7.1 Introduction

This section describes the effects construction activities are likely to have on the physical and biological environments in the Central Plains area, including the Rakaia and Waimakariri Rivers and Waianiwaniwa Valley, and also on the associated cultural, social and economic environment.

The Resource Management Act defines effects as:

Definition of Effects RMA

Under the RMA, Part 1, Section 3, the meaning of effect is given as the following:

"In this Act, unless the context otherwise requires, the term effect includes:

a) Any positive or adverse effect; and

b) Any temporary or permanent effect; and

c) Any past, present, or future effect; and

d) Any cumulative effect which arises over time or in combination with other effects – regardless of scale, intensity, duration, or frequency of the effect, and also includes –

e) Any potential effect of high probability; and

f) Any potential effect of low probability which has a high potential impact."

There are a number of temporary effects associated with building the scheme. These include heavy machinery movements, disruption to communities (noise, dust, traffic), visual effects of construction management areas, contractors' lay down areas, traffic issues due to road usage and loss of property access, disruption to farming while construction occurs on the land, disruption to recreational activities along rivers and streams and water races with machinery moving around in their beds, temporary tracks to construction sites, and the rehabilitation post construction. In general terms it is only the temporary nature of these impacts that makes them acceptable.

In assessing the effects of the construction activities, reference will be made to the use of management plans. These are outlined in more detail in Section 9 below, but have not been included in this application. Rather, it is proposed to develop such plans prior to the commencement of the construction activities. These plans will show how it is proposed to ensure compliance with the resource consent conditions that will govern the effects associated with the construction phase.

7.2 Dust Effects

Construction activities, such as those proposed, will result in areas of soil and gravel being exposed in workings and in stockpiles. Open areas of soil and gravel can result in the creation of airborne dust,

which has the potential to move offsite and affect other people and activities in the immediate area. Dust like this has the potential to create nuisance effects as well as adverse health effects. The type of activity undertaken, the materials present and other conditions can significantly impact on the potential for airborne dust, and in general dust is dependant upon the following:

- the areas of exposed surfaces;
- the moisture content of the aggregates and fill material;
- the particle size of the aggregates; and
- the wind velocity across stockpiles and other surfaces.

In addition to these factors, the activities being undertaken can also significantly impact on when the dust will be made airborne. For instance the methods used to crush, screen, stockpile, load and unload trucks; and the speed of vehicles travelling over unconsolidated ground.

The potential sources of dust during various construction activities, and some of the factors present that will influence the generation of dust are:

- Vehicle activity on dry unsealed roads -dependant on vehicle size, loading and speed;
- Stripping and clearing the site – leaving exposed easily dried surfaces with no vegetation cover;
- Excavation of canal routes and the placement of the fill either in stockpiles or directly to embankments – exposed gravel/soil stockpiles and surfaces;
- Transportation of fill on public roads – potential for dust from carried material, and truck wheels;
- Excavation of selected material from borrow pits and quarries -
- Crushing and screening or aggregates – dust from crusher, conveyors, and stockpiles; and
- The restoration of the sites with the placement of topsoil and sowing down of grass – trucking and grading operations with exposed soil surfaces.

The potential effects of dust from the various construction sites are discussed below.

The control of dust will be an essential part of the overall project, to ensure that the effects of the various activities do not cause significant effects on the public, economy and natural environments of the areas. Mitigation will include the use of water, to keep the surfaces of roads working and stockpiles moist to minimise dust generation. In addition to this, wetting of trucked soils and gravel may be required to ensure that material is not bounced out of the trucks or lost as dust in transit. Monitoring of potential effects will also be provided for to ensure no more than minor effects occur on communities and crops. A Dust Mitigation Plan will be prepared and used.

7.2.1 Water intakes

Dust will be generated by the earthworks both in the riverbed and on the adjacent river terraces where the canals, sediment traps and fish screens and bypasses will be built. Traffic to and from the construction areas on the temporary access roads will also create dust. The environment in this area is already characterised by large open areas of exposed gravel, sand and silt material from the river beds, and so dust is a natural component. Thus, it will be unlikely that the effects of dust from the construction works will be cause more than minor effects in addition to those naturally occurring at present. However, the Dust Management Plan will contain mitigation measures should factors indicate that more than minor effects could occur.

7.2.2 Headrace construction

As above, dust will be created from stripping cover from the site, excavation and placement of fill material, through to the final remediation. The potential to create nuisance effects will be greater for the headrace canal construction due to the proximity of residential properties. The conditions under which dust is most likely to cause a problem will be during the hot dry north-westerly winds. This is also the time when dust from other sources including river beds and agricultural land can cause nuisance problems. So during these conditions there will be a level of natural dust effects, but the proposed activities will be additive to this. It is considered that the environment is not one that is particularly sensitive to dust as it is already affected by these natural and farm related sources.

Dust mitigation measures will be present in the Dust Management Plan and they will be more stringent for areas close to residences, including measures such as watering for dust suppression in critical areas and not creating stockpiles close to residences. Watering is most likely to be with water tankers, but stockpile areas may be able to be watered with sprinkler systems.

In addition, trucks transporting material through residential areas could have their loads watered down to prevent dust emission during transit.

7.2.3 Waianiwaniwa Dam site

As the dam site will involve the largest volume of earthworks over the greatest area, the potential for dust generation will be greatest. In particular with the valley aligned with the direction of the north-westerly winds, winds will be funnelled down the valley, increasing the potential for dust generation. For this reason the material stockpiles for the dam construction will be located within the valley and as such they will be more than 2 km away from residences in Coalgate.

Dust control measures such as watering will be essential on this site. In addition to suppression measures, monitoring for dust effects would be advisable at locations within Coalgate, to provide feedback to the contractor on the effectiveness of the dust control measures used. The Dust Management Plan will provide a list of measures to be used for the control of dust at this location.

7.2.4 Waianiwaniwa tunnel site

Dust will also be created from the tunnelling operations within the valley. However, as these activities are well away from any residences and also because the effects will be contained within a valley soon to be flooded, there will be no significant adverse effects from any of the tunnelling or ancillary activities.

7.2.5 Distribution network

The distribution network is extensive as described in Section 3. The distribution canals are much smaller than the headrace canal with total widths generally between 13 – 26 m. Most of the canal corridors are 13 m wide from the outside of embankment to the outside of embankment. These canals will be very close to some residential properties and potentially sensitive agricultural activities. Dust control measures will be provided for in the Dust Management Plan, these are likely to be easier to implement for this activity, due to the narrow corridor of construction. The speed at which these canals can be constructed is also much greater and therefore, the time which any residences will be exposed to dust nuisance potential will be reduced. It is anticipated there will be no significant adverse effects arising from the construction of the distribution network.

7.3 Noise

Noise is another cause of nuisance effects and may have health implications through stress effects should these arise. The noisiest activities expected will be driving of piles for any cofferdams or bridge piles that may be required. If these activities are within 50 – 100 m of a residential property, special attention will be needed to mitigate the potential for adverse effects. Often this can be provided through close liaison with the residents and timing noisy activities to avoid sensitive times. Such measures would be documented in the Noise Management Plan that would form part of the Construction Management Plan. It is worth noting that Section 16 of the RMA provides a duty to avoid unreasonable noise. It requires that the adoption of the best practicable option to ensure that the emission of noise from the land does not exceed a reasonable level.

Vehicles such as excavators, dozers and scrappers can also be noisy when operating under load or during quiet background noise conditions. The remote location of many of the noisy activities minimises the potential for noise nuisance, and often there will not be a requirement for any special control or mitigation measures. Noise standards can be made a condition of consent should the need for particular control be evident.

7.3.1 Water intakes

The remote location of the intake sites will result in there being no potential for significant adverse effects from noise during construction, even though activities such as piling are likely.

7.3.2 Headrace construction

Noise from the construction of the races could be more of an issue as the construction works approach residential areas and isolated rural residences. Noise impacts will be controlled through restrictions to working hours, with limits of between 7.00 am to 9.00 pm from Monday to Saturday inclusive proposed. Operations outside these hours could be by negotiation with the local residents, as for example they may prefer the works to be completed as fast as possible even if it means operating for longer hours or over the weekend.

7.3.3 Waianiwaniwa Dam site

As the major construction site having the greatest number of heavy vehicles operating, the dam site will have the greatest potential to create noise. As above, restrictions on construction activities during quiet periods are likely, and normal construction activities will be limited to between 7 am and 9 pm. Noise monitoring at Coalgate may be needed to provide feedback to the contractor on the effectiveness of the noise mitigation measures adopted.

7.3.4 Waianiwaniwa tunnel site

The tunnelling in the Waianiwaniwa Valley is unlikely to have any adverse effects relating to noise. The construction of the portal on the northern side will have a greater potential to offend due to the proximity of residences. Mitigation measures identified in the noise management plan will be required.

7.3.5 Distribution network

As the distribution network will be constructed with smaller machinery that the headrace and dam, the potential for adverse noise effects is much reduced. The machinery anticipated for the construction of the distribution network would be similar to that seen on road construction, and such equipment can operate satisfactorily in close proximity to residences.

7.3.6 Noise summary

Given the nature of the receiving environment and the scale of the effects, noise will not cause a significant adverse effect. Nevertheless the construction contract will required the contractor to produce a Construction Management Plan that will incorporate a Noise Management Plan. Each of these documents will demonstrate how the contractor proposes to mitigate any potential adverse effect from the machinery and construction methodologies that they propose.

7.4 Construction Traffic Effects

Traffic during construction will be controlled through the use of a Traffic Management Plan. This will also form part of the Construction Management Plan required by the contract. It is not possible to estimate the number of traffic movements involved in the construction activities at this time. Traffic movements are permitted on the roading network, however given that the proposed activities require resource consent and the construction will result in an increase in traffic, this is a matter for assessment.

7.4.1 Water intakes

Most of the traffic associated with the intake sites will be within the site confines. There will be off site traffic movements for staff, material supply such as sheet piling, concrete, aggregates, equipment for fish screens, gates and other structures and machinery gaining access to site. Construction at the intake sites could take 12 months and traffic volumes will vary throughout the period. These may involve 100 vehicle movements per day.

7.4.2 Headrace construction

In regard to the headrace system, the traffic will be along the headrace system, and this will necessitate the crossing of the many roads across the plains. These crossings will be controlled by the contractors and will have the normal temporary traffic control systems required by the local roading authorities.

For the major structures such as bridges or culverts where the headrace crosses roads, there will added disruption to traffic as roads are diverted around the construction site. It may be possible to restrict road closures to a single lane, however in most instances it will be more practical to completely divert both lanes around the activities until such time as the bridge/culvert structures have been completed.

This will be disruptive, however given the short duration of these works, the adverse effects will not be significant.

The rail line to the West Coast will also be crossed by the canals from both of the intakes on the Waimakariri River. Given the significance to the regional economy of the rail line for coal transport and tourism, the rail line will have to remain operative throughout construction. This will pose particular challenges for the contractor, however given the above requirement and assuming that the rail traffic is not disrupted, the adverse effects of crossing the rail lines will be minor.

7.4.3 Waianiwaniwa Dam site

The Waianiwaniwa dam site is the largest of the construction sites. Access to the site will be from State Highway 77 – Homebush Road. Given the large number of vehicle movements onto the site, a fully designed intersection with slip lanes and adequate sight distances will be required on the state highway. The design of the intersection will be subject to Transit approval and therefore on the assumption that such a design will provide for safe traffic movements, the effects of traffic entering the site will be minor.

Most of the construction traffic will be contained within the Waianiwaniwa Valley with all material storage and aggregate processing areas located on the upstream side of the dam. This will keep most of the heavy traffic away from the state highway and residential areas.

7.4.4 Waianiwaniwa tunnel site

Once the head works have been established at the tunnel site, there will only be minor traffic associated with bringing materials such as aggregate, cement, steel and other equipment needed for the tunnel construction, as well as staff access. Most of this traffic will come from the dam site to the south although there will be traffic across Malvern Hills Road providing access to both ends of the tunnel.

7.4.5 Distribution network

There will be minor disruption to traffic along the routes of the distribution network in areas where the canals either cross the road or property access. The majority of the heavy machinery will be confined to the canal routes which will be on private property (yet to be secured) or public road verges. It will only be the crossings where there will be disruption to the traffic flows and this will only be for a short duration. It is a necessary part of implementing the scheme and as most of the properties involved will be part of the scheme, acceptance of the disruption will be higher within that section of the community compared to those not shareholders in the scheme.

7.4.6 Traffic summary

There will be disruption to traffic on roads where the canals cross, but as this will be temporary and be controlled in accordance with best practice, the effects will not be significant. There will also be an increases in traffic associated with the construction project supplying people, materials and equipment to the construction site. This will be a necessary and unavoidable part of the project. The major mitigation measure proposed is a Traffic Management Plan as part of the Construction Management Plan that will detail the methods proposed by the contractor to minimise the impacts of construction traffic.

7.5 Effects on River Hydrology

The effects of the construction activities on river hydrology predominantly related to profile changes within the river and stream beds as construction per se does not involve the taking of water and consequently flow regimes are unaltered.

7.5.1 Water intakes

The river braids and channels will need to be diverted away from the intake sites during construction. This will involve channel training works such as excavation of an alternate braid and gravel banks to deflect flow away from the site. Temporary works such as sheet piling will provide the full protection

required. The diversion works will not affect the river hydrology as water is diverted only and the diversions will not alter the flood carrying capacity of the stream. Floods will simply wash out the gravel training banks for example. This is a normal construction type risk to the contractor.

7.5.2 Headrace construction

The rivers and streams crossed by the headrace will involve siphons under the rivers or culverts under the canal. This will involve significant earthworks within the stream bed that may alter the cross sectional area available for floods. This would only be significant for the very large floods and generally this is a greater risk to the contractor than to the environment. Streams and rivers that are flowing will be diverted around or over the construction works and therefore the hydrology will not be affected.

7.5.3 Waianiwaniwa Dam site

The dam site will be excavated to allow for a cut off trench below the base of the dam. As this will be well below the existing ground level in the valley floor, the existing stream will be either diverted around the excavation or piped across the excavation. It will be a risk that the contractor takes during the time that the foundations are excavated, as to the capacity provided for the stream diversion. At worst a severe rain storm and flood event would flood the excavation and require the contractor to subsequently pump it out to recommence work. This is more of a risk to the contractor than the environment. While the hydrology of the stream will be significantly altered, this is an inevitable part of constructing a dam that ultimately will completely prevent flow from the valley.

7.5.4 Waianiwaniwa tunnel site

Construction on the south side of the tunnel will not affect river hydrology in any way. On the north side, the crossing of the Hawkins River will affect the width of the flood way. As this is very wide at this reach, it is unlikely that any construction restrictions will affect flood flows over the short construction period.

7.5.5 Distribution network

The distribution networks are smaller than the major construction works and there are many small stream beds and water races to be crossed. These will be for short durations and will not adversely affect the hydrology.

7.5.6 Hydrology summary

There will be no significant adverse effects on river or stream hydrology as a consequence of construction. The main potential effect is the reduction in the flood carrying capacity of the river/stream channels and as such this will pose a greater risk to the contractor than the environment.

7.6 Effects of sediment

Construction will result in the release of sediment in either runoff from the site or as a consequence of disturbance of the bed of the river/stream concerned. In general terms the rivers and streams of the upper central plains are adapted to a high sediment transporting environment and effects will be temporary and minor in nature.

7.6.1 Water intakes

Work at the intake sites will involve diversion of the braids or channels to enable the works to proceed. This will result in the disturbance of sediment within flowing channels. The nature of this effect will be very similar to that of gravel abstraction from the river that currently occurs at many locations along the Waimakariri River. Sediment will also be released from the construction site as a consequence of stormwater runoff. Both the Rakaia and Waimakariri Rivers are used to transporting heavy loads of sediment, both suspended and bedload, therefore there will be minimal impacts from any sediment that may be released.

The Upper Waimakariri River intake will cross the Kowai River near its confluence. The excavation will result in sediment being released down into the Waimakariri River. It is probable that the main stream flow will be diverted around the active excavation area and this will minimise the sediment transported. As discussed above, the Waimakariri River carries many thousands of tonnes of sediment annually and this discharge would be minor in comparison.

7.6.2 Headrace construction

The headrace crosses a number of stream beds, many of which are dry. The impacts of sediment discharges on these will be less than minor. The Selwyn River flows underground slightly downstream of the main headrace crossing and therefore any sediment released to that reach of the river will be filtered out and will not significantly affect the lower reaches with higher ecological values. Similarly the works will not inhibit to any significant extent the sediments that are carried down these rivers during flood events.

7.6.3 Waianiwaniwa Dam site

There will be significant potential for sediment to be discharged from the dam construction site. The site will be provided with sediment retention ponds to minimise the effects of this discharge. Nevertheless, given that the Waianiwaniwa Valley will ultimately be flooded, any sediment discharge that is contained within the valley will be of negligible consequence. Sediment discharges towards Coalgate would be of a greater concern, and it is this area that will be protected by the sediment traps and retention ponds. Although the Waianiwaniwa River is a tributary of the Selwyn River, it discharges to groundwater downstream of Coalgate before reaching the Selwyn River, and therefore any suspended material in the

stream will be filtered as it passes through the stream bed. This would therefore not affect the Selwyn River in it lower reaches.

7.6.4 Waianiwaniwa tunnel site

Sediment retention works will be provided at the tunnel site, but given that the site is generally completely within the Waianiwaniwa Valley, the impacts of sediment discharges will be minor.

7.6.5 Distribution network

The distribution network crosses many small streams and water races. Standard practice for works within the bed of streams is that sediment traps are put in place downstream of the works to minimise the impacts of sediment. This will ensure that the effects of sediment discharges on the water ways will be minor. Water races are not natural water courses and are therefore only of significance in relation to their ability to supply stock water. The stock water races often carry high sediment loads as a consequence of high sediment loads in the rivers. Small quantities of suspended sediment could enter the stockwater races during the construction period, however, these inputs of sediment will be brief, and will not be above the high levels experienced during normal race operation.

7.6.6 Sediment discharge summary

Resource consent is required for the discharge of sediment to the rivers. Standard practices including sediment traps and retention ponds and sediment barriers in stream beds will be used to minimise the discharge and the effects. The Construction Management Plan will have a requirement to include a Stormwater Management Plan that will include the measures proposed by the contractor to control runoff and sediment discharges from the construction sites.

7.7 Effects on water quality

There are no expected impacts on water quality from the construction of the intakes or headrace canal. The major contaminant that may be discharged is sediment. As discussed above these river systems have a high capacity to transport sediment and any effects will be small and temporary.

The storage and use of hazardous substances such as diesel in these construction areas will pose a risk from spills. The storage of fuel oil will be in specially designated areas and tanks in excess of 10,000 L will be stored on areas that are bunded to control any spills should they occur. Runoff from the major construction areas will pass through sediment traps or settling basins before discharge back into the rivers. This will provide protection against discharges of hazardous substances.

The contractor will be required to prepare a Spill Contingency Plan as part of the Construction Management Plan that will specifically address the ways in which they will address the risks to water quality from construction activities.

7.7.1 Water intakes

There will be no significant effect on water quality from the construction of the intakes and associated structures.

7.7.2 Headrace construction

There will be no significant effect on water quality from the construction of the headrace and associated structures.

7.7.3 Waianiwaniwa Dam site

There will be no significant effect on water quality from the construction of the dam and associated structures.

7.7.4 Waianiwaniwa tunnel site

There will be no significant effect on water quality from the construction of the reservoir inlet tunnel and associated structures.

7.7.5 Distribution network

There will be no significant effect on water quality from the construction of the distribution network and associated structures.

7.7.6 Water quality summary

The effects of construction are largely related to increased sediment input to streams, through increased soil exposure and disturbance of river beds. These effects can be mitigated by employing appropriate erosion and sediment control measures. Use of appropriate mitigation measures will ensure any water quality effects are minor. The Selwyn River and its tributaries are more sensitive to increased sediment, due to low flows and high ecological values in some areas but with appropriate mitigation measures, effects are expected to be minor.

In general, water quality will not be adversely affected by construction activities. The largest risk is from the storage and use of hazardous substances. There are controls on these substances through the Hazardous Substances and New Organisms Act as well as through the District Plan. Chemicals such as diesel if stored on site in significant quantities will be contained within bunded areas. A Spill Contingency Plan will be required from the contractor.

7.8 Effects on Aquatic biota

Aquatic biota can be affected by physical works and discharges. The physical works within stream beds will destroy the aquatic biota in the immediate vicinity and this cannot be mitigated. Due to the very localised nature of this effect, and the fact that affected habitats are already highly modified and have low sensitivities to disturbance, the impact on the environment will not be significant.

Localised riparian and wetland vegetation losses along the Waimakariri and Rakaia Rivers, and existing water races are considered minor, and can be mitigated and the habitat enhanced with site restoration.

Discharges of sediments or other contaminants could also affect biota. The river environment is well adapted to sediment discharges and the risks from the discharge of hazardous substances can be mitigated as described above. Therefore the effects on aquatic biota from construction will be less than minor.

7.8.1 Water intakes

Only aquatic biota within the braids or channels directly affected by the construct works in the river bed will be affected. This is not a significant issue as these braids and channel are subject to changes in location and the gravel substrates at regular intervals. Fish habitat and passage will not be affected by the works.

7.8.2 Headrace construction

The construction of the headrace will not affect aquatic biota to any significant extent. Sediment discharges from the works will not enter the lower reaches as the upper sections of all the major rivers are dry and sediment will be filtered. When these streams are in flood, they normally carry high sediment loads and the environment is adapted to this.

7.8.3 Waianiwaniwa Dam site

Ultimately the dam will completely change the aquatic biota within the valley. The change from a small stream isolated from the lowland streams, to a large lake or reservoir is significant. Mitigation in relation to this change is discussed elsewhere in this document. Any aquatic biota under the footprint of the dam will be destroyed.

7.8.4 Waianiwaniwa tunnel site

The tunnel construction will not affect aquatic biota to any significant extent.

7.8.5 Distribution network

The construction of the distribution network will not affect aquatic biota to any significant extent given the measures proposed to control sediment at the stream crossings.

7.8.6 Aquatic biota summary

Aquatic biota could be affected by sediment and hazardous substance discharges. Both will be controlled through the use of best practice including the preparation and use of Stormwater Management Plans and Spill Contingency Plans. There will be no significant adverse effects on aquatic biota as a consequence of the construction activities.

7.9 Effects on in-stream habitat

The construction of the intake and bywash discharge structures has the potential to have localised short term effects on instream habitat of the Waimakariri and Rakaia Rivers. The highly dynamic nature of the instream habitat of these rivers and the localised scale of the effects (river bed disturbance and sediment inputs), short term nature of the effects and the proposed mitigation will generally ensure that any construction related effects on instream habitat is less than minor. However riparian seep areas are relatively uncommon and provide high ecological values, and are sensitive to effects of sedimentation.

The construction of the inlet and head race canals and water race network has the potential to affect a large number of streams and water races (via physical disturbance and increased suspended and deposited sediments). The ephemeral and modified nature of some of these waterbodies (e.g., the Hawkins and Hororata Rivers), localised scale of the effects (riverbed disturbance and sediment inputs), short term nature of the effects, and the proposed mitigation, will ensure that any construction-related effects on instream habitat associated with stream and water race crossings will be minor.

The construction of the Waianiwaniwa Reservoir and dam structure has the potential to affect the Waianiwaniwa River through inundation of the valley, disturbance of the river bed and discharge of sediment to the lower Waianiwaniwa River. Inundation of the Waianiwaniwa Valley will result in the loss of approximately 37 km of moderately diverse but heavily modified hill-fed stream habitat and the creation of between 4 – 13 km^2 (depending on reservoir levels) of still water aquatic habitat. This loss of flowing habitat is considered a significant effect. However; water enhancement of flows in lowland streams (see below) will mitigate this effect to a degree (the magnitude of this mitigation was unclear at the time of writing). Disturbance and sediment discharge related effects will be mitigated by carefully managed and controlled construction activities, and as a result the disturbance and sediment discharge effects on downstream environments are expected to be minor.

7.10 Effects on significant terrestrial and aquatic vegetation

There are no areas of significant terrestrial or aquatic vegetation that will be affected by the construction.

7.11 Effects on birds and terrestrial fauna

Birds roosting and breeding habitats near construction sites will be displaced as a consequence of the activities. Braided river birds including the wry-billed plover and black fronted tern if nesting near the intake sites may be displaced. It would be advisable to initially occupy the construction sites outside of the roosting period of these birds so that they find more remote locations for their nests. Consideration will be given to conducting bird surveys prior to construction, and mitigation options such as translocation, and timing of works in relation to breeding seasons may be appropriate.

There are no other significant bird species that will be affected by the construction activities. Most other bird species will be able to recolonise elsewhere. There are no significant other fauna that will be adversely affected.

7.12 Effects on fish and recreation

Potential effects associated with the construction of the intake structures and stream crossings on instream habitat, water quality and benthic communities are expected to be localised and of short duration, and therefore minor in scale and significance. As a result of these assessments it is also concluded that any effects associated with the construction of intake structures on fish, fisheries and other recreational effects will be minor. Wherever possible, construction activities with or adjacent to waterbodies should be timed to avoid critical migratory periods for native fish and salmonids.

The construction of the Waianiwaniwa Reservoir and dam will result in the loss of stream habitat, the inundation of part of the Waianiwaniwa Valley, disturbance of the Waianiwaniwa River bed and the generation and possible discharge of sediment. Much of the habitat for Canterbury mudfish within the valley will be lost.

Inundation of part of the Waianiwaniwa Valley may result in the loss of some fishery (likely to be limited to occasional recreational or commercial eeling) and recreational values (likely to be limited to horse riding, trail bike riding, water fowl and small game hunting). However, it is expected that the creation of the reservoir will provide equal or greater fishery and recreational opportunities than currently exist in the Waianiwaniwa Valley.

7.13 Effects on social and cultural values

Many of the effects of construction on people have been discussed in the previous sections, such as dust, noise, and traffic etc. People will also be affected by the amenity impacts such as from the visual impact, potential loss of recreational activities and health and safety concerns. Large civil engineering projects of this nature that involve the stripping and removal of vegetation and topsoil do create a large visual impact, albeit temporary in nature. The mouth of the Waianiwaniwa Valley will be transformed by the dam construction activities that will be clearly visible from SH 77. The main river terraces will be altered by the construction of the canals from the intakes to the upper plains levels. These construction activities will be clearly visible from within the river (such as from jet boats or fishing activities) and also from the

opposite side of the rivers, such as from Browns Rock in the Waimakariri District and Highbank in the Ashburton District. This may affect individuals experience in this natural landscape. These affects are unavoidable and temporary in nature.

Experience with other dam construction projects shows that they can require considerable workforces, possibly including a construction camp or other temporary accommodation. Potential adverse effects can include dust and noise on the everyday activities of the residents, disruption of farm management and operation, increased heavy traffic volumes on local roads and associated safety concerns. Stress from construction activities can be alleviated by a phased approach, and keeping people informed.

To counter this, there is likely to be high public interest in the development of the scheme and it will be necessary to provide public vantage points and information boards at many points across the plains to provide the public with information.

Increased traffic and general activity in the area will also come with increased employment opportunities, increased demand for accommodation and the service industries. This will provide a very significant financial input into businesses within Selwyn District.

Loss of some recreational opportunities through restricted access due to construction activities in the short term will be offset by the increase in recreational activities in the long term. These will include water activities on the reservoir such as canoeing/kayaking, sailing and windsurfing, power boats and jet skis and swimming. The canals and distribution system will provide opportunity for swimming, canoeing, kayaking, walking, cycling, wild fowl shooting, picnicking and photography. Thus over a longer term the effects on recreation will be positive.

Loss of vegetation in the short term will be offset by the reinstatement and development and restoration of other areas within the plains. Visual impacts from construction activities are therefore temporary, although there will be long term alteration to the landscape by the canals, dam and other structures.

There is the potential for construction activities to impact on archaeological sites of importance/interest. It will be necessary to have a discovery protocol established prior to commencement of the physical works. It is proposed that an accidental discovery protocol be developed in consultation with tangata whenua and relevant bodies such as the Historic Places Trust.