HYDRO DEVELOPMENTS LTD

(HDL)

Resource Consent Application and Assessment of Effects on the Environment

for the

Stockton Plateau Hydro Scheme

VOLUME 1: Application and Assessment of Environmental Effects

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1 Introduction

1.1 The Application

Hydro Developments Ltd (HDL) is seeking resource consents from the West Coast Regional Council (WCRC) and the Buller District Council (BDC) to develop a hydro power scheme on the Stockton Plateau (Stockton Plateau Hydro Scheme – the "Project"). The location of the Project is shown in **plan C-000**.

The Project will dam and divert watercourses draining from the Stockton Plateau into two storage reservoirs by way of a system of tunnels. Water from these reservoirs will then be used to generate electricity through power stations located on the Stockton Plateau and at Granity. Following dilution in the scheme reservoirs, tailwater from the Project will be discharged into the coastal marine area via an ocean outfall diffuser located some 600 metres offshore. There will be no ecotoxic effects resulting from the discharge of the diluted flows into the coastal marine area.

The dams and diversions will be located on the Stockton Plateau on stewardship land managed by the Department of Conservation (DoC). The Project footprint is sandwiched between the Ngakawau Ecological boundary and Solid Energy New Zealand Limited's (SENZ) Coal Mining Licence (CML). The scheme has been designed to ensure that it will not constrain future mining operations within the current mining licence area nor will it isolate any other coal reserves.

The Project has a relatively small footprint. The most significant components of the scheme, the dams and reservoirs required to provide storage capacity, are contained on the Stockton Plateau beyond public view and on areas largely modified by previous human activity. The diversions, penstocks and the outfall pipeline will be buried underground over their entire length.

The Project is unusual for a hydro scheme, in that it is built on the tributaries, not the main course, of the Ngakawau River and results in significant improvements to the Ngakawau River system. The Project intercepts the majority of the tributaries of the Ngakawau River that have been affected by coal mining. The scheme has the ability to capture 95% of these flows with only a 17% reduction of the mean flow of the Ngakawau River. The reduction in mean flow is unlikely to be discernible. The most obvious change will be a significant improvement in water clarity and estuarine ecology. Flows over the Mangatini Falls will reduce in volume but the water quality at the waterfall will be significantly improved. The visitor experience of the Charming Creek walkway will also be greatly enhanced.

In accordance with the Resource Management Act 1991 (RMA), this report describes the Project and provides an Assessment of Environmental Effects (AEE). HDL's application comprises two parts:

Volume 1 – Application (this volume) including application forms, proposal description and AEE (comprising a summary of the supporting technical reports);
Volume 2 – Plans, Figures and Appendices A to N comprising the supporting technical reports.

1.2 Hydro Developments Ltd (HDL)

HDL is based in Westport, representing local interests involved in the development of the Buller District. Shareholders of the company currently employ over 100 people working in the Buller, Grey and Nelson Districts. They are committed to maximizing local involvement in the scheme and the economic, social and environmental benefits to the District. It is expected that HDL will enter

into both public and private partnerships with entities with strong local interests for the construction and operation of the Project.

1.3 Stockton Plateau Hydro Scheme

HDL has been investigating potential for hydro electric power generation opportunities in the Buller region for some time. Initial hydro concept designs where developed between 1996 and 2002 and concentrated on the Mangatini catchment. A resource consent application for this scheme was lodged with the WCRC in 2003. The application was placed on hold while further information was prepared. Preparation of this information has led to substantial re-design of the scheme. For this reason the earlier application has been replaced with the current application.

The current proposal is for the construction of an 'off-river' hydro scheme. The Project will create storage reservoirs within the elevated upper catchments of the Ngakawau River requiring the construction of two low dams; the Mt William dam, 40m high, impounding around 7 million cubic metres at an elevation of 575m above mean sea level (AMSL); and the Weka dam, 25m high, impounding around 3 million cubic metres at an elevation of 390m AMSL. Water will flow from Mt William reservoir through an underground tunnel to the Weka power station before discharging into the Weka reservoir. It will then flow from the Weka reservoir to a power station at Granity via an underground penstock, and then to the ocean via an underground outfall pipeline and diffuser.

This application is quite unlike most other hydro generation schemes in New Zealand, which typically involve the construction of high dams on the main stems of river systems. These are often referred to as 'run of the river' schemes. 'Run of river' schemes are dependent on diverting as much of the river flow through the turbines as possible and so necessitate flooding of the lower gorges and river flats, which are often the highest value areas within a catchment. In these circumstances, although power generation is by utilisation of a renewable resource, the environmental impacts of such schemes can be significant, with the loss of large areas of habitat and significant river flow impacts. For 'run of river' systems, there is a direct correlation between the amount of power that can be generated (dam size) and environmental effects.

HDL's proposal does not require the damming of the main stem of the Ngakawau River or any works within or under the adjoining ecological area. The diversions of the upper catchments will reduce the mean flow within the main stem of the river by approximately 17%. The installed generation capacity of the Project will be dictated by the capacity and costs of the underground penstocks and tunnels connecting the dams. Increasing or reducing installed capacity (the effective “size” of the scheme) will not significantly alter any of the anticipated environmental effects.

Furthermore, most of the watercourses being intercepted and diverted into the respective reservoirs are already affected by historic mining activities. Therefore, it is considered that the Project will have minimal effects in terms of instream values and removal of these flows from the Ngakawau River system will enhance the freshwater ecology within the Ngakawau Estuary.

1.4 Electricity Generation

Electricity in New Zealand is largely generated from hydro, gas, coal and geothermal resources with increasing development of wind generation. Electricity is produced at generation stations and is connected at high voltage to the national electricity transmission network, termed the National Grid, at Grid injection points. There are some 40 major electricity generation stations connected to the Grid, with these stations owned and operated by six main generator companies which compete to supply electricity to retailers.

The West Coast's peak electricity demand is expected to be 75 Megawatts (MW) in 2008 rising to approximately 80MW by 2011 (as per *Transpower New Zealand Ltd Annual Planning Report*, 2008). Currently the region's electrical demand is met through supply from 9 small power stations on the West Coast with a total peak output of 18.5MW. Otherwise the majority of the region's electrical demand is met through long distance transmission via the National Grid, primarily from the Waitaki Valley. This has considerable draw-backs in terms of consistency and reliability of supply to the West Coast region, with security of supply being of considerable concern to large industry users such as SENZ and Holcim.

This application provides for flows from the Stockton Plateau to be diverted through two hydro-electric power stations. Although the flow rates are small, the drop of more than 550m between the highest reservoir and the ocean outfall is sufficient to generate in the order of 240 Gigawatt hours (GWh) of renewable energy per year. This will more than meet the needs of the Buller District and ensure that the West Coast region is less reliant on remote electricity generation. (Note: the amount of power used annually on the West Coast is approximately 220GWh, with approximately 90GWh supplied from the 9 existing power stations within the region – as per Sinclair Knight Merz, *Renewable Energy Assessment West Coast Region*, 2008).

It is not anticipated that approval of Meridian's proposed Mokihinui Power station or the Trustpower development of the Arnold River scheme will in any way affect the viability of the Project. Given the anticipated growth in electrical demand of the Nelson region, which is also reliant on a significant portion of remote electricity generation, there is a need for additional generation closer to the demand.

1.5 Transmission

When fully commissioned the Project is expected to provide a continuous (24/7) base load in the order of 25MW (subject to the configuration of the installed capacity in the two power houses and the possible future addition of a third power house at Mt William). During the remaining life of Stockton Mine up to around 8MW, or 33% of base load, may be supplied to Stockton Mine. Power not used by Stockton Mine will be transmitted north to Karamea and south to Westport and beyond.

The Project also has the potential to double the baseload output to around 50MW for shorter periods during and following heavy rainfall.

HDL has worked with Buller Electricity Limited (BEL) to determine the optimum way to inject the electricity generated by the Project into the local distribution network. By the time the Project power comes on stream BEL will have upgraded the existing coastal transmission network to a capacity required to transmit the base load. BEL is confident that there will be a number of options available for distributing the extra power produced by the Project during periods of heavy rainfall. The best option cannot be determined until a number of improvements to the local distribution network, currently under consideration by BEL, are resolved.

This application includes consents to build spur lines to connect to the existing transmission lines. BEL advises that the best practical option is to connect Weka Power station to SENZ's 33kV line that serves Stockton Mine. This will require construction of 500m of overhead 33kV spur line from the Weka power station to connect to SENZ's 33kV line near No 4 Station (the building on the decommissioned aerial ropeway that is visible from Millerton township). Granity power station will be connected to BEL's coastal transmission line. This lines passes through Granity less than 50m from the Granity tunnel portal. These spur lines will also carry any communication and data cables

required for the operation of the Project.

Construction of the spur lines and connection to the existing lines will require the support of both BEL and SENZ. The connection is expected to serve the interests of both parties by improving the security of supply.

1.6 Central and Local Government Context

The government has recently developed energy strategies and made changes to the RMA to encourage greater development of renewable energy, reduction in climate change effects and increased security of energy supply. These government measures have relevance for the current application, as the Project directly assists in achieving the national aims of generating renewable energy and reduction in climate change effects.

1.6.1 Climate Change

New Zealand has ratified the Kyoto Protocol, which came into force in 2005. New Zealand has committed to reducing greenhouse gas emissions back to 1990 levels during the First Commitment Period (2008-2012) and has taken responsibility for any excess emissions. It was envisaged that this target would be achieved through a combination of domestic emissions reductions and increased carbon sinks. It was also anticipated that more significant emission measures would need to be implemented for future commitment periods.

Development of renewable energy such as with the current Project will help New Zealand to meet its obligations under the Kyoto Protocol while assisting in meeting the country's growing electricity demand without contributing additional greenhouse gas emissions.

1.6.2 New Zealand Energy Efficiency and Conservation Strategy

The New Zealand Energy Efficiency and Conservation Strategy 2007 (NZEECS) is the government's detailed action plan for increasing the uptake of energy efficiency and conservation, and renewable energy. It gives effect to a number of objectives set out in the strategy, in particular the achievement of the renewable electricity target. As the Strategy is authorised by the Energy and Efficiency and Conservation Act 2000 it is a matter which Council's should have regard to under section 104(1)(c) of the RMA.

The government has also published New Zealand Energy Strategy 2007 (NZES) which sets the strategic direction for the energy sector and sets down a target of 90% of electricity to be generated from renewable sources by 2025. Increasing the proportion of renewable electricity is considered to be an affordable option for New Zealand, using current technology and indigenous resources. It is projected that if New Zealand achieves this 90% target by 2025 then this coupled with energy efficiency measures will cut greenhouse gas emissions back to 1990 emission levels.

HDL's Project is entirely consistent with the stated government directives and will assist in achieving the governments 90% renewable energy generation target.

1.6.3 Amendments to the Resource Management Act 1991

The Resource Management (Energy and Climate Change) Amendment Act 2004 introduced the following matters into Part II, section 7, of the RMA:

- (i) the effects of climate change; and
- (j) the benefits to be derived from the use and development of renewable energy.

To support the section 7(j) amendment, section 2 of the RMA was amended to define "*renewable energy*" as "*energy produced from solar, wind, geothermal, hydro, biomass, tidal, wave and ocean current sources*".

This amendment reflects New Zealand's international obligations as regards climate change and implementation of government directives as outlined in the NZES and NEECS. Under the RMA Councils must balance the national benefits of renewable electricity generation projects with local environmental considerations.

The law relating to these matters has been refined to some extent by the Environment Court in its decision on *Genesis Power Ltd and the Energy Efficiency and Conservation Authority v Franklin District Council A148/2005*. This decision related to a resource consent application to establish a wind farm on the Awhitu Peninsula, south of Auckland. The Court gave considerable weight to the positive effects of renewable energy in its consideration of the decision and also found support for the renewable energy project in its general assessment of Part II of the RMA. The Court also identified the benefits to be derived from renewable energy to include:

- Security of supply,
- Reduction in greenhouse gas emissions
- Reduction in dependence on the national grid
- Reduction in transmission losses
- Reliability
- Development benefits
- Contribution to the renewable energy target.

Development of further renewable energy projects is an essential part of New Zealand's greenhouse gas emission controls and achievement of secure energy supply for the country. HDL's Project is a renewable energy proposal and assists in meeting the national targets as regards climate change effects.

1.6.4 West Coast Regional Renewable Energy Assessment 2008.

The Energy Efficiency and Conservation Authority (EECA) has implemented a program of Renewable Energy Assessments to assist Councils with their policy and plan reviews and their new infrastructure responsibilities for renewable energy under the RMA.

EECA appointed Sinclair Knight Merz (SKM) to identify and assess renewable energy potential within each region of New Zealand and advise Councils on their roles in realising this potential. The Renewable Energy Assessment undertaken for the West Coast region was released in August this year.

The reports states that the West Coast region endures up to 50% transmission losses at peak times from power delivered from the Waitaki hydro system. This has an impact on the coast of power on the West Coast and presents a risk to the security of its power supply if transmission problems occur along the route. The report states that greater uptake of renewable energy could allow the West Coast to:

- Improve the availability and stability of its power supply,
- Support and stimulate local economic activity,
- In part, address concerns over rising power prices. (It was noted in the report that electricity prices on the West Coast are one of the highest in the country with retail prices having

increased between 15% and 20% since 2006 to date – being 15 February 2008).

The Renewable Energy Assessment also stated that apart from hydro the West Coast region has limited renewable energy potential from other sources:

- About 12GWh per year of electrical energy could be derived from municipal solid waste combustion and 10GWh per year from woody biomass, However, this is unlikely to be economical;
- Limited potential for commercial wind power generation due to low wind power densities;
- Limited potential for commercial wave power due to ocean bathymetry and coastal terrain;
- No potential for power generation from geothermal sources;
- Very limited tidal energy potential.

Based on this information, hydro generation such as proposed by the present application is likely to be the only viable renewable energy option for the West Coast.

1.7 Other Required Approvals

The applicant will require building consents from the BDC for the structures and buildings associated with the Project. Currently the Otago Regional Council is responsible for issuing building consents for the proposed dams, while BDC is responsible for issuing building consents for the remaining aspects of the proposal.

The surface components of the Project located on the Stockton Plateau are intended to be on land owned by the applicant. HDL is in the process of negotiating a land swap with DoC for the Project area that is currently DoC stewardship land. Should this not proceed, then concessions from DoC will be required to enable works to be carried out on land administered by the Department.

The outfall pipeline from the Granity power station will be micro-tunneled, from below the Granity power station to the point of discharge, some 600m offshore. This will necessitate passing beneath crown land in the form of railway land, the railway line, state highway, land owned by the Northern Buller Communities Ltd (Lyric Theatre area) and BDC legal road.

Up-grade of the existing access from the state highway into the Granity construction site is required. Discussions have occurred with New Zealand Transport Agency (NZTA – formerly Transit New Zealand) regarding their requirements. HDL have been advised that an easement will be required for occupation of the pipeline beneath the state highway.

Activities within crown land in the form of railway land extend to:

- Formation of a temporary level crossing over the Stillwater to Ngakawau railway line;
- The construction site at Granity, required for the construction of the Granity tunnel, power station and ocean outfall (which also extends into SENZ land);
- The outfall micro tunnel jacking station within the Granity construction site; and
- The ocean outfall pipeline beneath railway land and the Stillwater to Ngakawau railway line.

As regards railway land, a 'Licence to Occupy" will be required from Ontrack for temporary occupation of railway land in the form of the Granity construction yard and the Jacking Station. Deeds of Grant will be required for the ocean outfall pipeline and the formation and use of the level crossing. These are standard requirements and ensure any services are installed in accordance with Ontrack specifications, as well as securing the necessary property rights for occupation of railway

land. A “Permit to Enter” will also be required from Ontrack's local area manager to ensure safety issues are adequately addressed.

1.8 Interception of Acid Mine Drainage (AMD)

The waterways draining from the Stockton Plateau do not support diverse or abundant aquatic ecological values, with very limited significant macro-invertebrate, plant or fish species identified in studies conducted to date. This paucity in diversity and value has been attributed to coal mining activity, resulting in highly acidic and conductive water and in some cases smothering of habitat by precipitated metal hydroxides and/or sediments.

Environmental effects of coal mining if not appropriately managed include chemical effects due to the accelerated oxidization of the disturbed coal measures, referred to as Acid Mine Drainage (AMD), and the smothering effects of the deposition of suspended silts and coal fines mobilized during mining operations. AMD affected water is characterized by depressed pH and dissolved heavy metal concentrations that are potentially ecotoxic in freshwater receiving waters. The smothering effect of quantities of suspended silts and coal fines discharged from active mining also has adverse effects on benthic invertebrates. The quantities of suspended material significantly decrease on mine closure and for the historic (closed) mines, sediment loadings are generally low, similar to undisturbed catchments.

HDL's Project will capture approximately 95% of the tributaries of the Ngakawau River that are affected by AMD. The AMD affected water will be diluted within the Project's reservoirs by less contaminated runoff during storm events so that the diluted flows can be discharged into the ocean environment without any adverse effects.

1.9 Consenting Strategy

1.9.1 The Best Practicable Hydro Option

The attached maps and images detailing the hydro scheme are indicative only, as the final configuration of the Project is dependent on detailed survey and geotechnical work. Changes that can be expected in final design are the positioning of surface and subsurface components to accommodate local ground conditions. The changes are not expected to significantly alter the scale of the components or their environmental effects.

Development of comprehensive engineering designs at the outset of a project is not feasible where the Project is one of considerable scale and complexity. In these circumstances it is an accepted approach to detail the framework and/or envelope of environmental standards to enable full assessment of all the environmental effects. This approach has been adopted for the present application. The 'Best Practicable Option' for the hydro development has been identified and developed to the stage where the effects on the environment can be fully described and assessed. On grant of consent, the applicant anticipates that final technical and engineering designs would be forwarded to the respective consent authorities.

1.9.2 Configuration of the Scheme

The hydro scheme is based around a core scheme which covers the main water collection, hydro-electric power and outfall infrastructure, as shown in **plan C-000**. Included within the scheme design are a number of diversions which will divert relatively small volumes of water. These diversions have little hydro potential but will contribute to the environmental benefits of the scheme. The core scheme can be built with or without these diversions.

The consent applications and AEE covers the core components and diversions listed below but the decision to build all the diversions will be dictated by funding.

The core components of the scheme are:

- Mt William impoundment reservoir
- Mt William reservoir – Weka reservoir transfer conduit (Stockton Tunnel)
- Weka penstock and power station
- Weka impoundment reservoir
- Mangatini Stream weir and diversion conduit
- Weka reservoir – Granity power station transfer conduit (Granity tunnel)
- Granity penstock and power station
- Granity ocean outfall

The diversions that will proceed if funding is available include:

- ***Mine Creek diversion weir*** – This involves diversion of the headwaters of Mine Creek by means of a tunnel. These headwaters are significantly impacted by historic mining activity. The additional flows into the Weka reservoir will not be large but will enable removal of a significant source of AMD leachate.
- ***Darcy Stream diversion weir*** – This involves intercepting the headwaters of Darcy Stream at three locations. These headwaters are impacted by historic mining activity in the Mt William area. Darcy stream is a tributary of St Patrick Stream but will not be captured by the scheme as it enters St Patrick Stream downstream of the Mt William reservoir. The additional flows into the Mt William reservoir will be minimal but will enable removal of a significant source of AMD leachate.
- ***T35 interception works*** – AMD leaches from the historic New Mine, McCabe's Mine and Fly Creek Mine into T35 Stream. T35 Stream joins the St Patrick Stream below the Mt William dam and hence will not be captured by the scheme but will be useful in maintaining low flows in the St Patrick Stream, down stream of the dam. The Project allows for the capture of some of the tributaries of T35 via drop shafts into the Stockton Tunnel, but the capture of all AMD is unlikely to be practical without disturbing land within the adjoining ecological area. The importance and practicalities of complete capture will be assessed during final design and the balance of effects discussed with DoC. A variation to the consents will be sought if it is agreed that full capture is desirable.
- ***Diversion of the Mangatini Sump*** – SENZ is building the Mangatini Sump to capture and treat water from current mining activities in the Mangatini catchment prior to treated water being discharged back into the Mangatini Stream. The sump outflow will be captured by the Project at the Mangatini weir. However, power generation can be increased if the Mangatini sump outflow is directed to the tunnel above the Weka power station.
- ***Granity Stream*** – The Granity tunnel will include ventilation shafts and these could be positioned to capture AMD affected waterways within the Granity catchment (Miller and Granity Streams).

Further, the scheme has been designed for the possible future addition of St Patrick's reservoir. This would require the refurbishment of the existing structure, the construction of a penstock from the dam to Mt William reservoir and the construction of a third power station above the Mt William reservoir. This may increase scheme power generation by around 3-7MW. To be economic, this would also require the diversion of Plover Stream and Fly Creek headwaters to the St Patrick dam. These works have not been included in this application as the refurbishment and use of the dam to

treat mine water from the proposed Cypress Mine has been consented by SENZ. HDL may seek consents for this work as an extension of the Project at the closure of Cypress Mine (c 2025).

2 Environmental Context

The environmental context for the Project involves several important considerations, these are outlined as follows:

2.1 Brunner Coal Measures

The Ngakawau catchment area is approximately 20,500 hectares which includes approximately 5,300 hectares (26%) exposed Brunner Coal Measures (BCM). BCM's are characterised by high concentrations of sulphur which can result in acid rock drainage, which in turn lowers pH enabling the solubilisation of heavy metals such as aluminium, arsenic, copper, lead and zinc. The acid and heavy metals released into surface waters can cause adverse effects on aquatic life either by direct toxic response, contact with acidic water or by removal of habitat due to metal precipitation, in particular iron flocs.

On the Stockton Plateau, streams draining from undisturbed BCM areas have naturally elevated acidity due to the lack of buffering from the poor vegetated surface and thin soil profile. Historic and contemporary mining activities have exacerbated the situation by disturbing BCMs and creating conditions in which AMD can be generated.

As a result of mining activities AMD, acid rock drainage and organic acid (derived from rotting vegetation) have been leaching into the two main sub-catchments on the Stockton Plateau, being Mangatini and St Patrick Streams. As such these streams have depressed pH levels and carry elevated loads of iron, aluminium and sulphate into the Ngakawau river.

2.2 Coal Mining Affects

There has been a long history of underground and open cut coal mining activity on the Stockton Plateau dating from the 1900s. This history of mining activities has affected the Ngakawau River system by increasing the acidity of runoff to the extent that some sections of the Ngakawau catchment are essentially devoid of life. AMD affected watercourses is a legacy of the historical mining activities which, without treatment, will continue to affect the Ngakawau River system for at least another 50 years or more.

Some of the historical mine sites which are continuing to leach AMD into the tributaries of the Ngakawau River, lie outside SENZ's CML and can be regarded as orphan contaminated sites, responsibility for which falls on the Crown and the local community. AMD from the historic mines on Mt William and the Stockton Plateau leach into St Patrick Stream, Mangatini Stream and Mine Creek which all drain from the Plateau to the Ngakawau River. AMD from the 3rd West Extended block of Millerton Mine, on the escarpment above Granity, leach into the Granity Stream and AMD from the Rockies Mine, also on the escarpment above Granity, leaches into the small streams that drain the escarpment. In the northern part of the Ngakawau catchment the historic Charming Creek Mine is the only source of AMD. This leaches into Charming Creek which flows into the lower reaches of the Ngakawau River.

SENZ currently mines the Stockton Mine and holds resource consents for taking, diverting and discharging water from the streams that drain the coal mining licence area. The consents establish requirements for water quality discharging from the licence area.

HDL's proposal is to divert AMD affected water from all the areas discussed above with the exception of:

- AMD affected water from a small area adjacent to the Ngakawau Ecological boundary that discharges to the T35 Stream and cannot be collected without works within the Ecological Area.
- AMD affected water discharging down the escarpment from Rockies Mine
- AMD affected water discharging into Charming Creek

Unfortunately it is physically impossible for the Project to capture AMD affected water from Charming Creek Mine or Rockies Mines. AMD leachate into these watercourses is expected to continue until the effects diminish with time. In total, the areas that cannot be collected by the current application represent less than 5% of the total AMD sources. The flows from the sources that cannot be captured should not prevent full recovery of the river systems downstream of the Project diversions within several years of commissioning the Project.

2.3 Ngakawau Ecological Area

The Ngakawau Ecological Area is adjacent to the proposed footprint of the Project, with the majority of the Project footprint falling within DoC stewardship land. HDL has submitted an application to DoC to enable the Project footprint to be swapped with a parcel of coastal forest which is of greater value to the Conservation Estate. It is expected that the land swap details will be agreed in principle shortly.

In respect of the ecological values within the development footprint, the history of the formation of the Ngakawau Ecological Area is noteworthy. The original ecological area boundary was proposed in 1974 and included the area planned for the Project. Subsequent to the gazettal process proceeding, the potential for a power scheme in the locality was identified. As a result, the boundary for the then proposed Ngakawau Ecological Area was subsequently amended to accommodate future hydro development. This was done on the basis that the area had negligible ecological value and/or values that were already well represented and under protection. Arguably this has consequences for the present resource consent application, as it supports the view that the ecological values within the proposed hydro footprint are not significant.

3 Site Description and Land Ownership

3.1 Location of Proposal

The Stockton Plateau is located on the West Coast of the South Island approximately 30km northeast of Westport. The towns of Granity, Ngakawau and Hector are located on the coastal plain below the Stockton escarpment. The Stockton Plateau reaches approximately 1000m above sea level and drains to the north into the Ngakawau River, via tributaries including St Patrick Stream and Mangatini Stream. The location of the project and land ownership are shown in **plan C-000**.

The town of Millerton is situated on the edge of the escarpment just below the Plateau. The closest aspect of the Project to Millerton is the Weka reservoir, which is approximately 2km above the town. No aspect of the proposal is visible from the township, which is physically separated from the Project by Mine Creek gully.

The majority of the infrastructure associated with the Project is situated on the Stockton Plateau, sandwiched between the Ngakawau Ecological boundary and SENZ's CML. Essentially the proposal creates a water barrier between the parts of the Ngakawau River catchment affected by mining activities and the pristine Ngakawau Ecological Area.

The two dam sites are to be located on tributaries of the Ngakawau River, being St Patrick Stream (Mt William dam) and Weka Creek (Weka dam). Weka dam is situated near the mouth of a gorge on Weka Creek. Weka and Sandy Creeks will flow into the proposed Weka reservoir, along with flows diverted from Upper Mine Creek and Mangatini Stream. The reservoir formed by the Weka dam will inundate an area of approximately 28 hectares, including part of the main haul road to Stockton mine, which will be relocated to skirt the area of inundation.

The Mt William dam is located on St Patrick Stream, to the north of Mt William and Fly Creek access road. Four streams being T31, Fly, Plover and St Patrick Streams will flow into the Mt William reservoir and Darcy Stream will be diverted via a tunnel into the storage reservoir. The reservoir formed by Mt William dam will inundate an area of approximately 50 hectares. The inundation area will also flood part of the Mt William access road, which will be relocated along the crest of the dam.

The Project is described in section 5 of this application, but in brief, the scheme incorporates 2 power stations referred to as the Granity power station (PS1 at Granity) and the Weka power station (PS2 at the head of Weka reservoir) and two storage reservoirs - Mt William and Weka. The Mt William reservoir is linked to the Weka power station by means of a tunnel approximately 3850m long (Stockton Tunnel), while the Weka reservoir is connected to the Granity power station by means of a tunnel approximately 4900m long (Granity Tunnel).

The Granity tunnel will traverse under SENZ land some 200m beneath the MAPPS area, from a drop shaft beneath the Weka reservoir to an outlet portal on DoC land, in the vicinity of the Granity museum. The Granity power station will be contained within the tunnel outlet. Tailwater from the Granity power station will then be conveyed by means of an underground pipeline and discharged by means of an outfall diffuser located some 600m offshore, in an approximate line with the Lyric Theatre at Granity.

3.2 Land Ownership

The land area within the Project footprint is owned and/or administered by the following:

- DoC
- BDC
- LINZ
- SENZ
- NZTA
- Ontrack
- Northern Buller Community Society Incorporated

The majority of the land on which the Project is located will be owned by HDL if the proposed land swap with DoC is approved. The land exchange under negotiation is for 110.59 hectares for all the components of the Project that are on land administered by DoC. Access will also be requested from the DoC to utilise the existing access road from the bath-house to Mt William (Fly creek access road).

Access across or under SENZ's coal mining licence and minerals permit is also required for the following aspects of the Project:

- Mt William reservoir will inundate the northern corner of MP 41 515.
- The Stockton tunnel will run beneath the ACML, in the vicinity of Mangatini Stream.
- Connection of the spur line from the Weka power station to SENZ's 33kV transmission line.
- Realignment of the 2-5 haul road Tin Town corner.
- Disposal of silt from the silt traps at Weka and Mt William reservoirs to SENZ's waste dump sites within the CML.
- Construction of the Granity tunnel beneath SENZ's MAPPS area, to an outlet portal on DoC land, in the vicinity of the Granity museum.
- Use of SENZ land at Granity for the construction and ongoing maintenance of the Granity tunnel, power station, emergency outfall and ocean outfall.

Discussions with SENZ have confirmed that the construction and operation of the Project will not adversely affect the operation of Stockton Mine.

The only other landowners directly affected by the Project are: Ontrack, LINZ, NZTA, the Northern Buller Communities Society Incorporated and BDC. All these parties have been approached and their respective requirements discussed.

On grant of consent, the necessary permission from all of these landowners for temporary and/or permanent occupation will be finalised.

The proposed land tenure within the Project area is detailed in **plans C-008a, b and c**.

4 Existing Environment

4.1 Land-use

The predominant land-use on the Stockton Plateau is coal mining, with the Stockton open cut mine having been operational on the Plateau since the 1950's. Historically coal mining has had a long association with the Plateau, with coal mining activities having been undertaken in the general area since 1872. There are no other significant land-uses on the Stockton Plateau as public access to the area is restricted due to current mining activities. The only avenue for general public to access the Project site is through the organised tours of the Stockton mine undertaken by Outwest Tours and via the Millerton-Repo Basin walking track.

4.2 Archaeological Context

HDL commissioned Katharine Watson to undertake an archaeological assessment of the Project site, with this report attached as **Appendix A**. The way points recorded in the survey are shown as green marks on **plan C-007**. This archaeological assessment included a survey which focused on four known areas of archaeological value within the general area of the Project, these being the formation of an electric loco line, Tintown, Fly creek workings and the Granity coal bins site. The following incorporates extracts from the archaeological report. (The New Zealand Archaeological Association data base number for each of these sites has been shown in brackets).

The Electric Loco Line Formation (L28/20) begins at the top of the Stockton Incline. It is estimated that construction of the electric loco line commenced in late 1906 or early 1907. This was the first electric railway line built in New Zealand. The locomotives on the line weighed 20 tons with the tubs they pulled (being up to 20), having a capacity of 30cwt. Power for the line was supplied by a powerhouse at Ngakawau through an overhead wire. The electric loco line was extended twice during the 1910s but ceased operation in 1953, when the aerial cable way opened.

The archaeological survey established that while much of the loco line formation remains intact, it has suffered damage with the passage of time and the expansion of Stockton Mine, particularly the widening of the Stockton haul road. The proposed realignment of the haul road adjacent to Weka reservoir is likely to be able to be routed through the sections of the formation that have previously been destroyed as shown in **plan C-007**.

The loco line is the only archaeological site listed in the Buller District Plan.

Tintown (L28/32) was a settlement also know as Darlington. The report states that it is not clear when the settlement of Darlington developed, but the men who lived there were working on the electric loco line, thus it was assumed that people were living there by 1907. Darlington became known as Tintown, due to the settlement consisting of fifteen working men's huts, most of which were clad in tin.

The Weka reservoir will flood the site of Tintown as shown in **plan C-007**. The archaeological survey of the site established that little remains of Tintown, with this site having suffered more damage than the other sites surveyed. As with the electric loco line formation, the township has been significantly disturbed during the widening of the Stockton Mine haul road. Only a small number of features were located during survey of the area.

The Fly Creek Workings (L29/50) – mining is estimated to have began in the early 1920s, with this section of the mine having closed in 1970. For most of its life, the mine was worked as an

underground mine but was working as a hydro mine from 1953. The archaeological survey noted, among other items, the presence of coal bins, associated fluming, part of the loco line and bulldozed bridge foundations. None of these artifacts will be affected by the Project, other than a small section of what was thought to be the remnants of the historic loco line.

The Granity Bins (L28/33) were built in the 1890s to hold the coal transported down the Millerton incline, prior to the coal being loaded on the railway and taken to Westport. The substantial coal bins were located on flat land between the railway line and the base of the hills (at the bottom of the Millerton incline). The Granity bins became defunct after the construction of the aerial ropeway, which took coal to the Ngakawau coal handling facility.

The Granity bins are located within the Project's Granity construction site. The archaeological survey established that the Granity coal bins were bulldozed in the early part of 2008. The report concluded that given the degree of disturbance, it was considered unlikely that any subsurface archaeological material existed.

Note, the Granity bin site is the only site that pre-dates 1900 and therefore falls within the ambit of the Historic Places Act 1993. Normally any construction activity within such an archaeological site would require an authority to disturb from the Historic Places Trust but the archaeologist expressed the opinion that this is unlikely to be required here given the extent of disturbance that has already taken place.

4.3 Site Geology and Regional Seismicity

HDL commissioned URS New Zealand Limited to undertake preliminary assessments and concept designs for the proposed Weka and Mt William dams. This investigation included a geological and geotechnical assessment. The URS report is attached as **Appendix B**. The following are extracts from that report, summarising the geological environment of the proposed site.

The geology of Stockton Plateau comprises uplifted and faulted BCM's and Kaiata Formation mudstone with local windows of underlying basement rocks. The Kongahu Fault is responsible for most of the uplift of the Stockton Plateau, which offsets the base of the Tertiary rocks by over 2000 metres, downthrown to the west. North-northeast striking normal and reverse faults and northwest-trending strike slip faults are also exposed over the Plateau, including the Mt William Fault adjacent to the proposed Mt. William dam.

BCM overlies basement and comprises basal conglomerate, quartzose sandstone, mudstone and coal seams. The coal seams are extensively mined at Solid Energy's Stockton Opencast Mine. Most of the Weka reservoir and some of the Mt William reservoir are underlain by sandstone and conglomerate of the BCM. Coal seams are not known to be present beneath either dam or reservoir sites. Sandstone of the BCM weather to grey colour, and the infertile siliceous soil supports only stunted vegetation.

Kaiata Formation mudstone occurs locally along the upthrown side of the Mt William Fault, and a faulted outcrop was mapped east of the proposed Mt William dam site. Kaiata mudstone was not found within the Weka reservoir.

The geological profile described above produces surface water flows which have a natural chemical composition that is often outside the envelope of accepted makeup, as found in much of the rest of New Zealand. The most notable effects of this geology is a depressed pH (often <4.5), slightly

elevated metals levels (Al, Zn) and little, if any, buffering alkalinity.

4.3.1 Weka Dam

The Weka dam, shown in **plan C-004,** is located near the entrance to Weka Gorge, an approximately 100m wide and 40m deep gorge eroded into granite**.** Figure 1 looks across the future reservoir to the Weka Gorge. The gorge is steep sided and the stream channel is 5m wide and 1m deep. Downstream of the proposed dam site, the stream loses elevation, quickly dropping though a series of small waterfalls. The area upstream of the gorge is characterised by relatively flat gradients and remnant alluvial terraces up to 4m high, swampy ground and surface outcrops of BCM. The proposed Weka dam is underlain directly by moderately strong to strong granite which outcrops over most of the footprint.

Figure 1 View across Weka Reservoir site

The nearest fault to Weka dam is the Millerton Fault, with the main trace located approximately 1.2km south of the proposed Weka dam site as shown on **plan C-004**. A spay of the fault reaches to within 1.1km southwest of the proposed dam site. The Millerton Fault is one of the many faults known to displace the BCM but that are not considered active.

URS concludes that the basal BCM and granite at the Weka site are considered suitable as foundation material for a Roller Compacted Concrete (RCC) dam, with a small amount of stripping required to achieve a suitable foundation surface. It was also determined that it appeared that the granite available within the reservoir footprint will be suitable to provide the appropriate aggregate material needed for a RCC dam.

4.3.2 Mt William Dam

The Mt William dam site, shown in **plan C-002** is located on St Patrick Stream, some 200m downstream of the Mt William access road bridge. Figure 2 looks across the Mt William Reservoir site. The St Patrick Stream occupies a channel approximately 15m wide and 5m deep at the main dam site. Upstream of the dam centre line, the stream meanders forming a small flood plane with ponds formed within an abandoned former stream channel, 1-2m above the current stream channel. The river has a flat gradient below the site and drops in elevation by about 5m through the dam footprint. The reservoir comprises the footwall block of the Mt William fault system and is mostly granite with higher topography capped by BCM.

Figure 2 View across Mt William Reservoir site

The proposed dam site is underlain directly by moderately strong to strong granite which outcrops across St Patrick Stream, and granite with soil and vegetation cover, as well as BCM. Part of the right abutment will be underlain by BCM sandstone and will reach within 10m vertically of an elevated coal outcrop.

A splay of the Mt William Fault passes close to the right abutment of the dam and to the southwest of the dam as shown in **plan C-002**.

Historic underground mining of coal seams around and above the southern perimeter of the reservoir area has resulted in collapse of the overlying sandstone. This does not affect the integrity of the reservoir or the area of inundation.

As with the Weka dam site, URS concludes that the basal BCM and granite at the Mt William site are suitable as foundation material for a RCC dam, with a small amount of stripping required to achieve a suitable foundation surface. It was also determined that it appears that the granite available within the reservoir footprint will be suitable to provide the appropriate aggregate material needed for a RCC dam.

4.4 Climate/Climate Change

The Stockton area has a moist, temperate climate with a prevailing north-westerly airflow. As the prevailing wind rises over the coastal ranges a strong condensation effect occurs resulting in significant rainfall. At sea level in Ngakawau township the mean annual rainfall is 2.7m (1979 – 1982), however, a strong rainfall-altitude gradient results in mean annual rainfall on the Plateau of up to 8m, ensuring it is one of the wettest places in New Zealand.

According to the International Panel on Climate Change it is likely that rainfall will increase with the rain concentrated in shorter periods, thereby increasing the chances of flooding. However, this also raises the possibility of longer dry periods between periods of rainfall.

The Ministry for the Environment provides guidelines – (C*limate Change Effects and Impacts Assessment: A guidance manual for Local Government in New Zealand, 2004*), on the likely changes in rainfall conditions over the next 30 and 70 years. This document indicates that by 2030 the pattern for seasonal rainfall around the Project site will be for a 0% - 5% increase in seasonal rainfall for Spring to Autumn and for a 5% - 10% increase in winter. What is not indicated is the relative distribution of the additional rainfall throughout each season.

This predicted pattern of increased rainfall should benefit the Project as it potentially enables increased generation from the same Project footprint. The more extreme patterns of rainfall will need to be managed. Drought will be covered by storage and throttling output below the base load. Periods of intense rainfall will be covered by storage and increasing power production above the base load. The final design of the Project will focus on maximizing storage volumes, including any sumps left at mine closure, and maximizing the hydraulic capacity to interconnect these reservoirs and sumps.

4.5 Hydrology

HDL commissioned URS New Zealand Limited to undertake an assessment of the existing hydrology and water quality data for the Ngakawau River and tributaries affected by the hydro power proposal. Two reports have been prepared, the first concerned with flow volumes, the second looking at water quality in more detail, attached as **Appendices C & K**. The following are extracts from **Appendix C** summarising the existing hydrological environment of the proposed site. The effects of the Project on water quality are discussed in section 8.9.

The Ngakawau Catchment extends over 197km². In general the Ngakawau River flows from east to west, discharging to the Tasman Sea at Hector township. The majority (57%) of the Ngakawau River catchment is located on the true left (southern side) of the main drainage channel. The geology and some geomorphic features, such as the Ngakawau gorge, dictate the overall drainage pattern. On the dip slope of the Stockton Plateau a rectilinear dendritic drainage pattern manifests under the influence of intersecting fault linaments and this is clearly represented on topographical maps or aerial photos of the area, as can be seen in **plan C-000**.

The second order tributaries of the Ngakawau River have been identified as Mangatini Stream, Charming Creek and St Patrick Stream. The Mangatini and St Patrick Streams drain the southern

area of the catchments and Charming Creek drains the northern area. A large number of first order streams are present which drain the remainder of the catchment, one of these being Mine Creek. Catchments which will be directly affected by the Project are Mine Creek, Mangatini and St Patrick Streams. Table 1 lists the catchment areas and stream lengths. Figure 3 shows the sub-catchments captured by the scheme, with sub-catchment areas summarised in Table 2.

Name	Catchment Area (m^2)	Main Stream Length (km)	Natural Outlet
Ngakawau River	186.0	27.0	Sea (Hector)
St Patrick Stream	43.7	15.1	Ngakawau
Mangatini Stream	20.9	11.5	Ngakawau
Mine Creek	7.6	8.7	Ngakawau

Table 1 Catchments affected by the Project

Figure 3 Sub-catchments captured by the Project

Catchment name(s)	Area (km^2)
St Patrick Dam collection area	9.52
Additional St Patrick collection area (including Darcy)	6.54
Additional parts of T35 Stream	0.83
Weka Dam collection area (including Mine Creek)	4.64
Mangatini Stream Weir intake (including AJ Stream)	10.06
TOTAL	**31.7**

Table 2 Sub-catchment areas captured by the Project

HDL intends collecting flows from St Patrick Stream catchment, Mangatini Stream catchment and Mine Creek catchment. This totals approximately 31km² of catchment, around 17% of the total catchment area of the Ngakawau River. The drainage of the catchments on the Stockton Plateau will effectively be cut off by the impoundment reservoirs along a line roughly parallel to the land ownership boundary between the CML and the Ngakawau Ecological Area.

4.6 Water Quality and Freshwater Ecology

HDL commissioned GHD to undertake a review of the extensive literature on the aquatic ecology of the watercourses that are potentially affected by the Project. On the basis of this information, GHD then assessed the impacts of the Project on the aquatic ecology of the various sub-catchments. This report is attached as **Appendix D**. The following are extracts taken from that report.

Streams draining the Stockton Plateau have high flows and frequent flood events. The density of stream channels is high, the vegetation is sparse and soil depths over basement rock are minimal. Most of the waterways draining the Plateau into the Ngakawau River are affected by coal mining related influences through three mechanisms:

- Direct physiological effects through low pH and high metal concentrations;
- Smothering of habitat by precipitated metal hydroxides or coal fines; and
- Affecting in-stream food supplies and predator-prey relationships.

The report notes that although the water draining the Plateau is naturally acidic, historical mining activity has inflated the natural acidity through exposing underlying pyritic bedrock to oxidation, with a by-product of this oxidation process being hydrogen sulphide.

Other surveys of West Coast streams have found benthic macro-invertebrates to be relatively tolerant of lower pH conditions but that low pH levels have the potential to increase the solubilisation of metals (namely zinc, lead and aluminium). The poor nature of the macro-invertebrate communities present in mine impacted water appears to be the result of elevated concentration of trace metals.

Several studies have been undertaken of the macro-invertebrate communities of the Ngakawau River catchment and associated tributaries over the years and generally the invertebrate communities in these mine-affected streams have been dominated by chironomids, oligochaetes and ceretopogonid midges, reflective of relatively poor water quality, low pH, elevated concentration of metal and variations in flow regimes.

Freshwater fish distributions appear to have been severely reduced by acidic mine drainage. There are also physical barriers to migratory fish populations in the Ngakawau catchment such as the waterfall at the confluence with the Mangatini Stream and the steep topography of the catchment in

general. Further, regular flooding is likely to have contributed to the absence of migratory fish.

On the basis of the reviewed existing aquatic ecology information, the GHD report describes the affected Ngakawau River sub-catchments as follows:

4.6.1 Mangatini Stream/Sandy Creek/Weka Creek Sub-Catchment

The small catchments of Sandy and Weka Creeks flow into the Mangatini Stream therefore are discussed together. The Mangatini Stream sub-catchment comprises tributaries draining from the central Stockton Plateau to the confluence with the Ngakawau River at the Mangatini Falls. Land cover in the Mangatini sub-catchment is generally highly modified by mining activity.

The water quality in the Mangatini Stream is reported as generally poor. A number of water quality monitoring points exist on the Stockton Plateau area. Data from these monitoring points was used by URS for their geochemical modeling assessment report and utilised in the GHD report for establishing water quality within the Mangatini Stream.

Comparison of untreated and treated water quality in the Upper Mangatini shows that median pH is recorded as 2.8 (monitoring point S14C) rising to 5.6 (monitoring point S14B) after treatment. Reduction in concentrations of dissolved aluminium, iron, copper and zinc are also noted after treatment in the Upper Mangatini. (ANZECC 2000 guidelines for the protection of aquatic ecosystems recommended pH range is 6.5-9).

In previous studies undertaken on the Mangatini Stream depauperate macro-invertebrate communities were found to exist in the stream, probably resulting from low pH, elevated concentrations of metals and variation in flow regimes.

The invertebrate communities in the mine-affected Sandy Creek and Weka Creek are dominated by chironomids, oligochaetes and ceretopogonid midges, again reflective of the relatively poor water quality, low pH, sedimentation and variable flow of these waterways.

Freshwater fish distributions have been severely reduced by the historical acidification of the Mangatini Stream. Poor water quality has formed a “chemical barrier” to fish migration. Further, the Mangatini waterfalls at the confluence with the Ngakawau River presents a physical barrier to migratory fish populations, as does the steep topography of the sub-catchment.

The GHD report concludes that from the existing data available there are no macro-invertebrate, fish or aquatic fauna species of significant value within the Mangatini Stream, Sandy and Weka creek sub-catchment. However, the report noted that a rare moss *Blindia lewinskyae* was found in an earlier survey of Weka Creek but its specific location is unknown. The report states this moss species is not threatened but is listed as it is naturally uncommon. It is found only on the West Coast of New Zealand.

4.6.2 Mine Creek Sub-Catchment

The tributaries of Mine Creek collect water from the historic Millerton underground mine in the northern part of the Stockton Plateau. Water quality data for the upper reaches of Mine Creek (monitoring point UN1) indicates elevated concentrations of dissolved aluminium, iron, zinc and nickel. The average pH level is 3.1, again below the recommended ANZECC guidelines.

Previous surveys on Mine Creek indicate that the macro-invertebrate community composition is similar to that of the Mangatini Stream, being dominated by chironomids, oligochaetes and

ceretopogonid midges, reflective of the relatively poor water quality, low pH, sedimentation and variable flow of this waterway. It has also been observed that no algae were present on the west branch of Mine Creek, while other sites on Mine creek supported several taxa of algae.

With the exception of one fish record from 1964, all previous studies in Mine Creek have observed no fish species present.

The GHD report concludes that from the existing data available, there are no macro-invertebrate or fish species of significant value within this sub-catchment.

4.6.3 St Patrick Stream Sub-Catchment

The St Patrick Stream sub-catchment includes water draining from the southern part of the Stockton Plateau and includes tributaries of Fly Creek, Plover Stream, T31 and T35 Streams. The existing St Patrick dam is noted as non-operational (upstream of proposed Mt William reservoir). Previous water quality assessments of St Patrick Stream at St Patrick Stream bridge have established average pH levels of 3.3 (+/-0.3).

The acidity of these water means they have increased potential to solubilise metals. The report states that St Patrick Stream is known to contain elevated concentrations of aluminium, lead, zinc and copper that, in combination with low alkalinity and hardness, does not meet the USEPA (1986) chronic criteria for the protection of aquatic ecosystems.

There have been several studies undertaken in the upper St Patrick Stream sub-catchment, which indicate that this area has high water quality and habitat containing a diverse range of fauna. The upper St Patrick Stream is not affected by AMD. However, the lower St Patrick Stream and Plover Stream macro-invertebrate communities are characteristic of poor water quality. Macro-invertebrate abundance and diversity is low and a low percentage of the more environmentally sensitive species support a poor macro-invertebrate community. The report notes that both these streams are influenced by acid mine runoff, characterised by low pH and elevated levels of some metals, often over the recommended ANZECC guideline values.

Previous fish surveys have found some freshwater crayfish (koura) present but no other fish species have been observed.

The GHD report concludes that there are no macro-invertebrate or fish species of significant value within St Patrick Stream sub-catchment. However there is a rare aquatic moss, *Blindia lewinskyae* present in mid St Patrick Stream (above the existing St Patrick's dam) and in T35 Stream; these reaches are not within the Project footprint or affected by the Project. This moss is found only on the West Coast of New Zealand. Also present in the upper St Patrick Stream (above the dam) is a rare liverwort, *Allisoniella scottii.* This species is known to be only found in streams flowing from the Tin Range on Stewart Island, and from Mt Euclid in the Paparoa Range.

4.6.4 Ngakawau River

Stream pH in the Ngakawau River is above pH 4 at all sites except for immediately below the Mine Creek confluence. Unlike its tributaries the mayfly *Deleatidium* has been found at all Ngakawau River sites and in relative abundance at the sites opposite or upstream of the Mine Creek confluence. Ostracods, copedpods and chironomid midges have also been found in all Ngakawau River samples at the lower sites but are largely absent from the tributaries. The report states that overall, the macro-invertebrate fauna in the Ngakawau River is considered to be sparse, most likely reflective of a combination of the flood-prone flow regime of the river, coupled with the low pH.

No aquatic bryophytes or algae were observed in previous surveys at any of the Ngakawau River sites except for large growths of filamentous green algae.

From the available information it would seem that the Ngakawau is primarily a koaro river with minimal habitat available for other Galaxiid (whitebait) species such as inanga and banded kokopu. A previous survey noted that long-finned eels and koaro were the only migratory species found above the Ngakawau River Gorge.

No brown trout or rainbow trout have been found in the Ngakawau River system. The report states that the poor fish communities present in the middle and upper reaches of the Ngakawau river are uncommon to other streams and rivers in the area, which are not subject to acid runoff and have no physical barriers to fish migration and support a diverse and abundant fish community.

The GHD report concludes that there are no macro-invertebrate or plant species of significant value within the Ngakawau River. However, the river is used by white-baiters and white-bait numbers in the Ngakawau River have anecdotally increased.

4.7 Terrestrial Flora

The value of the flora within the areas of the conservation estate occupied by the Mangatini Hydro Scheme (precursor to HDL's Project) was assessed in a report prepared by Dr Norton and Dr Roper-Lindsay, commissioned by DoC in 1997, report attached as **Appendix E**.

This report reviewed the boundary and conservation values of a part of the then proposed Ngakawau Ecological Area and focused on a proposed hydro scheme on Weka Creek. This had previously been identified as a potential hydro lake site (covering approximately the same site as HDL's proposed Weka reservoir). The study area encompassed a considerably wider area than the actual lake footprint. The following incorporates extracts from this report.

The study area, bounded by Weka creek and Burma Road (Stockton Mine haul road) to the west and Mangatini Stream to the east, comprises a gently sloping plateau, with the main creeks incised into this. The vegetation is predominantly open wirerush-tanglefern rushland with scattered shrubs of manuka and occasional tumingi (*Epacris pauciflora*), and seedlings of various woody species. Scattered through this are plants of *Gahnia rigida.* Small forest remnants and isolated forest trees are present, especially along stream courses and on steep slopes, mainly in the upper part of the study area. Denser Manuka stands are also present along stream courses.

The report states that the presence of isolated forest trees and plants of *Gahnia rigida* and *Phormium cookianum*, both common in fire-induced communities, suggests that the vegetation of the proposed lake area has been induced by fires. Fire has had a major impact on vegetation patterns through the Stockton Plateau, and the study area is no exception. The highest parts of the study area provide habitat for coal measure endemic *Chionochloa juncea,* while the distinctive rocky habitats associated with the gorges and cliffs are habitat for a number of plants including the biographically interesting fern *Sticherus flabellatus*, which appears to be centered on the Mangatini Stream area.

The area of the proposed lake is centered on Weka Creek, comprising the creek bed and tributaries and sloping surfaces above the creek. The proposed dam will be located where Weka Creek enters a small gorge, with the vegetation comprising rimu and mountain beech forest. Given the dam is to be located immediately upstream of the forest, it should not involve any damage to the forest.

The report concluded, that fire induced rushland and shrubland vegetation similar to that present in the proposed lake area is not unique to the locality, being the dominant vegetation type between Burma Road and Mangatini Stream, especially at lower altitudes in the Repo Creek area. Similar vegetation types also occur across the slopes above Millerton. While superficially similar to other rushland and shrubland communities present on coal measures elsewhere in the Ngakawau Ecological District, the plant communities described above are much less floristically diverse.

HDL has extended the footprint of the hydro scheme assessed in this earlier report to that described in this application, and has commissioned Richard Nichol to undertake an assessment of the flora for the extended Project footprint (Mt William), this report attached as **Appendix F**. The following incorporates extracts from this report.

Historical mining in the Mt William area has left a legacy in the form of mining relics, spoil dumps and tracking, as well as AMD and coal fines. The vegetation of the area reflects this history of disturbance, especially along the north-west and northern boundaries of the area.

The report describes nine indigenous vegetation associations and two adventive associations present within the Mt William footprint. The most widespread of these being Manuka shrubland, Mountain Beech-yellow silver-pink forest and *Chionocloa australis* rockland. Together it is estimated that they make up approximately 60-70% of the footprint area. The report goes on to state that two indigenous vegetation communities appear to be induced associations which have established as a result of human interference. The mountain flax association appears to have established preferentially after fire events and the carpet grass (*Chionocloa australis)* gravelfield community may have been induced by past disturbance. Other minor associations range in size from around one hectare upwards.

It is noted, that while most of the associations with more restricted ranges are represented elsewhere in the Ngakawau Ecological District, the *Carpha alpina* gravelfield is an unusual community not encountered elsewhere. This community lies near the northern boundary of the footprint area. The report stated that it was not certain whether this community is a natural one, but its proximity to a similar but more diverse community type on coal measures and the absence of exotic elements within the association would suggest that it was.

The report concluded that no threatened species were found and while some vegetation communities of particular interest were present, most are known to be well represented outside of the proposed Mt William footprint area.

4.8 Terrestrial Fauna

HDL commissioned Wayback Ltd and Wildlife Surveys to undertake an investigation of the terrestrial fauna to be found within the Project footprint. Wayback Ltd and Wildlife Surveys undertook a review of previous surveys undertaken in and around the impact area, this report attached as **Appendix G**. A survey of the application area was also undertaken by them with this report attached as **Appendix H.** The following incorporates extracts from these reports, summarising the terrestrial ecology within the location of the Project.

The reports state that the habitat potentially affected by the Project has primarily been modified through settlement, roading and coal mining processes. Landforms include terraces, gentle and steep slopes and bluffs. The main habitat type present on the elevated Stockton Plateau is Manuka, Tanglefern and rock platform. Other habitats present in the surrounding area are pockets of beech forest, riparian and wetland habitats, interspersed bare rock habitat, and coastal forest. All habitats

found on the Project footprint are represented in the surrounding landscape and in the adjacent Ngakawau Ecological Area.

These habitats support a range of common and threatened native avifauna, reptiles, *Powelliphanta* snails and bats. A total of four threatened birds (Great Spotted Kiwi, Western Weka, Kereru and South Island Fernbird), one threatened lizard (Speckled Skink) and one threatened invertebrate (Koura) was recorded during survey of the Project site.

Other threatened species such as New Zealand Falcon, Long Tailed Cuckoo, Rifleman, Long-Tailed Bat and lizards may also be present but missed because of their low numbers, seasonal presence or cryptic behaviour. Of the threatened fauna species identified on the current survey, low numbers of Western Weka were found throughout all habits from sea level to upland plateau, Kereru were recorded only in coastal-facing forest and shrubland, while Fernbirds were confined to upland Pakahi and shrubland where they were locally common. Two Kiwi (a pair) were heard near the proposed Lake Weka site near the Mangatini Stream.

The reports concluded that low numbers of threatened bird species and individuals (except Fernbirds) are present in the proposed development area and all species are well-represented outside the footprint area. Bats were not detected in the area and it was considered probable that *Powelliphanta* snails were absent from the Project footprint.

Given the high profile of Powelliphanta and the “nationally critical” classification for some of the populations in the area, land snails are discussed separately as follows.

4.8.1 Powelliphanta Land Snails

As part of the terrestrial fauna study, a detailed search for *Powelliphanta* snails was undertaken, with the following noted:

Powelliphanta lignaria 'Millertoni' (discovered in 2003) is known only from one localised site, a 0.5 hectare area on the southern side of Millerton settlement, outside the Project footprint. It is one of New Zealand's rarest *Powelliphanta* and as such is classified as “Nationally Critical”.

Another recently discovered “nationally critical” taxa in the Stockton mine area is *Powelliphanta* 'Mt Augustus', which has a localised distribution about 4km south of the proposed development. Recent extensive surveys for this snail failed to find it outside windswept sub-alpine scrub and herbfields on the skyline ridge near Mt Augustus. *Powelliphanta* 'Mt Augustus' is considered unlikely to be found within the proposed hydro development area due to these survey results and a lack of the snail's specific habitat type.

Powelliphanta 'patrickensis' is relatively widespread, extending from Mt Rochfort in the south to the headwaters of St Patrick Stream in the north, and from the Mt William range in the east to Mt Frederick in the west. The snail occupies a range of scrub and forest habitats, occurring most frequently in coal measure scrub dominated by stunted Manuka, Wire Rush, Tanglefern and Flax. The type locality for *Powelliphanta* 'patrickensis' lies relatively close to the upper part of the proposed development near St Patrick dam but no sign of snails were found in the immediate vicinity of St Patrick dam or north of it during the recent Wayback/Wildlife survey.

From observations of *Powelliphanta* 'patrickensis' habitat elsewhere, it was considered they are unlikely to be found in a tussock and rock platform dominated landscape with little shrub cover. No sign of *Powelliphanta* was found during the Wayback/Wildlife survey in the upper Mangatini

Stream area. There are no known populations of *Powelliphanta* between the headwaters of the Mangatini Stream and the mouth of the Ngakawau River, apart from the sparse population of *Powelliphanta* 'lignaria johnstoni' near the mouth of Mine Creek.

Despite being close to four different populations of *Powelliphanta* snails, the Terrestrial reports concluded that there appear to be no *Powelliphanta* snails within the footprint area of the Project.

4.9 Coastal Marine Environment

HDL commissioned Cawthron Institute to undertake an assessment of the marine environment in the Granity area. The report *Assessment of offshore acid mine drainage effluent disposal,* is attached as **Appendix L**.

The environmental characterization of this review addresses ecological values potentially affected by the discharge of AMD to the marine environment. The focus is on the ecological components potentially directly affected by the discharge, including the benthic infauna, resident fish populations, marine mammals, shellfish, plankton and plant communities. Evaluation of potential effects focuses on the relationship between effluent levels of contaminants and the dilution required to meet relevant water quality guidelines.

Cawthron's report includes the following:

- Summarises the freshwater and marine resources in the Granity area,
- Identifies the key stressors for marine discharge,
- Describes the benefits from bypassing freshwater catchments by the construction of the outfall,
- Provides an assessment of effects to marine resources,
- Makes recommendations for further investigation.

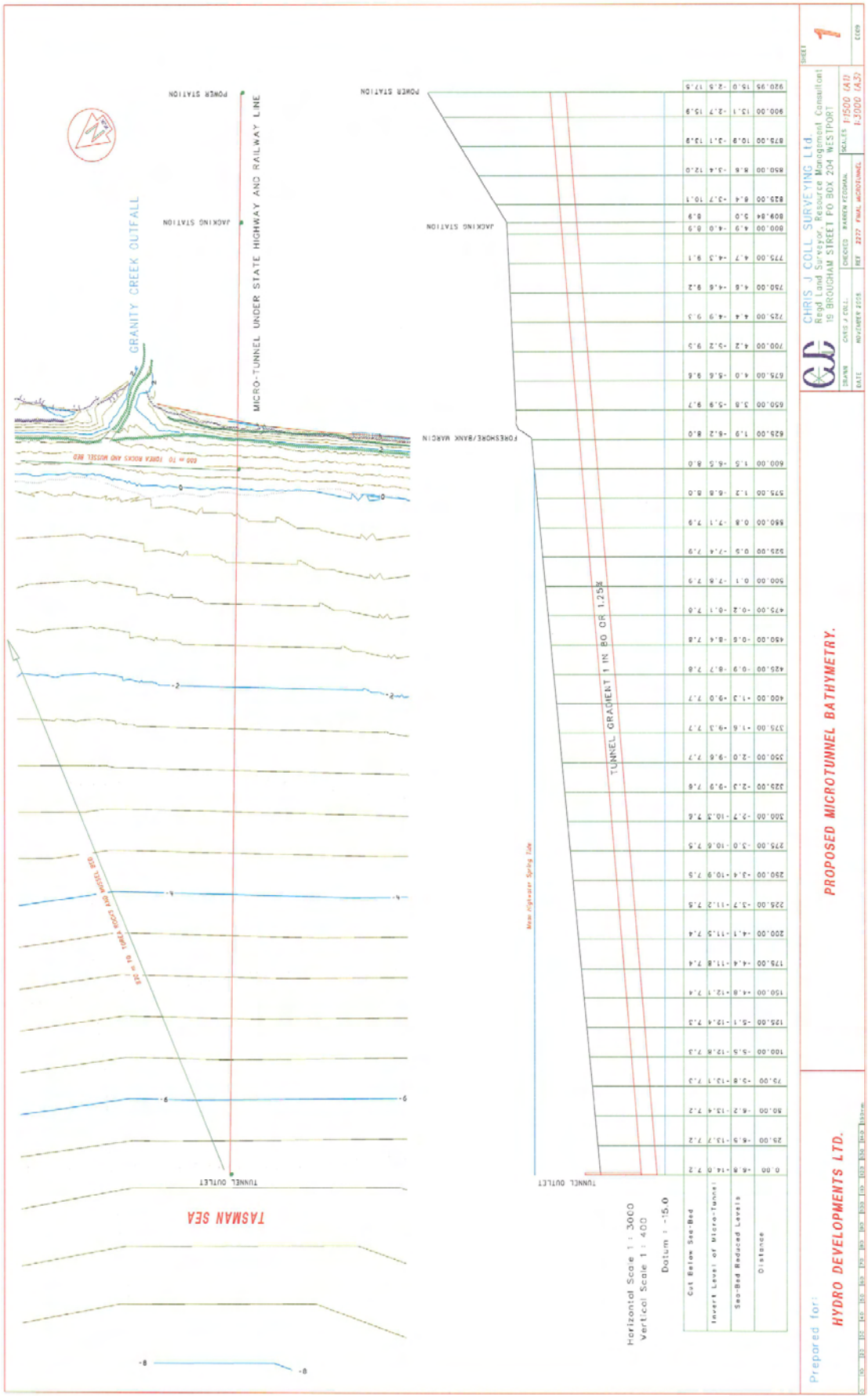
This assessment will be used as a foundation for more site specific studies that will be undertaken to specify the final design and construction of the diffuser. It is intended that site specific benthic and water quality surveys and monitoring will be undertaken during the three years leading up to the final specification of the diffuser. This site specific monitoring would serve as both a pre-discharge baseline and a validation of the diffuser design.

The bathymetry at the ocean outfall and the long section of the outfall pipeline is shown in the following Figure. The outfall pipeline terminates at a 12m x 6m rising caisson. The diffuser will be attached to the caisson. The diffuser shape, orientation and effective length will be specified to achieve the dilution required to meet receiving water thresholds based on the site specific information obtained during the detailed surveys and monitoring described in **Appendix L.**

4.9.1 Marine Bathymetry

The subtidal region between Westport and Granity forms an evenly sloping seabed with 5 metre isobaths spaced approximately 1km apart, out to a depth of around 40m, and more steeply sloping from 40m to 100m depth. Depths of greater than 100m occur approximately 20km form shore. The one exception to this even slope being a 30-35m shelf positioned 3-8km offshore from Granity. The coastline around Granity and the offshore area belong to the Buller Shelf ecological region and the Karamea shelf ecological district. Most of the rocky shoreline of the Karamea Bight, especially near Granity comprises unstable boulder and shingle beaches on a surf coast where there are reportedly abrupt seasonal changes in beach profiles. Subtidal substrates comprise granite or sedimentary boulders and bedrock, which offer relatively little habitat cover. This kind of rock

forms relatively barren reefs, even in very sheltered coasts.



Ocean Outfall Bathymetry and Long Section

Further northeast the bed-rock is soft mudstone supporting a depauperate intertidal and shallow subtidal marine biota. The dominant subtidal substrate is sand (with <10% mud), and covers most of the inner continental shelf out to the 30m isobath. Further out into the Karamea Bight, beyond the 50m isobath, there exists a band of muddy sand which progress to coarser sediments further seaward. To the north of Granity are the Torea Rocks, which consist of a series of stacks adjacent to the shore.

The Challenger Plateau rises to depths of 500m and forms a major bathymetric obstruction to circulation off the West Coast of the South Island in the southern Tasman Sea. Wind driven subtropical water derived form the east Australian current, flowing along the south-western edge of the Challenger Plateau, impinges on the West Coast of the South Island between 42-44 degrees south. As a consequence most of the flow moves southwards towards Fiordland.

Research off Westland has indicated both a weak north-easterly and south-westerly mean flow of 4-5cm/second. One model has shown that circulation on the West Coast continental shelf is derived mainly by variations in seabed slope and by local winds. It was reported that south of Greymouth both the slope and prevailing winds from the southwest combine to create an overall north-westerly flow. However, north of Greymouth these forces work against each other, where the seabed slope is to the south and the main wind direction is to the north, a southward drift was only likely to occur north of Greymouth in calm conditions.

4.9.2 Marine Resources

The West Coast marine environment shares many biological characteristics with other South Island coasts, particularly with respect to fish and algae but is separated from other New Zealand coasts by latitudinal location, the high degree of wave exposure, effects of sedimentation and sand scour and shelf and river hydrology.

Algae

The dominant large brown alga along the Haast-Buller coast is the bull-kelp (*Durvillaea*), which is relatively common in exposed sites where adequate stable rocky substrates exist. Other algae that are present are generally small and turfing and most commonly confined to intertidal sites. The Cawthron report states that algal cover is probably significantly limited by a combination of suspended sediment clouding the water and the scour effects of the exposed coast to rough seas with high sediment loads. The absence of large stands of laminarian algae results in a corresponding absence of fish species dependent on it for habitat and food.

Plankton

The Cawthron report states that plankton are an important component of the coastal biological community as they form a primary source in the coastal food chain. The distribution and abundance of plankton in the Karamea Bight are closely linked with coastal upwelling events. It has been reported that a total of 91 species of phytoplankton (flagellates and diatoms), with phytoflagellates being the most abundant. The zooplankton was found be dominated by copepods and euphasids.

Benthic Infauna

The infauna communities of subtidal sediments between the Karamea Bight and Westport have been described as highly variable. The Cawthron report referred to an earlier field investigation undertaken in 1996 as part of the proposal to construct a coal jetty approximately 2km south of the current proposal. This investigation sampled benthic infauna between 300m to 1500m offshore with a total of 88 species identified. This consisted of 32 species of polychaete worms, 15 species

of amphipods, 10 species of bivalves, 5 species each of gastropods, echinoderms and ostracods, 3 species each of cumaceans, isopods and decapods, 2 species of tanaid shrimps, and one species each of copepods, nemertea, nematodes, coelenterate and phoronida. The numerically dominant taxa were the amphipods (equating to 36% of the sample) and the polychaetes, with the least dominant being the copepods and decapods.

In general it was reported that both species richness and abundance increased with increasing distance from the shore, with a progression from shallow to deeper waters. With the progression into deeper water there was reportedly a decrease in the proportion of echinoderms and bivalves but an increase in tanaids, cumaceans, gastropods, isopods and decapods.

This earlier report concluded that the benthic communities sampled are typical of those along the inner continental shelf of the West Coast and concluded that given the textural characteristics of the inshore sediments along the inner coastline, it would be expected that similar biological communities would also be found along the Granity coastline.

Fisheries Resource

The western coast of the South Island supports a rich diversity of fish and invertebrate species that are targeted both commercially and recreationally by a number of fishing methods including trawl, long-line, trolling, potting and set netting. The Buller-Karamea Bight is worked by commercial fishers using methods including lobster potting, set netting and albarcore trolling, with the most common method being bottom trawl. The bulk of the commercial trawl fishery catch is comprised of deep water offshore species, including hoki, barracouta, jack mackerel, silver warehou, frost fish, ling and redbait. These are all largely taken in deeper waters outside of the Karamea Bight on the edge of the continental shelf.

Inshore trawl fisheries are multi-species and worked in a range of depths. They are primarily based on flatfish (mostly sole, turbot and sand flounder), red gurnard, red cod, giant stargazer, tarakihi and blue warehou. Other species taken as bycatch include arrow squid, dark ghost shark, ling, barracouta, jack mackerel, spiny dogfish, rig, school shark, sea perch, rough skate and smooth skate.

Surveys of coastal reef fish, seaweeds and shallow reef communities have found an abundance of species adapted to the prevailing turbid and exposed conditions of the area. A moderate diversity of 27 coastal reef fish species has been recorded.

Intertidal Biota

Cawthron report that there is a paucity of current information about the intertidal biota along the shoreline in the vicinity of Granity and the Ngakawau River mouth and estuary. Cawthron have referred to an earlier assessment of the intertidal resources in the vicinity of Granity undertaken by KMA in 1996. This survey reported generally low densities of infaunal bivalves in the intertidal soft shores. Mussels, limpets, barnacles and green algae had been reported to inhabit the rocky intertidal zone around the Torea Rocks. This previous study reported the presence (in very low abundance) of tuatua (*Paphies subtriangulata subtriangulata),* the triangle surf clam (*Spisula aequatorialis).* It also noted previous reports of the helmet shell (*Xenophalisum pyrum)* and the burrowing snail (*Amalda australis)* in the intertidal zone of sandy shorelines along the Granity coast. Observation of beach drift also noted the presence of the bivalve *Dosinia anus, P. subtriangulata subtriangulata* and *S. aequatorial,* and it was concluded that most of the bivalves associated with beach shell drift were likely to be more abundant offshore.

In a previous report the intertidal biota along the Westland-Buller coastline was described as

variable, dependent largely on the physical nature of the shoreline. Typical reef biota was dominated by mussels, limpets, anemones, reef stars and rockpool fishes. Limestone intertidal shorelines were described as generally barren, attributable to substrate instability and the high frequency of storms and severe sand scour.

Marine Mammals

Several dolphin species frequent West Coast waters, however only three species are regularly sighted. Of these three species Hector's dolphins are the only year-round near shore residents that could potentially be affected by the proposed outfall. Hector's dolphin are listed as a "nationally endangered" species by New Zealand's national threat classification.

Hector's dolphin is the only species endemic to New Zealand with the largest sub-population residing along the West Coast of the South Island. The abundance of this regional population of dolphins is estimated at 5,388 animals. Their distribution ranges from Kahurangi Point (near Karamea) to just north of Milford Sound in Fiordland. Recent aerial survey work has established that West Coast Hector's dolphins have a close inshore distribution in both summer and winter. The highest densities of dolphins occur between Karamea and Punakaiki in the north and from Okarito Lagoon to Arnott Point to the south.

Several occasional sightings of larger whale species have been reported within West Coast waters and range form the toothed sperm whale to the largest, the blue whale. However, only the southern right and humpback whales are regular seasonal transients through the coastal waters.

Four species of seals occur around the South Island; elephant, leopard, Hooker's sea lion and New Zealand fur seals. Of these species only the fur seal's distribution range extends along the whole of the West Coast with several established breeding rookeries and haul-out sites. New Zealand's population of fur seals is currently estimated at 50,000-60,000 animals with some of the largest sub-populations found along the West Coast. Fur seals are classed as "not threatened" and ranked as "least concern' internationally.

Fur seals range from inshore waters out to the continental shelf edge where they are thought to feed. On land fur seals prefer to haul-out on rocky coastlines but are occasionally seen along sand stretches of beaches along the West Coast. Well-known rookeries near the proposed Granity outfall include Kahurangi Point, Wekakura Point, Kongahu Point and Cape Foulwind.

5 Project Description

5.1 Project Overview

This section describes the core components of the Stockton Plateau Hydro Project. The components are listed in the order that they capture, store and divert water from the most remote areas of the Ngakawau catchment through the Weka and Granity power stations and the ocean outfall at Granity. **Plan C-000** provides an overview of the scheme.

The Project requires the construction of roads, tunnels, dams and diversions all of which must be located within or founded on sound bedrock. Reference to previous geotechnical investigations and extensive surveys of the surface topography (refer to **Appendix M**) have been used as indicators of subsurface ground conditions. The concept design presented in the application is based on this information.

The next stage of the Project following the grant of the resource consents covered by this application, will be the final design of the scheme components and the application for building consents. This will be preceded by a substantial investment in exploration drilling which will verify the assumptions that have been made about the subsurface conditions. Changes to the concept design that may result from the detailed investigations are expected to lead to insignificant changes in environmental effects but will be significant for the detailed engineering of these structures, which will be considered in the building consent approval process that follows. In particular the building consent process will address the adequacy of the structures in terms of the requirements of the Building Act 2004.

It is envisaged that the drilling programme would comprise in the order of 55-75 drill holes with a maximum of 100 holes should any unforeseen ground conditions be encountered which requires additional site investigation. All drill holes will be located within the footprint of the dams, tunnels and proposed construction work areas, with access to be gained via existing tracks or along the alignment of the proposed new access roads. The maximum area of disturbance resulting from siting of the drill rig will be limited to $75m^2$ but for most sites will be less than $50m^2$. The only drill sites where rehabilitation will be required will be the drill holes directly over the tunnels which do not coincide with the intake/ventilation boreholes. These areas will have vegetation stripped and stockpiled and reinstated once the drilling rig has been removed from the site.

The drill rig will require up to 1 litre per second of water for the duration of drilling at each hole, which is expected to take between 1-3 days (30 hours) per hole. Water for drilling will be taken from the same streams and locations required for construction of the Project. Drilling water will be passed through portable separation equipment before discharge to land. No contaminated water will be discharged to any watercourse.

Final design will require the following geotechnical investigations:

- Drilling in the base of the Mt William reservoir footprint to determine requirements for a grout curtain, borrow area for dam aggregate, the best position for the dam abutments and main dam, alignment of the shoulder dams and position for the Stockton Tunnel intake tower.
- Drilling along the line of the Darcy diversion tunnel to determine the best position for the portals and intakes.
- Drilling from the Stockton Tunnel intake along the line of the tunnel to determine the best

alignment for the tunnel, location of ventilation shafts and location of the tunnel outlet portal. Drilling at the tunnel outlet portal will determine the location of the Weka underground power station.
- Drilling along the line of the Mangatini and Mine Creek diversion tunnels to determine the best positions for the tunnels, portals and intakes.
- Drilling in the base of the Weka reservoir footprint to determine requirements for a grout curtain, borrow area for dam aggregate, the best position for the main dam and shoulder dam abutments, the alignment of the shoulder dams and position for the Granity Tunnel intake tower.
- Drilling or test pits along the line of the haul road realignment to confirm foundation conditions suitable for the haul road, the best alignment and cut and fill volumes.
- Drilling from the Granity Tunnel intake along the line of the tunnel to determine the best alignment for the tunnel, location of ventilation shafts and location of the tunnel outlet portal. Drilling at the tunnel outlet portal will determine the location of the Granity underground power station and the extent of slope debris stabilisation required.
- Geophysical investigations (ground radar and other ground scanning techniques) along the line of the outfall micro-tunnel to identify any isolated massive buried rock debris or rock formations which would be difficult to tunnel past.

Some of the investigations are sequential, for example the outfall geophysics would not be undertaken until the location of the Granity Tunnel outlet portal was confirmed. The nature of changes to the concept design that are expected as a result of final design investigations are described for each component in the sections that follow.

During the geotechnical investigations field and laboratory trials would be undertaken to verify material properties, the inputs to water quality modeling used in concept design and to verify the predictions of the water quality model. These will include:

- Test fills for the RCC dam construction.
- Water quality of inflows to the reservoirs and variation of water quality inflows with rainfall intensity
- Water quality improvements within the reservoirs
- Probability, extent and visibility of a plume at the outfall

5.2 Darcy Diversion

The Darcy diversion picks up the tributaries of St Patrick's Stream which drain from Mt William Mine, as shown in **plan C-001**. The south St Patrick's tributary flows directly into St Patrick's Stream. Darcy Stream flows into Erin Stream, before joining St Patrick's Stream.

A tunnel is to be driven from Mt William reservoir to intercept these streams. Drop shafts will be driven up from the tunnel into the stream beds. Intakes built into the stream beds will divert the flow into the tunnel. The intakes have been designed to capture as much of the flow as can be achieved, while also excluding the stream bedload. In flood flows up to 20% of the flood waters may bypass the intakes and continue down into St Patrick's Stream.

The tunnel will be the minimum size required for tunneling equipment, approximately 3m wide and 3.5m high. A relatively flat grade is required to intercept all three streams. Sediment would accumulate in the tunnel if it was not excluded at the intakes. Concept designs for the weir intakes are shown in **plan C-001**. Access to the tunnel will be from within the Mt William reservoir footprint. All effects of the tunnel and drop shaft construction can therefore be contained within the

tunnel and the footprint of the Mt William reservoir. Excavations from the tunnel will be used for aggregate in the construction of the Mt William dam. Drainage from the tunnel will drain to a silt trap at the tunnel portal before discharging into St Patrick Stream.

Access for construction of the intakes will be from tracks off Mt William Mine road. The stream will be diverted around the intake locations during break through of the drop shafts and during the assembly of the intake structures. The intake structures will be pre-cast concrete components which will be assembled on to the top of the drop shafts, requiring minimum works in the bed of the streams.

The anticipated sequence of construction is:

- Form an access track from the reservoir access road through the reservoir footprint to the tunnel portal site.
- Construct a silt trap downstream of the portal.
- Stabilise the portal site using ground anchors and drive the tunnel.
- Extend access tracks to the intake sites from the Mt William Mine access tracks.
- For each intake, divert the stream around the intake position and using a portable drill rig drill a pilot hole from each intake location into the tunnel. This will guide the boring machine that will bore the raise (drop shaft) up from within the tunnel.
- Assemble the pre-cast intake structures, remove the diversion and divert stream flows into the tunnel.

Final design investigations are likely to lead to minor changes in the location of the outlet portal but this will remain within the reservoir footprint generally as shown. The subsurface route of the tunnel may change without external effect. The positions of the intakes will not change.

Construction of the diversion is expected to take 18 months. The tunneling work will be scheduled after work commences on the Mt William dam and must be completed prior to filling Mt William reservoir.

5.3 Mt William Reservoir

Mt William reservoir will be formed by the construction of a roller compacted concrete (RCC) dam across St Patrick Stream, just upstream of the confluence with T35 Stream. The dam will include a main dam across St Patrick Stream and a saddle dam extending to high ground to the west of the main dam. The crest of the dam will include an access road to replace the existing access road to Mt William. A section of the saddle dam will be lower than the rest of the dam to form the dam spillway, which will discharge to T35 Stream. The dam will retain approximately 7 million cubic metres of runoff from St Patrick Stream, Plover Stream, Fly Creek, T31 Stream and Darcy Stream. The concept design of the dam is described in "*Weka Dam and Mt William Dam Concept Design Assessment*", URS 2008 (**Appendix B**). Mt William dam and reservoir is shown in **plan C-002.**

The likely configuration of the Mt William dam spillway is shown in Figure 4. The spillway will be built as part of the lowest section of the saddle dam well clear of the main dam structure across St Patrick's Stream. Overflow will discharge over basement rock to enter the section of T35 Stream where it passes through basement rock. Spills over the spillway will pass through a rock energy dissipater before entering T35 Stream. Spills over the spillway will only occur very infrequently during extreme rainfall events when the T35 stream will also be in flood.

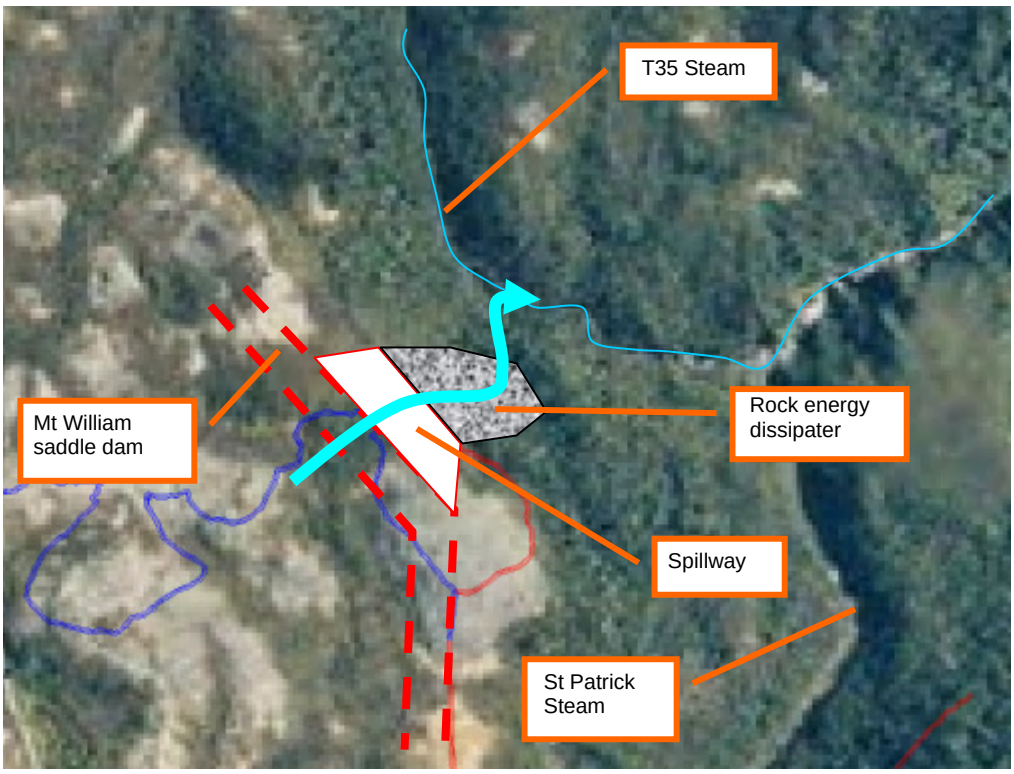


Figure 4 Concept design of Mt William Dam spillway

The anticipated sequence of construction of the Mt William reservoir is described below:

- Within the reservoir footprint, the areas that are to be disturbed to construct the intake channel, concrete batching plant and dam fill batching plant, will be stripped of vegetation. Strippings will be used to rehabilitate the Project site.
- Silt controls will be established.
- The intake channel will be excavated and will produce the aggregate required for dam construction. The excavations will augment the aggregate produced from the Stockton tunnel and the Darcy tunnel. Excavations will also be used for road sheeting.
- A concrete batching plant for dam ancillary structures will be setup.
- A batching plant for dam fill will be setup.
- The dam foundation will be stripped to competent rock
- Defects in the dam foundation will be repaired. A grout curtain may be installed.
- A sluice will be formed to one side of St Patrick Stream.
- St Patrick Stream will be diverted through the sluice.
- Dam construction will commence, including the installation of permanent monitoring galleries.
- An outlet tower will be constructed at the raise (drop shaft) into Stockton tunnel. Control systems will be installed.
- Sediment traps will be constructed across the Plover/Fly Creek and T31 Stream channels, at the head of the reservoir.
- A permanent access road to the Darcy Stream diversion will be constructed across the dam crest and above the eastern perimeter of the reservoir. The road will be extended to the sediment traps.
- On completion of the dam, the sluice will be sealed, all construction plant, equipment and materials will be removed from the reservoir footprint and controlled filling of the dam will take place.
- Full monitoring of the dam will take place as the dam is filled for the first time.

Extensive geotechnical drilling of the dam site will be required before the final design layout can be completed. Final design will determine the exact location of the main dam, saddle dams, spillway and outlet structure. Final design is likely to lead to changes in the depths, elevations and layout of the dam and reservoir but these are expected to remain within the reservoir footprint generally as shown and are not expected to lead to any changes in environmental effects.

Construction of the Mt William dam and the ancillary works described above is expected to take 18 months. Occupation of the site for geotechnical investigations will commence as soon as consents are granted. Construction will run in parallel with driving Stockton tunnel, which must be completed before the dam outlet tower can be built. Sealing of the sluice and flooding of the dam will not commence until Stockton tunnel is completed.

5.4 Stockton Tunnel

Stockton Tunnel will be approximately 3850m long and will connect the Mt William dam outlet tower to the Weka power station. The tunnel route and profile is shown in **plan C-003.** The Stockton Tunnel will function as a pressurized penstock, with pressure rising from approximately 30m at the intake to approximately 175m at the Weka power station.

The tunnel will be unlined, except for where defects in the rock mass need to be sealed. The tunnel will include several drop shafts for ventilation purposes and for managing surge. The drop shafts can be located to capture tributaries of T35 Stream, if capture of the tributaries is requested by DoC or SENZ (the number and location of the drop shafts will be determined in final design in discussion with these parties). There will be a bulkhead within the tunnel approximately 150m from the outlet, where the pressurized section of the tunnel will end. The intake manifold to the power station will connect to the bulkhead. The bulkhead will be located at that point where the rock and ground cover is suitable to resist pressures within the tunnel. The bulkhead will include a trap to collect rock fragments that fritter from the unlined surfaces of the tunnel or enter the tunnel through the drop shafts. Rock fragments will be discharged by shutting down the intake and draining the tunnel through the trap. The Weka power station will be built within competent rock within the tunnel outlet portal.

The tunnel will be approx 3m wide and 3.5m high, the minimum size required to provide for tunneling equipment and ventilation. The final grade, tunnel alignment and location of drop intakes will be determined by geotechnical drilling. All effects of the tunnel construction will be contained within the tunnel, the footprint of the Weka reservoir and around the drop intake structures. Access to the tunnel will be from the Weka reservoir footprint. Access to the drop intakes will be from the tunnel and from the Mt William Mine access road. Excavations will be used for aggregate in the construction of Weka dam. Drainage from the tunnel will drain to a silt trap, prior to discharge to Sandy Creek.

The anticipated sequence of construction is:

- Form an access track from the 2-5 haul road, through the Weka reservoir footprint to the site of the outlet portal.
- Construct the access tracks from Mt William Mine road to the locations of the drop shafts and drill pilot holes to intersect the tunnel alignment.
- Construct a silt trap downstream of the outlet portal.
- Stabilise rock at the portal site and drive the tunnel from the Weka reservoir.
- Bore the drop shafts following the pilot holes from within the tunnel.

- Bore the raise up into Mt William reservoir outlet channel.
- Undertake pressure sealing of the tunnel as required using fibre reinforced shotcrete.
- Construct the drop shaft intakes – involving temporary diversion of tributaries of T35 around intake sites and construction of intakes, as for the Darcy Stream intakes.
- Construct the bulkhead and rock trap.
- Pressure test the tunnel, following construction of the Mt William intake tower and the Weka power station.

Final design investigations will locate the Millerton fault and the extent of the fault zone and are likely to lead to minor changes in the location of the outlet portal with respect to the Millerton Fault. As is usual with tunneling operations, the subsurface alignment of the tunnel is also expected to change as a result of drilling, but will also change during the tunneling operation as the tunnelers respond to variations in rock strength and geotechnical properties. The positions of the ventilation shafts and intakes are not expected to change to any significant degree.

Construction of the tunnel and ancillary works described above is expected to take 36 months. The tunneling work may be scheduled to start at any time after consents are granted but must be completed before Mt William dam outlet tower can be built and before Mt William dam flooding commences.

5.5 Weka Power Station and Spur Line

The Weka power station will be built within the Stockton Tunnel to the south of the Millerton Fault, as shown in **plan C-004**. The power station will discharge into a reinforced concrete outlet channel within the tunnel to the tunnel portal where there will be a rock energy dissipater. This will transition into channel cut into the bedrock of Weka Creek, which will extend down to the upper operating level of the Weka reservoir. (Note: Weka Creek flows in a bedrock channel from the proposed portal site down to the reservoir. The portal will be approximately 20m below the existing ground level so will require deepening of the Weka Creek channel by means of precision blasting).

Geotechnical investigations may require that the power station be located to the north of the Millerton fault, as detailed in the alternative arrangement shown in **plan C-004**. In this eventuality the power station would be connected to the Stockton Tunnel by a length of steel penstock. The power station within the tunnel or external to the tunnel will comprise a reinforced concrete structure of approximately 200m² housing generator sets and high voltage electrical gear.

The power station will be connected to SENZ's 33kV transmission line near the disused No. 4 aerial ropeway station by a 33kV transmission spur line, as shown in **plan C-003.**

The over-all footprint of the outlet portal and access to the facility will be approximately 500 square metres. A permanent access road will be formed from the 2-5 haul road. The access will continue through to Mangatini diversion outlet and sediment trap around the southern perimeter of the Weka Reservoir.

The facilities within the Stockton Tunnel outlet portal and Weka power station will include the control room for the entire Project, staff room, maintenance depot and toilet facilities. An approved wastewater effluent system will be installed.

The location and layout of the portal, power house, energy dissipater, rocklined channel, external penstock and powerhouse (if required) and spur line will be determined in final design. Final design

will be affected by a number of factors which include:

- Results of geotechnical investigations, which will determine the full extent of the Millerton Fault zone, the location of the power house and the Stockton tunnel outlet portal final position.
- Hydraulic design, which will determine the selection of generator sets and the energy dissipation required.
- Stockton tunnel final design, which will determine the requirements for removal of rock fragments at the intake manifold.
- Bypass channel requirements, to drain the tunnel and power house for maintenance purposes.
- Agreement with SENZ on the spur line connection to Stockton Mine 33kV line.

The anticipated sequence of construction is:

- Construct the inlet manifold, rock scour, maintenance diversion and associated thrust blocks.
- Construct the generator plinths, outlet channel, energy dissipater and rock-lined outlet channel.
- Construct the power station structure.
- Construct the spur line and connection to SENZ's 33kV line
- Install the generator sets and commission.
- Complete the facilities, rehabilitate the disturbed areas and landscape the site.

Construction of the spur line can take place at any time. As the power station is part of the Stockton tunnel outlet portal, construction of the power station will need to follow the completion of Stockton tunnel. Construction is expected to take 6 months.

5.6 Mangatini Diversion

The Mangatini diversion captures flows in the Mangatini Stream (just below the confluence with A.J. Stream), and diverts the flow to the Weka reservoir. Concept designs have been developed for both tunnel and open channel diversions, with the tunnel the preferred option to minimize visual effects as shown in **plan C-004.** The tunnel would, however, pass through the Millerton fault and there is a possibility that geotechnical investigations and final design may determine that tunneling is not feasible in the immediate area of the fault zone. In this case, the outlet section of the tunnel will need to be replaced with an open channel diversion excavated along a similar route. The result would be that the tunnel will be slightly shorter than shown in plan **C-004** and the reservoir would extend up the diversion channel generally along the line of the tunnel alignment shown.

Diverted flows exiting the tunnel will pass through a sediment trap before entering the reservoir as shown in **plan C-004.** The concept design for the diversion weir is also shown in **plan C-004.** The weir is designed to divert sediment loads to minimize future maintenance works in the bed of the Mangatini Stream. Construction and maintenance access will be via the diversion from the Weka reservoir. A foot track will be formed from the Weka power station to the weir for routine maintenance inspections.

The diversion weir includes a gate that can be shut to prevent flows entering the Weka reservoir. This may be required for maintenance reasons or to prevent ingress of highly contaminated flows. The weir will be approximately 3m high with no ponding occurring behind the weir in normal flow conditions. However, in high flows when spillage occurs over the weir, or if the gate is closed,

ponding will extend 30-50m upstream as indicated in the plan by the blue hashed area.

The tunnel will be similar to the Darcy diversion and will be the minimum size required for tunneling equipment approximately 3m wide and 3.5m high. If the outlet section of the tunnel needs to be replaced with an open channel, a trapezoidal section will be formed. The diversion will have a grade adequate to pass sediment loads.

All construction effects will be contained within the diversion and the footprint of Weka reservoir. Access to the diversion will be from within Weka reservoir footprint. Access to the weir will be from the diversion. Excavations from the diversion will be used for aggregate in the Weka dam construction or will be dumped within the section of the reservoir which will be flooded. Runoff from the construction of the diversion will drain to a silt trap at the outlet to the diversion, before discharging to Weka Creek.

The anticipated sequence of construction is:

- Form an access track from the Weka power station access road through the reservoir footprint to the site of the outlet to the diversion.
- Construct a silt trap downstream of the outlet.
- Construct the diversion.
- Temporarily divert Mangatini Stream to one side of the stream bed and construct a permanent sluice on the other side.
- Divert the stream through the permanent sluice.
- Construct the diversion weir over the sluice and complete the weir.
- Seal the sluice and divert the stream through the diversion.

Construction of the diversion is expected to take 12 months and may be undertaken any time after work commences at Weka reservoir. Construction of the diversion weir will be scheduled to coincide with the completion of Weka dam but could be delayed if required. Diversion of stream flows into the reservoir cannot take place until all other works within the reservoir footprint are completed.

5.7 Mine Creek Diversion

The Mine Creek diversion captures flows in Mine Creek and diverts these through a tunnel to the head of Sandy Creek. Flows will pass through a sediment trap built upstream of the culvert under the realigned haul road, before entering Weka reservoir. The diversion is shown in **plan C-004.** The diversion weir used for Mine Creek will be the mirror image of the diversion weir for Mangatini Stream, shown in **plan C-004.**

The weir has been designed to divert the sediment load to minimize future maintenance works in the bed of Mine Creek. Construction and maintenance access will be from 2-5 haul road, via an access road formed to the diversion outlet and then via the tunnel to Mine Creek. A foot track will be formed from the outlet portal to the weir for routine maintenance inspections.

The diversion weir includes a gate that can be shut to prevent flows entering the Weka reservoir. This may be required for maintenance reasons or to prevent ingress of highly contaminated flows. Like the Mangatini weir the Mine Creek weir will be approximately 3m high and will operate as a small detention dam. In normal flow conditions there will be no ponding behind the weir, however, during high flood flows when spillage occurs or if the diversion gate is closed some ponding will extend upstream of the weir.

The Mine Creek tunnel will be the minimum size required for tunneling equipment and to provide access for the construction and maintenance of the weir and will be approx 3m wide and 3.5m high. The tunnel will have a grade adequate to pass sediment loads. Geotechnical drilling in final design will determine the final tunnel alignment and location of the portals in Mine Creek and Sandy Creek. The final position of the intake cannot move significantly from the position shown for hydraulic reasons and the outlet location is constrained within Sandy Creek. Final design changes are not expected to be significant.

All construction effects will be contained within the tunnel and weir footprint and a short section of Sandy Creek, immediately downstream of the outlet portal. Excavations from the tunnel will be used for aggregate for Weka dam. Runoff from construction will drain to a silt trap, built immediately downstream of the outlet which will drain to Sandy Creek.

The anticipated sequence of construction is:

- Form an access track from the 2-5 haul road to the outlet portal.
- Construct a silt trap immediately downstream of the portal.
- Construct the portal and drive the tunnel.
- Partially break through the intake portal to provide access to the weir site but to prevent stream diversion.
- Temporarily divert Mine Creek to one side of the stream bed and construct a permanent sluice on the other side.
- Divert the stream through the permanent sluice.
- Construct the weir over the sluice and complete the intake portal.
- Seal the sluice and divert the stream through the tunnel.

Construction of the tunnel and weir is expected to take 6 months. The tunnel may be driven any time after work commences on Weka dam and 2-5 haul road realignment. The diversion will ideally be scheduled to coincide with the completion of the culvert and sediment trap at the haul road realignment but may be delayed. Diversion of stream flows into the reservoir cannot take place until all other works within the Weka reservoir footprint are completed.

5.8 Weka Reservoir

The design and construction of Weka dam will be similar to Mt William dam.

Weka dam is to be a roller compacted concrete (RCC) structure, which will include a main dam built across Weka Creek at the entrance to the Weka Creek gorge, and saddle dams extending around the reservoir to both the east and west. The eastern saddle dam will run out into higher ground. The western saddle dam will abut against high ground near the cutting that the 2-5 haul road passes through. The 2-5 haul road will need to be realigned to the west, to avoid the abutment and inundation at Tin Town corner. The dam spillway will be cut into solid granite forming the right (eastern) abutment of the main dam which will discharge into Weka Creek gorge, as do the existing floods passing down Weka Creek

The dam will retain up to approximately 3.5 million cubic metres of runoff from Weka Creek, Mangatini Stream diversion, Sandy Creek, Mine Creek diversion and from Stockton tunnel. A sediment trap will be built upstream of the haul road in Sandy Creek and at the outlet of the Mangatini diversion. The concept design of the dam is described in "*Weka Dam and Mt William Dam Concept Design Assessment*", URS 2008 (**Appendix B**). Weka dam and reservoir is shown in

plan C-004.

The anticipated sequence of construction is:

- An access track will be constructed from the 2-5 haul road in the vicinity of Conrod Straight, to the location of the new haul road culvert and sediment trap, upstream of the existing haul road culvert.
- A temporary silt trap will be constructed in Sandy Creek, upstream of the existing culvert.
- A new haul road culvert will be constructed across Sandy Creek, to allow the realignment of the haul road.
- A sediment trap will be constructed in Sandy Creek upstream of the new culvert. A permanent access to the sediment trap will be constructed.
- Within the reservoir footprint silt controls will be established and areas will be stripped for the excavation of the outlet channel, concrete batching plant and dam fill batching plant. Strippings will be used to rehabilitate the Project site.
- The new section of haul road will be constructed using materials won from the Weka reservoir, with waste dumped back into the reservoir footprint.
- The new section of haul road will be transferred to SENZ and mine traffic will be diverted from the Weka reservoir footprint.
- A concrete batching plant will be setup.
- A batching plant for the dam fill will be setup.
- The dam foundation will be stripped to competent rock
- Defects in the dam foundation will be repaired. A grout curtain may be installed.
- At the main dam site, a sluice will be formed to one side of Weka Creek
- Weka Creek will be diverted through the sluice.
- Dam construction will commence, including the installation of permanent monitoring galleries.
- An outlet tower will be built over the drop shaft to Granity tunnel and the outlet control systems will be installed.
- The sediment trap will be constructed at the head of the reservoir, at the point of entry of Mangatini diversion. A permanent access road to the sediment trap will be constructed around the perimeter of the reservoir.
- On completion of the dam the sluice will be sealed, all construction plant, equipment and materials will be removed from the reservoir footprint and controlled filling of the dam will take place.
- Full monitoring of the dam will take place as the dam is filled for the first time.

As for the Mt William reservoir, extensive geotechnical drilling of the dam site will be required before the final design layout can be completed. Final design will determine the exact location of the main dam, saddle dams, spillway and outlet structure. Final design is likely to lead to changes in the depths, elevations and layout of the dam and reservoir but these are expected to remain within the reservoir footprint generally as shown and are not expected to lead to any changes in environmental effects.

Construction of the Weka dam and the ancillary works described above is expected to take 18 -24 months. Occupation of the site for geotechnical investigations will commence as soon as consents are granted. Construction will run in parallel with driving Stockton, Granity, Mangatini, and Mine Creek tunnels. Sealing of the sluice and flooding of the dam will not commence until the Granity Tunnel, Granity power station, and the ocean outfall are completed.

5.9 Granity Tunnel

Granity tunnel will be approximately 4900m long and will connect the Weka reservoir to the power station and the ocean outfall at Granity. The flow rates are expected to vary from 4 to 9 cubic metres per second, over a fall of approximately 370m. The tunnel alignment and profile is shown in **plan C-005.**

The escarpment immediately to the south of Millerton Township marks the line of the Millerton Fault. The fault continues to the east and is marked by the escarpment to the south of Weka reservoir. To the west and south the fault is marked by the down throw which forms the visible edge of the Stockton Plateau. The approximate surface positions of the fault and associated splinter faults are marked on **plan C-005**.

The alignment of the tunnel follows a curve to the south so that the tunnel will cross the fault features at near right angles and will remain an appropriate distance from the fault, where it runs parallel to the fault. The tunnel will be driven in competent granite basement rock at depths from 20m at the intake to over 300m below the surface near the outlet. The depth of the tunnel is required to resist the high water pressures within the tunnel. At these depths the fault discontinuities will be contained by ground pressure. The alignment of the tunnel has also been selected so that the drop shafts required to provide ventilation and power during tunneling can also be used to capture acid mine drainage from the headwaters of the tributaries of Granity Stream.

The location of the faults at depth will be different to those shown in surface mapping as the faults will not be vertical. Final alignment and depth of the tunnel will be determined by geotechnical investigations and by actual ground conditions met during the tunneling operation. The tunnel passes under the historic Old Dip Mine and its route may be within 500m of future open cut mining within SENZ's coal mining licence. The depth of the tunnel is such that it will not be affected by historic mining and will not constrain future mining activities.

The area the tunnel passes through is referred to by the Millerton Community as the MAPPS area – (the full extent of the MAPPS area is shown on **plan C-000**). The Millerton and Plateau Protection Society (MAPPS) has an agreement with SENZ and DoC that coal mining will not be undertaken within the area which is now managed as an historic reserve. The tunnel will be deep underground and will have no effect on the historic value of the area. Surface activities will be limited to drilling pilot holes for boring drop shafts. The drill rig will be flown in. Boring the drop shafts will take place from within the tunnel. Access to the drop shafts will be from existing access tracks within Stockton Mine.

The escarpment at the point of termination of the Granity tunnel is made of slope debris comprising massive granite blocks overlying basement rock. The area around the tunnel outlet will need to be stabilized using ground anchors before the tunnel can be excavated. An access ramp will be formed in the slope debris, using ground stabilisation techniques on the route shown in **plan C-006.**

It is estimated that the first 50m of the Granity tunnel will be through slope debris, before granite basement is encountered. This first section of tunnel will be approximately 6m in diameter, of larger cross- section than the main tunnel, which will be approximately 3m wide x 3.5m high in section. The larger cross section will continue into the granite basement to provide a foundation for the power house in basement rock. The exact location of the power house will be determined by geotechnical investigations and conditions found during the tunneling operations but it is anticipated that it will be located in a chamber cut within the granite basement some 50m in from the outer portal.

As for the Stockton tunnel and power house arrangement, the main tunnel will contain a bulkhead at the point where the depth of overburden is sufficient to contain water pressure within the tunnel (approximately 150m in from the tunnel outlet). The bulkhead will include a rock trap to prevent fritter from the unlined sections of tunnel entering the turbines. The sections of tunnel which pass through fault zones will be lined with fibre reinforced shotcrete. From the bulkhead, a steel penstock will supply the power station, which will discharge via an open channel within the tunnel to a surge chamber built at the tunnel entrance. The surge chamber will be a vertical tower, which will extend approximately 18m vertically down to the level of the ocean outfall pipeline. The tower will provide the head to drive water through the outfall pipeline to a diffuser 600m offshore.

An emergency outfall will be required at the top of the surge chamber. This will divert flows to Granity Stream in the unlikely event that the ocean outfall is damaged or blocked (operates in a similar way to the overflow from a toilet cistern). The emergency outfall pipeline will be approximately 1.6m diameter and will be buried within the access ramp leading up to the tunnel. The emergency outfall will pass through a baffled energy dissipater before discharging to Granity Stream. Maximum flows during an emergency discharge will be up to 9 cubic metres per second, smaller than the frequent freshes that pass down this stream. An emergency outfall will only continue until the water supply to the Granity tunnel can be shut down and is unlikely to continue for more than 24 hours. Water would be retained in Weka and Mt William reservoirs and the scheme diversions would be closed until the outfall was repaired.

During the construction phase, the emergency outfall will divert drainage from the tunnel into Granity Stream. The emergency outfall energy dissipater and diffuser will double as an oil separator and silt trap during the construction phase.

The access ramp (approximately 6m wide and 100m long) and portal apron (approximately 20m x 25m) will be formed within the existing bush using ground anchor techniques. There will be no side casting of material during construction. It is expected that both the access ramp and the portal apron will be largely concealed within the existing vegetation.

Rock from the excavation of the slope debris for the ramp and the first section of tunnel, will be carted to Weka reservoir for use in dam construction. Oversize rock may be suitable for coastal rock riprap protection works at the mouth of Granity Stream and could be placed for this purpose, if requested by the local community. WCRC and DoC, the authorities responsible for approving river and coastal protection works, would need to approve placement of rock riprap within the estuarine or coastal environment. Stream or coastal protection works are not required for the Project and are not included in these consent applications.

All the works at Granity, including the construction of the ocean outfall, will take place within the construction site boundaries shown on **plan C-006**. The site is located on SENZ land and railway reserve. The site will be used for storage of plant and equipment and may contain small stockpiles of aggregate. To minimise disturbance to Granity residents, all surface activities for establishment and site construction works will be undertaken during normal working hours. The underground works will continue as two 10 hour shifts, 7 days per week.

The site will be hidden from public view by a solid security fence. Access to the site will be from the existing access to Granity Museum on the railway reserve. An application has been made to Ontrack to establish access to the construction site via a railway crossing from the state highway, immediately south of the war memorial layby. If approved, this will keep the bulk of construction traffic away from residences to the south.

Concrete required for tunnel and power station construction will be sourced from the Project's batching plant, located at Weka reservoir. Approximately 200m³ of concrete will be required, equating to 40 truck loads. Concrete work at or around the tunnel entrance will be restricted to normal working hours.

The anticipated sequence of construction for the Granity tunnel is:

- Survey the Granity construction site area for historic artifacts that have not been formally identified (Note: most items of historic value on this site have been destroyed by previous bulldozing activity).
- Resurface the existing access to the Granity Museum.
- Establish a temporary level crossing off the state highway. This will reduce heavy vehicle movements past some 20 private dwellings. Around 8 light vehicle movements are expected each day, 7 days per week, at the start and end of each day, coinciding with the change in shifts.
- Construct a solid security fence on the Granity side of the construction site.
- Provide temporary transformer and power connection from the BEL network for power supply for construction activities.
- Construct the access ramp, apron at the tunnel outlet, outlet stabilization works and the section of tunnel within the slope debris. Use excavations to surface the construction site with surplus excavations carted to Weka dam. Oversize rock will be made available for stream and foreshore rock riprap works.
- Construct the emergency outfall energy dissipater, oil separator, sediment trap and diffuser on the south bank of Granity Stream.
- Lay the emergency outfall diversion pipeline (approx 1.6m diameter) within the access ramp, from the Granity tunnel portal to the sediment trap. Construct a temporary intake to the emergency outfall and extend this through the tunnel portal to the main tunnel, to intercept drainage from the tunnel.
- Construct the section of tunnel through the slope debris to the power station site in basement rock. Establish the main tunnel driving operation within this first section of tunnel.
- Drive the tunnel from the power station site to Weka reservoir. The tunnel will be driven on a continuous 24/7 basis for a period of approximately 36 months. A total of 40,000m³ of excavations will be removed from the site, with up to 10 heavy truck movements per day. Excavated material during the night shift will be stored inside the portal in a stone bay, for removal during the day shift. Excavated material will be carted to Weka reservoir for use in dam construction.
- Pilot drill holes will be drilled from the surface location of the drop shafts, which are necessary to provide air vents and electrical power supply during tunneling. The holes will be drilled as part of the geotechnical investigations for the final design of the tunnel, using an exploration rig.
- As the tunnel passes by the drop shaft locations, the drop shafts will be bored upwards from within the tunnel and power and ventilation will be fed down the drop shafts. The drop shafts will be capped with a breather cover, which may be replaced with a water intake at the completion of the tunnel.
- The tunnel will be lined with fibre reinforced shotcrete as it passes through fault zones.
- Complete rehabilitation of disturbed areas and landscape the construction site.

Geotechnical investigations and final design of the tunnel will commence as soon as consents are granted and agreements are reached with landowners, DoC, Ontrack and NZTA for access to the site. It is unlikely that the geotechnical investigations will lead to changes in the location of the

tunnel outlet portal or environmental effects, but the investigations will be critical for specifying the detailed engineering of the structures which form the power station, portal, surge chamber and ramp. Construction of the tunnel is not dependent on other Project activities.

5.10 Granity Power Station

The Granity power station will be an integral part of the outlet section of the Granity tunnel. The station will be of the same design as the Weka power station, appropriately scaled for the higher operating pressures at Granity.

Fit-out of the power house will include the generator sets and electrical control gear. A 33kV over head cable will connect the power house to BEL's transmission lines, located approximately 50m from the tunnel entrance.

The anticipated sequence of fit-out for the Granity power station is:

- Construct the bulkhead, inlet manifold, rock fragments scour, maintenance diversion and associated thrust blocks within the tunnel portal.
- Construct the generator plinths, outlet basin, energy dissipater and concrete outlet channel to the surge chamber, within the tunnel portal.
- Install the power station structural and electrical components.
- Construct the over head spur line and connection to BEL's transmission line.
- Install the generator sets and commission.

The installation and commissioning of the power station within the Granity tunnel outlet will take approximately 6 months and will follow the completion of the tunnel. Construction activities outside the tunnel will be limited to the connection to the ocean outfall and general site rehabilitation works and will be restricted to normal working hours.

5.11 Ocean Outfall

The Ocean Outfall consists of:

- A surge chamber to receive discharges from the power station outlet channel. The surge chamber provides approximately 18m head to drive water through the outlet to the outfall, approximately 600m off shore.
- A short section of high density polyethylene (HDPE) pipeline (approximately 2m diameter), buried from the base of the surge chamber to connect to the outfall micro-tunnel at a jacking station, located within the Granity construction site.
- A micro-tunnel, approximately 2m diameter and 750m long.
- A termination caisson sunk into the seabed.
- A diffuser connected to the termination caisson and laid on the seabed on the alignment of the micro-tunnel. The configuration of the diffuser laid on the seabed will be determined by the dilution required to meet receiving water standards.

The ocean outfall will be constructed on the alignment shown in **plan C-006**. The outfall pipeline will pass beneath the Granity Library, railway line, state highway and bare land, immediately to the north of Lyric Theatre and will be approximately 7m below the ground surface in this area.

The main section of the outfall will be driven using "micro-tunneling" techniques. Micro-tunneling involves lowering a tunneling machine into a "jacking station". The tunneling machine is attached onto the leading edge of the first section of pipe, orientated on the line and grade of the ocean

outfall, and then jacked forward as the machine excavates a cavity in front of itself. Additional lengths of pipe are added at the jacking station until the tunneling machine arrives at the diffuser, which has previously been sunk into the sea bed from a barge. The entire tunneling operation is controlled from the jacking station. A typical micro-tunnel site is shown in Figure 5, with the sheet-steel lined jacking station in the foreground.

Figure 5 Typical microtunnel site (Christchurch)

The final location of the jacking station will need to be determined by geophysical investigations along the proposed alignment to confirm the ground conditions are suitable. It may be necessary to locate the jacking station closer to the foreshore or to change the alignment of the outfall to avoid unsuitable ground conditions. For example, massive rock fragments may be buried within the coastal strip, originating from the escarpment.

The point of diffusion will be 1m above seabed some 800m from the surge chamber. The diffuser will be at the outer extent of the surf zone (under rough conditions) and will be accessible by diver for inspection and monitoring under normal conditions. To provide a combined termination point for the tunnel and a riser from tunnel level to seabed, a precast concrete caisson structure will be installed in the seabed offshore. In concept this structure will comprise an open topped 12m x 6m concrete box sized caisson to receive the tunneling machine. The caisson will be detailed with an appropriate un-reinforced wall section and seal, which will allow the tunneling machine to drill into it. The caisson would be built off-site, floated to site and sunk into a dredged pit at the discharge location, to the appropriate level and position. The pit will be backfilled around the caisson, which will be filled to provide a secure and stable structure to receive the micro-tunnel.

The final design of the diffuser is dependent on the pH of the outfall discharge and the properties of the seawater and currents at the site. Site specific information will be determined by baseline survey and monitoring of the outfall site, with this to be commissioned on the grant of consents. (Note: the diffuser will be the last component of the Project that will be constructed – the design does not need to be finalised until 2012). Concept design modeling based on existing information indicates that the diffuser will comprise an HDPE pipeline around 150m long laid on the seabed.

The pipeline will be anchored using concrete saddles or rock riprap. The diffuser pipeline will comprise 3 or more sections reducing in diameter from the termination caisson. The diffuser will be assembled on a barge and lowered into place.

The proposed construction methodology for the outfall pipeline and diffuser will minimise offshore work at this remote and exposed site and will provide for the recovery of the tunneling machine via the caisson. This would otherwise require sheet piling of a substantial pit, with the risk of disturbing the installed tunnel components. Rock scour protection will be required around the perimeter of the caisson, where it passes through the seabed.

The anticipated sequence of construction of the outfall is:

- Manufacture the concrete caisson at a location where it can be launched and floated to the diffuser site.
- Excavate a pit at the diffuser location.
- Tow the caisson to site and under controlled conditions sink it in position.
- Backfill the caisson with sand. The caisson must be installed early enough so that full compaction of the sand occurs before the micro-tunneling machine reaches the caisson.
- Place rock scour protection in the seabed around the perimeter of the caisson.
- Establish the micro-tunneling plant and equipment on the site of the jacking station. Establishment will include construction huts, suitable area for storing and handling a limited number of pipe sections, the necessary separation and drilling mud equipment and a solid 2.4m high security fence (typical of inner city construction sites), where all construction effects are contained within.
- Construct a temporary earth bund around the western perimeter of the jacking station to minimise noise effects for nearby properties.
- Excavate the jacking pit. The pit will be a rectangular sump with a base at the level of the outfall pipe approximately 4m below seabed level (approximately 7m deep).
- Install dewatering equipment. Dewatering of clean water will be to the settlement pond discharging to Granity Stream. All the drilling mud and water contaminated in the tunneling process will be contained within a closed water treatment system.
- Erect the gantries required to lower the tunneling head, jacking gear and sections of pipeline down the jacking pit.
- Assemble the surface equipment required to drive the tunneling head including generators, compressors, mud pumps and separators.
- Deliver by heavy truck or rail haulage the sections of pipeline from suppliers outside the Buller District. Pipes are expected to be sourced from a New Zealand supplier, and could be manufactured locally with appropriate expertise. A stockpile of pipes will be required but will be minimised by “just in time” deliveries.
- Drive the tunnel from the pit towards the seaward discharge location, passing beneath the railway line, rail reserve, state highway, private property and foreshore sections.
- Continue seaward to pre-established line and grade and complete tunneling into the caisson.
- Remove tunneling services from the tunnel, withdraw all plant and equipment from the jacking station, complete the connection between the inland HDPE and concrete ocean sections of the outfall pipeline and close the jacking station.
- Lay the HDPE pipeline from the inshore end of the tunnel in the jacking pit up to the surge chamber.
- Excavate the sand from the caisson interior, exposing the tunneling head for removal to a barge.
- Fit and fix the diffuser to the top of the caisson.
- Commission the outfall and reinstate disturbed areas.

Outfall construction can be undertaken at any time after the grant of consents. It is not dependent on any other Project activity. The ocean outfall will be completed over a 6 month period but will not be fully commissioned until the Weka dam, penstock and Granity power house are commissioned.

5.12 Operation and Maintenance

Once the Project is commissioned, the power stations and infrastructure will only require routine maintenance, this will include:

- Maintenance of access roads, including roading surfaces and water tables.
- General site maintenance, including works on power stations, electrical components, dam and spillway works.
- Generating plant and ancillary plant maintenance.
- Removal of sediment from sediment traps.
- Maintenance of the emergency outfall diffuser within Granity Stream

In the event that natural bank erosion threatens the integrity of the emergency outfall diffuser, rock riprap will be placed around the structure, to ensure it is adequately protected. The access route constructed for the emergency outfall diffuser installation, will be used to bring rock to the site.

Sediment traps have been incorporated into the Project design at each of the diversion intakes to ensure abrasive material does not enter the generation system. While mining activity continues on the Plateau, the sediment traps are expected to require regular removal of fines and this will occur when lake storage levels are low. Silt excavated from the silt traps will be deposited at sites adjacent to Mt William and Weka reservoirs, as shown on **plans C-001** and **C-004**. Run-off from the fill sites will be directed into the reservoirs.

While mining continues, removed sediment will be stockpiled in temporary storage areas adjacent to Weka and Mt William reservoirs until transported to suitable fill sites; this is likely to be within SENZ's CML. Once mining ceases, sediment loads are expected to decrease to back ground levels of undisturbed areas and cleaning of the sediment traps is expected to be required far less frequently. The temporary storage sites will then become permanent fill sites, with these to be progressively rehabilitated.

6 Council Application Forms

6.1 Resource Consent Requirements

The rules of the relevant regional and district planning documents establish the resource consents required for the Project. HDL hereby applies for the following consents to construct, operate and maintain the Project, as described below:

6.2 Buller District Council Consents

Activity	Description/Location	Activity Status	Plan	Rule
Land Use Consent (Stockton Plateau - Project infrastructure)	Earthworks and vegetation clearance to construct, operate and maintain the Project including RCC dams, inundation areas, embankments, saddle dams, spillways, diversion weirs, diversion intake sumps, tunnels, canals, inlet towers, drop shafts, portals, intake excavations, intake channels, penstocks, power stations, tracks, roads, silt traps, silt storage areas, stockpiling/fill areas, temporary buildings, construction plant and settling ponds. Located approx: N5948300 E2417600	*Vegetation clearance* – Restricted Discretionary *Earthworks* – Discretionary *Tunneling/excavations* - Discretionary *Geotechnical surveys/ drilling* -Discretionary *Power generation* – Discretionary *Batching plant* - Discretionary *Aggregate processing* - Discretionary *Dam height (Mt William 40m)* - Non-complying *Dam height (Weka 25m)* - Discretionary *Ground floor area (storage reservoirs)* - Non-complying *Riparian Margins* - Discretionary *Lighting* - Non-complying *Signage* – Discretionary	Buller District Plan	Rule 5.3.2.4.4 Rule 5.3.2.3.1 Rule 5.3.2.3.1 Rule 5.3.2.3.1 Rule 5.3.2.3.1 Rule 5.3.2.3.1 Rule 5.3.2.3.1 Table 5.7 & Rule 7.9.1.2 Table 5.7 Table 5.7 & Rule 7.9.1.2 Table 5.7 Rules 7.9.4.2 & 7.9.1.1 Rule 7.7.2.4.1
Land Use Consent (Granity Construction site)	Earthworks and vegetation clearance to construct, operate and maintain the Granity power station including construction of the portal outlet, access ramp, portal apron, surge chamber, ocean outfall pipeline, emergency outflow structures, settling pond, site access, the Granity construction yard and the Jacking Station. Located approx: N5952390	*Vegetation clearance* - Controlled *Earthworks* - Discretionary *Tunneling/excavations* - Discretionary *Geotechnical surveys/ drilling* -Controlled *Power generation* - Discretionary *Ground floor area*	Buller District Plan	Rule 5.3.2.2.1 Rule 5.3.2.3.1 Rule 5.3.2.3.1 Rule 5.3.2.3.1 Rule 5.3.2.3.1

Activity	Description/Location	Activity Status	Plan	Rule
	E2414660	*(apron/portal)* - Discretionary *Noise* - Non-complying *Access* - Restricted Discretionary *Riparian Margins* - Discretionary *Signage –-* Discretionary *Lighting* - Non-complying *Vehicle trips* - Non-complying *Hours of operation* - Non-complying *Storage* - Non-complying		Table 5.7 Rules 7.8.1 & 7.9.1.1 Rule 7.4.1.2 Table 5.7 Rules 7.7.1.5 & 7.7.2.4 Rules 7.9.4.1, 7.9.4.2 & 7.9.1.1 Rules 5.2.2.2.2 & 7.9.1.2 Table 5.1 & Rule 7.9.1.2 Table 5.1 & Rule 7.9.1.2
Land Use Consent (Tunneling)	Earthworks to construct, operate and maintain an ocean outfall pipeline beneath residential Granity. Located approx: N5952485 E2414524	*Tunnel (boundaries)* - Non-complying *Vehicle trips* - Non-complying *Hours of operation* - Non-complying *Noise* - Non-complying	Buller District Plan	Table 5.1 & Rule 7.9.1.2 Rules 5.2.2.2.2 & 7.9.1.2 Table 5.1 & Rule 7.9.1.2 Rules 7.8.1 & 7.9.1.1
Land Use Consent (Hazardous substance storage)	The use and storage of hazardous substances during construction and operation of the Project. Located approx: N5948300 E2417600 & N5952390 E2414660	Discretionary	Buller District Plan	Rule 6.4.2.7
Land Use Consent (Realignment of Stockton haul road)	Earthworks and vegetation clearance to realign the Stockton Mine haul road over approximately 1200m and undertake on-going maintenance.	*Vegetation clearance* - Restricted Discretionary *Earthworks* - Discretionary	Buller District Plan	Rule 5.3.2.4.4 Rule 5.3.2.3.1

Activity	Description/Location	Activity Status	Plan	Rule
	Located approx: N5948300 E2417600			
Land Use Consent (Transmission spur lines, telecommunic-ation cables and switch yards)	To construct, operate and maintain a temporary overhead power line from the existing coastal BEL network to the Granity portal outlet, a new overhead electricity line from the Granity power station to the existing BEL distribution network at Granity and a new overhead electricity line from the Weka power station to SENZ's 33kV line on the Stockton Plateau. To erect and maintain tele-communication cables along the above described overhead electricity poles. To construct, operate and maintain a temporary transformer at Granity and switch yards within Granity and Weka power stations. Located approx: N5952390 E2414660 and N5951760 E2418490	*Vegetation clearance* - Controlled *Power lines* - Discretionary *Telecommunication lines* - Discretionary *Switch yard/substation* - Discretionary	Buller District Plan	Rule 5.3.2.2.1. Rule 6.4.2.2 Rule 6.4.2.3 Rule 6.4.2.4
Land Use Consent (Disturb a historic coal tramway)	To disturb a 460m section of the historic coal tramway during realignment of the Stockton Haul Road and inundation of Weka Reservoir. Located approx: N5952250 E2418500	Non-complying	Buller District Plan	Rules 7.9.7.2 & 7.9.1.1

Notes:

1. It has been assumed that storage reservoirs fall within the definition of "building". On this basis, construction of the Mt William and Weka dams are non-complying activities, as they exceed the maximum floor area requirement in the Buller District Plan.
2. Mt William dam at 40m, exceeds the District Plan height criteria, therefore is a non-complying activity.
3. Establishment of the construction yard, Granity portal outlet and associated infrastructure has been deemed to be non-complying. On the basis that on occasion construction noise may exceed the District Plan limits and vehicle movements may exceed the permitted criteria, for the small area of the construction yard that falls within the residential zone.
4. Micro-tunneling for the ocean outfall pipeline beneath the residential zoned Granity township has been deemed to be a discretionary activity, on the basis that the permitted hours of operation will be exceeded.

1. Location of the proposed activity
Refer to section 3.1 of this document.

2. Description of the activity to which the application relates:
A full description of the Project is given in Section 5 of this document.

3. The names of the owners and occupiers of any land to which the application relates:
The land owners/occupiers affected by the Project are listed within section 3.2 of this document.

4. Additional resource consents required:
From the WCRC, land use consents, water permits, discharge permits and coastal permits as detailed in section 6.3 of this document.

5. Consultation
A description of the consultation undertaken by the applicant is given in section 9 of this document.

6. Assessment of effects on the environment:
An assessment of environmental effects in such detail that corresponds with the scale and significance of the effects of the proposed activities is detailed within and in the technical reports contained in Volume 2.

7. Term of Consents
All consents are required for an unlimited duration. Unless otherwise specified the default lapsing period for resource consents is five years. However, given the nature of the proposal and the need to maintain flexibility over construction commencement, HDL requests that a lapsing period of 10 years apply to all resource consents. It is not envisaged that any delay in giving effect to any of the resource consents will unduly affect any party other than the applicant.

Signature:

_____
Anthony Black, for and on behalf of HDL

Dated:

_____

Address for service of applicant:
Hydro Developments Ltd
Box 204
Westport

Contact Person:
Rebecca Inwood
Ph/fax: (03) 789 0220
Email: inhill@xtra.co.nz

6.3 West Coast Regional Council Consents

Activity	Description/Location	Activity Status	Plan	Rule
Coastal Permit (Occupation of CMA)	To occupy land within the coastal marine area with an ocean outfall pipeline and diffuser, the occupation will extend approximately 600m offshore. Located approx: N5952750 E2414175	Discretionary	Regional Coastal Plan	Rule 7.5.1.5
Coastal Permit (Ocean outfall structure)	To erect and place an ocean outfall pipeline approximately 600m long and outfall diffuser within the foreshore and seabed. Located approx: N5952750 E2414175	Restricted Coastal Activity (Discretionary)	Regional Coastal Plan	Rule 8.5.1.7c
Coastal Permit (Ocean outfall structure CMA disturbance)	The disturbance of the foreshore and seabed to facilitate burial of an ocean outfall pipeline approximately 600m long and outfall diffuser. Located approx: N5952750 E2414175	Discretionary	Regional Coastal Plan	Rule 9.5.3.7
Coastal Permit (Maintenance of ocean outfall structure**)**	To maintain an ocean outfall pipeline approximately 600m long and an outfall diffuser within the foreshore and seabed. Located approx: N5952750 E2414175	Discretionary	Regional Coastal Plan	Rule 8.5.2.3
Coastal Permit (Discharge into the CMA following hydro generation)	To discharge tailwater into the coastal marine area from the Granity power station, discharge to be via an ocean outfall pipeline and diffuser and to not exceed 9 cubic metres per second. Located approx: N5952920 E2413930	Discretionary	Regional Coastal Plan	Rule 10.5.7.2
Coastal Permit (Temporary structures)	To erect and place temporary structures on the foreshore and seabed including sheet piling, rock breast work, sea anchors and other navigational and securing structures for the purpose of constructing and maintaining an ocean outfall pipeline and diffuser. Located approx: N5952750 E2414175	Discretionary	Regional Coastal Plan	Rule 8.5.1.8

Activity	Description/Location	Activity Status	Plan	Rule
Coastal Permit (Temporary structures - occupation of CMA)	To occupy land within the coastal marine area with temporary structures on the foreshore and seabed including sheet piling, rock breast work, sea anchors and other navigational and securing structures for the purpose of constructing and maintaining an ocean outfall pipeline and diffuser. Located approx: N5952750 E2414175	Discretionary	Regional Coastal Plan	Rule 7.5.1.5
Coastal Permit (Temporary structures - CMA disturbance)	The disturbance of the foreshore and seabed with temporary structures including sheet piling, rock breast work, sea anchors and other navigational and securing structures for the purpose of constructing and maintaining an ocean outfall pipeline and diffuser. Located approx: N5952750 E2414175	Discretionary	Regional Coastal Plan	Rule 9.5.3.7
Land Use Consent (Vegetation disturbance/ earthworks – drilling programme)	Vegetation disturbance and earthworks associated with exploration drilling within the Project footprint. The activity will occur within the full extent of the scheme. Located approx: N5948300 E2417600 and N5952390 E2414660	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.1.6.1
Land Use Consent (Earthworks/ vegetation removal for Project infrastructure)	Earthworks and vegetation clearance to construct, operate and maintain the Project including RCC dams, embankments, saddle dams, spillways, diversion weirs, diversion intake sumps, tunnels, canals, inlet towers, drop shafts, portals, intake excavations, intake channels, penstocks, power stations, tracks, roads, silt traps, silt storage areas, stockpiling/fill areas, temporary buildings, construction plant, settling ponds, transmission spur lines and ocean outfall pipeline. The activity will occur within the full extent of the scheme. Located approx: N5948300 E2417600 and N5952390	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.1.5.3 and 6.1.6.1

Activity	Description/Location	Activity Status	Plan	Rule
	E2414660			
Land Use Consent (Earthworks/ vegetation removal - Weka storage reservoir)	Earthworks and vegetation clearance, including excavations for intakes and placement of fill to establish, repair and maintain a storage reservoir of approximately 28 hectares, upstream of Weka Creek gorge. Located approx: N5952245 E2418885	Discretionary	Proposed Regional Land and Riverbed Management Plan	Rule 6.1.5.3 and 6.1.6.1
Land Use Consent (Earthworks/ vegetation removal - Mt William storage reservoir)	Earthworks and vegetation clearance, including excavations for intakes and placement of fill to establish, repair and maintain a storage reservoir of approximately 50 hectares on St Patrick Stream at Mt William. Located approx: N5947510 E2419410	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.1.5.3 and 6.1.6.1
Land Use Consent (Earthworks/ vegetation removal – roading)	Earthworks and vegetation clearance to construct, operate and maintain temporary and permanent access roads and tracks within the Project footprint, including realignment of the Stockton Mine haul road over approximately 1200m. Located approx: N5948300 E2417600	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.1.5.3 and 6.1.6.1
Land Use Consent (Disturb bed of Weka Creek – Weka dam)	To disturb the bed of Weka Creek to erect, place, repair and maintain a RCC dam, spillway and associated structures, including temporary diversion works in the creek channel for construction purposes and deepening of the creek channel in the vicinity of the proposed Weka power station. Located approx: N5952640 E2418910	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.2.6.1 (i) and (ii)
Land Use Consent (Disturb beds of Upper Mine and Mangatini Streams – weirs/intakes)	To disturb the beds of Upper Mine Creek and Mangatini Stream to erect, place, repair and maintain weir/intake structures to divert flows into the Weka reservoir, including temporary diversion of the stream channel for construction	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.2.6.1 (i) and (ii)

Activity	Description/Location	Activity Status	Plan	Rule
	purposes. Located approx: N5951520 E2417850 and N5951520 E2419600			
Land Use Consent (Disturb bed of Sandy Creek).	To disturb the bed of Sandy Creek to create the Weka reservoir and erect, place, repair and maintain the Upper Mine Creek diversion tunnel outlet, a silt trap and placement of a culvert during realignment of the Stockton haul road and temporary diversion of the stream channel for construction purposes. Located approx: N5951765 E2418250	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.2.6.1 (i) and (ii)
Land Use Consent (Disturb bed of St Patrick Stream – Mt William dam)	To disturb the bed of St Patrick Stream to erect, place, repair and maintain a RCC dam and associated structures, including construction of a silt trap and temporary diversion works in the stream channel for construction purposes. Located approx: N5947615 E2419580	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.2.6.1 (i) and (ii)
Land Use Consent (Disturb bed of Darcy Stream – sump intakes)	To disturb the bed of Darcy Stream to erect, place, repair and maintain intake sumps to divert flows into Mt William storage reservoir, including temporary diversion of the stream channel for construction purposes. Located approx: N5946490 E2420460	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.2.6.1 (i) and (ii)
Land Use Consent (Disturb beds of Fly, Plover and T31 Streams)	To disturb the beds of Fly, Plover and T31 Streams to create the Mt William storage reservoir, including construction of silt traps and temporary diversion of stream channels for construction purposes. Located approx: N5947430 E2419120	Discretionary	Proposed Regional Land and Riverbed management Plan	Rule 6.2.6.1 (i) and (ii)
Land Use Consent (Disturb bed of Granity Stream – emergency	To disturb the bed of Granity Stream in constructing and maintaining an overflow diffuser for discharge of Granity power station tailwater in emergency	Discretionary	Proposed Regional Land and Riverbed management	Rule 6.2.6.1 (i) and (ii)

Activity	Description/Location	Activity Status	Plan	Rule
overflow structure)	situations and to disturb the bed in placing and maintaining rock work around the diffuser structure. Located approx: N5952545 E2414673		Plan	
Water Permit (Take and use – drilling rig)	To take and use water from St Patrick, Darcy, Weka, Mangatini, Mine, Sandy and Granity Streams and tributaries to supply water for operation of a drilling rig. The maximum rate of take to be 1 litre per second. Located approx: N5952640 E2418910 and N5947615 E2419580 and NN5952545 E2414673	Restricted Discretionary	Proposed Water Management Plan	Rule 12.1.5
Water Permit (Take, use, dam and divert – St Patrick Stream)	To take, use, dam and divert St Patrick Stream by means of a RCC dam to create the Mt William storage reservoir, including temporary diversion for construction purposes Located approx: N5947600 E2419575	Discretionary	Proposed Water Management Plan	Rule 12.6.2(a) & (b) – links to Rules 12.1.7 (take & use), 12.4.6 (divert) and 12.4.7 (dam)
Water Permit (Take, use and divert Darcy Stream)	To take, use and divert Darcy Stream by means of intake sumps to create the Mt William storage reservoir, including temporary diversions for construction purposes. Located approx: N5946490 E2420460	Discretionary	Proposed Water Management Plan	Rule 12.6.2(a) – links to Rules 12.1.7 and 12.4.6
Water Permit (Take, use and divert Plover, Fly and T31 Streams)	To take, use and divert water from Plover, Fly and T31 Streams to create the Mt William storage reservoir, including temporary diversions for construction purposes. Located approx: N5947430 E2419120	Discretionary	Proposed Water Management Plan	Rule 12.6.2(a) – links to Rules 12.1.7 and 12.4.6
Water Permit (Take and use for hydro generation – PS2)	To take and use water collected in the Mt William reservoir via the Stockton tunnel and penstock to supply the Weka power station. Located approx: N5949380 E2418090	Discretionary	Proposed Water Management Plan	Rule 12.6.2(b) – links to Rule 12.1.7

Activity	Description/Location	Activity Status	Plan	Rule
Water Permit (Take, use, dam and divert - Weka Creek)	To take, use, dam and divert Weka Creek by means of a RCC dam to create the Weka storage reservoir, including temporary diversion for construction purposes. Located approx: N5952640 E2418910	Discretionary	Proposed Water Management Plan	Rule 12.6.2(a) - links to Rules 12.1.7, 12.4.6 and 12.4.7
Water Permit (Take, use, dam and divert Upper Mine and Mangatini Streams)	To take, use, dam and divert Upper Mine Creek, Mangatini and A.J. Streams by means of weirs and diversion tunnels to create the Weka storage reservoir, including temporary diversions for construction purposes. Located approx: N5951520 E2417850 and N5951520 E2419600	Discretionary	Proposed Water Management Plan	Rule 12.6.2(a) - links to Rules 12.1.7, 12.4.6 and 12.4.7
Water Permit (Take, use and divert Sandy Creek)	To take, use and divert Sandy Creek to create the Weka storage reservoir, including temporary diversions for construction purposes. Located approx: N5951765 E2418250	Discretionary	Proposed Water Management Plan	Rule 12.6.2(a) - links to Rule 12.4.6
Water Permit (Take and use for hydro generation – PS1)	To take and use water collected in the Weka reservoir via the Granity tunnel and penstock to supply the Granity power station. Located approx: N5951070 E2416830	Discretionary	Proposed Water Management Plan	Rule 12.6.2(b) – links to Rule 12.1.7
Water Permit (Take for construction de-watering)	To take groundwater seepage as a result of de-watering during tunnel construction. Located approx: N5948300 E2417600 and N5952390 E2414660	Discretionary	Proposed Water Management Plan	Rule 12.2.5
Water Permit (Take and use groundwater seepage)	To take groundwater seepage from the Project's tunnels and reservoirs for use in the Weka and Mt William storage reservoirs. Located approx: N5951790 E2418590 and N5946890 E2419620	Restricted Discretionary	Proposed Water Management Plan	Rule 12.2.5
Water Permit (Construction water supply)	To take and use water from St Patrick, Weka, Mangatini, Mine, Sandy and Granity Streams and	Discretionary	Proposed Water Management	Rule 12.1.7

Activity	Description/Location	Activity Status	Plan	Rule
	tributaries to supply water for construction activities, including operation of the concrete and dam fill batching plants. The maximum rate of take to be 5 litres per second. Located approx: N5952640 E2418910 and N5947615 E2419580 and NN5952545 E2414673		Plan	
Discharge Permit - Water (Discharge from PS2 into Weka reservoir)	To discharge tailwater from the Weka power station into Weka reservoir. Located approx: N5952060 E2418900	Discretionary	Proposed Water Management Plan	Rule 12.6.2(c) – links to Rule 12.5.10
Discharge Permit – Water (Discharge of spill from Mt William dam)	To discharge spill from Mt William reservoir into T35 Stream. The maximum rate of discharge to be 300 cubic metres per second. Located approx: N5947830 E2419375	Discretionary	Proposed Water Management Plan	Rule 12.6.2(c) - links to Rule 12.5.10
Discharge Permit – Water (Discharge of spill from Weka dam)	To discharge spill from Weka reservoir into Weka Creek. The maximum rate of discharge to be 65 cubic metres per second. Located approx: N5952640 E2418910	Discretionary	Proposed Water Management Plan	Rule 12.6.2(c) - links to Rule 12.5.10
Discharge Permit – Water (Emergency outfall into Granity Stream)	To discharge tailwater from the Granity power station into Granity Stream during emergency overflow situations. The maximum rate of discharge to be 9 cubic metres per second. Located approx: N5952545 E2414673	Discretionary	Proposed Water Management Plan	Rule 12.6.2(c) - links to Rule 12.5.10
Discharge Permit - Water (Tunneling seepage into Granity Stream)	To discharge groundwater seepage during tunneling activities into Granity Stream, via the emergency outflow diffuser. Located approx: N5952545 E2414673	Discretionary	Proposed Water Management Plan	Rule 12.5.10
Discharge Permit – Water (Discharge of water during construction	To discharge stormwater from construction activities, plant process water and groundwater seepage from tunneling construction into St Patrick, Mangatini, Upper Mine and Weka, Sandy Streams or tributaries.	Discretionary	Proposed Water Management Plan	Rule 12.5.10

Activity	Description/Location	Activity Status	Plan	Rule
activities)	Located approx: N5946820 E2419530 and N 5951560 E2419585 and N 5951535 E2417850 and N5951640 E2418145			
Discharge Permit – Land (Discharge from drill rig).	To discharge water containing sediment to land from operation of a drill rig. The activity will occur within the full extent of the scheme. Located approx: N5948300 E2417600 and N5952390 E2414660	Discretionary	Regional Plan for Discharges to Land	Rule 28
Discharge Permit – Land (Silt storage areas)	To discharge solid contaminants, being sediment to land at fill locations adjacent to the Mt William and Weka reservoirs. Located approx: N5946655 E2418540 and N 5952055 E2418740	Discretionary	Regional Plan for Discharges to Land	Rule 28
Discharge Permit – Land (Construction stormwater)	To discharge stormwater and sediment associated with construction activities to land (in circumstances which may result in the stormwater entering water)	Controlled	Regional Plan for Discharges to Land	Rule 16
Discharge Permit – Air (Dust and ventilation emissions).	To discharge contaminants to air associated with the construction, operation and maintenance of the Stockton Plateau Hydro Scheme including but not limited to dust associated with the excavation, handling, conveying and processing of gravel, sand, soil, rock, and other natural materials; the operation of aggregate crushing and screening, and concrete batching plants and stockpiling activities; and dust /fumes emitted via tunnel ventilation systems. The activity will occur within the full extent of the scheme.	Discretionary	Regional Air Quality Plan	Rule 16

Notes:

The restricted coastal activity is an activity for which the Minister of Conservation is the consent authority. Initially the consent process is the same as with any application, with application made to the Regional Council. The application is then considered by a Regional Council hearings panel

which includes a Ministerial appointee. The panel then makes a recommendation to the Minister of Conservation who makes the final decision on the proposal.

1. Location of the proposed activity
Refer to section 3.1 of this document.

2. Description of the activity to which the application relates:
A full description of the Project is given in Section 5 of this document.

3. The names of the owners and occupiers of any land to which the application relates:
The land owners/occupiers affected by the Project are listed within section 3.2 of this document.

4. Additional resource consents required:
Land use consents from the BDC, as detailed in section 6.2 of this document.

5. Consultation
A description of the consultation undertaken by the applicant is given in section 9 of this document.

6. Assessment of effects on the environment:
An assessment of environmental effects in such detail that corresponds with the scale and significance of the effects of the proposed activities is detailed within and in the technical reports contained in Volume 2.

7. Term of Consents
All section 9 land use consents are required for an unlimited duration. The section 13 land use consents, water permits and discharge permits are required for 35 years.

Unless otherwise specified the default lapsing period for resource consents is five years. However, given the nature of the proposal and the need to maintain flexibility over construction commencement, HDL requests that a lapsing period of 10 years apply to all resource consents. It is not envisaged that any delay in giving effect to any of the resource consents will unduly affect any party other than the applicant.

Signature:

_____
Anthony Black, for and on behalf of HDL

Dated:

_____

Address for service of applicant:
Hydro Developments Ltd
PO Box 204
Westport

Contact Person:
Rebecca Inwood
Ph/fax: (03) 789 0220
Email: inhill@xtra.co.nz

6.4 Permitted Activity Schedule

The following is a list of the activities which it is proposed to be undertaken pursuant to the specified permitted activity rules:

- To place culverts during construction of temporary and permanent roads/tracks within the Project footprint - permitted activity pursuant to rule 6.2.1.3 of the Proposed Regional Land and Riverbank Management Plan.
- To construct tunnels under the beds of streams within the Project footprint – permitted activity pursuant to rule 6.2.1.2 of the Proposed Regional Land and Riverbed Management Plan.
- To discharge sewage effluent from a single toilet contained within the Weka power station building – permitted activity pursuant to rule 6 of the Regional Plan for Discharges to Land.
- To erect signs for traffic control purposes during up-grade of access into the Granity portal site – permitted activity pursuant to rule 7.7.1.1 of the Buller District Plan.
- To stockpile gravel, sand, rock and/or soil within the Project footprint during construction activities – permitted activity pursuant to rule 1 of the Regional Plan for Discharges to Land.
- To stockpile aggregate within the Project footprint for roading construction and maintenance purposes – permitted activity pursuant to rule 2 of the Regional Plan for Discharges to Land.
- To discharge stormwater collected from roofs, yards and paved areas – permitted activity pursuant to rule 5 of Regional Plan for Discharges to Land.

7 Alternatives Considered

7.1 RMA Requirements

The RMA requires that alternatives need to be assessed, where the effects of the activity are significant or discharges are involved. It is considered that the proposal to construct and operate the Project does not have effects which are significant. However, the development does include discharge of tailwater from the Granity power station into the coastal marine area.

7.2 Alternative Hydro Locations

Brief consideration was given to other locations for development of hydro power facilities within the Buller Region but all these alternatives entailed large scale 'run of the river' schemes which presented considerable hurdles in terms of capitalisation and effects on the environment. Thus these were quickly discarded in favour of investigating the Stockton Plateau area as a feasible site. This location has the considerable advantage of elevation and high rainfall. As mentioned above, the portion of the Ngakawau catchment area flowing from the Stockton Plateau affected by the Project has significantly degraded water quality and as a consequence marginal aquatic ecology, therefore it was considered an ideal catchment in which to locate a hydro scheme.

7.3 Alternative Design Scenarios

Various combinations have been considered for the final hydro development, including the addition of a third power station incorporating an up-graded St Patrick dam and various reservoir storage capacities, these are discussed in more detail below:

7.3.1 Up-grade of the Existing St Patrick Dam

This entailed damming the upper reaches of St Patrick Stream by up-grading the existing dam structure and routing flows through a canal and penstock to a power station above the Mt William reservoir. In addition part of the flow of Plover and Fly Creeks would have been diverted via a canal system into the St Patrick dam.

The original aim of the whole development was to not only generate power but to capture AMD affected water and this design scenario achieved this purpose.

Nevertheless, the hydro design parameters have been engineered so that this aspect of the scheme could be added on completion of mining.

7.3.2 Mt. William and Weka Dams

URS New Zealand has been commissioned by HDL to undertake hydro power scheme modeling; this report is attached as **Appendix I.** URS assessed the likely usable flows within the nominated catchments and therefore the theoretical power outputs for given storage scenarios.

A total of 14 scenarios have been modeled to respond to the variety of reservoir options under consideration. This assessment, combined with consideration of the dam concept designs has identified the optimum sizing and location of the core components of the scheme, as presented in this application.

Final design will involve a further stage of climate and hydrological and water balance modeling which may result in changes to the dams, storage volumes and the hydraulic capacities of the tunnels and penstocks. Final design of the surface structures and underground facilities will involve exhaustive geotechnical work which may also result in some changes. This process is expected to

involve close liaison with SENZ, and with BEL to optimize transmission and generation.

The changes resulting from final design, while significant in engineering terms, are not expected to increase any of the environmental effects of the Project. Potential adverse environmental effects are expected to reduce as the collection of AMD affected watercourses is optimized, and the generation of renewable energy is optimized.

7.4 Alternative Discharge Locations

Several alternatives have been considered for the penstock route from the Weka reservoir, siting of Granity power station and subsequent discharge of tailwater from the Granity power station. These are discussed below.

7.4.1 Outfall into Mine Creek

This option entailed construction of a penstock down the derelict Stockton Incline and construction of a power station in the vicinity of Mine Creek, with the discharge outfall into the same. This option posed considerable access difficulties that would need to be overcome. Public consultation also indicated a strong preference for an ocean outfall (provided the effects were properly managed), as opposed to any discharge back into a freshwater environment, particularly the Ngakawau estuary.

7.4.2 Outfall into the Ngakawau River

This option also involved construction of a penstock down the derelict Stockton Incline to SENZ's coal handling facility at Ngakawau, at which point a power station would be established. From the power station the outfall would discharge into either the Ngakawau River near the mouth or via an ocean outfall buried beneath the estuary and beach. Some discussions occurred with Solid Energy over the feasibility of using the Ngakawau coal handling yard for a power house site. These discussions highlighted legal issues associated with land tenure which would potentially prevent HDL from securing appropriate property rights for a power station in this locality.

Further, public consultation indicated a strong preference for an ocean outfall (provided the effects of such were properly managed) as opposed to discharge into the Ngakawau River and/or estuary. The general opinion being, that this would enable water quality within the Ngakawau River and estuary to improve; this had considerable benefits in terms natural character and freshwater ecology.

7.4.3 Outfall at Granity

Two options have been investigated for an outfall at Granity:

- A high pressure penstock located within Millerton Road with an outfall to the north of Granity Stream, and
- A high pressure tunnel with a micro tunnel outfall to beyond the wave break zone south of Granity Stream (topography excludes a high pressure tunnel option north of Granity Stream).

The first option has been discarded in favour of the high pressure tunnel due to engineering difficulties, high costs and levels of disruption associated with the construction of the high pressure penstock within the Millerton road reserve.

The power house may be located within the tunnel or at the tunnel portal. Locating the power house within the tunnel is considered the best practicable option as environmental effects are minimised and the risk of damage to the power station by earthquake induced rock falls from the escarpment or

movement of the slope debris is minimised.

Five options have been considered for the final discharge from the Granity power house to ocean:

1. An outfall pipeline buried adjacent to the Granity Stream, transitioning to a micro-tunneled ocean outfall to beyond the wave break zone;
2. An outfall pipeline buried beneath the Granity Stream bed, transitioning to a micro-tunneled ocean outfall to beyond the wave break zone;
3. A discharge directly into Granity Stream;
4. An outfall pipeline buried adjacent to or within the bed of Granity Stream, transitioning to a diffuser field buried beneath Granity beach;
5. A micro-tunnel driven beneath the Granity settlement from the power station outlet directly to an ocean outfall beyond the wave break zone.

Although all discharge options are feasible, the direct micro-tunnel outfall from the power station to the diffuser provided the most practicable option. The tunnel provides a robust design with the added benefit of further minimising the footprint of the Project. This option essentially removes any visual component with complete burial of the outfall pipeline on a route acceptable to landowners. Disposal to salt water will result in no ecotoxic or smothering effects. This was considered to be the best practicable discharge option having no more than minor environmental effects.

8 Assessment of Effects on the Environment

The RMA requires that every resource consent application be accompanied by an assessment of the environmental effects. In this regard the following is a summary of the anticipated effects and where appropriate, the means of avoiding, remedying or mitigating any effects. This assessment draws upon the various technical reports which are attached as appendices in Volume 2.

Discussion on the potential effects of the proposal is detailed within the following sections of the report:

8.1 Positive Effects
8.2 Terrestrial Flora
8.3 Terrestrial Fauna
8.4 Landscape/Visual/Natural Character
8.5 Amenity
8.6 Cultural
8.7 Heritage
8.8 Hydrological
8.9 Water Quality
8.10 Freshwater Ecology
8.11 Instream Sedimentation Processes
8.12 Natural Hazard
8.13 Recreation and Public Access
8.14 Hazardous Substances
8.15 Coastal Marine Area

8.1 Positive Effects

The proposal will have significant positive effects as detailed below:

8.1.1 Social/Economic Benefits

- The Project utilises a renewable energy resource to generate electricity and does not involve any greenhouse gas emissions beyond the construction phase. It is also consistent with the Governments stated energy strategy of ensuring the utilisation of renewable resources for energy generation as opposed to fossil fuels. In this regard the development is assisting the government in achieving their climate change objectives as per the Kyoto Protocol.
- On a regional basis, the proposal will increase the West Coast region's electricity generation capacity by up to 240GWh per annum and will support the continued growth of industries and businesses within the Buller District.
- From a local perspective, this additional generation capacity will enable the Buller District to be essentially self sufficient and not reliant on remote power generation and the associated reliability issues this brings.
- Power generated by the scheme will be embedded into the local transmission network rather than the National Grid, thereby minimising transmission losses.
- During construction, an estimated 50 jobs will be directly associated with the construction, as such the project will have considerable economic benefit to the District. Approximately $200M will be spent within the Buller District over a 4-5 year construction period.
- Once commissioned the revenue generated by electricity sales is expected to be in the order of $30-$40M per annum.
- There will be reduced flood risk for the townships of Hector and Ngakawau, resulting from the reduction in flood peaks from the Mangatini and St Patrick catchments, as flood peaks

from these catchments pass through the Project's storage reservoirs.

8.1.2 Environmental Benefits

- AMD contamination is an environmental legacy from historical coal mining activities on the Stockton Plateau. The Project provides a solution for the comprehensive management of AMD affected watercourses from abandoned mine sites, (with the exception of AMD affected water from Charming Creek Mine). These sites can be regarded as orphan contaminated sites, responsibility for which falls on the Crown and the local community.
- The Project design includes diversions which can intercept 95% of the tributaries of the Ngakawau River affected by mining activity.
- Significant environmental benefits are anticipated as a result of intercepting and treating by dilution AMD affected watercourses that currently enter the lower Ngakawau River and estuary. The Project will improve the water quality in the lower reaches of the River. Aesthetic and amenity values and the natural character and the life supporting capacity of aquatic ecosystems in the Ngakawau River will be enhanced.

8.2 Terrestrial Flora Effects

8.2.1 Construction Activities – Habitat Losses

The Project has been designed to minimise disturbance to flora and fauna on the Stockton Plateau. To achieve this, HDL has placed a priority on containing construction effects within the areas of future inundation and the immediate periphery of these sites:

- The majority of construction activities are concentrated within the highly modified areas on the Stockton Plateau.
- Aggregates for dam construction will be sourced from the outlet excavations within the inundation areas of the Weka and Mt William storage reservoirs which will not be visible when the reservoirs are formed.
- Stripping and surplus excavations will be disposed of in the bottom of the reservoirs, where they will remain saturated. The Project will not create any new waste dumps that can leach AMD.
- The inter-connecting components of the hydro scheme are tunnels accessed from portals immediately adjacent to the reservoirs, thus minimising any visual impacts and surface disturbance.
- The penstocks (Stockton and Granity tunnels) are buried over their total length, with the only visible component being the portals.
- The existing roading network on the Plateau will be used as much as practicable.

Geotechnical investigations have verified that both the Weka and Mt William inundation areas have granite suitable to be crushed to manufacture a range of materials from rockfill to aggregate. Therefore it is expected that there will be no need to bring any additional aggregate material to the construction sites, with the exception of cement and additives required for dam construction.

In addition, material excavated from the penstock tunnels (Stockton and Granity tunnels) and the other diversion tunnels are anticipated to be suitable for use in dam and embankment construction. SENZ has also expressed interest in utilising any excess excavated material for road sheeting and rehabilitating waste dumps.

The construction method of utilising tunnels to link the various components of the Project removes any visual component and minimises the disturbance footprint. It also allows the facilities to be

built in original ground, free of the subsidence effects of historic mining.

The following summarises the excavations, land disturbance and associated habitat losses which will occur during construction:

- Vegetation will be removed from the footprint of the storage reservoirs, roads and Weka power station. This will be direct transferred to disturbed areas around the Project site, with surplus offered to SENZ for other rehabilitation works on the Plateau.
- Aggregates will be sourced from outlet excavations within the inundation areas of Weka and Mt William reservoirs. The excavations will be built outside the flood corridors of the streams passing through the inundation areas and will have the normal water and silt control systems required for a earthworks operation.
- Two areas will be inundated to create storage reservoirs, being approximately 28 hectares at Weka and 50 hectares at Mt William.
- Tunnels will be constructed to connect the following components of the Project: Mt William reservoir and Weka power station; Mine Creek and Sandy Creek; Mangatini Stream and the Weka reservoir; Darcy Stream and the Mt William reservoir; Weka reservoir and the Granity power station; Granity power station and the ocean outfall diffuser. Surface disturbance will occur at the portals of the tunnels to provide access and at several points along the Stockton and Granity tunnels to provide drop shafts for air, power supply and the potential collection of AMD affected watercourses. Habitat disturbance will be limited to around the intake, drop-shafts and exit portals, with all disturbed areas to be rehabilitated on completion of construction activities.
- The Stockton tunnel linking the Mt William reservoir to the Weka power station will be in the order of 3850m long with dimensions of 3.5m high x 3m wide, to enable access by vehicles for maintenance purposes. All excavated material will be used for dam/embankment foundations or placed in the base of the reservoirs. Material excavated from the diversion tunnels will be used/disposed of in a similar manner. Further geotechnical investigations will be required to determine the final depth and orientation of the tunnel.
- At each reservoir, a site has been set aside for the placement of sediment removed from the sediment traps, shown on **plan C-002** and **plan C-004**. While mining continues on the Plateau, these will be temporary storage areas until the sediment is carted to permanent waste dumps, this is expected to be within SENZ's CML. After mine closure, when the sediment load is expected to drop dramatically, these will become permanent fill sites. Leachate from the fill sites will be directed into the reservoirs for treatment by dilution.
- Approximately 1km of permanent crushed rock access roads will be built to serve the power stations, silt traps and access for dam maintenance, connected to the existing roading network.
- Approximately 5km of temporary construction roads will be built within the Project footprint. These will be located on the footprints of the final access roads wherever possible. Sections of the roads which are not retained as part of the permanent roading network will be rehabilitated.
- Approximately 1200m of the Stockton haul road will be realigned at Tin Town bend. A new culvert will be constructed over Sandy Creek. A silt trap will be incorporated into the culvert inlet. Habitat disturbance will be limited to the road footprint and road shoulder, which will be rehabilitated on completion.
- The Mt William road will be relocated along the crest of the Mt William reservoir.
- An intake weir will be built on the Mangatini Stream to divert stream flows and bedload through a tunnel to the Weka reservoir. Access for construction and maintenance will be via the tunnel. A permanent foot track will be formed to the site across the ridge from the Weka

reservoir. Habitat disturbance will be limited to around the intake and exit portals.

- A similar intake weir will be built on Mine Creek to divert stream flows and bedload through a tunnel to Sandy Creek and the Weka reservoir. Access for construction and maintenance will be via an access road off the SENZ 2-5 haul road and via the tunnel to Mine Creek. A permanent foot track will be formed to the intake from the access road. Habitat disturbance will be limited to around the intake and exit portals.
- A 3.5m high x 3m wide tunnel will be driven from the Mt William impoundment reservoir to pick up drop shafts from the headwaters of Darcy Stream. Habitat disturbance will be limited to around the intake drop-shaft and exit portals. Access to the tunnel portal for construction will be from within the Mt William reservoir footprint, with access to the intakes being from the tunnel and from the Mt William mine tracks.
- A transmission line will be constructed from Weka power station to connect to the SENZ 33kV line near the disused no 4 aerial station, with the spur line traversing approximately 500m. Habitat disturbance will be limited to tracking damage by the all terrain equipment and vehicles used to install the power poles.
- The Granity tunnel linking the Weka impoundment reservoir and the Granity power station will be driven from a portal located immediately north of the Granity Museum. The tunnel will be approximately 4900m long with dimensions of 3.5m high x 3m wide. All excavated material will be used for dam/embankment foundations or placed in the base of the reservoirs. Further geotechnical investigations will be required to determine the final depth and orientation of the tunnel.
- Excavations will be required to build the Weka power station. The power station will include substantial foundations and underground chamber, thrust blocks and energy dissipaters. Habitat disturbance will be limited to the area immediately around the facilities, which will be landscaped on completion.
- The Granity power station (PS1) will be contained within Granity tunnel approximately 50m in from the outlet portal, located in the vicinity of the Granity museum. It will have all the components as described for the Weka power station, with these incorporated within the tunnel apron and portal. An access ramp some 6m wide and 100m long will be constructed up to the outlet portal and a portal apron with approximate dimensions of 20m x 25m will be constructed. Habitat disturbance will be limited to the immediate footprint of the infrastructure.
- From the Granity power station the outfall pipeline will be buried by means of micro-tunneling beneath land, foreshore and seabed. The tunnel diameter will be approximately 2m with excavations to be used for roading material at the Granity site or up on the Stockton Plateau.

8.2.2 Stockton Plateau - Flora Effects

Terrestrial flora effects have been assessed in a report prepared by Richard Nicol, attached as **Appendix F.** This report assessed the effects of the Project on flora within the footprint of the Mt William area. With regards to the Weka reservoir footprint, no additional studies were undertaken as this area was the subject of an earlier assessment undertaken by Dr Norton and Dr Roper-Lindsay, attached as **Appendix E.**

The Norton/Roper-Lindsay report reviewed the boundary and conservation values of a part of the then proposed Ngakawau Ecological Area and focused on a proposed hydro scheme on Weka Stream, which had been identified as a potential lake site.

The study area, bounded by Weka creek and Burma Road (Stockton Mine haul road) to the west and Mangatini Stream to the east, was assessed as comprising a gently sloping plateau, with the

main creeks incised into this. The vegetation was described as predominantly open Wirerush-Tanglefern rushland with scattered shrubs, with small forest remnants and isolated forest trees remain along stream courses. The area of the proposed lake (c 28 hectares) is centered on Weka creek, comprising the creek bed and tributaries and sloping surfaces above the creek and has similar vegetation to the overall study area. The vegetation of both the proposed lake area and the surrounding area has been strongly modified by fires, with similar vegetation occurring elsewhere in the Ngakawau Ecological Area.

The report concluded that exclusion of the proposed lake area from the proposed Ngakawau Ecological Area would not reduce the values for which this area had been recommended for protection nor would it affect the long-term viability of the ecological area. Indeed, formation of the proposed lake was seen to have a number of positive conservation benefits for the proposed Ngakawau Ecological Area. Specifically, through limiting trail bike access and fire into the ecological area and as a source of soil and plant material for restoration of degraded tracks in the locality.

The Norton/Roper-Lindsay report is some 10 years old but the conclusions are equally applicable to the present proposal. The report was clearly of the view that in terms of flora values, loss of habitat at the Weka lake site was not significant. This was on the basis that the area had been substantially modified by fire, no significant plant species were identified and that the vegetation of the proposed lake area was well represented elsewhere. Some of the other environmental reports (Terrestrial Fauna Survey and Archaeological Assessment) commissioned by HDL, also referred to the habitat of the Weka area as having been significantly modified through settlement (Tintown), roading, subsistence farming and coal mining processes.

HDL has extended the footprint of the hydro scheme assessed in this earlier report to that described in this application incorporating the proposed Mt William reservoir, and has commissioned Richard Nichol to undertake an assessment of the flora within the extended Project footprint, report attached as **Appendix F.**

Historical mining in the Mt William area has left a legacy in the form of mining relics, spoil dumps and tracking, as well as AMD contamination and coal fines. The vegetation of the area reflects this history of disturbance, especially along the north-west and northern boundaries of the area. The flora report describes the footprint area as comprising a mosaic of vegetation associations, which range from modified exotic shrubland through to unmodified beech-podocarp forest. Significant portions of the footprint area are sparsely vegetated, due either to exposure of the coal measure sandstone or loss of natural vegetation through historical activities.

The report concluded that no threatened species were found and while some vegetation communities of particular interest were present, most are known to be well represented outside of the proposed Mt William footprint area. The report outlined recommended mitigation measures which have been adopted below.

On the basis of these reports, the Project is considered to have no more than minor effects on terrestrial flora values.

Mitigation Proposed

- Cleaning of all machinery prior to bringing onto the Stockton Plateau, to avoid weeds invading the adjoining ecological area.
- To undertake a programme of *Juncus squarrosus* control on all disturbed areas within the

Project footprint, preventing the establishment of this invasive weed.

- To relocate species within earthwork/inundation areas including cedar saplings, red tussocks and *Exocarpus bidwillii* for direct transfer in rehabilitating disturbed areas within the Project footprint.
- To take cuttings of *Metrosideros parkinsonii* within earthwork/inundation areas for off-site propagation for rehabilitation on suitable sites within the Project footprint.
- A Landscaping and Rehabilitation Management Plan will be prepared to address rehabilitation strategies for all disturbed areas on the Plateau.
- To utilise the timber resource affected by inundation, for instance offering Ngai Tahu salvageable logs of Hall's Totara for cultural purposes.

8.2.3 Granity – Flora Effects

As described previously, the outlet portal for the Granity tunnel will be constructed between the Granity museum and the Millerton incline and will involve vegetation clearance for construction of the portal apron and access ramp. Figure 6 shows the current state of the construction site.

Figure 6 Granity construction site

Access to the site will be gained off the state highway and across the railway line, with a construction storage area to be established between the railway line and adjoining hill slope as shown in **plan C-006**.

The area beyond the railway is essentially bare land with some weed species and scattered pines present. Recent bulldozer activity cleared the area of vegetation and mounded it into piles, as can be seem in *Figur*. This is the area in which the construction storage yard will be established, with the Jacking Station located in the foreground.

The pine and macrocarpa trees bounding the railway line will be retained for screening purposes

with the bush at the bottom of the hill to remain undisturbed. The mounded piles of vegetation and soil will be buried, to enable access roading to be formed and a flat gravel pad for construction yard establishment.

The access ramp up to Granity portal, construction of the portal and portal apron will entail earthworks and removal of native vegetation. The vegetation in the area comprises a mixture of kamahi, flaxs, ferns, broadleaf and pungas, generally less than 6 metres in height. Excavations for the access ramp and portal construction will be limited to an area of approximately 1500m², with adjoining vegetated margins to be retained. A small section of access roading will be constructed from the bottom of the access ramp to a settling pond and outfall diffuser within Granity Creek. The settling pond will be approximately 30m² with the access road requiring the bare minimum excavations for construction.

Both the access ramp and the portal apron will utilise tie-back techniques to minimise disturbance to the surrounding vegetation. Such construction techniques will ensure that adjoining areas of vegetation remain undisturbed and vegetation below the access ramp is retained. No excavated material will be side cast during road and portal formation.

From the base of the surge chamber (contained in the portal apron), a trench will be required to be excavated for burial of the ocean outfall pipeline (see **plan C-006**). This will traverse some 100m before connecting into the micro-tunneled section of the outfall pipeline. This will entail excavation and removal of a strip of vegetation on the hill slope immediately in front of the portal outlet, with the excavated trench approximately 5m wide. The excavations will be the bare minimum required to bury the outfall pipe (approximately 2m diameter). Stripped topsoil and vegetation will be retained for re-spreading on completion of burial of the pipeline.

The lower hill slopes on which the Granity portal, portal apron and access ramp will be constructed, comprise lush vegetation. Disturbed areas are expected to rapidly regenerate and largely conceal the facilities from view. On completion of construction activities, any remaining visible excavations will be re-vegetated to ensure the site is appropriately rehabilitated.

In conclusion, the Granity site works will involve some minor clearance of vegetation but the construction techniques and relatively small footprint of the construction work area is considered to have no more than minor effects on flora.

Mitigation Proposed:

- Disturbance to surrounding vegetation during construction activities shall be minimised, in particular, formation of the access ramp shall be undertaken to ensure vegetation below the road formation remains undisturbed and disturbance to vegetation surrounding the portal and portal apron is kept to the immediate construction footprint.
- On completion of construction activities all plant and equipment will be removed from the Granity construction site.
- A Landscaping and Rehabilitation Management Plan will be prepared to address rehabilitation strategies for all disturbed areas at Granity.

8.3 Terrestrial Fauna Effects

The effects of construction of the Project on terrestrial fauna has been assessed in two reports prepared by Waybacks Ltd and Wildlife Surveys. The first report being a review of previous surveys undertaken in the general area of the Project, attached as **Appendix G** and a report detailing

the results of a recent survey undertaken by Waybacks Ltd and Wildlife Surveys, attached as **Appendix H.**

The reports state that a review of the literature shows that most of the Project footprint and its wider surrounds have been well surveyed over the years and a reasonably comprehensive data set exists.

The Project traverses coastal hills and the northern part of the Stockton Plateau and includes a wide range of habitats including pakahi grassland, coal-measure scrub, rock platform and podocarp/beech forest. The reports describe the habitat potentially affected by the Project as primarily modified through settlement, roading and coal mining processes.

Despite being close to four different populations of *Powelliphanta* snails, it was determined that there appeared to be no *Powelliphanta* snails within the Project footprint. Of these four snail populations, *Powelliphanta* lignaria 'Millertoni' is regarded as the most significant species. The population is currently known only to occur within 0.5 hectares of secondary growth forest on the southern side of Millerton township. Burial of the penstock via the Granity tunnel ensures there will be no impact on this snail population.

Over-all, the impacts on terrestrial fauna of the Project were assessed to be relatively low on the basis:

- That *Powelliphanta* snails appear to be extremely scarce and perhaps absent altogether from the Project footprint.
- The low density of Kiwi, Weka and Kereu within the Project footprint.
- That the potential impacts on Fernbirds – (the most abundant species of conservation significance within the footprint area), are small and unlikely to have any measurable effect on the local population of Fernbirds on the Stockton Plateau.
- That there appears to be no species of vertebrate or invertebrate that is confined entirely to the Project footprint.
- Of the relatively small footprint of the Project, the use of underground pipelines and other means of reducing impacts on the natural environment, such as following existing roads and developing areas already modified.
- That most of the disturbed areas will revegetate naturally over the following 5-15 years, allowing recolonisation by Weka, Fernbird and Kiwi.
- That the abundance and diversity of aquatic fauna in the lower catchment of the Ngakawau River should increase, when water contaminated with mine leachate is prevented form entering the catchment and piped directly to the Tasman Sea.

In the final analysis it was concluded that although the Stockton Plateau and its immediate surrounds supports several species of threatened fauna, the planned route and footprint of the Project avoids areas where these species are likely to be significantly affected, thus the overall impact of the Project was considered to be minor. Indeed, the reports noted that the Project is likely to have substantial benefits in terms of enhancing the environmental values of the Ngakawau River system, by reducing the quantity of contaminated flows that currently enter the River.

Mitigation Proposed:

The following measures, as recommended in the fauna report, will be undertaken to mitigate the effects on fauna within the Project footprint:

- Locate as much of the Project as possible on land that has been recently disturbed for road construction.
- All surfaces disturbed by construction activities will be rehabilitated to establish native vegetation, appropriate to the locality.
- Wherever possible, direct vegetative transfer will be used with vegetation sourced from disturbed/inundated areas within the Project footprint.
- Where practical ensure inundation of the two reservoir area is not carried out during the peak kiwi breeding season of (July-January). If this is not possible then the areas shall be searched with a certified and approved kiwi dog and handler to ensure no nesting kiwi are present.
- Locate and remove lizards prior to the storage reservoir areas being inundated.
- Pest and predator control will be undertaken, with strategies to be outlined within the Landscaping and Rehabilitation Management Plan
- A Landscaping and Rehabilitation Management Plan will be prepared to address rehabilitation strategies for all disturbed areas on the Stockton Plateau and at Granity.

8.4 Landscape/Visual/Natural Character

Landscape, visual and natural character considerations have been assessed for construction and operation of the Project.

It is noted that none of the planning documents classify the Stockton or Granity area as an outstanding natural feature or landscape.

8.4.1 Construction Activities – Stockton Plateau

During the construction phase there will be several temporary buildings, (including portable workshops and smoko room), concrete batching plant, gravel crushing plant, numerous heavy machinery and plant which will be required for construction of the Project works. The building facilities will be similar to other temporary construction buildings located within the Stockton Mine.

The Project's major structures are contained on the Stockton Plateau, these will not be visible to the public other than from the air. The town of Millerton is some 2km distant from the Weka dam/reservoir and no aspect of the works will be visible from any perspective within the town. Nor will residents be affected by increased noise, lighting or dust during construction activities given the distances involved. With the exception of the reservoirs, tunnel portals, Weka power house and stream intakes, all other construction activities involve excavation of tunnels beneath the ground surface, therefore the landscape and natural character effects are deemed to be no more than minor.

Mitigation Proposed:

- All surfaces disturbed by construction activities will be rehabilitated to establish native vegetation, appropriate to the locality.
- Wherever possible, direct vegetative transfer will be used with vegetation sourced from disturbed/inundated areas within the Project footprint.
- A Landscaping and Rehabilitation Management Plan will be prepared to address rehabilitation strategies for all disturbed areas on the Stockton Plateau.

8.4.2 Construction Activities – Granity

Construction activities at Granity will continue for a period of up to 4-5 years, which is the anticipated time frame for completion of the Granity tunnel and power station. Construction of the

ocean outfall pipeline is expected to occur in tandem with the tunneling operation.

Occupation of the site will entail establishment of a construction storage yard, which will be contained within a fenced area beyond the railway line. This will have the obvious appearance of a construction yard containing various plant, equipment and stockpiled aggregate for construction purposes. To minimise the visual effects and in agreement with the neighbours, mature plants recovered from the access construction will be replanted along the road frontage of the construction yard using direct vegetative transfer techniques.

A small cluster of pine trees and the buildings fronting the State Highway will largely conceal the construction area from the northern perspective, until immediately in front of the site. From a southern perspective the construction storage area will be visible from further away, as the state highway frontage is largely bare of buildings and vegetation. It is intended to enclose the construction yard with a fence with plantings along the fence frontage to minimise the visual effects.

As regards the Granity portal outlet, portal apron and access ramp, it is intended to minimise vegetation disturbance to the immediate footprint of these structures/roads by using ground stabilisation techniques to ensure the surrounding vegetation remains intact. From immediately in front of the Granity portal, disturbed vegetation and foundation works will be visible but from most locations the structures/roads will be obscured by the reasonably dense vegetation surrounding the site.

During consultation with the Granity community it was established that both the Granity Museum and the Northern Buller Community Society have a beautification project underway in the vicinity of the Granity museum and the band rotunda. HDL will work with the community to implement the communities objectives as regards the landscaping plans for this area and improvements to pedestrian access from the band rotunda through to the Granity museum.

In conclusion, the visual and landscape effects will be temporary and will not compromise landscape values beyond the construction phase. Likewise natural character effects will not be greater than those that exist currently, due to the fact that a portion of the site has already been substantially cleared of vegetation and the lower hill slopes to be disturbed adjoin the margins of the modified environment of Granity township.

Mitigation Proposed:

- Suitable plants recovered from the access ramp construction will be replanted along the entrance of the construction yard using direct vegetative transfer techniques to minimise the visual effects of the construction yard.
- On completion of construction activities all plant and equipment will be removed from the site, and the area landscaped with plantings appropriate to the locality.
- A Landscaping and Rehabilitation Management Plan will be prepared to address rehabilitation strategies for all disturbed areas at Granity. This shall be formulated in consultation with the Granity museum curator, Northern Buller Community Society and any interested community members.

8.4.3 Operation of the Project

Historic and current coal mining activities dominate the landscape of the Stockton Plateau. In the context of this modified environment, the infrastructure associated with the Project will be entirely

within the existing environmental context. Aside from the proposed Mt William and Weka dams/reservoirs, the penstocks and diversions linking the reservoirs and power stations will be buried and over time the reservoirs will blend with the natural landscape, as vegetation establishes around the margins.

The Granity penstock will be buried over its entire length, therefore removing any visual element. The exit portal in the vicinity of the Granity Museum and access roading will be the only visible components. Given that disturbance is confined to a relatively small area, construction techniques will ensure adjoining vegetation remains undisturbed and HDL intends landscaping any disturbed areas, it is anticipated that there will be no long term detraction to the natural character of the Granity coastal environment.

Incorporating the power station within the Granity portal also ensure there is no industrial element and noise from operation of the generating equipment will not be discernible to the residents of Granity.

The outfall pipeline from the Granity power house will also be buried along its entire length, ensuring no detraction to the coastal environment.

8.4.4 Charming Creek Walkway

The Charming Creek Walkway is one of the Buller Districts more popular walking tracks. Walker numbers for 2007 totaled 6693 (as per DoC figures), with numbers having nearly doubled in the last 10 years. The track takes approximately 2.5 hours with 1 hour of the walk alongside the Ngakawau River and passing the Mangatini falls.

Walkers experience of the Charming Creek walkway and the Mangatini Falls is lessened by the water quality within the Ngakawau River and the Mine Creek and Mangatini tributaries. The Mangatini falls is clearly visible from the walkway and is one of the features along the track. The disparity in water quality is evident at the point where the Mangatini Stream enters the Ngakawau River. The water quality is in stark contrast with the water quality typical of the undisturbed waterways within the District. The capture and diversion to sea of the mine affected watercourses draining from the Stockton Plateau will lead to significant landscape, visual and character enhancements to the Charming Creek walkway and the lower reaches of the Ngakawau River.

However, to achieve these enhancements in water quality the Project must divert the contaminated headwaters, with the result that, at the point of entry into the Ngakawau River, the mean flows of the Mangatini Stream will be reduced to approximately 40% of the existing mean flows. Periods of drought will be extended and flood peaks will be reduced. The flow reduction will be noticeable to a regular user of the walkway but will not be discernible to the casual visitors that make up the bulk of visitor numbers.

In order to mitigate the effects of the loss of flow over the Mangatini falls, the Project will undertake enhancement to the area in consultation with Ngakawau River Watch and DoC. Enhancements that have been proposed include, undertaking replanting and rehabilitation around the margins of the falls to re-establish the native vegetation and enhance the visual experience. Also proposed is improvements to the Charming Creek track, in order to provide improved outlook points and locations where visitors can rest and enjoy the enhanced river environment.

Mitigation Proposed:

In consultation with Ngakawau River Watch and DoC:

- The residue of sediment and scale will be removed from the rock surfaces at the Mangatini Falls.
- Appropriate native species shall be sourced and planted around the margins of the Mangatini Falls to revegetate the areas that have been affected by historic AMD contamination.
- Improvements to the Charming Creek track will be made to enhance the visitor experience.

8.5 Amenity Effects

Amenity values embrace a wide range of elements and experiences that contribute to the general character of an area and for this Project include consideration of the following aspects:

8.5.1 Traffic Effects

Stockton Plateau

Other than light vehicle movements carrying workers to the Project site on the Plateau, construction machinery will be focused within the immediate Project footprint. It is expected that there will be minimal haulage of additional construction materials from beyond the Plateau to the respective work sites. Most of the rock and aggregate material required for construction of the respective dams/embankments is expected to be sourced from excavations within the Weka and Mt William reservoirs and excavations from the tunnels on the Plateau. A concrete batching plant will also be sited at the respective dams for concrete requirements for dam construction.

Building plant and materials that will be transported up to the Plateau include:

- Portable equipment for producing aggregate (screens, crushers, etc).
- Portable concrete batching plant.
- Penstock pipes.
- Earthworking machinery and fuel trailers.
- Cement, concrete additives and reinforcing steel.
- False work and form work for construction of reinforced concrete works.
- Fixtures and fittings for the Weka power house and outlet towers.
- Poles, transmission wire and fittings for the Weka power station spur line.

This will generate additional heavy traffic flows within the town of Granity and along Millerton Road but flows will generally be sporadic and within the context of the existing traffic on the State Highway and the Stockton Mine traffic. The small increase in daily vehicle movements will not effect the safety and efficiency of the roading network.

Granity

Heavy vehicle movements to and from the Granity portal site will comprise:

- Up to 10 trucks per day removing material excavated from the Granity tunnel up to the Weka reservoir; this to continue for a period of up to 4-5 years (expected time-frame for tunnel construction).
- Approximately 40 concrete trucks, required for construction of portal and power station structures, likely to be sourced from the concrete batching plant located at Weka.
- Approximately 50 trucks over a 2 week period, carrying roading aggregate for roading and construction yard formation, again likely to be sourced from excavations at Weka.
- The occasional concrete truck supplying shotcrete for tunnel lining over the 4 year tunnel construction phase.

- Approximately 8 light vehicles per day transporting workers to and from the site.
- The occasional delivery of plant and equipment, including pipes required for the ocean outfall.

Construction activities will increase the amount of traffic along the State Highway and Millerton Road. The State Highway already caters for significant heavy traffic movements associated with the Stockton Mine. The current application is expected to increase traffic volume but not significantly in the context of the existing heavy traffic flows. The majority of heavy traffic movements is expected to be confined to the route between the Granity construction site up to the Plateau, therefore will not have a significant impact on residents or road users beyond this route. As to Granity residents along the aforementioned route, truck movements are not expected to occur over a concentrated period but will generally be spread over a full days operation.

Overall, in the context of the existing heavy traffic flows utilising the State Highway and Millerton Road, the Project will not result in a significant increase in heavy vehicle and therefore will have no more than a minor effect on the roading network.

8.5.2 Air Quality Effects

The potential air discharges that will be generated by construction activities are particulate matter (primarily dust), vehicle emissions and odour/fumes from blasting events. The potential effects for each of these sources are discussed below:

Stockton Plateau

During construction activities there will be additional vehicle/machinery movements but these will not be significant in the context of Stockton's operations. Other than light vehicle movements carrying workers to the development site, construction machinery will be focused within the immediate Project footprint. It is expected that there will be minimal haulage of additional construction materials from beyond the Plateau to the respective work sites.

Within the Project footprint, there will be considerable movement of material within each reservoir site. Less frequent movements between sites will follow the existing roading system on the Plateau, with dust emissions making a minor addition to that already occurring from the movement of Stockton Mine traffic.

The nearest neighbours to the dam sites are Millerton residents, which are approximately 2km from the Weka reservoir. Given the high rainfall and generally damp conditions encountered on the Stockton Plateau, it is not anticipated that there will be any significant dust/vehicle emissions from beyond the construction footprint on the Plateau.

Granity

Construction activities at Granity will be concentrated at the portal site, which is elevated some 20 metres on the hill slope behind the Granity museum. With the exception of the museum, the closest neighbours to the outlet portal are the Granity Library, Granity Rocks Craft shop and Drifters Cafe, some 150 metres distant. The main source of air emissions will be from minor surface blasting during the initial ground stabilization and excavation works, operation of the ventilation fan, heavy vehicle movements accessing the site and road/construction yard/Jacking Station establishment.

Minor blasting work is likely to be required to establish suitable foundations for the outlet portal and portal apron. Surface blasting is anticipated to be limited to small blast events over a short period. With the exception of the Granity museum, the distance to neighbours and coastal location,

is such that dust and fumes from blasting is expected to disperse before reaching any of the adjoining properties. Otherwise, all other blasting events will be confined to within the Granity tunnel.

As regards the museum, consultation with the museum curators will occur to establish the most suitable times for blasting to minimise disturbance to museum visitors. Overall, given the anticipated small number of blasting events the effects are considered to be no more than minor.

The ventilation extraction fan will operate continuously to circulate air within the Granity tunnel during tunneling activities. When blasting occurs within the tunnel, some dust and fumes may be discernible but blasting emissions are limited to a short period and the distance to the nearest neighbours is such that dust/odour emissions are likely to have adequately dispersed. Note, as the tunnel progresses, drop shafts further up the Plateau route will be utilised for ventilation purposes.

The existing access into the site will require up-grading and the construction yard will require formation of a gravel pad. The construction yard is approximately 40 metres behind the aforementioned neighbouring properties but is somewhat screened by the existing pines and macrocarpa trees, adjacent to the railway line. Formation of access and the construction yard will require minimal earthworks as the site is already largely bare of vegetation thus minimising the potential for dust emissions. Laying of a metal working surface will be required and is expected to take up to 2 weeks. Dust will be suppressed by addition of water required to produce the dense working surface.

Heavy vehicle movements entering and exiting the site is the other potential source of air emissions. Other than the initial intensive construction period for site establishment and construction of the portal/portal apron, truck movements into and out of the site will generally be spread over a significant period of the day and will mainly comprise the estimated 10 trucks per day carting excavated material from the tunnel up to the Stockton Plateau. The road surfaces will be kept damp to prevent dust becoming a nuisance to adjoining residents.

Proposed Mitigation:

- At the Granity construction site HDL will use all practicable measures, such as water sprinklers and/or water carts, to ensure that the concentration of dust attributable to construction activities does not exceed the Ministry for the Environment's dust nuisance criteria of 4g/m²/30 days above ambient for deposited particulate, at the notional boundary of any residential dwelling.
- The Granity site entrance adjacent to the band rotunda will be sealed to ensure dust generated by vehicle movements is minimised.

8.5.3 Lighting Effects

Stockton Plateau

During the construction phase on the Stockton Plateau it is expected that some activities, such as tunneling and dam construction, will be undertaken at night. Therefore night lighting will then be required. The Weka dam is elevated above the Millerton township, which is some 2 km from the work site. Lighting requirements will be temporary and focused on a given work area, thus spill and glare are unlikely to be an issue. In the context of Stockton mine which operates on a 24 hour basis and the distance to Millerton township, the effects of lighting is anticipated to be no more than minor.

Granity
All surface construction activities including roading, construction yard formation, portal construction and establishment of the Jacking Station will be undertaken during normal operating hours. Tunneling work on the Granity tunnel and micro-tunneling of the ocean outfall pipeline will be undertaken on a 24 hour basis. Lighting will then be required around the entrance of both the Jacking Station and the Granity portal, to aid shift workers accessing these areas. Such lighting will be directed into the tunnel entrances and will be somewhat screened by construction fencing. Night lighting will only be required over the 4 year construction phase for tunnel construction.

The Granity Museum is only operated during the day time, thus night lighting is not expected to pose any problem for the museum's operation. Other residents are some 150 metres distant from the Granity portal outlet but considerably closer to the Jacking Station. Micro-tunneling and hence the need for the Jacking Station is expected to be limited to a 6 month construction phase. Some spill may occur from the Jacking Station but is expected to be minimal and will be able to be contained with appropriate fencing and screens around the area.

Note: Once operational the Granity power station will only require security lighting around the portal entrance, of similar intensity to a street light.

Mitigation Proposed

- Screens, shields and fences will be utilised where necessary to ensure lighting does not cause a nuisance to Granity residents.

8.5.4 Noise Effects

Stockton Plateau
Noise emissions will be limited to the construction phase and will include the following:

- Vehicle movements along the state highway and Millerton road to the Stockton Plateau for contractors working on the Project, transport of plant/equipment, cartage of material excavated from the Granity tunnel up to the Plateau and cartage of concrete and aggregate down to the Granity portal site.
- Operation of heavy machinery including diggers, bulldozers and dump trucks, to construct the hydro infrastructure on the Stockton Plateau.
- Blasting activities for dam/embankments/tunnel and quarry activities on the Plateau.
- Operation of a gravel crushing plant within the respective excavation areas of Mt William and Weka reservoirs, to create aggregate for site works.
- Operation of concrete batching plants at the Weka and Mt William dam sites, to produce concrete for construction of ancillary works and dry mix for the construction of the rolled compacted concrete dams.

Significant volumes of material will be required for dam/embankment construction and this will be sourced from excavations within the inundation areas and from excavated material from the Stockton and Granity penstock tunnels and the other diversion tunnels. Excavation sites and tunneling will require extensive blasting and this will be undertaken in conformity with standard industry procedures.

The town of Millerton is some 2km from the Weka dam site. Given the distances to these residential properties and the presence of the nearby large scale coal mining operation, it is anticipated noise effects will indistinguishable from background noise and will be no more than

minor.

Granity
Noise emissions will be limited to the construction phase and will include the following:

- Traffic noise from movement of heavy machinery working at the site, heavy trucks delivering/removing equipment and materials, and light vehicles transporting workers to the site.
- Operation of machinery for site construction works.
- Rock drilling and rock splitting activities for Granity portal outlet, portal apron and access ramp construction.
- Blasting activities for Granity tunnel construction within the tunnel.
- Operation of equipment associated with tunneling including operation of the ventilation fan
- Establishment of the Jacking Station, including sheet piling.
- Operation of micro-tunneling gear to drive the outfall pipeline underground.

As regards traffic noise, the State Highway already caters for significant heavy traffic movements associated with the Stockton Mine. The current application is expected to increase volume but not significantly in the context of these existing flows. Heavy vehicle movements which has the potential to pose a noise nuisance to residents, such as the arrival of trucks transporting materials, will be managed to ensure unloading activity occurs during normal working hours. Excavated material from the Granity tunnel during the night shift will be stored in a stone bay within the tunnel for removal during the day shift.

The noise sources most likely to be discernible to Granity residents, will be from operation of machinery during formation of the construction yard, access roads, tunnel apron/ portal and pile driving required for the establishment of the Jacking Station. All these above ground construction activities will be scheduled within normal working hours to minimise disturbance to Granity residents.

With the exception of the Jacking Station, the activities described above will occur during site establishment, which is expected to take 2-3 months from the time of the first works to establish access to the site to the time when all works will have migrated into the tunnel, where noise and vibration will be contained underground. Over this period the level of activity and noise has the potential to cause disturbance to Granity residents in the immediate vicinity of the site. Once construction activities become concentrated in the area of the access ramp and the portal works, the distance to neighbours becomes greater and the noise effects are not expected to be any more intrusive than, for example, repairs to the state highway or railway track.

Construction of the access ramp and tunnel portal will be within the outer layer of slope debris that covers the escarpment. The slope debris consists of massive blocks of rock, some of which will need to be split into smaller fragments before they can be excavated. In addition, the slope around the portal and above the access ramp will need to be stabilized by securing the massive blocks using rock anchors. Stabilization will require rock drilling. Rock splitting will require drilling and the use of small explosive charges (popping). Both the drilling and small pops will be noticeable at the boundary of the construction site but will not be overly intrusive. Large blasts typical of quarry or mining operations will not be required. Over a period of approximately 1 to 2 months the construction work cycle will consist of several small pops over a short period followed by periods of excavation and rock drilling.

Once the Granity tunnel has progressed through the slope debris, which may be up to 50m thick, tunneling of the granite basement rock will commence. Noise effects will be the result of blasting at the tunnel face but will largely be contained within the tunnel. At this stage, the distance to neighbours will be such that tunneling noise is unlikely to be noticeable above background noise. There are precedents for operating tunnel portals close to residential dwellings in Reefton where the effects have been acceptable

The possible exception is potential nuisance to the Granity Museum. Tunneling noise effects may continue to be a nuisance for a longer period due to the proximity of the building and Millerton incline walkway to the tunnel. On-going consultation will occur with the museum curator to establish when special care will need to be taken to reduce the nuisance (for example by the use of sound baffles at the tunnel entrance). The high volume visitor period is over the summer months so depending on commencement of construction, the nuisance may well occur outside the busy visitor period.

Establishment of the micro tunnel Jacking Station, requires sheet piling to create the pit. This is expected to be completed within a two week period but given the proximity to neighbours has the potential to cause some noise and vibration disturbances while the piles are being driven. Again this work will occur during to normal working hours to minimise potential nuisance.

The actual micro-tunneling operation will be undertaken, 2 shifts per day, on a near continuous basis. Based on typical tunneling rates of 4-5 m per shift, tunneling should be completed over 100 days spanning a 3 - 4 month period. Noise from the site will be limited to the operation of surface machinery at the jacking station, including pumps, separators and filtering equipment. Such equipment will be operated with appropriate silencing measures, to ensure noise is adequately muffled.

No noise or vibration will be evident above ground emanating from the tunneling head, once the head has moved past the jacking station. There are precedents for operating such equipment within residential areas of Christchurch city, where the effects have been acceptable (see Figure 5). A temporary earth noise barrier, similar to that shown in this photograph, will be constructed around the western side of the jacking station to minimise noise effects for nearby properties. Given the proximity to the foreshore and the existing background levels provided by the sea and the adjoining state highway, it is expected that any increase in noise levels from the tunneling operation will be minimal.

With the exception of the Granity museum, the nearest neighbours to the Granity site also front onto the state highway. The existing noise environment for these properties includes elevated noise levels at various times. The state highway caters for a considerable volume of traffic associated with Stockton Mine and is the main thorough fare for traffic heading north, the railway line is also in very close proximity to many of the neighbouring properties. Within this context, noise emissions from the Granity site is not expected to continue for any significant period and once construction activity is concentrated within the Granity tunnel, noise emissions are expected to be no more than minor.

Once the Granity power station is operational noise levels are not expected to be intrusive, given the location of the power station within the Granity portal. As such the BDC plan noise limits are expected to be readily achieved.

Mitigation and Monitoring Proposed:

- All above ground construction activities including establishment of the Jacking Station, outlet portal, portal apron, access ramp construction and heavy vehicle movements will be scheduled during normal working hours, being 7am to 7pm (weekdays) and 8am to 6pm (weekends and public holidays). Construction activities which have the potential to cause noise to adjoining properties will be scheduled over as short a period as practicable.
- A temporary earth barrier will be constructed around the western side of the Jacking Station to minimise noise effects for nearby residents.
- All construction activities shall be designed and carried out to ensure that the noise from the work complies with the New Zealand Construction Standard NZS6803:1999 "*Acoustics – Construction Noise*" at all times.
- HDL will undertake noise monitoring (by a suitably qualified and experienced acoustic engineer) to ensure that noise emanating from construction activities meets NZS6803:1999. Monitoring at two representative dwellings shall be carried out on at least two occasions annually, with the results forwarded to the Buller District Council.
- HDL will develop a blasting programme in consultation with the Granity Museum curator. This is to ensure that the small blasts required for rock-splitting and establishment of the tunnel portal are undertaken so as to minimise effects on users of the Museum. A public notice will be erected at the Granity site entrance advising Granity residents of the blasting programme.
- All blasting shall be restricted to between the hours of 9am to 5pm Monday to Sunday and will occur at set intervals during the day, as established in the above blasting programme.
- Drilling and blasting within the tunnel will continue 24 hours per day, 7 days a week as noise and vibration will be contained within the tunnel. A noise barrier will be erected at the tunnel portal, if required to mitigate noise nuisance to residents.
- A Granity Noise and Vibration Management Plan will be prepared that addresses noise and vibration management and monitoring strategies during the construction phase at the Granity site.
- For operation of the Granity power station, the following maximum noise levels (as specified in the District Plan) measured at the stated times at the boundary of any land used for a residential activity shall not be exceeded:

Monday to "Friday 8 am to 11 pm	55dBA L10
Saturday – 8 am to 6 pm	55dBA L10
At all other times including any public holiday	45dBA L10
	Lmax 75dBA

8.5.5 Vibration Effects

Vibration effects may be apparent during the following construction activities:

- Construction of the Granity outlet portal, portal apron and access ramp,
- Construction of the outer 100m of the Granity tunnel,
- Establishment of the Jacking Station and
- During micro-tunneling of the ocean outfall pipeline in the area immediately above the tunneling machine.

With respect to the rail and road infrastructure, micro tunneling under these structures will have no effect on these utilities. The tunnel will be fully supported internally by shielding as tunneling progresses, ensuring ground stability remains unaffected and avoiding any disruption to the rail or road network. Ontrack have requested that micro-tunneling beneath the railway line be undertaken during routine closure periods of the line. Given the regular nature of line closures (currently every ten weeks for a period of 48 hours), HDL envisage no problems scheduling tunneling to occur as

requested.

Granity portal and tunnel construction
Surface blasting associated with construction works at Granity will be for the purpose of splitting large rock blocks. Small blasts of this type will not have the potential to create vibration or over pressure effects that could adversely affect the structural stability of buildings. However, some discernible vibration may occur for properties that immediately adjoin the Granity construction site that is not dampened by the nature of the ground (slope debris). Once tunneling is beyond the slope debris and within bedrock, discernible vibration is considered to be highly unlikely. As a rule people become aggravated by blasting well below any building damage thresholds.

Measurements will be undertaken on a sufficient number of blasts to ensure that the typical levels of vibration are known. This monitoring will identify the distance at which the requirements of the typically adopted Australian Standard AS2187.2- 2006 *"Explosives – Storage and Use"* is complied with. In the event that any results are within 20% of the specified vibration limits, measurements will continue to be undertaken until such time as the blasting levels are reduced. Furthermore if vibration is of concern to any property owner additional vibration measurements will be undertaken.

Pre-condition surveys will also be undertaken on any building considered by the owner to be at risk from vibration. On completion of construction, a post construction structural check will then be undertaken to assess any changes in structural integrity. Any detectable structural damage will be repaired at the applicant's expense.

Jacking Station and Micro-tunneling
As regards the establishment of the Jacking Station, this requires sheet piling for creation of the pit and vibration may be discernible within close proximity to the access pit. Sheet piling creates high frequency vibration which tends to be very localised, as such the risk of building damage during the sheet piling process is considered to be negligible. Sheet piling for establishment of the jacking pit will be restricted to normal operating hours to minimise resident discomfort.

With regards to micro-tunneling, vibration can be expected when passing immediately beneath a building (similar to a heavy truck passing by) but is generally not detectable beyond the immediate location of the tunneling machine. Based on the typical rate of progress for micro-tunneling, tunneling is expected to move beyond the residential area in 10 to 15 days. This time may be extended if difficult ground conditions are encountered, as could occur as the tunnel progresses through the historic beach formations in the areas closest to the escarpment.

Geotechnical survey will be undertaken prior to tunneling to determine ground conditions and any properties that may be at risk as a result of adverse conditions. A potential issue for micro-tunneling operations is ground subsidence in the immediate vicinity of the tunnel path where substantial de-watering during tunnel construction is required. The dewatering can lead to ground settlement along the tunnel margins, which has the potential to affect buildings within the immediate vicinity of the tunnel path. The geotechnical survey will determine the locations where this could occur and the provisions that will need to be made to prevent effects on buildings. Pre-condition surveys will be undertaken on any building deemed to be at risk. On completion of construction, a post construction structural check will then be undertaken to assess any changes in structural integrity. Any detectable structural damage will be repaired at the applicant's expense.

Mitigation and Monitoring Proposed:

- For all blasting the limit of peak particle velocity shall conform with the Australian Standard, AS2187.2-2006 *"Explosives – Storage and Use"* and shall not exceed the limits described in Table 3 below.
- Measurements will be undertaken on sufficient blasts to ensure that the typical levels of vibration are known. This monitoring will identify the distance at which the requirements of AS2187.2- 2006 are complied with. In the event that any results are within 20% of the specified vibration limits, measurements will continue to be undertaken until such time as the levels are reduced.
- Prior to construction activity occurring at the Granity site a geotechnical survey will be undertaken along the proposed marine outfall route to assess ground conditions and any properties that may be at risk as a result of adverse conditions.
- Pre-condition surveys of buildings deemed at risk from vibration from micro-tunneling activities and/or blasting will be undertaken prior to construction activity occurring at the Granity site. On completion of construction activities, a post construction structural check will then be undertaken to assess any changes in structural integrity. Any detectable structural damage will be repaired at the applicant's expense.
- Vibration measurements will be undertaken at the request of any property owner who is concerned by vibrations caused to their building due to blasting or tunneling activities.
- A Granity Noise and Vibration Management Plan will be prepared that addresses noise and vibration management and monitoring strategies during the construction phase at the Granity site.

Table 3 Vibration Limits defined by AS2187.2-2006 "Explosives – Storage and Use"

TABLE J4.5(A)
GROUND VIBRATION LIMITS FOR HUMAN COMFORT CHOSEN BY SOME REGULATORY AUTHORITIES (see Notes following Table J4.5(b))

Category	Type of blasting operations	Peak component particle velocity (mm/s)
Sensitive site*	Operations lasting longer than 12 months or more than 20 blasts.	5mm/s for 95% blasts per year 10mm/s maximum unless agreement is reached with the occupier that a higher limit may apply.
Sensitive site*	Operations lasting for less than 12 months or less than 20 blasts.	10mm/s maximum unless agreement is reached with occupier that a higher limit may apply.
Occupied non-sensitive sites, such as factories and commercial premises.	All blasting	25mm/s maximum unless agreement is reached with occupier that a higher limit may apply. For sites containing equipment sensitive to vibration, the vibration should be kept below manufacturer's specifications or levels that can be shown to adversely effect the equipment.

Note: a residential property or historical site/building is considered a sensitive site.

8.5.6 Water Supply Effects - Granity

A number of residential properties and businesses receive their water supply from a header tank along the lower reaches of the Millerton Incline walking track, this tank is fed by a spring.

Construction activity at the Granity site may disturb this water supply. In the event that construction activity causes interruption to the surface or ground water flows that feed this water supply or the header tank itself, the applicant will arrange an alternative system. Any such alternative water supply will be monitored to ensure adequate water quality and quantity and will be established without any loss or interruption of supply to the parties concerned.

Mitigation Proposed:

- Should construction activity at Granity cause any disruption to water supplies HDL will ensure that an alternative water supply, that meets recognised drinking water standards and is of sufficient flow, is established without any loss or interruption of exiting supply.

8.6 Cultural Effects

Mr Rick Barber representative of Te Runanga o Ngati Waewae has provided an initial assessment of the cultural effects of the Project copied in **Appendix M**. Mr Barber has indicated that the Project has some cultural issues, namely the reduction of the affected catchment flows and their diversion directly to sea. This is considered to be culturally inappropriate, given the mixing of different catchment waters and is detrimental to the mauri of the place. However, Ngati Waewae are supportive of any measures to improve water quality within the Mangatini Stream and hence the Ngakawau River and Estuary. Mr Barber indicated that cultural concerns are likely to be mitigated by the enhancement of water quality that will be achieved through discharge into the marine environment, as opposed to the Ngakawau River and Estuary.

Mr Barber has referred HDL to the Cypress / St Pats Dam CIA which he believes is close to the Project.

8.7 Heritage Effects

The effects of Project construction on 4 known archaeological sites was assessed in a report prepared by archaeologist Katharine Watson, this report is attached as **Appendix A**. An overview of the conclusions reached in this report is given below:

Electric Loco Line Formation(L28/20)
The electric loco line formation has been cut in several places by the Stockton haul road and has been damaged by other mining-related activity but the archaeological report concluded it is in reasonable condition. The loco line was the first electric railway line in New Zealand therefore giving it a level of technological significance. The line is also one of only three lines in New Zealand that were built to 3 foot gauge. On this basis the loco line is significant at a national level as opposed to just a local or regional level. Overall, the report concluded that the electric loco line formation has good to excellent archaeological values and should be protected from any future damage to the alignment or the associated infrastructure.

Tintown (L28/32)
Tintown has low condition values as most of the site has been destroyed through the widening of the Stockton haul road. It is also one of a number of coal mining settlements that developed on the Stockton Plateau, not to mention elsewhere on the West Coast. Overall, the report concluded that Tintown has low archaeological values due to the fact that so little of the settlement remains intact**.**

Fly Creek Workings (L29/50)
The sites that make up the Fly creek workings are in a poor condition. Most of the elements of the complex have suffered some damage with the passage of time, such as the flume, the bridges and

the bin sites. The report concluded that the workings have moderate to good archaeological values, based on their context, information and interpretative potential. With the exception of a very small section of what was thought to be the loco line none of the historic artefacts within the Fly Creek area will be affected by the Project. Due to time constraints the report noted the Fly creek area was not surveyed in its entirety.

Granity Bins (L28/33)
The Granity coal bin site was bulldozed earlier in the year and it was considered unlikely that any subsurface archaeological material remained. The report recommended that an accidental discovery protocol be put in place during earthworks in the area, as the possibility of archaeological materials been un-earthed could not be completely discounted.

Conclusion
The only historic item of significance to be affected by the Project is the loco line formation. In general, all that remains of the loco line is the formation which is overgrown in most places. The archaeologist's report has described this to be in reasonable condition, which is certainly the case in the areas where it has been cut in bedrock. Elsewhere the passage of time and mining related activity has seriously affected the formation, with this acknowledged in the archaeologist's report. It is incorrect to say that the loco line is in reasonable condition. Most of the rails, plant and equipment were stripped years ago.

Of the approximately 4500m length of the formation surveyed 460m will be inundated by Weka reservoir and a very small area inundated by the Mt William reservoir. These areas will be inundated less than 50% of the time, as they are at the upper range of the reservoir operating levels. By far the bulk of the loco formation is not affected by the Project.

The Weka reservoir and associated haul road relocation will be laid out to minimise any further damage to the formation. Any artefacts that will be buried by the dam or the area of inundation will be recovered to a display at the Granity museum. As part of the Project, HDL will provide protection to the remaining sections of the loco line within their land and will discuss with SENZ and DoC mechanisms for protecting the formation on adjoining land. Otherwise, all of the other recommendations within the archaeologists report have been adopted as proposed mitigation measures.

Mitigation Proposed:

- HDL will ensure that any loose artefacts discovered during the course of Project construction shall be analysed and reported on and recovered to display at the Granity Museum.
- An accidental discovery protocol will be put in place during earthworks in the area of the Granity bins. The protocol will be developed in consultation with the Councils and the Historic Places Trust. Contractors working within the Granity Bin site will receive training in the recognition, reporting and management of archaeological material from a recognised archaeological expert. Any loose artefacts will be recovered to display at the Granity Museum.
- The branch of the loco line within the Mt William footprint will be surveyed in more detail by a suitable qualified archaeologist prior to inundation and any artefacts collected, analysed and recovered to display at the Granity museum.
- The Weka reservoir and associated haul road relocation will be laid out to minimise any further damage to the loco line formation. Any artefacts that will be buried by the Weka dam or area of inundation will be recovered to display at the Granity museum.

- Remaining sections of the loco formation within HDL land will be protected and consultation with DoC and SENZ will occur to establish mechanisms for protecting the loco formation on adjoining land.

8.8 Hydrological Effects

The hydrology effects of the operation of the Project were assessed in a report prepared by URS New Zealand Ltd, attached as **Appendix C**. Subsequently, the hydrological model was extended to provide input for water quality modeling as described in URS New Zealand report *"Water Quality and Hydrological Modeling"*, 2008 attached as **Appendix K.** Both analysis utilised monitoring data collected by SENZ (the main flow gauge stations being S14 – Mangatini Stream and S16 - St Patrick Stream) to assess the mean flow variations for the watercourses affected by the Project.

During normal flow conditions all of the flows within the affected watercourses will be collected and diverted into the proposed storage reservoirs. This will result in no flow immediately downstream of the diversions, other than in times of flood. Flow downstream of the diversions will arise from the catchments and tributaries entering at varying points downstream. The water quality downstream of the diversions, as sub-catchments join the main stem, will be typical of undisturbed catchments. The anticipated catchment areas collected by the Project are displayed in Table 2, page 26.

8.8.1 Weka Impoundment Reservoir

Flow from the upper parts of Mangatini Stream will be detained by a small weir structure directly below the confluence of A.J. Stream. A tunnel will lead from the weir to the impoundment reservoir on Weka Creek. The reservoir will also capture all the flow from Weka and Sandy Creeks. In addition, flows from Mine Creek can be diverted via a tunnel into Sandy Creek and therefore into the same reservoir. The total catchment area of the Weka reservoir will be 14.7km², of which 12.4km² will be indirect catchment transferred in from adjacent catchments. The likely effects on the respective watercourses are described below:

Mangatini Stream

The flows in the Mangatini Stream below the diversion will originate from the catchment below the diversion but will remain substantially reduced until the Repo Stream enters, approximately 1.7km downstream. In addition, substantially reduced flows will enter the Mangatini from Weka Creek, due to the diversion caused by Weka dam. The resulting flow discharging into the Ngakawau will be around 40% of the existing mean flow. Given the capacity restraints of the proposed scheme, flows in the lower section of the stream during high flow events will be similar to those occurring at present.

Flood flow spilling over the Mangatini diversion weir will continue down Mangatini Stream as at present.

Weka Creek

The Weka Creek reservoir will capture all the flow of Weka and Sandy Creeks. Under normal low flow conditions the scheme will remove all of the flow in the section of the channel directly downstream of Weka dam. The flow in the channel downstream of the dam will originate from the catchment below the dam but will be substantially reduced until the creek meets Mangatini Stream, approximately 1.2km downstream. The resulting flow discharging into the Mangatini will be around 18% of the existing mean flow. Again peak flows in the lower section of the creek during high flow events will be similar to those occurring at present.

The spillway of the Weka dam will discharge into Weka Creek. Flood waters can only enter the Weka reservoir directly from the small Weka and Sandy Creek sub-catchments. Flood water in Mine Creek and Mangatini Stream will spill over the diversion weirs and will not enter the reservoir. The maximum flood flows over the spillway into Weka Stream will be less than the existing flood flows down this stream due to the impediment provided by the reservoir and is predicted to be up to 65 cumecs.

Sandy Creek
The Project will capture all the flow of Sandy Creek, which is a tributary of Weka Creek and would normally enter Weka Creek in the vicinity of the proposed impoundment reservoir.

Mine Creek
Under normal low flow conditions the Project will remove all of the flow in the section of the channel directly downstream of the abstraction point. The flow in the creek downstream of the diversion will originate from the catchments downstream of the diversion but will be substantially reduced until the next tributary enters the Creek, approximately 900m downstream. The resulting Mine Creek flow discharging into the Ngakawau River will be approximately 70% of the existing mean flow. As for the other watercourses, the capacity restraints of the reservoirs mean that flows in the lower section of the Creek during high flow events will be similar to those occurring at present.

Flood flow spilling over the Mine Creek diversion weir will continue down Mine Creek as at present.

8.8.2 Mt William Impoundment Reservoir

Flow from St Patrick Stream below the St Patrick dam will be captured by a second impoundment, Mt William dam. This storage reservoir will receive water from Plover, Fly, T31 and Darcy streams. Water is diverted from this dam into a tunnel and penstock which extends approximately 3850m to the second proposed power station (PS 2), at the head of the Weka Creek reservoir. En route to PS2, provision has been made in the tunnel to intercept flows from a number of minor tributaries of the T35 Stream and the Mangatini Sump. In total, 39% of the catchment areas of the St Patrick Stream is diverted into the Mt William reservoir.

The Mt William dam spillway will discharge into T35 Stream. The exact location will be determined after geotechnical investigations are undertaken during final design. In extreme rainfall events the discharge over the spillway will be similar to existing flood flows in the stream.

The likely effects on the respective watercourses are described below:

St Patrick Stream
Under normal low flow conditions the Project will remove all of the flow in the section of the channel directly immediately downstream of Mt William dam, until the T35 Stream enters the channel 300m downstream. The resulting flow discharging into the Ngakawau River will be approximately 78% of the existing mean flow. As with the other watercourses, flows in the lower section of the Stream during high flow events will be similar to those occurring at present.

Fly, Plover, T31 Streams
The project does not divert flows of the Fly, Plover and T31 Streams until they have naturally joined St Patrick Stream, within the footprint of the Mt William reservoir.

Darcy Stream
Under normal low flow conditions the Project will remove all of the flow from a small area of the upper headwaters of the Darcy stream below the points where drainage from Mt William Mine enters the tributaries. The purpose of the diversions will be to achieve water quality improvements downstream in Darcy, Erin and St Patrick streams. The proposed intake design will allow high flows that exceed the submergence rates to bypass the intakes. The total catchment area that will be affected is a small part of the overall catchment. The abstractions will have beneficial effects on the ecology of these streams.

T35 Stream
The Mt William dam spillway will discharge into T35 Stream. For the Mt William reservoir, flood water from St Patrick, Plover, Fly and T31 Streams will report to the reservoir. It is conceivable (although very low probability) that the flood peaks could combine so that the flood spill from the reservoir could be as high as 300m³/sec (approximately 50% of the current peak flow in St Patrick Stream). . With the exception of the immediate point of inflow to T35, the effects on T35 and St Patrick Streams will be less than in the existing situation when the flood flows pass done the streams unimpeded by a reservoir.

8.8.3 Flood Events
There will be a detaining effect on flood flows as water levels rise in the reservoirs or behind the diversions prior to discharge over the spillways. The small diversions have relatively small capacity and will have only a modest effect in reducing flood peaks.

The Mt William and Weka reservoirs will have more significant effects on reducing flood peaks at Ngakawau estuary, and hence on reducing flood risk to the Ngakawau and Hector townships. The diversions and storage volumes created by the Project will increase the ”time of concentration” of each sub-catchment, extending the time when the flood peak from the sub-catchment will enter the Ngakawau river. The catchments without diversions will drain more quickly and hence the coincidence of flood peaks that cause problem flooding at the Ngakawau estuary will be less likely. In certain circumstances, this may lead to very significant reduction in flood risk, to the extent that the flood that occurs on average every 50 years may only occur on average every 100 years.

In any given storm event the reduction in flood risk will be in:

- The rainfall distribution over the Ngakawau catchment. If the rainfall is distributed more to the south than the north, the reductions in flood risk will be greater.
- The storage within the reservoirs at the onset of the storms. If the reservoirs are close to empty at the onset of a storm, the reductions in flood risk will be greater.
- The passage of the storm over the catchment. If the storm moves across the catchment, the benefits will be greater than if it is stationary.

The degree of flood relief that will be provided by the Project can only be assessed through comprehensive hydrological modeling of the Ngakawau catchment which has not been undertaken at this stage. A first order analysis of the possible effects of the scheme on flood risk is shown in the tables in Figure 6. This indicates that the Project will reduce flood risk from a modest to significant extent, it will not increase flood risk.

Variability of flows, including high flushing flows, are considered necessary to maintain a balance of sediment within channels and hence maintain aquatic ecosystems in a healthy state. Rainfall events scour accumulated fine sediments and periphyton, flushing these from stream systems and

leaving clean substrates, which provides healthy habitat for benthic invertebrate and fish species. Flushing downstream of the diversions will occur on a regular basis. Current scheme modeling indicates that this would occur 10 to 20 times a year for the large reservoirs and much more frequently for the small diversions.

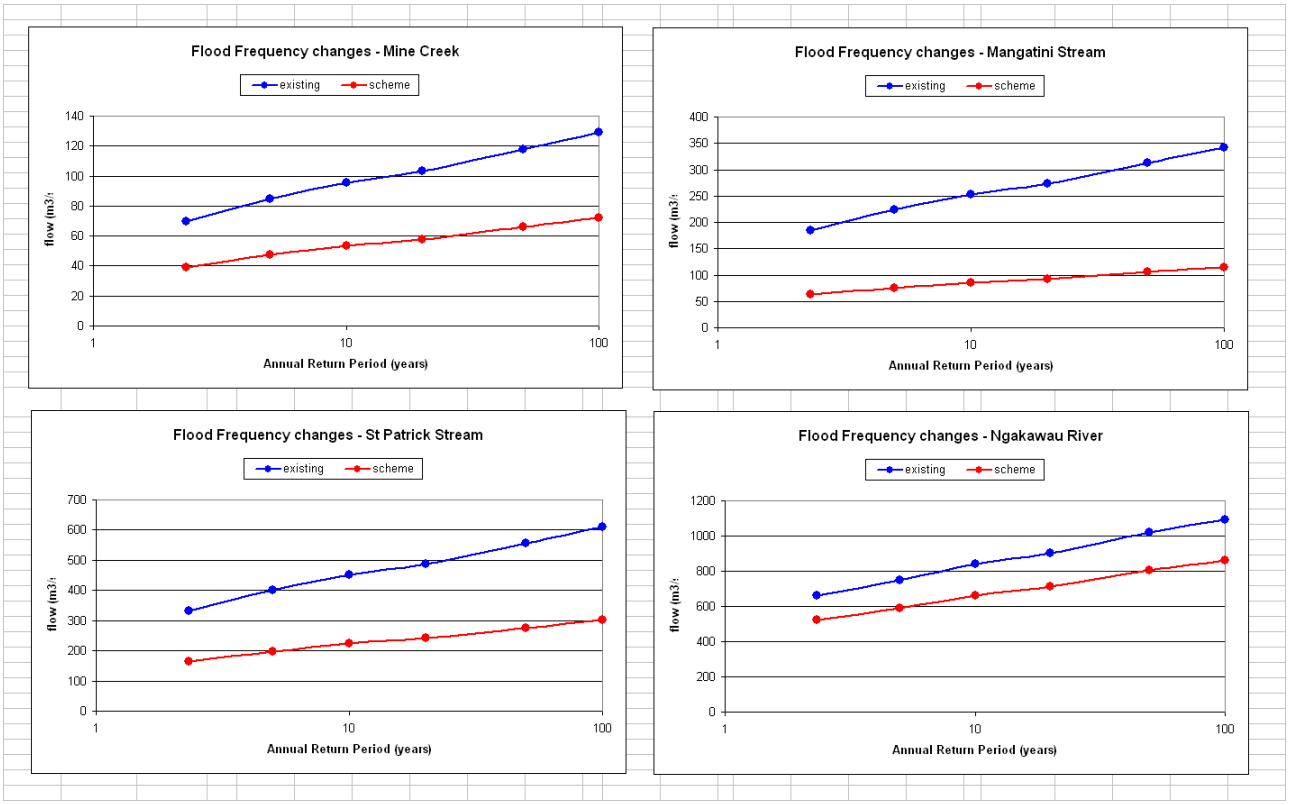


Figure 6 Possible changes in flood frequency

8.8.4 Conclusion on Hydrology Effects

The Project will result in reduced mean flows entering the Ngakawau River from all three of the affected sub-catchments – Mine Creek, Mangatini Stream and St Patrick Stream. The total area removed from the Ngakawau sub-catchments will be 31.7km², leaving around 154km² of the original catchment undisturbed, equating to removal of 17% of the existing mean flow within the Ngakawau River.

Under normal flow conditions the flows downstream of the abstraction points and reservoirs will be substantially reduced. The daily flow records from the period 2002 – 2006 have been modeled to assess the effects of the Project on stream flows downstream of the diversions (refer to Appendix K section 4. The models predict that for very low flows (flows exceeded 95% of the time) flows will reduce by 50% in the St Patrick Stream, by 75% in the Mangatini Stream, by 40% in Mine Creek and by 30% in the Ngakawau River(% time exceeded refers to the period of record, it is not an indication of Flood Frequency). Reductions of 50% would be considered significant in a healthy ecosystem. Given the existing poor water quality within these affected waterways and the associated marginal habitat for aquatic life, this removal of flow over short distances is expected to have no more than minor effects on instream values.

8.9 Water Quality Effects

8.9.1 Construction Effects

The components of the Project which will be constructed in the bed of streams are:

- A section of the Weka dam (Weka Creek)
- A section of the Mt William dam (St Patrick Stream)
- The Darcy Stream sump intakes
- The Mine Creek and Mangatini Stream diversion weirs
- The sediment traps built across the streams that flow into the reservoirs
- Granity Stream emergency overflow outlet

All other components of the Project including the ocean outfall are built on land. Earthworks for all aspects of the Project will be carried out with appropriate sediment control measures in place to ensure water quality is protected and this is anticipated to involve the use of sediment ponds/silt traps.

Weka and St Patrick Streams will be temporarily diverted under the proposed dam sites through culverts, while dam construction occurs. This will ensure construction of the dams will not effect water quality within Weka or St Patrick Streams. The sluices under the dams will have a capacity for a 10 year flood event. These culverts will be sealed on completion of the dam structures. The RCC dams may also be over-topped during construction without any resulting damage or water quality issues.

The flows of the Darcy Stream, Mangatini Stream and Mine Creek will be temporarily diverted past the intake structures to allow for construction works to take place. This will ensure minimal sedimentation of the waterways occurs during construction of the weir/intake structures. The temporary diversions will involve pushing the stream flows to one side of the bed to enable installation of pre-cast intakes and/or diversion weirs. The temporary diversions will not restrict stream flows and installation of structures will be undertaken during low flow periods.

Silt traps at the head of each of the waterways feeding into the reservoirs (as detailed in **Plans C-002** and **C-004**) will not be built until the dams are completed. Effects of construction will then be contained within the reservoirs.

The emergency overflow into Granity Stream will involve disturbance to the stream bank during installation but will not involve any disturbance within the active stream channel. Use of this emergency spillway is anticipated to be infrequent and restricted to emergency situations. The discharge of up to 9 cumecs will only occur for short periods not exceeding 24 hours and will be similar to the small freshes that currently occur in the stream on a reasonably frequent basis. It is not anticipated that this will have any adverse effect on channel stability or water quality.

During the construction of the Granity and Stockton tunnels and the micro-tunnel outfall there will be discharge of groundwater seepage encountered during tunnel construction. Discharges from the Granity tunnel and micro-tunnel will be treated to remove silt and chemical contaminants before discharge to the Granity Stream, via the emergency overflow diffuser. Noteworthy, is that Granity Stream is significantly degraded by AMD but the treatment measures will ensure this water quality is not further degraded.

De-watering of groundwater seepage from the Stockton tunnel and the other diversion tunnels on the Plateau will occur into watercourses on the Plateau, via treatment systems to remove silt and chemical contaminants prior to discharge.

Mitigation Proposed

- Water runoff and silt control from all components of the Project built on land will be managed in accordance with "Erosion & Sediment Control Technical Publication 90", Auckland Regional Council, March 1999 including the following measures:

  - Divert clean stormwater runoff around construction areas and
  - Any temporary silt or settling ponds constructed shall be designed to withstand a two year return period storm event.

- Discharge of groundwater seepage during tunnel construction will be via settling pond systems to ensure receiving waters are not adversely affected.

8.9.2 Operational Effects

The construction of the Project will improve water quality in the Ngakawau River and will capture low quality mine affected water and, after mixing in the reservoirs, discharge this water to ocean. The prediction of the quality of the water in Weka Reservoir (the water quality that will discharge at the ocean outfall) and the prediction of improvements in the quality of the Ngakawau River as a result of the diversion to ocean outfall have been assessed in the water quality report prepared by URS New Zealand Ltd, attached as **Appendix K.**

URS has developed "Goldsim" and "PHREEQC" models to predict the changes in water quality following the construction of the Project. Use of Goldsim and PHREEQC is internationally accepted best practice for determining the effects of mixing water from different sources and qualities and for predicting the quality of discharges into receiving waters.

The water quality models predicts water quality outcomes for water quality inflow scenarios that represent the situations that could exist over the life of the Project.

A full range of scenarios must be considered by HDL as operators of the hydro scheme as HDL will be the receivers of water inflows from areas over which it has no management control over land use. The land use scenarios that are most likely are those that are predicated by current planning provisions and these are reported in Appendix K. Appendix D of Appendix K also reports on the unplanned outcomes of natural disasters.

The two most likely scenarios that have been reported in Appendix K are:

Scenario 1: Current – assumes current water quality from historic underground mining areas and current mining practices including limestone dosing within the open cut mining areas.
***Scenario 2*:** Stockton Mine Closure – assumes current water quality from historic underground mining areas continues, and the full rehabilitation of mining areas with water treatment as currently planned for the open cut mining areas.

Consideration has also been given to water quality outcomes associated with failure of the planned treatment systems and rehabilitated engineering landforms for the open cut mining areas post closure. Modeling has focused on mine closure as this is deemed the most probable scenario for the

duration of the scheme. Modeled scheme water quality including all scheme diversions and during a median flow event is presented for each scenario in Table 4.

	Current		Stockton Mine Closure	
	Mt Williams Reservoir	Weka Reservoir / Outfall	Mt Williams Reservoir	Weka Reservoir / Outfall
pH	3.5	3.6	3.5	3.7
Cations (Dissolved fraction - mg/l)				
Fe	0.7	0.8	0.7	0.6
Al	5	4	5	4
Zn	0.09	0.22	0.09	0.24
Pb	0.0004	0.0003	0.0004	0.0003
Ni	0.01	0.05	0.01	0.06
Mn	0.421	0.302	0.421	0.301
As	0.006	0.005	0.006	0.005
Cu	0.003	0.005	0.003	0.005
Mg	0.5	2.0	0.5	2.3
Na	2.1	2.2	2.1	2.3
Ca	2	25	2	30
K	1.1	1.4	1.1	1.5
Anions (mg/l)				
SO_4	50	106	50	116
HCO_3	0.6	1.0	0.6	1.1
Cl	4	4	4	4

Table 4 Median flow water quality for current and planned closure scenarios

Flow has a significant effect on water quality within the reservoirs, with a high flow associated with improved water quality in the Weka reservoir. The pH within the Weka reservoir is predicted to vary from 3.6 to 4.5 from low to high flow events as shown in Table 5. This improved water quality represents dilution of poorer quality water from the Mt William reservoir (historic sites) with treated Mangatini water.

	Median Flow		Low Flow		High Flow	
	Mt Williams Reservoir	Weka Reservoir / Outfall	Mt Williams Reservoir	Weka Reservoir / Outfall	Mt Williams Reservoir	Weka Reservoir / Outfall
pH	3.5	3.7	3.5	3.6	3.5	4.5
Cations (Dissolved fraction - mg/l)						
Fe	0.7	0.6	0.7	0.6	0.7	0.4
Al	5	4	5	4	5	1
Zn	0.09	0.24	0.09	0.17	0.09	0.57
Pb	0.0004	0.0003	0.0004	0.0004	0.0004	0.0001
Ni	0.01	0.06	0.01	0.04	0.01	0.15
Mn	0.421	0.301	0.421	0.358	0.421	0.057
As	0.006	0.005	0.006	0.006	0.006	0.005
Cu	0.003	0.005	0.003	0.004	0.003	0.010
Mg	0.5	2.3	0.5	1.5	0.5	6.2
Na	2.1	2.3	2.1	2.2	2.1	2.6
Ca	2	30	2	17	2	90
K	1.1	1.5	1.1	1.3	1.1	2.3
Anions (mg/l)						
SO_4	50	116	50	85	50	252
HCO_3	0.6	1.1	0.6	0.8	0.6	2.0
Cl	4	4	4	4	4	3

Table 5 Water quality variation with flow for the planned closure scenario

The outcomes of modeling inflows from historic underground mines combined with post closure failure of the open cut mining areas are summarised in Table 6. This scenario represents the worst input water quality to the hydro scheme that could be reasonably anticipated, both while open cut mining continues and post closure, leading to the lower threshold conditions that could be expected at the ocean outfall. It also represents the scenario when the Project would provide greatest benefit for protecting water quality in the Ngakawau River (see TSS model predictions in Figure 9, page 110).

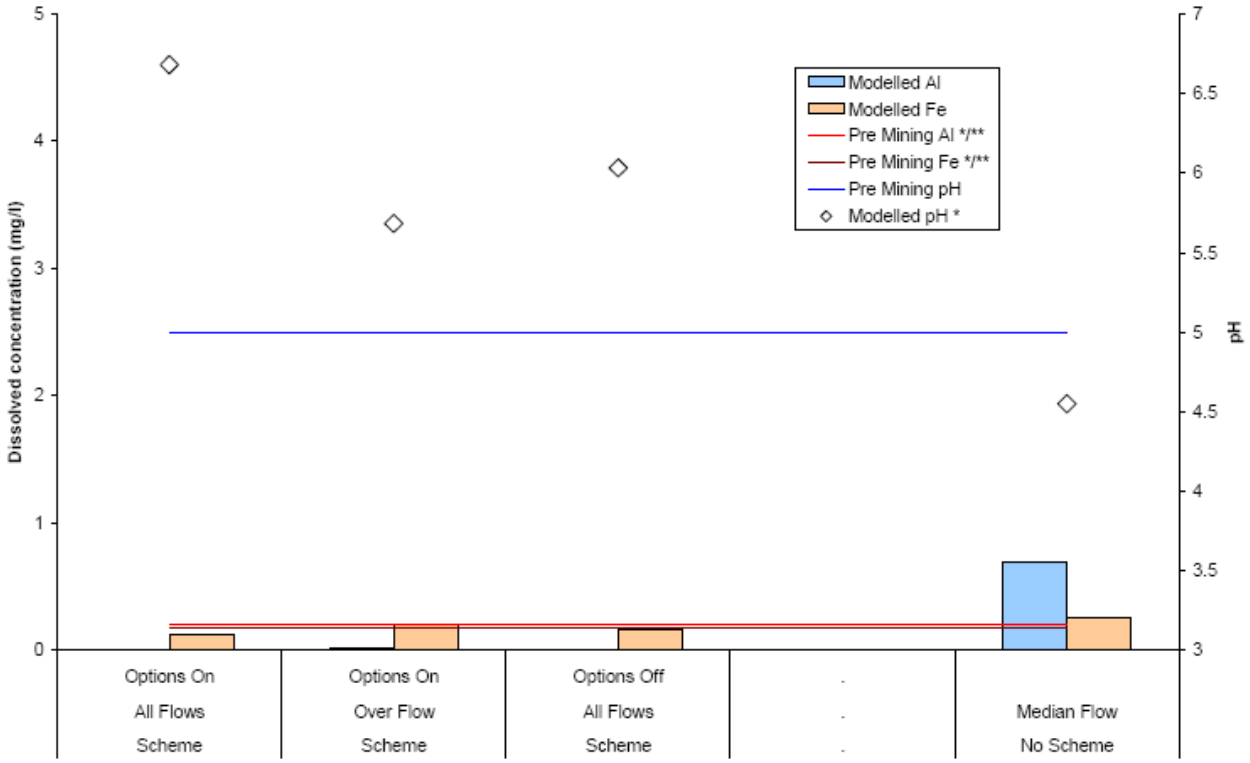
Post Closure-Flood Earthquake		
Parameter	**Mt Williams Reservoir**	**Weka Reservoir / Outfall**
pH	2.9	2.9
Fe	28.3	27.1
Al	42	40
Zn	2.16	2.05
Pb	0.0001	0.0001
Ni	0.24	0.23
Mn	0.002	0.002
As	0.012	0.011
Cu	0.048	0.046
Mg	10.0	9.5
Na	3.2	3.0
Ca	29	28
K	3.1	3.0
SO_4	433	414
HCO_3	1.3	1.3
Cl	34	32

Table 6 Median flow water quality for a possible worst case closure scenario

Modeled water quality scenarios also extend to the effects of including or excluding the diversions from the Darcy headwaters, T35 Stream and upper Mine Creek. The modeling found little overall difference in scheme water quality, whether the diversions were included or not, although a slight improvement in water quality was observed if they were excluded. This reflects the dominance of the Upper St Patrick Stream and the upper Mangatini into the Mt William and Weka reservoirs respectively and the relative small contribution the three diversions make to the scheme. The Darcy diversions contribute approximately 10% of Mt William's reservoir water, while the Upper Mine Creek and T35 Streams diversions contribute less than 5% of total scheme water inputs during low flows and approximately 1% in high flow events.

The modeled effects of the Project on the water quality of the Ngakawau River and pre-mining pH, aluminium and iron levels at sampling point NR (lower Ngakawau River monitoring site) are presented in Figure 7 below for Scenario 2. When the scheme is in place there is improvement to modeled water quality within the Ngakawau River with pH increasing from 4.5 (no scheme) to pH of 6.7 (scheme). With no scheme in place dissolved aluminium and iron concentration levels are 0.699 and 0.3mg/l respectively but decrease to concentrations less than 0.2 mg/l when the scheme removes the impacted waters from the Ngakawau River. If an overflow event were to occur, the impact of scheme water reaching the Ngakawau River can be seen with a decrease in the pH to 5.7. If the minor diversions are left out of the scheme the impacted waters of Upper Darcy and T35 Streams reach the Ngakawau River and decrease water quality at NR to: pH 6, aluminium <0.01

mg/l and iron 0.2 mg/l.



*Pre Mining pH and Al and Fe concentrations are from Lindsay *et al*. 2003 and are taken approximately 1km upstream from sampling point NR at sampling point NR5.

**Pre Mining Al and Fe concentrations are total recoverable concentrations.

Figure 7 Ngakawau River Quality at NR for Scenario 2

As water clarity and suspended solids impact on the ecological health of waterways total suspended solids concentrations and turbidity within the Ngakawau River and its sub-catchments were also considered as part of the water quality modeling

The URS report refers to a NIWA clarity classification with clarity greater than 54cm regarded as FAIR and greater than 70cm as GOOD.

Figure 8 below shows that historically the NR monitoring station did not meet the FAIR standard. Post closure the river meets the GOOD standard 90% of the time and the FAIR standard 94% of the time. For a unit such as clarity 100% compliance is highly unlikely as natural rainfall events will at times cause failure of the thresholds and this cannot be avoided. Therefore meeting a 90% standard in clarity is considered to be a significant benefit to the river.

The URS report states the Project provides opportunity for further sediment capture. The reservoirs will reduce overflow to the Ngakawau River in high flow events when sediment levels will naturally be higher. It is also noted that the Project design incorporates sediment capture structures to keep sediment out of the turbines. Thus while the sediment retention resulting form operation of the scheme has not been quantified, reductions greater than the mine closure case is expected with associated benefits to clarity in the Ngakawau River.

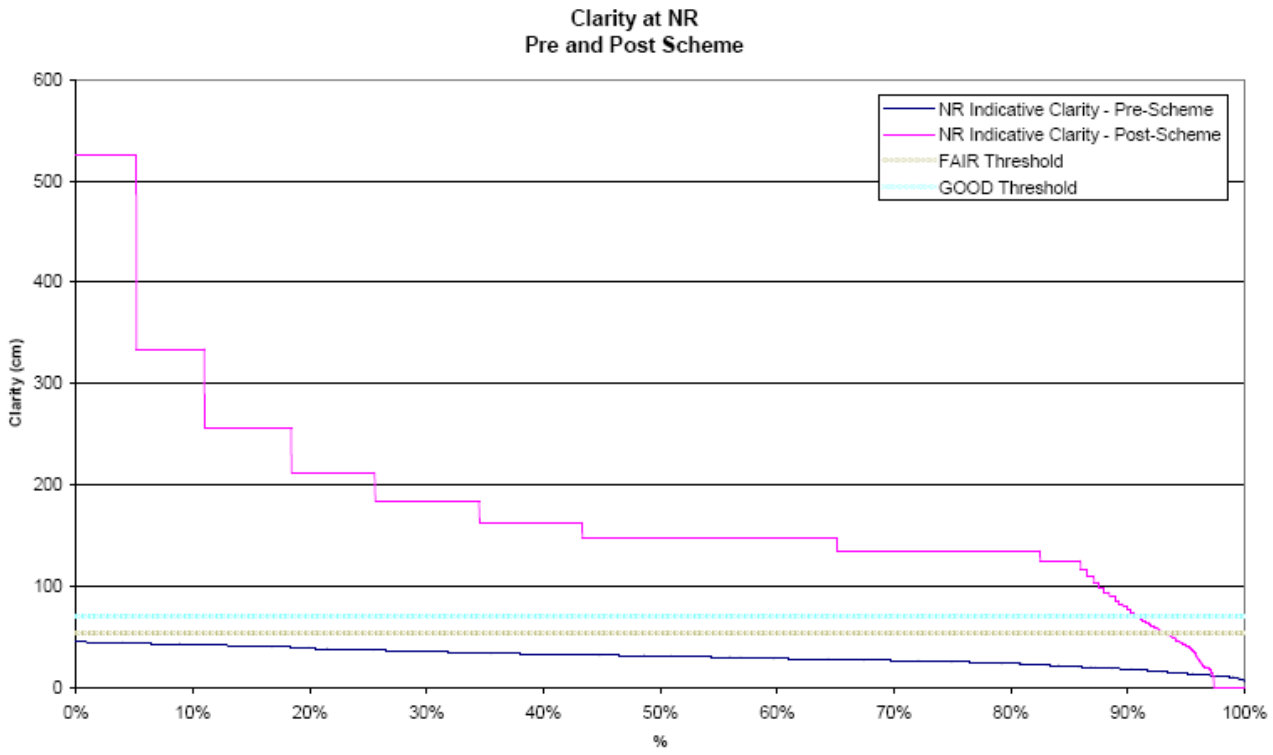


Figure 8 Ngakawau River NR Historic and scenario 2 water clarity

Modeled output water using Scenario 2 (Stockton Mine closure) has been assessed to determine the anticipated water quality parameters for the Project's discharge into the ocean and anticipated sea water mixing concentrations. This is shown in Table 7.

ANZECC criteria for 95 % protection in the marine environment for dissolved Ni, Pb and Zn are 0.07, 0.0044 and 0.015 mg/l respectively. Nickel and Pb are within this range at the point of discharge, whereas Zn exceeds this concentration to at least a 99 % sea water mix. Other parameters such as Cd, Cr and Hg have not been modeled here due to the lack of input data and no guideline values exist for Al and Fe.

Modeling also involved geochemical mixing with seawater to ascertain the potential concentrations of dissolved ions and precipitates which could potentially form a plume when Project water is discharged into the ocean. This analysis found that upon initial mixing dissolved iron will precipitate as oxyhydroxides and secondary minerals removing approximately 0.6mg/l from solution with only a 10% seawater mix. Aluminium begins to precipitate but only when the solution becomes more oxidised as sea water is the dominant mixture (60% and above). At lower percentages of seawater mixing, the decrease in aluminium is merely a function of dilution. URS has concluded that further laboratory and field based studies would be required to make any firm prediction on the dynamics of any discharge and associated plume.

% Sea water	0	10	20	30	40	50	60	70	80	90	95	98	99	99.5	99.9
pH	3.7	3.8	3.9	4.0	4.1	4.2	4.2	4.3	4.5	4.8	5.2	6.3	7.1	7.7	8.1
Cations (Dissolved fraction - mg/l)															
Fe	0.60	0.04	0.031	0.025	0.021	0.019	0.017	0.015	0.014	0.013	0.013	0.006	0.001	<0.001	<0.001
Al	3.63	3.27	2.91	2.55	2.19	1.83	1.32	0.83	0.42	0.10	0.014	0.001	0.004	0.007	0.014
Zn	0.24	0.22	0.20	0.17	0.15	0.13	0.10	0.08	0.06	0.03	0.02	0.01	0.01	0.01	0.01
Pb	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ni	0.06	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01
Mn	0.30	0.27	0.24	0.21	0.18	0.15	0.12	0.09	0.06	0.03	0.02	0.01	0.01	<0.01	<0.01
As	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cu	0.005	0.004	0.004	0.003	0.003	0.002	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Mg	2	134	265	396	527	658	790	921	1052	1183	1249	1288	1301	1308	1313
Na	2	1120	2237	3355	4472	5589	6706	7825	8942	10058	10617	10952	11065	11120	11164
Ca	30	70	109	149	188	228	267	307	346	386	406	418	422	424	425
K	2	42	83	125	166	207	248	289	330	371	391	404	408	410	412
Anions (mg/l)															
SO4	116	388	661	934	1207	1480	1753	2026	2298	2571	2708	2790	2818	2831	2843
HCO3	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.6
Cl	4	2013	4024	6034	8044	10054	12060	14070	16080	18090	19097	19700	19898	20001	20079

Table 7 Water Quality at the ocean outfall with increasing mixing with sea water

The water quality modeling reported in **Appendix K** is dependent on the quality of input data. As a number of the key input data have not been recorded or are of uncertain reliability, a number of assumptions have been made. In all cases the precautionary principle has been followed, whereby conservative assumptions have been made which will tend to overstate the negative environmental effects and understate the positive environmental effects. Despite this precautionary approach the overall conclusion that can be drawn from the modeling is that the effects of the ocean outfall should be acceptable and any minor effects will be offset by significant improvement in the Ngakawau River and its tributaries. Further discussion on the anticipated impacts of the modeled ocean discharge is detailed in Section 8.15 – CMA.

In conclusion, the modeling has demonstrated:

- The Project will have a positive effect on water quality in the Ngakawau River and will likely result in an increase in pH and decrease in metal loadings.
- The Project will improve water clarity in the Ngakawau River and reduce total suspended sediments
- The water quality at the ocean outfall will meet water quality standards for most indicators before mixing with salt water and will meet all standards after mixing has occurred.
- The precipitation of Iron and Aluminium could lead to a plume immediately at the point of diffusion but the probability and extent of the plume cannot be predicted by the model. The visibility of a plume against background turbidity will be dependent on sea conditions and the viewing elevation. Field trials will be required to determine if a plume would be visible from Granity during the range of sea conditions that are typical.

Mitigation Proposed:

- In final design, field trials will be undertaken and further data collected to improve the modeling to guide the final design and operation of the Project.
- In the unlikely event that adverse effects result following operation of the Project there will remain options to modify the scheme design to avoid the effects. These post construction options could include:
  - Modifications to the diffuser
  - Extension of the outfall
  - Provision for pH correction when water quality in the Weka reservoir becomes unacceptable during periods of extended drought.

8.10 Freshwater Ecology Effects

The effects of construction of the Project on aquatic ecology have been assessed in a report prepared by GHD, attached as **Appendix D**. This report reviewed the existing aquatic ecology information for the Ngakawau River catchment and sub-catchments and utilised this information and the hydrology and water quality modeling undertaken by URS New Zealand Ltd to evaluate the aquatic ecology effects.

The URS Hydrology and Water Quality report (**Appendix K**) evaluated the reduction in flows resulting from the proposed scheme. The low flow results for all the affected sub-catchments are displayed in Table 8 below:

Watercourse	Natural flow (m^3/s) 95% time exceeded	Modelled Flow with Optional Elements Included (m^3/s)	% Reduction from natural flow	Modelled Flow with Optional Elements Excluded (m^3/s)	% Reduction from natural flow
St. Patrick Stream	1	0.5	50%	0.6	40%
Mangatini Stream	0.4	0.1	75%	0.1	75%
Mine Creek	0.11	0.07	36%	0.11	0%
Ngakawau River	2.3	1.6	30%	1.7	26%

Table 8 Modeled effects of the Project on flows

The URS report also modeled the effects of the scheme on water quality within the Ngakawau River. The URS hydrology and water quality information was utilised by GHD to draw the following conclusions on the potential impacts of the proposed scheme on the existing ecological values of the affected sub-catchments:

8.10.1 Mangatini Stream/Sandy Creek/Weka Creek Sub-Catchment

The URS hydrology modeling established that flows in the Mangatini Stream will be reduced by a maximum of 75% as a result of the Project. The ecology report states that this is a significant decrease and will result in a noticeable reduction in flows, including over the Mangatini falls.

The Project will divert low and medium flows of the Mangatini Stream into the Weka reservoir at the Mangatini weir intake point (see **plan C-004**). During high flow events, flows which exceed the capacity of the diversion will continue down Mangatini Stream and into the Ngakawau River. It is anticipated that losses over the Mangatini weir will occur only infrequently. For the most part, operation of the scheme will remove all the Mangatini Stream flows immediately above the intake point, with residual water flows downstream of the weir fed from the surrounding catchment and Repo Stream, which are unaffected by AMD or the Project.

Mining is expected to continue in the Mangatini catchment with the effects mitigated by water treatment facilities, currently being built by SENZ, to the extent required by the conditions of consent that SENZ holds for discharges into the Mangatini Stream.

The Mangatini Stream, Sandy and Weka Creeks are described as not supporting a diverse ecology. However, in a previous survey the rare aquatic bryophyte *Blindia lewinskyae* has been observed to

be present in Weka creek, although the specific location is not known. This bryophyte is thought to be tolerant of acidic conditions and able to cope with the frequent floods that characterise the Plateau streams but is generally intolerant of drying. As such this bryophyte is likely to be impacted by the diversion of flows from Weka creek. However, the GHD report notes that Blindia *Lewinskyae* is present in other streams draining the Plateau, which are currently affected by mining activities and not affected by this Project.

The GHD report states that the significant diversion of mine-impacted water from the Mangatini Stream will result in improved water quality. There will likely be an adjustment phase whereby existing ecology within the Mangatini Stream adapts to a lower flow regime. Nonetheless, there will be a significant benefit to the water quality within the Ngakawau River. The report concludes that there will be no significant effects on the existing aquatic ecology within the Mangatini Stream.

8.10.2 Mine Creek Sub-Catchment

The URS hydrology modeling established that flows in Mine Creek will be reduced by a maximum of 36% as a result of the Project.

Currently water quality in Mine Creek is severely compromised by historical underground mining activity. This has significantly impacted upon the aquatic ecology of the stream. As such there are limited ecological values present and the impact of the proposed scheme is not expected to result in further adverse effects.

The report concludes that the removal of the acidic water will benefit the remaining Mine Creek catchment below the intake and is also likely to improve water quality within the Ngakawau River, at and below the confluence with Mine Creek.

8.10.3 St Patrick Stream Sub-Catchment

The URS hydrology modeling established that flows in St Patrick Stream will be reduced by a maximum of 50% as a result of the Project. If the optional elements (Upper Darcy and T35 diversions) of the scheme are not included then the flow will be reduced by 40%.

The upper St Patrick Stream catchment, with the exception of Plover Stream, is described as containing water of relatively high quality and a relatively diverse macro-invertebrate community. The rare moss *Blindia lewinskyae* and the liverwort *Allisoniella scottii* have been recorded in the upper reaches of this catchment. However, observations of these rare species are only from sites upstream of the Project and as such will not be affected.

Downstream of the Project, the report describes water quality and the associated ecology within St Patrick Stream as being of much poorer quality. Currently the average pH of St Patrick Stream, as measured at St Patrick Stream Bridge is 3.3 +/- 0.3 due to the effects of historical mining related AMD.

The reports concludes that in the lower reaches of St Patrick Stream, being the area affected by the Project, no macro-invertebrate or fish species of any significant value have been identified in any of the studies carried out to date. The removal of the acidic water will benefit the remaining St Patrick catchment below the Project intakes and is also likely to improve the water quality of the Ngakawau River.

8.10.4 Ngakawau River

The URS hydrology modeling established that the Project is likely to reduce mean flows in the

Ngakawau River by around 17% but could reduce flows by up to 30% in some circumstances.

The GHD report states that the risk of water abstraction decreasing available habitat is dependent on stream size and the species present in any given waterway, with higher risks of deleterious effects in small streams rather than larger watercourses. The proposed 30% maximum reduction of flow for the present proposal is not considered significant, due to the large residual flow that will remain in the main stem of the river and the limited ecological values that are currently known to exist.

Water quality (comprising pH, metal concentrations and sediment loads) within the Ngakawau River is expected to significantly improve as a result of the diversion of the mine-affected water from the Mangatini, St Patrick Streams and Mine Creek. The current ecological values within the Ngakawau River appear to be minimal, with the exception of whitebait species and the long finned eel.

The GHD report states that improved water quality is expected to result increased diversity and abundance of macro-invertebrate, plant and fish species. Improved water quality may also increase eel migration over time. Previous studies have also suggested that the shortjaw kokopu and koaro should be widespread in the Ngakawau River catchment in the absence of poor water quality. A comparison was made with the Mokihinui River which lies approximately 12km to the north of the Ngakawau River and contains highly diverse river ecology and supports a significant whitebait fishery. The report notes that it is possible that improvements in the Ngakawau River water quality will eventually result in a similar range and abundance of freshwater fish.

8.10.5 Freshwater Ecology Conclusions

The streams that currently drain the Stockton Plateau do not support diverse or abundant aquatic ecological values, with very limited macro-invertebrate, plant or fish species identified in studies conducted to date. This paucity in diversity and value is considered to be caused by historical and current coal mining activity, resulting in highly acidic and conductive water and in some cases the smothering of habitat by precipitated metal hydroxides and/or sediments. Studies worldwide have shown an overwhelming negative response of invertebrate communities to low pH, with taxa such as mayflies, crustaceans and molluscs being very sensitive to low pH.

The Project will impact upon the existing aquatic ecology of the affected streams by significantly reducing flows in each of the sub-catchments, particularly the lower Mangatini Stream and St Patrick Stream. The GHD report states that this reduction in flows is unlikely to have a major impact on the diversity of the macro-invertebrate, plant and fish populations in the greater Ngakawau catchment. The report suggests that the overall ecosystems consequences of this reduction in flows will be slight.

The diversion of flows from the affected sub-catchments may result in certain streams drying up or becoming ephemeral for periods of time. This was not considered problematic as many invertebrates are capable of moving into isolated pools and slow flow trickles during times of low flow. Overall, the impact of the Project on the affected aquatic ecology was considered to be beneficial.

Mitigation and Monitoring Proposed

Adoption of all the proposed measures outlined in the GHD report including:

- Comprehensive baseline surveys in each of the affected sub-catchments for monitoring

purposes following Project commissioning, with focus on rare bryophyte and liverwort species and distribution and freshwater fish species present in the Ngakawau River below the Mangatini Falls.
- Ensuring adequate water depths and velocities are retained within the Ngakawau River to maintain ecological values.
- An Aquatic Ecology Management and Monitoring Plan shall be prepared by an appropriately qualified person to address all the recommendations outlined within the GHD report.

8.11 Sediment Movement

Sediment bedloads from undisturbed catchments of the Ngakawau River are extremely low, as evidenced by the absence of fine bedload in the beds of the streams draining the undisturbed tributaries and the bed of the Ngakawau River, where bed material is predominantly granite with some greywacke. There is an absence of BCMs. Naturally high bedload movements are not a characteristic of the natural catchments and the transmission of bedload is not required to maintain bed morphologies. The construction of the Weka and Mt William dams will not interrupt natural bedloads or lead to bedload starvation downstream of the reservoirs.

However, high intensity rainfall on disturbed catchments can produce high sediment loads. High suspended sediment loads would damage the Project's turbines, reduce the clarity of the ocean outfall discharge and would reduce storage volumes within the reservoirs. Provision must be made to trap sediment in flows diverted to the Project reservoirs before it enters the reservoirs. This should take place within SENZ's silt traps but prudent design requires that HDL incorporates sediment traps at the points of inflow to the Weka and Mt William reservoirs.

The URS Scheme Modeling report (**Appendix I**) provides a first order assessment of sediment loads that could occur based on empirical relationship between flow and suspended sediment loads from disturbed catchments. This is a conservative assessment which has been used to determine the size of the sediment traps and dictated that such sediment traps be incorporated into the Project design. Draft water quality modeling of a natural disaster type event leading to failure of rehabilitation and treatment of the open cut mining areas, predicts that the traps would have a significant effect in preventing suspended sediment entering the Ngakawau River, as shown in Figure 9 below.

Sediment captured in the Project's sediment traps will be excavated from the traps while the reservoir levels are held at low levels and stockpiled in storage areas, as shown on **plan C-002** and **C-004**. While mining continues in the Mangatini and St Patrick catchments, these will be temporary storage areas until material can be transported to suitable fill sites, this is expected to be within the CML. Once mining ceases these silt storage areas will become permanent fill sites which will be progressively rehabilitated as they are filled.

In view of the above and given that the proportion of the Ngakawau catchment that is affected by the Project is relatively small, (being approximately 17%), it is considered that no adverse morphological changes will occur within the Ngakawau River.

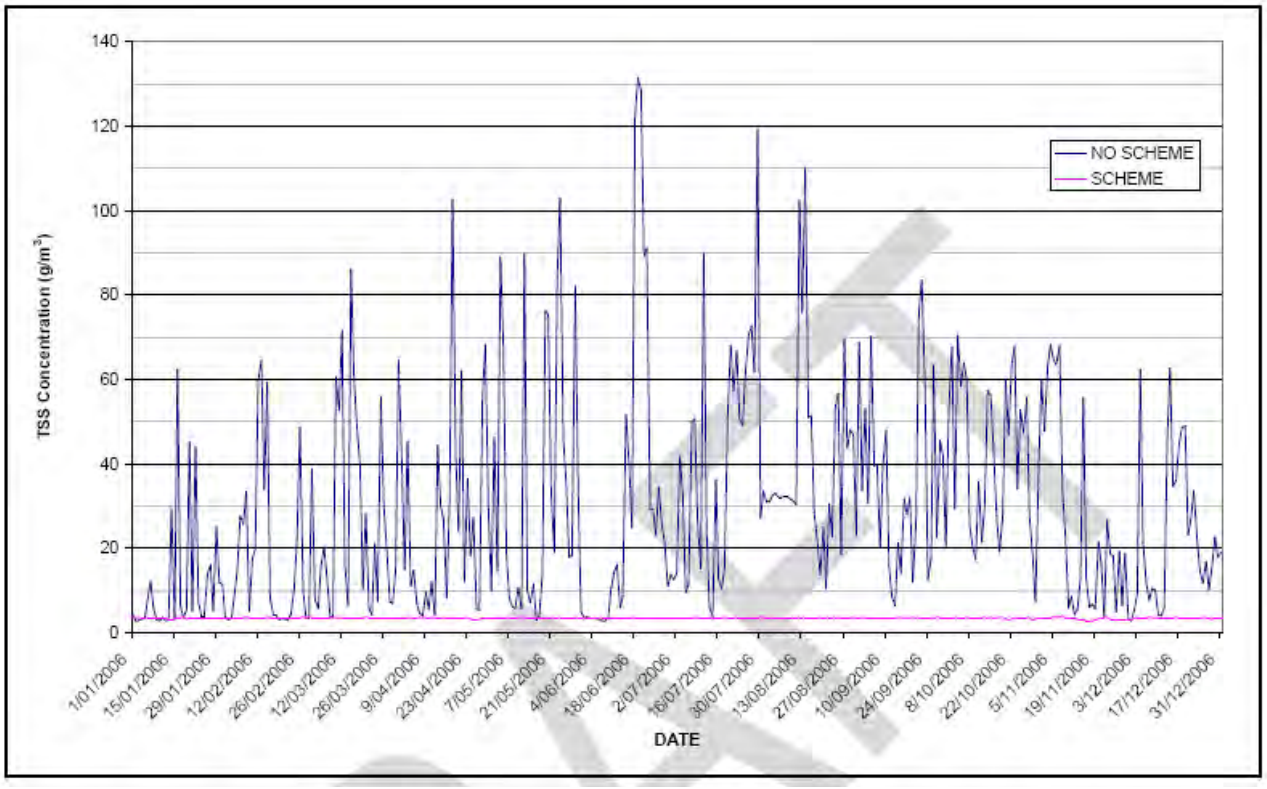


Figure 9 Ngakawau NR reduction in TSS for natural disaster scenario

Mitigation Proposed:

- As part of the final design process, HDL will undertake extensive modeling of sediment movement within all the affected watercourses. This will assist with final design of the sediment traps at the heads of the reservoirs, required to protect the turbines and to minimise sediment discharges at the ocean outfall.
- A Sediment Management Plan will be prepared to manage the ongoing process of sediment control at the Project's reservoirs.

8.12 Natural Hazards

The risk that a dam poses is related to both the likelihood and consequences of a dam failure. The destructive forces unleashed by an uncontrolled escape of water have the potential to harm people, property and the local environment. At an early stage of the concept design process, HDL commissioned URS to assess the potential effects of a dam breach and this report is attached as **Appendix J**. The results of this analysis have led to a dam design that cannot fail catastrophically.

The URS report modeled a range of scenarios for dam breach of both the Weka and Mt William dams. These models not only assumed catastrophic collapse of the dam embankments but also assumed erodable dam structures. It was determined that for the majority of breach scenarios the flows produced were similar to flows which would be produced by 'natural' extreme rainfall events over the Ngakawau catchment. In the worst cases modeled, rapid and catastrophic failure of the dam structures would lead to significant inundation of Hector and Ngakawau townships and the potential loss of life.

For all of the dam burst scenarios modeled, some level of threat was posed to users of the Ngakawau valley, either on the Charming Creek walkway or within the river itself. The short period of time available to warn river users of a dam breach (and ensuing flood wave), would make

any early-warning scheme impractical.

The New Zealand Dam Safety Guidelines (NZSOLD, 2000) require all dams to be categorised in terms of the potential consequences of failure. The URS report concluded that both the Weka and Mt William dams are likely to be classified as 'high potential impact category' dams, given the potential risk of fatalities in the event of total dam failure and the short warning time that could be expected to be given.

Mitigation of these effects will largely be addressed through the design of the impounding structures. The New Zealand Society on Large Dams (NZSOLD) provides guidelines for the design of large dams and other retention structures in New Zealand. The proposed Weka and Mt William dams will be built in accordance with these guidelines and both structures will be designed to ensure that the probability of a breach happening is as low as practicable and that if a breach were to occur, the rate of development and extent of any breach would be minimised.

Dam safety is an integral aspect of the design process and following the URS dam breach report, it is clearly obvious that an erodable structure is not an option for the two proposed dams. On this basis the applicant intends constructing RCC dams at the Weka and Mt William sites. The two RCC dam will be designed and constructed in accordance with the NZSOLD dam design guidelines. These RCC dams have also been selected as such dams can be safely over-topped, without creating any potential dam safety issues.

A further aspect to management of dam safety is the assessment of the geotechnical risks associated with the dam locations. In this regard, URS have investigated the two locations for the proposed Weka and Mt William dams. These initial site investigations have verified that the respective dam locations are suitable from a geotechnical viewpoint. Further intensive ground investigation, prior to final design, will be undertaken to determine whether any adverse conditions, which have yet to be identified exist.

The end result of the high potential impact classification, is that a high standard of design and construction will be required to ensure that any potential safety risks are managed to such a degree that all possible care has been taken. Further intensive geotechnical site investigations will be undertaken prior to the Project design being finalised, to ensure all potential design hazards have been identified and managed in the design process.

Legislation stipulates that the two dam structures will require building consents from the Otago Regional Council (acting on behalf of the WCRC). As such, detailed design information will be required for the respective dams and this work will be undertaken on grant of consent.

The diversion structures on the Mangatini, Mine and Darcy Streams will not dam water and do not create a flood hazard.

As has been discussed previously, the Project's reservoirs and diversions have a buffering effect and will in fact reduce natural flood risk for the townships of Ngakawau and Hector.

Mitigation Proposed:

- Further intensive geotechnical site investigations will be undertaken prior to the Project design being finalised, to ensure all potential design hazards have been identified and managed in the design process.

- The dam structures will be built to NZSOLD 'high potential impact category'.
- The dam structures shall be designed, constructed and maintained for the life of the Project in accordance with NZSOLD Dam Safety Guidelines, 2000 and any subsequent amendments.
- Building consents will be obtained from the Otago Regional Council. The conditions of consent will require a Dam Safety Management Plan, which will incorporate dam safety procedures and will include the requirements for annual independent safety audits and structural surveys.

8.13 Recreation and Public Access

Stockton Plateau

The Project will have no adverse impacts for the public. Access to the Stockton Plateau and hence to the various watercourses included in the scheme is already restricted for heath and safety reasons. It is anticipated that public access to the reservoirs would be appropriate but dependent on SENZ's activities in the area.

A section of the walking track that commences at Millerton and extends through to the Repo Basin will be affected by the Project. This walking track follows a portion of the historic coal tramway and crosses the Stockton haul road at Tin Town corner. The haul road will be relocated for construction of the Weka reservoir. The walking track will be re-routed around the reservoir linking back into the original Repo Basin track.

There will be a short period during construction and subsequent re-alignment of the walking track, where the track will be temporarily closed for public safety. It is anticipated that this would be for a minimal period while track re-instatement occurs. Discussions with locals have established that the track is not a heavily frequented walk-way, therefore disruption to walkers for a short period should have minimal effect.

Granity

Construction activities associated with the Granity portal outlet will entail disturbance to the Millerton Incline walking track. This track commences at the Granity Museum and leads up the Millerton Incline. During the peak summer months approximately 200 people per month visit the Granity museum, with a portion of these using the Millerton Incline track. Over the last 20 years considerable effort has been made by various community members to maintain this walking track. Preliminary ideas have also been discussed with SENZ to develop an overall historic plan for visitor exploration of the Millerton to Stockton area, with the walking track seen as an integral aspect.

Alternative foot access will be provided, prior to any disturbance occurring to the Incline track. This will ensure access to the Incline walking track remains un-interrupted.

Mitigation Proposed:

- The Millerton-Repo Basin walking track will be realigned as soon as practicable after construction works commence on the Weka reservoir. Notices will be erected at the end of the walking track informing the public of temporary track closure and expected re-opening.
- The Millerton Incline walking track shall be re-routed, prior to any construction activity occurring which has the potential to disturb the existing track or constrain public access.

8.14 Hazardous Substances

During construction activities fuel storage at the respective work sites will be required, this will

take the form of mobile diesel tankers. HDL will ensure that all re-fueling of machinery takes place in appropriately bunded facilities to contain any potential spills. Management practices will also ensure mobile tankers are located well away from any watercourses and that re-fueling is undertaken in such a manner that spills do not occur.

A range of other hazardous substances will also be used on-site, such as oils, explosives and cement. The safe and efficient storage, handling and use of such hazardous substances will be required by all HDL personnel and contractors.

The Granity and Weka power stations will each have a small switch room (contained inside the powerhouses), which will house one or more transformers and capacitors. The only hazardous substances used in the switch yards will be transformer oil needed for cooling purposes. Standard design for switch yards require that transformers are located in sealed areas to contain any potential leakage of fluids. In the event of a catastrophic failure, the bunded area will also be designed to contain the entire volume of transformer oil.

No hazardous substances will be disposed of on-site and the applicant will ensure that all hazardous substances are stored and handled in accordance with appropriate industry standards and guidelines.

8.15 Coastal Marine Area (CMA) Effects

The CMA is defined as extending from the line of mean high water springs, to the limits of territorial sea at 12 nautical miles. As regards the present proposal, the only component of the Project within the CMA is the outfall pipeline and diffuser. The effects of construction of these aspects of the Project on marine ecology has been assessed in the report *Assessment of offshore acid mine drainage effluent disposal* prepared by Cawthron Institute, attached as **Appendix L**.

8.15.1 Construction of the Outfall Pipeline and Diffuser

Cawthron expect that construction of the outfall pipeline and diffuser will result in minimal direct impacts on the coastal marine environment. With the exception of the diffuser footprint, the construction method of micro-tunneling is unlikely to disturb either the intertidal or subtidal habitats.

The final configuration of the outfall diffuser is dependent on further design assessment but is expected to require minimal disturbance to the seabed. Excavations of the seabed will only occur around the riser caisson at the termination of the micro-tunnel (some 72m^2). This disturbance will entail the resuspension of sediments, will potentially have a smothering effect upon communities in the immediate locality and will cause the physical removal of some epifuana and infauna species.

Cawthron note that resuspension of sediments can have the effect of releasing nutrients and or significant amounts of organic material into the water column. However, the level of resuspension anticipated from the diffuser construction will be small and localised in extent. The natural flushing processes are expected to rapidly disperse any sediment plumes, which will blend into the background turbidity of coastal waters within a relatively short distance.

The Cawthron report also states that organisms typical of intertidal and subtidal communities in high energy coastlines have adapted to the natural processes of sediment movement, erosion and deposition. As a result the fauna communities along this coastline are inherently turbidity-tolerant. Direct impacts (through physical disturbance) are not expected to extend more than a few metres beyond the installed structures and initial recovery of faunal communities via migration and

recruitment is expected to be relatively rapid (weeks to months).

8.15.2 Public Access

Micro-tunneling of the ocean outfall pipeline ensures that all construction activities within the CMA occurs underground, with the exception of removal of the tunneling equipment and installation of the diffuser, being some 600 metres offshore. As such, public access along the foreshore at Granity will remain unaffected.

8.15.3 Amenity and Recreational Values

The marine work to install the diffuser will be undertaken on a continuous 24/7 operation, until the work is completed over a favourable weather window. This construction phase is not expected to last more than one month, unless there is stand-down due to unfavourable weather conditions. Residents may incur minor noise and lighting effects during this period but this will emanate from outside the wave break zone. Noise is unlikely to be discernible over background wave noise.

The Granity beach area is used for a variety of recreational activities including walking, swimming and surf casting. As stated above, the construction method of micro-tunneling the outfall pipeline ensures that such recreational pursuits will not be affected.

With respect to the offshore work, some restriction on boating movements within the diffuser locality will be required, for safety reasons. However, recreational boating in this area is not high and should not be unduly affected by a relatively small exclusion area over a short period.

8.15.4 Water Quality

Cawthron's assessment approach in regard to water quality involved prediction of water quality impacts in relation to the available national guidelines, incorporating their background knowledge of marine metals concentrations and chemistry.

Cawthron's report refers to the ANZECC (2000) guideline criteria for trigger values for environmental performance, and includes comments on the application of the guidelines. The report states that the ANZECC (2000) guidelines are essentially conservative criteria that if complied with ensure that specific environmental values are protected. However, it is noted that the converse is not necessarily true (ie. exceedance of trigger values does not necessarily suggest environmental damage), the intent being that these values act as a trigger for more intensive assessment if they are not meet.

A key feature of the ANZECC guidelines is that the trigger levels differ for different types of ecosystems at three levels of disturbance, ranging from pristine to highly disturbed. For the purposes of their assessment Cawthron considered the trigger values for “Condition 2” ecosystems to be the most appropriate for the present proposal, whereby the Granity offshore environment is catergorised as “slightly to moderately disturbed”.

In regards to assessing the potential adverse effects for the proposed Granity outfall, Cawthron has identified a list of key parameters in the discharge, bing pH, total suspended solids and trace metals, particularly aluminium (Al), copper (Cu), iron (Fe), nickel (Ni) and zinc (Zn). Cawthron notes that other constituents of the discharge may also have the ability to cause adverse effects, however, the information available to date suggests that the concentrations of these constituents is not high enough to warrant significant investigation.

A series of dilutions of representative AMD with seawater has been modeled by URS (see

Appendix K) and is referred to in the Cawthron report. The dilution that may be required to meet ANZECC (2000) 95% trigger values could range from as low as 4:1, which could be achieved using a simple mushroom diffuser at the end of the outfall pipe, to possibly 1000:1, which would require a substantial length of perforated diffuser pipe laid on the sea bed. The modeling undertaken by URS and Cawthron demonstrate that the actual dilution required will be critically dependant on the pH of the discharge from the outfall and the characteristics of the receiving environment. Both URS and Cawthron recommend that baseline surveys and field trials will be required to determine the dilution required to meet the ANZEEC threshold water quality requirements for the marine environment typical at the outfall.

Cawthron's report highlights that the most critical aspect of the proposed outfall is the pH and this is discussed in further detail below.

pH

pH is used as a measure of acidity or alkalinity of receiving waters or discharges. In seawater pH does not change appreciably because of the natural buffering capacity of the carbonate-bicarbonate system. The average pH of seawater is around 8.2, slightly basic. However, surface seawater in areas affected by large freshwater river plumes usually has a pH range between 7.8 and 8.3, while the pH in some nutrient-enriched bays can be higher during large phytoplankton blooms and lower during times hypoxic or anoxic conditions. The input of contaminated discharges into the marine environment can also alter the natural pH and have an adverse effect on marine ecology, with planktonic and larval forms being particularly susceptible.

Cawthron discusses the range of ANZECC and USEPA pH guidelines and proposes a variation of no more than 0.2 pH units from the normal range (ANZECC 1992 guideline value). Adoption of the ANZECC (1992) guideline over the more recent ANZECC (2000) guideline reflects the nature of the West Coast coastal waters, which are subject to large inputs of freshwater and naturally have a pH that is below 8.

Clarity

Clarity is a measure of the transparency of a water body and decreases as suspended solids concentration and associated turbidity increases. While AMD discharges are relatively clear and free of suspended particulates, changes in pH cause precipitation of iron and aluminium in seawater. This has the potential to reduce visual clarity in the receiving environment, hence the need to assess clarity along with changes in pH.

Cawthron discusses the range of guideline documents to assist with assessing changes in clarity and colour, specifically the ANZECC (2000) guidelines and MfE (1994) Water Quality Guidelines No. 2. These guidelines aim to provide criteria for discharges that if met will avoid 'conspicuous' changes in receiving waters after reasonable mixing. Cawthron consider that the most appropriate guideline is the MfE (1994) guideline, which suggests a clarity trigger level of 50% change after reasonable mixing. The adoption of this upper end of the MfE (1994) guidelines recognises the highly variable natural clarity of West Coast waters.

In order to assess potential clarity effects for the Granity outfall Cawthron ran a dilution series using filtered seawater and Stockton Plateau AMD contaminated water with pH levels of both 4.5 and 3.3. For both of these dilution series the pH of the seawater was 7.9.

The modeling indicates that both the 50% clarity change and the more stringent 33% clarity change (MfE 1994 guideline) should be met with very little dilution, even when using very clear filtered

seawater. Therefore meeting clarity changes guidelines for the proposed Granity outfall is unlikely to be an issue.

8.15.5 Subtidal Habitats

Cawthron report that the subtidal zone and seabed in the vicinity of the proposal outfall is believed to support relatively common biota typical of the wider region, with no species of significant ecological interest or uniqueness. No habitats are present that would support sessile fouling biota or reef communities. The absence of a macroalgal flora conceivably reflects both low light levels and the lack of suitably stable habitat for attachment.

It is possible that the diffuser may provide a hard substratum for colonisation by reef-type communities, as has been observed on other outfall structures around New Zealand. This is likely to comprise a diversity of filter-feeders, sponges, mussels and other sessile organisms. The additional substratum and associated assemblage may also alter the benthic community in the close vicinity of the outfall diffuser, likely attracting scavenging invertebrates and fish.

The Cawthron report states that the potential impacts on the seabed will most likely originate from precipitation of iron and aluminium compounds. The exposed and well-flushed nature of the open coastal environment at the diffuser is expected to mitigate such effects. At worst, the discharge could lead to a localised increase of some trace metals in sediments adjacent to the immediate vicinity of the diffuser.

Shellfish

There are no published guidelines or standards for comparison of trace metal accumulation in biota exposed to effluent discharge, rather levels are reported in the context of back ground levels or in terms of food safety standards for human consumption.

The Cawthron report refers to a previous analysis of trace metals in mussels collected from the Torea Rocks in March 2007. Levels of metals except for arsenic, were below the maximum specified in the *Australian New Zealand Food Standards Code*, 2002. The report commented that elevated levels of arsenic in shellfish have been recorded in other regions around New Zealand and are largely attributed to natural sources form local geology.

It would appear that the high historical levels of AMD discharged via the Ngakawau River into the intertidal zone have not adversely affected the local shellfish beds. The proposed outfall will move the point of discharge beyond the intertidal zone and further from the beds.

Phytoplankton and Zooplankton

The Cawthron report states that the proposed discharge could negatively affect phytoplankton through decreased light levels in plumes of suspended material. Both phytoplankton and zooplankton could be affected through exposure to altered pH conditions or toxic substances. However, the report concludes that impacts to phytoplankton are expected to be negligible given the dynamic high energy nature of the receiving environment and that the discharge will meet relatively stringent receiving water criteria for water clarity close to the outfall, that.

Effects on both phytoplankton and zooplankton from exposure to low salinity water and altered pH are also expected to be negligible, in the latter case because of the high buffering capacity of seawater which will see such changes merging into the background rapidly with mixing. Effects from toxic substances is somewhat uncertain but the report concluded that given the high dilution expected any toxic effects are at worst, likely to be highly localised.

Fish and marine mammals

In terms of fisheries resources associated with the seabed, the Cawthron report states that any potential seabed impacts are expected to be highly localised. In the context of the wider region the significance of such localised effects is likely to be minor, considering the dynamic nature of the wider inshore region of the Karamea Bight.

With respect to potential effects on fisheries resources arising directly from the discharge plume, the Cawthron report states that effects from low pH and toxic contaminants are either negligible or require additional investigation to quantify. However, the report notes that avoidance responses by fish to sub-lethal concentrations of contaminants are well documented. As the bulk of commercial trawling occurs further offshore the commercial fishery is unlikely to be impacted by any potential precipitate plume.

Cawthron notes that the marine mammal species most likely to be impacted by the proposal are Hector dolphins and fur seals that may be resident in the area. For the construction phase of the diffuser, this will involve an increase in boating movements and underwater noise within the immediate vicinity of the outfall. However, the construction period for the diffuser is expected to be approximately 1 month and the affected coastline is very small, in relation to the distribution ranges of resident and transient marine mammal species. As such, any reaction of the animals will be temporary and most likely involve simple avoidance behaviors by individuals over the short-term of the construction phase.

Longer term effects due to any physico-chemical disturbance of nearby coastal waters from the Granity outfall may indirectly affect a particular marine mammal species by significantly changing the abundance, distribution and/or health of their prey species. While the AMD contaminated discharge is expected to be within a range of accepted standard levels, the effects of the low pH creates some uncertainty. However, the Cawthron report notes that despite lower pH levels being known to cause adverse effects in some freshwater invertebrates, there are several New Zealand species which are known to survive in naturally low pH streams along the West Coast. The coastal communities within the region of the proposed outfall have been exposed to lower pH levels from the nearby Ngakawau River and Granity Stream for decades.

In the final analysis Cawthron concluded that the Granity outfall discharge may represent a highly localised contaminant source surrounded by a vast dynamic body of 'clean' water, hence adverse impacts on fish and marine mammals due to toxicants in the discharge is highly unlikely.

8.15.6 Natural Character and Visual Effects

Natural character in this context is taken to include visual impacts and landscape effects. As described previously, the construction method of micro-tunneling ensures that all construction activity within the CMA occurs underground, with the exception of works at the discharge outfall, some 600m offshore. Residents may incur minor noise and lighting effects during this period but this will emanate from outside the wave break zone. The presence of a boat/barge is appropriate within the marine environment and is expected to be required for no longer than a month.

The diffuser discharge has the potential to change visual clarity in the receiving environment, with an associated change in water colour to an extent that may be conspicuous from a plane, boat or from higher elevations on the shore. A clear or discoloured plume may be visible against the normal background turbidity, as evidenced by many aerial photos of the Granity coastal area. The high

wave-energy environment along this part of the coastline and the consequent substantial mixing capacity will likely minimise any potential clarity issues, except directly adjacent to the discharge. Any localized change in colour or clarity due to the discharge is unlikely to persist in such a high energy environment.

8.15.7 CMA Conclusion

Cawthron states that there are no reported species of special scientific or ecological value identified in the marine receiving environment for the outfall. Any potential deposit of metal precipitates in the vicinity of the outfall is expected to be localised and plankton effects are expected to be minor, given the high initial dilution expected in the vicinity of the outfall. It is anticipated that any potential plume will disperse rapidly given the naturally turbid and dynamic coastal environment, with clarity guidelines expected to be met with low levels of dilution. Fish species and marine mammals such as Hector's dolphin and fur seals in the vicinity of the outfall are expected to naturally avoid any localized adverse conditions.

Initial laboratory tests have established that most contaminants in the discharge are expected to be reduced to levels that meet the ANZECC (2000) guidelines with relatively low levels of dilution. The key component of the discharge identified as having the greatest potential effect is pH. Small changes in pH levels can have a marked change in the amount of dilution required to meet receiving water guidelines. On this basis the Cawthron report recommends that additional dilution assessments be undertaken with representative AMD water to evaluate the envelope of pH and required dilution to meet the relative water quality guidelines. This information will assist in determining the optimum configuration of the outfall diffuser. HDL proposes undertaking further site specific assessment and laboratory trials over the next 3-4 years (prior to outfall construction commencing), to establish the optimum configuration of the diffuser design.

The initial work undertaken to date establishes that under most operating conditions the proposed outfall discharge will meet receiving water criteria with relatively low levels of dilution. However, there will remain infrequent periods when greater dilution and hence a larger mixing zone will be required. For example:

- During periods of extended drought the pH of the discharge may drop below 3.
- Following a natural disaster event which causes major land disturbances within the Stockton Mine area the pH of runoff may be depressed;
- Periods of completely calm sea conditions where dilution achieved at the diffuser would be reduced.

As Project operators there are a number of options available to HDL for responding to these infrequent events ranging from reducing flows, lime dosing to elevate pH in the Weka reservoir, or as an extreme action, ceasing discharge.

In the event that the Project's storage reservoirs are near capacity, reducing or ceasing discharge from the outfall would mean flows will revert to the current situation of discharging into the Ngakawau River (via the Weka and Mt William reservoir spillways). Both the GHD and to a lesser extent the Cawthron reports have discussed the impacts of AMD on freshwater systems, with the GHD report stating the paucity in diversity and value within the tributaries of the Ngakawau River and the Ngakawau River itself as being attributable to the impacts of AMD. Also suggested by the reports is that diversion of the AMD impacted run-off from the Ngakawau River system will both improve water quality and enhance freshwater ecology richness and abundance. Given this predicted enhancement of the Ngakawau River system any discharge back into the River system,

other than spill during high flow events (when contaminants loadings will be significantly diluted), is not viewed as a sensible course of action. Ceasing discharge at the Granity outfall could potentially lead to significantly worse adverse effects on the Ngakawau freshwater environment than any continuation of discharge into the marine environment. It is proposed that the infrequent, principally visual, effects of larger mixing zones at the outfall are acceptable as they result in protection of the Ngakawau freshwater ecology.

Mitigation and Monitoring Proposed:

Adoption of all the proposed recommendations outlined in the Cawthron report being:

- Additional laboratory dilution series be conducted at a range of pH levels to establish optimum dilution and assist with final design of the outfall diffuser.
- A baseline survey of the coastal environment within the diffuser locality, including benthic infauna and sediment chemistry. Followed by a monitoring surveys 1-2 years after commissioning of the outfall and at regular internals thereafter (eg. every 5 years).
- On commissioning of the outfall, a one-off dispersion and dilution study be undertaken to validate the predicted initial dilution results under reasonable worst-case conditions. Thereafter routine monitoring of the discharge to establish that the discharge is meeting required water quality criteria.

9 Consultation

Consultation has been undertaken with all the landowners, communities and interested parties to the Project, to gain their views on the proposal and assess any issues of concern.

9.1 Landowners

Consultation was undertaken with all the landowners within the Project footprint being:

DoC

As previously mentioned, negotiations are on-going with DoC to resolve issues associated with the land exchange. Initial discussions highlighted consenting issues of: consideration of low flow impacts on the Mangatini falls, effects of the ocean outfall on the marine environment and the need for adequate flora and fauna assessments.

Subsequently a site visit has been undertaken with the land exchange/concessions team and to date no further issues of concern have been identified.

SENZ

The Project has been designed to ensure that it will not constrain future mining operations within the current mining licence area nor will it isolate any other coal reserves. HDL has also been in close liaison with SENZ during development of the concept designs and over the effects the Project will have on SENZ land and operations within the CML and minerals permit.

Following the consent process and prior to final design work being undertaken, the specific details of access onto SENZ property and operations with in the CML will need to be agreed.

Northern Buller Communities Society Incorporated (NBCS)

Discussions have occurred with the society's president and Project information was provided to the Society for presentation at a committee meeting. The Society has confirmed (in writing), agreement in principle for the burial of the ocean outfall pipeline beneath bare land, adjacent to the Lyric Theatre. Following the consent process, the specific details of access beneath NBSC land will be negotiated.

Additional note: At one of the community meetings HDL was also advised by the deputy chairman of the society that NBCS hold a lease over railway land in the vicinity of the band rotunda and the Granity museum. The Society has had a landscape concept plan developed for this area as part of a beautification project and establishing pedestrian access from the band rotunda over to the museum. The Society asked to be kept informed of HDL's Project developments. It was also noted that the access road presently serving the Granity museum is maintained by the society.

HDL intends working with the NBCS and any other interested community members to develop landscape plans which achieve the communities objectives for the Granity area post construction.

Buller District Council

A presentation of the proposal was made to staff representing the consents and operations section, it concluded in a strong level of support for the project. As regards consenting issues, the existence of the historic coal tramway was noted and it was stated that an archaeologist's assessment would be needed prior to lodging the consent application. This archaeologist assessment has since been completed and is attached to this report as **Appendix A**.

BDC is also an affected landowner to the Project, with the ocean outfall pipeline passing under

legal road adjacent to the Granity foreshore. Project information has been forwarded to the Council's operations section and to date no issues of concern have been identified.

ONTRACK
Project information has been sent to Ontrack, regarding the Granity site and those aspects of the proposal that affect their utilities/railway land. Ontrack were concerned that their interests, as regards occupation on and under their property were protected and requested the following conditions be attached to any issued consent:

1. Prior to commencing Project construction HDL will gain from Ontrack all the necessary deed, grants and permits for their operation on and under railway land and on and under the Stillwater to Ngakawau railway line.
2. Construction of the ocean outfall pipeline beneath the Stillwater to Ngakawau railway line will be undertaken during routine closures of the line, (currently this occurs every ten weeks for a period of 48 hours).

NZ Transport Agency (NZTA)
Project information has been referred to the NZTA, regarding burial of the ocean outfall pipeline beneath the state highway. A written response was received on 10 November 2008 which stated that in terms of the RMA there were no major issues with the Project.

9.2 Affected/Interested Parties

West Coast Regional Council
A presentation to council's consents staff was made and discussion on consenting requirements was undertaken. At this initial stage no particular issues were identified.

Te Runanga o Ngati Waewae (Rick Barber)
Mr. Barber recognised that the Stockton Plateau is a highly modified environment and that the Ngakawau catchment has significantly degraded water quality. For cultural and potential food gathering reasons he was not in favour of any discharge near the Ngakawau estuarine environment.

Mr. Barber clarified that the current proposal to intercept watercourses on the Stockton Plateau and divert to sea is considered to be culturally inappropriate, given the mixing of different catchment waters. However, in his opinion this cultural concern is mitigated by the enhancement of water quality that will be achieved through discharge into the marine environment, as opposed to the Ngakawau River. This is on the basis, that a key cultural consideration is the enhancement of water quality and hence restoration of the River's mauri (life force).

Buller Electricity(BEL)
Throughout development of the concept design, HDL has been in discussion with BEL regarding transmission options for the power generated by the proposal and the involvement of BEL in the final design and operation of the generating plant and equipment.

BEL advise that the upgrade to the existing transmission network that is scheduled to meet SENZ short term demand, (capacity that will be required before power from the HDL Project can come on stream), will be adequate to transmit the proportion of the Project's base load that is not consumed by Stockton Mine or sent north to Karamea. Additional transmission capacity south will be required in the medium term when the demand from Stockton Mine reduces and may be warranted in the short term if final design concludes that the installed capacity can be increased.

BEL is confident that there will be a number of viable options to upgrade the connection south from

Granity when this is required. The most viable option for upgrading transmission capacity above the level already planned will be determined by changes in demand, generation and transmission within the district and beyond over the next 5 years, (including the outcome of the Mokihinui applications). With BEL's agreement, it has been decided to defer decisions on any potential consenting issues for future upgrades closer to the time in which the full Project is completed.

Debbie Chorley (Ngakawau River Watch)
A presentation was made to Debbie Chorley and a site visit undertaken. In principle, Debbie supports hydro generation, as it utilises a renewable resource and New Zealand has a looming energy crisis which requires some immediate action.

Debbie made a number of suggestions for the Project, including directing the final discharge from Granity power station into Granity Stream and improving the existing visitor experience along Charming Creek walkway, in the vicinity of the Mangatini Falls. With regard to Granity Stream, Debbie has been independently monitoring water within this watercourse and it is essentially devoid of life. She was of the opinion that the Granity Stream tailwater discharge option could receive support from the community, if HDL agreed to construct coastal protection works for those properties in the vicinity of Granity Stream. This would then provide a real benefit to the local community, as opposed to expenditure on an ocean outfall structure.

HDL has considered Debbie's proposal and has investigated the option. HDL's investigations have concluded that a Stream discharge will not be viable as a long term outfall for the following reasons:

- Sea conditions cause a bar to develop at the Granity Creek mouth that would need to be opened mechanically at reasonably frequent intervals. The Project outfall would not be sufficient to keep the mouth open.
- The Project offers the opportunity to capture AMD affected water from the upper Granity catchment as a future option, which would result in significant water quality improvements in the Granity Stream. The operation of the surge chamber on the ocean outfall can potentially be managed to supplement Granity Stream low flows when residual contamination has most effect, further improving water quality in the Stream.
- Tailwater discharge to Granity Stream would offset these potential improvements.
- Discharge of the outfall into the marine environment has no ecotoxic effects, whereas discharge into a freshwater environment will have some, albeit minor, effects on the freshwater ecology.

A stream discharge is, however, required to cover situations when the power house, surge chamber and ocean outfall may need to be closed for unforeseen circumstances. This report contains consent applications for the purpose of discharge to Granity Stream for short periods.

With regards to reduction in flows within the Mangatini Stream and subsequent effect on the falls, Debbie Chorley suggested mitigating these effects by improving the existing visitor experience by undertaking plantings around the margins of the falls and installing a picnic table or similar at the viewing area, (a picnic table used to be at the site). HDL has incorporated this suggestion into the Project plan.

Buller Conservation Group
A presentation was made to a number of the groups members. Initially some concerns were raised over the potential option of final discharge to sea, on the basis of the effects of heavy metals and

pH on the marine environment. The dilution provided by the reservoirs was discussed and the further environmental work being undertaken in this area. Some of the project reports (prepared at the time) were forwarded to the group.

A site visit was undertaken by various members of the group and a representative of the Nelson branch of Forest and Bird. No additional issues of concern were identified.

West Coast Conservation Board
A presentation was made to the Group and this was enthusiastically received. The group did raise the issue of marine environment effects but overall were supportive of the objectives of hydro generation with a relatively small footprint and enhancement of water quality within the Ngakawau River.

Granity Residents
A personal approach was made to several of the businesses and residents which immediately adjoin the Granity construction site. This included the following:

- Granity librarian, C/- Mr and Mrs Barry, 133 Torea St, Granity.
- Granity museum curator – Wayne Skelton ph 7828548
- Torea Gallery, C/- of Dinah Wallace, PO Box 7, Ngakawau.
- Drifters Cafe, 97 Torea St, Granity.
- Sandy Chorley, 94 Torea St, Granity.
- Mr T R McLaughlin, 18 Soleares Av, Mt Pleasant, Christchurch
- Mr Dawber (maintains water supply that may be affected by the proposal), 99 Beach Rd Granity.

The majority of people approached were supportive of the Project but concerns mentioned related to: maintenance of property water supplies (with several properties receiving their supply from a header tank on the hill in the vicinity of the proposed Granity portal outlet); the visual detraction created by Granity construction area; and the potential effects of the tailwater discharge on the marine environment.

Granity/Ngakawau/Hector Community
A brochure providing a description of the Project was circulated at the end of August to households within the northern Buller (approximately 700), as an attachment to the community newsletter. This was then followed up with two community meetings held at the Granity fire station on the 8th and 10th of September. Both meetings had relatively small attendance but involved considerable discussion on a wide range of issues associated with the Project, with some of these mentioned below: (Note: HDL's response at the meeting is provided in italics)

- The possibility of using rock excavated from the Granity tunnel and elsewhere within the Project footprint for coastal protection works. *Rock excavated from the Granity tunnel will be relatively small and not suitable for the exposed face of any rock wall but the formation of the Granity portal would likely result in some large rock being excavated. HDL indicated that if the community had the necessary resource consents in place for such protection works it is likely that there would be some suitable rock available within the Project footprint.*
- Concerns with the effects of the emergency outflow into Granity Stream, particularly if the stream was already running at a high flow. *Reiterated that the scheme will generally be operating at flows of around 4 cumecs and only when the scheme is working flat-out will the*

discharge be up to 9 cumecs. This is still only equivalent to a small fresh within Granity Stream. The likelihood of the main outfall pipe/diffuser failing coinciding with high flood flows within Granity Stream is considered very low. In addition the emergency overflow will only occur as long as it takes to shut down the system on the Plateau, not expected to be more than 24 hours.

- De-watering of the Mangatini falls. *At the Mangatini falls the mean stream flows will be approximately 40% of the existing flows but will be clean water. During low flows there will be substantially reduced flows passing over the falls.*
- Visual effect of the Granity construction yard and portal area. *The access ramp up to the Granity portal will be no wider than 6m and will be constructed to ensure that the vegetation below the road remains intact. The construction yard will be largely contained in an area to the north of the Granity museum, behind the pines trees along the railway line. A fence will be erected at the museum end of the yard to provide a visual barrier. The most visible structure will be the Granity portal outlet/portal apron.*
- Noise effects at the Granity construction site. *Reiterated that tunnel excavations during the night shift will be stored in a stone bay within the Granity tunnel so that truck movements only occur during the day shift. Once the Granity site is established heavy truck movements (just truck, not trailer) will be around 10 per day. With respect to micro-tunneling this has occurred elsewhere (within Christchurch city) next door to residential areas, while tunneling operations involving blasting also occur close to residential dwellings (Terrace Mine at Reefton) with noise effects appropriately managed.*
- Considerable concern was voiced over the potential option of using the southern entry point beyond the band rotunda for Granity site access as opposed to the northern entry. Residents stated there used to be a level crossing at this site as SENZ had fuel tanks situated beyond the railway line. *Most people considered this was too close to the skate board ramp and the school. HDL stated would discuss the issue with Ontrack and attempt to revert to the originally proposed northern entry point adjacent to the war memorial.*
- Marine outfall and effects of the discharge on the marine environment. *Reiterated that the large reservoirs will provide some dilution with rainwater and surface run-off, resulting in some improvement in water quality. The extensive modeling of the anticipated discharge parameters establish that the ANZECC criteria are meet at the point of discharge for both nickel and lead, while zinc meets the guideline levels with 99% sea water mixing. There are no guideline values for aluminium and iron as they are not ecotoxic within the saltwater environment. However there is a potential for a plume (related to iron and aluminium loadings) to develop around the diffuser in adverse conditions, being still seas and drought conditions, where discharge levels will be elevated.*

MAPPS

A meeting was undertaken with members of MAPPS, at which time various aspects of the Project were discussed. Members were particularly interested in what activities would be occurring within the MAPPS area. The Granity tunnel construction was discussed and the need for ventilation shafts along the route.

MAPPS members were generally in favour of the generation of renewable energy and interception of the degraded tributaries of the Ngakawau River. Some discussion occurred on the feasibility of the future option of collecting the headwaters of Granity Stream through drop shafts into the Granity tunnel. Most people present expressed the view that they would not be in favour of this occurring as it would adversely affect flows within Granity Creek and the Granity waterfall. It was clarified that this particular diversion option did not form part of the present consent application.

Historic Places Trust
A number of historic sites are within the Project footprint as such information was forwarded to the Historic Places Trust. To date no issues of concern have been identified.

Westport Harbour Master
The ocean outfall pipeline is within the bounds of the Westport Harbour Authority. Information on the Project was forwarded to the Westport Harbour Master. Subsequently a brief conversation occurred with the Harbour Master indicating he could foresee no concerns with the proposal.

Maritime New Zealand
Maritime NZ is responsible for maritime safety and development of marine protection rules. Information on the Project was forwarded to Maritime NZ and to date no issues of concern have been identified.

Land Information New Zealand (LINZ)
A small portion of the Mt William reservoir extends onto land administered by LINZ. Information on the Project was forwarded to LINZ and to date no issues of concern have been identified.

9.3 Consultation Feedback

Initial consultation involved discussion with various interest groups on the alternative discharge location options. Generally speaking all the groups approached on this matter expressed a preference for a marine discharge as opposed to discharge into any freshwater environment, provided the effects of such were adequately assessed and addressed. This was on the basis of the potential water quality improvements that could be achieved in removing the vast majority of degraded flows from the Ngakawau River system.

Later discussions, particularly with Granity community, focused on the effects of the Project for those residents that lived close to the Granity construction site. Concerns ranged from ensuring property water supplies were maintained to noise/visual effects. For the most part Granity residents seemed reasonably satisfied that the effects of the Project would be minor or would extend for a short duration.

Feedback received through the consultation process has established a strong degree of support for the proposal. The Project is seen as having considerable environmental benefits by removing mine affected flows from the Ngakawau River system and local generation and injection of power is seen as a positive and necessary objective for the Buller District.

10 Statutory Assessments

10.1 Introduction

The Resource Management Act 1991(RMA) and the Councils planning documents specify the circumstances in which resource consents for activities are required. As regards the current proposal, the consents sought from the respective Council's have been listed in section 6. The RMA and the relevant planning documents also specify environmental thresholds that must not be contravened by a proposed activity. This section discusses the relevant sections of the RMA and the relevant portions of the planning documents, as they relate to the Project.

10.2 The RMA

The most significant provisions of the RMA are contained within Part II of the act, whereby the purpose and principles are defined.

10.2.1 Section 5 – Purpose

Section 5 stipulates the purpose of the act as being "*... the sustainable management of natural and physical resources*". Section 5(2) goes on to define sustainable management as "*...managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well being and for their health and safety, while-*

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonable foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment."

As regards the present proposal, it will provide for the social and economic well being of people and the communities of the Buller District by providing the means for local power generation. In doing so it will provide an improved level of security of electrical supply and eliminate some of the vagaries that occur with remote generation and subsequent supply to areas such as the West Coast. In this way the Project will support the continued growth of communities and businesses within the Buller District and consequentially the West Coast region.

Furthermore, the development meets the purpose of sustainability, in that power generation is by means of renewable resource. The Project also provides a means of improving the existing environment by removing a significant portion of the degraded water flows which presently enters the Ngakawau catchment, thus sustaining the resource for future generations.

In terms of safeguarding the life supporting capacity of the ecosystems affected by the Project, the various supporting environmental reports have concluded that no significant habitats of indigenous flora will be affected by the proposal, land snails are unlikely to be present and the low numbers of threatened bird species found were well represented outside the footprint area. Further, the Project in capturing a large portion of AMD affected tributaries within the Ngakawau catchment and discharging this to sea, achieves the aim of safeguarding the life supporting capacity of the Ngakawau River and its tributaries.

Finally, the Project provides a sustainable solution for management of waterways affected by AMD through historical mining activities. Responsibility for controlling AMD leachate from sites outside the CML is not currently assigned to any party, nor has funding been allocated for this purpose. The Project requires minimal maintenance and expenditure while ensuring a long term solution to

management of AMD affected watercourses on the Stockton Plateau.

In all respects the proposed development of the Project is consistent with the stated principle of sustainable resource management.

10.2.2 Section 6 – Matters of National Importance

Section 6 of the RMA sets out matters of national importance Consent Authorities are required to "*recognise and provide*" for these matters when considering consent applications:

(a) The preservation of the natural character of the coastal environment (including the coastal marine area), wetland, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development;
(b) The protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development;
(c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;
(d) The maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers;
(e) The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga;
(f) The protection of historic heritage from inappropriate subdivision, use and development;
(g) The protection of recognised customary activities.

The only structures associated with the Project which are within the coastal environment, is the Granity outlet portal and the ocean outfall. The power station is contained within the Granity portal and on completion of construction activities the only visible component will be the portal outlet, portal apron and access ramp, which is expected to be largely concealed by the existing vegetation. The ocean outlet pipe will be buried, therefore there will be no detraction to the natural character of the coastal environment.

The landscape comprising the Stockton Plateau and Granity area has not been identified as outstanding within any planning document. In fact the Environment Court in its decision on *Solid Energy New Zealand Ltd v West Coast RC and Buller DC C074/05 (2005)* concluded that the Stockton mine site was not part of an outstanding natural landscape due to the amount of human interaction from past and present mining activities. Undoubtedly the coastal environment is one of considerable scenic beauty but the penstock coming down from the Plateau will be via a deeply excavated tunnel and the ocean outfall pipeline will be buried, therefore ensuring no detraction to the Granity coastal landscape.

The reservoirs required for storage purposes will result in inundation of some habitat on the Stockton Plateau but the terrestrial flora and fauna studies concluded that there will be no significant loss of habitat or effects on species within the inundation footprint. The waterways being diverted into the Project are already significantly degraded and aquatic life is marginal. Residual flows will be achieved below the scheme and it is anticipated that water quality within the Ngakawau River will be enhanced by the removal of a significant portion of tributaries affected by AMD.

On the Stockton Plateau, where the majority of the hydro infrastructure will be sited, public access is already restricted for safety reasons. For the future, when the Stockton mine is closed and public restrictions are removed, HDL envisages that the public would have full access to the area. The

only exception being to the power stations, which for obvious reasons will be secured to prevent public entry.

With respect to the ocean outfall, the construction method of micro-tunneling ensures that public access along the foreshore will remain unaffected. While installation of the diffuser will require restriction of access around the diffuser site for safety reasons, this restriction will be temporary and will be in place for a short period. The diffuser site is some 600 metres offshore and boating activity in this area is minimal.

Consultation has been undertaken with Te Runanga o Ngati Waewae to assess whether the scheme presents any aspects of concern. Initial discussions have established that cultural concerns regarding the mixing of different catchment waters is mitigated by the anticipated enhancement of the Ngakawau River.

An archaeologist has assessed the historic coal tramway and undertaken a survey of the line formation. A small section of the foundation will be inundated by Weka reservoir and a very small area inundated by Mt William reservoir. By far the bulk of the line is not affected by the Project. The Weka reservoir and associated haul road relocation will be laid out to minimise any further damage to the formation. Any artefacts that will be buried by the dam or the areas of inundation will be recovered to a display at the Granity museum.

10.2.3 Section 7 – Other Matters

Section 7 sets out matters which Consent Authorities must have "*particular regard to*" when considering resource consent applications. These are as follows:

(a) Kaitiakitanga;
(aa) The ethic of stewardship;
(b) The efficient use and development of natural and physical resources;
(ba) The efficiency of the end use of energy;
(c) The maintenance and enhancement of amenity values;
(d) Intrinsic values of ecosystems;
(f) Maintenance and enhancement of the quality of the environment;
(g) Any finite characteristics of natural and physical resources;
(h) The protection of the habitat of trout and salmon
(i) The effects of climate change; and
(j) The benefits to be derived from the use and development of renewable energy.

As noted above, consultation with local Iwi established support for the project, given the enhancement of water quality that can be achieved for the Ngakawau River and estuary. Restoration of the ecological and cultural values of degraded waters is a fundamental principle of Maori environmental management. On this basis the proposal provides for Maori and their cultural values and meets the various requirements of Sections 6 and 7 of the RMA.

Transmission of electricity over long distances can be inefficient as considerable power losses can occur. For the West Coast situation with transmission from the Waitaki Valley, loss figures of up to 50% at peak demand periods have been quoted. In this regard, the present scheme is an efficient use of natural and physical resources as the locally generated power will be embedded into the local electricity network ensuring minimal transmission losses.

The quality of the Stockton Plateau environment and the amenity value of the area is already

affected by coal mining activity. Incorporating hydro power infrastructure into such a landscape will not detract from the modified environment of the Plateau. With respect to the structures beyond the Plateau, as already indicated, the penstock down from the Plateau comprises a tunnel deeply buried beneath SENZ and DoC estate, with the Granity power station contained within the outlet portal. In addition, the ocean outfall will be buried within the foreshore and seabed, therefore providing no visible detraction.

The key amenity effects of the Project relate to the Granity construction site, as this is the component of the proposal that is within close proximity to residents. Construction activities at the Granity site is expected to take up to 4 years. Initial establishment activities will require roading and general site establishment work, which has the potential to impact on the residents of Granity. For the most part, once construction of the Granity tunnel is under way work will be concentrated underground and construction effects will be limited to the intermittent movement of materials to and from the site.

The Project is entirely consistent with the requirement to have particular regard to the effects of climate change and the benefits derived from development of renewable energy. Being hydro generation, it utilises a renewable resource and does not involve any greenhouse gas emissions, beyond the construction phase. It is also consistent with the Governments stated energy strategy, of ensuring the utilisation of renewable resources for energy generation as opposed to fossil fuels. In this regard, the development is assisting the government in achieving their climate change objectives as per the Kyoto Protocol.

10.2.4 Section 105 – Matters Relevant to Certain Applications

Section 105 sets out other matters that the consent authority must have regard to for certain applications, including discharge permits or coastal permits, to do something that would contravene Section 15 or 15B. These matters include:

(a) the nature of the discharge and the sensitivity of the receiving environment to adverse effects;
(b) the applicant's reasons for the proposed choice; and
(c) any possible alternative method of discharge into any other receiving environment.

Cawthrons description of the Granity receiving environment does not equate to a sensitive receiving environment. The report states that the Granity shoreline comprises unstable boulder and shingle beaches along a high energy coastline, with this kind of rocky substrate forming relatively barren reefs, even in sheltered quarters of the coast. The report states the infauna communities are variable but are considered to be typical of those along the West Coast shoreline with no significant scientific or ecological value.

Various alternative freshwater receiving environments (being Granity Creek, Mine Creek and the Ngakawau River) have been investigated prior to proceeding with the current proposal to discharge into the CMA. The fact that there is a large number of studies documenting the adverse effects of AMD run-off into freshwater environments has dictated to a large extent the final choice of discharge into the marine environment.

Further, one of the key objectives of the Project has been not only power generation but to improve water quality within the Ngakawau River and estuary, with the only practicable method to achieve this by diverting as many of the AMD affected tributaries out of the Ngakawau River system.

As regards the coastal marine environment, the Cawthron report states that there are no known species of ecological significance and that the outfall discharge represents a highly localised contaminant source surrounded by a vast dynamic body of 'clean' water, hence adverse impacts on fish and marine mammals due to toxicants in the discharge is highly unlikely. Initial laboratory studies have also established that under normal operating conditions the Granity outfall discharge is expected to meet recognised water quality guidelines with relatively low levels of dilution. Further field trials will be undertaken to ensure the outfall diffuser is designed to ensure optimum dilution of all the key constituents of the discharge.

Therefore it seems apparent that discharge into the marine environment is likely to result in minor environmental effects as opposed to the significant adverse effects that are well documented for the freshwater environment of the Ngakawau River catchment. Hence the applicant's selection of the marine outfall as being the most appropriate receiving environment.

10.2.5 Section 107 – Restrictions on Discharge Permits

Section 107 of the RMA specifies instances where a Consent Authority shall not grant a discharge permit. The relevant subsection for the Granity outfall discharge is as follows:

"...if after reasonable mixing, the contaminant or water discharged either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters: ....

(d) Any conspicuous change in the colour or visual clarity..."

The discharge of AMD affected water has the potential to reduce visual clarity with an associated change in water colour in the marine receiving environment to an extent that may be conspicuous from a plane, boat or elevated position onshore. Such reduction in light penetration can also effect marine ecology, particularly phytoplankton in the water column.

Cawthron discussed the range of guideline documents used to assist with assessing changes in clarity and colour, specifically the ANZECC (2000) guidelines and MfE (1994) Water Quality Guidelines No. 2. These guidelines aim to provide criteria for discharges that if met will avoid 'conspicuous' changes in receiving waters after reasonable mixing. Cawthron consider that the most appropriate guideline is the MfE (1994) guideline, which suggests a clarity trigger level of 50% change after reasonable mixing. The adoption of this upper end of the MfE (1994) guidelines recognises the highly variable natural clarity of West Coast waters.

In order to assess potential clarity effects for the Granity outfall Cawthron ran a dilution series using filtered seawater and Stockton Plateau AMD contaminated water with pH levels of both 4.5 and 3.3. For both of these dilution series the pH of the seawater was 7.9.

The modeling indicated that both the 50% clarity change and the more stringent 33% clarity change (MfE 1994 guideline) should be met with very little dilution, even when using very clear filtered seawater. Based on these results, meeting clarity change guidelines for the proposed Granity outfall is unlikely to be an issue.

10.3 Relevant Planning Documents

Section 104 of the RMA requires Consent Authorities to have regard to any relevant provisions of the following planning documents:

- New Zealand Coastal Policy Statement 1994 and the Proposed New Zealand Coastal Policy Statement 2008
- West Coast Regional Policy Statement
- Regional Coastal Plan for the West Coast
- Proposed Regional Land and Riverbed Management Plan
- Proposed Water Management Plan
- Regional Air Quality Plan
- Regional Discharge to Land Plan
- Buller District Council Plan

Other relevant documents which have also been referred to include:

- The Draft West Coast Management Strategy
- The West Coast Marine and Coastal Environment Report
- The New Zealand Energy Strategy

The following identifies the relevant objectives and policies of the respective plans and assesses the Project in terms of these:

10.3.1 Air Quality

The relevant objectives and policies are:

Objective 13.2 and Policy 13.1.1 of the Regional Policy Statement
Objective 7.3.1 & Policies 7.4.1, 7.4.2 and 7.4.3 of the Regional Air Quality Plan
Policy 4.4.5.2 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Policy Statement :

Policy 13.1.1: *Stabilise greenhouse gas emissions from the region in line with national policy.*

NZ has accepted a commitment to reduce greenhouse gas emissions through ratification of the Kyoto Protocol. The present proposal is consistent with the above stated policy to achieve stablisation of greenhouse gas emissions on a regional basis. The Project provides a renewable source of energy without any greenhouse gas emissions, beyond the construction phase.

Regional Air Quality Plan:

Objective 7.3.1: *The protection of human health, property, structures and ecosystems from the adverse effects of discharges of dust to air.*

Policy 7.4.2: *Adverse effects of suspended dust will be avoided, remedied or mitigated by ensuring that any discharge of dust does not occur at a volume, rate or in a manner that could cause an offensive or objectionable effect, including the impairment of human health.*

Policy 7.4.3: *In assessing offensive or objectionable effects from discharges of dust, the Regional Council will take into account the following factors:*

- *frequency of dust discharges;*

- *Intensity of dust discharges;*
- *Duration of dust discharges;*
- *Offensiveness of the odour;*
- *Extent of dust discharges (suspended and deposited);*
- *Location of dust discharges*

Given the temporary nature of the construction activities, the high rainfall and frequency of rainfall on the Stockton Plateau, minimal dust deposition beyond the site footprint is anticipated. The Stockton Plateau is an extremely damp climate with the nearest residents some 2 km from the main infrastructural work site (Weka reservoir). Furthermore, the proposal must be considered in the context of the adjoining large scale open caste coal mine operation, whereby large scale earthworks and machinery is operating on a daily basis and is expected to do so for the foreseeable future.

As regards construction activities at Granity, the main dust generating activity is expected to be limited to site establishment. With this anticipated to be completed within a relatively short time-frame. Some dust and fume emissions associated with blasting activities may be discernible but blasting activities to establish the Granity portal and access ramp is expected to be limited to a small number of blast events.

Once the Granity site is established potential dust/odour generating activities is expected to be limited to vehicles accessing the site and operation of the ventilation fan. With respect to vehicle movements these will not be significant in the context of existing state highway traffic and will generally be spread over a full days operation.

The ventilation extraction fan will operate continuously to circulate air within the Granity tunnel during tunneling activities. When blasting occurs within the tunnel, some dust and fumes may be discernible but blasting emissions are limited to a short period and the distance to the nearest neighbours is such that dust/odour emissions is likely to have adequately dispersed. Note, as the tunnel progresses, drop shafts further up the Plateau route will be utilised for ventilation purposes.

10.3.2 Natural Hazards

The relevant objectives and policies are:

Objective 11 and Policy 11.2 of the Regional Policy Statement
Objective 5.3.4 and Policy 5.4.1.(2) of the Proposed Water Management Plan
Objective 4.10.7.1 and Policy 4.10.8.2 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Proposed Water Management Plan:

Objective 5..3.4: *To avoid the exacerbation of any natural hazard or the creation of a hazard associated with the West Coast's water bodies.*

Buller District Plan:

Objective 4.10.7.1: *Taking into account community views, to reduce the risks to people and communities from natural hazards, and to avoid the establishment of activities which increase the likelihood of natural hazards occurring.*

Policy 4.10.8.2: *An assessment of natural hazard risk shall be provided where appropriate with all applications for resource consent.*

The applicant obtained an assessment into the potential effects of dam breach (URS report – **Appendix K**) This report detailed the likely effects of potential breaches of the dams located at the Weka and Mt William sites and used best practice models to assume catastrophic dam failure. These models not only assumed catastrophic collapse of the dam embankments but also assumed the use of erodable dam structures, which were completely destroyed by the dam breach. In these circumstances the report concluded that there will be varying degrees of flooding to residents adjoining the Ngakawau River, with failure of the Mt William dam resulting in potentially severe flooding. The report went on to state that the crucial issue was the significant risk to life, given the short warning times that could be expected for any potential dam breach scenario.

As a result of this modeling, the report concluded that the proposed dams are classified in the high category of breach impact risk under the New Zealand Society of Large Dams (NZSOLD) and that the best mitigation measures which can be undertaken surround the design of the two impounding structures.

Dam safety is an integral aspect of the design process and following the URS dam breach report, it is clearly obvious that an erodable structure is not an option for the two proposed dams. On this basis HDL will construct RCC dams at the Weka and Mt William sites. The two RCC dams will be designed and constructed in accordance with international best practice and the NZSOLD dam design guidelines. These RCC dams have also been selected as such dams can be safely over-topped during construction without creating any potential dam safety issues.

The conclusions gained from the URS report, is that a high standard of design and construction will ensure that all possible care will be taken and any potential safety risks can be managed to such a degree that the residual risk will not be significant.

To ensure all potential hazards have been identified and managed in the design process, further intensive geotechnical site investigations will be undertaken, prior to final design proceeding.

10.3.3 Cultural and Heritage Values

The relevant objectives and policies are:

- Objectives 5.2(a) and 6 & Policies 5.1.1, 5.2.1 and 6.1 of the Regional Policy Statement
- Objective 5.3.3 & Policies 5.4.1(1)(c) and (h) of the Proposed Water Management Plan
- Policies 4.4.1(h) and 5.4.2(c) of the Proposed Regional Land and Riverbed Management Plan
- Objective 4.6.7.1 & Policies 4.6.8.2, 4.6.8.4 and 4.4.14.2 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Policy Statement:

Objective 5.2(a): *Recognise and provide for the relationship of Poutini Ngai Tahu and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga within the West Coast region.*

As detailed in the consultation section, HDL have consulted with Te Runanga o Ngati Waewae (Mr Rick Barber) regarding the Project. The principle concern of Ngati Waewae is the mixing of the different catchment waters that will occur as a result of the operation of the proposed scheme. However, Ngati Waewae are supportive of any measures to improve water quality within the Mangatini Stream and the Ngakawau River and Estuary. Mr Barber indicated that cultural concerns are likely to be mitigated by the enhancement of water quality within the Ngakawau River. A Cultural Impact Statement is currently being prepared by Mr Barber.

Buller District Plan:

Objective 4.6.7.1: *To protect places and sites of historical and cultural value from the adverse effects of land use activities and to ensure where appropriate, access to historic and cultural sites is maintained and enhanced.*

Policy 4.6.8.2: *Evaluate and protect heritage resources by identifying those resources of historic, cultural or architectural value or of special significance to the District.*

Policy 4.6.8.4: *Assessment of resource consent applications shall include their potential impact on known places of historic and/or cultural value.*

The only historic item of significance to be affected by the Project is the loco line. It is recorded in the Buller District Plan as site number 109 and New Zealand Archaeological Association site number L28/20.

While some of the loco line remains intact, it has suffered damage with the passage of time and the expansion of the Stockton coal mine. The line formation begins at the top of the Stockton Incline and extends up to the Fly Creek workings, in the area of the Mt William reservoir. In the vicinity of the proposed Weka reservoir the loco line has been cut several times by the mine haul road.

The archaeologist's report has described this to be in reasonable condition, which is certainly the case in the areas where it has been cut in bedrock. Elsewhere the passage of time and mining related activity has seriously affected the formation, with this acknowledged in the archaeologist's report. It is incorrect to say that the loco line is in reasonable condition. Most of the rails, plant and equipment were stripped years ago and of the total 4500m length of the formation surveyed 460m of the foundation will be inundated by Weka reservoir and a very small area inundated by Mt William reservoir. By far the bulk of the line is not affected by the Project. .

The Weka reservoir and associated haul road relocation will be laid out to minimise any further damage to the formation. Any artefacts that will be buried by the dam or the area of inundation will be recovered to a display at the Granity museum. As part of the Project, HDL will provide protection to the remaining sections of the line on their land and will discuss mechanisms with DoC and SENZ for protecting the remaining sections of the loco formation.

The ocean outfall pipeline will also pass beneath the historic Granity Library building, which is recorded in the Buller District Plan as site number 262. Beside the Library is the historic war memorial, recorded in the Buller District Plan as site number 294. Micro tunneling beneath the historic Granity Library building is not expected to have any adverse effects on the integrity of the building structure or the war memorial. The tunnel will be some 4 metres below the ground surface and fully supported internally by shielding as tunneling progresses, ensuring ground stability and

the buildings above remain unaffected.

However, it is intended to undertake further geotechnical surveys along the outfall route and should this establish adverse ground conditions that could potentially affect the Granity Library building stability a pre-condition survey would be undertaken. On completion of construction of the outfall pipeline, a post construction structural check on the building would then be undertaken to assess any changes in structural integrity. Any detectable structural damage would be repaired at the applicant's expense.

10.3.4 Energy/Infrastructure

The relevant objectives and policies are:

- Objective 14 & Policies 14.1, 14.2 and 14.4 of the Regional Policy Statement
- Objective 5.4.1B of the Proposed Water Management Plan
- Objective 4.2.5.1 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Policy Statement:

Objective 14: *To promote the sustainable management of energy resources.*

Policy 14.1: *Recognise the importance of an adequate supply of energy resources for the needs of people and communities on the West Coast, provided that this is not inconsistent with other policies in this RPS.*

Policy 14.2:*Promote the sustainable management and efficient use of energy within the region.*

Policy 14.4: *Co-operate with any crown initiatives and policies, where practicable, that seek to promote greater energy conservation, efficiency and the use of renewable energy sources including the Governments' Voluntary Agreements Scheme for reduction of CO2 emissions.*

The RPS recognises the importance of an adequate supply of energy for the regions social and economic well being. It notes that despite there being several small hydro generation facilities in the region, the West Coast is currently a net importer of energy but that many rivers in the region have potential for hydro electric development.

At present, NZ electricity system requires electricity to be transmitted over long distances from the large power generation facilities of the central North Island and the Lower South Island. This leaves regions such as the West Coast, vulnerable to transmission faults that occur any where along the supply network. HDL's Project will alleviate the degree of dependency on imported energy.

As regards energy efficiency, the present proposal, in utilising local energy generation also has significant benefits. At present a large portion of the power for the West Coast is imported from the Waitaki Valley and significant power losses can occur over such a long transmission path, loss figures of up to 50% have been quoted. Utilisation of locally generated power minimises such transmission losses and therefore is an efficient use of energy.

The proposal is also consistent with the Government objectives of utilising renewable energy

sources and furthers the national commitment to reduce greenhouse gas emissions.

10.3.5 Public Access

The relevant objectives and policies are:

- Objective 9.4 and Policy 9.7 of the Regional Policy Statement
- Policies 4.4.1(d) and 4.4.3(c) of the Proposed Regional Land and Riverbed Management Plan
- Policy 4.4.14.7(iii) of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Policy Statement:

Policy 9.7: *Facilitate the maintenance and enhancement of public access to and along the margins of lakes and rivers, except where restrictions are necessary to:*
(c) Protect public health and safety...

The focus of these policies is on ensuring that existing public access to water bodies is maintained or enhanced. The main infrastructure for the Project is situated on the Stockton Plateau and public access to this area is restricted for safety reasons, due to SENZ's mining activities. This will remain unchanged, as access to the proposed hydro site is via the Stockton haul road. For the future, once coal mining ceases at Stockton, it is envisaged that public access to the reservoirs and surrounding areas would be appropriate but dependent on SENZ's activities in the area.

A section of the walking track that commences at Millerton and extends to the Repo Basin, will be flooded by the proposed Weka reservoir and disturbed by realignment of the Stockton haul road. This walking track follows a portion of the historic coal tramway and crosses the Stockton haul road at Tin Town corner. The Tin Town corner will be flooded by the proposed Weka Dam and a section of the walking track will destroyed through construction of the Weka dam western abutment.

The applicant intends re-instating the walking track and it is likely that this re-alignment will be around the proposed Weka reservoir linking back into the original Repo Basin track. Disruption to walkers would be kept to a minimum as it is anticipated that the track would be re-instated as quickly as possible.

Construction activities at Granity will entail disturbance to the Millerton Incline walking track. This track commences at the Granity Museum and leads up the Millerton Incline. During the peak summer months approximately 200 people per month visit the Granity Museum, with a portion of these using the Millerton Incline track. Alternative track access will be provided, prior to any disturbance occurring to the Incline Track. This will ensure access to the Incline walking track remains un-interrupted.

10.3.6 Indigenous Flora and Fauna

The relevant objectives and policies are:

- Objective 9.1 and Policy 9.2 of the Regional Policy Statements
- Objective 5.3.1(d) and Policies 4.4.1(e) and (i) & 5.4.2(g) and (i) of the Proposed Regional

Land and Riverbed Management Plan
- Objective 4.8.6.1 and Policies 4.8.7.1 – 4.8.7.8 of the Buller District Plan.,

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Policy Statement - Objective 9.1: *To protect areas of significant indigenous vegetation and significant habitats of indigenous fauna.*

Proposed Regional Land and Riverbed Management Plan - Policy 4.4.1(e): *To manage the disturbance of land and vegetation in order to avoid, remedy or mitigate any adverse effects on:*
(e) Natural character and aquatic ecosystems;
(i) Significant indigenous vegetation and significant habitats of indigenous fauna.

Buller District Plan - Objective 4.8.6.1: *To protect areas of significant indigenous vegetation and significant habitats of indigenous fauna and to recognise their importance to the character and quality of the natural and physical environment and to the wellbeing of the people and communities in Buller.*

Noteworthy, is that the Project footprint will be located on areas of the Stockton Plateau that were not deemed of significant value for inclusion in the Ngakawau Ecological area, in particular the Weka Creek surrounds. The report that reviewed the original boundaries of the ecological area (attached as **Appendix E**) concluded that the Weka Creek area was substantially modified by fire and that exclusion from the reserve would not reduce the long-term viability of the ecological area and the values were well represented elsewhere.

As regards the Mt William footprint, the flora report assessed the vegetation in accordance with the significance criteria set out in policy 4.8.7.4 of the Buller District Plan. It was noted that the area includes a significant number of communities which are representative of the character of the Ngakawau Ecological District, none of which is found solely within the Mt William footprint. No threatened species were found, with the area described as having had a history of human modification by road formation mining activity, fire and seed incursion.

Obviously the earthworks required to construct the dams, roads, tunnels and associated structures for the Project entail the loss of some habitat but the most significant habitat losses occur with the inundation of the two areas to create the storage reservoirs. As regards Weka dam, this entails inundation of approximately 28 hectares while Mt William dam inundation is approximately 50 hectares. However, it is important to emphasis that the Project footprint is minimised by a number of measures including:

- aggregate for dam/embankment construction will be sourced from the outlet excavations within the inundation areas of the Weka and Mt William storage reservoirs, which will not be visible when the reservoirs are formed,
- excavations from tunneling will also be used to form the dams and embankments,
- striping and surplus excavations will be disposed of in the bottom of the reservoirs,
- burying a large portion of the inter-connecting components of the Project by means of tunneling.
- using the existing roading network as much as practicable,
- and concentrating the majority of activities within highly modified areas on the Stockton Plateau.

A detailed search for *Powelliphanta* snails was undertaken as part of the terrestrial fauna assessment. The survey concluded that snails are probably not present, or at most in very low numbers and patchily distributed within the Project footprint. Low numbers of threatened bird species were also present but with all these affected species well represented outside the footprint area. The fauna reports concluded that the area of the proposed development is already significantly modified by industry and settlement and that the impacts on fauna and habitat are likely to be minor.

The waterways being diverted into the Project's reservoirs do not support diverse or abundant aquatic ecological values, with very limited significant macro-invertebrate, plant or fish species identified in all the aquatic studies carried out too date. This is considered to be a direct result of mining related effects of low pH, heavy metal contamination and increased suspended sediments.

The freshwater ecology report (**Appendix D**) stated that on the basis of the existing ecological values the reduction of flows in the affected sub-catchments is expected to have only minor effects. However, two species of considerable value were identified being the liverwort, *Allisoniella scottii* and the rare moss, *Blindia lewinskyae* . However, both species are relatively common within other streams on the Plateau and the majority of sites where these species are know to be present are beyond the scope of the present Project.

The freshwater ecology report also noted that the quality of the water (pH, metal concentrations and sediment loads) in the Ngakawau river will be significantly improved as a result of the diversion of significant volumes of mine-affected water from the Mangatini, St Patrick Streams and Mine Creek. In the presence of improved water quality, it is considered likely that macro-invertebrate, plant and fish species diversity and abundance will improve.

10.3.7 Landscapes/Natural Character/Amenity Values

The relevant objectives and policies are:

- Objectives 9.2 and 9.3 & Policies 9.1 and 9.5 of the Regional Policy Statements
- Objective 5.3.2 & Policies 5.4.1(1)(d), 5.4.1C(b) and (e). 4.4.3(d), 5.4.4 and 5.4.5 of the Proposed Water Management Plan
- Objectives 5.3.1(c) and (e) & Policies 4.4.1(e), 4.4.3(d), 5.4.1, 5.4.2(c) and (h) of the Proposed Regional Land and Riverbed Management Plan
- Objectives 4.3.27.1, 4.4.4.1 and 4.9.3.1 & Policies 4.3.28.2, 4.4.5.2, 4.4.14.7 and 4.9.4.1 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Policy Statement - Objective 9.3:*To preserve the natural character of the wetlands, lakes and rivers.*

Buller District Plan – Objective 4.9.3.1: *To protect the distinctive character and unique values of outstanding landscapes and natural features.*

Proposed Water Management Plan – Policy 5.3.2: *To protect water bodies from inappropriate use and development by maintaining and where appropriate enhancing their natural and amenity values including natural character and the life supporting capacity of aquatic ecosystems.*

As regards construction activities, the majority of the hydro infrastructure is confined to the Stockton Plateau, in an area not readily accessible to the general public. The hydro structures are essentially limited to already modified areas and land disturbance caused by construction activities will over-time naturally re-vegetate. The town of Millerton is some 2km away from the proposed Weka reservoir and there are no apparent views of the proposed dam/reservoir from any perspective within the town.

In the context of an environment modified by significant mining activity, both historic and current, the infrastructure associated with the Project will not be inappropriate. Over time it is expected that the reservoirs will blend with the natural landscape, as vegetation establishes around the margins. The penstocks linking the two power stations and the outfall structures are all underground.

As regards the Granity penstock tunnel, it will be buried over its entire length, therefore removing any visual element. Ventilation shafts along the tunnel route will be bored by a drilling rig flown to the respective sites, thereby confining disturbance to the immediate drill sites.

The Granity outlet portal, portal apron and access roading, will be the only visible components. Given that disturbance is confined to a relatively small area, construction techniques will ensure adjoining vegetation remains undisturbed and HDL intends landscaping any disturbed areas, it is considered that the visual and landscape effects will be temporary and will not compromise landscape values beyond the construction phase.

Incorporating the power station within the portal also ensure there is no industrial element and noise from operation of the generating equipment is unlikely to be discernible to the residents of Granity. Likewise, natural character effects will not be greater than those that exist currently, due to the fact that a portion of the site has already been substantially cleared of vegetation and the lower hill slopes to be disturbed, adjoin the margins of the modified environment of Granity township.

It is considered that the overall perception of the amenity of the Ngakawau River will be improved as a result of the Project. At present the River is visibly discoloured, as a side effect of the treatment process required for pH correction. Interception of these flows through the Project reservoirs will ensure that water quality within the Ngakawau River is enhanced and visible improvements in water clarity will be achieved. These improvements are not limited to visual appearance, interception of the waterways with significant AMD will also result in improved pH and reduction in the heavy metals within the Ngakawau and its affected tributaries. Thus in terms of natural character, aesthetic and amenity values the Project will enhance the natural character and the life supporting capacity of the Ngakawau river.

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Policy 4.4.5.2: *Sustainable land management practices which maintain and/or enhance the productive values of soils and amenities and character of the rural areas shall be encouraged and promoted.*

Objective 4.3.27.1: *To facilitate the "intermingling" of land use activities within the District's settlements and towns to the extent that this is compatible with protection of amenity values and the sustainability of existing natural and physical resources in urban areas.*

Policy 4.3.28.2: *The adverse effects of industrial and commercial operation, including noise, traffic, glare, shading, vibration, odour, effluent and waste emissions shall be minimised.*

The District Plan recognises that a wide range of activities can be compatible within the rural/residential zones, provided amenity values can be maintained. The key amenity effects of the Project relate to the Granity construction site, as this is the component of the proposal that is within close proximity to residents. Construction activities at Granity is expected to take 4-5 years. Initial establishment activities will require roading and general site establishment work, which has the potential to impact on the residents of Granity. For the most part, once construction of the Granity tunnel is well under way, work will be concentrated underground and construction effects will be limited to the movement of materials to and from the site.

10.3.8 Water Quantity

The relevant objectives and policies are:

- Objectives 7.2, 8.1.1 and 8.2.1 & Policies 8.1.1, 8.2.1 and 8.2.2 of the Regional Policy Statement
- Objectives 5.3.1, 6.3.1 and 6.3.2 & Policies 6.3.3, 6.4.3, 6.4.6, 6.5.5 and 6.5.6 of the Proposed Water Management Plan
- Objective 4.4.13.1 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Policy Statement

Objective 8.1.1: *To manage the quantity of the Region's water resources so as to:*
a) Meet the needs of a range of uses, including the reasonably foreseeable needs of future generations; and
b) Safeguard the life-supporting capacity of water and related ecosystems.

Proposed Water Management Plan :

Objective 6.3.1: *To retain flows and water levels in water bodies sufficient to maintain their instream values, natural character, and life supporting capacity.*

Hydrological assessments have concluded that water flows will be significantly reduced within the affected catchments of the Mangatini, Mine and St Patrick Streams. As regards Mine Creek and St Patrick Stream, flows are likely to be reduced to about 70% and Mangatini Stream to about 40% of their existing mean flows. As to impacts on the Ngakawau River, mean flow is expected to be reduced by approximately 17%. During low flow situations these reduction in flows will be considerably greater, particularly for the lower Mangatini and St Patrick Streams.

Under normal flow conditions, the channels of all the waterways diverted into the two reservoirs will be substantially reduced immediately downstream of the abstraction points. Recovery of flow rates is largely dependent on tributaries entering these channels at some point downstream. For the majority of affected waterways this occurs within a relatively short distance. Given the existing poor water quality within these affected waterways and the associated marginal habitat for aquatic life, this removal of flows over short distances is expected to have minimal effect on instream values.

The GHD ecology report stated that the diversion of flows from the affected sub-catchments may result in certain streams drying up or becoming ephemeral for periods of time. This same report concluded that this may not be an issue for invertebrates as many species are capable of moving into isolated pools and slow flowing trickles during times of low flow.

Of significance is the enhancement in terms of both water quality and aquatic habitat that is expected to occur as a result of the removal of these degraded tributaries. It is anticipated that all the affected sub-catchments downstream of the abstraction points will have significantly improved water quality and this will have a flow-on effect for the Ngakawau River. In this regard, the Project will enhance the existing water quality within the Ngakawau River and will safeguard the resource for future generations.

Policy 6.4.2: Where Policy 6.4.1 does not apply, a minimum flow based on 75% of the mean annual low flow will be applied as a consent condition.

As regards the current proposal, more than 75% of the respective flows will be removed from all the affected watercourses by either damming or diverting within the Project footprint.

Obviously such minimum flow requirements are attached as consent conditions to ensure that the natural character and life supporting capacity of aquatic ecosystems are protected. As previously described, this situation is not applicable to any of the watercourses proposed to be dammed and diverted into the present hydro system. The affected catchments of Mangatini, St Patrick and Mine Streams all have significantly degraded water quality and hence poor ecology, thus this policy is not relevant to the present proposal and Policy 6.4.3 is applicable.

Policy 6.4.3: *To consider granting an application for a resource consent to take water from a river, subject to a minimum flow lower than that specified in Policy 6.4.2, on a case-by-case basis, provided:*
a) Any adverse effects on instream values or natural character or the source water body or any other connected water body are avoided, remedied or mitigated; and
b) Any adverse effects on lawfully existing takes of water are no more than minor;
c) The application if granted, together with the cumulative effect of other existing lawful takes, avoids, remedies or mitigates adverse effects on the life supporting capacity of any waterbody.

The GHD freshwater ecology report stated that the Stockton Plateau and its immediate surrounds do not support diverse or abundant aquatic ecological values with very limited macro-invertebrate, plant or fish species identified in the numerous studies conducted to date. The report went on to state that the reduction of flows within the affected sub-catchments is unlikely to have a major impact on the diversity of the macro-invertebrate, plant and fish populations in the greater Ngakawau catchment and concluded that the ecosystem consequences will be slight. Overall, the impacts of the Project were expected to be beneficial with the anticipated improvement in water quality in the Ngakawau River and Estuary resulting from the reduction of AMD entering the river system seen as a significant part of the total mitigation package.

On the basis of this information, it is considered that the exception for minimum flow restrictions has been meet and flow restrictions would be neither appropriate nor necessary for the current proposal.

10.3.9 Water Quality

- Objectives 7.2 and 8.2.1 & Policies 7, 8.2.1 and 8.2.2 of the Regional Policy Statement
- Objectives 5.3.1 and 6.3.4 & 7.3.1 Policies 5.4.1C, 6.5.6, 7.4.2 and 7.4.3 of the Proposed Water Management Plan
- Objective 5.3.1(g) & Policies 4.4.1(b) and 5.4.2(d) of the Proposed Regional Land and Riverbed Management Plan
- Objective 5.3.1 of the Regional Discharge to Land Plan
- Objective 4.4.13.1 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Discharge to Land Plan

Objective 5.3.1: *To ensure that the adverse effects from the discharge of solid contaminants into or onto land, on water and soil quality, social, cultural and amenity values, and human health are avoided, remedied or mitigated.*

At each reservoir, a site has been set aside for the placement of sediment removed from the sediment traps. While mining continues on the Plateau, these will be temporary storage areas until sediment is removed to permanent fill sites, which is expected to be within SENZ's CML. After mine closure, when the sediment load is expected to drop dramatically, these will become permanent fill sites. These sediment fill areas will be designed to ensure run-off is directed into the reservoirs.

Proposed Water Management Plan:

Objective: 7.3.1:*To maintain or enhance the quality of West Coast's water*

The many policies regarding water quality recognise that high water quality is important for safeguarding the life supporting capacity of the region's water resources. Emphasis is also placed on enhancing or restoring water quality in situations where water resources are already degraded to an unacceptable degree. In this respect the Project is entirely consistent with the stated policies. The diversion of the majority of AMD affected waterways on the Plateau and the subsequent discharge to sea avoids contaminating the Ngakawau catchment and will significantly improve water quality within the lower reaches of the Ngakawau River.

As to the construction phase, works within the active stream channels will be kept to a minimum and are restricted to dam construction activities within Weka and St Patrick Streams, the in-take/diversion structures to divert watercourses into the reservoirs, sediment traps and Granity Stream emergency overflow. For the dam and diversion intake structures, all affected watercourses will be temporarily diverted while structures are being installed, while all other works will be undertaken with appropriate sediment control measures in place, to ensure water quality effects are minimised.

Policy 7.4.2: *Rivers which have acid drainage issues, particularly those identified in Figure 3, will be managed as follows:*
(a) Activities that reduce pH of receiving waters must avoid, remedy or mitigate acidity effects and should achieve the natural pH level of the affected river wherever practicable; and
(b) Activities that increase dissolved iron concentrations or the concentration of any other metal or

non-metal in the receiving water must avoid, remedy or mitigate adverse effects and the natural metal/non-metal concentration of the receiving water should be achieved wherever practicable.

Policy 7.4.3: *To encourage the remediation of orphan sites as a method to enhance existing water quality and offset adverse effects from new mining developments.*

The Proposed Water Management Plan recognises the issue of AMD within disturbed BCMs and states that: *where natural contaminant levels are high the aim is to require that mining activities avoid, remedy or mitigate effects to maintain water quality as close as practicable to natural conditions.* Policy 7.4.2 identifies rivers with acid drainage issues in the region and included in this schedule is Mine Creek, St Patrick Stream, Mangatini Stream and the Ngakawau River.

Policies 7.4.2 and 7.4.3 are directed more towards land disturbance activities such as mining, within areas where AMD is a likely consequence. However, the over-riding purpose is clear, that where natural contaminant levels are high the onus is on avoiding, remedying or mitigating the effects to maintain water quality as close as practicable to natural conditions. In this respect the present proposal achieves that aim by intercepting flows from the key AMD bearing catchments, which enables water quality to be enhanced in all of the aforementioned waterways.

10.3.10 Land Disturbance

The relevant objectives and policies are:

- Objective 4.3.1 & Policies 4.4.1, 4.4.2 and 4.4.3 of the Proposed Regional Land and Riverbed Management Plan
- Objective 4.4.4.1 and Policy 4.4.5.2 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Proposed Regional Land and Riverbed Management Plan

Policy 4.4.1:*To manage the disturbance of land in order to avoid remedy or mitigate any adverse effects on:*

(a) The stability of land (eg. slumping, subsidence, or erosion), river banks and riverbeds;
(b) Water quality, including clarity, turbidity, and temperature changes and instream values;
(c) Changes in water level including water table;
(d) Public access to rivers, lakes and their margins
(e) Natural character, cultural, recreational and ecosystem values;
(f) Soil depth and fertility
(g) The integrity of property or structures...

Considerable earthworks are required to construct the dam and embankments to create the storage reservoirs. Other aspects such as roading and tunnel construction will also require significant excavations. The earthwork components of the development are of a temporary nature and standard sediment control measures will be adopted to ensure minimal effects on watercourses.

A critical aspect of the scheme is the integrity of the hydro infrastructure, in particular the dam and tunnel structures. Part of the final engineering design process will include further intensive geotechnical investigation of the ground conditions to ensure stability issues are avoided.

All tunneling will be undertaken in original ground comprising competent geotechnical formations. All tunnels are of small cross-section determined by the minimum section required for safe and efficient tunneling operations. All Project works will be located clear of areas affected by historical subsidence and will not create voids that could lead to future subsidence.

10.3.11 Hazardous Substances

The relevant objectives and policies are:

- Objective 12.1 and Policy 12.1.2 of the Regional Policy Statement
- Objective 8.3.1 and Policy 8.4.1
- Objective 4.11.5.1 and Policy 4.11.6.1 of the Buller District Plan

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

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Objective 4.11.5.1: *To encourage and promote the safe and efficient handling and disposal of hazardous substances throughout the District.*

Policy 4.11.6.1: *Compliance with approved codes of practice and national guidelines and standards shall be required for all activities involving the use, storage and transport of hazardous substances.*

The management of hazardous substances is controlled by a number of specific industry guidelines and codes of practices, this is reflected in the Regional and District Plan rules. The plans indicate that these guidelines are considered the most appropriate means of controlling the handling of hazardous substances.

During the construction phase, extensive use of heavy machinery means fuel storage will be required in the vicinity of the respective work areas. This will be in the form of mobile diesel tankers and these will be stored within bunded areas where appropriate. A range of other hazardous substances will also be used on-site, such as oils, explosives and cement. The safe and efficient storage, handling and use of such substances will be required by all HDL personnel and contractors.

Following construction activities, the only hazardous substance used will comprise transformer oil at the Granity and Weka power stations. These power stations will each include a small switch yard (located within the power houses), with one or more transformers and capacitors. Standard design for switch yards require that transformers are located in sealed areas which will contain, not only leakage of fluids but the entire volume, in the event of some extreme failure.

The transportation, use and storage of hazardous substances will be undertaken in accordance with the Hazardous Substances and New Organisms Act and any applicable regulations.

10.3.12 Coastal Environment

The relevant objectives and policies are:

- Objective 4.7.5.1 & Policies 4.7.6.2 and 4.7.6.4 of the Buller District Plan

- Objectives 6.3.1 & Policies 6.4.1.3, 6.4.2.1, 6.4.2.2 and 6.4.2.3 of the Regional Coastal Plan
- Objectives 10.1 and 10.4 & Policies 10.1.1, 10.1.2, 10.1.3, 10.4.4 of the Regional Policy Statement.
- New Zealand Coastal Policy Statement 1994 - see specific provisions in following subsection.
- Proposed New Zealand Coastal Policy Statement 2008 – see specific provisions in following subsection.

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Policy Statement

Objective 10.1: *Allow appropriate subdivision, use and development in the coastal environment which avoids, remedies or mitigates adverse effects on the natural character of the coastal environment and on any outstanding natural features and landscapes.*

There is no statutory definition of the Coastal Environment boundary but it is defined in the RPS as including the coastal marine area (CMA), estuaries, beaches, tidal reaches and can also include coastal terraces and associated hillslopes in close proximity to the coast. However, for the purposes of this assessment, the objectives and policies directly related to the CMA have been discussed separately.

On this basis, this section discusses the aspects of the Project that fall within the Coastal Environment but above the CMA boundary, which encompasses those components of the scheme located at Granity.

The Granity coastal environment has not been identified as outstanding natural feature and landscape within any planning document. Undoubtedly the coastal environment is one of considerable scenic beauty but the penstock coming down from the Plateau will be via a deeply excavated tunnel and the ocean outfall pipeline will be buried, therefore ensuring no detraction to the Granity coastal landscape.

The only surface components of the Project at Granity are the outlet portal, portal apron, access roading/construction yard and Granity settling pond. Construction activities are expected to take 4-5 years. Initial establishment activities will require roading and general site establishment work, which has the potential to impact on the natural character of the area. For the most part, once construction of the Granity tunnel is well under way, work will be concentrated underground and although the construction yard will be a visual detraction, views of the construction site will be largely confined until within close proximity to the Granity outlet portal.

Given that the site works at Granity has a relatively small footprint, construction techniques will ensure adjoining vegetation remains undisturbed and HDL intends landscaping any disturbed areas, it is considered that the visual and landscape effects will be temporary and will not compromise landscape values beyond the construction phase.

Regional Coastal Plan

Objective 6.3.1: *To avoid, remedy or mitigate, cross boundary adverse effects arising from activities in the coastal marine area.*

Policy 6.4.1.3: *To recognise the following coastal hazard areas, as identified in Schedule 3.3.*

Although The Regional Coastal Plan is directed towards management of the CMA, it also recognises that some activities may cause adverse effects across the line of mean high water spring and these are termed as cross boundary issues. The potential for cross boundary adverse effects are required to be taken into account when considering resource consent applications, in order to bring about the integrated management of the coastal environment.

As regards the present application, it falls within CHA 3 which is an existing coastal hazard area defined as *'....extending from Dean Stream to Orowaiti River and encompassing settlements (Hector, Ngakawau, and Granity), farmland and natural values (wetlands, beach habitat) threatened by beach erosion'.* This coastal hazard area has been identified on the basis that existing adjoining land, property or structures of value to the community are at risk from beach erosion. The consequence of such a classification is that any development in the CMA, seaward of the coastal hazard area that could potentially exacerbate erosion, will require experts to further assess the potential hazard.

The ocean outfall pipe is to be buried some 4m deep within the foreshore and seabed and will not create any physical barrier that would affect the coastal processes along the Granity shoreline. As such there is no potential for erosion to be exacerbated as a result of the buried pipeline structure.

10.3.13 Coastal Marine Area

The CMA is defined as extending from the line of MHWS, to the limits of territorial sea at 12 nautical miles, with the line of mean high water springs being the boundary between the area covered by the Buller District Plan and the Regional Coastal Plan.

The relevant objectives and policies are:

Regional Coastal Plan Provisions:

- Coastal Management - Objectives 5.3.1, 5.3.2 and 5.3.3 & Policies 5.4.2.2 and 5.4.2.4
- Public Access – Objectives 7.3.1 and 7.3.2 & Policies 7.4.1 and 7.4.2
- Structures – Objectives 8.3.2, 8.3.3 and 8.3.4 & Policies 8.4.3, 8.4.4, 8.4.5 and 8.4.7
- Alteration – Objectives 9.3.2, 9.3.3, and 9.3.4 & Policies 9.4.1, 9.4.2, 9.4.3, 9.4.7, 9.4.8
- Discharge – Objectives 10.3.1, 10.3.2, 10.3.3, 10.3.5 and 10.3.6 & Policies 10.4.1, 10.4.2, 10.4.3, 10.4.5 and 10.4.8.
- Noise – Objective 12.3.1 and Policy 12.4.1

New Zealand Coastal Policy Statement 1994

- National Priorities for the Preservation of the Natural Character of the Coastal Environment – Policies 1.1.1, 1.1.2, 1.1.3, 1.1.4 and 1.1.5
- The Protection of the Characteristics of the Coastal Environment of Special Value to the Tangata Whenua – Policies 2.1.1 and 2.1.2.
- Activities Involving the Subdivision, Use or Development of Areas of the Coastal Environment – Policies 3.1.1, 3.2.2, 3.2.8, and 3.5.1
- The Crown's Interests in Land of the Crown in the CMA – Policies 4.1.3, 4.1.4, 4.2.1 and 4.2.2.

Proposed New Zealand Coastal Policy Statement 2008

- Objectives 1, 2, 3, 4, 6 and 7.
- Policies 2, 17, 19, 26, 30, 31, 32, 33, 34, 35, 39, 43, 44, 46, and 47

Of these provisions, the following are of particular importance to this consent application and have been repeated as follows:

Regional Coastal Plan

Objective 7.3.1: T*o maintain and as far as practical enhance public access to and along the coastal marine area.*

The maintenance and enhancement of public access to and along the coastal marine area is given particular emphasis in the Regional Coastal Plan. For the present proposal, the construction method of micro tunneling the outfall pipeline ensures that there will be no restriction of public access to and along the coastal marine area.

Objective 8.3.2: *To preserve the natural character of the West Coast's coastal environment as far as practicable from the adverse effects associated with structures.*

The ocean outfall pipeline is buried approximately 4m below the seabed while the point of diffusion will be approximately 1m above the seabed and under water, therefore the natural character effects are limited to the construction phase. As micro-tunneling is all undertaken underground the only obvious construction activity is with the removal of the tunneling equipment and installation of the diffuser. This to occur at the discharge point, some 600 metres offshore.

It is anticipated that removal of tunneling equipment and installation of the diffuser will be undertaken on a 24 hour basis, as the operation will need to take advantage of favourable weather conditions. Provided a significant period of adverse weather is not encountered, this work is expected to be completed within one month. Residents may incur minor noise and lighting effects over this time but this will emanate from outside the wave break zone. Noise is unlikely to be discernible over background wave noise.

Policy 8.4.4: *To require the removal of any structure that is redundant, or abandoned, or unauthorised, or structurally unsafe.*

The aim of this policy is to ensure that derelict structures are not left within the CMA resulting in a loss of natural character to the area or posing a potential hazard. This policy is not applicable to the current proposal, as the pipeline is buried some 4m beneath the seabed. It is also considered extremely unlikely that the Project would cease operating but should the Project be decommissioned all tunnels including, the ocean outfall tunnel will be sealed and the portals buried.

Policy 8.4.5: *Structures will only be allowed to locate in the coastal marine area where there are no practicable alternatives to locate the structure elsewhere.*

For the present application all practicable alternatives have been considered for locating the outfall into different receiving environments, these alternatives were discussed in section 7 of this report. The over-riding objectives of the scheme has been to not only generate power but to improve water quality within the Ngakawau River and estuary, hence the selection of the ocean outfall.

The GHD report clearly states that the AMD impacted tributaries of the Ngakawau River have had a

significant impact on the Ngakawau River system. The report states that '*... this paucity in diversity and value is considered to be caused by historical and current coal mining activity, resulting in highly acidic and conductive water and in some cases, the smothering of habitat by precipitated metal hydroxides and/or sediments. Studies worldwide have shown an overwhelming negative response of invertebrate communities to low pH...*" The GHD report also discusses the potential benefits of diverting these impacted flows out of the Ngakawau River system and the expected significant recovery of resident freshwater communities stating "*...It is considered that the proposed scheme may in fact enhance environmental values within the general area, by reducing the rates of sedimentation and acidification in Plateau streams flowing into the Ngakawau River. This benefit is potentially substantial."*

As regards the coastal marine environment, the Cawthron report states that there are no known species of ecological significance and that the outfall discharge represents a highly localised contaminant source surrounded by a vast dynamic body of 'clean' water, hence adverse impacts on fish and marine mammals due to toxicants in the discharge is highly unlikely. Initial laboratory studies have also established that under normal operating conditions the Granity outfall discharge is expected to meet recognised water quality guidelines with relatively low levels of dilution. Further field trials will be undertaken to ensure the outfall diffuser is designed to ensure optimum dilution of all the key constituents of the discharge.

Therefore it seems apparent that discharge into the marine environment is likely to result in minor environmental affects as opposed to the significant adverse effects that are well documented for the freshwater environment of the Ngakawau River system. Hence the applicant's selection of the marine outfall as being the most appropriate receiving environment.

Policy 8.4.7: *The importance of navigation aids for the safety of shipping is recognised.*

Navigation markers will be installed showing the presence of the diffuser.

Objective 10.3.2: *To take into account public health, community (including commercial, cultural and recreation values) and biological values associated with the coastal marine area when considering the discharge of contaminants into the coastal marine area.*

The bulk of commercial trawling occurs further offshore than is likely to be impacted by the Granity outfall discharge. For people surf casting along Granity beach the pipeline being deeply buried will provide no impediment. The Cawthron report states that fish avoidance responses to any discharge plume are well documented and that adverse impacts on fish and marine mammals due to toxicants is highly unlikely.

The Cawthron report also refers to a previous analysis of trace metals in mussels collected form the Torea Rocks in March 2007, with metal levels below recognised food safety standards. It appears that the high historical levels of AMD discharged via the Ngakawau River into the intertidal zone has not aversely affected the local shellfish beds. The proposed Granity outfall will move the point of discharge beyond the intertidal zone and further from the mussel beds.

Objective 10.3.5: *To consider the adverse effects associated with a discharge of contaminants directly to the coastal marine area relative to the adverse effects associated with the discharge of the same material to other receiving environments.*

As described above, the adverse effects of AMD impacted run-off into the freshwater environment

of the Ngakawau River system is well documented. While it is anticipated that the discharge of the same flows to the marine environment is expected to have only minor effects, due to the huge buffering capacity of the ocean.

Objective 10.3.6: *To reduce the potential for spills or leakages of hazardous substances and hazardous wastes into the coastal marine area.*

No fuel storage or refueling of machinery will occur within the CMA and contractors will be expected to dispose of any other waste in a responsible manner.

Policy 10.4.1: *To not allow point source discharge of contaminants into the coastal marine area where that discharge would, beyond an effective mixing zone, result in a lowering of the existing water quality in the receiving waters.*

The Granity outfall does not involve point source discharge but will incorporate a diffuser configured to achieve optimum dilution of all discharged contaminants, so as to meet recognised water quality guidelines within a reasonable mixing zone.

Policy 10.4.2: *To require an effective mixing zone for discharges of water or contaminants into the coastal marine area which takes account:*

(a) The sensitivity of the receiving environment; and
(b) The particular discharge, including contaminant type, concentration, and volume; and
(c) The physical processes acting on the area of discharge; and
(d) The community uses and values, including the values of Poutini Ngai Tahu, associated with the area affected by the discharge, and
(e) The ecosystem values associated with the area.

The accompanying explanation in the Regional Coastal Plan states that discharges into the coastal marine area result in localised contamination of the waters immediately surrounding the discharge point and that the size of the mixing zone will be determined on the basis of the values identified above.

Cawthrons description of the Granity receiving environment does not equate to a sensitive receiving environment. The report states that the Granity shoreline comprises unstable boulder and shingle beaches along a high energy coastline, with this kind of rocky substrate forming relatively barren reefs, even in sheltered quarters of the coast. The report states the infauna communities are variable but are considered to be typical of those along the West Coast shoreline with no significant scientific or ecological value.

The anticipated constituents of the outfall discharge have been modeled by URS including contaminant type and concentration for various flow regimes, these are set out in section 8.9.2 of this report.

The Cawthron report briefly describes the physical processes in the vicinity of the outfall. The discharge location is in shallow water of less than 10m depth with the West Coast separated from other New Zealand coasts by combinations of latitudinal location, the high degree of wave exposure, effects of sedimentation and sand scour and shelf and river hydrology.

The Granity beach area has considerable value to the local residents as a recreational area including swimming, surf casting and walking, although these activities are somewhat limited by the high

energy nature of the coastline. It is not anticipated that the proposed discharge will impact on any of these recreational pursuits.

Policy 10.4.3: *To not include intertidal areas within the mixing zones of particular discharges unless the discharge is treated so as to reduce the contaminant loading to an extent that any adverse effects on any intertidal areas can be shown to be minor.*

Intertidal areas are the areas of land between mean high water springs and mean low water springs. They can be ecologically sensitive areas and are generally deemed to be inappropriate locations for discharges, particularly in circumstances where a mixing zone is required to adequately disperse a discharge. The current proposal is for discharge beyond the intertidal area.

Policy 10.4.5: *The discharge of a contaminant (either by itself or in combination with other discharges) directly into the coastal marine area will only be allowed where:*

(a) It can be shown that the adverse effects of the discharge to any area, other than the coastal marine area, would create greater adverse effect than the discharge to the coastal marine area; or

(b) There are no practicable alternatives to the discharge occurring to the coastal marine area; and

(c) The discharge is of a standard which will achieve a water quality standard suitable for contact recreation and shellfish gathering in areas defined by Objective 10.3.1 within five years of this Plan becoming operative.

The accompanying explanation in the Regional Coastal Plan states that alternatives to discharging into the CMA will need to be investigated and assessed before any discharge will be allowed to occur. The costs and benefits of discharging to different receiving environments in each case should be considered and, where practicable, the alternative with the least adverse effects chosen.

As stated above, various alternative freshwater receiving environments (being Granity Creek, Mine Creek and the Ngakawau River) have been investigated prior to proceeding with the current proposal to discharge into the CMA. The fact that there is a large number of studies documenting the adverse effects of AMD run-off into freshwater environments has dictated to a large extent the final choice of discharge into the marine environment.

From a purely economic view point, discharge into any of the alternative freshwater environments would have been substantially cheaper than the proposed marine outfall pipeline and diffuser. For obvious reasons such a structure is extremely costly and adds significantly to the cost of the Project. Nevertheless, the applicant considers that there is no practicable environmentally sustainable alternative other than discharge into the CMA, given the greater adverse effects that would occur with continuation of the present discharge into the Ngakawau River system.

Objective 12.3.1: *To mange and control noise levels within the coastal marine area in order to avoid, remedy or mitigate any adverse effect on amenity values, ecosystems, use of the coastal marine area, adjacent land, and public health.*

For burial of the ocean outfall pipeline, no noise or vibration will be evident above ground emanating from the tunneling head, once the head has moved past the jacking station (with the jacking station situated in the vicinity of the Granity museum, well beyond the CMA). As mentioned above, the only obvious surface activity within the CMA is at the diffuser location. This is some 600m offshore, with noise unlikely to be discernible over background wave noise.

10.3.14 Conclusion on Planning Documents

The proposed hydro scheme utilises a renewable resource which will enable the West Coast region to provide for their social and economic well-being. The proposal is also sustainable in that it removes significant volumes of mine-affected water resulting in improved water quality in each of the sub-catchments affected by the Project and the Ngakawau River. In all respects the proposal is consistent with the various objectives and policies of all the relevant planning documents.

This conclusion is of particular relevance to the non-complying land use consent being sought from the Buller District Council With respect to non-complying activities, Consent Authorities must only grant consent if satisfied that either-

S104D(1)(a) the adverse effects of the activity on the environment (other than any effect to which section 104(3)(b) applies) will be minor; or

(b) the application is for an activity that will not be contrary to the objectives and policies of

(i) the relevant plan, if there is a plan but no proposed plan in respect of the activity; or

(ii) the relevant proposed plan, if there is a proposed plan but no relevant plan in respect of the activity; or

(iii) both the relevant plan and the relevant proposed plan if there is both a plan and a proposed plan in respect of the activity.

The test is whether the adverse effects as proposed to be remedied and/or mitigated and taken as a whole are more than minor. HDL is of the view that this test is meet, given the majority of the infrastructure associated with the Project is in areas largely modified by human activity, the environmental reports established that no significant loss of habitats or species would occur and the components of the scheme that are within public view are either buried or have minimal visual impact.

Alternatively, if BDC take a different view of the Project, it does not contravene any of the policies or objectives of the Buller District Plan, as established in the foregoing discussion on the relevant planning documents. Therefore there is no impediment to BDC granting the non-complying land use consents associated with the Project.

11 Proposed Management Plans

Management plans provide information about the way in which a consent holder intends to comply with the more specific controls stipulated by conditions of a consent. They also enable consent holders to adopt new technology, following completion of all design aspects associated with a particular development.

While HDL has undertaken a comprehensive assessment of the environmental effects and determined mitigation measures where appropriate, the scale and nature of the Project is such that specification of all performance standards at this early stage of the design process may not necessarily achieve the best environmental result. In such circumstances, it is appropriate to require management plans to be submitted closer to the time in which the Project works will commence.

HDL propose that the following management plans be prepared and submitted to the respective Consent Authorities, following the issue of consent and prior to construction works commencing.

11.1 Construction Management Plan

HDL envisages that this plan would describe construction methods for all the key components of the Project and would include:

- Construction programme including timetable, sequence of events and duration.
- Description of all construction works including the storage reservoirs, tunnels, roads, dams, transmission lines, power stations and diversion/intake structures.
- Detailed Plans, specifications, operation and maintenance of the various components of the Project including the dams, spillways, tunnels, power stations, intakes and diversion structures.
- Dust control measures.
- Sediment control measures including design and location of silt traps and silt storage areas.
- Hazardous substances management.
- Archaeological protocols.

11.2 Landscaping and Rehabilitation Management Plan

HDL envisages that this plan would detail the intended rehabilitation and landscaping of all disturbed areas on completion of construction activities and would include:

- Rehabilitation strategies for all disturbed areas within the Project footprint including roads, reservoir margins, dams/embankments, stream intake structures and the Granity construction site.
- Landscaping strategies for integrating the landforms and vegetation into the surrounding landscape to minimise visual affects, particularly at the Granity construction site.
- Consultation mechanisms for involving the Northern Buller Community Society, Granity museum curator and interested community members in development of landscaping plans for the Granity construction site.
- Weed and pest management strategies.
- Strategies for the progressive rehabilitation of the two sediment fill sites, once used as permanent fill sites.

11.3 Granity Noise and Vibration Management Plan

HDL envisages that this plan would address noise and vibration management and monitoring strategies during the construction phase at the Granity site and would include:

- Measures for notifying Granity residents of intended blasting and micro-tunneling activities.
- Establishment of a programme of blasting, as discussed with the Granity museum curator.
- Record keeping measures including time and location of blast, weather conditions, total charge weight, volume of rock blasted and distance to nearest buildings.
- Vibration monitoring and reporting procedures.
- Pre-condition surveys.
- Identification of additional mitigation measures that may be utilised in the event that noise monitoring establishes non-compliance.
- Procedures for dealing with complaints.

11.4 Aquatic Ecology Management and Monitoring Plan

HDL envisages that this plan would address the recommendations outlined in GHD's Aquatic Ecology Report and would be prepared by a suitably qualified person and include:

- Establishment of baseline surveys within each of the affected sub-catchments, with focus on rare bryophyte and liverwort species distribution and freshwater fish species in the Ngakawau River below the Mangatini Falls.
- Monitoring programme of water quality, flow, macro-invertebrates, aquatic plants and fish, including the timing and frequency of the sampling programme.
- Reporting procedures for monitoring results

11.5 Sediment Management Plan

As part of the final design process, HDL will undertake extensive modeling of sediment movement within all the affected watercourses. This will assist with final design of the sediment traps at the heads of the reservoirs, required to protect the turbines and to minimise sediment discharges at the ocean outfall. This plan will also address ongoing processes of sediment control during the active mining and post closure periods.

11.6 Dam Safety and Monitoring Plan

This plan to address dam safety procedures and to include requirements for annual independent safety audits and structural surveys.

11.7 Ocean Outfall Management Plan

HDL envisages that this plan would address the recommendations outlined in Cawthron Institutes report on the marine environment. The plan would be prepared by a suitable qualified person and would include:

- Establishment of further benchtop studies to evaluate the envelope of pH levels and required dilutions to meet relative water quality guidelines and determine the configuration of the final diffuser design.
- Establishment of a marine baseline survey in the vicinity of the final diffuser location, with focus on benthic infauna and sediment chemistry.
- Monitoring programme of benthic infauna, sediment chemistry and discharge water quality including the timing, location and frequency of the sampling programme.
- Establishment of a one-off dispersion and dilution study to be undertaken to validate the

predicted initial dilution results under reasonable worst-case conditions.

- Reporting procedures for monitoring results