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## MEMORANDUM

**To:** Hearing Panel PC5A  
**From:** Peter Stevenson, Tom de Pelsemaeker  
**Date:** 16/05/2016  
**Re:** PC5A Request for further information - Hydrological information

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The Hearing Committee has requested that the Otago Regional Council provides them with the following information:

1. **Information relating to the Clutha Confluence flow monitoring site on the Lindis River**
  - a. Provide GPS coordinates of the location of the Clutha Confluence flow monitoring site.
  - b. Supply an aerial photograph and topo map showing the exact location of the Clutha Confluence flow monitoring site.
  - c. Provide photograph of the Clutha Confluence flow monitoring site if available.
  - d. Identify the criteria that were considered for site selection.
  - e. Describe the cross section at the Clutha Confluence flow monitoring site.
  - f. Identify if the flow recorder location is in the driest section of the Lindis River between the Clutha Confluence and the Lindis Crossing Bridge.
  - g. Identify the stage / water level when recorded flow at the Clutha Confluence flow monitoring site is 0 l/s.
  - h. Provide the number of calibration gaugings at the Clutha Confluence flow monitoring site from the date of first recordings to the present day.
  - i. Identify any data that was excluded from the flow record collected the Clutha Confluence flow monitoring site from the date of first recordings to the present day, and provide reasons for excluding this data.
  - j. Provide statement regarding confidence level in the quality of the data collected from the Clutha Confluence flow monitoring site from the date of first recordings to the present day.
2. **Information relating to the Ardgour Road flow monitoring site on the Lindis River**
  - a. Provide certified hydro-graph data from the flow recorder at Ardgour Road for the period 1 April 2015 to 30 April 2015.

**1.a. *GPS coordinates of the location of the Clutha Confluence flow monitor.***

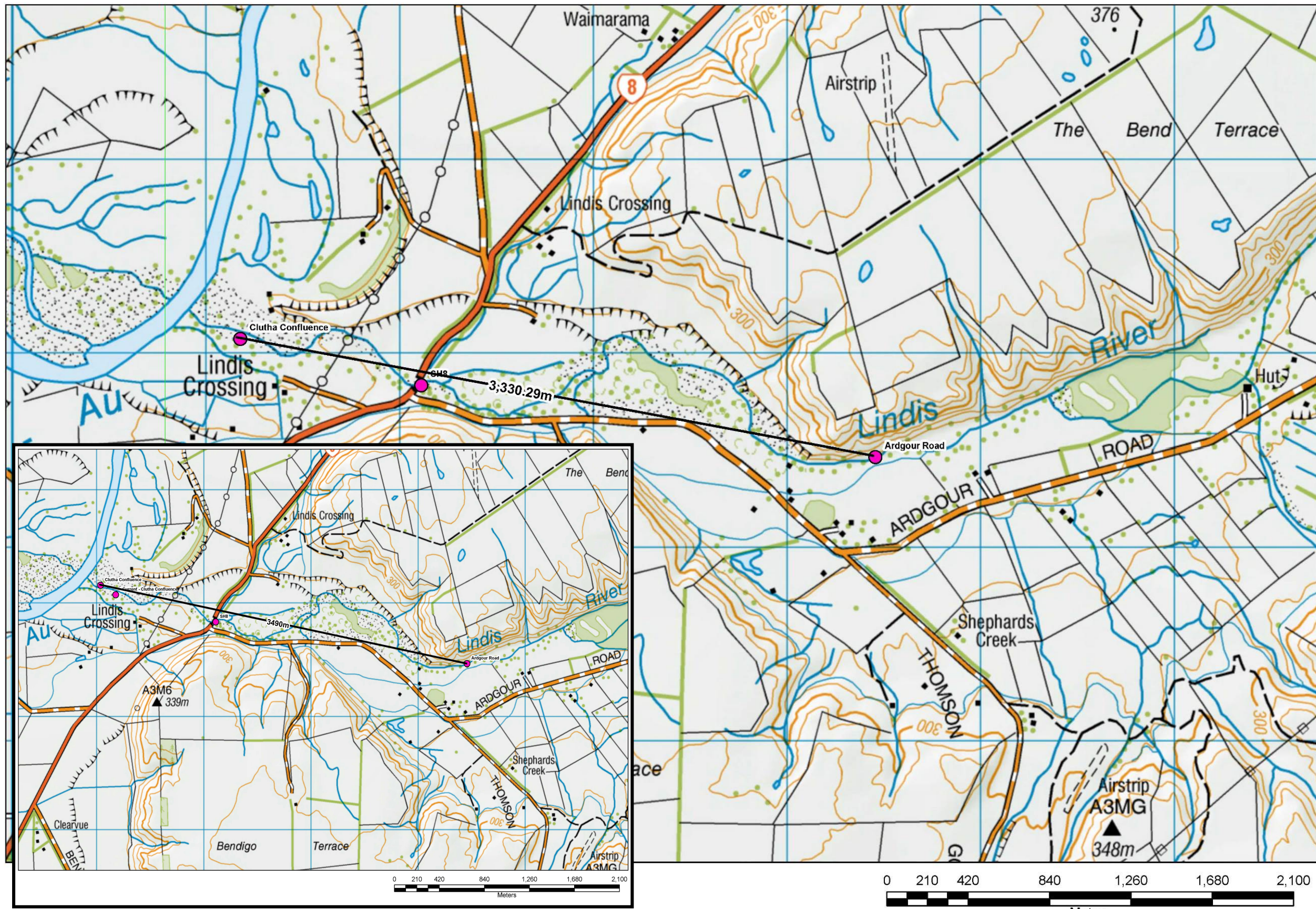
From November 2007 until May 2008 the monitoring station was at 1311035E 5024158N. The site was reopened October 2014 at 1311175E 5024075N

**1.b *aerial photograph & topo map showing the location of the Clutha Confluence flow monitor (Insert show location of 2007 until May 2008 the monitoring station).***











**1.c** *Photograph of the Clutha Confluence flow monitoring site*



**1.d** *Criteria for site selection.*

The station was re-established upstream from the original location as it gave better protection for the monitoring instrumentation and more sensitive and stable control for readings at low flow.

The flow is concentrated into one channel during low flow at the monitoring location. There is a reasonable depth of water for the water level sensor to have a calm point of measurement.

**1.e** *Cross section at the Clutha Confluence flow monitoring site.*

The flow site lies on the True left of the river in a channel that is approximately 10 to 15m wide. The entire cross section of the river at this site is approximately 50m wide.

**1.f** *Identify if the flow recorder location is in the driest section of the Lindis River between the Clutha Confluence and the Lindis Crossing Bridge.*

The flow stays in the main channel at the confluence monitoring site up to a flow of approximately 2 cumecs. Once the flow is over 2 cumecs it finds its way into side channels and becomes a braided river system.

The Lindis River at the Clutha confluence dries out completely over most of the summer months unless there is a significant rain event. When water ceases to flow at the actual mouth of the Lindis River there is still a small flow of around 20 to 30 l/s at the monitoring site. Flow in the lower section of the river is concentrated at the monitoring location during times of low flow.

**1.g Stage / water level when recorded flow at the Clutha Confluence flow monitoring site is 0 l/s.**

Zero flow is assumed when the monitoring station stage height is between 4.80 and 4.83m (assumed datum level). The sensor is out of water at 4.83m

**1.h Calibration gaugings at the Clutha Confluence flow monitoring site from the date of first recordings to the present day.**

List of flow gaugings with measured flow (cumecs)

~~~ Hilltop Hydro ~~~ Version 6.47  
May-2016

16-

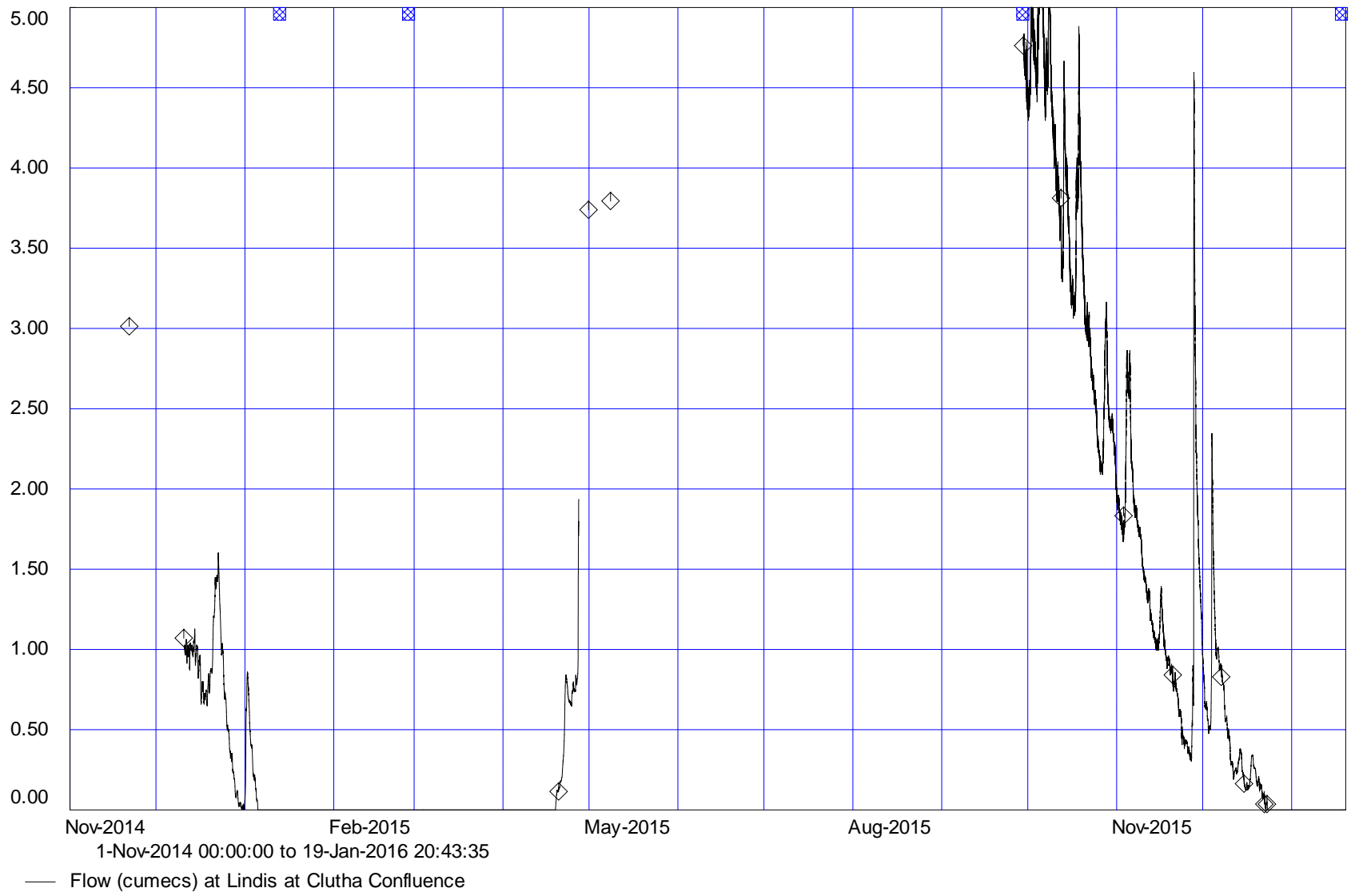
~~~ List ~~~

Source is U:\Global Data.hts

Flow (m3/sec) at Lindis at Clutha Confluence

From 7-Nov-2007 16:30:00 to 22-Apr-2016 13:27:00

|                      |       |
|----------------------|-------|
| 07-Nov-2007 16:30:00 | 3.773 |
| 16-Nov-2007 08:30:00 | 3.556 |
| 26-Nov-2007 13:50:00 | 1.902 |
| 29-Nov-2007 10:15:00 | 0.875 |
| 09-Dec-2007 08:15:00 | 0.265 |
| 06-May-2008 12:15:00 | 1.428 |
| 31-Oct-2014 14:16:00 | 3.143 |
| 21-Nov-2014 13:42:00 | 2.949 |
| 20-Apr-2015 11:20:00 | 0.114 |
| 30-Apr-2015 16:15:00 | 3.707 |
| 03-Jun-2015 09:10:00 | 3.227 |
| 07-Aug-2015 09:41:00 | 9.896 |
| 29-Sep-2015 12:19:00 | 4.458 |
| 29-Sep-2015 12:49:00 | 0.260 |
| 12-Oct-2015 14:04:00 | 3.932 |
| 12-Oct-2015 14:28:00 | 0.097 |
| 16-Oct-2015 09:45:00 | 3.073 |
| 16-Oct-2015 10:09:00 | 0.054 |
| 30-Oct-2015 12:18:00 | 2.433 |
| 03-Nov-2015 09:19:00 | 1.672 |
| 20-Nov-2015 11:40:00 | 0.814 |
| 07-Dec-2015 10:42:00 | 0.828 |
| 15-Dec-2015 12:29:00 | 0.163 |
| 23-Dec-2015 10:02:00 | 0.041 |
| 22-Feb-2016 13:36:00 | 0.013 |
| 22-Apr-2016 13:27:00 | 0.274 |



**1.i Data excluded from the flow record collected the Clutha Confluence flow monitoring site from the date of first recordings to the present day, and reasoning.**

Data from 15th October 2014 to 10th December 2014 has been removed from the dataset due to a fault with the water level sensor.

**1.j Confidence level in the quality of the data collected from the Lindis monitoring sites.**

Data from five hydrological monitoring stations on the main stem of the Lindis River have been collected over various periods of time. Two permanent flow monitoring stations, Lindis at Lindis Peak and Lindis at Ardgour Road have continuous datasets from 1976 and 2005 to present respectively.

The three temporary sites; Lindis at SH8 and Lindis at Clutha Confluence have datasets over the 2007-08, 2014-15 and 2015-2016 summer seasons while the Lindis at Rutherfords dataset is from late September 2014 to present. The Lindis at Ardgour Road station was moved approximately 500 metres upstream from its original location in November 2009 due to a change in the river channel caused from a flood event in May 2009 resulting in a poor flow measurement control.

The Lindis at Clutha Confluence flow monitoring station was reinstated in September 2014 at a site approximately 200 metres upstream from the location used in 2007.

Hydrological data for the Lindis Catchment have been collected by ORC and NIWA using national and international accepted methods and best practice to ensure they conform to standard levels of accuracy expected from a hydrological station. Data and flow gaugings have been processed through the Hilltop time-series manager to produce a continuous flow series for each of the stations.

Comments have been added to the metadata records when a problem that may compromise data quality has been identified. The flow derived from applying the flow rating to the stage data to produce the continuous time-series record has been compared with the gauged flow to ensure the time-series data agrees with the gauged flow at the time. Flow gaugings have a calculated uncertainty of 8% or better based on ISO 748:2007. The majority of gaugings are within the +/-8% of the rated flow data for all stations on the main stem of the Lindis River.

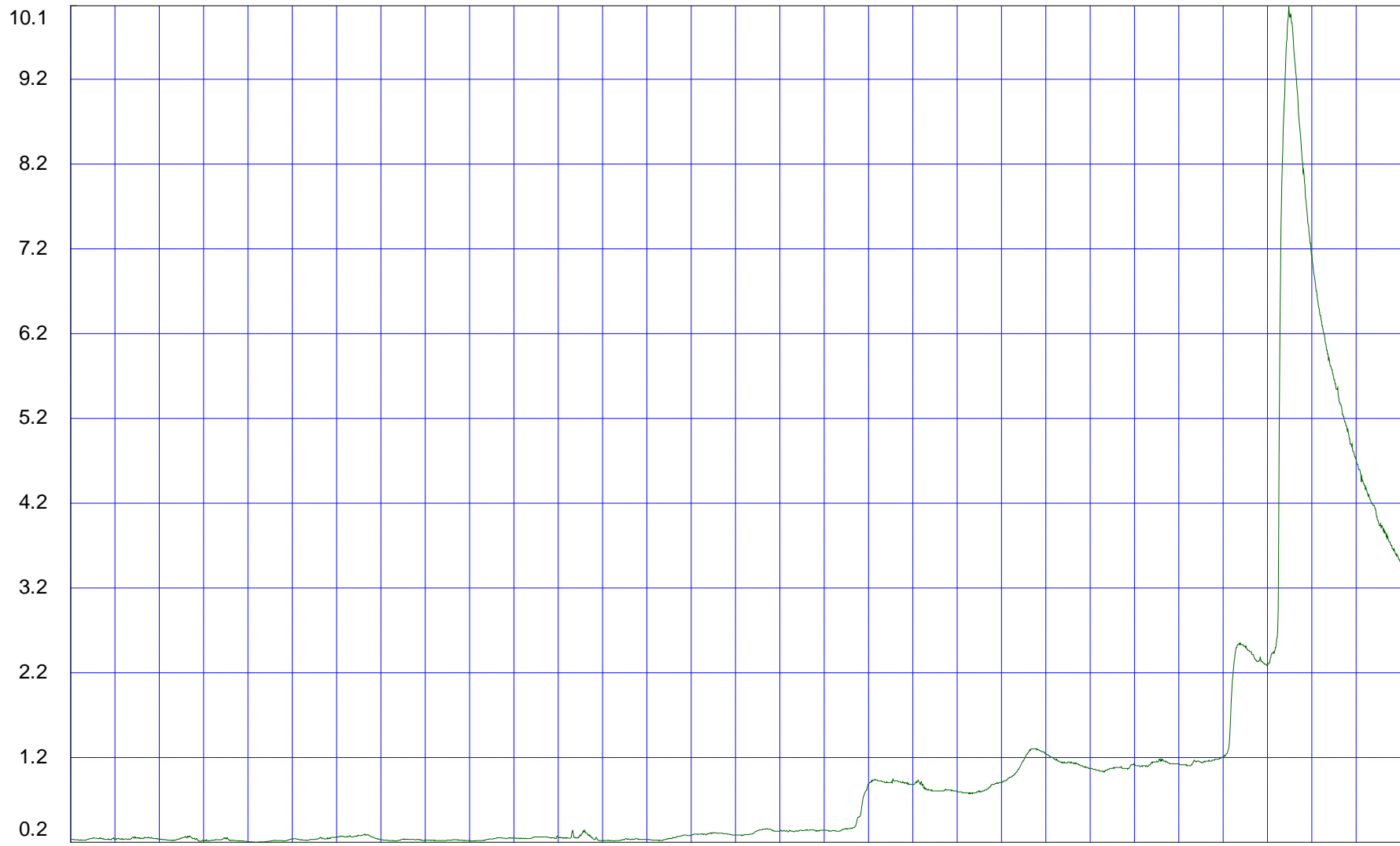
Data produced from the two permanent flow monitoring stations on the main stem of the Lindis River are expected to have an accuracy of 10% or better over the full range of flows.

Data from the three temporary stations have an expected accuracy of 10% or better for flows below 5 cumecs with exception of the Lindis at Clutha Confluence station during the 2014-15 season when a water level instrument fault caused data of lesser accuracy to be collected resulting in a large portion of the period being deleted and the remainder assigned as poor quality with a possible inaccuracy of 20%.

Zero flow recorded at the Clutha Confluence site occurs when there is still 15 litres per second flowing at the monitoring site.

**2.a Certified hydro-graph data from the flow recorder at Ardgour Road for the period 1 April 2015 to 30 April 2015.**

Hydrograph is shown below (Updated flow data for the Ardgour Rd Flow Monitoring Site can be downloaded from the ORC webpage)



1-Apr-2015 00:00:00 to 1-May-2015 00:00:00

— Flow (cumecs) at Lindis at Ardgour Road