IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application by Meridian Energy Limited for resource consents for the Mokihinui Hydro Project

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STATEMENT OF EVIDENCE OF CLIFFORD JOHN MAXWELL TIPLER ON BEHALF OF MERIDIAN ENERGY LIMITED

ANDERSON LLOYD
LAWYERS
DUNEDIN

Solicitor: Stephen Christensen/
Philippa Jones

Level 10, Otago House
Cnr Moray & Princes Street,
Private Bag 1959,
DUNEDIN 9054
Tel 03 477 3973
Fax 03 477 3184

1. QUALIFICATIONS AND EXPERIENCE

1.1 My full name is Clifford John Maxwell Tipler.

1.2 I am an Environmental Engineer with 29 years of experience. I hold the qualifications BSc (1976), BE (Hons) (1979) from the University of Canterbury.

1.3 I am a member of the Institution of Professional Engineers of New Zealand, and a Past President of the New Zealand Water and Wastes Association. I am the Chairperson of the Water Industry Training - Training Committee and the Deputy Chairman of the Agriculture Industry Training Organisation.

1.4 I am currently employed as a Senior Principal of the Christchurch office of URS New Zealand Ltd.

1.5 I have been involved in numerous hearings before territorial authorities and the Environment Court in relation to developments that involve the use of water and discharges of contaminants.

1.6 I was one of two Commissioners appointed by the Canterbury Regional Council to hear in excess of 2000 submissions on its Proposed Natural Resources Regional Plan, Chapters 1, 2 and 3. Principally this was to hear the “Air” sections of the Regional Plan.

1.7 My most recent experience in resource consent applications includes consenting for the construction and operation of the Central Plains Water Enhancement Scheme including the construction of an earth embankment dam storing 280,000,000 m^3 of water, and construction and operation of the ocean outfalls for Christchurch City Council and Waimakariri District Council.

1.8 In addition to these I have been involved in obtaining resource consents for a wide range of primary industries including meat processing plants, fellmongeries, tanneries and intensive pig farming operations involving the discharge of contaminants to air and to water..

1.9 I have read the Code of Conduct for Expert Witnesses (Rule 330A, High Court Rules and Environment Court Practice Note) and I agree to

comply with it. I have complied with it in the preparation of this statement of evidence.

1.10 I have been involved in the following work in relation to Meridian Energy Limited's (Meridian's) Mokihinui Hydro Project (MHP):

a. Evaluation of stormwater volumes, quality and control measures for the dam construction site.

b. Stormwater and erosion control measures for the power pole construction to the site; and

c. Wastewater disposal methodology from construction activities and from site accommodation;

And this culminated in the preparation of a report "Mokihinui Hydro Proposal – Construction Effects and Management Report" (URS November 2007) ('the report"). I have prepared my statement of evidence in reliance on this work.

1.11 I have also reviewed:

a. The reports and statements of evidence of other experts giving evidence on behalf of Meridian relevant to my area of expertise, including:

i. *Dam design evidence of Mr Peter Amos*

ii. *Mokihinui 110KV Line, Tee Line from Mokihinui Hydro Generation Scheme Constructability Report, August 2007*

iii. *Hydrology evidence of Mr Roddy Henderson*

iv. *Sediment evidence of Dr Murray Hicks*

v. *Terrestrial Ecological evidence of Dr Ruth Bartlett*

vi. *Construction Effects evidence of Mr Ron Fleming*

vii. *Traffic evidence of Mr Andrew Whaley*

viii. *Noise evidence of Dr Stephen Chiles*

ix. Water Quality evidence of Dr Bob Spigel

2. SCOPE OF EVIDENCE

2.1 I have been asked by Meridian to prepare evidence in relation to the actual and potential effects on the environment of the construction of the MHP within the Mokihinui Gorge. This includes:

a. Effects of the construction on Water Quality

b. Effects of the construction on Air Quality

c. Management Plans to ensure environmental compliance

3. EXECUTIVE SUMMARY

3.1 Water required for construction activities will be sourced from the Mokihinui River and will be of a quality suitable for this intended use. Water needed for potable use will be treated.

3.2 Stormwater will be managed on the site through the use of cut off drains, diversion channels and retention ponds. The primary contaminant of concern in stormwater is sediment, and the retention ponds will be effective in reducing sediment discharges to acceptable levels. The retention ponds also provide protection to the river in the event of a hazardous substances spill.

3.3 Domestic wastewater produced on site will be collected in a reticulation system and treated by septic tank treatment plants prior to discharge to infiltration beds and soakage to the river. The volumes of treated wastewater will be small compared to the flow in the river and therefore once the seepage reaches the river there will be negligible effects on water quality.

3.4 The construction of the transmission lines will involve the construction of access roads and building platforms. Stormwater discharges from these will carry sediment into the local streams. Best practice will minimise these effects, which will be small in scale and temporary.

3.5 The discharges to air relate to engine discharges and dust. Potential effects from engine discharges are very localised and for larger plant such as stationary generators can be avoided largely by providing appropriate discharge stacks. The combined effects of all mobile and stationary plant on site will be minor.

3.6 The potential effects from dust arise from a large number of sources and these will require good management practices to minimise the impact. The use of water to suppress dust will be the major mitigating measure. Nevertheless the site is sufficiently remote from residential properties that dust effects will be minor at these properties. The road upgrading works will require special attention as they pass residences along the access roads. This however will be no different from many road construction activities throughout New Zealand and roading contractors are experienced in controlling the adverse effects from these.

3.7 The management, monitoring and reporting of impacts on the environment is a critical step in ensuring environmental targets are being achieved and all statutory approvals are being complied with. As such, detailed Management Plans will be developed for a number of site specific issues in order to carry out a monitoring and reporting system with the overall objective of achieving a world class engineering and environmental project.

3.8 An Environmental Construction Management Plan (ECMP), will be prepared, which will be the over-arching document for environmental compliance. Within the ECMP there will be sub-plans to address specific issues as outlined in my evidence.

4. THE PROPOSAL

4.1 I confirm my evidence is based on the project proposal as described in the Assessment of Environmental Effects, accompanying the applications.

5. DESCRIPTION OF CONSTRUCTION ACTIVITIES

5.1 The construction activities have been described in the evidence of Mr Ron Fleming, and Mr Ray Brown describes the construction of the transmission line and I adopt their descriptions.

6. ACTUAL AND POTENTIAL EFFECTS WATER QUALITY

6.1 This section discusses the effects on water quality from the construction activities associated with the MHP. This includes:

- Water supply

- Stormwater discharges from the staging area
- Wastewater from amenity facilities
- Wastewater from concrete batching plants
- Stormwater and sediment control associated with the construction of the transmission line

Water supply

6.2 A water supply is required for the site to provide water for domestic use on site, toilets and fire fighting, aggregate production, concrete production, concrete water blasting, drilling and other general construction uses. The water supply will be sourced from the Mokihinui River. The estimated daily demand for the construction site will be in the order of 450 m^3/day; however, this could increase up to 650m^3/day depending on the concrete production rate for the dam. Approximately 30 m^3/day will be for domestic use, based on a workforce of approximately 310 people.

6.3 I understand from the evidence of Dr Spigel that the Mokihinui Rivers water quality is above national averages and typical of West Coast Rivers. It is anticipated that the volume of suspended sediments will be low for the majority of the year. The use of an infiltration gallery for abstraction will be sufficient to prevent an excessive volume of solids entering the supply system.

6.4 The water supply to the construction site will be to two specific areas, the amenities building and offices to the west of the site and the concrete batching plant. Small water treatment plants will be provided at each location to treat water for potable use, however, it is anticipated that the water from the river will meet the specification for use in concrete production and no treatment would be necessary for production, wash down or general construction water on site. A general layout of the water supply system is shown in Figure 4 of Appendix A.

6.5 As the volume of water proposed to be taken is so small in relation to the flow in the Mokihinui River, even when the river is at low flow, the effects of the take from the river will be less than minor.

Stormwater Management

6.6 The proposed dam construction area is located at the base of steep sloping tree and bush clad hill country adjacent to the Mokihinui River. The staging area will be located on the true left bank of the River where the River transitions from the gorge to open floodplain area. It will be located along the base of the hill on an area with slopes ranging from 1 vertical in 5 horizontal – 1vertical in 10 horizontal.

6.7 Soils on the hill country are likely to be shallow organic material overlying rock, transitioning to alluvial gravels at the base of the slope. Stormwater flows will be significantly attenuated by the vegetative cover and will percolate to ground through the gravels adjacent to the river or drain to small surface channels. Overland flow to the river would only occur during more extreme rainfall events.

Proposed site layout and drainage

6.8 The construction site will include the dam site, including the diversion channel and upstream and downstream cofferdams, and the staging area used for the storage of plant and materials, the winning of aggregate and production of concrete for the dam as shown on Figure 1 in Appendix A.

6.9 The staging area will be excavated into the slope on the true left bank of the River just downstream of the dam site and will occupy a total gross area of approximately 26 ha. The surface of this area will consist of alluvial sands and gravels and may include rock at the back of the site where cuts of up to 10m will be required. The surface of the staging area will be profiled to allow drainage in a northerly direction to a perimeter drainage channel which will collect surface runoff from the construction site. The perimeter drain will transport runoff to settlement ponds in the northwest corner of the site before it is discharged to the river. Figure 1 in Appendix A depicts the working site contours falling towards the north-west corner of the site. Figure 2 in Appendix A depicts the proposed catch drains and cut off drains that discharge into the retention pond.

6.10 The main contaminant in the stormwater discharge from the staging area will be suspended sediments from stockpiles, aggregate production areas and material entrained in overland flow across the site. Other

potential contaminants will include low concentrations of hydrocarbons and metals typically associated with vehicle use.

6.11 During construction, stormwater from the true left bank section of the dam will discharge to the staging area. Stormwater from the true right bank section of the dam will discharge to the excavated area of the river bed between the temporary cofferdams. The drainage from the dam immediately adjacent to the diversion channel will be diverted to the river bed excavation, however, there is potential for small volumes of runoff to discharge directly to the diversion channel at the upstream face of the dam, and I refer to Figure 2.

6.12 A bypass channel as described in the evidence of Mr Fleming will be excavated during the early stage of the works to accommodate the river flows during the dam construction.

6.13 Following construction of the bypass, river flows will be diverted from the existing channel and cofferdams will be constructed upstream and downstream of the dam site to allow excavation and construction of the foundations.

6.14 Dewatering of the cofferdam will be carried out using pumps located in low points of the excavation upstream and downstream of the dam site. The pumps will operate 24 hours a day and will discharge into the adjacent diversion channel.

6.15 As outlined above, all stormwater runoff from the staging area will flow to a perimeter drain and settlement ponds for treatment prior to discharging back to the river. The existing vegetative cover will be retained along a riparian margin approximately 20m wide between the staging area and the river channel.

6.16 Stormwater runoff from the slopes to the south of the staging area will be intercepted by a perimeter drain around the top of the cut slope for the staging area and the access road to the dam crest. This water will be diverted to a channel along the western boundary of the site and out to the river.

6.17 Stormwater runoff from the dam will be collected in a bunded area in the excavation immediately downstream of the dam to allow settlement of sediment before discharging to the dewatering sump and being pumped back to the River as part of the dewatering process.

6.18 The stormwater drainage system will be designed to accommodate runoff flows with an Annual Exceedance Probability (AEP) of 10%. Peak flows and runoff volumes from the staging area for the design event are provided in Table 1.

Table 1: Stormwater Flows for the 10% AEP event

Event Duration	1 hour	2 hour	6 hour	12 hours	24 hours
Flow L/s	85	61	36	26	18
Volume m^3	307	440	778	1114	1595

6.19 Potential contaminants in stormwater from the dam construction include suspended sediments and elevated pH. In addition to stormwater discharges from the dam, there will periodically be wastewater from the dam as a result of water blasting to prepare joints following breaks in concrete placement. This wastewater will have a high pH and elevated concentrations of sediment. Runoff from water blasting will be collected in the area downstream from the dam. This water will then be pumped up to the primary settlement ponds that receive wash water from the batching plant.

Stormwater treatment ponds

6.20 The stormwater treatment ponds will be constructed during the initial phase of the site establishment to allow collection and treatment of runoff from the staging area as it is excavated. The ponds will provide retention allowing suspended sediment to settle prior to the discharge to the river. The pond or ponds, will be unlined and it is anticipated that the majority of the stormwater from the staging area, during site establishment, will infiltrate to ground through the gravels in this area. The base of these ponds will gradually seal over time.

6.21 The proposed volume of the settlement ponds (approximately 2,000m^3) will ensure a high level of treatment providing removal of greater than 75% of particles down to medium silt size. Hydrocarbons and metals in the runoff from the staging area will be bound to sediments and retention of these sediments in the settlement pond will provide an efficient

method of removal of these contaminants. The pond design depth will be in the order of 1 – 1.5m but will be constructed at least 0.5m deeper to allow for sediment storage. The depth of the pond will be monitored and sediment removed as required to maintain design capacity. A forebay will be constructed immediately upstream of the settlement pond to remove coarse sediments and minimise the frequency of sediment removal from the main settlement pond.

6.22 The proposed mitigation measures will minimise stormwater flows through the site and provide a high level of treatment for sediment, metals and hydrocarbons that may be entrained in the site stormwater discharges. The settlement ponds will allow retention of more than 75% of sediment in stormwater runoff from the 10 % AEP event and will provide an even higher level of retention for smaller events. Given the level of dilution that will be provided by the river flows and the sediment concentrations during high flow conditions, the impact of the discharge of sediments, hydrocarbons and metals in stormwater from the site will be less than minor.

Concrete batching plant wastewater

6.23 Washwater from the batching plants and concrete truck wash areas along with stormwater from the immediate vicinity of the batching plant will discharge to a primary settlement pond system. This will consist of multiple ponds providing a total retention time of at least 48 hours to allow settlement of sands, grits and cement particles, before discharging to the stormwater system. Where possible, water from this system will be recycled for use as washwater to minimise volumes discharged. The retained sediments will be removed on a regular basis and those not suitable for reuse within the concrete plant or for construction material will be disposed of to a suitable location off site.

6.24 The stormwater from the dam, the washwater from the batching plant and wastewater from water blasting will have an elevated pH. The proposed system will provide dilution of these discharges by combining them with stormwater from other areas of the site in the settlement pond or with groundwater infiltrating into the river bed excavation downstream of the dam. Pumped volumes from the river bed excavation and

discharges from the settlement ponds will be small compared with river flows which will provide dilution ratios in excess of 5000:1.

Cofferdam and diversion flows

6.25 Construction of the cofferdam and diversion of flows down the bypass channel will be carried out by bulldozing bed material across the channel at the upstream and downstream locations. This will occur when flow in the river is low and will result in elevated sediment concentrations in the river as material is dozed into the channel and from the initial flush through the bypass channel. There are no practical mitigation measures to control this discharge, however, the majority of the material will be relatively coarse silts and sands and a high proportion of the material will settle out in the channel immediately downstream from the site. The duration of sediment discharge (likely to be less than 24 hours) and the total sediment load will be small in comparison to natural flood events and therefore there will be no greater effect on water quality in the river than that which occurs naturally several times each year.[1]

6.26 As described in the evidence of Mr Fleming, there may be a need to deposit fine silty material to the river bed upstream of the cofferdam to reduce seepage. Some of this silty material may wash through the cofferdam as it seals and would therefore affect the water quality down stream. The quantity of silt that may migrate in this manner will be very small compared to the sediment naturally carried by the river during flood periods and while a slight discolouration of the water may occur, this effect will be minor and temporary.

Dewatering discharges

6.27 The discharge from the dewatering of the river bed excavation within the cofferdam area may contain elevated concentrations of sediment during the initial stages of the dewatering process as finer material is flushed from the adjacent in situ material. However, this will reduce over time and the natural filtration that occurs as the water percolates through the gravel will result in relatively clean groundwater being discharged.

[1] Mokihinui River Proposed Hydropower Scheme: Sediment Report – November 2007

Wastewater discharges

6.28 It is estimated by DamWatch Services Ltd that during peak construction periods there will be approximately 310 personnel on site generating approximately 26 m^3/day of domestic wastewater. Two temporary wastewater treatment plants will be established at site for the duration of the construction period for the disposal of domestic wastewater from the toilets, showers and other amenity facilities. These will be package treatment plants discharging to a subsurface disposal field. The layout of the proposed sewerage system is shown in Figure 3 in Appendix A.

6.29 Discharges to groundwater from the site will include stormwater and domestic wastewater from the treatment system disposal field. Sediments and adsorbed contaminants in the stormwater discharge will be filtered out and retained in the surface soils as the water percolates to ground. Discharges from the wastewater treatment plant and elevated pH in the stormwater discharge will be attenuated as they percolate through the soil profile and will be diluted by groundwater flows. Therefore any impacts on groundwater quality would be minor and localised. There is no groundwater use within 500m of the site.

6.30 The treatment system proposed utilising septic tanks with internal filters will provide a relatively high quality effluent such that after passing through the infiltration beds, and passing through the stormwater retention ponds, the effects on the river will be minor.

6.31 The principal parameters of concern in relation to this discharge are faecal coliforms (as an indicator of public health risk) and ammonia (for its toxicity to fish and its ability to promote undesirable algal growth).

6.32 The 7 day mean annual low flow in the Mokihinui River[2] is 16.1 m^3/s. If the wastewater discharge mixes with only 10% of this flow given that the discharge will occur along the bank, then the available dilution is 5,350 times.

6.33 The faecal coliform concentration in the discharge is expected to be approximately 10^4 - 10^5 no./100mL after treatment. Therefore after reasonable mixing, the faecal coliform concentrations within the river will

[2] Notes on Mokihinui River Hydrology – NIWA Client Report:CHC2007-058 May 2007

be in the order of 2 – 20 no./100mL and will be well below the standard associated with contact recreation of 200 no./100 mL. I do note however that the preferred indicator of public health risk for bathing in freshwater is E coli. When assessing the microbiological status of freshwater, a Microbiological Assessment Category grade of A can be assigned if the 95%ile is less than 130 E coli/100mL. Similarly if monitoring shows that no single sample is greater than 260 E coli/100mL an Acceptable/Green Mode status can be assigned. Given that faecal coliform numbers will be greater than E coli numbers, and in the absence of any realistic data relating to the discharge or the river water quality, and the low risk indicated above, I do not see a need to undertake a full risk based assessment as outlined in the "Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas" (MfE 2002).

6.34 If there was no reduction in the ammoniacal nitrogen in the wastewater, it could be assumed that the concentration would be approximately 40 g/m^3 and therefore after mixing the in-river concentration would be $0.008g/m^3$ which is similar to the existing concentration in the river water (refer to evidence of Dr B Spigel) and this is well below any level that could cause a concern in relation to toxicity to fresh water fish or for the creation of undesirable algal growth (refer to ANZECC 2000 water quality guidelines).

6.35 The potential effect from the discharge of treated wastewater in the manner proposed will have less than minor effects on the Mokihinui River.

Mitigation measures

6.36 Prior to commencing construction an Environmental Construction Management Plan (ECMP) will be prepared for the project. The ECMP, in addition to documenting items such as site activities, construction methods and consent requirements includes a stormwater and wastewater management plan and a spill contingency plan. These plans define the control measures that will be put in place and procedures that will be adopted during construction for the specific areas of the site along with operational, maintenance and monitoring procedures. The plans will be reviewed on a regular basis and modified as required. Relevant

sections of the plans will be included in the induction and training sessions for site personnel.

Summary

6.37 Discharges of stormwater and wastewater will be treated prior to discharge and in determining the discharge methods, the sensitivity of the receiving environment has been taken into account. The discharges from the staging area will be temporary in the sense that it will only be during the construction period. Given the location of the site, there are no other alternative methods of discharge. In my opinion provided the mitigation measures suggested are adhered to, the discharges will not give rise to:

a. The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:

b. Any conspicuous change in the colour or visual clarity (excluding coffer dam construction):

c. Any emission of objectionable odour:

d. The rendering of fresh water unsuitable for consumption by farm animals:

e. Any significant adverse effects on aquatic life.

6.38 There is the possibility that a discharge of sediment may occur during the construction of the coffer dam and this may alter the colour or visual clarity of the water. In my opinion any such discharge would only be temporary and I have outlined earlier high sediment loads can occur during flood events.

TRANSMISSION LINE CONSTRUCTION EFFECTS ON WATER QUALITY

6.39 The construction of the transmission lines substation at Cedar Creek and associated access roads will be carried out using best practice methods to minimise erosion and the associated adverse effects on the local waterways from elevated levels of suspended sediments. A summary of these methods is provided below. As a preliminary point I note that in areas where it is proposed to use helicopter access, the impacts will be limited to clearance and construction activities associated with pole sites, as there will be no associated tracking required.

Diversion of runoff

6.40 Stormwater flows will be diverted by bunds or drainage channels to protect work areas and access tracks from up-gradient runoff. Runoff diversion channels will be designed to accommodate flows from events up to the 5 year return period event. Diversion channels will include turnouts into existing drainage paths at regular intervals to avoid concentrations of flow. Diversion channels or bunds on grades > 2% will be armoured where required to prevent scour.

6.41 The substation at Cedar Creek will include a cut off drain around the site that will provide permanent diversion of stormwater away from the site. During construction, a small retention pond will be located downgradient of the site to collect and store any sediment that runs off the site. This will perform much in the same manner as that proposed for the main staging area, but will be considerably smaller. Details of the substation are provided in the evidence of Mr Ray Brown. During and after construction, the effects from stormwater runoff from the substation site will be no more than minor.

Wastewater Discharge

6.42 As discussed in the evidence of Mr Brown, there will be a small septic tank installed at the substation site. The site will not be permanently manned and therefore the use of the septic system will be very rare. Discharges when they do occur are likely to be less than 500 litres per day. It is my opinion that this discharge will be a permitted activity under Rule 6 in the WRCP, in that it will meet the following conditions:

a) the discharge does not exceed 2000 litres per day (calculated as a weekly average);

b) the discharge is not within:

50m of any water body;

50m of any coastal water;

100m of any bore or well used for potable water supply;

c) the system is designed with a minimum of 24 hours effluent retention time;

6.43 Not withstanding the above, the discharge will not result in any effects that in my opinion will be more than minor.

Clearing of bush

6.44 Where bush exists at pole locations it will be cut down, and cut into smaller logs by chainsaw and left to decompose on site. Vegetation higher than 3m and within 10m of the transmission line must be removed due to its proximity to overhead conductors. This will be cut down at ground level and left to decompose along the line route. This operation will not disrupt the soil, therefore minimising erosion potential. Logs left on site will also protect the soil below from rainfall impact reducing the erosion potential until regeneration begins.

Foundations

6.45 Approximately 35 pole sites will require dug foundations. These sites will be dug with hydraulic excavators and backfilled with local or imported materials.

6.46 The works will create stockpiles of clay and gravel with excess material being potentially left on site after backfilling is complete. This material will be profiled to match the contours of the area and if necessary covered with a geotextile or erosion protection matting to prevent sediment erosion until revegetation occurs.

6.47 Stockpiles in the vicinity of waterways will be protected by silt fences to prevent the direct runoff of silt laden water into local waterways. In other areas overland flow through leaf litter and associated organic matter will provide a high level of filtration and will prevent sediment discharges to waterways.

6.48 Construction on or near steep slopes will require runoff to be diverted from the exposed soil to minimise erosion.

Works near watercourses

6.49 All works in close proximity to watercourses will need to be carefully managed to restrict sediment and materials from entering the water courses. Extra measures such as silt fences, diversions trenches and covering of exposed soils will need to be taken.

Road / track construction

6.50 Construction of tracks and roads for access equipment will be carried out in a staged manner with completion of the road formation and installation of the drainage system following on immediately from excavation. This will minimise potential for uncontrolled discharge of sediments to adjacent waterways. The tracks will be constructed to a standard suitable for medium sized trucks and earthmoving equipment. Shorter tracks serving only one pole will be formed by trimming and compacting cut surfaces. Longer tracks serving several structures will have a gravel surface to minimise erosion due to traffic movements.

6.51 A review of the proposed transmission line alignment indicates that the only major access road required for the transmission line construction will utilise an existing forestry track. This track crosses a number of streams and potential flow paths and it is unclear what condition the crossings are in and whether upgrading is required. Where gradients and flows allow, fords will be constructed. Where upgrading or construction of new culverts is required the culverts will be sized to accommodate flows from the 5 year return period event and the access road formed to allow larger events to flow over the road in the immediate vicinity of the culvert.

6.52 Where possible, the construction or upgrading of crossings will be carried out during periods of low or no flow. Works within stream beds will only be required for access to the pole sites and will be kept to a minimum. Where possible stormwater will be diverted away from the excavation activities to minimise entrainment of sediment.

Specific control measures

6.53 The construction area has been divided into zones based on the topography, existing access, vegetative cover and proposed method of construction. These zones are defined based on the pole numbering shown on the plans in Appendix 1 of the Linetech Ltd report[3] and as discussed in the evidence of Mr Brown. The construction issues and mitigation measures for the specific areas are discussed in the report, but in general follow the methods of construction and the effects outlined

[3] Mokihinui 110KV Line, Tee Line from Mokihinui Hydro Generation Scheme Constructability Report, August 2007.

above. In summary, where possible the poles will be placed and methods used will minimise vegetation clearance, earthworks and possible sediments discharges. These are not repeated herein.

Summary

6.54 Access for the construction of the transmission line will be generally be via existing roads or by helicopter with only relatively small sections of access road needing to be constructed. This will minimise earthworks and the resulting potential for discharges of elevated concentrations of sediment in stormwater discharges. Cleared vegetation will be left onsite to protect surface soils from direct rainfall impact and reduce surface flow velocities. This material will also aid re-establishment of low level vegetative cover which will assist in ongoing prevention of erosion along the transmission line corridor.

6.55 The southern section of the alignment will be constructed in an area of exposed sandstone with little or no soils and vegetative cover. No vegetation clearance is required in this area and poles will be constructed using rock anchors. Therefore there will be limited earthworks and no significant sediment resulting from the construction works in this area.

7. AIR QUALITY

7.1 There are a number of activities associated with the construction of the MHP that have the potential to result in discharges to air. These discharges will fall into two broad categories; engine related emissions and dust.

Offsite Vehicles

7.2 Vehicle related emissions will occur both on and off site, with off-site emissions occurring as vehicles move on the public roads to and from the site, and on-site emissions due to construction vehicles in the upper Mokihinui Valley around the dam construction site.

7.3 I consider the effects of the off-site traffic to be less than minor due to the small volume of vehicles involved, the well ventilated nature of the area and the fact that they do not require resource consent.

Construction Plant

7.4 Construction of the dam will require the use of a variety of construction plant such as trucks, excavators and compaction equipment. It is anticipated that the maximum number of plant items or construction vehicles operating at site at any one time will be less than 15.

7.5 The emissions from each of these vehicles will be comparable with an equivalently sized heavy truck.

7.6 Given the small number of construction vehicles, the baseline concentrations of the potential pollutants will be extremely small in this area. Therefore the cumulative concentrations that could occur will also be small, and unlikely to result in ambient concentrations exceeding any regional or national standards or guidelines. As the distance from the construction site to the nearest residential property is over 1 km, I consider that there is little potential for any air quality effects from this construction equipment operating at site.

7.7 While there is no specific mitigation required, the most effective means of mitigation is good vehicle tuning, vehicle maintenance and maintenance of the various roads. Both of these measures will be standard operating procedures and will minimise as far as practicable any emission from this equipment. It will also minimise the contractor's operating costs.

Stationary Engines

7.8 There is insufficient capacity in the existing electricity supply lines to run all of the plant on site. Therefore there will be a requirement for the site to be supplied electricity from a stationary generator set. Estimates of the power requirements for the site are in the order of 3 to 4 MW. Therefore I have assessed the potential emissions associated with a generator of this type.

7.9 The generator will most likely be a diesel fired stationary engine directly coupled to a generator. As such, the emissions will be identical to those associated with the other construction equipment on the site. The only difference will be that the generator will potentially operate at its full capacity for the majority of the time.

7.10 The exact details of the size and number of generation units and the generation capacity required will be dependant to a large degree on the

construction contractor's method of construction and the equipment they have available at the time of construction. Based on generating 3 MW, diesel emissions will be equivalent to those generated by 20 construction vehicles operating on site.

7.11 Given the isolated nature of the area, the relatively short period of time the equipment will be operating and the lack of any significant background concentrations of pollutants, it is considered that there will be no adverse effects from the operation of the generator. In fact it is unlikely that there will be any measurable change in ambient concentrations in Seddonville from the operation of the unit.

7.12 While there are no adverse effects, Meridian operates a best practice policy that would require the following management procedures to be adopted for stationary generators:

- As far as possible always operate at full load, as this is when the equipment is most efficient, and the emissions minimised.
- Ensure that the discharge stack is vertical and unimpeded.
- Ensure that the equipment is well maintained.

Dust Emissions

7.13 The majority of the construction activities at the site will have potential to generate dust. The activities that have the greatest potential to generate dust are:

- Upgrading of the Mokihinui-Seddonville road
- Development of the site borrow area/ construction area
- Processing of aggregate
- Manufacture of concrete
- Vehicle movement on haul roads
- Excavation/blasting of the diversion channel
- Construction of the coffer dams

7.14 I consider that dust generation that might be associated with track formation around the lake is minor, and extremely unlikely to result in any nuisance effects.

7.15 Before discussing “Dust” health effects it is very important to understand that the term “dust” relates to a particulate size fraction, and in particular it is generally the material that is bigger than 50 µm in size. The reason that this is important is that different size ranges can have different effects. In terms of human health it is the material less than 10 µm in size (PM_{10}) that is important. The dust that is potentially generated at MHP is much larger than that (typically greater than 100 µm) and consequently as can be seen in Table 2 following, is not able to be inhaled. There is the potential that very high dust concentrations may result in sneezing, as the body clears away accumulated material, or eye irritation. But these effects are transitory and go away when exposure stops (or soon there after).

Table 2: Dust Removal Efficiency of the Human Respiratory System

Particle Size (microns)	% Removal Efficiency
>10	nearly 100
5	50
2	20
<1	Negligible

7.16 Consequently there is no need to consider the wide range of health effects that are associated with PM_{10}. In addition, the dust will be inert, and will not result in allergic reactions such as those that occur from exposure to household dust consisting of pollen and household detritus (which primarily consists of organic matter). Consequently any emissions associated with the activity will not aggravate asthma or hayfever in susceptible individuals.

7.17 The effect of the dust emissions from the various activities will be similar, with the majority of the particulate being deposited within 300 m of the site. Activities such as proposed at this site would typically confine dust effects to within a zone of 300m from the site. Thus the potential for

causing any downwind dust nuisance effects is restricted to within that distance.

7.18 As the majority of the construction related activities will occur within a relatively small area over a relatively short period of time, the area within which the majority of any potential effects will occur is well defined and centred in the order of 1 km from any potentially affected residences. Therefore I consider that there are no potentially affected residential properties.

7.19 While it is possible to quantify the emissions from these various sources, I consider that there is little point in doing so, as the use of best practice measures outlined in the appropriate Management Plan will reduce any potential effects to minimal levels. In addition, there is a high local rainfall which will keep soils damp and significantly reduces the potential for dust generation and will also clean the surfaces onto which dust may settle.

Wind Directions

7.20 I have not undertaken an assessment of the relative wind speed and direction at the site, however I have visited the site and in my experience the predominant winds will be either up the valley or down the valley. Even when the wind is down the valley, towards neighbours and Seddonville, the effects of dust will be confined within a short distance from the site and will be less than minor at the closest residences to the site; therefore an analysis of wind speed and direction is not necessary.

7.21 Similarly, dust from the construction of the road through Seddonville will be either to one side of the road or the other, both of which have residences and/or sensitive location in close proximity and therefore strict control on construction activities will be required. This also does not warrant an analysis of wind speed and direction.

Local Rainfall

7.22 A summary of the analysis of rainfall data collected at Seddonville for the period February 1970 to June 1992 is provided in Tables 3 and 4. This is the only rainfall data available.

Table 3: Average Rainfall Statistics 1970 to 1992

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Average	232.6	165.1	183.5	228.7	263.9	238.2	233.7	231.3	284.9	278.5	280.0	274.5	2895
Maximum	432.9	305.4	305.4	511.0	481.0	396.8	434.1	434.5	504.2	495.2	441.6	454.5	5196
Minimum	79.5	31.8	68.6	56.0	109.2	102.4	33.7	92.7	80.9	69.9	125.9	136.2	987

Table 4: Other Seddonville Rain Statistics 1970 to 1992

Parameter	Value
Average daily rainfall	8 mm
Maximum measured daily rainfall	176.5 mm
99 Percentile	61.4 mm
75 percentile	8.6
Maximum number of consecutive rain days	28
Average number of consecutive rain days	3.9
Average number of rain events per year	50
Average number of rain days per year	180

7.23 It can be seen from the above tables that the wettest months are typically September to December, with February and March typically the driest and that on average it rains every second day. The longest consecutive period of rain is 28 days, although typically the events last for approximately 4 days.

Potential Dust Effects

7.24 There is little New Zealand or international information available on dust concentrations that can occur from construction projects. However, based on monitoring carried near agricultural activities in dry conditions, soil disturbing activities can generate average total dust concentrations

in the order of 20 mg/m^3 with peak concentrations up to 100 mg/m^3 in the vicinity of the works for short periods of time[4].

7.25 For this project the majority of the construction activities are far enough away from sensitive areas (such as residences) that the concentrations of dust that may be experienced at those sensitive locations will not be above those typically measured in remote rural areas. The exception to that is the upgrade of the Mokihinui Seddonville Road, which will pass close to residential properties. However the potential for nuisance effects from this is considered to be minor, given the high rainfall levels and frequency, in combination with appropriate control measures that will be used.

7.26 There is also the potential for dust to result in effects on vegetation if concentrations on the plants reach a point where there is a significant reduction in the ability of the plants to photosynthesise. However due to the high rainfall along the West Coast (with an average annual rainfall measured for Seddonville of 2.9 m and an average of 180 days per year of rain), any dust generated is likely to be regularly washed from the plants. Therefore I do not consider that there will be any adverse vegetation effects.

7.27 The potential effect of dust on workers on the site will be an Occupational Safety & Health matter and the control of dust on site to reduce the nuisance effects to workers will more than protect the wider community. As an OSH matter is it best assessed once actual construction commences.

Best Practice

7.28 Although I consider that there is little potential for effects from the majority of the construction related activities, I recommend that appropriate mitigation measures are employed to minimise any potential emissions or potential effects. The following mitigation measures are considered appropriate for the various construction related activities.

[4] Marc Schenker , Exposures and Health Effects from Inorganic Agricultural Dusts, Environmental Health Perspectives Vol108 Supplement 4, August 2000, Pages 661-664

These are consistent with the Good Practice Guide[5] prepared by the MfE.

General Mitigation

7.29 The measures that are recommended to be used on the entire project to assist in the mitigation of effects on air quality include:

a. Having a community liaison person who is available to deal with any concerns or complaints.

b. Having an effective complaints procedure, that ensures that all concerns are dealt with as quickly as possible. This procedure will include:

i. Details of the information to be logged (contact details, when the incident occurred etc).

ii. Details on steps required to investigate (activities being undertaken, mitigation measures that were used, weather conditions, etc).

iii. Details on the follow up reporting that will be undertaken (to complainant, management, regulators, etc.)

General Construction Activities

7.30 Construction work will include excavation of aggregates, building coffer dams and construction of haul roads. The following management measures will be used to minimise dust emissions from these activities:

a. Avoid removal and stockpiling of topsoil in wind speeds greater than 5 m/s in dry conditions unless dust controlled by a suitable sprinkler system.

b. A site speed limit of 20 km/h on unsealed construction roads in dry conditions.

[5] Ministry for the Environment, Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions, Wellington October 2001

c. Apart from material required in the production of concrete, material that is placed in stockpiles which will not be disturbed for more than three months will be vegetated as soon as practicable.

d. All finished batters or cuts will be revegetated as soon as practical.

Aggregate Processing Plant

7.31 The aggregate processing plant will have a production capacity of at least 700 tonnes per hour in order to allow for continuous concrete production. This is a large plant by New Zealand standards and will need to have appropriate mitigation to minimise dust generation. In general the most effective method used to control dust from crushing plants is water. It is anticipated that the following will be required to minimise dust generation:

- Water nozzles at the throats of the crushers
- Water nozzles at all conveyor drop points
- Water nozzles on the screens

7.32 In addition to the above the application of water, varying the drop height from the stacking conveyors can also be used to minimise dust from that source.

7.33 During particularly dry periods a chemical additive can be added to water used for dust suppression to reduce evaporation and improve wetting. However, given the high rainfall environment and the location of the site adjacent to the Mokihinui River, this measure is not recommended, despite the relatively innocuous nature of the various compounds available on the market.

Aggregate Storage

7.34 The aggregate produced by the crushing plant will be placed around the site. The processed aggregate will be relatively free of finer material resulting in little potential for dust generation from stockpiles. To further minimise any potential for dust generation I recommend that sprinklers be installed around the aggregate storage area for use during dry windy conditions that may result in on-site nuisance effects.

Concrete Batching Plants

7.35 There will be two concrete batching plants at the site. The first will be a conventional concrete batching plant with an approximate capacity of 50 cubic metres per hour. There is little potential for dust generation with this type of plant as the aggregate is stored in enclosed hoppers and fed directly into the mixer along with the cement. The mixed concrete is loaded into the concrete trucks for transfer to the construction area. This type of plant typically incorporates baghouse filters to control dust generated during the transfer of cement, and fly ash – a by-product from the incineration of coal, from road tankers to the storage hoppers and from hoppers to the mixer. Any dust collected is fed back into the process. Consequently it is considered that there will be little potential for dust generation from this source.

7.36 The second plant will produce the Roller Compacted Concrete (RCC) used in the dam construction. This plant is likely to be a twin shaft continuous mixer (sometimes know as a pugmill) and is likely to have a capacity of 300 cubic metres per hour.

7.37 As there is the potential for the RCC plant to share a common cement and aggregate storage system, the controls described above would also apply to this unit. However if the plant is separate, the same level of control would be applied such that there was minimal potential for dust to be generated by this activity.

Site Roads

7.38 There will be a number of site roads that are required as part of this project. There are three main measures that will be used to control the potential for dust from these roads.

7.39 The first is the imposition of an appropriate speed of 20 km/h, in dry conditions which will significantly reduce dust generation, as dust from roads is directly proportional to vehicle speeds, with lower speeds resulting in lower levels of dust generation.

7.40 The second measure which will be used in dry conditions is applying water to heavily used areas. This is typically done using a water cart at an application rate of 1 litre/m^2/hour to ensure adequate dust control, however, this will vary depending on climatic conditions.

7.41 The final measure will be an appropriate level of road maintenance. Over time, trafficking of the roads results in breakdown of the surface material increasing rolling resistance and the potential for dust generation. The haul roads will be maintained to provide optimum operational conditions. This will involve grading, and the laying of fresh gravel as required.

Upgrade of Mokihinui- Seddonville Road

7.42 The upgrade of the Mokihinui Road through Seddonville, is the activity likely to have the greatest potential to generate nuisance effects, due to the proximity of the road to 10 residences. Therefore it is important that appropriate mitigation measures are used to minimise as far as practical any nuisance effects from this activity.

7.43 In addition to the general measures already described, I recommend that the following additional mitigation measures are used:

a. A dedicated water-cart while road reconstruction is occurring.

b. Avoid undertaking particularly dusty activities such as road sweeping, when winds are likely to carry dust clouds over sensitive areas.

c. Provision of sufficient warning to residents prior to undertaking potentially dusty activities so that household activities such as hanging out washing can be timed to minimise dust nuisance.

Excavation of the Diversion Channel

7.44 Excavation of the diversion channel will require the use of blasting due to the hardness of the rock. Blasting will generate some combustion emissions (primarily nitrogen dioxide). Generally with modern explosives these are kept to a minimum and any air discharges from this activity are unlikely to have more than very minor temporary and localised effect that would not extend to the nearest residential properties given the distances involved.

Summary

7.45 The discharges to air arising from the construction of the MHP relate to engine discharges and dust. Potential effects from engine discharges are very localised and for larger plant such as stationary generators can be avoided largely by providing appropriate discharge stacks. The combined effects of all mobile and stationary plant on site will be minor.

7.46 The potential effects from dust arise from a large number of sources and these will require good management practices to minimise the impact. The use of water to suppress dust will be the major mitigating measure. Nevertheless the site is sufficiently remote from residential properties that dust effects will be minor at these properties. The road upgrading works will require special attention as they pass residences along the access roads. This however will be no different from many road construction activities throughout New Zealand and roading contractors are experienced in controlling the adverse effects from these.

8. ECOLOGICAL EFFECTS

8.1 During 2006 and 2007 Meridian commissioned Mitchell Partnerships and consultant ecologists to survey the vegetation and fauna of the Mokihinui River Gorge. My evidence relies on the information provided in the evidence of Dr Bartlett in commenting on potential ecological effects from the construction activities. It does not assess the wider effects of the dam, inundation area, or transmission line on terrestrial or aquatic ecology.

Assessment of Effects on Ecological Values

Construction Period

8.2 The construction of the staging area and temporary roads will require clearing approximately 26 hectares of forest at the end of the Mokihinui Road. The vegetative cover in the construction and staging area is a mix of podocarp and broadleaf forest of varying ages. Much of the site is younger, secondary succession vegetation rather than mature forest, the result of historic earthquakes, floods, landslides, and logging. No threatened species of plants or animals were located in this area during the field studies.

Measures to Avoid, Remedy or Mitigate Adverse Effects

8.3 Possible measures to avoid, remedy or mitigate adverse effects on terrestrial ecology during the construction phase include:

a. Collection of seeds from trees and shrubs prior to clearing is recommended. These seeds could then be propagated ready to plant out during rehabilitation of the site. This would maintain the genetic diversity of the local plant population, provide maximum ecosourcing potential and enable regeneration of the existing forest. Alternatively, seeds could be collected from trees in the remaining tracts of forest.

b. Minimising the area of vegetation to be cleared, if at all possible. This could involve leaving large specimen trees around the boundary of the site or in other areas where clear felling may not be necessary. It should be noted that Meridian has already selected a very small site to constrain its activities within; however opportunity exists to protect such specimen trees.

c. Meridian has agreed to leave a 20 metre buffer between the staging area and the Mokihinui River. Buffers of at least 20 metres are advisable for large rivers in order to maintain ecological functions such as shading the river, providing habitat for aquatic species, inputs of woody debris, stabilising the stream bank, allowing natural regeneration and suppression of weed growth. Leaving the trees will also prevent dust from entering the river and screen the site.

d. It is considered that harvesting large trees of value for timber would be a beneficial use for this resource if this is feasible and lawful. Smaller trees and shrubs should be mulched and stockpiled, ready for re-use during site rehabilitation. Placing this material along the boundary of the site as a windrow (if possible) would reduce logistical requirements for transport to and from the site and also act as a buffer for noise and dust. It may also help to preserve some native seeds and invertebrate diversity on-site for the rehabilitation phase.

e. Weed management and vermin control during construction will also be implemented in order to prevent and reduce the introduction and spread of weeds and mammalian pest species.

f. It should be noted that Meridian proposes a Terrestrial Ecological Management Plan to address such issues as weed management and rehabilitation. This plan will be consistent with the measures listed above as well as the mitigation suggested in the evidence of Dr Bartlett.

g. Ensure that best practice sediment and stormwater controls are in place through preparation and implementation of a Stormwater and Wastewater Management Plan and Sediment Control Plan.

Construction Completion

8.4 Following completion of construction, the site will need to be rehabilitated and restored. The area will need to be re-contoured and planted with native plants as soon as practicable after the conclusion of works. A general layout of the rehabilitated site showing finished contours and drainage channels is shown in Figure 5 in Appendix A.

8.5 Dense plantings (at one metre spacing for most plants) will help to reduce weed establishment and spread, taking into account the need for open amenity areas for a range of users post-construction. In addition, undertaking pest animal and weed control in and around the project site could help to improve the remaining habitat in the long term.

8.6 Possible post-construction tasks could include:

a. Removal of all buildings and machinery other than those necessary for functioning of the dam and possible tourist facilities etc. Removal and reinstatement through planting, of roads that are no longer required.

b. A Landscaping and Rehabilitation Plan for the site will need to be produced including a plant species list, planting and landscaping plan and maintenance schedule.

c. The stockpiled mulch should be spread over suitable parts the site. This will contain seeds which will help to re-establish vegetation over the site.

d. If additional plants are necessary to create a dense vegetation cover, suitable plants for the area include secondary succession species such as are present on old slips or other disturbed sites.

e. All plants should be eco-sourced from the local area. This will mean that they are better adapted to local environmental conditions, hence more likely to survive, and they help to preserve distinctiveness of plants from the region.

f. After planting, the plants should be mulched and/or weeded to minimise plant losses. Monthly maintenance and weed control may be required until the plants become established (up to two years).

g. The control and eradication (where possible) of weeds and pest animals should continue. Weed control should continue throughout the rehabilitation phase until a full cover of native species is established and the opportunity for weed colonisation is minimised. The duration of pest control should be discussed with the Department of Conservation.

8.7 Provided the suggested environmental controls are put in place, the dam construction and staging area will have no more than minor effects on terrestrial ecology during the construction period. Following completion and restoration adverse effects are likely to be minimal.

9. **Management Plans**

Introduction

9.1 The management, monitoring and reporting of impacts on the environment is a critical step in ensuring environmental targets are being achieved and all statutory approvals are being complied with. As such, detailed Management Plans will be developed for a number of site specific issues in order to carry out a monitoring and reporting system with the overall objective of achieving a world class engineering and environmental project.

9.2 In this project it is considered essential to monitor and record all those matters necessary to demonstrate compliance with statutory approvals. Where possible regular contact will be maintained with regulatory

authority representatives to review work performed on site, the management plans and effects on the environment.

9.3 It should be noted that 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 Plan
- River Erosion Monitoring and Management Plan
- Aquatic Ecology Management Plan

Environmental Construction Management Plan

9.3 The structure to be adopted for this project will be the creation of an Environmental Construction Management Plan (ECMP), which will be the over-arching document for environmental compliance. Within the ECMP there will be sub-plans to address specific issues as depicted in Figure 1 as outlined below. A copy of a Draft ECMP is attached as Appendix B.

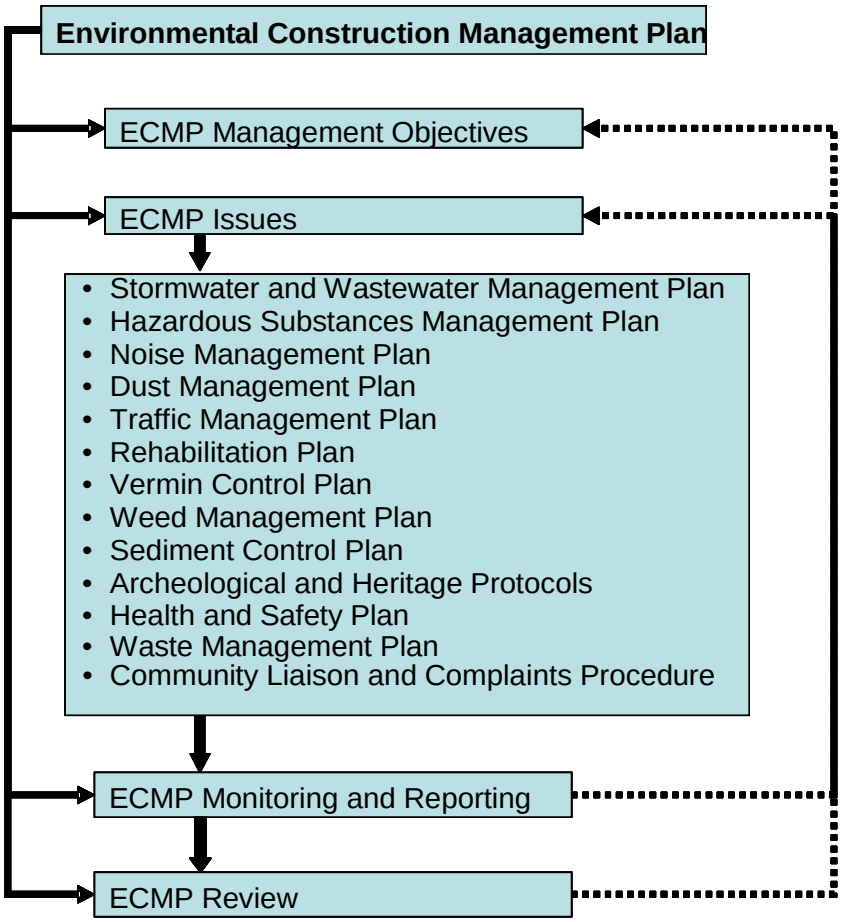

Figure 1: Structure of Environmental Construction Management Plan

ECMP Management Objectives

9.4 The objective of the ECMP is to avoid, remedy or mitigate the potential adverse effects of the construction activities on ecosystems, people and communities, natural and physical resources, amenity values and the social, economic, aesthetic and cultural conditions that pertain to this particular area.

ECMP Issues

9.5 The MHP will provide for the use of the natural resources within the Mokihinui valley to enable people and communities to provide for their social, economic and cultural wellbeing, with wider benefits associated with non-greenhouse gas generation of electricity. Nevertheless there are many issues that will require management throughout the project to

protect the environment. The key issues that need to be managed include:

a. Stormwater runoff and sediment control

b. Wastewater generation, treatment and disposal

c. The storage and use of hazardous substances with spill prevention, containment and cleanup measures identified in advance.

d. Noise impacts on residents of Seddonville and other neighbouring areas

e. Dust impacts on the residents of Seddonville and ecosystems around the construction site as well as impacts on workers on site

f. Traffic movement on the local roading network and the potential hazards that will be created through the use of narrow, winding, poorly formed and constructed roads and intersections

g. The rehabilitation of the construction area to as natural a state as practicable

h. The control of pests that will be attracted to human activities and have the potential to hinder or destroy efforts to rehabilitate the site

i. The control of invasive weed species that will take the opportunity to establish on the exposed surfaces of working areas

j. The accidental discovery of historical or cultural artefacts or sites that require the appropriate actions to record and/or preserve their value and to deal with any cultural issues in a sensitive and respectful manner

k. The protection of the health and safety of workers, visitors and residents in and around the construction site

l. The management of all project risks in a proactive manner to as far as possible reduce risks to an acceptable level

m. The management and disposal of solid waste generated on the site

n. The management of consultation during the consultation phase, as well as the management of any complaints received.

9.6 The method proposed to address these issues is through the creation of an ECMP that will become a contractual requirement upon the constructor. The individual plans as outlined below will be documents required to be prepared by the constructors as part of the construction contract and thus would become “submittals” required by the contract. Each would be a living document, subject to monitoring, review and amendment for the purposes of improving the environmental performance of the project.

10. Stormwater and Wastewater Management Plan

Management Objectives:

To contain and treat all stormwater run off, waste water and wash water within the development area, to minimise the effects on the Mokihinui River.

Issues:

- Control of sediment in stormwater run off to river
- Disposal of stormwater run off from staging area to river
- Disposal of stormwater run off from construction area to river
- Washwater treatment and disposal from batching plant(s)
- Wastewater treatment and disposal from truck washing
- Treatment and disposal of wastewater from workforce ablution facilities.

Management Strategies:

All practicable measures shall be undertaken to contain stormwater, wash water and waste water from the development area. 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.
- The discharge of high suspended sediment stormwater to river when the river is in flood.

11. Hazardous Substances Management Plan

Management Objective:

Implement sound practices for the storage and use of hazardous substances that minimise environmental impacts and eliminate health risks and nuisance to site staff and residents, from the accidental discharge of these hazardous substances.

Issues:

- Hazardous chemical storage
- Fuel and chemical spill control
- Spill containment
- Spill clean up
- Incident reporting

Management Strategy:

All practicable measures shall be undertaken to safely store hazardous substances and to reduce the potential for spills and to ensure if spills do occur that appropriate procedures are carried out. Spill management strategies include, but are not limited to the following:

- The management of the transportation of hazardous substances to and from the site.
- There shall be no refuelling of vehicles or machinery over free flowing water in the bed of any river.
- 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 bunded areas
- Hazardous chemical storage areas will be monitored to ensure they are complying with the appropriate standards/ guidelines/consents.

12. Noise Management Plan

Management Objective:

To avoid, remedy and mitigate the impacts from construction and operational noise.

Issues:

Noise from the following:

- Blasting activities;
- Concrete batching plant and transport of concrete to site;
- Mobile machinery, including excavators, bulldozers and graders;
- Construction truck movements;
- Workshops
- Spillway noise;
- Turbines and Tailrace;
- Transformers and generators;
- Operational noise

Management Strategies:

All practicable measures shall be undertaken to reduce noise levels from plant, equipment and personnel operating on site to achieve compliance with the District Plan and consents to provide a safe working environment and to avoid disturbance to other receivers:

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

- Blasting to occur at set times during day and of limited duration with residents forewarned
- Batch plant to be fitted with noise screening – e.g. cladding
- Aggregate processed and stockpiled as far as practicable during daylight hours
- Restrictions on truck movements through Seddonville at night, road improvements and speed restrictions
- Workshop(s) located away from dwellings and sound insulated
- Noise monitoring will be carried out as soon as practicable after any significant noise source commences work on site and thereafter whenever any further significant noise source commences work.
- A complaints procedure will be developed
- All practicable measures shall be undertaken to comply with the requirements NZS 6802:1999 Acoustics – Assessment of Environmental Sound and NZS 6803:1999 Acoustics – Construction Noise.
- Noise measurement and assessment shall be carried out in accordance with NZS 6801:1999 Acoustics – Measurement of Sound, utilising an independent noise expert. The results and conclusions of such assessments are to be submitted to the regulatory authorities on a frequent basis
- A Contingency Plan (in the event that noise limits are exceeded) to be developed.

13. Dust Management Plan

Management Objective:

To minimise the potential for deterioration of the quality of the air due to dust from construction related activities or vehicle emissions from construction operations.

Issues:

- Processing aggregate, manufacturing concrete, excavation and blasting
- Upgrade of Mokihinui – Seddonville Road
- Discharge of dust from machinery and vehicles on the construction site and access roads.

Management Strategies:

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

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
- A complaints procedure will be developed
- A Contingency Plan (in the event that dust emission limits are exceeded) to be developed.

14. Traffic Management Plan

Management Objective:

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 i.e. safety, noise, dust and traffic flow on nearby land owners and the roading network.

Issues:

- Site staff traffic arriving and departing from site
- Heavy construction traffic (HCVs) arriving and departing from site

Management Strategies:

All practicable measures shall be undertaken to reduce traffic volume and associated effects to provide a safe working environment and to avoid disturbance to residents and dwellings:

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

- 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.
- 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.

15. Rehabilitation Plan

Management Objective:

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

Issues:

Construction activities will result in a temporary impact on the receiving environment. It is necessary to rehabilitate the area at the end of construction to at least its pre-construction state. Opportunities exist for enhancement and these should be taken where practicable.

Management Strategy:

All practicable measures shall be undertaken to restore the construction site to a "natural" environment using locally sourced native species:

- 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;
- Disposal areas for surplus excavation material are identified in locations agreed in consultation with the Consent Authorities;
- All areas disturbed by spoil disposal, vegetation clearance, and soil disturbance shall be rehabilitated.
- 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, plant density, maintenance and pest control (refer to Terrestrial Ecology Management Plan and Habitat Enhancement 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.
- The Stormwater Management Plan will remain in place until cover has established on exposed surfaces.
- 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.

16. Vermin Control Plan

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. Note that

this is separate to the habitat enhancement and predator control programme that is discussed in detail in the evidence of Dr Bartlett. The habitat enhancement and predator control programme is subject to a separate management plan as discussed in the evidence of Mr Kyle.

Management Objectives:

To minimise the introduction and spread of mammalian pests during the dam construction and site restoration activities.

Issues:

Activities in and around the construction staging area and dam site have the potential to introduce and harbour mammalian pests, such as rats and mice.

Management Strategies:

- 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.

17. **Weed Management Plan**

Weed management during both the construction and operation of the scheme will be addressed in the Terrestrial Ecological Management Plan. As such this Weed Management Plan relates to general good practice weed prevention methods during construction. 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.

Management Objectives:

To minimise the introduction and spread of invasive weeds through the dam construction activities.

Issues:

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.

Management Strategies:

- 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® accredited.
- When spaying, 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.

18. Sediment Control Plan

Management Objectives:

To minimise erosion and landform instability as a consequence of the construction activities.

Issues:

Surfaces exposed during the construction can be subjected to erosion or instability and may lead to the discharge of sediment and other surface materials into waterways and potentially result in the loss of productive soils from the site.

Management Strategies:

- Minimise open areas of bare soil. Where practicable, mulch or plant open areas.
- Divert streams around the site where practical
- Use 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

19. **Archaeological and Heritage Protocols**

A protocol will be developed to cover instances where archaeological sites (prehistoric (Maori) and historic) are unearthed during the construction phase. This protocol will require an on-site assessment by a qualified archaeologist, notification of the New Zealand Historic Places Trust and Ngai Tahu, and further excavations, examinations and recording where necessary.

Management Objective

In the event that cultural or historical material is discovered during works, to immediately cease works affecting that material and for statutory process to be followed.

Issues:

- Cultural and historic sites and values hold a valuable record of New Zealand's history. Preserving these values is important.

- The discovery or any cultural or historical artefacts or sites needs to be treated very seriously and dealt with through the appropriate statutory channels.

Management Strategy:

Should any archaeological material be discovered during the course of any works, all works with the potential to damage or disturb those materials shall be ceased immediately and DoC, New Zealand Historic Places Trust, and Te Ao Marama advised immediately.

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.

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
- No work shall recommence until 72 hours after advice has been given to iwi or agreement reached between the parties regarding appropriate protection measures, whichever is the sooner.

20. Health and Safety Plan

Whilst of limited relevance in terms of effects on the environment, the Health and Safety Plan will primarily stipulate codes of practice and relevant construction regulations that contractors will be required to follow. In addition, the Health and Safety Plan will also include information on hazard identification, management and mitigation, public consultation and information sharing requirements, emergency protocols and incident reporting.

Management Objectives:

To comply with all relevant health and safety legislation, regulations and procedures, with the intended outcome being the avoidance of harm to workforce and visitors to the site.

To identify interfaces of the construction works with the public and manage to ensure the safety of all.

Issues:

- The health and safety of all workers involved in the construction of the Mokihinui Hydro Project, and any visitors to site, is of the utmost importance.
- Provision of safe pedestrian access to the upper valley, around the construction site.

Management Strategies:

Comprehensive health and safety plans shall be developed for the construction phase in accordance with the Health and Safety in Employment Act.

21. Risk Management Plan

Management Objectives:

To identify potential risks and determine a strategy for management with the options being to avoid, to mitigate, to transfer or to accept.

Issues:

- To identify all risks and opportunities for the project
- To identify which party is best positioned to manage the risk
- To establish a routine of continually reviewing risks and actions required.

Management strategies:

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

22. Waste Management Plan

Management Objectives:

To minimise the production of waste, manage the storage of solid 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.

Issues:

- Domestic waste from site staff (Recyclables, organics etc)
- Construction waste
- Hazardous waste (solid and liquid)

Management Strategies:

- 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.

23. Community Liaison Group and Complaints Procedure

Meridian proposes to establish a community liaison group and community complaints procedure to manage consultation with stakeholders and any complaints received during the construction phase.

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.

This is discussed in further detail in the evidence of Mr Baines and Mr Kyle.

24. **ECMP Monitoring and Reporting**

24.1 The ECMP in association with the resource consents and concessions that will be granted for the project will have extensive monitoring conditions. Associated with these monitoring requirements will be a requirement to report these results to the relevant stakeholders. The approach proposed in this report is that the MHP should be self regulating. The performance standards to be volunteered within the management plans will ensure that an excellent environmental outcome will be achieved. The monitoring and reporting is therefore an essential element to demonstrate that this outcome is being achieved.

ECMP Review

24.2 All of the management plans to be developed will be living documents, able to be amended for the purpose of improving the environmental outcome achieved. The plans will therefore be formally reviewed annually.

25. ISSUES RAISED BY SUBMISSIONS

25.1 There have been a number of submissions raised that relate to the matters covered in my evidence. These include:

- Contaminants released into rivers used for kayaking, swimming and fishing and whitebaiting
- Dust generated during construction preventing habitation of properties during construction, in particular during the summer.
- Water quality of Burke creek affected
- Discharge of treated sewage to land and water
- Dirty stormwater discharged during construction
- Storage of hazardous substances on site that will be a threat to the environment.

25.2 The contaminants that will be discharged to the river include stormwater, process washdown water, treated wastewater and dewatering water. My evidence has quantified the potential effects of these discharges and described the treatment methods and management strategies that will be used to minimise any adverse effects. As a consequence, I do not believe there will be any significant impact on the rivers relating to their use for kayaking, swimming, fishing or whitebaiting during construction.

25.3 Dust will be generated during construction, but with the combination of favourable climatic conditions, the use of water suppression measures and the distance to neighbouring properties, there will in my opinion be no adverse effects on any resident which will be more than minor.

25.4 Bourke Creek will be affected only for a very short period when the access road and bridge crossing is constructed. The effects will be caused by the excavation and placing of river gravels that will result in the release of sediment. This effect will reflect what naturally can occur. Any effects will be minor and temporary.

25.5 The sewage generated on site will be collected and treated prior to discharge to ground. It will then flow into the river and with the very large dilution available in the river; there will be no significant risk to water quality in the Mokihinui River and no effects which are more than minor.

25.6 Stormwater will be conveyed through treatment ponds to remove sediment and to provide the opportunity to contain spills of hazardous chemicals such as diesel, should they occur. This is standard practice on construction sites and will ensure there are no effects which are more than minor.

25.7 There will be hazardous substances stored on site. However the storage of these will be in contained storage areas such that if a spill does occur it can be contained at that point. Management Plans will be in place to address the containment and clean up required. In any event, there will be a treatment and retention pond at the lowest extremity of the site so that any spill can be contained prior to discharge to the river.

26. PROPOSED CONDITIONS

26.1 The section 42A report has included as Appendix 3, an evaluation of the draft conditions. I shall comment on the suggestions by the Reporting Officer in the following sections. I shall reference the Officer's comments by reference to the page number, Meridian proposed condition number and the Officers paragraph or heading number.

Page 3, Condition 6, Third comment

26.2 It is suggested that the construction plan should include insulation methods. I do not believe this serves any resource management purpose, as there may well be no insulation proposed or needed.

Page 4, Condition 6, First comment

26.3 The level of detail asked for in the programme as part of the construction plan is not warranted. It may be that the peer review process is completed before the contractor has been appointed. The contractor will prepare the final construction plan (referred to as the ECMP).

Page 4, Condition 8, Comment 8(a)

26.4 Specific reference to the stockpiles is not necessary. It is part of aggregate processing.

Page 4, Condition 8, Comment 8(d)

26.5 Haul roads only exist within the construction staging area and this condition does not need to refer to public roads. The machinery that uses the haul roads will be extremely large and likely to cause damage to the road surface which may lead to consequential dust effects, hence the need to reduce speed. These vehicles will not be used on the public roads from the SH.

Page 11, Condition20, Comment 20

26.6 The traffic management plan should not place a restriction on the hours of operation of heavy vehicles. It is necessary that construction be permitted 24/7 and while it is likely that deliveries of bulk materials will occur during daylight hours, it should not become a restriction. For example, when cement is required for the RCC placement phase, the consequences of delay would be significant, as discussed by Mr Fleming. I support voluntary methods, such as liaison and advanced notice of any special heavy or over width vehicles. In addition the contractor should be encouraged to minimise traffic volumes at night, but this should not become a prohibitive requirement.

Page 12, Condition 20, First comment 20

26.7 Dust mitigation measures should be in the Dust Management Plan, and there is no need for duplication in the Traffic Management Plan.

Page 15, Condition 25, First comment

26.8 Blasting is not a community health and safety issue. The notification of blast times has been proposed by Meridian and is supported in the evidence of Mr Fleming and Dr Chiles. I do not believe it should be included in the Health and Safety Plan.

Page 15, Condition 25, Third comment

26.9 I do not believe that hazardous substances spill procedures should be included in the Health and Safety Plan. There is a specific plan for this, and while it may be a hazard that should be identified in the Health and Safety Plan along with the use of personal protection equipment, the procedures for containing and cleaning up the spill are not necessarily a health and safety issue. I believe all the comments relating to the Health

and Safety Plan are over prescriptive, as there is separate legislation that determines what should or should not be included in this plan.

Page 32, Condition 58, Fourth bullet

26.10 The Officer proposes that no gravel extraction or aggregate crushing should occur at night. Dr Chiles has discussed the issue of aggregate crushing at night and proposed noise limits that will be met. This defines a performance standard for noise and if the contractor chooses to use noise suppressing methods to meet these limits, then aggregate crushing should be permitted. The impact of restricting aggregate crushing times has been discussed by Mr Fleming.

Page 33, Condition 58, Third bullet

26.11 Restrictions on the hours of operation of HCVs has been discussed above. For those reasons, I do not support the prohibition on HCV travel between 10 pm and 7 am.

27. CONCLUSION

27.1 While the construction of the MHP is a major project, it is my opinion that all construction activities should be able to take place in a way which recognises the sensitivity of this environment and gives rise to effects which are neither permanent nor significant. The approaches I have outlined to achieve good levels of environmental protection do require contractors to be informed, and to act with care. Having said that, all the approaches I have outlined can be considered as standard practice for construction of this type, and I do not consider them to be unduly onerous or difficult to comply with.

Appendix A

Appendix B