Court File Reference: ENV-2018-CHC-38

BEFORE THE ENVIRONMENT COURT

I MUA I TE KOOTI TAIAO O AOTEAROA

UNDER	The Resource Management Act 1991 (RMA)
IN THE MATTER	Appeals under clause 14(1) of the First Schedule of the Act in relation to the Proposed Southland Water and Land Plan
BETWEEN	**MERIDIAN ENERGY LIMITED** **Appellants**
AND	**SOUTHLAND REGIONAL COUNCIL** **Respondent**

SUPPLEMENTARY STATEMENT OF EVIDENCE OF ANDREW BAZEL CONRAD FEIERABEND

FOR

MERIDIAN ENERGY LIMITED

6 AUGUST 2019

Judicial Officer: Judge Borthwick

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(ENV-2018-CHC-27)

HORTICULTURE NEW ZEALAND
(ENV-2018-CHC-28)

ARATIATIA LIVESTOCK LTD
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(ENV-2018-CHC-34 AND 35)

DIRECTOR-GENERAL OF CONSERVATION
(ENV-2018-CHC-36)

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SOUTHWOOD EXPORT LTD, SOUTHLAND PLANTATION FOREST COMPANY OF NZ
(ENV-2018-CHC-46)

TE RUNANGA O NGAI TAHU, HOKONUI RUNAKA, WAIHOPAI RUNAKA, TE RUNANGA O AWARUA AND TE RUNANGA O ORAKA APARIMA
(ENV-2018-CHC-47)

PETER CHARTRES
(ENV-2018-CHC-48)

RAYONIER NEW ZEALAND LTD
(ENV-2018-CHC-49)

ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NZ INC
(ENV-2018-CHC-50)

Appellants

AND **SOUTHLAND REGIONAL COUNCIL**

Respondent

QUALIFICATIONS AND EXPERIENCE

1 My name is Andrew Bazel Conrad Feierabend.

2 I am employed by Meridian Energy Limited (Meridian). My qualifications and position with Meridian are described in my primary statement of evidence dated 15 February 2019.

SCOPE OF SUPPLEMENTARY EVIDENCE

3 This evidence responds to a request by Commissioner Howie for copies of the main operating resource consents for the Manapouri Power Scheme (**MPS**).

REBUTTAL EVIDENCE

4 At paragraph 46 of my evidence in chief I describe the primary activities authorised by the existing resource consents for the MPS. At paragraph 47 I explain that in 1996 a suite of resource consents was granted authorising up to 510 cumecs to be used for generation purposes. At paragraph 50 I explain that in 2010 another suite of consents was granted authorising the use of additional water for generation – up to a combined maximum of 550 cumecs.

5 Appendix 5 of my Evidence in Chief provides a summary table of the resource consents held for the MPS. The key operating consents are the 6 consents listed under the heading '**1996 Operating Consents**' and the 3 consents listed under the heading '**2010 Manapouri Tailrace Amended Discharge (MTAD) Consents**'. I reproduce that part of my table as **Appendix 1** to this statement of supplementary evidence.

6 Copies of the 9 resource consents – comprising 6 consents from 1996[1] and 3 consents from 2010[2] as described in paragraph 5 above are attached as **Appendix 2** to this statement of supplementary evidence.

7 In reading the resource consents it is important to bear in mind that some of the measures agreed with the Waiau Working Party and individual stakeholders in the Waiau Catchment are documented outside the resource consents, as I described at paragraphs 49 and 50 of my evidence in chief.

Andrew Feierabend

Statutory and Compliance Strategy Manager, Meridian Energy

6 August 2019

[1] Consents 96019, 96020, 96021, 96022, 96023 and 96024

[2] Consents 206156, 206157 and 206158

Appendix 1 Consolidated Summary of MPS Main Operating Resource Consents RMA

Number	Description – Key Requirements
'1996 Operating Consents'	
96019	Coastal Permit to discharge fresh water and contaminants to the waters of Doubtful Sound at Deep Cove by means of the artificial discharge channel. Limits tailrace discharge to 510 m3/s Flow measurement based on set point for total generator output (MW) Quarterly reporting of tailrace flow data Receiving water quality measured at the end of the tail race berms Appendix 1 monitoring and annual reporting
96020	Water Permit to dam and divert waters of Lake Te Anau by means of control structure with a crest level of 208.8 metres above m.s.l at the lake outlet, at or about Map Reference D43 944 163 NZMS 163 Compliance with Lake Level Guidelines 115 m3/s Upper Waiau minimum flow as measured at Queens Reach Lower flows < 115 m3/s allowed to comply with Guidelines, provided agreement of Lakes Guardians and consultation with representative of Nga Tahu and Southland Fish and Game Flows less than 80 m3/s allowed only with Environment Southland approval Eel migrant programme – elver and migrant eel trap and transfer (in lieu of native fish pass requirement) Annual reporting of lake level data Appendix 1 monitoring and annual reporting
96021	Discharge Permit to discharge the waters of Lake Te Anau to the bed of the Waiau River immediately downstream of the Lake Control Structure. Specified rates of change of flow, and no increase and decrease of flow in the same calendar day unless unforeseen hydrological conditions (flow fluctuations) Flood rules for operating structures Annual reporting of TLC discharge flow data Appendix 1 monitoring and annual reporting

Number	Description – Key Requirements
96022	Water Permit to dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers by means of a structure (with a crest level of 179.25 metres above m.s.l.) near the confluence of the Waiau and Mararoa Rivers, and to dam and divert the waters of the Mararoa River to an artificial diversion channel. Compliance with Lake Level Guidelines Minimum flows at MLC: 12 m^3/s (May–Sept) 14 m^3/s (Oct and April) 16 m^3/s (all other times) Whenever Mararoa River turbidity over 30 NTU (measured at Mararoa River at Cliffs site) lake control structure discharge shall be a flow no less than the flow in the Mararoa River at that time Eel migrant programme – Elver and migrant eel trap and transfer (in lieu of native fish pass requirement) Fish pass for brown and rainbow trout Recreational releases – 35 m^3/s for 24 hrs on fourth Sunday of each month between October and April inclusive Waiau River mouth flushing flow – one flow/year not less than 150 m^3/s of 24 hours during March – May, at the discretion of Council to sufficiently open the mouth to enable the passage of migratory fish (subject to compliance with Lake Level Guidelines) Annual reporting of discharge data. Appendix 1 monitoring and annual reporting.
96023	Discharge Permit to discharge the waters of Lake Manapouri and the Waiau and Mararoa Rivers to the bed of the Waiau River below the Manapouri Lake Control Records of the rate of discharge provided annually to Environment Southland Flood rules that record appropriate releases from the structure in the event of floods Warning signs to erected and maintained warning of the danger of the fluctuations in river level at points of public access to the river nominated by Environment Southland within 6 months of receipt of notification Appendix 1 monitoring and annual reporting
96024	Water Permit to take and use for the purposes of the Manapouri Power Scheme the waters of Lake Manapouri through intake gates at the Manapouri Power Station at West Arm at or about Map Reference S148-393 053 NZMS1. Compliance with Lake Guidelines Annual reporting of lake level data

Number	Description – Key Requirements
2010 Manapouri Tailrace Amended Discharge (MTAD) Consents	
206156 (MTAD)	Water Permit to dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers, for the purposes of the take and use of water for hydro-electricity generation in the Manapouri Power Scheme by means of the Manapouri Lake Control Structure. [Existing consent to which this consent and conditions refer are: 96019 and 96022. Exercised only when water permit 96022 is fully exercised and when additional water is being discharged at rates greater than 510 cumecs under coastal permit 96019 Compliance with Lake Level Guidelines Minimum flows at MLC: 12 m3/s (May–Sept) 14 m3/s (Oct and April) 16 m3/s (all other times) Whenever Mararoa River turbidity over 30 NTU (measured at Mararoa River at Cliffs site) lake control structure discharge shall be a flow no less than the flow in the Mararoa River at that time Protocol for monitoring changes in Waiau Arm and water quality monitoring under Appendix A Lower Waiau River voluntary supplementary flows developed and implementation Appendix A monitoring and annual reporting
206157 (MTAD)	Water Permit to take and use water, for the purposes of hydro-electricity generation in the Manapouri Power Scheme, from Lake Manapouri through the intake gates at the Manapouri Power Station at West Arm. (Existing ES consents to which these conditions refer – 96019 and 96024). Exercised when water permit 96024 is fully exercised and when additional water is being discharged at rates greater than 510 cumecs under coastal permit 96019 Water not taken and used at a rate greater than consented discharge under 2061548 Compliance with Lake Level Guidelines Ecological study on the use of extreme low and high ranges Rare lakeshore plant study on the relationships between recorded threatened species and lake levels Annual reporting of lake level data Prepare an eel trap and transfer programme Migrant eel research programme and mitigation plan Appendix A monitoring and annual reporting

Number	Description – Key Requirements
206158 (MTAD)	Coastal Permit to discharge fresh water to the waters of Doubtful Sound at Deep Cove by means of the tailrace from the Manapouri Power Station. (Existing ES consents to which these conditions refer are 96019, 96022 and 96024.) Exercised when coastal permit 96019 is fully exercised (510cumecs) and when additional water is being discharged at rates greater than 510 cumecs. Tailrace discharge no greater than 550 m^3/s Flow measurement based on set point for total generator output Quarterly reporting of tailrace flow data and contingent events > 550m^3/s Bottlenose dolphin research programme on its own or in cooperation with other parties Receiving water quality measured at the end of the tail race berms Deep Cove signage to advise recreational users of tail race flow Consultation with Deep Cover Outdoor Education Trust on best practical option of safety of their water users and measures to improve safety (provision of an emergency rescue boat) On receipt of anecdotal observation surface water conditions review potential effects of MTAD discharges annually (at time of anniversary of first exercise of consent) if required and provide a summary of findings. If requested by recreational groups make appropriately qualified person available to discuss surface water conditions in relation to tail race discharge Appendix A monitoring

environment SOUTHLAND

Application No: M289-009
Consent No: 96019

Cnr North Road and Price Street
(Private Bag 90116)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Coastal Permit

Pursuant to Section 105(1) of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 19 December 1996.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge fresh water and contaminants to the waters of Doubtful Sound at Deep Cove by means of the artificial discharge channel
Location	- site locality -	Deep Cove
	- map reference -	C43:538-106
	- receiving environment -	Doubtful Sound
Legal description of land at the site:		Foreshore/Seabed
Maximum Rate – m^3 per second:		510
Expiry date:		28 November 2031

Consent Amended

Conditions amended on 30 August 2004, 25 February 2011 and on 25 July 2012, as follows:

Schedule of Conditions

1. **Discharge Flow Limit**
   (a) The Manapouri Power Station (MPS) shall be set to generate at a setpoint for total generator output (MW) that would result in an equivalent total turbine flow not exceeding 510 m3/s, calculated in accordance with Condition 1(b). The discharge to Deep Cove from the MPS tailrace shall be regulated by compliance with the setpoint.

(b) The relationship between turbine flow, generator output, lake headwater level and station tailwater level shall be as set out in the table at Appendix 2, provided that whenever the relationship changes, the consent holder shall provide an updated table to Environment Southland within 24 hours of the relationship change, and this updated table shall be used for the purpose of determining total turbine flow.

Definitions for Condition 1:

(i) Total generator output is the sum of the individual outputs of all generating units.

(ii) Total turbine flow is the sum of the individual flows through all generating units.

(iii) In relation to Condition 1(a), it is acknowledged that generator governor response will cause generator output and turbine flow to vary about the setpoint as expected by the Electricity Governance Rules (EGRs). This includes instantaneous reserve response to contingent events as defined in the EGRs.

(iv) In relation to Condition 1(b), station tailwater level is defined as the water level at the station-end of the tailrace tunnels.

2. Records

The consent holder shall record the following information and report this information to Environment Southland at three monthly intervals:

(a) the total turbine flow calculated from the setpoint for total generator output at each setpoint change; and

(b) the total turbine flow calculated from actual total generator output as averages over every half hour period.

Both conditions 2(a) and 2(b) shall be calculated in accordance with Condition 1(b). The quarterly reporting dates shall be as agreed with the Council's Compliance Manager.

3. Monitoring Programme - General

The consent holder shall implement the monitoring programme annexed hereto as Appendix 1 and shall forward a copy of the results of that monitoring programme to the Council annually.

4. Quality of Water Discharged to Receiving Waters

"The receiving waters" means the waters of Deep Cove beyond the end of the tailrace berms. The quality of the tailrace waters discharged to the receiving waters shall comply with the following water quality specification:

4.1 No inorganic sediment with a particle size greater than 0.063mm shall be discharged to the receiving waters.

4.2 There shall be no conspicuous oil film on the surace of the tailrace waters as a result of any activity arising from the exercise of this permit.

4.3 At times other than provided for in Conditions 4.4 and 5;

(a) For a Q/q (dilution) ratio of < 100, the visual clarity of the tail race water discharged shall not be less than 3.79 metres.
(b) For a Q/q (dilution) ration of > 100, the visual clarity of the tailrace water discharged shall not be less than 4.54 metres.

Where:

(i) Q = the tailrace flow in cumecs discharged to the receiving waters but excluding the effluent contribution, q.
(ii) q = the effluent flow in cumecs discharged to the tailrace excluding any natural flows into which the treated effluent discharges prior to entering the tailrace.
(iii) The visual clarity (Y_{bd}) of any waters shall be that measured by the black disk method as outlined in Appendix A.2 of MfE Resource Management Water Quality Guidelines dated June 1994 No 2.

4.4 At times when the visual clarity of the Lyvia River in any previous and/or following 12 hour period is naturally less than 4.54 metres, the visual clarity of waters in the tailrace at that time shall not be less than that lesser visual clarity of the Lyvia River.

4.5 4.1, 4.3 and 4.4 of this condition shall expire or lapse six years from the date of grant of this permit.

5. Quality of Water Discharged to Receiving Waters Following Station Outages

Condition 4 shall not apply for a period of 24 hours from the start up of the power station after an outage, provided however that the consent holder shall take all prior reasonable steps to avoid the discharge of any sediment during this period.

6. Review Clause

At seven yearly intervals from the date of granting, the Council may review the results of all investigations carried out in accordance with Condition 3, or within 6 months of notifying the consent holder of the date of completing its own investigations.

Within three months of completing this review or investigation, and/or within 6 months of receiving a report or recommendation that a review take place from the Waiau Working Party, or at the request of the Director-General of Conservation in the event of his failing to reach agreement with ECNZ on issues arising as a result of clause 3.2 of the monitoring programme referred to in Condition 3, the Council may, in accordance with Sections 128(1)(a) of the Act, serve notice that it intends to review conditions 2 to 5 of this consent to deal with any significant adverse effect on the environment which may arise from the exercise of this consent which was not foreseen or reasonably forseeable at the time of granting, and which it is appropriate to deal with after the results of monitoring have been received.

7. Variation by Consent Holder

The consent holder may apply to the Southland Regional Council for a change or cancellation of Condition 1 and 4 by giving notice of its intention to do so pursuant to Section 127(1) of the Resource Management Act 1991 at not less than yearly intervals from the date of grant of the consent.

8. Charges

The consent holder shall pay to the Southland Regional Council the following user charges which are fixed under Section 36 of the Act:

(a) an administration charge; and
(b) a compliance monitoring charge.

User charges are payavble, in advance, on receipt of invoice on the first day of July each year.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Appendix 1

(Amended July 2012)

Applies to CN 96019, CN 96020, CN 96021, CN 96022 and CN 96023

Manapouri Power Scheme Resource Consents - Monitoring and Management Responses

Monitoring Contents

A. Lakes Te Anau and Manapouri
   1. Shoreline Vegetation
   2. Beach Sediments
   3. Littoral Macrophytes
   4. Waiau Arm

B. Control Structures
   5. Longfinned Eel

C. Upper & Lower Waiau River - Biological
   6. Periphyton and Macrophytes
   7. Periphyton and Macroinvertebrates

D. River Channel Morphology
   8. Upper Waiau River
   9. Lower Waiau River

E. Doubtful Sound Marine Environment

A.	Lakes Te Anau and Manapouri

Guidelines for lake level management are overseen by the Guardians of Lakes Manapouri, Te Anau and Monowai. These guidelines are derived by monitoring aspects of the shoreline vegetation and beach morphology. Ongoing monitoring of these aspects is necessary to allow the Guardians to continue their assessment and refinement of the guidelines.

1. Shoreline vegetation

Objective: To assess the effects of the lake level management regime on the shoreline vegetation of Lakes Manapouri and Te-Anau.

Methods: Monitoring will be undertaken using the transects and photo points set out in the previous monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (Landcare, 2010). Methods of data collection and analysis are to be the same as set out in the Landcare, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the selected transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, commencing from 2010. Re-measurement may also occur if the high-level lake operating guidelines are breached ("event-driven" monitoring).

For "event driven" monitoring surveys of the shoreline vegetation, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Landcare. 2010. Lakes Manapouri and Te Anau: Shore Vegetation Monitoring

2. Beach Sediments

Objective: To assess the effects of the lake level management regime on the beach stability of lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using the sites and transects as set out in the most recent monitoring report for Lakes Te Anau and Manapouri (Single, 2008). Methods of data collection and analysis are to be the same as set out in the Single, 2008, monitoring report so that the results are directly comparable. Any alterations to the sites or transects shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-inspection of the sites and re-measurement of the transects at Lakes Manapouri and Te Anau undertaken by Single (2008) will occur at 5-yearly intervals, with the next monitoring being undertaken in 2016. Re-inspection of the sites and re-measurement of the transects

may also occur if the lake operating guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of the shoreline monitoring sites and transects, and whether or not any of the transects are required to be re-measured, may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Single M. 2008. Beach changes on Lakes Manapouri and Te Anau and cliff erosion at Pearl Harbour Manapouri June 2002 – October 2006

3. Littoral Macrophytes

Objective: To assess the effects of the lake level management regime on the aquatic macrophytes of Lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using transects and photo points as set out by the most recent monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (NIWA, 2010). Methods of data collection and analysis (including analysis of inter-decile ranges) are to be the same as set out in the NIWA, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, with the next monitoring being undertaken in 2012. Re-measurement of the transects may also occur if the low-level guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai. The timing of an "event driven" monitoring survey may also be varied by Environment Southland, and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai, taking into account the timing of the next 5-yearly monitoring survey.

References:
NIWA. 2010. Monitoring the potential effects of MTAD on Lakes Te Anau and Manapouri macrophytes:baseline survey.

4. Waiau Arm

Objective: To enable the implementation of a protocol for monitoring changes in water quality and for subsequent flow management in the Waiau Arm. The purpose of the protocol is to establish a monitoring programme and a management plan specifying the

actions to occur should declining water quality and/or phytoplankton bloom be detected in response to more than minor effects arising from the operation of the MPS.

Method: Monitoring of water quality and subsequent flow management in the Waiau Arm shall be undertaken in accordance with the details set out in NIWA, 2010. Any changes to the monitoring from that set out in NIWA, 2010, shall require approval from Environment Southland prior to implementation.

Reference:
NIWA. 2010. Water quality monitoring protocol for Waiau Arm.

B. Control Structures

5. Long fin Eel

Objective: To further understand the migratory and population characteristics of long fin eel in the Te Anau, Manapouri and Waiau River catchments following the modification of natural conditions by the Manapouri Power Scheme, in order to further develop and implement appropriate monitoring and management responses for long fin eel conservation in these areas.

Methods:

(i) Meridian shall consult at least annually with the Te Waiau Mahika Kai Trust, the Waiau Fisheries and Wildlife Enhancement Trust, the Ministry of Fisheries, the Department of Conservation, interested commercial eel fishers, the Guardians of Lakes Manapouri, Monowai and Te Anau and other interested stakeholders and relevant experts to develop and implement research, monitoring and management response activities for long fin eel conservation in the Te Anau, Manapouri and Waiau River catchments. Meridian's ongoing role in these activities shall be to the satisfaction of Environment Southland and shall be reported upon annually.

(ii) The research and management response activities shall take into account the findings of Mitchell and Davis-Te Maire (1994) and Boubee et al (2003), and the findings and recommendations of Graynoth (2004).

References:
Mitchell, C.P.; Davis-Te Maire, K.T.A. 1994. "Mahingakai values of the Waiau River". Report to ECNZ, 1994.
Moss, Z. (1997 – 2002) to be completed.
Boubee, J. ; Williams, E. ; Richardson, J. (2003). Fish Survey of the Waiau River Catchment – January 2003.
Graynoth, E. (2004). Review of monitoring and mitigation strategies for longfinned eel management in the Te ANau and Manapouri Catchments. NIWA report to Meridian Energy Ltd.

C. Upper and Lower Waiau River - Biological

6. Upper Waiau - Periphyton and Macrophytes

Objective: To confirm that the MPS flow regime has not resulted in any long term changes to periphyton and macrophytes growth in the Upper Waiau River.

Methods: During 2012, periphyton and macrophyte monitoring will be undertaken of up to five transects in different habitat types (using the transects and methods set out in the previous monitoring report for periphyton and macrophtye monitoring in the Upper Waiau River (NIWA, 2007).

For macrophytes, assessments of species diversity, cover frequencies and biomass will be made. Periphyton analysis may include ash-free dry weight, chlorophyll-a and species composition.

The Consent Holder shall prepare a report comparing the results of the monitoring with the results of the programme undertaken in 2007 (NIWA, 2007) identifying whether any changes are attributable to the MPS flow regime and provide this report to Environment Southland. On the basis of this report, if no changes have been identified as being attributable to the MPS flow regime, Environment Southland shall confirm to the consent holder that no further monitoring is required. However, if there are changes attributable to the MPS flow regime, the Consent Holder shall, within 3 months of providing this report to the Council, provide recommendations to Environment Southland for ongoing periphyton and macrophyte monitoring, including time frames. Following approval by Environment Southland, the Consent Holder shall undertake the approved monitoring.

Reference:
NIWA. 2007. Manapouri Power Scheme resource consent monitoring programme: periphyton and macrophytes in the Upper Waiau River.

7. Lower Waiau - Periphyton and Macroinvertebrates

Objective: To monitor periphyton and macroinvertebrates in the Lower Waiau River, upstream of the Monowai confluence, to build upon data gathered about the effect of the flow regime on these biological values.

Methods: Monitoring shall be undertaken annually until 2015 in accordance with Kilroy, C., Lambert, P., Campbell, H., Blair, N. Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

Particularly, monitoring shall continue to be undertaken at the following sites:

- Excelsior – 100 m downstream of the Waiau R./Excelsior Ck confluence;
- Redcliff – just upstream of Redcliff Creek; and
- Blackmount – on large bend in river about 7 km upstream from Monowai confluence).

Control sites in the Mararoa River shall be monitored and all monitoring should be undertaken in late February/early March.

References:
Kilroy, C., Lambert, P., Campbell, H., Blair, N. (2010). Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

D. River Channel Morphology

8. Upper Waiau River

Objective: To continue to measure the amount of river bank erosion in the Upper Waiau River, after establishment of the refined flow regime.

Methods: Two "peglines" were installed in the Upper Waiau River in 1983. These were at Rainbow Reach and "Village Pond". Offset measurements of the peglines will be re-assessed every seven years with the next monitoring being undertaken in 2016; and after flows in excess of 800 cumecs (approximately 10 year return period) to enable the magnitude of erosion to be monitored. (The peglines were last surveyed in March 2003 (Opus 2003)). Reporting should give particular regard to the cliff aspect of any erosion occurring (fretting), relative to similar erosion in the general area so that the mechanisms of this type of erosion can be considered. Reporting should also identify events or trends of particular note and potential causes for these.

Photo stations established by Opus in 2003 (refer Opus, April 2003) on the true right bank opposite both pegline sites shall be re-photographed concurrently with the pegline surveys every two years and after flows in excess of 800 cumecs.

References:
Opus International Consultants (November 2002). "Waiau River Monitoring Programme and Cross Section Survey Review."
Opus International Consultants (April 2003). "Upper Waiau Peglines" (Letter, pegline surveys and photographs).

9. Waiau River

Objective: To assess the changes in the character and morphology of the Waiau River (downstream from Pearl Harbour), and assist in determining whether flow regulation is having an impact on any such changes in the river channel and at beach in the vicinity of the mouth of the lower Waiau River.

Methods: Geomorphological monitoring will measure and report erosion and accretion, vegetation cover and channel morphology along the lower Waiau River, and at the beach in the vicinity of the mouth of the river, using geodetic survey and aerial photography as follows:

- Measurement
  1. A geodetic survey of transects shall be undertaken in accordance with the details set out in the previous monitoring report for geomorphology of the lower Waiau River (URS, 2010), incorporating the following locations:

     (a) the Mararoa and Home creek Deltas;
     (b) the lower Waiau River;

(c) the beach in the vicinity of the mouth of the lower Waiau River.

The extent and elevation of all water surfaces shall also be surveyed at each transect. The river flow at each of the river transect locations on the day of survey shall be assessed. This survey enables erosion and accretion at these transects to be estimated. Any alterations to the transects shall require approval from Environment Southland prior to implementation.

2. An assessment is to be made from aerial photographs of the vegetation cover across each of the geodetic survey transects. The location of the boundaries between the following zones shall be surveyed:
   (a) bare clean river gravel;
   (b) river gravels with less than 50% total groundcover of lichen, moss, grass, herbs, and shrubs;
   (c) river gravels with 50% or more total groundcover of lichen, moss, grass, herbs, shrubs, and trees.

3. An aerial photographic survey of the lower Waiau River with coverage not less that of previous surveys is required. The aerial photography enables planform changes to the channel and barrier system to be monitored.

- Survey Timing

4. Surveys are required to be undertaken:
   (i) Post-flood: Following flows exceeding 1200 cubic metres per second (m^3/s) at Mararoa weir (MLC) or 2000 m^3/s at Tuatapere;
   (ii) Channel recovery (if recommended as part of the Post-flood analysis): Some two years following a post-flood survey; and
   (iii) No flood: At intervals of no longer than 7 years* following the most recent no flood, post-flood or channel recovery survey, whichever is the most recent.

5. River flow at Tuatapere should be less than 100 m^3/s during surveys.

- Analysis

6. Survey data are to be analysed and reported to Environment Southland following each survey, in the same manner as the analysis and reporting set out in URS, 2010. Any alterations to the analysis and reporting shall require approval from Environment Southland prior to implementation.

**Note: The next standard survey is due in 2019 (7 years following the post flood survey required in 2012), if no post flood and channel recovery surveys occur before this time.*

References:
URS. 2010. Lower Waiau River Cross Section Survey 2009.

E. Doubtful Sound Marine Environment

Objectives:

To maintain ongoing information about the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

To enable the identification of any long-term changes in the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

Methods:

1. Each year the Consent Holder shall implement a monitoring programme in accordance with the details set out in Cawthorn, 2010. The first year programme was completed in 2011.
2. Following the implementation of each monitoring programme, the Consent Holder shall report to Environment Southland presenting the data collected, a summary of the results of the monitoring, and any recommendations for changes to the monitoring programme for the following year.
3. Any recommended changes to the monitoring programme shall be discussed with the Fiordland Marine Guardians and shall be approved by Environment Southland prior to its implementation in the following year.

Reference:

Cawthron. 2010. Doubtful Sound Adaptive Monitoring Programme: Proposed Monitoring for 2011.

Appendix 2

(Added during amendment July 2012)

Manapouri Power Station Rating

The following table is the confirmed machine flow rating for the generating units at Manapouri, as at 7 September 2009:

P_{GEN}/(HWL-TWL) (MW/m)	Unit Flow (m^3/s)
0	7
0.28165	35
0.33234	40
0.38777	45
0.44256	50
0.49196	55
0.54013	60
0.58887	65
0.63579	70
0.68031	75
0.71946	80
0.75622	85
0.79059	90
0.82198	95
0.84803	100

environment
SOUTHLAND

Application No: M289-004
Consent No: 96020

Cnr North Road and Price Street
(Private Bag 90116)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 105(1) of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 19 December 1996.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To dam and divert the waters of Lake Te Anau by means of a control structure with a crest level of 208.8 metres above m.s.l. at the lake outlet.
Location	- site locality -	Te Anau
	- map reference -	D43:944-163
	- receiving environment -	Lake Te Anau
Legal description of land at the site:		Lake/River bed
Expiry date:		28 November 2031

Consent Amended

Conditions amended on 9 August 2000, 30 August 2004, 25 February 2011 and on 25 July 2012, as follows:

Schedule of Conditions

1. Lake Levels

The Consent Holder shall comply with Guidelines for the Operation of Lake Te Anau contained in the Manapouri-Te Anau Development Act ("Operating Guidelines") Notice 1992 notified in the New Zealand Gazette dated 29 April 1993 or any subsequent amendment thereof or substitution therefore (the "Gazetted Guidelines"), except in exceptional natural circumstances, or where life or structures are endangered, as provided for in section 4(A)(2) of the Manapouri-Te Anau Development Act 1963.

2. The Consent Holder shall maintain in the river downstream of the structure a flow not less than 115 cubic metres per second (cumencs) as measured at Queens Reach flow recorder.

If, due to low inflows into Lake Te Anau, the Consent Holder considers that flows lower than 115 cumecs are necessary to be maintained in order to comply with the gazetted Guidelines the Consent Holder may reduce flows below 115 cumecs with the prior agreement of the Chairman of the Guardians of Lakes Manapouri, Monowai and Te Anau and after consultation with the Manager, Southland Fish and Game Council and the nominee of the Chairperson of Te Runanga o Ngai Tahu. The Consent Holder shall advise the General Manager, Southland Regional Council, prior to reducing flows below 115 cumecs.

The Consent Holder shall not, in any event, reduce flows below 80 cumecs, provided that, on receipt of a requirement in writing from the General Manager, Southland Regional Council, the Consent Holder shall, within the time specified in the requirement, reduce the flows in accordance with that requirement.

3. Native Fish Pass

The Consent Holder shall, within two years of the date of grant of this permit, on the control structure, install, operate and maintain a native fish pass designed and constructed following consultation with the Director-General of Conservation and Trustees of Te Waiau Mahika Kai Trust.

4. Records

The Consent Holder shall measure and record the lake water level, relative to mean sea level Deep Cove, at a frequency not less than once every 60 minutes, and shall supply a copy of the records to the Southland Regional Council annually.

5. Monitoring

The Consent Holder shall implement the monitoring programme agreed with the Southland Regional Council and attached as Appendix 1, and shall supply a copy of the results to the Southland Regional Council annually.

6. Review

At seven yearly intervals from the date of granting, the Council may review the results of all investigations carried out in accordance with condition 5.

Within 3 months of completing these reviews and/or within 6 months of receiving a report or recommendation that a review take place from the Waiau Working Party, the Council may, in accordance with Sections 128(1)(a) of the Act, serve notice that it intends to review conditions 1 to 5 of this consent to deal with any significant adverse effect on the environment which may arise from the exercise of this consent which was not foreseen or reasonably foreseeable at the time of granting, and which it is appropriate to deal with after the results of monitoring have been received.

7. Charges

The consent holder shall pay to the Southland Regional Council the following user charges which are fixed under Section 36 of the Act:

a) an administration charge; and
b) a compliance monitoring charge.

User charges are payable, in advance, on receipt of invoice on the first day of July each year.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Appendix 1

(Amended July 2012)

Applies to CN 96019, CN 96020, CN 96021, CN 96022 and CN 96023

Manapouri Power Scheme Resource Consents - Monitoring and Management Responses

Monitoring Contents

A. Lakes Te Anau and Manapouri

Guidelines for lake level management are overseen by the Guardians of Lakes Manapouri, Te Anau and Monowai. These guidelines are derived by monitoring aspects of the shoreline vegetation and beach morphology. Ongoing monitoring of these aspects is necessary to allow the Guardians to continue their assessment and refinement of the guidelines.

1. Shoreline vegetation

Objective: To assess the effects of the lake level management regime on the shoreline vegetation of Lakes Manapouri and Te-Anau.

Methods: Monitoring will be undertaken using the transects and photo points set out in the previous monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (Landcare, 2010). Methods of data collection and analysis are to be the same as set out in the Landcare, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the selected transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, commencing from 2010. Re-measurement may also occur if the high-level lake operating guidelines are breached ("event-driven" monitoring).

For "event driven" monitoring surveys of the shoreline vegetation, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Landcare. 2010. Lakes Manapouri and Te Anau: Shore Vegetation Monitoring

2. Beach Sediments

Objective: To assess the effects of the lake level management regime on the beach stability of lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using the sites and transects as set out in the most recent monitoring report for Lakes Te Anau and Manapouri (Single, 2008). Methods of data collection and analysis are to be the same as set out in the Single, 2008, monitoring report so that the results are directly comparable. Any alterations to the sites or transects shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-inspection of the sites and re-measurement of the transects at Lakes Manapouri and Te Anau undertaken by Single (2008) will occur at 5-yearly intervals, with the next monitoring being undertaken in 2016. Re-inspection of the sites and re-measurement of the transects may also occur if the lake operating guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of the shoreline monitoring sites and transects, and whether or not any of the transects are required to be re-measured, may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Single M. 2008. Beach changes on Lakes Manapouri and Te Anau and cliff erosion at Pearl Harbour Manapouri June 2002 – October 2006

3. Littoral Macrophytes

Objective: To assess the effects of the lake level management regime on the aquatic macrophytes of Lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using transects and photo points as set out by the most recent monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (NIWA, 2010). Methods of data collection and analysis (including analysis of inter-decile ranges) are to be the same as set out in the NIWA, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, with the next monitoring being undertaken in 2012. Re-measurement of the transects may also occur if the low-level guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai. The timing of an "event driven" monitoring survey may also be varied by Environment Southland, and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai, taking into account the timing of the next 5-yearly monitoring survey.

References:
NIWA. 2010. Monitoring the potential effects of MTAD on Lakes Te Anau and Manapouri macrophytes:baseline survey.

4. Waiau Arm

Objective: To enable the implementation of a protocol for monitoring changes in water quality and for subsequent flow management in the Waiau Arm. The purpose of the protocol is to establish a monitoring programme and a management plan specifying the actions to occur should declining water quality and/or phytoplankton bloom be detected in response to more than minor effects arising from the operation of the MPS.

Method: Monitoring of water quality and subsequent flow management in the Waiau Arm shall be undertaken in accordance with the details set out in NIWA, 2010. Any changes to the monitoring from that set out in NIWA, 2010, shall require approval from Environment Southland prior to implementation.

Reference:
NIWA. 2010. Water quality monitoring protocol for Waiau Arm.

B. Control Structures

5. Long fin Eel

Objective: To further understand the migratory and population characteristics of long fin eel in the Te Anau, Manapouri and Waiau River catchments following the modification of natural conditions by the Manapouri Power Scheme, in order to further develop and implement appropriate monitoring and management responses for long fin eel conservation in these areas.

Methods:

(i) Meridian shall consult at least annually with the Te Waiau Mahika Kai Trust, the Waiau Fisheries and Wildlife Enhancement Trust, the Ministry of Fisheries, the Department of Conservation, interested commercial eel fishers, the Guardians of Lakes Manapouri, Monowai and Te Anau and other interested stakeholders and relevant experts to develop and implement research, monitoring and management response activities for long fin eel conservation in the Te Anau, Manapouri and Waiau River catchments. Meridian's ongoing role in these activities shall be to the satisfaction of Environment Southland and shall be reported upon annually.

(ii) The research and management response activities shall take into account the findings of Mitchell and Davis-Te Maire (1994) and Boubee et al (2003), and the findings and recommendations of Graynoth (2004).

References:
Mitchell, C.P.; Davis-Te Maire, K.T.A. 1994. "Mahingakai values of the Waiau River". Report to ECNZ, 1994.
Moss, Z. (1997 – 2002) to be completed.
Boubee, J. ; Williams, E. ; Richardson, J. (2003). Fish Survey of the Waiau River Catchment – January 2003.
Graynoth, E. (2004). Review of monitoring and mitigation strategies for longfinned eel management in the Te ANau and Manapouri Catchments. NIWA report to Meridian Energy Ltd.

C. Upper and Lower Waiau River - Biological

6. Upper Waiau - Periphyton and Macrophytes

Objective: To confirm that the MPS flow regime has not resulted in any long term changes to periphyton and macrophytes growth in the Upper Waiau River.

Methods: During 2012, periphyton and macrophyte monitoring will be undertaken of up to five transects in different habitat types (using the transects and methods set out in the previous monitoring report for periphyton and macrophtye monitoring in the Upper Waiau River (NIWA, 2007).

For macrophytes, assessments of species diversity, cover frequencies and biomass will be made. Periphyton analysis may include ash-free dry weight, chlorophyll-a and species composition.

The Consent Holder shall prepare a report comparing the results of the monitoring with the results of the programme undertaken in 2007 (NIWA, 2007) identifying whether any changes are attributable to the MPS flow regime and provide this report to Environment Southland. On the basis of this report, if no changes have been identified as being attributable to the MPS flow regime, Environment Southland shall confirm to the consent holder that no further monitoring is required. However, if there are changes attributable to the MPS flow regime, the Consent Holder shall, within 3 months of providing this report to the Council, provide recommendations to Environment Southland for ongoing periphyton and macrophyte monitoring, including time frames. Following approval by Environment Southland, the Consent Holder shall undertake the approved monitoring.

Reference:
NIWA. 2007. Manapouri Power Scheme resource consent monitoring programme: periphyton and macrophytes in the Upper Waiau River.

7. Lower Waiau - Periphyton and Macroinvertebrates

Objective: To monitor periphyton and macroinvertebrates in the Lower Waiau River, upstream of the Monowai confluence, to build upon data gathered about the effect of the flow regime on these biological values.

Methods: Monitoring shall be undertaken annually until 2015 in accordance with Kilroy, C., Lambert, P., Campbell, H., Blair, N. Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

Particularly, monitoring shall continue to be undertaken at the following sites:

- Excelsior – 100 m downstream of the Waiau R./Excelsior Ck confluence;
- Redcliff – just upstream of Redcliff Creek; and
- Blackmount – on large bend in river about 7 km upstream from Monowai confluence).

Control sites in the Mararoa River shall be monitored and all monitoring should be undertaken in late February/early March.

References:
Kilroy, C., Lambert, P., Campbell, H., Blair, N. (2010). Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

D. River Channel Morphology

8. Upper Waiau River

Objective: To continue to measure the amount of river bank erosion in the Upper Waiau River, after establishment of the refined flow regime.

Methods: Two "peglines" were installed in the Upper Waiau River in 1983. These were at Rainbow Reach and "Village Pond". Offset measurements of the peglines will be re-assessed every seven years with the next monitoring being undertaken in 2016; and after flows in excess of 800 cumecs (approximately 10 year return period) to enable the magnitude of erosion to be monitored. (The peglines were last surveyed in March 2003 (Opus 2003)). Reporting should give particular regard to the cliff aspect of any erosion occurring (fretting), relative to similar erosion in the general area so that the mechanisms of this type of erosion can be considered. Reporting should also identify events or trends of particular note and potential causes for these.

Photo stations established by Opus in 2003 (refer Opus, April 2003) on the true right bank opposite both pegline sites shall be re-photographed concurrently with the pegline surveys every two years and after flows in excess of 800 cumecs.

References:
Opus International Consultants (November 2002). "Waiau River Monitoring Programme and Cross Section Survey Review."
Opus International Consultants (April 2003). "Upper Waiau Peglines" (Letter, pegline surveys and photographs).

9. Waiau River

Objective: To assess the changes in the character and morphology of the Waiau River (downstream from Pearl Harbour), and assist in determining whether flow regulation is having an impact on any such changes in the river channel and at beach in the vicinity of the mouth of the lower Waiau River.

Methods: Geomorphological monitoring will measure and report erosion and accretion, vegetation cover and channel morphology along the lower Waiau River, and at the beach in the vicinity of the mouth of the river, using geodetic survey and aerial photography as follows:

- Measurement
  1. A geodetic survey of transects shall be undertaken in accordance with the details set out in the previous monitoring report for geomorphology of the lower Waiau River (URS, 2010), incorporating the following locations:

     (a) the Mararoa and Home creek Deltas;
     (b) the lower Waiau River;
     (c) the beach in the vicinity of the mouth of the lower Waiau River.

     The extent and elevation of all water surfaces shall also be surveyed at each transect. The river flow at each of the river transect locations on the day of survey shall be assessed. This survey enables erosion and accretion at these transects to be estimated. Any alterations to the transects shall require approval from Environment Southland prior to implementation.

2. An assessment is to be made from aerial photographs of the vegetation cover across each of the geodetic survey transects. The location of the boundaries between the following zones shall be surveyed:
   (a) bare clean river gravel;
   (b) river gravels with less than 50% total groundcover of lichen, moss, grass, herbs, and shrubs;
   (c) river gravels with 50% or more total groundcover of lichen, moss, grass, herbs, shrubs, and trees.

3. An aerial photographic survey of the lower Waiau River with coverage not less that of previous surveys is required. The aerial photography enables planform changes to the channel and barrier system to be monitored.

- Survey Timing

4. Surveys are required to be undertaken:
   (i) Post-flood: Following flows exceeding 1200 cubic metres per second (m^3/s) at Mararoa weir (MLC) or 2000 m^3/s at Tuatapere;
   (ii) Channel recovery (if recommended as part of the Post-flood analysis): Some two years following a post-flood survey; and
   (iii) No flood: At intervals of no longer than 7 years* following the most recent no flood, post-flood or channel recovery survey, whichever is the most recent.

5. River flow at Tuatapere should be less than 100 m^3/s during surveys.

- Analysis

6. Survey data are to be analysed and reported to Environment Southland following each survey, in the same manner as the analysis and reporting set out in URS, 2010. Any alterations to the analysis and reporting shall require approval from Environment Southland prior to implementation.

**Note: The next standard survey is due in 2019 (7 years following the post flood survey required in 2012), if no post flood and channel recovery surveys occur before this time.*

References:
URS. 2010. Lower Waiau River Cross Section Survey 2009.

E. Doubtful Sound Marine Environment

Objectives:
To maintain ongoing information about the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

To enable the identification of any long-term changes in the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

Methods:

1. Each year the Consent Holder shall implement a monitoring programme in accordance with the details set out in Cawthorn, 2010. The first year programme was completed in 2011.
2. Following the implementation of each monitoring programme, the Consent Holder shall report to Environment Southland presenting the data collected, a summary of the results of the monitoring, and any recommendations for changes to the monitoring programme for the following year.
3. Any recommended changes to the monitoring programme shall be discussed with the Fiordland Marine Guardians and shall be approved by Environment Southland prior to its implementation in the following year.

Reference:

Cawthron. 2010. Doubtful Sound Adaptive Monitoring Programme: Proposed Monitoring for 2011.

environment SOUTHLAND

Application No: M289-004
Consent No: 96021

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Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Discharge Permit

Pursuant to Section 105(1) of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 28 November 1996.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge the waters of Lake Te Anau to the bed of the Waiau River immediately downstream of the Lake Control Structure.
Location	- site locality -	Te Anau
	- map reference -	D43:944-163
	- receiving environment -	Waiau
Legal description of land at the site:		River Bed
Maximum Rate – cubic metres/day:-		See conditions
Expiry date:		28 November 2031

Consent Amended

Conditions amended on 9 August 2000, 30 August 2004, 25 February 2011 and on 25 July 2012, as follows:

Schedule of Conditions

1. **Rates of Change of Flow** (for lake levels below 203.30 m.a.m.s.l.):
   (a) Subject to (b) and (c) below, the maximum rate of change of flow shall be limited to 20 cubic metres per second (cumecs) per hour.
   (b) For flows below 400 cumecs and above 180 cumecs, the total reduction in flow in any calendar day shall not exceed 30 per cent of the mean flow for the previous calendar day.
   (c) For flows below 180 cumecs, the total reduction in flow in any calendar day shall not exceed 20 per cent of the mean flow for the previous calendar day.

2. Flow Fluctuations

In any event the Consent Holder shall not both increase and decrease flows during the same calendar day unless unforeseen hydrological conditions require such changes to comply with the operating guidelines.

3. Review Clause

At seven yearly intervals from the date of granting, the Council may review the results of all investigations carried out in accordance with condition 6.

The Council may also review the flood rules required by condition 4 within three months of receiving those rules.

Within 3 months of completing these reviews and/or within 6 months of receiving a report or recommendation that a review take place from the Waiau Working Party, the Council may, in accordance with Sections 128(1)(a) of the Act, serve notice that it intends to review conditions 1, 2, 4 to 6 of this consent to deal with any significant adverse effect on the environment which may arise from the exercise of this consent which was not foreseen or reasonably foreseeable at the time of granting, and which it is appropriate to deal with after the results of monitoring have been received.

4. Flood Rules

For lake levels above 203.3 m.a.m.s.l. the Consent Holder shall have flood rules that record the operating procedures for the structure in the event of floods. The Consent Holder shall provide the Southland Regional Council with a copy of such flood rules within six months of the date of grant of this consent.

5. Records

The Consent Holder shall record the rate at which water is discharged at a frequency of not less than once every 60 minutes, and shall supply a copy of such records to the Southland Regional Council annually.

6. Monitoring

The Consent Holder shall implement the monitoring programme agreed with the Southland Regional Council and attached as Appendix 1 and shall supply a copy of the results to the Southland Regional Council annually.

7. Charges

The consent holder shall pay to the Southland Regional Council the following user chargers which are fixed under Section 36 of the Act:

a) an administration charge; and
b) a compliance monitoring charge.

User charges are payable, in advance, on receipt of invoice on the first day of July each year.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Appendix 1

(Amended July 2012)

Applies to CN 96019, CN 96020, CN 96021, CN 96022 and CN 96023

Manapouri Power Scheme Resource Consents - Monitoring and Management Responses

Monitoring Contents

A. Lakes Te Anau and Manapouri
   1. Shoreline Vegetation
   2. Beach Sediments
   3. Littoral Macrophytes
   4. Waiau Arm

B. Control Structures
   5. Longfinned Eel

C. Upper & Lower Waiau River - Biological
   6. Periphyton and Macrophytes
   7. Periphyton and Macroinvertebrates

D. River Channel Morphology
   8. Upper Waiau River
   9. Lower Waiau River

E. Doubtful Sound Marine Environment

A. Lakes Te Anau and Manapouri

Guidelines for lake level management are overseen by the Guardians of Lakes Manapouri, Te Anau and Monowai. These guidelines are derived by monitoring aspects of the shoreline vegetation and beach morphology. Ongoing monitoring of these aspects is necessary to allow the Guardians to continue their assessment and refinement of the guidelines.

1. Shoreline vegetation

Objective: To assess the effects of the lake level management regime on the shoreline vegetation of Lakes Manapouri and Te-Anau.

Methods: Monitoring will be undertaken using the transects and photo points set out in the previous monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (Landcare, 2010). Methods of data collection and analysis are to be the same as set out in the Landcare, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the selected transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, commencing from 2010. Re-measurement may also occur if the high-level lake operating guidelines are breached ("event-driven" monitoring).

For "event driven" monitoring surveys of the shoreline vegetation, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Landcare. 2010. Lakes Manapouri and Te Anau: Shore Vegetation Monitoring

2. Beach Sediments

Objective: To assess the effects of the lake level management regime on the beach stability of lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using the sites and transects as set out in the most recent monitoring report for Lakes Te Anau and Manapouri (Single, 2008). Methods of data collection and analysis are to be the same as set out in the Single, 2008, monitoring report so that the results are directly comparable. Any alterations to the sites or transects shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-inspection of the sites and re-measurement of the transects at Lakes Manapouri and Te Anau undertaken by Single (2008) will occur at 5-yearly intervals, with the next monitoring being undertaken in 2016. Re-inspection of the sites and re-measurement of the transects may also occur if the lake operating guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of the shoreline monitoring sites and transects, and whether or not any of the transects are required to be re-measured, may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Single M. 2008. Beach changes on Lakes Manapouri and Te Anau and cliff erosion at Pearl Harbour Manapouri June 2002 – October 2006

3. Littoral Macrophytes

Objective: To assess the effects of the lake level management regime on the aquatic macrophytes of Lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using transects and photo points as set out by the most recent monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (NIWA, 2010). Methods of data collection and analysis (including analysis of inter-decile ranges) are to be the same as set out in the NIWA, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, with the next monitoring being undertaken in 2012. Re-measurement of the transects may also occur if the low-level guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai. The timing of an "event driven" monitoring survey may also be varied by Environment Southland, and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai, taking into account the timing of the next 5-yearly monitoring survey.

References:
NIWA. 2010. Monitoring the potential effects of MTAD on Lakes Te Anau and Manapouri macrophytes:baseline survey.

4. Waiau Arm

Objective: To enable the implementation of a protocol for monitoring changes in water quality and for subsequent flow management in the Waiau Arm. The purpose of the protocol is to establish a monitoring programme and a management plan specifying the actions to occur should declining water quality and/or phytoplankton bloom be detected in response to more than minor effects arising from the operation of the MPS.

Method: Monitoring of water quality and subsequent flow management in the Waiau Arm shall be undertaken in accordance with the details set out in NIWA, 2010. Any changes to the monitoring from that set out in NIWA, 2010, shall require approval from Environment Southland prior to implementation.

Reference:
NIWA. 2010. Water quality monitoring protocol for Waiau Arm.

B. Control Structures

5. Long fin Eel

Objective: To further understand the migratory and population characteristics of long fin eel in the Te Anau, Manapouri and Waiau River catchments following the modification of natural conditions by the Manapouri Power Scheme, in order to further develop and implement appropriate monitoring and management responses for long fin eel conservation in these areas.

Methods:

(i) Meridian shall consult at least annually with the Te Waiau Mahika Kai Trust, the Waiau Fisheries and Wildlife Enhancement Trust, the Ministry of Fisheries, the Department of Conservation, interested commercial eel fishers, the Guardians of Lakes Manapouri, Monowai and Te Anau and other interested stakeholders and relevant experts to develop and implement research, monitoring and management response activities for long fin eel conservation in the Te Anau, Manapouri and Waiau River catchments. Meridian's ongoing role in these activities shall be to the satisfaction of Environment Southland and shall be reported upon annually.

(ii) The research and management response activities shall take into account the findings of Mitchell and Davis-Te Maire (1994) and Boubee et al (2003), and the findings and recommendations of Graynoth (2004).

References:
Mitchell, C.P.; Davis-Te Maire, K.T.A. 1994. "Mahingakai values of the Waiau River". Report to ECNZ, 1994.
Moss, Z. (1997 – 2002) to be completed.
Boubee, J. ; Williams, E. ; Richardson, J. (2003). Fish Survey of the Waiau River Catchment – January 2003.
Graynoth, E. (2004). Review of monitoring and mitigation strategies for longfinned eel management in the Te ANau and Manapouri Catchments. NIWA report to Meridian Energy Ltd.

C. Upper and Lower Waiau River - Biological

6. Upper Waiau - Periphyton and Macrophytes

Objective: To confirm that the MPS flow regime has not resulted in any long term changes to periphyton and macrophytes growth in the Upper Waiau River.

Methods: During 2012, periphyton and macrophyte monitoring will be undertaken of up to five transects in different habitat types (using the transects and methods set out in the previous monitoring report for periphyton and macrophtye monitoring in the Upper Waiau River (NIWA, 2007).

For macrophytes, assessments of species diversity, cover frequencies and biomass will be made. Periphyton analysis may include ash-free dry weight, chlorophyll-a and species composition.

The Consent Holder shall prepare a report comparing the results of the monitoring with the results of the programme undertaken in 2007 (NIWA, 2007) identifying whether any changes are attributable to the MPS flow regime and provide this report to Environment Southland. On the basis of this report, if no changes have been identified as being attributable to the MPS flow regime, Environment Southland shall confirm to the consent holder that no further monitoring is required. However, if there are changes attributable to the MPS flow regime, the Consent Holder shall, within 3 months of providing this report to the Council, provide recommendations to Environment Southland for ongoing periphyton and macrophyte monitoring, including time frames. Following approval by Environment Southland, the Consent Holder shall undertake the approved monitoring.

Reference:
NIWA. 2007. Manapouri Power Scheme resource consent monitoring programme: periphyton and macrophytes in the Upper Waiau River.

7. Lower Waiau - Periphyton and Macroinvertebrates

Objective: To monitor periphyton and macroinvertebrates in the Lower Waiau River, upstream of the Monowai confluence, to build upon data gathered about the effect of the flow regime on these biological values.

Methods: Monitoring shall be undertaken annually until 2015 in accordance with Kilroy, C., Lambert, P., Campbell, H., Blair, N. Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

Particularly, monitoring shall continue to be undertaken at the following sites:

- Excelsior – 100 m downstream of the Waiau R./Excelsior Ck confluence;
- Redcliff – just upstream of Redcliff Creek; and
- Blackmount – on large bend in river about 7 km upstream from Monowai confluence).

Control sites in the Mararoa River shall be monitored and all monitoring should be undertaken in late February/early March.

References:
Kilroy, C., Lambert, P., Campbell, H., Blair, N. (2010). Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

D.	River Channel Morphology

8. Upper Waiau River

Objective: To continue to measure the amount of river bank erosion in the Upper Waiau River, after establishment of the refined flow regime.

Methods: Two "peglines" were installed in the Upper Waiau River in 1983. These were at Rainbow Reach and "Village Pond". Offset measurements of the peglines will be re-assessed every seven years with the next monitoring being undertaken in 2016; and after flows in excess of 800 cumecs (approximately 10 year return period) to enable the magnitude of erosion to be monitored. (The peglines were last surveyed in March 2003 (Opus 2003)). Reporting should give particular regard to the cliff aspect of any erosion occurring (fretting), relative to similar erosion in the general area so that the mechanisms of this type of erosion can be considered. Reporting should also identify events or trends of particular note and potential causes for these.

Photo stations established by Opus in 2003 (refer Opus, April 2003) on the true right bank opposite both pegline sites shall be re-photographed concurrently with the pegline surveys every two years and after flows in excess of 800 cumecs.

References:
Opus International Consultants (November 2002). "Waiau River Monitoring Programme and Cross Section Survey Review."
Opus International Consultants (April 2003). "Upper Waiau Peglines" (Letter, pegline surveys and photographs).

9. Waiau River

Objective: To assess the changes in the character and morphology of the Waiau River (downstream from Pearl Harbour), and assist in determining whether flow regulation is having an impact on any such changes in the river channel and at beach in the vicinity of the mouth of the lower Waiau River.

Methods: Geomorphological monitoring will measure and report erosion and accretion, vegetation cover and channel morphology along the lower Waiau River, and at the beach in the vicinity of the mouth of the river, using geodetic survey and aerial photography as follows:

- Measurement
  1. A geodetic survey of transects shall be undertaken in accordance with the details set out in the previous monitoring report for geomorphology of the lower Waiau River (URS, 2010), incorporating the following locations:

     (a) the Mararoa and Home creek Deltas;
     (b) the lower Waiau River;
     (c) the beach in the vicinity of the mouth of the lower Waiau River.

The extent and elevation of all water surfaces shall also be surveyed at each transect. The river flow at each of the river transect locations on the day of survey shall be assessed. This survey enables erosion and accretion at these transects to be estimated. Any alterations to the transects shall require approval from Environment Southland prior to implementation.

2. An assessment is to be made from aerial photographs of the vegetation cover across each of the geodetic survey transects. The location of the boundaries between the following zones shall be surveyed:
   (a) bare clean river gravel;
   (b) river gravels with less than 50% total groundcover of lichen, moss, grass, herbs, and shrubs;
   (c) river gravels with 50% or more total groundcover of lichen, moss, grass, herbs, shrubs, and trees.

3. An aerial photographic survey of the lower Waiau River with coverage not less that of previous surveys is required. The aerial photography enables planform changes to the channel and barrier system to be monitored.

- Survey Timing

4. Surveys are required to be undertaken:
   (i) Post-flood: Following flows exceeding 1200 cubic metres per second (m^3/s) at Mararoa weir (MLC) or 2000 m^3/s at Tuatapere;
   (ii) Channel recovery (if recommended as part of the Post-flood analysis): Some two years following a post-flood survey; and
   (iii) No flood: At intervals of no longer than 7 years* following the most recent no flood, post-flood or channel recovery survey, whichever is the most recent.

5. River flow at Tuatapere should be less than 100 m^3/s during surveys.

- Analysis

6. Survey data are to be analysed and reported to Environment Southland following each survey, in the same manner as the analysis and reporting set out in URS, 2010. Any alterations to the analysis and reporting shall require approval from Environment Southland prior to implementation.

**Note: The next standard survey is due in 2019 (7 years following the post flood survey required in 2012), if no post flood and channel recovery surveys occur before this time.*

References:
URS. 2010. Lower Waiau River Cross Section Survey 2009.

E.	Doubtful Sound Marine Environment

Objectives:
To maintain ongoing information about the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

To enable the identification of any long-term changes in the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

Methods:
1. Each year the Consent Holder shall implement a monitoring programme in accordance with the details set out in Cawthorn, 2010. The first year programme was completed in 2011.
2. Following the implementation of each monitoring programme, the Consent Holder shall report to Environment Southland presenting the data collected, a summary of the results of the monitoring, and any recommendations for changes to the monitoring programme for the following year.
3. Any recommended changes to the monitoring programme shall be discussed with the Fiordland Marine Guardians and shall be approved by Environment Southland prior to its implementation in the following year.

Reference:
Cawthron. 2010. Doubtful Sound Adaptive Monitoring Programme: Proposed Monitoring for 2011.

environment SOUTHLAND

Application No: M289-005
Consent No: 96022

Cnr North Road and Price Street
(Private Bag 90116)
Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 105(1) of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 19 December 1996.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers by means of a structure (with a crest level of 179.25 metres above m.s.l.) near the confluence of the Waiau and Mararoa Rivers, and to dam and divert the waters of the Marara River to an artificial diversion channel
Location	- site locality -	Te Anau
	- map reference -	D44:960:969 (structure) and D44:964:974 (channel)
	- receiving environment -	Mararoa and Lower Waiau Rivers
	- catchment -	Waiau
Legal description of land at the site:		River bed
Expiry date:		28 November 2031

Consent Amended

Conditions amended on August 9, 2000, November 6, 2002, 30 August 2004, 25 February 2011 and on 25 July 2012, as follows:

Schedule of Conditions

1. **Operating Guidelines**
The Consent Holder shall comply with Guidelines for the operation of Lake Manapouri contained in the Manapouri-Te Anau Development Act (Operating Guidelines) Notice 1992 gazetted in the New Zealand Gazette dated 29 April 1992 or any subsequent

amendment thereof or substitution therefore (the "Gazetted Guidelines"), except in exceptional natural circumstances, or where life or structures are endangered, as provided for in Section 4(A)(2) of the Manapouri-Te Anau Development Act 1963.

2. Minimum Flow

Except as provided for in conditions 2.1, 2.2, 3.1 and 3.2 the Consent Holder shall maintain, in the river downstream of the structure, a flow not less than 12 cubic metres per second (cumecs) between 1 May and 30 September, not less than 14 cumecs during October and April, and not less than 16 cumecs at all other times.

2.1 At times other than provided for in condition 2, 3.1 and 3.2, a minimum flow of not less than 6 cumecs shall be allowed for three 10 hour periods, between 1 March to 31 August in any one year only for the purposes of sill lowering at Gate 2 of the Manapouri Lake Control Structure.

2.2 Condition 2.1 shall expire and cease to have any effect from 1 September 2008.

3. Exceptions to Minimum Flow Condition

3.1 During the first twenty four months following the date of the grant of consent, the Consent Holder shall not be obliged to comply with Condition 2 but shall, subject to Condition 3.2 provide the flows in Condition 2 to the extent possible within the constraints imposed by the existing gate sill level, the Manapouri lake levels and the flow in the Mararoa River.

3.2 During the first twelve months following the date of the grant of the consent, the Consent Holder shall not be obliged to comply with Conditions 2 and/or 3.1 for such period or periods as are necessary or requisite in order to carry out such works within the stilling basin downstream of the gates as are necessary to enable compliance with the conditions of this consent.

4. Review Clause

At seven yearly intervals from the date of granting, the Council may review the results of all investigations carried out in accordance with Condition 12.

Within 3 months of completing these reviews and/or within 6 months of receiving a report or recommendation that a review take place from the Waiau Working Party, the Council may, in accordance with any Sections 128(1)(a) of the Act, serve notice that it intends to review Conditions 1 to 10 of this consent to deal with any significant adverse effect on the environment which may arise from the exercise of this consent which was not foreseen or reasonably foreseeable at the time of granting, and which it is appropriate to deal with after the results of monitoring have been received.

5. Mararoa Turbid Water

Whenever water in the Mararoa River has a turbidity greater than 30 NTU at the site referred to in Condition 7 the Consent Holder shall discharge from the lake control structure a flow no less than the flow in the Mararoa River measured at the same time.

6. Native Fish Pass

The Consent Holder shall, within two years of the date of grant of this permit, on the Manapouri Lake structure, install, operate and maintain a native fish pass designed and constructed following consultaton with the Director General of Conservation and Trustees of Te Waiau Mahika Kai Trust.

7. Records

Within three months of the date of grant of consent, the Consent Holder shall measure and record the turbidity levels and flow of the Mararoa River at "Cliffs" (or such other suitable site as is agreed with the General Manager, Southland Regional Councl), at a frequency of not less than once every 60 minutes and shall supply the correlated records to the Southland Regional Council annually.

8. Recreational Flows

The Consent Holder shall release a flow of not less than 35 cumecs for a period of 24 hours, on the fourth Sunday of each month between October and April inclusive or such alternative dates as are agreed with the Southland Regional Council, into the river below the Manapouri Lake Control Structure for recreational purposes provided that any of these two flows may be increased to not less than 45 cumecs as required by the New Zealand Jet Boat Association Southland Branch for specific events.

9. Other Flows

The Consent Holder shall release the following additional flows immediately below the Mararoa Weir, as follows:

One flow per year of not less than 150 cumecs of 24 hours duration during the period March to May inclusive and one further such flow during the period September to November inclusive each year. These flows will be released only if necessary to ensure the mouth of the Waiau River is in the opinion of the General manager, Southland Regional Council, sufficiently open to enable the passage of migratory fish during these periods and the Gazetted Guidelines can be complied with by the release of such flows.

10. Mararoa Trout/Fish Pass

The consent holder shall design, in consultation with the Southland Fish and Game Council, and within three years of the date of grant of the consent, install, operate, and maintain, an effective fish pass which allows the upstream and downstream passage of brown and rainbow trout at the Manapouri Lake Control Structure.

11. Erosion

The Consent Holder shall:

(a) take such precautionary measures which the General Manager, Southland Regional Council may require to prevent damage from erosion which is likely to occur as a result of the exercise of this permit; and

(b) make such remedial repairs which the General Manager, Southland Regional Council may require to remedy damage from erosion which occurs as a result of the exercise of this permit.

12. Monitoring

The Consent Holder shall implement the monitoring programme agreed with the Southland Regional Council and attached as Appendix 1 and shall supply a copy of the results to the Council annually.

13. Charges

The Consent Holder shall pay to the Southland Regional Council the following user charges which are fixed under Section 36 of the Act:

(a) an administration charge; and
(b) a compliance monitoring charge.

User charges are payable, in advance, on receipt of invoice on the first day of July each year.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Appendix 1

(Amended July 2012)

Applies to CN 96019, CN 96020, CN 96021, CN 96022 and CN 96023

Manapouri Power Scheme Resource Consents - Monitoring and Management Responses

Monitoring Contents

A. Lakes Te Anau and Manapouri
   1. Shoreline Vegetation
   2. Beach Sediments
   3. Littoral Macrophytes
   4. Waiau Arm

B. Control Structures
   5. Longfinned Eel

C. Upper & Lower Waiau River - Biological
   6. Periphyton and Macrophytes
   7. Periphyton and Macroinvertebrates

D. River Channel Morphology
   8. Upper Waiau River
   9. Lower Waiau River

E. Doubtful Sound Marine Environment

A. Lakes Te Anau and Manapouri

Guidelines for lake level management are overseen by the Guardians of Lakes Manapouri, Te Anau and Monowai. These guidelines are derived by monitoring aspects of the shoreline vegetation and beach morphology. Ongoing monitoring of these aspects is necessary to allow the Guardians to continue their assessment and refinement of the guidelines.

1. Shoreline vegetation

Objective: To assess the effects of the lake level management regime on the shoreline vegetation of Lakes Manapouri and Te-Anau.

Methods: Monitoring will be undertaken using the transects and photo points set out in the previous monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (Landcare, 2010). Methods of data collection and analysis are to be the same as set out in the Landcare, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the selected transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, commencing from 2010. Re-measurement may also occur if the high-level lake operating guidelines are breached ("event-driven" monitoring).

For "event driven" monitoring surveys of the shoreline vegetation, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Landcare. 2010. Lakes Manapouri and Te Anau: Shore Vegetation Monitoring

2. Beach Sediments

Objective: To assess the effects of the lake level management regime on the beach stability of lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using the sites and transects as set out in the most recent monitoring report for Lakes Te Anau and Manapouri (Single, 2008). Methods of data collection and analysis are to be the same as set out in the Single, 2008, monitoring report so that the results are directly comparable. Any alterations to the sites or transects shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-inspection of the sites and re-measurement of the transects at Lakes Manapouri and Te Anau undertaken by Single (2008) will occur at 5-yearly intervals, with the next monitoring being undertaken in 2016. Re-inspection of the sites and re-measurement of the transects

may also occur if the lake operating guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of the shoreline monitoring sites and transects, and whether or not any of the transects are required to be re-measured, may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Single M. 2008. Beach changes on Lakes Manapouri and Te Anau and cliff erosion at Pearl Harbour Manapouri June 2002 – October 2006

3. Littoral Macrophytes

Objective: To assess the effects of the lake level management regime on the aquatic macrophytes of Lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using transects and photo points as set out by the most recent monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (NIWA, 2010). Methods of data collection and analysis (including analysis of inter-decile ranges) are to be the same as set out in the NIWA, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, with the next monitoring being undertaken in 2012. Re-measurement of the transects may also occur if the low-level guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai. The timing of an "event driven" monitoring survey may also be varied by Environment Southland, and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai, taking into account the timing of the next 5-yearly monitoring survey.

References:
NIWA. 2010. Monitoring the potential effects of MTAD on Lakes Te Anau and Manapouri macrophytes:baseline survey.

4. Waiau Arm

Objective: To enable the implementation of a protocol for monitoring changes in water quality and for subsequent flow management in the Waiau Arm. The purpose of the protocol is to establish a monitoring programme and a management plan specifying the

actions to occur should declining water quality and/or phytoplankton bloom be detected in response to more than minor effects arising from the operation of the MPS.

Method: Monitoring of water quality and subsequent flow management in the Waiau Arm shall be undertaken in accordance with the details set out in NIWA, 2010. Any changes to the monitoring from that set out in NIWA, 2010, shall require approval from Environment Southland prior to implementation.

Reference:
NIWA. 2010. Water quality monitoring protocol for Waiau Arm.

B. Control Structures

5. Long fin Eel

Objective: To further understand the migratory and population characteristics of long fin eel in the Te Anau, Manapouri and Waiau River catchments following the modification of natural conditions by the Manapouri Power Scheme, in order to further develop and implement appropriate monitoring and management responses for long fin eel conservation in these areas.

Methods:

(i) Meridian shall consult at least annually with the Te Waiau Mahika Kai Trust, the Waiau Fisheries and Wildlife Enhancement Trust, the Ministry of Fisheries, the Department of Conservation, interested commercial eel fishers, the Guardians of Lakes Manapouri, Monowai and Te Anau and other interested stakeholders and relevant experts to develop and implement research, monitoring and management response activities for long fin eel conservation in the Te Anau, Manapouri and Waiau River catchments. Meridian's ongoing role in these activities shall be to the satisfaction of Environment Southland and shall be reported upon annually.

(ii) The research and management response activities shall take into account the findings of Mitchell and Davis-Te Maire (1994) and Boubee et al (2003), and the findings and recommendations of Graynoth (2004).

References:
Mitchell, C.P.; Davis-Te Maire, K.T.A. 1994. "Mahingakai values of the Waiau River". Report to ECNZ, 1994.
Moss, Z. (1997 – 2002) to be completed.
Boubee, J. ; Williams, E. ; Richardson, J. (2003). Fish Survey of the Waiau River Catchment – January 2003.
Graynoth, E. (2004). Review of monitoring and mitigation strategies for longfinned eel management in the Te ANau and Manapouri Catchments. NIWA report to Meridian Energy Ltd.

C. Upper and Lower Waiau River - Biological

6. Upper Waiau - Periphyton and Macrophytes

Objective: To confirm that the MPS flow regime has not resulted in any long term changes to periphyton and macrophytes growth in the Upper Waiau River.

Methods: During 2012, periphyton and macrophyte monitoring will be undertaken of up to five transects in different habitat types (using the transects and methods set out in the previous monitoring report for periphyton and macrophtye monitoring in the Upper Waiau River (NIWA, 2007).

For macrophytes, assessments of species diversity, cover frequencies and biomass will be made. Periphyton analysis may include ash-free dry weight, chlorophyll-a and species composition.

The Consent Holder shall prepare a report comparing the results of the monitoring with the results of the programme undertaken in 2007 (NIWA, 2007) identifying whether any changes are attributable to the MPS flow regime and provide this report to Environment Southland. On the basis of this report, if no changes have been identified as being attributable to the MPS flow regime, Environment Southland shall confirm to the consent holder that no further monitoring is required. However, if there are changes attributable to the MPS flow regime, the Consent Holder shall, within 3 months of providing this report to the Council, provide recommendations to Environment Southland for ongoing periphyton and macrophyte monitoring, including time frames. Following approval by Environment Southland, the Consent Holder shall undertake the approved monitoring.

Reference:
NIWA. 2007. Manapouri Power Scheme resource consent monitoring programme: periphyton and macrophytes in the Upper Waiau River.

7. Lower Waiau - Periphyton and Macroinvertebrates

Objective: To monitor periphyton and macroinvertebrates in the Lower Waiau River, upstream of the Monowai confluence, to build upon data gathered about the effect of the flow regime on these biological values.

Methods: Monitoring shall be undertaken annually until 2015 in accordance with Kilroy, C., Lambert, P., Campbell, H., Blair, N. Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

Particularly, monitoring shall continue to be undertaken at the following sites:

- Excelsior – 100 m downstream of the Waiau R./Excelsior Ck confluence;
- Redcliff – just upstream of Redcliff Creek; and
- Blackmount – on large bend in river about 7 km upstream from Monowai confluence).

Control sites in the Mararoa River shall be monitored and all monitoring should be undertaken in late February/early March.

References:
Kilroy, C., Lambert, P., Campbell, H., Blair, N. (2010). Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

D. River Channel Morphology

8. Upper Waiau River

Objective: To continue to measure the amount of river bank erosion in the Upper Waiau River, after establishment of the refined flow regime.

Methods: Two "peglines" were installed in the Upper Waiau River in 1983. These were at Rainbow Reach and "Village Pond". Offset measurements of the peglines will be re-assessed every seven years with the next monitoring being undertaken in 2016; and after flows in excess of 800 cumecs (approximately 10 year return period) to enable the magnitude of erosion to be monitored. (The peglines were last surveyed in March 2003 (Opus 2003)). Reporting should give particular regard to the cliff aspect of any erosion occurring (fretting), relative to similar erosion in the general area so that the mechanisms of this type of erosion can be considered. Reporting should also identify events or trends of particular note and potential causes for these.

Photo stations established by Opus in 2003 (refer Opus, April 2003) on the true right bank opposite both pegline sites shall be re-photographed concurrently with the pegline surveys every two years and after flows in excess of 800 cumecs.

References:
Opus International Consultants (November 2002). "Waiau River Monitoring Programme and Cross Section Survey Review."
Opus International Consultants (April 2003). "Upper Waiau Peglines" (Letter, pegline surveys and photographs).

9. Waiau River

Objective: To assess the changes in the character and morphology of the Waiau River (downstream from Pearl Harbour), and assist in determining whether flow regulation is having an impact on any such changes in the river channel and at beach in the vicinity of the mouth of the lower Waiau River.

Methods: Geomorphological monitoring will measure and report erosion and accretion, vegetation cover and channel morphology along the lower Waiau River, and at the beach in the vicinity of the mouth of the river, using geodetic survey and aerial photography as follows:

- Measurement
  1. A geodetic survey of transects shall be undertaken in accordance with the details set out in the previous monitoring report for geomorphology of the lower Waiau River (URS, 2010), incorporating the following locations:

     (a) the Mararoa and Home creek Deltas;
     (b) the lower Waiau River;

(c) the beach in the vicinity of the mouth of the lower Waiau River.

The extent and elevation of all water surfaces shall also be surveyed at each transect. The river flow at each of the river transect locations on the day of survey shall be assessed. This survey enables erosion and accretion at these transects to be estimated. Any alterations to the transects shall require approval from Environment Southland prior to implementation.

2. An assessment is to be made from aerial photographs of the vegetation cover across each of the geodetic survey transects. The location of the boundaries between the following zones shall be surveyed:
   (a) bare clean river gravel;
   (b) river gravels with less than 50% total groundcover of lichen, moss, grass, herbs, and shrubs;
   (c) river gravels with 50% or more total groundcover of lichen, moss, grass, herbs, shrubs, and trees.

3. An aerial photographic survey of the lower Waiau River with coverage not less that of previous surveys is required. The aerial photography enables planform changes to the channel and barrier system to be monitored.

- Survey Timing

4. Surveys are required to be undertaken:
   (i) Post-flood: Following flows exceeding 1200 cubic metres per second (m^3/s) at Mararoa weir (MLC) or 2000 m^3/s at Tuatapere;
   (ii) Channel recovery (if recommended as part of the Post-flood analysis): Some two years following a post-flood survey; and
   (iii) No flood: At intervals of no longer than 7 years* following the most recent no flood, post-flood or channel recovery survey, whichever is the most recent.

5. River flow at Tuatapere should be less than 100 m^3/s during surveys.

- Analysis

6. Survey data are to be analysed and reported to Environment Southland following each survey, in the same manner as the analysis and reporting set out in URS, 2010. Any alterations to the analysis and reporting shall require approval from Environment Southland prior to implementation.

**Note: The next standard survey is due in 2019 (7 years following the post flood survey required in 2012), if no post flood and channel recovery surveys occur before this time.*

References:
URS. 2010. Lower Waiau River Cross Section Survey 2009.

E. Doubtful Sound Marine Environment

Objectives:
To maintain ongoing information about the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

To enable the identification of any long-term changes in the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

Methods:

1. Each year the Consent Holder shall implement a monitoring programme in accordance with the details set out in Cawthorn, 2010. The first year programme was completed in 2011.

2. Following the implementation of each monitoring programme, the Consent Holder shall report to Environment Southland presenting the data collected, a summary of the results of the monitoring, and any recommendations for changes to the monitoring programme for the following year.
3. Any recommended changes to the monitoring programme shall be discussed with the Fiordland Marine Guardians and shall be approved by Environment Southland prior to its implementation in the following year.

Reference:

Cawthron. 2010. Doubtful Sound Adaptive Monitoring Programme: Proposed Monitoring for 2011.

COPY
ORIGINAL.

environment SOUTHLAND

Application No: M289-005
Consent No: 96023

Cnr North Road and Price Street
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Invercargill

Telephone (03) 211 5115
Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Discharge Permit

Pursuant to Section 105(1) of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 19 December 1996.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge the waters of Lake Manapouri and the Waiau and Mararoa Rivers to the bed of the Waiau River below the Manapouri Lake Control Structure
Location	- site locality -	Te Anau
	- map reference -	D44:960:969
	- receiving environment -	Waiau River
	- catchment -	Waiau
Legal description of land at the site:		River bed
Maximum Rate – m^3 per day:		See the conditions of Consent Number 96022
Expiry date:		28 November 2031

Consent Amended

Conditions amended on August 9, 2000, 30 August 2004, 25 February 2011 and on 25 July 2012, as follows:

Schedule of Conditions

1. **Records**
Within three months of the date of grant of the consent, the consent holder shall record the rate at which water is discharged, at a frequency not less than every 60 minutes, and supply a copy of such records to the Southland Regional Council annually.

2. Flood Rules

The consent holder shall have flood rules that record the appropriate releases from the structure in the event of floods. The consent holder shall provide the Southland Regional Council with a copy of such flood rules within six months of the issue of this permit.

3. Warning Signs

The consent holder shall erect and maintain signs warning of the danger of the fluctuations in the river level at points of public access to the river nominated by the General Manager, Southland Regional Council within six months of receipt of such notification.

4. Monitoring

The consent holder shall implement the monitoring programme agreed with the Southland Regional Council and attached as Appendix 1 and shall supply a copy of the results to the Council annually.

5. Review Clause

The Council may review the flood rules required by Condition 2 within three months of receiving those rules.

At seven yearly intervals from the date of granting, the Council may review the results of all investigations carried out in accordance with Condition 4.

Within three months of completing these reviews and/or within six months of receiving a report or recommendation that a review take place from the Waiau Working Party, the Council may, in accordance with Sections 128(1)(a) of the Act, serve notice that it intends to review Conditions 1, 2 and 4 of this consent to deal with any significant adverse effect on the environment which may arise from the exercise of this consent which was not foreseen or reasonably forseeable at the time of granting, and which it is appropriate to deal with after the results of monitoring have been received.

6. Charges

The consent holder shall pay to the Southland Regional Council the following user charges which are fixed under Section 36 of the Act:

(a) an administration charge; and
(b) a compliance monitoring charge.

User charges are payable, in advance, on receipt of invoice on the first day of July each year.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Appendix 1

(Amended July 2012)

Applies to CN 96019, CN 96020, CN 96021, CN 96022 and CN 96023

Manapouri Power Scheme Resource Consents - Monitoring and Management Responses

Monitoring Contents

A. Lakes Te Anau and Manapouri

Guidelines for lake level management are overseen by the Guardians of Lakes Manapouri, Te Anau and Monowai. These guidelines are derived by monitoring aspects of the shoreline vegetation and beach morphology. Ongoing monitoring of these aspects is necessary to allow the Guardians to continue their assessment and refinement of the guidelines.

1. Shoreline vegetation

Objective: To assess the effects of the lake level management regime on the shoreline vegetation of Lakes Manapouri and Te-Anau.

Methods: Monitoring will be undertaken using the transects and photo points set out in the previous monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (Landcare, 2010). Methods of data collection and analysis are to be the same as set out in the Landcare, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the selected transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, commencing from 2010. Re-measurement may also occur if the high-level lake operating guidelines are breached ("event-driven" monitoring).

For "event driven" monitoring surveys of the shoreline vegetation, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Landcare. 2010. Lakes Manapouri and Te Anau: Shore Vegetation Monitoring

2. Beach Sediments

Objective: To assess the effects of the lake level management regime on the beach stability of lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using the sites and transects as set out in the most recent monitoring report for Lakes Te Anau and Manapouri (Single, 2008). Methods of data collection and analysis are to be the same as set out in the Single, 2008, monitoring report so that the results are directly comparable. Any alterations to the sites or transects shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-inspection of the sites and re-measurement of the transects at Lakes Manapouri and Te Anau undertaken by Single (2008) will occur at 5-yearly intervals, with the next monitoring being undertaken in 2016. Re-inspection of the sites and re-measurement of the transects

may also occur if the lake operating guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of the shoreline monitoring sites and transects, and whether or not any of the transects are required to be re-measured, may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai.

References:
Single M. 2008. Beach changes on Lakes Manapouri and Te Anau and cliff erosion at Pearl Harbour Manapouri June 2002 – October 2006

3. Littoral Macrophytes

Objective: To assess the effects of the lake level management regime on the aquatic macrophytes of Lakes Manapouri and Te Anau.

Methods: Monitoring will be undertaken using transects and photo points as set out by the most recent monitoring report for Lakes Te Anau, Manapouri and Lake Hauroko (NIWA, 2010). Methods of data collection and analysis (including analysis of inter-decile ranges) are to be the same as set out in the NIWA, 2010, monitoring report, so that the results are directly comparable. Lake Hauroko shall be used as the control site to identify any observed changes that may be due to a regional climatic phenomenon, rather than lake management. Any alterations to the transects, photo points, methods of data collection or analysis shall be discussed with the Guardians of Lakes Manapouri, Te Anau and Monowai, and shall require approval from Environment Southland prior to implementation.

Re-measurement of the transects in Lakes Manapouri, Te Anau and Hauroko will occur at 5-yearly intervals, with the next monitoring being undertaken in 2012. Re-measurement of the transects may also occur if the low-level guidelines have been breached ("event driven" monitoring).

For "event driven" monitoring surveys, the number of transects and/or photo points may vary from those required for the 5-yearly monitoring, depending on the nature and extent of the "event", as agreed with Environment Southland and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai. The timing of an "event driven" monitoring survey may also be varied by Environment Southland, and following consultation by the consent holder with the Guardians of Lakes Manapouri, Te Anau and Monowai, taking into account the timing of the next 5-yearly monitoring survey.

References:
NIWA. 2010. Monitoring the potential effects of MTAD on Lakes Te Anau and Manapouri macrophytes:baseline survey.

4. Waiau Arm

Objective: To enable the implementation of a protocol for monitoring changes in water quality and for subsequent flow management in the Waiau Arm. The purpose of the protocol is to establish a monitoring programme and a management plan specifying the

actions to occur should declining water quality and/or phytoplankton bloom be detected in response to more than minor effects arising from the operation of the MPS.

Method: Monitoring of water quality and subsequent flow management in the Waiau Arm shall be undertaken in accordance with the details set out in NIWA, 2010. Any changes to the monitoring from that set out in NIWA, 2010, shall require approval from Environment Southland prior to implementation.

Reference:
NIWA. 2010. Water quality monitoring protocol for Waiau Arm.

B. Control Structures

5. Long fin Eel

Objective: To further understand the migratory and population characteristics of long fin eel in the Te Anau, Manapouri and Waiau River catchments following the modification of natural conditions by the Manapouri Power Scheme, in order to further develop and implement appropriate monitoring and management responses for long fin eel conservation in these areas.

Methods:

(i) Meridian shall consult at least annually with the Te Waiau Mahika Kai Trust, the Waiau Fisheries and Wildlife Enhancement Trust, the Ministry of Fisheries, the Department of Conservation, interested commercial eel fishers, the Guardians of Lakes Manapouri, Monowai and Te Anau and other interested stakeholders and relevant experts to develop and implement research, monitoring and management response activities for long fin eel conservation in the Te Anau, Manapouri and Waiau River catchments. Meridian's ongoing role in these activities shall be to the satisfaction of Environment Southland and shall be reported upon annually.

(ii) The research and management response activities shall take into account the findings of Mitchell and Davis-Te Maire (1994) and Boubee et al (2003), and the findings and recommendations of Graynoth (2004).

References:
Mitchell, C.P.; Davis-Te Maire, K.T.A. 1994. "Mahingakai values of the Waiau River". Report to ECNZ, 1994.
Moss, Z. (1997 – 2002) to be completed.
Boubee, J. ; Williams, E. ; Richardson, J. (2003). Fish Survey of the Waiau River Catchment – January 2003.
Graynoth, E. (2004). Review of monitoring and mitigation strategies for longfinned eel management in the Te ANau and Manapouri Catchments. NIWA report to Meridian Energy Ltd.

C. Upper and Lower Waiau River - Biological

6. Upper Waiau - Periphyton and Macrophytes

Objective: To confirm that the MPS flow regime has not resulted in any long term changes to periphyton and macrophytes growth in the Upper Waiau River.

Methods: During 2012, periphyton and macrophyte monitoring will be undertaken of up to five transects in different habitat types (using the transects and methods set out in the previous monitoring report for periphyton and macrophtye monitoring in the Upper Waiau River (NIWA, 2007).

For macrophytes, assessments of species diversity, cover frequencies and biomass will be made. Periphyton analysis may include ash-free dry weight, chlorophyll-a and species composition.

The Consent Holder shall prepare a report comparing the results of the monitoring with the results of the programme undertaken in 2007 (NIWA, 2007) identifying whether any changes are attributable to the MPS flow regime and provide this report to Environment Southland. On the basis of this report, if no changes have been identified as being attributable to the MPS flow regime, Environment Southland shall confirm to the consent holder that no further monitoring is required. However, if there are changes attributable to the MPS flow regime, the Consent Holder shall, within 3 months of providing this report to the Council, provide recommendations to Environment Southland for ongoing periphyton and macrophyte monitoring, including time frames. Following approval by Environment Southland, the Consent Holder shall undertake the approved monitoring.

Reference:
NIWA. 2007. Manapouri Power Scheme resource consent monitoring programme: periphyton and macrophytes in the Upper Waiau River.

7. Lower Waiau - Periphyton and Macroinvertebrates

Objective: To monitor periphyton and macroinvertebrates in the Lower Waiau River, upstream of the Monowai confluence, to build upon data gathered about the effect of the flow regime on these biological values.

Methods: Monitoring shall be undertaken annually until 2015 in accordance with Kilroy, C., Lambert, P., Campbell, H., Blair, N. Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

Particularly, monitoring shall continue to be undertaken at the following sites:

- Excelsior – 100 m downstream of the Waiau R./Excelsior Ck confluence;
- Redcliff – just upstream of Redcliff Creek; and
- Blackmount – on large bend in river about 7 km upstream from Monowai confluence).

Control sites in the Mararoa River shall be monitored and all monitoring should be undertaken in late February/early March.

References:
Kilroy, C., Lambert, P., Campbell, H., Blair, N. (2010). Periphyton and Invertebrate Monitoring Programme Lower Waiau River 2010 Survey. NIWA report to Meridian Energy Ltd.

D. River Channel Morphology

8. Upper Waiau River

Objective: To continue to measure the amount of river bank erosion in the Upper Waiau River, after establishment of the refined flow regime.

Methods: Two "peglines" were installed in the Upper Waiau River in 1983. These were at Rainbow Reach and "Village Pond". Offset measurements of the peglines will be re-assessed every seven years with the next monitoring being undertaken in 2016; and after flows in excess of 800 cumecs (approximately 10 year return period) to enable the magnitude of erosion to be monitored. (The peglines were last surveyed in March 2003 (Opus 2003)). Reporting should give particular regard to the cliff aspect of any erosion occurring (fretting), relative to similar erosion in the general area so that the mechanisms of this type of erosion can be considered. Reporting should also identify events or trends of particular note and potential causes for these.

Photo stations established by Opus in 2003 (refer Opus, April 2003) on the true right bank opposite both pegline sites shall be re-photographed concurrently with the pegline surveys every two years and after flows in excess of 800 cumecs.

References:
Opus International Consultants (November 2002). "Waiau River Monitoring Programme and Cross Section Survey Review."
Opus International Consultants (April 2003). "Upper Waiau Peglines" (Letter, pegline surveys and photographs).

9. Waiau River

Objective: To assess the changes in the character and morphology of the Waiau River (downstream from Pearl Harbour), and assist in determining whether flow regulation is having an impact on any such changes in the river channel and at beach in the vicinity of the mouth of the lower Waiau River.

Methods: Geomorphological monitoring will measure and report erosion and accretion, vegetation cover and channel morphology along the lower Waiau River, and at the beach in the vicinity of the mouth of the river, using geodetic survey and aerial photography as follows:

- Measurement
  1. A geodetic survey of transects shall be undertaken in accordance with the details set out in the previous monitoring report for geomorphology of the lower Waiau River (URS, 2010), incorporating the following locations:

     (a) the Mararoa and Home creek Deltas;

(b) the lower Waiau River;
(c) the beach in the vicinity of the mouth of the lower Waiau River.

The extent and elevation of all water surfaces shall also be surveyed at each transect. The river flow at each of the river transect locations on the day of survey shall be assessed. This survey enables erosion and accretion at these transects to be estimated. Any alterations to the transects shall require approval from Environment Southland prior to implementation.

2. An assessment is to be made from aerial photographs of the vegetation cover across each of the geodetic survey transects. The location of the boundaries between the following zones shall be surveyed:
   (a) bare clean river gravel;
   (b) river gravels with less than 50% total groundcover of lichen, moss, grass, herbs, and shrubs;
   (c) river gravels with 50% or more total groundcover of lichen, moss, grass, herbs, shrubs, and trees.

3. An aerial photographic survey of the lower Waiau River with coverage not less that of previous surveys is required. The aerial photography enables planform changes to the channel and barrier system to be monitored.

- Survey Timing

4. Surveys are required to be undertaken:
   (i) Post-flood: Following flows exceeding 1200 cubic metres per second (m^3/s) at Mararoa weir (MLC) or 2000 m^3/s at Tuatapere;
   (ii) Channel recovery (if recommended as part of the Post-flood analysis): Some two years following a post-flood survey; and
   (iii) No flood: At intervals of no longer than 7 years* following the most recent no flood, post-flood or channel recovery survey, whichever is the most recent.

5. River flow at Tuatapere should be less than 100 m^3/s during surveys.

- Analysis

6. Survey data are to be analysed and reported to Environment Southland following each survey, in the same manner as the analysis and reporting set out in URS, 2010. Any alterations to the analysis and reporting shall require approval from Environment Southland prior to implementation.

**Note: The next standard survey is due in 2019 (7 years following the post flood survey required in 2012), if no post flood and channel recovery surveys occur before this time.*

References:
URS. 2010. Lower Waiau River Cross Section Survey 2009.

E. Doubtful Sound Marine Environment

Objectives:
To maintain ongoing information about the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

To enable the identification of any long-term changes in the environmental condition (both physical and biological parameters) of the Doubtful-Thompson-Bradshaw Sounds system during the ongoing operation of the Manapouri Power Station.

Methods:

1. Each year the Consent Holder shall implement a monitoring programme in accordance with the details set out in Cawthorn, 2010. The first year programme was completed in 2011.
2. Following the implementation of each monitoring programme, the Consent Holder shall report to Environment Southland presenting the data collected, a summary of the results of the monitoring, and any recommendations for changes to the monitoring programme for the following year.
3. Any recommended changes to the monitoring programme shall be discussed with the Fiordland Marine Guardians and shall be approved by Environment Southland prior to its implementation in the following year.

Reference:
Cawthron. 2010. Doubtful Sound Adaptive Monitoring Programme: Proposed Monitoring for 2011.

environment
SOUTHLAND

Application No: M289-006
Consent No:96024

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Invercargill

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Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 105(1) of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 28 November 1996.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To take and use for the purpose of the Manapouri Power Scheme the waters of Lake Manapouri, through intake gates at the Manapouri Power Station at West Arm
Location	- site locality -	West Arm
	- map reference -	C43:632-050
	- receiving environment -	Lake Manapouri
Legal description of land at the site:		Lake Bed
Maximum Rate – cubic metres/day:-		510
Expiry date:		28 November 2031

Schedule of Conditions

1. Operating Guidelines

The Consent Holder shall comply with Guidelines for the operation of Lake Manapouri contained in the Manapouri-Te Anau Development Act (Operating Guidelines) Notice 1992 gazetted in the New Zealand Gazette dated 29 April 1993 or any subsequent amendment thereof or substitution therefore (the "Gazetted Guidelines") except in exceptional circumstances, or where life or structures are endangered as provided for in Section 4(A)(2) of the Manapouri-Te Anau Development Act 1963.

2. Records

The Consent Holder shall measure and record the lake water levels relative to mean sea level Deep Cove at a frequency not less than every 60 minutes and shall supply a copy of the records to the Southland Regional Council annually.

3. Charges

The Consent Holder shall pay to the Southland Regional Council the following charges which are fixed under Section 36 of the Act:

(a) an administration charge; and
(b) a compliance monitoring charge.

User charges are payable, in advance, on receipt of invoice on the first day of July each year.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

environment SOUTHLAND

File No: M289-044
Consent: 206156

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(Private Bag 90116)
Invercargill

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Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 2 August 2010.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers, for the purposes of the take and use of water for hydro-electricity generation in the Manapouri Power Scheme by means of the Manapouri Lake Control Structure
Location	- site locality	Manapouri Lake Control Structure, Lower Waiau River
	- map reference	NZMS 260 D44:960-969
	- receiving environment	Lake Manapouri and the Waiau and Mararoa Rivers
Legal description of land at the site:		River bed
Expiry date:		28 November 2031

Consent Amended

Conditions amended on 25 February 2011 and again on 21 September 2012 and on 16 January 2013, as follows:

Schedule of Conditions

1. This consent is granted for a period to expire on 28 November 2031.

2. This consent shall only be exercised at times when water permit no 96022 [refer to table at end of conditions] is being fully exercised and when additional freshwater is being discharged at flows greater than 510 m^3/s to the waters of Doubtful Sound at Deep Cove in accordance with coastal permit no. 96019 [refer to table at end of conditions]. This consent shall be deemed to commence on the first occasion that consent no 206158 is exercised, i.e. on the first occasion that the discharge to Doubtful Sound exceeds 510 m^3/s.].

Operating Guidelines

3. At all times when exercising this consent, the consent holder shall comply with the provisions of condition 1 of water permit no 96022 [refer to table at end of conditions].

Minimum Flow

4. At all times when exercising this consent, the consent holder shall ensure that the provisions of condition 2 of water permit no 96022 [refer to table at end of conditions] are met.

Mararoa Turbid Water

5. At all times when exercising this consent, the consent holder shall ensure that the provisions of condition 5 of water permit no 96022 [refer to table at end of conditions] are met.

Waiau Arm Water Quality

6. Prior to exercising this consent, the consent holder shall prepare and implement a protocol for monitoring changes in water quality and for subsequent flow management in the Waiau Arm, in accordance with the details set out in Appendix A of this consent. The purpose of the protocol will be to establish a monitoring programme and a management plan specifying the actions to occur should declining water quality and/or a phytoplankton bloom be detected. The aim of the protocol will be to ensure that the flushing of the affected water in the Waiau Arm, with water derived from Lake Manapouri, occurs in an effective manner in response to the actual measured effect and until the affected water is removed. The protocol shall be forwarded to Environment Southland for its approval prior to the exercise of this consent.

Lower Waiau River Voluntary Supplementary Flows

7. The consent holder shall prepare and implement a protocol relating to controlled releases of voluntary supplementary flows from the Manapouri Lake Control (MLC) structure to the Lower Waiau River, in order to assist in managing periphyton biomass.

   The protocol shall include the following:

   (a) Any monitoring to be undertaken to assess periphyton biomass;
   (b) The size, duration, frequency and timing of the supplementary flows considered useful to assist in managing periphyton biomass;
   (c) The circumstances, relating to periphyton biomass and natural flow occurrences, under which controlled releases of supplementary flows will be considered by the consent holder;

(d) The circumstances, relating to lake levels and security of electricity supply, under which controlled releases of supplementary flows may not be able to be provided by the consent holder;
(e) The procedures to be followed by the consent holder in considering and deciding upon the provision of a controlled release of a supplementary flow, in terms of the circumstances in (c) and (d) above.

The consent holder shall consult the Waiau Working Party; the Guardians of Lakes Manapouri, Monowai and Te Anau; and Te Ao Marama during the development of the initial protocol and any subsequent changes to the protocol.

The protocol shall be forwarded to Environment Southland for certification by the Director of Environmental Management as to compliance with this condition, prior to the 1st of December following the grant of consent to this condition. Any changes to the protocol shall also require certification from the Director of Environmental Management prior to implementation. The results of any monitoring undertaken in terms of this protocol shall be forwarded to Environment Southland annually, in conjunction with the monitoring results provided under Condition 8. This shall include the dates and flow parameters of all controlled releases of supplementary flows provided under this protocol by the consent holder in the preceding year.

Environmental Monitoring

8. The consent holder shall implement the monitoring programme annexed to this water permit as Appendix A and shall forward a copy of the results of that monitoring to Environment Southland annually.

9. In addition to the monitoring programme set out in Appendix A to this water permit, the consent holder shall implement all monitoring and associated reporting required by condition 12 of water permit no 96022 [refer to table at end of conditions].

Review Clause

10. At any time during 2017 and at any time during every subsequent seventh year from 2017, the Council may review the results of all investigations carried out in accordance with condition 12 of water permit no 96022 [refer to table at end of conditions] and with all monitoring and investigations carried out in accordance with this water permit. Within three months of completing this review, the Council may, in accordance with Sections 128(1)(a) and 129 of the Act, serve notice that it intends to review the conditions of this consent for the purpose of dealing with any actual or potential adverse effect on the environment that may arise from the exercise of this consent and are appropriate to deal with after the results of the monitoring have been received.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Existing Environment Southland Consents to which these conditions refer:
Consent no 96019:
Coastal Permit to Discharge Water to Deep Cove, Doubtful Sound

Consent no 96022:
Water Permit to dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers for purposes of the take and use of water for hydroelectricity generation in the Manapouri Power Scheme

Consent no 96024:
Water Permit to take and use water from Lake Manapouri for hydroelectricity generation in the Manapouri Power Scheme

Appendix A
Monitoring Programme for Manapouri Tailrace Amended Discharge (MTAD) Coastal and Water Permits (Consents 206516, 206157 and 206158)

Overview

Appendix A sets out the key environmental monitoring programmes for the above consent associated with the Manapouri Tailrace Amended Discharge (MTAD)

It should be emphasised that this monitoring programme can be revised from time to time as new technologies or methods arise, in accordance with Sections 127 and 128 of the Resource Management Act 1991.

Monitoring Contents

A. Deep Cove and Doubtful Sound
   (i) Marine Physical
   (ii) Marine Biological
   (iii) Recreation and Tourism

B. Lakes Manapouri, and Te Anau
   (i) Lake Macrophytes
   (ii) Water quality Sampling
   (iii) Lakeshore Vegetation
   (iv) Lakeshore Sediments
   (v) Waiau Arm Water Quality

C. Lower Waiau River
   (i) Interaction between River Flow regime, Groundwater and Wetlands Water Levels
   (ii) River Bed Material Transport

A. Deep Cove and Doubtful Sound

(i) *Marine Physical*

1. Prior to exercising this consent, the consent holder shall submit to the Compliance Manager, Environment Southland, a report setting out how the existing physical marine monitoring programme shall be amended to monitor for any incremental physical effects of MTAD, including the location of additional monitoring sites and the parameters of such monitoring, <u>such as:</u>
   - <u>*addition of salinity sensors at moorings beyond M4, within top 3 m of the water column.*</u>

(ii) *Marine Biology*

2. Prior to exercising this consent, the consent holder shall submit to the Compliance Manager, Environment Southland, a report setting out how the existing biological monitoring programme, shall be amended to take into account possible incremental effects from MTAD. Additional monitoring should target those areas where the assessment has identified the incremental physical effects associated with MTAD may lead to biological changes and will be developed in consultation with the researchers and Fiordland Marine Guardians. Additional monitoring shall include:

- mapping of organisms in the intertidal zone including focused sampling in transitional areas of the fiord where potential changes in populations would be most likely to be observed, as well as at reference sites in Milford and Bradshaw Sounds;
- sampling to be at a high resolution and using quantitative methods such as photoquadrants and field counts at permanently marked stations. Similar sampling conducted in reference sites in Milford and Bradshaw Sounds;
- monitoring of conditions of the soft sediment habitat and associated species (e.g. bivalves, infauna, epibiota, sediment characteristics) at Deep Cove and Hall Arm and reference locations in Thomson, Bradshaw and Milford Sounds.

(iii) *Recreation and Tourism*

3. In accordance with condition 11 of consent no 206158, the consent holder shall monitor the potential ongoing effects of increased discharge on surface water conditions by correlating all information received in accordance with clause 4 of Appendix A with actual tailrace discharge data.

4. The consent holder shall maintain a record of all information supplied by the Deep Cove Outdoor Education Trust (DCOET), and commercial kayak and boating operators in Doubtful Sound on their observed experience with the use of Deep Cove, and the potential effects of increased current speed as a result of the increased tailrace discharge. This information should include:

   (a) date, time and location of observation;
   (b) observed weather conditions;
   (c) observed sea state, including wave and current conditions; and
   (d) effect on boating activity (including the reason for making a decision which limits or changes activities).

B. Lakes Te Anau and Manapouri and Waiau Arm

(i) *Lake Macrophytes*

Lakes Te Anau and Manapouri Macrophytes

5. The consent holder shall undertake a macrophyte monitoring survey using the existing approach described in Appendix 1 of existing consent CN96022 [Manapouri Power Scheme: Water Permit to Dam and Divert Water from Lake Manapouri and Mararoa River for Hydroelectricity Generation] for each of the first two summers after this consent is first exercised.
   (Note 1: This annual monitoring is additional to the existing and event-driven MPS monitoring requirements contained in Appendix 1 of the existing MPS consents. At those times when the survey required under this programme coincides with monitoring required under Appendix 1 of the existing MPS consents, only one integrated survey need be undertaken.
   Note 2: An initial macrophyte monitoring survey was carried out during the 2009/10 summer.)

Waiau Arm Macrophytes

6. The consent holder shall undertake the following surveys of the macrophyte community within the Waiau Arm of Lake Manapouri using the survey methodology of Sutherland (2007)[1]:

   (a) the survey will be undertaken for each of the first two summers following the first exercise of this consent *(Note: An initial macrophyte monitoring survey was carried out during the 2009/10 summer)*;

   (b) a survey will also be undertaken following the first period where flood flows do not exceed 250 m^3/s (duration at least one day) between two consecutive summer growth periods; and

   (c) a survey will also be undertaken following a flood that exceeds 1,000 m^3/s in the Waiau Arm.

7. The surveys required under 6(b) and (c) shall only occur independently of the first three year surveys if these specified events do not occur within the first three years.

8. Survey requirements will be reviewed following the outcome of the collective surveys.

(ii) *Water Quality*

9. The consent holder shall undertake water quality and clarity monitoring in accordance with the protocol set out in Biggs et al (2006) and as currently undertaken in Waiau Arm. The consent holder will submit the protocol to Environment Southland prior to the exercise of the consent. The consent holder will keep Environment Southland and stakeholders informed on the implementation and ongoing development of the protocol.

10. Fortnightly water quality samples shall be collected by appropriately trained personnel from 1 January to 31 March.

(iii) *Lakeshore Vegetation*

11. The consent holder shall monitor the potential effects of MTAD on lakeshore vegetation in accordance with the methodology outlined in Appendix 1 of consent no 96022 [Manapouri Power Scheme: Water Permit to Damn and Divert Water from Lake Manapouri and Mararoa River for Hydroelectricity Generation].
    (Note: A study has been commissioned by the consent holder to investigate the relationships between recorded threatened species and lake level data. That study will make best use of historical monitoring records and will provide a useful basis to determine the need for any modifications to scheduled monitoring.)

(iv) *Lakeshore Sediments*

12. The consent holder shall undertake an annual photographic and field inspection of the monitored beaches for the first five years after the commencement of MTAD.

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1 "Water Quality and Macrophyte Monitoring Waiau Arm - Summary of December 2006-September 2007 Measurements", NIWA client report 2007

The aim of these inspections will be to assess beach changes related to lake level management and to assess non-lake related changes.

C. Lower Waiau River

(i) *Interaction between River Flow Regime, Groundwater and Wetlands Water Levels*

13. The consent holder shall undertake further monitoring of the relationship of groundwater and wetland water levels with the current river flow regime. The monitoring shall capture a range of climatic and river flow conditions, and shall be for a period of five years from the granting of these consents, or shorter period approved by the Council's Director of Environmental Management if sufficient data is considered to have been collected.

    The existing three water level monitoring locations (one groundwater well at Clifden and two wetlands water level recorders at Rakatu Wetlands) shall be retained and reported on for a period of two years following implementation of the MTAD.
    Water levels in two other wetlands will also be monitored to help clarify the relationship of the range of wetlands in the valley to the river flow regime. The consent holder will identify these wetlands through consultation with the Waiau Fisheries and Wildlife Habitat Enhancement Trust

(ii) *River Bed Material Transport*

14. The consent holder shall implement a monitoring programme to detect channel adjustment to the MTAD flow regime at the sites most likely to experience change, including:

    - the river reach immediately downstream of MLC;
    - the confluences of the main tributaries that join the Lower Waiau River in alluvial/storage reaches (including Redcliff Creek, Wairaki River, and Lill Burn); and
    - the reach between Tuatapere and the coast.

    Channel adjustment shall be monitored to determine the style, extent, and rates of adjustment and to quantify changes in bed-material storage.

15. In addition to the existing MPS monitoring programme, the consent holder shall undertake new monitoring in the area of the Redcliff Creek, Wairaki River, and Lill Burn confluences with the Lower Waiau River to detect the expected tributary fan-delta and main river adjustments, namely:

    - fan-delta progradation;
    - erosion of the opposite bank;
    - aggradation, steepening, and increased braiding activity of the main river downstream of the confluence;
    - parallel aggradation of the main river bed upstream of the fan-delta.

    To achieve this, the monitoring at each site shall include:

    - cross-sections across the lower ends of pools upstream, immediately downstream, and in the next pool downstream from the confluence;
    - cross-sections at the apex (or where it emerges from terrace confinement) and lower down the fan-delta;

- a long-profile down the fan-delta from its apex, following the active channel centreline;
- a water-surface profile (always at the same reference flow) along an approximate 5 km long reach centred on the confluence (it should not be necessary to navigate exactly the same path on repeat surveys);
- the position of both banks of the active channel (typically marked by the vegetation edge, an eroding bank, or the delta shore) from the upstream end of delta to 1-2 km downstream, noting also the existence of eroding banks.

The general locations of the proposed survey lines are described in the MTAD River Sediment Transport report. The existing cross-sections at the Wairaki confluence and at the Lill Burn would also be incorporated.

The survey interval would be every seven years and after major floods exceeding 1,200 m^3/s at Mararoa Weir or 2,000 m^3/s at Tuatapere. RTK-GPS would be used for the surveying and a jet boat would be required for the cross-sections and long-profile of the main river (a continuous topography survey, with points measured approximately every 10 m would be used). In addition, the bank positions may be captured with RTK-GPS or alternatively, from geo-referenced aerial photographs.

Appendix B
Manapouri Power Station Rating

Overview

The following table is the confirmed machine flow rating for the generating units at Manapouri, as at 7 September 2009:

P_{GEN}/(HWL-TWL) (MW/m)	Unit Flow (m^3/s)
0	7
0.28165	35
0.33234	40
0.38777	45
0.44256	50
0.49196	55
0.54013	60
0.58887	65
0.63579	70
0.68031	75
0.71946	80
0.75622	85
0.79059	90
0.82198	95
0.84803	100

Consent no 96019 requires a record of the flow discharged into the tailrace to be maintained.

Due to the inability to undertake flow measurements at the tunnel exit to the degree of accuracy required for consent compliance purposes, as a result of tidal and climatic influences, the flow is calculated from the station electricity generation. The calculation uses the above machine flow rating to determine water flows.

environment SOUTHLAND

File No: M289-044
Consent: 206157

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Invercargill

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Fax No. (03) 211 5252
Southland Freephone No. 0800 76 88 45

Water Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 2 August 2010.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To take and use water, for the purposes of hydro-electricity generation in the Manapouri Power Scheme, from Lake Manapouri through the intake gates at the Manapouri Power Station at West Arm
Location	- site locality	West Arm, Lake Manapouri
	- map reference	NZMS 260 C43:632-050
	- receiving environment	Lake Manapouri
Legal description of land at the site:		Fiordland National Park
Expiry date:		28 November 2031

Consent Amended

Conditions amended on 25 February 2011 and again on 1 November 2011, as follows:

Schedule of Conditions

1. This consent is granted for a period to expire on 28 November 2031.

2. This consent shall only be exercised at times when water permit no 96024 [refer to table at end of conditions] is being fully exercised and when additional freshwater is being discharged at flows greater than 510 m^3/s to the waters of Doubtful Sound at Deep Cove over and above that authorised by coastal permit no 96019 [refer to table at end of conditions].

Maximum Take and Use Limit

3. Water shall not be taken and used at a rate greater than the consented discharge flow limit to Deep Cove in Doubtful Sound in terms of coastal permit no 206158.

Operating Guidelines

4. At all times when exercising this consent, the consent holder shall comply with the provisions of condition 1 of water permit no 96024 [refer to table at end of conditions].

5. The consent holder will investigate, in co-operation with the Guardians of Lakes Manapouri, Monowai and Te Anau, the appropriateness and feasibility of periodically taking the lakes into the extreme high and low levels. The consent holder shall report on the outcome of the investigation to Environment Southland within 24 months of the granting of this consent.

Recording

6. At all times when exercising this consent, the consent holder shall comply with the provisions of condition 2 of water permit no 96024 [refer to table at end of conditions].

Environmental Monitoring

7. The consent holder shall implement the monitoring programme annexed to this water permit as Appendix 1 and shall forward a copy of the results of that monitoring to Environment Southland annually.

8. Rare lakeshore plant study

   The consent holder will complete a report on the relationships between recorded threatened species and lake level data. The study will be based on historical monitoring records and will provide the basis to determine the need for any modifications to scheduled monitoring implemented in accordance with Appendix 1 of Consent No 96022. The study shall be completed and a report submitted to the Council by 30 June 2011.

Migrating Eels

9. Prior to the exercise of this consent, the consent holder shall prepare an eel trap and transfer programme to be submitted to Environment Southland for approval. The objective will be to mitigate the additional effect of MTAD on the percentage of longfin eels migrating downstream through the MLC outlet by increasing the number of net nights over the existing eel trap and transfer programme by 1,200 net nights (i.e. 20 nets set for an additional 60 nights). The trap and transfer programme shall continue until such time the consent holder is advised in writing by Environment Southland that the programme can be discontinued.

10. Migrating eels research and implementation

The consent holder will prepare an Eel Mitigation Research Programme. The programme will detail the existing and future investigation programme into cost effective technology and/or methods to mitigate the existing impacts of the MPS on the migratory patterns of longfin eels. The objective of the programme will be to identify options and potential solutions for the existing impact of the MPS on migrating eels, in order that the effects at the MPS are consistent with sustainable management of the longfin eel population. The consent holder will consult with stakeholders in the development of the programme. The consent holder will submit the programme to Environment Southland within six months of commencement of consent. The results of the investigation programme will be provided to Environment Southland on completion and once approved by Environment Southland, the recommended mitigation measures shall be implemented by the consent holder.

Review Clause

11. At any time during 2013 and 2017 and at any time during every subsequent seventh year from 2017, the Council may review the results of all monitoring and investigations carried out in accordance with this water permit. Within three months of completing this review, the Council may, in accordance with Sections 128(1)(a) and 129 of the Act, serve notice that it intends to review the conditions of this consent for the purpose of dealing with any actual or potential adverse effects on the environment that may arise from the exercise of this consent and are appropriate to deal with after the results of the monitoring have been received.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Existing Environment Southland Consents to which these conditions refer:
Consent no 96019:
Coastal Permit to Discharge Water to Deep Cove, Doubtful Sound

Consent no 96022:
Water Permit to dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers for purposes of the take and use of water for hydroelectricity generation in the Manapouri Power Scheme

Consent no 96024:
Water Permit to take and use water from Lake Manapouri for hydroelectricity generation in the Manapouri Power Scheme

Appendix A
Monitoring Programme for Manapouri Tailrace Amended Discharge (MTAD) Coastal and Water Permits (Consents 206516, 206157 and 206158)

Overview

Appendix A sets out the key environmental monitoring programmes for the above consent associated with the Manapouri Tailrace Amended Discharge (MTAD)

It should be emphasised that this monitoring programme can be revised from time to time as new technologies or methods arise, in accordance with Sections 127 and 128 of the Resource Management Act 1991.

Monitoring Contents

A. Deep Cove and Doubtful Sound
   (i) Marine Physical
   (ii) Marine Biological
   (iii) Recreation and Tourism

B. Lakes Manapouri, and Te Anau
   (i) Lake Macrophytes
   (ii) Water quality Sampling
   (iii) Lakeshore Vegetation
   (iv) Lakeshore Sediments
   (v) Waiau Arm Water Quality

C. Lower Waiau River
   (i) Interaction between River Flow regime, Groundwater and Wetlands Water Levels
   (ii) River Bed Material Transport

A. Deep Cove and Doubtful Sound

(i) *Marine Physical*

1. Prior to exercising this consent, the consent holder shall submit to the Compliance Manager, Environment Southland, a report setting out how the existing physical marine monitoring programme shall be amended to monitor for any incremental physical effects of MTAD, including the location of additional monitoring sites and the parameters of such monitoring, such as:
   - addition of salinity sensors at moorings beyond M4, within top 3 m of the water column.

(ii) *Marine Biology*

2. Prior to exercising this consent, the consent holder shall submit to the Compliance Manager, Environment Southland, a report setting out how the existing biological monitoring programme, shall be amended to take into account possible incremental effects from MTAD. Additional monitoring should target those areas where the assessment has identified the incremental physical effects associated with MTAD

may lead to biological changes and will be developed in consultation with the researchers and Fiordland Marine Guardians. Additional monitoring shall include:

- mapping of organisms in the intertidal zone including focused sampling in transitional areas of the fiord where potential changes in populations would be most likely to be observed, as well as at reference sites in Milford and Bradshaw Sounds;
- sampling to be at a high resolution and using quantitative methods such as photoquadrants and field counts at permanently marked stations. Similar sampling conducted in reference sites in Milford and Bradshaw Sounds;
- monitoring of conditions of the soft sediment habitat and associated species (e.g. bivalves, infauna, epibiota, sediment characteristics) at Deep Cove and Hall Arm and reference locations in Thomson, Bradshaw and Milford Sounds.

(iii) *Recreation and Tourism*

3. In accordance with condition 11 of consent no 206158, the consent holder shall monitor the potential ongoing effects of increased discharge on surface water conditions by correlating all information received in accordance with clause 4 of Appendix A with actual tailrace discharge data.

4. The consent holder shall maintain a record of all information supplied by the Deep Cove Outdoor Education Trust (DCOET), and commercial kayak and boating operators in Doubtful Sound on their observed experience with the use of Deep Cove, and the potential effects of increased current speed as a result of the increased tailrace discharge. This information should include:

   (a) date, time and location of observation;
   (b) observed weather conditions;
   (c) observed sea state, including wave and current conditions; and
   (d) effect on boating activity (including the reason for making a decision which limits or changes activities).

B. Lakes Te Anau and Manapouri and Waiau Arm

(i) *Lake Macrophytes*

Lakes Te Anau and Manapouri Macrophytes

5. The consent holder shall undertake a macrophyte monitoring survey using the existing approach described in Appendix 1 of existing consent CN96022 [Manapouri Power Scheme: Water Permit to Dam and Divert Water from Lake Manapouri and Mararoa River for Hydroelectricity Generation] for each of the first two summers after this consent is first exercised.
   (Note 1: This annual monitoring is additional to the existing and event-driven MPS monitoring requirements contained in Appendix 1 of the existing MPS consents. At those times when the survey required under this programme coincides with monitoring required under Appendix 1 of the existing MPS consents, only one integrated survey need be undertaken.
   Note 2: An initial macrophyte monitoring survey was carried out during the 2009/10 summer.)

Waiau Arm Macrophytes

6. The consent holder shall undertake the following surveys of the macrophyte community within the Waiau Arm of Lake Manapouri using the survey methodology of Sutherland (2007)[1]:

   (a) the survey will be undertaken for each of the first two summers following the first exercise of this consent *(Note: An initial macrophyte monitoring survey was carried out during the 2009/10 summer)*;

   (b) a survey will also be undertaken following the first period where flood flows do not exceed 250 m^3/s (duration at least one day) between two consecutive summer growth periods; and

   (c) a survey will also be undertaken following a flood that exceeds 1,000 m^3/s in the Waiau Arm.

7. The surveys required under 6(b) and (c) shall only occur independently of the first three year surveys if these specified events do not occur within the first three years.

8. Survey requirements will be reviewed following the outcome of the collective surveys.

(ii) *Water Quality*

9. The consent holder shall undertake water quality and clarity monitoring in accordance with the protocol set out in Biggs et al (2006) and as currently undertaken in Waiau Arm. The consent holder will submit the protocol to Environment Southland prior to the exercise of the consent. The consent holder will keep Environment Southland and stakeholders informed on the implementation and ongoing development of the protocol.

10. Fortnightly water quality samples shall be collected by appropriately trained personnel from 1 January to 31 March.

(iii) *Lakeshore Vegetation*

11. The consent holder shall monitor the potential effects of MTAD on lakeshore vegetation in accordance with the methodology outlined in Appendix 1 of consent no 96022 [Manapouri Power Scheme: Water Permit to Damn and Divert Water from Lake Manapouri and Mararoa River for Hydroelectricity Generation].
(Note: A study has been commissioned by the consent holder to investigate the relationships between recorded threatened species and lake level data. That study will make best use of historical monitoring records and will provide a useful basis to determine the need for any modifications to scheduled monitoring.)

(iv) *Lakeshore Sediments*

12. The consent holder shall undertake an annual photographic and field inspection of the monitored beaches for the first five years after the commencement of MTAD.

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1 "Water Quality and Macrophyte Monitoring Waiau Arm - Summary of December 2006-September 2007 Measurements", NIWA client report 2007

The aim of these inspections will be to assess beach changes related to lake level management and to assess non-lake related changes.

C. Lower Waiau River

(i) *Interaction between River Flow Regime, Groundwater and Wetlands Water Levels*

13. The consent holder shall undertake further monitoring of the relationship of groundwater and wetland water levels with the current river flow regime. The monitoring shall capture a range of climatic and river flow conditions, and shall be for a period of five years from the granting of these consents, or shorter period approved by the Council's Director of Environmental Management if sufficient data is considered to have been collected.

    The existing three water level monitoring locations (one groundwater well at Clifden and two wetlands water level recorders at Rakatu Wetlands) shall be retained and reported on for a period of two years following implementation of the MTAD.
    Water levels in two other wetlands will also be monitored to help clarify the relationship of the range of wetlands in the valley to the river flow regime. The consent holder will identify these wetlands through consultation with the Waiau Fisheries and Wildlife Habitat Enhancement Trust

(ii) *River Bed Material Transport*

14. The consent holder shall implement a monitoring programme to detect channel adjustment to the MTAD flow regime at the sites most likely to experience change, including:

    - the river reach immediately downstream of MLC;
    - the confluences of the main tributaries that join the Lower Waiau River in alluvial/storage reaches (including Redcliff Creek, Wairaki River, and Lill Burn); and
    - the reach between Tuatapere and the coast.

    Channel adjustment shall be monitored to determine the style, extent, and rates of adjustment and to quantify changes in bed-material storage.

15. In addition to the existing MPS monitoring programme, the consent holder shall undertake new monitoring in the area of the Redcliff Creek, Wairaki River, and Lill Burn confluences with the Lower Waiau River to detect the expected tributary fan-delta and main river adjustments, namely:

    - fan-delta progradation;
    - erosion of the opposite bank;
    - aggradation, steepening, and increased braiding activity of the main river downstream of the confluence;
    - parallel aggradation of the main river bed upstream of the fan-delta.

    To achieve this, the monitoring at each site shall include:

    - cross-sections across the lower ends of pools upstream, immediately downstream, and in the next pool downstream from the confluence;

- cross-sections at the apex (or where it emerges from terrace confinement) and lower down the fan-delta;
- a long-profile down the fan-delta from its apex, following the active channel centreline;
- a water-surface profile (always at the same reference flow) along an approximate 5 km long reach centred on the confluence (it should not be necessary to navigate exactly the same path on repeat surveys);
- the position of both banks of the active channel (typically marked by the vegetation edge, an eroding bank, or the delta shore) from the upstream end of delta to 1-2 km downstream, noting also the existence of eroding banks.

The general locations of the proposed survey lines are described in the MTAD River Sediment Transport report. The existing cross-sections at the Wairaki confluence and at the Lill Burn would also be incorporated.

The survey interval would be every seven years and after major floods exceeding 1,200 m^3/s at Mararoa Weir or 2,000 m^3/s at Tuatapere. RTK-GPS would be used for the surveying and a jet boat would be required for the cross-sections and long-profile of the main river (a continuous topography survey, with points measured approximately every 10 m would be used). In addition, the bank positions may be captured with RTK-GPS or alternatively, from geo-referenced aerial photographs.

environment
SOUTHLAND

File No: M289-044
Consent: 206158

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Southland Freephone No. 0800 76 88 45

Coastal Permit

Pursuant to Section 104B of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to **Meridian Energy Ltd** (the "consent holder") of **P O Box 2454, Christchurch** from 2 August 2010.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge fresh water to the waters of Doubtful Sound at Deep Cove by means of the tailrace from the Manapouri Power Station
Location	- site locality	Deep Cove, Doubtful Sound
	- map reference	NZMS 260 C43:538-106
	- receiving environment	Coastal marine area in Fiordland
Legal description of land at the site:		Coastal marine area
Expiry date:		28 November 2031

Consent Amended

Conditions amended on 25 February 2011, as follows:

Schedule of Conditions

1. This consent is granted for a period to expire on 28 November 2031.

2. This consent shall only be exercised at times when coastal permit no 96019 [Manapouri Power Scheme: Coastal Permit to Discharge Water to Deep Cove, Doubtful Sound] is being fully exercised and when additional freshwater is being discharged to the waters of Doubtful Sound at Deep Cove over and above the amount authorised by coastal permit no 96019, that being 510 m3/s.

Discharge Flow Management

3. The Manapouri Power Station (MPS) shall be set to generate at a setpoint for total generator output[i] (MW) that would result in an equivalent total turbine flow[ii] not exceeding 550 m^3/s, calculated in accordance with condition 4. The discharge to Deep Cove from the MPS tailrace shall be regulated[iii] by compliance with the setpoint.

4. The relationship between turbine flow, generator output, lake headwater level and station tailwater level[iv] shall be as set out in the table at Appendix B, provided that whenever the relationship changes, the consent holder shall provide an updated table to Environment Southland within 24 hours of the relationship change, and this updated table shall be used for the purpose of determining total turbine flow.

Definitions for Conditions 3 and 4

(i) Total generator output is the sum of the individual outputs of all generating units.

(ii) Total turbine flow is the sum of the individual flows through all generating units.

(iii) In relation to condition 3, it is acknowledged that generator governor response will cause generator output and turbine flow to vary about the setpoint as expected by the Electricity Governance Rules (EGRs). This includes instantaneous reserve response to contingent events as defined in the EGRs.

(iv) In relation to condition 4, station tailwater level is defined as the water level at the station-end of the tailrace tunnels.

Recording and Reporting to Environment Southland

5. The consent holder shall record the following information and report this information to Environment Southland at three monthly intervals:

(a) the total turbine flow calculated from the setpoint for total generator output at each setpoint change; and

(b) the total turbine flow calculated from actual total generator output as averages over every half hour period;

each calculated in accordance with condition 4. The quarterly reporting dates shall be as agreed with the Council's Compliance Manager.

In addition to the annual reporting requirement, the consent holder shall advise the Southland Regional Council immediately of any instantaneous reserve response to a contingent event that causes the tailrace discharge to exceed 550 cubic metres per second.

Environmental Monitoring

6. The consent holder shall implement the monitoring programme annexed to this coastal permit as Appendix A and shall forward a copy of the results of that monitoring to Environment Southland annually.

7. Multi Party Bottlenose Dolphin monitoring and research programme

   The consent holder shall, either on its own or in co-operation with other parties, have a Bottlenose Dolphin monitoring and research programme agreed on and implemented, designed to improve understanding of the Doubtful Sound Bottlenose Dolphin and the factors that may be contributing to the decline in the population. The consent holder will report to Environment Southland's Compliance Manager within six months of the commencement of consent on the development of the programme.

Quality of Water Discharged to Receiving Waters

8. At all times when exercising this consent, the consent holder shall comply with the provisions of condition 4.2 of coastal permit no. 96019 [refer to table at end of conditions].

Recreational Signage and Information

9. Prior to exercising this consent, the consent holder shall, in consultation with the Department of Conservation and the Council's Maritime Manager, determine the exact form, wording and location of appropriate signage it will erect at Deep Cove. The purpose of the signage shall be to inform kayakers and other boat users in Doubtful Sound about potential adverse surface water conditions, particularly when combined with adverse weather conditions. The proposed form, wording, and location of the signage shall be approved by Environment Southland, prior to the erection of such signage.

10. The consent holder shall consult with the Deep Cove Outdoor Education Trust (DCOET) on the best practical option for improving the safety of DCOET water users at Deep Cove. The consent holder shall report on the results of this consultation and any measures taken to improve safety Environment Southland at the same time as it submits the annual monitoring report required by condition 6.

11. The consent holder shall annually review the information on the potential effects of MTAD in relation to anecdotal surface water conditions, measured frequency and duration of MTAD discharges on the anniversary of the first exercise of this consent, and shall provide a summary of this review on the consent holder's website. Hard copies of this summary shall be forwarded to the Fiordland i-SITE visitor centre, the Department of Conservation's Fiordland National Park Visitor Centre, to the Deep Cove Outdoor Education Trust, commercial kayak operators in Deep Cove, and to the Mana Cruising Club (publisher of the Fiordland Cruising Guide) to provide up-to-date information regarding potential current speeds, wave effects and frequency and duration of MTAD discharges.

12. The consent holder shall make appropriately qualified persons available to discuss surface water conditions in relation to the tailrace discharge with recognised Southland recreation groups if requested.

Review Clause

13. At any time during 2013 and 2017, and at any time during every subsequent seventh year from 2017, the Council may review the results of all investigations carried out in accordance with condition 3 of coastal permit no 96019 [refer to table at end of conditions], and all monitoring and investigations carried out in accordance with this coastal permit. Within three months of completing this review, the Council may, in accordance with Sections 128(1)(a) and 129 of the Act, serve notice that it intends to review the conditions of this consent for the purpose of dealing with any actual or potential adverse effect on the environment that may arise from the exercise of this consent and are appropriate to deal with after the results of the monitoring have been received.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Existing Environment Southland Consents to which these conditions refer:
Consent no 96019:
Coastal Permit to Discharge Water to Deep Cove, Doubtful Sound

Consent no 96022:
Water Permit to dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers for purposes of the take and use of water for hydroelectricity generation in the Manapouri Power Scheme

Consent no 96024:
Water Permit to take and use water from Lake Manapouri for hydroelectricity generation in the Manapouri Power Scheme

Appendix A
Monitoring Programme for Manapouri Tailrace Amended Discharge (MTAD) Coastal and Water Permits (Consents 206516, 206157 and 206158)

Overview

Appendix A sets out the key environmental monitoring programmes for the above consent associated with the Manapouri Tailrace Amended Discharge (MTAD)

It should be emphasised that this monitoring programme can be revised from time to time as new technologies or methods arise, in accordance with Sections 127 and 128 of the Resource Management Act 1991.

Monitoring Contents

A. Deep Cove and Doubtful Sound
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A. Deep Cove and Doubtful Sound

(i) *Marine Physical*

1. Prior to exercising this consent, the consent holder shall submit to the Compliance Manager, Environment Southland, a report setting out how the existing physical marine monitoring programme shall be amended to monitor for any incremental physical effects of MTAD, including the location of additional monitoring sites and the parameters of such monitoring, such as:
   - addition of salinity sensors at moorings beyond M4, within top 3 m of the water column.

(ii) *Marine Biology*

2. Prior to exercising this consent, the consent holder shall submit to the Compliance Manager, Environment Southland, a report setting out how the existing biological monitoring programme, shall be amended to take into account possible incremental effects from MTAD. Additional monitoring should target those areas where the assessment has identified the incremental physical effects associated with MTAD may

lead to biological changes and will be developed in consultation with the researchers and Fiordland Marine Guardians. Additional monitoring shall include:

- mapping of organisms in the intertidal zone including focused sampling in transitional areas of the fiord where potential changes in populations would be most likely to be observed, as well as at reference sites in Milford and Bradshaw Sounds;
- sampling to be at a high resolution and using quantitative methods such as photoquadrants and field counts at permanently marked stations. Similar sampling conducted in reference sites in Milford and Bradshaw Sounds;
- monitoring of conditions of the soft sediment habitat and associated species (e.g. bivalves, infauna, epibiota, sediment characteristics) at Deep Cove and Hall Arm and reference locations in Thomson, Bradshaw and Milford Sounds.

(iii) *Recreation and Tourism*

3. In accordance with condition 11 of consent no 206158, the consent holder shall monitor the potential ongoing effects of increased discharge on surface water conditions by correlating all information received in accordance with clause 4 of Appendix A with actual tailrace discharge data.

4. The consent holder shall maintain a record of all information supplied by the Deep Cove Outdoor Education Trust (DCOET), and commercial kayak and boating operators in Doubtful Sound on their observed experience with the use of Deep Cove, and the potential effects of increased current speed as a result of the increased tailrace discharge. This information should include:

   (a) date, time and location of observation;
   (b) observed weather conditions;
   (c) observed sea state, including wave and current conditions; and
   (d) effect on boating activity (including the reason for making a decision which limits or changes activities).

B. Lakes Te Anau and Manapouri and Waiau Arm

(i) *Lake Macrophytes*

Lakes Te Anau and Manapouri Macrophytes

5. The consent holder shall undertake a macrophyte monitoring survey using the existing approach described in Appendix 1 of existing consent CN96022 [Manapouri Power Scheme: Water Permit to Dam and Divert Water from Lake Manapouri and Mararoa River for Hydroelectricity Generation] for each of the first two summers after this consent is first exercised.

(Note 1: This annual monitoring is additional to the existing and event-driven MPS monitoring requirements contained in Appendix 1 of the existing MPS consents. At those times when the survey required under this programme coincides with monitoring required under Appendix 1 of the existing MPS consents, only one integrated survey need be undertaken.
Note 2: An initial macrophyte monitoring survey was carried out during the 2009/10 summer.)

Waiau Arm Macrophytes

6. The consent holder shall undertake the following surveys of the macrophyte community within the Waiau Arm of Lake Manapouri using the survey methodology of Sutherland (2007)[1]:

   (a) the survey will be undertaken for each of the first two summers following the first exercise of this consent *(Note: An initial macrophyte monitoring survey was carried out during the 2009/10 summer)*;

   (b) a survey will also be undertaken following the first period where flood flows do not exceed 250 m^3/s (duration at least one day) between two consecutive summer growth periods; and

   (c) a survey will also be undertaken following a flood that exceeds 1,000 m^3/s in the Waiau Arm.

7. The surveys required under 6(b) and (c) shall only occur independently of the first three year surveys if these specified events do not occur within the first three years.

8. Survey requirements will be reviewed following the outcome of the collective surveys.

(ii) *Water Quality*

9. The consent holder shall undertake water quality and clarity monitoring in accordance with the protocol set out in Biggs et al (2006) and as currently undertaken in Waiau Arm. The consent holder will submit the protocol to Environment Southland prior to the exercise of the consent. The consent holder will keep Environment Southland and stakeholders informed on the implementation and ongoing development of the protocol.

10. Fortnightly water quality samples shall be collected by appropriately trained personnel from 1 January to 31 March.

(iii) *Lakeshore Vegetation*

11. The consent holder shall monitor the potential effects of MTAD on lakeshore vegetation in accordance with the methodology outlined in Appendix 1 of consent no 96022 [Manapouri Power Scheme: Water Permit to Damn and Divert Water from Lake Manapouri and Mararoa River for Hydroelectricity Generation].
    (Note: A study has been commissioned by the consent holder to investigate the relationships between recorded threatened species and lake level data. That study will make best use of historical monitoring records and will provide a useful basis to determine the need for any modifications to scheduled monitoring.)

(iv) *Lakeshore Sediments*

12. The consent holder shall undertake an annual photographic and field inspection of the monitored beaches for the first five years after the commencement of MTAD. The aim of these inspections will be to assess beach changes related to lake level management and to assess non-lake related changes.

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1 "Water Quality and Macrophyte Monitoring Waiau Arm - Summary of December 2006-September 2007 Measurements", NIWA client report 2007

C. Lower Waiau River

(i) *Interaction between River Flow Regime, Groundwater and Wetlands Water Levels*

13. The consent holder shall undertake further monitoring of the relationship of groundwater and wetland water levels with the current river flow regime. The monitoring shall capture a range of climatic and river flow conditions, and shall be for a period of five years from the granting of these consents, or shorter period approved by the Council's Director of Environmental Management if sufficient data is considered to have been collected.

    The existing three water level monitoring locations (one groundwater well at Clifden and two wetlands water level recorders at Rakatu Wetlands) shall be retained and reported on for a period of two years following implementation of the MTAD.
    Water levels in two other wetlands will also be monitored to help clarify the relationship of the range of wetlands in the valley to the river flow regime. The consent holder will identify these wetlands through consultation with the Waiau Fisheries and Wildlife Habitat Enhancement Trust

(ii) *River Bed Material Transport*

14. The consent holder shall implement a monitoring programme to detect channel adjustment to the MTAD flow regime at the sites most likely to experience change, including:

    - the river reach immediately downstream of MLC;
    - the confluences of the main tributaries that join the Lower Waiau River in alluvial/storage reaches (including Redcliff Creek, Wairaki River, and Lill Burn); and
    - the reach between Tuatapere and the coast.

    Channel adjustment shall be monitored to determine the style, extent, and rates of adjustment and to quantify changes in bed-material storage.

15. In addition to the existing MPS monitoring programme, the consent holder shall undertake new monitoring in the area of the Redcliff Creek, Wairaki River, and Lill Burn confluences with the Lower Waiau River to detect the expected tributary fan-delta and main river adjustments, namely:

    - fan-delta progradation;
    - erosion of the opposite bank;
    - aggradation, steepening, and increased braiding activity of the main river downstream of the confluence;
    - parallel aggradation of the main river bed upstream of the fan-delta.

    To achieve this, the monitoring at each site shall include:

    - cross-sections across the lower ends of pools upstream, immediately downstream, and in the next pool downstream from the confluence;
    - cross-sections at the apex (or where it emerges from terrace confinement) and lower down the fan-delta;
    - a long-profile down the fan-delta from its apex, following the active channel centreline;

- a water-surface profile (always at the same reference flow) along an approximate 5 km long reach centred on the confluence (it should not be necessary to navigate exactly the same path on repeat surveys);
- the position of both banks of the active channel (typically marked by the vegetation edge, an eroding bank, or the delta shore) from the upstream end of delta to 1-2 km downstream, noting also the existence of eroding banks.

The general locations of the proposed survey lines are described in the MTAD River Sediment Transport report. The existing cross-sections at the Wairaki confluence and at the Lill Burn would also be incorporated.

The survey interval would be every seven years and after major floods exceeding 1,200 m^3/s at Mararoa Weir or 2,000 m^3/s at Tuatapere. RTK-GPS would be used for the surveying and a jet boat would be required for the cross-sections and long-profile of the main river (a continuous topography survey, with points measured approximately every 10 m would be used). In addition, the bank positions may be captured with RTK-GPS or alternatively, from geo-referenced aerial photographs.

Appendix B
Manapouri Power Station Rating

Overview

The following table is the confirmed machine flow rating for the generating units at Manapouri, as at 7 September 2009:

Power (HWL-TWL) (MW/m)	Unit Flow (m^3/s)
0	7
0.28165	35
0.33234	40
0.38777	45
0.44256	50
0.49196	55
0.54013	60
0.58887	65
0.63579	70
0.68031	75
0.71946	80
0.75622	85
0.79059	90
0.82198	95
0.84803	100

Consent no 96019 requires a record of the flow discharged into the tailrace to be maintained.

Due to the inability to undertake flow measurements at the tunnel exit to the degree of accuracy required for consent compliance purposes, as a result of tidal and climatic influences, the flow is calculated from the station electricity generation. The calculation uses the above machine flow rating to determine water flows.