Waitaki Resource Consents Compliance Report

Period: 1/07/2022 - 30/06/2023

31 August 2023

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Revision Details

Revision	Details
1.0	Draft for client comment
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Executive Summary

This report compares the operation of the Waitaki Power Scheme, relative to conditions attached to various resource consents issued to Meridian Energy Ltd. (Meridian) for the 12-month period 1/07/2022 to 30/06/2023.

The recorded lake levels, canal and power station flows, and spill-weir and spillway flows have been plotted for each lake and power station, along with the minimum and maximum consented limits. 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. All of the 34 resource consent conditions checked were complied with fully (Table 11-1).

Given the high number and diversity of resource consents and associated conditions, the operation of the Waitaki Power Scheme to such a high degree of compliance shows a high level of management, operation, and planning by Meridian, and is consistent with the high degree of compliance observed for previous years.

Contents

Disclaimers and Limitations vi

1 Introduction 1

2 Operational Levels 4

3 Compliance with the Resource Consents 4

4 Lake Pukaki 7

4.1 Lake Level 7

4.2 Lake Pukaki Spill Flows 8

4.3 Pukaki – Ōhau Canal 13

4.4 Pukaki – Ōhau Canal Spill 13

5 Lake Ōhau 15

5.1 Lake Level 15

5.2 Ōhau Canal Flow 19

5.3 Ōhau River Flow 20

6 Lake Ruataniwha 22

6.1 Ōhau A Power Station 22

6.2 Lake Ruataniwha Level 23

6.3 Lake Ruataniwha Spill Flow 24

6.4 Ōhau B Power Station 25

6.5 Ōhau C Power Station 26

6.6 Labyrinth Weir 27

7 Lake Benmore 28

7.1 Lake Level 28

7.2 Benmore Machine Flows 29

7.3 Benmore Spillway and Sluice Flows 30

8 Lake Aviemore 32

8.1 Lake Level 32

8.2 Aviemore Machine Flows 33

8.3 Aviemore Spillway and Sluice Flows 34

9 Lake Waitaki 36

9.1 Lake Level 36

9.2 Waitaki Station and Dam Flows 37

9.3 River Flows at Kurow 42

10 Compliance with the Resource Consents - Notifications 48

11 Summary 51

Disclaimers and Limitations

This report '**Waitaki Resource Consents Compliance Report**' has been prepared by WSP New Zealand Limited ('WSP') exclusively for '**Meridian Energy Ltd'** ('Client') in relation to '**Yearly Waitaki Consent Compliance Review**' ('Purpose') and in accordance with the Task Order with the Client dated 27th June 2023 ('Agreement'). The findings in this Report are based on and are subject to the assumptions specified in the Report WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

In preparing this Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('Client Data') provided by or on behalf of the Client. Except as otherwise stated in this Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable for any incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to WSP.

1 Introduction

Water rights for the operation of Waitaki Power Scheme were granted to Meridian Energy Ltd. (Meridian) in February 1991; under the Water and Soil Conservation Act (1967). These 'rights' are now managed as resource consents under the Resource Management Act (1991).

This report compares the operation of the Waitaki Power Scheme (Figure 1-1) relative to the hydrological related conditions attached to the various resource consents for the period 1/07/2022 to 30/06/2023. The management of Lake Takapō (Tekapo) and its associated plant was passed to Genesis Energy Ltd. on 1 June 2011. Compliance with consents associated with Genesis' operations are not included in this report.

Plots and tables of the recorded lake levels, canal and power station flows, minimum flows, spill-weir and spillway flows, and rates of change in these parameters have been included in this report; with critical limits shown. Comments regarding compliance, or any non-compliance, with the various resource consents have been included.

All the hydrometric data used in this compliance review were obtained using industry best practice. Despite this, there remains some minor residual uncertainty regarding the 'exactness' of the data. For example, 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'.

To recognise this uncertainty, the Canterbury Regional Council (Environment Canterbury) has provided Meridian with confirmation that any flows within ±10% of those stated in the consent conditions are considered to be compliant.

All raw hydrometric data relating to the Waitaki Hydro System are currently supplied as 5-min averages. These data are resampled to longer period averages prior to archiving so that they reflect realistic measurements and changes in the particular parameter i.e. some of the random variability is removed. The data are held in the Power Archive managed on behalf of Meridian by WSP. New data are audited monthly for accuracy and continuity before being appended to the archive.

The Power Archive, including its various processes and procedures, has now been maintained in a consistent manner for over 30 years. The procedures and quality assurance meet the guidelines and recommendations of the relevant National Environmental Monitoring Standards. Consequently, the Power Archive contains reliable, consistent, quality assured data.

While WSP maintains the Power Archive, it has no role or responsibility in the operation of the Waitaki Hydro System. Consequently, there is no conflict of interest when

undertaking a compliance audit and preparing this report. WSP is certified by JAS-ANZ to the Quality Management System standard ISO 9001:2015.

Resource consents relating to the operation of the Waitaki Hydro System have general 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 30-mins*. This has always been interpreted to mean that the frequency of measurement should not be greater than 30-mins. 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.

To be consistent with these conditions, data held within the Power Archive has been resampled to the temporal resolution specified within the various conditions (i.e. 30-min averages for discharges, spills, and flows; and 60-min averages for lake level) prior to its use in monitoring compliance with the various resource consents.

The adoption of these sampling intervals, while consistent with the various resource consent conditions, is also consistent with the real-time monitoring of compliance at the various stations and associated infrastructure.

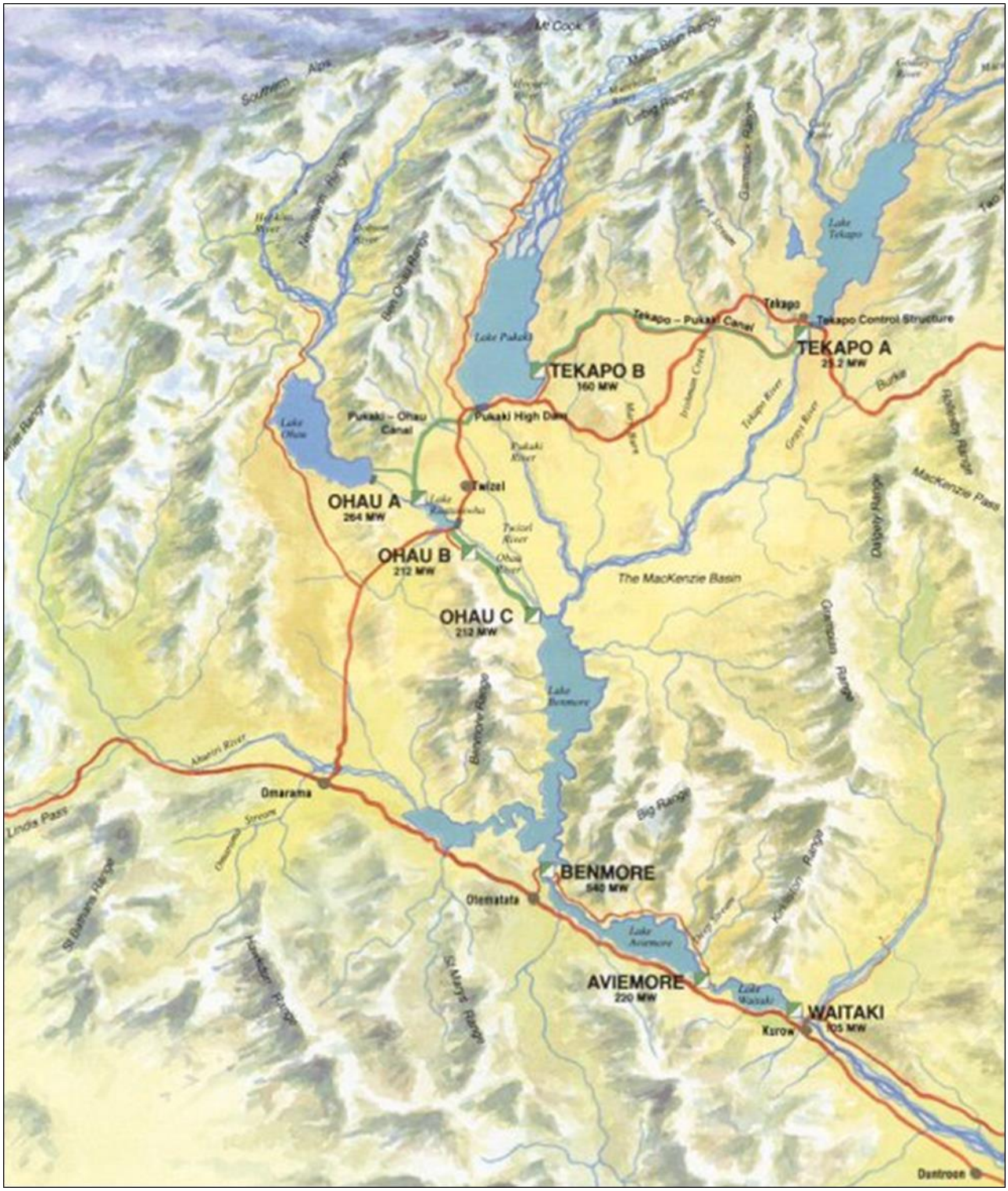

Figure 1-1: The Waitaki Hydro System.

2 Operational Levels

A summary of the range of operational levels for each of the six lakes in the Waitaki Hydro System managed by Meridian is provided in Table 2-1.

Table 2-1: Consented operational levels (metres amsl) for the various lakes within the Waitaki Hydro System.

Lake	Extreme Minimum Control Level	Maximum Control Level
Pukaki	513.00[1] 518.00	532.50
Ōhau	519.45	520.25
Ruataniwha	458.00	458.80
Benmore	355.25	361.45
Aviemore	265.50	268.30
Waitaki	227.00	230.80

3 Compliance with the Resource Consents

The resource consents associated with the operation of all the lakes, power stations, and canals have been listed individually under each section, along with the relevant consent number.

The operative resource consents and conditions have been obtained from Canterbury Regional Council (Environment Canterbury). Certain conditions of the resource consents are linked to the operating rules for the Waitaki Power Stations defined in "*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (9 November 1990): As modified by an order pursuant to section 112 of the Electricity Industry Act 2010*"[2]. This document is referred to in the current report as "*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*".

Several of the consent conditions therefore specify both an operating range (i.e. the difference between the maximum and minimum control levels), and a series of actions that must be followed if water levels go outside this range. Testing compliance against some consent conditions consequently involves a two-stage process:

i) Did the lake level remain within the operating range? And then,

ii) If the lake level went outside the operating range, were the operating rules defined in "Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)" followed?

[1] Waitaki Catchment Water Allocation Plan (v Plan Change 3), Rule 3 – minimum under electricity supply emergency

[2] As further amended by CRC180721, Sept 2017

Compliance with the various resource consents therefore occurs; either, if the lake level remains within the control range; or, if the operating rules are followed when the lake level is outside the control range. Non-compliance occurs only when the lake level goes outside the control range, and the operating rules are not followed (Figure 3-1).

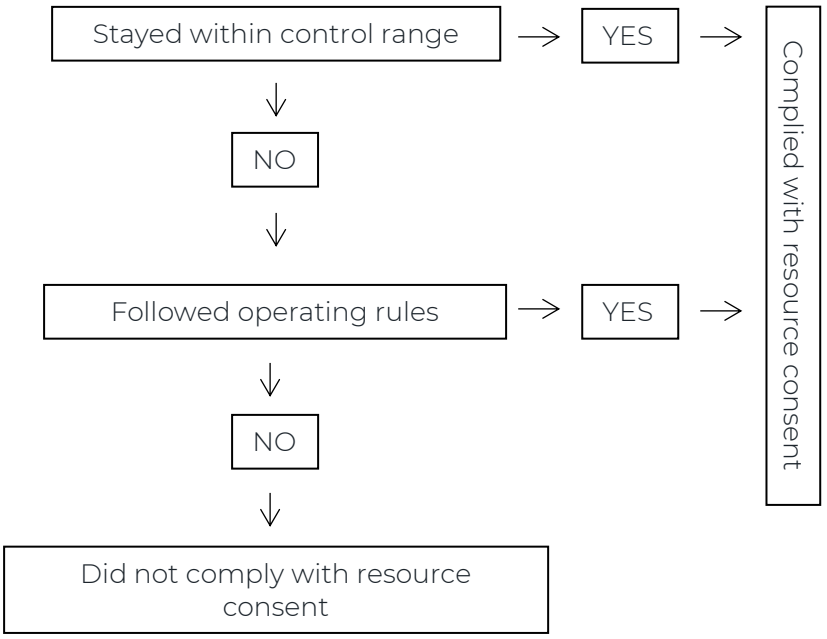

Figure 3-1: Process for assessing compliance against several of the resource consent conditions.

The following sections assess compliance with the resource consents granted to Meridian for the operation of the Waitaki Hydro System, including six lakes (i.e. Pukaki; Ōhau; Ruataniwha; Benmore; Aviemore; and Waitaki) and various canals and rivers (Figure 3-2).

The recorded flows and water levels have been compared against the consented limits, and various other conditions, for the 12-month period (1 July 2022 to 30 June 2023). Comparative plots and tables are shown for each case, from which compliance can be assessed.

WAITAKI HYDRO SYSTEM

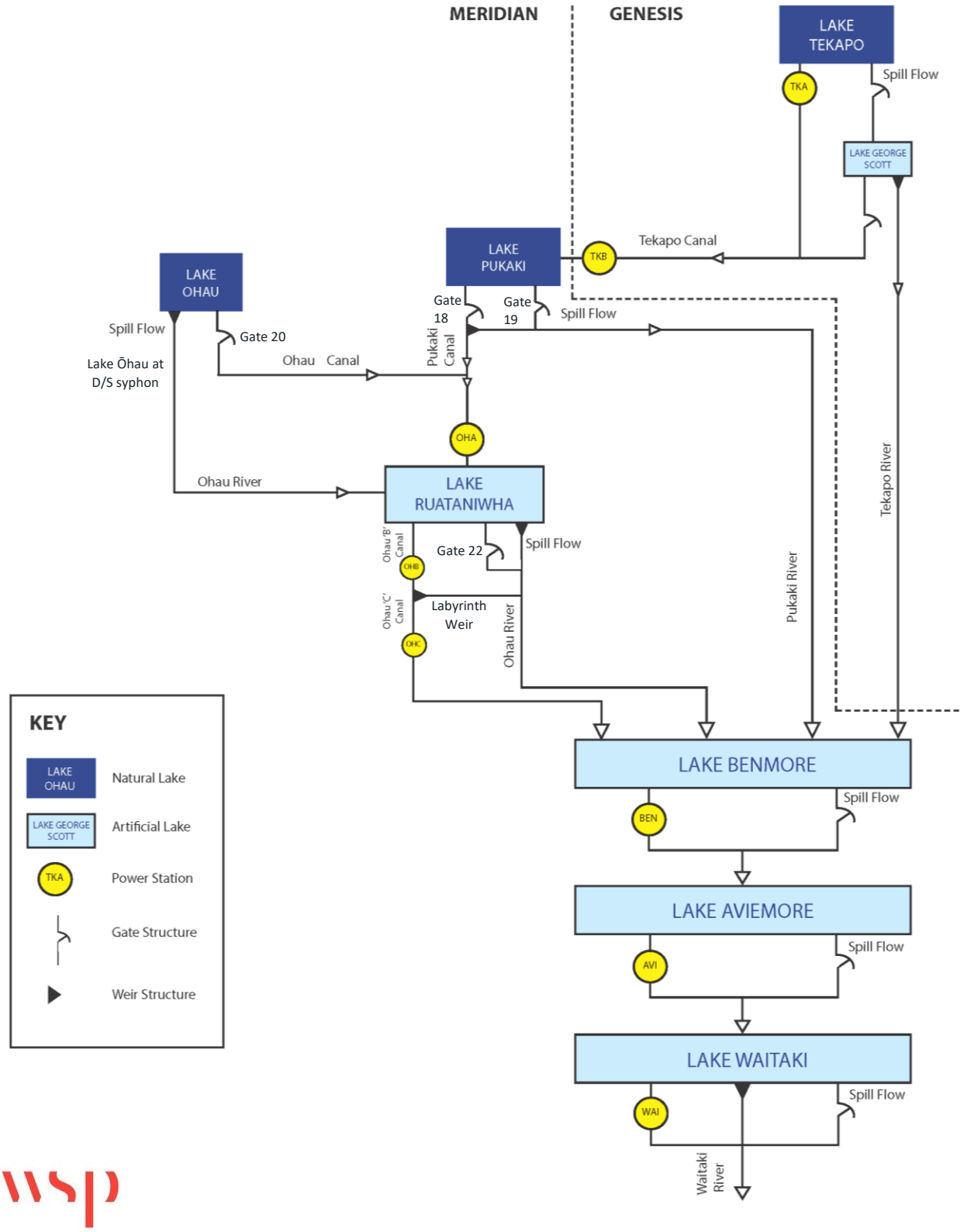

Figure 3-2: Infrastructure layout of the Waitaki Hydro System.

4 Lake Pukaki

4.1 Lake Level

CRC905321.7: To dam the Pukaki River to control and operate Lake Pukaki between the levels of 518.00 and 532.50 metres (msl), at or about Map Reference NZMS 260 H38:820-649 (Lake Pukaki Control Structure).

CRC185833: To operate Lake Pukaki below 518 metres AMSL at or about Map Reference NZMS 260 H38:820-649 (Lake Pukaki Control Structure)

Figure 4-1 shows the recorded lake level together with the maximum and minimum control level thresholds.

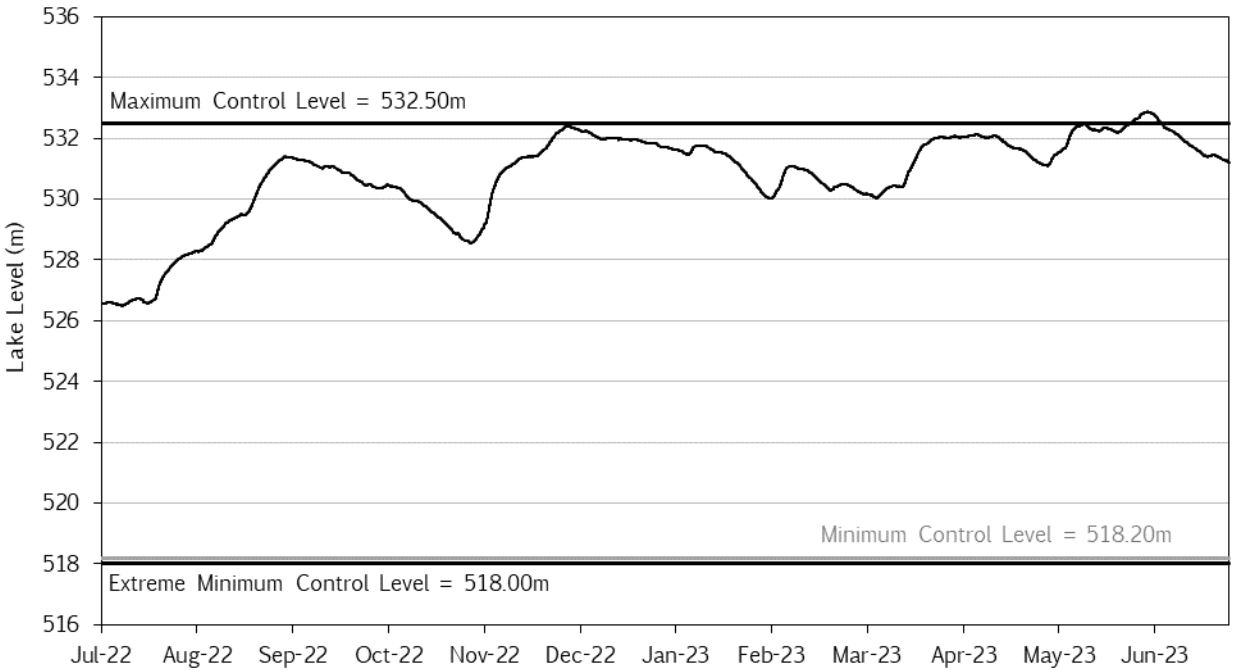

Figure 4-1: Lake Pukaki Lake level (Site 88775) from 1/07/2022 to 30/06/2023.

The maximum control level for Lake Pukaki is 532.50m. The operating rules outlined in "*Waitaki Power Stations, Appendix A - Extracts of Waitaki Operating Rules (1990)*" require the lake level of Lake Pukaki to reach 0.1m above the maximum control level before mandatory minimum total discharges start. The lake level reached at least 0.1m above the maximum control level between the period 31/05/2023 05:00 to 8/06/2023 09:00 and therefore the discharge from Lake Pukaki (spillway plus canal flows) has been checked for compliance against the minimum requirements. The discharge requirements were found to be met throughout this period (Table 4-1).

Table 4-1: Lake Pukaki - periods above MCL and minimum discharges (spillway + canal flows).

Period	Height above MCL (m)	Required minimum discharge (m^3/sec)	Actual minimum discharge (m^3/sec)
31/05/2023 05:00 - 1/06/2023 23:00	0.1	70	101.03
2/06/2023 00:00 – 2/06/2023 16:00	0.2	140	148.36
2/06/2023 17:00 - 6/06/2023 12:00	0.3	200	222.22
6/06/2023 13:00 – 7/06/2023 14:00	0.2	140	216.84
7/06/2023 15:00 – 8/06/2023 09:00	0.1	70	271.96

A summary of the actual minimum and maximum lake levels during the period 1/07/2022 through 30/06/2023, and the consented control levels, are shown in Table 4-2.

Meridian also have consent to operate Lake Pukaki below 518m (to a minimum of 513m) if the Electricity Authority declare a security of supply alert. This consent does not appear to have been exercised over the period 1/07/2022 through 30/06/2023. Therefore, this condition was fully met.

Table 4-2: Lake Pukaki – consented control levels and actual levels.

CRC905321.7	Minimum Control Level (m)	Maximum Control Level (m)
Consented Levels	518.00	532.050
Actual Levels during the period 1/07/2021-30/06/2022	526.48	532.88
Stayed within control range	YES	NO
Complied with operating rules when outside the control levels?	N/A	YES
Complied fully with the resource consent?	YES	
CRC185833		
Was consent utilised?	NO	
Complied fully with the resource consent?	YES	

Figure 4-1 and Table 4-2 and Table 4-3 show that the maximum control level condition and operating rules were complied with fully over the period 1/07/2022 through 30/06/2023.

4.2 Lake Pukaki Spill Flows

(a) Maximum Spill Flows

CRC905322.2: To discharge water up to a maximum rate of 3400m^3/s into the Pukaki River, at or about Map Reference H38:820-649 via Lake Pukaki Control Structure Spillway.

Figure 4-2 shows the spill flows from Lake Pukaki; with the maximum consented flow labelled. Table 4-3 lists the maximum recorded and consented spill flows. Compliance with the 24-hour notification provision is assessed in Section 10.

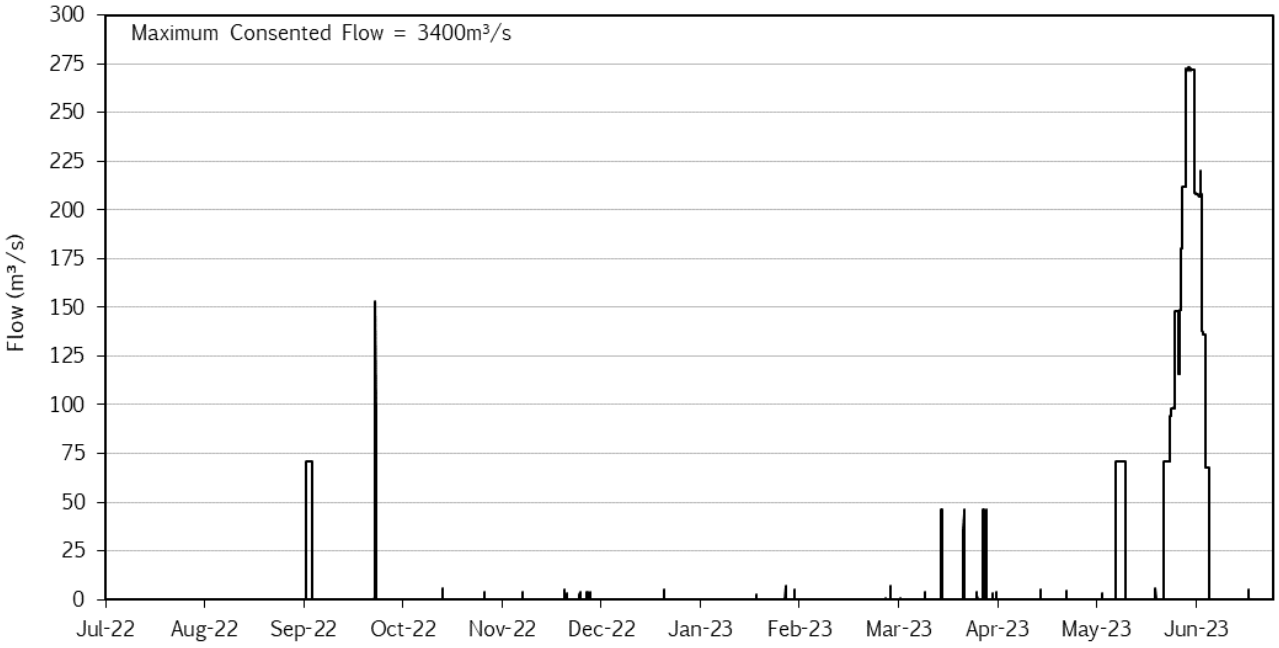

Figure 4-2: Lake Pukaki spill flows (Site 8772) - 1/07/2022 to 30/06/2023.

Table 4-3: Lake Pukaki spill flows - consented and actual maximum flows.

	Maximum Flow (m³/s)
Consented maximum flow	3400
Recorded maximum flow during the period 1/07/2022-30/06/2023	273
Complied fully with the resource consent for maximum flows?	YES
Complied fully with the resource consent for notification?	YES

Figure 4-2 and Table 4-3 show that the maximum flow condition was complied with over the period 1/07/2022 through 30/06/2023.

The periods of spill flow into the Pukaki River shown in Figure 4-2 on 19 and 26 March 2023, and 1 and 2 April 2023 relate to recreational flows. These have been checked for compliance in Table 4-4, Table 4-5, and Table 10-1.

The spill event on 23 September 2022 was for annual gate testing. The spill events on 1 September 2022, 12 May 2023 and 27 May 2023 were due to rising lake levels and forecast high rainfall. These are permitted under the consent condition so long as the requirements of the Waitaki Operating Rules are met. These have been checked for compliance in Table 4-5 and Table 10-1. Other small spill events are presumed to be a result of monthly gate testing.

(b) Recreational Flows

The requirements relating to the recreational flows below the Lake Pukaki Control Structure are outlined in Condition 7 of Resource Consent No. CRC905321.7 and described below. Note that the NZ Canoeing Association is now known as Whitewater New Zealand.

The Grantee shall release the following flows, as measured immediately below the Lake Pukaki Control Structure, into the Pukaki River each year for the recreational purposes represented by the New Zealand Canoeing Association, at the specified dates and times[3] *unless the NZ Canoeing Association does not require the release:*

> *Flow on one weekend between 1 November and 31 March following: the flow shall be 140m³/s for at least 4 hours continuously between 10 am and 4 pm on each day of the weekend.*

PROVIDED THAT if the Grantee advises the Canterbury Regional Council at least 14 days prior to the event that hydraulic storage conditions do not enable the flow requirements to be met, then the flow may not be released and the scheduled flow release shall either be rescheduled to an alternative date or cancelled as determined by the Water Resource Manager, Canterbury Regional Council after discussion with the Grantee and the New Zealand Canoeing Association Incorporated.

An understanding between Meridian, Whitewater NZ, and the Water Resource Manager at Canterbury Regional Council allows flow release times to vary from the above recommendations from year to year. Whitewater NZ and Meridian consult and agree on a schedule which includes the ability for Meridian to work with, or around, operational constraints such as Transpower outages, and to take account of hydrological and storage conditions at the time. Environment Canterbury are notified of the dates of these releases once finalised with Whitewater NZ. Agreement with Whitewater NZ is for a preferred flow release of 45m³/s and therefore the recreational releases have been assessed against this flow target rather than 140m³/s.

Table 4-4 details the recreational flow releases below the Lake Pukaki Control Structure. The small variation between the set and measured flow lies within the ±10% margin agreed with Environment Canterbury.

[3] *The specified dates to be determined by the Water Resources Manager, Canterbury Regional Council before 30 June each year after discussion with the Grantee and Whitewater NZ.*

Table 4-4: Summary of times and flows agreed for recreational flow releases.

Date	Time (NZST)	Target Flow (m^3/s)	Actual Flow (m^3/s)	Compliance?
19-March-2023	05:00 – 09:00	35	35	YES
	09:00 – 15:00	45	46*	
26-March-2023	05:00 – 09:00	35	36*	YES
	09:00 – 15:00	45	46*	
1-April-2023	05:00 – 09:00	35	36*	YES
	09:00 – 15:00	45	46*	
2-April-2023	05:00 – 09:00	35	36*	YES
	09:00 – 15:00	45	46*	
Complied fully with the agreed recreational flow requirements?				YES

*These values are within the ±10% margin agreed with Environment Canterbury

The recreational flow releases from Lake Pukaki fully complied with the notification requirements during the period 1/07/2022 through 30/06/2023.

(c) Lake Pukaki Spillway Discharge Ramping Rates

Rule 1.3 for the Waitaki Hydro Scheme defined in "*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*" states that:

The initial spillway discharge shall be 35m^3/s and shall not be increased for at least 4 hours. The second discharge shall be 70m^3/s and shall not be increased for at least 2 hours.

Operational data are collected in real-time and used to make decisions regarding the active management of the lakes and generation flows. These data, however, are on occasion different to the quality assured data held in the Power Archive, and which is used to assess consent compliance. Data from the Power Archive, however, are only available up to one month following any operational decision. Meridian have procedures in place to ensure the operational datasets are as accurate as possible and continued review is undertaken to align the operational and archived data sets.

Table 4-5 compares the actual spillway discharge with the required discharge. The small variations between the set and measured flows lie within the ±10% margin agreed with Environment Canterbury. Management of these events therefore complied fully with the Operating Rules.

This section of the Waitaki Operating Rules was therefore complied with during the period 1/07/2022 through 30/06/2023.

Table 4-5: Summary of times and flows of spillway discharge ramping.

Date		Time	Target Flow (m^3/s)	Actual Flow (m^3/s)	Compliance?
Recreational releases	19/03/2023	05:00 – 09:00 09:00 – 15:00	35 45	35 (average) 46* (average)	YES
	26/03/2023	05:00 – 09:00 09:00 – 15:00	35 45	36* (average) 46* (average)	YES
	1/04/2023	05:00 – 09:00 09:00 – 15:00	35 45	36* (average) 46* (average)	YES
	2/04/2023	05:00 – 09:00 09:00 – 15:00	35 45	36* (average) 46* (average)	YES
Spill (gate testing)	23/09/2022	02:30 – 06:30 06:30 – 08:30	35 70	34* (average) 70 (average)	YES
Spill (high lake levels/rainfall)	1/09/2022	16:00 – 21:00 21:00 – 12:30	35 70	36* (average) 71* (average)	YES
	12/05/2023	18:30 – 22:30 22:30 - 16/05/23 02:30	35 70	34* (average) 71* (average)	YES
	27/05/2023	21:30 – 13:30 13:30 – 29/05/23 15:30 15:30 – 11/06/23 00:00	35 70 **	36* (average) 71* (average) **	YES
Complied with the operating rules ramping requirements?					YES

*These values are within the ±10% margin agreed with Environment Canterbury

**Further flow increases required as lake level was above MCL, see Table 4-1.

(d) Lake Pukaki Diversion Culvert

CRC905323.2: To discharge water up to a maximum rate of 420m^3/s into the Pukaki River, at or about Map Reference H38:820-649 via Lake Pukaki Diversion Culvert.

The Lake Pukaki Diversion culvert has not been in operation for years and is unlikely to become operational. As there was no discharge via the diversion culvert over the period 1/07/2022 through 30/06/2023 this condition was fully met.

Complied fully with the resource consent?	YES

4.3 Pukaki – Ōhau Canal

CRC905324.1: To take water up to a maximum rate of 560m³/s into the Pukaki-Ōhau Canal from Lake Pukaki, at or about Map Reference H38:810-648.

Figure 4-3 shows canal flows from Lake Pukaki; together with the maximum consented flow. Table 4-6 lists the maximum recorded and the consented canal flows.

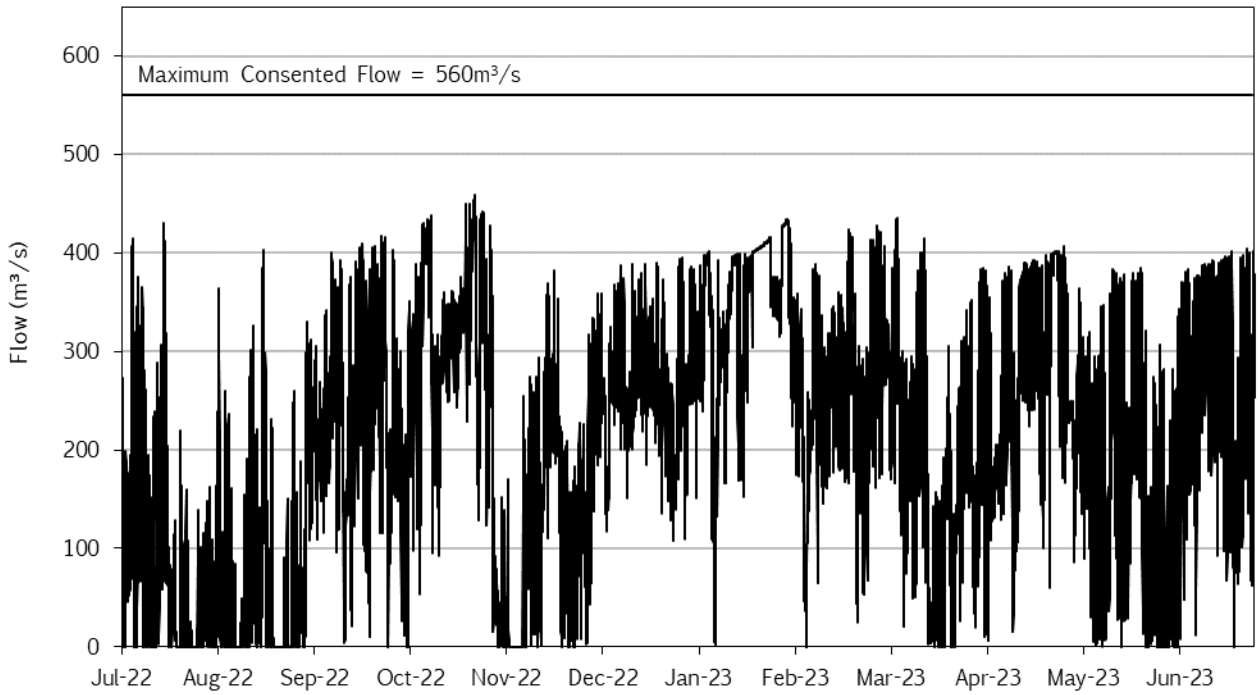

Figure 4-3: Pukaki – Ōhau Canal flows (Site 8773) - 1/07/2022 to 30/06/2023.

Table 4-6: Pukaki – Ōhau Canal flows – consented and the actual flows.

	Maximum Flow (m³/s)
Consented maximum flow	560
Recorded maximum flow during the period 1/07/2022-30/06/2023	458.27
Complied fully with the resource consent?	YES

Figure 4-3 and Table 4-6 show that the maximum flow condition was complied with fully during the period 1/07/2022 through 30/06/2023.

4.4 Pukaki – Ōhau Canal Spill

CRC905325.2: To discharge water up to a maximum rate of 560m³/s from the Pukaki-Ōhau Canal into the Pukaki River, at or about Map Reference H38:802-637 via Spill Channel.

Figure 4-4 shows that the Pukaki Canal tailwater level over the period 1/07/2022 to 30/06/2023 remained below the tipping range i.e. 518.85 – 519.05m. Consequently, there

were no spill flows into the spill channel. It has been advised that the spike in the Pukaki Canal tailwater on 3/08/2022 was a result of Pukaki Canal Protection functional testing.

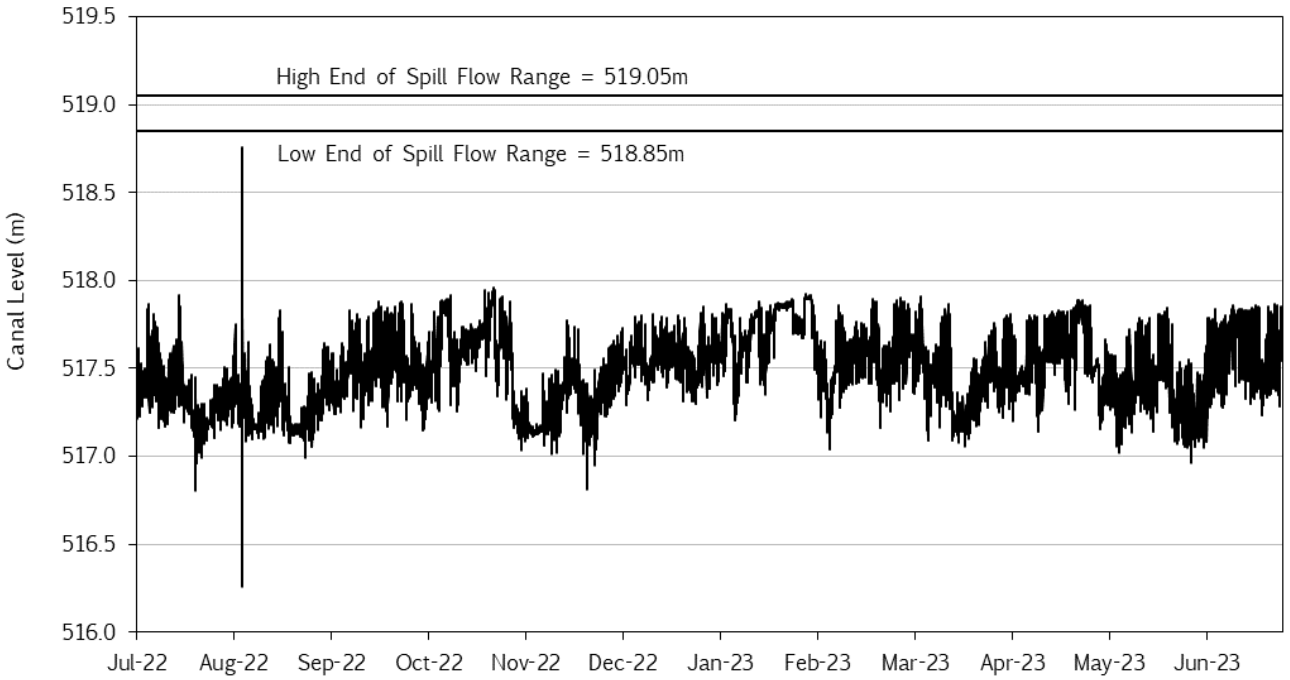

Figure 4-4: Pukaki – Ōhau spill (Site 8778(4)) - 1/07/2022 to 30/06/2023.

Table 4-7: Pukaki – Ōhau canal spill maximum and permitted and actual spill flow.

	Maximum Flow (m^3/s)
Maximum Spill flow	560
Spill flow range	518.85–519.05
Recorded maximum spill flow during the period 1/07/2022-30/06/2023	518.76
Complied fully with the resource consent?	**YES**

Figure 4-4 and Table 4-7 show that the maximum spill flow condition was complied with fully over the period 1/07/2022 through 30/06/2023.

5 Lake Ōhau

5.1 Lake Level

CRC905330.3: To dam the Ōhau River to control and operate Lake Ōhau between the levels of 519.45 and 520.40 metres (msl), at or about Map Reference NZMS 260 H38:655-550.

Figure 5-1 shows the recorded lake levels, with the consented control levels labelled. A summary of the actual minimum and maximum levels during the period 1/07/2022 to 30/06/2023, and the consented control levels, is given in Table 5-1.

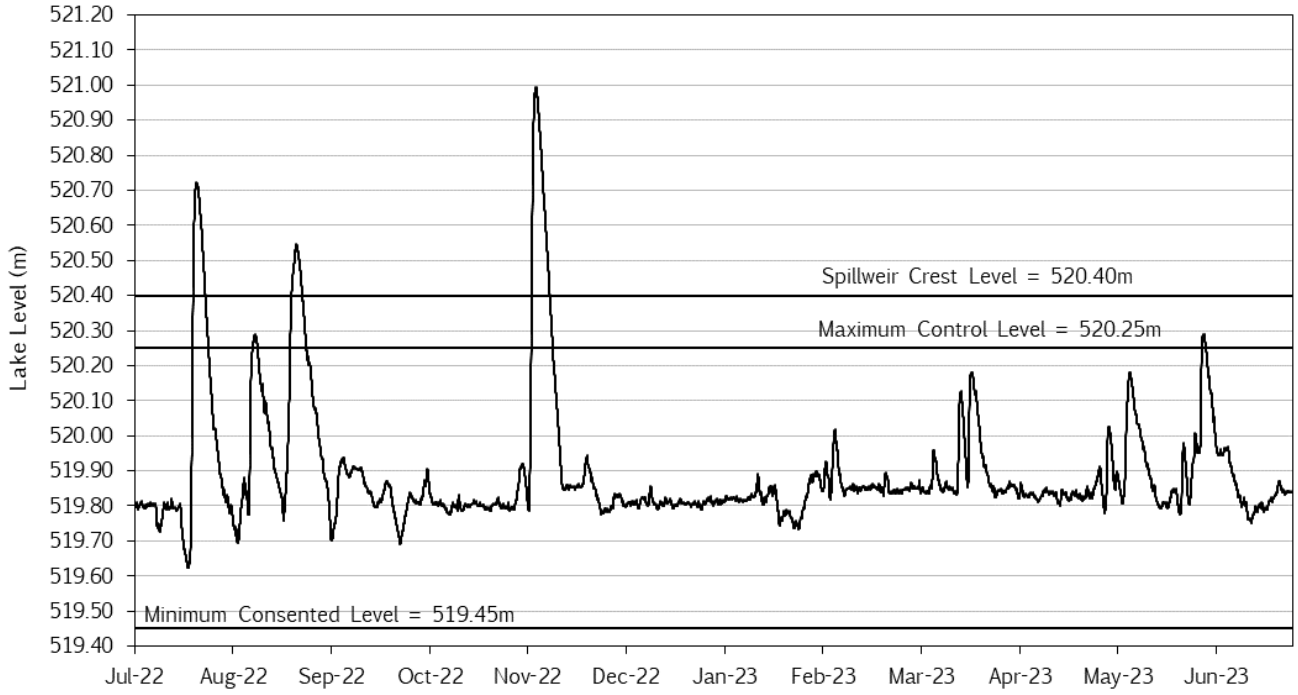

Figure 5-1: Lake Ōhau level (Site 88765) – 1/07/2022 to 30/06/2023.

The maximum control level is 520.25m. This was exceeded on five occasions: on 19 – 24 July 2022, 7 – 8 August 2022, 19 – 24 August 202, 3 – 9 November 2022, and 2 – 3 June 2023. The lake level also exceeded 520.40m on three occasions; 19 – 23 July 2022, 19 – 22 August 2022, and 3 – 8 November 2022. These events were checked for further compliance below.

A check was undertaken of compliance with the operational rules outlined in "*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*", and described below.

When Lake Ōhau is above 520.25m, the Ōhau Canal Inlet must be operated to discharge 170-200m^3/s to limit flood levels in the lake. The discharge will require the use of machine bypass facilities if the requisite flows cannot be passed through the generating plant. When Lake Ōhau rises above 520.40m the Ōhau Canal inlet shall be set to 200m^3/s.

Figure 5-2 to Figure 5-6 show the level of Lake Ōhau, and Ōhau Canal inlet flow, for the five-exceedance events when the lake level was above the maximum control level of

520.25m. Also shown, is the minimum required canal inlet flow when Lake Ōhau is above the maximum control level.

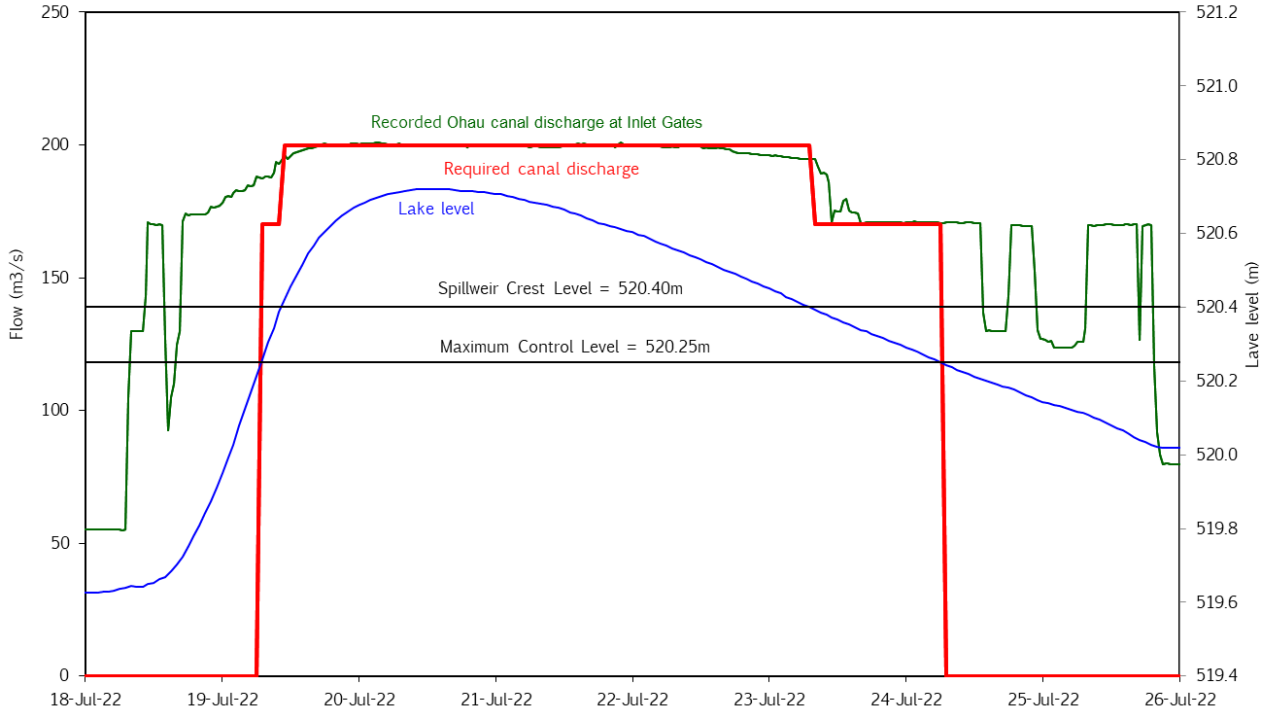

Figure 5-2: Lake Ohau levels and canal flows during flow event of 19/07/2022 - 24/07/2022

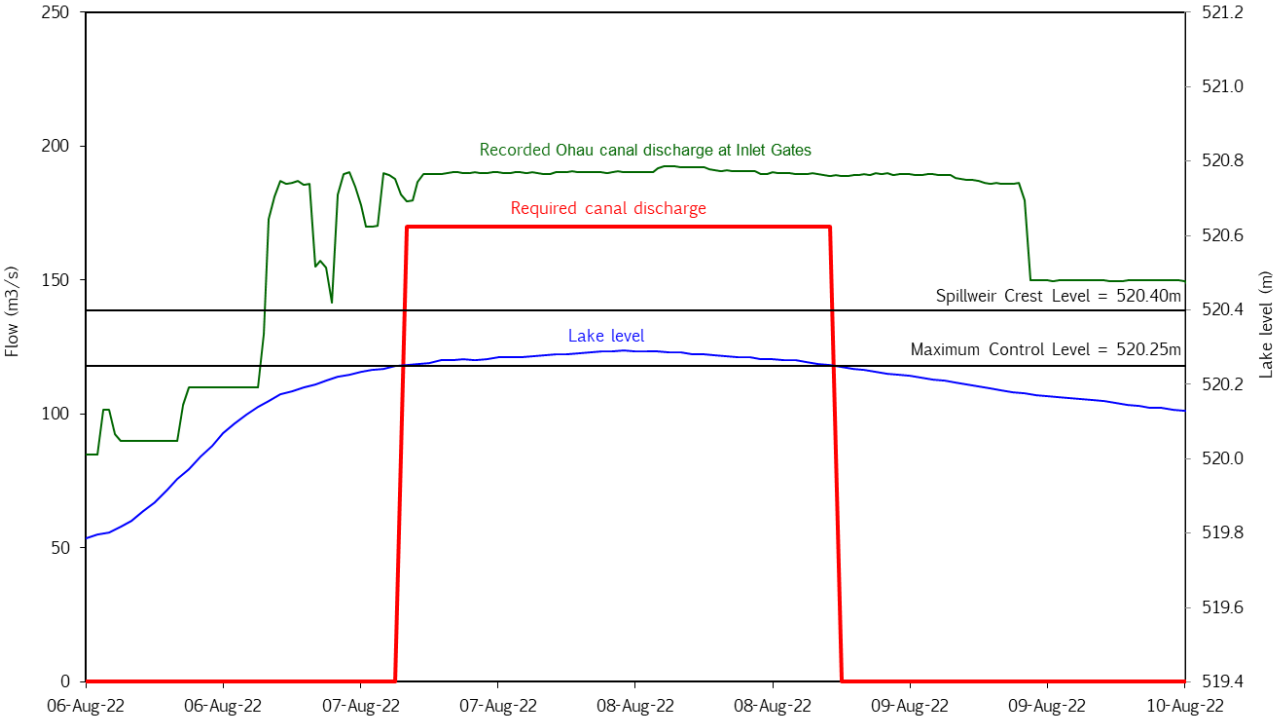

Figure 5-3: Lake Ōhau levels and canal flows during flow event of 7/08/2022 – 8/08/2022.

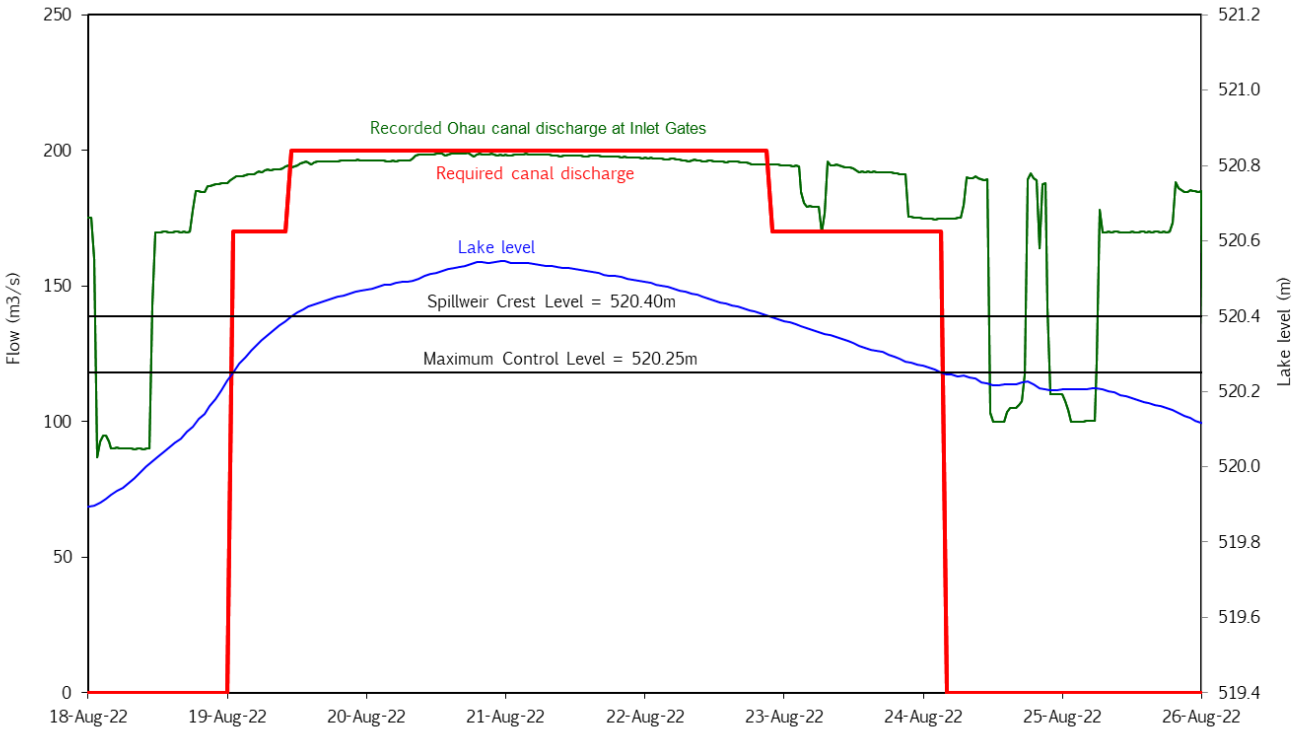

Figure 5-4: Lake Ōhau levels and canal flows during flow event of 19/08/2022 – 24/08/2022.

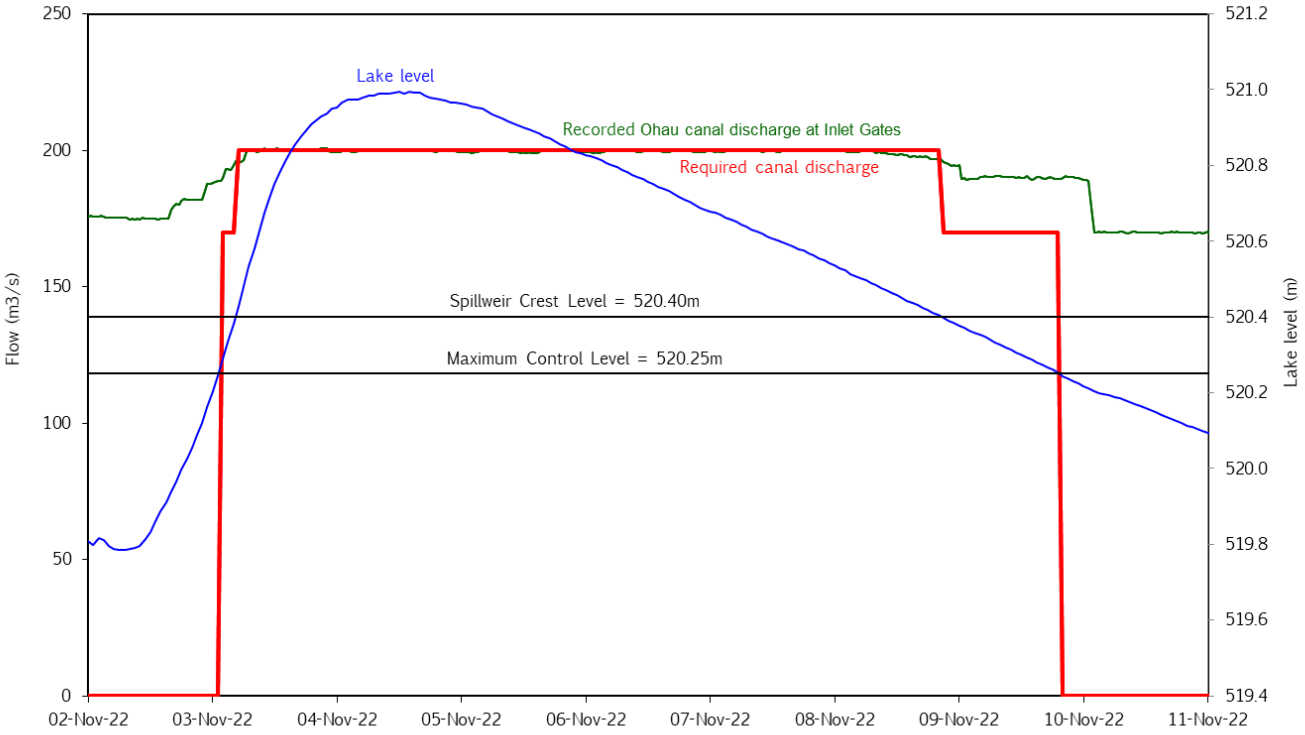

Figure 5-5: Lake Ōhau levels and canal flows during flow event of 3/11/2022 – 9/11/2022.

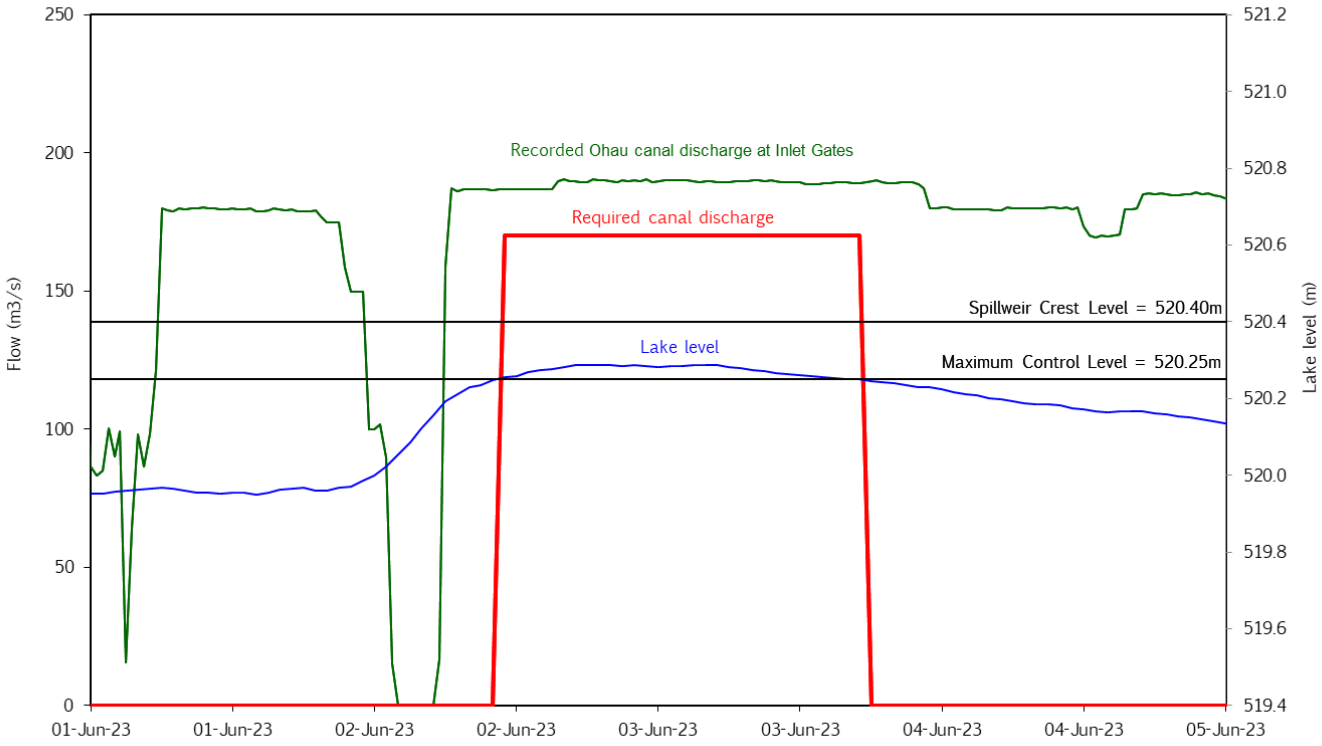

Figure 5-6: Lake Ōhau levels and canal flows during flow event of 2/06/2023 – 3/06/2023.

For the August event (7 – 8), and the June 2023 flow event, the Ōhau Canal discharge met the requirement for a flow of 170m³/s when the lake level was between the maximum control level and the spill-weir crest level.

During the July 2022 flow event, the Ōhau Canal discharge met the requirement for a flow of 170m³/s when the lake level was between the maximum control level and the spill-weir crest level. From 19 to 24 July, when the required canal discharge was 200m³/s, recorded spill dropped to 170.5m³/s, averaging 194.1m³/s.

The Ōhau Canal discharge met the requirement during the August (19 – 24) flow event where a flow of 170m³/s occurred when the lake level was between the maximum control level and the spill-weir crest level. From 19 to 24 August, when the required canal discharge was 200m³/s, recorded spill dropped to 169.9m³/s, averaging 194.3m³/s.

During the November flow event, the Ōhau Canal discharge met the requirement for a flow of 170m³/s when the lake level was between the maximum control level and the spill-weir crest level. From 3 to 9 November, when the required canal discharge was 200m³/s, recorded spill dropped to 189m³/s, averaging 198.2m³/s.

The small variation between the set and actual flow lies within the ±10% margin agreed with Environment Canterbury. Management of these events therefore complied fully with the operating rules.

Table 5-1: Lake Ōhau - consented control levels and actual levels.

	Minimum Control Level (m)	Maximum Control Level (m)
Consented Levels	519.45	520.25
Actual Levels during the period 1/07/2022-30/06/2023	519.63	520.99
Stayed within control range?	YES	NO
Complied with operating rules when outside the control levels?	N/A	YES
Complied fully with the resource consent?	YES	

Figure 5-1 through to Figure 5-6, and

Table 5-1 show that the maximum control level condition was complied with fully over the period 1/07/2022 through 30/06/2023.

5.2 Ōhau Canal Flow

CRC905331.1: To take water up to a maximum rate of 200m³/s into the Ōhau Canal from Lake Ōhau, at or about Map Reference H38:655-550.

Figure 5-7 shows Ōhau Canal flows; with the maximum consented flow shown in Table 5-2 lists the maximum recorded and the consented spill flows.

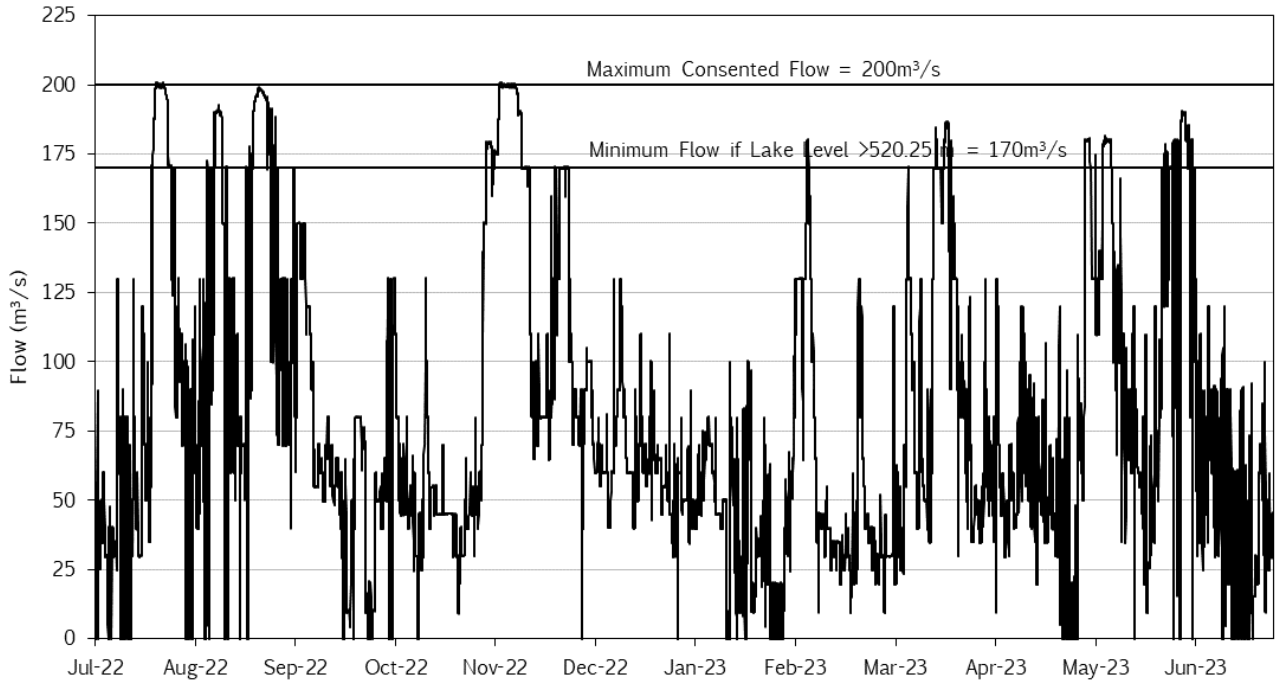

Figure 5-7: Ōhau Canal flows (Site 8763) - 1/07/2022 to 30/06/2023.

Table 5-2: Ōhau Canal flows - consented and the actual flows.

	Maximum Flow (m^3/s)
Consented maximum flow	200
Recorded maximum flow during the period 1/07/2022-30/06/2023	201*
Complied fully with the resource consent?	**YES**

*This value is within the ±10% margin agreed with Environment Canterbury.

The maximum consented flow is 200m^3/s. This was exceeded during two spill events on 19 – 22 July 2022 and 3 – 8 November 2022. The maximum flow during the July 2022 event was 201.06m^3/s, and the maximum flow during the November 2022 event was 200.82m^3/s. The small variation between the set and actual flow lies within the ±10% margin agreed with Environment Canterbury. This event therefore complied fully with the resource consent.

Figure 5-7 and Table 5-2 show that the maximum flow was complied with fully during the period 1/07/2022 through 30/06/2023.

5.3 Ōhau River Flow

CRC905330.3: Condition 19. The Grantee shall maintain the following flows in the Ōhau River as measured immediately below the Ōhau Weir Control Structure (at or about Map Reference H38:661-536) 1 May to 31 October following: at least eight cubic metres per second; 1 November to 30 April following: at least 12 cubic metres per second.

Figure 5-8 shows the spill flows from Lake Ōhau; with the minimum flow requirements shown. Table 5-3 lists the recorded and the consented flows.

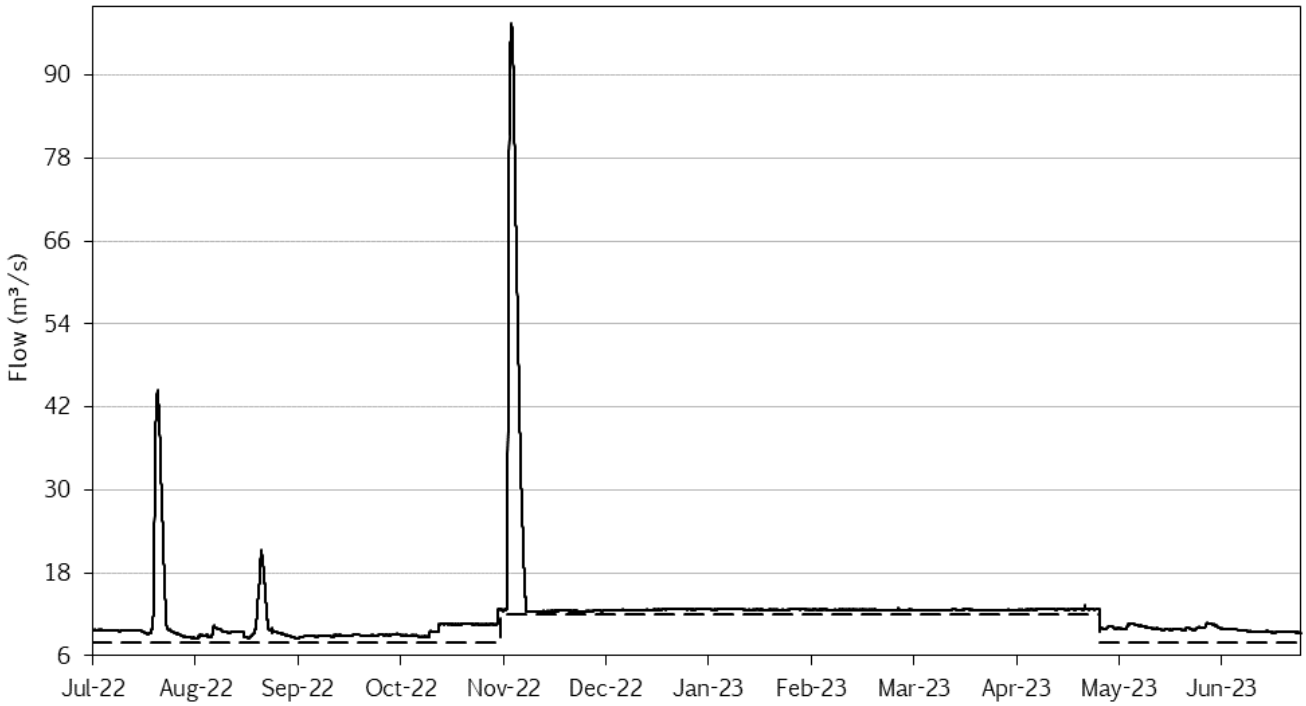

Figure 5-8: Ōhau River at downstream syphon (Site 8601) - 1/07/2022 to 30/06/2023.

Table 5-3: Lake Ōhau spill flows - consented and the actual flows.

	Flow (m^3/s)
Consented minimum flow – 1/11/2022 to 30/04/2023	12.0
Recorded minimum flow – 1/11/2022 to 30/04/2023	12.4
Consented minimum flow – 1/07/2022to 31/10/2022 and 1/05/2023 to 30/06/2023	8.0
Recorded minimum flow – 1/07/2022 to 31/10/2022 and 1/05/2023 to 30/06/2023	8.4
Complied fully with the resource consent?	YES

Figure 5-8 and Table 5-3 show that the minimum spill flow condition was fully complied with over the period 1/07/2022 through 30/06/2023.

CRC905332.1 To discharge natural flood flows from Lake Ōhau via Lake Ōhau Control Weir into the Ōhau River at or about map reference H38:661-536

While this consent does not contain specific lake level or flow requirements, Condition 3 requires that the rate at which water is taken/discharged/diverted be recorded and supplied to Environment Canterbury annually. This information is shown in Figure 5-8 above.

6 Lake Ruataniwha

6.1 Ōhau A Power Station

CRC905333.1: To use water up to a maximum rate of 560 m³/s from Pukaki-Ōhau Canal, at or about Map Reference H38:731-561 for the purpose of Power Generation (Ōhau A Power Station).

CRC905334.1: To discharge water up to a maximum rate of 560 m³/s into Lake Ruataniwha via Ōhau A Power Station Tailrace, at or about Map Reference H38:731-561.

Figure 6-1 shows the machine flows from Ōhau A Power Station, compared to the maximum consented flow. Table 6-1 lists the maximum recorded and the consented flows.

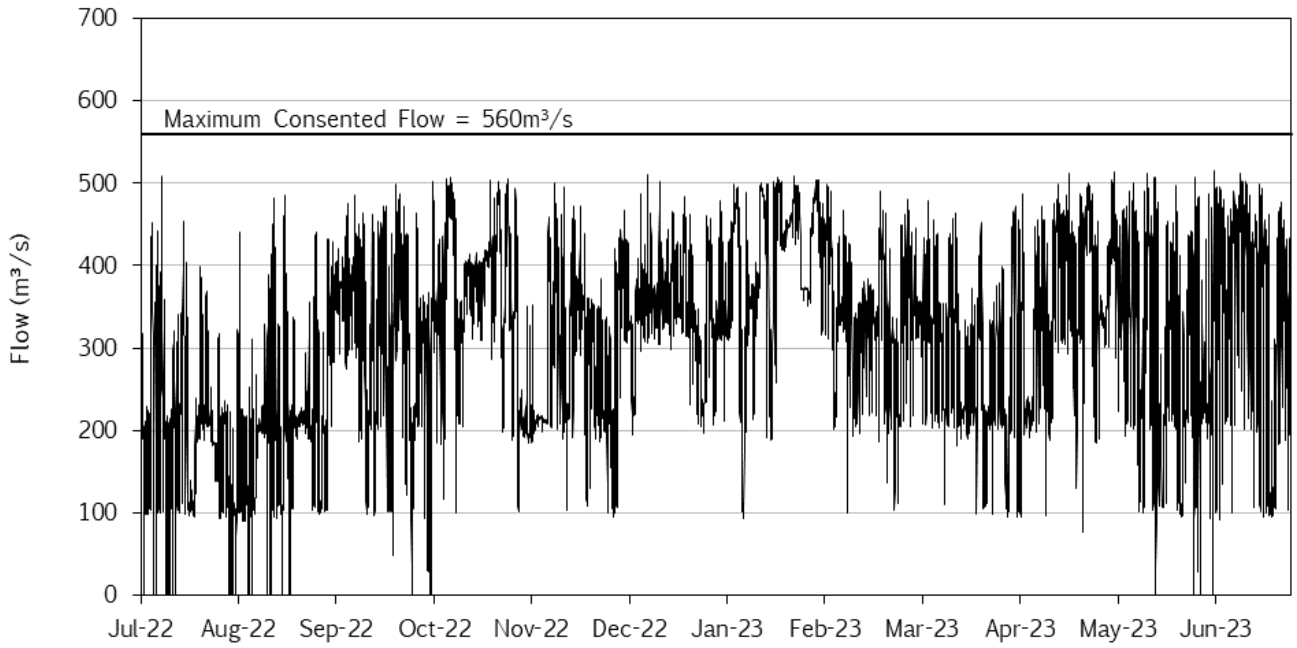

Figure 6-1: Ōhau A Power Station machine flows (Site 8758) - 1/07/2022 to 30/06/2023.

Table 6-1: Ōhau A Power Station machine flows - consented and the actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum flow	560
Recorded maximum flow during the period 1/07/2022 - 30/06/2023	515.05
Complied fully with the resource consent?	YES

Figure 6-1 and Table 6-1 show that the maximum flow condition was complied with fully over the period 1/07/2022 through 30/06/2023.

6.2 Lake Ruataniwha Level

CRC905335.3: To dam the Ōhau River to control and operate Lake Ruataniwha between the levels of 458.00 and 458.80 metres (msl) at or about Map Reference NZMS 260 H38:777-540 (Lake Ruataniwha Control Structure).

Figure 6-2 shows the recorded lake levels; together with the consented control levels. A summary of the actual minimum and maximum levels over the period 1/07/2022 through 30/06/2023, and the consented control levels, are listed in Table 6-2.

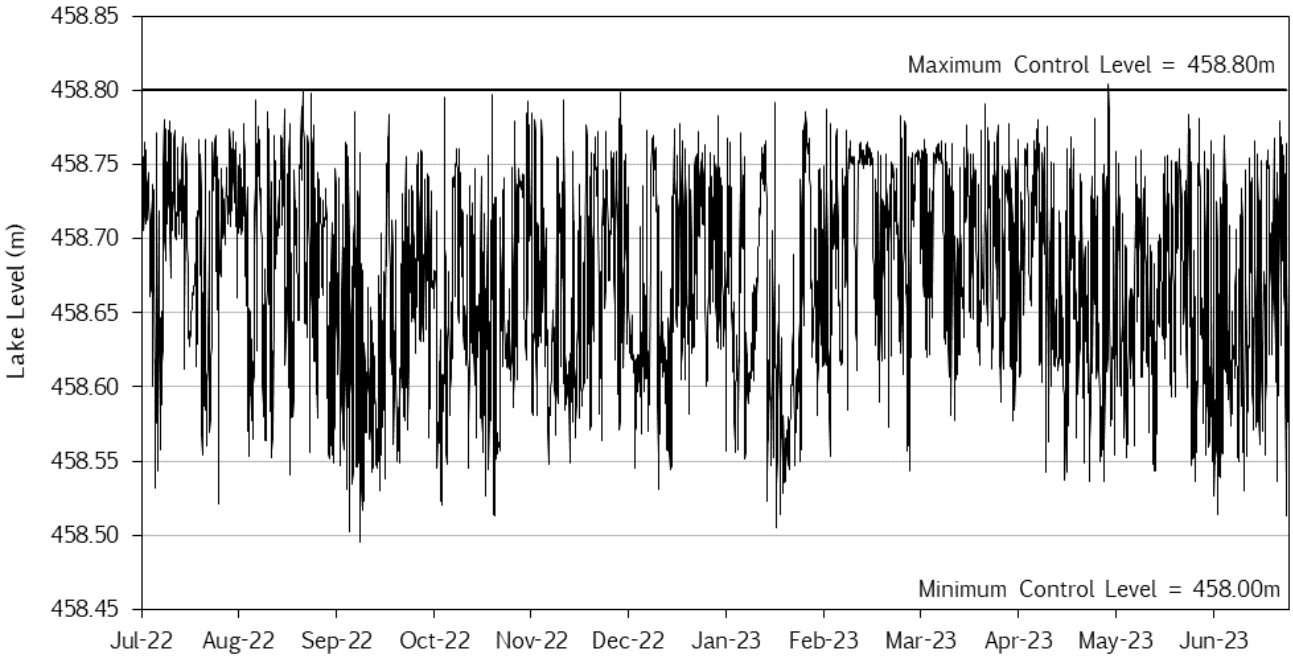

Figure 6-2: Lake Ruataniwha level (Site 8695) - 1/07/2022 to 30/06/2023.

Although the lake level of Lake Ruataniwha reached the maximum control level of 458.80m on two occasions, 21/08/2022 07:00 and 4/05/2023 16:00 – 17:00, the MCL was not exceeded and therefore compliance has been met.

Table 6-2: Lake Ruataniwha - consented and the actual levels.

Level	Minimum Control Level (m)	Maximum Control Level (m)
Consented Control Levels	458.00	458.80
Actual Levels during the period 1/07/2022 to 30/06/2023	458.50	458.80
Complied fully with the resource consent?	YES	YES

Figure 6-2 and Table 6-2 show that the minimum and maximum level control level condition was complied with fully over the period 1/07/2022 to 30/06/2023.

6.3 Lake Ruataniwha Spill Flow

(a) Maximum Spill Flows

CRC905336.2: To discharge water up to a maximum rate of 1740m³/s into the Ōhau River via Lake Ruataniwha Control Structure, at or about Map Reference H38:777-570.

Figure 6-3 shows the spill flows from Lake Ruataniwha; together with the maximum consented flow. A summary of the actual maximum spill flow during the period 1/07/2022 through 30/06/2023, and the consented maximum spill flows, are shown in Table 6-3. The 24-hour notification provision is assessed in Section 10.

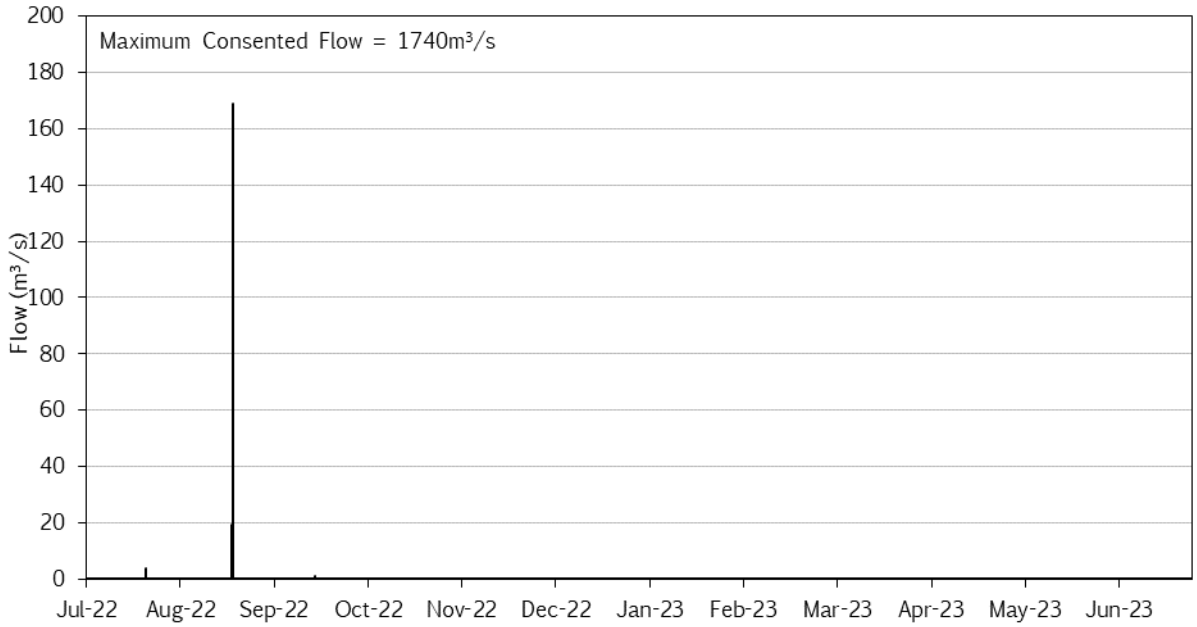

Figure 6-3: Lake Ruataniwha spill flows (Site 8750) – 1/07/2022 to 30/06/2023.

Table 6-3: Lake Ruataniwha spill flows - consented and actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum flow	1740
Recorded maximum flow during the period 1/07/2022-30/06/2023	168.87
Complied fully with the maximum consented flows?	YES
Complied fully with the resource consent for notification?	YES

Figure 6-3 and Table 6-3 show that the maximum flow conditions were complied with fully over the period 1/07/2022 to 30/06/2023.

(b) Lake Ruataniwha Spillway Discharge Ramping Rates

Rule 3.5 of the Waitaki Power Scheme defined in "*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*" states that:

If Lake Ruataniwha spillway gates are opened when lake level is below 459.0m the initial discharge shall not exceed 20m³/s. The initial discharge shall not be exceeded for at least 3 hours. The second discharge shall not exceed 45m³/s and shall not be increased for at

least 2 hours. While lake level remains below 459.0m further increases in discharge shall ensure that:

(a) *Maximum increase in flow at each gate change shall be 20m³/s; and*

(b) *There shall be at least one hour between gate changes.*

An e-mail from Nic Froude at Environment Canterbury (dated 13 August 2014) to Jeff Page at Meridian verified that Rule 3.5 was intended to apply only to the normal use of dams. It was not intended to place limitations on annual gate testing. Environment Canterbury therefore do not consider that spill flows and ramping rates associated with gate testing need to be tested for compliance against the flow rate conditions.

6.4 Ōhau B Power Station

CRC905338.1: To take water up to a maximum rate of 560m³/s into Ōhau B Canal from Lake Ruataniwha, at or about Map Reference H38:744-536.

CRC905339.1: To use water up to a maximum rate of 560m³/s, at or about Map Reference H38:792-525 for the purposes of Power Generation (Ōhau B Power Station).

Figure 6-4 shows the machine flows from Ōhau B Power Station; with the maximum consented flow shown. Table 6-4 lists the maximum recorded and the consented flows.

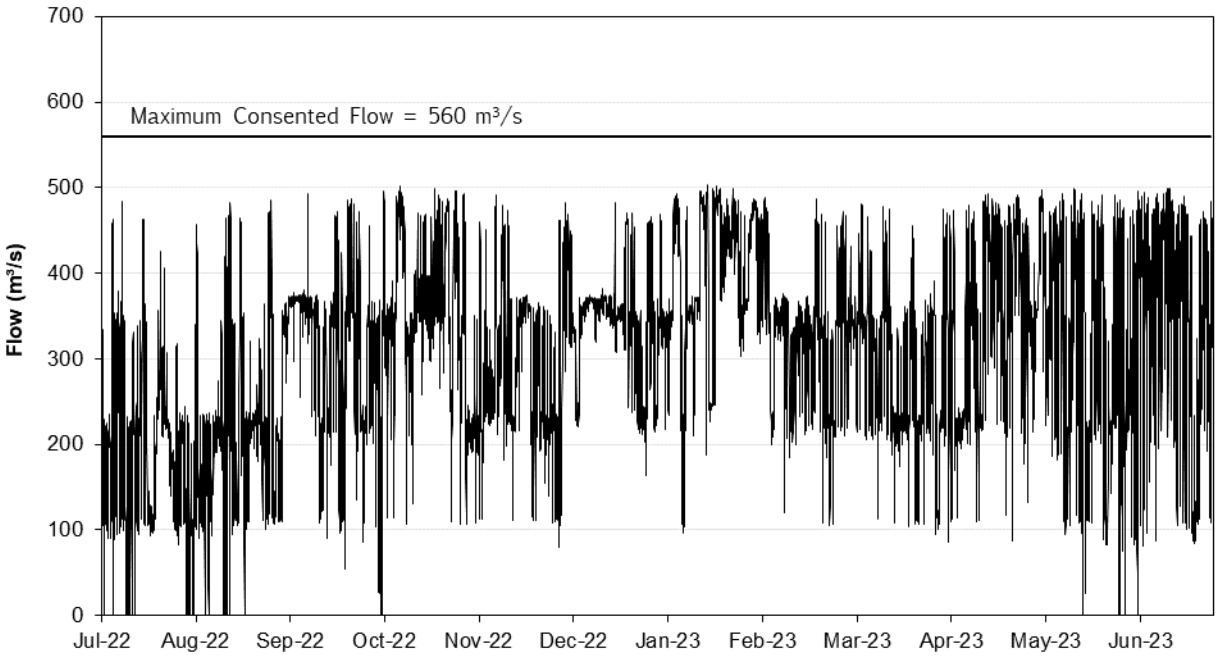

Figure 6-4: Ōhau B Power Station machine flows (Site 8743) - 1/07/2022 to 30/06/2023.

Table 6-4: Ōhau B Power Station machine flows - consented and actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum flow	560
Recorded maximum flow during the period 1/07/2022-30/06/2023	502.91
Complied fully with the resource consent?	YES

Figure 6-4 and Table 6-4 show that the maximum flow condition was complied with fully over the period 1/07/2022 through 30/06/2023.

6.5 Ōhau C Power Station

CRC905340.1: To use water up to a maximum rate of 560m³/s, at or about Map Reference H39:854-479 for the purposes of Power Generation (Ōhau C Power Station).

CRC905343.1: To discharge water up to a maximum rate of 560m³/s into Lake Benmore via Ōhau C Power Station Tailrace, at or about Map Reference H39:857-478.

Figure 6-5 shows the machine flows from Ōhau C Power Station; together with the maximum consented flow. Table 6-5 lists the maximum recorded and the consented flows.

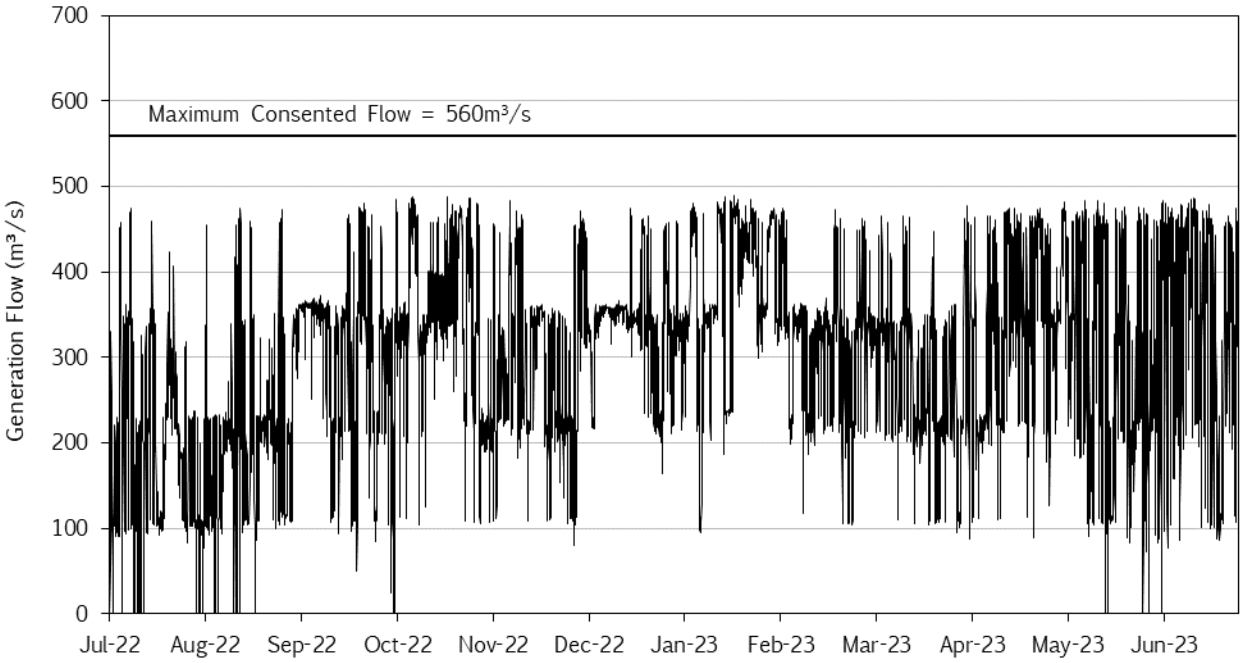

Figure 6-5: Ōhau C Power Station machine flows (Site 8748) - 1/07/2022 to 30/06/2023.

Table 6-5: Ōhau C Power Station machine flows - consented and the actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum flow	560
Recorded maximum flow during the period 1/07/2022 - 30/06/2023	489.47
Complied fully with the resource consent?	YES

Figure 6-5 and Table 6-5 show that the maximum flow condition was complied with fully over the period 1/07/2022 through 30/06/2023.

6.6 Labyrinth Weir

CRC905341.2: To discharge water up to a maximum rate of 560m³/s from Ōhau B - Ōhau C Canal via Labyrinth Weir into Ōhau River, at or about Map Reference H38:812-515.

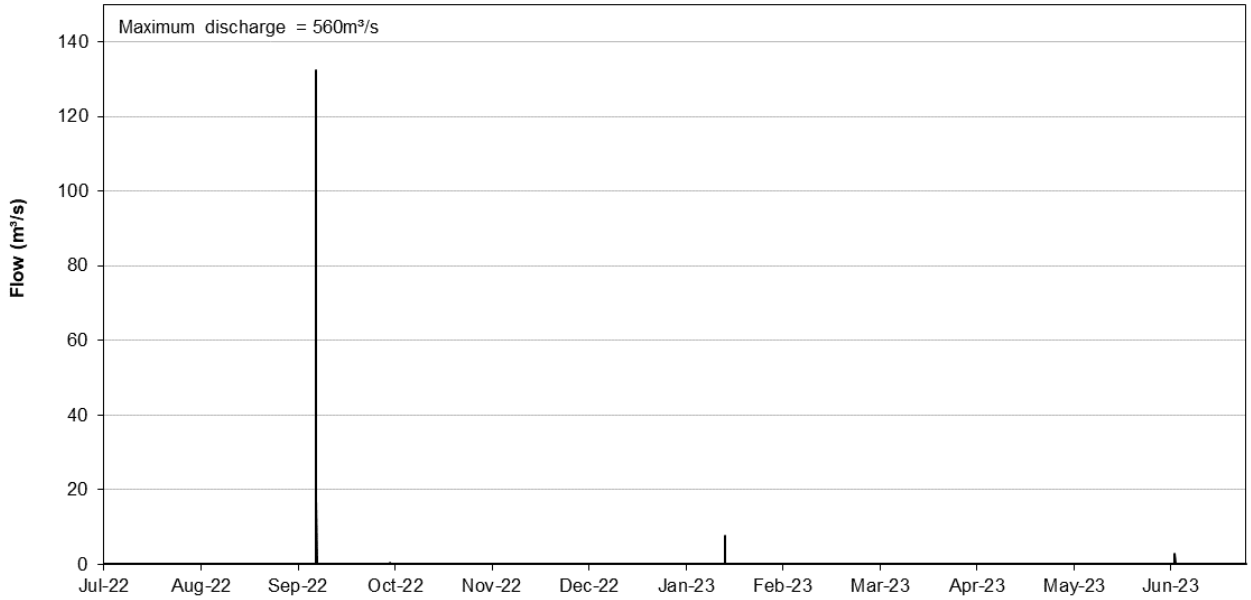

Figure 6-6: Labyrinth spillweir flows (8691) - 1/07/2022 – 30/06/2023.

Figure 6-6 shows flows over the Labyrinth Weir; with the maximum consented flow labelled. The 24-hour notification provision is assessed in Section 10.

Table 6-6 lists the maximum recorded and the consented flows.

Table 6-6: Labyrinth Weir - consented and actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum flow	560
Recorded maximum flow during the period 1/07/2022-30/06/2023	132.40
Complied fully with the resource consent?	YES
Complied fully with the resource consent for notification?	YES

Table 6-6 shows that the maximum flow condition was complied with fully over the period 1/07/2022 through 30/06/2023.

7 Lake Benmore

7.1 Lake Level

CRC905344.4: To dam the Waitaki River to control and operate Lake Benmore between the levels of 355.25 and 361.45 metres (msl) at or about Map Reference NZMS 260 H39:874-232 (Benmore Power Station).

Figure 7-1 shows the recorded lake levels, together with the consented control levels. A summary of the actual minimum and maximum levels over the period 1/07/2022 through 30/06/2023, and the consented control levels, are shown in Table 7-1.

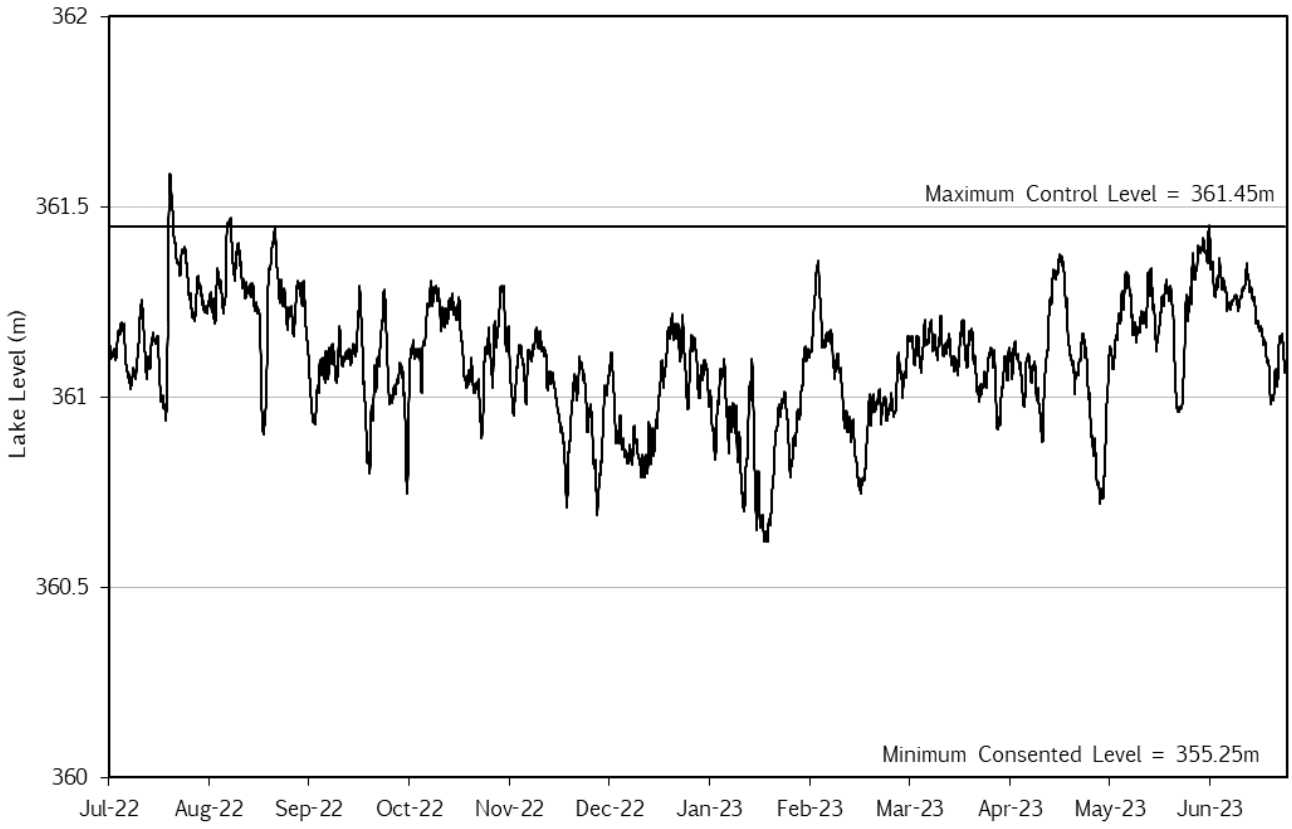

Figure 7-1: Lake Benmore level (Site 8737) – 1/07/2022 to 30/06/2023.

Table 7-1: Lake Benmore - consented and the actual levels.

Level	Minimum Control Level (m)	Maximum Control Level (m)
Consented Levels	355.25	361.45
Actual Levels during the period 1/07/2022-30/06/2023	360.62	361.59
Stayed within control range?	YES	NO
Complied with operating rules when outside the control levels?	N/A	YES
Complied fully with the resource consent?	YES	

The maximum control level for Lake Benmore is 361.45m. The operating rules outlined in "*Waitaki Power Stations, Appendix A - Extracts of Waitaki Operating Rules (1990)*" require the lake level of Lake Benmore to reach 0.05m above the maximum operating level before discharge through spillway and turbines combined shall not be less than the value given in the table outlined in section 4.4 of Appendix A.

Figure 7-1 and Table 7-1 show the maximum control level condition was exceeded 61 times over the period 1/07/2022 through 30/06/2023. Figure 7-1 shows the exceedance occurred on 19/07/2022 – 21/07/2022 with a maximum flow of 361.6m^3/s and averaging 361.5m^3/s during the exceedance period. The second exceedance event occurred on 6/08/2022 – 7/08/2022 with a maximum and average flow of 361.5m^3/s. These exceedances were checked for further compliance against the operating requirements.

As per the Benmore Power Station operating instructions, the Spillway and Turbines combined discharge met the required levels to comply fully over the period 1/07/2022 to 30/06/2022.

7.2 Benmore Machine Flows

CRC905345.1: *To use water up to a maximum rate of 660m^3/s at or about Map Reference H39:874-232 (Benmore Power Station) for the purposes of power generation.*

CRC905346.2: *To discharge water up to a maximum rate of 660m^3/s into Waitaki River via Benmore Power Station Tailrace at or about Map Reference H39:874-232.*

Figure 7-2 shows the machine flows from Benmore Power Station, together with the maximum consented flow. Table 7-2 lists the maximum recorded and consented flows.

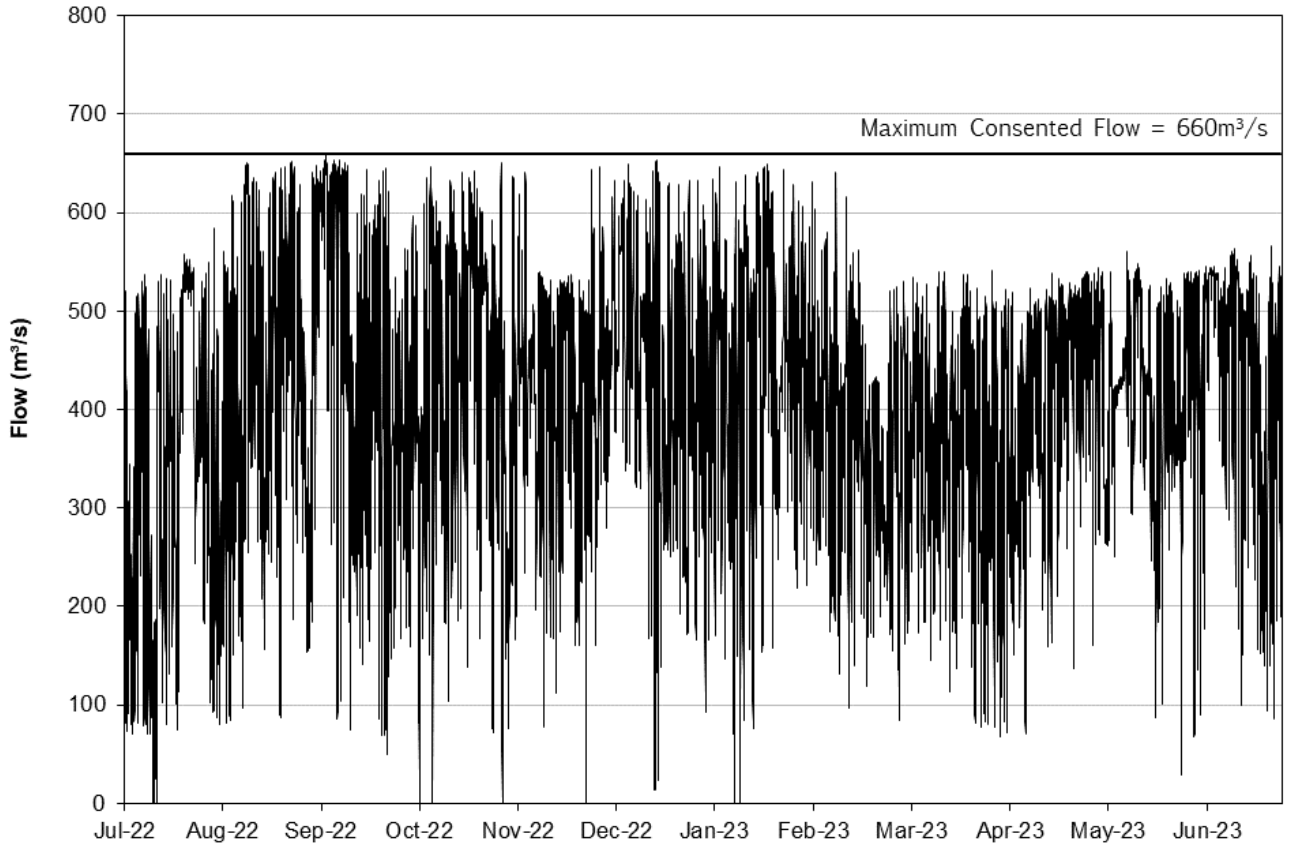

Figure 7-2: Benmore Power Station machine flows (Site 8738) - 1/07/2022 to 30/06/2023.

Table 7-2: Benmore Power Station machine flows - consented and actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum flow	660
Recorded maximum flow - 1/07/2022 to 30/06/2023	659.75
Complied fully with the resource consent?	YES

Figure 7-2 and Table 7-2 show that the maximum machine flow condition was complied with fully over the period 1/07/2022 through 30/06/2023.

7.3 Benmore Spillway and Sluice Flows

CRC905347.2: To discharge water up to a maximum rate of 1,700m³/s into Waitaki River via Sluice Gates Lake Benmore Control Structure, at or about Map Reference H39:874-232.

CRC905348.2: To discharge water up to a maximum rate of 3,400m³/s into Waitaki River via Spillway Lake Benmore Control Structure, at or about Map Reference H39:874-232.

Figure 7-3 shows the spill and sluice flows, and combined spill + sluice + turbine flows, from Lake Benmore over the compliance period. Table 7-3 lists the maximum recorded spill and sluice flows, and the maximum consented flows.

The combined discharge of spillway, turbines and sluice gate flow was greater than 850m³/s on three occasions; from 19 July 2022 13:00 until 21 July 2022 14:00; from 6 August 2022 13:00 to 8 August 2022 18:30, and marginally greater for a period of about an hour from 6 June 2023 22:00. The 24-hour notification provision relating to these combined flows is assessed in Section 10.

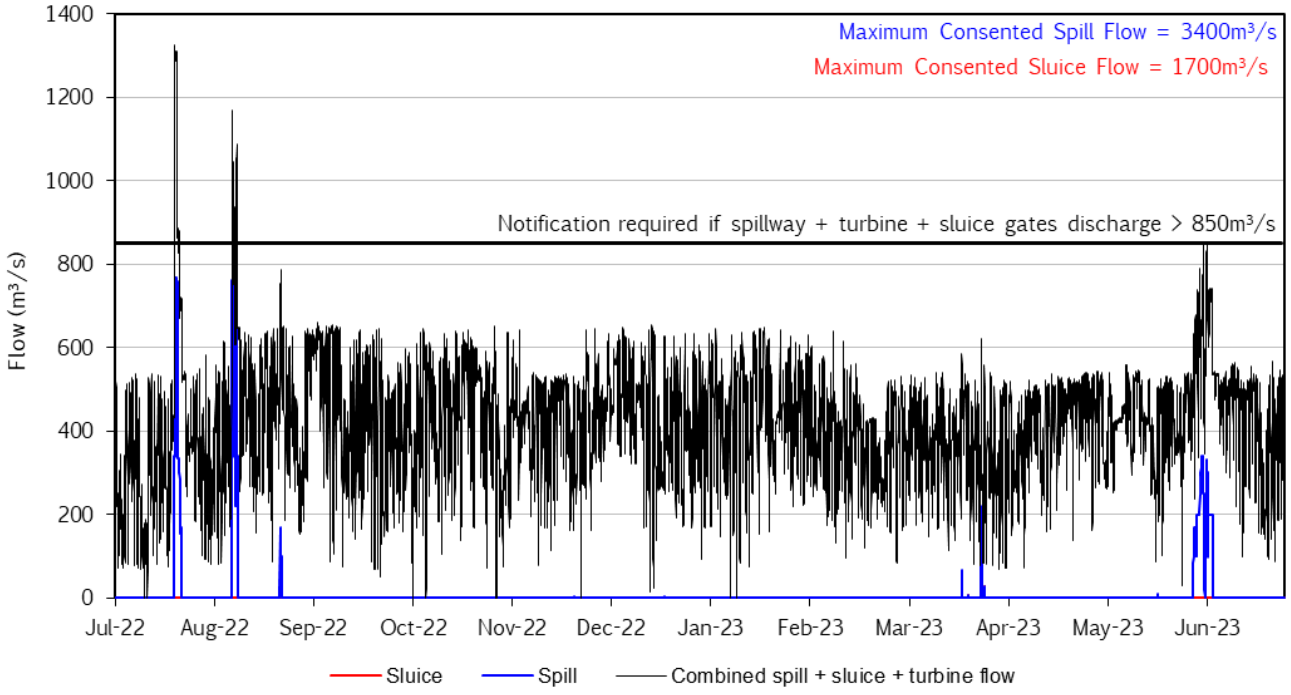

Figure 7-3: Lake Benmore spillway and sluice flows (Sites 8732 and 8736) - 1/07/2022 to 30/06/2023. Note: all sluice flows were associated with gate testing.

Table 7-3: Lake Benmore spill / sluice flows - consented and actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum spill flow	3400
Recorded maximum spill flow during the period 1/07/2022-30/06/2023	767.1
Consented maximum sluice flow	1740
Recorded maximum sluice flow during the period 1/07/2022-30/06/2023	29.2*
Complied fully with the resource consent?	YES
Complied fully with the resource consent for notification?	NO - minor

*These small flows were the result of gate testing.

Figure 7-3 and Table 7-3 show that the maximum flow conditions for spill and sluice flow were complied with fully over the period 1/07/2022 through 30/06/2023 however the condition for notification was not (see Section 10).

8 Lake Aviemore

8.1 Lake Level

CRC905351.3: To dam the Waitaki River to control and operate Lake Aviemore between the levels of 265.50 and 268.30 metres (msl) at or about Map Reference NZMS 260 I40:002-134 (Aviemore Power Station).

Figure 8-1 shows the recorded lake level; with the consented control levels labelled. A summary of the actual minimum and maximum levels over the period 1/07/2022 through 30/06/2023, and the consented control levels, are shown in Table 8-1.

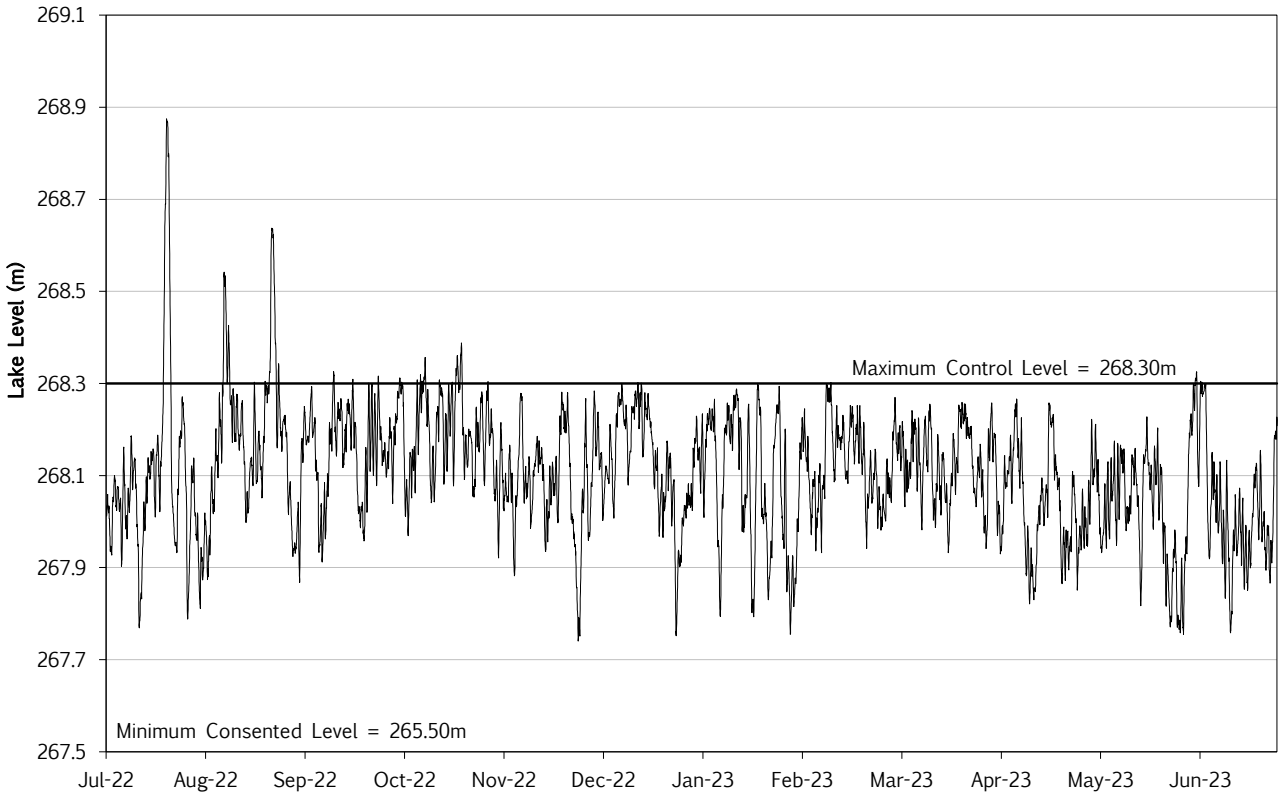

Figure 8-1: Lake Aviemore level (Site 8727) - 1/07/2022 to 30/06/2023.

Figure 8-1 shows the recorded lake level; with the consented control levels labelled. A summary of the actual minimum and maximum levels over the period 1/07/2022 through 30/06/2023, and the consented control levels, are shown in Table 8-1.

Table 8-1: Lake Aviemore - consented and actual levels.

Level	Minimum Control Level (m)	Maximum Control Level (m)
Consented Levels	265.50	268.30
Actual Levels during the period 1/07/2022 - 30/06/2023	267.74	268.88
Stayed within control range	YES	NO
Complied with operating rules when outside the control levels?	N/A	YES
Complied fully with the resource consent?	YES	

The lake level exceeded the maximum control level of 268.30m on thirty occasions between 1 July 2022 and 30 June 2023. These exceedances range in duration from 1 to 52 hours, with a maximum lake level of 268.88m.

The "*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*" states that when the lake level is between 268.30m and 268.75m "*no water needs be discharged over the spillway*". When the lake level "*has risen to 268.80m, the total discharge shall be brought equal to inflow by increasing the discharge by 175m³/s for every 25mm in lake level*".

The lake level exceeded the maximum lake level threshold of 268.80m for 23 hours between 1 July 2022 and 2 July 2022. During this time the maximum level reached was 268.88m, below the maximum permitted lake level of 269.20m. For each hourly reading the combined flows were checked against the Spillway and Turbines combined discharge table in section 5.4 of the "*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*". For each of the 23 hours the flow was maintained above the required combined flow threshold of "*175m³/s for every 25mm in lake level*". Therefore, the condition was complied with fully over the period 1/07/2022 through 30/06/2023.

8.2 Aviemore Machine Flows

CRC905352.1: To use water up to a maximum rate of 710m³/s at or about Map Reference I40:002134 (Aviemore Power Station) for the purposes of Power Generation.

CRC905353.2: To discharge water up to a maximum rate of 710m³/s into Waitaki River via Aviemore Power Station Tailrace at or about Map Reference I40:002-134.

For compliance purposes, *"use water for generation"* has been interpreted as the flow through the station being tested. 'Water use' is therefore calculated as the total machine flow through the Aviemore Power Station.

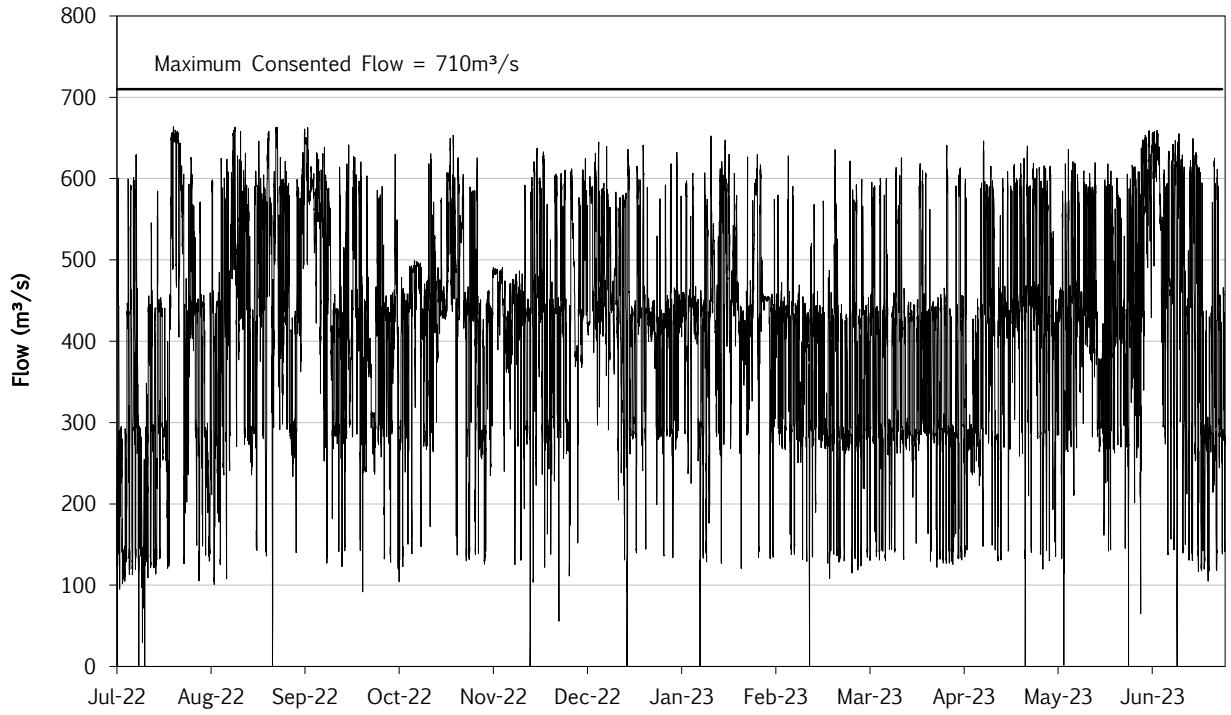

Figure 8-2: Aviemore Power Station machine flows (Site 8728) - 1/07/2022 to 30/06/2023.

Figure 8-2 shows the machine flows from Aviemore Power Station; together with the maximum consented flow. Table 8-2 lists the maximum recorded and the consented flows during the period 1/07/2022 through 30/06/2023. This shows that the maximum machine flow condition was fully met.

Table 8-2: Aviemore Power Station machine flows - consented and actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum flow	710
Recorded maximum flow during the period 1/07/2022-30/06/2023	664
Complied fully with the resource consent?	**YES**

8.3 Aviemore Spillway and Sluice Flows

CRC905354.2: To discharge water up to a maximum rate of 5,400m³/s into Waitaki River via Spillway Lake Aviemore Control Structure at or about Map Reference I40:002-134.

CRC905355.2: To discharge water up to a maximum rate of 1,700m³/s into Waitaki River via Sluice Gates Lake Aviemore Control Structure, at or about Map I40:002-134 (Aviemore Power Station).

Figure 8-3 shows the spill and sluice flows, and combined spill + sluice + turbine flows, from Lake Aviemore over the compliance period. Table 8-3 lists the maximum recorded spill and sluice flows, and the maximum consented flows.

The combined discharge of spillway, turbines and sluice gate flow was greater than 850m³/s on two occasions; from 19 July 2022 14:30 until 21 July 2022 09:00, and from 6 August 2022 16:00 to 8 August 2022 11:30. The 24-hour notification provision relating to these combined flows is assessed in Section 10.

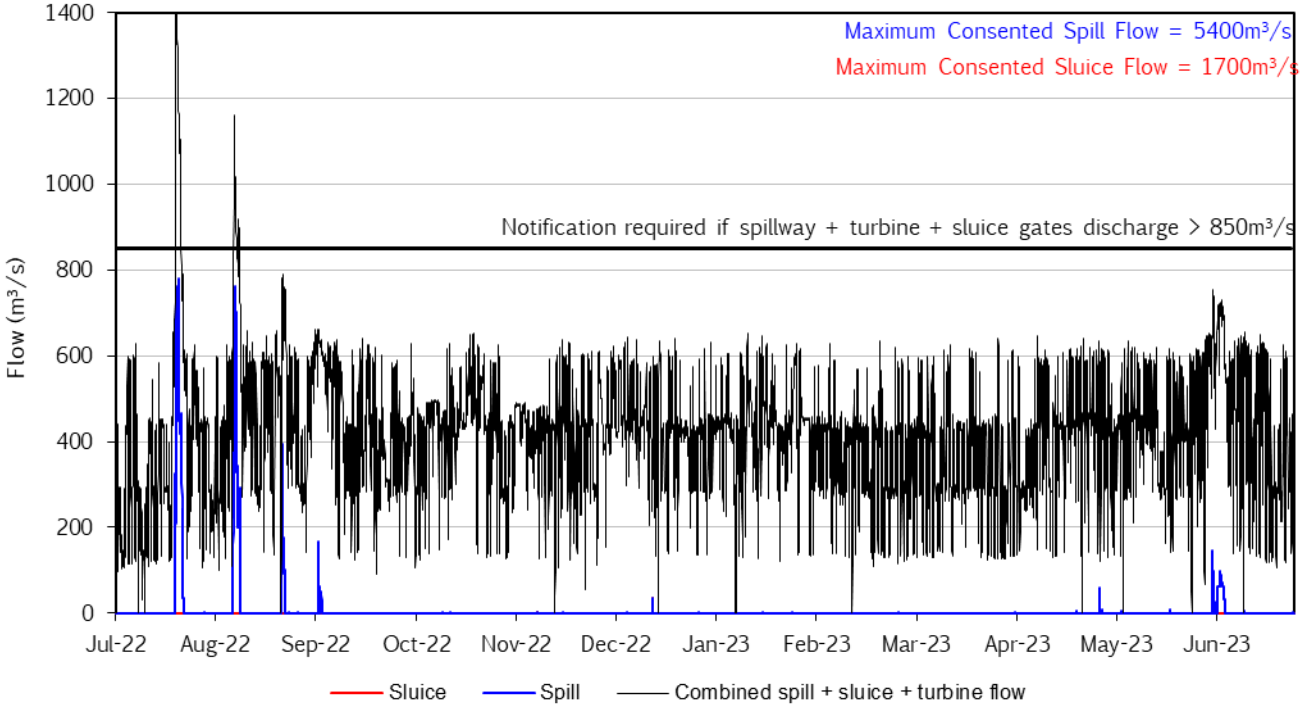

Figure 8-3: Lake Aviemore spill/sluice flows (Site 8722 and 8726) – 1/07/2022 to 30/06/2023. Note: some of these are associated with gate testing.

Table 8-3: Lake Aviemore spill / sluice flows - consented and actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum spill flow	5400
Recorded maximum spill flow during the period 1/07/2022-30/06/2023	780
Consented maximum sluice flow	1700
Recorded maximum sluice flow during the period 1/07/2022-30/06/2023	34*
Complied fully with the resource consent?	**YES**
Complied fully with the resource consent for notification?	**NO - minor**

*These small flows were the result of gate testing.

Figure 8-3 and Table 8-3 show that the maximum flow conditions for spill and sluice flow were complied with fully over the period 1/07/2022 through 30/06/2023, however the condition for notification was not (see Section 10).

9 Lake Waitaki

9.1 Lake Level

CRC905360.1: To dam the Waitaki River to control and operate Lake Waitaki between the levels of 227.00 and 230.80 metres (msl) at or about Map Reference I40:060-101 (Waitaki Power Station).

Figure 9-1 shows the recorded lake level; together with the consented control levels. A summary of the actual minimum and maximum levels over the period 1/07/2022 through 30/06/2023, and the consented control levels, are shown in Table 9-1.

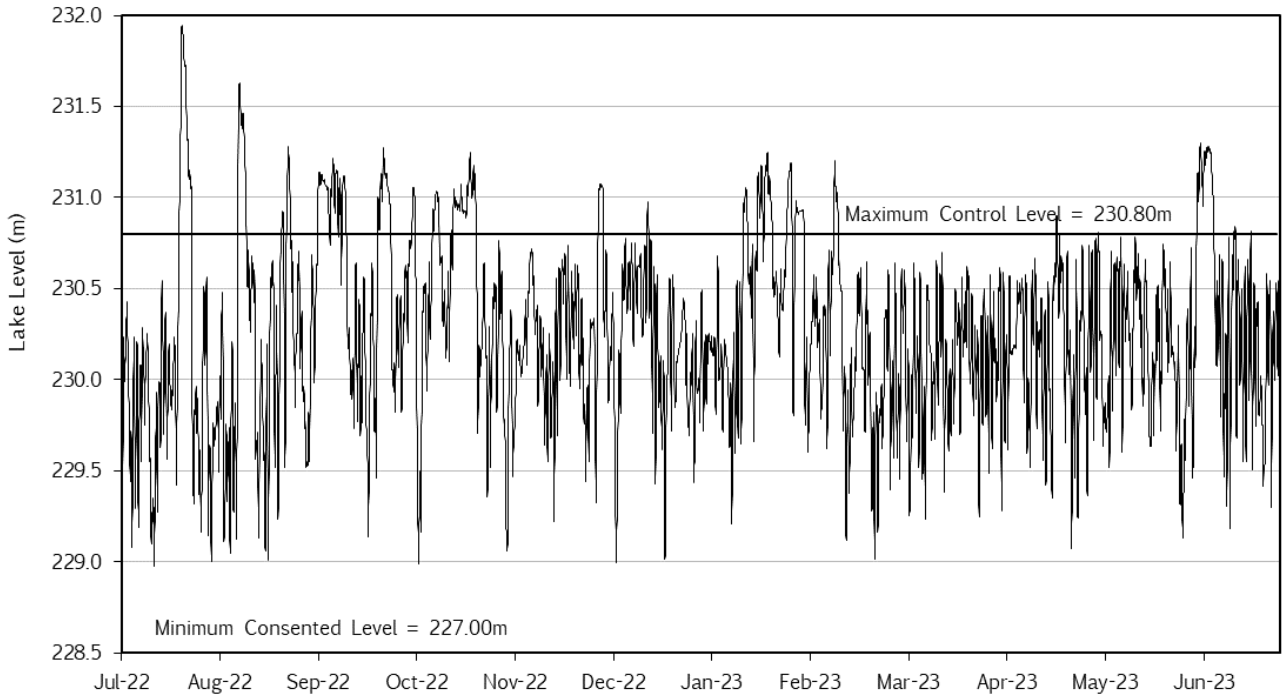

Figure 9-1: Lake Waitaki Lake level (Site 8717) - 1/07/2022 to 30/06/2023.

The lake level exceeded the maximum control level on 20 occasions over this compliance monitoring period. Of these there were 14 occasions when lake level exceedances extended for over 24 hours. These exceedances were checked for further compliance against the operating rules in Section 9.2.

Table 9-1: Lake Waitaki – consented and actual levels.

Level	Minimum Control Level (m)	Maximum Control Level (m)
Consented Levels	227.00	230.80
Actual Levels during the period 1/07/2022 - 30/06/2023	228.98	231.95
Stayed within control range?	YES	NO
Complied with operating rules when outside the control levels?	N/A	YES
Complied fully with the resource consent?	YES	

9.2 Waitaki Station and Dam Flows

(a) Station Flows

CRC905361.3 To use water up to a maximum rate of 650m³/s at or about Map Reference NZMS 260 I40:060101 (Waitaki Power Station) for the purposes of power generation [1 July – 7 Sept 2017].

Condition 22. The Grantee shall maintain a flow of at least 120 cubic metres per second in the Waitaki River as measured immediately below the Waitaki Dam (at or about Map Reference I40:060-101), PROVIDED HOWEVER that lower flows shall be maintained whenever considered necessary for emergency safety purposes, and requested by the Water Resources Manager, Canterbury Regional Council.

CRC180721 To use water up to a up to a maximum rate of 650 cubic metres per second at or about map reference NZMS 260 I40:060-101 (Waitaki Power Station) for the purposes of Power Generation.

CRC905364.2: To discharge water up to a maximum rate of 650m³/s into the Waitaki River via Waitaki Power Station Tailrace at or about Map Reference I40:060-101.

For compliance purposes, *'use water for generation'* has been interpreted as the flow through the station being tested. 'Water use' is therefore calculated as the total machine flow through the Waitaki Power Station.

Figure 9-2 shows the machine flows from Waitaki Power Station; together with the maximum and minimum consented flows. A summary of the actual maximum and minimum flows over the period 1/07/2022 through 30/06/2023, and the consented control levels, are shown in Table 9-2.

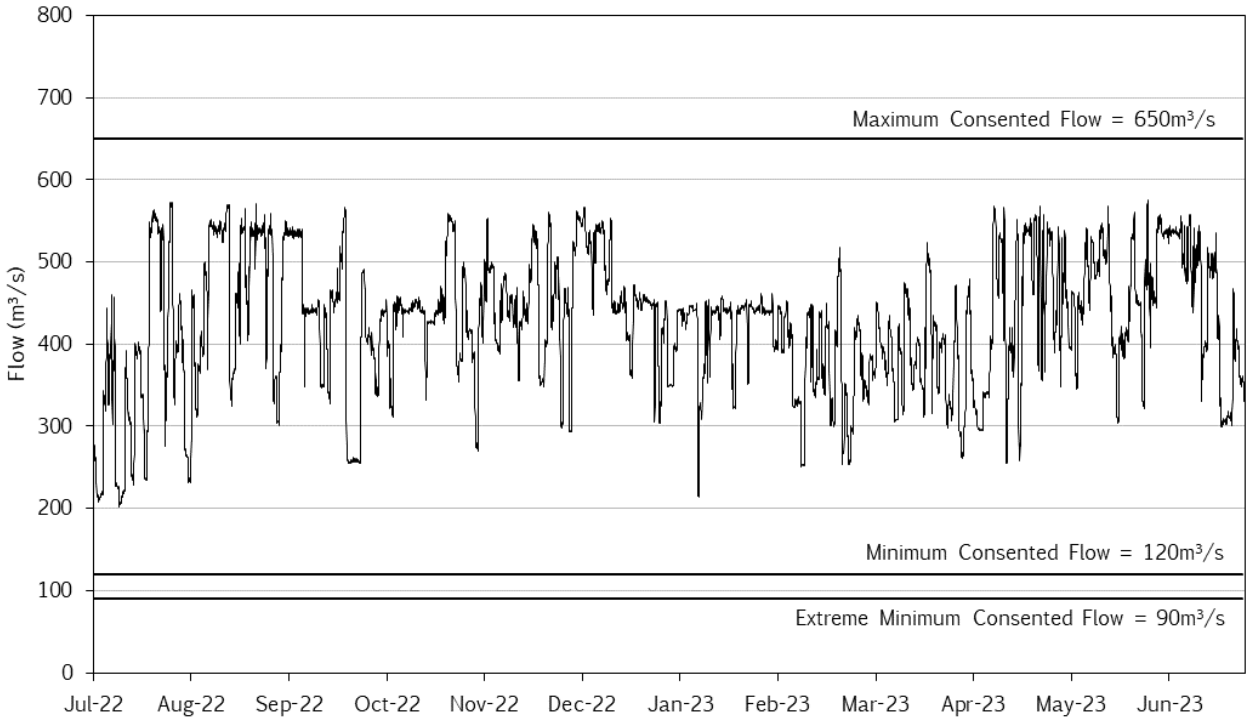

Figure 9-2: Waitaki Power Station machine flows (Site 8718) - 1/07/2022 to 30/06/2023.

Table 9-2: Waitaki Power Station machine flows - consented and actual flows.

Flow	Maximum Flow (m³/s)	Minimum Flow (m³/s)
Consented machine discharge	650	120
Recorded machine discharge during the period 1/07/2022 - 30/06/2023	575	202
Complied fully with the flow conditions?	**YES**	**YES**

Figure 9-2 and Table 9-2 show that the maximum and minimum flow conditions were complied with fully over the period 1/07/2022 through 30/06/2023.

(b) Maximum Discharge Rates

CRC905365.2: To discharge water up to a maximum rate of 5,380m³/s into the Waitaki River via Lake Waitaki Control Structure Spillweir at or about Map Reference I40:060-101.

CRC905365.2: The Grantee shall give at least 24 hours prior warning to the Water Resource Manager, Canterbury Regional Council, of the intention to exercise this right whenever the combined discharge of spillway, turbines and sluice gates will be greater than 850m³/s and shall advise as soon as practicable after incrementing each flow step as stipulated in "Waitaki Power Stations, Appendix A, Extracts of Operating Rules, 9 November 1990".

CRC905366.2: To discharge water up to a maximum rate of 285m³/s into the Waitaki River via Lake Waitaki Control Structure Sluice Gates at or about Map Reference I40:060-101.

Figure 9-3 shows the spill and sluice flows, and combined spill + sluice + turbine flows, from Lake Waitaki over the compliance period. Table 9-3 lists the maximum recorded spill and sluice flows, and the maximum consented flows.

The combined discharge of spillway, turbines and sluice gate flow was greater than 850m³/s on two occasions; from 19 July 2022 17:00 until 21 July 2022 11:30 and from 6 August 2022 19:00 to 8 August 2022 11:30. The 24-hour notification provision relating to these combined flows is assessed in Section 10.

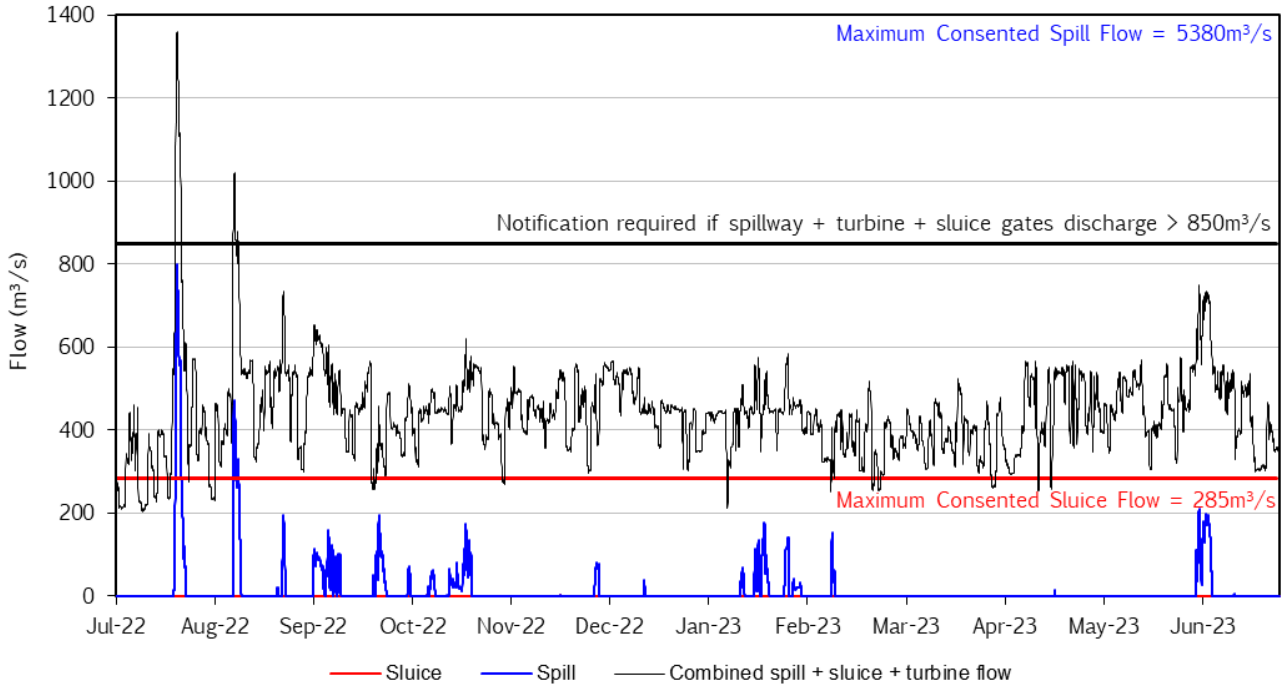

Figure 9-3: Lake Waitaki spillway and sluice flows (Site 8712) - 1/07/2022 to 30/06/2023. Note: all sluice flows were all associated with gate testing.

Table 9-3: Lake Waitaki spill and sluice flows - consented and the actual flows.

Flow	Maximum Flow (m³/s)
Consented maximum spill flow	5,380
Recorded maximum spill flow during the period 1/07/ 2022- 30/06/2023	800.5
Consented maximum sluice flow	285
Recorded maximum sluice flow during the period 1/07/2022 - 30/06/2023	5.52*
Complied fully with the resource consent?	YES
Complied fully with the resource consent for notification?	NO - minor

*These small flows were the result of gate testing.

Figure 9-3 and Table 9-3 show that the maximum flow condition was complied with over the period 1/07/2022 through 30/06/2023 however the condition for notification was not (see Section 10).

(c) Spill and Flood Operations

"*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*" specifies an operating condition (Clause 6.2) that "*When it is apparent that water will be spilled over the weir, the station should be put on maximum load, with load changes not exceeding 5 MW per hour.*"

This Operating Rule is a historical engineering guideline with the aim of safeguarding the structural integrity of the weir (dam) during large spill events. In its current form, the requirement stated above is no longer considered appropriate, or necessary, to convey large spill flows safely. Therefore, the condition is no longer exercised under Meridian's operational procedures.

"*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*" further specifies Flood Operation guidelines (Clause 6.3) including that:

"*During periods of high inflows, the station should be brought to maximum load at normal operation rate and at the same time available storage at Benmore and Aviemore used to buffer short duration floods.*" *and*

"*During a major flood, all alternative water bypassing methods should be put into full discharge. This includes the power station being put on full load, and both sluice gates being opened. This provision should be initiated on any flood exceeding 2m head over the spillway (A level of 232.82m)*". Over the course of the assessed period, the lake level did not exceed 232.82m and therefore a compliance check for this is not necessary.

It is not possible to definitively test compliance with these Operating Rules, particularly since the requirement is expressed as 'should' rather than 'must'. However, as shown in Figure 9-4 and Figure 9-5, periods of spillway discharge from Waitaki Dam at times occurred when Lake Benmore, and particularly Lake Aviemore, was at or approaching the Maximum Control Level. It appears that, where possible, the storage within Lakes Benmore and Aviemore was used to buffer the potential effects of high inflows on the discharge from Waitaki Dam via the spillway.

It would therefore appear that Meridian managed Lakes Benmore and Aviemore to mitigate the potential effect of high inflows by using the available storage within these lakes. However, during either very high or sustained inflows to the upper catchment, the capacity to mitigate the full effects is limited.

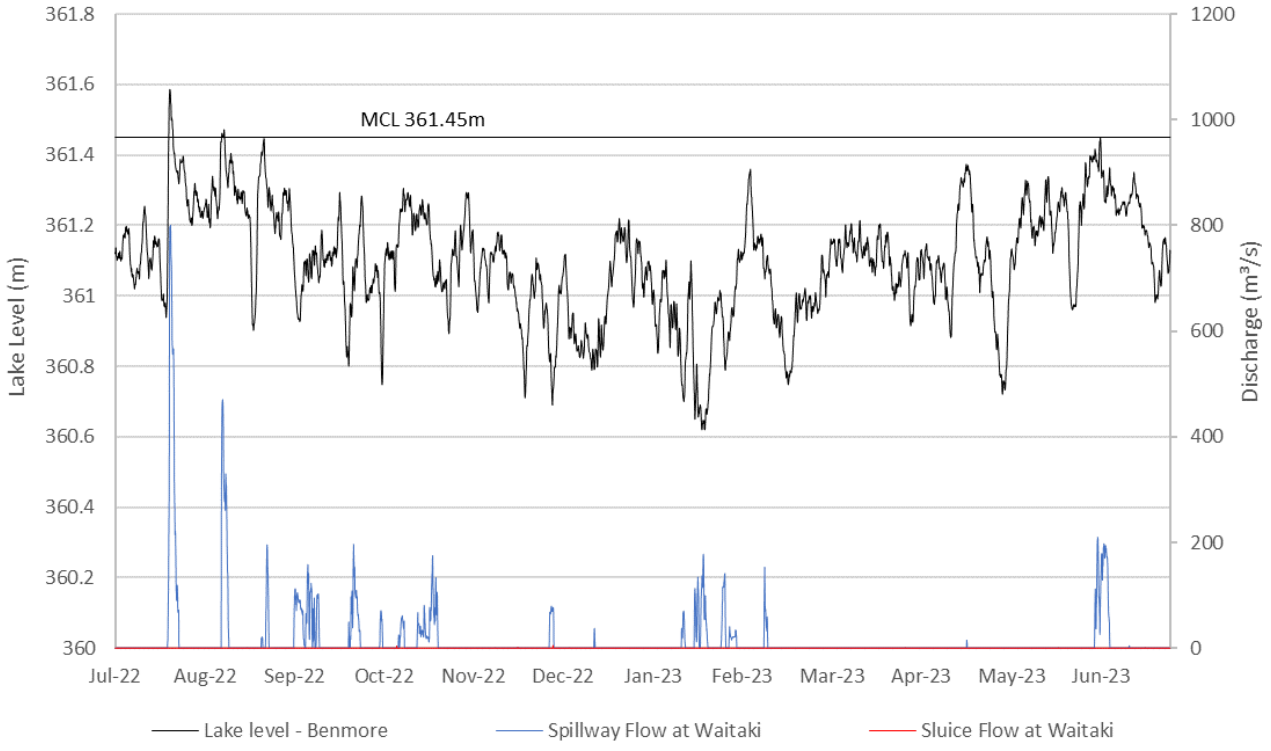

Figure 9-4: Periods of discharge via the spillway of Waitaki Dam plotted against the lake level of Lake Benmore.

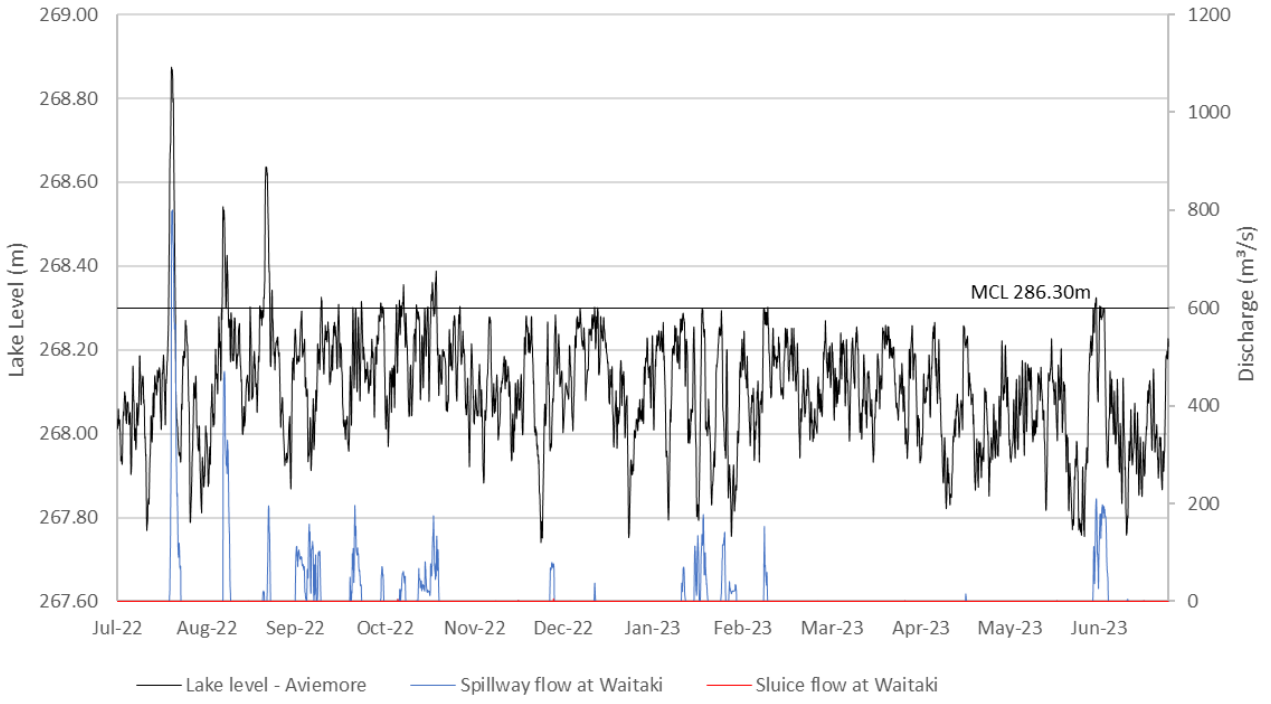

Figure 9-5: Periods of discharge via the spillway of Waitaki Dam plotted against the lake level of Lake Aviemore.

9.3 River Flows at Kurow

Data from the Waitaki River at Kurow flow site, downstream of Waitaki Dam, has been accepted as the most suitable for verifying compliance with minimum flow requirements in the Waitaki River for many years. This site is regarded as more reliable and accurate than the 'below dam site' where flows are inferred from machine and spill discharge calculations. Consent condition 22.5 of CRC180721 now formally requires that flows set by Conditions 22.1, 22.2, 22.3 and 22.4 are to be measured at Kurow.

Minimum Flows and alternate flows below Waitaki Dam

CRC180721 *Condition 22.1. Except as provided for in conditions 22.2 and 22.3, the Grantee shall maintain the flows in the Waitaki River, calculated as the mean flow over a 24-hour period from midnight-to-midnight New Zealand Standard Time, of being at least:*

a. 150 cubic metres per second; plus

b. The Flows for Activities as set out in Table 1:

Table 1.

Month	*Cubic metres per second*
October to March	*40*
April and September	*22*
May and August	*12*
June and July	*8*

Figure 9-6 shows flows in the Waitaki River measured at the Kurow. Table 9-4 lists the minimum recorded flows at these sites, and the consented flows.

No alternative flow proposals have been provided and therefore it is presumed that none were in place for the compliance period.

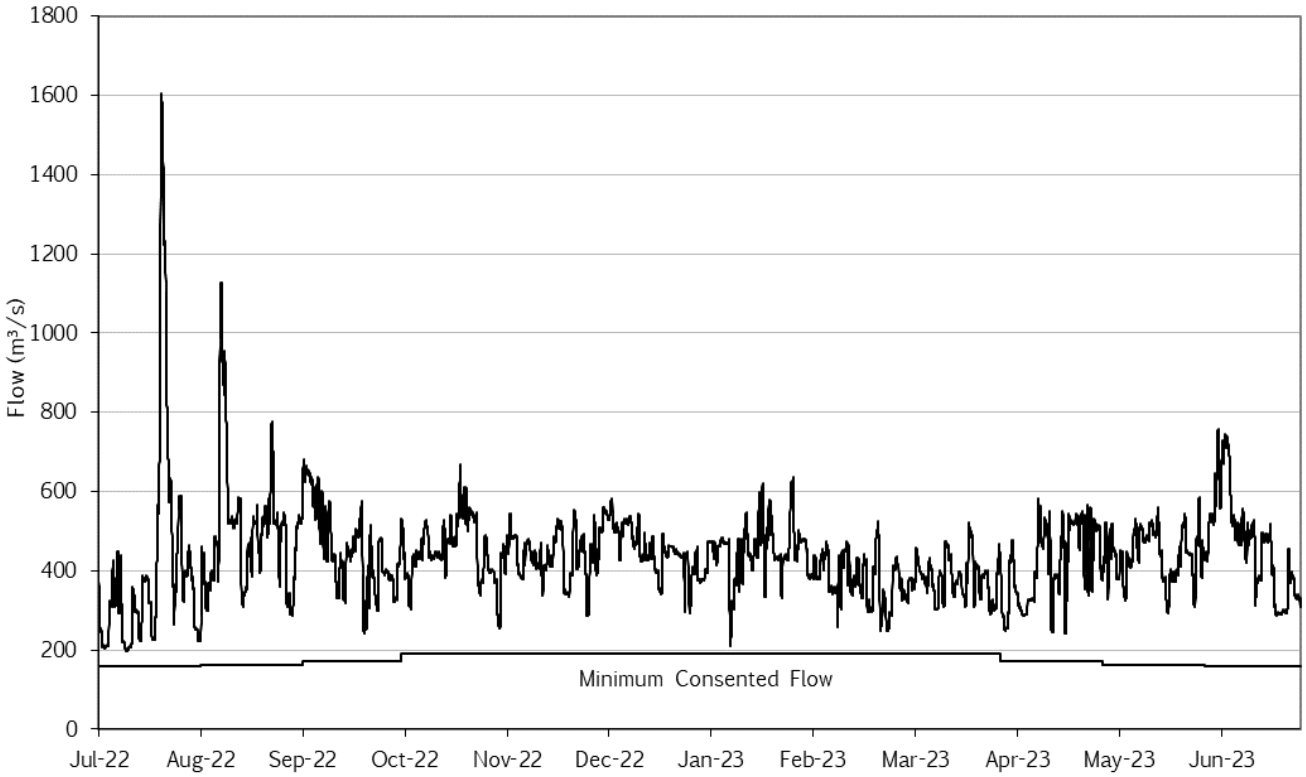

Figure 9-6: Waitaki River at Kurow flow - 1/07/2022 to 30/06/2023.

Table 9-4: Waitaki Station flows verification.

Flow	Minimum Flow (m^3/s)
Consented minimum flow to be released downstream of the dam during the period 1/07/2022 – 30/06/2023 (October to March)	190
Recorded minimum flow released downstream of the dam during the period 1/07/2022 – 30/06/2023 (October to March)	211
Consented minimum flow to be released downstream of the dam during the period 1/07/2022 – 30/06/2023 (April and September)	172
Recorded minimum flow released downstream of the dam during the period 1/07/2022 – 30/06/2023 (April and September)	240
Consented minimum flow to be released downstream of the dam during the period 1/07/2022 – 30/06/2023 (May and August)	162
Recorded minimum flow released downstream of the dam during the period 1/07/2022 – 30/06/2023 (May and August)	221
Consented minimum flow to be released downstream of the dam during the period 1/07/2022 – 30/06/2023 (June and July)	158
Recorded minimum flow released downstream of the dam during the period 1/07/2022 – 30/06/2023 (June and July)	195
Complied fully with minimum flow condition?	YES

Figure 9-6 and Table 9-4 show that the minimum flow conditions were fully complied with over the period 1/07/2022 to 30/06/2023.

Flow change limits for flows less than 200m³/s

The "*Waitaki Power Stations, Appendix A, Extracts of Waitaki Operating Rules (1990)*" specifies two additional conditions (under 6.2) relating to total flow changes below 200m³/s. These conditions are:

> *When increasing the flow downstream of Waitaki, for flows less than 200m³/s, the maximum change in any one hour should be limited to 30m³/s (5MW).*
>
> *When reducing the flow downstream of Waitaki, for flows less than 200m³/s, the maximum change in any one hour should be limited to 10% of the previous hour's flow.*

This Operating Rule is checked by comparing the mean total flow for each hour with the mean total flow for the previous hour. These flows are calculated as fixed averages, not moving averages.

Figure 9-7 shows two plots of the hourly changes in total flow when the flows were less than 200m³/s. The first shows hourly changes for increasing flow, and the second shows the percent changes for decreasing flow.

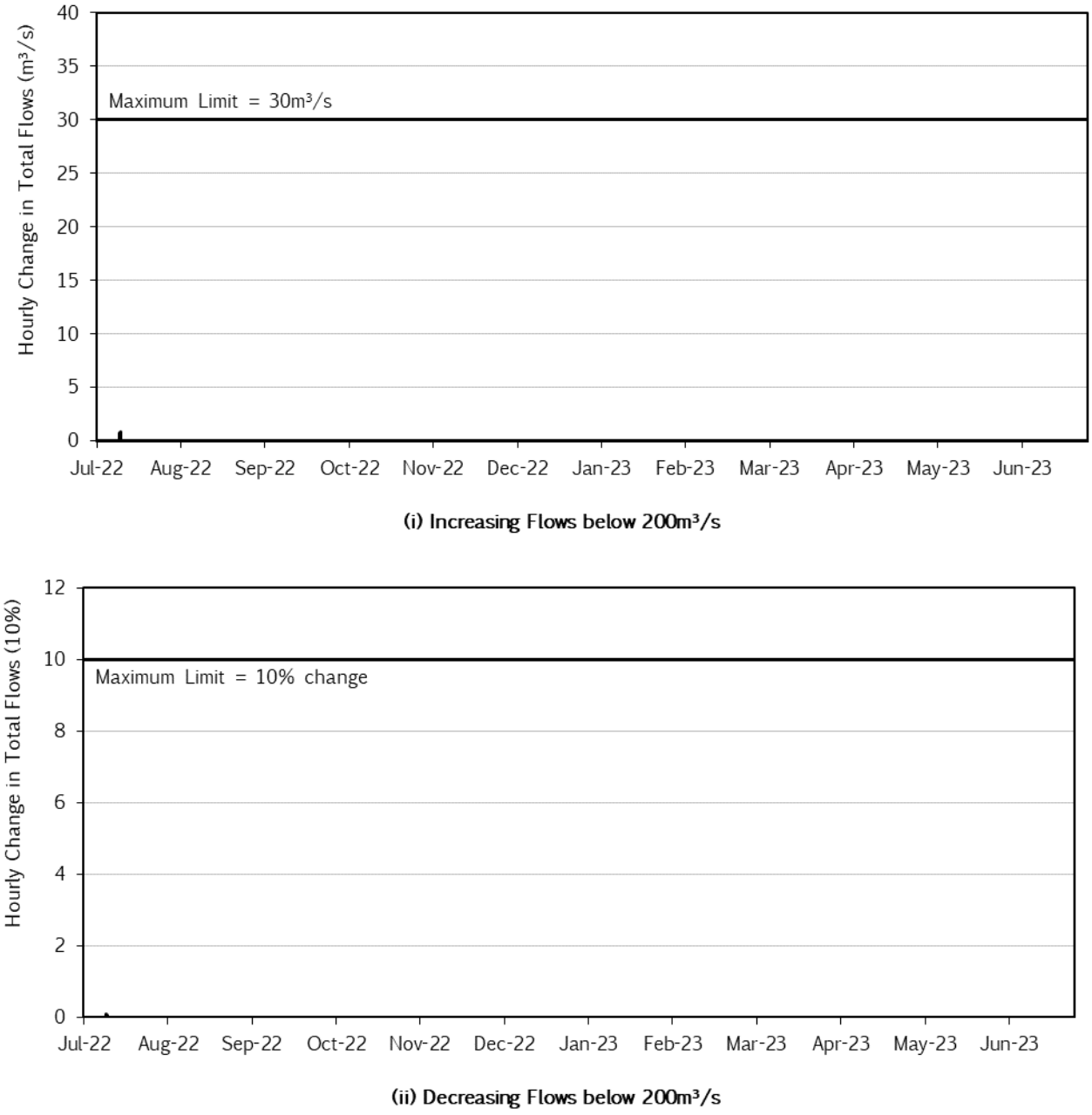

Figure 9-7: Waitaki Power Station at Kurow – hourly total flow changes below flows of 200m³/s (1/07/2022 – 30/06/2023).

Table 9-5: Waitaki Power Station at Kurow – total flows below 200m³/s.

Flows	Increasing Flows (m³/s)	Decreasing Flows (%)
Consented maximum hourly change in total flow	30	10
Recorded maximum hourly change in total flow during the period 1/07/2022 – 30/06/2023	0.89	0.09
Complied with the Appendix A Operating Rules increasing and decreasing flow limits fully?	YES	YES

Figure 9-7 and Table 9-5 show that the consent condition for increasing flow below 200m³/s, and decreasing flow below 200m³/s, was met fully.

Flushing Flows

CRC180721 *Condition 22.4: The Grantee shall pass flows into the Lower Waitaki River of at least 450 cubic metres per second for a duration of not less than 24 hours 7 times per calendar year, of which no fewer than 2 must be in the period 1 February to 31 March.*

Table 9-6 shows the flushing flows recorded at Kurow over the 2022 and part-2023 calendar years.

Table 9-6: Flushing flows recorded at Kurow over the 2022 and part-2023 calendar years. Flushing flows within the period 1 February to 31 March are highlighted.

Flushing Flows					
2022 Calendar Year			2023 Calendar Year (to 30 June 2023)		
Date	Min flow	Duration (hours)	Date	Min flow	Duration (hours)
4 Jan 2022	452	98.5	2 Jan 2023	455	37.5
10 Jan 2022	457	90	5 Jan 2023	450	131.5
21 Jan 2022	451	28.5	17 Jan 2023	458	43
24 Jan 2022	450	62.5	19 Jan 2023	452	55
27 Jan 2022	454	40	26 Jan 2023	452	41
2 Feb 2022	456	39.5	29 Jan 2023	453	65
4 Feb 2022	455	33	21 Feb 2023	461	27
5 Feb 2022	450	149	15 Mar 2023	459	25
14 Feb 2022	455	138.5	22 Mar 2023	452	36
22 Feb 2022	453	34	12 Apr 2023	456	78.5
24 Feb 2022	453	39	21 Apr 2023	453	111.5
1 Mar 2022	451	114.5	29 Apr 2023	450	48.5
8 Mar 2022	451	77.5	11 May 2023	450	34.5
31 Mar 2022	461	70	13 May 2023	456	149
4 May 2022	450	38.5	25 May 2023	453	38.5
18 July 2022	464	111.5	30 May 2023	452	39.5
25 July 2022	463	30.5	3 Jun 2023	458	264.5
5 Aug 2022	450	24			
6 Aug 2022	453	162.5			
16 Aug 2022	452	44			
19 Aug 2022	453	130			
25 Aug 2022	450	43.5			
29 Aug 2022	451	224			
8 Sep 2022	450	121			
24 Sep 2022	455	26.5			
30 Sep 2022	451	25			
7 Oct 2022	453	41			
14 Oct 2022	462	218.5			
25 Oct 2022	453	25.5			
2 Nov 2022	456	59.5			
7 Nov 2022	450	34.5			
16 Nov 2022	450	73			
22 Nov 2022	470	26			
29 Nov 2022	452	150.5			
6 Dec 2022	457	136			

A summary of the flushing flow and duration recorded at Kurow during the period 1/01/2022 through 30/06/2023 are shown in Table 9-7.

Table 9-7: Flushing flow verification.

Flows	Complied?
2022 calendar year	YES
Part-2023 calendar year	YES
Complied fully with the Condition 22.4	**YES**

Table 9-6 and Table 9-7 show that flushing flow conditions were complied with fully over the period 1/01/2022 through 30/06/2023.

10 Compliance with the Resource Consents - Notifications

There are certain conditions attached to some of the resource consents which specify that 24-hours notification must be given to the appropriate authorities prior to exercising certain rights. These conditions, numbered 9, 10, 11, and 17, are reproduced here.

CRC905322.2, CRC905325.2, CRC905336.2 -

> *Condition 9: The Grantee shall give at least 24 hours prior warning to the Water Resource Manager, Canterbury Regional Council, and the Field Centre Manager, Twizel, Department of Conservation, of the intention to exercise this right and shall advise as soon as practicable after incrementing each flow step as stipulated in* "Waitaki Power Stations, Appendix A, Extracts of Operating Rules, 9 November 1990".

CRC905341.2 -

> *Condition 10: The Grantee shall give at least 24 hours prior warning to the Water Resource Manager, Canterbury Regional Council, and the Field Centre Manager, Twizel, Department of Conservation, of the intention to exercise this right.*

CRC905346.2, CRC905347.2, CRC905348.2, CRC905353.2, CRC905354.2, CRC905355.2, CRC905364.2, CRC905365.2, and CRC905366.2 -

> *Condition 11: The Grantee shall give at least 24 hours prior warning to the Water Resource Manager, Canterbury Regional Council, of the intention to exercise this right whenever the combined discharge of spillway, turbines and sluice gates will be greater than 850m^3/s and shall advise as soon as practicable after incrementing each flow step as stipulated in* "Waitaki Power Stations, Appendix A, Extracts of Operating Rules, 9 November 1990".

CRC905323.2 -

> *Condition 17: The Grantee shall give at least fourteen (14) days prior notice to the Water Resource Manager, Canterbury Regional Council, of the intention to exercise this right; the purpose of which shall be only for the grantee's maintenance programme.*

A summary of the compliance checks relative to those conditions requiring notification is presented in Table 10-1.

A letter from Environment Canterbury (dated 5 January 2005) to Dave Herrick at Meridian allows Meridian to undertake monthly gate testing at the Lake Ruataniwha spillway (Gate 22) and the Lake Pukaki spillway (Gate 19) without giving 24-hours notification (as stipulated under resource consents CRC905336 and CRC905322). These gate releases must adhere to the specifications detailed in previous letters from Meridian to Environment Canterbury. All other flow releases are to be notified in accordance with the above consent conditions. Although there were five small, short-duration flows recorded over the Labyrinth Weir on the Ōhau C Canal over the assessment period, these are considered normal and are usually a result of large load changes or sudden cessation of flow. As these are not planned flows, no 24-hour notice is required for them.

Table 10-1: Waitaki Power Scheme – Conditions requiring notification compliance summary (1/07/2022 to 30/06/2023). All require 24-hr notification except for CRC905323.2 Condition 17 (requiring a 14 day notification).

Resource Consent and the condition no.	Brief Description	When was the notification given? (NZST)	At what time the consent was exercised? (NZST)	Complied with the consents?
CRC905322.2 Condition 9	Lake Pukaki Spill Flows	31/08/2022 3:54 PM 16/09/2022 12:28 PM 23/01/2023 2:06 PM 13/03/2023 1:34 PM 20/03/2023 12:17 PM 27/03/2023 3:56 PM 27/03/2023 4:18 PM 28/03/2023 3:48 PM 10/05/2023 4:30 PM 25/05/2023 3:15 PM	1/09/2022 3:55 PM 23/09/2022 12:03 PM 27/01/2023 3:53 PM 19/03/2023 5:46 AM 26/03/2023 5:42 AM 1/04/2023 5:52 AM 2/04/2023 4:45 AM 4/04/2023 9:06 AM 12/05/2023 5:53 PM 27/05/2023 8:59 PM	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
CRC905323.2 Condition 17	Lake Pukaki Diversion culvert	N/A - not in operation	Not exercised	N/A
CRC905325.2 Condition 9	Pukaki-Ōhau Canal Spill Flows		Not exercised	N/A
CRC905336.2 Condition 9	Lake Ruataniwha Spill Flows	16/08/2022 3:37 PM	18/08/2022 3:53 AM	Yes
CRC905341.2 Condition 10	Labyrinth Weir Spill Flows	5/09/2022 3:58 PM 7/09/2022 9:35 AM 2/02/2023 4:46 PM	6/09/2022 5:01 PM Not exercised Not exercised	Yes N/A N/A
CRC905346.2 Condition 11 CRC905347.2 Condition 11 CRC905348.2 Condition 11	Total Benmore flows expected to exceed 850 m^3/s, notification required 24 hours in advance	18/07/2022 11:08 AM 6/08/2022 7:29 AM 30/05/2023 3:48 PM	19/07/2022 12:33 PM 6/08/2022 12:46 PM 6/06/2023 10:00 PM	Yes Yes* Yes
CRC905353.2 Condition 11 CRC905354.2 Condition 11 CRC905355.2 Condition 11	Total Aviemore flows expected to exceed 850 m^3/s, notification required 24 hours in advance	18/07/2022 11:06 AM 6/08/2022 7:31 AM 30/05/2023 3:51 PM	19/07/2022 12:07 PM 6/08/2022 1:27 PM Not exercised	Yes Yes* N/A
CRC905364.2 CRC905365.2 CRC905366.2	Total Waitaki flows expected to exceed 850 m^3/s, notification required 24 hours in advance	18/07/2022 11:08 AM 6/08/2022 7:32 AM 1/09/2022 2:08 PM 30/06/2023 3:52 PM	19/07/2022 2:47 PM 6/08/2022 6:29 PM Not exercised Not exercised	Yes Yes* N/A N/A

* Although less than 24 hours' notice was given before the discharge occurred, these are considered compliant, see explanation below.

Table 10-1 shows that the 24-hour requirement for notification was met for all spill events. One event on 6 August 2022 involving the discharge of >850m^3/s from Aviemore,

Benmore and Waitaki was notified 5.3 hours before the Benmore discharge occurred, 5.9 hours before the Aviemore discharge occurred and 11 hours before the Waitaki discharge occurred. However, these discharges were originally notified on 7:29 – 7:32am Saturday 6 August as intending to start from Sunday 7 August 2022 and in this case the 24 hour notification of intent to discharge has met. These spills needed to happen earlier than was anticipated when the notice was given, due to higher than expected tributary inflow into Lake Benmore in terms of volume and timing and Lake Benmore reaching the maximum control level before expected. When this became apparent, additional notices were issued as soon as were practicable. Therefore, the notices given for these discharges are considered compliant with Condition 11.

11 Summary

A summary of the resource consents affecting lake levels, machine flows, spill flows, and canal flows for the Waitaki Power Scheme, with a brief explanation of the level of compliance over the period 1/07/2022 through 30/06/2023, is provided in Table 11-1.

Table 11-1: Summary of compliance with the resource consents.

Resource Consent No.	Brief Description	Fully Complied?	Degree of non-Compliance
CRC905321 and CRC185833	Pukaki Lake Level	Yes	
CRC905322	Lake Pukaki Spill Flows	Yes	
CRC905323	Pukaki Diversion Culvert Flows	Yes	
CRC905324	Pukaki-Ōhau Canal Flows	Yes	
CRC905325	Pukaki-Ōhau Canal Spill Flows	Yes	
CRC905330	Ōhau Lake Levels	Yes	
CRC905331	Ōhau Canal Flow	Yes	
CRC905333 and CRC905334	Ōhau A Machine Flows	Yes	
CRC905335	Ruataniwha Lake Level	Yes	
CRC905336	Lake Ruataniwha Spill Flow	Yes	
CRC905338 and CRC905339	Ōhau B Machine Flows	Yes	
CRC905340 and CRC905343	Ōhau C Machine Flows	Yes	
CRC905341	Labyrinth Weir Spill Flow	Yes	
CRC905344	Benmore Lake Level	Yes	
CRC905345 and CRC905346	Benmore Machine Flows	Yes	
CRC905347 and CRC905348	Benmore Spillway and Sluice Flows	Yes	
CRC905351	Aviemore Lake Level	Yes	
CRC905352 and CRC905353	Aviemore Machine Flows	Yes	
CRC905354 and CRC905355	Aviemore Spillway and Sluice Flows	Yes	
CRC905360	Waitaki Lake Level	Yes	
CRC905361 and CRC905364	Waitaki Station and Dam Flows	Yes	
CRC905365 and CRC905366	Waitaki Maximum Discharge Rates	Yes	
CRC180721 and CRC905361	River flows at Kurow (a) Minimum Flows and alternate flows (b) Flows change limits (during flows <200m^3/s) (c) Flushing Flows (d) Calculated Natural Inflows	 Yes Yes Yes Yes	

Table 11-1 shows that all of the 34 resource consent conditions checked were complied with fully.

Given the high number and diversity of resource consents and associated conditions, the operation of the Waitaki Hydro System to such a high degree of compliance shows a high level of management, operation, and planning by Meridian, and is consistent with the high degree of compliance observed for previous years.

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