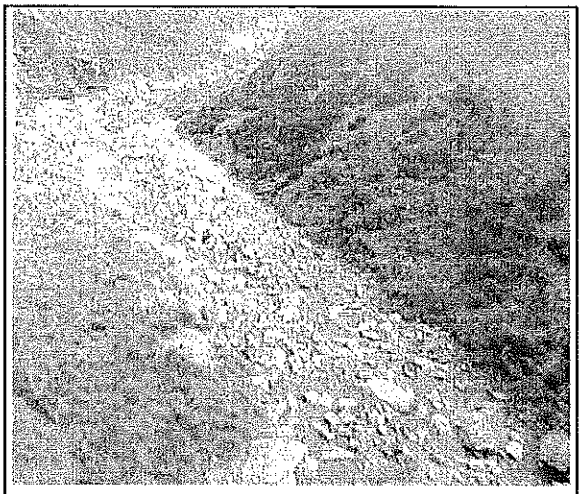
ISSUE - KAI TAHU VALUES	Impact
Place Names	Major - Pioneer should begin to re-use the traditional Kai Tahu palcenames associated with the Fraser River system. This will then begin to reaffirm Kai Tahu status as Kitiakaitanga and manawhenua. Pioneer should consider the use of traditional names or duel names for information produced on their Fraser hydro scheme.
Mauri	Significant – As a consequence of damning and dewatering of sections of the Fraser River the mauri has been significantly impacted upon. Discussions should occur with Kai Tahu with a view to begin to restore the Mauri of the Fraser River.

Awa/Ngai Wai	Significant - Establishment of minimum flows that will maintain instream ecosystems below the Pioneer Generation Ltd. weir should investigated and implemented
Mahika Kai Air/Land/Species	Significant - Further research is required to characterise the water fowl population in the catchment and to determine how Pioneer Generation Ltd's. activities, structures and water manipulations effect these species. Methods and processes that allow the migration of fish species past the Fraser Dam and Pioneer Generation Ltd. weir should be investigated
Kaitiakitanga	Significant – To begin to ensure the Kaitiakitanga status of Kai Tahu an integrated approach to catchment management needs to be established through discussions with Kai Tahu.
Waahi Tapu/Waahi Taoka	Significant – Pioneer in discussion with the Papatipu Runanga should investigate the commissioning of an archaeological survey.

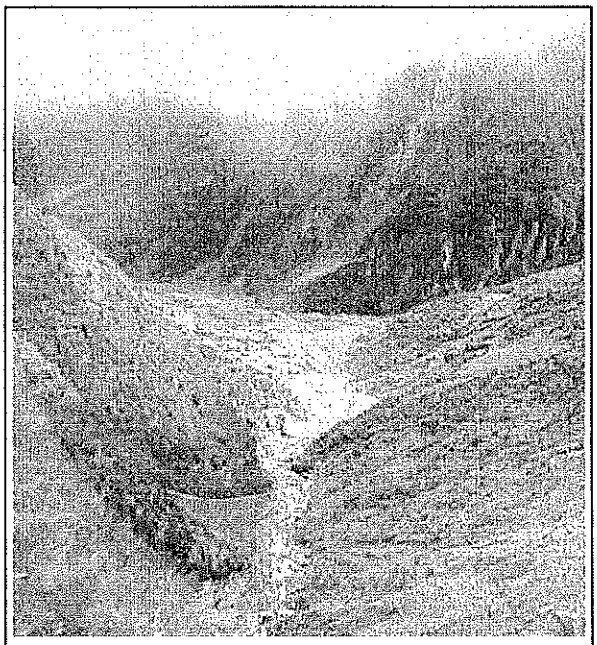
6.0 Ox Burn Hydro Electric Power Scheme

6.1 General Description

The Ox Burn finds its source in the Richardson Mountains draining particularly the peaks of Round Hill (2067 m) and to its north Stair Peak (2164 m) and encompasses a catchment area of about 37 km^2. It flows westwards about 10 km to its confluence with the Rees River which is about 9 km upstream from where the Rees meets Lake Wakatipu near Glenorchy. The upper reaches of both branches are relatively steep in gradient (1:5 to 1:9) and are constrained in steep V shaped valleys. Although the mid reaches are also within a steep V shaped valley, the valley floor is wider and flatter (1:15) in places allowing the river to meander and braid a little. The lower reaches pass into a steep sided, steep gradient (1:9) beech forested gorge.

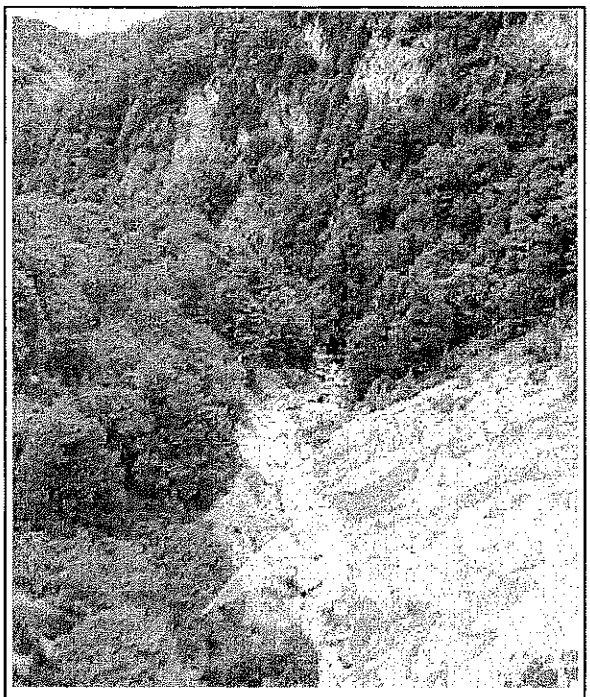


Headwaters of the Ox Burn south branch



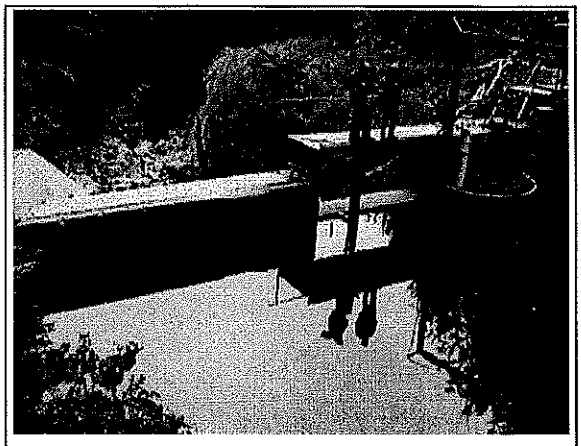
Upper reaches of the Ox Burn looking downstream from the south branch with north branch mid right

A 14 m high weir is located at the end of this gorge and 500 m downstream a small powerhouse is situated on the true right bank of the river (Refer to Map 5). The hydro-electric system is a run of the river type with no storage lake. Water is taken from the weir by a pipe to the power house and is then discharged into the Ox Burn where it only has a further 500 m to travel until it meets the Rees River. A minimum flow of 2 to 4 l/s is allowed for and this is provided by a small discharge from the pipeline adjacent to the weir. Leakage and groundwater flowing beneath the weir surfaces further downstream and also supplements the minimum flow. At times, when the Ox Burn is running high, water over tops the weir flowing down a spillway returning to the Ox Burn river channel. At other times flow in the Ox Burn



Mid reaches of the Ox Burn passes from tussock high country into steep beech forest

rock can move through the Ox Burn system and become trapped behind the weir. Periodically, a large valve is opened in a bottom sluice allowing rock, gravel and other debris to pass through the structure.

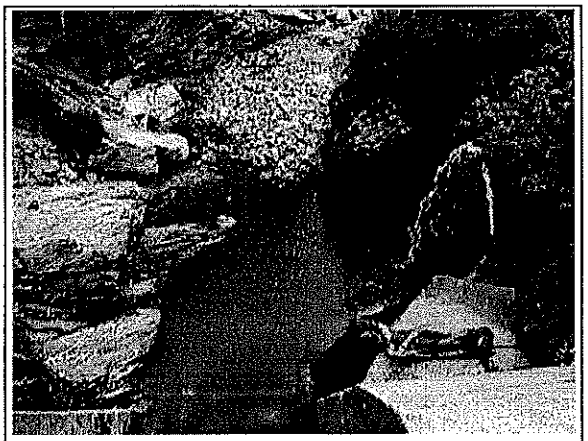


Ox Burn Weir

between the weir and power house discharge can become a series of pools isolated by subterranean flow, i.e. dry reaches of river bed.

During floods large quantities of gravel and

Reservoir behind Ox Burn power scheme weir



Ox Burn minimum flow provision

6.2 Mahika Kai and other Species

Steep snow tussock (*Chionochloa* spp.) covered schist slopes intermittently broken by long eroding slips characterised the upper catchment. A variety of more delicate plants such as native violets, harebells and geraniums shelter under the tussock. Spiky clusters of spaniard could be seen. Matagauri, *Coprosma* and inaka formed scrub patches on the valley floor. Below the snow line, a distinctive ecotone between snow tussock dominated and forest dominated ecosystems, the lower catchment featured dense beech forest with an understory of ferns, flaxes, *Coprosma*, etc.

Bird species that occupy this high country area includes, kea, silver eye, grey warbler, kereru, bellbird, morepork, Australsian harrier, paradise shelduck, blue duck (rare), Canada geese, mallard, and grey duck (rare).

Only two site surveys for fish are reported by Allibone (1997) and these were within the last few hundred metres before the river's confluence with the Rees River. Brown trout were reported at the lower and no fish at the upper site. It is difficult to estimate what species might exist in the catchment upstream of the weir. There appeared to be favourable habitat for self sustaining populations of brown trout. Longfin eel, common bully, and brown trout are reported in the Rees River. Common bully are poor climbers and even in the absence of the weir, are unlikely to scale the steep bouldery gorge. Brown trout may also find it difficult to access the catchment but if released in the upper catchment may sustain viable populations. Koaro, also a good climber are common in Lake Wakatipu and are reported in many tributaries close by. It is unlikely that either longfin eel or koaro could scale the weir, but in the absence of the weir may well have sustained populations in the river. If they were present prior to the construction of the weir in 1969, all adult koaro would have migrated out of the system and although long lived, in the 33 year period to the present day most if not all eels would have migrated from the catchment. In the absence of further information one should not discount the likely hood that a non-diadromous galaxiid species may be present. Alpine galaxias and Southland flathead galaxias are reported in catchments to the north and south of Ox Burn (Richmond, 2000). Another roundhead galaxias (*Galaxias anomalus*), separate from the recently re-described Otago roundhead galaxias found in the Taieri and Teviot Rivers, is reported in the Nevis River (Allibone, 1997) and is yet to be redefined.

6.3 Assessment

Positive Effects

No information is known about the presence of native or exotic fish species in the catchment upstream of the weir. If a non-diadromous galaxiid species is present, its continued existence may be assured through the existence of the weir which most probably presents an insurmountable barrier to trout, eels and koaro. Presence of these species is often associated with the absence of non-diadromous native fish species.

Negative Effects

The weir presents a significant barrier to up and downstream migration of longfin eel and koaro. The reach of river between the weir and power house discharge is often drained of all but a minuscule flow.

Place Names

Under the Ngai Tahu Claims Settlement Act 1998 the following place names within the Wakatipu/Dart River area became dual place names.

Pikirakatahi	(Mt Earnslaw)
Ari	(Mt Alfred)
Te Awa Whakatipu	(Dart River)
Wawahi Waka	(Pigeon Island)
Matau	(Pig Island)
Tarahaka Whakatipu	(Harris Saddle)

Pioneer Generation should endeavour to incorporate the duel placenames in any information produced.

Mauri

The Ox Burn catchment as a whole is in a relatively unmodified state. One weir is located in the main stem and forms a very small reservoir. Flow rates and patterns are controlled in a 500 m reach of the Ox Burn between the weir and power house. This reach is essentially de-watered at times. Land development in the catchment is minor with only some high country grasing. If the weir and hydro development had not occurred in this catchment the mauri

could be considered intact. Unfortunately the weir has been constructed in the river and flows are manipulated. Consequently the mauri of the Ox Burn is adversely affected.

Awa/Ngai Wai

Ox Burn is not free running from source to the Rees River having a weir in the lower river. Water flows between the weir and power house discharge are markedly reduced to a small minimum flow. Often the river becomes a number of pools connected by subterranean flow. Pioneer Generation Ltd's developments does not impact upon water quality. Mahika kai in the half kilometre reach between the weir and power house has been significantly adversely affected as a result of the decreased flow. Upstream of the weir, without further information characterising the fishery, effects upon mahika kai are difficult to determine except that bird life and mammalian species are probably not affected by Pioneer Generation Ltd's developments.

Kaitiakitanga

Effective processes and systems have not been developed that involve Kai Tahu in the management of natural resources in the Ox Burn catchment including hydro-electric developments. Kai Tahu values have not been accepted or expressed in the management of the area including the hydro-electric developments. Consequently it is clear that kaitiakitanga is not being provided for.

Mahika Kai

Air

Pioneer Generation Ltd's weir and power house are relatively small, do not produce any discharges to air and only cause minor visual impacts. Therefore, it is reasonable to conclude that visual impacts upon mahika kai are negligible.

Land

Upper catchment predominantly remains in tussock grassland. Beech forest still remains in the lower catchment. Although the area has probably been grassed, the high elevation, aspects and steep slopes preclude intensive grasing and land development. It appears that land use in the catchment, and particularly the small area used by Pioneer Generation Ltd. does not impact adversely upon mahika kai.

Species

Longfin eel and koaro are probably locally extinct as a result of the weir which present significant barriers to migration. Down stream in the Clutha River/Mata-au, the Roxburgh and Clyde Dams have almost certainly influenced the presence of longfin eel. Water fowl are also important mahika kai species and little is known of species, population sizes and locations except Canada geese populations are reputedly to be high in the wider area.

Kaitiakitanga

Effective processes and systems have not been developed that involve Kai Tahu in the management of natural resources in the Ox Burn catchment including hydro-electric developments. Kai Tahu values have not been accepted or expressed in the management of the area including the hydro-electric developments. Consequently it is clear that kaitiakitanga is not being provided for.

Waahi Tapu/Waahi Taoka

A desktop review of archaeological sites has shown many sites in the Dart River/Rees River area.

In the Tähuna area, about'... *30 prehistoric sites are known to exist within a 20-kilometre radius of Glenorchy and a large number of artefacts have been found in the district. Some of the settlements were probably temporary camps used for working pounamu into pieces small enough to be carried to the coastal settlements. Te Koroka (Dart / Slip Stream) was also an important camping spot for parties travelling to and from the West Coast via the Hollyford Valley. In 1860 Europeans began to visit the head of the lake and found signs of recent camps, along with eel baskets, stake nets and spears*'. (Extract from 'Ki Uta, Ki Tai - Southern Mäori in the Lakes District' Exhibition).

Pounamu was extremely important to the development of Käi Tahu culture. As well as being durable it is also beautiful and was valued both as a tool and as an ornament. Pounamu was worked into toki (adzes), oki (chisels), mere (club like hand weapons) and personal ornaments such as hei-tiki, hei-matau and ear pendants. The toughness of pounamu meant that much skill and patience were required to work it

There are two pounamu sources at the head of Lake Wakatipu; the Routeburn Valley and tributaries and the Slip Stream area in the Dart Valley.

'The actual slip from which the pounamu is gathered is known as Te Horo. The name of the mountain where the pounamu vein occurs is Koroka. When viewed from the right vantage point, Koroka resembles a reclining giant. Captain Cook's men were informed while moored in Dusky Sound, of a giant in the interior that emits pounamu from his mouth.' (Extract from the Ngäi Tahu Claims Settlement Act 1998, Schedule 91).

Because of the fame of inaka, and the relative accessibility of other varieties of pounamu in the district, the headwaters of Wakatipu-wai-Mäori (Lake Wakatipu) became known among the people of the east and south of the Island as Te Wahi Pounamu (the place of pounamu). The popular contraction of this name into 'Te Wai Pounamu' meant literally 'The Waters of Greenstone' - a name expressive of the status of the whole island in Mäori tradition. Te Wai Pounamu was, in other words, the island famous for greenstone. It was the Greenstone Island.

'The retrieval of large amounts of pounamu from the head of Lake Wakatipu, so far inland and over a range of physical barriers attests to the importance of this resource to the economy and customs of the iwi over many generations. Strategic marriages between Hapü strengthen the kupeka (net) of whakapapa and thus rights to access the pounamu resource. It is because of these patterns of activity that Te Koroka (Dart / Slipstream) continues to be important to Rünaka located in Otago, Murihiku and beyond'. (Extract from the Ngäi Tahu Claims Settlement Act, Schedule 91).

'Pikirakatahi (Mt Earnslaw) stands as kaitiaki over the pounamu resource and marks the end of a trail, with the tohu (marker) to the pounamu resource sitting opposite on Koroka (Cosmos Peak). Pikirakatahi was of crucial significance to many generations that journeyed to that end of Whakatipu-wai-Mäori and beyond. The creation of Pikirakatahi relates in time to Te Waka o Aoraki, and the efforts of Tu Te Rakiwhanoa. It is said that during its formation a wedge of pounamu was inserted into this mountain, which is the highest and most prominent peak in this block of mountains.' (Extract from the Ngäi Tahu Claims Settlement Act, Schedule 87).

Ngai Tahu has made claims with regard to the ownership Pounamu against the Crown under the Treaty of Waitangi Act 1975, These claims have been the subject of two reports by the Waitangi Tribunal, the 1991 Ngai Tahu Report and the 1995 Ancillary Claims Report. Since 1991 there have been a number of attempts by Ngai Tahu and the Crown to reach a negotiated settlement of Ngai Tahu's claims and to remove the sense of grievance felt by Ngai Tahu. The resulting Ngäi Tahu Pounamu Vesting Act 1997 provides that:

- All pounamu occurring in its natural condition in the takiwa of Ngäi Tahu Whänui is owned by Ngäi Tahu.
- "Pounamu" means
  (a) Bowenite:
  (b) Nephrite, including semi-nephrite:
  (c) Serpentine occurring in its natural condition in the land

This includes a regime for access to land where pounamu is situated.

Effects Upon Cultural Values

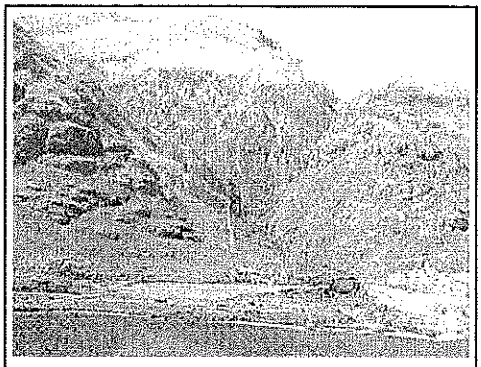
ISSUE - KAI TAHU VALUES	Impact/Recommendations
Place Names	Significant - Pioneer should endeavour to ascertain and use traditional Kai Tahu Place names in any information it produces
Awa/Nga Wai	Significant - A minimum flow between the weir and power house discharge that will support instream ecosystems should be investigated and implemented.
Mauri	Significant - As a consequence of dewatering of sections of the Oxburn the mauri has been significantly impacted upon..
Mahika Kai Air/Land/ Species	Significant - Fish species and populations in the river upstream of the weir should be investigated and if species that would be

	adversely effected by the presence of eels of koaro no fish passage should be provided. However, if no sensitive species are present fish passage over the weir should be provided. Methods that will protect the land catchment flora, particularly the tussock cover and beech forest should be investigated and implemented. This is important for maintaining good water supply and quality in the Ox Burn and tributaries.
Kaitiakitanga	Significant - To begin to ensure the Kaitiakitanga status of Kai Tahu an integrated approach to catchment management needs to be established through discussions with Kai Tahu.
Waahi Tapu/Waahi Taoka	Major – Due to the extensive historical use of the Tahuna area by Kai Tahu the potential for archaeological sites in and around the Oxburn is immense. Pioneer in discussions with Kai Tahu should investigate the commissioning of an archaeological report.

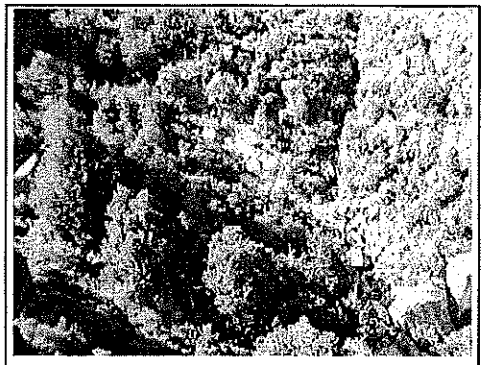
7.0 Wye Creek Hydro Electric Scheme

7.1 General Description

Wye Creek has two branches. The north branch drains the eastern flanks of the Remarkables. Much of the creek passes along a high elevation valley (1000 to 1400 m) until it reaches the southern end of the Remarkables where it plunges through a steep narrow gorge to Lake Wakatipu which has an elevation of 308 m (Ref Map 6). The south branch which finds its source in Lake Hope (1500 m) and drains the northern slopes of Ben Nevis (2234 m) flows into the north branch on the steep slopes above Lake Wakatipu. The gradient at this location is about 1:2·5 which appears somewhat like a stream cascading down a cliff.



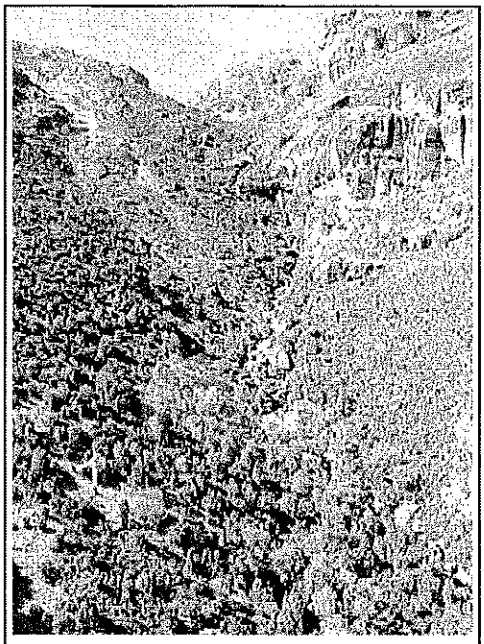
Wye Creek and Lake Wakatipu



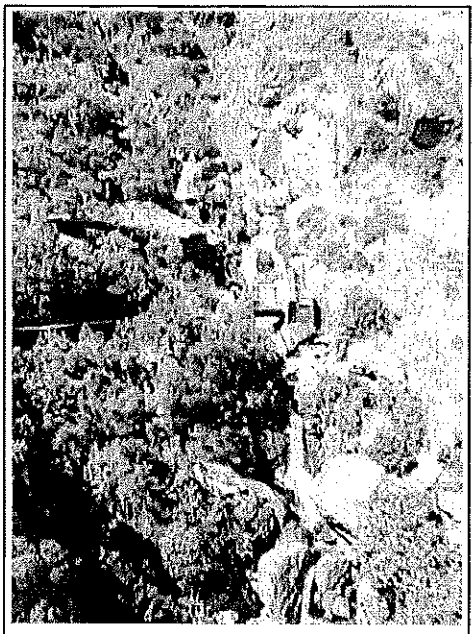
Wye Creek confluence south and north branch

The hydro-electric scheme collects water from two intake structures each located 300 m upstream of the confluence of the north and south branches. Having no storage facility, the system is a run of the river type. Water collected from the south branch is passed to the north branch intake structure via a pipe line across the hillside. From the north branch intake, water passes through a pipe, 0·8 km to a power house located on the true right bank of the creek 310 vertical metres below.

Wye Creek south branch



Wye Creek north branch



Water intake structure

Wye Creek Scheme power house

No minimum flow is provided at each of the intake structures. However, the steep slope and rugged nature of the site allows water to cascade over and around the intake structures which maintains flow in the creek downstream.

7.2 Mahika Kai and other Species

Only two fish site surveys have been completed and these were both at the confluence of Wye Creek with Lake Wakatipu. Koaro were found during both surveys and brown trout during one. It is very likely that the remarkably steep slope that the creek descends down to the lake presents significant barrier to the migration of koaro upstream. Long fin elvers may be able to ascend the steep slope to gain access to the upper catchment but even with the absence of the Clyde and Roxburgh Dams, eels of elver size are unlikely to have reached this point in the catchment. As eels move upstream they grow from elvers to small eels and loose their exceptional climbing abilities. No information is available describing fish species and distribution in the upper catchment. *Galaxias anomalus*, a nondiadromous native fish species is reported in the nearby Nevis River (Allibone, 1997). With the absence of trout, eels and koaro, *G. anomalus* and other sensitive native fish may maintain large viable populations.

The inspection only included an aerial visit of the Creek from the intake structures downstream to Lake Wakatipu. In this locality riparian zones and the catchment behind

featured native bush indispersed with snow tussock and bare rocky bluffs. Willows and *Pinus* spp had colonised some areas adjacent to Lake Wakatipu.

7.3 Assessment

Positive Effects

The only apparent positive effect is the generation of electricity.

Negative Effects

It appears that the scheme causes little adverse effects except by reducing the flow in the Creek between the intake structures and the power house discharge.

Place Names

Some of the place names that exist in and around Wye Creek are.

Tupuae Uenuku	Hector Mountains
	'the footsteps of Uenuku - the Rainbow God'
Kimia-kau or **Kimi-akau**	Shotover River
	'looking for a ford'
O-ka-korokio	Maori Point, Skippers.
	'The place of the korokio shrub'.
Kawa-rau	The Remarkables
	Same name as the River, after an old-time chief.

(Beattie, 1944)

Pioneer Generation should where possible use the traditional Kai Tahu names for information they may produce.

Mauri

The flow in Wye Creek is interrupted by the intake structures and decreased between the structures and powerhouse discharge. As a consequence of this the mauri of Wye Creek has been significantly impacted upon by Pioneer Generation Ltd.

Awa/ Ngai Wai

Wye Creek is essentially free running from source to Lake Wakatipu. Water flows are reduced between the intake structures and the power house discharge. Water quality is not impacted upon by Pioneer Generation Ltd's developments.

Mahika Kai

Air

Pioneer Generation Ltd's intake structures and power house are relatively small, do not produce any discharges to air and only cause minor visual impacts. Power lines are also relatively inconspicuous. Therefore, it is reasonable to conclude that visual impacts upon mahika kai are negligible.

Land

Pioneer Generation Ltd. activities in Wye Creek impact upon land by the physical presence of pipes passing across land and the powerhouse building on the creek bank.

Species

It appears that the intake structures, pipelines, power house, discharge and reduced flows in the reach between the intake structures and power house are not impacting on mahika kai species.

Kaitiakitanga

Effective processes and systems have not been developed that involve Kai Tahu in the management of the natural resources in the Wye Creek catchment including hydro-electric developments. Kai Tahu values have not been accepted or expressed in the management of the area including the hydro-electric developments. Consequently it is clear that kaitiakitanga is not being provided for.

Waahi Tapu/Waahi Taoka

It is beyond the scope of this impact assessment to undertake a full archaeological study of the area. It however is recommended that an assessment is undertaken to ascertain current cultural areas of significance and to look for sites that may have become exposed destroyed due to changes from Hydro activity.

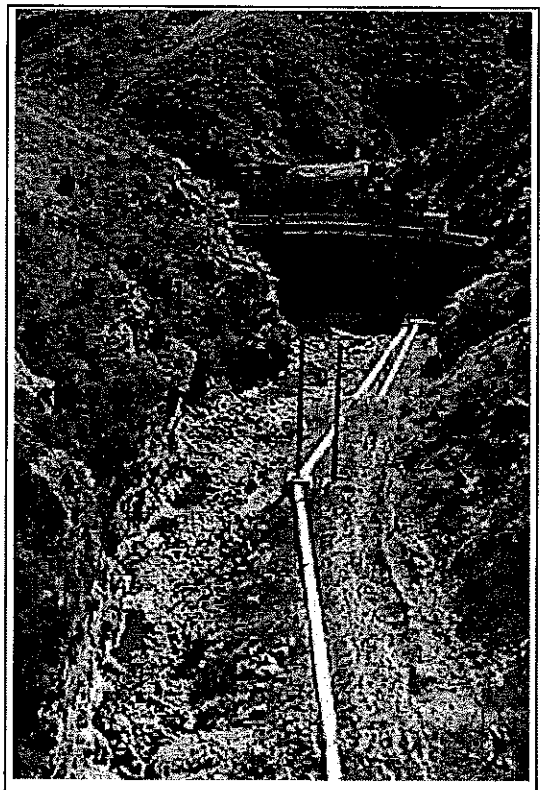
ISSUE – KAI TAHU VALUES	Impact
Place Names	Significant – As discussed above Kai Tahu seek to ensure the use of traditional place names in and around the Wye Creek area.
Mauri	Significant – Due to the lack of continuity of adequate flows the impact upon Mauri is significant. Kai Tahu seek to ensure a flow of mountains to the sea.
Awa/Nga Wai	Minor
Mahika Kai Air/Land/ Species	Significant - Fish species and populations in the upper Wye Creek catchment should be investigated to better understand the ecology of the Creek and how Pioneer Generation Ltd's activities may impact on it. Methods that will protect the land catchment flora, particularly the tussock cover and native forest should be investigated and implemented. This is important for maintaining good water supply and quality in Wye Creek and tributaries.
Kaitiakitanga	Significant - Pioneer Generation Ltd. and Kai Tahu should meet on an as needed basis to discuss any changes to the hydro activity of Pioneer in the Wye Creek area.
Waahi Tapu/Waahi Taoka	Uncertain

8.0 Roaring Meg Hydro Electric Scheme

8.1 General Description

The Roaring Meg, reputedly named after a barmaid who worked in a hotel during the gold rush era, drains the south west quarter of the Pisa Range located between Wanaka in the north and Cromwell in the south. From just below Mount Pisa (1964 m) to its confluence with the Kawarau River, a distance of more than 30 km, 59 tributary streams and subcatchments feed the stream. Significant among these are Prince Burn, Leopold Burn, Colour Burn, Mitre Creek, Skeleton Stream all draining the Pisa Range to the north east and draining Mount Allan (1492 m) to the west is Evan Roberts Creek and Plank Creek. A dominating feature of this high country is the extensive rolling snow tussock clad hills with many schist rocky outcrops or tors and many alpine moss swamps.

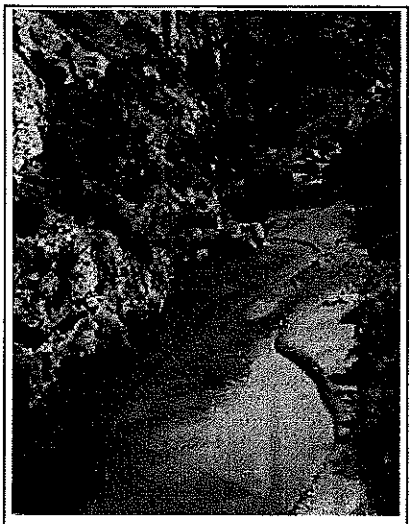
In early Maori times a walking track linked Southland with Wanaka crossing the Kawarau River at 'the natural bridge' a narrow neck of rock that allowed a person to jump across. This has since eroded away and cableway currently spans the gap. The track, still used by trampers today, ran up the Cardrona valley from Wanaka to Cardrona then to the Roaring Meg through Tuohys Gully. Down the lower Roaring Meg valley, a distance of about 12 km to the natural bridge. Across the bridge, the track ascended steeply to Mount Difficulty (1285 m), across the Carrick Range and down to Nevis Crossing. It then continued up the Nevis River valley and into Southland.



Roaring Meg weir and reservoir. Skeleton Stream flowing in from far right, Roaring Meg from far left.

Just below the confluence of Skeleton Stream with the Roaring Meg, about 3·5 km upstream from the Meg's confluence with the Kawarau River, is the Roaring Meg weir which was constructed in 1935-36. This weir forms a small reservoir which stores water drawn off at about 1·3 cumecs to supply

firstly and upper power house located about 1 km downstream of the weir and then the lower power house on the banks of the Kawarau adjacent to the Meg's confluence with the Kawarau (Ref Map 7).

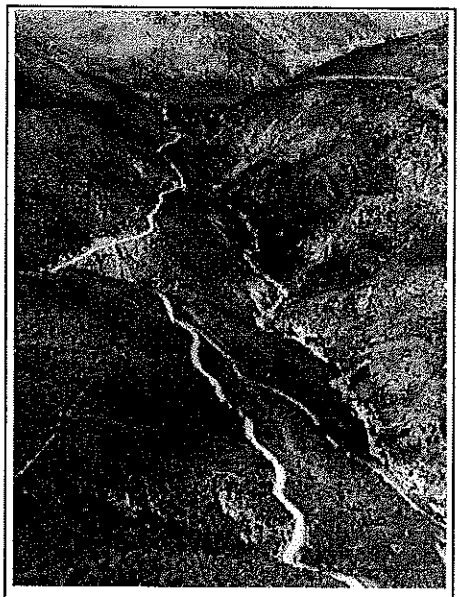


Roaring Meg flowing into upper end of reservoir

Roaring Meg reservoir. Looking down Roaring Meg arm to weir. Skeleton Creek far left opposite weir.

Upper Roaring Meg power house

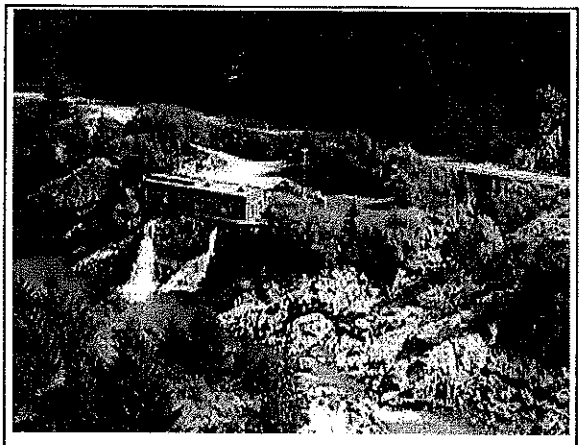
No minimum flow is provided for by the Roaring Meg weir but a residual flow passes under the weir through the schist rock substrate which is porous. Essentially no reserve capacity is stored in the reservoir and the system is therefore a run of the river type. There are periods when the river flow is high and water overtops the weir and freely flows down the 3·5 km river channel to the Kawarau. At other times when the river is low, no flow passes the weir



Roaring Meg below weir

Roaring Meg looking downstream with Kawarau River in distance.

and even with the input of several small tributaries, flow in the lower reach of the Meg can be extremely low.



Lower Roaring Meg Scheme power house. Roaring Meg confluence with Kawarau to right.

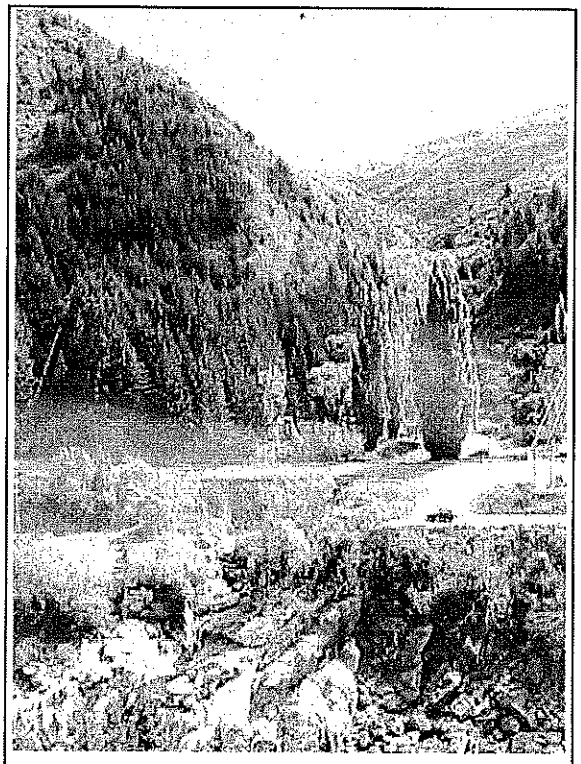
Most of the Roaring Meg catchment passes through snow tussock dominated high country landscape. In contrast the last 1·5 km of channel is constrained in a narrow bushy gorge.

The lower Roaring Meg power house discharges directly into the Kawarau River about 50 m upstream of the Meg's confluence with the Kawarau.

8.2 Mahika Kai and other Species

A reasonable number of fish surveys have been carried out in the Roaring Meg and tributaries. Only brown and rainbow trout were discovered. Many tributary headwaters were not surveyed. Some of these may have natural barriers preventing invasion by trout. It is not impossible that populations of nondiadromous native species exist in the catchment. The Roaring Meg weir presents an almost certainly insurmountable barrier preventing the upstream migration of longfin eel and koaro past this point. Build in 1935-36, the barrier has been in place for almost 70 years. Consequently it would be highly unlikely that longfin eel, koaro and any other diadromous species exists upstream of the weir. In the early 1990s the author walked the track from Cadrona to the Kawarau and at that time the Roaring Meg upstream of the weir contained ideal trout habitat. It would also be quite optimal for eels, koaro, wai-koura and many water fowl species. During the later inspection three mallard were observed flying upstream towards the reservoir

The stream was closely inspected at a location adjacent to the power station and about 75 m from its confluence with the Kawarau River. At this location there was some long green filamentous algae and thick dark brown algal turfs. These are indicators of increased nutrient levels. However, levels were not expected to be high on account of the common presence of mayfly and caddis fly larvae on many submerged cobbles which are indicative of good water quality.



Lower reach of Roaring Meg immediately prior to confluence with Kawarau River. Lower power house is located immediately to the left of this view.

8.3 Assessment

Positive Effects

The reservoir created by the weir is relatively small. It may provide some additional waterfowl habitat but it would be unlikely that it could alone sustain a population or even a pair of birds.

Negative Effects

The weir presents a significant barrier preventing migration of native diadromous species including longfin eel and koaro into the long main stem and many tributaries. Flow patterns downstream of the weir have been significantly reduced and may not be sustaining a viable ecosystem.

Place Names

The following placenames have been recorded in and around the Kawarau River and roaring Meg site.

Potiki-whaka-rumaki-nao'	Natural bridge' on the Kawarau River. So named because of a successful attempt to catch ducks just above it, but they escaped through the narrow waterway between the rocks.
Taha-uri	Mt Difficulty 'Dark side' - named after an ancestor of 22 generations ago (1914).
Papa-puni	Nevis River 'encampment on a flat rock'
Te Wai-reika	Gentle Annie 'the waterfall' or 'the greatly desired stream' or 'the stream of the afterworld'
Wai-koroiko	Roaring Meg

(Beattie, 1944)

Kaitiakitanga

Effective processes and systems have not been developed that involve Kai Tahu in the management of natural resources in the Roaring Meg catchment including hydro-electric developments. Kai Tahu values have not been accepted or expressed in the management of the area including the hydro-electric developments. Consequently it is clear that kaitiakitanga is not being provided for.

Mauri

The Roaring Meg catchment as a whole is in a relatively unmodified state. One weir is located in the main stem and forms a small reservoir. Flow rates and patterns are controlled in a 3·5 km reach between the weir and the Kawarau River. This reach can be essentially de-watered at times. Land development in the catchment is minor with only some high country

grasing. If the weir and hydro development had not occurred in this catchment the mauri could be considered intact. Unfortunately the weir has been constructed in the river and flows are manipulated. Consequently the mauri of the Roaring Meg is adversely affected.

Awa/Ngai Wai

The Roaring Meg is not free running from source to the Kawarau River having a weir in the lower river. Water flows between the weir and power house discharge are markedly reduced to a small residual flow. At times of low rainfall the river can become a number of pools connected by subterranean flow, however, water from the upper catchment is still available for power generation. Pioneer Generation Ltd's developments do not impacted upon water quality. Mahika kai in the 3·5 km reach between the weir and the Kawarau has been significantly adversely affected as a result of the decreased flow. Upstream of the weir, without further information characterising the fishery, effects upon mahika kai are difficult to determine except that bird life and mammalian species are probably not affected by Pioneer Generation Ltd's developments.

Kai Tahu expresses in the Otago Regional Plan: Water Incorporating Decisions on Submissions Received 7th July 2000, the values associated with the Teviot River, these are as follows,

Lakes sub-region									
Water body	**MA1**	**MA2**	**MA3**	**MA4**	**MB1**	**MB2**	**MB**	**MB4**	**MB5**
Kawarau River, between Lake Dunstan and Lake Wakatipu	✓	✓		✓			✓	✓	

Code	Mana Interests:
MA1	**Kaitiakitanga** – the exercise of guardianship by Kai Tahu in accordance with tikanga Maori*[1] in relation to Otago's natural and physical resources; and includes the ethic of stewardship.
MA2	**Mauri** – life force; for example the mauri of a river is most recognisable when there is abundance of water flow and the associated ecosystems are healthy and plentiful; a most

[1] Dec 20-02-15

	important element in the relationship that Kai Tahu have with the water bodies of Otago.
MA4	**Waahi taoka** – treasured resource; values, sites and resources that are valued and reinforce the special relationship Kai Tahu have with Otago's water resources.

Code	Access/Customary Use Interests:
MB3	**Trails** – sites and water bodies which formed part of traditional routes, including tauraka waka (landing place for canoes).
MB4	**Cultural materials** – water bodies that are sources of traditional weaving materials (such as raupo and paru) and rongoa (medicines).

Mahika Kai

Air

Pioneer Generation Ltd's weir and power houses are relatively small, do not produce any discharges to air and only cause visual impacts. Power lines are relatively inconspicuous. Therefore, it is reasonable to conclude that visual impacts upon mahika kai are negligible.

Land

Upper catchment predominantly remains in tussock grassland. Beech forest still remains in the lower catchment. Although the area is grassed, stocking rates do not appear to have adversely effected the river, riparian zones and land behind. Riparian zones are not protected and farming intensification could damage the tussock cover and riparian zones resulting in reduced overall water discharge and increased sedimentation. At present it appears that land use in the catchment, and particularly the small areas used by Pioneer Generation Ltd. does not impact adversely upon mahika kai.

Species

Longfin eel and koaro are probably locally extinct as a result of the weir which present significant barriers to migration. Down stream in the Clutha River/Mata-au, the Roxburgh and Clyde Dams have almost certainly influenced the presence of longfin eel. Water fowl are also important mahika kai species and little is known of species, population sizes and locations except Canada geese populations are reputedly to be high in the wider area and mallard were present.

Waahi Tapu/Waahi Taoka

As discussed above in early Maori times a walking track linked Southland with Wanaka crossing the Kawarau River at 'the natural bridge' a narrow neck of rock that allowed a person to jump across. This has since eroded away and cableway currently spans the gap. The Natural Bridge is an important landmark for Kai Tahu. Kai Tahu will seek to protect this landmark from further impacts upon it.

ISSUE - KAI TAHU VALUES	Impact
Place Names	Significant – Many Kai Tahu places names exist in and around the Roaring Meg area. Kai Tahu seeks to ensure use of these names.
Mauri	Significant – Due to the lack of continutiy of flows the mauri of the river has been impacted upon.
Awa/Nga Wai	Significant - A minimum flow between the weir and the Kawarau River that will support instream ecosystems should be investigated and implemented.
Mahika Kai Air/Land/Species	Significant - Fish passage for migratory species should be provided for. Methods that will protect the land catchment flora, particularly the tussock cover should be investigated and implemented. This is important for maintaining good water supply and quality in the Roaring Meg and tributaries.
Kaitiakitanga	Significant – Kai Tahu seek integrated catchment management plans that involve Kai Tahu and begin to re-establish the role of Kai Tahu as Kaitiakitanga.
Waahi Tapu/Waahi Taoka	Uncertain

9.0 Summary

The five hydro-electric power developments owned by Pioneer Generation Ltd. have many and varied effects. All five schemes have impacted adversely upon Kai Tahu values.

Kai Tahu have outlined earlier in this report, adverse effects that are to be avoided, the outcomes sought and the commitment required from Pioneer in relation to issues raised by Kai Tahu. Mitigation, avoidence and remedying can only occur through subsequent discussions between Pioneer and Kai Tahu.

In the Teviot River catchment an interconnected system of four dams and weirs and five power houses most certainly prevents the movement of longfin eel upstream into the catchment but by default probably in part protects the existence of non-diadromous native galaxiid species. Some mahika kai and habitat has certainly been increased by the creation of Lake Onslow which appears to support significant populations of wai-koura, brown trout, Canada geese, black swan, paradise shelduck and mallard. However, the creation of Lake Onslow has had an adverse effect upon the mahika kai and flora and fauna that would have once existed when this area was a swamp.

No nondiadromous native fish have been observed in the Fraser River or tributaries. However, this does not suggest they do not exist. Populations of several different fish species including longfin eel can be found in the lower reaches of the river and brown trout appear to be common in the upper catchment. The weir and Fraser Dam prevent longfin eel or koaro from gaining access to the increased habitat the reservoirs provide.

The schemes in the Ox Burn and Wye Creek are relatively small and have been developed in catchments where little is known of fish species or populations. The Ox Burn weir certainly presents an impassable fish barrier and the amasingly steep slopes that Wye Creek plunges down probably excludes almost all diadromous fish from the catchment. It is important to determine what species inhabit these catchments and how, especially in the Ox Burn, Pioneer Generation Ltd's development are effecting them.

The Roaring Meg is a trout stream however, this would not always have been the case. Prior to the construction of the weir (and the construction of the Roxburgh and Clyde Dams) longfin eel and koaro probably maintained healthy populations in this catchment. Given the presence of trout in much of the catchment it is unlikely that populations of sensitive native species exist. This should be verified prior to establishing fish passage.

Most importantly, together, Pioneer Generation Ltd. and Kai Tahu need to increase their knowledge of the species in these catchments and then consider where fish passage should be provided. Minimum flows should be investigated and at some schemes e.g. the Fraser there may be a need to increase the flow Artificial barriers may be required in some tributaries to safe guard sensitive native species. Increasing knowledge of water fowl should also be an objective as these are also important mahika kai species.

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Appendix 1

3.2 Kai Tahu ki Otago Natural Resource Management Plan

In 1996 the four Kai Tahu Runanga of Otago published a natural resource management plan. One of the purposes of the plan was to provide information on natural resource issues. The plan aimed to achieve greater public understanding of Kai Tahu ki Otago's natural resource issues and objectives. Chapter 13 of the plan outlines issues, objectives and management guidelines, and includes five sections: kaitiakitanga, mahika kai, water, air, and land which are relevant to Pioneer Generation's hydro electric schemes. These sections with the relevant issues, objectives and management guidelines are inserted below.

13.1 Kaitaikitanga

Kaitiakitanga is the exercise of cultural custodianship over natural and physical resources in a manner that incorporates spiritual values. This is an incident of tino rangatiratanga reserved to Kai Tahu Whanui under Article II of the Treaty of Waitangi.

13.1.1 Issues:

13.1.1.3 Past natural resource management practices have failed to recognise and address Kai Tahu cultural values.

13.1.1.4 Crown policy and legislation have prevented Kai Tahu from accessing and using traditional resources in a manner consistent with their cultural, spiritual and economic needs.

13.1.1.6 Legislative definition of Maori concepts and terms such as 'kaitiakitanga' has not always reflected traditional understanding of them. This has resulted in appropriation of such concepts.

13.1.1.7 In direct breach of the Treaty, Iwi have been historically excluded through repressive legislation, from the decision making processes of natural resource management.

13.1.2 Objectives:

13.1.2.1 To give effect to the principles of the Treaty of Waitangi in the management of the region's natural and physical resources.

13.1.2.2 To recognise and provide for the relationship Kai Tahu and their culture and traditions with land, water, sites, waahi tapu and other taoka in the Otago Region.

13.1.2.3 To recognise and provide for: (i) the Manawhenua concept and practice of kaitiakitanga in the management of Otago's natural and physical resources, and (ii) the rights of Manawhenua to manage their resources in a sustainable manner and according to tribal customs and cultural preferences.

13.1.2.4 To encourage and assist the up-skilling of Iwi knowledge and understanding of kaitiakitanga and associated values through wananga and practical experience.

13.1.2.6 To continue to support Kai Tahu in their articulation of kaitiakitanga through initiatives such as this plan, supplementary policies, hui, wananga and advocacy.

13.1.2.7 To support and encourage the involvement of Runanga in the management, use and protection of the natural and physical resources that constitute the Kai Tahu dimension.

13.1.2.10 To implement and encourage scientific and other research which addresses the values and interests of Kai Tahu.

13.1.3 Management Guidelines:

13.1.3.8 Require that all applications for resource consent, permit, authority, or concession be assessed in terms of their impact on cultural values.

13.1.3.12 Acknowledge Kai Tahu as kaitiaki and facilitate the joint management of resources that are of significance to them.

13.1.3.13 Contract Kai Tahu to: (i) provide Manawhenua input to planning processes, and (ii) undertake research projects or specific projects that are necessary to address issues that are of concern to Kai Tahu.

13.1.3.14 Establish procedures to ensure the provision of technical assistance to Kai Tahu to enable their informed participation in the management of natural resources.

13.1.3.15 Provide information to Kai Tahu when required, including: (i) advice on the type of resource consent, permit, authority, or concession that is being sought, (ii) provision of sufficient information to make an informed decision, (iii) the assistance and advise of a technical advisor or consultant, (iv) an assessment of the effects of the proposal or plan on Iwi values, and (v) the periodic review of the type of conditions that are applied to resource consents, permits, authorities and concessions.

13.1.3.16 Provide opportunities for Kai Tahu to participate in the design of monitoring programmes.

Mahika Kai

Mahika Kai are the places where food is produced or procured on a sustainable basis in a way that meets the cultural needs of Kai Tahu. The maintenance of custom, the transfer of information and the physical and spiritual health of the Iwi are inseparable.

13.4.1 Issues: 13.4.1.2 Modification of waterways, estuaries, bays and harbours has destroyed and degraded traditional tauranga ika and mahika kai.

13.4.1.4 Introduced species have displaced or interbred with indigenous mahika kai species, yet customary take rights have not been transferred.

13.4.1.5 Management of water and damming regimes have recognised the needs of introduced species above those of the indigenous fisheries.

13.4.1.7 Indigenous flora and fauna, have been significantly compromised by: (i) some introduced plant and animal species, (ii) unsustainable use, (iii) destruction of supporting ecosystems, and (iv) contamination from discharges to air, land and water.

13.4.2 Objectives:

13.4.2.1 To recognise the importance of mahika kai to Kai Tahu by, maintaining and where possible enhancing mahika kai.

13.4.2.2 To support initiatives to identify and record significant mahika kai.

13.4.2.3 To maintain and facilitate access to mahika kai.

13.4.2.4 To minimise or avoid adverse effects of resource use and development on mahika kai.

13.4.2.5 To recognise the cultural importance of tikanga and its application in the management and use of mahika kai and provide for cultural models such as: (i) protection of breeding stock, (ii) transfer of knowledge through generations, (iii) priority of indigenous species needs over exotics, and (iv) harvest methods considered appropriate by Kai Tahu.

13.4.2.6 To encourage and assist the up-skilling of Iwi knowledge and understanding of mahika kai and their values through wananga and practical experience.

13.4.2.7 To achieve, through the full utilisation of legislative provisions, the protection of mahika kai consistent with tikanga.

13.4.2.8 To implement scientific surveys of mahika kai which reflects the needs and aspirations of Kai Tahu.

13.4.3 Management Guidelines: 13.4.3.1 Develop and implement a strategy to improve the quality and quantity of water in all waters to a level which ensures that mahika kai are fit for human consumption.

13.4.3.2 Ensure that Runanga are involved in the management of mahika kai, including introduced and indigenous species.

13.4.3.3 Require the assessment of environmental effects that accompanies an application for a resource consent includes an assessment of the impacts of the proposed activity on mahika kai.

13.4.3.5 Protect remaining indigenous fisheries from intrusion by exotics and, where possible, enhance the habitat by: (i) identifying waterways that support exclusively an indigenous fishery and designating these waterways as an indigenous fishery, (ii) excluding trout-free indigenous fish habitats from suction dredging, (iii) ensuring indigenous fisheries and habitat receive higher priority for protection than exotic fisheries, and (iv) prohibiting the introduction of exotic species of any kind until there is an application for a resource consent which includes a thorough assessment of the effects on indigenous flora and fauna.

13. 4. 3. 6 Permit the establishment of facilities by Kai Tahu for the purpose of collecting mahika kai during the appropriate seasons.

13.4.3.7 Permit and encourage initiatives to: (i) actively protect indigenous fish habitat and spawning areas, and (ii) restock lagoons and other waterways with native fish species.

13.4.3.9 Facilitate the involvement of Kai Tahu in monitoring and scientific surveys of mahika kai and habitats which achieve effective Iwi participation in management processes.

13.5 Water

Domain of Takaroa, Kai Tahu recognise water as an essential element of life which requires responsible management in the interests of current and future generations.

13.5.1 Issues:

13.5.1.1 Management that reduces natural shading and filtering capacities of riparian areas of streams, rivers and wetlands adversely effects habitat conditions.

13.5.1.2 The introduction of exotic plants in riparian zones can detrimentally change water ecosystems.

13.5.1.3 Abstraction, contaminants, cross-mixing and drainage negatively impacts on the mauri and integrity of the regions waterways.

13.5.1.4 The damming of waterways for hydro-electric purposes has devastating effects on indigenous fish species and their habitats. These include: (i) barring upstream and downstream migration, (ii) providing exotic species access to tributaries which was previously beyond their range, and (iii) altering natural sedimentation processes throughout the whole waterway.

13.5.1.5 Water management has historically emphasised the commodity value of water over its intrinsic value.

13.5.1.6 Water permits can be exploited as a tradable commodity while ownership of the resource remains unresolved.

13.5.1.9 Management processes for the recording, monitoring and evaluation of effects and quantum of water abstraction have been inadequate.

13.5.1.11 Baseline and monitoring data which exists has often not been made readily available to Iwi.

13.5.1.12 Resource consents for water abstraction have been allocated to a level where, if fully exercised, they would result in some waterways running dry.

13.5.1.20 Wetlands are treasured habitats for indigenous species which continue to be at risk from: (i) drainage, (ii) discharges, (ii) reclamantations, and (iv) inundations.

13.5.1.22 Facilitate the involvement of Kai Tahu in monitoring and scientific surveys of which achieve effective Iwi participation in management processes.

13.5.2 Objectives:

13.5.2.1 To recognise the spiritual and cultural significance of water to Kai Tahu.

13.5.2.2 To protect wetland systems as: (i) an essential source of mahinga kai, (ii) a means of improving water quality, (iii) important spawning areas for native fish, and (iv) as a food resource for birds.

13.5.2.6 To prohibit in-stream activities which adversely effect fishery habitats and mahika kai values.

13.5.2.9 To implement scientific surveys of mahika kai which reflect the needs and aspirations of Kai Tahu.

13.5.3 Management Guidelines:

13.5.3.1 Establish processes to incorporate Kai Tahu in all management practices which will impact on waterways.

13.5.3.8 Investigate and set minimum flow levels and flow regimes for Otago waterways.

13.5.3.9 Investigate and set appropriate lake operating levels.

13.5.3.10 Establish the critical requirements of quantity and timing of water release in waterways to provide for the healthy functioning of associated ecosystems.

13.5.3.15 For any proposal to dam a waterway to: (i) require an assessment of the effects on indigenous habitat that would result from the proposal, (ii) provide for indigenous fish passage as a part of the dam design to enable fish migration, and (iii) require an assessment of the effects on waahi tapu and waahi taoka.

13.5.3.23 Recognise and protect the value of wetlands: (i) as buffers in times of high rainfall, and (ii) as indigenous habitats.

13.5.3.26 Encourage landholders to create and enhance riparian vegetation.

13.5.3.27 Use rules, consent conditions and other methods to ensure in-stream activities avoid adverse effects on the indigenous fishery habitat, water quality, and other in-stream values.

13.5.3.28 Facilitate the involvement of Kai Tahu in monitoring and scientific surveys which achieve Iwi participation in management processes.

13.6 Air

An essential resource that by its very nature provides a medium for climate elements, life giving components, its creation is recognised by Kai Tahu tradition as the dawn of light.

13.6.2.1 Objectives: 13.6.2.1 To protect sites of significance to Kai Tahu from noise, odor and visual pollutants.

13.6.3 Management Guidelines: 13.6.3.3 Require that all applicants for air discharge consents assess the impact of the discharge on

health, mahika kai, indigenous flora and fauna, and waahi tapu and taoka.

13.7 Land

Papatuanuku (land) is the basis of tribal territory and mana - an essential link to the ancestors. It is an integral part of Kai Tahu culture, identity and community strength.

13.7.1 Issues:

13.7.1.3 Significant reduction in indigenous habitats.

13.7.1.4 High country and tussock lands have been developed and exploited with adverse effects on: (I) the values attached to those lands by Kai Tahu, and (ii) middle and lower catchments.

13.7.1.10 Poor land management practices which have allowed infestation by pest plants have adversely affected indigenous ecosystems.

13.7.2 Objectives:

13.7.2.1 To recognise the relationship that Manawhenua have with land.

13.7.2.3 To protect the cultural values of the high country and upper catchment areas.

13.7.2.4 To protect resources and areas of value to Kai Tahu that may be vulnerable to flooding, erosion or other natural hazards where practicable.

13.7.2.7 To encourage and assist the up-skilling of iwi knowledge and understanding of indigenous flora and fauna and associated values through wananga, hui and practical experience.

13.7.3 Management Guidelines:

13.7.3.5 Encourage the re-vegetation and enhancement of high altitude and other significant indigenous ecosystems.

13.7.3.6 Encourage the protection of areas of indigenous vegetation and realistically compensate owners for any loss of income that is caused by such protection.

13.7.3.25 Facilitate the involvement of Kai Tahu in monitoring and scientific surveys of habitats which achieve effective Iwi participation in management processes.

3.3 Te Runanga o Ngai Tahu Freshwater Policy

This document has the status of an iwi management plan because Te Runanga o Ngai Tahu has formally adopted it as such. The strategies that are set out in the policy are a guide for resource management agencies and Papatipu Runanga. This policy statement complements Kai Tahu Ki Otago's Natural Resource Management Plan and must be read alongside it. Although most of the policy is directed towards regional councils and Government agencies, some sections are relevant to independent resource users such as Pioneer Generation. These sections are included below.

4.2 IDENTIFICATION OF NGAI TAHU VALUES AND USES ASSOCIATED WITH FRESHWATER RESOURCES

4.2.1 Mauri

With respect to waterways mauri can be tangibly represented in terms of elements of the physical health of a river ecosystem. While there are also many intangible qualities associated with the spiritual presence of a river, elements of physical health which Ngai Tahu use to reflect the status of mauri and to identify the enhancements needed include:

- aesthetic qualities e.g. clarity, natural character and indigenous flora and fauna;
- life-supporting capacity and ecosystem robustness;
- depth and velocity of flow;
- continuity of flow from the mountain source of a river to the sea;
- fitness for cultural usage; and
- productive capacity.

The mauri should not be desecrated. Resource management agencies need to be aware that natural disasters cannot harm the mauri only those resulting from the actions of man. The mauri of a waterway is unable to protect itself against unnatural aspects of the environment. If the mauri of an entity is desecrated or defiled, the resource itself, resource users and others depending on that entity are at risk.

Sadly, the mauri of many waterbodies have been seriously eroded by water use and development including:

- The damming of rivers;
- Abstracting water from rivers, streams, and lakes;
- The diverting of waters;
- Mixing the waters of distinct ecosystems; and
- River protection works.

Activities have the potential to degrade or extinguish the mauri of the waterbody and as a result may offend the mana of Papatipu Runanga who hold traditional rights and responsibilities with respect to that waterbody. The mauri of the river is degraded if it no longer has the capacity to support traditional uses and values. Across the rohe, one of the principle indicators by which Ngai Tahu assesses the mauri of a waterbody is its productivity of the food and other materials sourced from it. Each Runanga has specific examples of rivers, streams, lakes and wetlands where the mauri is degraded. Further they can identify activities that have adversely affected the mauri and the actions that must be taken to restore the mauri.

Restorative action will need to be determined with Papatipu Runanga on a case by case basis but will include:

- establishing minimum flow levels that afford protection to instream values;
- prohibiting the unnatural mixing of water sourced from different waterbodies; and

- developing with Runanga a programme for habitat restoration, particularly in riparian margins.

Restorative action is a priority, particularly for waterbodies of high original ecological or cultural value.

4.3 INSTREAM WATER FLOWS

The two principle issues that need to be addressed by resource managers are water quality and water quality. From Ngai Tahu's perspective, the Treaty guarantees fishing rights and implicitly promises water of sufficient quantity and quality to sustain the fisheries.

4.3.1 Water quantity

Protecting the mauri of a waterbody requires:

- protection of water's capacity to renew its groundwater and surface water flows and stocks;
- instream flows sufficient to sustain mahinga kai species and habitats in their freshwater and coastal environs;
- development of flow regime that incorporate a minimum flow and flow variability. Streams and rivers are supposed to experience a range of flows and seasonal floods of different magnitudes; and
- prohibiting flow augmentation schemes, where such augmentation involves the unnatural mixing of waters from different waterbodies.

When considering what is an acceptable minimum flow Papatipu Runanga will want to know:

- How much water is there?
- How much is needed to protect mahinga kai species and habitats?

- How much is sought by abstractors?
- How the current low flows and the proposed minimum flow relate to natural low flow conditions.

The issue of inadequate minimum flows is a concern that is shared by all Runanga. Waterbodies are affected by serious competition from industrial, household and agricultural users. Ngai Tahu considers that the instream and environmental value of this water exceeds the value of water in some of its other uses and this should be recognised when determining an appropriate allocation regime.

Damming of waterbodies is another activity that may cause unacceptable adverse effects. The siting and construction of a dam are undertaken for many purposes, including flood control, power generation, irrigation, livestock watering, fish farming, and community water supply. Some reservoir impoundments are also used for recreation and water sports, for fish and wildlife propagation, and for augmentation of low flows. Dams can adversely affect the hydrological regime, the quality of the surface waters, and habitat in the stream or river where they are located. A variety of impacts can result from the siting, construction, and operation of these facilities.

The siting of dams can result in the inundation of wetlands, riparian areas, and lands in upstream areas of the waterway. Dams either reduce or eliminate the downstream flooding needed by some wetlands and riparian areas. Dams can also impede or block migration routes of fish. Construction activities from dams can cause increased turbidity and sedimentation in the waterway resulting from vegetation removal and soil disturbance.

4.4 FRESHWATER FISHERIES HABITATS

Ngai Tahu's fishing rights were explicitly protected by the Treaty of Waitangi. Not only was the right to engage in mahinga kai activity confirmed, also included was the right to expect that such activity will continue to be successful as

measured by reference to past practice. Unfortunately adverse impacts on freshwater resources have resulted in adverse effects on the diversity and abundance of mahinga kai resources and harvesting activity.

Mahinga kai refers to the resources of the land, and the resources from the bush and the forests. This includes all birds and animals dependent upon these resources. The uri o Tangaroa refers to all living things within the waterways which include all water be it lake, river, lagoon or seawater.

Mahinga kai was and remains one of the cornerstones of Ngi Tahu existence and culture. Survival was dependent upon knowledge of mahinga kai and the ability to gather resources from land, waterbodies and the sea. Healthy waterbodies continue to be a direct source of mahinga kai, provide ecosystem support for mahinga kai species and support other significant mahinga kai environments such as forests, riparian habitats and coastal environs. Sadly there are many examples across the rohe where inappropriate water management has impacted adversely on mahinga kai. Observable effects include alterations to the abundance and distribution of species, disturbances to the breeding cycles and patterns, loss of access to waterbodies, and the deterioration, reduction and removal of habitat.

Ensuring the health and wellbeing of freshwater is a prerequisite for ensuring the continued health and wellbeing of mahinga kai resources and ultimately the people. Papatipu Runanga are likely to accord special value to a waterbody that:

- provides significant habitats for important food species and materials such as eels, watercress, flax etc.;
- affords breeding and migratory environments for those species and the species they feed on e.g. wetlands and lagoons;
- has long-standing use histories for whanau, hapu, iwi; or
- deserves protection because it safeguards critical habitats, protects robust ecosystems or represents degraded mahinga kai environments that are in need of restoration.

For Ngai Tahu Whanui today, participation in mahinga kai activities is an expression of cultural identity. Continuation of traditional practices is an important means of passing values down to children and grandchildren, ensuring their survival through the generations.

Native Forest Species

Pakeha name	Maori name	Scientific name
black beech	tawhairaunui	*Nothofagus solandri*
silver beech	tawhai	*Nothofagus menziesii*
	totara	*Podocarpus totara*
	kohuhu	*Pittosporum tenifolium*
pepper tree	horopito	*Pseudowintera colorata*
five finger	puahou	*Pseudopanax arboreus*
	koromiko	*Hebe salicifolia*
fuchsia	kotukutuku	*Fuchsia excorticata*
broadleaf	papauma	*Griselinia littoralis*
lancewood	horoeka	*Pseudopanax crassifolius*
red matipo	mapou	*Myrsine australis*
whiteywood	mahoe	*Melicytus ramiflorus*
grass tree	inaka	*Dracophyllum longifolium*
ti tree	manuka	*Letospernum scoparium*
	kanuka	*Kunzea ericoides*
	tutu	*Coriaria arborea*
	pohuehue	*Muehlenbeckia australis*
bush lawyer		*Rubus ssp.*
bracken fern	rahurahu	*Pteridium esculentum*
Colenso's hard fern	peretao	*Blenchnum colensoi*
crown fern	piupiu	*Bechnum discolor*
shield fern	tuakaru	*Lastreopsis glabella*
bush flax		*Astelia fragrans*
	kaikomako	*Pennentia corymbosa*
	pate	*Schefflera digitata*
cabbage tree	ti-kouka	*Cordyline austrsalis*

soft tree fern	katote (punga)	*Cyathea smithii*
rough tree fern	wheki (punga)	*Dicksonia squarrosa*
black pine	matai	*Prumnopitys taxifolia*
pine	miro	*Prumnopitys ferruginea*
red pine	rimu	*Daerydium cupressinum*
	pukatea	*Laurelia novae-zelandiae*
	hutu	*Ascarina lucida*
lemonwood	tarata	*Pittosporum eugenioides*
	kohuhu	*Pittosporum tenuifolium*
narrow leaved lacebark		*Hoheria angustifolia*
	putaputaweta	*Carpodetus serratus*
wineberry	makomako	*Aristotelia serrata*
	hinau	*Elaevcarpus dentatus*
	kamahi	*Weinmannia racemosa*
	kowhai	*Sophora tetraptera*
	mingimingi	*Coprosma propinqua*

Appendix 2

Tussock Meadow and Wetland Species

Pakeha name	Maori name	Scientific name
snow tussock	hunangamoho	*Chionochloa conspicua*
sedges		*Carex spp.*
flax	harakeke	*Phormium tenax*
	toetoe	*Cortaderia richardii*
Spaniard		*Aciphylla spp.*
cutty grass		*Mariscus ustulatus*
cutty grass	ruatahi	*Carex geminata*
bull rush	raupo	*Typha muelleri*
wire rush	oioi	*Leptocarpus similis*
nigger head	pukio	*Carex secta*

Appendix 3

Introduced Plants

Pakeha name	Maori name	Scientific name
willow		*Salix spp.*
gorse		*Ulex europeaus*
broom		*Cytisus scoparius*
oxygen weed		*Elodea canadensis*
water cress		
poplar		*Populus spp.*

Appendix 4

Production Forest Species

Pakeha name	Maori name	Scientific name
Monterey pine		*Pinus radiata*
Douglas fir		*Pseudotsuga menziesii*
Monterey cypress		*Cupressus macrocarpa*
Eucalyptus		*Eucalyptus delegatensis*
larch		*Larix spp.*
birch		*Betula spp.*

Appendix 5

Fresh Water and Esturine Fish Species

Pakeha name	Maori name	Scientific name
longfin eel	koikoiwaha	*Anguilla dieffenbachii*
shortfin eel	tunahinahina	*Anguilla australis*
lamprey	kanakana	*Geotria australis*
upland bully		*Gobiomorphus breviceps*
common bully	toitoi	*Gobiomorphus cotidianus*
bluegilled bully		*Gobiomorphus hubbsi*
redfinned bully	kopu	*Gobiomorphus huttoni*
torrentfish	piripiripowhatu	*Cheimarrichthys fosteri*
giant kokopu	kökopara	*Galaxias argentius*
inanga	inaka	*Galaxias maculatus*
koaro	hiwihiwi	*Galaxias brevipinnis*
brown trout		*Salmo trutta*
quinnat salmon		*Oncorhynchus tshawytscha*
perch		*Perca fluviatilis*
common smelt	paraki	*Retropinna retropinna*
black flounder	mohoao	*Rhombosolea retiaria*
sand flounder	pätaki	*Rhombosolea plebeia*
yellow belly flounder	pätötara	*Rhombosolea leporina*
yelloweye mullet	aua	*Aldrichetta forsteri*
sea salmon	kahawai	*Arripis trutta*

Appendix 6

Stream Invertebrate Species

Pakeha name	Maori name	Scientific name
crayfish	wai-koura	*Paranephrops zealandicus*
mayfly		*Coloburiscus*
smooth-cased caddis		*Olinga*
stony-cased caddis		*Pycnocentrodes*
spiral caddis		*Helicopsyche*
axehead caddis		*Oxyethira*
free living caddis		*Costachorema*
pond snail		*Potamopyrgus*
snail		*Physa spp*
flat worm		*Triciadida*
water boatman		*Sigara spp*
damselfly		*Xanthocnemis*

Appendix 7

Bird Species

Pakeha name	Maori name	Scientific name
black shag	kawau	*Phalacrocorax carbo*
little shag	kawaupaka	*Phalacrocorax melanoleucos*
blue duck	kowhiowhio	*Hymenolaimus malacorhynchos*
paradise shelduck	putakitaki	*Tadorna variegata*
mallard		*Anus platyrhynchos*
grey warbler	riroriro	*Greygone igata*
fantail	piwakawaka	*Rhipidura fuliginosa*
Australasian Harrier Hawk	Kähu	*Circus approximans*
feral geese		*Anser anser*
Canada geese		
black swan		*Cygnus atratus*
swamp hen	pukeko	*Porphyrio melanotus*
mallard		*Anus platyrhnchos*
red billed gull	tarapunga	*Larus novaehollandiae*
black billed gull		*Larus bulleri*
black backed gull	karoro	*Larus dominicanus*
spur-winged plover		*Vanellus miles*
oystercatcher	törea	*Haematopus finschi*
pied stilt	poaka	*Himantopus leucocephalus*
New Zealand shoveller	hoho	*Anus rhynchotis*
black shag	mapua	*Phalacrocorax carbo*
little shag	kahia	*Phalacrocorax melanoleucos*
black bird		*Turdus merula*
thrush		*Turdus philomelos*
starling		*Sturnus vulgaris*
sparrow		*Passer domesticus*
grey teal	tete	*Anus gracillis*
white faced heron	kotuku	*Egretta alba*
white heron	kötuku	*Egretta alba modesta*

royal spoonbill		*Platalea regia*
king fisher	kötare	*Halcyon sancta vagans*
silver eye	tauhou	*Zosterops lateralis*
fantail	pïwakawaka	*Phipidura fuliginosa*
fern bird	mata	*Bowdleria punctata*
sky lark		*Alauda arvensis*
welcome swallow		*Hirundo tahitica*
	kea	*Nestor notabilis*

Appendix 8

Ross Dungey Letter

8/8/02

Mr Terry Broad

1 Lomond St.

Caversham

Dunedin.

Re Cultural Impact Assessment- Aquatic Habitat Information for Pioneer Generation Ltd.

Dear Terry,

Peter Mulvihill sent me a copy of the report and asked me if there was any information for the gaps that the report had identified. There is some and it is listed below. Is it possible to have these references included in the Cultural Impacts Assessment?.

With regard to wildlife Fish and Game as the statutory managers have a good feel for the regions resources though they may not have quantitative information available. For example annual bird counts are made and these cover Lake Onslow and several of the regions other waterbodies. These at least identify that waterfowl are present in a particular locality in low, moderate or high numbers. The value of particular water bodies for various fisheries and wildlife resources are summarised in tables in the Otago Catchment Board/Otago Regional Council Water Resource Inventory publications.

With regard to the specific waterways your report considered;

Wye Creek. Barry Robertson did an assessment of this water body some years ago, I am in the process of trying to track down a copy and will let you know.

Roaring Meg. There are some references to this water body in the Kawarau Conservation Order evidence documents.

Ox Burn. In an assessment I did for Pioneer Generation I found brown trout and Galaxiids, probably Koaro, below the weir and adult Koaro above the weir. In the section I fished I would have expected to catch trout if they had been present. It seems most unlikely that trout are present above the weir.

Fraser River. The Upper Fraser is well regarded as a trout fishery and in the headwaters galaxiids are to be found, pers com Monty Wright Otago Fish and Game. The Fraser Dam has also been regarded as an important trout fishery though of limited productivity on account of steep sides and possibly variable levels. I have electrofished the Hawksburn and collected invertebrates from there. Brown trout are present but no other fish species were located. The Department of Conservation records support this finding. The weir on the Fraser River forms a small steep sided impoundment. The Hawksburn flows directly into this and brown trout are resident here also. It is very steep sided and therefore of limited productivity and angling value. Below the weir electrofishing records brown trout as the only fish species present from sites near the Weir and the Powerhouse. With the augmentation flows in the Lower Fraser River this fish distribution may change as habitat becomes available all year.

Teviot River. Monitoring programs by Pioneer Generation have established a sound record of the Teviot River Brown Trout population in recent years. This has included the fishing competition and electrofishing. No species other than brown trout have been seen. Koura were caught on the electrofishing survey and though in relatively low numbers a few did reach a moderate size, about 160mm. Report in prep. and Pioneer Generation reports.

In addition recent surveys conducted for the Department of Conservation has documented (unpublished) the fish populations present in many of the tributary streams though galaxiid identification is still to be confirmed. Some of the tributary streams of Lake Onslow were fished also, revealing various trout and galaxiid populations.

Hope this is of some help.

Yours sincerely,

Ross Dungey

cc. Mr. Peter Mulvihill, Pioneer Generation Ltd.

PIONEER
GENERATION

2/10/3 and 2/36/3

19 January 2007

Hoani Langsbury
Te Runanga o Otakou Incorporated
Tamatea Road
RD 2
Dunedin 9077

Dear Hoani

Fraser & Teviot Hydro Electric Schemes – Resource Consents & Mitigation Proposals

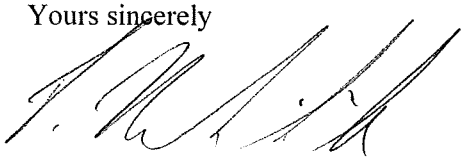
You will recall that in June and September 2006 I wrote to you with respect to the Section 42A (Resource Management Act 1991) reports that the Otago Regional Council Hearing Panel would consider in making a decision on the resource consent applications made by Pioneer Generation Limited for the continued operation of the Fraser & Teviot Hydro Electric Power Schemes. The purpose of that correspondence was to determine if the recommendations contained in the Staff Report satisfy the submission made by the Otakou Runanga in respect of the applications.

Subsequent discussions with you resulted in the preparation of two documents in which the Chief Executive of Pioneer Generation (Peter Dowling) recorded the agreed mitigation proposals for each of the schemes and provided for Kuao Langsbury to accept the proposal as Upoko on behalf of Te Runanga o Otakou. These documents were forwarded to you in October 2006 for review and comment. As I'm sure you will be aware, the hearings have since been conducted by the ORC and the resource consents granted essentially as per the respective staff reports – the Teviot consents effective from 13 December 2006 and the Fraser consents effective from 8 January 2007.

We are progressing with the implementation of the various conditions of consent and as part of that process it is appropriate to confirm the mitigation proposals agreed with Te Runanga o Otakou. The acceptance or otherwise of the proposal provided to you last October would be appreciated. On the basis that the proposal is acceptable I have enclosed two originals signed by PGL's Chief Executive of each of the two documents for consideration.

Thank you for your continued cooperation with this matter. Please contact me should you require any further information or wish to discuss any details further.

Yours sincerely



Peter Mulvihill
Asset Manager
ptm@pioneergen.co.nz

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PIONEER
GENERATION

2/36/3

16 October 2006

Kuao Langsbury
Te Runanga o Otakou Incorporated
Tamatea Road
RD 2
Dunedin 9021

Dear Kuao

Resource Consents for the Teviot Hydro Electric Scheme – Mitigation Proposals

As part of the resource consent renewal process for Pioneer Generation Limited's (Pioneer) Teviot Hydro Electric Scheme, Kai Tahu identified a number of adverse effects relating to their cultural values. Through the development of an ongoing relationship between Pioneer and the Otakou Runaka of Kai Tahu, a number of proposals have been agreed that will address these effects to the satisfaction of both parties. Details of these proposals have been provided to the Otago Regional Council (ORC) and, as noted in the table provided under cover of Peter Mulvihills' letter to Hoani Langsbury of 27 June 2006, have, where appropriate, been incorporated as conditions of the proposed consents that that been recommended by the staff report to the ORC's hearing panel. While the decision in respect of those consents is not yet known it is anticipated that they, including the recommended conditions, will be issued as per the staff report.

To provide for those proposals not considered appropriate for inclusion as a condition of any resource consent I am pleased to confirm Pioneer's commitment to address the effects relating to Kai Tahu cultural values through the implementation of the mitigation package as set out below.

Place Names

To help re-establish Kai Tahu status as manawhenua and kaitiakitaka it is agreed that information developed by Pioneer should contain dual names or where possible traditional Kai Tahu names should be used. In the development of future hydro dams/schemes etc the use of traditional Kai Tahu names is vitally important.

Pioneer has agreed to:

- amend general public relations material and annual report to include dual names where identified.

PIONEER GENERATION LIMITED
Ellis Street, PO Box 275 Alexandra, New Zealand. Telephone 03-448-6081. Fax 03-448-9439. Email pgl@pioneergen.co.nz

- initiate a protocol where dual place names can be applied to sites Pioneer is involved with in Otago.
- provide a list of names and locations for interpretation by Kai Tahu.

Awa/Ngai Wai

It is agreed that in consultation with Kai Tahu that the requirement for minimum flows needs to be investigated, that the de-watering of stretches of the Teviot river needs to be remedied and that the possible build up of algae in these sections of river needs to be addressed.

Proposals for a minimum flow and periodic flushing flows have been developed to resolve these issues and these are expected to become conditions of consent issued.

Mauri

It is agreed that ways in which the mauri of the river may be restored needs to be addressed and that the proposals developed for a minimum flow and periodic flushing flows that are expected to become conditions of consent issued will resolve this issue.

In addition to maintain and enhance the riparian margin of the Teviot River, Pioneer shall be responsible for:

- the control and maintenance of Crack Willow to 0% along the length of the Teviot River upstream of the Marslin Dam for the duration of consent granted. Any willows that are poisoned should be physically removed or cut up into a size that will rot away quickly.
- Conducting an annual Old Mans Beard (*Clematis vitalba*) survey and control within the area bounded by the marginal strip in the lower Teviot River with the aim of its total eradication in line with the ORC Pest Management Strategy.

It is noted that these issues are not an effect of damming and will not be a condition of any consent to be granted to Pioneer. However Pioneer has agreed separately with the Department of Conservation that it will be responsible for these mitigation measures.

Mahika Kai - Air/Land/Species

It is agreed that research should be carried out to ascertain the full range and distribution of roundhead galaxias in the Teviot River catchment. A proposal has been developed for Pioneer to fund a study of the Teviot River galaxiid by a suitably qualified freshwater ecologist to resolve these issues and this is expected to become a condition of the consents issued. Should this study indicate habitat enhancement options Pioneer agrees to implement any reasonable recommendations regarding constructing barriers to fish passage, and habitat enhancement and this also is expected to become a condition of the consents issued.

The waikoura population in Lake Onslow is unknown and Pioneer has agreed that it should be surveyed. This is expected to become a condition of the consents issued.

To assist Kai Tahu in gaining first hand knowledge of research methods and field work, Pioneer will give prior notification to Kai Tahu of research or monitoring projects being

undertaken and use personnel offered by Kai Tahu to assist or act as observers during the field work. It is expected that this will reflect the similar arrangement that Kai Tahu has with the Otago Harbour Board.

Kaitiakitanga

To help re-establish the kaitiakitanga status of Kai Tahu, Pioneer undertakes to make available future reports in respect of river systems where it operates hydro electric schemes in Otago. This may take the form of a layman's summary of reports that is forwarded on an annual basis with full copies available on request.

Waahi Tapu/Waahi Taoka

Given the extensive nature of waahi tapu/waahi taoka sites in the Lake Onslow/Teviot region, it is agreed that an accidental discovery protocol will be developed by Pioneer and Kai Tahu.

Property Access

It is noted that some of the activities outlined above require permission from private landowners to enter their property. Should accessibility or landowner agreement become an issue in implementing these provisions, Pioneer will demonstrate its best endeavours in negotiating to achieve the above outcomes.

Pioneer acknowledges that Kai Tahu consider that if landowner approval is not forthcoming then alternative mitigation or research projects should be investigated, agreed upon and implemented. Given that it is expected that any property access will be required as a result of a consent condition Pioneer considers it unlikely that this situation will eventuate but should it do so then a review of the consent conditions would likely be implemented by the ORC in terms of the Resource Management Act.

General

This agreement is conditional on and not effective until, the ORC grants the appropriate resource consents to enable Pioneer to carry on its electricity generation activities associated with the Teviot Hydro Electric Scheme and the determination of any Environment Court appeals. As soon as this occurs the parties will establish an agreed implementation time table.

In the event that the conditions of the resource consents granted don't reflect the agreements recorded in this letter, Pioneer confirms that it will use its reasonable endeavours to give effect to them and Kai Tahu agrees to assist and cooperate as required to bring this about.

I would like to take this opportunity to thank Te Runanga for your interest in the Teviot Hydro Electric Scheme and the positive approach taken to assist Pioneer in understanding the effects that it has on Kai Tahu cultural values. I am pleased to have reached this agreement with you and look forward to your acceptance of it by signing the attached copy of this letter,

and to an enduring relationship between us into the future. Please do not hesitate to contact me should you require any further information or wish to discuss any details further.

Yours sincerely

Peter Dowling
Chief Executive Officer
pjd@pioneergen.co.nz

Accepted for and on behalf of Te Runanga o Otakou Incorporated.

_____ Date: _____

Kuao Langsbury
Upoko
Te Runanga o Otakou Incorporated

Teviot Hydroelectric Scheme - Effects Upon Cultural Values

The following outlined in red is a summary of discussions held with Hoani Langsbury at the Otakou Marae on Thursday 5 August 2005.

ISSUE – KAI TAHU VALUES	Impact	Proposed Mitigation
Place Names	Significant - To help re-establish Kai Tahu status as manawhenua and kaitiakitaka information developed by Pioneer should contain duel names or where possible traditional Kai Tahu names should be used. In the development of future hydro dams/schemes etc the use traditional Kai Tahu names is vitally important.	As discussed in Mr Fletchers letter of 12 November 2003 Pioneer has offered the following: ▪ Amend general public relations material and annual report to include dual names where identified. ▪ Initiate a protocol where dual place names can be applied to sites Pioneer is involved with in Otago. ▪ Pioneer to provide a list of names and locations for interpretation by Ngai Tahu.
Awa/Ngai Wai	Significant – Minimum flows need to be investigated in consultation with Kai Tahu. De-watering of stretches of the Teviot river need to be remedied.	As conditions of consent the following conditions have been agreed to: ▪ a residual flow equal the $Q_{7,5}$ amount of 345 litres per second shall be maintained in the Teviot

	Discussions were held on the possible build up of algae in this section of river. The proposed flushing flows are designed to resolve this issue.	River immediately downstream of the Lake Onslow Dam. Consultation with affected parties will be initiated with affected parties in low flow years when the Teviot Irrigation Company may exercise its mining privilege beyond this amount. A minimum of 10 working days notice shall be given for any such consultation. ▪ a residual flow of 50 litres per second shall be maintained in the Teviot River downstream of the Marslin Dam and Teviot Irrigation Company Intake Weir. ▪ Release of a flushing flow below Marslin Dam and Teviot Irrigation Company Intake Weir of at least 250 litres per second, for at least 2 hours, every 6 weeks throughout the year
Mauri	Major – Discussions with Kai Tahu need to occur to investigate how the mauri of the river may be restored.	Please refer above to conditions of consent regarding residual flows. To maintain and enhance the riparian margin of the Teviot River Pioneer Generation shall be responsible for the following: i. Control of Crack Willow to 0%

		along the length of the Teviot River upstream of the Marslin Dam and maintain this level for the duration of this consent. If any willows are poisoned they should be physically removed or cut up int a size that will rot away quickly. ii. Conduct annual Old Mans Beard (*Clematis vitalba*) survey and control within the area bounded by the marginal strip in the lower Teviot River. The aim of this is total eradication in line with the ORC Pest Management Strategy.
Mahika Kai Air/Land/Species	Major - Research should be carried out to ascertain the full range and distribution of roundhead galaxias in the Teviot River catchment. Potential sites for re-introduction of roundhead galaxias should be identified, trout removed, trout barriers constructed, roundhead galaxias introduced and monitored. The wai-koura population in Lake Onslow should be surveyed.	Pioneer Generation shall fund a study of the Teviot River galaxiid by a suitably qualified freshwater ecologist to achieve the following objectives: b) Complete the current survey of galaxid distribution in the Teviot catchment c) Genetic identification of any non-migratory galaxiids found during such a survey

	Ngai Tahu are interested in gaining first hand knowledge of research methods and field work. This could be achieved by giving prior notification to Ngai Tahu of research or monitoring projects being undertaken and using personnel offered by Ngai Tahu to assist or act as observers during the field work. It is understood that there is a similar arrangement with the Otago Harbour Board.	d) Determination of the upper and lower limits of the Teviot River galaxiid in streams where they are currently known or may subsequently be found e) Identification and assessment of existing barriers to fish passage in streams where Teviot River galaxiid are currently known or may subsequently be found. f) Identification of locations where the construction or enhancement of barriers to fish passage would be beneficial to the Teviot River galaxiid g) The above work shall begin within 2 years of the resource consents being issued and a report outlining the above work, results and recommendations shall be forwarded to interested parties within 6 months of such work being completed. Pioneer Generation shall make best endeavours to implement any reasonable recommendations regarding constructing barriers to fish passage, and habitat enhancement options. Pioneer is also prepared to undertake a

		survey to ascertain the status of Waikoura in Lake Onslow.
Kaitiakitanga	Significant – To help re-establish the Kaitiakitanga status of Kai Tahu due consideration should be given to the issues raised in this report. Agreed that a layman's summary of reports would be helpful.	As discussed in Mr Fletchers letter of 12 November 2003 Pioneer will undertake to forward further reports in respect to the river systems it operates power schemes in Otago. It may be more practical to forward a list of the various reports on an annual basis and supply full copies of interest on request.
Waahi Tapu/Waahi Taoka	Major - Given the extensive nature of waahi tapu/waahi toaka sites in the Lake Onslow/Teviot region, Pioneer should investigate the commissioning of an archaeological assessment. Conclusion of discussions was that an accidental discovery protocol would be more appropriate than a full archaeological survey as all of the works currently exist.	As discussed in Mr Fletchers letter of 12 November 2003 Pioneer will undertake to carry out an archaeological assessment of the area impacted upon by the scheme.

NOTE

Some of the activities outlined above require permission from private landowners to enter their property. Should accessibility or landowner agreement become an issue in implementing these provisions, Pioneer Generation will demonstrate its best endeavours in negotiating to achieve the above outcomes. Although it was agreed that some of the above work was contingent on landowner approval Ngai Tahu consider that if landowner approval was not forthcoming alternative mitigation or research projects should be investigated agreed upon and implemented.

Fraser Hydroelectric Scheme - Effects Upon Cultural Values

Issue - Kai Tahu Values	Impact	Proposed Mitigation
Place Names	Major - Pioneer should begin to re-use the traditional Kai Tahu placenames associated with the Fraser River system. This will then begin to reaffirm Kai Tahu status as Kitiakaitanga and manawhenua. Pioneer should consider the use of traditional names or duel names for information produced on their Fraser hydro scheme.	As discussed in Mr Fletchers letter of 12 November 2003 Pioneer has offered the following: ▪ Amend general public relations material and annual report to include dual names where identified. ▪ Initiate a protocol where dual place names can be applied to sites Pioneer is involved with in Otago. ▪ Pioneer to provide a list of names and locations for interpretation by Ngai Tahu
Mauri	Significant – As a consequence of damning and dewatering of sections of the Fraser River the mauri has been significantly impacted upon. Discussions should occur with Kai Tahu with a view to begin to restore the Mauri of the Fraser River.	To maintain and enhance the riparian margin of the Fraser River Pioneer Generation shall be responsible for the following ▪ Control of crack willow to current levels upstream of the Fraser Dam for the period of the consent. ▪ Control of crack willow by poisoning for a 350 metre section downstream of the Fraser Dam for the period of the consent. Prepare a riparian enhancement plan for this section of

		river and fund planting and ongoing maintenance of native plants up to a value of $3000. This work is to be carried out within 2 years of granting the resource consent. ▪ If any willows are poisoned they should be physically removed or cut up into a size that will rot away quickly.
Awa/Ngai Wai	Significant - Establishment of minimum flows that will maintain instream ecosystems below the Pioneer Generation Ltd. weir should investigated and implemented. Discussions were held on the possible build up of algae in this section of river. The proposed flushing flows are designed to resolve this issue.	▪ a residual flow of 50 litres per second shall be maintained in the Fraser River downstream of the Fraser Intake Weir ▪ Release of a flushing flow below the Fraser Intake Weir of at least 250 litres per second, for at least 2 hours, every 6 weeks throughout the year
Mahika Kai Air/Land/Species	Significant - Further research is required to characterise the water fowl population in the catchment and to determine how Pioneer Generation Ltd's. activities, structures and water manipulations effect these species. Methods and processes that allow the migration of fish species past the Fraser Dam and Pioneer Generation Ltd. weir should be investigated. After discussions it was considered unnecessary to research issues regarding the water fowl in the catchment. Ngai Tahu are interested in gaining first hand knowledge	In reference to water fowl in the catchment there is little on ground evidence that there are significant populations in the catchment and therefore the impact of the structures and operations of the current scheme appear minimal. As discussed in Mr Fletchers letter of 12 November 2003 introducing facilities on the Fraser Intake Weir for migrating fish passage issues at this particular time would have little benefit unless fish passage at the Roxburgh

	of research methods and field work. This could be achieved by giving prior notification to Ngai Tahu of research or monitoring projects being undertaken and using personnel offered by Ngai Tahu to assist or act as observers during the field work. It is understood that there is a similar arrangement with the Otago Harbour Board. Although there is limited scope or need for native fish passage at present, it was agreed that should this situation change, there should be allowance made for implementation of a mechanism for native fish passage over the Fraser Intake Weir at a later stage in the consent. If any conflicts arise between DOC and Iwi on the types of native fish that should be catered for this will be resolved by agreement between DOC and Iwi.	Dam is improved and species of migrating fish can move freely through the Clutha River system. This issue could be revisited under one of the review dates at a later stage during operation of the consents.
Kaitiakitanga	Significant – To begin to ensure the Kaitiakitanga status of Kai Tahu an integrated approach to catchment management needs to be established through discussions with Kai Tahu. Agreed that a layman's summary of reports would be helpful.	As discussed in Mr Fletchers letter of 12 November 2003 Pioneer will undertake to forward further reports in respect to the river systems it operates power schemes in Otago. It may be more practical to forward a list of the various reports on an annual basis and supply full copies of interest on request.
Waahi Tapu/Waahi Taoka	Significant – Pioneer in discussion with the Papatipu Runanga should investigate the commissioning of an archaeological survey.	As discussed in Mr Fletchers letter of 12 November 2003 although Pioneer has not dismissed undertaking an archaeological survey does question the benefits of such an

	Conclusion of discussions was that an accidental discovery protocol would be more appropriate than a full archaeological survey as all of the works currently exist.	exercise given the rugged nature of the terrain in the area and the relatively minimal footprint impacted on by the current scheme.

NOTE

Some of the activities outlined above require permission from private landowners to enter their property. Should accessibility or landowner agreement become an issue in implementing these provisions, Pioneer Generation will demonstrate its best endeavours in negotiating to achieve the above outcomes. Although it was agreed that some of the above work was contingent on landowner approval Ngai Tahu consider that if landowner approval was not forthcoming alternative mitigation or research projects should be investigated agreed upon and implemented.

Teviot Catchment Galaxiid Population

A Review of information currently available on Teviot Galaxiids.

Report to Pioneer Generation Ltd.

Waterfall barrier to trout invasion & Dusky galaxiids above, Photo Ross Dungey Consulting.

Ross Dungey Consulting Ltd

November 2013.

Table of Contents.

Aim

The aim of this review is to identify and collate the available information on galaxiids in the Teviot River catchment. Particular areas of interest include tributary streams above Lake Onslow, those flowing into Lake Onslow, and those flowing into the Teviot River below Lake Onslow down to Marslin Dam, Figure 1. Below Marslin Dam the terrain is very steep and most tributaries are ephemeral.

Background.

Pioneer Generation Ltd. Consent No 2001.447.

As part of the consent to operate the Horse Shoe Bend hydro-scheme Pioneer Generation Ltd. were to provide additional information on the distribution and status of galaxiids within the catchment. The Department of Conservation, (DoC), were involved in initial discussions to identify key aspects of the investigation. Identification of habitat and barriers to invasion by trout were noted as key components of the information to be gathered. The Department of Conservation has statutory management responsibility for New Zealand native fish, such as the Galaxiids found in the Teviot catchment.

Galaxiid Species.

There are two species of galaxiid recorded from the Teviot Catchment. They are Dusky galaxiid, *Galaxias pullus* and the Teviot flathead galaxiid. The general distribution of both species is shown in figure1. The current detailed distribution of the Teviot Galaxiid is shown in figure 2, sites T1-T5. The Teviot flathead galaxiid is a separate species but is in the process of being described and currently does not have a specific name. By virtue of low numbers and very limited distribution the Teviot galaxiid has a conservation status of "nationally critical" being the category indicating greatest threat of extinction. It is however also "data poor" so its critical status could be alleviated if more populations were found although there is little opportunity for this in the Teviot Catchment.

Both these galaxiid populations (Dusky and Teviot) are very limited in extent. They are found only in streams where physical barriers (waterfalls or swamps) have prevented trout access and there has historically been limited agricultural use, typically only grazing. There are indications that some populations found in the last decade may already have disappeared.

Various river capture geological events in Otago from glaciations and tectonic uplift have lead to historic isolation of galaxiid populations. This isolation has allowed the development of about 10 lineages, as identified at a molecular level. Within these 10 lineages there are two main groups, flathead and roundhead. The Teviot galaxiid is one of the flathead group (DoC internal reports).

The Department of Conservation "Non-migratory galaxiid recovery plan" lists 3 major threats to Non-migratory galaxiids, they are; water quantity and quality and invasion by other fish species, (of which trout are the most common and widespread problem).

Sources of Information

In conducting this review information was gathered from;

1. New Zealand Freshwater fisheries database
2. Department of Conservation records, internal reports, monitoring and reconnaissance survey data, and personal communications
3. Pioneer Generation Ltd studies of galaxiids of the Teviot Catchment

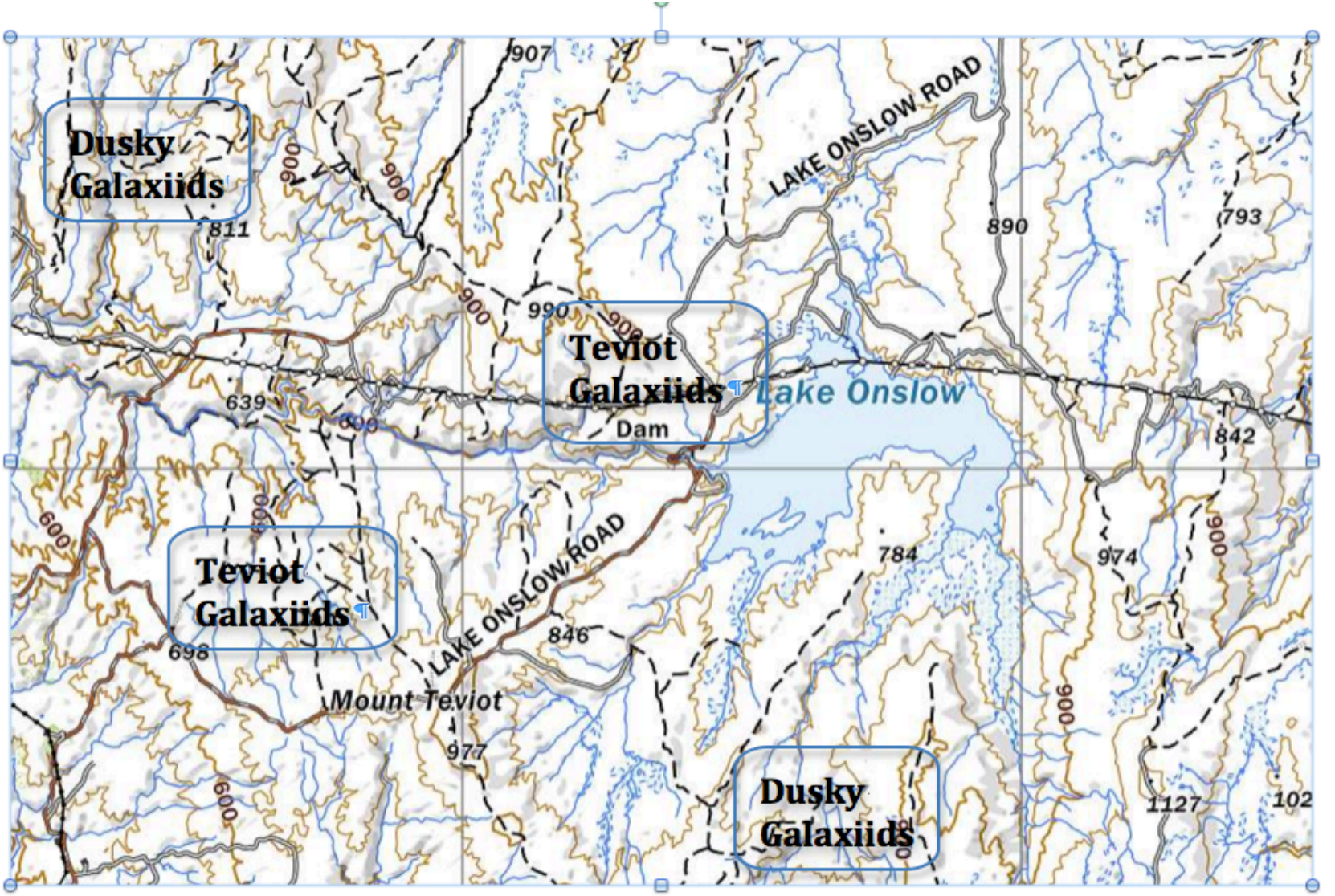

Figure 1, General galaxiid distribution in the Teviot Catchment.

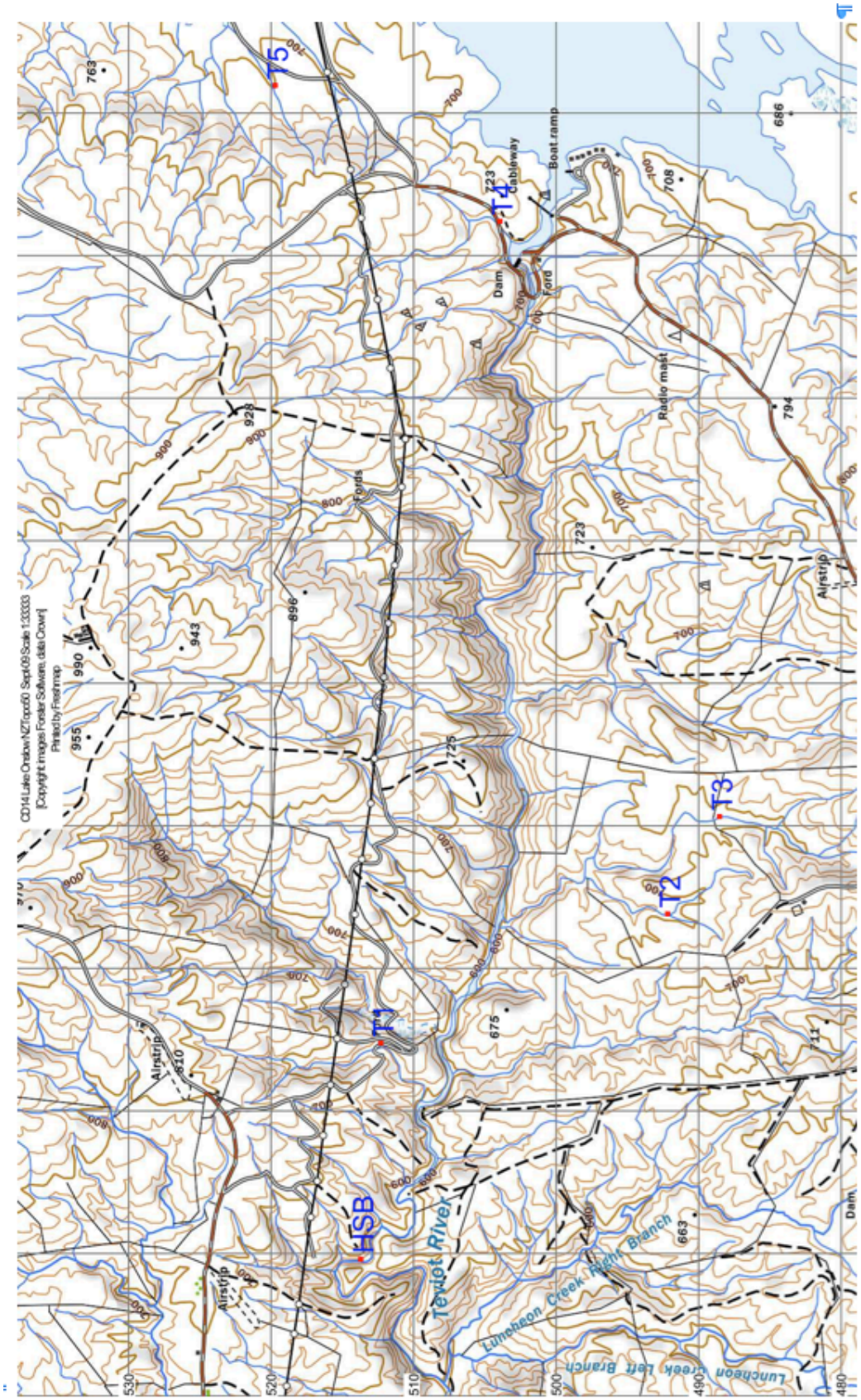

Figure 2. Teviot Galaxiid sites. HSB = Horseshoe Bend Dam, T1-T5 recorded locations of Teviot Galaxiid.

Location of Galaxiid populations.

Locations supporting galaxiid populations recorded from the 2003 survey and subsequent surveys include;

- Old Hut Creek, Pinelheugh Creek and tributaries and Armstrong Creek and tributaries, which have *G pullus* present.
- Teviot River and L Onslow tributaries, which have Teviot Galaxiid present.

Table 1, GPS references from map references, off survey cards, and for recent surveys. T1-T5 **2003** sites of *Teviot Galaxiid*, T4 and T5 recent DoC surveys and permanent monitoring sites. (T Gx =Teviot Galaxiid, Pinel = Pinelheugh Creek, Trib = tributary)

Stream	**GPS**	**Species**	**Sample**
Pinel Crk (162)	1323640-4954994	G Pullus	N=10
Pinel Trib #1 (87)	1325633-4952874	G Pullus	N=18
Pinel Trib #2(88)	1325626-4953740	G Pullus	N=47
Pinel Trib #3 (168)	1325320-4954467	G Pullus	N=18
Old Hut Crk #1 (164)	1321420-4952947	G Pullus	N=24
Old Hut Crk #2 (165)	1322226-4954020	G Pullus	N=12
Armstrong Ck Trib		G Pullus	na
Teviot Trib #9 Pylon Rd TRB, (**T1)**	1328441-4951148	T Gx?	N=9
Teviot Trib #1, (**T2)**	1329383-4949205	T Gx	N=12
Teviot Trib #2, (**T3)**	1330046-4948882	T Gx	N=9
Teviot Trib #3 (PMS low b) (**T4)**	1334243-4950428	T Gx	N=21
Doc (a) Onslow, Trib (**T5)**	1327180-4951764	T Gx	na

Previous Studies

Reconnaissance Survey.

This survey is titled, Department of Conservation, (DoC) Central Otago Native Fish Survey, (Dungey 2003). This was a regional reconnaissance survey conducted over three years 2001-03. It located scattered populations of galaxiids at 13 locations in the Teviot catchment. These included Armstrongs Creek (a tributary of Teviot River south branch), Old Hut Creek, Pinelheugh and tributaries; (Dusky galaxiids), and Teviot tributaries in the reach from the Onslow Dam to Horseshoe Bend Dam, an unnamed creek just above the dam on the north shore, and another unnamed creek off the Onslow road also on the north shore; (Teviot galaxiid).

This survey identified the presence of galaxiids but only gathered basic information on population structure and distribution of galaxiids in the creeks they were located in.

Preliminary density estimates from the 2003 survey put Teviot galaxiids 0.27-0.35 fish.m^2. Mean length is strongly influenced by the presence/absence of juveniles and size range gives a better description of population structure. The 4 streams with Teviot galaxiids had a fish size range of 23-126mm in late summer, table 2. (DoC have conducted additional survey work at T4 and T5.)

Table 2, Teviot Galaxiid, T1-T4, 2001 survey, T4 Doc 2004 survey, T5 Doc 2004 Survey, and Pioneer 2013. (na=not available)

Site	**Sample Size**	**Mean L(mm)**	**Range (mm)**	**Density F/m^2**
T1	8	90.75	35-119	0.32
T1 2013	No Fish			
T2	12	36.75	29-65	0.27
T2, 2013	25	80.48	51-122	na
T3	9	81.78	61-119	0.35
T3, 2013	24	72.04	43-120	na
T4	21	48.52	23-126	0.29
T4 Doc	22	52.86	32-126	0.47
T5 DoC	17	113.24	53-137	na
Mean				**0.34**

2. Unnamed Tributary Monitoring; 2004.

DoC have established two permanent monitoring sites (**PMS)** where the Teviot galaxiid is monitored annually. On the Teviot Galaxiid tributary north of the Onslow Dam (Tributary b, figure 3), DoC. have set up a permanent monitoring site, (PMS), and tagged adult fish beginning in 2004. Two barriers, that consist of a 1.3m high waterfall and a culvert with a 300mm over hang, protect the galaxiids in this stream, Fig 3. DoC map and these correspond to T4 and T5 in Figure 2.

In summary information from this survey on T4 is as follows.

- Adult fish have been tagged with a small numbered subcutaneous tag. Tagging allows growth rates to be determined and individual fish to be monitored.
- Mean annual growth rate has been assessed at 8.2mm.
- Teviot galaxiids range in size from 32-126mm.
- Population density is low (.47fish/m^2) when compared with other galaxiid species.
- Recruitment is annually substantial but leads to little change in the population size.
- Adults are regularly recaptured suggesting that in-spite of significant recruitment juveniles are largely lost, perhaps due to limitations in available habitat.
- Some spawning behaviour has been observed with the location of eggs under stones and among riparian vegetation and roots.
- Habitat seems to be limited by a lack of loose substrate over the bedrock schist base.

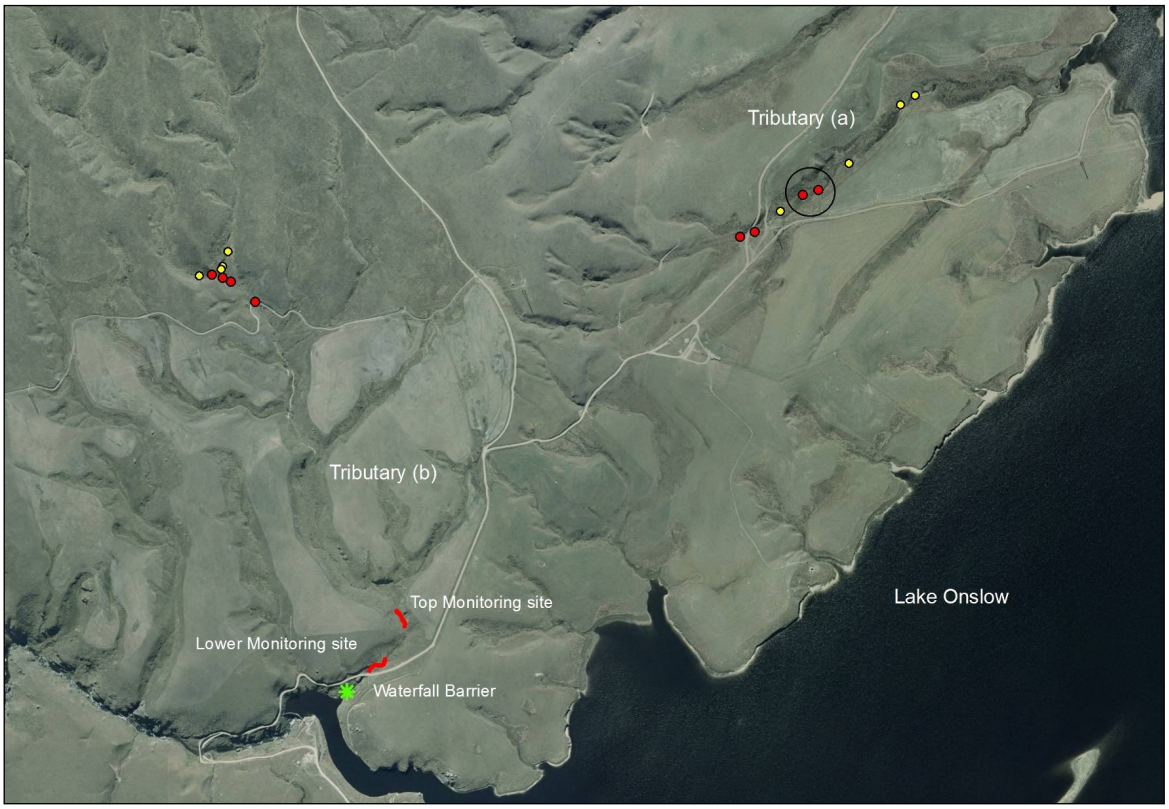

Figure 3. Aerial photograph of unnamed tributaries (a) and (b), Lake Onslow. Red circles are surveyed sites containing Teviot flathead galaxias. DoC unpublished data.

Otago non-migratory Galaxiid Monitoring Surveys.

These studies conducted at strategic locations throughout Otago have established a descriptive outline of these galaxiid populations. Non-migratory galaxiids such as Teviot Galaxias do not have high reproductive rates and their consequent low numbers increases their vulnerability to adverse impacts; for example a salmonid predator. Such a predator is likely to completely exclude the galaxiids from the stream soon after invasion. These galaxiids also seem to lack "plasticity in their behaviour" a feature that allows some species to adapt to the presence of a predator. The critical management issue for non-migratory galaxias is the maintenance of barriers to trout.

Teviot galaxiids typically have the lowest densities of any galaxiids so far assessed in Otago. Non-migratory galaxiids from other parts of Otago have population densities ranging from 0.5 fish/m2 to 7 fish/m2, Doc unpublished reports. A comparison with other species is shown in Table 3.

Table 3, comparison of galaxiid species fish density, fish/m2. (Doc data).

Galaxiid species	**Low density**	**High Density**
Clutha Flathead	0.5	1.5
Central Otago Roundhead	1	7
Dusky	.5	1.5
Eldons	.5	1.5
Nevis Gollum	.06	5.49
Teviot Galaxiid	0.27	0.47

Other DoC surveys have;

1. defined the range and population structure of Teviot galaxiid distribution on the two tributary streams to the north of the Teviot River on the property of Mr G McDonald.
2. Sampled and identified galaxiids of Pinelheugh and Old Hut creeks,
3. Eliminated potential Teviot tributary creeks from being Teviot galaxiid habitat. A 2012 survey, covering several small tributaries on the south side of the Teviot River, property of Mr P McDougall did not locate any galaxiids.

Pioneer Generation Ltd Surveys.

Aerial Survey

An aerial survey of the Teviot catchment to locate likely barriers and the extent of habitat was conducted in 2008. This involved flying up tributaries of the Teviot and GPS recording the location of what looked like barriers and noting the upstream extent of habitat and the different habitats available. An aerial survey allowed a rapid assessment method of potential habitat and a means to cover the large area in a short time. It was a useful means to determine priority sites for ground visits and physical measurements of barriers, habitat, and fish where they were located.

Potential barriers were defined by abrupt changes in gradient, usually around rocky outcrops, and the presence of swampy areas where there seemed to be no open water. Waterfalls around bedrock outcrops provide the most secure and obvious barriers.

The upper limits of the streams were also noted so that the extent of habitat (barrier to stream source) could be estimated and access for surveys planned..

The aerial surveys recorded 25 likely barriers, 5 on Onslow tributaries, 12 on true left bank of the Teviot River, and 8 tributaries on the true right bank; of these 3 are on Pinelheugh and 2 on Old Hut Creeks. The distribution of Galaxiids indicates another barrier somewhere on the on lower Pinelheugh Creek. These sites (Pinelheugh and Old Hut Creeks) were not able to be visited on the recent surveys.

From the aerial surveys key galaxiid streams for verification of barriers by ground visits was organized and these sites have been surveyed.

Electro-fishing Surveys.

To update Teviot Galaxiid data, known sites were revisited in October/November 2013; Pioneer Generation Ltd. studies. Electro-fishing was conducted on T1, T2, and T3. Information was collected on fish distribution, size range, and barrier characteristics. Galaxiids were located at T2 and T3 but were not found at T1 on this recent survey. These streams are often dark, very narrow, often deep relative to width with undercut banks, have underground sections and low water velocities. These conditions make electro-fishing challenging and the escape rate of fish in these conditions may be substantial.

Ideal conditions of clean open wide channel with moderate flow allow fish to be easily spotted and often washed into a stop net as opposed to being scooped up. Such conditions are rare in Teviot streams in which galaxiids are typically found. The consequence of these limitations on sampling are that catch rate is low, fish are likely to be missed, and where numbers are already low a nil result does not necessarily indicate that fish are totally absent.

The absence of fish at T1 is not related to trout invasion as none were found and a substantial barrier still remains between the sampling site and the confluence with the Teviot River. A 100m reach was fished in the general vicinity of the original survey but no fish were seen or captured. This is not to say that galaxiids have disappeared from T1 but that they are likely to remain (as they were in the surveys of 2003, Dungey 2004) in very low numbers. The stream appears in reasonable order with a rich invertebrate fauna of species with a low tolerance to enrichment (*Nesameletus and Zealandoperla*) and should therefore still provide satisfactory habitat.

At T2 galaxiids were found over approximately 800m of stream. The lower limits are diffuse but essentially a swampy section and shallow stream following over bedrock. Trout are present about 420m below the first recorded galaxiid. The upper limits are also a swamp where the stream gradually disappears into

swamp-bog. Swamp is a feature through the small valley with sections of flow underground and seepages through the dense vegetation. Small reaches of open channel allow sporadic electrofishing. Within these habitat limitations, fish distribution is patchy with no obvious difference in areas where fish were captured vs those where they were not. Fish captured at this site were mostly adults suggesting limited recruitment that maybe related to spawning habitat and juvenile survival. Fish ranged in size from 51-122mm, table 2.

At T3 site electrofishing was particularly difficult because of water depth (up to 1m), slow flow, and dark tannin stained water. In these conditions galaxiids are very difficult to locate and retrieve when electrofishing. A small shallow rocky section produced a high density of smaller fish indicating a higher recruitment success at this site than the stream at T2. Six galaxiids were captured from under 1 large boulder. This stream branches into two about 300m upstream from this sampling site both of which are extensive swamps. As such they become problematical to sample. The upper limit in this creek (as established by electrofishing) was located at a waterfall at an altitude of approximately 772m, GPS location 1329804-4947460). There is approximately 1530m of stream in the main branch of this creek that supports Teviot galaxiids. Fish ranged in size from 43-120mm, table 2.

In both these streams (T2 & T3) galaxiid distribution is very patchy and on occasion there are extensive reaches of stream in which fish appear to be absent or at least at a very low density.

A search for barriers on Armstrong Creek indicated that the barriers are not in Armstrong Creek itself but usually in the form of waterfalls where tributary streams meet Armstrong Creek, the connection is often from a “hanging valley” where waterfalls vary from 0.5 to approximately 30m. Not all streams support galaxiids and some streams have no fish species at all.

Barriers.

DoC have described the barriers protecting T4 and T5. The barriers protecting T2 and T3 and the tributaries of Armstrong Creek (Dusky 1-3) range from swamp and culvert, T1, to a 6m high bedrock water fall, Armstrong Creek, Dusky 1, Table 4, figure 4, and photographs of appendix 1. Brown trout are present in all the streams below the barriers.

Table 4, Barrier characteristics of known galaxiid streams in the Teviot catchment. Na = not applicable.

Location	Barrier Structure	Height	Species above
T2	Swamp	na	Teviot
T3	Waterfall & Pond Dam	3m & 4m	Teviot
T4	Waterfall & culvert	1.3m	Teviot
T5	Swamp	na	Teviot
Dusky 1	Waterfall, bedrock	6m	Dusky
Dusky 2	Waterfall, bedrock	0.5	Dusky
Dusky 3	Waterfall & Chute, bedrock	2.5m	Dusky

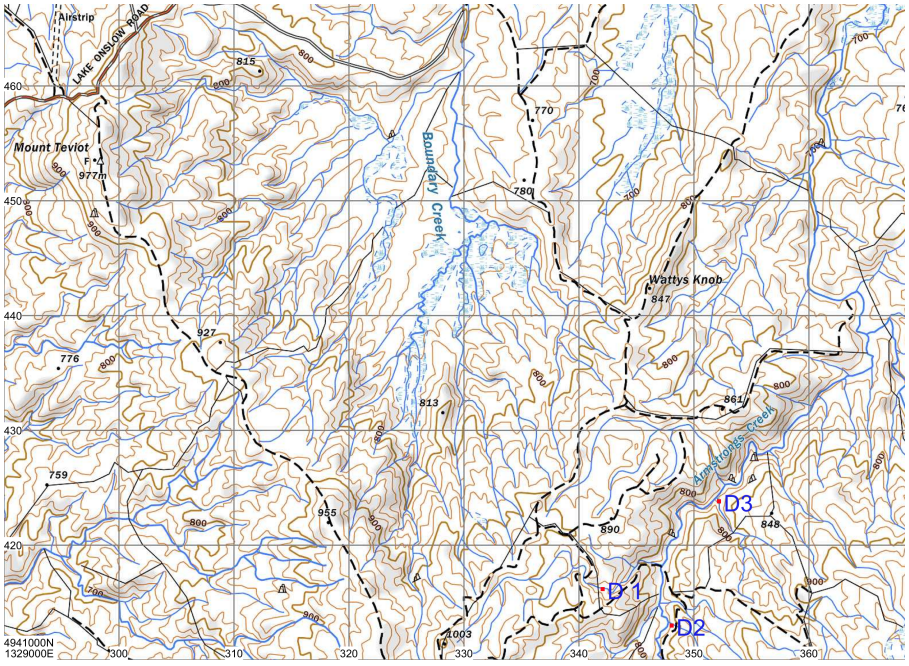

Figure 4, location of barriers on Armstrong Creek tributariesD1-D3.

Translocation Sites.

The fact that habitat continues to diminish for galaxiids has lead to consideration of translocation as a means to preserve threatened species populations and the Department of Conservation has investigated this strategy and is therefore interested in potential sites. Two streams were located (one on each of the Teviot River and Armstrongs Creek tributaries) where the invertebrate fauna indicated good habitat quality but electro-fishing indicated no fish were present. Both streams have substantial and very secure barriers and are therefore sites that could be considered for translocation of galaxiids to extend their current limited range.

Teviot Catchment Galaxiid Habitat.

The *G pullus* of Pinelheugh and Armstrongs Creeks are wide spread throughout Otago but in isolated pockets and therefore the populations are relatively insecure. There continues to be annual losses of galaxiid populations throughout Otago. The Teviot galaxiid is recorded from six locations in tributary streams of the Teviot River. Barriers protecting Dusky galaxiid populations are more secure than those protecting the Teviot Galaxiid.

In the last 15 years 12 of 38 Central Otago Roundhead galaxias populations have been lost. Of those that remain most are in a poor state, 3 are of unknown quality and 3 classified as viable populations. Losses of Central Otago Roundhead galaxias have been to brown trout invasion as barriers have failed. For Dusky galaxias of 25 fragmented populations 7 have been lost since 1996 mostly to brook char. Clutha flatheads have been lost in Lindis and Pomahaka tributaries. Maintenance of barriers to trout is the critical management issue for most galaxiid species. (pers com P Ravenscroft.)

Definition of barrier security is part of determining population security and a priority for conservation planning. The barriers protecting galaxiids of the Teviot catchment are generally reasonably secure but the swamp of T2 could be washed out in a serious rain event and the pond of T3 would support trout if they were released there, which would undoubtedly lead to the loss of Galaxiids in that stream.

The Teviot galaxiid was only confirmed in significant numbers in 2 small streams that are tributaries of L Onslow and occupies a total stream length of about 2km, *Doc unpublished data*. This was the complete documented range of this species. Spot checks on a two other small tributaries about 14 years ago revealed low numbers of fish, follow up checks have extended the knowledge of Teviot galaxiids.

Recent Pioneer Generation Ltd. studies however, have extended this range with the confirmation of populations on the south side of the Teviot River on the property of Mr P McDougall. The creeks involved are quite small in length (1.53 and 0.8 kms) and water volume and habitat is therefore still very limited. The total known range of the Teviot galaxiid is on 4 properties, Messers McDougall, McDonald, Wright, and Peters, all tributaries of the Teviot River. The total length of stream is now recorded at approximately 4.33kms. The Old Hut Creek population is not included in this total.

In terms of habitat T2 and T3 generally are also lacking in the loose gravel substrate noted as a likely limiting habitat feature by DoC at T4. As with the Dusky galaxiid the Teviot galaxiid streams are frequently soft bottomed and with overhanging vegetation, flowing through a valley floor with frequent swampy and boggy reaches. Where ever a gravel/cobble substrate is located in these streams, galaxiids are usually found. Occurrence in the soft bottom reaches is less regular.

Summary

Barriers.

The location and status of barriers currently preventing trout access to Teviot tributaries has been assessed from the air on almost all streams. Where there are known populations of galaxiids, barriers have been further assessed on the ground. Three barriers on Armstrong Creek and two on unnamed tributaries on the Teviot River reach between Horseshoe Bend and Onslow dams have been described and photographed. Others including those on Pinelheugh and Old Hut Creeks have only been assessed from the air. The barriers protecting the Dusky galaxiid populations are the more secure, usually substantial bedrock water-falls. The barriers at T2 and T3 could potentially allow trout access.

Galaxiid distribution.

Work has been conducted on the extent of Galaxiid populations in small tributaries where they have been observed, in particular tributaries of the Teviot River between the dam and Horseshoe Bend Hydro-scheme. Department of Conservation PMS surveys at T4 and T5 have described the galaxiid populations in detail, such as population structure, (proportions of adults/juveniles, size range). Pioneer Generation Ltd. studies have done similarly for T2 and T3.

Low numbers of fish were typical of the 2002 survey (Dungey 2004) and subsequent site revisits have in one case failed to locate any fish. This suggests habitat is limited and populations are in a risky and perhaps tenuous position rather than stable and well established at these locations.

Initial surveys to establish the presence/absence of Teviot galaxiids provided basic population information. Doc monitoring has provided some detailed population structure information based on site T4. Recent Pioneer Generation studies have extended the known occupied stream length from approximately 2 km to 4.33kms for the Teviot galaxiid.

DoC Research Priorities.

Teviot galaxiid distribution and structure of barriers are key areas of interest. These priorities have largely been dealt with by the Pioneer Generation Ltd. studies. The extent of habitat occupied by the two populations of Teviot Galaxiid, on Mr P McDougalls property has been assessed and some descriptors of population parameters recorded.

Barrier assessments on the known galaxiid streams have been completed so the security of the various populations from salmonid invasion can be described. Barriers are generally very secure but the presence of a pond at T3 carries the risk of being suitable trout habitat though they are absent at present. The swamp protecting T2 however is less secure than a bedrock waterfall. Of the three Dusky galaxiid barriers two are very secure and the other moderately so probably assisted by low summer flows. All three are based around bedrock waterfalls.

Impediments to surveys.

Some landowners are unsympathetic to galaxiid surveys and chose not to allow access for the work to be conducted.

Acknowledgements.

I am grateful to Messers P Garden, P McDougall, and T Peters for their permission to access creeks on their properties and conduct field surveys for galaxiids and barriers to trout invasion.

References.

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