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Hydrological Modelling Dataset

Report 3a: 2018 Storage and Spill Series Comparison with 2015

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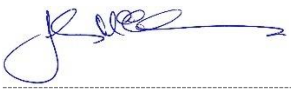

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3-53422.00	2018.1	29 March 2018	Full update 2018 – draft for EA review
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Preface

A large proportion of New Zealand's electricity needs are met by generation from hydro power. Information about the distribution of inflows and the capability of the various hydro systems is necessary to ensure a reliable, competitive and efficient market and electricity system.

The hydrological modelling dataset (HMD) is a dataset of hydrological information made available by the Electricity Authority. The dataset was known as the SPECTRA update until 2010. In 2015 the dataset was revised to become the HMD, a comprehensive dataset that can be relied upon by modellers and analysts to test scenarios, provide commentary and inform decisions.

The HMD is comprised of data provided by hydro generators and supplemented with some from other sources. These parties are acknowledged for their contribution and for making this data available.

The HMD consists of three main components:

1. Infrastructure and hydrological constraint attributes:

   This dataset records standing information about the capability of the main hydro schemes.

2. Flows:

   This time series dataset records data for inflows for reservoirs and flows at various existing or potential hydro generating sites.

3. Storage and spill:

   This time series dataset records storage for the main hydro schemes.

This report describes the third component of the HMD, the storage and spill series.

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1. Introduction

Care is taken to ensure consistency of data between successive HMD updates. A comparison of the storage and spill flows for each series was undertaken and any changes are discussed further in Sections 2, 3 and 4.

2. Data Differences for Calculated Flow Sites

Differences between datasets may occur from one update to the next for a variety of reasons. These include: rating changes; data modifications; and various other reasons. Table 2.1 shows if there were any differences in the data between the previous and current update for the storage sites and Table 2.2 shows if there were any differences in the data between the previous and current update for the storage sites. The following sections highlight the reasons for these differences.

Table 2.1: Data differences for previous and current updates for storage sites

STORAGE SITE NAME	DATA DIFFERS
Lake Taupo	NO
Lake Waikaremoana	YES
Lake Ohau	YES
Lake Tekapo	YES
Lake Pukaki	NO
Lake Wanaka	NO
Lake Hawea	YES
Lake Wakatipu	YES
Lake Te Anau	NO
Lake Manapouri	YES

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Table 2.2: Data differences for previous and current updates for spill sites

LAKE	SPILL SITE NAME	DATA DIFFERS
Lake Waikaremoana	Onepoto	NO
	Waikareteheke River at Piripaua	YES
	Waikareteheke River at Upstream Mangaone	NO
Lake Tekapo	Lake Tekapo at Gate 17	YES
	Lake George Scott to Tekapo River	YES
Lake Pukaki	Lake Pukaki	NO
Lake Ruataniwha	Lake Ruataniwha	NO
Lake Ohau	Lake Ohau	NO
Lake Benmore	Lake Benmore	YES
Lake Aviemore	Lake Aviemore	YES
Lake Waitaki	Lake Waitaki	NO
Lake Te Anau	Lake Te Anau	NO
Lake Manapouri	Lake Manapouri	NO
Lake Hawea	Lake Hawea	NO
Lake Dunstan	Clyde Dam	NO
Lake Roxburgh	Lake Roxburgh	NO
Lake Taupo	Lake Taupo	NO
Lake Aratiatia	Lake Aratiatia	NO
Lake Ohakuri	Lake Ohakuri	NO
Lake Atiamuri	Lake Atiamuri	NO
Lake Whakamaru	Lake Whakamaru	NO
Lake Maraetai	Lake Maraetai	NO
Lake Waipapa	Lake Waipapa	NO
Lake Arapuni	Lake Arapuni	NO
Lake Karapiro	Lake Karapiro	NO

3. Storage Sites

3.1. Lake Waikaremoana

There are minor differences from 26-Dec-2016 to 1-Jan-2017 (Figure 3.1). Genesis Energy provided different lake level data this update which had minor corrections made to it. This resulted in minor alterations to the active storage of Lake Waikaremoana.

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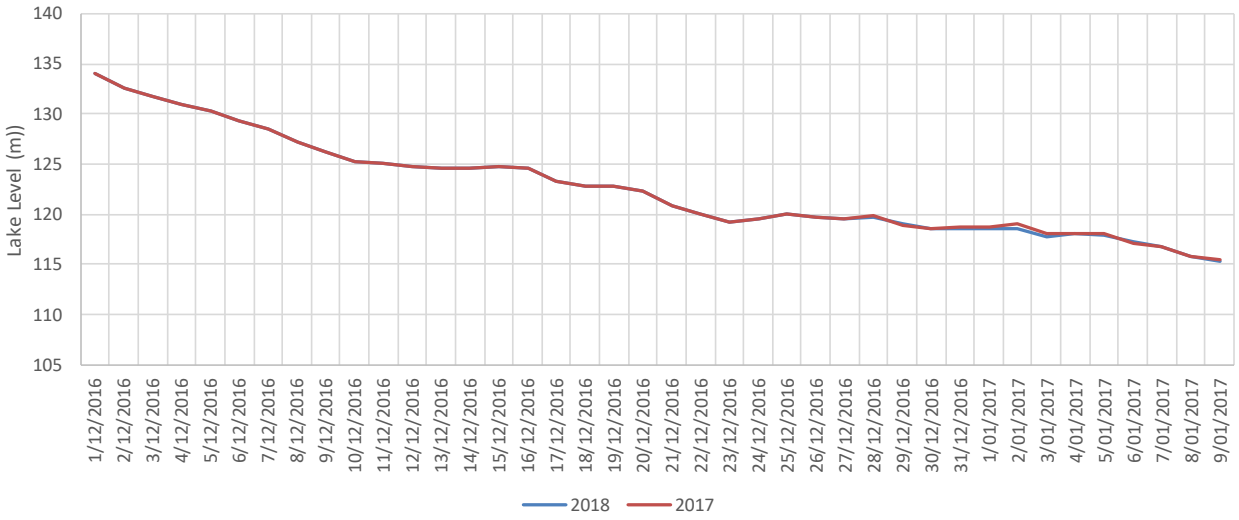

Figure 3.1: Comparison of the lake level data provided by Genesis for previous and current updates for Lake Waikaremoana.

3.2. Lake Ohau

The area-lake-storage volume curve was updated by Meridian in 2016. The relationship changed from :

Storage = 67.102*Lake Level -34862

to:

Storage = 62.181*Lake Level – 32300

This resulted in minor differences to the datasets between the 2015 and 2018 outputs for storage volume for Lake Ohau of approximately +/- 0.2Mm³.

3.3. Lake Tekapo

The area-lake-storage volume curve was updated by Genesis Energy in 2016. The relationship changed from:

Storage = (1.2190049106*Lake Level^2) – (1,631.7191716929*Lake Level) + 544,754.0319642890

to:

Storage = (-0.0120654091*Lake Level^3) + (26.637859371*Lake Level^2) - (19,481.1751129075*Lake Level) + 4,722,566.4558139

This resulted in minor differences to the datasets between the 2015 and 2018 outputs for storage volume for Lake Tekapo of approximately +/-4Mm³.

3.4. Lake Hawea

The area-lake-storage volume curve was updated by Contact Energy in 2016. The relationship changed from:

Storage = 142.389580*Lake Level – 48,137

to:

Storage = (0.9395 * (Lake Level^2)) - (Lake Level * 500.58605) +61865.8469

This resulted in minor differences to the datasets between the 2015 and 2018 outputs for storage volume for Lake Hawea of approximately +/-2.3Mm³. .

Furthermore, the updated storage volume relationship also included the pre-consent conditions from April 1980 to 1985, where there was more available storage water. This results in a clear step down in available storage volume in Lake Hawea for power generation (Figure 3.2).

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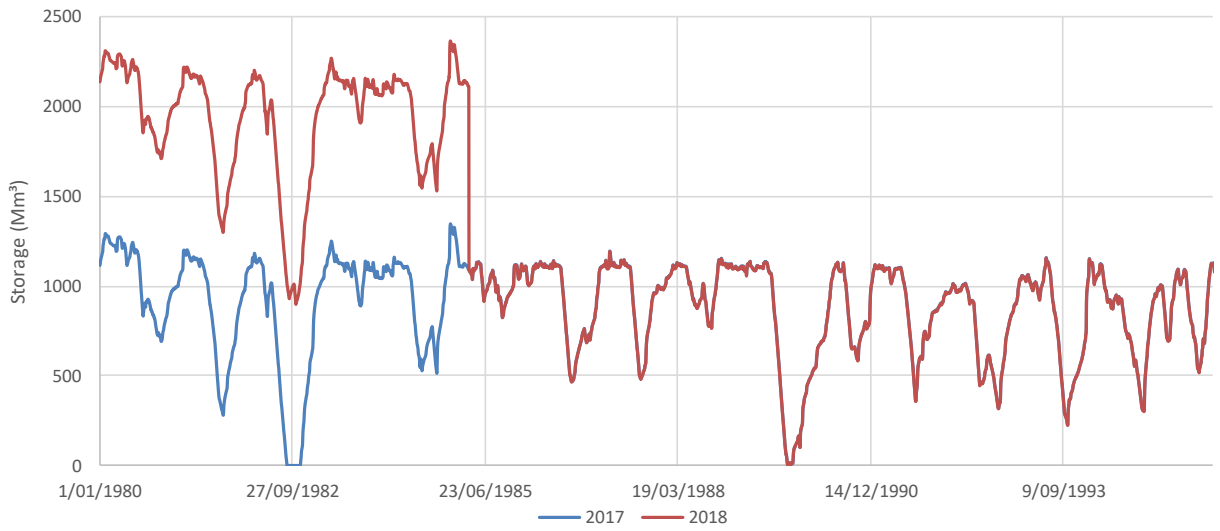

Figure 3.2: Difference of available storage in Lake Hawea for previous and current updates. The step down is a result in the change to the consent conditions, which restricted the available active storage for use from 1985 to the present.

3.5. Lake Wakatipu

The area-lake-storage volume curve was updated by Contact Energy in 2016. The relationship changed from:

Storage = 293*Lake Level -90487

to:

Storage = 289*Lake Level - 89252

This resulted in minor differences to the datasets between the 2015 and 2018 outputs for storage volume for Lake Wakatipu of approximately +/-5Mm³.

3.6. Lake Manapouri

The area-lake-storage volume curve was updated by Meridian Energy in 2016. The relationship changed from:

Storage = 141*Lake Level -24796

to:

Storage = 139.34*Lake Level - 24506

This resulted in minor differences to the datasets between the 2015 and 2018 outputs for Storage volume for Lake Manapouri of approximately +/-5Mm³.

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4. Spill Sites

4.1. Waikaretaheke River at Piripaua

There are very minor differences of less than +/-0.1m³/s from 22-Apr-2002 to 31-Dec-2016, with the largest differences on 24-Jan-2011 to 7-Dec-2011. Genesis Energy provided different data this update because of minor alterations to the ratings associated with the site.

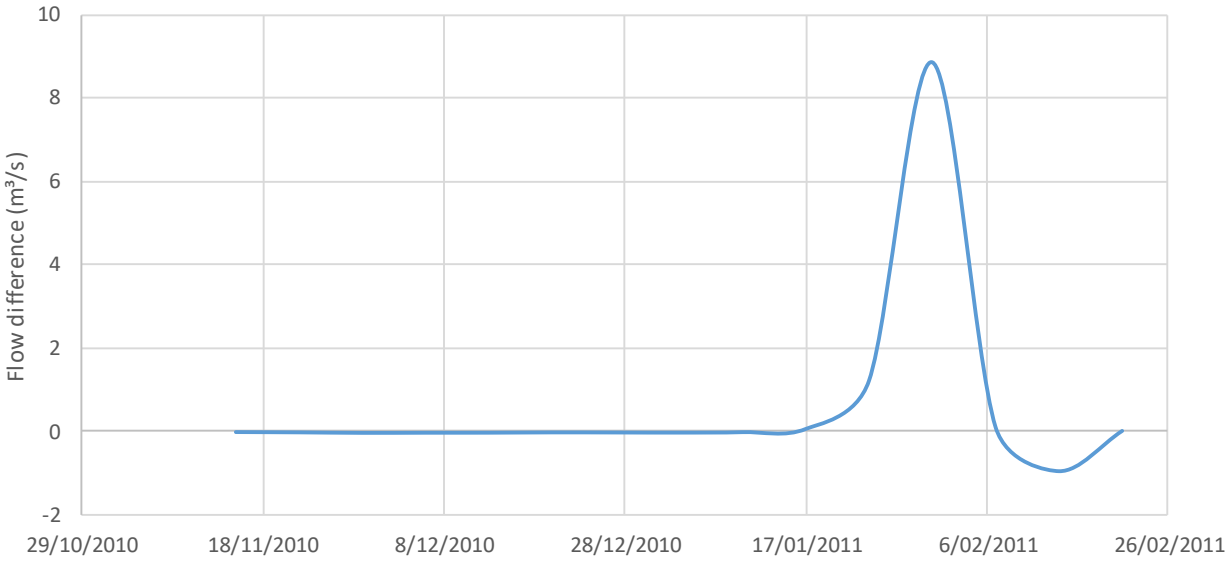

Figure 4.1: Differences between the previous and current updates, showing the largest change that occurred for Waikaretaheke.

4.2. Lake George Scott

There are some differences from 29-Jan-2001 to 14-Apr-2003 (Figure 4.2). Genesis Energy provided different data this update because of changes to the ratings associated with the site. There are very minor differences sporadically throughout the dataset of less than +/-0.5m³/s, where the change in rating has impacted the calculated spill flow.

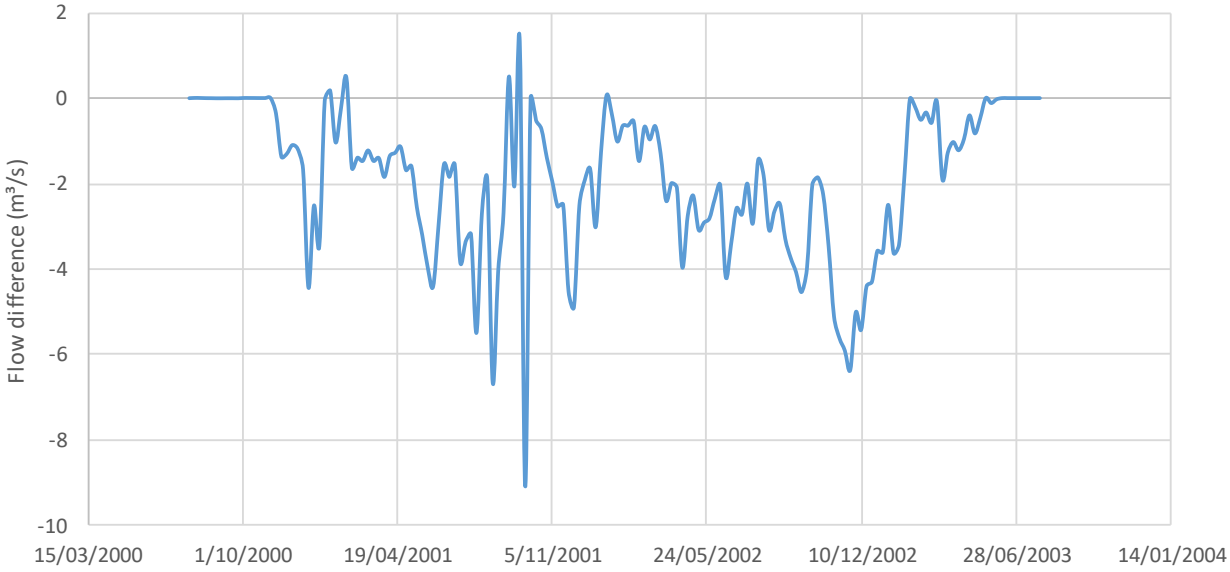

Figure 4.2: Differences between the previous and current updates for Lake George Scott to the Tekapo River.

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4.3. Lake Tekapo

There are very minor differences of less than +/- 0.1m³/s from 29-Dec-1979 to 31-Dec-2016, with slightly larger differences from 20-Nov-2000 to 11-Apr-2011 (Figure 4.4). Genesis Energy provided different data this update based on internal processing procedures.

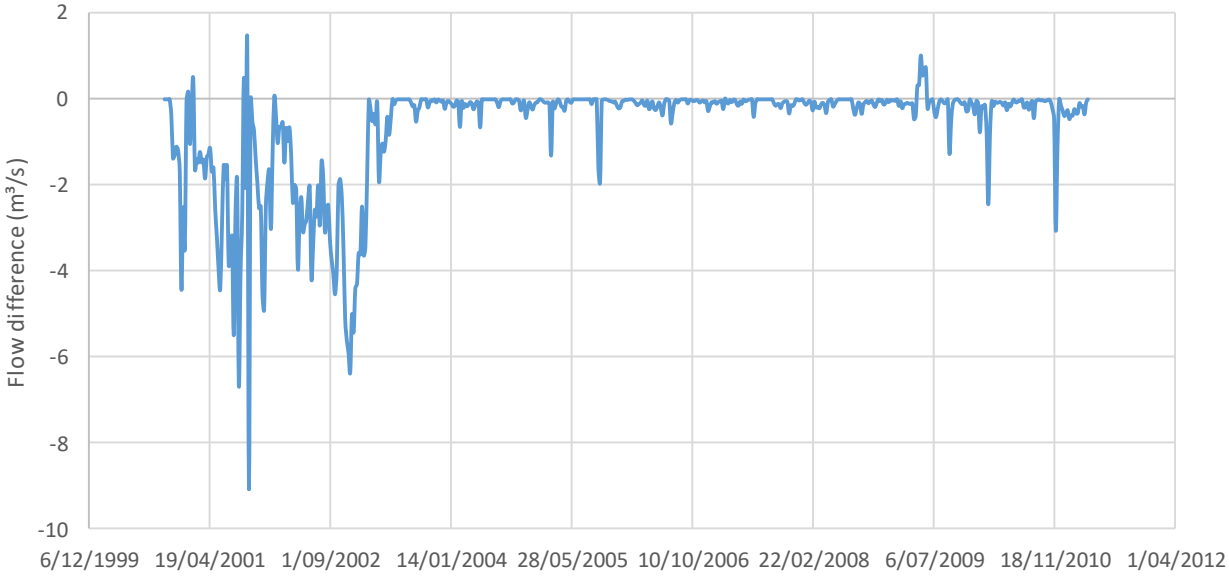

Figure 4.3: Differences between the previous and current updates for Lake Tekapo spill through Gate 17.

4.4. Lake Aviemore

There are very small differences from 1-Jan-2010 to 31-Dec-2016 (Figure 4.4). Meridian Energy reviewed this dataset which included some recalculation of the spill data. Differences between 2010 and 2016 differ by less than +/-0.1m³/s.

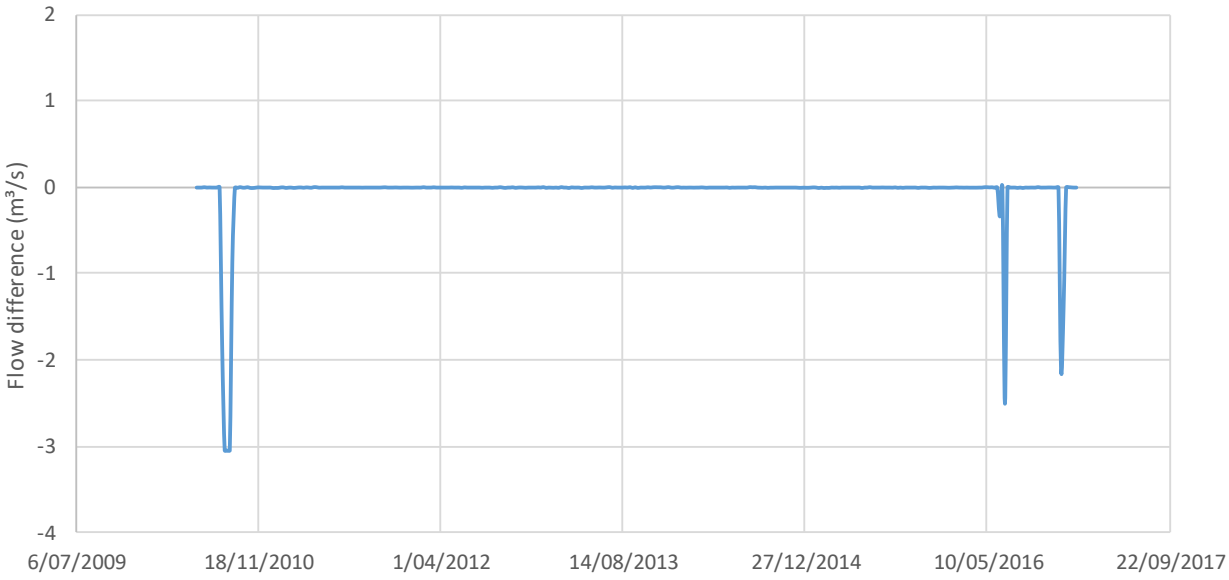

Figure 4.4: Differences between the previous and current update for Lake Aviemore.

4.5. Lake Benmore

There are some small differences from 1-Jan-1990 to 31-Dec-2016 of up to +/-0.1m³/s. A large change occurred from 22-Mar-2004 to 17-May-2004, where up to 30m³/s of difference was derived (Figure 4.5). Meridian Energy reviewed this dataset which included some recalculation of the spill data and gap analysis.

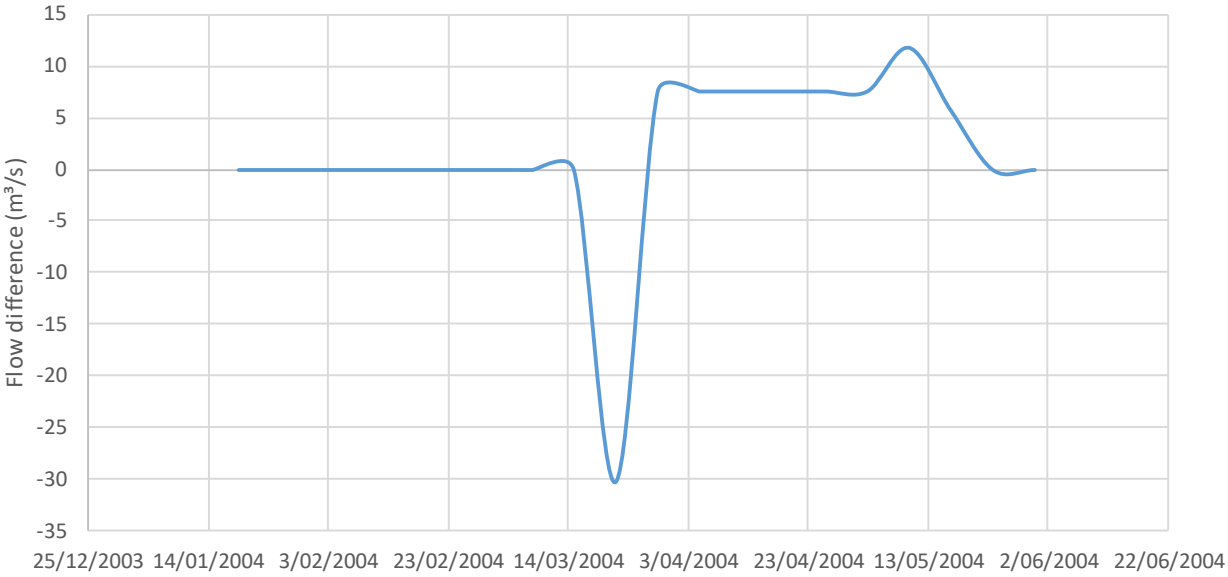

Figure 4.5: A large difference between the previous and current updates from March 2004 to May 2004 for Lake Benmore spill.

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