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Meridian Energy Limited

Mokihinui Hydro Proposal  
Environmental Construction Management Plan

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# Table of Contents

	Page
<b>1 INTRODUCTION.....</b>	<b>1</b>
1.1 PURPOSE OF THIS PLAN.....	1
1.2 STRUCTURE OF THIS PLAN.....	1
1.3 OUTLINE OF THE SCHEME.....	1
<b>2 KEY POSITIONS AND POINTS OF CONTACT.....</b>	<b>6</b>
2.1 INTRODUCTION.....	6
2.2 MHP CONSTRUCTION MANAGER.....	6
2.3 COMMUNITY RELATIONS MANAGER.....	6
<b>3 ASSOCIATED MANAGEMENT AND OTHER PLANS.....</b>	<b>7</b>
<b>4 COMMUNITY LIAISON GROUP AND COMPLAINTS PROCEDURE.....</b>	<b>8</b>
4.1 GENERAL.....	8
4.2 MEMBERS.....	8
4.3 OBJECTIVES OF THE COMMUNITY LIAISON GROUP.....	9
<b>5 PROJECT STAGING.....</b>	<b>10</b>
5.1 INTRODUCTION.....	10
5.2 PROGRAM.....	10
<b>6 CONSTRUCTION METHODOLOGY.....</b>	<b>11</b>
6.1 INTRODUCTION.....	11
6.2 CONSTRUCTION PROGRAMME.....	11
6.3 CONSTRUCTION ACTIVITIES.....	11
6.4 VEGETATION CLEARANCE.....	17
6.5 CONSTRUCTION RESOURCES.....	18
<b>7 HEALTH AND SAFETY PLAN.....</b>	<b>20</b>
<b>8 HAZARDOUS SUBSTANCES MANAGEMENT PLAN.....</b>	<b>21</b>
<b>9 STORMWATER AND WASTEWATER MANAGEMENT PLAN.....</b>	<b>22</b>
<b>10 SEDIMENT CONTROL PLAN.....</b>	<b>23</b>
<b>11 TRAFFIC MANAGEMENT PLAN.....</b>	<b>25</b>
<b>12 TRANSMISSION LINE CONSTRUCTION.....</b>	<b>26</b>
<b>13 WASTE MANAGEMENT PLAN.....</b>	<b>28</b>
<b>14 DUST MANAGEMENT PLAN.....</b>	<b>29</b>
<b>15 NOISE MANAGEMENT PLAN.....</b>	<b>30</b>

16	CONTAMINATED SITES .....	31
17	ARCHAEOLOGICAL AND HERITAGE PROTOCOLS .....	32
18	REHABILITATION PLAN.....	34
19	RISK MANAGEMENT PLAN .....	35
20	VERMIN CONTROL AND WEED MANAGEMENT PLAN .....	36

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# 1 INTRODUCTION

## 1.1 PURPOSE OF THIS PLAN

The primary goals of this Environmental Construction Management Plan (ECMP) are to:

- describe what actions will be taken in the event of a range of events occurring during construction of the Mokihinui hydro scheme
- describe the methods proposed for construction of the scheme and the program for construction of each element
- provide a list of key positions and points of contact during scheme construction
- describe how stakeholders will be kept informed during construction and how complaints will be managed.

At this stage the ECMP is in draft form. Considerable more detail will be added once a Contractor is selected to construct the works, who will develop highly detailed construction methodologies and programs for construction works. Even after this stage, changes to program during construction will mean that the plan will need updating throughout the construction process. The document should be thought of as a 'live document' that will be updated and referred to throughout the construction process.

An up to date copy of this plan will be maintained at the main site office throughout construction. This will also be available in electronic form from the projects public website *[insert reference when available]*.

## 1.2 STRUCTURE OF THIS PLAN

To complete

## 1.3 OUTLINE OF THE SCHEME

The scheme is comprehensively described in the following documents:

- Civil Engineering Feasibility Study
- Associated layout figures
- *[additional/alternate references to be added at later stages of design/construction]*.

However, a brief description of the primary scheme concept and components is included here for completeness.

*[note that the following description is from the existing level of detail for the scheme. It will be updated in detail at later stages of detail and construction]*

The Scheme can be divided into the following main components:

- The dam
- The staging area

- The spillway
- The powerstation
- Penstocks and powerstation bypass
- Substations
- Transmission line

### 1.3.1 The Dam

A concrete gravity dam will be constructed using Roller Compacted Concrete (RCC). This type of dam was chosen because it:

- Is conventional, safe and fast to construct
- Can accommodate an overflow spillway
- Has a small footprint
- Requires shorter diversion works
- Performs very well in extreme earthquakes
- Can withstand overtopping during construction with negligible damage.

The 85m high dam will have a 120m length spillway at a height of 77m (100m RL). The typical dam section has a straight vertical upstream face and an inclined downstream face.

### 1.3.2 Staging Area

A 26ha Staging Area for dam and power station construction activities is located immediately downstream from the dam site and on the true left bank. The Staging Area will accommodate the aggregate extraction pit, stockpiling areas, production plant, buildings, settling ponds, diesel generators, and parking areas.

### 1.3.3 Spillway

The spillway, chute lining and flip bucket will be constructed of conventional concrete, as will the ogee crest which will be at RL100 m. The ogee crest refers to the curved profile of the concrete surface at the spillway crest to smooth the water passing over the dam crest thereby avoiding destructive erosion damage to the concrete while minimising surcharge in the reservoir during floods. The spillway will be designed to pass floods up to the probable maximum flood (PMF) estimated at 7200 cumecs.

### 1.3.4 Power station Layout

The final power station layout is part of the detailed design process. The current configuration of the power station is that it will house three turbines comprising twin vertical shaft Francis turbines, each of approximately 40 MW nominal rated output under a net head of 77m, and a smaller approximately 13 MW unit primarily to operate at minimum flow periods and at high flows when spilling. Under normal operation of the power station the maximum generation flow will be approximately 120 cumecs or nominally 80MW. However, when inflows into the lake are great than 120 cumecs or the power station would otherwise be spilling, the maximum generation flow will be approximately 150 cumecs and nominally 100MW.

The turbine units are each fed by penstocks which source water from a screened intake and head gate about 10m below the spillway crest, to withdraw water for power generation. The turbines discharge into individual draft tubes to the common tailrace channel. Bypass valves are proposed to maintain station discharge if a station generation outage occurs.

A conventional power station layout has been adopted and at this early stage of design is likely to have a steel or concrete frame structure with external cladding in pre-cast concrete panels or steel. The power station will be founded on competent rock.

Vertical intake screens will be installed to intercept debris from the inflow. Grill spacing on screens is a balance between minimising the risk for fish and eels to ingress the station, the propensity to become blocked with debris, hydraulic efficiency, and ease of cleaning by an automatic screen cleaner.

A floating log boom will limit floating debris being drawn into the intakes. The accumulated trash will be cleared from the intake screens by means of a trash raking machine. Assembly and maintenance of intake equipment is proposed to be carried out by mobile crane from the dam crest with provision of outrigger support platforms.

### **1.3.5 Penstocks and Power Station Bypass**

In order for river flow to be maintained downstream of the dam, a by-pass facility is to be included which will pass flow downstream in the event of a power station trip when the lake level is below the spillway crest. The discharge capacity of the bypass facility will be between the river low flow of 16 cumecs and the capacity of the two main generating units of 120 cumecs.

### **1.3.6 Boat Launching Ramp, Jetty and Log Management Area**

A boat launching ramp is proposed to provide boat access to the lake for dam maintenance and safety inspections of the reservoir shoreline. The log management area will be concrete surfaced and will accommodate beaching, and cutting to manageable size, logs intercepted by the log boom.

### **1.3.7 Mokihinui Substation Layout**

The power station output will be connected to the new single circuit 110 kV transmission line via the power station substation which will contain a single generator transformer near the power station. It will have a compact and low profile having minimal visual impact and will be enclosed inside a security fence for public safety. All power station control and switching functions will be arranged for both local and remote operation.

### **1.3.8 Transmission Line**

A single circuit 110kV line will transmit power from the proposed power station to a new substation at Cedar Creek located between tower 46 and tower 47 on Transpowers' Inangahua – Westport line.

The line will be approximately 28km long and contain approximately 152 concrete or steel single pole structures typically ranging from 14m to 20m tall,

above ground, with an additional 2.8m of single box section steel earth peak. Approximately 20 poles will be up to 50m high for the Stockton Plateau and Ngakawau Gorge to improve vegetation clearance.

This consent application seeks the approval to locate the transmission line within a defined corridor, typically in the order of 200 metres wide. The purpose of a corridor is to allow flexibility for precise placement of poles, while operating within a defined area. Flexibility is required to suit topographical variations and to avoid environmental effects encountered during construction.

The line route was selected by Linetech Ltd from various maps, aerial observations and ground inspections in collaboration with the Department of Conservation, Solid Energy and the Technical Report authors (in order to avoid adverse effects). The proposed route traverses native bush, forestry, road easements, pasture land and both scrub covered and bare rock plateau land. Aerial photographs showing the transmission corridor and an indicative location of the line and transmission poles is shown in Figure XX.

The proposed transmission line passes over the following properties:

- Legal road administered by Buller District Council;
- Private land owned by Ngai Tahu Forest Estates, and two other private landowners;
- Deemed Stewardship Land and an Ecological Reserve Area administered by DoC;
- LINZ land, over which Solid Energy has a mining permit;
- Solid Energy freehold land.

### 1.3.9 Cedar Creek Substation

The switchyard within the main substation area will be designed so that the Transpower Inangahua to Westport B line, the Transpower Inangahua to Waimangaroa A line, and the new line to Mokihinui power station, can be terminated onto new structures within the switchyard.

Two 10 kV / 33 kV transformers up to 5m high will be located within the substation. The transformers will be fully bunded to capture any potential oil spills. Storm water collected within the bund will be discharged via a water-oil separation and containment system.

The substation control, communications and monitoring equipment and their associated power supplies will be accommodated within a building. The building will contain a toilet and washroom. The water supply will be via rain water collection and storage tank. A small septic tank wastewater treatment plant will be used to treat the minimal quantities of wastewater. A car park will be located within the building area.

The proposed substation and building areas are relatively flat. However a slope begins on the southern portion of the site which may require a cut of up to 7 m in height with an appropriately contained embankment. A minor water course currently drains the area. This will be moved to the perimeter of the area and

extended in the form of a drainage channel which will capture runoff from the uphill slope behind the substation and also ensure adequate drainage of the substation area.

The site will require basic levelling by heavy machinery which may create some dust for up to two weeks. The substation development will take approximately 12 months from initial site levelling through to operational commissioning. Further additions to the substation (for example transformers and associated switchgear) may be piecemeal over several years depending on local electricity offtake requirements. The actual construction period will be over four to six months with the majority of truck movements confined to a shorter period while civil works take place. It is envisaged that the material excavated to level the site would be distributed in the immediate vicinity.

The existing Cedar Creek Road will require repair between the Cedar Creek substation and Burnett's Face hairpin. The fords and bridges along this road section will be repaired or upgraded to facilitate concrete trucks and transformer transportation weights up to 25 tonnes.

### **1.3.10 Communications**

With respect to the communication system, a steel pole up to 20m high would be sited on the bank or dam within 35m of the top of the true right side of the dam. A communications dish up to 2m in diameter would be mounted near the top of the pole.

Two other communication sites will be developed between the dam and the Cedar Creek substation as outlined below.

A steel pole up to approximately 30m high would be sited on the existing cleared site at the top of the 264m high hill approximately 1.5km south of Seddonville (at or about NZTM 1515138E 5397906N - within a 50m radius to ensure suitable ground conditions). Two communications dishes up to 2m in diameter would be mounted near the top of the pole. The pole may also have a cell phone transmitter mounted on it.

A steel pole up to approximately 30m high would be sited at the top of the 425m high hill approximately 1km north east of Stockton (at or about NZTM 1508844E 5391045N - within a 50m radius to ensure suitable ground conditions). Up to two communications dishes of up to 2m diameter would be mounted near the top of the pole. These would be installed and maintained by helicopter.

**Include figure here showing scheme components**

## 2 KEY POSITIONS AND POINTS

### 2.1 INTRODUCTION

A number of key positions are identified in terms of operating this ECMP, and for the construction of the scheme. The named roles are discussed below, along with contact details for the specific person in that role. These people are the first point of contact for the public, or other organizations, in each of the key areas identified.

### 2.2 MHP ENVIRONMENTAL ISSUES MANAGER

The MHP Environmental Issues Manager has overall responsibility for responding to and managing any environmental issues at the site. In doing this, he/she must ensure that all environmental consent conditions are met, and that the environmental requirements of the ECMP and associated Management Plans are adhered to at all times during construction.

Name	<i>[position yet to be filled]</i>
Postal address	<i>[to be filled]</i>
Email	<i>[to be filled]</i>
Phone	<i>[to be filled]</i>
Cellphone	<i>[to be filled]</i>

### 2.3 COMMUNITY RELATIONS MANAGER

The Community Relations Manager has responsibility as the point of contact between the community (or other public) and the project. This includes management of a 24 hour complaints contact.

Name	<i>[position yet to be filled]</i>
Postal address	<i>[to be filled]</i>
Email	<i>[to be filled]</i>
Phone	<i>[to be filled]</i>
Cellphone	<i>[to be filled]</i>

### 2.4 PROJECT ARCHAEOLOGIST

The Project Archaeologist for the project has the responsibility to ensure that all construction staff receive appropriate pre construction training in methods for identifying, reporting and managing any features of archaeological significance.

Name	<i>[position yet to be filled]</i>
Postal address	<i>[to be filled]</i>
Email	<i>[to be filled]</i>
Phone	<i>[to be filled]</i>
Cellphone	<i>[to be filled]</i>

### **3 ASSOCIATED MANAGEMENT AND OTHER PLANS**

Several other management plans have been developed for use in the construction phase of the project. The requirements of these plans are not repeated in this document, but the ECMP refers to these documents when they are needed to address a certain aspect of construction. The associated plans are:

- Terrestrial Ecology Management Plan;
- Habitat Enhancement and Predator Control Plan;
- Aquatic Ecology Management Plan;
- Erosion Monitoring and Management Plan.

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## 4 COMMUNITY LIAISON GROUP AND COMPLAINTS PROCEDURE

### 4.1 GENERAL

Effective communication with the community is essential during construction of the project (and further into operation). The Community Liaison Group has the role of ensuring that effective communication actually takes place

### 4.2 MEMBERS

The Community Liaison Group has a range of responsibilities associated with communication between the various construction parties and the Community. The responsibilities of this group are discussed in more detail in a later section.

The Community Liaison Group includes representatives from:

- West Coast Regional Council
- Buller District Council
- Meridian Energy
- Scheme Contractor *[insert name when available]*
- Community representatives

Name	Address	Email	Phone
<b>West Coast Regional Council and Buller District Council</b>			
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>
<b>Meridian Energy Limited</b>			
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>
<b>Contractor(s)</b>			
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>
<b>Community Representatives</b>			
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>
<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>	<i>[to be filled]</i>

### **4.3 OBJECTIVES OF THE COMMUNITY LIAISON GROUP**

The objective of the Group is to:

- Maintain effective working relationships and mutual trust between the local community and the consent holder (including its contractors), especially during construction;
- Promote the free flow of information in all directions between the local community, the consent holder, the contractors and the Consent Authority, in order to try to anticipate and resolve any potential issues before they arise;
- Evaluate the results of monitoring activities on a periodic basis;
- Oversee a Community Complaints Procedure, ensuring appropriate responses from the consent holder are forthcoming; and
- Respond to matters which may arise as a result of the monitoring.

### **4.4 MEETINGS OF THE COMMUNITY LIAISON GROUP**

The initial target for the Group will be to meet at least once every two months during construction, and at least annually after construction. More frequent meetings may be needed especially if there are issues which are urgent or ongoing. Agenda will be set for each meeting, and these should be address each of the objectives, as discussed above.

### **4.5 COMMUNITY COMPLAINTS PROCEDURE**

Complaints from the public or community will be dealt with in the first instance by the Community Relations Manager for the project. A 24 hour/seven day freephone complaints line will be established for the local community to call if there are any concerns regarding construction. The complaints number will be advertised at regular intervals in the local newspaper, as well as being displayed on signs where the construction works is nearby to roads.

A log will kept of all complaints which will include the following details:

- date and time
- complainant name and contact details
- nature of complaint including cause and effect (if known).

The target of the Community Relations Manager will be to respond to the complaint within 24 hours, ideally with a solution, or if not with a programme for solution. All communications related to the complaint will be logged.

The Community Relations Manager will report on complaints and actions to the Community Liaison Group prior to each meeting with sufficient detail to satisfy the Group. The log of complaints and actions will also be made available to the Consent Authorities on request.

## 5 PROJECT STAGING

### 5.1 INTRODUCTION

This section presents in detail the proposed timing for construction activities throughout the project.

### 5.2 PROGRAM

*[at this stage the program provided in the DamWatch and URS Construction Reports, and provided during the Resource Consent Hearing is the most recent. More detail will be introduced as the project proceeds through detailed design, tendering and construction stages. The current construction program is repeated below for completeness.]*

*[to insert construction program figure]*

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## 6 CONSTRUCTION METHODOLOGY

### 6.1 INTRODUCTION

This section presents the methodology that will be used to construct the works. It also provides specific design detail of the significant temporary works components that have not been covered in the detailed design of the scheme.

*[At this pre-consents stage of the project, the description discusses the types of work that will be needed as part of the construction and offers estimates of the likely timing, sequencing and durations of particular activities.]*

*The description is based on the design work progressed to date, and the associated geological/geotechnical work and consideration of environmental effects.*

*The actual methodology is not likely to be completed until detail design has been finalised and the construction contract awarded, and some departure from the description here is most likely. The overall effects are likely to be similar, regardless of detailed methods. Hence, the objective of this section at the current time is to highlight the type of expected activities. This will be updated as the project progresses into further stages of detail.]*

### 6.2 CONSTRUCTION PROGRAMME

Meridian intends to construct the MHP as a single continuous project utilising a number of specialist contractors and sub contractors working collaboratively as required throughout the procurement, construction and commissioning stages of the scheme. The main construction phase will take approximately three years. A further approximately two years will be required to complete the inundation vegetation clearance program.

Shift work is anticipated for a number of construction activities including the river diversion, cofferdam construction, RCC concrete dam construction, conventional concrete works, power station and tailrace excavation. Shifts are expected to be over 24 hour working days, 7 days per week to enable best construction practice (i.e. best RCC construction quality requires continuous placement). This will also minimise the project duration which will reduce the duration of any adverse effects. The contractor will also ensure that any lighting to enable construction work at night will comply with the consent conditions and the provisions of the Buller District Plan.

### 6.3 CONSTRUCTION ACTIVITIES

#### River Diversion

The Mokihinui River will be diverted through a channel excavated on the true left bank of the gorge. On completion of the diversion channel excavation, and associated structures, the river will be diverted through the diversion channel by removing the final sections of rock at either end of the channel and closing the river channel (upstream cofferdam first).

### **Cofferdam Construction**

Temporary rockfill cofferdams will be constructed in the river upstream and downstream of the dam site to enable dewatering of the dam foundation. The upstream coffer dam will redirect river flow into the diversion channel, whilst the downstream coffer dam will prevent river flow backwash into the dam construction site. The cofferdams will enable dam foundation dewatering so that the dam can be constructed on “dry” land.

### **Concrete Aggregate Supply**

Concrete aggregate material will be sourced largely from the alluvial terraces located within the Staging Area. Gravel will be excavated in a manner that will provide relatively flat areas for the Staging Area facilities. Gravel and rock stripped from the dam footprint (including the riverbed) during foundation preparation will also be used to manufacture concrete. Another aggregate source will be rock excavated for the diversion channel. This will need to be crushed and screened.

There is sufficient material for production of concrete aggregate on site (1.45M tonnes available versus 1.38M tonnes required).

Sourcing aggregate onsite will reduce the volume of truck traffic through Seddonville. For example every 1,000 m<sup>3</sup> of aggregate sourced offsite results in approximately 50 traffic movements (equivalent to 25 trucks). Meridian is making every attempt to obtain sufficient aggregate material onsite to avoid the need to truck in additional aggregate supplies.

### **Cement Source**

Cement will be required for both RCC in the dam body and conventional concrete for the diversion culvert, power station, spillway chute and other structural elements. Most of the cement imported will be used in the RCC dam body. While concrete mixes have not been finalised, an assessment of the quantity of cement required is included below for initial planning purposes.

RCC mixes utilise a combination of cement and pozzolan. The total concrete volume is approximately 640,000 m<sup>3</sup> (conventional and roller compacted concrete). The RCC mix is likely to have about 160kg of cement and pozzolan per cubic metre of RCC. Accordingly, approximately 100,000 tonnes of cement and pozzolan material will be used for the proposal. The maximum rate of cement and pozzolan use will be during RCC placement and is estimated to peak at 300 to 400 tonnes per day.

The source of the cement and pozzolan is not yet determined. While the cement plant south of Westport is known to Meridian, the cement source will be a commercial arrangement between the construction contractor and cement supplier. Pozzolan is a substitute for cement to reduce concrete heat generation and improve long term concrete performance. Flyash, a by-product of coal fired electricity generation, is often used as pozzolan. While there are some natural sources in New Zealand it is more likely that pozzolans for RCC would be flyash

conforming to prescribed quality standards shipped in from overseas. Cement and pozzolan not sourced from the area would be likely to be shipped through Westport. From Westport they would be transported by bulk road transporters to site and stored in purpose built silos.

### **Concrete Batching Plant and Concrete Conveyance**

Two concrete batching plants are anticipated: a batching plant for conventional concrete (capacity ~ 50 m<sup>3</sup>/hr) and a high capacity RCC batching plant (~ 200 to 300 m<sup>3</sup>/hr). Batching plants tend to be modular structures with components sized for ease of transport and installation.

The batching plants will be supplied from the aggregate production plant where allowance for large aggregate stockpiles is included to increase availability of aggregate. A minimum of three days capacity of cement is included in the current silo volume design to increase security of availability of cement. The contractor may elect to increase this storage facility for further security of supply. Inadequate cement and pozzolan material delivery and storage can limit RCC production and therefore sufficient storage capacity is required on site.

The rate of aggregate use during RCC placing may exceed the capacity of the aggregate production plant. Therefore it is important to stockpile sufficient aggregate prior to commencement of RCC production. Conveyance of aggregate and cement to the batch plants will be by equipment appropriate to the scale of the proposal. Aggregate conveyance is likely to include a combination of trucks and conveyor systems.

Sustained rapid transporting and placing of RCC from the plant to the dam is essential to maintain quality and prevent re-work. At the dam, RCC will be placed by either trucks or conveyor system, where it will be spread in layers with a bulldozer and compacted with 10 to 15 tonne vibratory rollers. The integrity of the completed dam is reliant on good RCC quality and placing practices with the best quality achieved through continuous construction. Night lighting will be necessary at the aggregate stockpiles, bin storage, RCC batching plant and the dam to enable continuous 24 hour RCC placement operation, the duration of which is approximately 48 weeks.

Conventional concrete may be used in:

- The diversion culvert;
- The spillway;
- Upstream and downstream faces of the RCC dam;
- The penstock intakes;
- The penstock supports;
- The power station and ancillary structures (switchyard etc), and
- The dam gallery forms.

Conventional concrete will be transported and placed by a combination of transit mixer, pump, hopper and crane and conventional concrete placement will generally be during daylight hours. Construction logistics may, however, require the contractor to pour some concrete at night. These logistics will

include consideration of the concrete pour size and impact on the overall sequence of works and the ability to comply with night time noise limits.

### **Dam Foundation Preparation**

Foundation preparation and RCC placement will commence on the true left abutment of the dam before diversion is complete, allowing an initial period for RCC batching start up and also to reach operational production targets outside of the proposed construction critical path.

The dam will be founded on sound rock. Foundation preparation will utilise hydraulic excavators and dump trucks. It is currently anticipated that the bulk of cleanfill material (unsuitable for aggregate production) will be distributed on site in the borrow and stockpile area.

Dam foundations will be mapped by a suitably qualified geologist on completion of excavation to confirm excavation levels, to identify additional local foundation preparation requirements and provide a historical record of the foundation condition. Some “dental” treatment, such as consolidation grouting or dental concrete may be required at the stripped foundation in accordance with normal dam construction practices for dealing with pockets of poorer rock quality or foundation irregularities.

It is anticipated from geotechnical investigations carried out to date that suitable foundations will be found on:

- the true left abutment at a depth of between 5 and 20 m;
- the river channel at a depth of at least 20m and this requires the removal of large boulders;
- the true right abutment at a depth of 1 to 3m, the existing steep rock slope will require labour intensive attention from the construction contractor because of the difficulty for construction machine access.

It is anticipated that the excavation of large boulders in the river channel will require a combination of mechanical breakers, drilling rigs and blasting to prepare for haulage to the quarry for aggregate processing.

Progressively, after dam foundation excavations and placement of dental or levelling concrete and prior to commencement of the RCC operation, conventional concrete can be used to achieve a level working area on which to start RCC placement.

### **RCC Dam Construction**

RCC construction involves placing relatively thin layers of concrete (~ 300mm) over a large area. The process of mixing, transporting, placing, spreading and compacting should be accomplished as rapidly as possible and with as little rehandling as possible. The time lapse between start of mixing and completion of compaction should be considerably less than the set time of the mixture and generally within 30 to 45 minutes of mixing.

Because of the relatively high unit weight of freshly mixed RCC, weight rather than volume normally controls the amount of material hauled to the dam site by vehicle. In general a Caterpillar D6 (or similar) bulldozer spreads RCC in 300mm thick layers with laser survey equipment used to control layer thickness. It is anticipated that two rollers and one D6 (size) dozer, with a back up dozer, can spread RCC at a rate of 230 to 380 m<sup>3</sup>/hr in 300mm layers.

There are two common methods of RCC spreading and compaction: horizontal lifts and sloping layer method. The more common is to spread RCC in horizontal lifts but care is required to prevent horizontal joints from forming in the mass RCC. When an RCC lift is not covered with the next RCC layer prior to reaching its initial set, a cold joint will be formed. A cold joint normally forms in RCC after approximately four to six hours, without the use of retarders to slow the setting process down. Typically a bedding mortar is used prior to the next lift if a cold joint has formed. This is usually mortar (sand/cement mix) or grout applied just in front of the fresh RCC. Mortar application increases the tensile bond across the joint, thereby improving shear strength and improving watertightness.

Upstream and downstream faces of the dam will be placed against temporary formwork and the concrete adjacent to the forms will be either grout enriched RCC or conventional concrete in order to achieve water tightness at the upstream face and a durable downstream face. Grout enrichment of RCC is achieved by locally adding cement grout to the RCC layer adjacent to the form prior to vibration and compaction. An alternative to formwork is the use of precast panels which become a permanent feature of the dam face. The use of formwork or precast panels will be determined by the construction contractor subject to consent conditions.

### **Construction Access**

Initial site set up and road construction will include upgrading the Mokihinui – Seddonville road from SH67 through to the site, the Burke Creek crossing, access road to the dam crest and to the power station extending into the diversion channel area.

Upgrading of the Mokihinui to Seddonville Road will be necessary where it crosses Chasm Stream to ease the corners at that location for access by large road transporters. Widening of the carriageway and gravel surface maintenance will be necessary also between Seddonville and the site. The ford at Burke Creek will be replaced with either a bridge or culvert. In parallel with the activities outlined above, the gravel supply will be excavated. Following clearance of vegetation and topsoil, the excavated material will then be placed selectively in the borrow and stockpile area for aggregate processing.

Much of the terrace alluvial material moved will be processed subsequently for concrete aggregate. These activities will be paralleled as early as is practicable by construction of the diversion works including the box culvert and flood wall. As space is made available by the site clearance and levelling, site buildings and facilities will be installed.

Upgrading of the Mokihinui to Seddonville Road from SH67 to Burke Creek will develop a two lane road width with eased bend radii safely negotiable by the increased traffic loading during construction and as a consequence special traffic management will be necessary only for over wide transporters bringing major items of equipment.

### **Power station Construction**

The power station has a reinforced concrete substructure below ground and either steel or reinforced concrete superstructure above ground. It will be constructed using conventional methods, with reinforcing steel and structural steel fabricated off site. Formwork will probably be fabricated on site and concrete will be batched on site.

Mechanical and electrical equipment, particularly turbines, generators and the transformer and switch gear require significant lead design and delivery times. All this plant and equipment will be trucked to the site. Truck loads will vary from up to 20 tonnes for smaller components, and up to 90 tonnes for the crane beam and transformer.

Facilities will be included on site (warehouse, storage yard, fabrication shop) for receiving and fabrication of components prior to installation.

### **Transmission Construction**

Construction of the bulk of the transmission line will be weather dependent. Helicopter operations will require relatively settled, clear weather conditions. For this reason most of the construction would be undertaken in the warmer months between September and March over two consecutive summers taking into consideration any ecological constraints.

The order of main construction activities starts with formation or upgrading of access tracks where required, followed by removal of vegetation at pole sites and completion of any other vegetation control where the vegetation is likely to rise close to the line conductors. Rock anchors and concrete pads with embedded holding down bolts would then be installed. Holes for concrete poles would be dug and concrete poles installed, in parallel with the installation of the steel poles on their concrete bases. Conductor stringing and tensioning followed by a final vegetation check and cut would be required before the line is ready for testing.

Testing activities would be operated from the power station and Cedar Creek substation to ensure the integrity of the line before it is livened.

The length of the construction programme will depend significantly upon the number of experienced line construction crews available, and the weather conditions. Helicopter landing zones will be determined following detailed design.

### **Access Tracks**

The construction and maintenance of a transmission line typically requires the formation of a track for vehicle access. Only 420 metres of new tracks are

proposed along the entire 28km long transmission line. In addition to helicopter installation, existing roads and tracks will be upgraded if required and used for transmission line installation.

### **Pole Foundation**

Approximately 35 pole sites will be suitable for dug foundations and 114 sites for rock anchor foundations. Sub soils in section P1 (P1 means pole 1 etc) to P23 appear to be mostly gravels and clays which will be suitable for dug foundations. Sub soils in section P23 to P45 appear to be a mixture of gravels and rock. It is expected that the vast majority of sites from P45 onwards will require rock anchor foundations.

Gravel or clay sub soils can be dug with hydraulic diggers for direct buried poles and back filled with local or imported materials. A cement stabilizer can be added to the compacted backfill if necessary and bracing blocks installed for weaker soils. Where guy ropes are necessary a conventional buried “dead-man” would be installed.

It is expected that the rock anchor foundations will require 4 – 6 grouted steel reinforcing rods 3m deep in a 50mm diameter drilled hole. A steel reinforcing cage will be fitted to the exposed 500mm of grouted rods above the ground. This will then be boxed with the pole holding down bolts fitted. The boxing will be filled with concrete and then removed.

Where access is by helicopter, the foundation holes will be drilled with a compressed air driven drill. The reinforcing steel, grout, concrete and other materials will also be transported to site by helicopter along these line sections.

## **6.4 VEGETATION CLEARANCE**

### **Staging area**

Clearing of all vegetation within the staging area, including all trees and bush, will need to be undertaken at commencement of site establishment to permit development of the site for the temporary facilities and for the permanent structures. It is intended that a buffer zone of trees and bush will be retained along the river bank adjacent to the staging area to retain the character of the river bank and to avoid any construction effects on the river bank or bed, except where required for the diversion and tailrace channels.

### **Reservoir**

Prior to impoundment of the lake it is proposed to clear trees between RL92m and RL102m, and tall canopy trees which extend above RL92m from between RL70m and RL92m. These minimum limits have been established based on:

- an upper limit at nominally above the 1 in 2 AEP flood RL102m;
- a lower limit 5m below minimum operating level, RL 92m; and
- the fact that removal of additional vegetation will result in a very limited improvement on lake water quality and could exacerbate erosion.

The tree felling operations will be carried out manually (as topography permits) as there is minimal access available for plant or machinery. Large trees (greater than 4 m in height) will be felled and moved to the log handling facility or left in situ. The timing of the tree felling operation will depend on the methodology chosen and the practicality of accessing the reservoir perimeter. Some areas may be cleared prior to lake filling, however, it is anticipated that the more difficult areas may require barge access, which would be undertaken during or after lake filling.

### Transmission

Where installation of the transmission line via helicopter is necessary, a clear area of approximately 15m x 15m is required during construction. Minimal vegetation clearance will be required for new access tracks. Vegetation cutting will vary beneath the line conductors. The general principle when cutting vegetation is to maintain statutory clearances between the conductors and vegetation. In all locations, short growth up to 3m height can remain beneath the line. Under spans crossing gullies tree felling may not be required, dependant upon the slope and depth of the gully. Where felling of native trees is required, they can be felled at ground level limiting damage to the surrounding virgin bush and cut into short lengths and left to decompose and positioned to control sediment runoff. Conventional hand held chainsaws would be used for this task.

It should be noted that there is no vegetation clearance proposed in the Ngakawau Ecological Reserve.

## 6.5 CONSTRUCTION RESOURCES

### Equipment and Facilities

Construction facilities (summarised in the table below) will be accommodated in the area west of the damsite.

Facility	Use
Office accommodation	Meridian representatives, construction contract supervisors and contractors professionals
Warehouse	Interim storage of contractors equipment and proposal consumables
Mechanical workshop	Plant repair and maintenance and steel fabrication
Carpentry workshop	Fabrication of concrete shuttering and other construction
Borrow and stockpile area	Stockpile material moved to form access roads, diversion channel, plunge pool and working areas in the construction site. Also borrow area for aggregate material.
Aggregate production plant	Crushing, screening washing and stockpiling material for concrete aggregate.
Concrete precasting yard	Production of precast concrete components
Concrete batch plant	Concrete production for power station, spillway chute,

Facility	Use
	precast items and penstock intake.
RCC batch plant	RCC production
Laboratory	Concrete testing for quality control of normal and RCC concrete
Construction site substation	Power for construction from local network operator

**Table 1.0 Summary of Site Construction Facilities**

There are a number of construction methodologies available to the construction contractor and therefore a number of construction plant selections are possible. It is anticipated that the contractor will adopt a conservative approach to construction using standard construction equipment with some specialist selections where necessary, for example the choice of RCC batching plant.

### **Labour**

It is anticipated that up to 97 personnel will be employed during the first six months of construction. This will increase to about 310 persons during the dam construction phase. Workforce numbers will decrease, initially after completion of dam body construction and subsequently after power station construction and mechanical and electrical equipment is installed.

The work force could be accommodated; in purpose built accommodation, existing houses, in Westport and bussed to site, or a combination of these methods. Detailed consideration of work force requirements will be the construction contractor's responsibility in consultation with the Community Liaison Group.

### **Transmission**

Generally line construction is a low impact activity requiring in the order of six construction staff for much of the activity plus engineering and project management supervision, plus equipment and transportation support. Construction vehicles include small excavators, four wheel drive vehicles, cement trucks, a helicopter and trucks for equipment transportation to lay-down areas or pole sites where access is provided.

During the erection and fitting stage as many as four line crews of approximately six construction staff may be mobilized in order to gain most efficient use of the helicopter and reduce the activity timeframe.

### **Construction Completion**

Following completion of the proposal, the various construction areas will need to be rehabilitated and restored in accordance with the landscaping and rehabilitation plan and the terrestrial ecology management plan.

## 7 HEALTH AND SAFETY PLAN

A comprehensive health and safety plan will be prepared by the Contractor prior to the start of construction.

### **Objectives**

The objectives of the health and safety plan will be to comply with all health and safety legislation, regulation and procedures, with the intended outcome being the avoidance of harm to workforce and visitors to the site, and to identify interfaces of the construction works with the public and manage to ensure the safety of all. In addition, the Health and Safety Plan will also include information on hazard identification, management and mitigation, emergency protocols and incident reporting.

### **Methods**

- Develop a comprehensive health and safety plan in accordance with the Health and Safety in the Employment Act.
- Provide for the health and safety of all workers involved in the construction of the Mokihinui Hydro Proposal and any visitors to the site;
- Provide safe pedestrian access to the upper valley, around the construction site.

## 8 HAZARDOUS SUBSTANCES MANAGEMENT PLAN

A comprehensive hazardous substances management plan will be prepared which ensures the contractors will implement sound practices for the storage and use of hazardous substances.

### Objectives

To minimise environmental impacts and eliminate health risks and nuisance to site staff and residents from the accidental discharge of hazardous substances.

The plan shall required that all practicable measures are undertaken to safety store hazardous substances and to reduce the potential for spills and to ensure if spills do occur that appropriate procedures are carried out.

### Methods

Spill management strategies include, but are not limited to the following:

- Management of the transportation of hazardous substances to and from the site.
- There shall be no refuelling of vehicles or machinery over water or adjacent to stormwater drains. This does not preclude refuelling of equipment on the dam itself during construction where this cannot be avoided.
- Equipment will be regularly inspected and maintained for leaks or damage before they burst or fail.
- A spill kit or alternative material will be available on site or where fuel or chemicals are stored in the event that a spill occurs. PVC chemical resistant gloves will be made available for personnel to use while cleaning up a spill.
- All personnel will be made aware of the location of the spill kit or clean up materials at the site induction. Nominated spill response personnel will be trained in their use.
- Regulatory Authorities will be notified when a spill occurs that may result in environmental impact to ascertain their involvement, instructions.
- Procedures for the control, containment and clean up of a spill will be developed
- Records will be kept in the event of a spill and will be made available to the appropriate authorities. These records will be reviewed on an ongoing basis to ensure incidents are not repeated.
- Hazardous substances will be stored in covered and imperviously banded areas.
- Hazardous chemical storage areas will be monitored to ensure they are complying with the appropriate standards/ guidelines/consents.

## 9 STORMWATER AND WASTEWATER MANAGEMENT PLAN

A comprehensive stormwater and wastewater management plan will be prepared which ensures the contractors will implement sound practices for the prevention and management of stormwater and wastewater discharges.

### Objectives

The construction of the scheme may result in stormwater runoff, wastewater and wash water within the development area. As such all practicable measures shall be undertaken to contain and treat stormwater, wash water and waste water from the development area.

### Methods

Stormwater management strategies include, but are not limited to the following:

- Settlement ponds to be constructed during initial phase of site establishment.
- Dilution system included in settlement ponds for high pH waters.
- All wastewater from amenity buildings, toilets, showers, and hand basins shall be collected in a reticulated sewerage system and treated by septic tank treatment and filters prior to disposal through infiltration beds to groundwater and then the river.
- Any wastewater from temporary toilets, showers, and hand basins that is not able to be collected in the reticulated system shall be collected in storage tanks. These tanks shall be sized based on predicted workforce numbers in the respective areas. Wastewater shall be removed periodically from the sites by tanker and disposed offsite at an appropriate facility.
- Minimise the effect of stormwater runoff from spoil disposal areas and cleared ground by keeping the active working area to a minimum and completing areas ready for revegetation at the earliest practicable time.
- Control sediment runoff from cleared ground and spoil disposal areas to prevent it entering any existing waters untreated.
- Implement such measures as perimeter drains, erosion control, silt fences, bunding around working areas, maximising soakage, check dams, rock lined channels, and energy dissipation structures. Should these or other measures prove unsatisfactory, channel stormwater runoff through the water treatment system.
- The consent holder shall periodically monitor water flowing out of the settlement pond outlet for pH, Total Petroleum Hydrocarbons (TPH) and conductivity.
- The settlement pond(s) shall be configured such that in the event that contamination is detected the outflow can be stopped/managed for conditions which do not result in flow over the auxiliary spillway.
- If monitoring of the discharge system indicates significant contamination, then immediate steps shall be taken to prevent further contamination.
- Discharge high suspended sediment stormwater to river only when river is in flood.

## 10 SEDIMENT CONTROL PLAN

### Objectives

The goal with respect to sediment control is to minimise erosion and landform instability as a consequence of construction activities.

### Methods

Construction of the scheme will require earthworks and vegetation clearance introducing the potential for erosion during rainfall events if protective action is not taken in advance. Works will be included to exclude surface flow from the works area as much as possible, and to collect sediment at the extent of the site and to protect the environment from contamination. The protective works will generally be in accordance with Auckland Regional Council TP90, and will include the following features:

- Minimise open areas of bare soil, and where practicable mulch or plant open areas
- Diversion of clean runoff and streams around the construction site
- Use of energy dissipaters on any drop structures on steep sections of stream and drainage channels
- Cut all batters to a stable slope
- Provide toe drains and cut off drains to excavated batters
- Provide sediment traps within stream channels
- Silt fencing and hay bailing at the downslope extents of the site
- Containment of runoff from the worked site in a pond to settle sediment before discharge to the receiving stream or water
- Where practicable, the discharge from sediment ponds will be passed over a grass swale to further reduce the sediment load
- Protection against erosion will be provided at the discharge points

The specific location of the features will be identified as the definition of the project improves with detailed design and thorough construction methodology assessment.

Wherever practicable, clean water will be kept separate from that which has suspended sediment. This clean water will be conveyed along channels and discharged to existing watercourses that are closest to the extraction or diversion point.

The sediment control works will be in place prior to any significant earthworks, other than establishing access routes which will enable the works. The first step will be to establish the contour drains at the upslope edge of the site. These will be shallow channels that are excavated, and will immediately be grassed. Where grades in the channel are steep or expected flows are high, armour rock may be placed in specific areas to avoid erosion during use. The diversion channels will discharge to the natural water courses that cross the scheme alignment.

Sediment control works will then be set-up at the downslope extent of the works. This will consist of another series of contour drains and/or silt fences

that filter sediment discharge locally, or direct sediment laden flow towards sediment ponds where the solids can be settled out. These ponds will be sized depending on their catchment area and will be maintained following storm events to ensure that they are functional. The settled sediment will be excavated and disposed of within the works area after drying out as appropriate. The catchment areas for individual sediment ponds will be minimised as far as practicable with a preference towards discharging lower volumes at more locations.

The extent of stripped area will be kept to the minimum practicable. Once work has been essentially completed (or will not be worked on for six months) in each area, it will be topsoiled and re-grassed as soon as possible to minimise the potential for sediment generation.

Where issues with sediment discharge do occur the West Coast Regional Council and Community Liaison Group will be notified as soon as possible by the Environmental Issues Manager. Cleanup work will be agreed between these parties and started as soon as practicable.

## 11 TRAFFIC MANAGEMENT PLAN

### Objectives

Construction of the scheme will require roading improvements to State Highway 67, local road network and existing forestry tracks. A traffic management plan will be prepared to minimise construction traffic and vehicle movements to the extent necessary to allow a safe and practicable construction programme and to minimise the impact of traffic associated effects, including safety, noise, dust and traffic flow on nearby landowners and the roading network.

### Methods

The plan will detail the following measures and strategies:

- To determine extent of vibration generated by traffic movement - prior to use of the Mokihinui Road by construction traffic a suitably qualified inspector will undertake a structural assessment of every building within 20m of the Mokihinui Road, subject to agreement of the land owner.
- Road improvements, in particular State Highway 67 and the Mokihinui – Seddonville Road
- Widening of bends to increase line of sight and reduce accident risk
- Bridge replacement on Coal Creek and bridge construction on Burke Creek
- Increased level of traffic/vehicle safety due to higher quality roads
- Decreased level of noise and dust due to higher quality roads
- The erection of signs on all public roads warning motorists of haul road intersections and associated hazards.
- Warning signage prohibiting public access to construction areas.
- The notification of all temporary local road closures to local emergency services.
- All construction vehicles to be fitted with flashing lights while operating in the construction zone and on haul roads.
- Night time traffic restrictions
- Speed restrictions
- Construction vehicles to comply with the Land Transport Safety Authority requirements for vehicle dimensions and mass on public roads, unless specific over dimension permits are obtained.
- Movement of oversize vehicles and equipment on SH 67 to comply with Transit New Zealand requirements.
- Road safety audits to be carried out every six months of traffic signals/stop signs controlling the intersections of all public roads with haul roads and the review of these audits and implementation of any necessary steps to ensure motorists do not suffer unreasonable delays.

## 12 TRANSMISSION LINE CONSTRUCTION

### Objectives

The construction of the transmission line will be managed to ensure that the effects arising from noise, vegetation clearance and access requirements are not significant. The final alignment of the transmission line within the transmission corridor has yet to be determined and further detail will be provided once the detailed design has commenced.

### Methods

The line will contain some 35 concrete poles and approximately 114 steel single pole structures generally ranging from 14m to 20m high above ground, with an additional 2.8m steel earth peak on top. Approximately four poles will be up to 50m high above ground to accommodate Stockton Plateau mining operations and a number of poles will be up to 45m high in the Ngakawau Gorge to reduce vegetation clearance requirements.

The extent of vegetation clearance varies along the line. In all locations short growth up to 3 metres in height can remain within the area formed between 10m to 15m on each side of the line. Where possible use of existing road clearings would be maximised to reduce the amount of addition clearing required. Some sections will require negligible tree clearing.

Access tracks will only be formed where structures are positioned close to existing roads, and where possible follow the line route. These accesses would be formed using excavators rather than dozers to limit the damage to surrounding bush and reduce the clearance required.

To avoid intrusive vehicle access to pole sites, installation of the majority of rock formations, steel poles and conductors will be with helicopters.

As outlined in the Terrestrial Ecology Management Plan, an appropriately qualified ecologist will be engaged to:

- Determine the areas of high ecological significance within the transmission line corridor;
- Provide guidance as to the placement of poles and new access tracks within locations identified as being of high ecological significance;
- Confirm the presence of snails within the transmission line corridor by undertaking snails searches where the transmission line crosses the known habitat of *Powelliphanta* snail species;
- Relocating snails from proposed areas of disturbance within the transmission line corridor prior to the commencement of construction;
- Defining areas for pole platforms within the transmission line corridor occupied by great spotted kiwi, and searching for nests along the route by a specifically trained certified dog;
- Guidance for the timing of construction of the transmission line so as to ensure that it occurs outside the breeding season of great spotted kiwi or fernbirds where these birds are known to exist; or methods for moving great

spotted kiwis to temporary captivity prior to construction of the transmission line commencing.

An appropriately qualified archaeologist will be engaged to undertake site investigations at each proposed pole location prior to construction to identify and manage any potential issues.

An appropriately qualified landscape architect will also be engaged to determine the most appropriate location for poles near the Charming Creek walkway.

Noise arising from the construction of the transmission line and the mitigation required is set out in the noise management plan.

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## 13 WASTE MANAGEMENT PLAN

### Objectives

A Waste Management Plan will be prepared to minimise the production of solid waste, manage the storage of waste to prevent contamination of soil or water on and in the vicinity of the site and to manage the disposal of waste in accordance with legislation.

### Methods

The strategies to achieve this include:

- Encourage the reduction of waste at source
- Provide for the reuse of objects and materials prior to recycling or disposal.
- Provide facilities on site that enable waste material to be recycled or recovered.
- Provide industrial bin/s of sufficient size for construction waste and empty regularly.
- Collect surplus hazardous waste (oils, grease, chemicals etc) and store separately.
- Concrete trucks and bitumen sprayers washed-out on site into prepared containments.
- Provide bins for the collection of domestic waste.
- Dispose of waste at suitably licensed landfill sites.
- Dispose of hazardous waste (oil, grease, chemicals etc) at licensed recycling facility.
- Site will be monitored through regular inspection of site facilities.
- Emergency Response procedures in particular for hazardous waste to be developed
- Records of all inspections to be kept.

## 14 DUST MANAGEMENT PLAN

### Objectives

To minimise the potential for deterioration of the quality of air due to dust from construction related activity. Issues may arise from the processing of aggregate, concrete batching, excavation and blasting; road upgrades and potential discharges from dust from machinery and vehicles on the construction site and access roads.

### Methods

All practicable measures shall be undertaken to reduce dust and emissions on site to achieve compliance with relevant District and Regional Plans and consent conditions to provide a safe working environment and to avoid disturbance to other receptors offsite.

Dust management methods outlined in plan are to include:

- Methods for management for processing of aggregate, manufacturing concrete, excavation and blasting;
- Methods for the development of site borrow areas and construction areas including the staging area;
- Methods for vehicle movement on haul roads, including speed limitations in close proximity to local residences, and ensuring a high level of maintenance on haul road occurs;
- Methods for the dust management during the construction of coffer dams.

The dust/air quality management strategies include, but are not limited to the following:

- Dust suppression at aggregate processing plant including use of sprinklers and water nozzles if required
- Road maintenance/sealing to ensure optimal surface conditions
- Application of water to heavily used roads via water carts
- Dust emission due to blasting and use of extraction equipment to be minimised through wetting rock face
- Consultation with local residents about dust during construction; identification of areas which are sensitive to the effects of dust (e.g., houses, specific crops, dairy sheds etc) and identification of specific measures to avoid, remedy or mitigate the effects of dust on these sites
- Vehicles and generators will be required to meet relevant emission criteria and site speed limits to be enforced
- All practicable measures will be made to limit the duration and frequency that dust and sand associated with construction activities is discharged into the air
- Community complaints procedure for detection of any adverse dust effects
- A Contingency Plan (in the event that dust emission limits are exceeded) to be developed

## 15 NOISE MANAGEMENT PLAN

Although there are no immediately adjacent dwellings to the Mokihinui hydro scheme, construction activities will include numerous potentially noisy processes over a number of years. Accordingly a noise management plan will be prepared to address these potential issues.

The cumulative noise from operational sources is predicted to comply with the Buller District Plan noise limits at adjacent properties and generally will not be audible.

### Objectives

To avoid, remedy or mitigate the impacts from noise arising from construction activities.

### Methods

All practicable measures shall be undertaken to reduce noise levels from plant, equipment and personnel operating on site to achieve compliance with any conditions of consent, District Plan and construction standards to provide a safe working environment.

The mitigation and management strategies that will be employed are outlined below:

- 
- Blasting to occur at set times of the day (eg between 9.00am – 5.00pm Monday to Sunday) and will occur at set intervals during the day determined in consultation with the consent holder and the community liaison group.
- The programme of agreed blasting times shall be notified publicly by way of temporary notice erected at the road entrance to the construction area and by a circular or public newspaper advertisement prior to any blasting taking place.
- Batching plants to be fitted with noise screening.
- Undertaken aggregate processing and stockpiling as far as practicable during daylight hours.
- Restrictions on truck movements through Seddonville at night, road improvements and speed restrictions (associated also with dust mitigation).
- Workshop to be fitted with appropriate sound mitigation measures.
- Monitoring of noise levels adjacent to site to ensure compliance with NZS 68023:1999.
- Noise associated with helicopter landings shall be measured and assessed in accordance with NZS6807:1994 – Noise Management and Land Use Planning for Helicopter Landing Areas.
- Undertake the construction (including implosive jointing) of the transmission line during daylight hours.
- A Contingency Plan (in the event that noise limits are exceeded) to be developed.

## 16 CONTAMINATED SITES

There is some limited potential for sites to be uncovered on the route which are contaminated. Where such a site is uncovered during construction, the West Coast Regional Council and the Buller District Council will be notified and the construction team will propose a method for remediation of the site. This could include:

- removal to a nearby adjacent site that is properly prepared for the contaminated material (most likely for very low level contamination)
- removal to an approved off-site disposal facility.

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## 17 ARCHAEOLOGICAL AND HERITAGE PROTOCOLS

### Objectives

To manage any potential or actual construction effects on any cultural, archaeological or heritage sites (either identified prior to construction or unearthed during the construction phase).

### Methods

Prior to the start of any construction, Meridian will undertake an archaeological survey of the historic packtrack, Seatonville and Jones Creek Battery areas and the transmission line route. The survey and reporting shall be carried out by an appropriately qualified archaeologist and will be submitted as part of the ECMP.

A map outlining the area potentially affected by the construction activities with all items of significance plotted shall be prepared and submitted. All items listed as being of significance shall be catalogued, relocated and presented in an appropriate manner under the guidance of an appropriately qualified archaeologist and in consultation with the West Coast Regional Council, the Buller District Council and the Historic Places Trust. It is noted that prior to this being undertaken an Archaeological Authority is required prior to any disturbance or relocation of any artifacts is permitted.

Prior to the start of any construction, training will also be given to all construction staff by the Project Archaeologist regarding methods of identifying, reporting and managing features of archaeological significance.

The following protocols will be adhered at all times during earthworks and construction activities:

If any artefacts or historical, cultural or archaeological material (including any artifact), is found or uncovered whilst undertaking construction work, then the following shall be undertaken:

- Work shall cease immediately within a 50m radius of the artifact or cultural, historical or archaeological material;
- Advice of the discovery shall be given, as soon as possible, to Ngati Waewae, and the Project Archaeologist (who will in turn contact the necessary authorities including the Historic Places Trust); and
- No work shall recommence until 72 hours after advice has been given to iwi, the Project Archaeologist and the Historic Places Trust or agreement reached between the parties regarding appropriate protection measures, whichever is the sooner.

If during construction any pounamu is accidentally discovered, the following shall be undertaken:

- Reported to Ngati Waewae's Land and Environmental Portfolio Team Leader as soon as is practicable.
- Any artifact made of pounamu discovered or found within the project area on land administered by the Department of Conservation should be left

untouched and notified immediately both the local Department of Conservation Officer and Ngati Waewae's Land and Environmental Portfolio Team Leader. If the artifact happens to be collected it should be handed directly to the local Department of Conservation Officer along with all information about the find and Ngati Waewae's Land and Environmental Portfolio Team Leader is to be notified.

- Any artifact made of pounamu discovered or found on all other land within the project area should be left untouched and notified immediately to the local regional museum and Ngati Waewae's Land and Environmental Portfolio Leader. If the artifact happened to be collected it should be handed directly to the local regional museum along with all information about the find and Ngati Waewae's Land and Environmental Portfolio Team Leader is to be notified.
- All pounamu discovered, other than through authorised collection, cannot be removed without consultation with Te Runanga o Ngai Tahu and authorisation from Ngati Waewae.

## 18 LANDSCAPE AND REHABILITATION PLAN

### Objectives

To ensure that all construction areas not subject to operational buildings, permanent structures and access roads are rehabilitated as far as practicable to a natural state, taking into account the time it takes for rehabilitation to occur.

To ensure that all operational buildings, transmission poles and permanent structures are designed and finished in colours that are muted and consistent with the colours of the surrounding landscape.

### Methods

Prior to the commencement of earthworks and construction activities to establish the scheme, a rehabilitation plan is to be prepared which outlines the following:

- All cuts, fills and embankments are graded and formed to the extent reasonably practicable so that they appear as natural extensions of the adjacent landforms and landscape patterns;
- All areas of disturbed spoil disposal, vegetation clearance and soil disturbance shall be rehabilitated;
- The Stormwater Management Plan shall remain in place until cover has established on exposed surfaces;
- The transmission poles, substation and the power house are to be designed and finished in colours that are muted and consistent with the colours of the surrounding landscape;
- The penstocks and other built elements are finished or painted and maintained in an appropriate colour that integrates with the landscape;
- Rehabilitation, including planting around the staging area and proposed details of species location and selection (which is to be undertaken in consultation with the Department of Conservation), plant density, maintenance and pest control (refer to Terrestrial Ecology Management Plan and Habitat Enhancement and Predator Control Plan).
- On completion of work at any location, all plant, equipment, fuels, hazardous substances, buildings, fencing, signage, debris, rubbish and any other materials brought onto site shall be removed, and the site left clean.
- Parking areas to be provided for recreational users accessing the upper valley.
- Walking tracks and picnic areas to be considered as part of the long term development planning process to enhance local amenity values.

## 19 RISK MANAGEMENT PLAN

### Objectives

The objective of the Risk Management Plan is to identify potential risks and determine a strategy for management with the options being to avoid, to mitigate, to transfer or to accept.

### Methods

Meridian will be required to develop and maintain on a regular basis a risk register that provides at a minimum the following core areas:

- Health and Safety
- Environmental
- Cost / Financial
- Technical
- Existing Operations
- Political
- Timing
- Procurement
- Public Interface

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## 20 VERMIN CONTROL AND WEED MANAGEMENT PLAN

Vermin control and weed management during construction relates predominately to ensuring good practice construction methodology is employed. Longer term weed and pest management and rehabilitation methods are contained in detail in the Terrestrial Ecology Management Plan and habitat enhancement and predator control elsewhere in the catchment is discussed in the Habitat Enhancement and Predator Control Plan.

### Objectives

The objectives of the Vermin Control and Weed Management Plan are to:

- Minimise the introduction and spread of mammalian pests during the dam construction and site restoration activities;
- Minimise the introduction and spread of invasive weeds through the dam construction activities.

### Methods

#### Vermin Control

Pests including possums, rats, mice, ferrets, stoats, feral cats and deer have the potential to destroy flora and fauna during the construction period and establishment period of plants used in the site restoration programme. The objective of this plan is to ensure that good practice construction methodology is employed to minimise the introduction and spread of mammalian pests during the dam construction and site restoration activities.

Key issues relate to activities in and around the construction staging area and dam site which have the potential to introduce and harbour mammalian pests, such as rats and mice.

The key management strategies to avoid this include, but are not limited to:

- Maintain a tidy site through good house keeping practices
- Ensure that rubbish and food scraps are disposed of correctly. Composting may not be appropriate on this site.
- Utilise fixed Broadifacoum stations around the site and site buildings to control rats and mice. A Broadifacoum tablet can be nailed to a board or tube to allow rodents to feed, but eliminates the ability for pests to stockpile pellets.
- Check and replace poison regularly when eaten or spoiled.

#### Weed Management

Surfaces exposed during the construction and restoration periods present an opportunity for invasive weed species to become established. Often these species can hinder or even prevent the development of native species used for site restoration. These weeds require control by the most appropriate means recognising the type of weed to be controlled and the other species requiring protection. The key objective of this plan is to minimise the introduction and spread of invasive weeds through the dam construction activities.

The key issue is the clearance of vegetation creates open ground ideal for the establishment of weeds. In addition, the movement of vehicles and people have to potential to introduce and spread weeds around the site. The following measures will be employed to minimise any potential adverse effects arising:

- Minimise open areas of bare soil. Where practicable, mulch or plant open areas.
- Conduct regular weed control monitoring in and around the site.
- Ensure that the weed control contractor can accurately distinguish native from exotic plants, including mature and immature plants.
- Suitable control for weeds includes manual, mechanical and chemical methods, as appropriate. Manual and mechanical control is preferable to chemical methods, where appropriate.
- If using chemical weed control, ensure that the contractor is Growsafe<sup>®</sup> accredited.
- When spraying, use a marker die to identify sprayed areas.
- Sprays used should be the least toxic option to control the weed in question. Target the type of spray to be used for the weed to be controlled. A broad spectrum spray is not suitable in all situations, particularly around planted areas.
- Keep a record of weeds controlled on the site.