

Project Number: 3-9C700.01

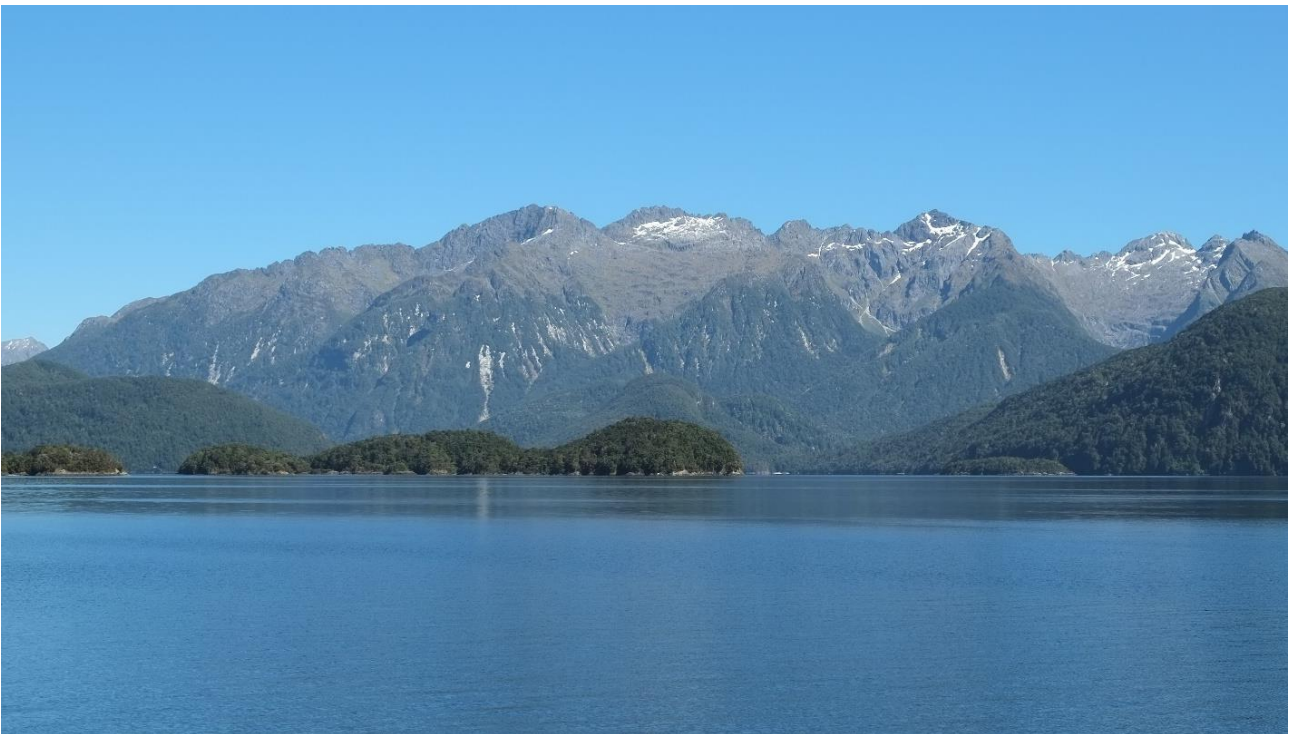
Manapouri Power Scheme

Hydrometric Compliance Report

Period: 1/1/2023 to 31/12/2023

Meridian Energy Ltd.

14 May 2024



Contact Details

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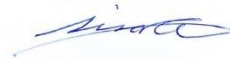
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Document Details:

Date: 14 May 2024
Reference: 3-9C700.01
Status: Final

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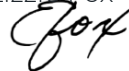
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Executive Summary

This report compares the operation of the Manapouri Power Scheme (MPS), relative to conditions attached to the resource consents issued to Meridian Energy Ltd, for the 12-month period 1-Jan-2023 to 31-Dec-2023.

The recorded lake levels, discharges, turbidity, and river flows have been plotted for those sites where limits and requirements are established by consent. Comments regarding compliance, or any identified non-compliance, with the various resource consents have been included.

Summary

Lake level and flow records have been checked for compliance with the resource consents and their associated conditions. Non-compliance with one consent condition involved three minor non-compliance events and the intent of these conditions was still met.

Given the number and diversity of resource consents and associated conditions, the operation of the MPS to restrict the nature and duration of departures from the Guidelines shows a high level of management, operation, and planning by Meridian. The degree of compliance with the resource consents and their associated conditions was high.

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1 Introduction

1.1 Resource consents

Southland Regional Council (Environment Southland) granted six key resource consents to Electricity Corporation of New Zealand (ECNZ) in late 1996 for the operation of the Manapouri Power Scheme (MPS) (Table 1-1).

On 1 April 1999, ECNZ was split and the MPS is now owned and operated by Meridian Energy Ltd (Meridian). Accordingly, the consents for the operation of the scheme were also transferred to Meridian (ref: Consents 96019-96024).

In addition, three Manapouri Tailrace Amended Discharge (MTAD) consents (206156, 206157 & 206158) were granted in 2010, and first exercised on 23 October 2012. The activities provided for in these consents are also outlined in Table 1-1.

In exercising its consents, Meridian must fulfil monitoring and reporting requirements and to report the results of these activities to Environment Southland on an annual basis. The focus of this report is the hydrometric limits and requirements set out within the relevant consents (Table 1-1) over the period 1 January to 31 December 2023. Other non-hydrometric consent requirements are the subject of separate reporting by Meridian to Environment Southland e.g., biophysical monitoring.

Table 1-1: MPS resource consents.

Consent No.	Key Activities
96019	Discharge fresh water and contaminants to the waters of Doubtful Sound at Deep Cove by means of an artificial channel (tailrace)
96020	Dam and divert the waters of Lake Te Anau by means of a lake control structure (Te Anau Lake Control)
96021	Discharge waters of Lake Te Anau to the Waiau River immediately downstream of the Te Anau lake control structure (TLC)
96022	Dam and divert waters of Lake Manapouri and the Waiau and Mararoa Rivers by means of a control structure (Manapouri Lake Control Structure) 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.
96023*	Discharge waters of Lake Manapouri and the Waiau and Mararoa Rivers to the Waiau River below the Manapouri Lake Control Structure (MLC)
96024	Take and use water from Lake Manapouri for the purpose of the MPS through intake gates at the Manapouri Power Station at West Arm
206156	Dam and divert 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 MPS by means of a control structure (MTAD consent)
206157	Take and use water from Lake Manapouri for the purposes of hydro- electricity generation in the MPS through the intake gates at the Manapouri Power Station at the West Arm (MTAD consent)
206158	Discharge fresh water and contaminants to Doubtful Sound at Deep Cove by means of the tailrace from the Manapouri Power Station (MTAD consent)

Consents marked with * do not contain flow and / or level limits and are therefore not reviewed in this report.

Plots and tables of the recorded data are included in this report, with critical limits indicated. Comments regarding the degree of compliance with the various resource consents have been included.

A layout of the Manapouri Hydro Scheme is presented in Figure 1-1.

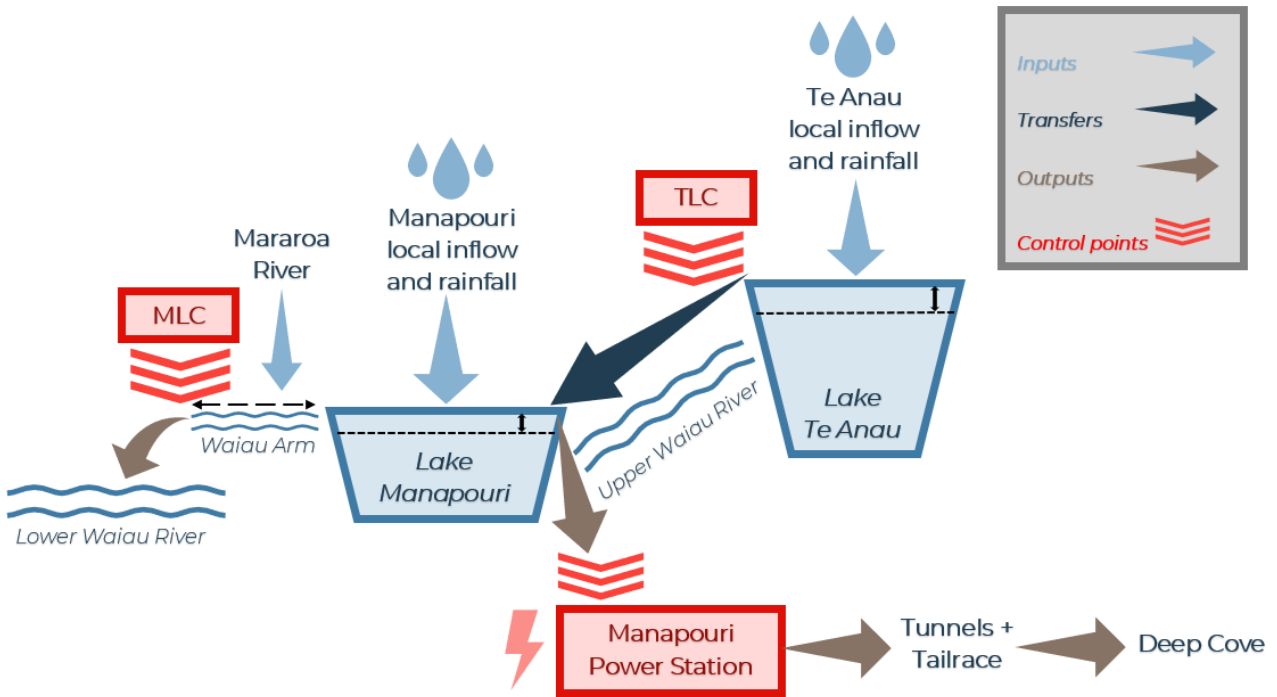


Figure 1-1. Schematic of the MPS. (MLC = Manapouri Lake Control, TLC = Te Anau Lake Control).

1.2 The “Guidelines”

Some conditions within the resource consents detailed above require Meridian to comply with the ‘Operating Guidelines for Levels of Lakes Manapouri and Te Anau’ (the “Guidelines”), as required by the Manapouri-Te Anau Development Act 1963. As such, assessing Meridian’s performance in following the Guidelines is needed as a part of the resource consent compliance assessment. A full copy of the Guidelines is attached at Appendix A.

The Guidelines were notified in the New Zealand Gazette on 29 April 1993 and amended in November 2002. They outline operating ranges for the management for Lakes Manapouri and Te Anau with the aim to “... protect the natural patterns, ecological stability and recreational values of their respective shorelines and to optimise the energy output of Manapouri power station” (the Guidelines, 2002). The Guidelines are to be followed except in “exceptional natural circumstances, or where life or structures are endangered”.¹

The operational ranges outlined in the guidelines for each lake are presented in Table 1-2. Operational ranges are defined within three categories:

- Main Operating Range, within which Meridian shall endeavour to maintain continuous variation of lake level;

¹ See s4A(2) Manapouri - Te Anau Development Act 1963

- High Operating Range. When in this range, Meridian shall use its best endeavours to manage levels to the specified maximum durations, minimum intervals, and specified ratios set out in the Guidelines.
- Low Operating Range. When in this range Meridian shall use best endeavours to manage levels to the specified maximum durations and draw-down rates set out in the Guidelines.

It is important to note that the lakes are not operated as conventional water storage lakes for hydro-generation, but as a short-run storage system, with a small capacity to buffer inflows. As such, the lakes are dynamic and highly responsive to catchment rainfall.

Table 1-2: Operational ranges (metres above mean sea level) for Lakes Manapouri and Te Anau as per the Guidelines (version 2002).

Lake	Low Operating Range	Main Operating Range	High Operating Range
Te Anau	201.5m 201.1m* 200.86m**	201.5m - 202.7m	202.7m
Manapouri	176.8m 176.2m* 175.86m**	176.8m - 178.6m	178.6m

* Lake levels below these operational levels are to be avoided during the equinox (March, April, October and November)

** Absolute minimum level

The Guidelines contain requirements and limits to be followed when lake levels are within the respective ranges. These are assessed where required in the following sections of this report.

Clause 7 of the Guidelines recognises that the Lakes Guardians and Meridian have agreed on gate opening and closing procedures in the event of floods. These are commonly known as the ‘flood rules’ and may be amended following agreement by both parties. The flood rules were last updated in 2011.

1.3 Conditions relating to flow

The operating consents also contain conditions setting out specific flows and flow metrics for the Upper and Lower Waiau Rivers below their respective lake control structures, e.g., minimum flows, flow fluctuation limits, and turbidity rules. These requirements are also identified and tested within this report. Conditions within two of the consents also require the consent holder to have flood rules (to mirror the same requirement in the Guidelines).

1.4 Data

The data used within this compliance monitoring report are from Meridian’s Power Archive, maintained on behalf of Meridian by WSP (previously Opus International Consultants). However, industry best practice and the National Environmental Standard for Measuring Water Levels (July 2019) in rivers and lakes indicate that water levels measured within stilling wells are within ±3mm of the ‘actual level’. Also, industry best practice and the National Environmental Standard for Open Channel Flow Measurement (June 2013) indicate that discharges and flows derived using stage/discharge ratings are likely to be within ±8% of the ‘actual flow’.

The accuracy of generation flows, and gate and spill data are likely to be less than indicated above because of the way they are estimated i.e., a function of generation, machine ratings, gate and spillway dimensions, size of opening, and the headwater level.

Before any data are uploaded to the Power Archive, they are quality assured, but this is after decisions have already been made by Meridian for operational management and consent compliance. However, Meridian has procedures in place to ensure the operational datasets are as accurate as possible at the time of use. Continued review is also undertaken to align the operational and archived data.

To support operational decisions, much of the above data is collected at a high frequency i.e., 5-mins or less. However, the resource consents relating to the operation of the MPS have conditions relating to the temporal resolution of hydrometric data to be used in compliance monitoring. For example, discharges and flows are to be “*measured and recorded at a frequency of not less than 60-mins*”. However, this has always been interpreted to mean ‘not more than 60-mins’. For compliance testing, a 30-min average (derived from the average of six 5-min readings) is considered a practical application of the “*not less than 60-min*” requirement. Also, the water level in the various lakes shall be “*measured and recorded at a frequency of not less than 60-mins*.” Again, this has always been interpreted to mean that the frequency of measurement should not be greater than 60-mins. However, for the purpose of following and testing the Guidelines, daily lake levels are used, as agreed with the Lakes Guardians. The daily lake levels agreed are derived as a three-hour average lake level from 22:30 to 01:30, based on hourly averages, and filed at midnight.

1.5 Compliance with resource consents

Lake levels

As noted in Section 1.2, the Guidelines specify a Main Operating Range for Lakes Te Anau & Manapouri. They also set out a series of actions to be followed when levels are within the High or Low ranges. Testing compliance against the Guidelines consequently involves a three-stage process:

- i. Did the lake level remain within the Main Operating Range? And then;*
- ii. If the lake level went outside the Main Operating Range, were the High and Low range clauses in the Guidelines followed? And then;*
- iii. If not, were best endeavours applied to avoid departures from these limits?*

Non-compliance with the resource consents occurs only if Environment Southland was not satisfied that best endeavours were applied to minimise or avoid any departure/s from the Guidelines.

The three-stage process is shown in the decision tree below.

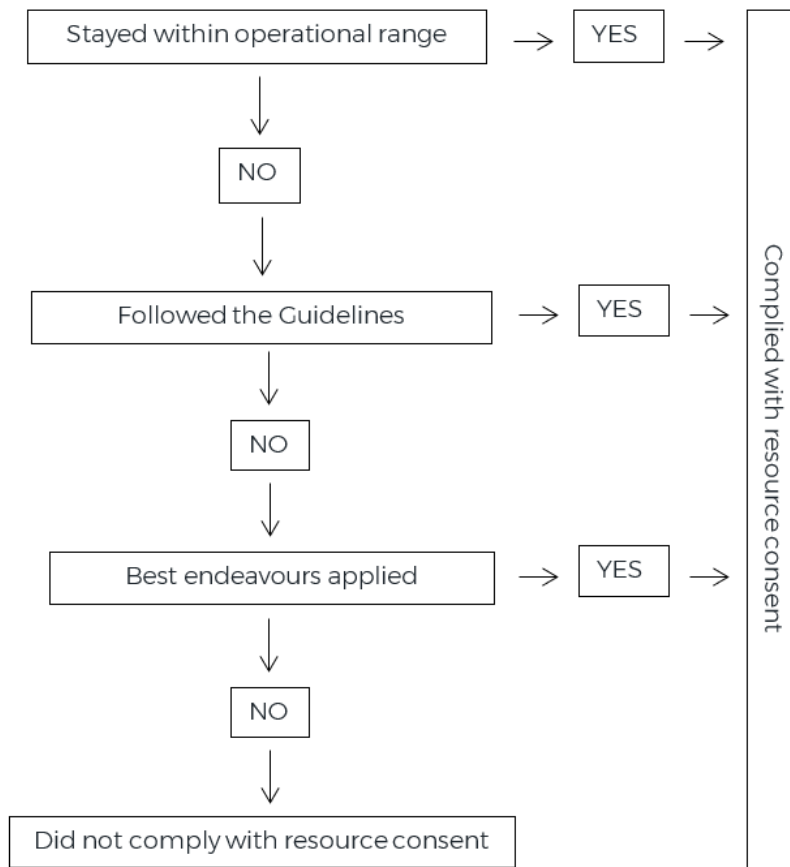


Figure 1-2: Process for assessing compliance against several of the resource consent conditions with reference to the Guidelines.

Flows

Flow data supplied by Meridian is used to test compliance with the consent conditions relating to flow. Unlike lake levels, where consent compliance is assessed through the Guidelines and best endeavours, conditions for flows are absolute. In the event these checks identify a non-compliance, lake levels are checked to confirm if flood rules were in effect (as is the case for the Upper Waiau River). If flood rules were not in effect, the tested conditions are considered non-compliant.

The following sections assess compliance with the resource consents granted to Meridian for the operation of the MPS, including the two lakes (i.e., Manapouri and Te Anau), and various rivers. The recorded flows and water levels have been compared against the consented limits, and the Guidelines, for the 12-month period (1 January 2023 to 31 December 2023). Comparative plots and tables are shown for each case, from which compliance can be assessed.

2 Lake Te Anau

2.1 Lake levels

Condition 1 of the consent 96020 requires that:

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 thereof (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.

Figure 2-1 shows the recorded Lake Te Anau level; with the Main Operating Range indicated.

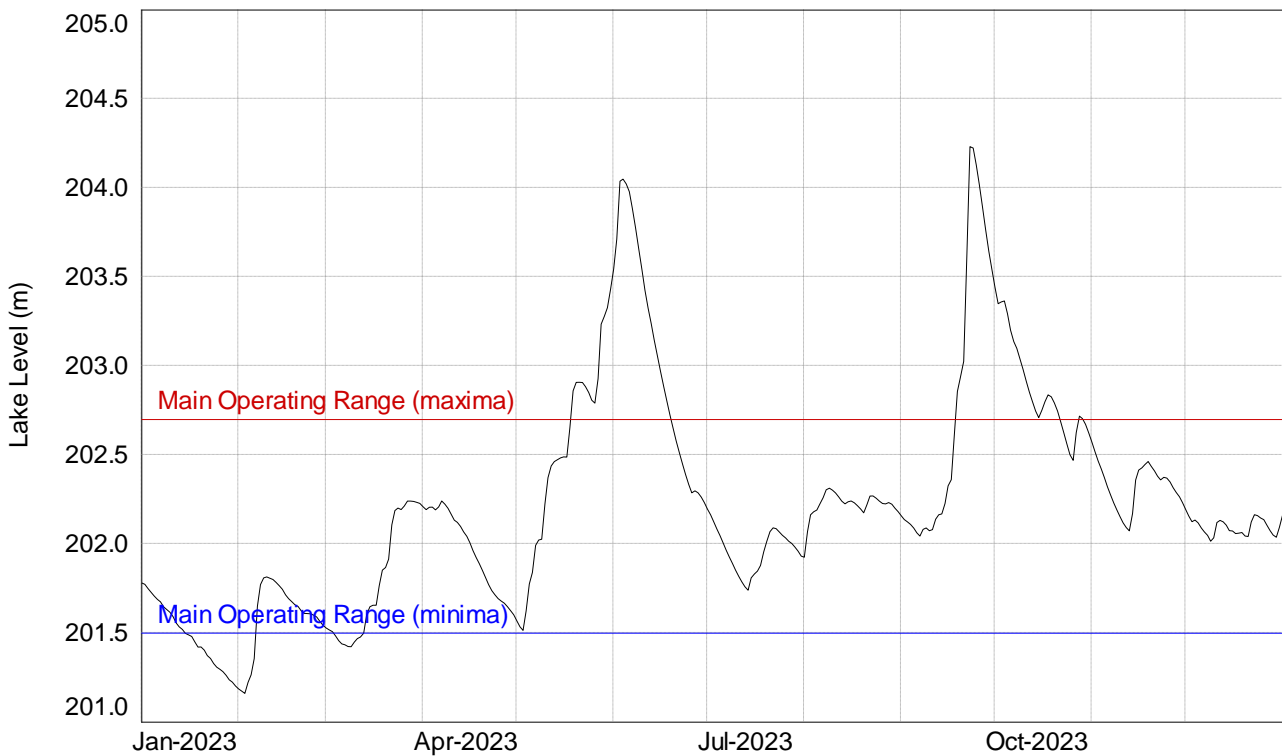


Figure 2-1: Lake Te Anau water level with Main Operating Range over-plotted for the period 1 Jan 2023 – 31 Dec 2023.

Clause 4 (1a) requires Meridian to endeavour to maintain continuous variation in the operating range of Lake Te Anau of between 201.5m to 202.7m. Despite periods where the lake level has increased above and decreased below the main operating range, continuous variation for the most part has been maintained within the operating range as shown in Figure 2-1. Therefore, Meridian has complied with Clause 4 (1a).

Clause 4 (2) of the Guidelines requires Meridian to achieve an annual mean level “within the applicable Main Operating Ranges as specified in this notice”. Meridian (and its predecessors) and the Lakes Guardians have always accepted that this is tested using a 365-day rolling mean. The 365-day rolling mean lake level of 202.22m is a small increase on the 2022 365-day rolling mean

for Lake Te Anau of 201.99m. The 2023 mean level is within the Main Range and on this basis, Meridian has met the requirements of Clause 4 (2).

A check was undertaken of compliance with *Clause 5 (1), (2)(b)* and *Clause 6 (1), (2)(b)* of the Guidelines (Figure 2-2, Table 2-1 and Table 2-2) and is described below.

When lake levels are outside the Main Operating Range, and in the High Operating Range, Meridian is required to use its best endeavours to manage levels to the specified maximum durations, minimum intervals, and specified ratios set out under *Clause 5* of the Guidelines (refer Table 1-2). The top of the Main Range is 202.7m. Lake Te Anau levels were above this level on three occasions over the compliance monitoring period. Within the monitoring period, the duration that the lake level was within each of the high operating ranges met the maximum duration requirements specified in the Guidelines. Minimum intervals and the ratio between the intervals and durations were also checked and found to be compliant with the Guidelines.

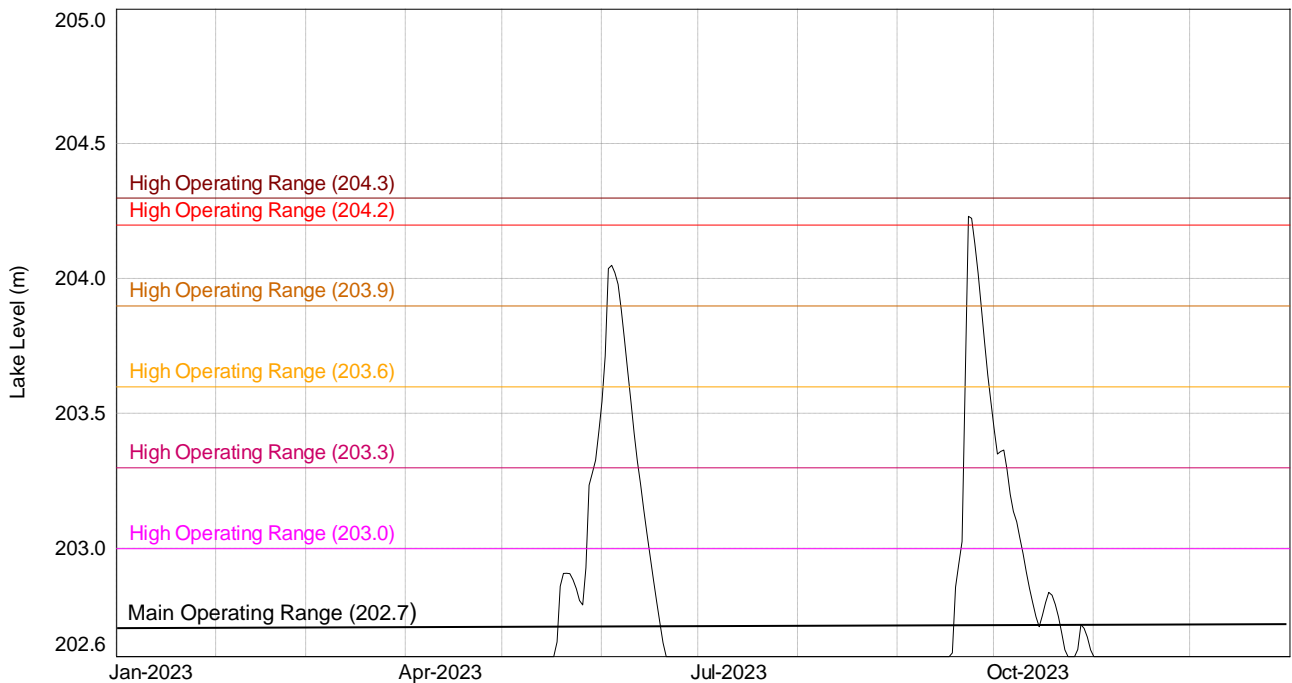


Figure 2-2: Lake Te Anau High Operating Range for the period 1 Jan 2023 - 31 Dec 2023.

Table 2-1: Lake Te Anau High Operating Range for the period 1 Jan 2023 - 31 Dec 2023.

Elevation (m)	Guideline Specifications			Compliance monitoring period		
	Maximum Duration <i>(continuous days within range)</i>	Minimum Interval <i>(continuous days below range)</i>	Interval / Duration Ratio	Max. Duration (days)	Departure Event Start Date	Departure from Guidelines
At 204.3	7	100	14.29	-	-	No
Above 204.2	10	100	10.00	2	23/09/2023	No
Above 203.9	15	60	4.00	4	23/09/2023	No
Above 203.6	22	30	1.36	8	22/09/2023	No
Above 203.3	39	30	0.77	13	22/09/2023	No
Above 203.0	65	30	0.46	19	21/09/2023	No
Above 202.7	125	20	0.16	33	19/09/2023	No

Clause 6 of the Guidelines requires that Meridian use its best endeavours with respect to low range requirements. Lake Te Anau levels did drop below 201.5m on two occasions in 2023 (Figure 2-3). The maximum continuous duration below 201.5m was 23 days, with a total of 32 days below 201.5m (Table 2-2). The number of continuous days at which Lake Te Anau did drop below 201.5m is less than that specified in the Guidelines (88 days) and therefore Meridian complied with Clause 6 of the guidelines.

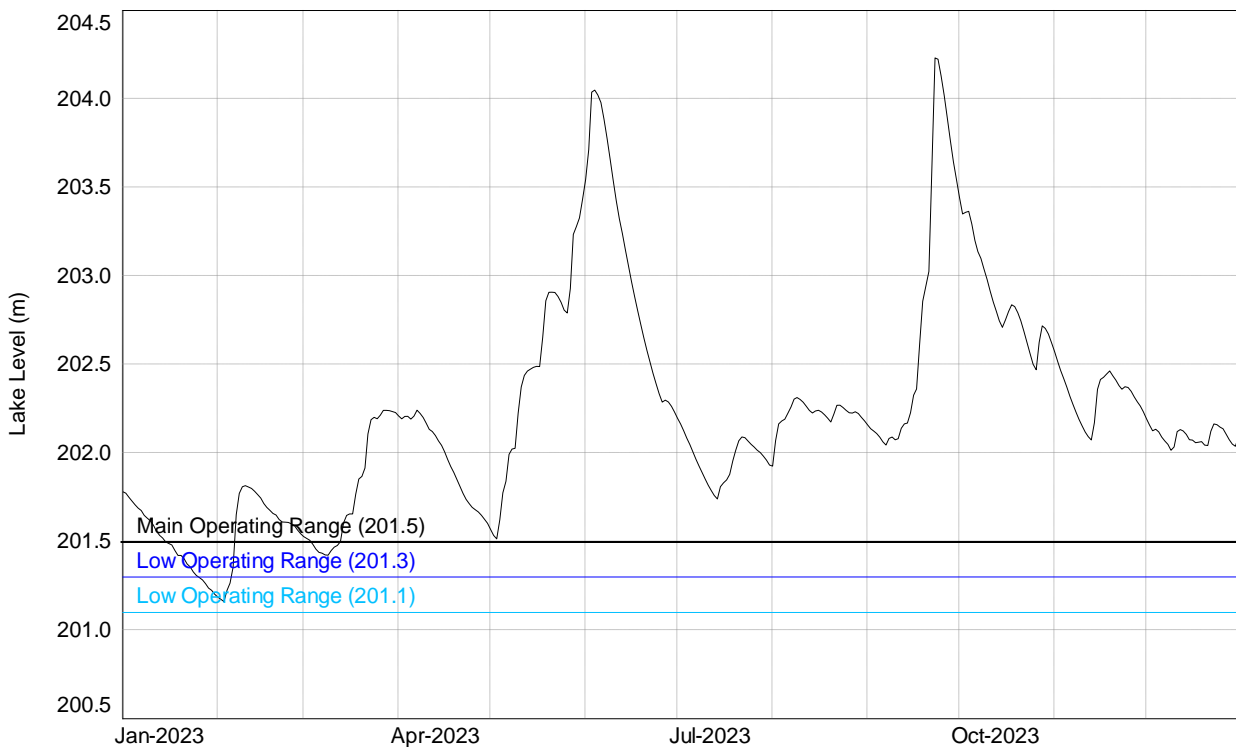


Figure 2-3: Lake Te Anau Low Operating Range for the period 1 Jan 2023 - 31 Dec 2023.

Table 2-2: Lake Te Anau Low Operating Range for the period 1 Jan 2023 - 31 Dec 2023.

Elevation (m)	Guideline Specifications		Compliance monitoring period			
	Maximum Duration (Continuous Days)	Annual Total duration (Days)	Maximum Continuous duration of exceedance (Days)	Event Start Date	Total Days of Exceedance	Departure from Guidelines
Below 201.5	88	176	23	15/01/2023	32	No
Below 201.3	46	92	11	26/01/2023	11	No
Below 201.1	21	42	-	-	-	No

Te Anau levels - summary

Table 2-3: Lake Te Anau - Operating Ranges and actual levels over the period 1 Jan 2023 - 31 Dec 2023.

	Main range lower limit (m)	Main range upper limit (m)
Operational Ranges	201.5	202.7
Actual levels during the period 1/1/2023- 31/12/2023	201.16	204.23
365-day rolling mean lake level	202.22	
Levels outside of Main Operating Range	Yes	
High Operating Ranges complied with	Yes	
Best endeavours applied	N/A	
Low Operating Ranges complied with	Yes	
Best endeavours applied	N/A	
Complied fully Condition 1 of Consent 96020	YES	

Figure 2-1, Figure 2-2, Figure 2-3, Table 2-1, Table 2-2, and Table 2-3 show the management of the lake level complies fully with the Guidelines over the monitoring period 1-Jan-2023 – 31-Dec-2023.

2.2 Upper Waiau River - minimum flows

Condition 2 of the consent 96020 requires that:

The Consent Holder shall maintain in the river downstream of the structure a flow not less than 115 cubic metres per second (cumecs) 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.

Figure 2-4 shows the flow in the Upper Waiau River at Queens Reach, with the minimum consented flow indicated.

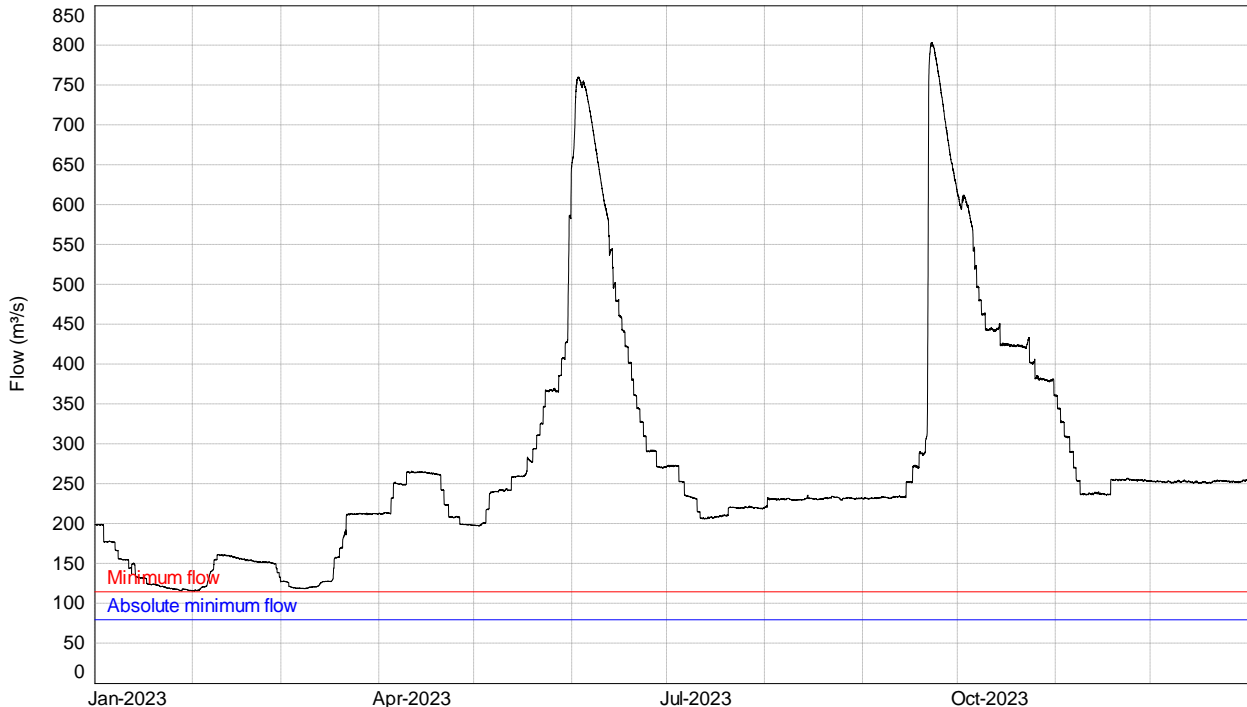


Figure 2-4: Recorded flow in the Upper Waiau River at the Queens Reach flow recorder for the period 1 Jan 2023 - 31 Dec 2023.

Flows did not drop below 115m³/s during 2023, and therefore the other requirements of condition 2 did not apply. Table 2-4 lists the recorded and consented minimum flows.

Table 2-4: Upper Waiau River at Queens Reach consented and actual minimum flows for the period 1 Jan 2023 - 31 Dec 2023.

	Flow (m ³ /s)
Consented minimum flow	115
Recorded minimum flow during the period 1/1/2023- 31/12/2023	115.57
Complied fully with Condition 2 of Consent 96020	YES

2.3 Upper Waiau River - rates and changes of flow

Condition 1 of the consent 96021 requires that:

Rates and Changes 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.*

Figure 2-5 shows the rate of change in flow recorded in the Waiau River at Queens Reach, while Figure 2-6 shows the percentage change in daily flow, with the associated consented thresholds.

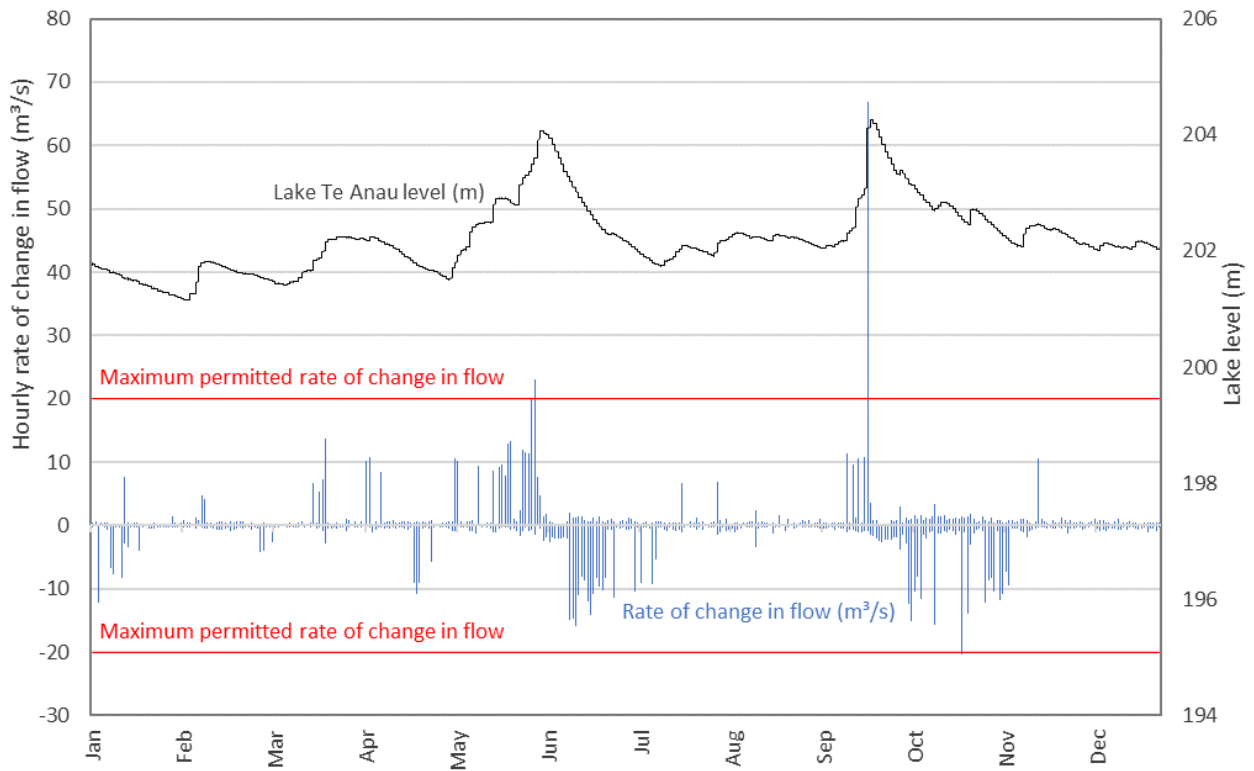


Figure 2-5: The rate of change in hourly flow recorded at Waiiau River at Queens Reach with associated consented threshold limits and lake level over plotted (condition 1a), for the period 1-Jan-2023 to 31-Dec-2023.

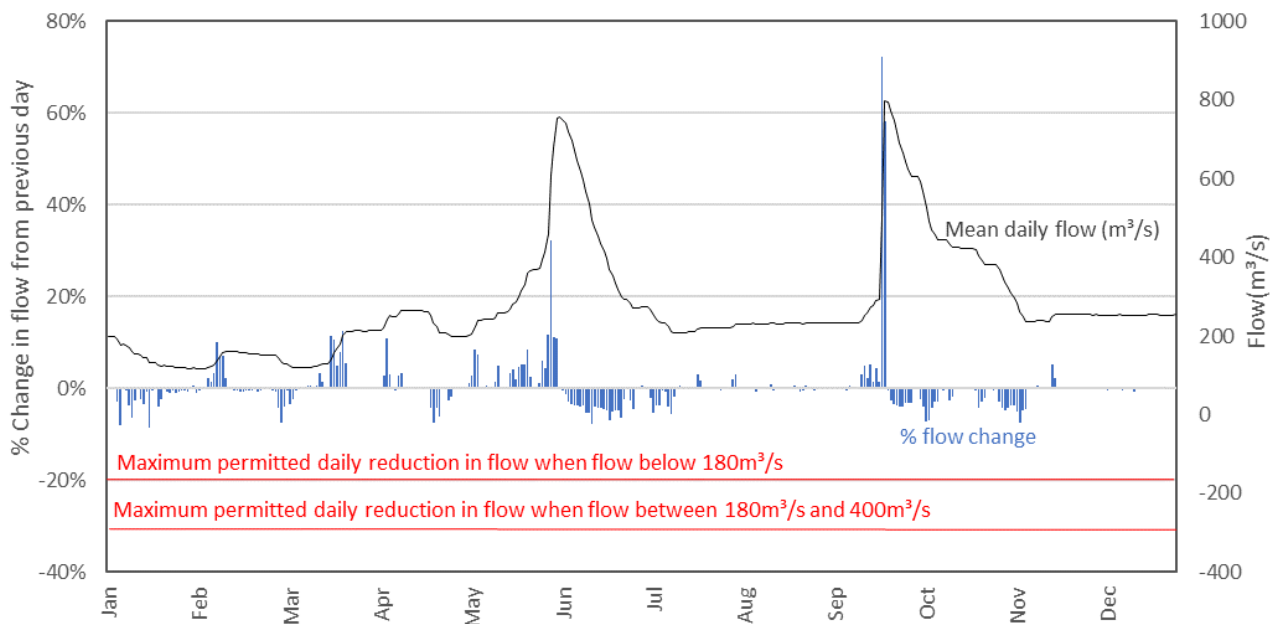


Figure 2-6: The percentage change in daily flow recorded at Waiiau River at Queens Reach with associated consented threshold limits and recorded flow level over plotted (conditions 1b and 1c), for the period 1-Jan-2023 to 31-Dec-2023.

The consented maximum hourly rate of change in flow ($20\text{m}^3/\text{s}$) was exceeded on 12 occasions at Waiiau River at Queen’s Reach over the compliance monitoring period: once on 31 May 2023, 10 times on 21 September 2023, and once on 23 October 2023. However, it is noted that the hourly

rate of change on 23 October 2023 was minor ($-20.30\text{m}^3/\text{s}$) and well within the margin of error of measured flows, so is not deemed to be a true non-compliance event. The event on 31 May 2023 had a recorded change in hourly flow of $23.03\text{ m}^3/\text{s}$ at 16:00, and the maximum recorded change in hourly flow was $66.80\text{m}^3/\text{s}$ on 21 September 2023 at 18:00 (but was recorded as above a $20\text{m}^3/\text{s}$ change from 10:00 – 19:00) (Table 2-5). The hourly average lake level of Lake Te Anau exceeded 203.30m between the periods of 28 May – 11 June 2023 and 21 September – 4 October 2023, therefore the 'Flood Rules' were in effect over these periods, and Condition 1 explicitly applies only to lake levels below 203.30m . Therefore, the change in flows greater than $20\text{m}^3/\text{s}$ on 31 May and on 21 September were both compliant per the conditions.

The maximum hourly rate of change in flow in non-flood operations was $-15.84\text{m}^3/\text{s}$ on 14 June 2023 18:00. Therefore, this is considered to be compliant with Condition 1a) of consent 96021.

The largest daily decrease in flow recorded at Waiau River at Queen's Reach over the compliance monitoring period was 8% of the previous calendar day. A decrease of 8% of the previous calendar day occurred on six dates over the compliance monitoring period; 5 & 15 January, 1 March, 22 April, 15 June and 8 November 2023. The recorded change in flow as a percentage of the previous calendar day was therefore not exceeded during the compliance monitoring period, and Condition 1b) has been complied with (Table 2-5).

The recorded flow in the Waiau River at Queens Reach did fall below $180\text{m}^3/\text{s}$ during January, February, and March, and therefore the 20% threshold for flows below $180\text{m}^3/\text{s}$ was triggered. However, the largest daily decrease in flow was 8% over these periods, and therefore Condition 1 c) has been complied with (Table 2-5).

Condition 2 of the consent 96021 requires that:

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.

To assess if Meridian has complied with this rule, the hourly Waiau at Queens Reach flow data is extracted into a spreadsheet and the difference between each timestep is calculated. The difference data is then filtered to highlight instances where there has been both an increase and decrease in flow occurring in the same calendar day. Such instances are then further investigated to determine if this is due to the natural 'flux' inherent in flow datasets and the residual uncertainty in the hydrometric data ($\pm 8\%$), or due to gate movements increasing and/or decreasing the flow purposefully.

Over the 2023 compliance monitoring period flows were not increased and decreased during the same day and therefore compliance with this requirement was met.

Table 2-5: Upper Waiau River at Queens Reach - consented and actual changes in flow for the period 1 Jan 2023 - 31 Dec 2023.

	Flow (m ³ /s)
1a. Consented maximum hourly change in flow	±20
Recorded maximum hourly change in flow during the period 1/1/2023- 31/12/2023 (in non-flood operations)	-15.84
Recorded maximum hourly change in flow during the period 1/1/2023- 31/12/2023 (Flood Rules in effect)	66.80
1b. Consented maximum % change in flow (decreasing) from previous calendar day for flows below 400 cumecs and above 180 cumecs	30
Recorded maximum % change in flow (decreasing) from previous calendar day for flows between 400 cumecs and above 180 cumecs	8
1c. Consented maximum % change in flow (decreasing) from previous calendar day for flows below 180 cumecs	20
Recorded maximum % change in flow (decreasing) from previous calendar day for flows between below 180 cumecs	8
2. No increase and decrease in flows in the same calendar day	Complied
Complied fully with Condition 1 and 2 of Consent 96021	YES

Figure 2-5, Figure 2-6 and Table 2-5 show the consented conditions for changes in flow recorded in the Waiau River at Queens Reach were fully met.

3 Lake Manapouri

3.1 Lake levels

Condition 1 of consent 96022 requires that:

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 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.

Condition 3 of consent 206156 requires that:

At all times when exercising this consent, the consent holder shall comply with the provisions of condition 1 of water permit 96022.

Condition 1 of consent 96024 requires that:

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 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.

Condition 4 of consent 206157 requires that:

At all times when exercising this consent, the consent holder shall comply with the provisions of condition 1 of water permit 96024.

Figure 3-1 shows the recorded lake level; with the Main Range limits indicated.

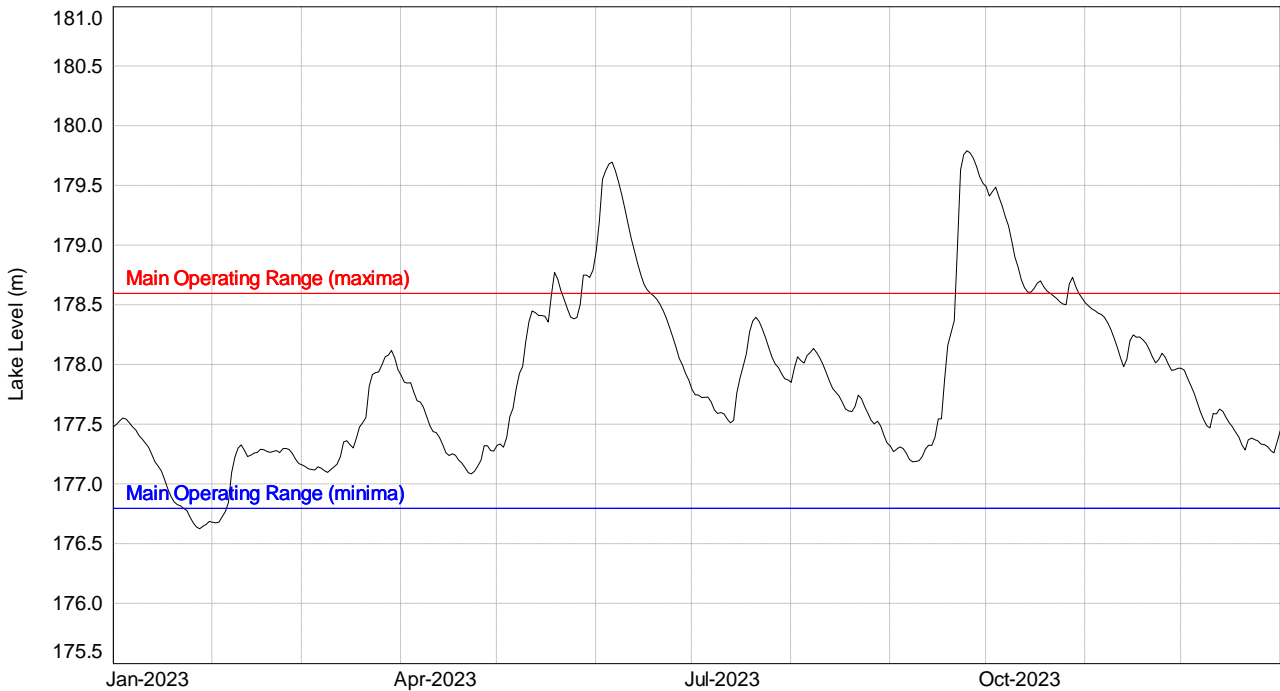


Figure 3-1. Lake Manapouri lake level with maximum and minimum limits of the Operating Ranges over-plotted, for the period 1-Jan-2023 to 31-Dec-2023.

Clause 4 (1a) requires Meridian to endeavour to maintain continuous variation in the Main Operating Range of Lake Manapouri of between 176.8m to 178.6m. Despite periods where the lake level has increased above and decreased below the main operating range, continuous variation for the most part has been maintained within the operating range as shown in Figure 3-1. Therefore, Meridian complied with Clause 4 (1a).

Clause 4 (2) of the Guidelines states that Meridian shall aim to achieve an annual mean lake level “within the applicable Main Operating Ranges as specified in this notice”. Meridian (and its predecessors) and the Lake’s Guardians have always accepted that this is tested using a 365-day rolling mean.

The 365-day rolling mean lake level is 177.88m. This is a small increase on the 2022 rolling mean of 177.49m. The 2023 mean level is within the Main Range and on this basis, Meridian has met the requirement of Clause 4 (2).

When lake levels are in the High Operating Range, Meridian is required to use its best endeavours to manage levels to the specified maximum durations, minimum intervals, and specified ratios, set out under Clause 5 of the Guidelines (refer Table 1.3). A check was undertaken of compliance with Clause 5 of the Guidelines (Figure 3-2; Table 3-1) and described below.

The top of the Lake Manapouri Main Operating Range is 178.6m. Lake levels were above this level on four occasions over the compliance monitoring period. The duration that the lake level was within each of the high operating ranges met the maximum duration requirements specified in the Guidelines. Minimum intervals and the ratio between the intervals and durations were also checked and found to be compliant with the Guidelines.



Figure 3-2. Lake Manapouri High Operating Range for the period 1 Jan 2023 - 31 Dec 2023.

Table 3-1. Lake Manapouri High Operating Range for the period 1 Jan 2023 - 31 Dec 2023.

Elevation (m)	Guideline Specifications			Compliance monitoring period		
	Maximum Duration (Continuous Days)	Minimum Interval (Continuous Days)	Interval / Duration Ratio	Maximum Duration (Days)	Departure Event Start Date	Departure from Guidelines
At 180.5	1	100	100.00	-	-	No
Above 180.4	3	100	33.33	-	-	No
Above 180.1	9	100	11.11	-	-	No
Above 179.8	22	80	3.64	-	-	No
Above 179.5	35	40	1.14	8	23/09/2023	No
Above 179.2	44	40	0.91	15	23/09/2023	No
Above 178.9	99	20	0.2	19	22/09/2023	No
Above 178.6	119	20	0.17	30	22/09/2023	No

Clause 6 of the Guidelines require that Meridian use its best endeavours with respect to low range requirements (refer Table 1.3). A check was undertaken of compliance with Clause 6 of the Guidelines (Figure 3-3; Table 3-2) and described below.

The bottom of the Lake Manapouri Main Operating Range is 176.8m. Lake levels were below this level on one occasion over the compliance monitoring period.

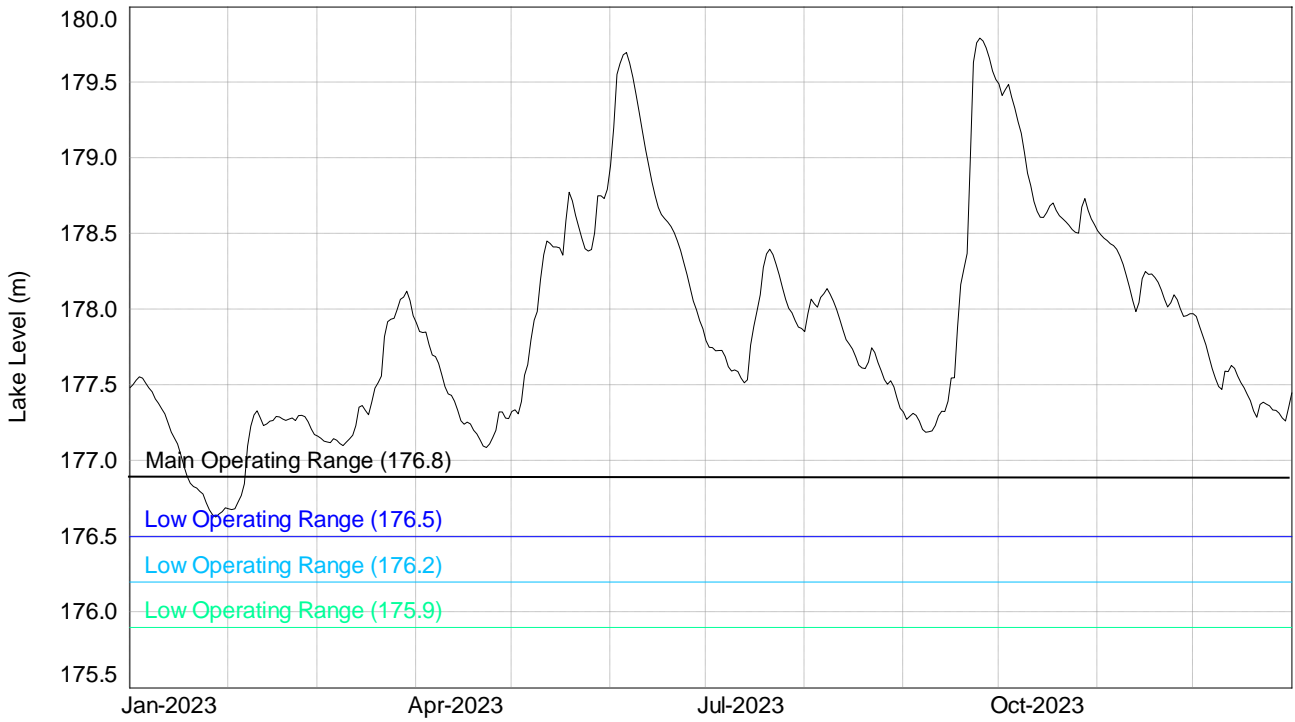


Figure 3-3. Lake Manapouri Low Operating Range for the period 1 Jan 2023 - 31 Dec 2023.

Table 3-2: Lake Manapouri Low Operating Range for the period 1 Jan 2023 - 31 Dec 2023.

Elevation (m)	Guideline Specifications		Compliance monitoring period			
	Maximum Duration (Continuous Days)	Annual Total Duration (days)	Maximum Continuous duration of exceedance (days)	Departure Event Start Date	Total days of exceedance	Departure from Guidelines
Below 176.8	107	214	13	24/01/2023	13	No
Below 176.5	66	132	-	-	-	No
Below 176.2	20	40	-	-	-	No
At 175.9	5	10	-	-	-	No

Manapouri levels – summary

Table 3-3: Lake Manapouri - Operating Guideline levels and actual levels for the period 1-Jan-2023 to 31-Dec-2023.

	Minimum Control Level (m)	Maximum Control Level (m)
Consented Control Levels	176.8	178.6
Actual levels during the period 1/1/2023- 31/12/2023	176.63	179.80
12-month mean lake level	177.88	
Levels outside of Main Operating Range?	Yes	
High Operating Range limits met?	Yes	
Low Operating Range limits met?	Yes	
Best endeavours applied	N/A	
Complied fully with: Condition 1 of Consent 96022; Condition 3 of Consent 206156; Condition 1 of Consent 96024; and Condition 4 of Consent 206157	YES	

Figure 3-1, Figure 3-2, Figure 3-3, Table 3-1 and Table 3-2 show the management of the lake level complied fully with the Guidelines over the period 1-Jan-2023 – 31-Dec-2023.

3.2 Lower Waiau flows

Flows in the lower Waiau River, below Manapouri Lake Control (MLC), are measured at a hydrological recorder downstream of the MLC rather than using gate flow data. In recent years, there has been substantial gravel movement from the Mararoa River, through the MLC, and into the river downstream of the MLC structure. This has resulted in frequent rating changes and some uncertainties in the flow record during higher flows.

For this reason, the MLC flow record used to assess compliance involving MLC flows has been derived from a combination of calculated gate flow data (when flows are above 40m³/s) and the downstream recorder site (when flows are below 40m³/s). This data set is referred to as the MLC Control Flow.

Condition 2 of consent 96022 requires that:

Minimum Flow

Except as provided for in conditions 2.1,2.2,3.1 and 3.2 the Meridian is required to maintain, a flow not less than 12 cubic meters per second (cumecs) between 1 May and 30 September, or not less than 14 cumecs during October and April, and not less than 16 cumecs at all other times in the Lower Waiau River.

Condition 4 of consent 206156 requires that:

Minimum Flow

At all times when exercising this consent, the consent holder shall ensure that the provisions of condition 2 of water permit 96022 are met.

Figure 3-4 shows flows below the Manapouri Lake Control (MLC). Table 3-4 lists the minimum recorded flows and the consented flows.

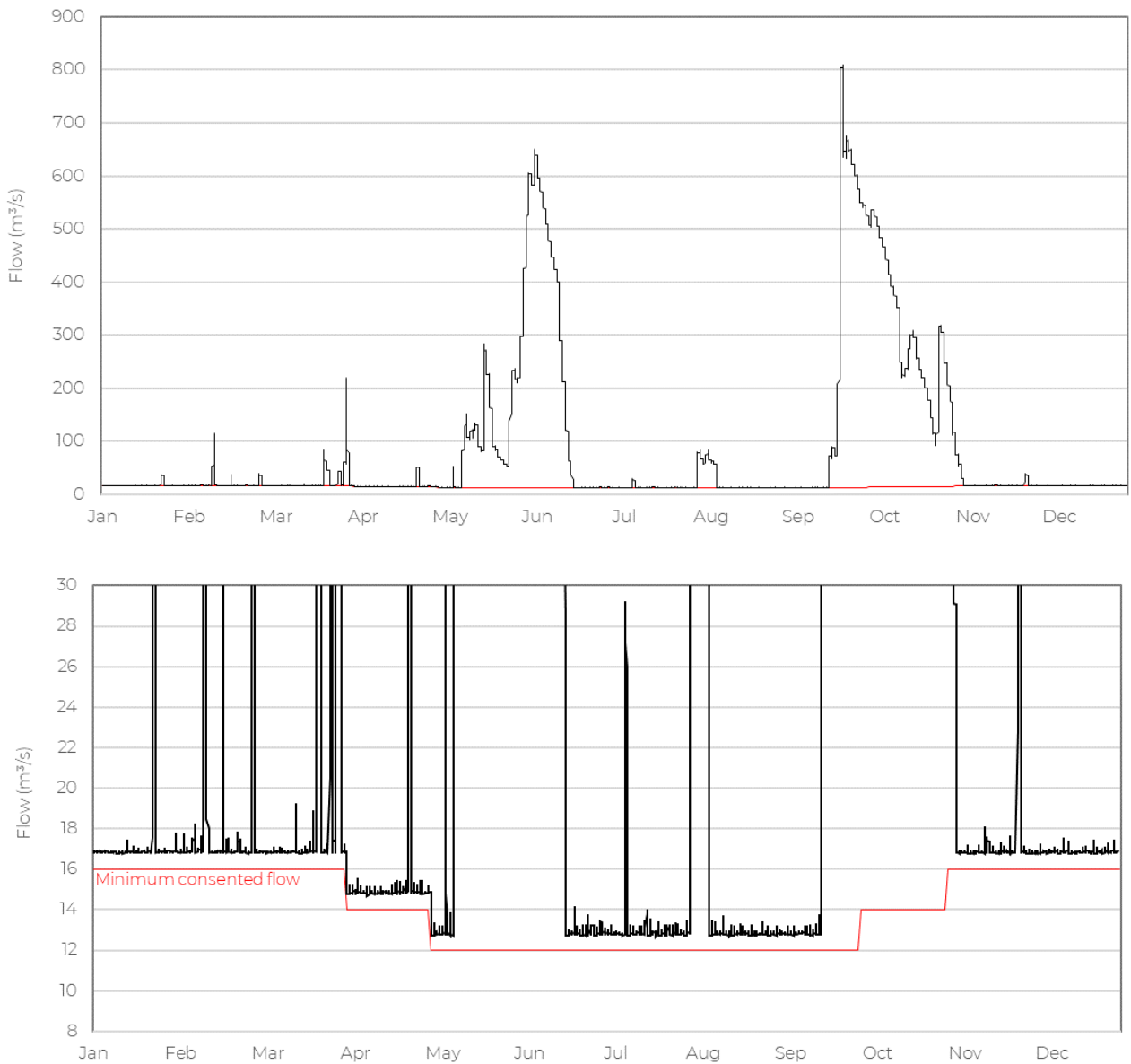


Figure 3-4. Flows in the Lower Waiou River downstream of the Manapouri Lake Control and the minimum consented flows (for the period 1-Jan-2023 to 31-Dec-2023). The upper graph shows the total range of data, and the lower graph is zoomed in to demonstrate minimum flows vs. consent limits.

Table 3-4. MLC flow verification comparing the consented minimum flow and recorded minimum flow for each period, for the period 1-Jan-2023 to 31-Dec-2023.

Flow	Minimum Flow (m ³ /s)
Consented minimum flow to be maintained downstream of the MLC during the period 1 May and 30 September	12
Recorded minimum flow downstream of the MLC during the period 1 May and 30 September	12.69
Consented minimum flow to be maintained downstream of the MLC during October and April	14
Recorded minimum flow downstream of the MLC during October and April	14.67
Consented minimum flow to be maintained downstream of the MLC during the period 1 November 30 April	16
Recorded minimum flow downstream of the MLC during the period 1 November 30 April	16.72
Complied fully Condition 2 of Consent 96022 and Condition 4 of 206156	YES

Figure 3-4 and Table 3-4 show the minimum flow conditions were complied with fully over the period 1-Jan-2023 – 31-Dec-2023.

3.3 Mararoa River - turbid water

Condition 5 of consent 96022 requires that:

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 lake control structure a flow no less than the flow in the Mararoa River measured at the same time.

Condition 5 of consent 206156 requires that:

Mararoa Turbid Water

At all times when exercising this consent, the consent holder shall ensure that the provisions of condition 2 of water permit 96022 are met.

Backscattering-type (or nephelometric) turbidity sensors are popular for monitoring suspended sediment because their signal-to-noise ratio increases with sediment concentration. However, because of the very low turbidity threshold specified in Condition 5 of consent 96022 (30 NTU), the data contains a number of anomalous values; caused by a combination of both instrumental and environmental factors. The use of 30-min averages helps to mitigate the effect of these anomalous values, but there is still a relatively high noise to signal ratio.

Turbidity was measured previously at the Cliffs' hydrometric site on the Mararoa River. However, a new site, Mararoa at Weir Road Bridge, approximately 200m downstream of the Cliffs site, was installed in late 2019. These data, however, are not connected to Meridian's SCADA system and so operational decisions must rely on 5-min telemetered data. Meridian has approval from Environment Southland to use this site currently for compliance monitoring of turbidity, however works are now underway to upgrade this site to a full SCADA site which will have two in-river sensors for redundancy. As of May 2023, email correspondence between Meridian and Environment Southland has confirmed that the turbidity sampling site can move down

permanently to 200m downstream of Weir Bridge and will not impact the consent conditions, although as of March 2024 the permanent site has not yet been commissioned.

Figure 3-5 plots both the flow within the Mararoa River and that released through the MLC, against turbidity. It also plots all instances when flows recorded downstream of the MLC did not at least equal flows recorded in the Mararoa when turbidity exceeded 30 NTU i.e., Condition 5 of consent 96022 was apparently not met.

For the reasons discussed above, any anomalous NTU data was identified and, if required, removed. NTU data is considered anomalous if flows in the Mararoa River are below 30m³/s and the turbidity value has 'spiked' i.e., a single elevated value 'nested' within lower values. For the 2023 year, no data 'spikes' were identified to be removed that met this criteria.

Table 3-5 details all instances when there was a deficit in the difference between the two flows i.e., flow through the MLC is less than flow in the Mararoa River when turbidity exceeded 30 NTU.

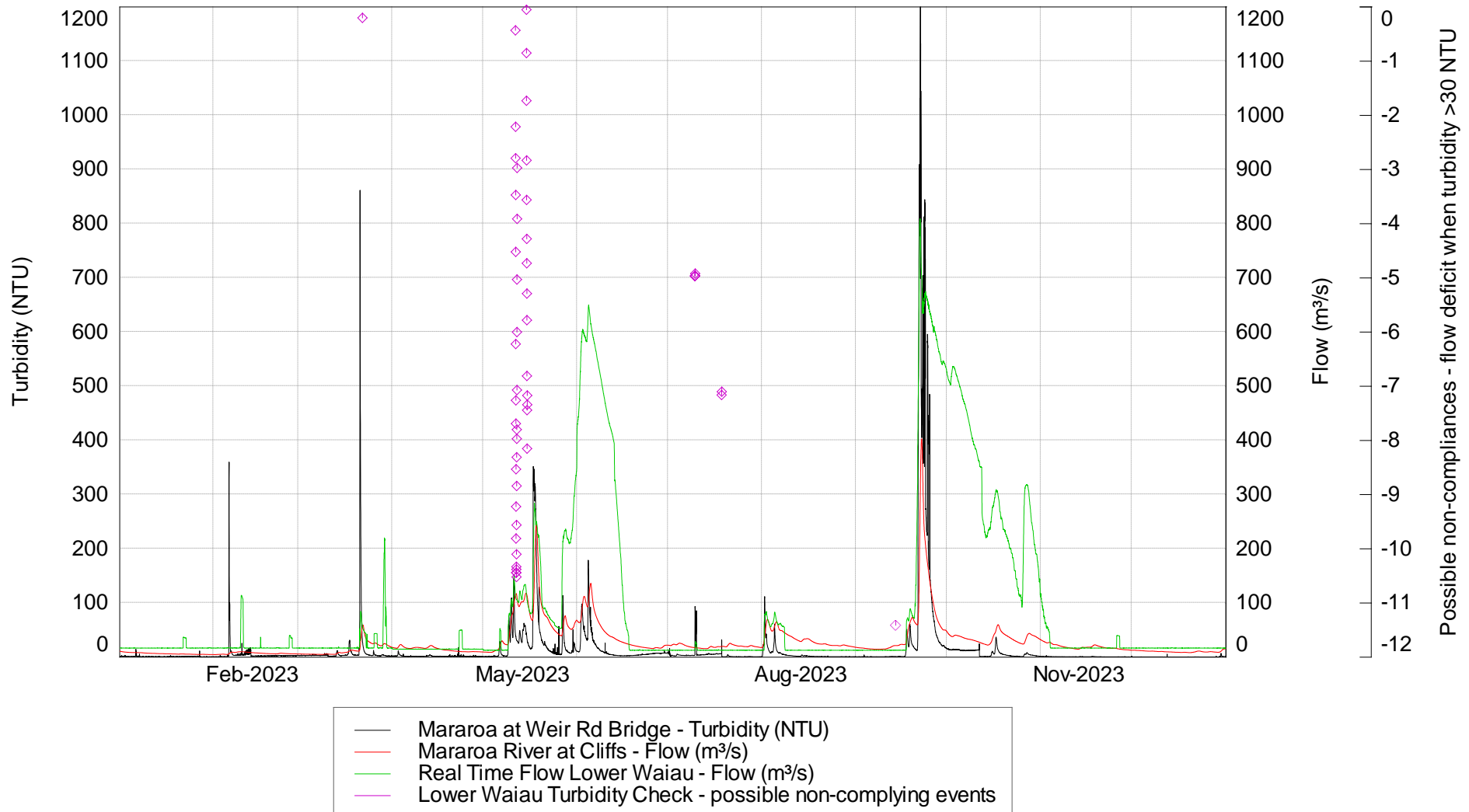


Figure 3-5: Turbidity and flows in the Mararoa River and downstream flows (real time data), and possible instances of consent non-compliance over the period 1-Jan-2023 to 31-Dec-2023.

Table 3-5: Instances where flow recorded downstream of the MLC did not equal or exceed flow in the Mararoa when turbidity exceeded 30 NTU, over the period 1-Jan-2023 to 31-Dec-2023.

Date / time	Turbidity (Weir Road Bridge) (NTU)	MLC Flow (SCADA) (m ³ /s)	Mararoa Flow (m ³ /s)	Flow Deficit (m ³ /s)	Flow Deficit as a % of Mararoa Flow
22/03/2023 3:00	30.35	57.1	57.3	-0.2	0%
11/05/2023 15:00	41.26	114.31	114.74	-0.43	0%
11/05/2023 15:30	40.33	112.93	115.14	-2.21	-2%
11/05/2023 16:00	40.7	112.73	115.52	-2.79	-2%
11/05/2023 16:30	39.77	112.49	115.96	-3.47	-3%
11/05/2023 17:00	39.32	111.75	116.27	-4.52	-4%
11/05/2023 17:30	38.34	110.37	116.59	-6.22	-5%
11/05/2023 18:00	37.96	109.61	116.87	-7.26	-6%
11/05/2023 18:30	38.17	109.37	117.06	-7.69	-7%
11/05/2023 19:00	35.92	108.75	117.28	-8.53	-7%
11/05/2023 19:30	34.94	108.19	117.41	-9.22	-8%
11/05/2023 20:00	34.27	107.69	117.5	-9.81	-8%
11/05/2023 20:30	34.2	107.06	117.5	-10.44	-9%
11/05/2023 21:00	34.14	107.06	117.5	-10.44	-9%
11/05/2023 21:30	33.31	106.99	117.32	-10.33	-9%
11/05/2023 22:00	32.89	106.75	117.13	-10.38	-9%
11/05/2023 22:30	32.32	106.34	116.86	-10.52	-9%
11/05/2023 23:00	31.65	106.35	116.45	-10.1	-9%
11/05/2023 23:30	31.72	106.41	115.97	-9.56	-8%
12/05/2023 0:00	31.42	106.53	115.37	-8.84	-8%
12/05/2023 0:30	31.44	106.42	114.73	-8.31	-7%
12/05/2023 1:00	31	105.95	113.92	-7.97	-7%
12/05/2023 1:30	30.94	105.31	113.11	-7.8	-7%
12/05/2023 2:00	30.91	105.22	112.29	-7.07	-6%
12/05/2023 2:30	30.83	105.21	111.21	-6	-5%
12/05/2023 3:00	30.4	105.24	110.27	-5.03	-5%
12/05/2023 3:30	30.41	105.34	109.25	-3.91	-4%
12/05/2023 4:00	30.13	105.27	108.24	-2.97	-3%
15/05/2023 5:30	42.78	117.37	117.42	-0.05	0%
15/05/2023 6:00	41.74	116.38	117.23	-0.85	-1%
15/05/2023 6:30	41.01	115.25	116.98	-1.73	-1%
15/05/2023 7:00	39.8	113.83	116.66	-2.83	-2%
15/05/2023 7:30	39.72	112.78	116.34	-3.56	-3%
15/05/2023 8:00	39.33	111.67	115.95	-4.28	-4%
15/05/2023 8:30	37.49	110.83	115.56	-4.73	-4%
15/05/2023 9:00	35.61	109.77	115.06	-5.29	-5%
15/05/2023 9:30	34.96	108.81	114.59	-5.78	-5%
15/05/2023 10:00	34.48	107.27	114.08	-6.81	-6%
15/05/2023 10:30	33.36	106.03	113.47	-7.44	-7%
15/05/2023 11:00	32.6	104.75	112.9	-8.15	-7%
15/05/2023 11:30	31.92	105.12	112.29	-7.17	-6%
15/05/2023 12:00	30.57	104.35	111.69	-7.34	-7%
9/07/2023 20:00	35.03	12.73	17.7	-4.97	-28%

Date / time	Turbidity (Weir Road Bridge) (NTU)	MLC Flow (SCADA) (m ³ /s)	Mararoa Flow (m ³ /s)	Flow Deficit (m ³ /s)	Flow Deficit as a % of Mararoa Flow
9/07/2023 20:30	86.37	12.74	17.7	-4.96	-28%
9/07/2023 21:00	93.57	12.74	17.7	-4.96	-28%
9/07/2023 21:30	89.36	12.73	17.65	-4.92	-28%
18/07/2023 15:30	32.42	12.74	19.9	-7.16	-36%
18/07/2023 16:00	31.09	12.8	19.9	-7.1	-36%
17/09/2023 13:30	34.24	17.01	28.48	-11.47	-40%

It should be noted, however, that compliance with Condition 5 of consent 206156 requires consideration of the difference in the estimates of flow at two locations. As discussed previously, estimates of open channel flow are considered to be within $\pm 8\%$ of the actual flow. Therefore, when comparing two flows, it is possible that, even using industry best practice, variation from the actual difference could be up to $\pm 16\%$.

To recognise the inherent uncertainty in these flow data, Table 3-6 shows only those instances when the 'flow deficit' as a percentage of the flow within the Mararoa River was greater than 10%. The threshold of 10% was chosen over 16%, which could be feasible due to the $\pm 8\%$ of the actual flow at each location, as the first step of investigating potential non-compliances to ensure any instances where there is a difference is explored thoroughly.

Table 3-6: *Instances when flow recorded downstream of the MLC did not equal flow in the Mararoa when turbidity exceeded 30 NTU and the flow deficit is greater than 10% of Mararoa flow, over the period 1-Jan-2023 to 31-Dec-2023.*

Date / time	Turbidity (Weir Road Bridge) (NTU)	MLC Flow (SCADA) (m ³ /s)	Mararoa Flow (m ³ /s)	Flow Deficit (m ³ /s)	Flow Deficit as a % of Mararoa Flow
9/07/2023 20:00	35.03	12.73	17.7	-4.97	-28%
9/07/2023 20:30	86.37	12.74	17.7	-4.96	-28%
9/07/2023 21:00	93.57	12.74	17.7	-4.96	-28%
9/07/2023 21:30	89.36	12.73	17.65	-4.92	-28%
18/07/2023 15:30	32.42	12.74	19.9	-7.16	-36%
18/07/2023 16:00	31.09	12.8	19.9	-7.1	-36%
17/09/2023 13:30	34.24	17.01	28.48	-11.47	-40%

The first event occurred in July 2023 over about two hours from 20:00. The average deficit in the release flows was high (28% of the Mararoa flow). The second event also occurred in July 2023 for about an hour from 15:30, and the deficit in the release flow was also high (36% of the Mararoa flow). The third event occurred in September 2023 and lasted about half an hour from 13:30, and again the deficit in the release flow was high (40% of the Mararoa flow).

All three events are considered to be non-compliant, however these are considered to be minor non-compliances as they occurred over very short durations (two hours or less). These data are summarised in Table 3-7 which shows that there were three occasions where the difference in flows were outside of the limit set by Condition 5 of consent 206156.

Table 3-7: Events when flow recorded downstream of the MLC did not meet flow in the Mararoa when turbidity exceeded 30 NTU and the flow deficit is greater than 16% of Mararoa flow, over the period 1-Jan-2023 to 31-Dec-2023.

Event	Start	End	Average Flow Deficit (m ³ /s)	Average Flow Deficit as a % of Mararoa Flow	Comment
Jul-2023	9/07/2023 20:00	9/07/2023 22:00	-4.95	-28%	Minor non-compliance, isolated event over two hours.
Jul-2023	18/07/2023 15:30	18/07/2023 16:30	-7.13	-36%	Minor non-compliance, isolated event over about an hour.
Sep-2023	17/09/2023 13:30	17/09/2023 14:00	-11.47	-40%	Minor non-compliance, isolated event over about half an hour.

The objective of Condition 5 is to prevent sediment laden water from travelling up the Waiau Arm into Lake Manapouri. Meridian also operates a back-up turbidity unit on the Waiau Arm channel between the MLC and Lake Manapouri; approximately 2-3km upstream from the control structure. If turbid water is detected at this point, water may be released from Lake Manapouri to ensure any turbid water in the Arm is flushed down to the Lower Waiau River. A check of turbidity data from the back-up unit at the time of the three minor non-compliant events showed that turbidity was not recorded above 30 NTU for any of these time periods, indicating that no turbid water had reached this back-up unit location (and therefore not entered Lake Manapouri).

Condition 5 was technically breached during three events, two in July and one in September 2023, with these considered to be minor non-compliances. These events had a combined duration of less than one day. However it is also noted that the intent of Condition 5 was met (preventing turbid water from entering Lake Manapouri).

Table 3-8: Lower Waiau River turbidity compliance over the period 1-Jan-2023 to 31-Dec-2023.

Mararoa River Flow-Turbidity	Complied
Complied fully with Condition 5 of Consent 96022 and Condition 5 of Consent 206156	NO - minor

3.4 Lower Waiau River - recreational flows

Condition 8 of consent 96022 requires that:

The consent holder shall release 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 event.

Table 3-9 compares actual discharges against the required recreational flows over the compliance monitoring period.

Table 3-9: Summary of times and flows of flows released below the MLC structure over the period 1-Jan-2023 to 31-Dec-2023.

Date	Target Flow (m ³ /s)	Actual Flow (m ³ /s)	Compliance
22 January 2023	35	39.3	YES
26 February 2023	35	37.4	YES
26 March 2023	35	43.5	YES
23 April 2023	35	49.3	YES
22 October 2023	35	154.7	YES
26 November 2023	35	39.4	YES
24 December 2023	35	N/A	YES
Complied with Condition 8 of Consent 96022			YES

For January, February, March, April, October, and November 2023, the actual flows released below the Manapouri Lake Control Structure on the fourth Sunday of each month were above the target flow of 35 m³/s. During December, there was no recreational flow of 35m³/s released, as this was cancelled by agreement with the New Zealand Jet Boat Association. Therefore, compliance has been met for Condition 8 of consent 96022.

3.5 Lower Waiau River - other flows

Condition 9 of consent 96022 requires that:

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.

No requests from Environment Southland were received by Meridian in 2023, therefore Meridian have complied with this condition.

4 Manapouri Power Station

4.1 Discharge flow limits

Condition 1(a) of consent 96019 requires that:

Discharge flow limit

The Manapouri Power Station (MPS) shall be set to generate at a setpoint for total generator output (MW) that would result in an equivalent 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.

Condition 3 of consent 206158 requires that:

The Manapouri Power Station (MPS) shall be set to generate at a setpoint for total generator output (MW) that would result in an equivalent turbine flow not exceeding 550 m³/s, calculated in accordance with Condition 4. The discharge to Deep Cove from the MPS tailrace shall be regulated by compliance with the setpoint.

Condition 2 of Consent 96019 and Condition 5 of Consent 206158 both have the same requirement. Meridian must report quarterly to Environment Southland the total turbine flow calculated from both (i) setpoint for total generator output, and (ii) actual total generator output; as averages over every half hour period.

The quarterly reporting requirements have already been met by Meridian and are not assessed in this report. However, for the purpose of completeness, the set point total generator data has been presented (Figure 4-1). The total turbine flow was recorded as being just above 510m³/s on a number of occasions between April and July 2023, however Condition 3 of consent 206158 allows turbine flows up to 550m³/s, therefore overall compliance is met.

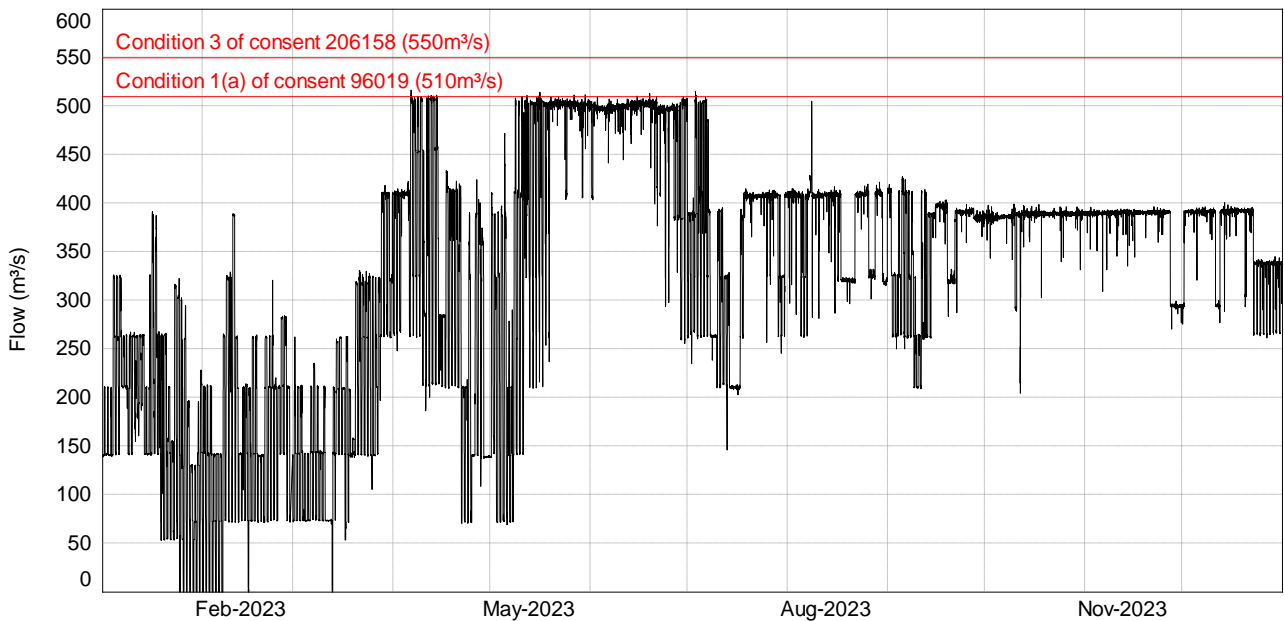


Figure 4-1. Manapouri Power Station Set Point Generation flow over the period 1-Jan-2023 to 31-Dec-2023.

5 Overall Compliance

Table 5-1 summarises all of the consents and conditions that were assessed in this compliance report, and any pertinent comments where non-compliance has been identified.

Table 5-1: Summary of consents and conditions assessed in the Manapouri 2023 calendar year compliance report.

Consent number	Condition number	Complied	Comment
96019	1	YES	
96019	2	YES	
96020	1	YES	
96020	2	YES	
96021	1	YES	
96022	1	YES	
96022	2	YES	
96022	5	NO - minor	Three minor non-compliance events (two hours or less duration).
96022	8	YES	
96022	9	YES	
96024	1	YES	
206156	3	YES	
206156	4	YES	
206156	5	NO - minor	See above comment for 96022 Cond. 5
206157	4	YES	
206158	3	YES	
206158	5	YES	

Appendix A

New Zealand Gazette (Nov 2002)

Manapouri Te Anau Development Act 1963

(The Guidelines)



New Zealand Gazette

WELLINGTON: THURSDAY, 21 NOVEMBER 2002

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USING THE GAZETTE

The *New Zealand Gazette*, the official newspaper of the Government of New Zealand, is published weekly on Thursday. Publishing time is 4.00 p.m.

Closing time for lodgement of notices under the Companies, Partnership, Insolvency and Land Transfer Acts is 12.00 midday on Monday (except where that day is a public holiday, in which case the deadline will be 12.00 midday on the last working day of the preceding week).

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Otago*Members Appointed*

Marcia Garven

Brian Patrick

Location

Palmerston

Dunedin

Dated at Wellington this 13th day of November 2002.

CHRIS CARTER, Minister of Conservation.

go7770

Courts**Sentencing Act 2002****Notice of Confiscation of Motor Vehicle**

Pursuant to section 128 or 129 of the Sentencing Act 2002, an order was made in the Timaru District Court on 5 November 2002, against **Aaron Mathew Gregan** for the confiscation of the following motor vehicle:

Ford Falcon station wagon, Registration No. JX7907.

C. A. TAPPER, Deputy Registrar.

go7715

Notice of Confiscation of Motor Vehicle

On 14 November 2002 in the Papakura District Court, an order was made against **Travel-o-Turimaki Pongi** for the confiscation of the following motor vehicle:

Mitsubishi Gallant, Registration No. YN3850.

Anyone who has a legal interest in this vehicle should contact the Registrar of the Court urgently as the Registrar may sell the vehicle.

This advertisement is placed pursuant to the Sentencing Act 2002.

M. J. SOPPET, Deputy Registrar.

go7814

Order for Confiscation of Motor Vehicle

Pursuant to section 128 or 129 of the Sentencing Act 2002, on 13 November 2002 at the Tauranga District Court, **Hector John Lloyd** was convicted of the following offence – driving with excess breath alcohol level – and in addition to the sentence imposed on him, the Court has ordered that a

1991 Mitsubishi (coloured silver) motor vehicle, Registration No. ZR4989

owned by the above-mentioned defendant, be forfeited to Her Majesty, pursuant to section 136 of the Sentencing Act 2002.

M. DEANE, Deputy Registrar.

go7714

Economic Development**Commerce Act 1986****Appointment of a Member and an Associate Member to the Commerce Commission**

Pursuant to section 9 of the Commerce Act 1986, Her Excellency the Governor-General has been pleased to appoint

Donal Francis Curtin of Auckland

to be a member of the Commerce Commission for a period of three years commencing on 4 November 2002; and pursuant to section 11 of the Commerce Act 1986, the Minister of Commerce has been pleased to appoint

Shaan Winiata Stevens of Wellington

to be an associate member of the Commerce Commission for a period of three years commencing on 30 October 2002. Dated at Wellington this 6th day of November 2002.

LIANNE DALZIEL, Minister of Commerce.

go7701

Manapouri-Te Anau Development Act 1963**Operating Guidelines for Levels of Lakes Manapouri and Te Anau**

Pursuant to section 4A of the Manapouri-Te Anau Development Act 1963, I, Pete Hodgson, Minister of Energy, based upon the recommendations of the Guardians of Lakes Manapouri and Te Anau and of Meridian Energy Limited, hereby give the following notice of the operating guidelines for the levels of Lakes Manapouri and Te Anau aimed to protect the existing patterns, ecological stability, and recreational values of their vulnerable shorelines and to optimise the energy output of Manapouri power station.

Notice

1. Title and commencement—(1) This notice may be cited as the Manapouri-Te Anau Development Act (Operating Guidelines) Notice 2002.

(2) This notice shall come into force on its publication in the *New Zealand Gazette*.

2. Application and interpretation—(1) This notice applies to Lakes Manapouri and Te Anau.

(2) In this notice, unless the context otherwise requires:

“Duration” means the number of continuous days any of the Lakes were within a particular range of level specified within the High or Low Operating Ranges.

“High Operating Ranges” are those set out in clause 5 of this notice.

“Interval” means, in relation to either of the Lakes, the number of continuous days that a Lake was below a particular range of level specified for the High Operating Ranges for that Lake.

“Lakes” means Lakes Manapouri and Te Anau.

“Level” means height, in metres, above mean sea level.

“Low Operating Ranges” are those set out in clause 6 of this notice.

“Main Operating Ranges” are those set out in clause 4 of this notice.

“Maximum duration” means, in relation to any of the Lakes, the number of continuous days that a Lake may be within a particular range of level specified for the High or Low Operating Ranges, and in relation to the High Operating Ranges, subject to the specified minimum interval.

“Minimum interval” means the number of continuous days that should elapse from either of the Lakes moving below a particular range of level, until that Lake returns within that range of level.

“Parties” means the Guardians of the Lakes and Meridian Energy Limited.

“Specified ratio” means the ratio derived from dividing the minimum interval by the maximum duration, and applies only to the High Operating Ranges.

3. Lakes management—The parties recognise three separate operating ranges of levels for each of the Lakes within which Meridian Energy Limited may operate, being Main, High and Low, as set out in clauses 4, 5 and 6 of this notice.

4. The Main Operating Ranges—(1) The Main Operating Ranges, within which Meridian Energy Limited shall endeavour to maintain continuous variation, are:

- (a) for Lake Manapouri, levels from 176.8m to 178.6m; and
- (b) for Lake Te Anau, levels from 201.5m to 202.7m.

(2) Meridian Energy Limited shall, for each of the lakes, aim to achieve annual mean levels within the applicable Main Operating Ranges as specified in this notice.

5. The High Operating Ranges—(1) Meridian Energy Limited shall use its best endeavours to:

- (a) not exceed the maximum durations; and
- (b) achieve the specified ratio in relation to the ranges of level set out in subclause (2) of this clause, where the actual interval (in days) between the Lake moving below a particular range of level and returning to within that range of level is divided by the actual duration (in days) that the Lake was originally within that range of level.

(2) Subject to subclause (3) of this clause, the High Operating Ranges are:

- (a) for Lake Manapouri, above 178.6m, in accordance with the following maximum durations, minimum intervals, and specified ratios for the ranges of level set out:

<i>Level (m)</i>	<i>Maximum Duration</i>	<i>Minimum Interval</i>	<i>Specified Ratio</i>
At 180.5	1	100	100.00
Above 180.4	3	100	33.33
Above 180.1	9	100	11.11
Above 179.8	22	80	3.64
Above 179.5	35	40	1.14
Above 179.2	44	40	0.91
Above 178.9	99	20	0.20
Above 178.6	119	20	0.17

- (b) for Lake Te Anau, above 202.7m, in accordance with the following maximum durations, minimum intervals, and specified ratios for the ranges of levels set out:

<i>Level (m)</i>	<i>Maximum Duration</i>	<i>Minimum Interval</i>	<i>Specified Ratio</i>
At 204.3	7	100	14.29
Above 204.2	10	100	10.00
Above 203.9	15	60	4.00
Above 203.6	22	30	1.36
Above 203.3	39	30	0.77
Above 203.0	65	30	0.46
Above 202.7	125	20	0.16

(3) Where the ratio derived from dividing the interval between the lake level moving below a particular range of level and returning to that range of level by the duration that the lake was in that range of level immediately prior to the interval:

- (a) results in a ratio greater than or equal to the specified ratio, then the guidelines are deemed to be complied with.

- (b) results in a ratio less than the specified ratio, then subject to subclause (4) of this clause, the interval occurring after a particular duration shall be added to that duration along with the duration occurring after that interval, in order to determine the duration for which the specified ratio must be achieved.

(4) The period of duration within any range of level, including accumulations as provided for in paragraph (b) of subclause (3) of this clause, shall not exceed the relevant maximum duration.

(5) The parties record that:

- (a) High Operating Range guidelines were reviewed in 2001 and are based on the mean of the three extreme events during the period of natural and synthetic record from 1933 to 2000.
- (b) the 1988 flood was excluded from this review because of its damaging high levels and extended duration. Extreme natural floods have occurred historically, e.g. 1988: Lake Te Anau 205.41m, Lake Manapouri 182.15m. It is accepted that guideline breaches may occur on rare occasions despite the best endeavours of the power station operator.

6. The Low Operating Ranges—(1) Subject to subclause (2) of this clause, the Low Operating Ranges are:

- (a) for Lake Manapouri levels from 175.86m to 176.8m, with an absolute minimum level of 175.86:

<i>Level (m)</i>	<i>Maximum Duration</i>
Below 176.8	107
Below 176.5	66
Below 176.2	20
At or below 175.9	5

- (b) for Lake Te Anau from 200.86m to 201.5m, with an absolute minimum level of 200.86m:

<i>Level (m)</i>	<i>Maximum Duration</i>
Below 201.5	88
Below 201.3	46
Below 201.1	21

(2) For the purposes of the Low Operating Ranges outlined in subclause (1) of this clause, Meridian Energy Limited shall use its best endeavours to:

- (a) not exceed the maximum durations for the individual ranges of levels specified;
- (b) avoid lake levels below 201.1m for Lake Te Anau and below 176.2m for Lake Manapouri during the equinoctial periods (March, April, October and November);
- (c) not exceed, in any continuous period of 365 days, twice the maximum duration specified for any particular range of level; and
- (d) ensure the rates of drawdown do not exceed the natural rates of drawdown averaged over four days, being 0.05m per day for Lake Manapouri and 0.03m per day for Lake Te Anau.

(3) The parties record that:

- (a) in the period of natural record, the level of Lake Manapouri has been below the absolute minimum level of 175.86m; and
- (b) these guidelines are based on the mean of three extreme events during the period of natural record and may result in low ranges of level being experienced more often than would have occurred naturally.

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