Generator SPECTRA Update – Issue 6

18 September 2007

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Executive Summary

This report incorporates and comments on feedback from particapents regarding:

- Any incorrect datasets identified in the draft output and the resultant fixes
- Feedback from Meridian and the Electricity Commission
- And negative data values that exist in the datasets.

Also included in this release are four new SPECTRA sites, these being Highbank, Patea, Wheao/Flaxy and Kaimai.

Incorrect datasets identified from the draft report were Grey_Tara (77106), Arapuni Trib Inflow (92724), Karapiro Trib Inflow (92714) and Roxburgh Inflow (99110).

Grey_tara had two gaps in the actual data and this caused gaps in the resultant SPECTRA dataset. The historic gaps have been synthetically filled and the error will not occur again.

The Arapuni, Karapiro and Roxburgh weekly Tideda file, excel file and DAT file contained errors caused in the transformation process from daily to weekly. Quality checks have now been put in place to capture any future errors. The tideda files, list files, excel files and DAT files have all been corrected and are supplied in this release.

Meridian provided feedback and identified that:

- The Waitaki P.S Inflow dataset was poor when compared to Benmore
- Synthetic Cobb Inflows were poor/inconsistent prior to 1945
- That their was a poor relationship between Karapiro and Arapuni from 1995
- Mangahao Inflows were poor/inconsistent before October 1997
- Matahina inflows had poor/inconsistent data prior to 1948.

All the points identified via feedback are either commented on in the report under the relevant section or consideration is being given to fixing these inconsistencies.

Feedback has promoted discussion regarding negative data in datasets. Given that the SPECTRA series is derived to provide potential generation values a negative value then concludes that no available water for generation exists for that data value. In reality negative data would not exist as water would be consumed from storage.

Therefore a negative data value is not incorrect it shows that there is no available potential water for use and that storage has to be consumed.

Contents

1 Introduction

This SPECTRA update was requested by the Electricity Commission and includes data from 30 June 1931 to 30 June 2006.

The report provides a description of how each dataset is constructed and details are included for any data differences, changes to mean flows, any new SPECTRA datasets and any negative inflows in the datasets.

SPECTRA flow routines are re-run for each update and new datasets created. These datasets are then compared with previous SPECTRA data to ensure continuity and accuracy is continued for the current update.

Monthly data (PCAL) listings and daily flow distribution tables (PDISTS) are included in Appendix A. These listings and tables enable checks against new output any identify and substantial changes in data.

The following companies have provided data for this update:

- Genesis Energy Ltd
- Meridian Energy Ltd
- Mighty River Power Ltd
- Contact Energy Ltd
- Trust Power
- Joint Venture (Todd/King Country Power Company)

All input data sites have been checked for gaps and where necessary these have been filled.

2 Datasets and mean flows

Table 2.1: Flow dataset names and mean values derived from previous SPECTRA updates and this update.

Flow	Model flow name	Site Number	Description	Mean Flow (cumecs)			Type
				1931 to July 1997	1931 to Jun 2005	1931 to Jun 2006	
Arapuni Tributaries	Arapuni	92724 (1)	Waikato tributary flow between Taupo and Arapuni PS	79.1	78.5	78.4	T
Benmore	Benmore	98614 (4)	Waitaki tributary flow between Lakes Pukaki & Tekapo and Benmore (Separate Tekapo simulation)	127.0	126.1	125.8	T
	Ben_tp	98615 (2)	Waitaki tributary flow between Lakes Pukaki & Tekapo and Benmore (Combined lakes Tekapo - Pukaki simulation)	125.0	124.4	124.2	T
Cobb	Cobb	97904 (2)		5.69	5.53	5.52	C
Coleridge	Coleridge	97904 (1)		24.2	24.5	24.5	C
Grey + Taramakau - Taipo	Grey_tara	77106(1)	Grey River at Dobson including Taramakau but not Taipo	437.0	437.3	436.3	T
Hawea	Hawea	9170 (1)	Hawea Inflows	65.8	65.5	65.2	C
Karapiro Tributaries	Karapiro	92714 (1)	Waikato tributary flow between Taupo and Karapiro PS	93.1	91.2	91.5	T
Mangahao	Mangahao	975201(1)	Local inflows	8.03	8.08	8.4	T
Manapouri	Manawmara	99551 (1)	Manapouri local with Mararoa dirty water spill	136.0	136.8	136.4	T
	Manapouri	99550 (1)	Manapouri local flows with no Mararoa	121.0	121.9	121.5	T
	Manareduced	99552 (1)	Manapouri with 12, 14 and 16 cumec min flow + Mararoa dirty water spill, flushing and recreational releases	124.0	125.4	120.1	T
Matahina	Matahina	93254 (1)		65.5	65.2	65.3	T
Ohau (separate Tekapo model)	OhauRes	98614 (6)	Ohau A only, minimum flows of 12 m^3/s May to Oct and 8 m^3/s Nov to Apr	71.8	71.1	70.9	T
	Ohau	98614 (3)	Ohau B and C only	81.4	81.1	80.9	T

Pukaki, Tekapo	Tek_puk	98615 (1)	No Tekapo - Pukaki simulation, one combined flow for both Pukaki and Tekapo	210	208.3	207.9	C
Pukaki	Pukaki	98614 (2)	Pukaki + Tekapo for separate Tekapo simulation	208.0	206.8	206.3	C
Natural Pukaki	Nat_Puk	98770 (1)	Natural Lake Pukaki Inflow	128.0	127.0	126.8	T
Rangipo	RangipoTPD	92790 (2)	Sub-catchment inflows are based on non-linear function of Taupo inflows. Incorporates latest water right discharges.	35.6	35.7	35.7	T
Rangipo	Rangi_linear	22790 (2)	Linear correlations of Taupo natural inflows used	29.4	29.5	29.5	C
Roxburgh	Roxburgh	99110 (1)	Tributary flows – but excluding Hawea outflows	445	446.4	445.1	T
TeAnau	Teanau	9570 (1)	Te Anau Inflows	284.0	284.9	284.2	C
Tekapo	Tekapo	98614 (1)	Separate Tekapo simulation	79.3	79.8	79.6	T
Natural Tekapo	Nat_Tek	98770 (2)	Natural Lake Tekapo Inflow	81.0	81.3	81.1	T
Tokaanu	TokaanuTPD	92790 (3)	Non linear correlations of Taupo natural inflows used	53.6	53.7	53.8	T
Tokaanu	Toka_Linear	22790 (3)	Linear correlations of Taupo natural inflows used	54.8	54.5	54.5	C
Taupo	TaupoTPD	92790 (1)	Sub catchment inflows non linear functions of Taupo inflows	158.0	158.8	158.9	C
Taupo	Taupo_Linear	22790 (1)	Linear correlations of Taupo natural inflows used	156.0	156.7	156.8	C
Taupo	Taupo_Oper	42790 (1)	Rating distribution correlates TPD flow and Taupo inflow, from 1993 to 2005. Reflects the current operating regime.		153.1	153.1	C 6
Waikaremoana	Waikaremoana	3650 (1)	Waikaremoana Inflows	18.0	17.3	17.8	C
Waitaki P.S. Tribs	Waitaki	98714 (2)	Waitaki Tributary flows between Lakes Pukaki & Tekapo and Waitaki Power Station	148.0	152.6	152.2	T
Wanaka	Wanaka	9154 (1)	Wanaka outflows	197.0	197.8	197.3	T

T denotes a tributary, uncontrolled flow.
C denotes a controllable, lake inflow.
(*) Denotes item number of Tideda file

Table 2.2 Flow dataset names and mean values derived from the Additional SPECTRA update and this update.

Flow	Model flow name	Site Number	Description	Mean Flow (cumecs)			Type
					1931 to Jun 2005	1931 to Jun 2006	
Waiau	Clarence	162107 (1)	Waiau River flow at Clarence at Jollies recorder		14.7	14.6	T
	Glenhope	164604 (1)	Waiau River flow at Waiau at Glenhope recorder		33.4	33.2	T
	Marble	164602 (1)	Waiau River flow at Waiau at Marble Point recorder		95.2	94.8	T
Ngarururoro	WhanaWhana	123103 (1)	Ngarururoro River flow at Ngarururoro at Whana Whana recorder		35.4	35.4	T
	Kuripapango	123104 (1)	Ngarururoro River flow at Ngarururoro at Kuripapango recorder		17.7	17.7	T
	Chesterhope	123150 (1)	Ngarururoro River flow at Ngarururoro at Chesterhope recorder		43.8	43.9	T
Wairau	DipFlat	160114 (1)	Wairau River flow at Wairau at Dip Flat recorder		26.5	26.5	T
Hurunui	Mandamus	165104 (1)	Hurunui River flow at Hurunui at Mandamus recorder		51.5	51.3	T
	SH1	165101 (1)	Hurunui River flow at SH1 Bridge		67.0	66.8	T
Mohaka	Raupunga	121801 (1)	Mohaka River flow at Mohaka at Raupunga		79.2	79.3	T
Monowai[(1)]	Mono_Inflow	199540 (1)	Monowai Power Station inflow		13.0	15.3	C
Wheao	Wheao	15462(1)	Wheao/Flaxy Power Station outflow		-	13.0	C
Patea	Patea	34300(1)	Patea Power Station outflow		-	18.4	C
Highbank	Highbank	7968(1)	Highbank Power Station outflow		-	13.4	C
Kaimai	Wairoa	14130(1)	Wairoa River flows above Ruahihi		-	11.8	C

Note [(1)]: At present Monowai inflow is based on a correlation with Lake Te Anau inflow. However in future inflows will be calculated via an inflow routine or supplied by Pioneer Generation who owns Monowai power station.

T denotes a tributary, uncontrolled flow.
C denotes a controllable, lake inflow.
(*) Denotes item number of Tideda file

3 Dataset construction

3.1 Data sources

The SPECTRA data record for any particular site is often a composite record derived using different methods for different periods. The following table (Table 3.1) lists the source of the record for each site and period. Three basic methods are identified, on which there may be variations:

1. Correlation - data is synthesised based on correlation with another site, the source site is noted in brackets.

2. Simulation - data is calculated by a model of the scheme, sometimes the model may be very complex (e.g. Tongariro Power Development) and other cases may simply involve adding or subtracting one site from another. In the later case an "(A)" is used to indicate essentially "Actual" data.

3. Actual - actual recorded data is used for the site.

As indicated above, where records are not available or a scheme component was not commissioned for the early part of the period, such as the Ahuriri River at Benmore prior to 1949, synthetic flows are often used based on correlation with some other flow record. This procedure can ensure that the mean, standard deviation etc. of the simulated flow are as accurate as statistical methods allow, but it has the unavoidable feature that the high and low flows in the simulated flow follow those of the site to which they are correlated. This can result in more extreme events in the overall generation system than would actually have occurred, or alternatively it may result in a slightly compressed record with fewer extremes. As most of the simulated flows are relatively small, this is unlikely to have a major effect except if there is a focus on a specific flow event.

Table 3.1 Source of SPECTRA Data Records at Each Site

Site	Period	Source
Matahina	01/07/31 - 09/06/48	Correlation (Taupo)
	09/06/48 - 01/06/67	(Rangitaiki @ Te Teko)
	01/06/67 - 19/07/98	Actual
	19/07/98 – 1/1/2005	Synthetic
	1/1/2005 - present	Actual
Karapiro tributaries	01/07/31 - 07/07/47	Correlation (Arapuni)
	07/07/47 - 30/06/06	Simulation (A)
Arapuni tributaries	01/07/31 - 30/06/06	Simulation (A)
Taupo	01/07/31 - 30/06/06	Simulation (A)
Rangipo	01/07/31 - 30/06/06	Simulation
Tokaanu	01/07/31 - 30/06/06	Simulation

Waikaremoana	01/07/31 - 30/06/06	Actual
Mangahao	01/07/31 - 28/03/34 28/03/34 - 22/11/45 22/11/45 - 01/07/97 01/07/97 - 01/01/05 1/1/2005 – 30/06/06	Simulation Actual Simulation(rainfall) Synthetic Actual
Cobb	01/07/31 - 28/03/34 28/03/34 - 22/11/45 22/11/45 - 30/06/06	Correlation (Coleridge) Correlation (Gowan) Actual
Coleridge	01/07/31 - 01/07/97 01/07/97 – 1/1/2005 01/01/05 – 30/06/06	Actual Synthetic Actual
Grey + Taramakau (no Taipo)	01/07/31 – 1/1/78 1/1/78 -30/06/06	Correlation (Te Anau) Actual Data
Pukaki + Tekapo (S)	01/07/31 - 30/06/06	Simulation (A)
Tekapo A (S)	01/07/31 - 30/06/06	Simulation
Pukaki + Tekapo (C)	01/07/31 - 30/06/06	Simulation
Natural Pukaki	01/07/31 - 30/06/06	Simulation (A)
Natural Tekapo	01/07/31 - 30/06/06	Actual
Ohau (S)	01/07/31 - 30/06/06	Actual
OhauRes (S)	01/07/31 - 30/06/06	Simulation (A)
Benmore tributaries (S)	01/07/31 - 30/06/06	Simulation
Benmore tributaries (C)	01/07/31 - 30/06/06	Simulation (A)
Waitaki tributaries (C)	01/07/31 - 30/06/06	Simulation (A)
Roxburgh tributaries (Roxburgh.sim)	01/07/31 - 30/06/06	Simulation (A)
Hawea	01/07/31 - 30/06/06	Actual
Wanaka	01/07/31 - 30/06/06	Actual
Manapouri (w. Mararoa)	01/07/31 - 30/06/06	Simulation
Manapouri (w.o. Mararoa)	01/07/31 - 30/06/06	Simulation (A)
Manapouri (water right reduction)	01/07/31 - 30/06/06	Simulation
Te Anau	01/07/31 - 30/06/06	Actual
Clarence at Jollies	01/07/31 - 27/03/34 28/03/34 - 31/12/59 01/01/60 - 30/06/06	Synthetic Correlation (Gowan) Actual
Waiau at Glenhope	01/07/31 - 31/01/74 31/01/74 -06/07/99 09/07/99 - 27/09/03 27/09/03 - 30/06/06	Correlation (Clarence) Actual Correlation (Clarence) Actual
Waiau at Marble Point	01/07/31 - 06/10/67 06/10/67 - 30/06/06	Correlation (Clarence) Actual
Ngaruroro at Whana Whana	01/07/31 - 31/08/60 01/09/60 - 30/06/06	Correlation (Lake Waikaremoana inflow) Actual
Ngaruroro at Kuripapango	01/07/31 - 19/09/63 20/09/63 - 30/06/06	Correlation (Whana Whana) Actual
Ngaruroro at Chesterhope	01/07/31 - 25/11/76 25/11/76 - 30/06/06	Correlation (Whana Whana) Actual

Wairau at Dip Flat	01/07/31 - 29/03/34 30/03/34 - 31/05/51 01/06/51 - 30/06/06	Synthetic Correlation (Gowan) Actual
Hurunui at Mandamus	01/07/31 - 29/03/34 30/03/34 - 25/10/56 26/10/56 - 30/06/06	Synthetic Correlation (Gowan) Actual
Hurunui at SH1 Bridge	01/07/31 - 13/12/74 13/12/74 - 18/06/99 18/06/99 - 30/06/06	Correlation (Mandamus) Actual Correlation (Mandamus)
Mohaka at Raupunga	01/07/31 - 28/02/57 01/03/57 - 30/06/06	Correlation (Lake Waikaremoana Inflow) Actual
Monowai Inflow	01/07/31- 30/06/07	Synthetic
Wheao	2/01/99 - 25/07/07 1/07/1931 - 1/0199	Actual Synthetic
Patea	2/04/99 - 26/07/07 1/07/1931 - 1/04/99	Actual Synthetic
Highbank	6/06/02 - 26/07/07 1/05/51 - 19/05/98 01/07/31 - 30/04/51 20/05/98 - 05/06/02	Actual Actual Synthetic Synthetic
Kaimai	11/07/93 – 8/02/07 01/07/31 – 10/07/93	Actual Synthetic

Key: (S) **S**eparate Tekapo simulation (C) **C**ombined Pukaki and Tekapo simulation
(A) Essentially **A**ctual data with minor simulation

4 Description of historical SPECTRA datasets

4.1 Matahina

Flows are available for the Matahina Power Station since it's commissioning in 1967. From 1948 to 1967 flows are simulated from the Rangitaiki River at Te Teko and prior to 1948 from Lake Taupo outflow.

Feedback has highlighted that synthetic data prior to 1948 is considered to be inconsistent with data after 1948, with the standard deviation being 50% lower than. Correction of this inconsistency is being currently discussed.

4.2 Waikato (Arapuni and Karapiro)

The flow that each station receives can be broken down into two components. The controllable flow released from the Lake Taupo gates, and the tributary flow, which enters the Waikato between Lake Taupo and the stations. For the SPECTRA flow files, tributary flow is calculated at Arapuni and Karapiro. Flow records at Karapiro do not begin until 1947; however, earlier record has been simulated from the Arapuni record.

Tributary flows at Arapuni are calculated simply by subtracting the Taupo outflows from the outflows at Arapuni.

Karapiro tributary flows are calculated similarly for the period of actual record (470707 - 970701) and are simulated from Arapuni tributary flows, scaled up by 20%, for the period before 1947 (Halliburton, December 1993).

Feedback has highlighted that trib flow after 1995 for Karapiro/Arapuni is 54% of the flow prior to 1995. Mean tirb flow before 1995 is 15m^3/s, after 1995 is 3 m^3/s. Correction of this inconsistency is being currently discussed.

4.3 Tokaanu, Rangipo and Taupo

For the SPECTRA modelling, the required flows associated with the Tongariro Power Development (TPD) are those inflows available for generation at Tokaanu and Rangipo Power Stations and the inflows to Lake Taupo. In order to determine these flows however, several component flows at diversion points must first be determined. A series of operations using recorded data from the rivers, reservoirs and diversion canals of the TPD culminate in two TIDEDA simulation programs called "TAUPOFUN.SIM" and "TAUPOTPD.SIM" which model the river flows and current scheme operation respectively. These two simulation programs supersede the original simulation program TAUPO.SIM

The linear dataset (site number 22790) was the original dataset for TPD flow calculation. It has now been superseded by the TPD datasets (site number 92790) but is still included for historic reference. For SPECTRA the 92790 TPD datasets should be used.

An additional TPD dataset has been created in this SPECTRA update. This operational inflow dataset (site number 42790) more accurately represents the true TPD operating regime, as specified in the 1992 Waikato River consent hearing. An outcome from this hearing was a decrease in the diversion take as residual flow in the Whakapapa Stream was increased to 3 m^3/s. This site differs from the 92790 TPD dataset which also adjusts for post 1992 hearing conditions, but does not optimise diversion flows, and is based on the actual operating regime of the TPD diversion from 1993 to 2005.

Net Taupo outflows

Subtract recorded diversion flows (Wairehu Canal and Moawhango Tunnel) from Taupo outflows to give net Taupo outflows.

Taupo natural inflows

Use TAUPOIN.EXE to calculate natural inflows to Lake Taupo from net outflows and lake levels.

Outline of TAUPOFUN.SIM

Use full record of Taupo Natural Inflows as input to TAUPOFUN.SIM
Apply non-linear transformations to Taupo natural inflows, to simulate flows at the following locations in the scheme.

- Western Diversion with no minimum flow rules
- Tongariro at Turangi natural flows
- Natural inflow to Lake Rotoaira
- Natural inflows to the lower Tongariro above Turangi and downstream of Poutu Dam and Poutu Intake
- Natural inflows to the middle Tongariro between Rangipo Dam and Poutu Intake
- Natural flows in the Tongariro River at Rangipo Dam
- Natural flows in the Waihohonu Stream at Waihohonu Tunnel
- Natural inflows to Lake Moawhango
- Flows in the Wahianoa Aqueduct at Mangaio Tunnel
- Natural flows in the Whanganui River at Te Maire
- Write results to an intermediate TIDEDA file.

Merge modelled natural flows

Overwrite modelled flows in the intermediate file at all locations listed above (except Wahianoa Aqueduct) with simulated natural flows based on recorded data.

Outline of TAUPOTPD.SIM

- Model effect of Te Maire minimum flows to reduce Western Diversion flows
- Add Waihohonu tunnel flows to Rangipo and subtract from mid Tongariro
- Add Wahianoa flow to Moawhango inflow
- Model Lake Moawhango operation and Moawhango Tunnel flows
- Determine Poutu spill required
- Determine Rangipo spill required
- Determine if Rangipo (and Moawhango) should be shut down because flows too high
- Calculate total available flow at Rangipo
- Calculate total available flow at Tokaanu
- Calculate Taupo inflow including diversion flows for full record

More detail is given for the various components below:

Net Taupo outflows. - Because the next step uses an algorithm based on the idea of natural river flow recessions, the net outflows are needed rather than the total outflows as recorded. Taupo net outflows are those that would have occurred if no additional water was diverted into the catchment.

Taupo natural inflows - a lake inflow algorithm that takes lake levels and net outflows and calculates inflows that have realistic recession shapes is also used, so that the resulting inflow time series is useable for simulation of natural flows at other locations. Previous inflows have had erratic behaviour especially at low flows, caused by fluctuations in recorded levels due to atmospheric effects on the lake, and fluctuations in outflows due to generation requirements. Taupo natural inflows are those, which would have flowed into Lake Taupo anyway, and so no adjustment is necessary here. It is the Taupo Natural inflow record which is used to extend shorter low flow records, and to simulate the flows that would have occurred at various sites, had they been as they are today back in 1931.

Flow Transformations - Data recorded in the rivers and diversions of the scheme has been used to model natural flows at various locations since 1960 when data recording began. The results of this work, done mostly as part of resource consent studies and for the Whanganui Minimum Flows Appeal, has been used to derive a set of non-linear transformations. These quasi-quadratic functions allow the transformation of Taupo natural inflows into time series that preserve the flow distribution of the modelled series. This means that not only the mean, but also higher order moments of the modelled series, are preserved, whereas linear regressions preserve the mean unless the relationship modelled is in fact linear. These considerations are particularly important when using the modelled series to simulate rules that involve minimum flows and flood flows.

Merge modelled natural flows - Application of the flow transformations is for the full length of record (1931 to present). A better estimate of natural flow at each location since approximately 1960 can be gained by using the model data that was used to derive the transformations. This has the advantage that during extreme vents, flows at all sites will be

independently measured, rather than a scaled version of Taupo inflows. The true magnitude of extremes will thus be better estimated.

Western Diversion - The flow in the Western Diversion, as if it were run with no releases down the Whakapapa River, is modelled by transforming Taupo natural inflows. The result is a 'natural' looking hydrograph with a maximum value of 41.6 cumecs. Flow in the Whanganui River at Te Maire is also modelled by transforming Taupo natural inflows. The Western Diversion flow is subtracted from The Te Maire flow, and the result tested against the new minimum flow rule (29 cumecs from 1 December to 31 May each year, no rule at other times). If the rule is violated, water is released from the Western Diversion to meet it. At times this means no diversion.

Eastern Diversion and Tongariro - Inflows to various parts of the Tongariro River are determined. Flows above Rangipo are derived by subtracting modelled flows there from modelled flows at Turangi. Waihohonu River diversion flows and Moawhango Inflows (including Wahianoa Aqueduct flows) are calculated and the total flows at Rangipo (RangipoTPD) are then determined by adding these to the Tongariro flow at Rangipo.

The contribution to flow at Tokaanu from the Tongariro River is calculated by adding Rangipo inflows to the Tongariro inflows between Rangipo and Poutu and subtracting Poutu spill (Moawhango Tunnel contribution is included at each step so that the tunnel capacities are properly dealt with).

Rotoaira local inflows are calculated and the minimum release (0.6 m^3/s) down Poutu Stream is subtracted. Finally the Western Diversion flows and Poutu Tunnel flows are added to the Rotoaira local inflows and water diverted from the Tongariro River to establish the total flow available at Tokaanu Power Station (TokaanuTPD).

Taupo Inflow - The total inflow to Lake Taupo (TaupoTPD), incorporating diverted water, is the last to be determined. This is achieved by subtracting the diverted component of the natural Tongariro flows from the Taupo Natural inflows and then adding the total flow diverted into Lake Rotoaira.

Operational Taupo Inflow – TPD flows were subtracted from the Taupo inflow record then rated against the recorded TPD inflows, for the period between 1993 and 2005. The very strong linear correlation (r^2 = 0.9911) was used to extend the TPD flows back to 1931. Actual TPD flows since 1 September 1992 are used.

The dataset should be used if water balance modelling is done, however the Taupo TPD dataset is more similar to inflow datasets because optimal water table (within consents etc) is included in the dataset.

4.4 Waikaremoana

Inflow records for Lake Waikaremoana exist back to 1929 and for the purposes of the SPECTRA flow files these are simply reduced to average weekly values. Inflows to individual scheme components are not available and so inflows are based on flows at Tuai

Power Station. These include leakage but do not include water spilt at the Kaitawa gates, which is not recaptured at the Whakamarino canal intake.

Waikaremoana inflow data has recently been revised and improved and the methods used to recalculate inflows can be found in Works Consultancy Services Ltd "*Hydrological Data Reference Manual; Lake Waikaremoana Inflow Data 1929 to 1995"* (April 1996).

From June 2001 onwards Genesis has calculated Waikaremoana inflows. Data supplied for this and the previous update suffered from negative inflows due to leakage associated with Lake Waikaremoana. Negative inflows supplied in the previous dataset were set to zero but as this is an ongoing problem data is presented as supplied.

Until this problem is rectified negative inflows will exist in the Waikaremoana dataset. Genesis state they are working on ways to solve this inflow issue.

4.5 Mangahao

Due to the limited data available for the Mangahao Power Scheme a simulated No.2 reservoir inflow record has been produced (Freestone & Maslin, October 1991). The No.2 inflow record represents 97% of the total scheme inflow; the remaining 3% comes from the Arapeti (No.3) catchment. The synthetic record is based on a series of different methods each considered appropriate for a particular period of the scheme's history. A trend is apparent when the cumulative deviation from the mean is examined for the synthetic record; however this has been compared with the Manawatu River record and is considered to be real.

The composite flow record is filed on the Power Archive and the only processing required for SPECTRA flows is a simple scaling to allow for inflows from the Arapeti (No.3) catchment.

Mangahao PS machine flows (site 5028) have been recalculated from 20 September 1994 since the previous SPECTRA update. Machine flows have been calculated using a modified cumecs per megawatt ratio based on analysis of individual machine loads (G1, G2 and G3) and accusonic data over the 1996 period. Revised cumecs/MW ratios of 0.431 (G1 Francis) and 0.503 (G2 and G3 Peltons) have been calculated.

Mangahao data from 8 October 1997 to 30 June 2006 is actual data. Inflow data is based on spill from the number 2 dam and machine generation.

This dataset is currently under review. Both the historic synthetic data and actual data supplied by Mangahao are being analysed. Correction of this inconsistency is being currently discussed.

4.6 Cobb

Prior to 1945, inflow to the Cobb reservoir was not recorded. Previously it has been simulated back to 1931 based on correlation with Lake Coleridge inflows. The 1993

SPECTRA flow files update used an improved method, utilising Lake Rotoroa outflows for the correlation for the period the data was available, i.e. post 1934 (Palmer, January 1992 and Maslin *et al*, February 1993), the first few years, however, are still based on Coleridge.

The early (pre 1951) Lake Coleridge inflows have recently been amended. From July 1931 to March 1934 these inflows are used to correlate inflows to the Cobb reservoir.

This correlation was reassessed for the May 1996 update and an unsatisfactory R^2 value was obtained. After discussion with Lennie Palmer, ECNZ Generation, it was decided to continue with the value (0.224) in the existing PSIM, which is based on the correlation of mean inflows at Coleridge and Cobb.
From March 1934 to November 1945 the inflows are based on a correlation with Gowan at Rotoroa.

From November 1945 to present, the inflows are calculated from actual outflow records with an allowance for change in lake storage.

Feedback from the draft SPECTRA report highlighted inconsistent flows exist prior to 1945. The standard deviation is 50% of the data after 1945. Correction of this inconsistency is being currently discussed.

4.7 Grey River

Scheme Description

Data for the Grey River is used for investigative work on the feasibility of a Power Station on the river. A proposed scheme involves diverting water from the Taramakau River into the Grey, via a canal and the Arnold River (Figure 4.7.1). Other proposals have also included diversion of the Taipo River; however data here **does not include Taipo**.

The recording site used on the Grey River is located at Dobson at the downstream end of the Brunner Gorge. The site is approximately 10 km upstream of the mouth and has a catchment area of 3830 km^2. Data for the Taramakau River is from the Taramakau at Greenstone Bridge water level recording site, which is downstream of the Taramakau/Taipo confluence and has a catchment area of 863 km^2.

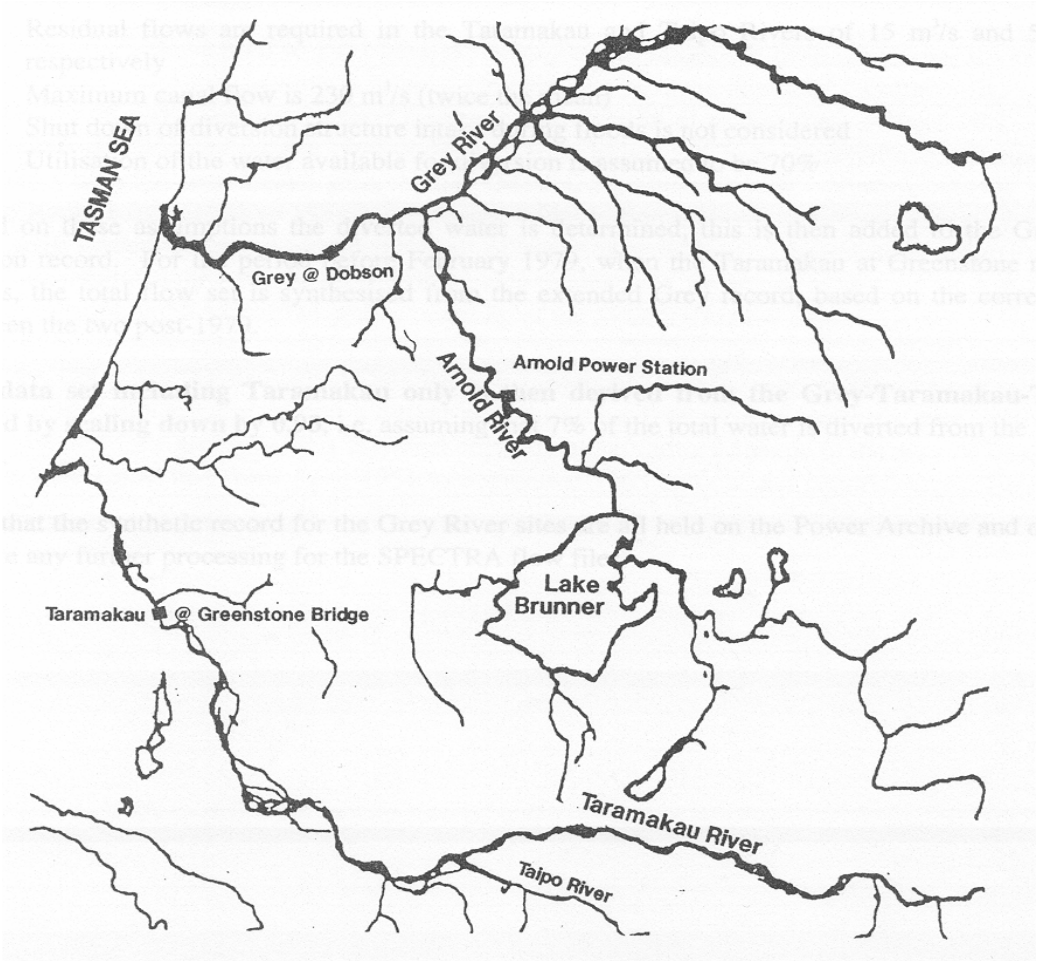

Figure 4.7.1 Location Map for Grey, Taramakau and Taipo

Record for the Grey River at Dobson is available from July 1968 until present. Earlier record is synthesised from the Buller River at *"Berlins"* from 1952 to 1968, and from Lake

Te Anau inflow prior to 1952. Lake Te Anau gave the best results of the few records available for the early period from 1930 (Freestone & Mills, June 1990).

The dataset used in SPECTRA is the flow in the Grey River at Dobson, including water diverted from the Taramakau River. This is derived from another dataset that also includes water diverted from the Taipo River. This is because the Taramakau at Greenstone Bridge recorder includes Taipo river flow, as it is downstream of the Taipo confluence. The calculation of the combined Grey-Taramakau-Taipo data is outlined below.

To determine the flows available for diversion into the Grey some assumptions must be made, as there are no firm scheme details to go on. These are summarised as follows:

- Residual flows are required in the Taramakau and Taipo Rivers of 15 m^3/s and 5 m^3/s respectively
- Maximum canal flow is 230 m^3/s (twice the mean)
- Shut down of diversion structure intake during floods is not considered
- Utilisation of the water available for diversion is assumed to be 70%

Based on these assumptions the diverted water is calculated, this is then added to the Grey at Dobson record. For the period before February 1979, when the Taramakau at Greenstone record begins, the total flow set is synthesised from the extended Grey record, based on the correlation between the two post-1979.

4.8 Coleridge

The inflows into Lake Coleridge are the local catchment inflows plus inflows from diversions on the Wilberforce, Harper and Acheron Rivers. Diversions from the Harper and Wilberforce rivers cease when they are in flood and the diversion bunds are washed away. During the floods the only inflows are from the local lake catchment and the Acheron Diversion. There are also turbidity constraints imposed on the lake.

The inflows are calculated using the equation;

Inflow = outflow $\pm$ change in storage

where outflows include machine discharge, spill flow and the Oakden diversion outflows, and change in storage volume is calculated from measured lake levels (at the Power Station intake) and a lake level area relationship.

Lake Coleridge inflows prior to 1951 have previously been synthesised from the Harper River flows and have been somewhat lacking in quality. In 1993 a superior method of synthesising inflows was adopted for the 1993 updating. Then in late 1993 some early Power Station data for Lake Coleridge was loaded to computer (Maslin, November 1993). Historic weekly power Station Reports from 1928 to 1951 were located in the station archives and from these several data items were loaded which enabled the calculation of

actual lake inflows. The resulting inflow record was a substantial improvement on the previously synthesised flows and was used to replace the synthetic record in the May 1994 update of the SPECTRA flow files.

When the Coleridge "Hydrological Data Reference Manual" (Greer, Sept. 1994) was compiled the inflows were again scrutinised and a further period of record, recalculated with the pre 1951 dates, was replaced on the archive. This involved only a relatively minor change to the way in which the inflows were calculated from April 1951 to September 1963 and has not significantly affected the mean flow. Note that the efficiency of the diversion works varies and my affect flow trends.

There have been no changes to the data or the method of calculation since the January 1995 SPECTRA update.

Data from 26 January 1998 to 31 December 2002 is synthetic record. Since December 2002 actual data has been used.

4.9 Waitaki

For SPECTRA modelling, the flows in the Waitaki River are considered in two components, inflow to Lakes Pukaki and Tekapo and tributary inflows below the Lakes at Benmore and Waitaki Power Stations.

Pukaki and Tekapo Inflows - Three options available:

- Aggregate both lakes into one, and scale Tekapo A and B cumecs/MW factors by the ratio of the mean flows to ensure the correct mean generation with the combined flow. Flow set: Tek_Puk (Total inflows to both lakes) (controllable)

- Two-lake simulation of Tekapo-Pukaki system (i.e. separate Tekapo simulation). Lake Tekapo treated separately with a stand-alone TIDEDA simulation of its operation, intended to account for bottleneck effect of canal. Flow sets: Tekapo (trib), Pukaki (including Tekapo outflow) (controllable).

- Natural Inflows to each lake separately. Flow sets: Tek_nat and Puk_nat (Tributary).

Ohau - Ohau A is affected by residual flows in the Upper Ohau River.

Two simulations are run for Ohau based on separate Tekapo simulation of Tekapo - Pukaki system:

- Ohau - Ohau B & C only, no loss of water
- OhauRes - Residual flows diverted to the Upper Ohau River of 8 m^3/s (Nov to Apr) and 12 m^3/s (May to Oct).

Benmore Tributary - includes Ahuriri, Ohau, and tributaries between Tekapo, Pukaki, and Ohau outfalls. Prior to 1949 the Ahuriri was not measured, so it is simulated from Ohau inflows. After 1964 the flow gauging site was inundated by Lake Benmore, so a site further up the river at South Diadem is used, with a scaling factor to account for additional inflows. Small tributary flows in the areas between the major lakes and Benmore are accounted for by adding 33% to the Ahuriri flow.

There are two flows sets for Benmore Tributaries:

- BENMORE.DAT (mean 126 m^3/s) is based on the separate Tekapo simulation and includes Tekapo spill.
- BEN_TP.DAT (mean 124 m^3/s) is based on the combined lakes Tekapo-Pukaki simulation and is simply Ohau inflow plus Ahuriri scaled up by 1.33.

Waitaki Tributary - A separate tributary flow has also been produced for Waitaki power station (Halliburton, December 1993). Previously, Waitaki and Aviemore tributaries were scaled off Benmore. Waitaki tributary equals total Waitaki flow minus the outflow from lakes Tekapo and Pukaki. Prior to 22 August 1977 this is calculated from total discharge from each lake, whereas after that date it is calculated from total Pukaki discharge minus Tekapo spill only.

There are a number of gaps in the early Pukaki outflow record. A simulation has been incorporated into the updating routines, which fills these gaps with synthetic data based on Tekapo outflows.

Feedback from the draft SPECTRA output highlighted poor Waitaki flow data when compared to Benmore. Measuring inaccuracies produce large negative flows when compared to Benmore power station tribs. Meridian is working to solve these inaccuracies.

4.10 Clutha

Hawea – Flow from Lake Hawea are read directly from the Power Archive.

Wanaka Outflows - from Lake Wanaka are read directly from the Power Archive.

Roxburgh Inflows - Roxburgh Inflows are read directly from the Power Archive and Hawea outflows are subtracted.

4.11 Manapouri

SPECTRA Manapouri data is intended to be used as a tributary flow, whereas Te Anau is a controllable flow. Hence two separate files are required for SPECTRA. Inflows and outflows for Lake Te Anau are available from 1926 and for Lake Manapouri from May 1932. The local catchment, or tributary, contribution to Manapouri inflow is determined by subtracting the Te Anau outflows from the total Manapouri inflows. For the period before 30th April 1932 when the record at Manapouri began, the local inflows are simulated from Te Anau outflow.

For the purposes of SPECTRA modelling a record of Manapouri local inflows is required upon which future predictions of inflows can be based. To achieve this records are synthesised which either include or exclude the Mararoa River for the entire record. The Mararoa has been included in the Archive inflows since the commissioning of the Manapouri Power Station in August 1969. Outflow was first measured downstream of the Mararoa confluence (with power station flows added) (Duffy *et al*, October 1993).

Prior to the availability of actual Mararoa River records, and for filling gaps, synthetic flows are simulated from Te Anau outflows. The equations used were derived by Robertson *et al* (April 1989) and later confirmed by Maslin *et al* (February 1993).

Several options are available for the Manapouri flows:

1. With Mararoa diversion. Note that When Mararoa flows are above 40 cumecs, the Mararoa is spilled. This only approximates the actual operation of the Mararoa control structure. Also when Mararoa water is being spilled, it is not possible to avoid some clean water spill from Lake Manapouri.
2. Without Mararoa, which represents the view of a possible extreme outcome of water rights application.
3. With the minimum flow regime implemented and Mararoa dirty water spill.

Distribution plots are included at the end of this report that illustrates the results of the simulations and the effects on potential generation available.

The minimum flow regime was introduced to the model. Previously, the minimum flow was assumed to be a constant 15 cumecs throughout the year, although to date, there has not been a regular minimum flow except for a nominal minor flow through the fish pass. The 15 cumec figure was hypothetical only subject to pending consent hearings.

5 New SPECTRA datasets

5.1 Introduction

SPECTRA records have been assembled at a number of sites throughout New Zealand for proposed hydro-electric investigations. Opus has regularly provided the Electricity Commission (and its predecessors) with SPECTRA updates. The most recent report *Generator SPECTRA Update – Issue* 5 was completed in January 2006 to update flow data at all SPECTRA sites. A complete flow series was provided at all sites for the period between 1 July 1931 and 30 June 2005.

In our discussion with the Electricity Commission five further rivers have been identified where a complete record of flow data would be useful. These rivers are:

- Waiau River, Canterbury
- Ngaruroro River, Hawke's Bay
- Wairau River, Marlborough
- Hurunui River, Canterbury
- Mohaka River, Hawke's Bay

Complete flow records have been created at a number of sites on the above rivers for the period from 1 July 1931 to 30 June 2006. Few recording sites have data back to 1931 so the records have been extended through correlation with longer records. The Lake Waikaremoana inflow record was used to extend the Hawke's Bay records; the Gowan at Lake Rotoroa record and statistical analyses have been used to extend the Marlborough and Canterbury records.

This report describes how each record was extended and details some of the quality checks used to ensure the extended flows represent actual flows in the Rivers. Monthly data (PCAL) listings and daily flow distribution tables (PDISTS) are included in Appendix A. These enable checks against computer files/new data to identify any substantial changes in data.

5.2 Waiau River, Canterbury

Introduction

Four possible hydro-power scheme sites have been identified along the Waiau River. These are the Clarence to Waiau Diversion, Upper Waiau, Mid Waiau and Lower Waiau. SPECTRA records have been developed at three sites within the catchment; these are: Clarence at Jollies (Clarence diversion), Waiau at Glenhope (Upper Waiau), and Waiau at Marble Point (Mid Waiau). The Clarence diversion is important to a Waiau power scheme as flow from the Clarence catchment could be diverted into the Waiau catchment near

Hamner Springs to maximise generation. Figure 5.2.1 shows a location map for the possible Waiau River schemes.

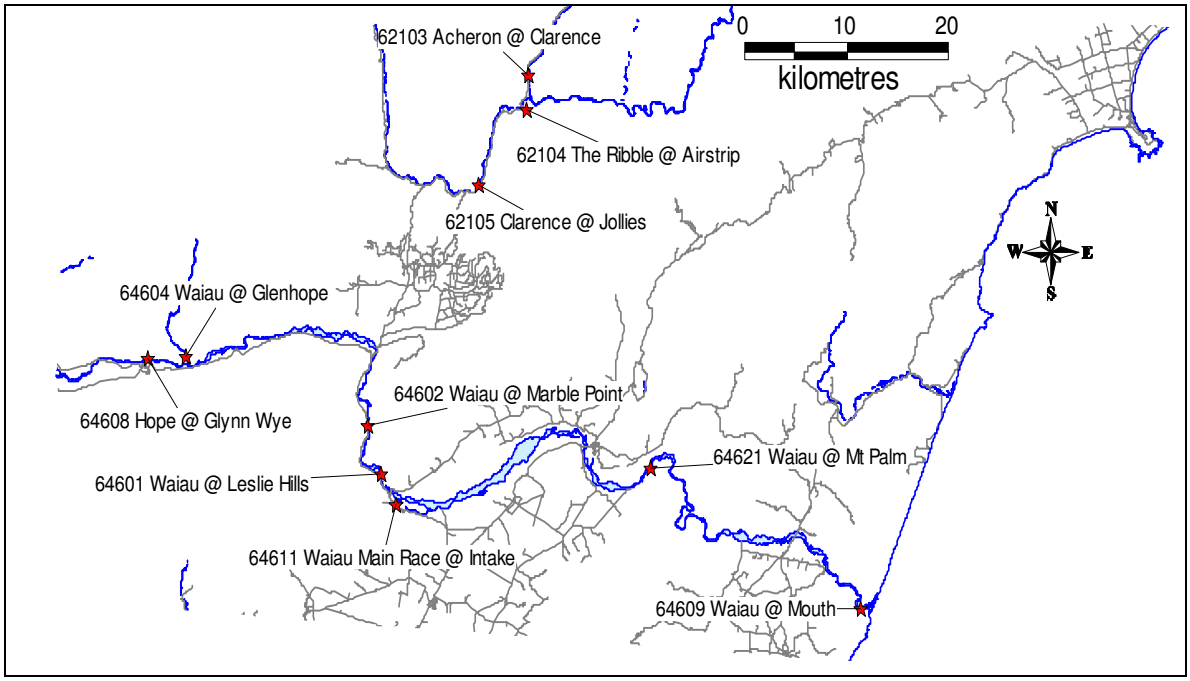

Figure 5.2.1 Waiau River Location diagram

5.3 Clarence at Jollies

The longest flow record in the vicinity of the Waiau River is the Clarence at Jollies recorder. This recorder extends back to 1960. The Clarence at Jollies recorder was correlated with the longer Gowan at Lake Rotoroa flow record to extend the SPECTRA series back to April 1934.

The best correlation was obtained through a flow distribution rating of the Gowan record (1934-1991). The distribution of flow in the resulting dataset is similar to the actual distribution of flow. However, the Gowan record is based on lake inflows so many flood peaks have been reduced. Actual data from the Clarence at Jollies record (1960 – 2006) replaces the rated data.

The first four years of record (1931-1934) were selected from average flows. The Works Consultancy Services Ltd produced a report in 1993 titled *Trends in Flow Data for Manapouri Local Inflows, Mangahao, Cobb, Coleridge Inflows and Waikato Tributary Flows*. Appendix III of the report specified ratios from sites throughout New Zealand of the mean annual inflow to the mean total record, since 1932. Ratios less than one indicated inflows to the site were less than average and hence a dryer year; ratios greater than one indicated inflows to the site were greater than average and hence a wetter year. The mean annual ratios at Lake Coleridge, which is the nearest site to the Waiau River, were 0.77, 0.65, and 1.05 during 1932, 1933, and 1934 respectively. 1932 and 1933 were dryer years than average.

The ratios were then applied to the total mean flow of the rated Clarence at Jollies record. Mean annual flows were determined for the three years and compared to annual flows from the entire record. Flows from years that had similar mean annual flows were replicated in the earlier record. Flows from 1956 are repeated in 1932, flows from 1969 are repeated in 1933 and flows in the first three months of 1953 are repeated in 1934.

The six months from 1 July 1931 to 31 December 1931 were replicated from the year 1936 with the mean annual flow nearest to the total record mean flow of 14.7 m^3/s. 1936 has a mean flow of 14.8 m^3/s.

Care was taken to maintain the water balance in the River. Table 5.3.1 details the mean flows during the record correlation phases. This flow has remained constant. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.3.1 Mean flow, Clarence at Jollies

Record	Record Length	Mean Flow (m^3/s)
Clarence at Jollies (62105)	1960-1999	14.9
Rated Clarence at Jollies*	1960-1999	15.0
Rated Clarence at Jollies	1931-2006	14.6

*Prior to superimposing the actual Clarence at Jollies record over the SPECTRA series

Although the mean flows compare well there is less flood peak amplitude in the correlated record 1931 to 1960. However, the overall water balance is good.

5.4 Waiau at Glenhope

The Waiau at Glenhope record begins in 1974. This record was extended back to 1931 through a distribution correlation with the extended Clarence at Jollies record. The distribution rating compared flow data over the period 1974 to 1999. The Glenhope site was not rated between July 1999 and September 2003. The correlated data from Clarence at Jollies filled this period. Actual data from the Waiau at Glenhope record is used when present.

Care was taken to maintain the water balance in the River. Table 5.4.1 details the mean flows during the record correlation phases. This flow has remained fairly constant. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.4.1 Mean flow, Waiau at Glenhope

Record	Record Length	Mean Flow (m^3/s)
Waiau at Glenhope	1974-1999	35.8
Rated Waiau at Glenhope*	1974-1999	35.7
Rated Waiau at Glenhope	1931-2006	33.2

*Prior to superimposing the actual Waiau at Glenhope record over the SPECTRA series

There is less flood activity in the synthetic record (pre 1974) and this may, when combined with the low flow period in the 1930's, produce an overall slightly lower long-term mean flow (2.3 m^3/s (6%) lower). The monthly flows (Appendix A) contain annual flows that are very similar over the actual and synthetic record periods.

5.5 Waiau at Marble Point

The Waiau at Marble Point record begins in 1967. This record was extended back to 1931 through a distribution correlation with the extended Clarence at Jollies record. The distribution rating compared flow data over the period 1967 to 2002. Data from February 2003 at the Marble Point site is provisional and was therefore not used in the distribution rating. Actual data from the Waiau at Marble Point record (1967 – 2006) is applied to the rated data.

Care was taken to maintain the water balance in the River. Table 5.5.1 details the mean flows during the record correlation phases. This flow has remained fairly constant. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.5.1 Mean flow, Waiau at Marble Point

Record	Record Length	Mean Flow (m^3/s)
Waiau at Marble Point	1967-2002	98.7
Rated Waiau at Marble Point*	1967-2002	98.8
Rated Waiau at Marble Point	1931-2006	94.8

*Prior to superimposing the actual Waiau at Marble Point record over the SPECTRA series

The slightly lower mean flow for the longer record (1931 to 2006) is due to a dry period in the 1930's and the reduced flood activity in the synthetic record. The monthly summary table (Appendix A) shows the annual maxima and minima for the actual and synthetic record periods are very similar.

5.6 Ngaruroro River, Hawke's Bay

Introduction

In the previous Opus report *Additional SPECTRA Investigations* (September 2005), five possible hydro-power schemes were identified along the Ngaruroro River. SPECTRA series have been developed at three of the flow recording sites to represent flows at these schemes. SPECTRA series have been created at Ngaruroro at Whana Whana, Ngaruroro at Kuripapango and Ngaruroro at Chesterhope Bridge. These sites are shown in Figure 5.6.1.

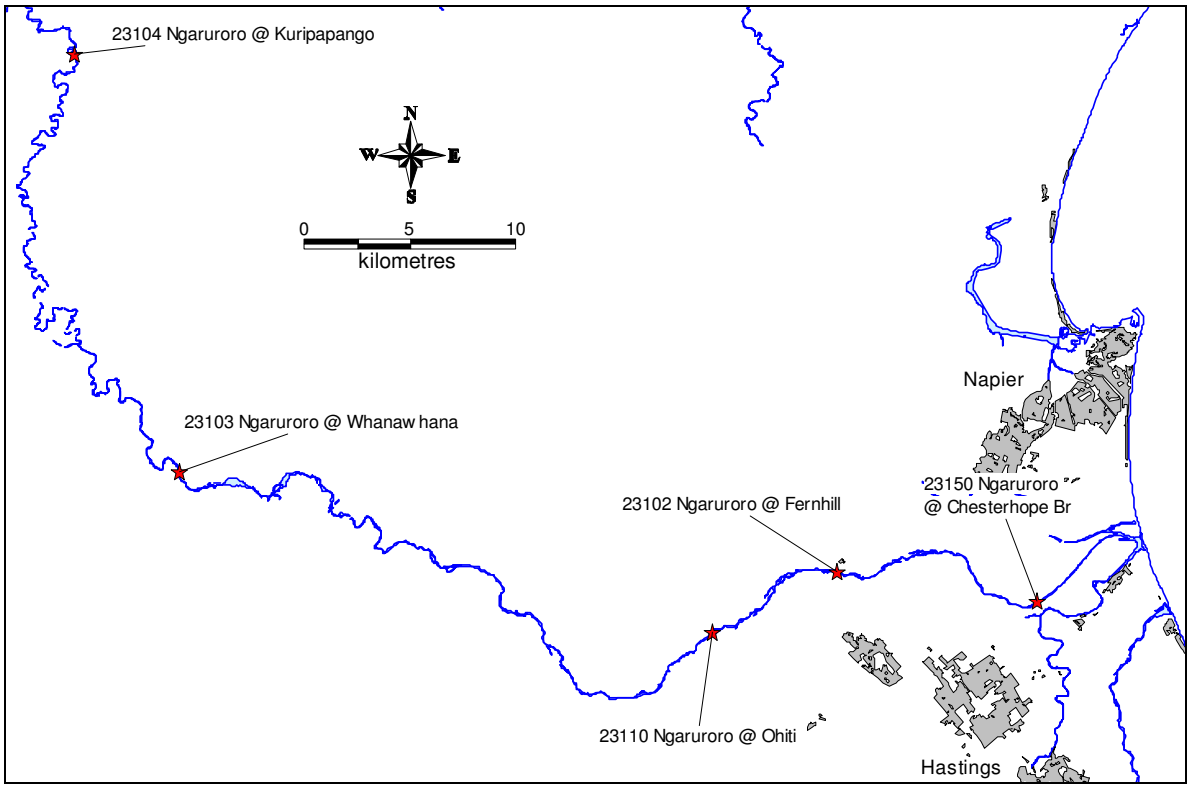

Figure 5.6.1 Ngaruroro River Location diagram

5.7 Ngaruroro at Whana Whana

The longest flow record in the vicinity of the Ngaruroro River is the Ngaruroro at Fernhill recorder. This record extends back to 1953. Unfortunately no gaugings were available at this site between 1974 and 2005 resulting in unreasonable flows. Consequently data from this period could not be used. The Ngaruroro at Whana Whana record, which extends back to 1960, is used instead. The Ngaruroro at Whana Whana recorder was correlated with the longer Lake Waikaremoana inflow record to extend the SPECTRA series back to July 1931.

The best correlation was obtained through a distribution rating of the Lake Waikaremoana record (1960-2001). The distribution of flow in the resulting dataset is similar to the actual distribution of flow. The Ngaruroro at Whana Whana record is used from 1960 to present.

Inflow to Lake Waikaremoana is calculated from lake level and outflow data. The resulting Ngaruroro at Whana Whana rated record between 1931 and 1960 has some lake level characteristics, including a greater number of flood events.

Care was taken to maintain the water balance in the River. Table 5.7.1 details the mean flows during the record correlation phases. This flow has remained constant. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.7.1 Mean flow, Ngaruroro at Whana Whana

Record	Record Length	Mean Flow (m^3/s)
Ngaruroro at Whana Whana	1960-2001	35.2
Rated Ngaruroro at Whana Whana*	1960-2001	34.9
Rated Ngaruroro at Whana Whana	1931-2006	35.4

*Prior to superimposing the actual Ngaruroro at Whana Whana record over the SPECTRA series

The monthly data displayed in Appendix A shows that there is slightly more variation in annual totals for the period of actual record. Also, summer flows in 1948 and 1954 are very low. In general the water balance (Table 5.7.1) is good.

5.8 Ngaruroro at Kuripapango

The Ngaruroro at Kuripapango record begins in 1963. This record was extended back to 1931 through a distribution correlation with the extended Ngaruroro at Whana Whana record. The distribution rating compared flow data over the period 1963 to 2006. Actual data from the Ngaruroro at Kuripapango record is applied to the rated data.

Care was taken to maintain the water balance in the River. Table 5.8.1 details the mean flows during the record correlation phases. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

The monthly data in (Appendix A) confirmed the longer duration similarity between the synthetic and recorded data.

Table 5.8.1 Mean flow, Ngaruroro at Kuripapango

Record	Record Length	Mean Flow (m^3/s)
Ngaruroro at Kuripapango	1963-2005	17.2
Rated Ngaruroro at Kuripapango*	1963-2005	17.1
Rated Ngaruroro at Kuripapango	1931-2006	17.7

*Prior to superimposing the actual Ngaruroro at Kuripapango record over the SPECTRA series

5.9 Ngaruroro at Chesterhope Bridge

The Ngaruroro at Chesterhope Bridge record begins in 1976. This record was extended back to 1931 through a distribution correlation with the extended Ngaruroro at Whana Whana record. The distribution rating compared flow data over the period 1976 to 2006. Actual data from the Ngaruroro at Chesterhope Bridge record is applied to the rated data. Gaps in the Chesterhope Bridge record are filled from the synthetic data.

Care was taken to maintain the water balance in the River. Table 5.9.1 details the mean flows during the record correlation phases. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.9.1 Mean flow, Ngaruroro at Chesterhope Bridge

Record	Record Length	Mean Flow (m^3/s)
Ngaruroro at Chesterhope Br	1976-2005	41.8
Rated Ngaruroro at Chesterhope Br*	1976-2005	41.3
Rated Ngaruroro at Chesterhope Br	1931-2006	43.9

*Prior to superimposing the actual Ngaruroro at Chesterhope Br record over the SPECTRA series

The data showed very low summer flows in 1948 and 1954. The rest of the synthetic data is reasonable.

5.10 Wairau River, Marlborough

Introduction

The proposed scheme in the Wairau River is an extension of Trustpower's Branch River hydro-electric scheme. It would involve diverting water from the Wairau River into the existing Branch scheme through interconnecting canals and penstocks to new power stations. The tailrace of the last station would be approximately 25 km southwest of Blenheim. The Wairau at Dip Flat record is important for this scheme. Figure 5.10.1 is a location map of possible power schemes for the Wairau River.

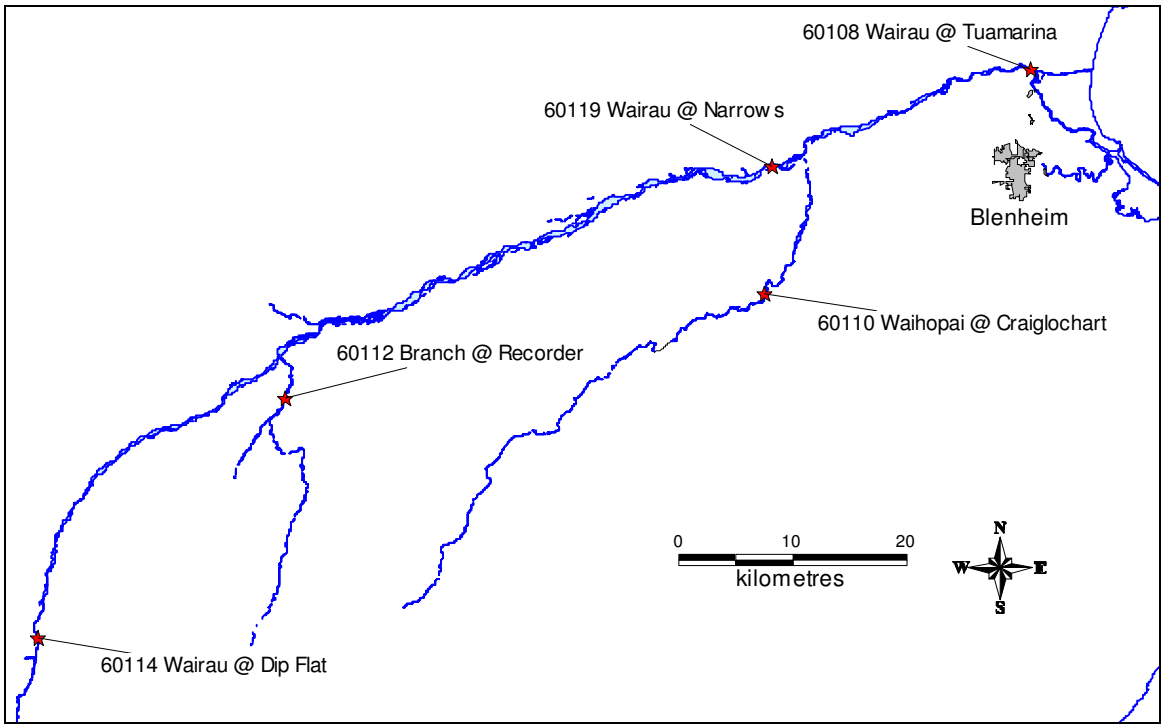

Figure 5.10.1 Wairau River Location diagram.

5.11 Wairau at Dip Flat

The longest flow record in the vicinity of the Wairau River is the Wairau at Dip Flat recorder. This record extends back to 1951. The Wairau at Dip Flat recorder was correlated with the Gowan at Lake Rotoroa flow record to extend the SPECTRA series back to April 1934.

The best correlation was obtained through a distribution rating of the Gowan record comparing flow data over the period 1934-1991. The distribution of flow in the resulting dataset is similar to the actual distribution of flow. Actual data from the Wairau at Dip Flat record (1951-2006) is used.

As with the Waiau extension, the first four years of record were selected from average flows from the Works Consultancy Services Ltd report titled *Trends in Flow Data for*

Manapouri Local Inflows, Mangahao, Cobb, Coleridge Inflows and Waikato Tributary Flows (1993). The mean annual inflow ratios (averaging ratios from Mangahao and Coleridge) were 0.805, 0.795, and 0.995 in 1932, 1933, and 1934 respectively. This period was dryer than average.

The ratios were applied to the total mean flow of the correlated Gowan record (1934-2006, including actual data from the Wairau at Dip Flat record from 1951). Mean annual flows were determined for the three years and compared to annual flows from the entire record. Flows from years that had similar mean annual flows were replicated in the earlier record. Flows from 1941 are replicated in 1932 and 1933, and flows in 1954 are replicated in the initial three months of 1934.

The six months from 1 July 1931 to 31 December 1931 were replicated from the year with the nearest mean annual flow to the total mean flow of 26.6 m^3/s (1934-2006). 1976 has a mean flow of 26.7 m^3/s. The six months of record from 1 July 1976 to 31 December 1976 are replicated in 1931.

Gaps in the record were filled from correlation with the Wairau at Hells Gate record (1965-1975) and the Wairau at Tuamarina site (1989-1999) which was replaced with the Barnett's Bank recorder 390 m upstream (1999-2006).

Care was taken to maintain the water balance in the River. Table 5.10.1 details the mean flows during the record correlation phases. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.10.1 Mean flow, Wairau at Dip Flat

Record	Record Length	Mean Flow (m^3/s)
Wairau at Dip Flat	1951-1991	26.7
Rated Wairau at Dip Flat*	1951-1991	27.0
Rated Wairau at Dip Flat	1931-2006	26.5

*Prior to superimposing the actual Wairau at Dip Flat record over the SPECTRA series

The monthly and annual data in Appendix A shows that the synthetic and actual segments of the record have similar patterns and extremes, although the synthetic low flows may be slightly higher at times.

5.12 Hurunui River, Canterbury

Introduction

There are two options for a proposed hydro-power scheme along the Hurunui River. The first is upstream of State Highway 1 Bridge near the mouth of the River. The second possible site is upstream of the Hurunui at Mandamus site. These sites are shown in Figure 5.12.1.

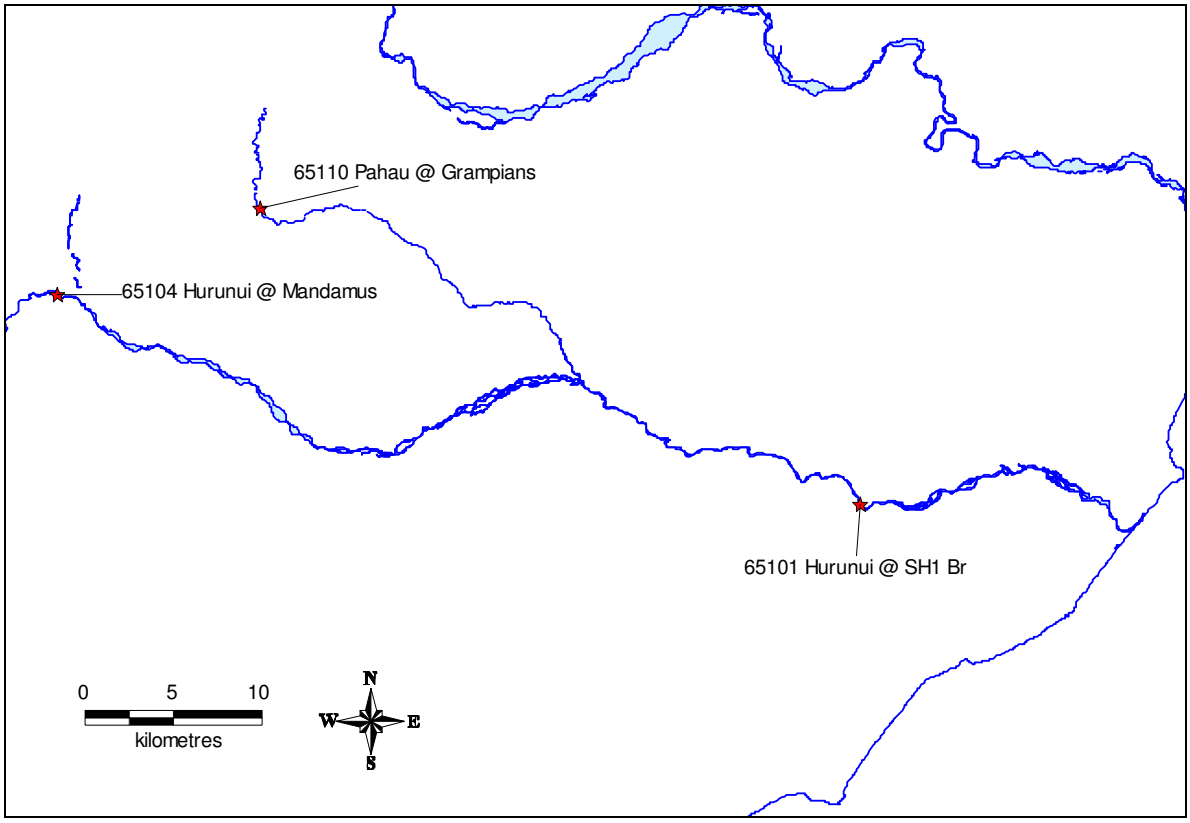

Figure 5.12.1 Hurunui River Location diagram

5.13 Hurunui at Mandamus

The longest flow record in the vicinity of the Hurunui River is the Hurunui at Mandamus recorder. This record extends back to 1956. The Hurunui at Mandamus record was correlated with the longer Gowan at Lake Rotoroa flow record to extend the SPECTRA series back to 1934.

The best correlation was obtained through a distribution rating of the Gowan record comparing flow data over the period 1934-1991. The distribution of flow in the resulting dataset is similar to the actual distribution of flow. However, the Gowan record is based on lake inflows so flood peaks are often smoothed. The Hurunui at Mandamus record is used from 1956 to present.

As with the Waiau extension, the first four years of record were selected from average flows from the Works Consultancy Services Ltd report titled *Trends in Flow Data for Manapouri Local Inflows, Mangahao, Cobb, Coleridge Inflows and Waikato Tributary Flows* (1993). The mean annual inflow ratios at Coleridge were 0.77 in 1932, 0.65 in 1933, and 1.05 in 1934.

The ratios are applied to the total mean flow of the correlated Gowan at Lake Rotoroa record (1934-2006, including actual Hurunui at Mandamus data from 1956). Mean annual flows were determined for the three years and compared to annual flows from the entire record. Flows from years that had similar mean annual flows were replicated in the earlier

record. Flows from 1989 are replicated in 1932, flows from 1960 are replicated in 1933 and flows from 2003 are replicated in the initial three months of 1934.

The six months from 1 July 1931 to 31 December 1931 were replicated from the year with the nearest mean annual flow to the total mean flow of 51.7 m^3/s. 1936 has a mean flow of 51.1 m^3/s. The six months of record from 1 July 1936 to 31 December 1936 are replicated in 1931.

Care was taken to maintain the water balance in the River. Table 5.13.1 details the mean flows during the record correlation phases. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.13.1 Mean flow, Hurunui at Mandamus

Record	Record Length	Mean Flow (m^3/s)
Hurunui at Mandamus	1956-1991	51.2
Rated Hurunui at Mandamus*	1956-1991	52.1
Rated Hurunui at Mandamus	1931-2006	51.3

*Prior to superimposing the actual Hurunui at Mandamus record over the SPECTRA series

The monthly and annual flows in Appendix A show less amplitude in the synthetic record for flood flows although low flows are comparable.

5.14 Hurunui at SH1 Bridge

The most downstream site in the Hurunui catchment is the Hurunui at SH1 Bridge site. Flow data at this site exists from 1974 to 1999. Since June 1999 this site is used for flood warning only. The lower Hurunui River is potentially the most useful for hydro-power development because of the greater catchment area and Pahau tributary.

The Hurunui at SH1 Bridge was extended back to 1931 through a distribution correlation with the extended Hurunui at Mandamus record. The distribution rating compared flow data over the period 1974 to 1999. Actual data from the Hurunui at SH1 Bridge record is applied to the rated data.

Care was taken to maintain the water balance in the River. Table 5.14.1 details the mean flows during the record correlation phases. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.14.1 Mean flow, Hurunui at SH1 Bridge

Record	Record Length	Mean Flow (m^3/s)
Hurunui at SH1 Bridge	1974-1999	72.8
Rated Hurunui at SH1 Bridge*	1974-1999	72.9
Rated Hurunui at SH1 Bridge	1931-2006	66.8

*Prior to superimposing the actual Hurunui at SH1 Bridge record over the SPECTRA series

A study of the monthly low flows in Appendix A show the synthetic record contains lower monthly flows than the actual record and this is reflected in the lower mean flow for the whole record period. The Hurunui at Mandamus extended record is preferred as the main Hurunui flow dataset.

5.15 Mohaka River, Hawke's Bay

Introduction

The Mohaka River originates in the Kaweka Ranges in Hawke's Bay. The catchment area is large at 2430 km^2 and drains the steep and rugged landscape. The proposed hydro-power scheme is in the lower reaches of the 172 km long river, near Raupunga. Figure 5.15.1 shows a possible power scheme location for the Mohaka River.

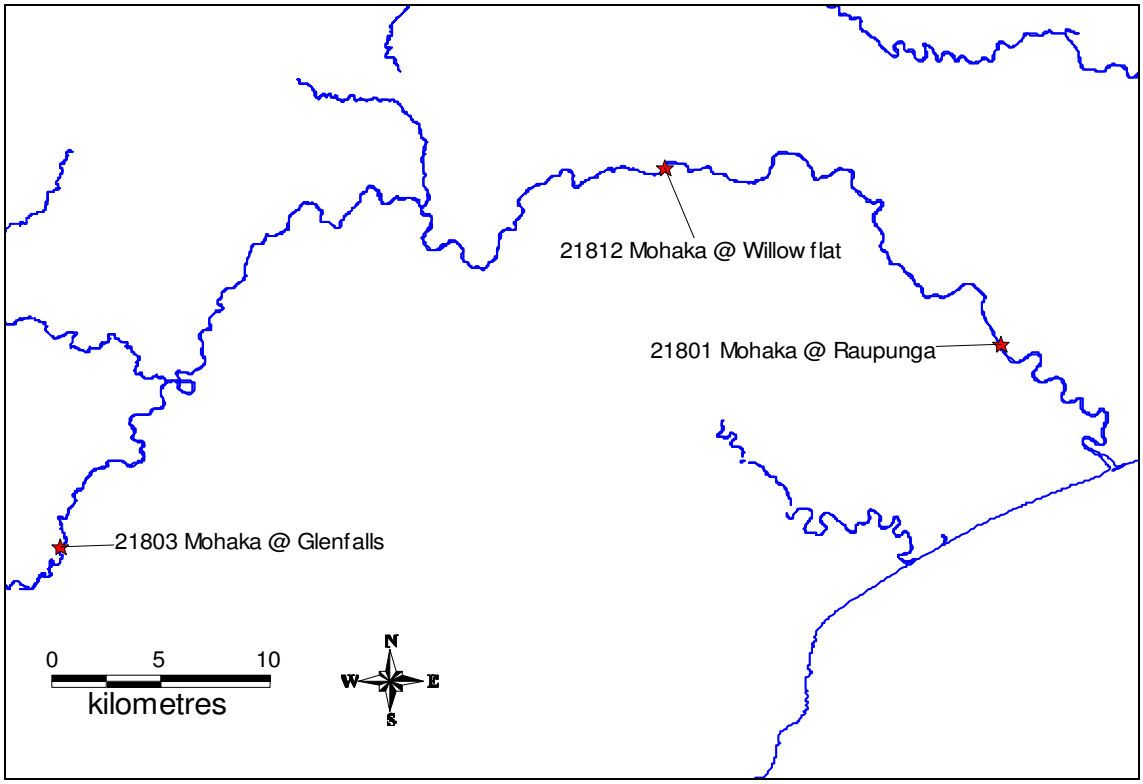

Figure 5.15.1 Mohaka River Location diagram.

5.16 Mohaka at Raupunga

The longest flow record in the vicinity of the Mohaka River is the Mohaka at Raupunga recorder. This record extends back to 1957. The Mohaka at Raupunga record was correlated with the Lake Waikaremoana inflow record to extend the SPECTRA series back to 1931.

On 6 January 1985 a large landslide occurred upstream of the Raupunga gauge. This suppressed flow at the gauge significantly for approximately 10 hours and impacted on flows for approximately 3 days. The low stage value resulting from the landslide was removed from the data for the distribution analysis to provide a normal distribution of data.

The best correlation was obtained through a distribution rating of the Lake Waikaremoana inflow record comparing flow data over the period 1957-2001. The distribution of flow in the resulting dataset is similar to actual flow at the high end of the spectrum. Flows at the low end of the spectrum are slightly lower than the actual record.

Inflow to Lake Waikaremoana is calculated from lake level and outflow data. The resulting Mohaka at Raupunga rated record between 1931 and 1957 has some lake level characteristics, including a greater number of oscillations. Rated low flows are slightly lower and more common than in the actual record as the Lake inflow regularly drops to zero.

The Mohaka at Raupunga record (including the suppressed flow values in 1985) is used from 1957 to present. Gaps in the record were filled from correlation with the Ngaruroro at Whana Whana record.

Care was taken to maintain the water balance in the River. Table 5.16.1 details the mean flows during the record correlation phases. Mean monthly flow values and the distribution of flow are displayed in Appendix A.

Table 5.16.1 Mean flow, Mohaka at Raupunga

Record	Record Length	Mean Flow (m^3/s)
Mohaka at Raupunga*	1957-2001	79.5
Rated Mohaka at Raupunga**	1957-2001	78.7
Rated Mohaka at Raupunga	1931-2006	78.2

*Without low flows triggered the landslide

**Prior to superimposing the actual Mohaka at Raupunga record over the SPECTRA series

5.17 Monowai

Introduction

The Monowai hydro-electric power station is situated on the banks of the Waiau River 51 km's from Tuatapere. The scheme was investigated in 1919; construction started in 1922 and opened in 1925. Initially there were two machines and a third was added in 1927.

The annual energy output is 30 GWH pa and the turbines are the horizontal Francis type.

Monowai Lake area is 31 km^2 and about 8.5 km's from the power house and controlled by gates at the Monowai River outlet. Waters flows down the river for about 6 km's into a lake formed by a weir across the river. The water is then diverted into a canal that is 856 m long and arrives at a fore bay area where a 1036 m pipeline leads to a surge tank. From the surge tank three penstocks take the water to the turbines in the power house. Figure 5.17.1 shows a plan of the Monowai Power Development.

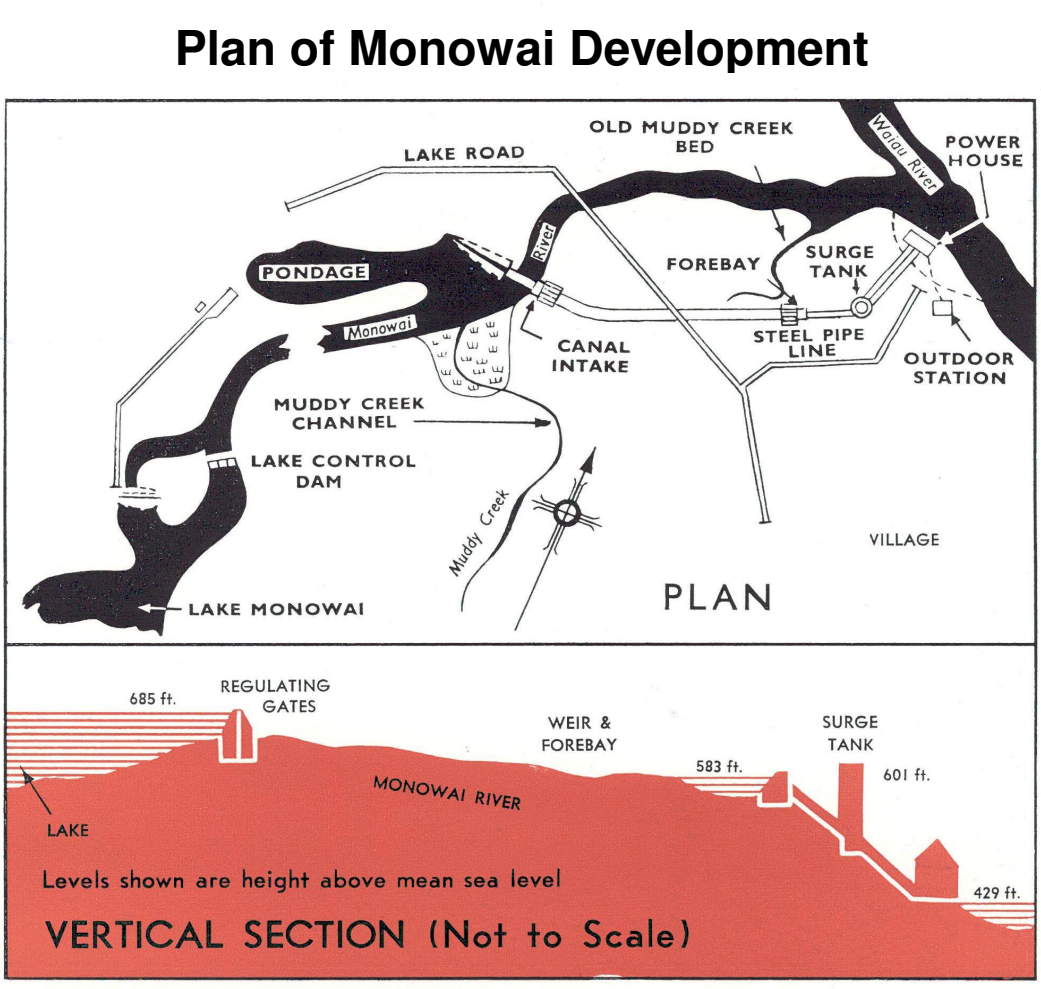

Figure 5.17.1 Monowai Power Development Plan (original development).

Inflows exist from 1960 to 1999. It was therefore necessary to extend the lake inflows back to 1931 and forward to 2006.

A linear regression with Te Anau and Manapouri did not provide a suitable correlation; therefore a flow distribution rating was applied to extend the Monowai record. A rating was derived from the Monowai Riddell - Opus and Lake Te Anau inflow data and then applied to the Te Anau inflow data.

This resulted in some differences for peak flow events in regard to timing but overall the two systems tracked each other well and flows were similar.

Table 5.17.1 details the mean flows for the records and included in Appendix A are mean monthly flows values and a flow distribution.

Table 5.17.1 Monowai Mean Flow

Record	Record Length	Mean Flow (m^3/s)
Riddell Inflow 1986 Report	1960 - 1985	12.322
Riddell –Opus Inflow	1960 - 1999	12.880
Monowai Rated Inflow	1960 - 1999	13.076
Monowai Rated Inflow & Riddell – Opus Inflows	1927 - 2006	13.022
Monowai Rated Inflow & Riddell – Opus Inflows[(1)]	1931 - 2006	15.3

Note[(1)]: A study is currently underway regarding Monowai flood rules and the inflow is being revised and the mean for 1931 to 2006 may differ for the final report.

5.18 Wheao/Flaxy Trustpower

Scheme Description

The Wheao and Flaxy Scheme had it's beginnings in 1974; the scheme was commissioned in 1980. The Wheao Hydro Electric Scheme, in the Kaingaroa Forest, is 82 km from Rotorua, 25 km from Murupara and 74 km from Taupo.

The 26MW scheme produces power using water from the Wheao and Rangitaiki Rivers as well as from Flaxy Creek. Water from the Rangitaiki River flows through a 4.7 km open canal into the Wheao penstock intake. When a lot of power is needed, the Flaxy Power Station supplements supply. A complex arrangement of canals, tunnels and pipelines feed the water from the upper Wheao River and Flaxy Creek to the Flaxy Power Station.

Here two Norwegian designed, water driven turbines and generators produce 12,000 kW each. The generators turn at 428 revolutions per minute and develop 16,000 hp at full power. Above the power station are the two massive penstocks through which the water plunges 126 m down a rock wall at up to 45 degrees to the generators inside the power station.

Figure 5.18.1 shows the Wheao/Flaxy Power Stations and the associated flow recorders on or in the vicinity of the Wheao/Flaxy Power Stations. Table 5.18.1 shows the site number, site name, and the length of record existing for the sites in the vicinity.

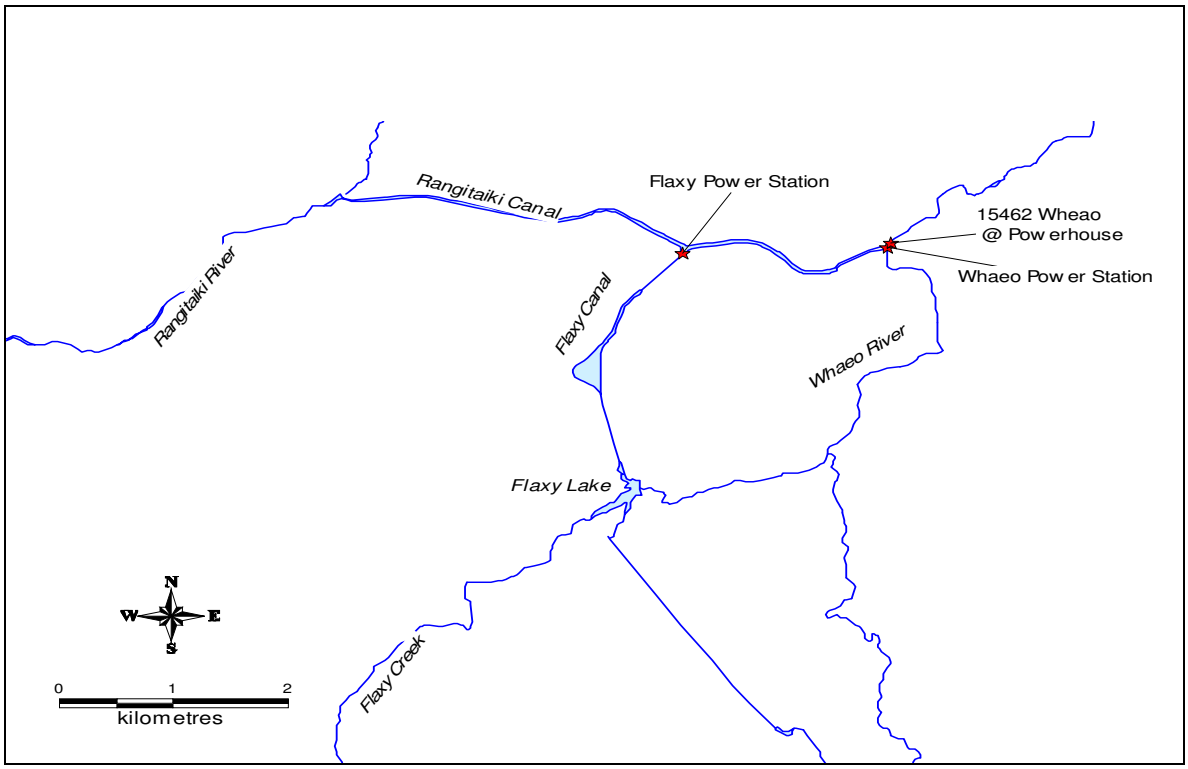

Figure 5.18.1 Wheao/Flaxy Power Station location diagram

Table 5.18.1 Flow Recording Stations in the vicinity of the Wheao/Flaxy Power Stations

Site Number	Site Name	Record Length
15462	Wheao at Powerhouse	Nov 85 to Sep 98
15408	Rangitaiki at Murapara	Jun 48 to present

Creation of synthetic data for Wheao Power Station

Data for the Wheao Power Station was supplied by TrustPower from 1999 to 2007. It was therefore necessary to extend this record back from 1999 to 1931. Data was available from Rangitaiki at Murapara from 1948 to 2007.

To create a synthetic record for Rangitaiki at Murupara from 1948 back to 1931 a flow distribution rating (obtained via analysis of Taupo Natural Outflows and Rangitaiki at Murupara) was applied to Taupo Natural Outflow.

In order to reduce the Rangitaiki at Murupara flow range to resemble Wheao Power Station flows another flow distribution rating was derived using Rangitaiki at Murupara and Wheao

Power Station. This flow distribution was then applied to actual and synthetic Rangitaiki at Murupara data to derive synthetic Wheao flow data.

Care was taken to maintain the water balance of the power station output. Table 5.18.2 details the mean flows for the synthetic and actual data. Mean monthly flow values and the distribution of the flow are displayed in Appendix A.

Table 5.18.2 Mean flows for Actual and Synthetic Wheao Power Station Data

Record	Record Length	Mean Flow (m^3/s)
Actual Wheao Power Station (TrustPower)	1999-2007	12.5
Synthetic Wheao Power Station	1999-2007	12.3
Actual and synthetic Wheao Power Station	1931-2007	13.0
Synthetic Wheao Power Station	1931-2007	13.0

5.19 Patea Trustpower

Scheme description

This catchment has an existing hydro-electric power station (Patea) and controlled lake storage (Lake Rotorangi). Figure 5.19.1 shows the Patea River and the associated flow recorders on or in the vicinity of the Waiau River. Table 5.19.1 shows the site number, site name, and the length of record existing for these sites.

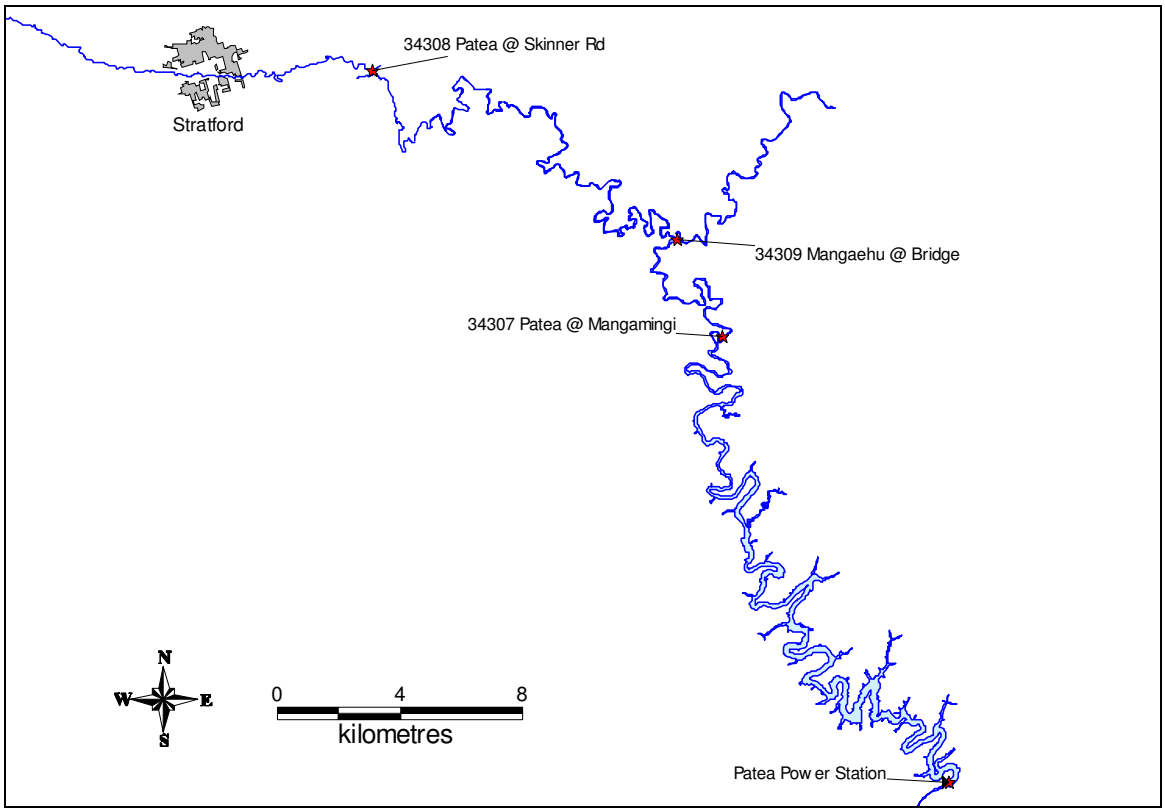

Figure 5.19.1 Patea River Location diagram

Table 5.19.1 Flow Recording Stations in the vicinity of the Patea power station

Site Number	Site Name	Record Length
34308	Patea at Skinner Road	Feb-78 to present
34307	Patea at Mangamingi	Apr 75 to May 84
34309	Mangaehu at Bridge	Jan 78 to present
34305	Patea at McColls	Nov 86 to Jul 95

Patea – Diversion into Mangaehu

The Patea River originates on the eastern side of Mt Taranaki and flows down through Stratford and into the inland hill country where it is joined by a major tributary, the Mangehu Stream.

The upper reaches of the Patea River are not as deeply incised as the middle reaches, upstream of Lake Rotorangi behind Patea Dam. However, approximately 1.7 km upstream of the Mangamingi Bridge there is a site suitable for a storage dam with an overall height up to 64 m. The river channel itself is about 30 m deep.

A reservoir area of 3.9 km^2 at an impoundment height of 50 m with an installed capacity of 18 MW would generate approximately 79 GWh p.a. (50% plant factor).

Creation of synthetic data for Patea River

Data for the Patea Power Station was supplied by TrustPower from 1999 to 2007. It was therefore necessary to extend this record back from 1999 to 1931. To do this data from Patea River at Mangamingi and McColls were used.

The Patea at Mangamingi record begins in April 1975 and ends in April 1984. The Patea at McColls records is from November 1986 to July 1995. Data from these two sites were combined to give a non-continuous record from 1975 to 1995.

To create a synthetic record for Patea from 1975 back to 1931 a flow distribution rating (obtained via analysis of Taupo Natural inflow and combined Patea) was applied to Taupo Natural inflow.

In order to reduce the combined Patea flow range to resemble Patea Power Station flows another flow distribution rating was derived using combined Patea and Patea Power Station. This flow distribution was then applied to actual and synthetic Patea data to derive synthetic Patea flow data.

Care was taken to maintain the water balance in the Patea River. Table 5.19.2 details the mean flows during the record for the synthetic and actual data. Mean monthly flow values and the distribution of the flow are displayed in Appendix A.

Table 5.19.2 Mean flows for Patea Power Station and Patea River

Record	Record Length	Mean Flow (m^3/s)
Patea at Mangamingi	1975-1984	24.2
Patea at McColls	1986-1995	28.1
Patea Power Station (Trustpower)	1999-2007	18.5
Synthetic Patea Power Station Data	1999-2007	16.9
Synthetic Patea Power Station Data	1931-2007	18.2
Patea Power Station (synthetic and actual data)	1931-2007	18.4

5.20 Highbank Trustpower

Scheme description

The Highbank Power Station was constructed between 1939 and 1945 as part of a combined project to irrigate dry farmland and generate electricity. Water for the station is collected from the Rangitata River by means of a 66 km long irrigation race, which provides water for use by farms in summer, when demand for electricity is lower. In winter when electricity demand increases, and demand for irrigation water reduces, the water is used for power generation purposes.

With an installed capacity of 25,200 kW, the Highbank scheme has an average annual output of 94 GWh.

Figure 5.20.1 shows the Highbank Power Station and the associated flow recorders on or in the vicinity of the Highbank Power Station. Table 5.20.1 shows the site number, site name, and the length of record existing for the sites.

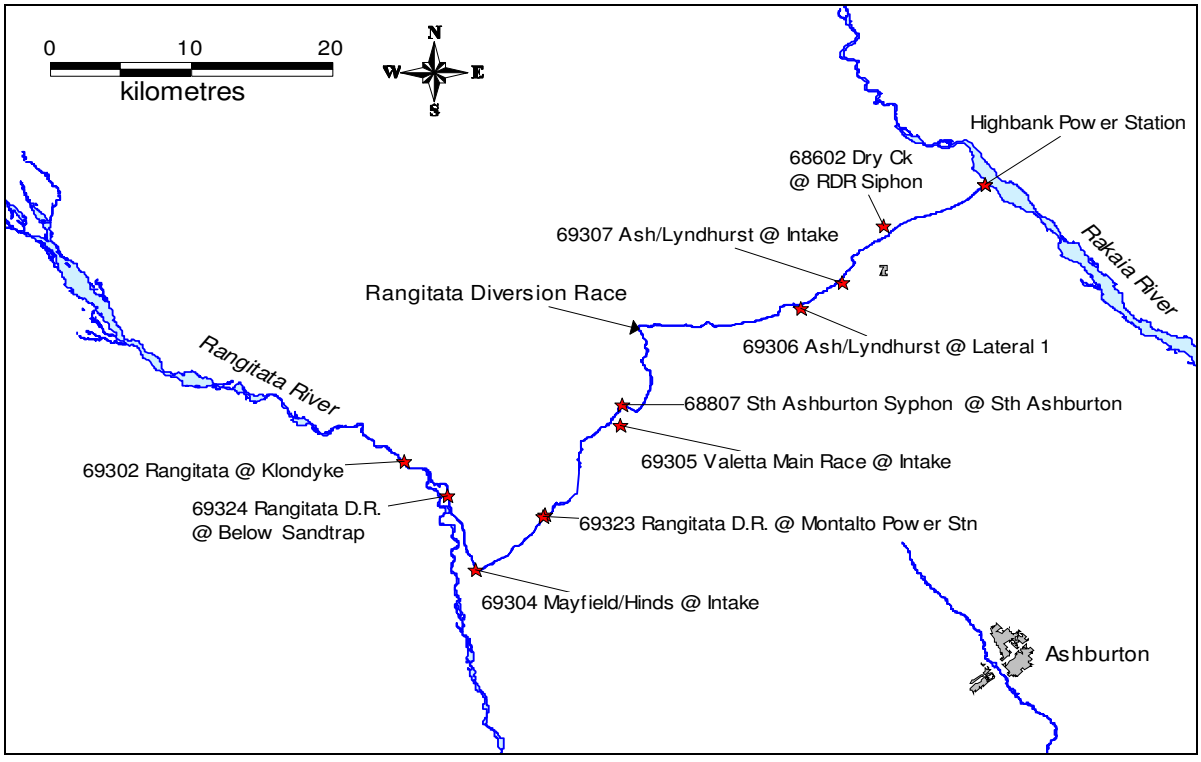

Figure 5.20.1 Highbank Power Station Location diagram

Table 5.20.1 Flow Recording Stations in the vicinity of the Highbank power station

Site Number	Site Name	Record Length
7968	Highbank Power Station (Machine Output)	May 51 to Jul 98
77963	Highbank Power Station (Ext Flow Record)	Jan 30 to May 98

Creation of synthetic data for Highbank Power Station

The ECNZ Highbank Power Station record begins in May 1951 and ends in May 1998. In June 2002 TrustPower began recording flow which extends to 2007.

In a 1990 Opus report "Extended Flow Study – Mohaka, Mangahao, Grey, Arnold and Highbank" a synthetic Highbank dataset was created from 1931 to 1951. Some gaps exist in the dataset so as part of this report a synthetic dataset was created to fill these gaps. The same PSIM that was used in the 1990 report was used in this study.

The PSIM uses variations in Lake Coleridge inflows to produce synthetic data. Actual Highbank data (ECNZ and Trustpower) and synthetic data were combined to provide a Spectra flow record for Highbank Power Station from 1931 to 2007.

Table 5.20.2 shows the mean flow for each record for the synthetic and actual data. Comparisons were made to ensure a similar water balance was maintained for the Highbank Power Station when creating synthetic data. The differences in mean flow may be partly caused by different companies running the power station in different ways.

Table 5.20.2 Mean flow for Highbank Power Station

Record	Record Length	Mean Flow (m^3/s)
Highbank actual (ECNZ)	1951-1988	13.7
Highbank actual (TrustPower)	2002-2007	12.2
Synthetic Highbank	1931-2007	14.2
Actual and synthetic Highbank	1931-2007	13.4

5.21 Kaimai Trustpower

Scheme description

Electricity generation in the Wairoa River Catchment had it's beginnings in 1915 with the construction of a 150kW plant at Omanawa Falls which was increased to 750kW in 1921. This was followed in 1925 by the commissioning of the 2700kW McLaren Falls Station.

Today the scheme consists of the 350kW Kaimai 5 Station on a diversion tunnel feeding Lake Mangaonui, the 15,600kW Lloyd Mandeno station, sited on the west bank of the Mangapapa River, the 6,000kW Lower Mangapapa Station, and 4km further downstream the 20, 000kW Ruahihi Station. The total annual output of the scheme is 165GWh. The McLaren Falls power station was decommissioned in 1989 and a bypass was subsequently installed to allow the continued release of recreational flows into the Wairoa River on set days each year for activities such as rafting and canoeing.

Ruahihi Power Station

The Ruahihi Power Station is situated on the Wairoa River adjacent to SH29. Ruahihi is the third and largest section of the overall scheme. Construction contracts were let in mid

1977, and the station was commissioned in 1981, but a failure in the feed canal later that year required major rebuilding. The station was recommissioned in 1983.

The reservoir for this station is Lake McLaren and the canal links the reservoir to the station. Lake McLaren was formed in 1925 by the construction of a 26m high concrete arch dam across the lower Mangapapa River to operate the now decommissioned McLarens Falls Power Station. Water from the lake passes through a gated inlet structure into a 2.5 kilometre-long canal. The construction of the canal involved moving 2, 400, 000 cubic metres of soil at depths up to 46 m below original ground level, making it one of the larger canals in New Zealand. The depth of the water in this canal is 6m and the width at normal operating level is 30m. Flow velocities are up to 0.9m per second depending on machine settings and water levels.

Transition from the canal to penstock is a fore bay which again has screens, a cleaner and control gates. Downstream of the fore bay is a 1.6km low pressure conduit leading to twin high pressure penstock pipes down the escarpment and under State Highway 29 into the power house. There are two generating sets in the station, each producing 10, 000kW at 86.4m head of water. Operating speed is 500 rpm and the average energy produced is 75.6GWh per annum.

Figure 5.21.1 shows Power Stations of the Kaimai Power Scheme and the associated flow recorders on, or in, the vicinity of the Kaimai Power Scheme. Table 5.21.1 shows the site number, site name, the length of record existing for each flow site.

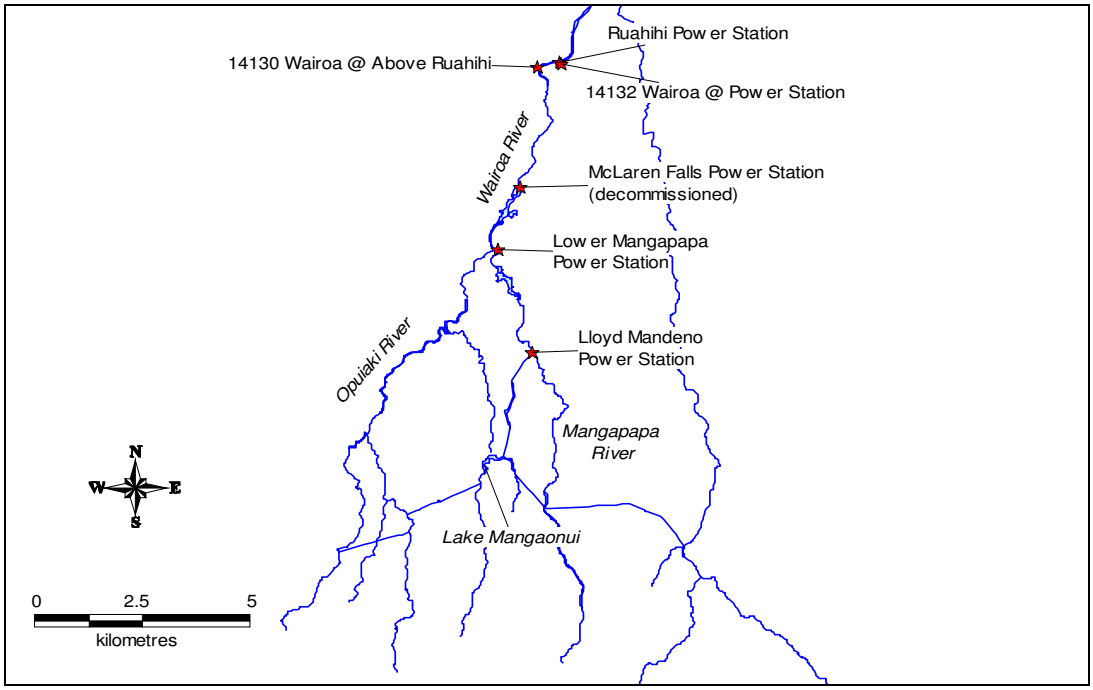

Figure 5.21.1 Kaimai Hydro Power Scheme Location diagram.

Table 5.21.1 Flow Recording Stations in the vicinity of the power station, plus possible power station records.

Site Number	Site Name	Record Length
14130	Wairoa at Above Ruahihi	Sep 90 to present
14132	Wairoa at Power Station	Jul 93 to present

Creation of synthetic data for Ruahihi Power Station

To create a SPECTRA dataset for the Kaimai scheme, site 14132 Wairoa at Power Station was used. The site begins July 1993 and finishes in February 2007. The Wairoa at Power Station record was extended back from 1993 to 1931. Synthetic data was created by analysing simulated natural Taupo inflow and Wairoa at Power station and applying the distribution rating to the simulated natural inflow record at Lake Taupo.

Actual data and synthetic data were combined to provide a flow record for Wairoa at Power Station from 1931 to 2007.

Table 5.21.2 shows the mean flow for each record for synthetic and actual data. Comparisons were made to ensure a similar water balance was maintained for Wairoa at Power Station when creating synthetic data.

Table 5.21.2 Mean flow for Wairoa at Power Station

Record	Record Length	Mean Flow (m^3/s)
Wairoa at Power Station (actual)	1993-2007	12.0
Synthetic Wairoa at Power Station	1993-2007	12.1
Extended synthetic Wairoa at Power Station	1931-2007	11.8
Actual and synthetic Wairoa at Power Station	1931-2007	11.8

6 Non calculated sites

Some sites are not recalculated as part of the SPECTRA process. The annual data is supplied by the parent company and is added to the previous dataset. Table 6.1 shows the sites that are not recalculated as part of the annual SPECTRA update.

Table 6.1 Sites that annual data supplied.

Site number/item number	Site name	Data supplied by
97904 (1)	Coleridge	Trustpower
97904 (2)	Cobb	Trustpower
97520 (1)	Mangahao[(1)]	Todd Group
93254 (1)	Matahina	Trustpower
3650 (1)	Waikaremoana	Genesis
42790 (1)	Taupo_Oper	Mighty River Power
77106 (1)	Grey_tara	FRST site

Note [(1)]: Mangahao data was supplied from 8 October 1997 up to 30 June 2006, therefore data will differ for this and the previous update. In future data will be supplied annually.

7 Data differences for calculated sites

For each SPECTRA update it is conceivable that differences between datasets will occur for variety of reasons such as rating changes, data has been modified, inflows recalculated and other reasons. Table 7.0 shows if any data differences have occurred in relation to the previous and current update for the SPECTRA datasets.

All previous updates have had the 1997 datasets copied over top of any newly created data. This includes the data used in the merge and processing routines.

Reasons why the 1997 datasets were copied over data for all previous updates was because these datasets were created in an era where all the required flow sites were open and the SPECTRA processing scripts, executables, psims, and visual basic routines were all linked to power archive directories therefore the 1997 dataset was considered to be a an accurate reflection of the data up to 1997.

However if any data is modified before 1997 then a problem exists as data is over ridden by copying the 1997 datasets over modified data. Therefore the practice of copying the 1997 datasets over calculated data will cease for some sites and any differences along with reasons for differences will be noted in this report.

However the practice of copying 1997 data over current calculated data will continue for the TPD. The TPD processing scripts, psims and executables are very complicated and may need revising to reflect current operation practices. This issue will be discussed with Genesis to ensure the scripts are still producing output that is consistent with Genesis operational practices.

Table 7.1 shows if there were any data differences for the previous and current update and the following sections highlight reasons for these differences.

Table 7.1 Data differences for previous and current updates

Site Number/item number	Site Name	Data differs
92724 (1)	Arapuni Tributaries	YES
98614 (4)	Benmore	YES
98615 (2)	Ben_tp	YES
9170 (1)	Hawea	YES
92714 (1)	Karapiro	YES
99551 (1)	Manawmara	YES
99550 (2)	Manapouri	YES
99552 (1)	Manareduced	YES
98614 (6)	OhuaRes	YES
98613 (3)	Ohau	YES
98615 (1)	Tek_puk	YES
98614 (2)	Pukaki	YES
98770 (1)	Nat_puk	YES
99110 (1)	Roxburgh	YES
9570 (1)	Tenaua	NO
98614 (1)	Tekapo	YES
98770 (2)	Nat_tek	YES
98714 (2)	Waitaki	YES
9154 (1)	Wanaka	NO

7.1 Karapiro (92714) and Arapuni Tributaries (92724)

The 2006 Karapiro and Arapuni Tributary dataset differs from the 2005 dataset.

The reason is that the input data, Karapiro outflow, Arapuni outflow and Taupo outflow used in the merge and pre-processing phase have all been modified. Figures 7.1.1 and 7.1.2 show the daily flow differences in m^3/s for the two SPECTRA datasets (2005 versus 2006).

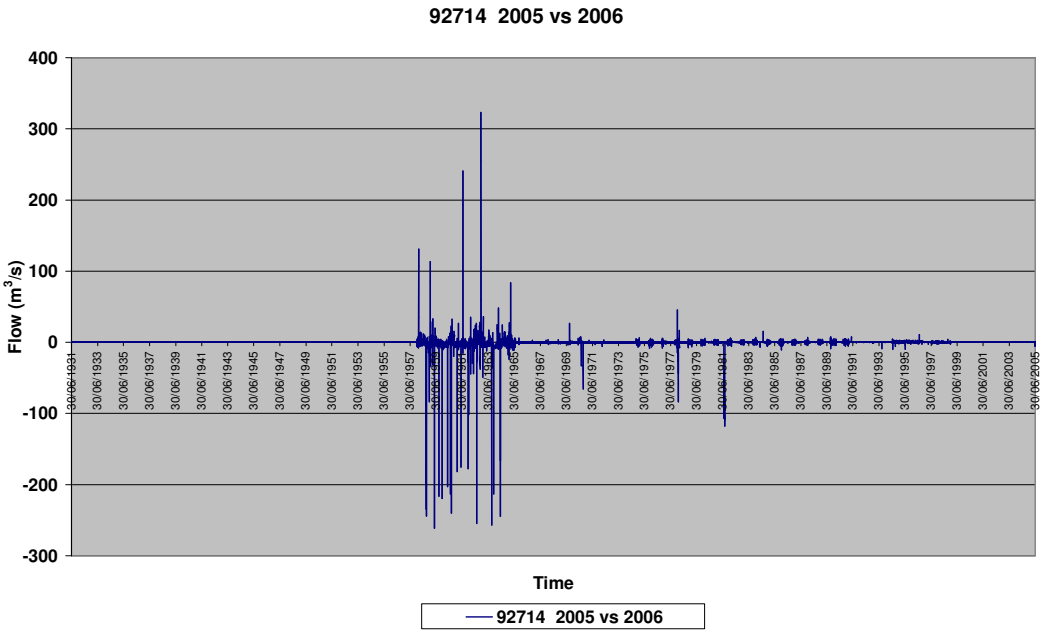

Figure 7.1.1 92714 Daily Karapiro Tributaries difference plot.

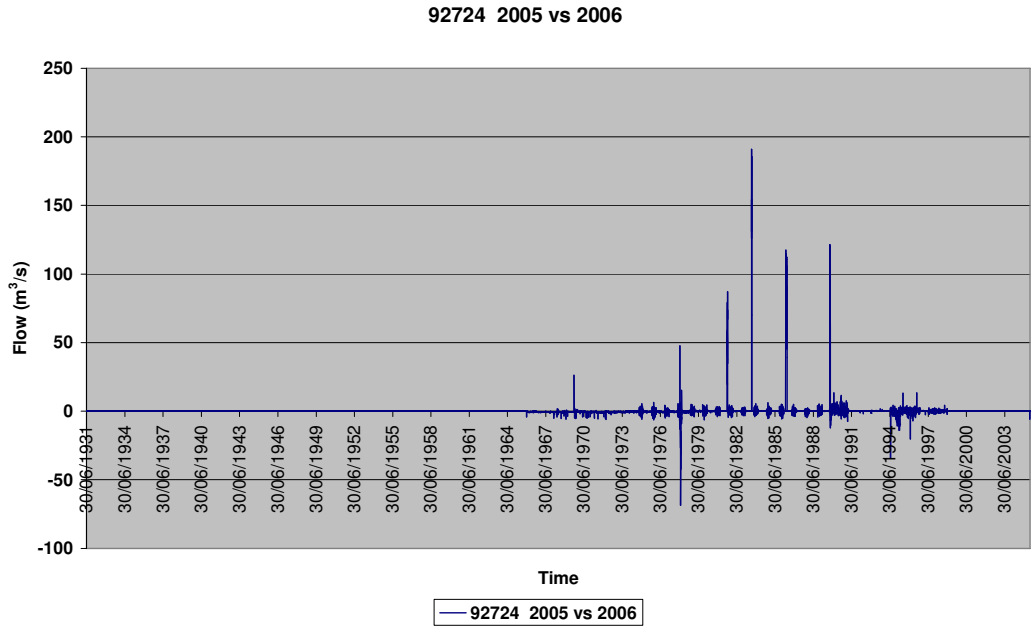

Figure 7.1.2 92724 Daily Arapuni Tributaries difference plot.

Figures 7.1.3 to 7.1.5 are difference plots for each of the components used to produce the Karapiro and Arapuni Tributaries datasets (reiterating that the last update had data up to 1997 copied over it).

Figure 7.1.3 shows major differences for Karapiro over the 1958 to 1965 period along with data chatter at different periods up until 1997.

The reason for the major difference in the 1958 to 1965 period is that sheet data comprising machine load, headwater levels, tail water and spill flow data was turned from paper record into electronic tideda format and added to the power archive and then inflows were rerun. The chatter is because of a report produced in June 1998 "Historical PS Record Improvements Karapiro PS 1965 to 1995. This report went through and fixed any headwater, tail water level spikes and incorrect machine load data. The inflows were then recalculated thus creating differences in the 1997/2005 versus 2006 dataset.

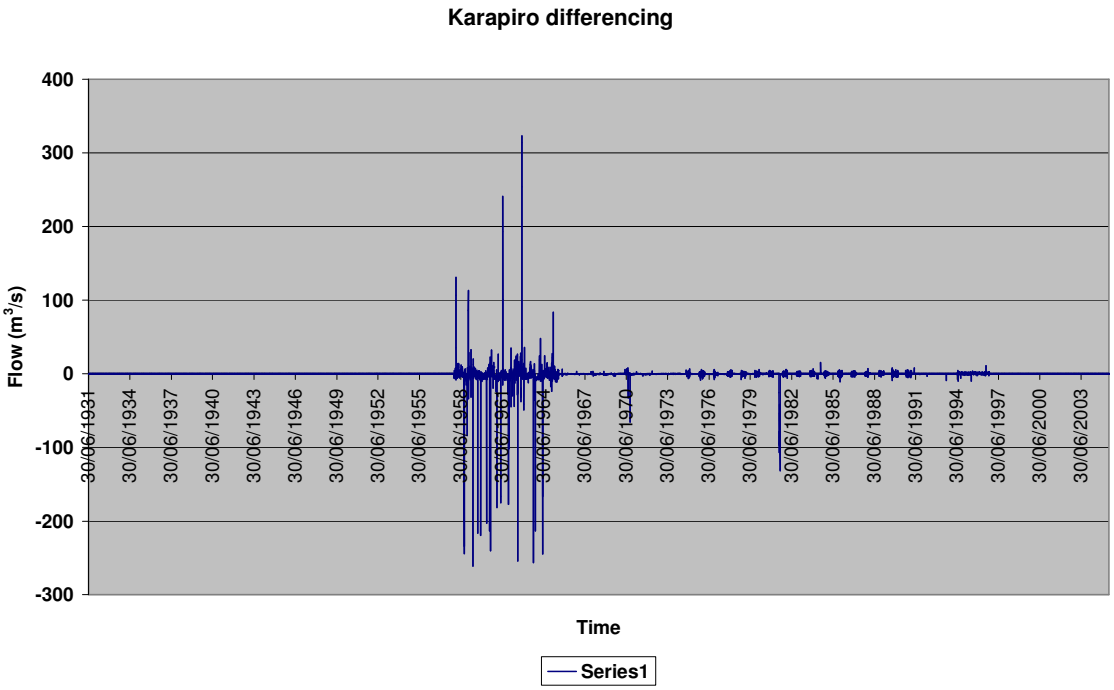

Figure 7.1.3 Karapiro input data difference plot.

Figure 7.1.4 shows Arapuni differences. There are four major differences and chatter. A similar data improvement report (Historical PS Record Improvements Karapiro PS 1965 to 1995) was conducted on the Arapuni data. There four major differences were corrected when the improvement report was carried out and the chatter is also from rerunning the outflows because of the improvement report.

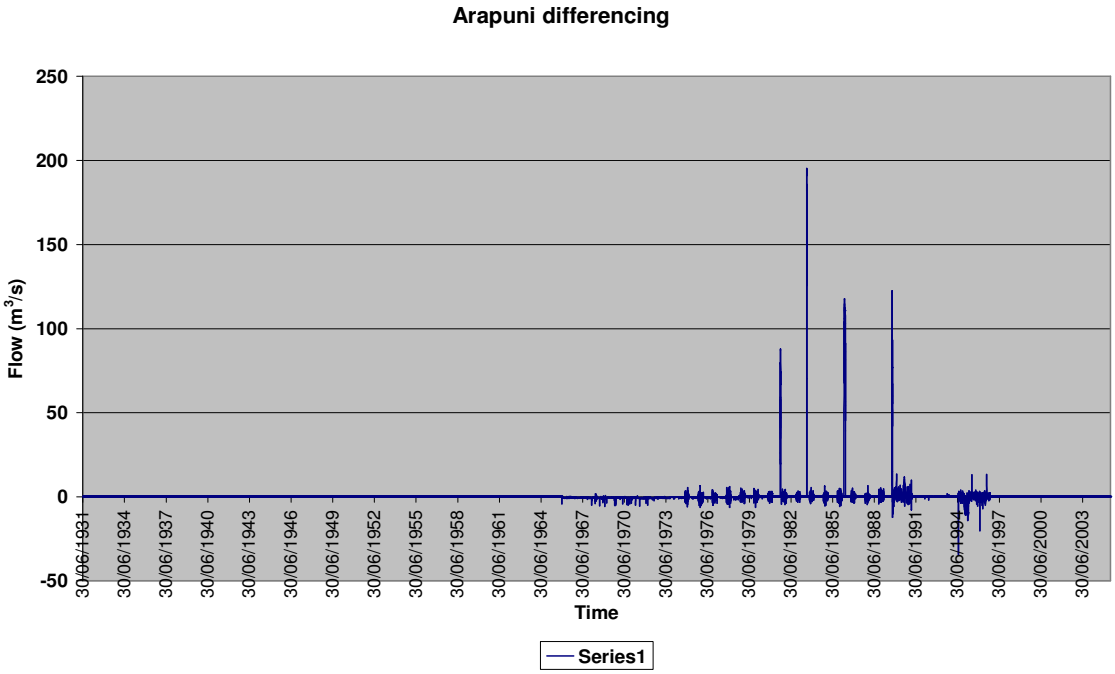

Figure 7.1.4 Arapuni input data difference plot

Figure 7.1.5 shows that Taupo data differs. This is because data over a period Jan 78 to Feb 78 was incorrect and recalculated. Chatter from 1993 to 1999 is due to a rating change and recalculation. The rating change extends to Aug 1976 to the present but recalculation of outflow was only taken back to 1993 as other data was filled using synthetic means and it was decided that data before 1993 should not be changed.

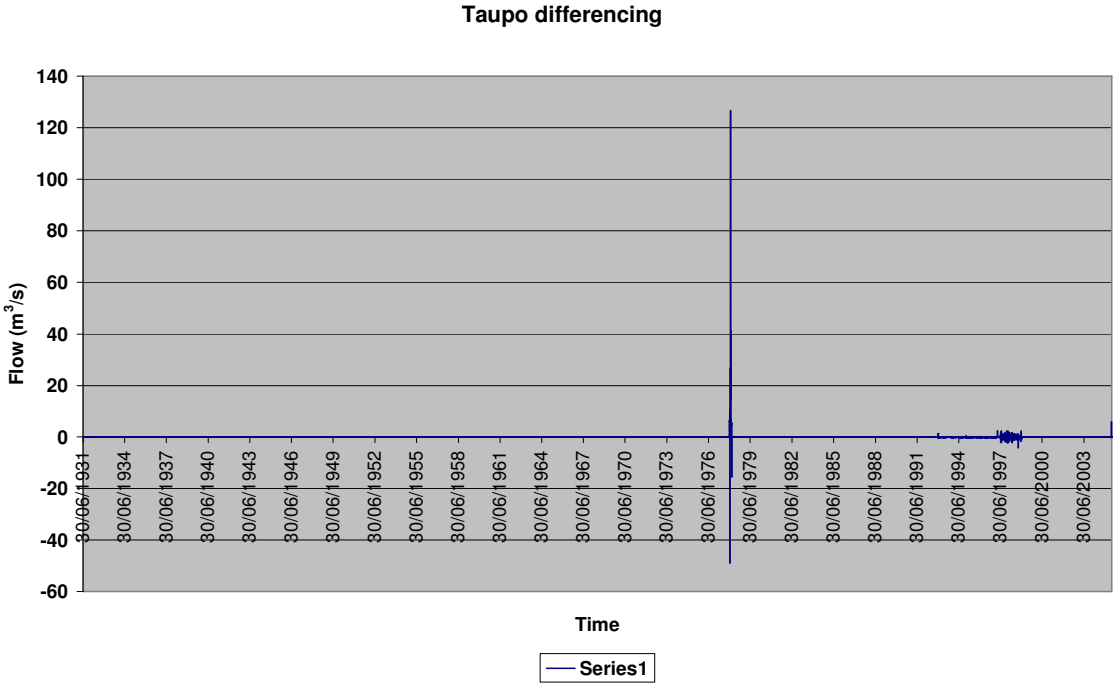

Figure 7.1.5 Taupo input data difference plot

7.2 Roxburgh Tribs (99110)

Figure 7.2 shows a major difference between the 2005 and 2006 updates for the period 31 January 1996 to 30 June 1997. Over this period Contact was split from ECNZ and did not wish to supply Roxburgh inflow data. Therefore synthetic data was used to fill this gap.

This synthetic data has been replaced with actual Roxburgh inflows and this has created the data difference. There are other smaller differences. For the period 31 July 1998 to 1 January 1989 the Roxburgh inflow graph was found to contain errors. This data was recalculated hence the data difference. There is also some chatter for the period 26 April 1994 to 1 January 1996 this is due to a rating change for Hawea at Camphill Bridge (Hawea outflow site). Data was recalculated.

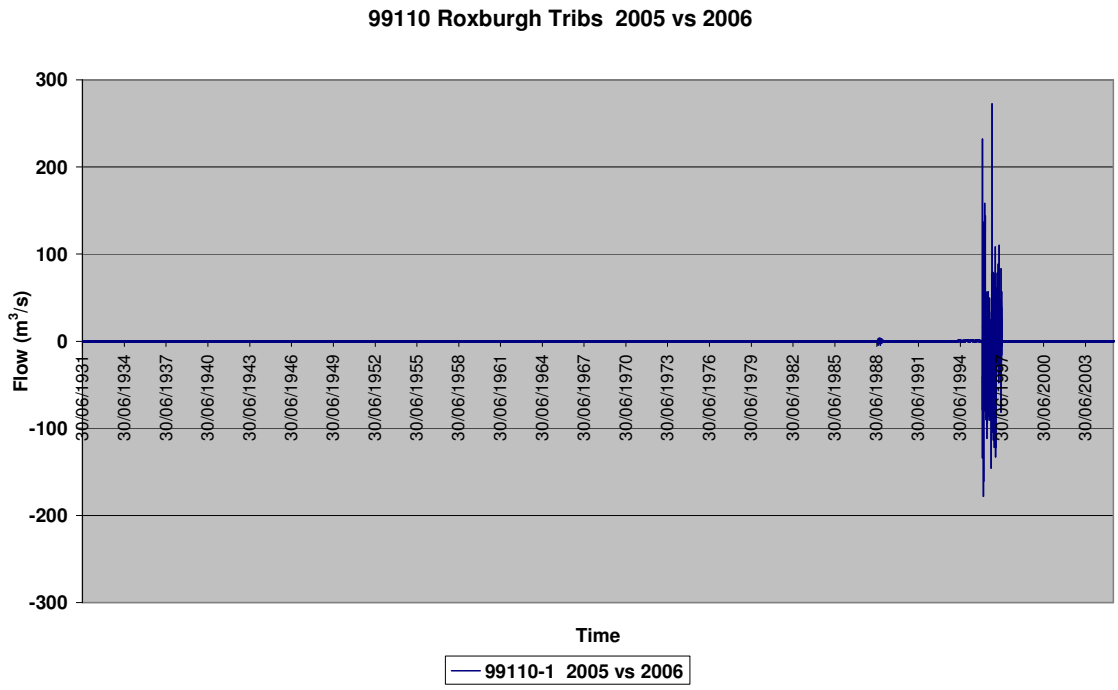

Figure 7.2 Daily Roxburgh Tributary data difference plot

7.3 Hawea (9170)

Figure 7.3 shows a data difference occurs between 30 January 1996 to 11 January 1997. A reason for the difference can not be found. It seems coincidental that the data difference occurs over the period when Contact split with ECNZ. However there is no evidence that Contact withheld any Hawea data.

A rating change does occur from 27 April 94 and it could be possibility that data was not re calculated over the 30 January 96 to 11 January 97 period but again this can not be proved.

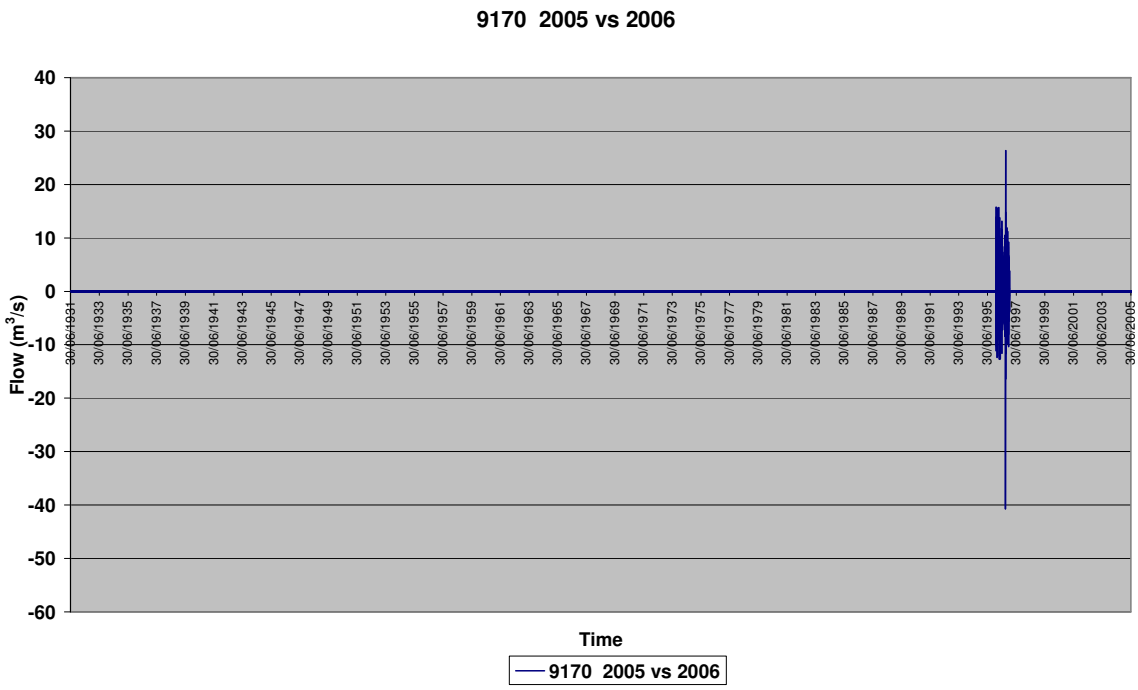

Figure 7.3 Daily Hawea data difference plot.

7.4 Natural Tekapo and Natural Pukaki (98770 items 1 and 2)

Figure 7.4.1 shows two major data differences for natural Pukaki. The first occurs on 21 August 1977 (as a single daily value) and the second over the period 2 November 99 to 5 November 99. The first data difference is due to an error in the psim where Tekapo B comes into operation. The psim has since been amended. The second difference is a result of a three day gap in the input data for the 2005 update. This gap has now been filled.

Figure 7.4.2 shows minute data differences of 1 l/s over along period for the natural Tekapo dataset. The 1 l/s differences are intermittent and can not be explained but as they are so small in size in-depth analysis were not conducted. I believe it is a rounding difference that has occurred resulting from the change from Tideda 3 to Tideda 4.

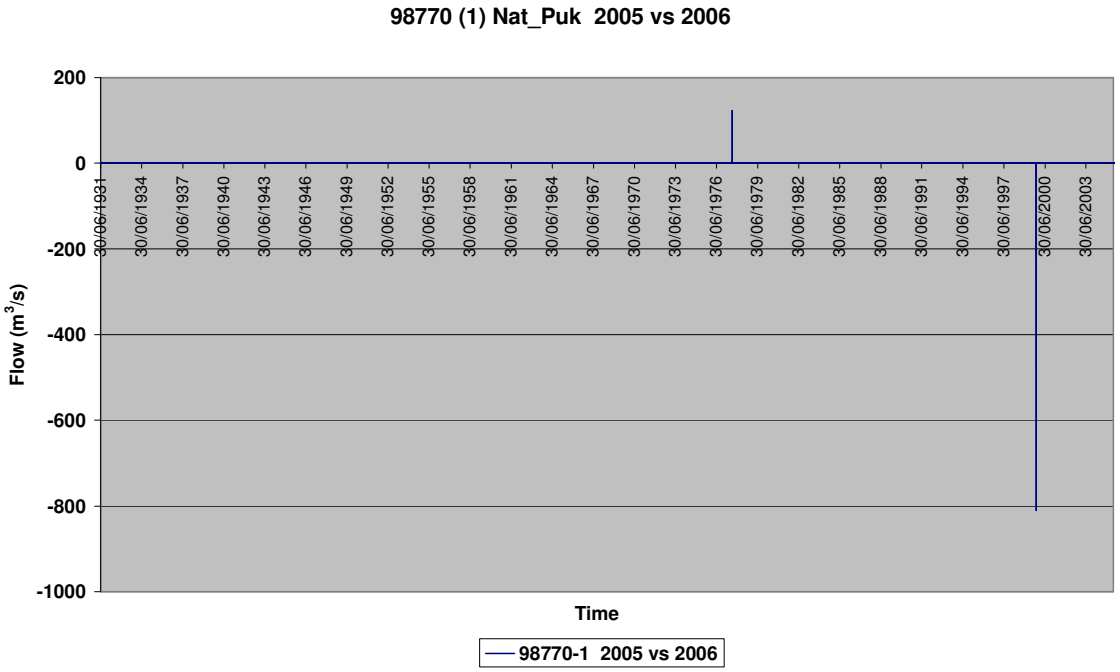

Figure 7.4.1 Daily Nat_puk data difference plot.

Figure 7.4.2 shows data differences for 98770(2). These differences are small, 1 l/s and I believe are the result of using Tideda 4 for this update.

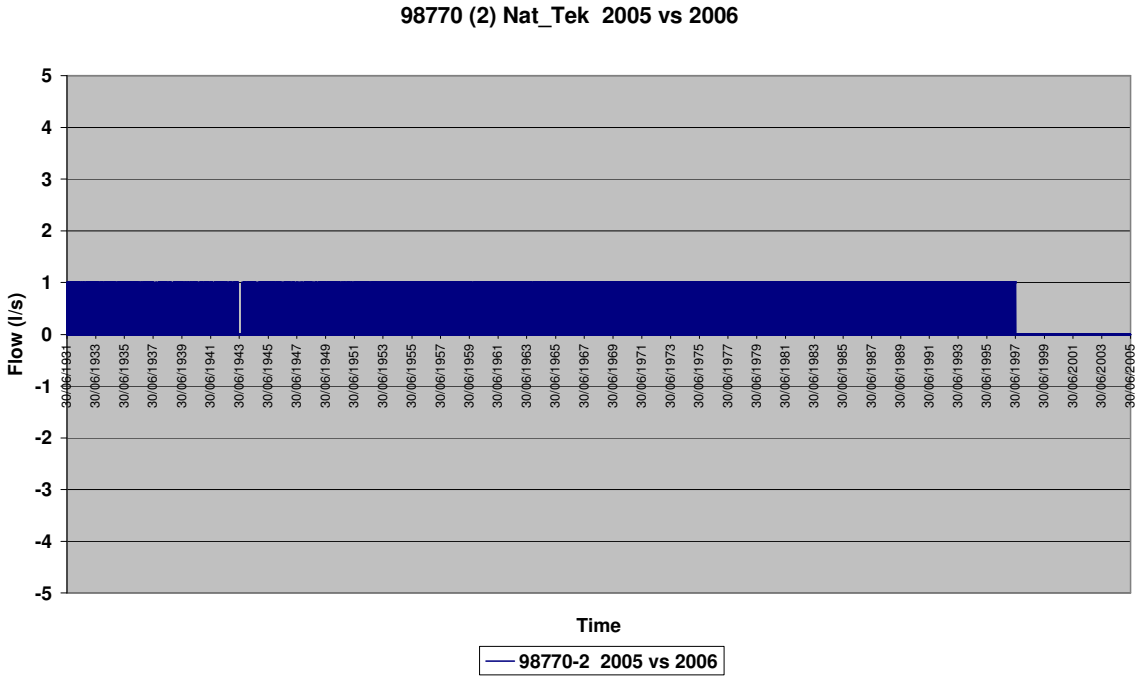

Figure 7.4.2 Daily Nat_tek data difference plot.

7.5 Manawmara (99551) – Manapouri (99550) – Manareduced (99552)

Manapouri

Figure 7.5.1 shows the data differences for the 2005 and 2006 updates. This is because when Meridian's SODAPOP model was being developed it was found that a number of rating changes to site 9566 Manapouri Lake Control at Tailwater were not picked up. With the recalculation of outflows from 1995 onwards the inflows also changed hence the difference.

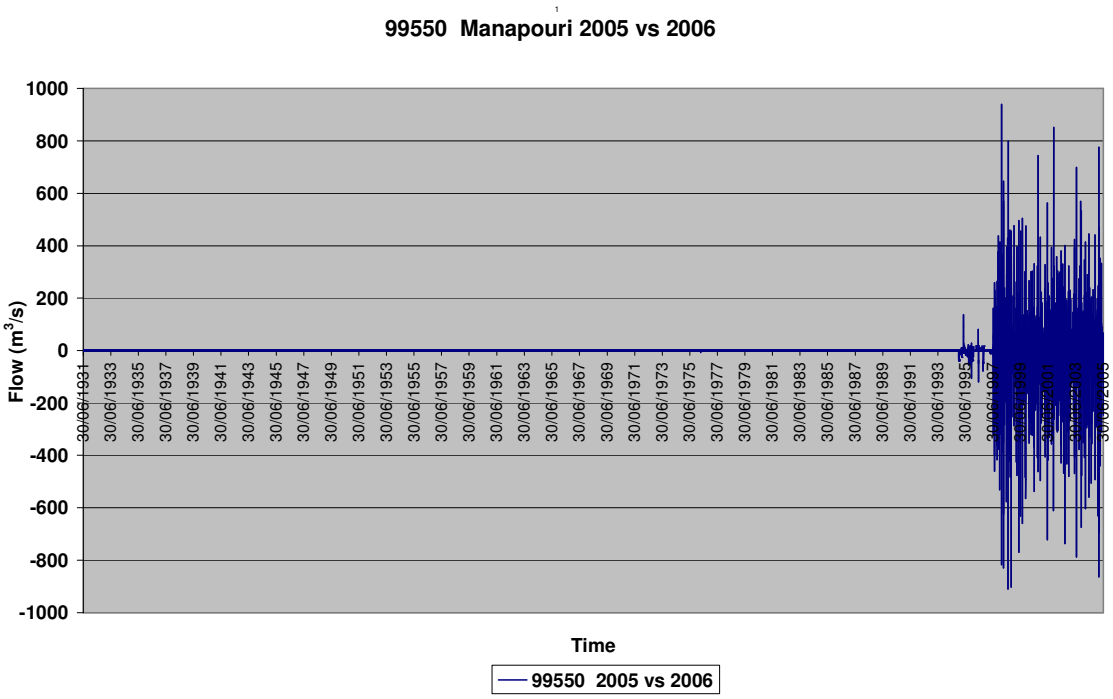

Figure 7.5.1 Daily Manapouri data difference plot.

Manawmara

Figure 7.5.2 shows the data differences for the Manawmara dataset are the same as for Manapouri. This is because the same base data is used in processing.

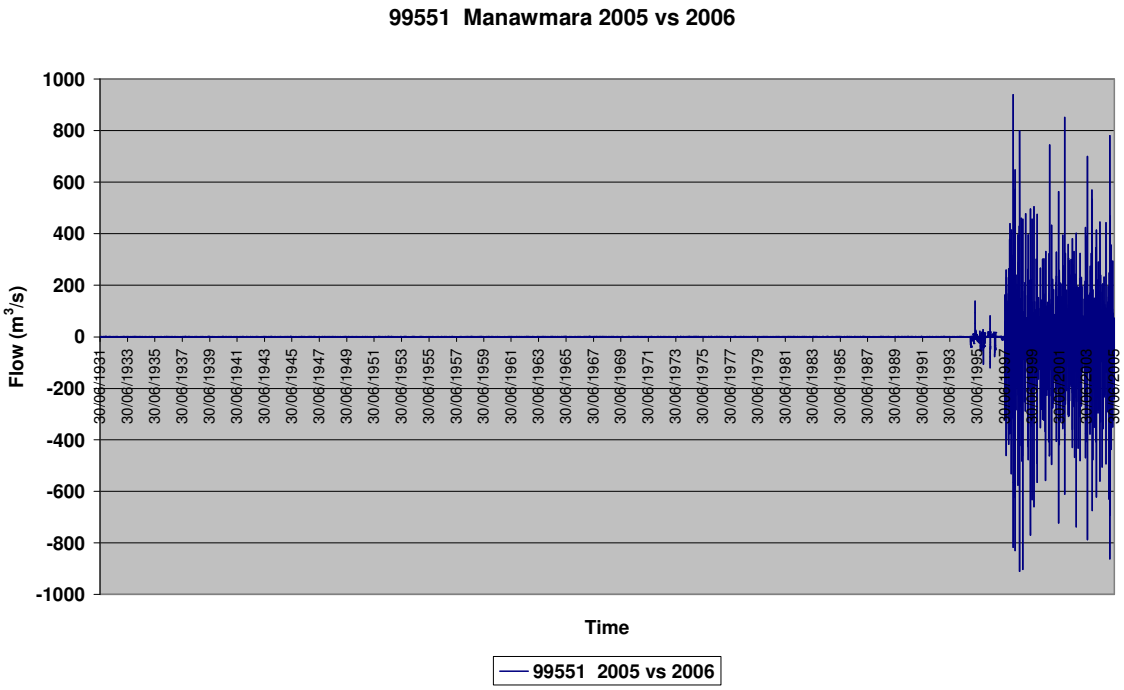

Figure 7.5.2 Daily Manawmara data difference plot.

Manareduced

After the last update errors were found in the psim that have existed throughout all previous updates including 1997. The minimum flows were modelled as l/s not m^3/s and flushing and recreational flows were not calculated correctly. The psim has since been modified to reflect these events.

This dataset also uses the same base data as 99550 and 99551 so the same differences found for the SODAPOP modelling exist in this dataset

Figure 7.5.3 show data differences for the 2005 and 2006 updates.

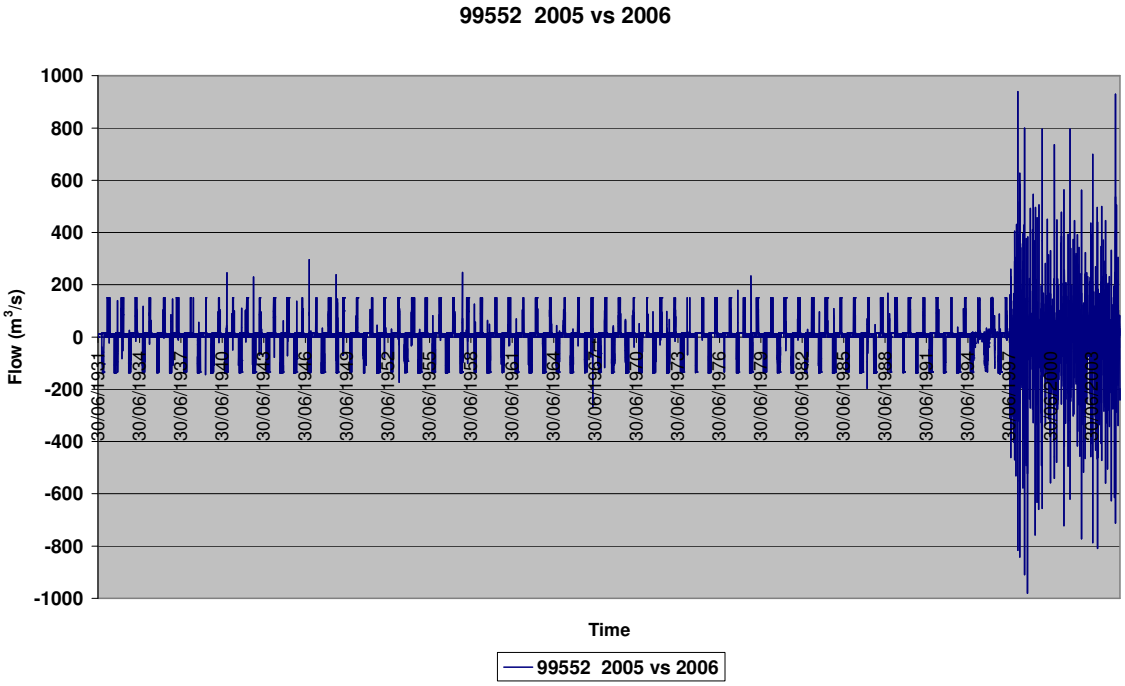

Figure 7.5.3 Daily Manareduced data difference plot.

7.6 Tekapo – Ohau – Pukaki (98614 items 1 to 6)

98614 (1)

Figure 7.6.1 shows very small annual data differences occur for the 2005 and 2006 updates. The input data and merge data for the 1997, 2005 and 2006 updates are identical so at the moment no reason can be found for why these small annual differences are occurring.

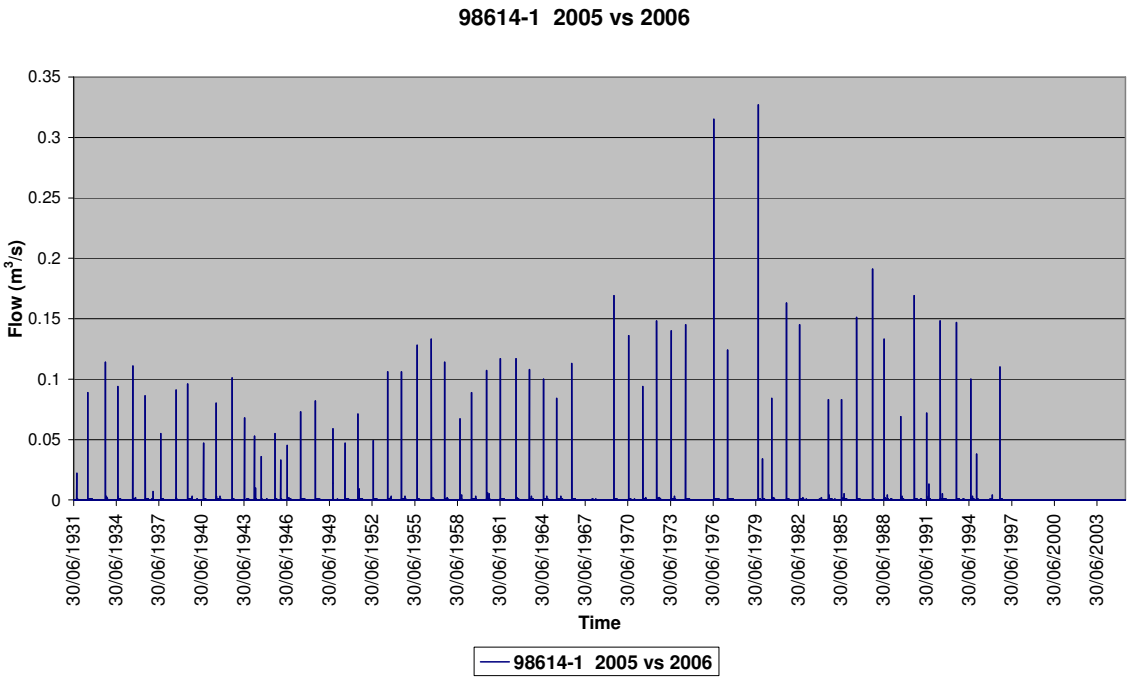

Figure 7.6.1 98614(1) Tekapo data difference plot.

98614 (2)

This dataset also has the same small annual data differences as site 98614(1). However one more data difference occurs over the period 2 to 5 November 1999. This difference was due to a gap existing in site 8973 on the Power Archive.

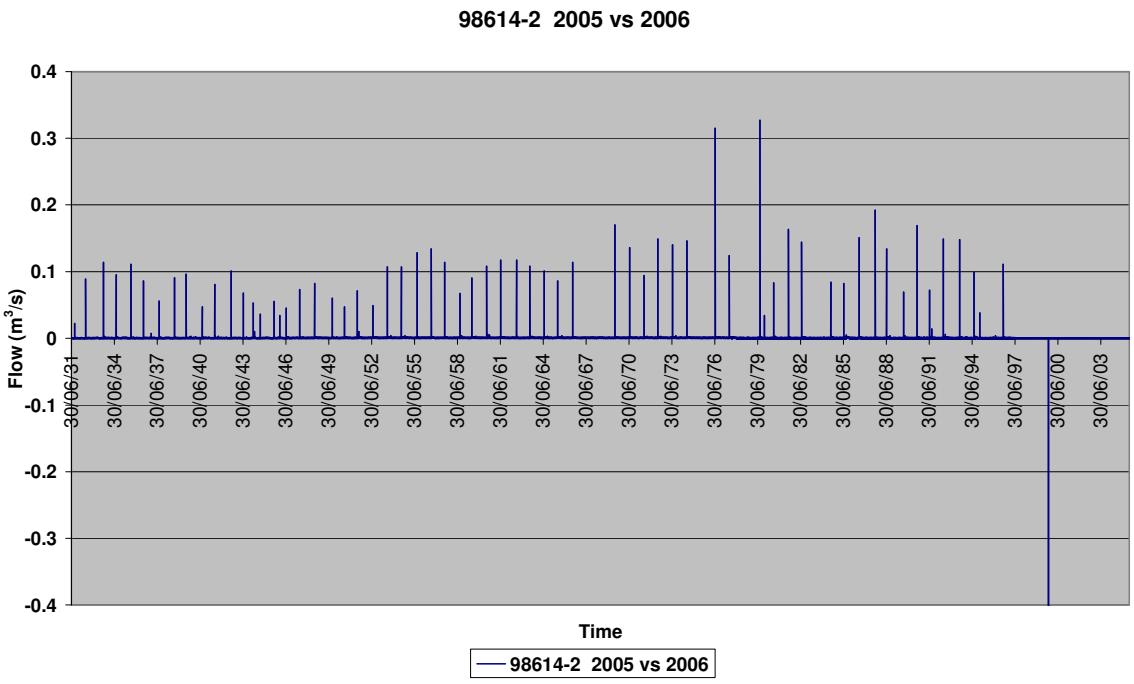

Figure 7.6.2 98614(2) Pukaki data difference plot.

98614 (3) Ohau

Figure 7.6.3 shows data differences for the 2005 and 2006 updates for the period 19 March to 19 November 1957. A gap that existed on the Power Archive was filled. In previous updates the gap was filled via correlation therefore with real data filling the gap a difference occurred.

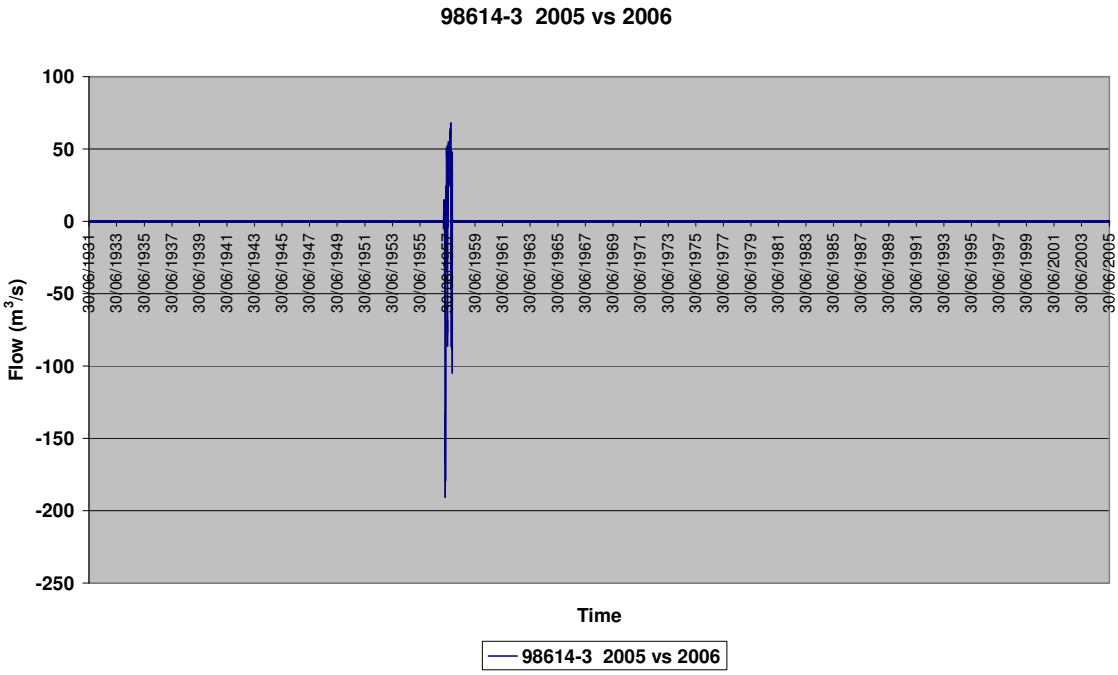

Figure 7.6.3 Daily Ohau data difference plot.

98614 (4) Benmore

Figure 7.6.4 shows this dataset has a number of differences mostly minor. The difference for 19 March to 19 November 1957 has already been covered in the 98614 (3). Minor data differences occur from 10 July 89 to 28 December 1989 and from 29 January 91 to 4 February 91 and due to modified data.

Data differences from 24 November to 29 November 97 were due to data being modified. Rating changes over updates resulted in changed data from 4 January 02 to March 05 and differences from March 05 to June 05 were caused by a missed rating change.

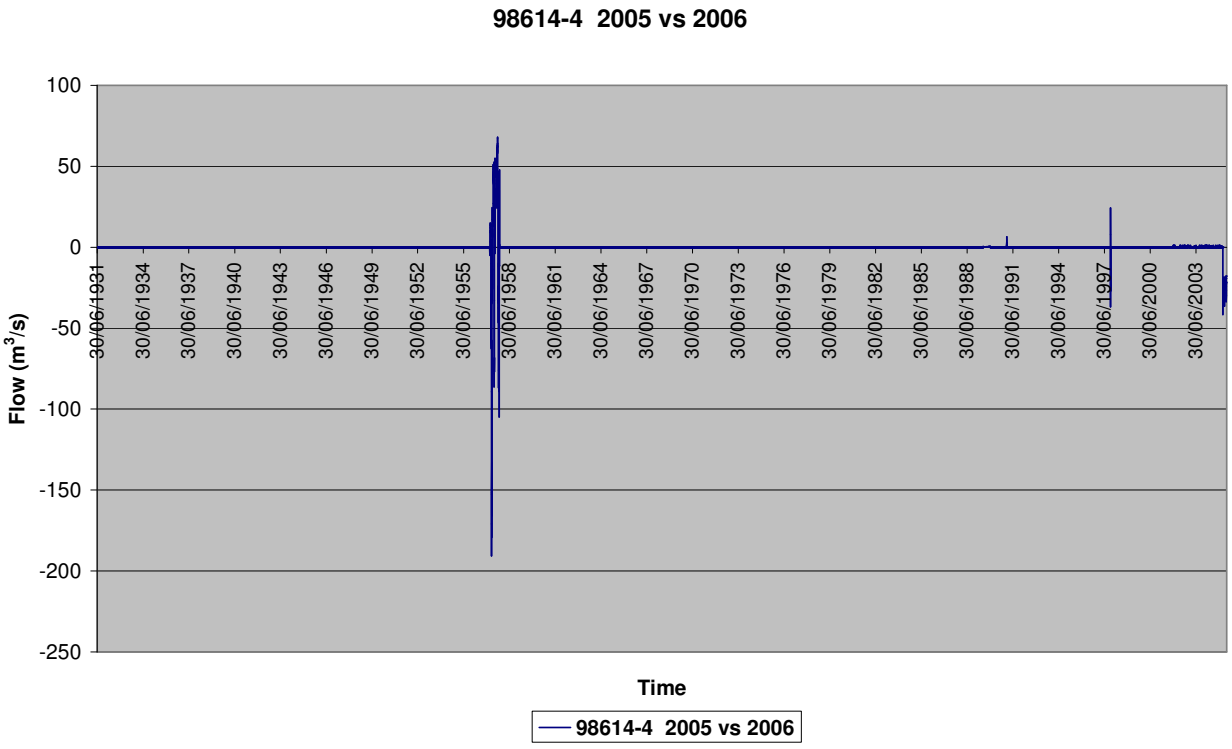

Figure 7.6.4 Daily Benmore data difference plot.

98614 (6) OhuaRes

Figure 7.6.5 shows the difference plot for 98614-6, OhauRes. This dataset uses the same base data as 98614-3 Ohau and the difference was because a gap that existed on the Power Archive was filled. In previous updates the gap was filled via correlation therefore with real data filling the gap a difference occurred.

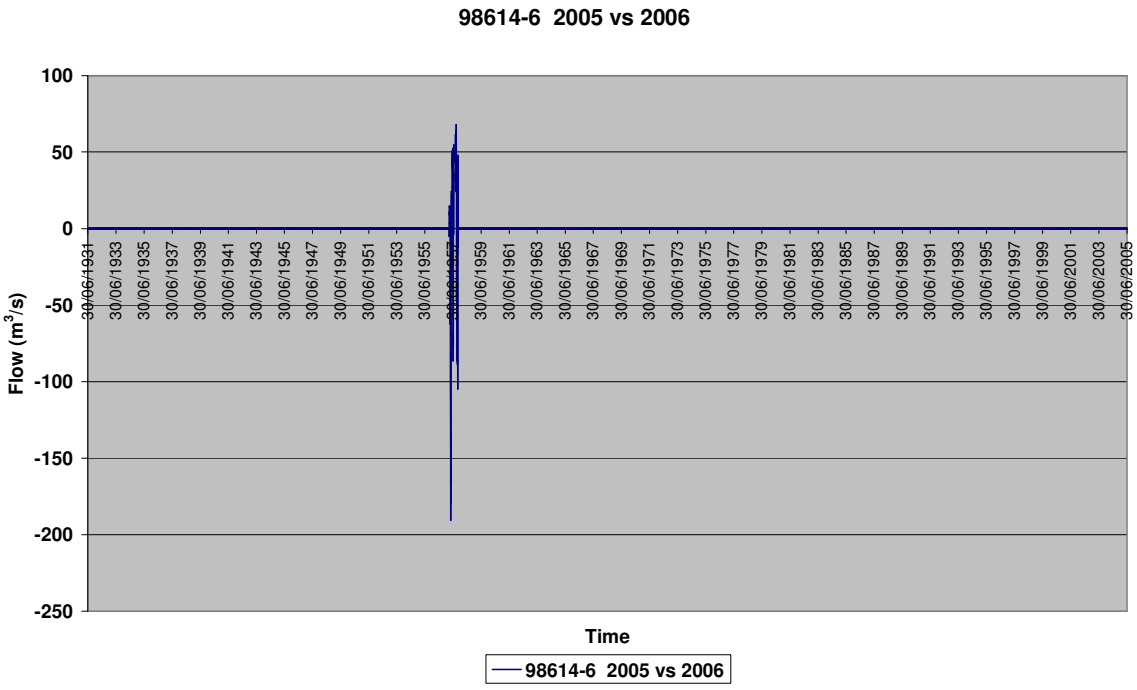

Figure 7.6.5 Daily OhauRes data difference plot.

7.7 Pukaki Tekapo – Benmore (items 1 and 2)

98615 (1) Tek_puk

Figure 7.7.1 shows that a difference occurred from 2 November 99 to 5 November 99. This difference was due to a gap existing in site 8973 on the Power Archive.

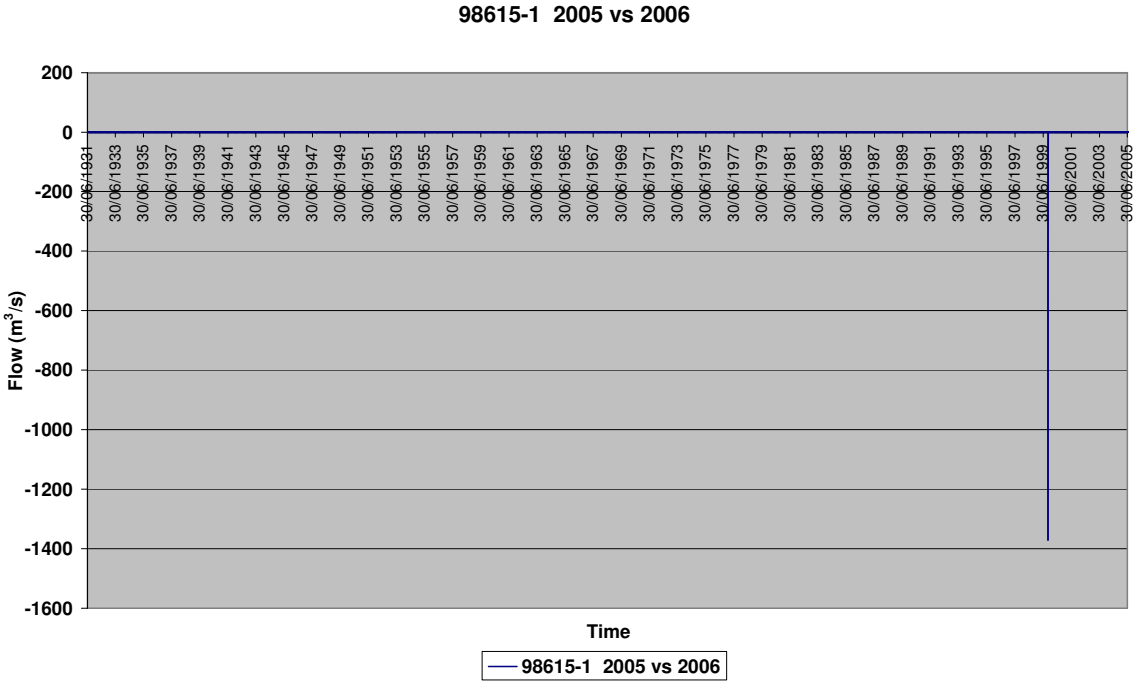

Figure 7.7.1 Daily Tek_puk data difference plot.

98615 (2)

This dataset uses the same base data as site 98614 (4). Figure 8.2 show this dataset has a number of differences mostly minor. The difference for 19 March to 19 November 1957 has already been covered in the 98614 (3). Minor data differences occur from 10 July 89 to 28 December 1989 and from 29 January 91 to 4 February 91 and due to modified data. Data differences from 24 Nov to 29 Nov 97 were due to data being modified. Rating changes over updates resulted in changed data from 4 January 02 to March 05 and differences from March 05 to June 05 were caused by a missed rating change.

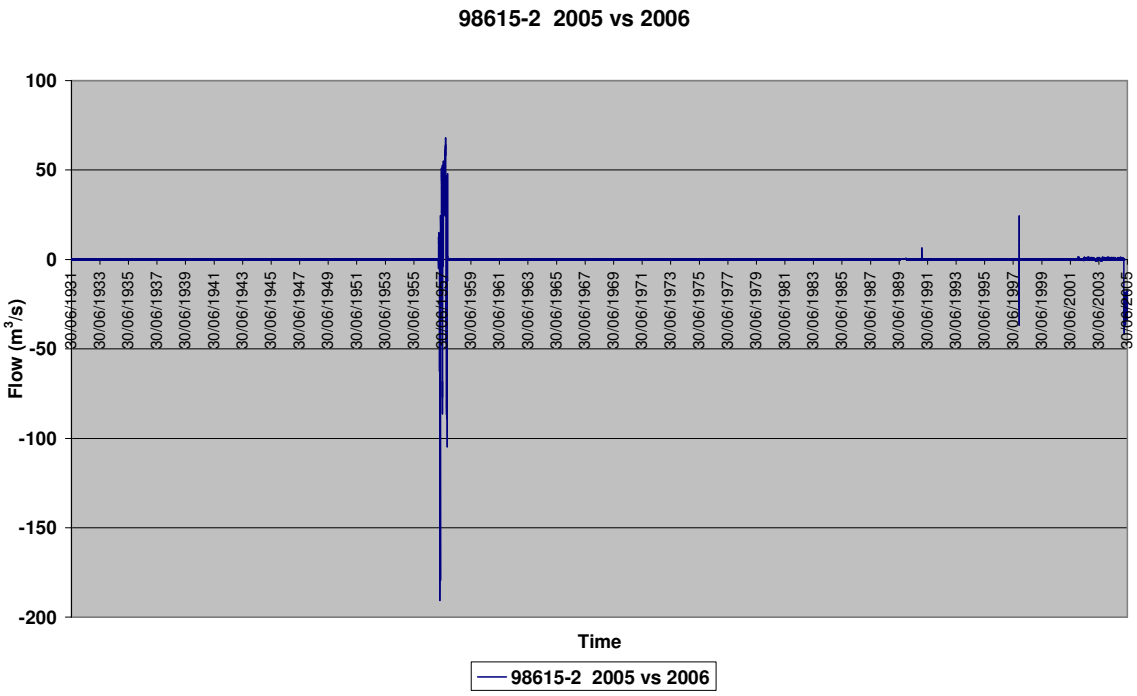

Figure 7.7.2 Daily Ben_tp data difference plot.

7.8 Waitaki Tributaries 98714 (2)

Figure 7.8 shows that data differences occurred from 2 March 1978 through to 2004 due to a rating change at Lake George Scott.

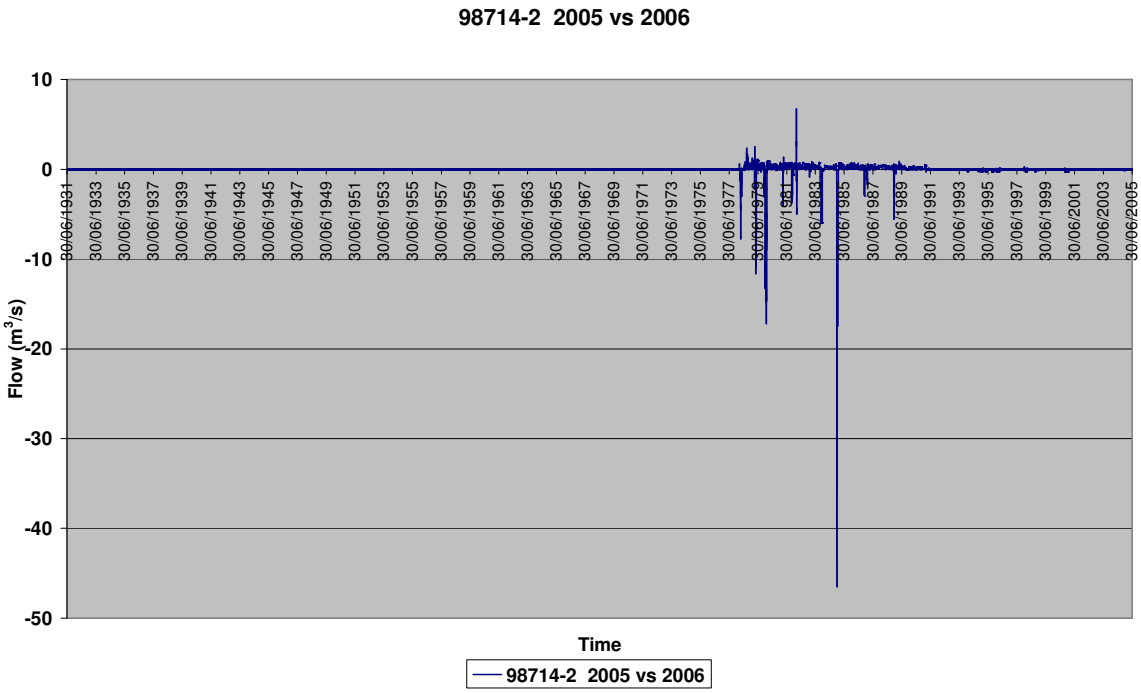

Figure 7.8 Daily Waitaki Tribs data difference plot.

7.9 TPD Sites (22790 and 92790 items 1 to 3)

To create the TPD datasets the base data must first be pre packaged using seven script files and one executable. Included in these seven script files are a number of psims that transform, manipulate the data to create a number of synthetic datasets along with actual datasets.

In 1997 all data relating to the TPD was contained in the Power Archive (this includes some theoretical lake ratings etc) and the script files all pointed to the required drives. Since 1997 the Power Archive has been broken up to reflect the separate power companies and Genesis now maintains its own database.

The scripts have been edited to reflect this change but new data calculated from 1931 to 1997 does not compare exactly with the 1997 dataset. This could be due to closed sites since 1997, rating changes that have occurred in any of the 18 input datasets, or operational changes since 1997.

Therefore for this update data from 30 June 2005 to 30 June 2006 will de added onto last years data. However for the next update discussion should be conducted with Genesis to ensure the SPECTRA TPD datasets are still producing their intended output.

8 Negative flows in datasets

There has been discussion regarding negative data in datasets. Given that the SPECTRA series is derived to provide potential generation values a negative value then concludes that their is no available water for generation for that data value. In reality negative data would not exist as water would be consumed from storage.

Therefore a negative data value is not incorrect it shows that there is no available potential water for use and that storage has to be consumed (except for Waikaremoana because the lake leaks).

The following four sites have negative flows in the dataset. They are:

- Lake Waikaremoana - 3650: Waikaremoana has negatives due to leakage from Lake Waikaremoana. Opus who previously calculated Waikaremoana inflows on behalf of Genesis had a minimum inflow value set into the routine to ensure no negative inflows were calculated. Genesis prefers to have negative inflows in the data until a solution can be found regarding lake leakage.

- OhauRes – 98614(6): This dataset has negative data values when the inflow to Lake Ohau drops below the required residual consent flow of 8 m^3/s for 1 May to 31 October and 12 m^3/s for 1 November to 30 April.

- Manareduced – 99551: This dataset simulates the effects of minimum flow regimes, Mararoa dirty water spill and flushing and recreational flows. The dataset will have negative values if the inflow to Lake Manapouri is less than the required 150 m^3/s flushing and recreational consent flows. In some instances when the Mararoa is in flood and the spill of dirty water is required (if flow is greater then 40 m^3/s) due to timing issues inflows to Manapouri will be less and negatives will result.

- Manawmara – 99551: This dataset only simulates the effects of dirty water flows. In some instances when the Mararoa is in flood and the spill of dirty water is required (if flow is greater then 40 m^3/s) due to timing issues inflows to Manapouri will be less and negatives will result.

As already discussed in reality storage is consumed from Lake Manapouri.

9 Recommendations for future Improvements

Some negative values were removed from the SPECTRA datasets due to the data improvements and recalculation of datasets. However negatives exist in four datasets and as already stated these negatives are an indication of unavailable water therefore are valid data and should be part of the dataset.

Four of the five additional sites recommended in the draft SPECTRA report have been constructed and are included in this report. Waipori is still under construction and will be included in the next SPECTRA update.

A recommendation of this report is to solve the data oddities pointed out via the Meridian feedback.

The data oddities are:

- Cobb Inflows
- Karapiro/Arapuni trib inflows
- Mangahao inflows
- Matahina inflows

Cobb Inflows

In 1993 the "Trends in Flow Data" report was produced and the issue of Cobb inflows was investigated. In the Trends report a recommendation was given to recalculate Cobb inflows based on a new equation using Lake Rotoroa for data prior to 1945. This equation is in the Spectra PSIM.

The correlation was obtained from ECNZ and the 1993 report is sparse on information relating to how good the correlation fits the data so this issue needs to be revisited.

In a meeting we had at the Electricity Commission David Harte suggested that a correlation with a North Island site may be more appropriate and this would be investigated to see if Cobb reflects more of a North Island trend.

Correlations will be investigated using North Island sites as they may be more appropriate and the use of flow distribution ratings may produce a better result than linear correlations used in the past. The end result would be that the dataset is accurate in respect to hydrological and statistical parameters and does not show poor/inconsistent standard deviations.

Karapiro Inflows

We are currently discussing this dataset with Mighty River Power (MRP). Grant Telfar has identified a change in 1995 which Tom Halliburton also identified when he analysed the Spectra data some years ago. The problem exists with input data into the Spectra process not as a result of the Spectra process.

Mangahao

Mangahao inflows are used in the Spectra PSIM but are not calculated by the Spectra process. Mangahao inflows were calculated under an ECNZ contract and the data was stored in the Power Archive. With the break up of ECNZ in 1999 Mangahao inflow calculations were terminated.

Calculation of Mangahao inflows is a complicated process as there are three dams, spillways and diversion tunnels. The inflow process has not been run in 8 years and would require some modification to make it work in today's environment.

Matahina

Matahina record form 1931 to 1948 is based on a linear correlation with Taupo inflows. A report can not be sourced at this time to determine if the correlation is adequate. To solve the data oddity further analysis can be conducted to see if the current correlation is adequate or another linear correlation of flow distribution using other sites can be applied.

TPD

When the SPECTRA process is run annually the newly calculated data is checked against the historical data. Any differences have to be explained, this was implemented for the last update. The TPD uses around 40 flow recording sites as inputs to produce the six SPECTRA flow sites.

All the SPECTRA updates have followed the instructions set out in the 1997 report as to how the ten script files and one executable should be run. But the newly calculated data does not compare with the historical data series.

This could be because:

- some of the 40 input sites may have closed,
- sites that Opus previously calculated under ECNZ contracts are now not calculated by the parent power companies hence some input datasets are incomplete or are not updated
- flow ratings for recorder sites have changed since 1997
- other changes since 1997

Because of the complexity of the TPD routines trying to find causes of why new data does not compare with historic data is a reasonably large task. However until some time can be spent on trying to find causes why data can not be replicated then the new datasets will continue to differ.

10 Appendix A - Statistical Summaries - PCAL and PDIST Listings

Contents **Site Number**

* **New 2006 update Site**

Note: All PCAL and PDIST listings are based on daily data

10.1 Matahina – 93254 (Item 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							75	73	74	67	67	65	70
1932	57	58	53	59	58	72	61	60	62	70	59	56	60
1933	59	64	66	61	73	59	68	71	63	57	60	56	63
1934	53	68	54	60	59	67	72	68	61	70	68	62	63
1935	55	69	61	58	70	86	75	84	68	72	84	66	71
1936	79	88	66	66	65	61	74	72	75	68	68	63	70
1937	72	58	60	62	79	63	61	58	60	59	57	60	63
1938	57	67	51	74	61	66	66	71	67	59	70	64	64
1939	65	54	53	53	50	68	63	83	70	60	57	67	62
1940	72	83	64	57	60	62	57	58	61	69	71	58	64
1941	65	58	70	55	53	68	67	70	68	83	72	65	66
1942	65	62	63	67	69	58	84	75	96	78	67	70	71
1943	57	54	56	61	57	84	81	73	88	77	67	61	68
1944	55	67	62	59	61	60	67	69	68	68	61	67	64
1945	77	63	67	60	70	69	72	79	77	76	68	58	70
1946	57	50	58	68	63	59	66	91	80	78	71	61	67
1947	64	55	51	56	53	85	76	68	71	84	62	65	66
1948	62	51	50	60	80	77	104	76	58	68	72	59	68
1949	59	47	38	35	97	93	81	79	68	52	48	43	62
1950	33	45	35	37	49	54	65	56	54	47	56	41	48
1951	52	49	45	38	38	47	106	71	48	49	64	58	56
1952	52	51	41	39	42	77	79	70	55	69	122	111	67
1953	76	73	56	53	74	93	133	114	93	89	68	60	82
1954	48	42	55	51	58	56	61	80	74	50	42	50	56
1955	41	38	35	42	56	61	77	79	69	73	53	53	57
1956	53	43	37	63	104	149	140	114	90	95	89	74	88
1957	61	52	54	45	70	58	70	50	46	50	48	49	54
1958	40	70	56	40	40	41	61	68	60	53	90	120	62
1959	88	73	77	93	75	74	58	57	49	73	61	47	69
1960	40	82	64	45	44	86	79	69	71	75	67	52	65
1961	49	41	39	37	38	36	51	53	60	48	39	44	45
1962	41	50	78	74	142	144	101	99	103	136	126	125	102
1963	87	69	53	47	46	73	106	76	117	73	55	50	71
1964	48	42	70	40	41	42	120	91	91	102	74	66	69
1965	64	137	73	60	52	67	70	98	70	53	73	61	73
1966	80	65	82	61	77	76	109	104	101	85	86	69	83
1967	62	135	74	50	52	55	57	107	99	69	75	97	77
1968	42	52	48	55	76	95	101	88	86	72	63	70	71
1969	83	98	59	49	55	48	47	46	87	58	46	59	61

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	49	39	40	43	43	94	73	164	131	152	121	69	85
1971	74	62	59	52	115	134	70	75	117	120	105	97	90
1972	78	59	103	62	55	51	77	69	69	66	52	46	66
1973	46	39	40	39	40	54	43	58	73	63	51	44	49
1974	38	38	35	70	54	78	105	104	85	87	71	82	71
1975	71	57	66	58	61	103	71	80	84	102	74	56	74
1976	78	93	57	61	67	67	75	80	75	74	65	57	71
1977	49	45	42	39	45	69	86	76	65	61	49	52	57
1978	41	37	34	39	35	37	75	53	57	55	65	54	49
1979	40	52	80	63	68	56	56	105	106	99	95	68	74
1980	73	57	51	62	54	56	72	70	79	57	56	68	63
1981	60	50	48	50	57	80	87	92	69	68	92	75	69
1982	64	56	56	50	53	66	54	53	49	45	41	41	52
1983	37	32	31	36	36	46	54	47	53	122	102	78	56
1984	51	55	68	54	44	44	67	59	59	51	44	69	55
1985	57	46	44	55	46	62	64	66	82	51	49	64	57
1986	97	59	59	46	56	63	63	90	86	65	56	47	66
1987	50	43	50	53	48	55	47	57	47	48	49	63	51
1988	47	50	44	36	41	46	55	84	83	80	64	69	58
1989	119	75	55	44	52	85	87	59	67	107	80	54	74
1990	52	48	52	45	57	54	57	116	72	89	100	65	67
1991	51	59	48	45	48	45	53	89	83	75	67	46	59
1992	54	51	44	41	37	40	58	94	71	72	56	85	59
1993	50	43	39	39	42	80	52	43	39	34	38	37	45
1994	35	30	30	36	35	61	82	101	71	75	77	51	57
1995	44	45	42	79	64	70	111	91	89	93	72	94	75
1996	74	63	58	75	88	79	82	78	97	68	57	58	73
1997	57	49	57	54	49	92	73	58	58	68	56	48	60
1998	41	41	40	40	43	63	182	100	84	86	73	63	72
1999	54	47	49	51	56	79	72	77	81	59	101	67	66
2000	53	50	41	47	50	71	61	67	68	65	52	50	56
2001	48	61	49	59	73	56	49	58	57	66	75	108	63
2002	70	53	47	50	50	69	88	63	54	53	49	50	58
2003	38	33	32	36	40	55	51	37	62	93	56	75	51
2004	66	68	64	43	55	93	155	102	77	85	74	67	79
2005	82	53	50	45	59	63	65	56	62	72	53	62	60
2006	59	73	50	56	93	97							71
Min.	33	30	30	35	35	36	43	37	39	34	38	37	45
Mean	59	58	54	53	59	69	76	76	74	73	68	64	65
Max.	119	137	103	93	142	149	182	164	131	152	126	125	102

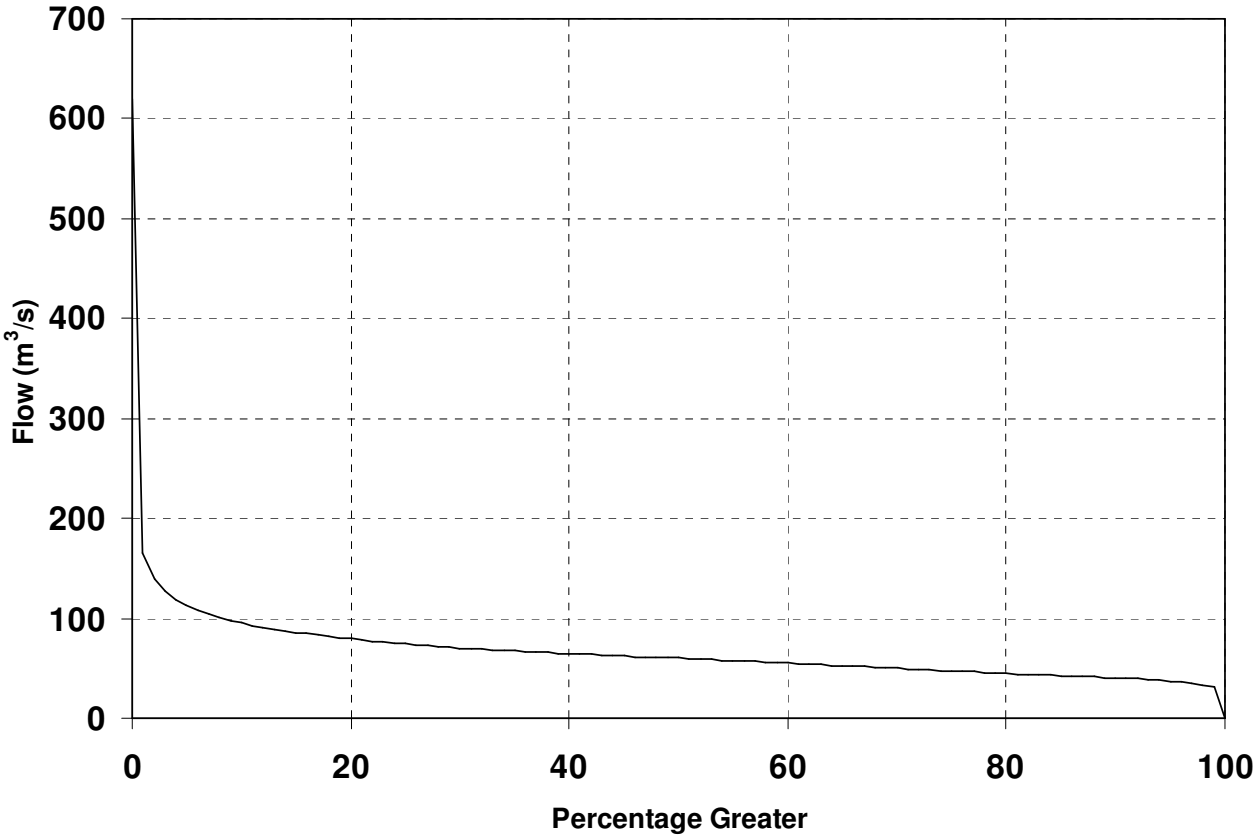

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	620	165	140	127	118	113	108	104	101	98
10	96	93	91	89	88	86	85	83	82	81
20	79	78	77	76	75	74	73	73	72	71
30	70	70	69	69	68	67	67	66	66	65
40	65	64	64	63	63	62	62	61	61	61
50	60	60	59	59	58	58	57	57	56	56
60	55	55	54	54	53	53	52	52	51	51
70	50	49	49	48	48	47	47	46	46	46
80	45	44	44	43	43	42	42	42	41	41
90	40	40	39	39	38	37	36	35	34	32
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	65	60	620

10.2 Taupo Linear – 22790 (Item 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							200	188	195	158	158	147	175
1932	108	115	92	118	113	184	132	123	132	173	121	102	126
1933	119	145	154	130	192	121	163	181	139	110	123	106	140
1934	90	168	93	123	121	158	185	164	131	175	162	136	142
1935	97	168	131	116	173	257	201	248	166	186	247	152	178
1936	218	266	152	155	150	130	195	184	198	165	163	140	176
1937	186	116	125	134	219	140	129	113	125	121	111	126	137
1938	109	161	82	195	130	152	153	177	161	118	177	144	146
1939	149	93	88	90	76	164	139	239	176	125	111	161	135
1940	184	242	144	107	123	132	111	117	127	170	178	115	145
1941	152	113	177	100	92	165	162	176	162	243	186	152	157
1942	148	137	141	157	169	112	248	202	305	217	159	173	181
1943	110	97	102	130	111	249	231	191	267	211	158	129	166
1944	99	163	137	118	131	127	162	172	164	167	130	158	144
1945	209	140	159	124	176	169	186	219	212	208	162	115	174
1946	107	75	113	167	137	120	152	281	227	214	182	131	159
1947	143	98	81	104	89	252	206	165	178	244	132	146	154
1948	135	80	77	124	226	173	220	178	148	218	180	124	157
1949	123	121	103	119	198	239	236	188	148	150	145	111	157
1950	79	143	70	94	107	132	130	161	150	134	176	117	124
1951	125	108	101	111	101	120	227	138	110	184	228	191	146
1952	133	145	86	104	130	310	212	163	130	172	283	230	175
1953	152	131	98	122	202	234	265	209	175	219	194	140	179
1954	114	103	131	100	126	134	142	182	161	105	113	144	130
1955	96	121	79	133	210	191	175	199	179	179	152	154	156
1956	164	118	82	197	181	312	276	222	170	207	197	189	193
1957	142	98	139	96	176	148	163	126	120	176	180	193	147
1958	116	313	141	91	148	168	193	202	137	142	151	346	178
1959	198	140	154	175	152	153	135	145	116	180	145	107	150
1960	94	180	102	73	116	188	193	176	187	146	127	89	139
1961	116	98	85	120	85	126	195	139	176	141	97	116	125
1962	133	100	215	148	191	257	186	220	219	287	231	246	203
1963	153	136	86	102	118	187	205	145	242	114	117	103	142
1964	137	106	186	81	98	111	277	225	268	233	160	218	176
1965	159	203	148	124	113	179	155	211	132	111	222	167	160
1966	168	156	133	141	167	165	253	174	186	131	166	169	168
1967	149	181	133	89	114	109	124	240	148	115	200	187	149
1968	102	88	77	85	151	212	169	162	139	175	142	169	139
1969	145	179	86	95	133	105	104	135	199	118	104	153	129

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	92	58	88	92	136	216	173	211	296	234	187	125	159
1971	150	134	90	84	137	187	139	204	242	280	196	182	169
1972	122	89	251	100	166	120	228	173	177	165	138	111	154
1973	120	81	91	72	149	163	100	172	227	126	168	125	133
1974	79	89	60	111	131	158	291	209	173	210	149	174	153
1975	141	83	103	103	181	219	201	246	214	228	164	130	168
1976	218	170	124	114	151	170	232	235	213	185	146	149	176
1977	132	105	92	84	160	271	236	188	188	172	144	130	159
1978	103	77	54	111	86	100	220	152	164	144	190	141	129
1979	84	129	189	154	211	131	149	210	190	256	195	171	173
1980	192	121	145	185	146	159	181	210	212	168	184	202	176
1981	139	124	126	109	132	229	217	197	187	186	201	189	170
1982	118	156	123	93	147	145	125	126	151	138	122	159	133
1983	111	92	75	132	142	150	139	137	176	242	195	150	145
1984	120	136	166	93	119	120	189	162	138	116	132	182	140
1985	133	92	97	101	77	174	149	137	164	125	130	185	130
1986	253	159	97	97	161	148	191	199	178	189	133	116	160
1987	138	79	128	137	146	145	116	135	154	176	143	183	140
1988	87	103	117	94	150	194	195	245	235	227	234	224	176
1989	233	153	125	100	133	225	187	141	152	275	163	127	168
1990	144	109	186	142	182	132	165	287	165	178	186	110	166
1991	118	171	107	111	100	97	166	275	227	188	138	129	152
1992	151	137	123	107	86	135	214	269	194	175	157	197	162
1993	114	90	82	91	141	214	114	105	105	103	152	116	119
1994	99	84	57	94	130	180	213	253	216	200	271	141	162
1995	118	133	145	229	159	194	281	200	255	238	202	217	198
1996	163	163	137	224	176	160	233	224	278	194	173	213	195
1997	128	119	89	106	108	131	127	127	162	160	150	139	129
1998	118	126	90	104	140	166	357	201	192	294	178	154	177
1999	132	82	110	112	195	207	173	189	188	127	259	155	161
2000	151	107	68	124	125	189	169	176	192	276	147	176	158
2001	124	151	98	98	187	151	126	165	124	143	204	320	158
2002	152	106	98	108	123	215	244	173	205	166	147	189	161
2003	113	76	91	66	140	178	153	107	232	267	188	204	152
2004	128	311	179	112	167	277	233	234	190	252	170	192	203
2005	185	122	103	70	127	140	170	149	152	242	107	186	147
2006	154	153	93	177	176	178							155
Min.	79	58	54	66	76	97	100	105	105	103	97	89	119
Mean	136	131	116	118	144	173	186	185	182	183	167	160	157
Max.	253	313	251	229	226	312	357	287	305	294	283	346	203

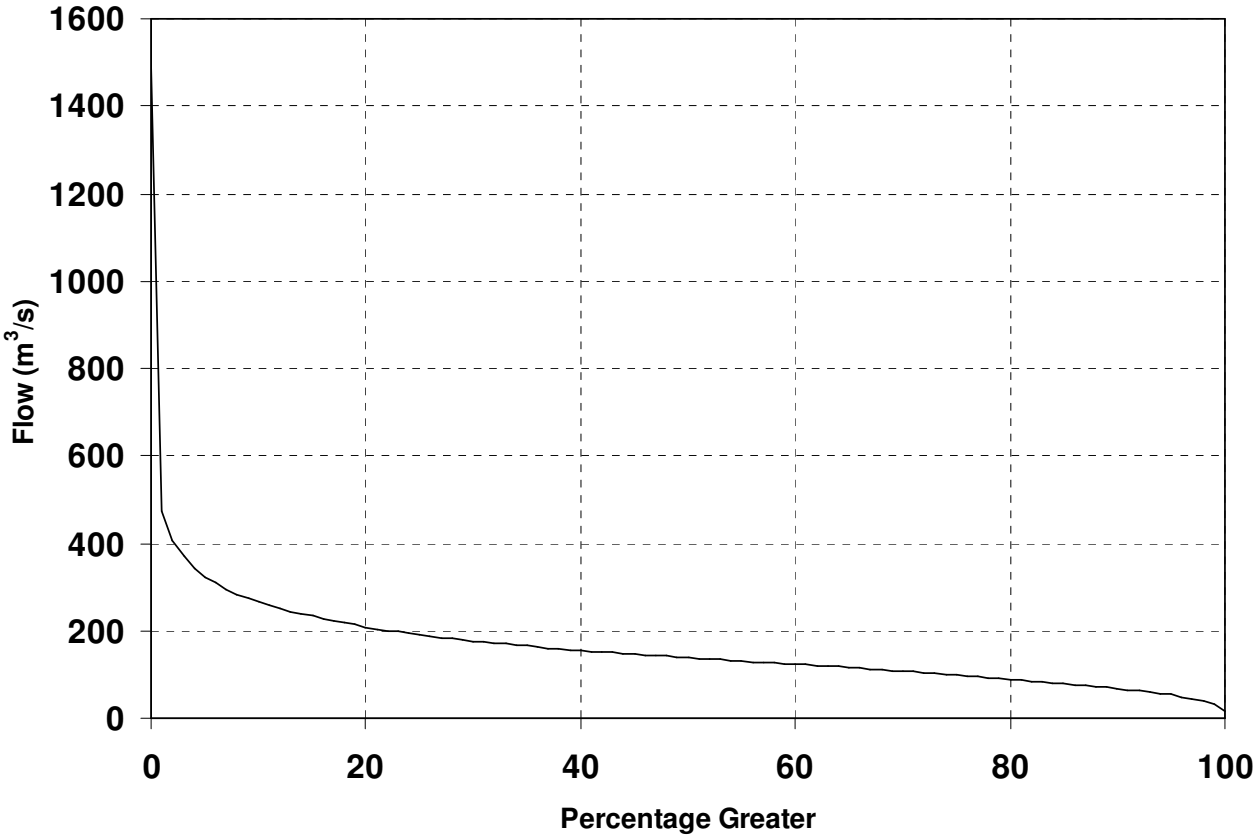

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1489	473	408	369	344	323	309	295	284	274
10	265	258	251	244	239	233	228	222	218	213
20	209	205	201	197	194	191	188	184	182	179
30	177	174	172	169	167	165	163	161	159	157
40	155	153	151	150	148	147	145	143	141	140
50	139	137	135	134	132	131	129	128	126	125
60	124	122	120	119	118	116	115	113	111	109
70	108	106	104	103	101	99	97	95	93	91
80	90	87	85	83	81	79	77	74	72	70
90	68	65	63	60	57	54	49	45	39	31
100	18									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	18	157	139	1489

10.3 Rangipo Linear – 22790 (Item 2)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							43	41	43	33	32	29	37
1932	18	20	14	21	20	38	24	22	25	37	22	16	23
1933	21	29	25	24	41	21	32	38	27	19	22	18	27
1934	13	23	14	22	22	28	39	34	24	37	33	26	26
1935	15	30	25	21	36	56	44	55	35	40	55	31	37
1936	42	52	31	32	31	24	42	39	42	35	33	26	36
1937	40	20	23	25	39	27	24	19	23	22	19	23	25
1938	19	33	11	34	24	31	30	37	33	21	37	29	28
1939	30	13	13	14	9	32	27	44	37	23	20	33	25
1940	32	41	28	18	22	25	19	21	24	35	37	21	27
1941	29	20	33	16	15	33	32	37	33	47	37	30	30
1942	29	26	27	32	35	20	52	43	58	47	32	37	36
1943	19	16	16	24	19	42	45	40	52	46	32	24	31
1944	16	21	26	21	25	21	32	35	34	31	25	31	27
1945	38	27	32	23	35	35	40	42	43	37	33	20	34
1946	18	9	20	32	26	22	30	57	44	46	39	25	31
1947	28	16	11	17	12	48	44	35	38	53	25	29	30
1948	25	10	10	23	43	36	48	37	30	48	38	23	31
1949	23	22	17	21	34	52	47	40	29	30	28	19	30
1950	10	18	8	14	18	24	24	32	29	26	37	21	22
1951	23	18	16	19	16	21	42	27	19	38	48	40	27
1952	25	29	12	17	25	55	39	34	25	36	58	50	34
1953	31	24	15	22	37	46	53	45	37	43	41	27	35
1954	20	17	21	15	23	25	28	37	33	17	20	28	24
1955	15	22	9	20	45	41	37	43	38	38	31	30	31
1956	33	21	10	41	35	55	49	49	36	45	40	40	38
1957	27	15	27	15	36	29	33	23	22	37	38	41	29
1958	21	37	28	13	30	34	35	45	26	27	29	45	31
1959	31	27	31	32	30	31	25	29	20	38	28	17	28
1960	15	31	16	8	20	39	36	37	39	29	24	13	26
1961	19	15	11	21	11	23	42	27	37	27	15	20	22
1962	24	15	30	28	37	46	40	42	47	51	48	38	37
1963	24	26	12	16	21	37	43	29	49	20	21	16	26
1964	27	16	27	10	15	19	40	49	49	52	33	43	32
1965	32	33	29	22	19	37	30	40	25	19	40	33	30
1966	31	32	25	22	29	32	46	36	37	24	30	31	31
1967	28	26	24	12	18	19	22	43	29	20	36	36	26
1968	16	12	9	11	26	43	34	33	27	37	28	29	26
1969	27	30	12	15	24	17	17	26	36	21	17	29	22

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	14	5	12	13	24	43	36	44	50	43	39	22	29
1971	29	21	13	11	26	36	26	42	52	54	43	37	33
1972	22	12	40	16	25	21	46	36	38	34	27	19	28
1973	21	11	13	8	29	32	16	35	40	23	34	25	24
1974	10	15	7	20	22	30	55	44	37	44	30	36	29
1975	27	12	16	18	36	43	42	44	46	49	33	24	33
1976	40	26	22	18	29	34	47	47	38	39	28	29	33
1977	24	18	14	12	29	46	48	41	37	35	28	24	30
1978	17	11	6	17	13	17	43	31	32	25	28	27	22
1979	12	26	31	27	37	25	28	42	39	46	41	34	33
1980	37	24	28	38	29	32	37	39	45	35	35	39	35
1981	28	23	24	19	25	47	45	42	38	39	42	39	34
1982	20	23	23	16	29	29	23	23	29	26	21	31	25
1983	17	13	9	24	25	28	26	26	35	48	35	30	26
1984	23	26	34	14	21	22	39	33	27	20	25	34	27
1985	25	14	17	16	11	31	30	26	33	24	25	33	24
1986	41	31	15	16	25	29	34	37	34	39	25	20	29
1987	23	10	24	26	28	28	20	26	30	35	27	37	26
1988	13	18	20	15	27	34	39	52	51	51	44	38	34
1989	45	34	23	17	27	42	39	28	31	53	33	23	33
1990	28	20	25	26	34	24	34	54	34	38	38	19	31
1991	21	28	18	22	18	15	33	51	49	38	26	24	29
1992	25	24	20	17	12	25	42	49	41	36	32	41	30
1993	20	16	13	14	20	41	21	18	17	17	27	21	20
1994	17	15	7	15	23	35	44	47	42	43	45	27	30
1995	23	26	28	45	28	37	51	40	46	48	37	35	37
1996	26	30	27	41	33	32	47	45	49	41	35	39	37
1997	25	25	17	19	20	25	24	24	30	31	29	26	24
1998	22	27	17	18	24	33	49	39	38	49	37	29	32
1999	25	15	22	22	31	38	36	37	37	25	43	31	30
2000	28	20	10	25	24	36	30	35	41	44	30	34	30
2001	23	31	17	18	36	31	24	33	25	28	41	50	30
2002	31	19	18	17	23	41	40	37	41	33	28	36	30
2003	21	13	17	10	18	35	28	20	42	47	35	39	27
2004	24	46	32	21	34	45	45	48	40	51	35	34	38
2005	38	25	20	11	25	27	36	30	28	47	19	37	29
2006	25	24	17	35	37	37							29
Min.	10	5	6	8	9	15	16	18	17	17	15	13	20
Mean	25	22	20	20	26	33	36	37	36	36	33	30	29
Max.	45	52	40	45	45	56	55	57	58	54	58	50	38

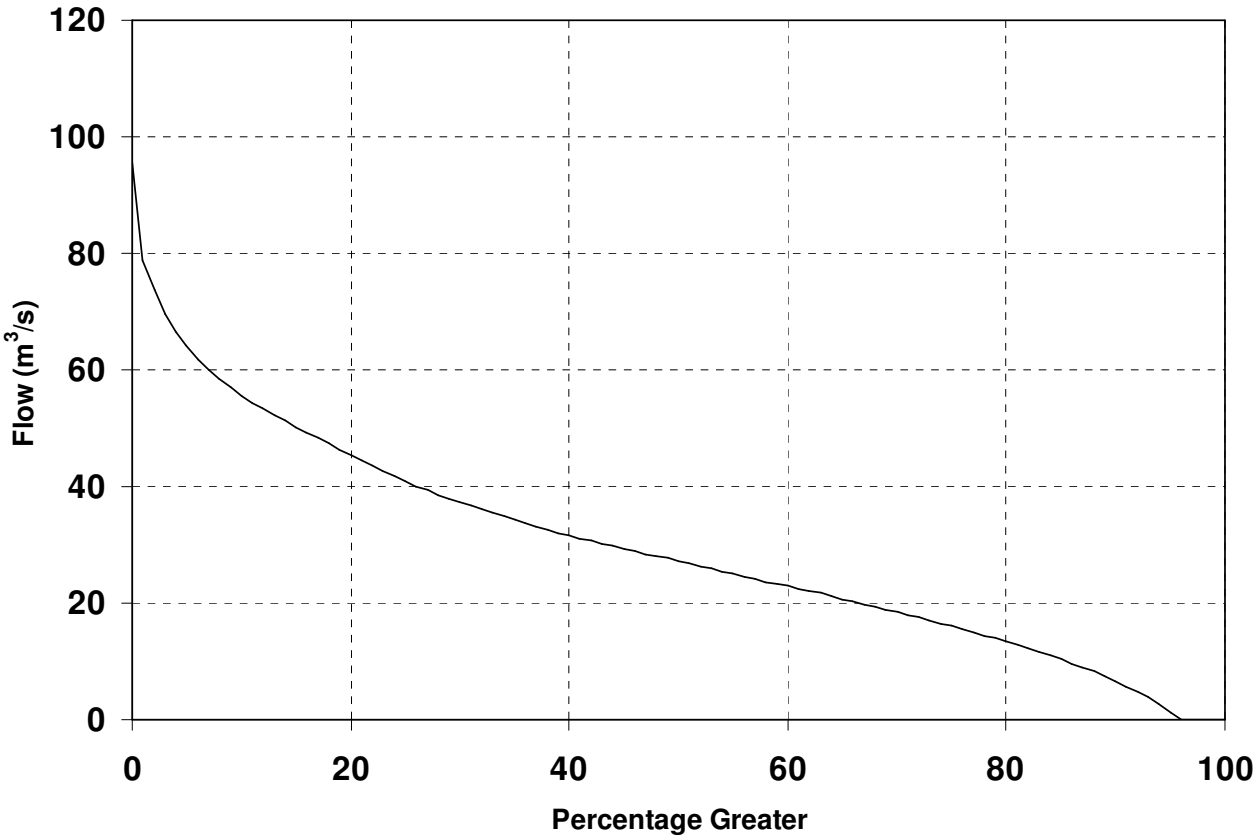

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	95	79	74	70	67	64	62	60	58	57
10	56	54	53	52	51	50	49	48	47	46
20	45	44	44	43	42	41	40	39	39	38
30	37	37	36	35	35	34	34	33	33	32
40	32	31	31	30	30	29	29	29	28	28
50	27	27	26	26	25	25	25	24	24	23
60	23	23	22	22	21	21	20	20	19	19
70	18	18	18	17	17	16	16	15	14	14
80	13	13	12	12	11	10	10	9	8	8
90	7	6	5	4	3	1	0	0	0	0
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	30	27	95

10.4 Tokaanu – Linear 22790 (Item 3)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							70	66	69	56	56	52	62
1932	39	42	35	43	41	64	48	45	47	61	44	38	46
1933	43	51	54	47	68	44	57	64	50	40	45	39	50
1934	34	52	35	44	44	55	65	59	47	62	57	49	50
1935	36	58	47	43	61	88	71	86	59	65	85	54	63
1936	74	88	54	55	53	47	69	65	69	58	57	49	61
1937	65	43	45	48	73	50	46	41	45	44	41	45	49
1938	40	58	32	65	47	54	54	62	57	43	62	51	52
1939	53	35	33	35	30	58	50	81	62	45	41	57	48
1940	63	80	51	39	45	47	40	43	46	60	63	42	51
1941	55	42	62	38	35	58	58	62	57	82	65	55	56
1942	53	49	51	55	59	41	85	70	102	76	56	61	63
1943	41	38	37	46	41	82	78	67	89	73	56	46	58
1944	36	54	49	43	47	46	57	61	58	59	46	56	51
1945	70	50	56	45	61	60	65	75	73	69	57	42	60
1946	39	30	41	58	49	43	54	94	77	74	64	47	56
1947	51	36	32	39	32	84	71	58	63	84	47	52	54
1948	48	31	30	46	77	61	76	63	52	76	63	44	56
1949	44	43	38	43	65	82	80	66	52	53	51	40	55
1950	30	49	28	35	39	47	46	57	53	48	62	42	44
1951	45	39	37	40	38	43	75	49	40	64	79	67	51
1952	47	52	32	38	47	101	71	58	46	60	96	79	61
1953	54	47	35	44	69	79	89	73	62	75	67	49	62
1954	41	37	46	36	45	48	51	64	57	37	41	51	46
1955	35	43	30	46	73	67	61	70	63	63	54	54	55
1956	57	43	31	68	63	101	90	77	60	72	68	66	67
1957	50	35	49	35	62	52	57	45	43	62	64	67	52
1958	42	80	50	33	53	59	66	71	49	50	53	101	59
1959	66	50	55	60	54	54	48	52	42	64	51	39	53
1960	35	61	37	28	42	66	67	62	66	52	45	33	49
1961	42	36	32	43	31	45	68	50	62	50	35	42	45
1962	48	37	72	52	66	84	65	75	76	94	79	79	69
1963	52	48	32	37	43	65	71	52	83	41	42	38	50
1964	49	39	60	30	35	40	90	78	88	81	57	74	60
1965	56	67	52	44	40	63	55	73	48	41	74	58	56
1966	57	56	47	49	58	58	83	61	65	47	57	59	58
1967	52	56	47	33	42	40	44	80	53	41	68	65	52
1968	37	32	29	33	54	74	59	57	50	62	50	58	50
1969	52	61	32	36	47	38	37	48	68	43	37	53	46

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	34	25	33	35	48	74	61	73	97	79	65	45	56
1971	53	47	33	31	49	65	49	71	83	93	69	63	59
1972	45	33	81	37	56	43	78	61	63	58	49	41	54
1973	43	31	34	28	53	59	34	59	77	46	61	39	47
1974	28	28	20	35	41	53	101	74	59	76	54	60	52
1975	50	29	36	35	64	78	74	81	77	80	60	48	60
1976	69	52	42	37	56	63	80	88	74	67	53	55	61
1977	50	37	31	29	60	93	83	66	67	61	53	48	57
1978	36	25	17	34	28	33	77	55	59	51	64	52	44
1979	31	38	56	55	75	46	50	73	68	85	69	63	59
1980	61	40	52	68	52	57	65	75	80	61	66	71	62
1981	49	44	40	39	46	83	80	72	71	69	70	69	61
1982	44	48	42	28	53	51	45	45	55	50	45	60	47
1983	44	34	28	48	56	56	50	48	66	86	65	52	53
1984	39	46	56	33	45	42	69	60	48	43	46	65	49
1985	49	31	33	32	25	57	52	49	58	43	45	64	45
1986	72	57	35	34	56	55	67	69	64	71	49	42	56
1987	47	28	45	46	51	53	41	47	57	66	52	69	50
1988	30	33	42	32	57	68	73	91	89	71	85	75	62
1989	66	45	44	33	42	81	66	49	52	95	59	44	56
1990	53	37	58	49	68	49	62	100	60	63	67	39	59
1991	39	59	37	31	32	35	56	93	82	70	51	45	53
1992	56	52	47	39	31	49	78	98	72	61	53	70	59
1993	41	26	23	31	44	77	39	35	37	35	52	41	40
1994	32	22	16	29	50	68	79	87	77	72	90	52	56
1995	38	44	50	80	54	69	99	71	86	87	74	71	69
1996	53	56	45	78	63	58	82	79	86	70	63	75	67
1997	44	33	23	35	31	44	42	45	53	57	54	51	43
1998	37	36	25	34	49	60	91	64	68	84	57	52	55
1999	37	20	31	33	60	71	60	65	63	42	82	54	52
2000	49	34	16	36	38	65	55	59	64	84	50	61	51
2001	44	48	30	29	61	52	42	58	40	49	73	95	52
2002	52	33	28	31	40	77	78	62	75	61	56	66	55
2003	37	18	22	16	39	63	53	34	79	91	66	76	50
2004	44	98	55	35	57	89	78	85	69	90	61	69	69
2005	66	35	29	17	39	48	59	51	50	83	35	61	48
	49	47	26	58	60	62							50
Min.	28	18	16	16	25	33	34	34	37	35	35	33	40
Mean	47	44	40	41	50	60	64	65	64	64	59	56	55
Max.	74	98	81	80	77	101	101	100	102	95	96	101	69

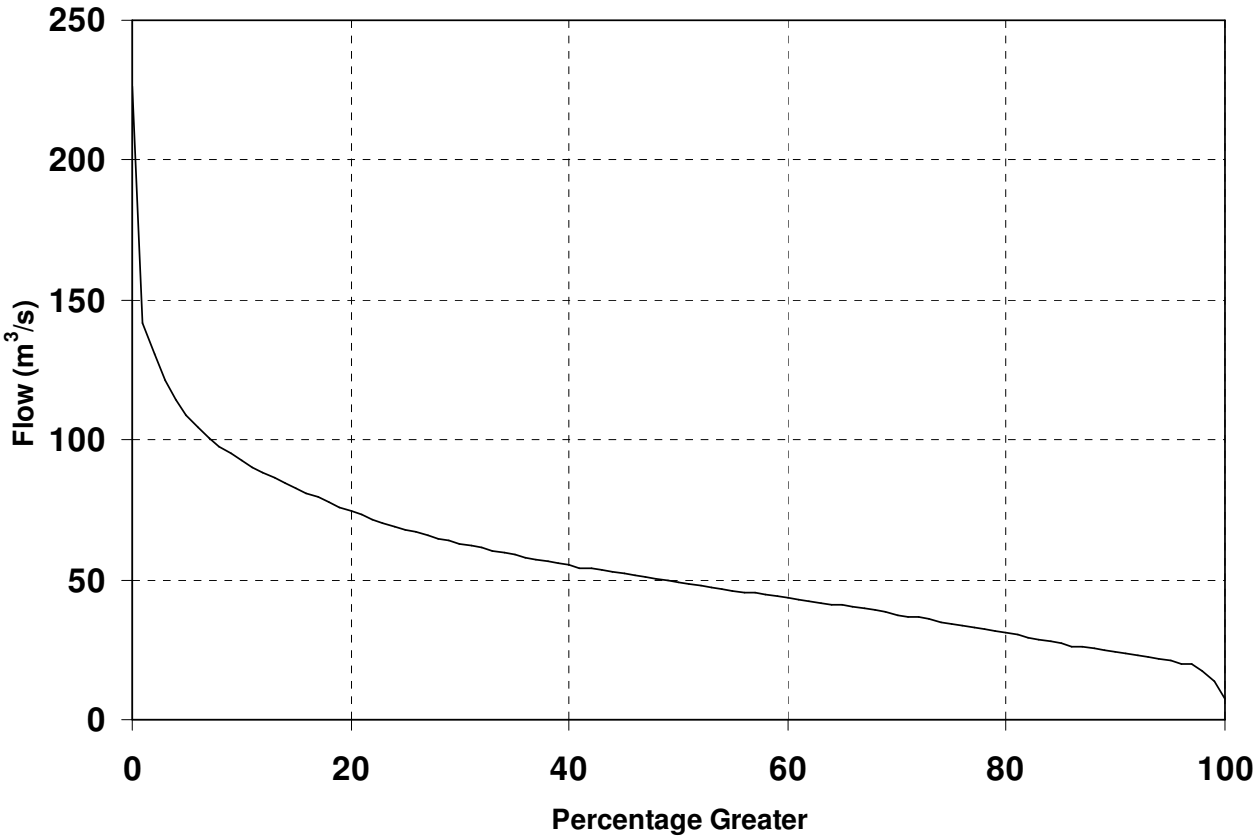

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	226	142	131	121	115	109	105	101	98	95
10	93	90	88	86	85	83	81	79	78	76
20	75	73	72	70	69	68	67	66	65	64
30	63	62	61	60	60	59	58	57	57	56
40	55	54	54	53	53	52	51	51	50	50
50	49	49	48	47	47	46	46	45	45	44
60	44	43	42	42	41	41	40	40	39	38
70	38	37	36	36	35	35	34	33	32	32
80	31	30	30	29	28	27	26	26	25	25
90	24	24	23	23	22	21	20	20	17	13
100	7									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	7	55	49	226

10.5 Taupo Operational – 42790 (Item 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							203	191	199	159	158	147	176
1932	100	107	81	113	105	183	127	118	130	175	117	94	121
1933	114	145	148	127	195	114	160	180	137	104	117	99	137
1934	80	157	83	114	116	153	186	160	127	178	162	135	137
1935	88	165	128	110	173	259	204	251	167	188	249	152	178
1936	218	267	152	155	151	126	198	185	198	166	163	135	176
1937	188	109	121	131	219	139	126	106	123	115	105	122	134
1938	102	159	70	189	126	153	152	177	161	113	177	144	143
1939	151	83	78	78	60	160	136	237	177	120	105	160	129
1940	177	241	142	99	116	130	105	111	123	169	179	110	141
1941	144	107	172	91	81	163	159	178	164	243	188	148	154
1942	145	133	134	157	170	106	249	203	306	220	157	174	180
1943	102	82	94	125	103	244	232	191	265	213	157	125	161
1944	91	152	132	113	128	119	158	171	165	163	128	155	140
1945	207	138	158	117	173	166	188	219	213	205	162	108	172
1946	99	60	106	162	133	117	150	281	229	216	183	128	156
1947	141	90	68	96	79	249	206	167	180	247	130	145	150
1948	130	66	64	116	225	174	222	179	148	221	181	120	154
1949	119	115	95	110	194	241	238	190	147	150	142	104	154
1950	66	134	55	82	101	127	126	160	148	132	176	112	118
1951	121	102	93	104	90	115	226	136	105	184	230	191	142
1952	130	143	75	95	126	308	210	164	127	172	284	232	172
1953	152	126	89	116	201	236	266	211	176	220	195	139	178
1954	109	95	122	91	123	131	141	181	162	99	108	140	125
1955	87	115	66	123	211	193	176	202	180	181	153	150	153
1956	162	111	70	197	180	311	276	225	173	209	198	190	192
1957	140	90	136	88	174	147	164	123	117	177	182	195	145
1958	111	301	140	82	148	168	192	206	136	139	148	337	175
1959	196	137	153	172	150	153	132	145	110	182	144	99	148
1960	84	176	94	59	111	189	191	178	188	146	125	80	135
1961	105	89	74	113	74	122	197	137	178	139	89	109	119
1962	129	89	210	145	191	256	188	222	220	286	232	243	202
1963	149	134	74	93	112	187	207	145	243	108	111	94	138
1964	136	94	180	69	91	105	273	227	266	236	161	216	172
1965	159	201	146	119	105	180	153	208	129	103	220	166	157
1966	166	154	128	131	162	162	252	175	186	128	163	167	165
1967	144	175	126	79	104	103	119	239	147	111	197	187	144
1968	94	78	63	73	142	215	169	162	139	177	141	167	135
1969	140	175	73	85	128	98	97	133	198	113	97	150	123

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	83	39	76	80	130	217	175	213	295	235	187	118	155
1971	146	126	80	72	132	186	134	201	243	281	196	180	165
1972	115	78	247	88	157	111	225	172	177	161	131	97	147
1973	111	66	77	55	129	161	95	174	226	121	165	131	126
1974	69	88	52	111	130	162	285	210	178	208	148	175	152
1975	139	75	95	100	178	217	198	245	213	229	162	125	165
1976	222	172	121	112	146	165	232	228	212	184	143	146	174
1977	125	100	86	77	151	265	234	191	188	172	140	125	155
1978	99	72	45	110	81	98	218	151	162	140	183	137	125
1979	75	137	197	149	204	130	148	212	190	255	190	162	171
1980	212	114	145	180	134	154	186	213	213	162	173	210	175
1981	135	109	121	103	130	232	221	194	180	179	202	184	166
1982	102	155	122	94	142	144	121	122	149	135	114	153	129
1983	96	81	64	129	133	144	138	135	175	247	196	141	140
1984	110	134	168	90	109	114	192	160	137	124	122	178	137
1985	123	81	92	101	77	186	148	138	164	115	122	191	128
1986	281	150	90	84	149	140	199	201	179	182	119	102	157
1987	135	67	129	148	134	137	108	133	149	173	138	179	136
1988	78	102	116	83	142	190	194	243	236	240	220	219	172
1989	260	166	113	85	136	230	185	133	155	279	162	117	169
1990	135	103	186	130	176	129	162	296	159	177	183	95	162
1991	118	171	90	120	96	90	168	287	224	180	130	116	149
1992	144	123	108	98	76	132	215	269	201	185	160	199	159
1993	116	90	81	91	147	220	120	106	110	105	152	116	121
1994	98	82	54	92	134	188	222	258	221	206	282	142	165
1995	118	133	145	230	163	199	288	208	265	240	201	214	201
1996	165	164	137	227	180	164	244	231	284	196	172	213	198
1997	129	118	89	108	105	135	133	135	166	166	151	137	131
1998	114	123	87	101	136	164	367	204	194	293	179	153	177
1999	121	75	101	103	181	193	162	176	175	117	242	144	150
2000	140	99	60	114	115	177	157	164	179	258	137	164	147
2001	115	140	89	89	174	141	117	154	115	133	191	300	147
2002	141	97	90	98	114	202	228	162	192	155	137	177	150
2003	104	68	82	58	128	166	142	99	217	251	176	192	141
2004	118	292	167	103	155	260	218	219	178	236	158	179	190
2005	173	113	95	62	116	130	159	139	141	226	98	174	136
2006	143	142	85	165	164	166							144
Min.	66	39	45	55	60	90	95	99	105	99	89	80	118
Mean	132	124	109	111	138	170	185	185	180	181	164	155	153
Max.	281	301	247	230	225	311	367	296	306	293	284	337	202

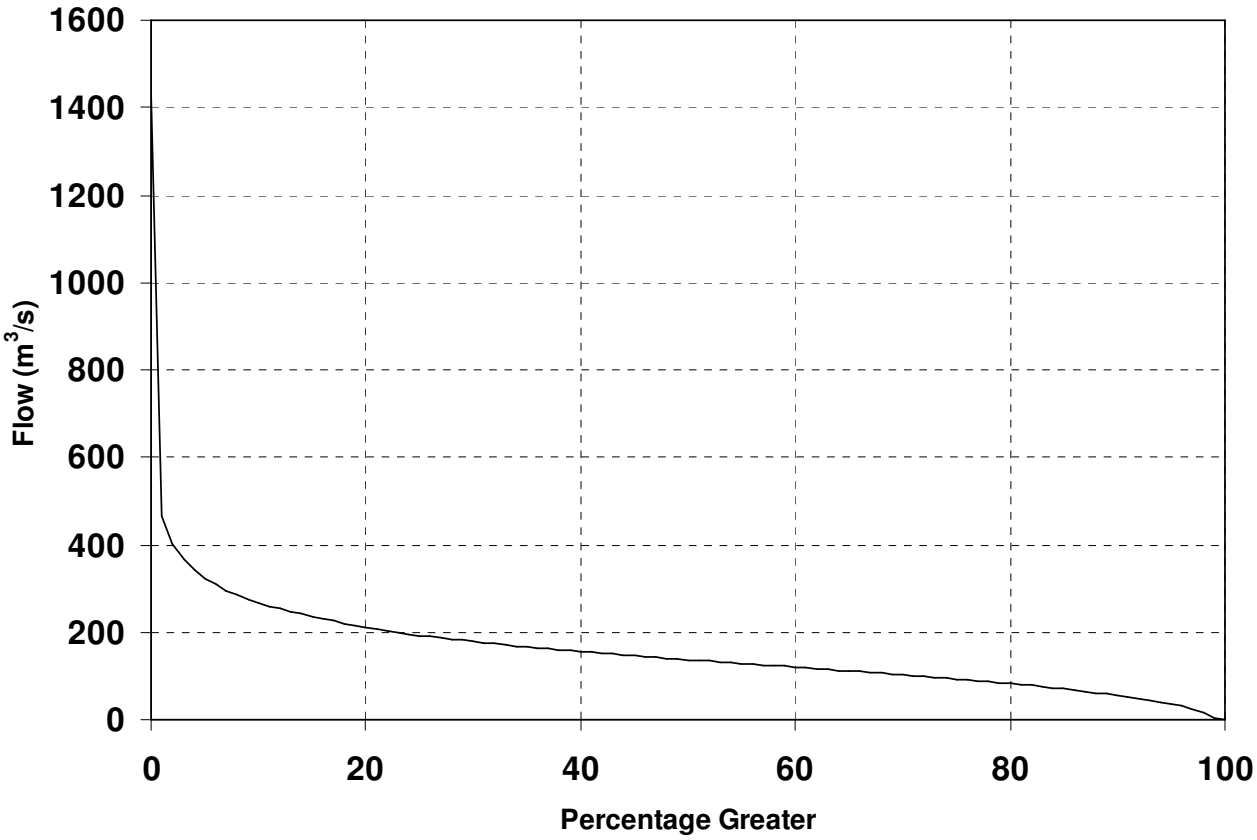

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1426	467	403	367	342	323	309	296	285	276
10	268	260	253	247	241	235	230	225	220	215
20	211	207	203	200	196	193	189	186	184	181
30	178	176	173	171	169	167	164	162	159	157
40	156	154	152	150	148	146	145	142	141	139
50	137	135	134	132	130	128	127	125	123	122
60	120	118	117	115	113	111	110	108	106	104
70	102	100	99	97	95	93	91	89	87	84
80	82	80	78	75	73	70	67	64	61	58
90	55	52	48	45	41	36	30	24	16	4
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	153	137	1426

10.6 Waikato tributaries at Arapuni – 92724 (Item 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							73	58	54	51	51	55	57
1932	59	68	72	65	69	89	77	56	65	71	55	64	67
1933	66	47	60	54	69	61	65	70	75	66	69	64	64
1934	66	69	63	62	68	83	101	92	73	81	80	65	75
1935	59	61	61	81	84	112	99	124	109	103	129	94	93
1936	106	129	107	91	105	90	117	115	123	106	107	99	108
1937	114	91	89	93	121	92	79	79	78	75	71	77	88
1938	61	89	62	79	90	73	97	108	102	81	85	106	86
1939	76	52	44	48	66	82	89	114	107	86	69	78	76
1940	78	99	84	65	76	77	71	75	77	77	85	68	78
1941	68	63	80	74	68	94	95	91	89	118	81	84	84
1942	75	61	66	65	70	60	97	112	166	120	86	98	90
1943	75	119	39	63	63	99	86	67	109	119	103	69	84
1944	59	78	87	74	66	90	101	99	99	98	79	80	84
1945	87	79	85	71	96	88	109	115	122	104	93	76	94
1946	57	58	68	76	77	76	89	132	114	95	83	77	84
1947	64	59	65	73	68	107	85	71	82	83	75	66	75
1948	63	56	56	69	102	92	101	84	77	112	85	71	81
1949	68	61	67	76	101	109	97	81	73	68	66	62	77
1950	53	64	56	64	67	76	84	87	83	69	80	57	70
1951	56	54	61	62	61	62	107	80	65	82	91	78	72
1952	56	57	54	61	68	134	87	76	69	81	121	99	80
1953	71	67	57	60	109	107	113	121	97	100	82	74	89
1954	61	66	74	70	74	84	88	97	85	66	67	70	75
1955	54	65	55	72	70	83	81	86	82	82	68	67	72
1956	61	51	52	75	81	138	116	107	91	100	98	89	88
1957	72	62	77	60	85	87	94	82	77	93	84	80	79
1958	64	112	71	61	77	73	88	100	83	84	78	117	84
1959	77	78	74	108	94	89	89	83	79	103	77	71	85
1960	64	78	71	65	67	96	102	92	110	89	78	68	82
1961	68	52	57	57	62	77	105	78	84	70	60	64	70
1962	57	57	106	80	106	125	114	105	117	138	134	163	109
1963	88	78	73	70	79	90	124	97	118	82	83	72	88
1964	73	70	94	74	78	87	159	126	120	130	90	92	100
1965	86	121	93	81	83	106	100	113	85	78	84	68	91
1966	83	77	92	76	101	100	142	122	131	108	99	96	103
1967	94	121	96	81	84	90	92	122	111	88	113	113	100
1968	81	79	68	89	99	123	118	115	110	98	88	100	97
1969	66	89	70	71	82	82	87	86	96	65	70	52	76

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	54	53	43	51	56	85	75	107	99	112	95	69	75
1971	59	78	64	59	71	87	70	77	120	127	91	85	83
1972	60	62	70	69	72	67	108	88	90	76	62	64	74
1973	57	51	53	58	57	76	67	79	102	74	69	66	67
1974	50	62	53	59	58	91	110	104	94	89	70	82	77
1975	78	61	69	51	66	98	79	100	91	84	66	55	75
1976	73	81	56	62	73	78	104	100	87	87	72	66	78
1977	60	57	54	49	69	94	101	84	78	76	61	66	71
1978	54	54	51	52	47	57	82	63	66	59	70	53	59
1979	41	52	85	67	81	66	75	102	92	111	86	75	78
1980	86	72	64	73	61	69	85	88	92	63	69	81	75
1981	64	55	56	58	55	86	93	90	77	78	73	77	72
1982	58	61	52	52	60	57	57	57	58	59	46	49	55
1983	44	42	39	46	51	60	58	56	71	96	84	62	59
1984	47	56	58	58	50	51	74	76	66	55	58	63	59
1985	57	50	50	48	50	72	67	63	64	56	53	61	58
1986	90	59	52	50	59	58	82	99	82	69	57	51	67
1987	58	44	55	65	64	65	58	62	64	64	56	58	59
1988	45	50	50	39	58	72	80	103	80	97	83	79	70
1989	86	68	59	56	63	91	89	70	81	121	90	75	79
1990	66	56	84	74	82	74	71	132	84	80	80	62	79
1991	57	68	55	53	56	59	75	118	96	89	71	61	72
1992	59	58	51	51	58	67	90	116	101	83	77	89	75
1993	61	54	56	58	67	95	70	61	60	57	66	53	63
1994	47	44	48	57	65	78	109	114	90	102	99	70	77
1995	59	54	58	78	74	104	149	114	116	103	96	81	91
1996	85	80	74	92	94	92	120	125	144	101	90	92	99
1997	77	73	71	69	72	90	85	84	88	89	83	64	79
1998	53	56	53	59	68	93	175	116	96	101	89	72	86
1999	63	59	58	57	70	78	82	81	77	61	85	67	70
2000	55	53	50	58	55	74	67	73	81	94	60	58	65
2001	55	62	58	54	75	67	63	70	61	61	78	89	66
2002	71	57	53	57	60	92	110	78	72	73	64	70	72
2003	55	47	54	52	58	82	64	57	85	99	72	81	67
2004	73	81	91	59	76	106	103	111	87	96	83	82	87
2005	66	59	61	52	73	70	88	83	87	110	68	87	75
2006	68	75	67	79	87	92							78
Min.	41	42	39	39	47	51	57	56	54	51	46	49	55
Mean	66	67	65	65	73	85	93	92	90	88	80	75	79
Max.	114	129	107	108	121	138	175	132	166	138	134	163	109

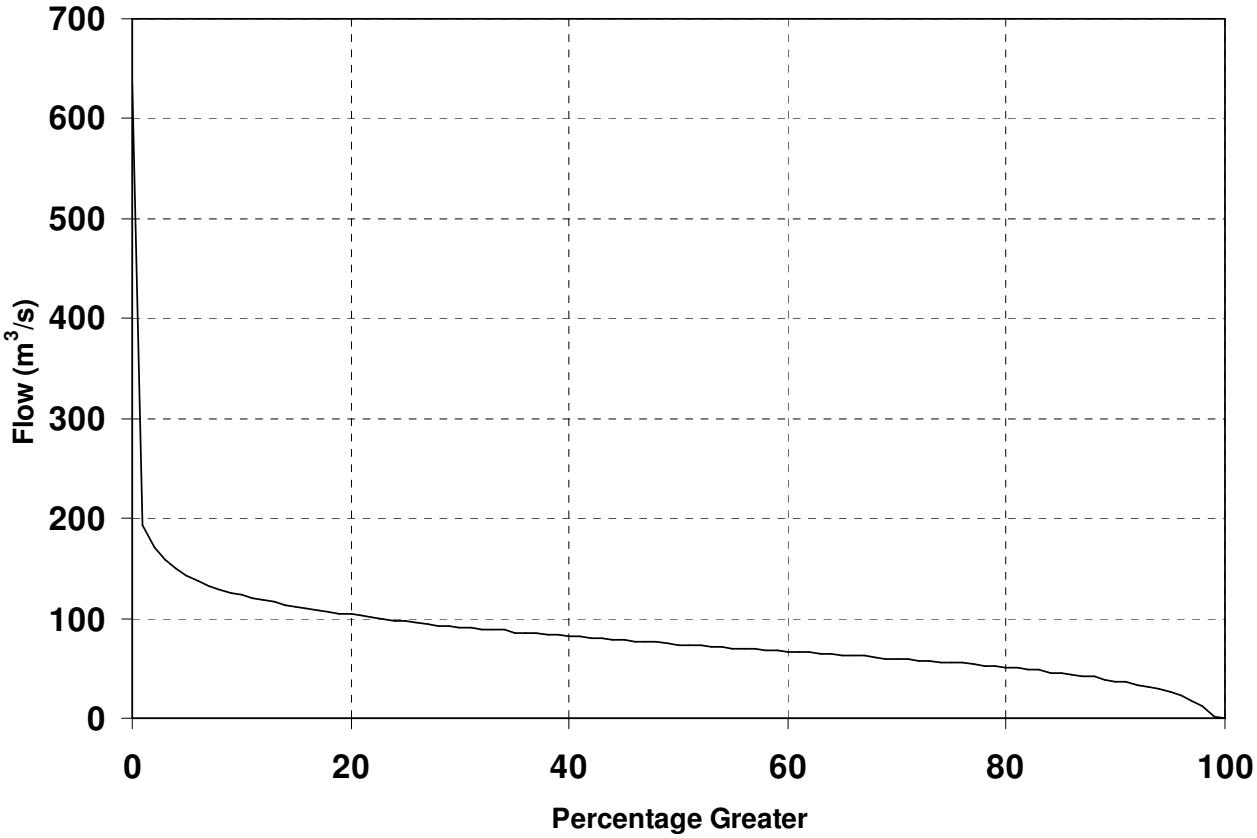

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s)

	0	1	2	3	4	5	6	7	8	9
0	636	194	170	158	150	142	137	133	129	126
10	123	120	118	116	114	112	110	108	107	105
20	104	102	101	99	98	97	96	94	93	92
30	91	90	89	88	88	86	86	85	84	83
40	82	81	80	80	79	78	77	76	76	75
50	74	73	73	72	71	70	70	69	68	68
60	67	66	66	65	64	63	63	62	61	60
70	60	59	58	57	56	55	55	54	53	52
80	51	50	49	48	46	45	44	42	41	39
90	37	36	33	31	29	26	22	18	12	2
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	78	74	636

10.7 TPD Flows at Taupo – 92790 (Item 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							237	193	203	163	160	149	184
1932	103	110	82	113	104	189	134	118	133	175	121	95	123
1933	115	146	156	131	195	126	160	186	141	107	121	99	140
1934	79	171	84	118	117	159	193	173	127	177	169	134	142
1935	90	173	128	111	173	273	205	264	170	191	263	155	183
1936	230	272	157	157	152	131	200	192	199	173	168	138	180
1937	193	113	124	133	227	143	132	107	124	122	108	121	138
1938	109	163	71	198	125	152	158	181	163	116	182	147	147
1939	151	83	77	81	57	167	139	246	183	126	107	164	132
1940	183	248	152	99	118	132	107	113	128	173	183	117	146
1941	149	107	178	99	77	171	172	180	166	253	195	149	158
1942	156	136	138	159	172	109	262	210	320	230	163	177	186
1943	103	89	97	123	104	249	242	205	279	225	164	126	168
1944	93	167	133	113	128	132	160	178	169	172	131	162	145
1945	217	146	158	125	179	173	193	222	230	215	169	107	178
1946	102	59	108	170	138	118	157	296	245	219	192	132	162
1947	141	86	74	95	77	263	220	169	184	254	130	152	154
1948	131	70	66	116	235	179	233	181	148	230	184	123	159
1949	123	116	101	113	208	248	246	197	149	150	150	109	159
1950	65	141	56	81	102	128	133	164	152	134	184	115	121
1951	122	105	94	105	92	123	235	139	109	190	234	202	146
1952	131	143	77	96	128	318	228	170	130	178	299	243	178
1953	155	133	91	115	217	252	277	216	180	233	199	143	185
1954	111	97	129	93	127	134	145	189	163	102	112	144	129
1955	90	117	67	125	219	199	180	206	188	184	151	157	157
1956	162	119	70	205	188	318	288	238	180	212	207	191	198
1957	142	93	137	88	182	148	166	124	121	182	186	198	148
1958	115	315	148	95	151	172	199	210	140	140	158	341	181
1959	201	168	154	184	152	156	135	146	117	185	147	104	154
1960	82	181	94	61	116	196	205	180	196	143	127	87	139
1961	111	88	76	115	75	127	209	151	187	147	93	108	124
1962	126	79	225	147	200	265	200	232	227	296	244	245	208
1963	158	129	74	91	117	203	219	154	248	111	122	95	143
1964	139	90	189	70	99	112	284	241	278	250	178	221	180
1965	164	212	156	128	112	192	161	225	139	115	231	182	168
1966	177	150	126	148	168	169	258	181	184	129	166	173	169
1967	150	195	127	78	116	106	123	248	158	112	209	195	151
1968	100	83	59	83	160	218	189	172	152	185	149	172	144
1969	141	178	73	89	134	109	108	137	208	112	103	146	128

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	79	37	70	75	133	221	184	216	299	251	194	120	157
1971	148	118	76	67	140	197	137	200	253	296	204	187	169
1972	113	76	244	94	170	125	237	179	181	163	128	101	152
1973	111	59	69	57	131	156	86	164	227	119	162	124	122
1974	60	67	44	102	121	158	284	212	172	203	144	160	145
1975	143	75	95	101	177	235	204	256	220	229	163	125	169
1976	226	174	117	102	161	170	248	239	221	184	146	151	178
1977	129	96	86	73	166	273	242	193	201	175	142	129	159
1978	91	65	41	103	77	99	224	157	164	143	191	138	125
1979	75	133	198	153	214	130	153	210	195	256	197	172	174
1980	224	126	144	193	138	155	194	197	221	166	173	220	180
1981	136	116	118	101	133	242	226	200	184	185	205	189	170
1982	108	154	118	97	150	146	125	126	156	143	118	165	134
1983	108	82	63	134	145	155	150	140	184	252	210	145	148
1984	104	133	170	96	120	117	198	165	139	131	123	189	141
1985	132	81	89	106	72	185	152	146	168	118	126	201	132
1986	291	160	96	79	154	148	207	204	180	186	124	104	161
1987	138	71	134	156	136	141	116	133	152	183	145	187	142
1988	79	99	121	84	151	195	203	257	247	274	230	221	180
1989	284	172	112	80	146	238	189	131	158	280	163	125	173
1990	135	101	194	141	187	131	166	303	166	176	190	100	166
1991	117	188	86	126	107	97	171	297	231	188	134	110	154
1992	158	137	118	103	82	136	224	283	203	182	151	201	165
1993	107	83	77	96	156	221	112	102	109	106	159	117	120
1994	98	83	57	97	136	198	228	260	219	210	286	149	169
1995	118	140	153	241	166	193	292	204	262	245	208	222	204
1996	166	163	148	226	190	161	248	235	297	239	177	214	206
1997	137	117	86	107	101	148	129	142	157	175	151	142	133
1998	111	147	95	101	147	177	393	218	200	319	208	175	191
1999	134	83	113	116	192	246	190	193	190	128	265	167	168
2000	151	113	64	130	127	195	189	206	207	286	154	181	167
2001	124	149	95	104	198	149	130	145	151	154	205	323	161
2002	154	114	100	109	124	219	256	178	208	174	149	196	165
2003	116	73	88	64	147	186	166	116	239	276	197	205	157
2004	121	299	219	115	172	277	244	246	192	257	173	185	208
2005	203	122	104	68	125	149	170	153	150	242	108	189	149
2006	161	159	92	180	180	181							159
Min.	60	37	41	57	57	97	86	102	109	102	93	87	120
Mean	136	128	112	115	144	177	194	191	187	188	170	161	159
Max.	291	315	244	241	235	318	393	303	320	319	299	341	208

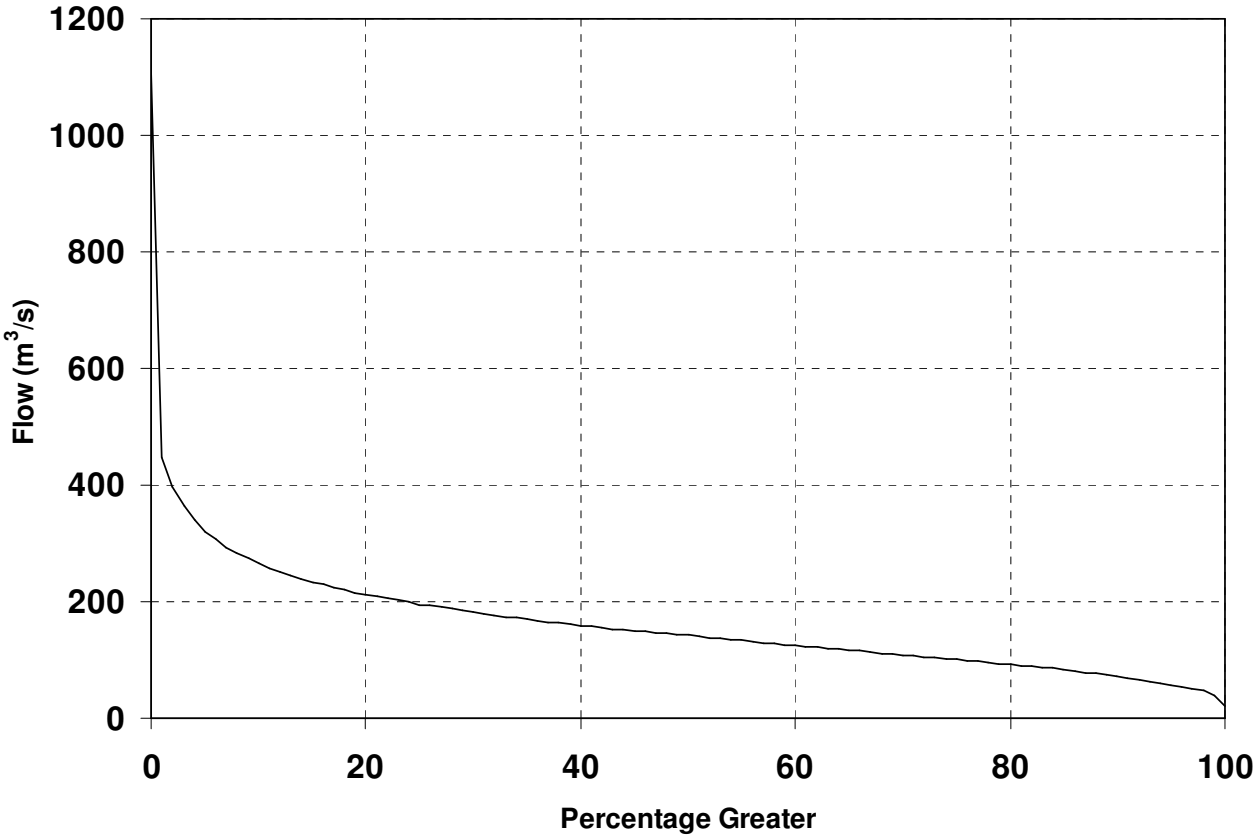

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1105	449	396	364	341	321	307	294	283	274
10	265	258	251	245	239	234	229	224	220	216
20	212	209	205	202	199	196	193	190	187	184
30	182	179	177	174	172	170	168	166	163	161
40	159	157	155	154	152	150	149	147	145	144
50	142	140	139	137	135	133	132	130	128	126
60	125	123	122	120	118	117	115	114	112	110
70	109	107	106	104	102	100	99	97	96	94
80	92	91	89	87	85	83	81	79	76	74
90	72	69	66	64	61	57	54	51	47	40
100	21									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	21	159	142	1105

10.8 TPD Flows at Rangipo – 92790 (Item: 2)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							49	44	47	38	37	35	42
1932	26	28	23	29	27	43	32	29	32	41	30	25	30
1933	28	34	36	31	44	30	33	42	33	27	29	26	33
1934	22	32	23	29	29	36	43	40	31	41	39	32	33
1935	24	35	31	29	40	53	49	57	40	44	57	36	41
1936	49	51	38	37	36	32	46	44	45	40	39	32	41
1937	45	29	30	32	42	35	32	27	30	30	27	30	32
1938	27	38	21	41	32	36	37	41	38	28	41	35	34
1939	35	23	22	23	18	39	33	50	43	30	26	38	32
1940	36	43	41	25	29	32	26	28	31	39	42	28	33
1941	31	28	36	26	22	39	39	42	39	49	46	35	36
1942	35	33	34	37	40	27	57	47	62	53	37	42	42
1943	27	23	25	30	26	34	51	51	53	54	38	31	37
1944	24	30	35	28	31	31	37	41	39	39	31	37	34
1945	44	34	37	30	41	40	44	48	50	39	42	27	40
1946	26	18	27	39	33	29	37	55	46	53	42	32	36
1947	33	23	21	25	22	45	49	41	42	56	31	36	35
1948	32	20	20	29	48	43	51	42	35	52	43	29	37
1949	30	29	26	29	38	55	47	48	35	35	34	27	36
1950	20	32	18	23	26	31	32	37	36	32	42	28	30
1951	30	26	25	26	25	30	46	33	27	43	53	45	34
1952	31	34	21	26	31	47	53	42	31	40	62	54	39
1953	36	32	24	28	45	50	58	48	42	48	44	34	41
1954	27	25	28	25	30	32	34	41	38	25	27	34	31
1955	24	29	20	26	50	45	40	47	43	42	36	37	37
1956	37	29	21	45	39	55	50	55	48	48	47	44	43
1957	34	24	33	23	42	35	39	30	29	42	42	44	35
1958	28	28	45	33	35	39	38	50	33	32	36	33	36
1959	46	47	40	39	36	37	32	35	29	43	34	25	37
1960	19	32	29	20	32	45	45	44	42	32	31	24	33
1961	31	25	22	26	22	30	51	47	47	32	25	24	32
1962	27	20	39	30	40	45	53	52	48	46	52	46	42
1963	32	27	21	20	25	45	49	42	47	29	27	21	32
1964	28	20	31	19	23	31	36	53	42	56	55	43	37
1965	36	42	39	32	30	42	34	52	39	30	42	41	38
1966	39	33	29	27	42	40	45	46	44	29	32	36	37
1967	37	34	28	24	29	30	32	49	44	27	37	41	34
1968	28	22	18	27	35	48	47	48	42	45	36	35	36
1969	35	34	23	24	31	27	28	30	39	29	22	28	29

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	20	14	15	20	27	41	43	46	45	52	42	29	33
1971	33	25	23	18	38	43	30	40	53	56	53	43	38
1972	30	23	33	25	39	31	49	41	41	34	26	22	33
1973	23	17	18	17	29	35	23	35	43	27	33	24	27
1974	20	17	16	29	30	39	53	52	42	43	34	30	34
1975	30	21	24	24	35	46	47	42	51	42	32	26	35
1976	39	34	25	23	39	39	52	55	50	38	34	34	39
1977	32	27	22	23	41	48	53	48	47	46	30	31	38
1978	22	19	15	20	23	23	39	40	35	30	32	32	28
1979	24	30	35	33	45	30	30	47	45	49	42	39	37
1980	45	36	35	42	36	35	40	42	50	37	36	40	40
1981	27	24	29	30	34	49	46	39	38	39	41	39	36
1982	28	26	32	24	32	34	28	27	36	29	25	37	30
1983	25	17	18	34	41	37	37	34	44	48	44	36	35
1984	28	30	40	27	30	27	47	42	35	35	29	42	34
1985	36	25	29	28	23	39	39	41	38	29	29	45	33
1986	40	46	33	24	32	35	38	44	39	40	28	26	35
1987	29	23	34	37	32	33	28	30	34	42	37	43	34
1988	25	26	33	24	38	36	37	53	56	57	38	44	39
1989	50	47	30	24	34	47	46	30	35	51	40	32	39
1990	36	25	33	33	37	32	39	41	49	41	45	26	37
1991	27	37	23	30	31	24	35	49	56	43	34	26	35
1992	34	30	31	26	22	31	46	47	53	43	32	44	37
1993	29	23	23	27	31	45	28	23	31	26	34	27	29
1994	24	23	25	24	34	41	50	50	38	54	45	46	38
1995	30	40	38	52	37	43	50	44	47	53	46	42	43
1996	42	39	38	47	42	36	45	50	46	52	40	48	44
1997	35	27	26	26	21	36	27	36	34	38	31	36	31
1998	26	32	27	26	29	39	37	55	50	39	55	53	39
1999	30	23	29	33	35	45	39	43	40	28	44	43	36
2000	32	31	18	29	31	40	37	41	41	47	41	42	36
2001	31	26	22	26	38	33	30	39	29	37	45	44	33
2002	37	34	27	27	31	47	47	44	48	39	34	45	38
2003	28	21	20	21	31	45	37	25	47	52	47	41	35
2004	29	50	50	31	36	43	54	56	43	50	40	40	43
2005	46	26	27	21	28	34	38	30	30	45	24	39	32
2006	30	33	24	39	40	39							34
Min.	19	14	15	17	18	23	23	23	27	25	22	21	27
Mean	31	29	28	29	33	38	41	43	41	41	38	36	36
Max.	50	51	50	52	50	55	58	57	62	57	62	54	44

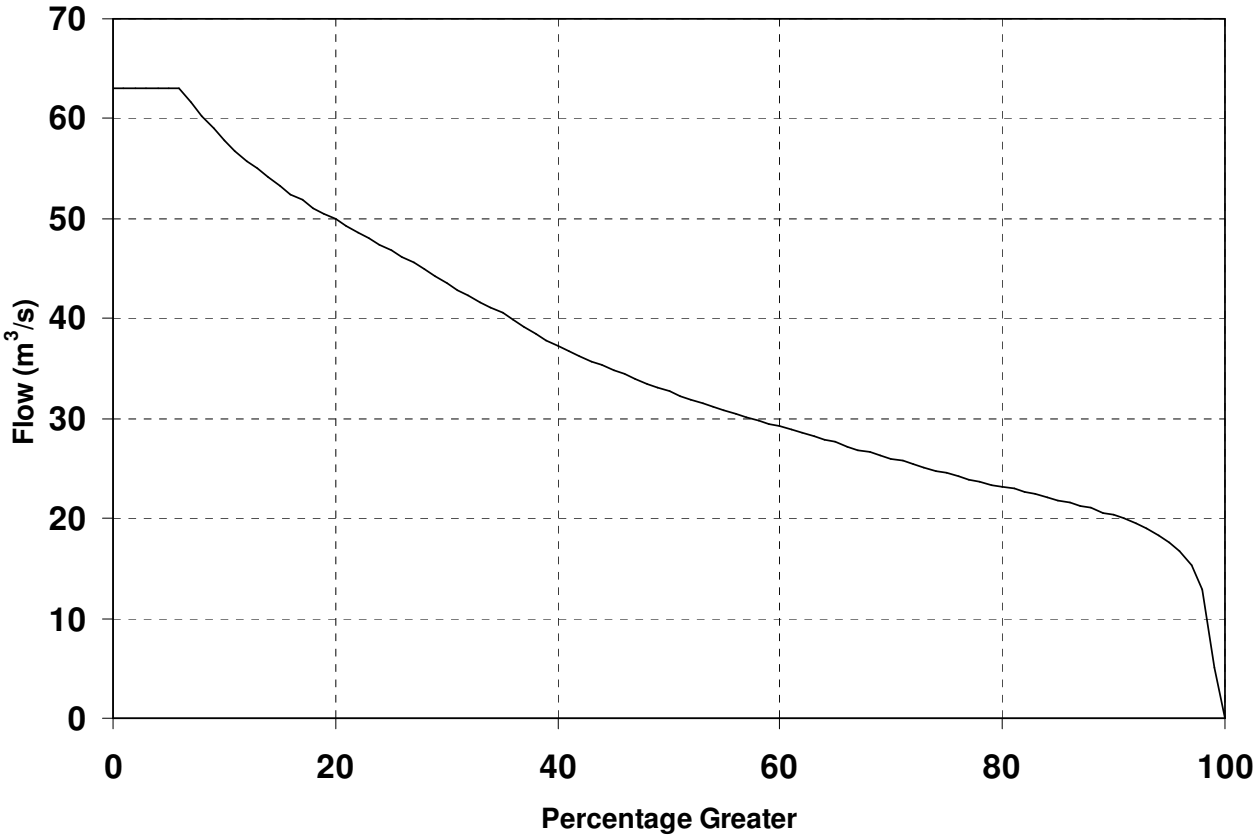

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	63	63	63	63	63	63	63	62	60	59
10	58	57	56	55	54	53	53	52	51	51
20	50	49	49	48	47	47	46	46	45	44
30	44	43	42	42	41	41	40	39	39	38
40	37	37	36	36	35	35	34	34	34	33
50	33	32	32	32	31	31	31	30	30	30
60	29	29	29	28	28	28	27	27	27	26
70	26	26	25	25	25	25	24	24	24	23
80	23	23	23	22	22	22	22	21	21	21
90	20	20	20	19	18	18	17	15	13	5
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	36	33	63

10.9 TPD Flows at Tokaanu – 92790 (Item: 3)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							82	67	70	56	55	51	63
1932	33	35	24	37	33	66	46	40	45	60	41	30	41
1933	38	50	52	44	67	43	56	64	48	36	41	32	48
1934	24	56	26	38	39	55	66	60	43	61	58	46	48
1935	29	59	43	36	60	95	73	93	59	66	93	53	63
1936	80	93	55	54	52	45	70	67	69	60	58	47	62
1937	67	37	42	45	78	50	45	36	42	42	37	41	47
1938	36	56	20	67	42	52	54	63	56	39	63	50	50
1939	52	26	23	24	14	58	48	85	64	43	36	56	44
1940	61	82	57	32	39	45	36	38	44	59	63	39	50
1941	48	37	61	33	23	59	59	62	57	88	68	51	54
1942	53	46	46	54	59	37	91	73	110	82	55	61	64
1943	33	27	32	41	34	80	85	76	94	81	56	42	57
1944	30	51	46	38	43	45	56	62	58	59	45	56	49
1945	75	50	54	42	62	60	67	77	80	68	62	34	61
1946	33	15	35	59	47	40	54	102	82	80	66	45	55
1947	48	27	22	30	23	88	79	59	64	90	44	52	52
1948	44	20	18	37	80	63	81	63	51	81	64	42	54
1949	41	38	32	36	68	87	83	71	51	51	51	36	54
1950	18	46	14	23	33	44	46	56	52	45	64	38	40
1951	41	35	30	35	28	42	82	47	37	66	82	70	50
1952	45	49	23	30	43	106	83	60	44	61	105	85	61
1953	53	45	29	38	74	85	97	77	64	80	68	48	63
1954	37	31	43	29	42	45	49	66	56	34	37	46	43
1955	28	40	20	38	76	72	65	74	67	67	53	54	55
1956	54	40	20	70	64	107	99	89	70	76	72	66	69
1957	48	32	43	28	60	49	57	43	41	62	62	67	50
1958	39	70	61	37	49	54	63	73	47	45	53	92	57
1959	71	65	55	63	54	54	46	47	38	60	45	29	52
1960	18	55	34	17	41	73	76	67	72	54	45	30	48
1961	38	28	22	32	21	39	75	62	68	46	33	29	41
1962	39	19	68	49	67	84	77	84	76	93	91	75	69
1963	51	46	23	24	39	76	71	61	82	40	43	25	48
1964	49	20	58	21	33	43	93	90	97	96	83	78	64
1965	61	73	60	47	45	67	59	82	54	45	81	68	62
1966	64	53	43	47	62	61	78	63	61	39	52	59	57
1967	51	53	45	27	37	36	41	84	59	39	65	68	51
1968	38	26	16	33	61	73	73	69	63	71	58	58	53
1969	53	52	24	27	45	39	38	42	60	38	26	39	40

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	17	5	7	16	31	69	59	68	93	87	66	42	47
1971	43	33	18	11	48	75	41	58	84	102	79	66	55
1972	42	22	60	33	62	45	80	62	65	53	41	29	50
1973	33	10	13	11	48	51	28	48	67	40	56	36	37
1974	19	10	9	24	31	47	92	72	55	73	50	45	44
1975	44	24	25	30	55	76	71	81	78	71	50	40	54
1976	69	54	29	26	61	64	88	89	76	60	52	53	60
1977	49	29	18	23	63	87	84	66	71	66	49	45	54
1978	21	12	8	17	18	25	70	53	52	48	61	47	36
1979	26	45	47	55	73	41	43	70	64	81	65	63	56
1980	83	55	53	69	53	53	64	70	81	58	61	65	64
1981	41	35	36	37	44	81	79	62	66	65	65	62	56
1982	43	37	39	28	46	47	40	38	51	43	37	64	43
1983	40	23	15	47	62	57	55	49	68	85	81	55	53
1984	33	40	57	35	46	37	70	63	48	48	41	67	49
1985	54	31	29	30	18	54	55	60	63	41	40	71	46
1986	94	69	40	23	50	52	68	68	63	65	43	34	56
1987	40	28	41	61	44	48	36	41	52	65	53	70	49
1988	30	31	46	27	62	64	74	98	101	107	83	81	67
1989	102	76	38	22	50	86	66	41	45	89	60	44	60
1990	53	27	67	49	67	49	60	98	68	58	68	37	59
1991	37	60	28	47	37	34	56	101	85	67	50	37	53
1992	53	55	48	36	28	45	83	103	84	70	52	73	61
1993	48	26	24	37	52	80	40	29	43	38	57	40	43
1994	30	19	22	26	53	77	88	94	80	85	102	67	62
1995	44	55	58	87	60	68	93	74	87	88	79	77	73
1996	64	59	56	78	74	63	81	82	97	78	65	82	73
1997	48	27	25	36	22	44	36	49	45	55	48	54	41
1998	36	48	33	32	42	60	109	85	84	114	88	69	67
1999	35	18	28	38	62	72	60	65	56	38	81	60	51
2000	52	38	12	31	35	66	68	81	67	96	56	65	56
2001	47	33	25	29	55	47	40	57	37	50	73	94	49
2002	52	41	28	29	37	79	83	63	76	62	56	71	57
2003	39	15	14	15	40	66	53	30	77	96	72	72	49
2004	45	101	82	40	52	84	84	88	65	84	62	69	71
2005	71	33	27	16	33	44	66	54	51	79	40	62	48
2006	53	59	36	60	73	77							59
Min.	17	5	7	11	14	25	28	29	37	34	26	25	36
Mean	46	41	35	37	48	60	66	67	65	65	59	55	54
Max.	102	101	82	87	80	107	109	103	110	114	105	94	73

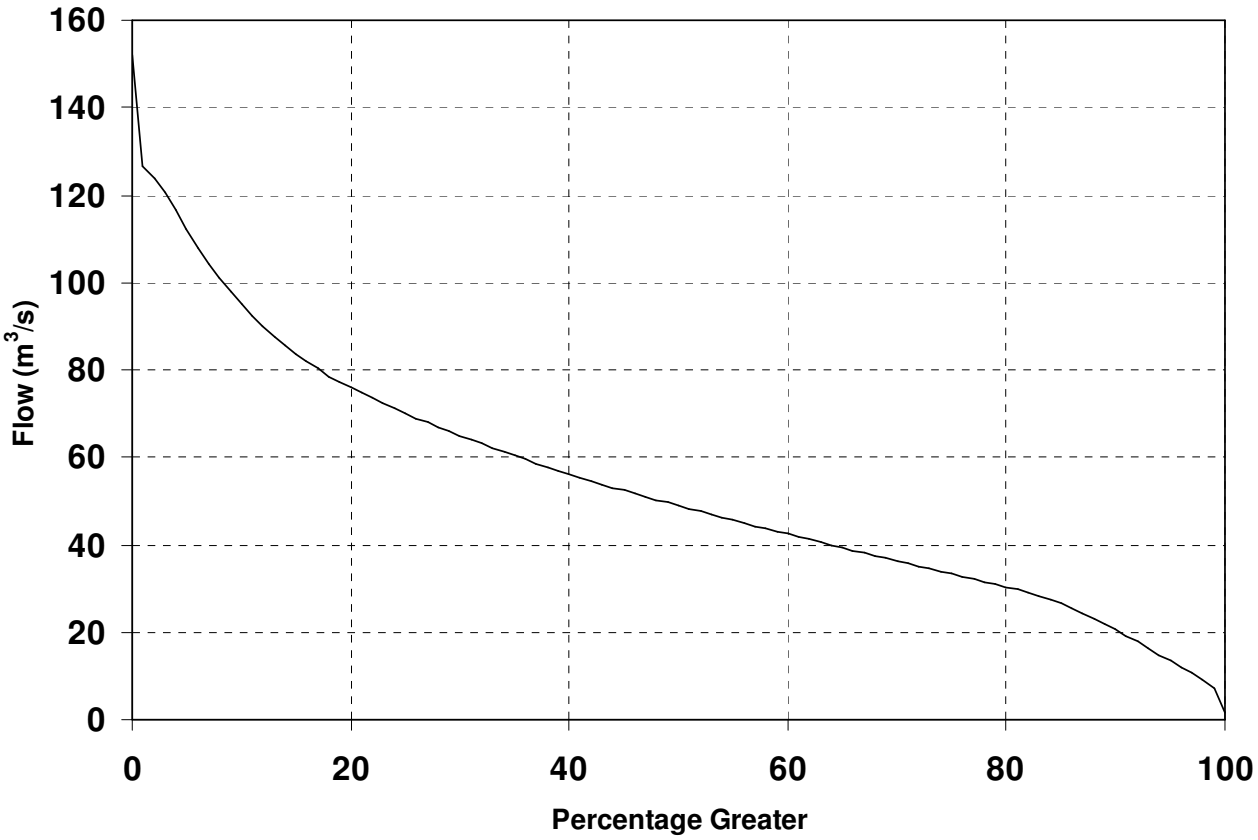

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	152	126	124	121	117	112	108	104	101	98
10	95	92	90	88	86	84	82	80	79	77
20	76	75	74	72	71	70	69	68	67	66
30	65	64	63	62	61	61	60	59	58	57
40	56	55	55	54	53	52	52	51	50	50
50	49	48	48	47	46	46	45	44	44	43
60	43	42	41	41	40	39	39	38	38	37
70	36	36	35	35	34	33	33	32	32	31
80	30	30	29	28	28	27	26	24	23	22
90	21	19	18	16	15	14	12	11	9	7
100	2									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	2	54	49	152

10.10 Lake Waikaremoana Inflow – 3650 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							29	16	29	8	4	2	15
1932	3	53	33	14	28	11	14	22	17	15	4	3	18
1933	4	12	12	3	31	18	31	24	26	18	10	9	17
1934	2	20	4	8	16	17	19	24	14	13	10	4	13
1935	1	9	17	44	17	29	23	33	19	10	31	8	20
1936	23	27	18	8	12	17	22	10	12	9	10	9	15
1937	15	5	5	7	9	20	37	17	20	15	11	11	14
1938	6	25	5	52	24	20	51	28	8	6	7	17	21
1939	3	4	3	9	21	16	14	24	22	13	9	16	13
1940	14	13	14	13	22	14	29	26	18	21	24	7	18
1941	11	4	13	17	9	19	30	31	18	27	10	7	17
1942	22	28	10	12	14	31	43	37	25	9	12	15	21
1943	14	9	10	20	47	51	20	26	54	15	24	15	25
1944	28	29	66	8	22	24	30	31	16	13	7	10	24
1945	13	10	4	3	24	20	19	20	21	21	6	3	14
1946	1	0	1	15	24	27	31	23	24	18	8	4	15
1947	8	10	8	31	28	45	42	13	11	14	5	4	18
1948	3	0	0	17	73	33	19	16	12	26	28	7	20
1949	12	1	6	4	34	22	15	40	13	13	11	7	15
1950	6	12	1	19	19	13	37	22	27	39	42	7	20
1951	16	19	35	19	40	17	22	29	9	13	13	9	20
1952	6	14	4	2	5	25	16	36	47	16	34	32	20
1953	15	10	3	14	16	46	18	13	9	12	3	3	13
1954	0	0	10	67	25	16	23	65	21	8	12	22	23
1955	6	6	17	29	16	19	66	33	29	19	9	9	22
1956	5	8	8	15	62	42	39	33	16	20	13	5	22
1957	5	3	7	8	11	22	30	27	22	19	9	8	14
1958	3	11	3	0	14	6	28	27	13	29	12	24	14
1959	9	13	19	18	37	16	18	26	12	34	10	4	18
1960	7	31	19	42	27	30	29	21	26	11	64	30	28
1961	7	3	6	7	19	31	29	35	33	12	7	9	16
1962	5	8	9	23	30	33	52	28	19	27	13	25	23
1963	13	4	4	4	9	36	37	15	25	10	9	24	16
1964	8	4	8	3	13	20	35	16	19	15	10	6	13
1965	7	20	6	8	6	20	27	65	27	13	24	9	20
1966	11	4	13	9	27	18	33	54	25	10	16	13	20
1967	16	20	10	10	10	13	25	36	20	9	20	9	16
1968	7	1	0	21	43	38	34	44	12	11	10	20	20
1969	15	27	4	5	12	9	10	14	19	10	8	8	12

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	4	35	13	13	28	32	14	44	31	17	16	5	21
1971	11	19	21	11	43	20	17	27	31	37	22	15	23
1972	4	11	37	12	13	15	33	17	9	11	3	11	15
1973	7	4	3	21	6	35	12	39	19	9	7	6	14
1974	9	5	19	43	25	36	41	33	30	24	10	12	24
1975	15	4	12	7	16	35	13	15	17	24	13	16	16
1976	35	30	6	32	12	8	11	17	65	21	15	23	23
1977	10	16	10	31	10	39	25	38	39	16	5	12	21
1978	3	7	0	10	11	28	33	20	20	15	13	6	14
1979	1	18	29	12	24	19	18	37	30	31	15	12	20
1980	16	3	22	25	8	44	23	24	14	6	8	39	19
1981	9	2	7	15	31	28	43	36	11	21	15	10	19
1982	2	6	11	42	17	25	3	1	9	16	5	9	12
1983	1	0	0	5	23	17	26	15	16	29	16	15	14
1984	6	10	17	9	11	25	20	15	26	13	5	10	14
1985	5	1	35	20	23	45	35	21	17	7	9	12	19
1986	9	2	16	2	13	9	28	23	45	12	8	13	15
1987	16	5	29	21	9	10	32	19	11	6	22	19	17
1988	9	21	68	12	12	18	35	20	32	13	6	8	21
1989	21	11	3	0	29	35	22	30	59	25	17	18	22
1990	9	5	17	5	7	28	23	46	12	38	15	3	18
1991	2	9	16	23	30	20	12	26	12	14	39	5	17
1992	9	13	4	8	22	22	27	22	17	38	26	22	19
1993	6	25	11	10	24	27	22	12	28	4	13	7	16
1994	5	4	3	9	11	35	21	19	15	31	28	4	15
1995	5	18	5	22	33	16	34	13	15	14	9	3	15
1996	45	25	32	36	25	10	28	16	14	7	6	14	22
1997	10	7	33	10	5	42	39	31	22	23	10	3	20
1998	1	8	3	4	3	13	57	20	13	13	8	13	13
1999	18	3	3	11	17	19	18	18	12	7	16	15	13
2000	10	3	20	25	12	17	35	9	14	15	16	14	16
2001	12	20	9	10	11	10	20	24	19	23	21	32	18
2002	8	14	5	6	6	18	44	28	10	10	7	11	14
2003	3	2	12	11	13	16	13	33	46	24	14	15	17
2004	14	13	6	4	27	28	42	29	13	21	8	10	18
2005	7	4	15	7	19	24	19	11	15	39	30	14	17
2006	9	9	17	26	30	43							22
Min.	0	0	0	0	3	6	3	1	8	4	3	2	12
Mean	10	12	13	16	21	24	27	26	22	17	14	12	18
Max.	45	53	68	67	73	51	66	65	65	39	64	39	28

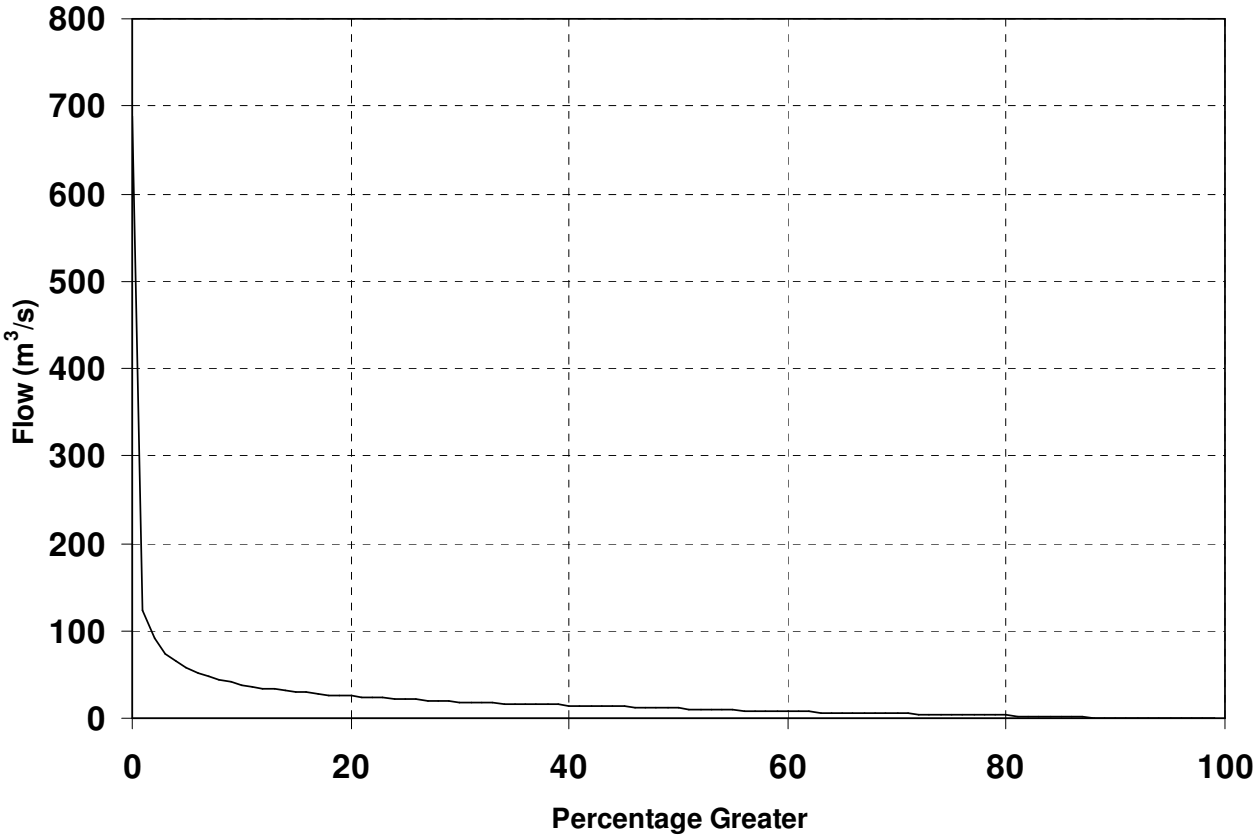

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	689	123	91	75	65	58	52	47	44	41
10	38	36	35	34	32	31	29	28	27	26
20	25	25	24	23	23	22	21	20	20	19
30	19	18	18	17	17	16	16	16	15	15
40	15	15	14	14	14	13	13	12	12	12
50	11	11	10	10	10	9	9	9	8	8
60	8	7	7	7	7	6	6	6	6	5
70	5	5	5	5	5	4	4	4	4	3
80	3	3	2	2	2	2	1	1	1	1
90	1	0	0	0	0	0	0	0	0	0
100	-10									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	-10	18	11	689

10.11 Mangahao Inflow – 97502 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							13.2	8.5	9.8	8.6	8.4	6.2	9.1
1932	6.2	5.5	4.3	9.9	4.7	8.9	5.3	10.9	6.2	9.1	9.2	6.9	7.2
1933	6.3	7.0	7.9	8.9	9.6	9.8	6.7	5.9	8.3	7.8	5.9	4.6	7.4
1934	8.9	5.1	7.7	8.2	8.3	5.8	9.1	10.7	7.7	9.5	4.6	3.3	7.4
1935	5.7	7.6	6.9	8.2	10.3	10.4	6.9	9.6	9.1	29.9	9.1	6.4	10.0
1936	8.1	5.7	6.6	8.8	5.9	6.7	9.8	13.1	10.5	9.4	9.8	26.0	10.1
1937	10.1	11.2	7.0	6.5	12.7	5.1	6.3	5.9	11.1	5.9	6.4	5.1	7.7
1938	5.3	8.6	7.4	8.9	8.4	9.0	8.4	8.1	10.2	9.6	8.4	14.1	8.9
1939	8.7	6.8	6.6	10.2	6.9	13.8	9.6	17.3	11.4	8.1	9.9	8.5	9.8
1940	9.8	10.8	6.6	7.0	8.6	7.3	4.8	6.3	10.4	9.6	6.7	6.7	7.9
1941	7.1	7.0	8.2	5.3	7.1	8.3	6.6	8.7	8.9	12.5	12.0	10.8	8.6
1942	9.3	9.2	14.7	10.6	13.4	6.9	11.1	8.7	7.9	7.6	10.6	10.6	10.1
1943	9.0	13.4	13.0	6.2	7.4	9.6	10.5	8.7	7.5	7.9	4.7	9.4	8.9
1944	10.5	4.5	9.8	9.9	8.4	10.5	8.7	8.6	8.3	10.2	12.5	13.6	9.7
1945	8.4	9.0	11.3	12.7	13.5	11.6	10.0	12.7	13.7	11.1	9.4	14.4	11.5
1946	13.9	11.8	10.4	11.6	9.9	10.5	11.1	13.8	13.2	12.5	12.8	13.9	12.1
1947	10.5	6.9	3.3	7.0	11.3	11.3	9.0	11.5	13.7	11.2	4.8	6.9	9.0
1948	7.6	9.3	5.0	8.5	13.6	9.9	11.8	10.5	11.4	12.4	11.0	12.4	10.3
1949	5.0	10.7	9.8	11.6	7.6	13.1	14.3	12.7	6.8	15.4	8.3	13.4	10.7
1950	10.6	10.3	8.5	10.1	6.3	11.9	11.9	9.4	8.4	6.7	7.0	14.3	9.6
1951	5.4	5.4	7.9	8.6	7.5	8.3	9.6	12.3	11.6	14.5	13.9	13.6	9.9
1952	13.1	6.6	4.6	6.6	9.4	14.8	5.0	5.2	4.7	7.5	13.8	6.9	8.2
1953	7.9	9.5	4.9	6.9	10.2	9.3	7.5	6.5	9.5	9.7	11.1	8.2	8.4
1954	5.4	10.3	6.3	4.7	6.2	9.0	9.8	9.6	6.5	5.7	12.1	8.4	7.8
1955	4.8	16.1	5.0	8.7	9.1	11.3	10.4	10.8	7.3	9.6	6.9	5.5	8.7
1956	10.4	5.5	5.7	11.3	5.8	10.0	10.6	7.1	4.7	8.6	7.7	6.7	7.9
1957	5.7	6.9	5.5	8.1	9.3	8.5	5.8	5.8	6.8	9.3	10.4	12.5	7.9
1958	7.5	6.9	6.4	6.7	11.3	7.7	6.6	8.9	3.7	4.8	6.1	10.4	7.3
1959	6.9	9.0	5.4	6.1	10.3	6.7	8.9	5.2	9.7	8.1	10.3	6.8	7.8
1960	6.0	4.9	3.5	4.7	6.8	6.9	8.1	6.7	6.4	5.9	8.5	4.1	6.0
1961	3.5	4.6	6.0	6.5	6.2	7.4	10.9	5.8	8.7	6.0	7.1	4.1	6.4
1962	8.7	3.6	6.2	5.5	7.5	10.5	10.6	10.8	6.2	9.9	6.7	7.1	7.8
1963	4.2	7.3	5.1	4.2	8.6	11.0	7.2	6.8	9.9	5.5	10.6	6.0	7.2
1964	8.3	2.9	6.6	3.4	7.8	5.6	10.4	9.4	11.1	7.2	6.4	7.4	7.2
1965	4.2	6.5	8.5	3.6	6.4	7.9	8.3	7.8	7.2	13.6	9.1	6.6	7.5
1966	5.3	5.4	3.1	7.3	5.4	7.9	7.5	5.6	5.2	6.1	8.7	9.7	6.4
1967	5.9	5.2	4.9	4.9	5.5	5.2	4.8	9.9	5.8	7.0	8.4	7.0	6.2
1968	5.3	7.5	4.8	8.3	8.9	10.7	9.3	6.3	9.4	10.9	7.3	7.3	8.0
1969	5.0	3.2	3.6	6.5	6.2	5.2	5.4	8.4	5.3	7.8	2.1	5.9	5.4

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	5.5	1.9	3.0	3.4	6.3	9.2	9.2	5.6	12.8	12.4	3.8	6.1	6.6
1971	5.3	3.1	2.2	3.5	5.4	9.0	5.7	9.2	9.2	11.4	6.8	5.4	6.4
1972	5.8	0.2	6.6	7.7	12.3	3.2	9.6	9.0	10.6	11.8	7.4	5.9	7.5
1973	5.6	3.6	6.0	6.6	14.3	9.3	3.3	6.2	10.1	7.4	9.7	2.8	7.1
1974	4.3	4.9	2.7	5.2	8.9	4.6	13.9	6.2	9.7	8.8	3.6	4.9	6.5
1975	1.5	3.6	11.3	8.0	13.0	7.0	11.4	10.4	9.0	7.8	6.1	8.6	8.2
1976	10.4	2.3	8.2	5.3	7.2	8.3	12.3	9.9	7.3	8.6	4.1	11.4	8.0
1977	5.8	0.1	4.1	7.2	10.0	10.3	7.5	7.9	10.0	8.1	9.7	5.9	7.3
1978	2.9	2.1	2.2	9.3	4.3	6.3	12.0	7.8	7.9	5.7	7.8	5.6	6.2
1979	7.5	5.6	7.2	7.7	9.7	7.0	8.5	8.0	10.5	8.6	6.7	10.1	8.1
1980	14.2	9.5	6.1	13.2	8.1	6.6	9.6	11.4	12.1	10.8	13.1	8.4	10.3
1981	3.2	4.8	0.8	6.1	7.2	11.4	8.5	8.5	10.9	9.7	3.7	10.1	7.1
1982	5.1	7.2	2.5	2.2	5.3	4.8	5.2	8.5	7.2	6.8	9.0	12.7	6.4
1983	6.0	2.9	4.8	7.6	8.8	8.1	4.7	8.5	11.2	9.0	8.9	5.2	7.2
1984	3.5	4.1	2.0	3.0	8.0	6.7	10.6	7.1	5.2	8.2	7.7	5.3	6.0
1985	6.6	3.0	2.1	2.2	3.4	8.6	9.1	6.7	4.4	6.1	8.2	5.3	5.5
1986	7.6	5.5	3.5	6.1	8.9	9.4	7.7	8.7	9.5	17.8	6.3	4.7	8.0
1987	5.7	5.6	1.1	5.6	9.1	9.6	5.4	7.4	9.3	10.1	6.7	8.7	7.0
1988	4.7	7.2	4.1	4.3	8.7	8.5	11.4	10.1	21.0	14.7	9.7	9.3	9.5
1989	5.3	3.4	6.9	5.0	9.1	7.3	6.1	3.5	6.0	8.6	6.8	5.5	6.1
1990	8.3	4.1	7.3	3.9	6.6	9.4	9.2	13.1	3.9	6.7	7.8	8.8	7.5
1991	12.8	14.8	2.0	13.9	3.7	8.5	7.6	15.5	8.9	10.9	8.8	13.9	10.1
1992	9.6	10.3	2.7	8.1	5.9	8.6	11.7	12.8	11.3	8.7	7.0	14.5	9.3
1993	7.3	5.2	5.2	8.0	6.4	5.5	5.2	5.8	6.5	6.4	12.0	7.7	6.8
1994	5.8	2.1	5.4	4.4	8.1	8.6	9.0	8.6	9.8	6.4	17.9	7.3	7.8
1995	5.3	5.8	8.7	10.8	5.3	9.2	8.7	6.8	10.8	8.2	10.4	6.9	8.1
1996	2.0	6.6	5.8	11.6	10.7	11.5	9.4	8.9	10.3	9.7	11.1	11.0	9.0
1997	3.1	8.4	9.1	9.1	2.5	4.5	6.3	7.1	9.4	3.4	1.1	0.5	5.3
1998	0.3	0.4	0.9	7.2	13.7	14.6	13.8	16.3	15.3	27.5	5.9	13.3	10.9
1999	7.2	4.0	2.2	7.7	14.5	10.7	11.8	10.8	9.5	13.2	14.9	12.6	10.0
2000	12.0	4.8	6.6	19.0	9.1	11.2	10.2	7.8	15.7	28.0	5.9	12.7	12.0
2001	10.6	4.4	9.0	2.3	9.2	14.2	6.9	15.9	6.5	19.5	27.3	20.1	12.2
2002	12.5	27.2	21.3	4.8	6.4	16.7	15.7	9.1	11.9	12.5	12.4	13.7	13.6
2003	3.5	2.3	1.9	1.8	7.5	16.8	10.7	3.4	13.2	10.6	13.9	18.1	8.7
2004	8.1	32.3	9.2	7.0	7.1	20.0	7.5	15.2	25.4	28.9	10.7	22.0	16.0
2005	17.1	5.5	5.6	3.0	13.5	8.7	13.9	8.7	8.1	9.5	4.7	13.6	9.4
2006	9.3	5.4	5.6	9.1	15.7	35.1							13.4
Min.	0.3	0.1	0.8	1.8	2.5	3.2	3.3	3.4	3.7	3.4	1.1	0.5	5.3
Mean	7.1	6.8	6.1	7.2	8.5	9.5	9.0	9.0	9.4	10.3	8.7	9.2	8.4
Max.	17.1	32.3	21.3	19.0	15.7	35.1	15.7	17.3	25.4	29.9	27.3	26.0	16.0

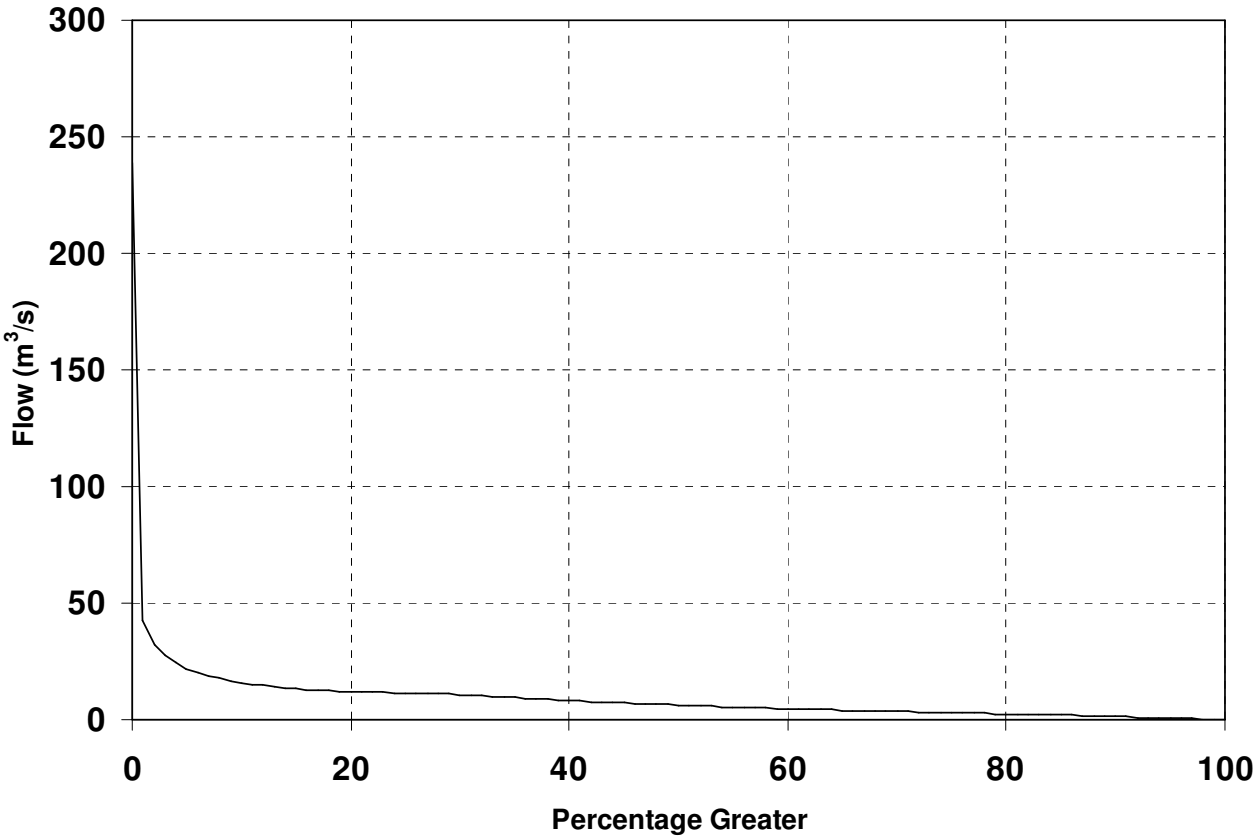

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
0.0	239	43	32	27	24	22	20	19	18	17
10.0	16	15	15	14	14	13	13	13	12	12
20.0	12	12	12	12	12	11	11	11	11	11
30.0	11	10	10	10	10	9	9	9	9	9
40.0	8	8	8	8	7	7	7	7	7	6
50.0	6	6	6	6	6	5	5	5	5	5
60.0	5	5	4	4	4	4	4	4	4	4
70.0	4	3	3	3	3	3	3	3	3	3
80.0	3	2	2	2	2	2	2	2	2	2
90.0	1	1	1	1	1	1	1	0	0	0
100.0	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	8	6	239

10.12 Inflow at Cobb [Coleridge & Cobb] – 97904 (Item: 2)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							7.1	7.4	8.1	11.3	11.5	9.9	9.2
1932	7.0	7.3	4.9	6.2	6.8	4.6	4.1	4.5	6.3	11.1	10.0	7.7	6.7
1933	5.5	9.4	6.2	7.9	8.1	5.2	6.8	7.1	6.2	6.7	7.1	8.6	7.1
1934	8.1	5.1	5.4	6.2	6.9	6.2	6.4	7.1	6.4	9.3	6.3	4.7	6.5
1935	6.9	6.1	5.7	6.0	6.8	7.7	5.1	4.5	3.9	5.5	4.4	5.7	5.7
1936	5.0	4.7	4.0	4.6	6.4	3.2	5.0	5.5	6.6	10.4	10.6	7.3	6.1
1937	9.3	7.0	7.5	6.5	9.6	6.3	3.7	3.3	4.1	4.1	5.6	5.9	6.1
1938	7.1	6.0	7.9	8.4	5.5	5.6	4.5	5.0	7.4	6.9	7.5	11.3	6.9
1939	8.4	5.6	4.2	3.0	4.5	6.5	4.9	4.2	6.0	6.4	8.1	11.1	6.1
1940	7.1	12.2	8.6	5.0	4.7	4.8	3.5	2.5	2.9	7.1	6.6	5.1	5.8
1941	5.3	9.1	5.0	5.5	3.8	4.4	5.7	5.0	3.7	3.4	5.5	8.8	5.4
1942	7.3	5.3	6.9	15.0	9.2	4.5	7.8	4.6	5.6	9.3	8.0	7.8	7.6
1943	5.3	8.8	5.6	4.7	4.8	4.0	3.9	3.1	6.2	6.8	6.7	6.1	5.5
1944	3.7	5.2	5.3	6.4	5.6	4.4	4.7	4.0	5.5	7.3	9.0	9.2	5.9
1945	9.4	7.5	6.7	6.2	5.3	4.1	3.9	6.6	7.5	5.5	11.4	4.2	6.5
1946	2.5	1.5	1.3	3.7	3.0	3.3	4.4	7.0	6.9	6.9	6.3	5.6	4.4
1947	1.8	0.6	0.5	2.1	1.5	8.2	3.9	7.0	6.8	8.3	2.7	2.8	3.9
1948	3.9	1.2	2.0	5.0	10.4	5.5	7.5	2.8	2.2	7.9	3.5	3.1	4.6
1949	1.4	3.6	2.2	3.9	7.3	5.6	6.2	2.9	2.0	5.6	2.2	4.1	3.9
1950	2.1	1.3	1.4	2.6	6.2	4.6	3.7	5.8	2.5	1.1	0.7	2.8	2.9
1951	2.3	1.7	3.6	5.2	4.7	2.6	9.0	2.8	3.3	5.8	8.8	7.9	4.8
1952	5.5	3.6	2.7	2.2	7.7	11.1	3.8	5.6	2.9	3.8	5.7	5.4	5.0
1953	1.5	4.9	3.2	5.1	10.4	5.5	5.6	8.4	5.6	5.1	5.5	4.7	5.5
1954	2.4	2.0	9.8	3.5	7.9	8.1	5.1	4.7	3.9	2.4	2.7	3.0	4.6
1955	0.9	10.7	4.1	2.5	10.6	7.5	4.1	10.0	3.1	6.1	3.3	3.1	5.5
1956	3.5	4.4	3.3	5.8	4.9	5.1	7.1	4.1	4.3	6.9	9.1	7.0	5.5
1957	4.4	1.8	6.5	16.2	10.2	6.5	7.2	9.3	3.5	10.3	11.7	12.5	8.4
1958	2.7	5.0	5.5	5.6	16.0	6.4	4.2	6.5	4.9	6.1	2.1	8.5	6.1
1959	1.5	0.9	3.5	7.2	6.3	5.9	3.3	4.5	8.1	5.9	3.6	3.0	4.5
1960	1.4	1.6	5.1	1.4	5.0	10.8	4.2	3.8	8.8	6.0	5.9	1.4	4.6
1961	4.1	3.9	3.5	2.1	5.8	5.1	9.1	5.0	9.6	5.9	8.0	1.6	5.3
1962	6.9	1.7	3.5	3.8	9.7	7.0	8.4	6.3	7.5	16.8	8.3	1.5	6.8
1963	0.9	3.4	2.0	1.5	6.3	6.3	6.3	9.5	8.9	1.6	6.9	1.6	4.6
1964	10.0	1.6	3.8	2.1	5.5	3.6	7.5	7.2	7.9	10.1	7.0	6.1	6.1
1965	4.2	2.5	1.6	3.7	6.3	7.8	5.6	6.6	6.8	6.3	9.6	6.3	5.6
1966	3.1	1.3	1.3	6.8	4.0	5.5	5.1	2.5	6.0	3.2	6.2	6.7	4.3
1967	3.5	1.1	2.0	4.7	5.5	2.3	3.8	9.9	3.3	3.7	20.0	5.9	5.5
1968	1.5	3.1	5.1	8.4	6.1	6.7	7.0	8.0	8.6	21.6	11.9	7.4	8.0
1969	4.5	1.7	1.0	5.7	4.6	2.6	3.7	3.4	13.7	2.7	1.9	6.5	4.3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	2.0	1.0	2.0	2.1	3.8	5.6	7.0	10.0	15.3	7.2	3.5	1.2	5.1
1971	2.5	1.8	1.2	3.5	8.3	11.7	4.4	6.7	7.0	14.7	5.4	3.5	5.9
1972	1.7	1.0	4.1	6.9	10.2	4.9	8.5	5.3	7.6	9.9	4.1	3.9	5.7
1973	1.0	0.5	0.6	4.1	7.6	3.3	1.6	6.4	3.5	1.8	5.3	1.4	3.1
1974	1.5	1.3	1.0	12.5	4.0	2.5	9.1	4.9	5.5	6.3	2.6	1.2	4.4
1975	1.0	0.8	6.6	7.7	11.6	6.4	6.2	10.1	5.6	5.8	3.6	2.8	5.7
1976	9.2	8.5	2.1	3.8	5.0	6.7	8.4	7.3	5.0	6.2	4.8	7.0	6.2
1977	4.2	1.6	2.1	1.5	5.1	6.9	5.9	5.1	4.7	8.3	5.6	6.2	4.8
1978	1.7	0.7	1.1	3.3	4.9	3.3	7.2	4.4	5.0	5.2	3.5	3.7	3.7
1979	1.6	4.8	5.7	5.4	8.0	3.0	6.2	5.2	5.8	8.3	7.6	7.4	5.8
1980	10.4	7.6	5.2	7.5	5.3	5.7	3.9	8.2	16.0	8.0	5.8	2.4	7.1
1981	0.7	0.3	3.5	4.4	6.3	8.6	8.6	4.0	7.4	9.1	14.1	7.9	6.3
1982	3.8	6.0	2.8	4.5	15.2	13.2	7.2	7.7	11.3	3.6	4.3	5.2	7.1
1983	5.5	1.4	2.1	10.3	13.6	7.1	7.9	4.5	9.6	13.4	4.5	5.6	7.2
1984	1.6	1.9	5.0	4.5	4.7	3.5	8.9	8.9	5.4	6.7	4.1	10.4	5.5
1985	6.7	2.7	1.7	4.9	1.6	5.3	5.2	5.7	8.6	4.4	6.0	8.3	5.1
1986	5.9	4.1	6.3	3.6	3.9	6.3	4.8	7.4	5.3	5.7	4.1	3.2	5.1
1987	2.5	1.2	3.9	4.9	5.5	4.3	3.1	6.4	8.3	8.1	6.7	6.1	5.1
1988	1.9	10.1	12.7	2.1	7.5	5.0	12.5	10.0	5.6	20.7	6.6	4.2	8.3
1989	4.8	3.7	2.7	2.6	3.7	10.3	5.8	6.3	4.9	7.3	4.0	4.1	5.0
1990	3.8	1.2	1.3	4.1	6.1	3.6	6.7	20.2	5.3	5.0	6.8	2.6	5.6
1991	4.9	2.8	1.5	4.1	2.8	2.6	2.8	11.9	9.9	6.9	4.5	4.9	5.0
1992	3.3	2.9	5.2	1.5	2.7	3.1	7.6	16.1	4.4	8.6	4.5	6.3	5.6
1993	3.1	2.7	3.6	2.7	6.0	12.0	3.3	2.8	5.3	6.0	4.1	4.0	4.7
1994	4.3	1.5	2.3	2.0	7.4	7.5	8.7	7.9	8.6	5.7	22.6	2.0	6.7
1995	2.3	5.4	5.2	7.4	6.3	5.6	5.4	7.9	15.3	10.2	4.8	9.4	7.1
1996	6.0	2.3	3.5	5.6	3.8	6.0	8.4	6.8	15.7	9.4	14.2	3.4	7.1
1997	2.6	2.4	1.7	4.4	2.9	4.4	2.1	5.6	4.2	4.5	5.8	5.1	3.8
1998	2.1	2.6	3.6	4.8	4.3	5.9	9.1	5.8	5.9	23.1	4.5	3.8	6.3
1999	1.4	0.9	1.9	5.3	3.2	5.4	5.0	5.4	5.3	4.0	7.9	2.2	4.0
2000	3.8	4.2	0.7	5.0	4.0	7.7	6.6	6.5	6.5	7.7	2.9	4.5	5.0
2001	3.1	0.9	0.5	1.4	10.0	5.2	1.1	5.4	2.6	5.9	4.9	9.3	4.2
2002	3.5	1.5	2.5	2.2	4.6	13.7	3.8	3.7	8.4	5.0	5.5	4.7	4.9
2003	3.1	2.0	3.1	2.3	4.3	8.2	3.7	4.2	7.4	7.0	5.4	2.5	4.4
2004	1.9	4.0	1.5	2.5	6.6	10.2	4.5	5.8	7.4	6.9	3.6	4.6	5.0
2005	3.1	0.8	2.8	0.9	3.7	4.7	7.1	5.8	2.4	3.1	1.0	2.5	3.2
2006	4.1	1.7	1.3	10.1	5.1	5.4							4.6
Min.	0.7	0.3	0.5	0.9	1.5	2.3	1.1	2.5	2.0	1.1	0.7	1.2	2.9
Mean	4.0	3.5	3.7	4.9	6.3	6.0	5.8	6.3	6.5	7.3	6.4	5.3	5.5
Max.	10.4	12.2	12.7	16.2	16.0	13.7	12.5	20.2	16.0	23.1	22.6	12.5	8.4

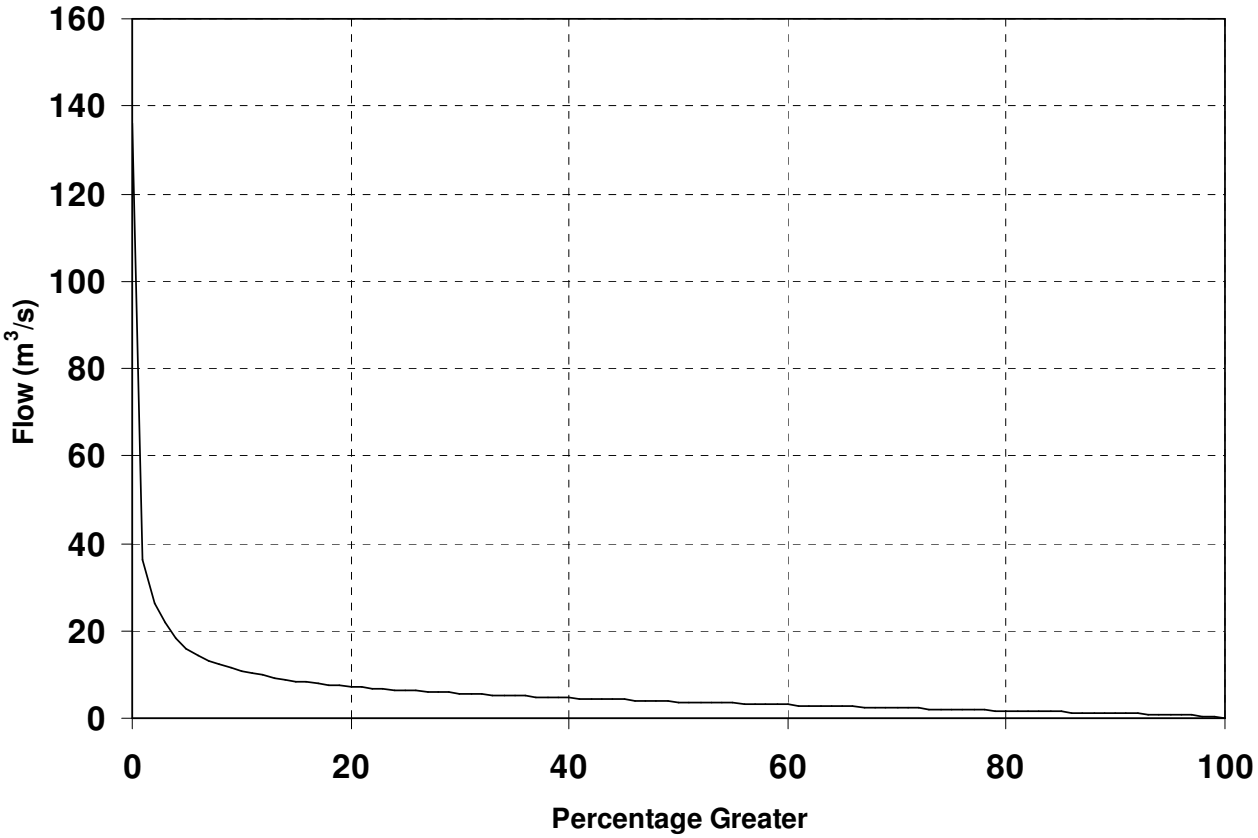

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	136	36	26	22	18	16	14	13	12	12
10	11	10	10	9	9	9	8	8	8	7
20	7	7	7	7	7	6	6	6	6	6
30	6	6	5	5	5	5	5	5	5	5
40	5	5	4	4	4	4	4	4	4	4
50	4	4	4	4	3	3	3	3	3	3
60	3	3	3	3	3	3	3	3	2	2
70	2	2	2	2	2	2	2	2	2	2
80	2	2	2	2	1	1	1	1	1	1
90	1	1	1	1	1	1	1	1	0	0
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	6	4	136

10.13 Inflow at Coleridge [Coleridge & Cobb] – 97904 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							21	22	25	40	41	33	30
1932	21	22	11	17	20	10	8	9	17	39	34	24	19
1933	14	31	17	25	26	13	20	21	17	19	21	28	21
1934	25	12	12	23	37	27	27	34	34	25	33	19	26
1935	18	22	22	25	26	33	16	11	11	34	22	28	22
1936	13	23	27	17	19	11	22	22	29	13	8	25	19
1937	31	25	20	14	26	17	5	1	2	10	15	9	15
1938	19	23	18	23	19	17	10	24	32	33	29	26	23
1939	17	11	7	3	8	18	12	14	29	30	19	20	16
1940	16	34	19	25	31	19	12	11	17	32	27	18	22
1941	10	16	18	25	24	26	21	21	33	35	31	31	24
1942	24	18	23	22	20	18	27	20	27	23	37	29	24
1943	15	24	17	17	16	26	21	18	35	40	29	21	23
1944	16	25	22	27	21	22	29	26	27	26	28	35	25
1945	27	33	27	25	27	20	18	34	42	36	21	30	28
1946	28	22	19	19	19	14	23	31	28	35	26	22	24
1947	30	24	13	10	10	23	19	22	31	40	29	16	22
1948	17	10	12	15	18	25	20	13	19	36	39	33	21
1949	24	18	21	22	22	28	33	28	17	37	12	17	23
1950	26	11	8	10	12	24	22	31	38	29	26	34	23
1951	26	22	14	42	27	16	26	21	24	40	39	27	27
1952	24	24	7	8	26	29	16	15	23	36	43	40	24
1953	22	21	16	34	33	29	21	25	32	35	41	41	29
1954	26	23	12	13	18	24	22	25	25	32	33	28	23
1955	16	31	20	10	33	29	18	28	35	32	30	19	25
1956	14	15	11	19	28	28	28	20	16	27	30	37	23
1957	23	14	27	14	28	23	14	14	16	38	39	29	23
1958	26	25	22	25	25	23	16	18	15	19	18	17	21
1959	19	13	20	25	28	26	16	18	24	27	24	30	22
1960	16	12	20	12	15	25	19	19	14	16	18	13	17
1961	11	15	16	15	17	22	29	26	23	29	38	22	22
1962	17	13	10	13	35	30	27	29	24	25	28	15	22
1963	11	15	15	22	27	37	31	28	42	35	43	31	28
1964	33	18	28	19	34	22	30	34	31	43	43	40	31
1965	30	22	14	16	16	22	17	25	27	40	37	32	25
1966	20	17	15	18	22	19	16	17	21	22	36	29	21
1967	18	9	14	14	33	16	21	35	28	36	41	27	24
1968	24	27	25	34	27	26	27	30	33	26	33	25	28
1969	26	19	16	17	19	15	15	19	31	23	19	23	20

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	24	14	24	17	13	25	30	29	32	35	21	33	25
1971	20	11	9	11	18	29	19	19	34	32	33	31	22
1972	15	8	13	19	29	15	22	18	35	36	15	23	21
1973	7	7	9	15	31	26	12	35	41	39	37	27	24
1974	20	20	16	26	24	24	32	26	39	41	38	44	29
1975	27	29	29	35	25	39	36	42	43	39	25	34	34
1976	37	40	23	19	30	34	35	35	40	42	42	49	35
1977	34	36	13	5	7	13	17	6	15	35	39	34	21
1978	28	20	14	29	26	26	28	37	40	38	34	33	29
1979	27	26	20	26	22	23	23	22	39	40	38	38	29
1980	38	35	31	29	26	29	22	28	32	29	28	28	30
1981	26	19	22	28	30	37	33	25	29	53	34	30	31
1982	20	10	11	10	16	17	11	19	32	26	38	23	19
1983	19	15	14	23	29	30	29	27	28	33	36	33	26
1984	32	31	27	18	22	18	37	34	19	17	16	22	24
1985	14	10	7	11	10	21	21	24	35	22	10	20	17
1986	14	11	19	18	25	34	27	32	30	36	31	31	26
1987	27	20	31	29	31	31	18	22	26	34	28	30	27
1988	27	24	28	18	21	31	31	26	26	26	23	26	26
1989	23	23	22	18	17	33	20	15	12	24	27	35	22
1990	29	17	13	16	30	19	22	27	20	28	26	27	23
1991	30	26	16	24	19	13	9	18	24	35	35	35	24
1992	29	25	25	19	14	10	16	49	24	44	30	29	26
1993	30	27	23	24	24	32	19	15	16	41	30	39	27
1994	25	22	26	20	28	35	34	29	31	28	32	30	28
1995	29	22	22	23	12	21	16	20	39	18	10	9	20
1996	7	6	2	10	19	14	18	17	38	41	37	38	21
1997	28	29	27	31	24	22	21	29	19	29	36	30	27
1998	33	30	32	31	25	25	40	38	30	33	32	35	32
1999	25	17	16	17	20	32	28	22	24	39	44	20	25
2000	25	37	17	35	33	45	31	40	41	33	34	36	34
2001	31	22	11	16	16	28	23	26	20	30	35	31	24
2002	32	18	23	17	16	30	24	27	35	34	37	35	27
2003	29	27	17	18	30	31	28	10	32	46	41	33	28
2004	30	23	17	15	29	29	20	24	31	35	37	27	26
2005	27	26	24	17	16	15	18	17	28	20	18	26	21
2006	27	17	11	31	28	34							25
Min.	7	6	2	3	7	10	5	1	2	10	8	9	15
Mean	23	21	18	20	23	24	22	24	28	32	30	28	24
Max.	38	40	32	42	37	45	40	49	43	53	44	49	35

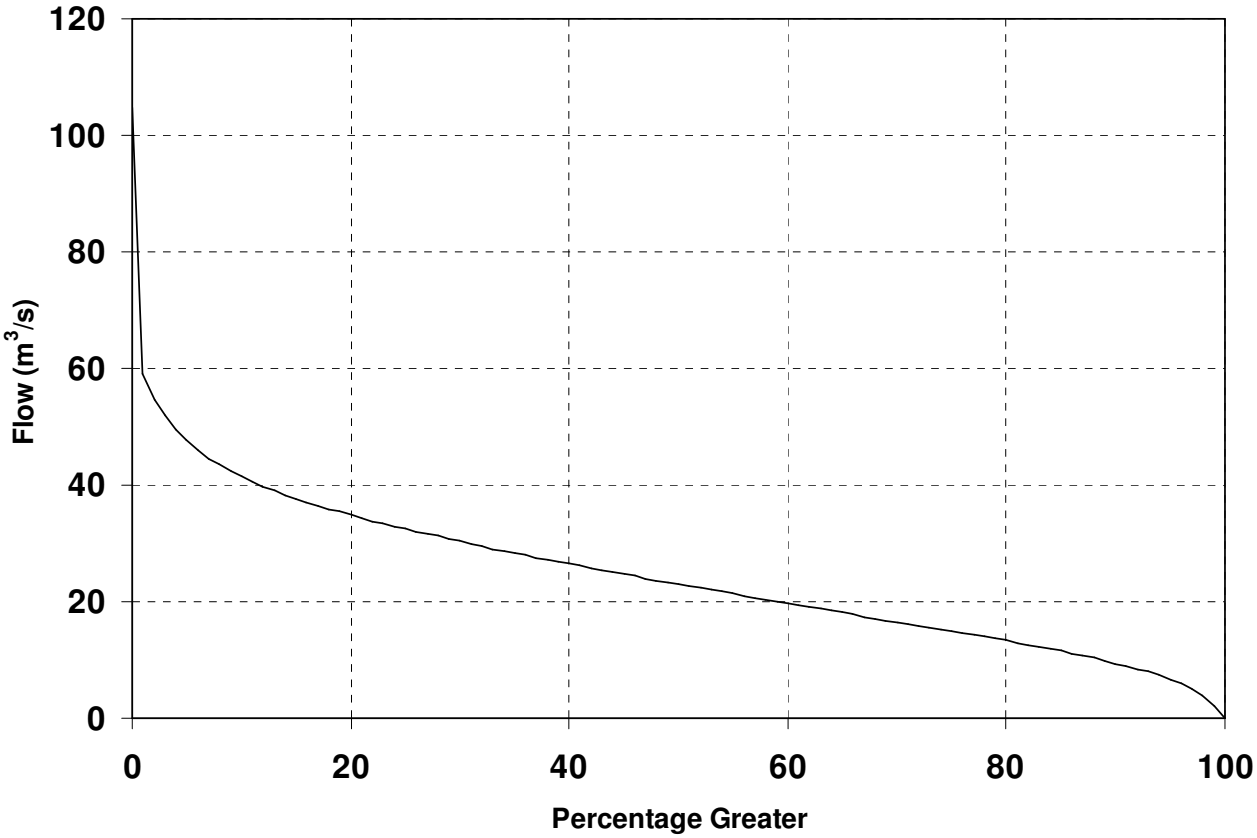

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	105	59	55	52	50	48	46	45	44	42
10	41	41	40	39	38	38	37	36	36	35
20	35	34	34	33	33	32	32	32	31	31
30	30	30	30	29	29	28	28	28	27	27
40	27	26	26	25	25	25	24	24	24	23
50	23	23	22	22	22	21	21	21	20	20
60	20	19	19	19	18	18	18	17	17	17
70	17	16	16	16	15	15	15	14	14	14
80	13	13	13	12	12	12	11	11	10	10
90	9	9	9	8	7	7	6	5	4	2
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	25	23	105

10.14 Grey + Taramakau – Taipo – 77106 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							391	297	278	655	567	447	439
1932	638	390	221	353	306	229	174	264	370	420	616	348	360
1933	360	686	520	774	713	174	275	412	443	640	381	431	483
1934	351	165	454	540	571	291	344	459	589	598	317	302	417
1935	787	220	436	360	395	308	219	369	178	559	277	337	373
1936	355	289	313	475	445	227	302	613	607	854	739	428	471
1937	581	373	354	581	405	211	321	271	293	269	374	292	360
1938	456	293	329	260	298	364	185	385	412	708	387	537	385
1939	486	500	186	441	382	498	263	224	453	341	540	591	407
1940	287	951	429	393	505	415	181	301	388	705	372	439	445
1941	431	379	342	402	512	317	308	171	383	326	749	317	386
1942	455	271	472	532	653	359	447	409	577	608	574	407	482
1943	378	533	487	513	382	337	263	206	342	363	448	337	381
1944	276	482	304	527	267	491	376	265	409	593	567	432	415
1945	492	459	772	536	295	201	218	442	477	385	897	402	464
1946	432	806	238	269	212	207	333	537	608	724	328	638	442
1947	299	274	161	177	322	457	288	340	578	479	419	312	342
1948	341	229	528	231	352	277	415	297	512	657	616	655	427
1949	298	708	561	580	252	169	517	416	303	638	308	503	437
1950	604	334	326	295	386	330	371	306	386	297	292	489	369
1951	212	195	195	282	257	172	585	237	486	462	559	336	332
1952	538	540	464	498	704	855	461	228	322	282	414	407	475
1953	250	277	287	571	765	492	434	364	523	460	593	826	488
1954	520	521	389	510	327	752	547	446	380	311	526	335	462
1955	202	1233	503	358	745	644	304	737	414	469	560	351	538
1956	323	272	303	626	324	627	644	475	385	344	684	479	457
1957	444	265	292	677	755	494	529	400	246	681	811	1348	581
1958	584	612	638	644	1070	584	410	577	390	516	320	520	573
1959	242	262	275	373	435	559	256	406	612	576	497	473	414
1960	335	388	399	220	489	508	394	368	560	446	381	219	392
1961	145	277	445	416	199	429	612	425	436	357	769	245	396
1962	637	280	210	228	506	581	581	518	572	832	576	272	484
1963	203	398	354	252	562	562	275	495	656	270	623	246	407
1964	910	245	448	316	622	318	632	714	621	676	562	607	559
1965	392	315	196	301	1239	562	366	418	426	487	821	493	503
1966	471	457	286	540	290	378	340	235	262	250	415	445	363
1967	314	231	399	579	515	272	352	647	365	388	1011	615	475
1968	399	519	600	325	518	191	250	391	570	928	796	332	485
1969	201	184	337	614	368	327	296	372	791	355	154	284	357

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	379	158	241	342	148	306	537	505	1133	617	393	347	426
1971	137	159	115	140	196	474	225	305	636	831	336	251	317
1972	272	113	313	489	572	298	466	318	656	838	559	401	442
1973	186	122	131	523	914	449	117	339	307	279	675	285	361
1974	247	354	189	803	304	291	619	218	172	383	457	229	355
1975	108	193	329	637	821	453	623	565	477	430	437	408	458
1976	452	283	249	212	472	571	595	454	284	437	341	610	415
1977	599	241	315	202	454	434	325	210	348	610	631	588	415
1978	269	105	212	169	264	175	535	417	317	359	387	474	309
1979	324	372	294	552	811	335	383	345	664	748	517	771	511
1980	729	526	434	366	599	375	352	606	1025	462	638	386	541
1981	165	450	453	505	446	511	511	276	659	729	456	618	481
1982	639	326	280	160	572	260	279	380	464	319	746	678	426
1983	638	217	428	565	754	432	487	404	664	649	477	522	522
1984	333	249	251	298	357	399	503	486	244	635	700	723	433
1985	571	232	149	242	232	357	385	300	390	224	257	524	323
1986	407	302	229	385	423	622	332	273	285	442	242	328	356
1987	577	470	211	473	542	648	275	365	467	618	380	504	460
1988	330	507	467	265	615	597	717	650	906	1255	652	403	614
1989	312	256	529	411	282	605	324	175	116	307	459	660	370
1990	591	233	272	526	822	427	488	520	186	310	423	577	450
1991	649	576	154	468	265	327	245	869	516	559	345	374	445
1992	324	407	472	222	182	318	463	880	247	293	291	291	367
1993	617	315	210	280	364	885	350	232	296	663	232	429	407
1994	1008	218	338	317	721	549	563	592	591	365	1168	350	567
1995	425	292	555	447	472	421	568	527	959	665	490	625	539
1996	281	386	369	637	424	407	221	387	557	881	796	489	485
1997	208	435	277	514	325	335	275	589	193	381	782	1025	445
1998	359	436	567	527	325	416	781	526	502	1220	289	449	535
1999	245	204	245	625	655	484	397	328	328	788	530	169	417
2000	339	292	155	575	455	627	373	396	521	857	263	398	438
2001	310	245	205	244	372	485	180	401	217	337	660	865	378
2002	484	134	469	265	421	1079	382	376	645	542	631	530	498
2003	316	353	170	261	447	714	455	180	552	453	512	358	397
2004	426	657	462	260	415	725	309	544	602	522	354	506	481
2005	341	444	415	209	306	343	448	360	384	309	262	337	346
2006	590	200	241	695	252	520							418
Min.	108	105	115	140	148	169	117	171	116	224	154	169	309
Mean	411	364	345	418	471	438	394	410	468	536	515	466	437
Max.	1008	1233	772	803	1239	1079	781	880	1133	1255	1168	1348	614

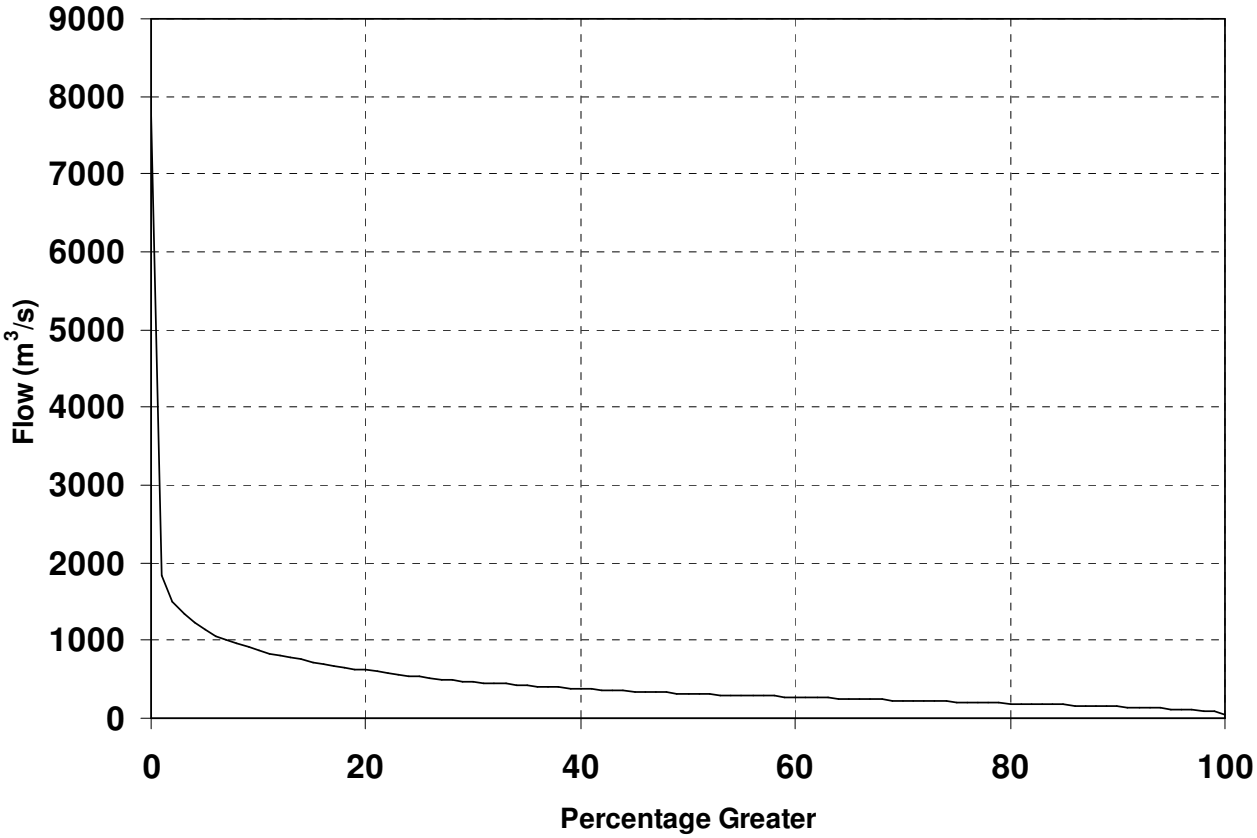

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	7740	1845	1507	1351	1232	1138	1059	1003	956	912
10	871	839	810	779	753	724	698	677	655	632
20	617	597	580	560	545	529	514	502	488	478
30	467	457	446	437	428	419	411	403	394	386
40	379	372	365	358	353	347	341	335	330	324
50	318	314	309	302	298	295	289	285	280	277
60	273	267	263	259	253	249	245	242	237	233
70	230	225	222	217	213	210	206	201	197	194
80	190	185	181	177	173	170	165	161	157	152
90	147	142	137	132	126	119	112	104	94	80
100	42									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	42	437	318	7740

10.15 Tekapo Natural – 98770 (Item: 2)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							35	33	33	84	85	114	64
1932	90	97	68	76	44	32	19	22	28	61	93	96	60
1933	113	198	98	130	77	45	72	57	34	51	70	135	89
1934	113	97	69	133	76	60	43	56	52	117	92	101	84
1935	150	122	118	75	71	70	35	47	30	51	71	121	80
1936	90	108	93	107	58	30	43	46	56	125	168	117	87
1937	122	106	67	122	66	45	31	27	28	31	56	94	66
1938	170	120	113	175	56	46	40	48	58	72	97	118	93
1939	70	73	66	50	47	58	36	26	46	55	102	123	63
1940	147	151	115	66	91	53	32	28	28	71	82	108	81
1941	120	129	88	54	39	67	44	32	38	33	84	108	69
1942	110	72	84	161	108	38	57	29	36	146	90	106	87
1943	79	127	81	83	41	33	28	29	47	97	107	120	72
1944	103	174	113	140	63	36	45	38	37	73	126	110	88
1945	222	178	121	100	48	38	39	54	93	64	182	138	106
1946	129	145	100	49	36	26	25	50	90	110	60	139	80
1947	90	88	59	37	25	30	28	28	35	99	95	136	62
1948	99	92	70	59	34	50	39	28	31	90	176	124	74
1949	112	172	102	82	102	65	62	49	31	135	100	99	92
1950	180	70	52	45	96	57	46	53	53	52	67	143	76
1951	101	92	69	112	42	26	61	38	35	95	129	121	77
1952	98	184	95	55	67	39	26	22	31	72	80	94	71
1953	81	80	77	82	109	52	31	35	48	40	120	155	76
1954	116	146	108	53	43	53	33	36	30	47	97	104	72
1955	89	208	87	65	129	67	35	42	54	64	74	107	84
1956	114	95	56	111	88	79	55	36	31	56	141	113	81
1957	106	99	74	88	96	43	57	38	28	80	154	281	95
1958	217	260	134	85	96	55	27	30	37	84	90	158	105
1959	91	78	70	60	39	40	28	21	42	48	120	135	64
1960	126	104	101	49	55	57	36	63	68	70	75	70	73
1961	71	92	107	117	39	42	39	45	35	107	116	105	76
1962	143	69	72	37	99	47	65	62	70	127	93	87	81
1963	88	126	87	56	82	60	36	41	66	56	66	67	69
1964	95	80	98	55	84	39	49	43	45	52	77	119	70
1965	158	95	81	50	43	38	29	35	31	50	112	136	72
1966	171	128	85	74	48	35	29	29	40	71	96	107	76
1967	131	98	159	145	62	52	106	85	34	69	149	157	104
1968	100	132	145	95	136	54	37	63	58	111	107	109	96
1969	110	79	79	66	53	32	24	24	142	40	58	159	72

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	141	80	110	93	36	43	35	88	216	89	113	114	97
1971	79	68	51	38	54	83	28	28	51	103	89	105	65
1972	97	59	112	69	59	42	44	33	74	107	162	97	80
1973	89	65	56	76	62	57	27	32	45	93	146	80	69
1974	75	130	94	114	43	34	36	27	30	73	109	98	71
1975	87	110	127	161	90	56	42	70	58	89	103	97	91
1976	108	64	72	42	52	65	26	27	28	37	50	149	60
1977	115	105	81	58	49	43	40	27	27	50	77	83	63
1978	106	69	83	102	123	54	47	81	83	79	93	99	85
1979	92	103	134	97	130	50	39	43	54	111	120	259	103
1980	174	102	78	80	60	59	43	64	84	93	103	117	88
1981	95	93	152	77	67	82	49	38	36	104	97	143	86
1982	122	102	125	42	66	51	33	34	43	52	182	122	81
1983	143	63	85	94	108	62	68	72	82	182	169	148	107
1984	119	99	103	55	41	32	73	64	44	82	147	261	94
1985	169	71	64	67	49	49	40	57	67	48	93	139	76
1986	108	92	103	84	56	85	52	54	42	80	92	105	79
1987	142	132	127	104	89	85	40	39	47	109	101	98	93
1988	92	89	69	48	47	52	66	64	81	143	134	138	85
1989	112	101	130	63	69	86	48	36	30	30	102	183	82
1990	122	80	78	61	89	63	61	68	36	106	96	162	85
1991	147	138	51	93	36	30	30	95	96	84	67	97	80
1992	117	94	53	42	34	29	31	65	39	78	128	107	68
1993	121	77	86	65	63	116	40	35	34	93	59	82	72
1994	281	80	109	66	53	56	51	52	60	51	208	127	100
1995	128	88	120	139	78	43	33	38	136	121	99	285	109
1996	111	117	89	139	73	49	33	33	50	161	93	88	86
1997	88	109	69	104	57	38	38	62	40	54	90	151	75
1998	129	160	156	97	71	69	103	67	85	174	83	97	107
1999	89	86	102	78	85	61	48	37	48	110	206	72	85
2000	133	95	56	121	74	120	80	56	85	110	68	148	95
2001	89	69	70	40	43	44	33	35	36	70	103	181	68
2002	180	71	69	58	43	77	43	66	98	70	92	129	83
2003	94	92	63	50	111	76	62	36	53	68	85	109	75
2004	138	120	106	46	84	71	50	50	52	65	102	88	81
2005	119	102	90	47	47	40	39	41	91	49	62	79	67
2006	94	65	43	103	69	78							75
Min.	70	59	43	37	25	26	19	21	27	30	50	67	60
Mean	119	107	91	81	67	54	43	45	54	82	105	125	81
Max.	281	260	159	175	136	120	106	95	216	182	208	285	109

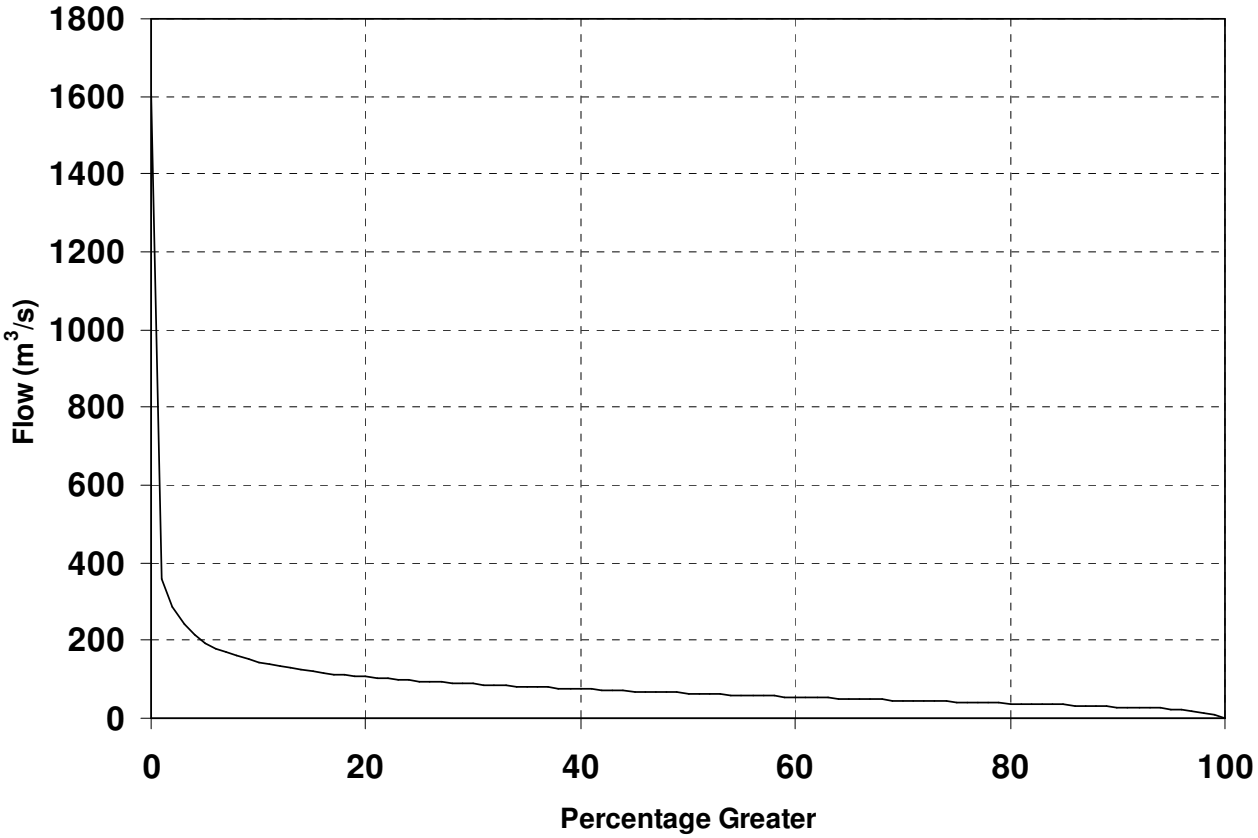

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1607	359	285	240	215	194	180	169	160	152
10	145	139	134	129	125	121	117	114	112	109
20	106	104	102	100	98	96	95	93	91	89
30	88	87	85	84	82	81	80	79	77	76
40	75	74	73	72	71	69	68	67	66	65
50	64	63	62	61	60	59	58	57	56	55
60	54	53	52	52	51	50	49	48	48	47
70	46	45	44	43	43	42	41	40	40	39
80	38	37	36	36	35	34	33	32	31	30
90	29	28	28	26	25	23	21	19	15	10
100	2									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	2	81	64	1607

10.16 Pukaki Natural – 98770 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							49	39	37	117	85	165	82
1932	205	205	125	96	63	47	26	23	34	83	159	168	103
1933	212	402	209	235	107	50	84	74	45	85	104	228	151
1934	222	216	143	227	147	75	54	73	73	163	113	179	140
1935	348	277	217	133	97	83	48	65	50	70	92	215	141
1936	181	201	137	165	76	44	61	68	69	203	199	174	131
1937	200	193	129	192	79	50	38	37	41	49	89	164	104
1938	337	268	243	312	69	58	39	55	63	79	125	173	151
1939	121	166	145	88	77	86	39	31	57	59	125	175	97
1940	250	244	296	123	108	59	32	30	38	111	110	176	131
1941	234	282	173	92	57	82	54	35	36	45	123	163	114
1942	211	140	171	343	165	48	74	37	60	236	174	199	155
1943	189	252	147	121	49	44	38	27	61	101	137	206	114
1944	197	290	187	196	72	45	53	45	47	88	147	138	125
1945	404	309	206	160	55	33	33	56	105	72	245	177	153
1946	258	340	195	81	50	36	38	70	111	135	88	219	134
1947	168	187	148	83	61	57	48	45	57	148	146	292	120
1948	226	218	157	78	61	62	62	38	67	119	236	216	128
1949	204	390	194	142	112	72	82	76	47	165	133	152	146
1950	285	135	125	86	178	80	80	77	80	82	116	252	132
1951	189	173	121	130	62	42	91	47	56	119	168	164	113
1952	174	218	217	131	98	81	54	46	75	122	119	148	123
1953	167	165	161	148	130	44	41	63	91	55	195	244	125
1954	212	314	209	77	53	73	55	49	24	69	160	167	121
1955	196	427	188	98	182	68	32	66	82	97	112	182	143
1956	236	159	109	204	120	103	67	59	50	75	140	193	126
1957	184	207	162	150	136	55	46	56	35	107	168	348	138
1958	305	474	273	135	145	82	48	52	41	116	134	255	170
1959	187	165	139	91	55	60	42	34	81	62	158	187	105
1960	267	198	182	80	80	76	60	66	104	101	115	120	120
1961	143	186	178	181	58	68	67	63	58	127	168	149	120
1962	280	147	136	59	133	67	87	70	79	122	128	134	120
1963	166	232	156	65	102	79	29	49	83	74	89	108	102
1964	160	134	163	88	138	65	43	50	61	72	99	174	104
1965	248	167	184	78	60	56	40	43	53	81	152	204	114
1966	329	308	176	127	56	49	48	51	52	69	122	187	130
1967	270	205	371	260	92	45	92	114	60	103	176	245	170
1968	195	236	271	136	161	55	50	73	76	142	139	148	140
1969	179	162	163	128	72	52	44	46	185	73	108	255	122

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	277	185	208	169	54	55	53	105	241	113	176	215	154
1971	177	169	120	69	79	101	50	24	74	137	107	162	106
1972	193	136	235	120	86	42	54	53	115	118	219	147	127
1973	173	196	143	163	128	91	44	48	56	135	230	157	130
1974	149	287	183	227	60	58	54	40	46	90	148	197	127
1975	203	213	242	248	116	48	26	76	64	103	127	143	134
1976	177	103	145	69	65	81	28	12	15	31	44	208	82
1977	166	195	149	107	43	44	48	74	27	61	103	122	94
1978	183	161	185	187	171	72	55	90	88	91	109	127	126
1979	169	181	267	132	140	65	59	54	81	157	142	394	154
1980	300	180	133	134	93	78	45	75	99	121	141	170	131
1981	195	250	279	131	92	109	56	47	59	145	124	219	142
1982	289	218	265	71	105	59	38	51	66	61	226	194	137
1983	262	136	195	153	154	74	66	76	98	202	147	196	147
1984	200	176	189	100	55	44	85	90	71	117	195	357	140
1985	275	143	124	116	66	52	44	78	84	63	123	218	116
1986	216	182	163	140	68	104	39	44	53	104	110	173	116
1987	262	226	197	169	117	106	43	46	67	146	149	170	141
1988	191	179	136	84	76	69	74	80	116	200	167	232	134
1989	206	214	245	98	86	93	48	44	34	68	153	348	136
1990	237	201	170	104	145	78	70	81	52	123	126	280	139
1991	278	267	109	153	49	42	34	122	107	99	84	131	122
1992	190	190	94	69	49	16	48	83	35	92	139	159	97
1993	259	165	141	98	74	138	46	43	50	127	81	126	112
1994	509	170	161	98	71	68	62	63	70	52	252	172	146
1995	242	186	210	185	82	58	43	55	151	138	121	466	161
1996	231	225	152	186	91	54	33	33	57	180	110	116	122
1997	139	213	115	149	71	41	33	79	38	76	141	257	112
1998	261	345	286	151	98	75	114	74	85	218	121	159	165
1999	187	177	186	126	111	63	49	24	45	124	283	112	123
2000	205	173	91	151	85	139	83	55	85	130	77	210	123
2001	133	151	143	60	52	65	31	47	45	108	140	286	105
2002	293	121	108	84	55	102	43	73	111	71	103	182	112
2003	166	168	113	63	141	85	66	31	72	76	116	179	106
2004	279	179	203	64	106	75	40	49	55	71	142	123	115
2005	197	199	163	60	55	40	41	51	103	64	99	162	102
2006	204	135	83	145	72	76							119
Min.	121	103	83	59	43	16	26	12	15	31	44	108	82
Mean	224	213	177	133	92	67	52	57	70	107	140	196	127
Max.	509	474	371	343	182	139	114	122	241	236	283	466	170

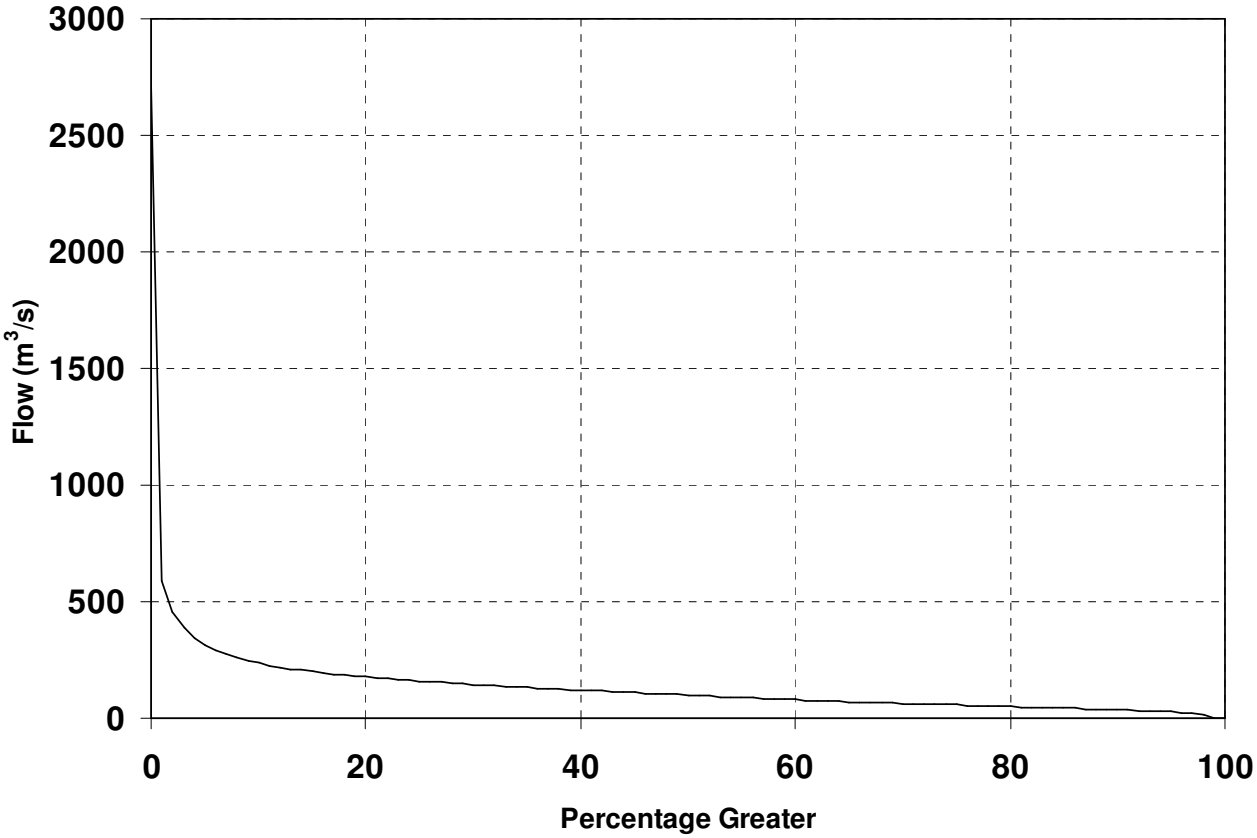

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	2699	588	457	389	345	315	292	274	259	246
10	236	227	220	212	206	200	195	190	186	181
20	177	173	169	166	162	159	156	153	150	147
30	145	142	139	137	134	132	130	127	125	123
40	120	118	116	114	111	109	107	105	103	101
50	98	96	94	92	90	88	86	84	82	81
60	79	77	75	74	72	70	69	67	66	64
70	63	61	60	58	57	56	54	53	52	51
80	50	48	47	46	44	43	42	40	39	38
90	36	35	33	32	30	28	25	20	14	3
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	127	98	2699

10.17 Waitaki System at Ohau [separate Tekapo sim] – 98614 (Item: 3)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							37	30	32	101	83	102	64
1932	98	91	51	53	44	35	20	18	29	72	107	91	59
1933	94	164	111	148	93	42	78	73	40	78	77	117	93
1934	105	79	62	112	102	59	39	58	65	145	83	83	83
1935	140	94	85	68	69	53	25	38	23	61	71	104	69
1936	71	80	63	93	52	28	38	60	57	157	148	112	80
1937	110	95	68	114	68	45	27	27	35	42	65	90	65
1938	142	90	96	135	56	55	34	54	67	84	98	122	86
1939	69	74	59	43	58	68	38	24	56	61	104	109	64
1940	129	160	129	83	90	58	29	23	33	108	94	93	85
1941	86	98	72	69	50	68	49	25	25	32	115	105	66
1942	107	75	90	165	131	45	63	35	56	192	129	132	102
1943	95	120	90	81	49	36	36	24	54	87	106	111	74
1944	99	143	108	131	65	42	49	41	42	86	130	115	88
1945	226	177	143	104	53	32	29	56	105	75	207	142	112
1946	144	156	86	51	43	32	32	64	102	137	76	134	88
1947	95	85	55	32	33	37	35	35	51	123	99	124	67
1948	91	63	72	50	33	53	50	30	55	113	190	137	78
1949	100	182	107	102	78	49	63	51	37	139	89	95	91
1950	164	72	56	43	82	52	59	52	72	65	76	139	78
1951	87	63	50	93	46	30	80	42	66	98	152	132	78
1952	124	181	74	53	78	50	32	20	44	97	83	111	79
1953	70	70	70	125	95	54	40	48	66	41	161	142	82
1954	103	125	96	57	38	58	43	35	32	60	114	101	72
1955	80	184	83	54	120	76	34	47	69	67	71	105	82
1956	76	70	41	110	85	86	57	46	43	74	128	130	79
1957	100	81	68	103	113	40	51	28	27	103	177	280	98
1958	185	243	141	112	147	77	33	35	31	109	109	178	116
1959	89	68	61	56	37	58	28	22	68	59	134	126	67
1960	122	95	78	44	63	50	47	61	85	73	76	67	72
1961	53	74	83	97	43	50	55	54	44	111	121	91	73
1962	98	58	52	29	72	51	74	53	57	98	118	80	70
1963	69	88	84	46	66	53	29	37	76	67	72	65	62
1964	106	60	83	48	98	35	42	39	44	67	86	115	69
1965	164	87	88	48	43	46	28	27	42	68	141	138	77
1966	172	121	75	85	35	40	28	32	36	53	92	112	73
1967	143	114	165	166	80	32	68	106	40	71	149	185	110
1968	114	109	123	66	127	50	34	65	74	133	117	120	94
1969	112	73	76	81	54	36	28	34	178	60	79	147	80

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	115	75	80	72	31	39	42	108	250	104	135	129	98
1971	71	52	48	42	52	67	31	28	62	125	97	115	66
1972	91	50	95	72	74	34	40	31	110	91	170	106	80
1973	81	55	48	96	86	63	29	33	40	112	163	73	73
1974	56	100	89	92	40	36	52	32	35	77	119	106	69
1975	82	87	114	176	111	59	52	82	67	97	115	100	95
1976	100	64	66	41	68	82	33	29	27	40	52	142	62
1977	120	101	74	62	55	47	41	23	32	60	83	88	65
1978	99	60	78	98	118	61	43	97	92	119	108	93	89
1979	95	99	145	114	134	55	39	35	69	123	118	242	106
1980	161	99	78	97	76	61	37	60	79	96	100	116	88
1981	78	89	141	81	66	73	40	28	33	106	74	117	77
1982	143	86	112	41	89	49	25	40	50	39	184	141	83
1983	177	64	94	88	110	50	49	58	82	164	154	122	101
1984	129	83	95	52	44	36	62	63	44	111	140	258	93
1985	162	59	44	56	52	51	49	62	54	48	103	133	73
1986	106	97	108	86	55	86	39	43	44	85	81	91	77
1987	134	124	133	103	90	99	33	38	53	123	94	90	93
1988	76	84	67	49	50	64	67	66	104	180	145	134	90
1989	94	80	124	52	43	71	44	36	25	44	83	188	74
1990	102	66	84	64	128	64	55	60	28	84	82	175	83
1991	114	138	47	93	36	36	23	105	95	79	66	96	77
1992	96	88	57	43	33	16	39	64	29	89	117	92	64
1993	117	78	62	57	69	128	51	36	37	114	58	90	75
1994	266	76	96	62	61	58	51	54	55	47	209	131	97
1995	123	81	135	116	64	45	34	49	150	121	107	291	110
1996	105	107	84	137	80	53	28	28	52	156	86	95	84
1997	78	98	61	105	53	33	32	70	36	70	126	138	75
1998	107	126	132	102	58	67	94	61	73	160	79	84	95
1999	70	67	84	79	81	55	48	30	43	92	212	63	77
2000	92	68	45	74	76	130	75	50	90	121	67	157	87
2001	89	62	58	43	43	61	34	42	37	68	87	168	66
2002	140	49	64	54	42	87	45	71	109	65	93	139	80
2003	96	87	57	42	86	83	53	30	60	67	97	109	72
2004	138	124	115	49	90	75	45	50	53	64	108	89	83
2005	104	80	80	43	51	40	42	50	86	55	66	75	64
2006	93	52	51	86	60	58							67
Min.	53	49	41	29	31	16	20	18	23	32	52	63	59
Mean	111	95	85	80	70	55	43	47	61	92	111	123	81
Max.	266	243	165	176	147	130	94	108	250	192	212	291	116

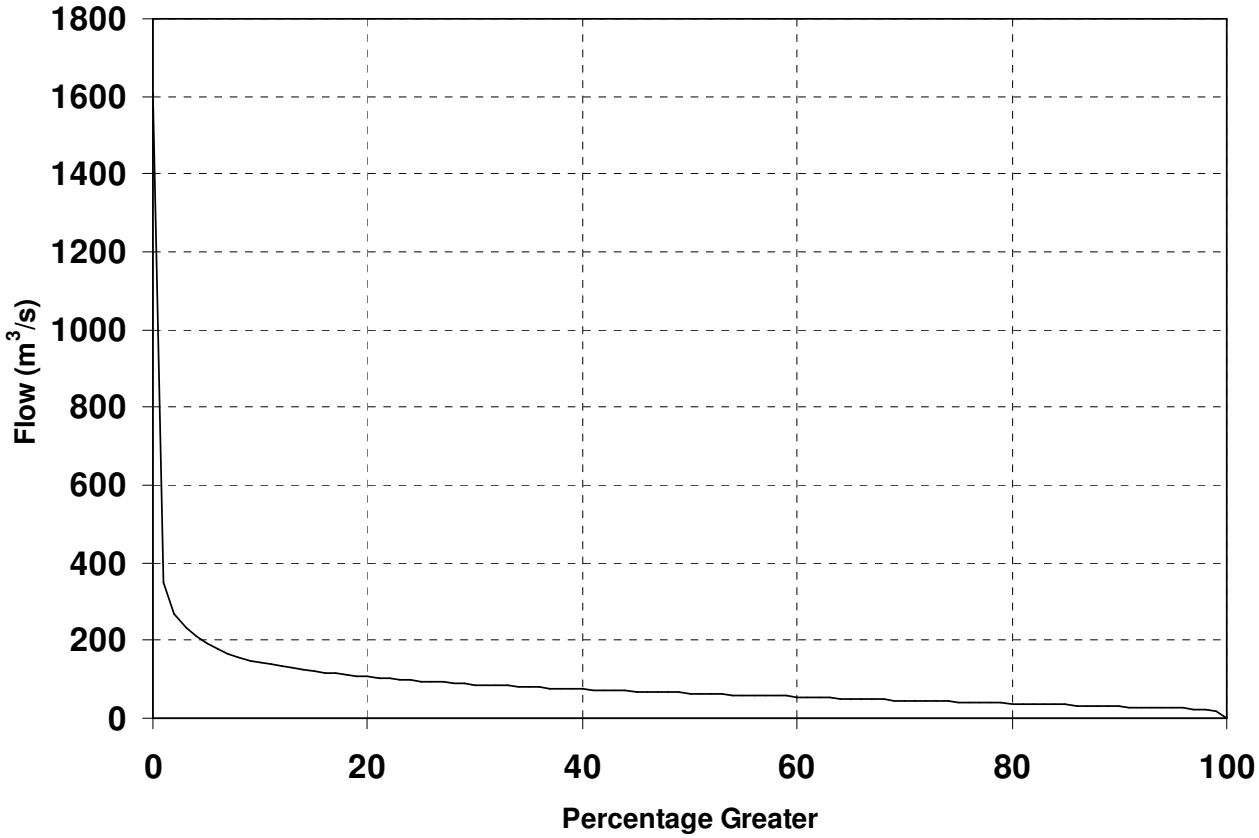

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1606	349	269	235	212	192	179	167	158	150
10	144	139	134	129	125	122	118	115	112	109
20	107	104	102	100	98	96	94	93	91	89
30	87	86	85	83	82	81	79	78	77	75
40	74	73	72	71	70	69	68	67	66	65
50	64	63	62	61	60	59	58	57	57	56
60	55	54	53	52	51	51	50	49	48	47
70	46	45	45	44	43	42	41	41	40	39
80	38	37	37	36	35	34	33	32	32	31
90	30	29	28	28	27	26	25	24	21	18
100	2									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	2	81	64	1606

10.18 Waitaki System at Benmore tr [separate Tekapo sim] - 98614 (Item: 4)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							57	46	48	154	127	157	98
1932	150	140	78	81	68	54	30	28	45	110	163	140	90
1933	143	251	170	227	143	65	120	112	61	119	118	179	142
1934	161	121	95	171	157	90	60	89	100	223	128	127	127
1935	215	145	131	104	106	81	39	58	35	94	109	160	106
1936	108	123	96	142	79	42	59	91	87	241	227	177	123
1937	183	146	105	174	104	69	42	41	54	64	99	138	101
1938	218	137	147	207	85	84	52	82	103	129	150	186	132
1939	106	113	91	67	88	105	58	37	86	94	159	167	97
1940	197	245	201	126	138	88	44	35	50	165	145	143	131
1941	131	150	111	106	77	105	75	39	38	49	176	161	101
1942	164	115	137	253	201	68	97	54	85	294	198	203	156
1943	145	185	138	124	75	55	54	37	83	134	162	170	113
1944	151	220	166	207	100	65	76	62	64	132	200	177	135
1945	375	335	232	159	82	49	45	86	161	115	317	217	180
1946	234	279	132	79	66	49	48	98	156	210	117	206	139
1947	146	129	85	49	51	57	54	53	78	188	151	191	103
1948	139	97	110	76	51	82	77	47	85	174	291	209	120
1949	154	326	164	157	120	76	96	78	56	212	136	134	141
1950	236	107	82	64	115	82	96	90	128	112	115	190	118
1951	129	89	65	143	76	52	122	80	116	165	238	201	123
1952	177	262	103	73	117	87	56	36	76	161	135	174	121
1953	96	91	90	177	151	93	61	80	110	65	212	193	118
1954	136	159	130	89	62	104	81	68	66	99	162	139	108
1955	102	241	116	69	168	123	54	74	106	98	97	132	114
1956	91	83	47	136	123	139	96	71	67	120	192	196	113
1957	137	103	101	145	175	70	88	48	45	166	285	531	159
1958	403	501	233	167	246	130	58	58	50	149	152	252	198
1959	125	92	83	79	61	87	48	39	107	103	200	182	100
1960	166	132	112	71	96	84	73	102	146	118	113	95	109
1961	72	101	121	140	70	83	104	108	87	182	176	134	115
1962	131	79	81	47	105	92	119	102	103	160	187	112	110
1963	93	122	120	69	95	91	55	71	147	121	114	96	99
1964	139	80	108	67	142	58	64	66	77	112	139	178	103
1965	261	128	126	74	70	76	49	46	70	115	220	203	120
1966	251	166	105	125	57	61	45	49	58	81	133	152	106
1967	192	161	235	253	128	53	103	167	66	109	224	311	167
1968	167	164	212	98	196	79	52	108	126	219	192	192	151
1969	165	104	110	111	81	54	47	55	279	99	119	228	121

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	165	105	107	100	47	60	72	168	380	174	211	227	151
1971	101	73	72	68	81	110	52	45	102	212	160	178	105
1972	127	72	129	102	115	59	66	52	197	156	258	156	124
1973	113	76	66	131	129	98	48	52	64	175	248	104	109
1974	79	146	135	135	63	58	82	53	63	113	175	144	104
1975	121	135	169	263	180	99	84	128	110	152	174	142	146
1976	134	88	88	58	100	125	54	47	45	68	85	209	92
1977	180	139	100	87	87	73	63	38	50	94	126	127	97
1978	133	81	102	133	176	99	68	156	150	201	174	139	135
1979	130	138	211	172	197	85	63	57	109	201	186	460	168
1980	300	159	121	156	121	111	65	108	138	161	174	174	149
1981	111	120	207	127	110	121	68	51	59	173	116	171	120
1982	193	121	158	63	141	80	42	68	85	72	290	217	128
1983	270	95	128	133	179	85	86	111	144	273	273	264	171
1984	200	124	151	82	74	59	100	107	76	188	213	492	156
1985	298	87	67	81	80	80	78	106	97	82	161	192	118
1986	154	143	170	126	86	144	66	73	76	143	126	132	120
1987	190	179	217	167	137	164	57	64	85	200	145	130	144
1988	106	122	101	75	73	96	107	107	170	292	224	200	140
1989	137	113	184	80	69	115	70	56	41	67	114	261	109
1990	148	90	122	93	205	109	91	100	51	136	125	250	127
1991	169	231	69	143	61	56	38	172	165	140	110	143	124
1992	135	121	84	67	55	31	68	108	49	150	193	135	100
1993	171	114	89	89	112	213	90	64	64	184	93	145	119
1994	446	117	147	94	99	96	92	96	96	86	330	206	159
1995	190	117	193	169	96	73	54	84	258	210	181	589	185
1996	161	165	124	202	124	85	46	45	86	249	138	150	131
1997	122	143	95	158	85	58	53	124	64	120	202	206	119
1998	149	179	210	159	92	112	158	106	116	254	134	141	151
1999	94	87	116	125	123	89	81	51	76	137	348	102	119
2000	142	103	69	109	119	227	130	88	158	200	115	240	142
2001	140	89	79	62	64	98	58	68	60	101	134	266	102
2002	243	74	90	78	63	134	74	114	186	106	140	209	126
2003	143	124	81	59	122	125	91	48	97	115	155	158	110
2004	198	185	180	77	145	125	75	85	90	109	173	136	131
2005	168	118	120	69	76	62	65	84	140	92	103	106	100
2006	135	73	72	126	96	93							99
Min.	72	72	47	47	47	31	30	28	35	49	85	95	90
Mean	168	142	125	119	108	89	71	77	100	147	172	192	126
Max.	446	501	235	263	246	227	158	172	380	294	348	589	198

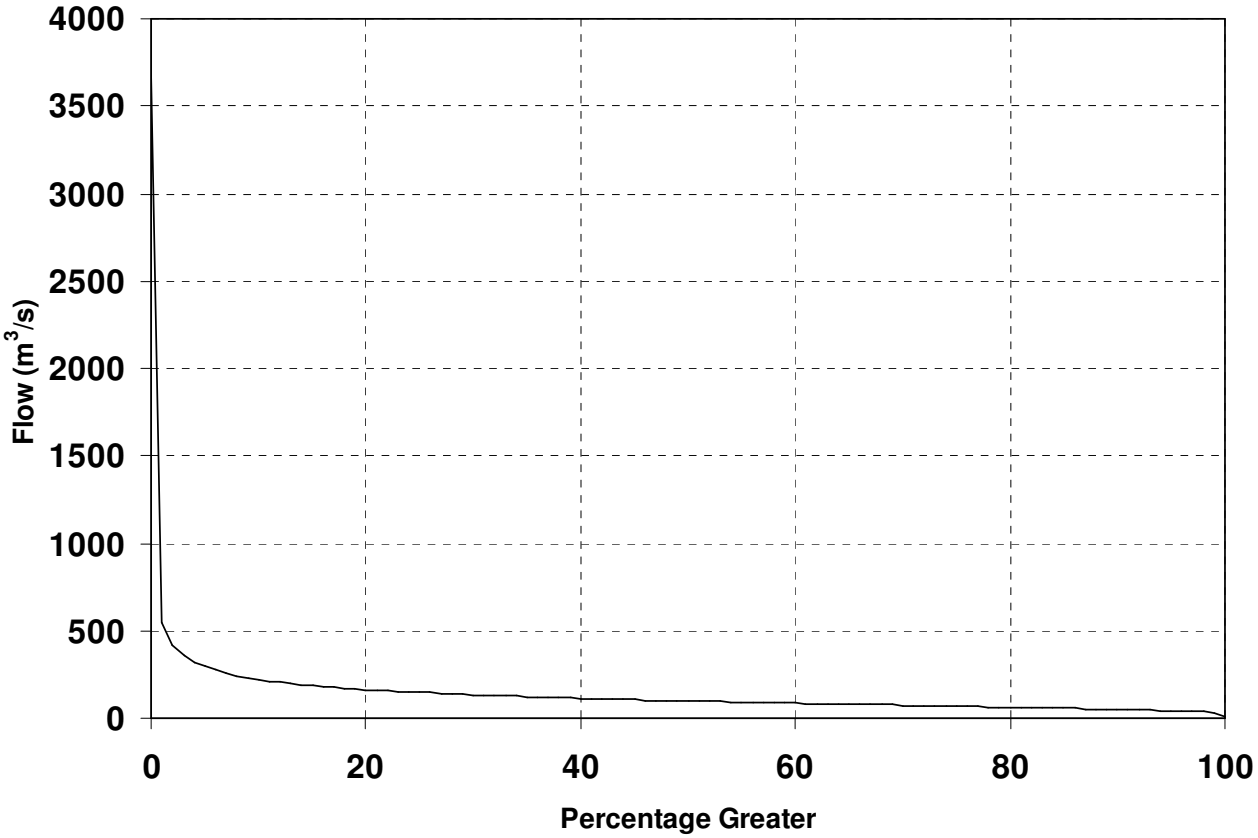

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	3659	543	419	359	323	296	275	256	243	231
10	221	212	205	198	192	186	181	176	171	167
20	163	160	157	153	150	147	145	142	139	137
30	134	132	130	128	126	124	122	120	118	116
40	114	113	111	109	108	106	104	103	102	100
50	99	97	96	95	93	92	91	89	88	87
60	86	84	83	82	81	80	78	77	76	75
70	73	72	71	70	69	67	66	65	64	63
80	62	61	60	59	57	56	55	53	52	51
90	50	48	47	46	44	43	41	39	36	32
100	8									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	8	126	99	3659

10.19 Lake Wanaka Outflow – 9154 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							131	87	97	237	242	238	172
1932	250	232	173	181	150	107	72	60	107	223	211	260	169
1933	204	325	310	362	271	173	120	155	122	208	164	184	216
1934	185	163	127	276	314	181	138	133	141	300	206	179	196
1935	327	247	215	251	157	160	104	88	63	131	155	179	173
1936	158	179	166	200	178	90	86	145	208	317	396	307	202
1937	245	198	173	299	225	153	87	84	99	110	140	164	164
1938	266	184	219	229	151	142	109	114	175	222	206	265	190
1939	176	161	158	152	163	188	166	84	166	191	243	337	182
1940	228	298	321	199	209	173	110	81	109	234	314	267	212
1941	212	231	183	180	124	190	155	88	74	104	225	290	171
1942	252	189	192	262	243	183	167	139	181	366	313	243	228
1943	241	277	293	215	197	137	132	76	105	157	223	216	188
1944	190	242	286	272	215	127	140	128	104	172	282	232	199
1945	369	365	432	311	150	89	83	112	204	210	373	331	252
1946	230	351	245	136	142	103	97	167	236	374	222	286	215
1947	214	169	131	92	93	99	127	112	131	269	281	252	164
1948	249	161	177	146	101	168	141	99	104	226	506	289	197
1949	267	376	360	313	192	161	146	166	143	266	243	242	239
1950	367	177	125	120	141	211	126	126	152	142	148	230	172
1951	163	119	101	143	102	92	164	163	113	217	304	258	162
1952	205	371	194	177	185	140	109	68	86	218	182	157	173
1953	115	88	89	151	272	180	90	118	156	108	221	375	164
1954	244	222	258	188	99	111	146	87	93	139	259	193	170
1955	166	281	234	168	292	204	108	97	158	188	165	245	192
1956	155	114	89	163	253	211	169	109	108	146	321	307	179
1957	253	241	174	197	288	135	162	110	86	180	391	501	227
1958	374	570	386	303	307	247	106	89	85	210	303	257	268
1959	187	146	132	102	87	110	93	64	160	188	261	265	150
1960	185	260	172	110	122	181	141	214	192	174	168	150	172
1961	119	110	160	210	119	111	127	163	121	217	292	215	164
1962	221	148	144	81	162	153	156	193	169	207	291	186	176
1963	146	175	198	144	136	153	92	93	180	165	191	148	151
1964	209	165	156	153	229	133	118	121	131	191	185	308	175
1965	401	191	225	156	137	158	119	82	98	167	309	319	197
1966	287	264	181	245	152	95	85	71	91	129	181	275	171
1967	222	296	369	325	300	115	121	268	157	178	250	404	250
1968	261	202	376	167	276	171	81	108	158	280	335	281	225
1969	247	150	184	169	129	86	81	104	450	206	181	301	191

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	313	231	185	188	120	99	120	223	565	310	288	316	246
1971	166	116	114	111	124	166	95	75	177	331	245	260	165
1972	220	128	228	225	196	114	100	94	260	268	338	193	197
1973	173	152	118	183	234	179	104	95	131	234	408	184	183
1974	135	159	207	200	113	76	113	100	90	173	201	194	147
1975	141	195	261	468	333	213	111	228	166	209	249	201	231
1976	165	122	125	103	135	209	97	74	63	74	95	229	124
1977	216	219	155	161	144	134	112	67	65	118	217	196	150
1978	188	136	125	269	258	176	103	211	199	359	260	208	208
1979	234	250	285	191	239	142	111	99	146	225	251	440	218
1980	304	278	157	199	204	179	156	165	268	272	256	254	224
1981	186	171	311	200	200	159	127	99	91	251	225	285	193
1982	262	275	328	143	231	204	85	98	153	131	305	348	213
1983	469	213	186	249	277	144	149	214	208	369	364	293	262
1984	251	273	296	171	158	114	127	211	172	298	319	516	243
1985	500	207	155	144	186	156	158	176	198	160	215	243	209
1986	318	168	216	192	186	253	155	119	107	186	169	203	190
1987	278	285	224	292	181	302	134	120	152	294	260	191	225
1988	169	145	161	134	97	130	160	189	271	433	401	345	220
1989	234	167	231	177	117	178	151	147	81	135	267	288	181
1990	270	157	219	144	302	203	175	174	97	160	174	359	204
1991	308	336	154	197	116	90	60	237	294	232	195	165	197
1992	222	187	129	129	84	60	95	158	95	206	337	221	160
1993	261	218	155	145	179	335	210	155	115	238	176	170	196
1994	561	276	188	169	154	169	161	170	174	142	420	341	244
1995	290	213	227	332	192	148	95	103	355	375	280	613	269
1996	373	261	187	263	206	159	86	74	133	460	271	211	224
1997	172	135	130	221	162	140	98	174	147	168	273	385	184
1998	301	372	396	317	213	200	244	237	173	356	276	177	271
1999	174	134	183	283	261	231	155	95	139	177	692	250	231
2000	145	174	121	141	187	343	292	181	168	301	196	254	209
2001	277	135	114	123	96	157	134	122	106	178	212	438	175
2002	318	119	132	125	115	178	161	170	295	245	212	303	198
2003	204	171	153	83	120	183	224	111	155	216	276	281	182
2004	278	277	264	145	203	221	195	135	157	166	259	201	208
2005	285	188	223	134	132	118	114	136	239	145	155	148	168
2006	200	117	113	164	167	172							156
Min.	115	88	89	81	84	60	60	60	63	74	95	148	124
Mean	245	213	204	196	182	161	129	131	159	221	262	267	198
Max.	561	570	432	468	333	343	292	268	565	460	692	613	271

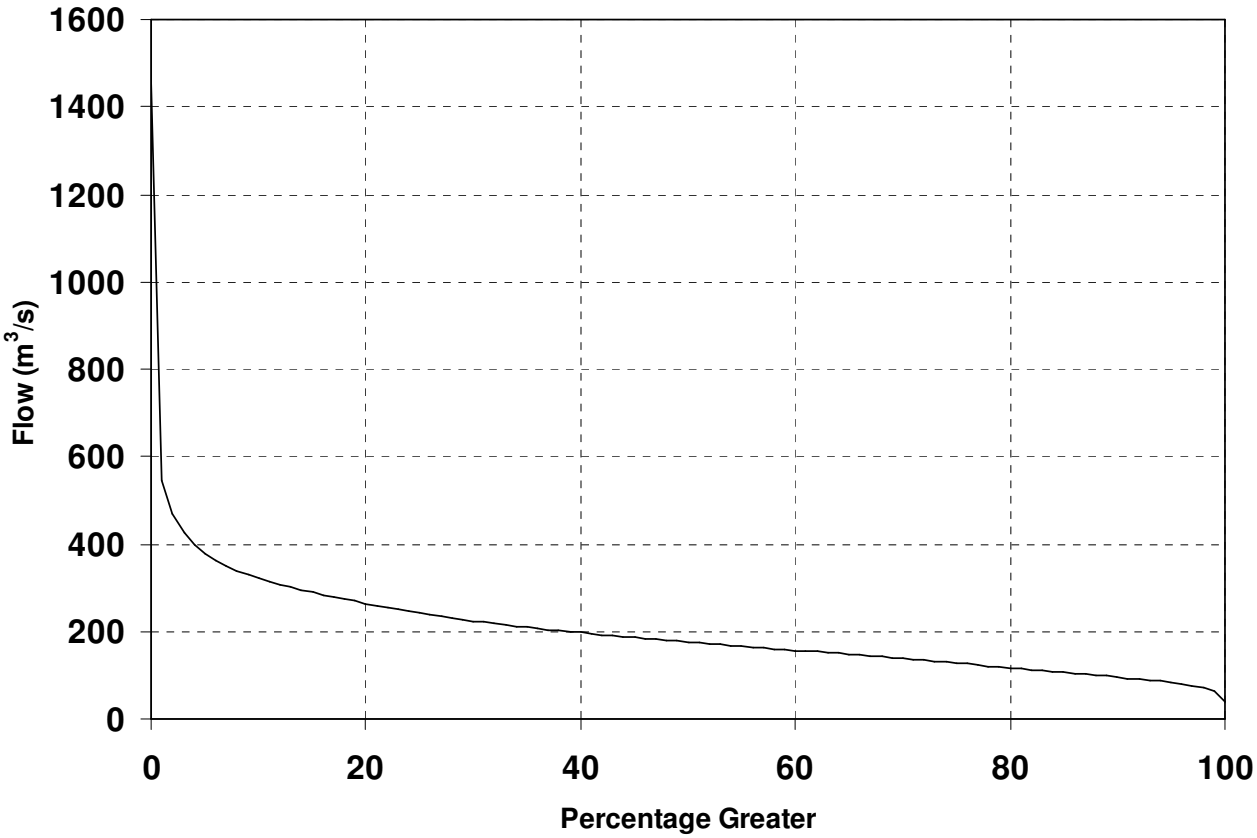

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1453	545	470	427	398	379	363	351	340	330
10	323	315	308	302	296	290	284	278	274	269
20	264	260	255	251	246	242	238	235	231	228
30	225	221	218	215	212	210	207	204	202	200
40	197	195	192	190	188	186	184	182	180	178
50	176	174	172	170	168	166	164	162	160	159
60	157	155	153	151	150	148	146	144	142	140
70	138	136	134	132	130	128	126	124	121	119
80	117	115	112	110	108	106	104	102	100	98
90	96	93	91	89	86	83	80	77	72	65
10	39									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	39	197	176	1453

10.20 Lake Hawea Inflow – 9170 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							43	36	35	108	70	73	61
1932	51	52	41	55	30	10	19	20	32	73	84	69	45
1933	50	112	78	126	81	32	70	42	52	81	55	75	71
1934	54	39	38	99	100	48	34	73	57	136	60	57	66
1935	88	64	74	54	63	52	26	36	24	62	62	67	56
1936	40	57	48	77	47	28	41	91	81	160	143	88	75
1937	79	61	52	102	82	60	23	39	42	41	54	61	58
1938	80	49	61	88	43	51	32	62	58	85	83	91	65
1939	45	46	37	43	51	69	29	24	93	54	95	84	56
1940	80	93	83	56	94	60	31	29	45	125	86	74	71
1941	52	49	52	46	46	61	58	24	27	33	107	77	53
1942	81	39	58	102	122	42	68	35	83	172	92	90	82
1943	66	72	81	81	58	47	40	28	59	41	32	38	53
1944	74	90	73	90	58	39	52	42	21	96	95	80	68
1945	132	126	113	77	41	25	23	53	119	64	166	102	86
1946	85	90	54	28	36	27	41	66	106	140	58	99	69
1947	61	46	28	22	23	38	35	35	57	103	76	74	50
1948	54	44	44	29	44	37	39	24	56	100	179	96	62
1949	67	133	93	85	69	39	77	65	33	130	61	79	77
1950	125	42	33	28	64	34	55	62	57	52	53	81	57
1951	33	35	30	58	35	24	97	32	57	83	117	80	57
1952	89	110	47	41	55	45	31	19	48	86	55	56	57
1953	28	25	42	115	80	42	36	50	61	37	118	100	61
1954	60	69	79	45	28	54	46	43	32	64	88	53	55
1955	45	108	56	41	100	77	28	44	52	49	56	62	59
1956	48	24	20	79	70	71	44	37	38	65	107	97	58
1957	70	46	53	77	82	46	49	32	28	87	162	206	78
1958	111	179	97	61	125	57	28	30	27	102	81	106	83
1959	46	35	37	35	24	44	21	17	84	51	97	81	48
1960	68	50	41	23	57	49	44	62	74	60	58	36	52
1961	26	41	52	67	23	48	55	51	44	109	93	57	55
1962	60	32	31	21	56	42	87	52	54	124	93	54	59
1963	42	69	52	33	62	51	30	52	76	60	56	40	52
1964	77	31	54	36	87	25	48	55	61	70	78	98	60
1965	148	43	64	36	40	47	26	30	42	65	116	90	62
1966	101	82	47	69	25	35	27	30	48	40	73	70	54
1967	83	67	114	154	60	34	63	110	56	61	114	126	87
1968	57	69	99	43	118	42	33	60	73	128	115	98	78
1969	66	35	51	44	46	29	35	47	195	58	69	110	65

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	83	31	43	38	20	44	61	107	232	97	103	78	78
1971	33	28	26	22	33	47	25	29	67	128	82	89	51
1972	53	29	71	52	63	42	55	42	135	94	122	63	68
1973	46	27	32	75	58	73	50	67	50	89	137	42	62
1974	30	68	56	49	39	44	58	28	32	74	75	53	50
1975	34	64	84	120	104	61	71	89	75	94	83	59	78
1976	51	36	46	47	63	71	48	45	39	49	44	98	53
1977	84	45	36	44	44	35	45	26	46	51	63	58	48
1978	54	24	40	48	73	36	32	91	79	115	85	56	61
1979	59	67	99	83	90	44	51	55	95	111	86	171	85
1980	107	70	61	72	65	58	54	99	106	106	97	77	81
1981	44	46	109	66	57	68	55	49	54	110	62	94	68
1982	80	55	78	29	112	58	46	76	61	58	153	104	76
1983	139	41	56	79	111	59	74	91	107	166	139	96	97
1984	103	64	96	45	47	57	92	69	61	144	114	232	94
1985	164	44	32	54	50	73	50	90	99	46	99	96	75
1986	86	55	64	66	45	105	51	70	50	72	65	69	67
1987	90	77	116	85	84	101	45	72	63	121	67	59	82
1988	48	50	48	37	41	63	65	92	110	199	123	96	81
1989	59	45	94	35	30	67	53	67	53	53	60	121	62
1990	61	34	59	48	104	67	48	54	19	70	54	122	62
1991	80	86	26	68	23	21	18	126	104	74	46	62	61
1992	57	52	32	28	20	19	48	57	21	103	99	55	49
1993	73	40	35	36	61	126	56	33	32	104	44	66	59
1994	215	47	53	42	52	54	48	59	58	49	187	92	80
1995	75	48	95	80	50	30	22	56	174	111	94	251	91
1996	69	62	58	110	62	39	15	19	57	164	70	71	66
1997	41	41	26	79	40	27	29	87	36	70	107	105	57
1998	71	88	101	74	39	63	95	58	71	140	55	53	76
1999	28	28	56	72	68	45	44	23	53	83	227	40	64
2000	58	37	23	41	69	152	81	40	86	110	46	114	71
2001	55	31	30	18	26	63	26	38	33	53	70	139	49
2002	91	18	31	29	21	75	35	74	133	62	70	103	62
2003	60	50	30	12	51	75	49	28	68	73	87	78	55
2004	98	88	76	25	79	86	40	59	59	61	94	73	70
2005	75	42	57	22	38	30	30	51	86	47	45	45	48
2006	56	20	24	58	50	46							42
Min.	26	18	20	12	20	10	15	17	19	33	32	36	45
Mean	71	56	57	58	59	52	46	53	67	88	89	86	65
Max.	215	179	116	154	125	152	97	126	232	199	227	251	97

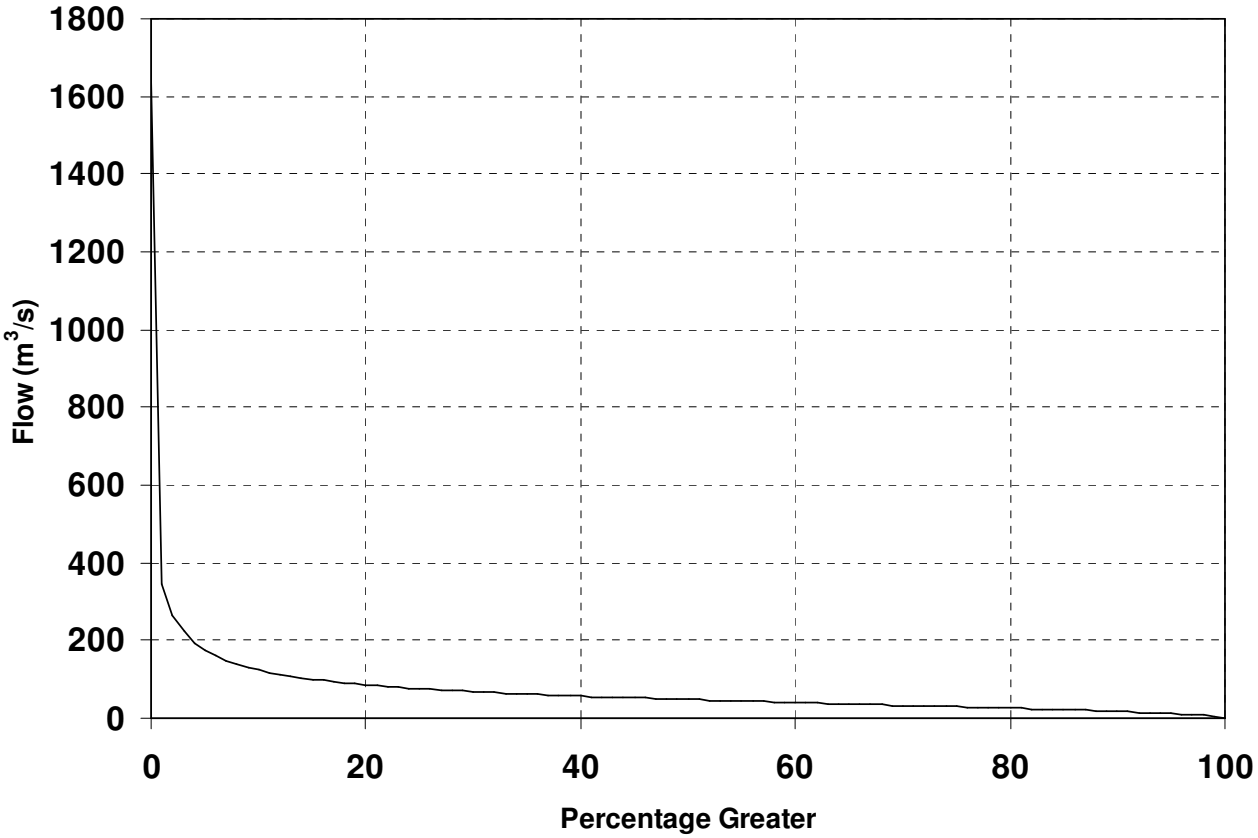

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1634	344	264	222	195	174	159	148	139	131
10	125	119	113	108	104	101	97	94	91	88
20	86	84	81	80	78	76	75	73	72	70
30	69	67	66	65	63	62	61	60	59	58
40	57	56	55	54	54	53	52	51	50	49
50	48	47	47	46	45	44	43	43	42	41
60	40	39	39	38	37	36	36	35	34	33
70	33	32	31	31	30	30	29	29	28	27
80	26	25	25	24	23	22	21	20	19	18
90	17	16	15	14	13	12	10	9	8	5
100	2									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	2	65	48	1634

10.21 Clutha Tributaries at Roxburgh – 99110 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							329	276	284	537	572	516	419
1932	527	486	344	319	293	201	130	164	255	393	443	474	335
1933	395	586	585	677	655	363	328	455	338	472	429	430	475
1934	429	362	317	534	635	404	330	376	432	705	495	410	453
1935	629	502	435	565	402	409	234	261	188	351	372	394	394
1936	344	361	359	421	442	239	238	361	470	717	839	701	458
1937	578	484	506	630	571	497	312	224	240	250	296	339	410
1938	562	369	390	428	319	327	279	268	432	522	466	549	409
1939	393	370	344	294	324	347	365	226	426	449	573	632	395
1940	468	598	608	482	555	433	280	194	259	519	669	512	464
1941	428	463	363	398	281	376	293	202	209	240	489	565	358
1942	501	384	393	602	603	385	410	277	394	868	710	593	511
1943	496	508	602	416	445	318	283	228	380	429	569	515	432
1944	393	497	521	553	457	337	396	327	309	436	599	529	446
1945	687	729	847	666	461	286	216	292	463	503	802	749	557
1946	542	733	499	310	282	236	227	381	546	875	547	640	483
1947	516	394	303	238	206	250	310	277	301	553	566	465	365
1948	474	327	349	303	225	354	308	234	261	499	1080	685	425
1949	568	738	855	765	445	359	378	386	337	546	497	438	525
1950	729	424	310	274	308	449	313	265	387	369	350	462	387
1951	384	278	229	297	258	252	393	372	342	523	691	561	382
1952	459	776	426	399	383	335	291	195	243	536	425	360	401
1953	271	212	225	339	530	368	238	255	390	276	437	704	355
1954	489	406	468	382	246	266	345	262	261	360	551	421	371
1955	371	495	473	343	580	470	290	264	379	422	335	473	408
1956	307	241	194	320	459	368	335	331	298	380	627	697	380
1957	583	517	416	433	704	357	419	303	217	468	1072 1	220	560
1958	950 1	274	861	746	929	633	248	236	218	465	652	559	643
1959	389	305	255	192	210	274	267	189	371	426	639	608	344
1960	412	532	375	262	216	345	306	552	468	391	367	333	379
1961	264	243	362	467	278	256	316	389	295	563	645	498	382
1962	481	315	321	183	350	361	399	470	426	514	635	407	406
1963	316	368	400	287	309	333	203	234	456	433	463	335	344
1964	441	343	341	326	469	281	248	236	319	443	450	702	384
1965	813	431	488	347	313	395	301	222	260	450	759	688	456
1966	672	557	378	513	311	205	210	168	205	277	373	577	369
1967	476	635	756	642	694	269	255	524	337	414	620	937	547
1968	603	425	909	463	578	376	220	305	385	654	791	695	535
1969	557	345	389	398	300	203	207	253	945	478	429	647	429

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	675	454	386	357	227	194	259	507 1	272	792	665	680	539
1971	381	255	253	252	278	403	254	204	458	755	598	558	388
1972	495	280	502	525	470	288	291	252	717	675	798	424	476
1973	349	329	240	377	565	419	233	193	318	534	854	391	400
1974	289	341	418	394	212	161	268	250	234	442	445	399	321
1975	306	393	504	957	697	499	275	565	399	471	567	442	506
1976	368	248	243	178	295	458	235	205	180	238	296	605	296
1977	482	473	319	350	379	330	235	156	152	349	573	438	352
1978	400	291	251	528	516	381	215	482	490	837	623	513	461
1979	524	581	541	384	565	363	262	239	351	591	587	943	494
1980	755	675	384	455	463	548	383	523	730	736	658	609	576
1981	434	369	607	420	446	357	282	234	244	593	492	581	423
1982	555	639	681	318	470	458	187	234	388	324	793	821	488
1983	1075	530	475	573	658	418	397	530	550	891	816	642	631
1984	564	642	637	388	407	279	310	487	391	694	691	973	539
1985	1005	475	322	294	379	323	332	367	401	379	438	485	434
1986	627	365	448	393	406	591	362	293	284	504	408	443	428
1987	547	613	661	706	422	677	332	287	378	706	582	404	525
1988	399	368	369	309	212	303	376	401	648	987	941	795	509
1989	531	353	439	382	268	402	339	293	165	285	486	545	374
1990	539	328	412	297	652	452	403	389	226	363	368	664	426
1991	655	706	341	432	275	225	149	642	670	587	477	409	462
1992	467	402	301	299	184	150	258	344	256	512	803	491	372
1993	545	495	292	293	370	698	499	354	302	571	388	466	439
1994	1226	759	540	405	383	424	478	442	433	365	957	834	603
1995	639	454	478	686	426	373	238	290	877	918	705 1	345	620
1996	903	538	361	550	489	464	247	197	322	989	621	455	511
1997	398	319	281	466	384	303	228	434	340	386	595	789	411
1998	618	668	757	673	436	427	496	532	421	794	619	380	568
1999	353	274	337	520	497	470	365	247	334	367	1430	641	486
2000	388	401	272	297	399	757	655	436	467	756	504	541	490
2001	602	317	250	270	216	341	289	282	267	391	444	792	373
2002	690	278	287	272	265	425	375	403	676	598	545	695	460
2003	480	381	324	190	265	413	473	263	363	513	599	596	405
2004	554	528	549	322	445	504	454	340	398	433	600	540	472
2005	684	455	493	318	317	275	271	314	445	329	339	328	380
2006	456	269	265	352	390	368							351
Min.	264	212	194	178	184	150	130	156	152	238	296	328	296
Mean	531	457	432	419	410	371	309	321	390	525	595	582	446
Max.	1226 1	274	909	957	929	757	655	642 1	272	989	1430 1	345	643

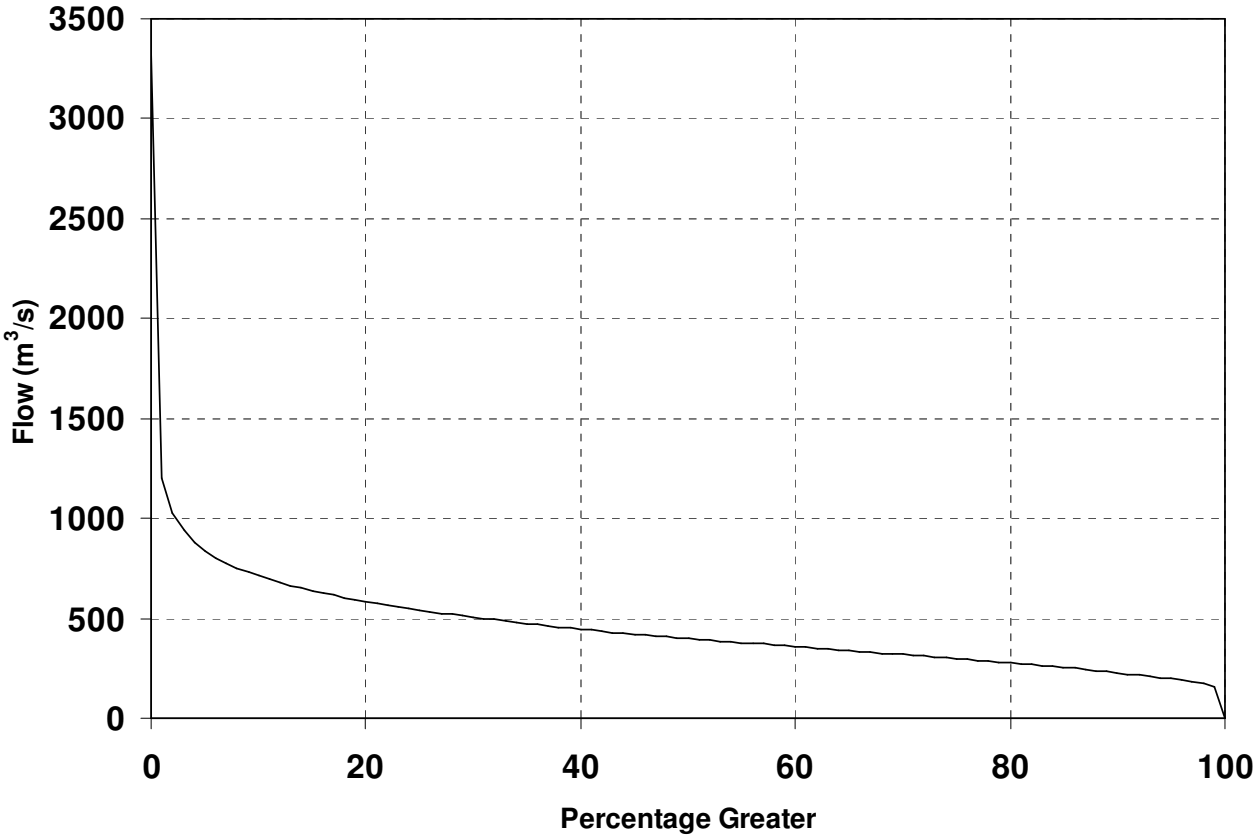

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	3315	1197	1030	941	877	836	803	776	753	729
10	710	693	680	665	652	638	625	615	605	594
20	585	575	565	556	548	540	533	527	520	513
30	506	499	492	486	479	473	467	462	456	451
40	445	440	435	430	425	421	416	412	407	403
50	399	395	391	387	382	379	375	370	366	362
60	358	354	351	347	343	338	335	330	326	322
70	319	315	310	306	302	299	294	290	286	281
80	276	271	267	263	258	253	249	244	239	233
90	228	222	216	210	204	197	190	182	172	155
100	3									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	3	445	399	3315

10.22 Manapouri Local Inflow at Water Right Reduction – 99552 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							146	117	102	162	201	183	152
1932	200	177	76	85	97	63	46	76	108	94	163	64	104
1933	62	156	124	174	266	41	52	113	139	176	91	94	124
1934	87	15	116	135	177	68	96	147	182	192	55	48	111
1935	188	24	128	64	115	86	55	120	51	180	76	103	100
1936	110	75	65	106	134	65	87	185	201	269	187	123	134
1937	152	117	86	122	154	77	115	93	85	82	118	98	108
1938	115	72	44	24	74	97	83	100	111	223	111	118	98
1939	164	137	32	86	111	128	75	82	196	109	165	168	121
1940	85	337	96	107	165	141	54	72	112	198	110	110	131
1941	78	119	75	104	155	121	84	46	135	89	232	101	111
1942	123	68	120	103	182	113	141	132	184	180	167	136	138
1943	71	127	134	120	130	90	85	41	112	118	144	79	104
1944	73	128	50	128	61	164	98	69	123	186	177	119	114
1945	142	96	202	99	135	54	55	117	161	112	251	129	130
1946	93	229	35	63	38	43	91	174	232	253	120	211	131
1947	93	62	16	15	76	132	90	111	184	164	114	102	97
1948	104	57	105	48	114	81	136	80	189	227	192	211	129
1949	69	167	150	109	62	32	190	125	87	214	52	125	115
1950	186	102	53	51	63	104	130	89	117	81	83	150	101
1951	40	25	30	44	99	97	228	115	175	166	166	107	108
1952	223	136	109	79	147	164	81	32	132	203	60	56	118
1953	7	15	78	174	128	56	108	143	167	80	170	157	107
1954	101	106	113	81	30	265	115	116	138	201	141	73	123
1955	165	121	68	70	167	174	69	116	174	98	157	73	121
1956	44	34	43	110	84	139	128	113	149	109	139	179	106
1957	169	87	59	130	223	200	138	102	70	211	343	239	165
1958	158	217	131	130	324	212	51	88	110	136	100	93	145
1959	47	95	44	72	122	196	124	52	210	125	222	117	118
1960	108	155	59	43	56	141	106	175	98	85	95	98	102
1961	53	79	60	151	122	180	193	114	84	232	254	99	135
1962	115	82	56	67	147	150	167	98	150	143	102	73	113
1963	123	116	69	67	164	90	53	131	135	174	211	116	121
1964	233	59	115	106	186	79	94	137	152	142	207	157	139
1965	88	85	91	69	195	187	47	11	153	163	212	152	121
1966	150	132	71	137	77	122	69	66	54	90	112	145	102
1967	116	132	118	246	177	38	70	148	91	154	248	211	146
1968	125	161	148	67	135	38	90	135	153	252	186	93	132
1969	76	40	101	91	58	86	107	128	344	243	116	139	128

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	100	64	60	86	25	67	177	194	319	201	99	123	127
1971	28	1	54	58	78	75	41	87	165	142	95	45	73
1972	56	17	125	83	145	120	133	51	309	185	150	57	119
1973	63	98	36	130	181	123	38	55	79	152	138	71	97
1974	34	71	44	24	48	91	134	30	61	80	57	41	60
1975	61	80	108	179	168	105	127	186	111	107	68	99	117
1976	63	31	64	41	151	155	100	57	29	52	89	83	77
1977	150	133	40	144	137	107	43	20	78	184	153	70	104
1978	92	53	62	65	165	49	72	168	77	143	150	63	97
1979	233	141	56	101	127	125	125	72	193	121	58	173	127
1980	143	128	80	42	124	116	76	236	227	162	167	100	133
1981	84	85	56	108	109	91	101	60	166	230	85	162	112
1982	210	164	112	67	226	85	86	193	99	138	354	152	157
1983	293	86	119	92	122	136	116	93	182	109	121	145	135
1984	229	114	55	131	165	154	100	152	132	225	136	138	145
1985	210	72	40	84	99	123	122	108	105	88	69	72	100
1986	153	127	85	132	121	184	144	93	133	162	101	130	130
1987	132	175	130	105	125	145	117	146	161	233	103	69	136
1988	232	137	71	82	118	191	191	163	255	463	251	154	193
1989	80	56	87	71	55	131	77	77	27	77	153	145	86
1990	125	51	60	94	242	142	104	67	74	138	56	229	116
1991	147	192	42	78	101	116	44	200	125	209	133	90	123
1992	110	170	93	77	73	63	164	114	59	144	109	68	104
1993	213	109	49	58	100	211	152	112	93	212	92	108	126
1994	191	64	69	103	184	115	173	188	125	99	262	135	143
1995	150	59	155	65	162	96	82	149	270	183	116	229	144
1996	96	71	39	117	161	161	62	73	137	229	122	136	117
1997	29	89	59	146	126	90	102	196	73	183	296	253	137
1998	117	223	164	184	108	163	130	142	187	263	73	74	152
1999	62	22	74	75	189	115	122	114	82	122	185	67	103
2000	46	63	35	72	208	176	110	121	161	204	96	205	125
2001	110	72	50	81	68	176	47	111	104	100	134	135	99
2002	68	83	86	73	160	239	112	148	213	142	169	209	142
2003	93	114	40	37	172	180	111	103	185	139	221	137	128
2004	107	174	81	85	141	225	72	118	168	123	154	128	131
2005	135	119	127	73	165	137	147	128	91	85	104	72	115
2006	264	53	86	64	84	94							109
Min.	7	1	16	15	25	32	38	11	27	52	52	41	60
Mean	121	103	81	93	132	122	104	112	141	162	146	123	120
Max.	293	337	202	246	324	265	228	236	344	463	354	253	193

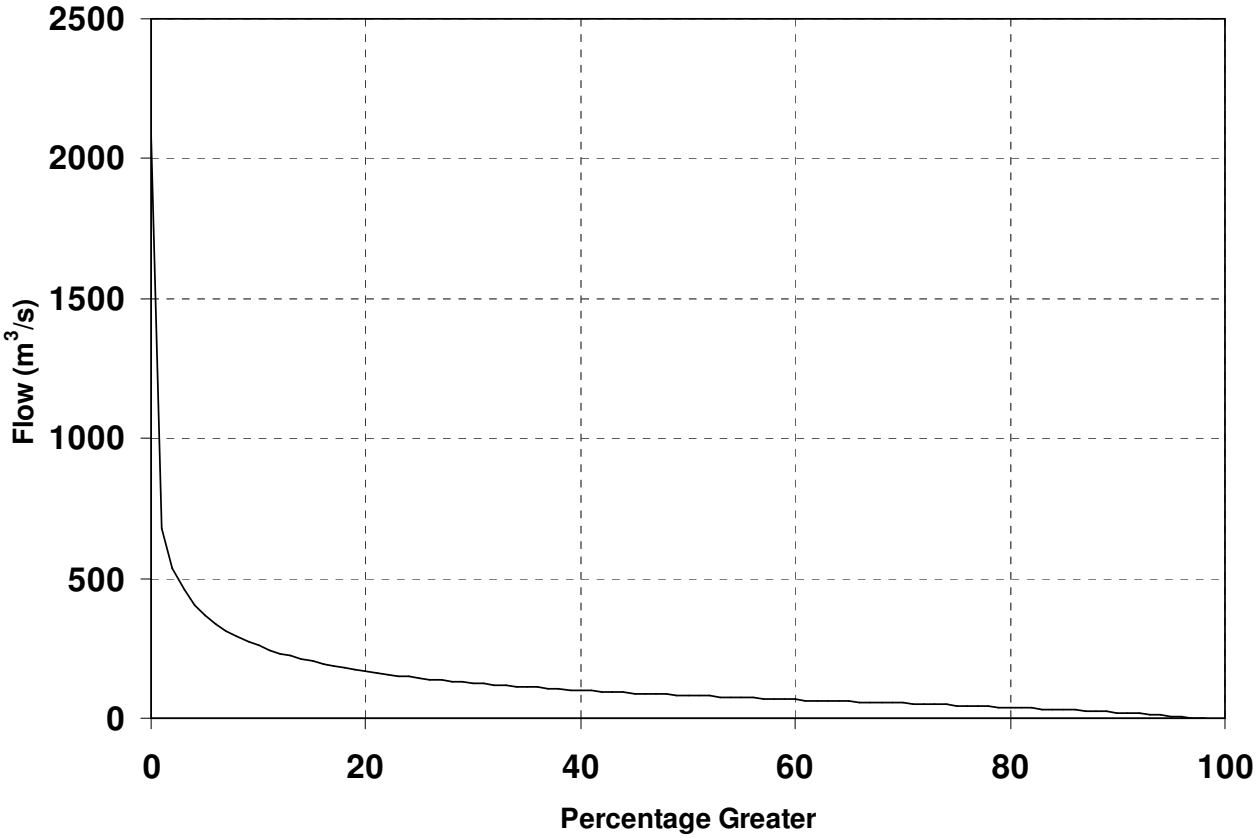

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	2078	675	533	458	405	367	337	313	291	274
10	259	245	232	221	211	203	195	188	181	174
20	169	162	157	152	147	143	138	135	131	128
30	125	122	119	116	113	111	109	106	104	102
40	100	98	96	94	92	90	88	87	85	83
50	82	80	78	77	75	74	72	71	69	68
60	67	65	64	62	61	60	58	57	56	54
70	53	52	50	49	48	46	45	43	42	40
80	39	37	36	34	32	31	29	27	25	23
90	21	19	17	14	11	9	5	1	-3	-9
100	-90									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	-90	120	82	2078

10.23 Lake Te Anau Inflow – 9570 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							266	190	177	458	385	299	296
1932	447	263	139	243	196	145	108	175	245	281	446	234	243
1933	245	484	380	591	556	110	181	281	318	467	255	295	346
1934	238	101	324	385	420	193	230	321	416	430	205	198	290
1935	600	146	317	241	265	197	138	242	111	390	176	217	255
1936	248	184	203	331	316	143	194	433	428	653	559	300	333
1937	407	246	236	419	272	135	211	174	188	172	244	187	241
1938	330	188	214	166	192	241	116	260	283	523	261	373	263
1939	329	367	115	324	249	350	177	142	305	220	378	431	281
1940	189	746	310	275	361	286	111	200	260	547	257	302	319
1941	309	247	235	276	354	214	205	109	262	209	563	210	266
1942	327	177	336	369	483	241	312	286	412	460	417	269	342
1943	258	369	352	374	263	217	169	133	226	241	302	217	259
1944	183	335	196	372	170	338	251	169	268	417	400	286	281
1945	352	332	582	380	197	126	139	297	323	259	690	284	330
1946	294	633	157	171	135	134	225	371	450	567	228	479	319
1947	194	174	100	112	215	316	184	221	404	331	287	219	230
1948	220	145	364	148	247	176	288	180	396	479	480	489	302
1949	196	511	420	432	160	104	365	287	196	440	200	348	304
1950	451	221	210	196	277	218	251	200	264	190	191	338	251
1951	132	123	126	182	173	107	440	151	343	321	395	218	226
1952	382	423	321	245	350	300	140	95	279	458	146	146	273
1953	69	80	232	438	242	145	218	280	374	160	408	382	253
1954	226	276	406	218	84	422	312	221	244	378	353	192	277
1955	312	330	276	194	381	305	122	254	368	181	325	239	273
1956	157	101	154	378	200	312	220	246	269	238	332	409	251
1957	373	220	197	340	407	249	297	197	164	407	708	604	348
1958	422	666	453	458	725	423	112	196	227	370	264	242	378
1959	131	246	179	199	181	369	206	133	438	233	455	233	249
1960	248	315	135	172	184	248	226	361	248	175	197	212	226
1961	120	152	201	396	196	293	274	199	206	437	447	243	264
1962	282	184	138	145	310	320	369	232	359	320	231	165	255
1963	252	270	270	193	324	168	104	256	270	294	362	198	247
1964	519	118	374	239	414	118	207	275	304	299	440	393	310
1965	261	174	256	194	355	325	139	92	337	330	463	291	268
1966	303	325	197	376	114	242	106	131	167	183	261	312	225
1967	335	340	359	617	301	73	189	322	198	283	533	473	335
1968	251	356	433	196	337	101	129	267	335	607	471	275	313
1969	204	104	357	283	153	156	218	297	615	321	172	390	274

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	241	221	200	304	64	138	404	478	610	346	318	381	309
1971	118	72	151	144	160	200	85	232	508	465	355	293	232
1972	276	95	569	308	276	146	260	98	698	376	403	185	308
1973	149	240	182	452	407	274	95	144	204	386	426	159	259
1974	104	257	188	168	110	222	293	65	160	238	154	179	178
1975	168	289	353	600	509	198	308	330	304	334	294	316	334
1976	165	108	121	171	329	343	196	126	80	143	188	284	188
1977	341	264	183	477	250	260	114	83	200	411	312	214	259
1978	238	141	302	300	540	141	139	385	177	400	395	178	279
1979	508	367	177	273	296	249	246	138	421	313	195	555	311
1980	396	314	277	146	293	228	165	536	528	377	347	266	323
1981	183	222	232	329	204	176	195	93	288	455	159	362	242
1982	439	432	410	147	526	176	110	338	214	247	755	353	345
1983	761	129	445	270	384	266	225	298	452	289	337	311	349
1984	552	246	206	327	276	256	220	310	270	523	301	445	329
1985	631	144	132	261	227	272	225	224	230	144	157	211	239
1986	343	235	216	382	210	433	253	166	231	322	201	309	275
1987	312	421	369	279	319	387	187	279	298	484	204	238	314
1988	288	255	206	200	185	342	333	321	565	1007	420	438	381
1989	187	166	316	155	194	305	202	204	78	233	385	384	235
1990	280	129	254	308	528	363	243	168	123	286	147	590	287
1991	407	413	105	301	164	182	99	571	292	431	208	170	278
1992	239	341	257	199	117	123	356	230	90	364	250	165	228
1993	448	191	125	151	230	527	308	199	196	457	183	252	273
1994	605	183	177	314	395	236	303	382	267	170	693	289	335
1995	336	144	480	256	363	171	146	319	645	387	258	656	349
1996	228	197	135	418	290	341	84	126	298	632	255	300	275
1997	87	217	196	458	242	133	190	438	133	347	619	565	302
1998	269	551	522	513	234	348	325	292	371	615	149	171	362
1999	157	111	312	288	435	241	255	182	190	328	645	147	275
2000	136	220	144	212	454	501	236	215	340	510	161	521	305
2001	183	132	216	198	160	379	111	227	198	238	316	358	226
2002	185	160	305	160	223	502	220	317	592	300	356	462	315
2003	176	244	135	84	340	474	256	234	453	317	482	338	294
2004	322	384	284	197	355	526	171	255	341	226	343	244	303
2005	259	286	435	183	325	204	254	259	215	171	212	166	248
2006	477	129	230	263	192	183							248
Min.	69	72	100	84	64	73	84	65	78	143	146	146	178
Mean	293	258	264	286	288	253	213	242	306	360	340	307	284
Max.	761	746	582	617	725	527	440	571	698	1007	755	656	381

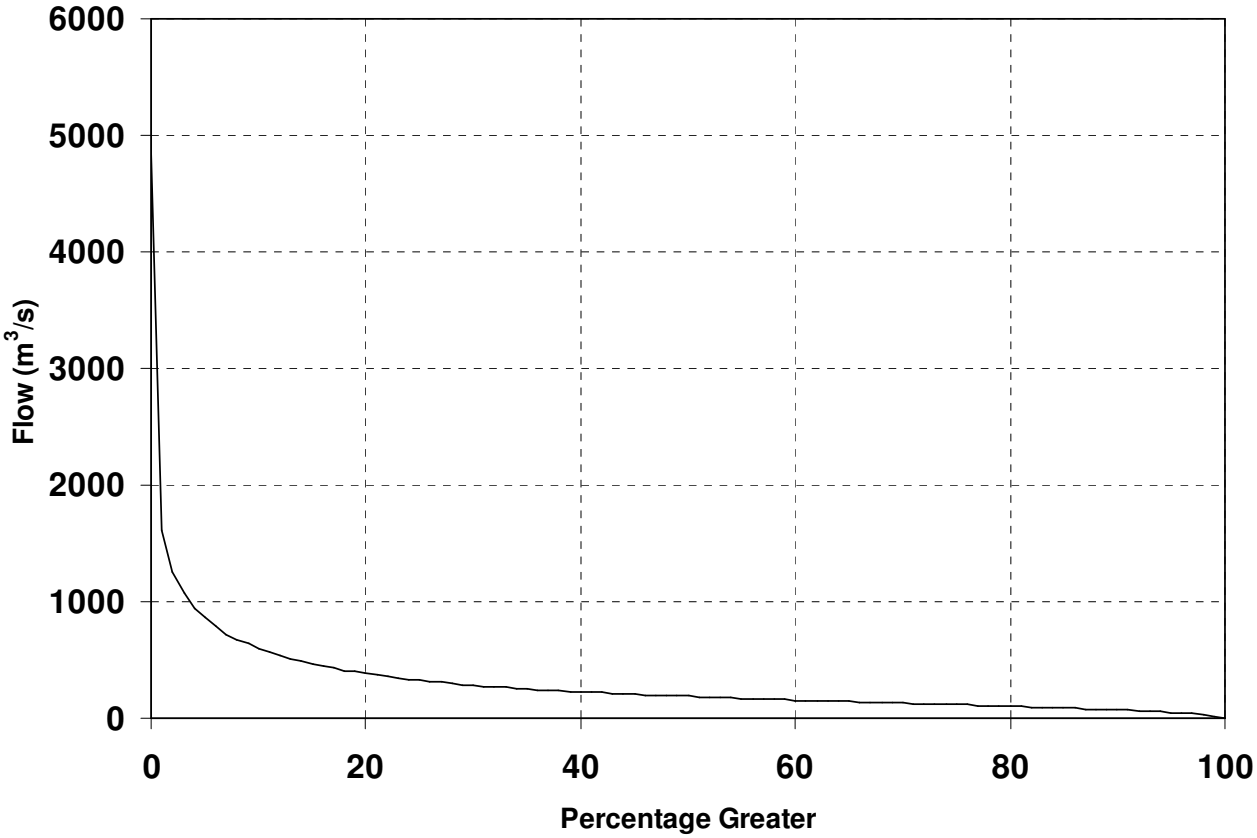

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	4839	1617	1258	1073	945	860	787	723	674	635
10	594	564	535	509	487	466	445	427	410	396
20	383	370	355	344	334	323	314	306	297	289
30	282	275	269	263	257	250	245	240	234	230
40	225	221	217	213	209	205	201	197	193	191
50	187	183	180	177	174	171	168	165	162	159
60	156	154	151	148	145	142	140	137	134	132
70	129	126	123	121	119	117	114	111	108	106
80	103	100	97	95	92	88	86	82	79	76
90	73	69	65	61	56	52	45	39	30	20
100	5									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	5	284	187	4839

10.24 Benmore at Ben_tp – 98615 (Item: 2)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							57	46	48	154	127	157	98
1932	150	140	78	81	68	54	30	28	45	110	163	140	90
1933	143	251	170	227	143	65	120	112	61	119	118	179	142
1934	161	121	95	171	157	90	60	89	100	223	128	127	127
1935	215	145	131	104	106	81	39	58	35	94	109	160	106
1936	108	123	96	142	79	42	59	91	87	241	227	172	122
1937	168	146	105	174	104	69	42	41	54	64	99	138	100
1938	218	137	147	207	85	84	52	82	103	129	150	186	132
1939	106	113	91	67	88	105	58	37	86	94	159	167	97
1940	197	245	198	126	138	88	44	35	50	165	145	143	131
1941	131	150	111	106	77	105	75	39	38	49	176	161	101
1942	164	115	137	253	201	68	97	54	85	294	198	203	156
1943	145	185	138	124	75	55	54	37	83	134	162	170	113
1944	151	220	166	201	100	65	76	62	64	132	200	177	134
1945	346	272	219	159	82	49	45	86	161	115	317	217	172
1946	221	239	132	79	66	49	48	98	156	210	117	206	135
1947	146	129	85	49	51	57	54	53	78	188	151	191	103
1948	139	97	110	76	51	82	77	47	85	174	291	209	120
1949	153	279	164	157	120	76	96	78	56	212	136	134	138
1950	226	107	82	64	115	82	96	90	128	112	115	190	118
1951	129	89	65	143	76	52	122	80	116	165	238	201	123
1952	177	255	103	73	117	87	56	36	76	161	135	174	120
1953	96	91	90	177	151	93	61	80	110	65	212	193	118
1954	136	159	130	89	62	104	81	68	66	99	162	139	108
1955	102	241	116	69	168	123	54	74	106	98	97	132	114
1956	91	83	47	136	123	139	96	71	67	120	192	196	113
1957	137	103	101	145	175	70	88	48	45	166	285	420	149
1958	302	358	206	167	246	130	58	58	50	149	152	252	176
1959	125	92	83	79	61	87	48	39	107	103	200	182	100
1960	166	132	112	71	96	84	73	102	146	118	113	95	109
1961	72	101	121	140	70	83	104	108	87	182	176	134	115
1962	131	79	81	47	105	92	119	102	103	160	187	112	110
1963	93	122	120	69	95	91	55	71	147	121	114	96	99
1964	139	80	108	67	142	58	64	66	77	112	139	178	103
1965	261	128	126	74	70	76	49	46	70	115	220	203	120
1966	251	166	105	125	57	61	45	49	58	81	133	152	106
1967	192	161	235	253	128	53	103	167	66	109	224	273	164
1968	166	153	191	98	196	79	52	108	126	219	192	192	148
1969	165	104	110	111	81	54	47	55	279	99	119	228	121

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	165	105	107	100	47	60	72	168	380	174	209	187	148
1971	101	73	72	68	81	110	52	45	102	212	160	178	105
1972	127	72	129	102	115	59	66	52	197	156	258	156	124
1973	113	76	66	131	129	98	48	52	64	175	248	104	109
1974	79	146	135	135	63	58	82	53	63	113	175	144	104
1975	121	135	169	263	180	99	84	128	110	152	174	142	146
1976	134	88	88	58	100	125	54	47	45	68	85	209	92
1977	180	139	100	87	87	73	63	38	50	94	126	127	97
1978	133	81	102	133	176	99	68	156	150	201	174	139	135
1979	130	138	211	172	197	85	63	57	109	201	186	379	161
1980	245	152	121	156	121	111	65	108	138	161	174	174	144
1981	111	120	207	127	110	121	68	51	59	173	116	171	120
1982	193	121	158	63	141	80	42	68	85	72	290	217	128
1983	266	95	128	133	179	85	86	111	144	273	246	189	162
1984	195	122	151	82	74	59	100	107	76	188	213	399	148
1985	242	87	67	81	80	80	78	106	97	82	161	192	113
1986	154	143	170	126	86	144	66	73	76	143	126	132	120
1987	190	179	217	167	137	164	57	64	85	200	145	130	144
1988	106	122	101	75	73	96	107	107	170	292	224	192	139
1989	132	113	184	80	69	115	70	56	41	67	114	261	109
1990	148	90	122	93	205	109	91	100	51	136	125	250	127
1991	160	203	69	143	61	56	38	172	165	140	110	143	121
1992	135	121	84	67	55	31	68	108	49	150	193	135	100
1993	171	114	89	89	112	213	90	64	64	184	93	145	119
1994	405	117	147	94	99	96	92	96	96	86	330	206	156
1995	178	111	193	169	96	73	54	84	258	210	181	440	171
1996	156	151	124	202	124	85	46	45	86	249	138	150	129
1997	122	143	95	158	85	58	53	124	64	120	202	206	119
1998	149	179	195	159	92	112	158	106	116	254	130	121	148
1999	94	87	116	125	123	89	81	51	76	137	348	100	119
2000	135	101	69	109	119	227	130	88	158	200	115	240	141
2001	140	89	79	62	64	98	58	68	60	101	134	266	102
2002	213	74	90	78	63	134	74	114	186	106	140	209	124
2003	143	124	81	59	122	125	91	48	97	115	155	158	110
2004	198	185	180	77	145	125	75	85	90	109	173	136	131
2005	168	118	120	69	76	62	65	84	140	92	103	106	100
2006	135	73	72	126	96	93							99
Min.	72	72	47	47	47	31	30	28	35	49	85	95	90
Mean	163	137	124	119	108	89	71	77	100	147	171	184	125
Max.	405	358	235	263	246	227	158	172	380	294	348	440	176

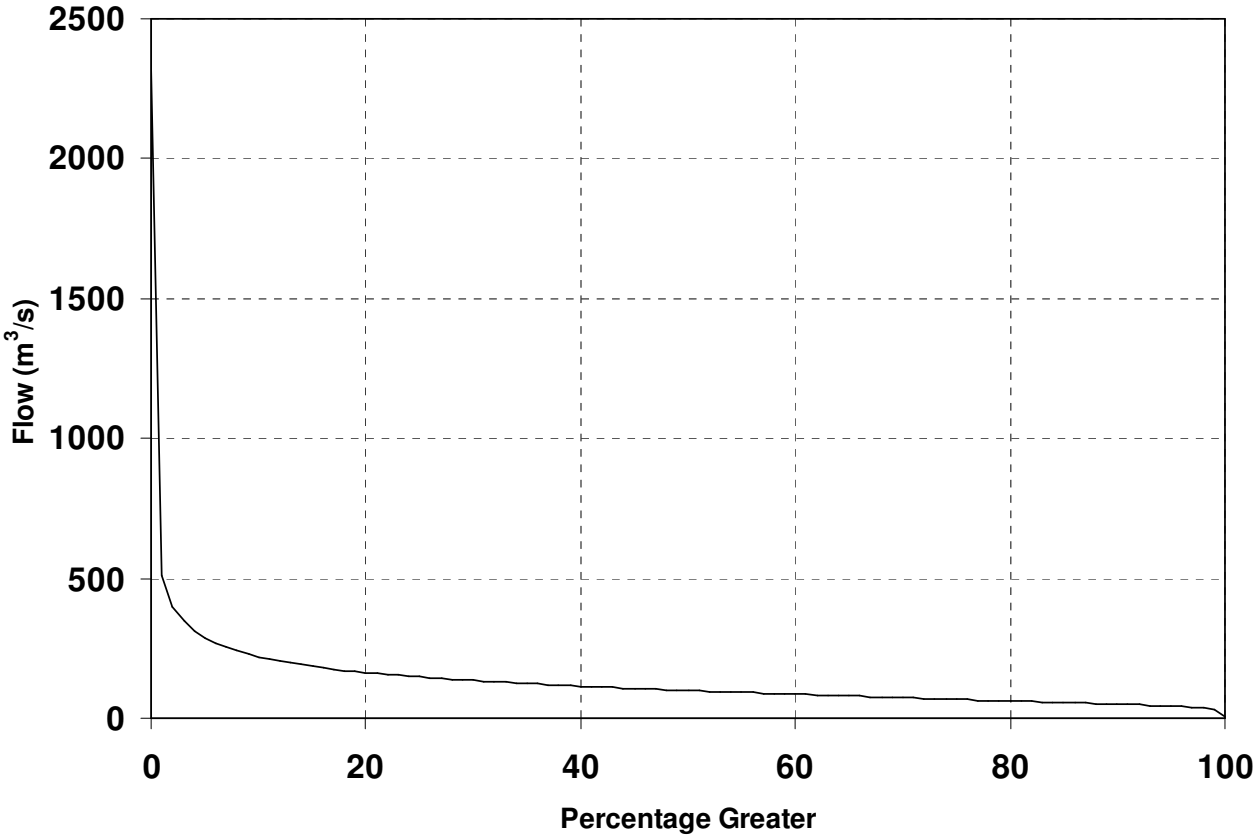

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	2313	510	401	349	314	288	268	252	240	228
10	219	210	203	196	190	185	180	175	170	166
20	163	159	156	153	150	147	144	141	139	136
30	134	132	130	128	125	123	122	120	118	116
40	114	112	111	109	108	106	104	103	102	100
50	99	97	96	95	93	92	91	89	88	87
60	86	84	83	82	81	80	78	77	76	75
70	73	72	71	70	69	67	66	65	64	63
80	62	61	60	59	57	56	55	53	52	51
90	50	48	47	46	44	43	41	39	36	32
100	8									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	8	124	99	2313

10.25 Karapiro Tributaries at Karapiro – 92714 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							88	69	65	61	62	66	69
1932	70	82	86	77	82	107	92	68	78	85	66	77	81
1933	79	56	72	65	83	74	78	84	89	79	83	77	77
1934	79	82	75	74	82	99	121	110	87	97	96	78	90
1935	71	73	74	97	101	135	119	149	130	124	155	112	112
1936	127	154	128	110	127	108	140	137	148	127	129	119	129
1937	137	109	106	111	145	111	94	94	94	90	86	92	106
1938	73	107	74	95	108	88	116	130	122	97	102	128	103
1939	92	63	53	58	79	98	107	136	129	103	82	94	91
1940	93	119	101	78	91	93	86	90	92	93	102	82	93
1941	82	76	96	88	82	112	114	110	107	141	98	101	101
1942	90	74	80	78	84	72	116	134	199	143	103	117	108
1943	90	142	47	75	76	119	103	81	131	142	123	82	101
1944	70	94	105	88	79	109	121	119	119	117	94	95	101
1945	105	95	102	85	116	106	131	138	146	125	111	91	113
1946	68	70	81	91	92	92	107	158	137	114	99	92	100
1947	77	71	78	87	82	129	52	8	7	28	40	71	61
1948	74	65	62	83	111	106	124	106	97	134	107	84	96
1949	84	72	73	89	112	127	100	82	86	80	74	70	87
1950	60	72	59	68	69	84	96	94	89	75	93	62	77
1951	62	59	63	67	69	71	118	92	70	92	105	88	80
1952	69	69	63	67	71	156	111	94	85	98	153	125	97
1953	86	83	63	72	136	136	73	119	113	83	93	88	95
1954	72	76	88	81	87	99	106	114	98	69	68	75	86
1955	54	67	56	75	71	87	91	95	88	88	73	67	76
1956	65	54	53	80	83	166	133	118	105	115	113	104	99
1957	81	73	87	70	94	100	111	94	86	107	94	87	90
1958	73	126	77	62	86	82	98	115	110	105	96	134	97
1959	85	86	79	115	114	101	102	100	99	117	90	92	98
1960	78	92	80	77	93	108	114	117	129	98	87	84	96
1961	82	72	72	69	81	88	108	90	99	85	72	83	84
1962	71	67	119	90	108	132	110	122	131	147	147	144	116
1963	107	92	88	83	93	106	139	112	131	102	103	86	104
1964	87	80	101	85	89	110	176	137	129	141	95	103	111
1965	96	135	109	98	99	125	118	137	105	96	104	87	109
1966	103	94	111	94	114	118	167	145	154	128	121	117	123
1967	115	137	114	97	101	106	110	145	131	106	136	137	119
1968	104	95	84	106	119	150	142	137	130	116	107	122	118
1969	89	105	83	84	99	100	105	104	115	81	86	67	93

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	66	63	52	62	70	100	90	140	123	153	114	84	93
1971	76	90	76	70	86	105	89	94	153	149	111	102	100
1972	79	82	93	87	94	83	139	110	115	101	82	82	96
1973	71	64	62	72	71	92	78	94	125	92	86	78	82
1974	59	72	65	70	71	108	135	129	115	107	83	99	93
1975	91	74	82	65	81	111	88	118	109	100	80	68	89
1976	85	87	69	75	89	98	133	128	112	103	89	83	96
1977	77	70	65	62	83	117	127	107	100	99	78	86	89
1978	69	66	64	67	60	72	102	81	88	76	92	71	76
1979	57	70	99	81	100	79	95	130	116	131	107	92	97
1980	96	85	80	90	75	80	100	108	114	86	87	99	92
1981	76	61	70	69	69	102	110	112	95	92	91	97	87
1982	72	75	64	64	75	73	75	75	77	75	61	66	71
1983	59	56	50	58	62	73	71	69	87	120	89	72	72
1984	63	69	71	72	64	60	89	94	84	67	69	76	73
1985	68	60	61	56	61	91	82	78	81	69	68	79	71
1986	101	77	67	66	75	75	107	119	99	84	70	65	84
1987	74	59	75	78	78	83	76	82	86	84	72	74	77
1988	62	67	66	55	76	87	100	126	91	125	99	92	87
1989	97	81	71	63	75	108	106	88	99	152	99	84	94
1990	76	66	90	81	101	95	94	174	109	102	102	80	98
1991	75	88	76	69	70	75	96	146	114	103	87	77	90
1992	75	77	67	70	96	83	112	145	109	127	94	121	98
1993	82	73	74	76	87	119	89	82	79	70	82	69	82
1994	65	61	63	74	82	97	114	119	103	102	95	73	87
1995	67	65	62	86	70	110	166	116	120	103	94	88	96
1996	88	85	80	108	105	101	134	134	152	100	101	94	107
1997	79	81	80	78	81	100	91	91	98	98	92	72	87
1998	59	61	61	66	75	100	182	114	96	99	82	75	89
1999	68	62	64	61	73	73	89	90	82	64	90	71	74
2000	58	54	53	64	58	72	71	75	87	103	60	61	68
2001	56	66	61	57	82	65	66	72	63	63	83	91	69
2002	73	59	55	58	61	97	106	74	70	71	63	74	72
2003	54	46	57	56	60	87	62	55	90	99	70	88	69
2004	75	80	87	57	78	109	96	106	88	98	81	85	87
2005	63	60	63	56	75	70	92	89	91	115	70	91	78
2006	74	71	67	86	90	89							80
Min.	54	46	47	55	58	60	52	8	7	28	40	61	61
Mean	78	79	76	77	86	99	107	107	105	102	92	89	92
Max.	137	154	128	115	145	166	182	174	199	153	155	144	129

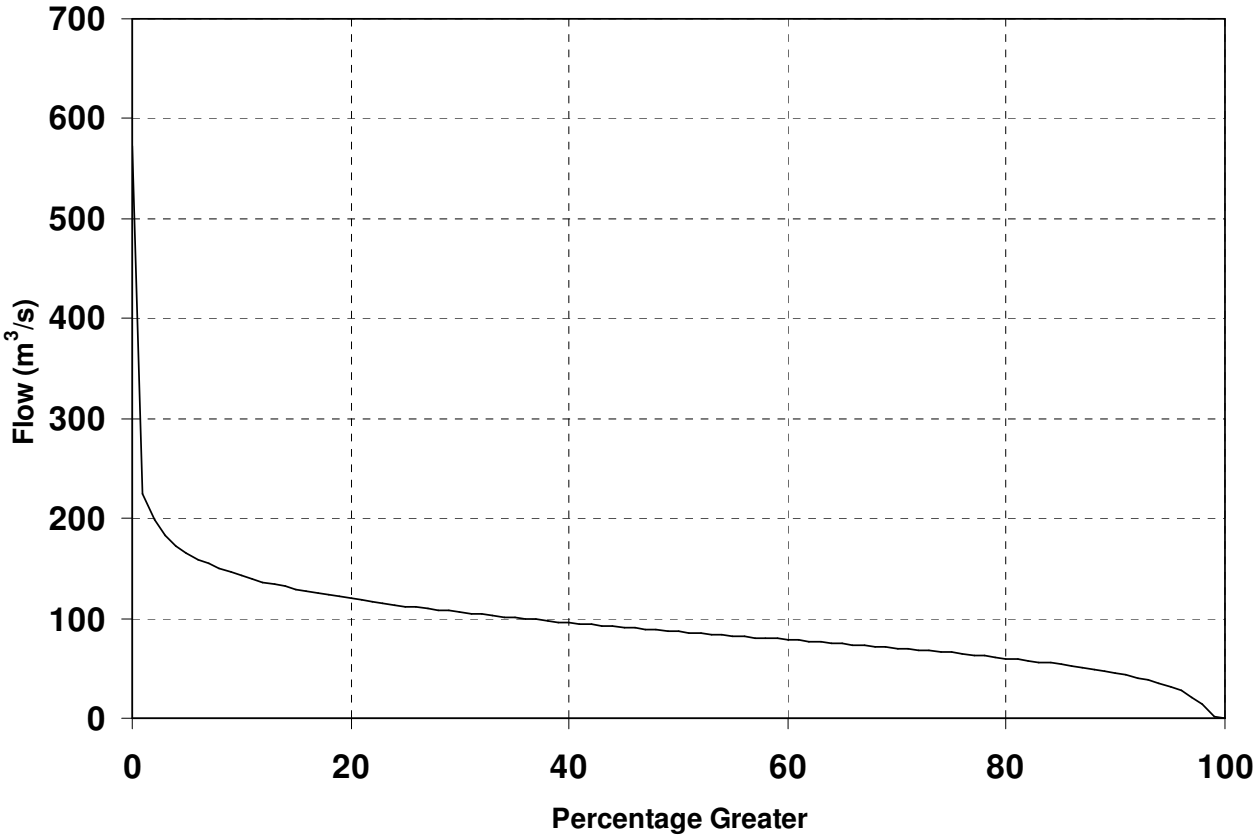

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	572	225	198	183	173	165	159	154	150	146
10	142	139	137	134	132	129	127	125	123	122
20	120	118	116	115	113	112	111	110	108	107
30	106	105	104	103	102	101	99	98	97	96
40	96	95	94	93	92	91	90	89	88	87
50	87	86	85	84	83	82	82	81	80	79
60	78	78	77	76	75	74	74	73	72	71
70	70	69	68	67	66	65	64	63	62	61
80	60	59	58	57	55	54	52	51	49	47
90	45	43	41	38	35	32	27	22	14	1
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	91	87	572

10.26 Manapouri at Manawmara – 99551 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							156	129	114	172	211	194	163
1932	207	189	135	111	114	75	58	86	124	106	172	78	121
1933	76	160	158	228	272	53	63	123	147	182	105	106	139
1934	100	31	158	179	186	78	107	158	193	197	70	62	127
1935	195	39	166	103	127	99	66	132	66	190	92	116	117
1936	124	91	95	138	149	78	98	192	213	272	192	134	148
1937	161	131	145	168	169	89	126	106	101	95	131	113	128
1938	127	86	73	37	89	108	95	108	124	229	126	127	111
1939	175	149	48	112	120	132	87	94	211	123	175	179	133
1940	99	342	125	134	178	151	67	83	128	205	125	122	146
1941	91	132	102	158	163	133	96	58	150	102	239	116	128
1942	135	82	144	182	194	123	150	142	192	190	175	147	155
1943	84	137	177	143	141	101	97	53	125	131	157	93	119
1944	87	140	89	184	73	173	108	81	134	191	187	130	131
1945	154	109	274	197	147	66	66	127	173	125	256	142	153
1946	106	236	50	96	54	55	102	182	242	263	133	222	144
1947	109	77	32	38	89	142	101	121	192	176	127	117	110
1948	116	73	166	73	128	93	146	92	200	233	201	220	145
1949	83	173	203	204	72	45	196	135	103	219	65	136	136
1950	195	116	82	86	72	115	140	100	130	95	97	160	116
1951	56	41	55	69	112	110	236	128	188	178	176	120	123
1952	234	149	155	128	157	173	93	45	145	211	75	70	136
1953	23	30	121	214	136	68	119	153	180	94	178	167	124
1954	115	118	167	142	47	275	126	128	152	211	151	88	143
1955	177	132	101	111	176	184	81	124	188	113	169	86	136
1956	60	50	72	139	94	148	138	123	164	121	150	191	121
1957	178	101	114	163	231	210	149	113	86	217	348	244	180
1958	166	221	169	218	328	220	64	99	124	146	113	107	164
1959	62	108	68	100	134	206	136	64	221	138	231	132	133
1960	122	166	75	82	72	152	117	185	113	99	108	113	117
1961	68	94	103	197	138	190	203	125	101	242	262	112	153
1962	128	97	79	93	157	159	174	110	161	153	115	89	126
1963	135	128	118	113	175	102	65	142	149	183	221	131	138
1964	238	75	169	139	192	92	106	147	165	154	216	165	155
1965	100	101	116	102	205	196	60	24	162	174	221	165	135
1966	162	142	104	213	90	133	82	79	69	102	125	157	121
1967	128	144	145	266	187	51	81	158	105	165	253	222	159
1968	137	172	183	100	144	51	103	144	167	255	191	107	146
1969	90	56	159	133	73	98	119	138	348	254	132	150	146

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	113	78	79	128	38	79	183	193	326	213	110	134	140
1971	44	17	75	88	93	87	54	98	173	147	107	57	87
1972	67	33	182	125	156	132	143	64	315	194	160	72	137
1973	79	111	62	163	187	133	51	68	95	162	147	86	112
1974	50	84	66	38	65	98	144	43	78	92	73	57	74
1975	77	96	157	229	177	111	134	191	126	116	79	115	134
1976	79	47	141	65	161	163	108	70	42	71	104	95	96
1977	166	147	64	211	142	116	56	32	92	192	162	86	122
1978	108	69	95	97	179	59	84	172	94	152	162	78	113
1979	246	151	80	138	128	136	135	84	206	130	73	179	140
1980	151	137	131	62	136	124	88	237	229	170	176	115	146
1981	100	101	85	146	120	104	114	72	180	238	101	173	128
1982	224	173	153	95	233	94	99	201	111	148	354	162	171
1983	299	102	195	136	134	140	123	96	190	114	132	159	152
1984	238	129	91	192	172	167	113	159	147	232	152	150	162
1985	216	88	65	138	115	131	133	119	118	103	85	88	117
1986	166	142	118	208	132	185	152	102	150	172	115	145	149
1987	147	185	139	159	137	143	127	157	176	240	119	85	151
1988	247	151	134	122	135	199	200	170	263	460	260	165	209
1989	96	72	149	103	72	134	87	90	40	96	169	158	106
1990	140	67	92	155	241	145	107	77	91	151	72	238	132
1991	157	198	62	126	117	128	56	200	136	216	149	106	137
1992	126	185	165	116	88	76	169	121	76	152	123	84	123
1993	224	123	70	82	118	211	159	123	108	219	108	122	139
1994	197	76	97	168	187	121	176	194	132	114	265	145	156
1995	164	75	189	106	175	104	92	154	268	186	127	232	157
1996	109	87	68	162	173	165	74	85	151	230	137	151	133
1997	45	104	105	190	138	103	112	199	90	195	300	257	153
1998	131	234	245	238	125	165	137	147	196	262	86	90	171
1999	78	38	125	130	205	124	130	124	98	135	189	83	122
2000	62	79	73	119	223	175	118	132	173	208	112	217	141
2001	124	88	88	141	85	179	59	119	121	114	148	150	118
2002	83	99	162	115	172	241	122	157	221	149	179	219	160
2003	109	130	74	61	189	183	119	111	188	149	231	152	141
2004	123	185	123	136	154	229	81	125	179	136	168	142	148
2005	147	133	169	105	177	149	156	139	109	99	120	87	133
2006	274	69	149	108	101	105							136
Min.	23	17	32	37	38	45	51	24	40	71	65	57	74
Mean	133	116	120	136	143	131	114	122	154	171	158	136	136
Max.	299	342	274	266	328	275	236	237	348	460	354	257	209

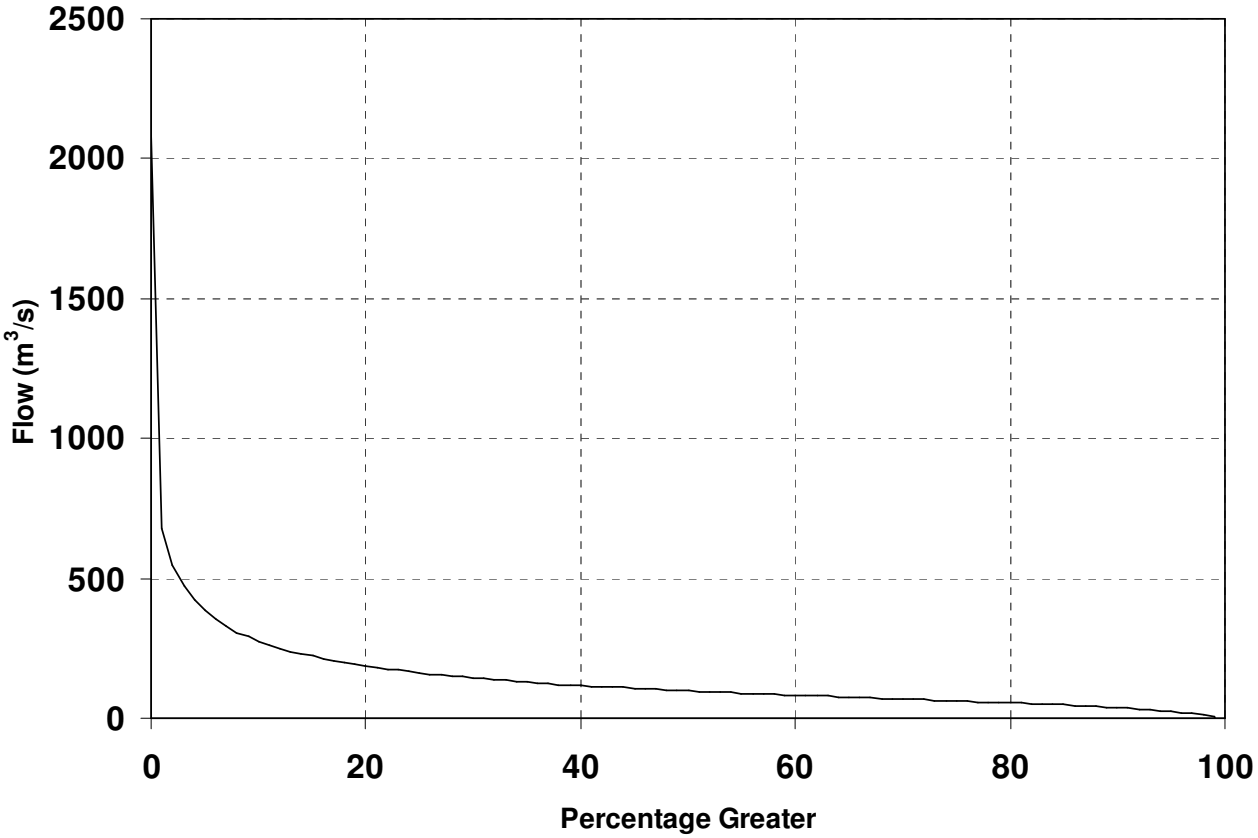

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	2078	678	545	472	420	383	352	328	307	290
10	275	263	251	239	228	221	213	206	200	193
20	188	182	176	172	167	163	158	155	151	147
30	144	141	138	135	132	129	126	124	121	119
40	117	115	113	111	109	107	105	103	101	99
50	98	96	94	93	91	90	88	86	85	83
60	82	80	79	78	76	75	73	72	71	69
70	68	67	66	64	63	62	60	59	58	56
80	55	53	52	50	48	47	45	43	41	40
90	37	35	33	30	27	24	21	16	11	4
100	-90									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	-90	136	98	2078

10.27 Manapouri at Manapouri (no Mararoa) – 99550 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							137	107	95	158	189	174	144
1932	194	175	121	97	94	60	46	73	106	89	159	60	106
1933	59	155	145	215	262	41	51	110	134	168	86	91	126
1934	86	19	143	166	173	65	90	137	176	188	52	48	113
1935	184	26	156	88	113	78	57	112	56	174	72	98	102
1936	112	71	79	118	131	63	83	179	197	267	182	119	134
1937	146	112	128	154	150	77	110	88	85	79	114	94	111
1938	116	73	58	23	72	92	85	95	110	218	103	112	97
1939	157	133	35	101	105	121	72	82	192	102	160	160	118
1940	85	334	109	119	161	135	56	70	110	196	104	105	131
1941	77	115	90	143	151	117	82	49	135	82	226	97	113
1942	123	70	128	167	181	110	135	128	178	174	165	130	141
1943	70	121	158	132	129	85	85	43	111	113	137	75	105
1944	75	124	75	166	57	156	93	66	119	175	168	112	115
1945	139	94	261	180	131	55	56	112	157	106	249	123	139
1946	90	225	37	83	42	44	90	168	228	246	119	204	131
1947	88	59	20	27	76	126	87	107	178	156	110	103	95
1948	103	58	151	59	116	75	125	73	180	220	190	207	130
1949	69	160	189	188	59	34	181	121	88	207	50	120	122
1950	181	98	64	71	62	99	127	85	113	75	84	146	101
1951	41	27	45	52	99	98	226	112	175	162	160	103	109
1952	217	132	141	109	143	158	80	34	135	199	61	58	122
1953	16	23	108	204	116	55	106	138	167	80	166	150	111
1954	102	103	154	126	37	257	111	109	138	194	136	71	128
1955	165	119	79	94	163	169	69	112	173	92	149	75	121
1956	44	38	59	124	81	137	126	110	147	103	134	176	107
1957	164	85	97	147	215	195	136	99	73	203	337	237	166
1958	155	215	154	208	317	206	52	83	113	129	95	91	151
1959	50	94	56	87	117	191	119	53	206	120	216	109	118
1960	108	151	60	66	58	136	101	174	101	83	95	98	102
1961	57	78	85	185	124	177	188	113	81	223	249	98	138
1962	114	81	65	79	142	139	157	90	148	132	100	70	110
1963	120	113	103	96	160	85	55	121	134	167	207	113	123
1964	229	61	160	128	183	80	91	131	149	133	202	152	142
1965	86	83	100	86	189	181	46	13	149	155	205	148	120
1966	147	129	95	196	77	117	70	64	58	86	111	142	107
1967	118	129	130	255	168	43	71	144	91	148	243	205	145
1968	122	158	171	83	128	39	89	130	149	243	180	83	131
1969	73	44	144	119	58	88	101	121	334	239	114	137	131

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	99	65	68	114	31	66	172	184	319	192	94	121	127
1971	32	9	65	75	82	69	45	82	162	134	93	46	75
1972	57	26	173	115	136	120	129	53	309	177	143	60	125
1973	63	103	50	156	171	116	40	54	78	148	131	72	98
1974	41	73	58	25	55	93	131	28	62	74	59	45	62
1975	68	80	140	221	167	103	120	182	108	98	67	103	122
1976	69	40	136	58	144	145	90	48	26	56	81	78	81
1977	149	131	54	196	127	99	37	24	83	176	146	70	107
1978	95	62	87	84	167	46	64	160	69	139	145	58	98
1979	227	136	65	128	123	114	112	62	188	112	53	167	124
1980	139	121	110	46	127	108	62	226	225	156	162	92	131
1981	89	93	67	135	96	83	93	53	161	221	85	160	111
1982	201	159	139	77	227	78	80	177	92	134	354	142	155
1983	287	87	184	121	133	121	108	90	176	102	111	136	138
1984	223	107	71	173	161	147	92	142	128	216	128	133	144
1985	206	71	55	126	93	115	109	102	104	80	71	71	101
1986	148	128	102	189	115	181	131	83	129	154	97	125	132
1987	125	168	124	141	114	143	103	134	150	224	97	70	133
1988	229	139	116	102	114	179	179	153	253	460	244	148	193
1989	78	60	135	84	51	127	68	71	31	83	152	146	91
1990	124	59	78	139	241	137	97	61	82	131	59	229	120
1991	141	187	52	110	97	105	44	197	119	201	122	84	121
1992	109	161	145	99	71	63	156	104	56	137	98	69	106
1993	208	106	58	67	99	210	141	101	89	206	88	102	123
1994	185	61	74	154	174	104	169	182	124	93	259	129	143
1995	144	62	184	91	162	88	72	145	268	182	106	224	145
1996	88	69	57	142	149	156	55	66	129	226	114	127	115
1997	32	90	92	180	113	84	95	189	71	175	293	249	139
1998	113	220	232	224	101	154	123	134	181	261	68	75	157
1999	69	33	115	116	188	104	114	105	79	119	180	65	108
2000	48	63	63	104	208	173	101	108	157	200	92	202	127
2001	107	79	80	127	72	172	43	100	102	97	130	129	103
2002	68	90	148	98	151	233	102	142	211	133	160	200	145
2003	93	112	62	53	172	175	102	96	180	129	212	132	126
2004	109	172	104	120	140	217	65	114	157	110	143	119	130
2005	127	118	150	89	151	125	135	116	89	80	102	73	113
2006	259	60	131	92	81	85							119
Min.	16	9	20	23	31	34	37	13	26	56	50	45	62
Mean	119	102	106	121	129	118	99	107	139	156	142	119	121
Max.	287	334	261	255	317	257	226	226	334	460	354	249	193

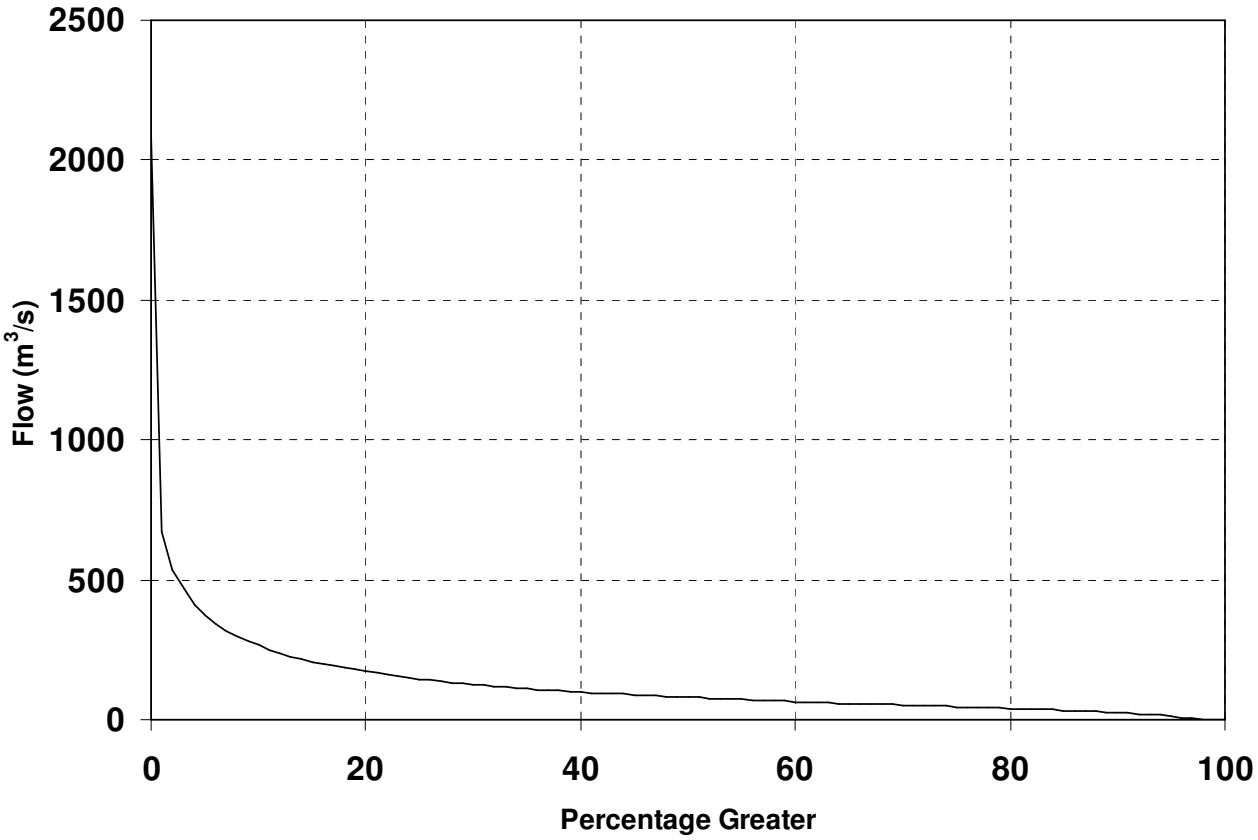

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	2078	671	537	465	412	374	344	319	298	281
10	265	251	238	225	216	208	199	192	185	179
20	172	166	160	155	149	145	140	137	133	129
30	125	122	119	116	113	110	108	105	103	100
40	98	96	94	92	91	89	87	85	83	81
50	79	78	76	74	73	72	70	69	67	66
60	65	63	62	60	59	58	57	56	54	53
70	52	51	50	49	47	46	45	44	43	42
80	40	39	38	36	35	34	32	30	29	27
90	26	24	21	19	16	13	9	4	0	0
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	121	79	2078

10.28 Ohau (separate Tekapo simulation) at Ohau Res. – 98614 (Item: 6)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							25	18	20	89	75	94	54
1932	90	83	43	45	32	23	8	6	17	60	99	83	49
1933	86	156	103	140	81	30	66	61	28	66	69	109	82
1934	97	71	54	104	90	47	27	46	53	133	75	75	73
1935	132	86	77	60	57	41	13	26	11	49	63	96	59
1936	63	72	55	85	40	16	26	48	45	145	140	104	70
1937	102	87	60	106	56	33	15	15	23	30	57	82	55
1938	134	82	88	127	44	43	22	42	55	72	90	114	76
1939	61	66	51	35	46	56	26	12	44	49	96	101	54
1940	121	152	121	75	78	46	17	11	21	96	86	85	75
1941	78	90	64	61	38	56	37	13	13	20	107	97	56
1942	99	67	82	157	119	33	51	23	44	180	121	124	92
1943	87	112	82	73	37	24	24	12	42	75	98	103	64
1944	91	135	100	123	53	30	37	29	30	74	122	107	78
1945	218	169	135	96	41	20	17	44	93	63	199	134	102
1946	136	148	78	43	31	20	20	52	90	125	68	126	78
1947	87	77	47	24	21	25	23	23	39	111	91	116	57
1948	83	55	64	42	21	41	38	18	43	101	182	129	68
1949	92	174	99	94	66	37	51	39	25	127	81	87	80
1950	156	64	48	35	70	40	47	40	60	53	68	131	68
1951	79	55	42	85	34	18	68	30	54	86	144	124	68
1952	116	173	66	45	66	38	20	8	32	85	75	103	69
1953	62	62	62	117	83	42	28	36	54	29	153	134	72
1954	95	117	88	49	26	46	31	23	20	48	106	93	62
1955	72	176	75	46	108	64	22	35	57	55	63	97	72
1956	68	62	33	102	73	74	45	34	31	62	120	122	69
1957	92	73	60	95	101	28	39	16	15	91	169	272	88
1958	177	235	133	104	135	65	21	23	19	97	101	170	106
1959	81	60	53	48	25	46	16	10	56	47	126	118	57
1960	114	87	70	36	51	38	35	49	73	61	68	59	62
1961	45	66	75	89	31	38	43	42	32	99	113	83	63
1962	90	50	44	21	60	39	62	41	45	86	110	72	60
1963	61	80	76	38	54	41	17	25	64	55	64	57	52
1964	98	52	75	40	86	23	30	27	32	55	78	107	59
1965	156	79	80	40	31	34	16	15	30	56	133	130	67
1966	164	113	67	77	23	28	16	20	24	41	84	104	63
1967	135	106	157	158	68	20	56	94	28	59	141	177	100
1968	106	101	115	58	115	38	22	53	62	121	109	112	84
1969	104	65	68	73	42	24	16	22	166	48	71	139	70

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	107	67	72	64	19	27	30	96	238	92	127	121	88
1971	63	44	40	34	40	55	19	16	50	113	89	107	56
1972	83	42	87	64	62	22	28	19	98	79	162	98	70
1973	73	47	40	88	74	51	17	21	28	100	155	65	63
1974	48	92	81	84	28	24	40	20	23	65	111	98	59
1975	74	79	106	168	99	47	40	70	55	85	107	92	85
1976	92	56	58	33	56	70	21	17	15	28	44	134	52
1977	112	93	66	54	43	35	29	11	20	48	75	80	55
1978	91	52	70	90	106	49	31	85	80	107	100	85	79
1979	87	91	137	106	122	43	27	23	57	111	110	234	96
1980	153	91	70	89	64	49	25	48	67	84	92	108	78
1981	70	81	133	73	54	61	28	16	21	94	66	109	67
1982	135	78	104	33	77	37	13	28	38	27	176	133	73
1983	169	56	86	80	98	38	37	46	70	152	146	114	91
1984	121	75	87	44	32	24	50	51	32	99	132	250	83
1985	154	51	36	48	40	39	37	50	42	36	95	125	63
1986	98	89	100	78	43	74	27	31	32	73	73	83	67
1987	126	116	125	95	78	87	21	26	41	111	86	82	83
1988	68	76	59	41	38	52	55	54	92	168	137	126	80
1989	86	72	116	44	31	59	32	24	13	32	75	180	64
1990	94	58	76	56	116	52	43	48	16	72	74	167	73
1991	106	130	39	85	24	24	11	93	83	67	58	88	67
1992	88	80	49	35	21	4	27	52	17	77	109	84	54
1993	109	70	54	49	57	116	39	24	25	102	50	82	65
1994	258	68	88	54	49	46	39	42	43	35	201	123	87
1995	115	73	127	108	52	33	22	37	138	109	99	283	100
1996	97	99	76	129	68	41	16	16	40	144	78	87	74
1997	70	90	53	97	41	21	20	58	24	58	118	130	65
1998	99	118	124	94	46	55	82	49	61	148	71	76	85
1999	62	59	76	71	69	43	36	18	31	80	204	55	67
2000	84	60	37	66	64	118	63	38	78	109	59	149	77
2001	81	54	50	35	31	49	22	30	25	56	79	160	56
2002	132	41	56	46	30	75	33	59	97	53	85	131	70
2003	88	79	49	34	74	71	41	18	48	55	89	101	62
2004	130	116	107	41	78	63	33	38	41	52	100	81	73
2005	96	72	72	35	39	28	30	38	74	43	58	67	54
2006	85	44	43	78	48	46							57
Min.	45	41	33	21	19	4	8	6	11	20	44	55	49
Mean	103	87	77	72	58	43	31	35	49	80	103	115	71
Max.	258	235	157	168	135	118	82	96	238	180	204	283	106

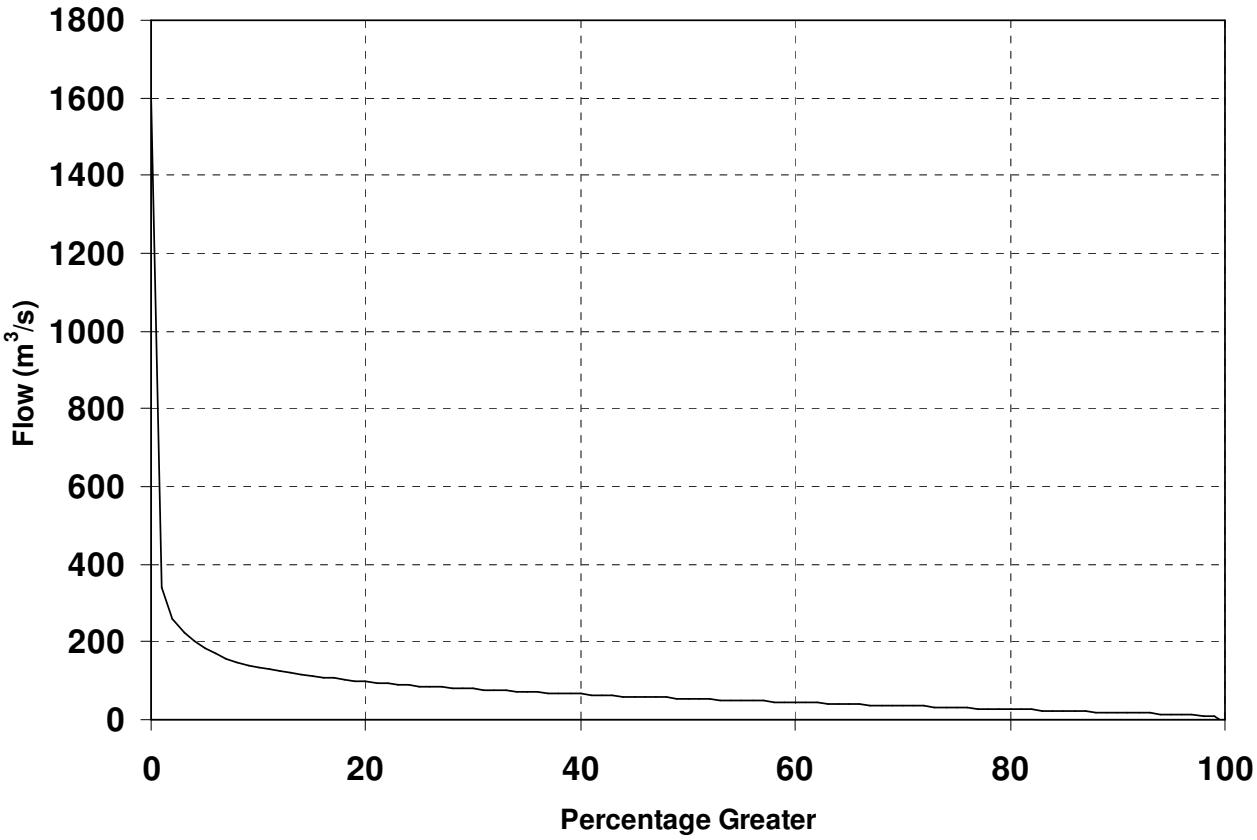

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1598	340	260	226	203	183	170	158	149	141
10	135	130	125	120	116	113	109	106	103	100
20	98	95	93	91	89	87	85	83	82	80
30	79	77	76	74	73	71	70	69	67	66
40	65	64	63	62	60	59	58	57	56	55
50	54	53	52	51	50	49	48	48	47	46
60	45	44	43	42	41	40	39	38	37	36
70	36	35	34	33	32	31	30	29	28	28
80	27	26	25	24	24	23	22	21	20	19
90	19	18	17	16	15	14	13	12	10	7
100	-8									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	-8	71	54	1598

10.29 Pukaki, Tekapo at Tek_puk - 98615 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							84	72	70	202	169	279	146
1932	296	303	192	173	107	79	45	46	62	144	252	263	163
1933	325	599	307	365	185	96	156	131	79	136	174	362	241
1934	335	313	213	360	222	135	98	130	125	280	206	281	224
1935	498	400	335	209	167	154	83	111	80	121	163	336	221
1936	271	309	230	272	134	74	104	114	125	328	367	291	218
1937	322	299	195	314	145	96	69	64	69	80	144	258	170
1938	506	387	357	487	125	104	80	103	121	150	221	291	243
1939	190	239	212	138	125	144	75	56	103	114	227	298	160
1940	397	395	411	189	199	112	64	58	66	181	191	284	212
1941	354	411	261	146	95	148	99	67	74	78	207	271	183
1942	321	212	255	504	274	85	131	66	96	382	264	305	241
1943	268	379	227	204	90	77	66	56	109	198	244	327	186
1944	300	464	300	336	135	82	99	83	83	161	272	248	212
1945	626	487	327	260	102	71	72	109	198	136	427	315	259
1946	387	485	294	131	85	62	63	121	201	245	148	357	214
1947	258	275	208	120	86	87	76	72	92	246	240	428	182
1948	325	310	227	136	95	112	101	66	99	208	411	340	202
1949	316	562	296	224	214	137	144	125	78	300	233	251	238
1950	465	205	177	131	274	136	126	130	133	134	183	395	208
1951	290	265	190	242	103	67	152	85	91	214	297	284	190
1952	272	402	311	186	166	120	80	68	106	194	199	242	195
1953	248	245	238	230	239	95	73	99	139	95	315	399	201
1954	328	460	317	130	95	126	88	85	54	116	257	271	192
1955	285	635	275	163	311	135	67	108	136	161	186	289	227
1956	350	253	165	315	208	182	122	95	81	131	280	306	207
1957	289	306	235	238	232	98	102	94	63	187	321	628	233
1958	522	734	407	220	240	137	75	82	78	200	224	413	275
1959	278	243	209	151	94	100	69	55	124	110	278	322	169
1960	394	302	282	130	135	133	96	129	171	171	189	190	193
1961	213	278	285	297	97	110	106	108	94	234	284	254	196
1962	423	216	208	96	232	114	152	132	148	249	221	221	202
1963	255	358	243	121	185	139	65	90	149	130	155	175	171
1964	255	214	261	143	222	104	92	93	106	124	176	293	174
1965	407	263	265	128	102	95	69	78	84	130	264	340	185
1966	500	437	261	201	104	84	77	80	92	139	218	294	206
1967	402	303	530	405	155	98	198	200	93	172	324	402	274
1968	295	368	416	232	297	109	86	137	134	253	246	257	236
1969	289	241	243	195	125	84	67	70	327	113	167	413	194

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	418	266	318	263	90	98	89	193	457	202	289	329	250
1971	255	237	172	107	133	184	78	52	126	241	197	267	170
1972	290	194	347	190	146	85	98	87	189	224	382	244	206
1973	261	261	199	239	190	147	70	81	101	228	376	237	199
1974	224	417	277	341	103	92	90	67	75	164	257	295	198
1975	291	324	369	409	205	104	68	146	122	192	230	240	224
1976	285	167	217	111	117	147	54	39	43	67	93	357	142
1977	281	300	230	165	92	87	88	104	52	111	180	205	157
1978	289	230	268	288	294	122	102	171	171	170	202	226	211
1979	261	284	402	229	269	115	97	97	135	268	262	653	257
1980	474	282	211	215	153	137	88	133	182	214	244	287	218
1981	290	343	431	209	159	191	104	85	94	249	221	363	228
1982	411	320	390	113	171	110	69	85	109	113	408	316	217
1983	405	199	278	247	262	136	133	148	180	384	315	343	253
1984	319	275	292	155	96	75	158	154	115	199	341	618	234
1985	443	215	188	183	115	101	84	134	152	112	217	357	192
1986	325	274	265	224	124	188	92	97	94	185	202	278	195
1987	404	358	324	272	206	192	83	86	114	255	250	268	234
1988	283	267	205	132	123	121	139	143	197	343	300	369	219
1989	318	315	375	161	155	179	95	80	63	99	255	531	219
1990	358	282	248	164	234	141	131	149	85	229	221	441	224
1991	425	405	161	246	86	72	64	217	203	183	151	228	202
1992	306	283	147	111	83	45	80	148	75	170	267	266	165
1993	380	242	227	163	133	254	86	78	85	220	139	207	184
1994	790	250	269	165	123	124	112	114	129	103	460	299	245
1995	370	273	330	323	160	101	75	94	287	258	220	751	271
1996	343	342	241	325	163	103	66	66	107	341	203	204	208
1997	227	322	184	253	128	79	71	141	79	130	231	408	187
1998	390	506	442	248	169	144	217	141	170	392	204	256	272
1999	276	263	288	204	196	124	96	61	92	234	489	184	208
2000	338	268	147	271	158	259	162	111	169	240	145	357	219
2001	222	220	213	99	96	110	64	82	79	178	243	467	173
2002	473	193	177	142	97	180	86	139	209	141	194	311	195
2003	260	260	176	113	253	161	127	66	126	144	201	288	181
2004	417	300	309	110	190	147	90	99	107	136	244	211	196
2005	316	302	252	107	102	80	80	92	194	112	161	241	169
2006	298	200	126	249	142	155							195
Min.	190	167	126	96	83	45	45	39	43	67	93	175	142
Mean	344	320	267	214	159	120	95	102	124	189	245	321	208
Max.	790	734	530	504	311	259	217	217	457	392	489	751	275

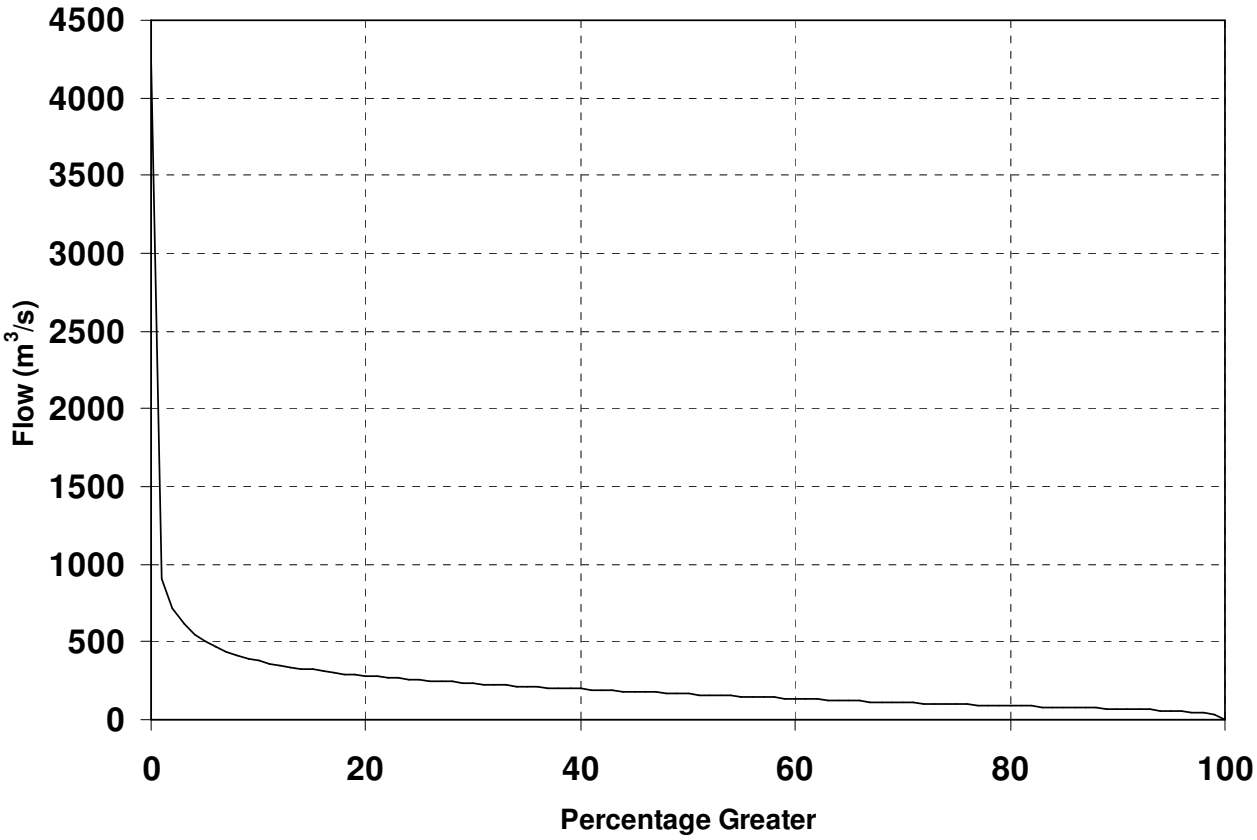

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	4234	912	720	617	549	502	466	437	414	394
10	377	363	350	340	330	321	312	303	296	289
20	282	276	270	264	259	255	250	246	241	237
30	233	228	224	221	217	213	209	206	203	199
40	196	192	189	186	183	180	177	174	171	168
50	165	162	159	156	152	149	146	144	141	138
60	135	132	129	127	124	121	119	117	114	112
70	110	107	105	103	101	99	97	95	93	91
80	88	86	85	83	81	79	77	75	74	72
90	69	67	65	63	60	58	54	50	45	35
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	208	165	4234

10.30 Tekapo at Tekapo – 98614 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							108	108	78	59	30	55	73
1932	100	94	71	76	108	98	19	22	28	51	30	39	61
1933	92	104	108	108	108	108	108	108	102	51	30	45	89
1934	94	100	86	86	108	108	108	86	52	60	30	55	81
1935	104	108	108	108	108	108	108	101	30	51	30	34	83
1936	88	86	100	100	108	108	67	46	56	60	30	59	76
1937	112	108	108	108	108	108	108	65	28	31	30	34	79
1938	85	100	107	108	108	108	108	108	80	59	30	55	88
1939	83	74	65	50	108	108	54	26	46	55	30	55	63
1940	100	102	109	108	108	108	108	76	28	49	30	47	81
1941	100	100	100	96	108	108	62	32	38	33	30	34	70
1942	83	100	81	106	108	108	108	95	36	59	30	58	81
1943	101	101	105	100	108	108	43	29	47	58	30	55	73
1944	100	107	109	111	108	108	108	108	63	51	30	55	88
1945	112	114	110	108	108	108	108	98	78	60	30	58	91
1946	111	114	108	107	108	108	52	50	76	60	30	55	81
1947	100	100	88	42	108	70	28	28	35	59	30	55	62
1948	102	100	100	74	108	106	39	28	30	60	30	58	69
1949	109	112	108	108	108	108	108	108	100	54	30	56	92
1950	112	108	104	86	108	108	108	53	53	49	30	39	80
1951	100	100	79	100	108	100	59	40	35	60	30	58	72
1952	104	109	108	107	108	108	105	22	31	51	30	37	77
1953	79	83	67	74	108	108	108	48	48	40	30	55	71
1954	107	108	108	106	108	108	93	36	30	47	30	41	77
1955	90	103	108	103	108	108	108	108	59	59	30	34	85
1956	90	100	71	68	108	108	108	102	31	46	30	55	77
1957	100	100	100	100	108	108	108	52	28	53	30	65	79
1958	116	117	111	108	108	108	108	108	40	50	30	55	88
1959	104	100	100	66	108	99	28	21	42	48	30	55	67
1960	100	106	105	100	108	108	73	63	68	57	30	34	79
1961	40	89	98	100	108	108	58	45	35	58	30	55	69
1962	107	106	100	70	108	108	108	71	74	60	30	55	83
1963	100	100	100	90	108	108	90	41	66	52	30	34	76
1964	40	81	81	74	108	108	84	43	45	52	30	37	65
1965	100	105	100	82	108	102	29	35	31	49	30	55	69
1966	107	108	108	107	108	108	86	29	40	60	30	53	79
1967	79	100	106	108	108	108	108	108	108	60	30	65	91
1968	109	110	114	108	108	108	108	108	108	60	30	58	94
1969	108	108	106	100	108	108	45	24	93	60	30	47	78

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	102	105	105	104	108	108	78	47	108	60	32	77	86
1971	108	105	100	52	108	108	73	28	51	60	30	55	73
1972	100	81	94	88	108	108	58	33	74	60	30	58	74
1973	108	103	88	70	108	108	65	32	45	52	30	55	72
1974	100	100	101	102	108	108	82	27	30	54	30	55	75
1975	88	96	100	108	108	108	108	108	108	60	30	55	90
1976	100	98	73	42	108	108	56	27	28	37	30	39	62
1977	100	100	100	62	108	108	44	27	27	45	30	34	65
1978	65	85	55	100	108	108	108	108	108	60	30	55	82
1979	96	96	100	100	108	108	108	103	54	60	30	65	86
1980	119	112	108	104	108	108	108	84	84	60	30	55	90
1981	100	100	102	103	108	108	108	93	36	58	30	58	84
1982	104	108	108	105	108	108	99	34	43	49	30	58	79
1983	110	108	104	100	108	108	108	108	108	60	42	77	95
1984	109	111	108	106	108	108	108	72	44	50	30	62	85
1985	117	108	106	100	108	108	65	57	67	48	30	51	80
1986	100	100	100	100	108	108	108	62	42	59	30	53	81
1987	100	107	108	108	108	108	108	108	83	59	30	55	90
1988	100	100	85	50	108	108	74	66	81	60	30	62	77
1989	111	108	108	108	108	108	108	108	56	29	30	56	86
1990	108	107	101	94	108	108	108	90	36	51	30	58	83
1991	109	115	108	105	108	108	61	92	93	60	30	35	85
1992	100	100	65	44	108	80	31	65	39	51	30	55	64
1993	102	103	100	96	108	108	108	55	34	57	30	34	78
1994	101	108	108	107	108	108	108	75	60	49	30	58	85
1995	110	110	108	108	108	108	108	108	108	60	30	69	95
1996	111	110	108	108	108	108	108	108	59	60	30	58	90
1997	103	100	100	100	108	108	78	62	40	54	30	55	78
1998	100	106	112	108	108	108	108	108	108	60	48	78	96
1999	108	108	108	106	108	108	108	87	48	56	30	60	86
2000	109	109	107	106	108	108	108	108	108	60	30	58	93
2001	109	108	101	78	108	108	33	35	36	56	30	58	71
2002	115	108	104	100	108	108	83	66	86	60	30	55	85
2003	100	100	79	52	108	108	108	86	53	60	30	43	77
2004	96	100	107	100	108	108	108	68	52	57	30	35	81
2005	100	100	100	64	108	105	39	41	91	49	30	34	72
2006	44	64	44	80	108	108							75
Min.	40	64	44	42	108	70	19	21	27	29	30	34	61
Mean	99	102	98	92	108	107	86	68	59	54	30	52	80
Max.	119	117	114	111	108	108	108	108	108	60	48	78	96

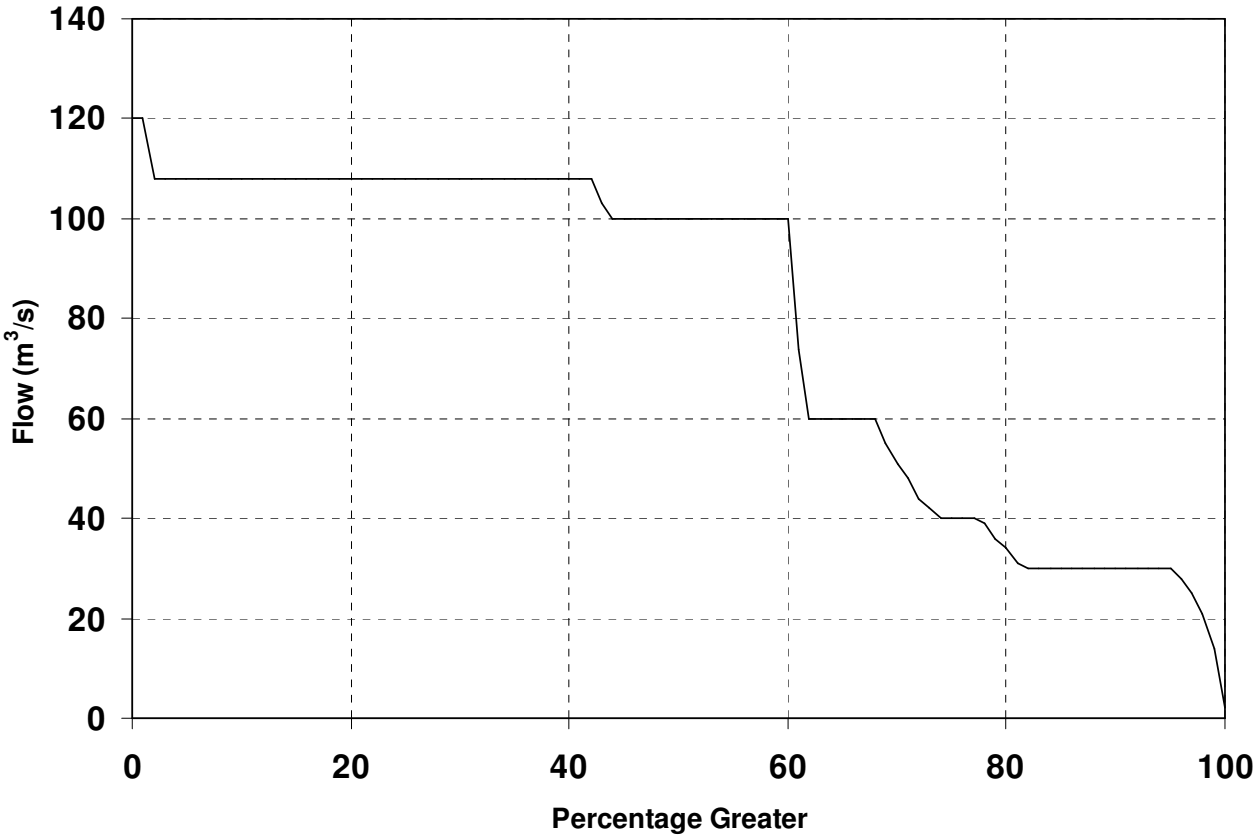

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	120	120	108	108	108	108	108	108	108	108
10	108	108	108	108	108	108	108	108	108	108
20	108	108	108	108	108	108	108	108	108	108
30	108	108	108	108	108	108	108	108	108	108
40	108	108	108	103	100	100	100	100	100	100
50	100	100	100	100	100	100	100	100	100	100
60	100	74	60	60	60	60	60	60	60	55
70	51	48	44	42	40	40	40	40	39	36
80	34	31	30	30	30	30	30	30	30	30
90	30	30	30	30	30	30	28	25	21	14
100	2									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	2	80	100	120

10.31 Pukaki at Pukaki - 98614 (Item: 2)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							157	147	114	176	115	220	155
1932	305	299	196	172	171	145	45	46	62	134	189	207	164
1933	304	505	317	343	215	158	192	182	147	136	134	273	241
1934	316	316	230	313	255	183	162	159	125	223	143	234	221
1935	452	385	325	241	205	191	156	166	80	121	122	249	224
1936	269	286	237	265	184	152	127	114	125	263	229	233	207
1937	312	301	237	300	187	158	146	101	69	80	119	197	183
1938	421	368	350	420	177	166	147	163	142	138	155	228	239
1939	203	241	210	138	185	194	94	56	103	114	155	230	160
1940	350	346	405	231	216	167	140	106	66	159	140	223	212
1941	334	382	273	188	165	190	116	67	74	78	153	197	183
1942	294	240	251	449	273	156	182	133	96	294	204	256	236
1943	290	353	251	221	157	152	81	56	109	159	167	261	187
1944	297	397	296	306	180	153	161	153	110	139	177	193	213
1945	516	423	316	268	163	141	141	154	184	132	275	235	244
1946	368	454	303	188	158	144	90	121	187	195	118	274	215
1947	268	287	237	125	169	128	76	72	92	207	176	347	182
1948	328	318	257	152	169	168	101	66	98	179	266	273	197
1949	313	503	302	250	220	180	190	184	148	219	163	208	238
1950	397	243	229	172	286	188	188	130	133	130	146	292	211
1951	289	273	200	230	170	142	150	87	91	179	198	221	185
1952	277	327	325	238	206	189	159	68	106	173	149	185	200
1953	246	248	228	222	238	152	149	112	139	95	225	299	196
1954	319	422	317	184	161	181	148	85	54	116	190	209	197
1955	287	530	296	202	290	176	140	174	141	156	142	216	227
1956	327	259	180	272	228	211	175	161	81	121	170	248	203
1957	284	307	262	250	244	163	154	108	63	160	198	412	217
1958	421	591	384	243	253	190	156	160	81	166	164	310	258
1959	290	265	239	157	163	159	69	55	124	110	188	242	171
1960	368	304	286	180	188	184	132	129	171	157	145	153	200
1961	183	275	276	281	166	176	125	108	94	185	198	204	188
1962	387	253	236	129	241	175	195	142	153	182	158	188	203
1963	266	332	256	155	210	187	120	90	149	126	119	142	178
1964	200	215	243	162	246	173	127	93	106	124	129	212	169
1965	348	273	284	160	168	158	69	78	84	130	182	259	182
1966	436	416	284	235	164	157	134	80	92	128	152	240	209
1967	349	305	477	368	200	153	200	222	168	163	206	311	260
1968	305	346	385	244	269	163	158	181	184	202	169	205	234
1969	287	270	270	228	180	160	88	70	279	133	138	302	200

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	379	290	312	273	162	163	132	152	349	173	208	291	240
1971	285	274	220	121	187	209	124	52	126	197	137	217	179
1972	293	217	329	208	194	150	113	87	189	178	249	205	201
1973	281	299	232	233	236	199	109	81	101	187	260	212	202
1974	249	387	284	329	168	166	136	67	75	145	178	252	202
1975	292	309	342	356	224	156	134	184	172	163	157	198	223
1976	277	201	218	111	173	189	84	39	43	67	74	247	144
1977	266	295	249	169	151	152	92	104	52	106	133	156	160
1978	248	246	240	287	278	176	163	198	196	151	139	181	208
1979	266	277	367	232	248	173	167	157	135	217	172	459	239
1980	419	292	241	238	201	186	153	154	182	181	171	225	220
1981	295	350	380	235	200	217	164	140	94	203	154	277	225
1982	393	326	373	176	213	167	135	85	109	110	256	251	216
1983	371	244	297	253	262	182	173	184	206	262	187	273	242
1984	309	287	297	206	163	151	193	162	115	167	225	419	225
1985	392	251	230	216	174	160	109	134	152	112	153	269	196
1986	316	282	263	240	176	212	147	106	94	164	140	226	197
1987	362	333	305	277	225	214	151	154	150	205	179	224	231
1988	291	279	220	134	184	177	148	145	197	260	196	294	210
1989	317	322	354	206	194	201	156	152	89	98	183	403	223
1990	345	308	271	198	253	186	178	172	85	174	156	337	222
1991	387	383	217	259	157	150	94	214	199	158	114	166	207
1992	290	290	160	113	157	96	80	148	75	142	169	213	161
1993	361	268	241	194	178	246	154	99	85	184	111	159	190
1994	610	278	269	206	179	176	170	138	129	101	282	229	231
1995	352	295	318	293	190	166	151	163	259	198	151	535	256
1996	342	335	260	294	199	162	141	141	116	240	140	173	212
1997	242	313	215	249	179	149	111	141	79	130	171	312	190
1998	361	451	399	259	206	183	222	182	193	278	169	237	261
1999	295	285	294	232	219	171	157	111	92	180	313	172	210
2000	314	282	198	257	193	247	191	163	193	190	107	267	217
2001	242	259	244	138	160	173	64	82	79	164	170	343	176
2002	407	229	212	184	163	210	126	139	197	131	133	237	197
2003	266	268	191	115	249	193	174	115	126	136	146	222	183
2004	375	279	310	164	214	183	148	117	107	127	172	158	196
2005	297	299	263	124	163	145	80	92	194	112	129	196	174
2006	248	199	127	225	180	184							194
Min.	183	199	127	111	151	96	45	39	43	67	74	142	144
Mean	323	315	275	225	200	173	138	124	129	161	170	248	207
Max.	610	591	477	449	290	247	222	222	349	294	313	535	261

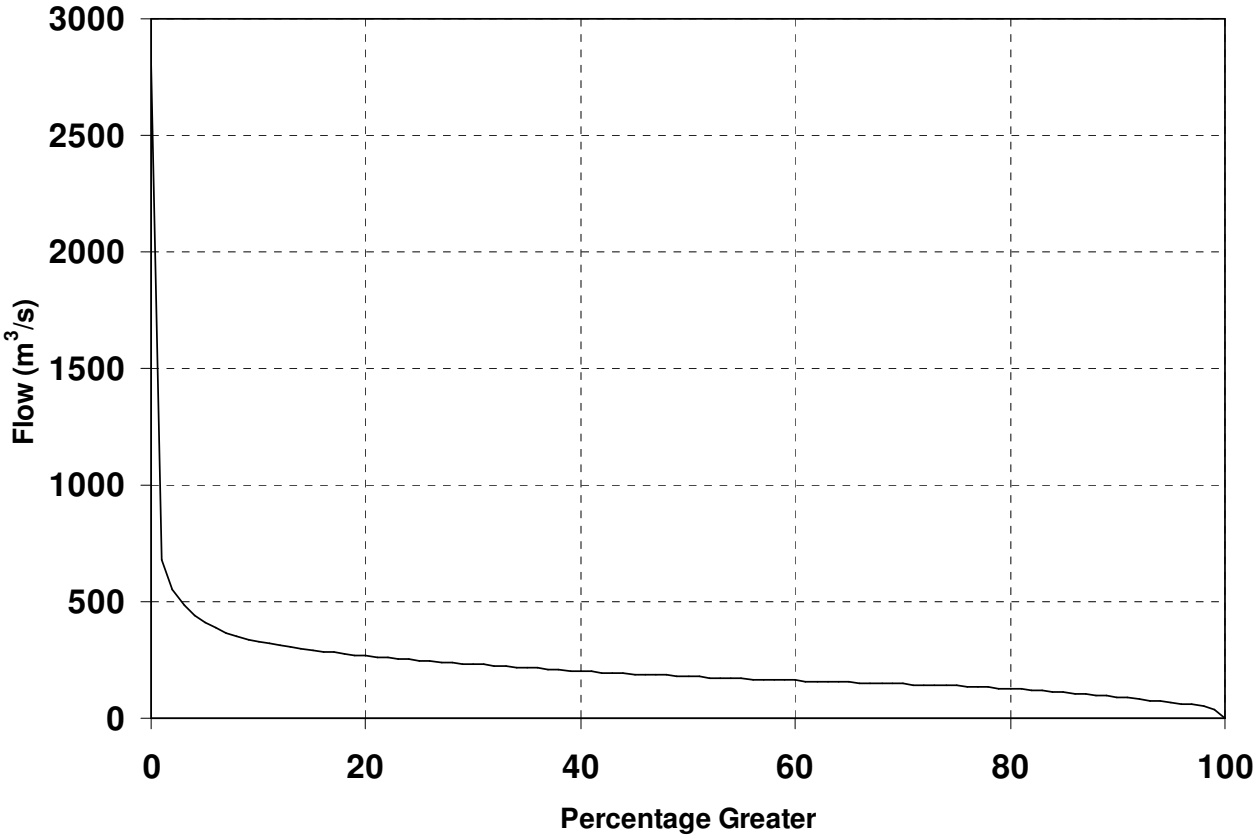

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	2799	680	553	487	440	409	386	368	352	339
10	329	320	312	305	298	292	287	281	276	272
20	267	263	259	255	251	247	244	241	238	235
30	231	228	225	222	219	216	213	210	207	204
40	202	199	196	194	192	189	187	185	183	181
50	179	177	175	173	171	169	167	166	164	163
60	161	160	158	157	155	154	152	151	150	148
70	147	145	144	142	141	139	137	134	132	130
80	127	124	121	118	114	110	108	104	100	95
90	91	87	82	78	73	68	63	58	52	41
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	206	179	2799

10.32 Waitaki Power Station at Waitaki – 98714 (Item: 2)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							88	84	111	334	234	267	187
1932	144	167	108	126	111	76	74	77	105	170	188	197	128
1933	127	216	184	246	186	98	138	152	98	134	141	132	154
1934	103	116	97	131	222	150	96	127	157	322	194	172	158
1935	162	122	128	128	93	102	60	61	26	96	128	148	104
1936	130	110	116	168	126	60	83	140	149	250	273	190	150
1937	183	144	152	199	149	124	72	75	82	91	92	112	123
1938	197	92	112	190	128	119	103	126	163	172	161	190	146
1939	107	83	79	68	85	109	90	70	130	150	158	159	107
1940	181	192	188	127	207	137	85	65	66	172	197	146	147
1941	112	130	123	132	83	120	97	65	80	78	146	163	111
1942	136	98	102	191	215	114	126	76	103	314	245	244	164
1943	150	134	128	68	100	74	80	63	146	188	167	154	121
1944	145	235	220	252	157	105	135	126	107	150	224	222	173
1945	335	288	225	182	138	88	65	137	248	220	306	283	209
1946	174	194	134	105	90	71	66	131	197	297	152	184	149
1947	146	107	72	53	56	63	75	73	93	206	148	127	102
1948	101	68	81	87	59	96	75	54	75	166	360	185	117
1949	145	228	180	171	122	108	130	128	100	178	129	140	146
1950	212	117	85	73	84	105	99	93	156	128	113	177	120
1951	135	92	61	186	95	68	133	103	115	191	268	213	139
1952	168	316	62	57	113	69	47	34	53	167	161	216	121
1953	116	99	83	160	206	143	83	95	116	84	193	211	132
1954	147	135	123	88	71	87	76	74	93	115	171	161	111
1955	113	225	136	120	166	172	94	85	134	135	117	161	137
1956	132	134	90	123	152	172	139	86	90	154	208	195	139
1957	137	121	105	108	219	88	144	63	81	195	307	514	174
1958	352	420	270	227	287	167	63	58	52	130	149	174	195
1959	144	92	86	98	91	112	65	60	120	139	193	210	118
1960	145	173	110	96	97	102	77	125	162	147	134	114	123
1961	112	144	180	187	97	85	157	136	112	210	209	174	150
1962	139	111	112	69	119	124	119	141	121	136	269	158	135
1963	123	140	155	121	118	116	123	120	219	176	151	122	140
1964	142	118	134	97	140	71	104	86	91	121	129	0	103
1965	207	215	171	121	93	114	92	81	100	162	244	223	151
1966	484	221	159	133	80	70	59	70	86	78	123	169	144
1967	177	244	295	258	228	68	74	187	103	124	265	413	203
1968	241	200	236	157	228	117	59	185	195	280	279	228	201
1969	196	127	130	117	96	61	72	69	289	119	130	224	136

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	206	148	112	100	57	73	82	156	599	277	226	190	185
1971	96	80	72	88	84	138	79	90	149	243	195	152	122
1972	154	93	143	95	159	95	93	93	253	233	278	154	154
1973	125	66	65	107	127	87	91	118	71	141	261	107	114
1974	169	57	141	138	91	69	107	107	124	174	209	102	125
1975	115	130	155	339	236	149	154	232	176	198	207	164	188
1976	158	122	72	107	89	161	75	133	150	90	174	211	128
1977	187	166	93	101	170	159	85	43	73	114	164	120	122
1978	117	109	103	160	198	156	90	221	227	265	200	176	169
1979	151	137	206	213	254	125	116	75	148	197	281	326	186
1980	369	213	148	152	215	225	119	180	207	186	257	201	206
1981	124	140	290	170	136	178	114	99	105	205	145	183	158
1982	180	116	224	85	158	104	137	135	120	59	333	266	160
1983	289	110	144	155	225	143	161	173	220	380	387	332	228
1984	207	220	174	106	102	86	170	168	101	203	191	471	184
1985	381	99	82	94	91	97	102	132	144	115	170	219	144
1986	181	159	267	153	109	180	111	167	143	228	157	172	169
1987	192	224	322	236	175	213	104	116	137	225	163	153	188
1988	129	144	109	94	84	109	121	133	212	273	267	239	160
1989	139	131	202	115	103	152	105	76	70	106	123	250	131
1990	185	100	123	93	233	133	117	154	99	204	162	255	156
1991	167	210	96	155	89	82	98	223	259	206	142	174	158
1992	158	141	113	79	78	120	131	121	63	176	245	159	132
1993	186	131	106	107	152	236	119	85	99	206	109	210	146
1994	462	218	212	140	122	131	155	164	159	140	398	225	210
1995	194	136	181	188	118	96	78	113	308	290	211	521	203
1996	239	223	148	237	189	131	81	103	124	302	174	166	176
1997	159	169	136	175	110	86	93	170	101	142	204	200	145
1998	158	195	265	210	103	121	196	139	154	270	193	148	179
1999	124	123	110	138	155	120	130	94	123	148	380	134	148
2000	193	151	107	153	160	289	218	192	317	274	173	246	206
2001	210	119	110	99	114	103	117	71	98	137	184	305	139
2002	311	130	124	119	108	179	135	209	235	172	195	256	181
2003	182	162	112	102	180	163	170	90	151	187	205	202	159
2004	243	262	239	123	192	189	135	129	154	159	211	173	184
2005	251	160	151	109	109	87	98	109	170	118	121	125	134
2006	140	79	70	139	132	151							119
Min.	96	57	61	53	56	60	47	34	26	59	92	0	102
Mean	182	154	143	139	138	121	105	115	144	183	202	202	152
Max.	484	420	322	339	287	289	218	232	599	380	398	521	228

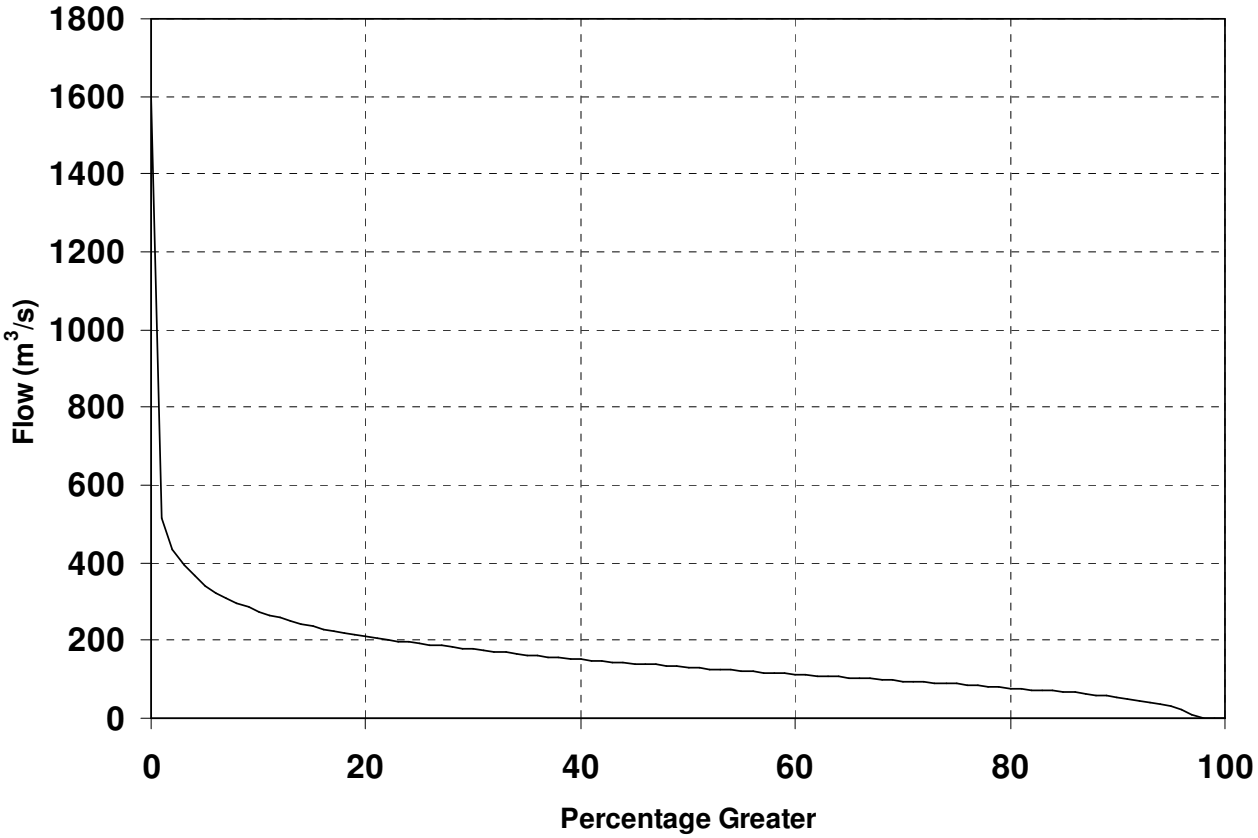

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1593	513	435	394	366	341	322	308	295	285
10	275	266	258	250	242	236	230	225	220	215
20	211	207	203	199	196	192	189	186	183	180
30	177	174	171	169	166	163	161	159	156	154
40	152	149	147	145	143	141	139	137	135	133
50	132	129	128	126	124	122	120	118	116	115
60	113	111	110	108	106	105	103	101	100	98
70	96	95	93	91	89	88	86	84	82	80
80	78	76	74	72	70	68	65	63	60	58
90	54	51	47	42	37	30	21	10	0	0
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	152	132	1593

10.33 Waiau River at Clarence at Jollies – 162107 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							10	12	16	34	35	18	21
1932	5	8	5	13	10	10	19	6	7	8	29	16	11
1933	8	4	3	7	10	9	10	11	21	7	6	8	9
1934	10	12	10	14	17	14	15	18	15	28	15	9	15
1935	17	13	12	13	17	20	10	8	6	11	8	12	12
1936	10	9	6	8	15	4	10	12	16	34	35	18	15
1937	28	17	20	15	29	15	5	4	7	7	12	13	14
1938	18	13	22	23	11	12	8	10	19	16	19	38	17
1939	23	12	7	4	9	15	10	7	13	15	22	44	15
1940	18	43	29	9	9	9	5	3	3	18	16	10	14
1941	11	27	10	11	6	8	12	10	6	5	12	25	12
1942	18	11	17	93	27	8	21	8	12	30	21	21	24
1943	11	25	12	9	9	7	6	4	17	16	16	14	12
1944	6	10	11	15	12	8	9	6	12	20	26	27	13
1945	28	20	16	14	11	6	6	15	19	12	31	30	17
1946	17	17	7	8	4	4	7	17	14	16	14	36	13
1947	19	11	5	4	2	8	7	8	9	27	19	15	11
1948	17	6	6	11	13	14	9	5	5	20	34	19	13
1949	15	21	15	12	11	16	17	13	5	25	15	18	15
1950	20	7	4	14	12	20	8	11	9	6	6	16	11
1951	11	4	3	8	7	7	15	9	6	19	37	46	14
1952	21	18	13	10	16	24	10	4	4	7	15	15	13
1953	10	12	9	18	27	15	7	8	11	9	23	36	15
1954	20	15	13	16	7	17	10	5	6	6	21	12	12
1955	6	64	33	9	25	12	4	10	7	12	15	10	17
1956	4	8	5	13	10	10	19	6	7	8	29	16	11
1957	18	6	10	16	23	10	7	5	3	14	29	89	19
1958	33	22	24	14	39	24	8	9	8	14	15	22	19
1959	10	5	8	7	7	9	4	5	18	16	22	23	11
1960	5	5	6	5	6	12	17	15	16	12	15	15	11
1961	9	8	9	7	9	12	21	19	14	31	17	5	14
1962	10	4	5	9	9	16	21	19	20	22	14	7	13
1963	5	5	7	7	12	17	24	19	26	13	23	7	14
1964	22	5	6	5	14	14	17	18	21	21	15	11	14
1965	10	8	21	24	11	16	12	19	21	18	29	11	17
1966	8	8	7	12	24	9	11	14	22	15	15	13	13
1967	15	8	7	7	9	8	9	18	13	11	35	14	13
1968	6	10	5	19	13	12	15	15	15	43	30	21	17
1969	8	4	3	7	10	9	10	11	21	7	6	8	9

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	6	3	11	5	7	14	15	19	37	14	10	6	12
1971	9	3	2	2	6	13	8	18	22	34	15	7	12
1972	4	3	4	12	16	9	17	9	23	31	11	10	13
1973	5	2	2	5	13	12	6	27	21	9	20	7	11
1974	6	6	12	50	23	26	33	15	42	33	20	7	23
1975	11	8	12	16	23	17	29	28	26	29	22	9	19
1976	11	23	5	7	13	18	22	17	19	26	19	27	17
1977	23	9	5	4	15	17	21	11	23	29	18	11	16
1978	6	4	3	20	26	17	24	21	29	21	13	13	16
1979	5	7	10	20	32	12	19	32	29	24	19	26	20
1980	33	10	22	23	16	22	18	33	27	22	19	15	22
1981	5	3	5	8	17	22	16	13	25	29	11	11	14
1982	6	4	3	6	23	23	9	16	18	15	25	16	14
1983	10	4	4	15	38	26	26	16	20	38	15	15	19
1984	9	24	10	6	8	6	20	12	9	23	22	16	14
1985	10	5	5	6	9	16	20	29	22	14	18	21	15
1986	8	8	12	24	8	14	16	26	34	44	16	8	18
1987	9	8	38	12	12	14	8	14	8	18	13	18	14
1988	6	9	13	6	19	15	31	20	27	36	15	8	17
1989	5	6	6	6	5	32	10	11	11	19	11	13	11
1990	8	4	4	7	22	13	14	25	14	14	19	10	13
1991	7	16	5	17	11	13	13	37	13	15	22	11	15
1992	11	6	15	7	10	6	16	21	24	39	24	16	16
1993	12	7	5	9	13	24	8	5	22	24	13	31	15
1994	24	6	9	6	23	20	19	19	16	19	54	10	19
1995	7	7	9	9	13	25	15	18	30	37	19	12	17
1996	7	7	9	15	14	14	15	22	27	28	23	12	16
1997	9	9	17	14	8	14	14	21	13	17	11	23	14
1998	6	5	6	9	7	11	34	18	18	36	13	4	14
1999	3	2	5	9	10	21	14	19	14	20	26	10	13
2000	9	8	9	10	9	26	12	28	17	33	9	10	15
2001	8	3	2	3	5	12	11	21	11	17	21	19	11
2002	24	10	6	7	6	21	13	12	15	12	27	17	14
2003	9	6	4	16	10	17	17	12	38	33	14	8	15
2004	9	24	11	7	12	20	11	21	22	24	11	13	15
2005	9	4	7	8	9	10	12	10	6	10	6	5	8
2006	9	5	4	15	16	18							11
Min.	3	2	2	2	2	4	4	3	3	5	6	4	8
Mean	12	10	10	12	14	15	14	15	17	20	19	17	15
Max.	33	64	38	93	39	32	34	37	42	44	54	89	24

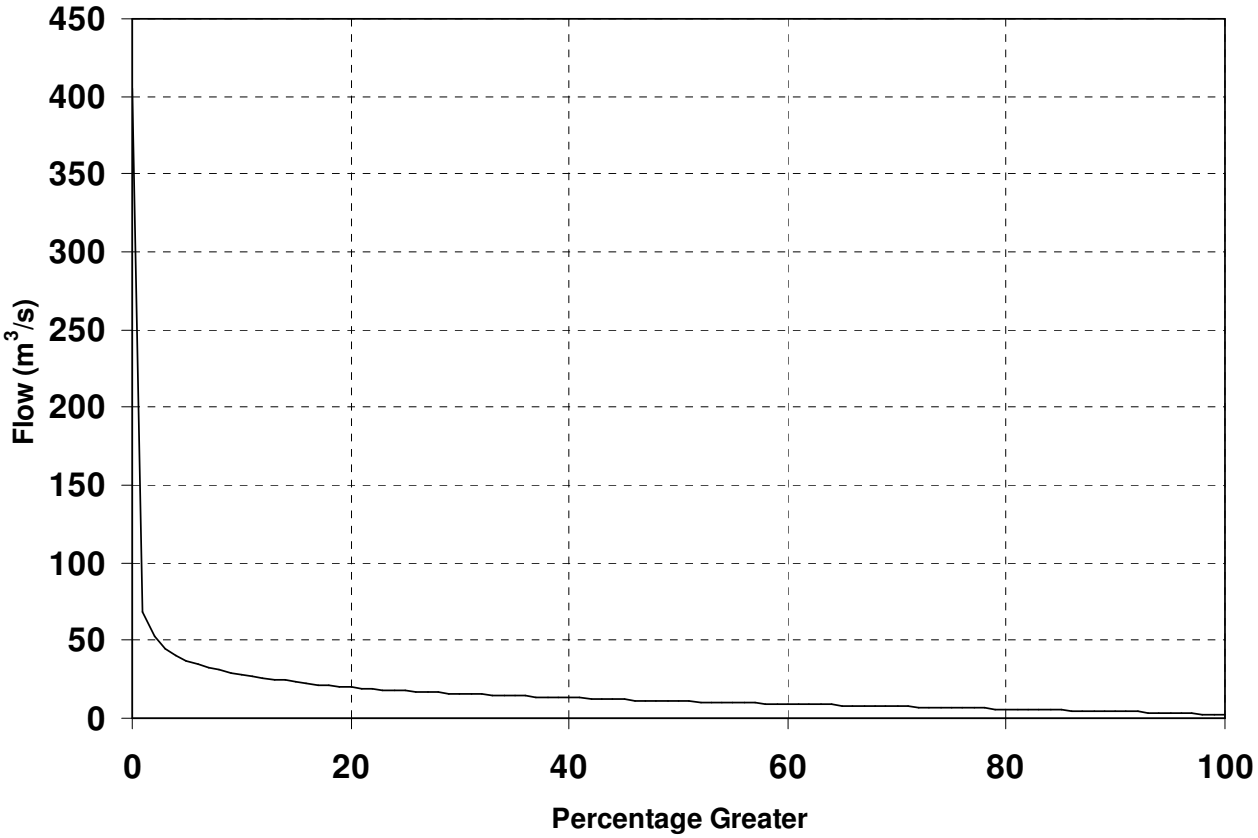

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	406	68	52	45	40	37	35	33	31	30
10	28	27	26	25	24	23	23	22	21	21
20	20	19	19	18	18	18	17	17	17	16
30	16	16	15	15	15	14	14	14	14	13
40	13	13	13	12	12	12	12	12	11	11
50	11	11	11	10	10	10	10	10	9	9
60	9	9	9	9	8	8	8	8	8	8
70	7	7	7	7	7	7	7	6	6	6
80	6	6	6	5	5	5	5	5	5	5
90	4	4	4	4	4	4	3	3	3	2
100	2									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	2	15	11	406

10.34 Waiau River at Glenhope – 164604 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							25	28	36	66	69	40	44
1932	17	22	15	31	25	25	41	19	20	22	58	36	28
1933	22	15	11	19	26	24	26	27	45	20	18	22	23
1934	25	29	25	33	37	33	34	39	34	57	33	23	34
1935	37	32	29	31	37	43	26	22	18	28	21	29	29
1936	25	23	19	22	35	15	25	28	36	66	69	40	34
1937	56	38	43	35	59	34	17	15	20	20	29	31	33
1938	39	31	46	49	28	29	22	25	42	37	42	73	38
1939	49	29	20	14	23	35	25	20	31	34	46	81	34
1940	39	81	57	24	23	23	16	11	13	40	36	25	32
1941	27	54	25	28	18	21	30	25	17	16	28	52	28
1942	40	27	37	142	55	22	45	22	29	60	45	44	47
1943	27	51	29	23	24	19	19	14	36	37	36	32	29
1944	17	26	27	34	30	21	23	19	28	42	54	55	31
1945	57	43	35	32	27	19	18	35	42	28	62	60	38
1946	37	38	20	21	14	15	20	38	32	37	32	69	31
1947	42	28	17	14	10	21	19	22	24	55	41	34	27
1948	37	18	18	27	31	33	23	15	16	43	67	42	31
1949	34	44	34	30	28	35	37	31	17	51	33	39	34
1950	43	21	13	31	28	42	22	28	23	18	19	36	27
1951	27	14	12	21	21	21	33	24	18	40	73	87	33
1952	45	40	31	25	36	50	26	14	14	20	34	34	31
1953	25	29	24	39	55	33	21	21	27	24	48	71	35
1954	42	35	32	36	19	37	25	16	18	18	44	29	29
1955	18	104	64	23	51	29	13	25	21	28	34	26	36
1956	15	22	15	31	25	25	41	19	20	22	58	36	27
1957	39	19	25	36	47	25	20	17	13	33	57	153	41
1958	65	47	50	33	75	49	22	24	22	32	35	46	42
1959	26	17	22	20	20	23	14	15	38	36	47	49	27
1960	17	16	18	17	18	29	37	35	36	28	34	34	27
1961	23	21	24	21	24	29	44	41	24	61	38	17	31
1962	26	14	16	24	24	36	45	41	42	46	32	20	31
1963	16	16	20	20	29	38	47	41	54	31	48	20	32
1964	46	16	18	16	32	31	38	40	45	46	34	28	33
1965	26	21	43	48	27	35	29	40	44	39	58	27	37
1966	23	21	19	28	48	23	27	33	46	34	34	30	31
1967	34	21	20	21	23	22	24	39	30	26	67	32	30
1968	18	26	16	41	31	29	34	34	34	79	59	45	37
1969	22	15	11	19	26	24	26	27	45	20	18	22	23

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	18	12	26	16	19	32	35	40	71	32	25	18	29
1971	24	12	9	10	18	30	21	39	46	67	34	20	28
1972	14	11	14	29	36	24	38	24	48	61	27	25	29
1973	16	10	8	14	31	28	19	55	44	24	43	20	26
1974	17	22	20	90	50	41	57	30	44	53	53	27	42
1975	21	18	26	42	56	43	43	41	45	58	61	36	41
1976	41	44	20	18	27	45	38	30	25	38	37	55	35
1977	59	28	19	14	23	26	30	18	27	43	46	37	31
1978	23	14	14	27	44	25	32	41	48	44	40	42	33
1979	22	27	24	36	80	28	35	57	62	70	42	66	46
1980	64	47	45	43	36	41	25	44	56	48	53	40	45
1981	21	19	29	35	36	41	31	22	34	62	35	42	34
1982	33	19	14	14	34	30	19	31	32	29	62	46	30
1983	33	15	19	36	70	41	48	31	45	82	34	34	41
1984	23	30	20	18	21	20	43	38	22	54	70	62	35
1985	51	21	14	20	17	29	31	35	38	29	32	46	30
1986	30	25	24	42	24	31	28	41	45	66	42	27	35
1987	35	28	42	36	33	41	20	29	24	47	34	45	35
1988	25	31	40	24	47	41	58	41	55	101	56	32	46
1989	20	17	26	20	14	63	27	17	19	40	27	31	27
1990	25	19	19	26	50	24	24	40	21	26	33	33	28
1991	31	37	16	30	21	28	22	67	35	38	41	34	33
1992	31	23	40	20	15	15	27	44	28	47	50	37	31
1993	42	24	16	16	20	52	18	13	24	52	28	70	31
1994	77	22	22	15	44	43	39	39	36	36	148	44	47
1995	33	26	33	31	36	43	33	31	63	71	50	48	41
1996	29	23	23	33	17	27	24	32	53	73	62	40	37
1997	27	29	26	30	24	27	23	35	22	34	48	80	34
1998	25	21	25	33	19	28	66	40	37	94	37	20	37
1999	14	12	19	30	27	40	32	41	32	43	53	26	31
2000	24	22	23	26	24	54	29	52	37	65	24	25	34
2001	21	12	9	10	16	29	26	45	27	38	44	41	27
2002	48	25	19	20	18	44	30	29	34	29	56	38	33
2003	24	18	13	36	26	37	37	29	75	70	51	37	38
2004	36	49	31	19	30	53	30	38	35	50	36	36	37
2005	28	19	22	16	15	20	25	22	17	19	16	16	20
2006	32	15	11	47	30	35							28
Min.	14	10	8	10	10	15	13	11	13	16	16	16	20
Mean	31	27	24	29	31	32	30	31	34	44	44	41	33
Max.	77	104	64	142	80	63	66	67	75	101	148	153	47

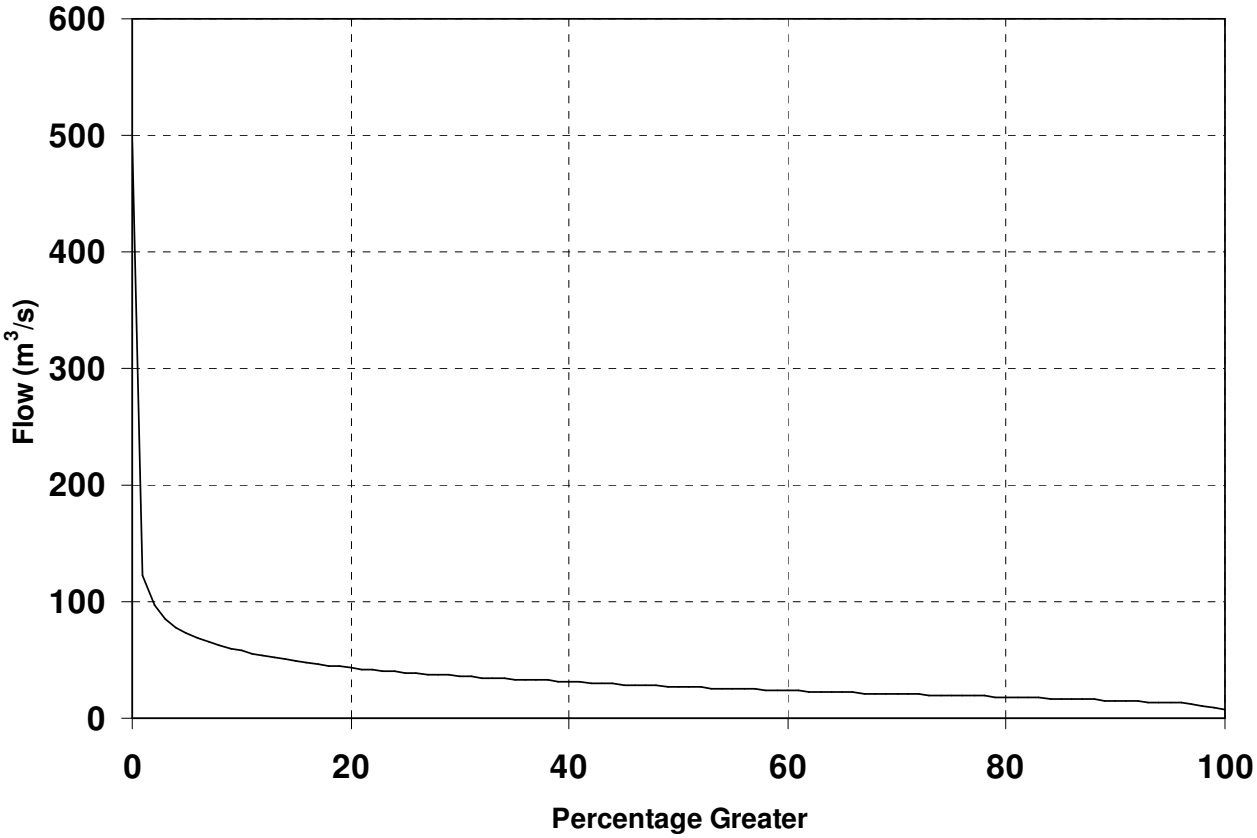

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	495	122	97	85	78	72	68	65	62	60
10	58	56	54	52	51	49	48	47	45	44
20	43	42	41	41	40	39	38	38	37	37
30	36	36	35	34	34	33	33	33	32	32
40	31	31	30	30	30	29	29	28	28	28
50	27	27	27	26	26	25	25	25	24	24
60	24	23	23	23	23	22	22	22	21	21
70	21	21	20	20	20	20	19	19	19	18
80	18	18	18	17	17	17	16	16	16	16
90	15	15	14	14	14	13	13	12	11	10
100	7									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	7	33	27	495

10.35 Waiau River at Marble Point – 164602 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							68	78	100	208	211	113	129
1932	44	59	40	88	69	69	120	51	55	59	173	100	77
1933	61	40	30	52	71	66	72	75	130	55	47	61	63
1934	69	78	69	92	105	90	96	110	97	168	93	62	94
1935	104	87	81	86	105	122	69	58	49	76	57	79	81
1936	67	62	50	60	97	38	68	78	100	208	211	113	96
1937	167	107	123	98	175	96	45	40	53	52	80	84	93
1938	110	84	138	142	77	78	58	67	120	104	118	225	110
1939	141	79	54	36	64	97	68	53	85	93	136	268	98
1940	111	258	177	66	62	63	43	28	34	115	100	68	93
1941	74	160	68	75	46	57	82	69	46	41	77	152	78
1942	114	73	104	470	164	60	130	60	80	189	130	127	142
1943	72	149	80	62	64	51	50	36	107	103	100	88	80
1944	46	71	73	94	82	57	62	50	79	124	157	162	88
1945	168	122	99	89	74	51	48	97	118	77	188	183	109
1946	103	108	53	57	37	38	53	107	88	103	89	215	88
1947	118	76	45	36	27	57	52	60	66	163	117	94	76
1948	104	48	47	74	86	91	63	40	44	125	212	119	88
1949	95	133	95	81	75	100	105	87	44	151	93	111	98
1950	122	56	35	89	87	124	59	76	62	47	50	102	76
1951	74	36	31	57	56	56	95	65	48	115	222	282	95
1952	129	114	87	67	102	147	72	35	38	55	96	94	86
1953	69	78	66	111	161	93	56	57	73	65	141	217	99
1954	123	97	87	102	52	110	67	41	48	47	129	79	82
1955	47	357	200	63	154	80	35	68	56	77	95	72	107
1956	40	59	40	88	69	69	120	51	55	59	173	100	77
1957	112	49	67	101	136	68	53	45	34	91	182	546	125
1958	205	135	147	90	241	149	59	65	58	90	97	133	123
1959	70	44	58	54	55	63	36	40	116	102	134	144	76
1960	44	42	47	44	48	83	107	98	103	77	97	96	74
1961	62	57	65	57	66	82	128	120	67	185	110	45	87
1962	74	37	43	66	65	101	129	116	121	134	90	54	86
1963	42	43	54	53	82	109	143	118	160	86	144	55	91
1964	135	42	47	41	90	89	108	115	132	131	95	76	92
1965	72	57	131	145	73	101	81	115	128	111	174	73	105
1966	61	59	52	82	145	63	77	94	133	96	95	85	87
1967	99	57	54	56	64	61	67	113	83	74	261	130	93
1968	64	93	68	88	82	67	84	73	87	248	198	151	109
1969	89	44	41	59	64	50	52	57	134	63	49	68	64

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	60	31	46	43	42	53	81	115	266	130	89	65	85
1971	53	29	23	24	36	64	45	74	141	262	127	78	80
1972	57	42	64	101	115	69	102	62	147	218	117	80	98
1973	44	25	25	63	122	83	41	93	82	76	152	57	72
1974	53	69	51	194	83	99	162	92	174	153	131	57	110
1975	54	56	92	122	171	119	127	132	138	166	134	90	117
1976	114	113	53	48	84	123	117	83	95	123	115	143	101
1977	161	78	54	41	79	90	100	63	96	130	132	95	93
1978	69	36	47	90	124	86	108	127	146	115	97	86	94
1979	45	66	66	99	170	77	87	125	163	168	122	171	114
1980	179	132	139	123	108	118	82	151	194	151	146	106	136
1981	48	52	60	80	104	115	90	73	128	186	94	111	95
1982	101	50	33	35	112	108	68	83	100	82	195	139	92
1983	130	51	73	94	207	127	134	93	142	232	109	98	125
1984	65	85	65	56	62	60	114	103	63	145	183	132	95
1985	106	47	34	47	41	76	93	95	100	78	82	120	77
1986	67	60	49	89	66	89	86	142	124	188	103	75	95
1987	100	70	120	93	89	121	60	79	70	131	86	122	95
1988	64	97	95	60	141	130	205	137	202	287	145	76	137
1989	50	42	73	56	39	152	71	46	56	86	70	102	70
1990	90	45	50	82	166	75	81	121	70	78	93	95	88
1991	91	123	39	77	63	86	75	200	100	116	118	93	98
1992	77	66	114	52	45	49	98	141	86	139	128	98	91
1993	120	66	44	53	62	159	57	38	72	149	76	151	87
1994	191	47	48	44	140	111	123	119	108	92	373	110	126
1995	84	62	89	70	83	114	101	114	215	201	147	121	117
1996	62	62	62	112	88	75	83	90	146	202	179	115	106
1997	67	93	86	98	67	79	68	100	56	91	137	212	96
1998	60	53	66	87	49	69	187	117	118	256	86	62	101
1999	33	33	54	83	66	111	77	76	75	145	144	60	80
2000	62	46	40	95	81	137	93	146	152	239	72	98	105
2001	69	36	34	33	51	84	62	80	57	80	128	175	75
2002	135	52	70	57	49	190	83	77	124	117	175	144	106
2003	84	79	47	72	83	117	101	65	193	185	132	78	103
2004	97	151	84	49	96	163	75	119	118	141	85	90	105
2005	64	52	61	42	45	51	70	58	46	55	43	48	53
2006	102	43	37	122	65	103							79
Min.	33	25	23	24	27	38	35	28	34	41	43	45	53
Mean	88	76	68	81	89	90	85	86	101	127	128	117	95
Max.	205	357	200	470	241	190	205	200	266	287	373	546	142

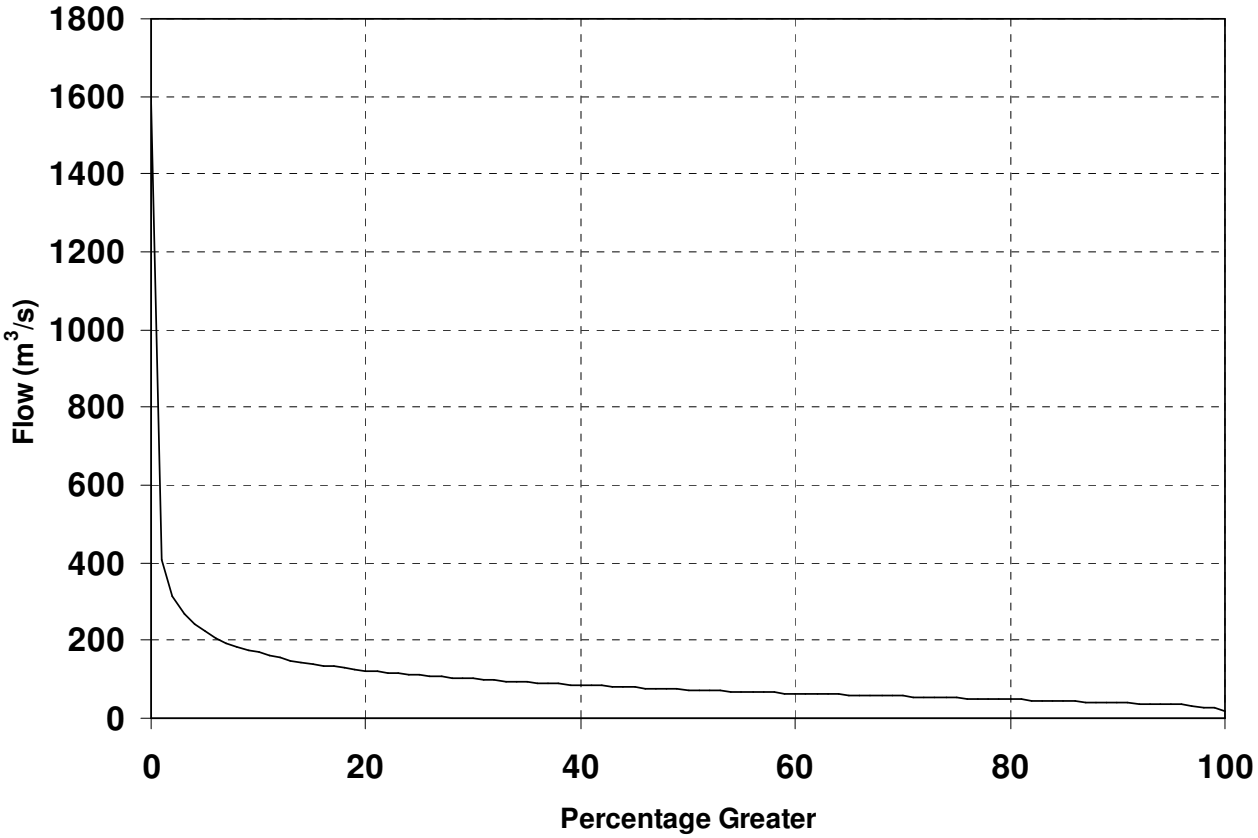

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1579	408	314	269	241	222	206	194	184	176
10	168	161	155	150	145	141	136	133	129	126
20	123	120	118	115	113	111	109	107	105	103
30	101	100	98	96	95	93	91	90	89	87
40	86	84	83	82	80	79	78	77	76	75
50	73	72	71	70	69	68	68	67	66	65
60	64	63	62	62	61	60	59	59	58	57
70	56	55	55	54	53	52	51	51	50	49
80	48	47	46	45	45	44	43	42	41	40
90	39	38	37	36	36	35	34	32	29	25
100	20									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	20	95	73	1579

10.36 Ngaruroro River at Whana Whana – 123103 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							52	34	53	23	15	11	31
1932	9	85	59	29	52	26	29	42	33	34	14	13	35
1933	14	27	28	14	53	39	52	48	49	36	26	24	34
1934	12	38	15	22	34	35	38	46	30	28	24	16	28
1935	9	20	35	76	34	53	42	61	38	23	56	20	39
1936	43	50	37	20	27	34	44	24	28	23	23	23	31
1937	33	16	16	20	22	36	66	34	42	32	27	28	31
1938	15	46	17	87	47	37	85	52	22	18	19	35	40
1939	11	16	13	17	42	33	30	45	42	29	24	33	28
1940	30	28	31	29	42	30	53	48	38	41	46	20	36
1941	26	15	28	34	24	37	54	57	38	49	24	20	34
1942	43	51	25	27	29	57	72	65	47	23	25	33	41
1943	30	23	23	40	75	87	41	48	90	32	45	32	47
1944	51	53	109	20	39	47	53	56	34	29	20	24	45
1945	29	23	14	10	45	39	39	38	37	43	21	11	29
1946	8	2	4	30	45	43	62	46	44	37	22	14	30
1947	21	23	21	57	51	74	74	29	26	30	18	14	36
1948	12	2	2	35	119	58	41	34	28	48	51	20	38
1949	28	9	15	10	60	43	32	69	30	29	25	20	31
1950	18	26	6	36	38	29	66	43	50	67	71	18	39
1951	33	38	60	38	71	35	42	54	23	28	29	23	40
1952	17	30	13	7	17	45	35	62	81	34	58	57	38
1953	33	26	14	27	35	78	37	28	23	28	13	11	29
1954	2	2	19	111	48	35	40	109	42	21	28	42	42
1955	19	18	35	51	35	38	107	58	53	38	23	23	42
1956	17	21	21	32	98	74	69	58	34	40	29	16	43
1957	17	14	18	22	25	41	53	50	43	36	23	22	30
1958	12	20	13	6	26	19	49	51	30	53	28	44	29
1959	22	28	35	40	61	36	36	50	27	59	26	16	37
1960	19	55	39	71	49	55	54	40	92	42	79	91	57
1961	55	29	17	17	31	55	79	73	72	26	16	19	41
1962	16	22	31	25	32	52	73	42	34	43	30	76	40
1963	27	13	9	10	10	54	74	40	49	36	21	19	30
1964	19	13	28	9	11	25	56	24	35	17	10	8	21
1965	12	15	61	13	7	16	28	97	14	9	32	37	29
1966	47	31	27	32	73	45	65	78	52	9	14	14	41
1967	25	47	32	14	17	42	45	102	42	22	54	63	42
1968	35	15	8	61	83	126	104	83	50	49	30	36	57
1969	29	35	16	20	23	26	27	33	43	28	21	31	28

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	15	17	29	24	38	52	37	54	48	39	29	13	33
1971	27	18	23	56	57	30	50	67	72	72	42	30	45
1972	15	12	41	20	37	33	44	34	26	21	13	25	27
1973	19	15	14	37	18	42	35	52	44	24	17	17	28
1974	16	8	17	43	43	31	41	54	53	49	28	26	34
1975	32	14	43	22	32	70	43	51	39	38	23	19	36
1976	73	52	16	26	36	30	54	65	106	39	39	31	47
1977	20	12	12	35	40	65	57	85	88	49	18	25	42
1978	10	16	6	19	21	54	79	39	29	31	23	17	29
1979	9	12	44	32	29	30	35	66	59	44	26	20	34
1980	35	22	64	54	20	36	47	42	40	23	24	73	40
1981	43	20	29	60	52	68	68	68	49	43	37	26	47
1982	14	20	20	35	28	38	37	32	18	20	15	21	25
1983	12	7	6	13	29	43	46	30	27	51	34	27	27
1984	13	15	21	14	18	17	28	37	55	33	15	23	24
1985	18	13	50	24	26	77	88	63	47	21	19	35	40
1986	42	30	25	10	19	20	38	47	72	33	15	15	30
1987	21	14	62	42	20	18	75	40	24	27	33	29	34
1988	14	30	113	23	26	29	72	54	87	27	18	22	43
1989	35	27	10	8	27	68	43	53	151	68	40	26	46
1990	19	12	18	12	19	30	44	92	23	52	31	13	31
1991	9	17	15	48	65	22	26	62	27	25	55	15	32
1992	17	16	14	17	21	41	69	63	41	99	56	41	42
1993	18	40	26	18	35	34	21	20	27	19	18	13	24
1994	10	10	9	11	18	33	54	51	33	43	62	14	29
1995	9	13	16	35	41	35	50	36	43	29	22	26	30
1996	36	33	23	52	30	35	70	42	42	22	16	21	35
1997	25	13	19	16	12	36	70	40	35	34	19	13	28
1998	9	10	8	9	10	14	107	40	27	44	21	35	28
1999	27	15	11	23	41	40	31	35	27	14	43	42	29
2000	25	15	10	31	28	36	92	33	31	44	22	24	33
2001	17	10	9	10	45	34	47	67	43	39	40	70	36
2002	22	24	14	12	16	41	141	99	37	29	14	40	41
2003	21	13	23	11	27	30	25	95	105	67	26	21	39
2004	17	47	29	10	21	45	58	54	31	38	20	20	32
2005	19	10	15	12	34	47	45	22	18	51	26	46	29
2006	23	19	19	43	81	45							39
Min.	2	2	2	6	7	14	21	20	14	9	10	8	21
Mean	23	23	26	29	37	42	54	52	45	36	29	27	35
Max.	73	85	113	111	119	126	141	109	151	99	79	91	57

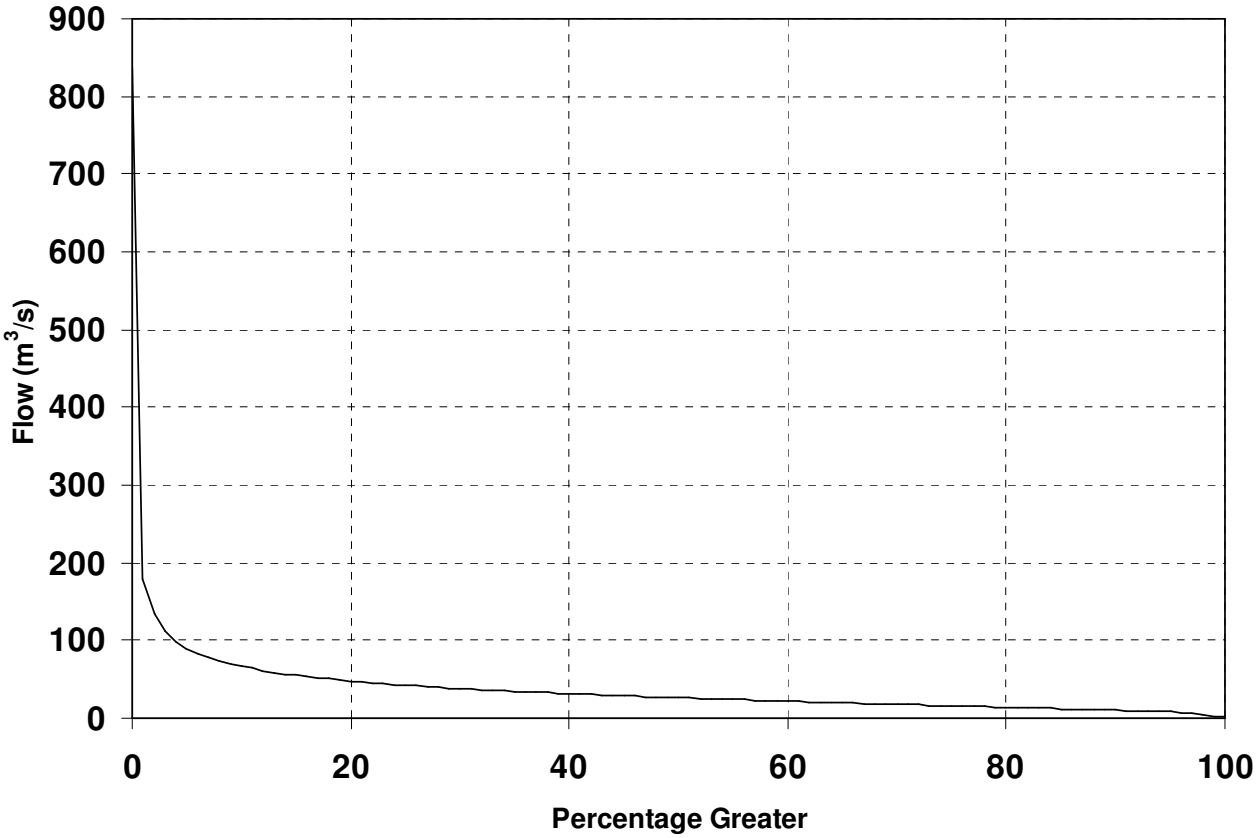

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	837	180	135	113	99	91	84	78	74	70
10	67	64	61	59	57	55	54	52	51	49
20	48	47	46	45	43	43	42	41	40	39
30	38	37	37	36	35	35	34	33	33	32
40	32	31	31	30	30	29	29	28	27	27
50	26	26	25	25	25	24	24	23	23	22
60	22	21	21	21	20	20	19	19	18	18
70	18	17	17	17	16	16	16	15	15	14
80	14	14	13	13	13	12	12	12	11	11
90	10	10	10	9	9	8	8	7	5	2
100	1									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	1	35	26	837

10.37 Ngaruroro River at Kuripapango – 123104 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							26	16	26	11	8	5	15
1932	4	43	29	14	26	12	14	21	16	16	7	7	17
1933	7	13	14	7	26	19	26	24	24	17	12	12	17
1934	6	19	7	11	17	17	19	23	15	14	12	8	14
1935	5	10	17	38	17	26	20	30	18	11	28	10	19
1936	22	25	18	10	13	17	21	12	14	11	11	12	15
1937	16	8	8	10	11	18	33	16	20	16	13	14	15
1938	8	23	8	43	23	19	43	26	11	9	9	17	20
1939	5	8	6	8	21	16	15	22	21	14	12	17	14
1940	15	14	15	14	21	15	26	24	18	20	23	10	18
1941	13	7	14	17	12	18	27	28	18	24	12	10	17
1942	21	25	12	13	14	29	36	32	23	11	12	16	21
1943	15	11	11	20	38	44	20	24	45	16	22	15	23
1944	25	26	55	10	20	23	27	28	17	14	10	12	22
1945	14	12	7	5	23	19	19	19	18	22	10	5	14
1946	4	1	2	15	22	21	31	23	22	18	11	7	15
1947	11	11	10	28	25	37	37	14	13	15	9	7	18
1948	6	1	1	17	60	29	20	16	14	24	26	10	19
1949	14	5	8	5	30	21	16	34	15	14	12	10	15
1950	9	13	3	18	18	14	33	21	25	34	36	9	19
1951	16	19	30	18	36	17	20	27	11	14	14	11	20
1952	9	15	7	3	8	22	17	31	41	16	29	28	19
1953	16	12	7	13	17	39	18	14	11	13	7	5	14
1954	1	1	9	56	24	17	20	55	21	10	14	21	21
1955	10	9	17	26	17	19	54	29	26	19	11	11	21
1956	8	10	10	16	50	37	35	29	16	20	14	8	21
1957	9	7	9	11	12	21	26	25	21	18	11	11	15
1958	6	10	7	3	13	9	25	25	15	26	14	22	15
1959	11	14	17	20	31	17	18	25	13	30	13	8	18
1960	9	28	19	36	25	27	27	20	47	20	39	46	28
1961	28	14	9	9	15	28	40	37	37	13	8	10	20
1962	8	11	16	12	16	26	37	20	16	21	15	38	20
1963	13	6	5	5	5	27	37	19	27	10	8	9	14
1964	13	7	24	4	6	13	44	22	36	19	14	15	18
1965	14	20	25	11	7	20	21	61	19	11	24	18	21
1966	18	9	11	16	29	21	33	40	33	11	16	14	21
1967	20	21	15	7	9	16	18	45	18	8	21	16	18
1968	9	5	4	11	25	44	46	38	20	23	13	16	21
1969	15	18	7	6	13	11	10	14	26	12	7	16	13

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	6	9	9	13	23	34	18	33	41	19	17	6	19
1971	14	10	11	16	28	27	18	29	35	38	18	15	22
1972	7	5	21	9	20	10	27	15	15	10	6	6	13
1973	6	4	4	5	10	24	11	24	22	9	10	7	11
1974	6	4	8	26	22	32	45	22	20	25	12	12	20
1975	12	7	13	8	14	32	19	29	20	22	11	9	16
1976	35	28	7	12	21	17	27	27	56	19	14	15	23
1977	9	6	7	18	17	32	28	39	40	22	9	11	20
1978	5	6	3	10	9	21	39	15	17	13	15	8	13
1979	4	9	21	15	14	13	14	33	25	29	16	12	17
1980	24	9	24	31	12	21	29	22	20	10	11	37	21
1981	15	7	9	20	24	34	28	27	16	19	21	16	20
1982	7	11	12	20	16	24	15	13	13	12	9	16	14
1983	8	4	3	10	16	21	24	16	16	32	19	17	15
1984	7	10	15	9	11	11	22	18	23	16	8	13	14
1985	9	6	30	15	13	42	33	32	26	10	9	16	20
1986	27	14	12	5	13	12	24	26	38	18	7	8	17
1987	14	7	29	23	11	12	30	19	13	16	16	18	17
1988	8	12	54	10	14	17	33	27	39	18	13	16	22
1989	23	18	6	4	13	40	20	19	50	34	17	13	21
1990	11	6	16	9	14	15	22	52	14	23	18	7	17
1991	5	13	8	22	27	11	14	37	15	13	23	6	16
1992	9	9	8	8	8	17	23	30	17	43	22	20	18
1993	7	14	10	8	23	23	11	8	14	9	10	7	12
1994	6	5	5	6	10	22	27	30	19	23	45	8	17
1995	6	9	12	23	22	17	29	21	27	17	13	19	18
1996	24	18	13	27	18	13	32	20	29	13	10	15	19
1997	13	6	9	9	6	24	34	21	21	20	10	7	15
1998	5	7	5	5	7	11	60	23	17	33	12	15	17
1999	9	6	6	10	22	19	16	20	15	7	24	14	14
2000	10	8	5	13	13	18	34	16	17	23	10	12	15
2001	8	5	4	6	22	14	17	26	14	16	19	32	15
2002	8	12	8	7	9	21	41	28	15	12	7	19	16
2003	8	5	7	7	19	16	14	39	49	38	14	13	19
2004	9	33	19	3	13	31	32	30	15	22	11	10	19
2005	12	4	6	5	15	23	22	10	10	29	12	20	14
2006	12	12	10	24	34	20							19
Min.	1	1	1	3	5	9	10	8	10	7	6	5	11
Mean	11	12	13	14	19	22	26	26	23	18	15	14	18
Max.	35	43	55	56	60	44	60	61	56	43	45	46	28

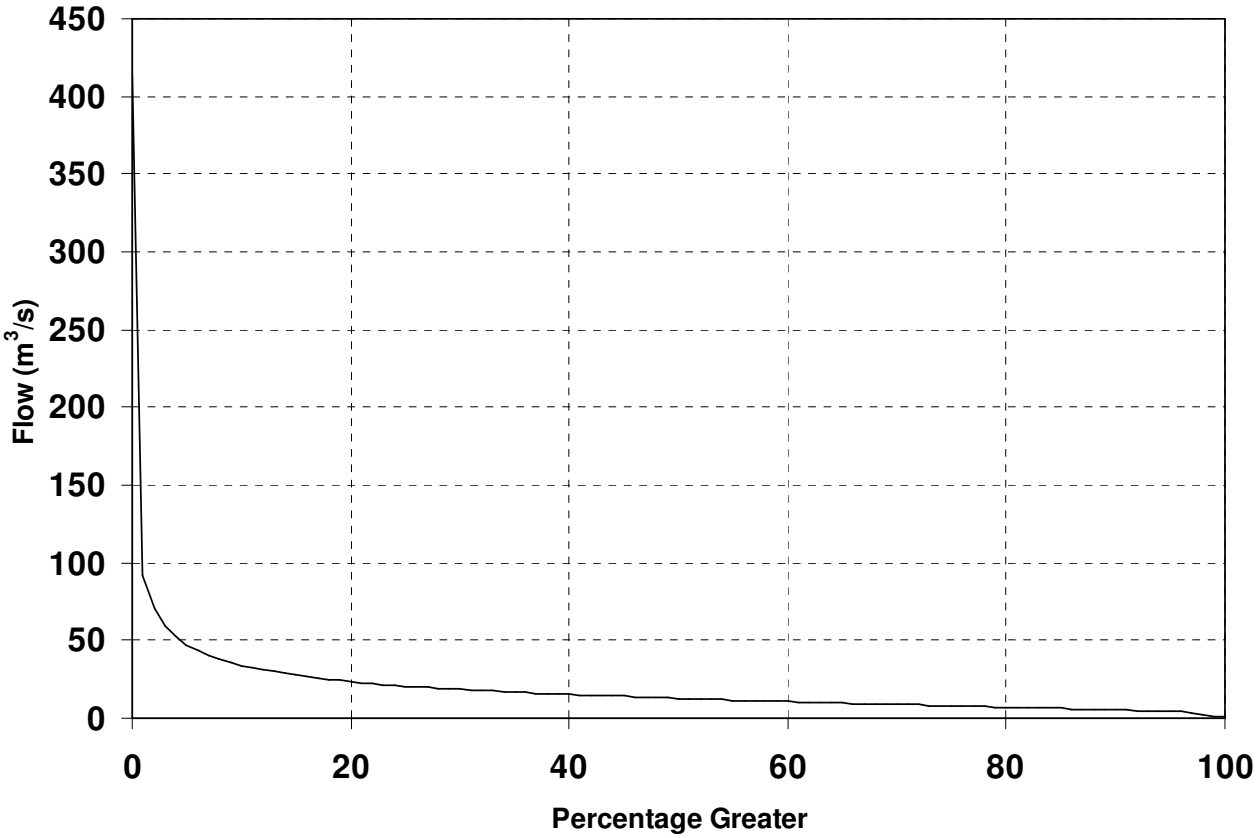

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	414	92	70	59	52	47	44	41	38	36
10	34	33	31	30	29	28	27	26	25	24
20	24	23	22	22	21	21	20	20	19	19
30	19	18	18	17	17	17	16	16	16	16
40	15	15	15	15	14	14	14	14	13	13
50	13	13	12	12	12	12	12	11	11	11
60	11	11	10	10	10	10	10	9	9	9
70	9	9	8	8	8	8	8	8	7	7
80	7	7	7	7	6	6	6	6	6	6
90	5	5	5	5	5	4	4	4	3	1
100	1									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	1	18	13	414

10.38 Ngaruroro River at Chesterhope – 123150 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							66	39	67	25	15	9	37
1932	9	128	82	33	68	28	33	51	38	39	14	12	44
1933	13	30	32	13	76	47	65	61	62	42	28	26	41
1934	10	46	14	24	40	42	45	57	35	33	26	15	32
1935	8	23	41	114	41	67	50	81	44	25	72	21	49
1936	54	66	45	21	30	40	53	27	32	25	24	26	37
1937	39	16	15	20	23	44	90	39	50	37	30	31	36
1938	17	59	17	135	58	45	118	66	23	18	20	41	51
1939	10	16	11	19	52	39	34	55	52	33	26	39	32
1940	34	32	36	33	51	35	69	59	45	49	58	21	44
1941	29	14	32	40	26	44	70	72	45	61	26	21	40
1942	54	65	27	30	33	75	100	86	59	25	28	38	52
1943	35	25	24	48	104	117	49	59	132	37	55	37	60
1944	71	69	166	21	50	59	69	72	40	32	21	26	58
1945	33	26	13	9	59	47	47	46	45	54	22	10	34
1946	7	2	4	38	58	55	85	56	54	45	24	13	37
1947	23	26	22	78	66	98	100	33	29	34	18	13	45
1948	12	1	1	41	199	74	49	39	32	60	65	21	50
1949	32	8	16	10	81	52	37	99	35	33	28	21	38
1950	18	30	5	46	45	33	93	52	63	90	95	19	49
1951	39	45	78	45	100	41	51	70	25	31	33	25	49
1952	18	35	13	6	17	55	42	82	117	39	75	73	48
1953	38	28	13	30	42	110	44	32	25	31	12	10	35
1954	1	1	21	177	59	41	49	163	51	22	32	52	56
1955	20	18	43	70	42	46	157	75	67	46	24	25	53
1956	17	22	22	37	142	98	93	75	39	49	33	16	54
1957	17	13	18	23	28	51	68	63	52	46	25	24	36
1958	11	26	13	4	33	20	62	63	34	73	32	59	36
1959	23	33	41	48	84	42	43	63	30	76	28	16	44
1960	19	73	46	102	62	69	69	48	127	50	116	130	76
1961	71	33	17	17	36	71	106	96	95	29	15	20	51
1962	16	23	37	28	38	66	97	51	40	53	34	112	50
1963	30	11	7	9	8	77	102	47	61	41	22	20	36
1964	19	13	34	7	9	28	72	26	43	17	8	6	24
1965	11	14	93	11	5	16	32	149	13	7	37	44	37
1966	57	35	30	38	97	55	87	108	65	8	15	14	51
1967	27	62	38	13	17	52	56	148	51	24	70	81	53
1968	41	14	6	79	111	188	154	116	61	61	33	42	76
1969	33	40	16	21	25	28	29	38	53	31	23	35	31

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	14	17	34	27	44	65	43	68	60	47	32	12	39
1971	30	18	24	78	76	34	62	87	95	97	50	34	58
1972	13	11	51	20	45	37	54	40	29	22	12	28	30
1973	20	14	13	46	19	52	41	65	53	26	17	17	32
1974	16	6	17	56	52	35	50	67	68	62	31	29	41
1975	37	13	56	23	37	94	53	64	47	45	24	23	43
1976	109	67	15	29	42	34	69	85	160	47	44	31	61
1977	17	11	13	41	42	88	83	147	127	63	24	27	57
1978	7	17	5	24	20	85	116	47	35	29	25	15	35
1979	7	12	88	39	33	45	62	108	117	74	30	21	53
1980	40	30	105	106	30	54	76	52	42	24	19	151	61
1981	59	19	21	88	58	98	78	109	67	50	45	31	60
1982	12	23	21	43	30	48	44	38	20	19	16	15	27
1983	7	4	3	12	24	53	50	27	25	62	32	22	27
1984	10	15	21	13	19	18	32	59	82	38	16	23	29
1985	14	10	84	24	26	111	178	85	51	18	16	36	55
1986	40	33	21	9	15	16	37	54	95	42	15	13	32
1987	16	11	78	47	22	20	108	48	29	25	46	28	40
1988	12	38	176	22	16	14	102	70	130	31	14	19	54
1989	34	24	7	5	30	67	39	62	288	74	39	32	58
1990	16	12	19	10	17	23	43	129	42	39	28	10	33
1991	6	11	13	31	92	25	29	64	25	23	71	14	34
1992	16	14	12	15	21	49	90	68	52	150	73	65	52
1993	24	80	42	22	49	45	24	23	33	17	16	11	32
1994	8	7	6	7	17	39	76	65	32	47	70	10	32
1995	5	12	14	62	65	45	74	51	47	31	26	25	38
1996	45	41	21	59	36	45	106	46	58	20	14	21	43
1997	40	13	21	16	12	63	130	54	59	57	22	11	42
1998	6	7	5	7	10	16	121	45	29	30	19	42	28
1999	38	15	12	26	52	58	38	37	32	15	49	44	35
2000	20	14	7	34	27	38	138	45	45	51	27	28	40
2001	19	9	8	10	45	28	44	62	41	33	32	71	34
2002	25	24	13	10	15	45	144	109	45	38	16	44	44
2003	25	10	45	16	35	34	29	171	180	83	21	30	57
2004	20	65	40	11	31	64	89	76	35	49	21	18	43
2005	19	8	16	14	55	76	82	27	16	80	36	70	42
2006	30	26	23	69	147	73							62
Min.	1	1	1	4	5	14	24	23	13	7	8	6	24
Mean	25	26	32	36	47	54	72	68	59	43	33	32	44
Max.	109	128	176	177	199	188	178	171	288	150	116	151	76

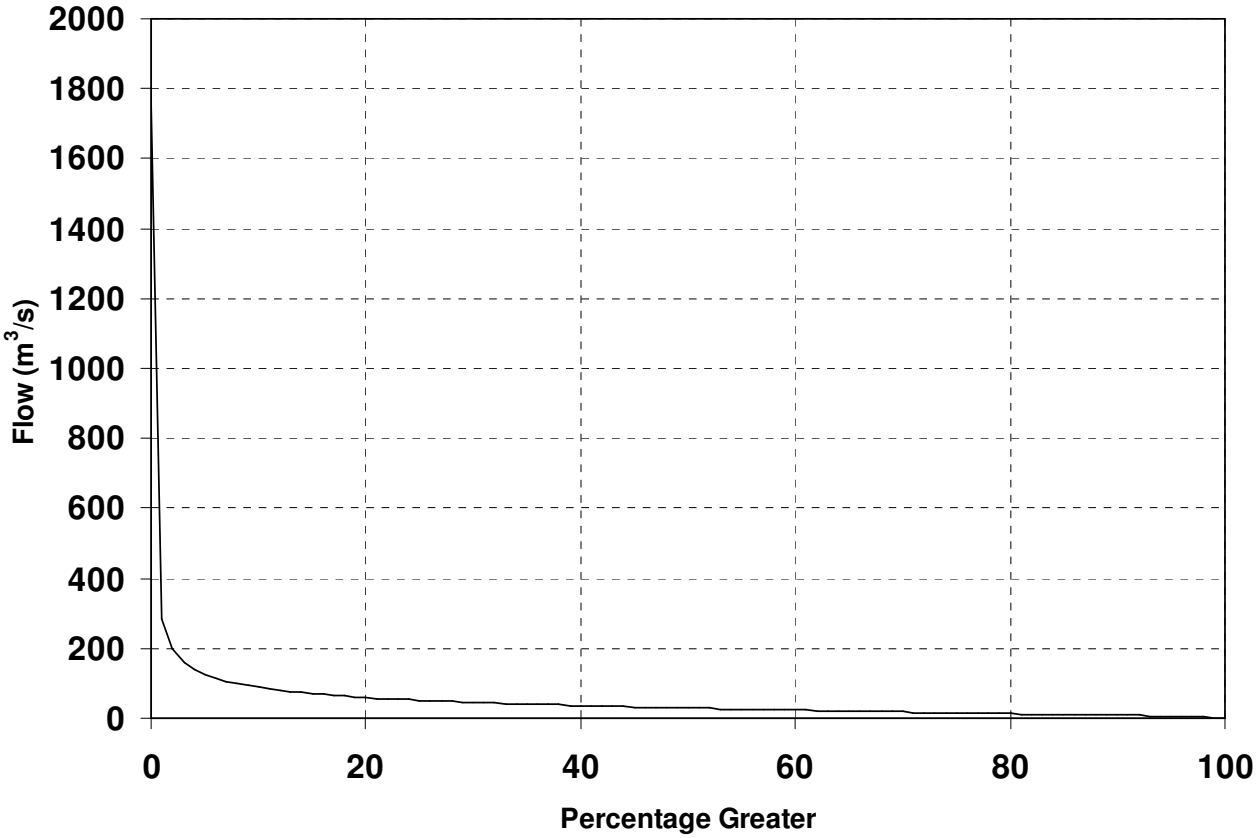

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1750	283	199	159	138	124	113	105	98	92
10	87	83	79	75	73	70	68	65	63	61
20	59	57	56	54	53	51	50	49	47	46
30	45	44	43	42	41	40	39	38	37	37
40	36	35	35	34	33	32	32	31	30	30
50	29	28	28	27	27	26	25	25	24	24
60	23	22	22	21	21	20	20	19	19	18
70	18	17	17	16	16	15	15	14	14	13
80	13	12	12	11	11	11	10	10	9	9
90	9	8	8	7	7	6	5	4	3	1
100	1									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	1	44	29	1750

10.39 Wairau River at Dip Flat – 160114 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							23	20	19	33	33	52	30
1932	21	44	18	20	13	15	22	19	13	11	21	42	21
1933	21	44	18	20	13	15	22	19	13	11	21	42	21
1934	38	24	29	25	29	25	26	30	27	46	25	17	28
1935	28	24	22	23	29	33	19	16	13	21	15	21	22
1936	18	17	13	16	27	11	18	21	27	58	58	31	26
1937	46	29	34	27	49	26	12	11	14	14	22	23	26
1938	30	23	38	39	21	21	16	18	33	28	32	63	30
1939	39	21	15	10	18	26	18	14	23	25	38	77	27
1940	30	72	50	18	17	17	12	8	9	32	27	18	26
1941	20	44	18	20	13	15	22	19	13	11	21	42	21
1942	31	20	28	149	45	16	36	16	22	53	35	35	40
1943	20	41	22	17	17	14	13	10	30	28	27	24	22
1944	13	19	20	25	22	16	17	14	21	34	43	45	24
1945	46	33	27	24	20	14	13	27	32	21	52	51	30
1946	28	29	14	16	10	11	14	29	24	28	24	60	24
1947	32	21	12	10	8	16	14	16	18	45	32	25	21
1948	28	13	13	20	23	25	17	11	12	34	59	32	24
1949	26	37	26	22	21	27	29	24	12	42	25	30	27
1950	33	15	10	25	24	34	16	21	17	13	14	28	21
1951	20	10	9	15	15	13	32	14	15	39	60	52	25
1952	24	23	20	14	34	36	21	14	18	25	39	38	26
1953	29	26	20	27	47	29	19	22	29	26	47	54	31
1954	38	24	29	34	23	37	18	14	17	21	37	27	26
1955	13	72	22	8	39	23	12	25	21	25	22	17	24
1956	15	15	12	33	21	29	30	13	18	27	50	28	24
1957	17	12	20	38	38	16	15	15	13	35	66	90	31
1958	28	22	33	18	55	28	19	21	18	32	30	34	28
1959	14	15	19	25	24	25	12	13	38	33	39	32	24
1960	16	19	23	13	25	28	19	20	22	28	23	11	21
1961	11	12	24	22	12	13	20	21	21	50	54	13	23
1962	31	14	14	11	36	30	26	24	27	77	43	15	29
1963	8	18	12	11	27	30	16	24	39	19	39	20	22
1964	54	11	20	13	24	13	18	17	24	38	43	36	26
1965	32	18	10	13	13	19	11	14	20	28	64	31	23
1966	29	22	16	27	22	15	14	11	17	21	31	26	21
1967	17	12	22	27	22	14	19	45	18	26	74	49	29
1968	18	31	22	41	32	20	22	22	23	79	80	64	38
1969	36	17	12	17	23	13	10	10	67	21	16	27	22

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	21	10	13	15	8	14	20	36	96	37	31	22	27
1971	20	14	12	14	34	49	16	17	29	66	37	25	28
1972	21	12	22	37	32	18	26	18	39	77	40	19	30
1973	12	7	6	15	27	20	10	21	20	18	56	18	19
1974	17	20	12	79	19	18	29	17	23	52	48	20	29
1975	16	15	24	36	41	25	22	25	30	46	47	23	29
1976	37	22	13	14	21	32	23	20	19	33	33	52	27
1977	45	18	14	9	15	23	24	9	11	28	39	37	23
1978	17	9	10	15	35	18	18	21	29	35	31	34	23
1979	18	29	10	21	60	17	24	18	26	44	44	56	31
1980	60	38	27	27	23	29	16	31	39	40	36	31	33
1981	15	11	21	21	32	37	24	17	22	52	36	44	28
1982	26	16	11	9	36	28	13	13	32	20	61	37	25
1983	33	14	12	41	51	25	46	19	24	64	34	32	33
1984	17	18	15	17	16	13	25	24	17	34	53	37	24
1985	39	17	12	21	14	23	17	18	36	22	20	43	23
1986	32	22	25	28	20	26	16	19	23	44	32	20	26
1987	32	22	19	29	29	29	12	20	20	37	28	42	27
1988	18	30	46	17	40	25	49	33	47	78	46	33	39
1989	24	17	22	18	11	54	23	13	12	22	26	36	23
1990	29	13	13	20	38	16	22	38	15	23	41	29	25
1991	31	36	11	18	14	12	9	42	36	31	27	28	24
1992	27	22	31	15	9	8	12	26	14	35	45	34	23
1993	31	15	16	14	17	46	14	10	13	40	25	28	22
1994	48	17	17	11	26	31	24	25	26	29	138	37	36
1995	28	28	24	34	34	24	18	23	57	66	48	53	36
1996	32	23	23	45	19	17	13	19	47	67	53	32	32
1997	18	20	27	24	17	20	13	17	14	28	34	59	24
1998	21	17	21	28	18	25	75	40	37	87	33	15	35
1999	11	10	14	25	20	33	17	15	20	39	58	17	23
2000	20	19	9	35	25	37	30	27	38	65	21	23	29
2001	21	10	8	9	15	27	11	18	18	33	47	70	24
2002	25	12	18	14	13	47	20	18	36	27	39	43	26
2003	20	14	11	17	23	32	31	11	35	51	44	31	27
2004	29	43	25	11	20	49	22	26	28	51	37	29	31
2005	28	18	24	17	11	19	21	21	16	16	13	12	18
2006	25	15	9	43	26	27							24
Min.	8	7	6	8	8	8	9	8	9	11	13	11	18
Mean	26	22	19	24	25	24	20	20	25	37	39	35	26
Max.	60	72	50	149	60	54	75	45	96	87	138	90	40

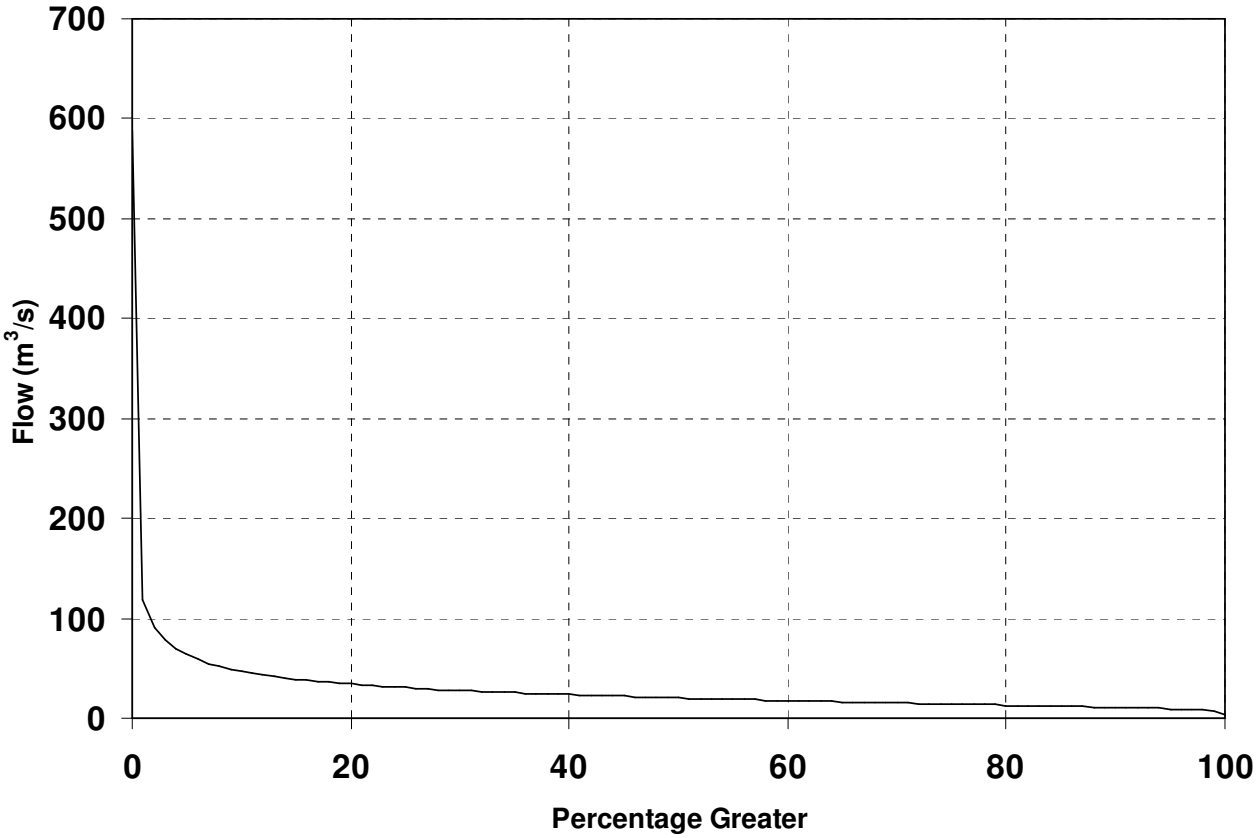

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	588	118	91	78	70	64	59	55	52	49
10	47	45	43	42	40	39	38	37	36	35
20	34	33	33	32	31	31	30	29	29	28
30	28	27	27	26	26	26	25	25	24	24
40	24	23	23	23	22	22	22	21	21	21
50	20	20	20	19	19	19	19	18	18	18
60	18	17	17	17	17	16	16	16	16	16
70	15	15	15	15	14	14	14	14	13	13
80	13	13	13	12	12	12	12	12	11	11
90	11	11	10	10	10	9	9	9	8	8
100	4									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	4	26	20	588

10.40 Hurunui River at Mandamus – 165104 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							73	64	56	70	78	35	63
1932	29	23	41	33	24	81	39	27	39	44	39	59	40
1933	27	35	32	22	26	33	31	35	71	37	33	27	34
1934	47	47	28	50	57	49	52	59	52	89	50	33	51
1935	56	47	44	47	56	65	38	32	27	41	31	43	44
1936	36	34	27	33	52	21	37	42	54	106	109	61	51
1937	88	57	66	53	92	51	25	22	29	29	43	46	50
1938	59	45	72	76	42	42	32	36	64	56	64	117	59
1939	75	43	30	19	34	52	37	29	46	50	72	133	52
1940	59	131	90	36	34	34	23	13	18	61	54	37	49
1941	40	85	37	41	26	31	44	37	25	23	42	81	42
1942	61	39	56	260	87	33	69	32	43	95	70	68	76
1943	39	79	43	34	35	28	27	19	55	56	54	48	43
1944	25	39	39	51	44	31	34	28	43	66	84	86	47
1945	89	65	54	48	40	28	27	53	63	42	97	94	58
1946	56	58	29	31	20	20	28	57	48	55	48	110	47
1947	63	41	25	19	13	30	28	33	36	86	63	51	41
1948	56	27	26	40	46	49	34	22	23	66	107	64	47
1949	51	69	51	44	41	54	57	47	25	79	50	59	52
1950	66	31	18	47	44	65	32	41	33	26	28	55	41
1951	40	20	15	31	31	31	51	35	26	62	116	140	50
1952	69	61	47	37	55	78	39	19	19	30	52	51	46
1953	37	42	36	59	85	50	30	31	40	35	74	112	53
1954	65	52	47	55	28	58	37	23	26	26	68	43	44
1955	26	183	102	34	79	43	19	36	31	42	51	39	56
1956	22	32	21	47	38	38	64	28	30	33	77	54	40
1957	44	29	41	54	72	46	61	32	25	90	120	164	65
1958	81	57	55	39	135	74	39	59	39	50	37	53	60
1959	26	19	24	36	38	50	33	48	59	55	72	45	42
1960	25	35	32	22	26	33	31	35	71	37	33	27	34
1961	21	31	40	45	60	45	73	64	56	70	78	35	52
1962	54	23	11	13	34	38	50	40	58	77	67	22	41
1963	19	23	31	27	42	54	67	41	70	36	81	34	44
1964	97	28	43	33	93	35	57	68	63	73	60	58	59
1965	40	41	22	27	40	55	43	45	52	84	90	54	50
1966	48	41	26	34	43	28	38	35	31	29	41	43	36
1967	34	35	52	61	51	28	37	57	38	36	150	85	55
1968	34	47	39	45	43	36	49	40	46	134	105	65	57
1969	33	22	25	43	31	27	30	35	77	35	26	38	35

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	38	21	21	26	22	27	40	66	177	65	45	34	48
1971	25	12	10	10	11	37	33	36	70	138	59	35	40
1972	29	19	28	47	74	34	46	26	71	136	60	42	51
1973	26	15	13	28	66	52	22	46	46	41	80	38	39
1974	28	42	31	111	34	39	69	40	65	73	71	31	53
1975	26	28	58	84	100	72	76	77	78	81	80	47	68
1976	53	47	25	20	41	73	60	46	54	56	53	55	49
1977	83	44	28	21	34	39	44	27	32	48	57	41	41
1978	32	18	21	50	57	38	54	75	74	73	47	39	48
1979	31	37	40	44	125	39	38	51	64	84	59	93	59
1980	96	58	74	54	49	72	35	81	128	80	78	57	72
1981	22	31	33	40	51	59	40	36	65	136	59	69	54
1982	63	34	24	17	54	44	37	52	55	39	120	94	53
1983	75	29	35	60	107	70	83	55	84	114	60	65	70
1984	40	42	42	29	36	40	65	72	40	93	136	91	61
1985	58	25	19	19	21	42	53	46	47	39	38	57	39
1986	39	35	35	54	38	56	47	85	61	98	43	36	52
1987	55	44	52	57	51	91	40	43	39	79	45	61	55
1988	35	43	48	30	77	69	127	88	139	132	95	50	78
1989	29	23	41	33	24	81	39	27	39	44	39	59	40
1990	54	24	25	36	86	37	40	61	31	41	41	73	46
1991	59	90	20	39	34	37	32	129	57	58	48	41	54
1992	43	35	61	29	22	33	52	99	50	59	50	36	48
1993	74	43	20	26	29	97	33	23	31	86	38	74	48
1994	149	28	28	21	66	68	95	78	76	50	230	48	78
1995	42	26	46	42	44	56	55	64	129	122	69	68	64
1996	39	36	38	100	52	47	54	44	86	137	105	62	66
1997	35	51	48	64	44	39	38	66	30	43	73	155	57
1998	44	32	40	59	31	34	116	82	61	156	57	41	63
1999	22	19	27	47	44	68	43	39	35	87	105	30	47
2000	35	30	19	61	40	83	54	90	118	153	37	40	63
2001	42	21	15	22	23	43	29	37	25	32	81	106	40
2002	97	21	45	31	22	133	55	44	84	71	94	69	64
2003	48	47	26	30	49	64	58	25	97	112	65	36	55
2004	50	75	46	30	58	95	37	74	67	78	47	42	58
2005	34	30	39	25	26	28	41	36	36	36	24	25	32
2006	61	27	21	64	35	67							46
Min.	19	12	10	10	11	20	19	13	18	23	24	22	32
Mean	49	41	37	44	48	50	47	48	55	69	68	60	51
Max.	149	183	102	260	135	133	127	129	177	156	230	164	78

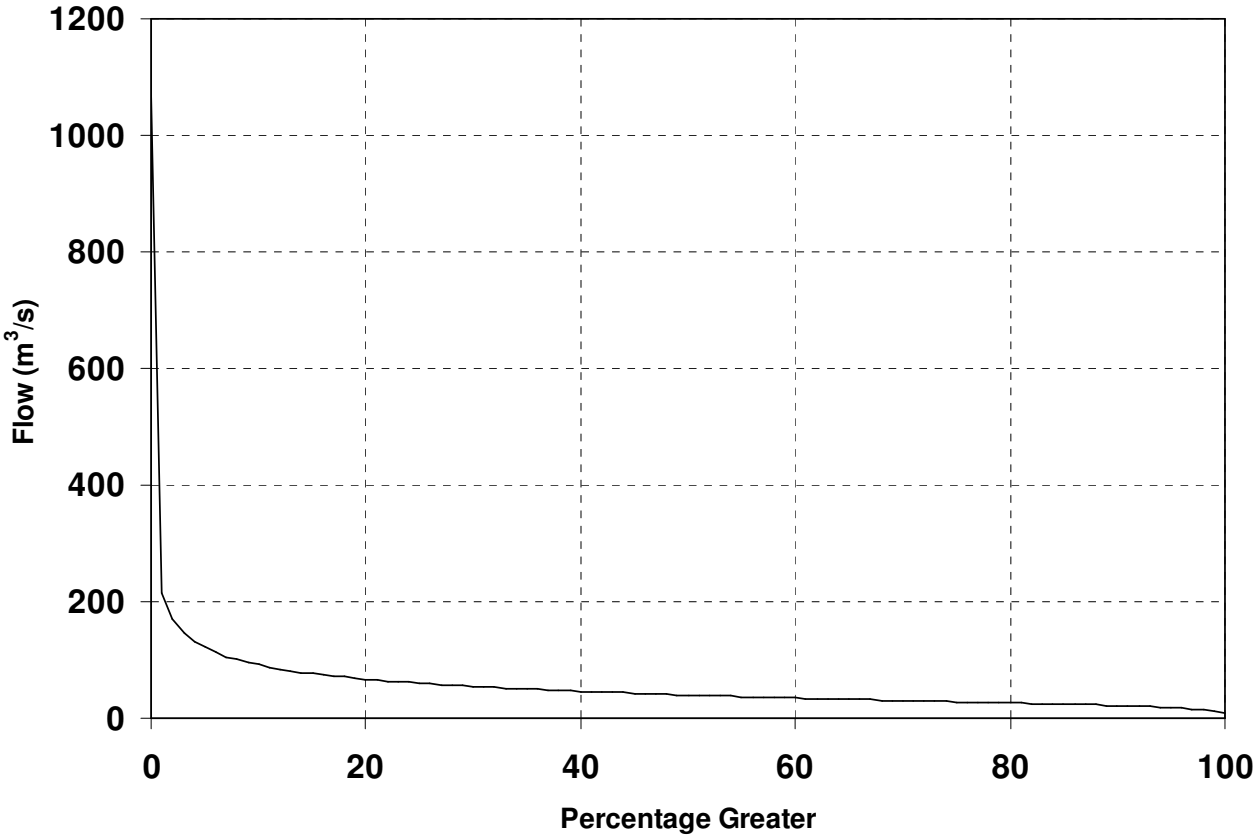

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1066	214	169	146	131	121	113	106	100	96
10	91	88	85	82	79	77	75	73	71	69
20	67	66	64	63	61	60	59	58	57	56
30	55	54	53	52	51	50	49	49	48	47
40	46	46	45	44	43	43	42	41	41	40
50	40	39	39	38	37	37	36	36	36	35
60	35	34	34	33	33	32	32	32	31	31
70	30	30	29	29	29	28	28	27	27	27
80	26	26	25	25	24	24	24	23	23	22
90	21	21	20	20	19	18	17	16	15	12
100	8									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	8	51	40	1066

10.41 Hurunui River at SH1 Bridge – 165101 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							93	84	74	91	99	46	81
1932	37	30	52	43	31	104	51	35	50	57	51	76	51
1933	35	46	42	28	33	44	40	46	92	49	43	35	44
1934	62	60	36	65	74	64	68	77	68	113	66	44	66
1935	73	62	57	61	73	85	50	41	35	54	40	57	57
1936	48	45	35	42	68	26	49	55	71	135	138	79	66
1937	112	74	85	69	117	67	32	28	37	37	56	60	65
1938	77	60	92	97	55	56	42	48	83	73	82	146	76
1939	97	56	38	25	44	68	48	38	61	66	92	173	67
1940	77	165	116	47	44	45	30	17	23	78	71	49	63
1941	53	108	49	54	33	41	58	49	33	29	55	103	55
1942	80	52	73	383	110	43	89	43	56	122	90	88	102
1943	52	102	56	44	46	36	35	24	69	73	71	63	55
1944	33	51	52	66	58	40	44	36	55	83	107	110	61
1945	114	84	70	64	53	36	34	69	82	55	123	119	75
1946	73	76	38	41	26	26	37	75	62	73	62	140	61
1947	82	54	32	24	16	39	37	43	48	109	82	67	53
1948	73	34	33	52	61	64	45	28	30	86	136	83	61
1949	67	88	67	58	54	70	74	61	31	101	66	76	68
1950	85	40	24	60	56	84	42	54	44	33	36	72	52
1951	52	25	19	40	40	40	65	46	34	80	145	176	64
1952	90	80	61	48	72	99	51	24	24	39	68	67	60
1953	50	56	47	77	109	66	40	40	52	47	95	141	68
1954	84	68	62	72	37	74	48	29	34	33	88	56	57
1955	33	257	132	45	102	57	23	47	40	55	67	51	75
1956	28	42	27	60	49	49	82	36	39	43	99	71	52
1957	58	38	54	70	93	60	79	41	32	114	157	216	85
1958	104	74	71	51	173	94	51	76	52	65	49	68	78
1959	34	24	31	46	50	64	42	62	74	71	93	60	54
1960	33	45	42	28	33	44	40	46	92	49	43	35	44
1961	27	40	52	58	80	58	94	84	74	91	99	46	67
1962	71	29	14	16	44	50	65	52	75	99	85	29	53
1963	24	30	41	34	55	70	90	53	90	47	104	45	57
1964	123	37	56	43	119	46	74	88	81	94	79	76	77
1965	52	54	28	36	53	72	57	60	69	107	115	71	64
1966	62	53	34	44	56	36	50	46	41	38	53	57	48
1967	45	46	68	79	67	36	47	74	49	48	193	108	72
1968	44	61	51	59	56	47	64	52	60	175	134	84	74
1969	43	28	33	56	40	35	39	46	98	45	34	48	46

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	50	27	27	33	29	35	52	88	227	84	59	44	63
1971	32	14	12	12	13	49	42	48	91	178	76	47	51
1972	38	24	37	60	96	45	60	34	91	184	77	54	67
1973	33	18	15	36	85	67	29	61	60	54	102	50	51
1974	37	54	40	142	45	51	89	53	86	94	92	39	68
1975	33	38	105	106	103	107	98	106	102	102	102	48	88
1976	57	68	30	27	48	87	97	70	109	83	64	73	68
1977	108	54	33	27	44	54	92	63	69	76	69	48	62
1978	36	20	22	94	81	79	132	121	136	94	59	51	77
1979	36	40	78	71	144	49	58	111	86	97	77	106	80
1980	133	85	142	93	61	108	56	104	143	98	91	71	99
1981	30	35	39	47	69	88	54	62	87	145	62	69	66
1982	63	37	27	22	58	73	57	68	66	53	125	88	62
1983	74	33	38	72	121	73	92	71	107	147	74	80	82
1984	48	70	87	33	45	47	91	80	50	109	143	104	76
1985	61	29	19	21	26	47	70	63	58	50	57	89	49
1986	49	45	53	72	46	68	79	191	109	125	53	42	78
1987	55	48	99	65	67	110	64	57	49	92	63	80	71
1988	42	47	58	40	85	85	146	93	173	193	98	55	93
1989	36	30	51	45	32	104	61	47	92	76	44	65	57
1990	61	30	32	42	97	48	50	79	40	46	57	81	56
1991	61	90	32	49	52	56	71	148	78	69	71	50	69
1992	48	35	69	36	33	46	102	139	98	99	65	48	68
1993	82	52	24	36	50	112	40	30	52	90	53	119	62
1994	158	34	34	30	79	79	141	98	88	72	287	56	97
1995	49	34	52	59	60	127	94	124	189	150	91	82	93
1996	47	43	45	107	72	65	116	75	102	138	109	69	82
1997	48	74	83	85	57	64	68	85	43	59	74	148	74
1998	43	36	47	63	34	38	134	94	75	176	70	48	72
1999	26	23	39	64	61	96	57	50	46	111	133	39	62
2000	46	38	25	79	52	106	70	120	151	195	49	51	82
2001	54	26	18	28	29	56	37	49	33	42	103	135	51
2002	125	27	57	41	28	173	72	58	107	92	120	88	82
2003	63	60	34	39	63	84	74	33	125	142	84	48	71
2004	65	96	61	40	75	120	48	95	87	100	62	56	75
2005	44	38	50	33	33	37	54	47	47	47	31	32	41
2006	78	34	27	81	45	87							59
Min.	24	14	12	12	13	26	23	17	23	29	31	29	41
Mean	60	53	49	58	61	66	65	65	74	88	86	75	67
Max.	158	257	142	383	173	173	146	191	227	195	287	216	102

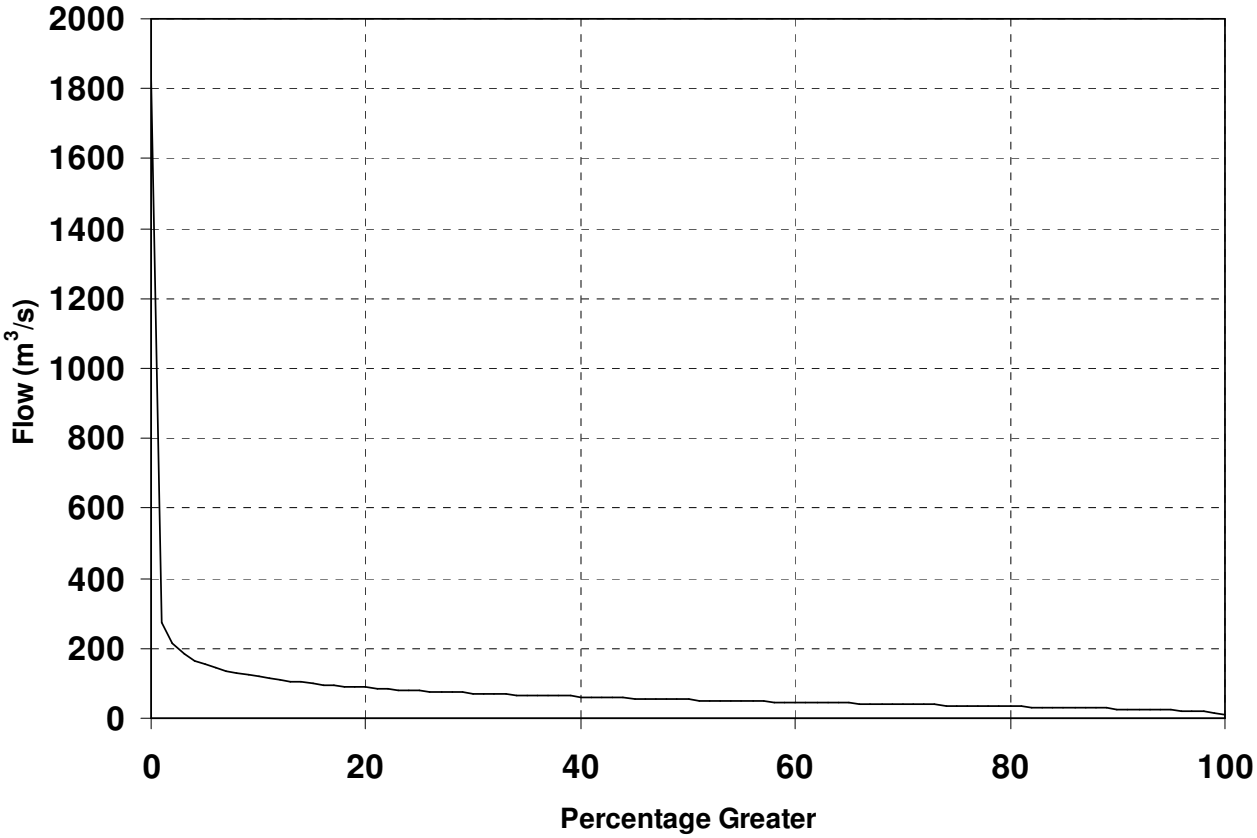

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1828	275	213	182	165	152	143	135	128	122
10	117	113	109	106	102	100	97	94	92	90
20	87	85	83	82	80	78	77	75	74	73
30	72	70	69	68	67	66	65	64	63	62
40	61	60	60	59	58	57	56	55	55	54
50	53	52	51	51	50	49	49	48	47	47
60	46	45	45	44	43	43	42	41	41	40
70	40	39	39	38	37	37	36	36	35	34
80	34	33	32	32	31	30	30	29	28	28
90	27	26	26	25	25	24	22	20	18	15
100	10									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	10	67	53	1828

10.42 Mohaka River at Raupunga – 121801 (Item 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931								78	114	55	38	29	63
1932	28	176	126	67	115	59	66	94	75	77	36	34	79
1933	35	61	65	36	108	90	112	105	110	81	61	56	77
1934	31	84	36	52	78	77	86	103	69	65	57	39	65
1935	26	49	79	157	78	116	91	133	85	54	123	48	87
1936	95	106	85	47	61	76	97	57	65	54	52	55	71
1937	76	40	39	47	52	79	142	76	94	72	62	64	70
1938	40	101	42	178	104	83	178	115	53	42	46	79	88
1939	29	41	32	43	93	77	69	100	92	68	55	76	65
1940	67	65	72	66	93	70	113	108	85	90	103	49	82
1941	59	37	64	77	56	84	116	125	87	107	57	49	77
1942	94	112	58	61	67	126	151	140	105	53	58	77	92
1943	71	54	53	90	156	186	93	105	187	74	99	72	103
1944	108	114	225	48	85	104	116	121	77	66	48	56	98
1945	67	55	36	29	97	86	88	85	81	97	51	30	67
1946	25	16	19	69	97	89	139	103	95	85	54	35	69
1947	50	54	49	121	109	156	159	67	60	68	44	35	81
1948	34	16	15	79	248	124	94	77	66	107	111	49	85
1949	65	27	40	29	127	97	73	147	71	66	58	49	71
1950	43	59	22	80	85	67	140	96	111	145	152	44	87
1951	77	86	126	86	151	79	93	117	56	64	67	55	88
1952	43	69	35	24	41	98	81	131	171	77	126	126	85
1953	76	60	34	61	80	163	84	65	53	64	35	30	67
1954	15	15	47	230	107	79	87	227	93	50	64	92	93
1955	47	43	78	106	82	85	220	125	117	87	53	54	92
1956	41	50	50	73	202	159	147	126	78	91	67	40	94
1957	42	35	46	31	55	120	140	107	88	106	99	71	79
1958	45	124	60	29	66	62	114	125	88	95	84	175	89
1959	65	56	71	115	148	100	105	119	60	141	99	50	94
1960	41	67	76	102	73	122	120	94	112	71	207	163	104
1961	85	55	31	32	59	104	124	120	139	56	32	32	72
1962	30	52	89	72	116	140	205	138	126	129	111	150	114
1963	76	31	23	23	25	111	156	78	115	56	37	59	66
1964	52	28	66	28	34	49	176	103	106	98	69	44	71
1965	52	85	62	43	30	60	87	198	88	42	83	58	74
1966	78	46	49	45	97	78	159	202	114	62	63	68	89
1967	89	135	53	33	34	62	90	129	89	50	80	70	76
1968	45	27	23	44	84	194	178	190	86	91	60	75	92
1969	63	121	43	30	38	40	42	50	70	52	33	52	52

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	31	44	37	45	91	116	72	156	147	121	71	33	81
1971	55	51	71	77	145	93	94	132	189	199	91	106	109
1972	40	31	96	37	61	60	114	66	47	46	29	33	55
1973	35	26	24	34	43	113	57	111	110	71	41	32	58
1974	29	22	39	79	76	154	179	144	102	110	63	64	89
1975	70	36	47	33	63	163	115	103	124	125	79	48	84
1976	199	174	51	80	81	63	85	109	252	109	77	56	111
1977	44	36	35	87	67	161	143	176	191	93	45	51	94
1978	29	33	19	51	37	101	149	90	83	80	79	42	66
1979	26	50	129	84	98	81	71	163	144	129	74	56	92
1980	102	51	133	155	63	124	117	103	105	58	52	160	102
1981	86	41	41	85	103	145	146	152	78	89	70	78	93
1982	42	39	46	96	75	96	74	62	46	62	44	38	60
1983	26	18	17	32	50	80	86	66	70	145	105	55	63
1984	42	52	74	38	37	59	72	69	94	71	37	43	57
1985	37	28	181	75	71	189	201	81	86	33	26	60	90
1986	88	57	51	28	52	47	90	115	145	93	49	40	71
1987	51	34	77	96	48	53	137	78	51	44	56	64	66
1988	39	83	179	39	55	88	135	124	192	94	45	54	94
1989	135	72	30	22	64	126	96	108	174	144	65	53	91
1990	46	33	61	36	61	62	75	206	61	148	81	43	77
1991	30	47	39	42	115	55	61	146	68	72	144	39	72
1992	48	54	37	41	43	79	125	127	70	166	102	113	84
1993	43	74	44	42	68	91	66	47	52	37	47	37	54
1994	28	24	19	25	36	86	108	132	69	114	192	44	73
1995	26	41	40	90	110	78	153	89	96	92	56	47	77
1996	84	73	57	147	95	62	157	98	111	52	40	56	86
1997	65	32	82	48	29	105	172	98	85	87	51	32	74
1998	24	29	29	24	29	47	248	110	66	87	54	67	68
1999	49	24	20	29	65	98	65	75	67	38	64	56	54
2000	34	31	26	59	46	80	182	68	69	142	54	51	71
2001	54	47	43	55	54	50	66	89	63	58	71	148	67
2002	55	44	35	34	40	75	189	134	51	51	33	52	66
2003	34	26	35	29	46	54	54	142	165	121	61	77	70
2004	66	86	65	28	53	108	165	136	59	95	66	39	81
2005	56	29	27	19	49	91	92	44	45	163	54	87	63
2006	52	48	39	74	172	159							91
Min.	15	15	15	19	25	40	42	44	45	33	26	29	52
Mean	55	56	57	62	79	96	118	112	97	86	69	62	79
Max.	199	176	225	230	248	194	248	227	252	199	207	175	114

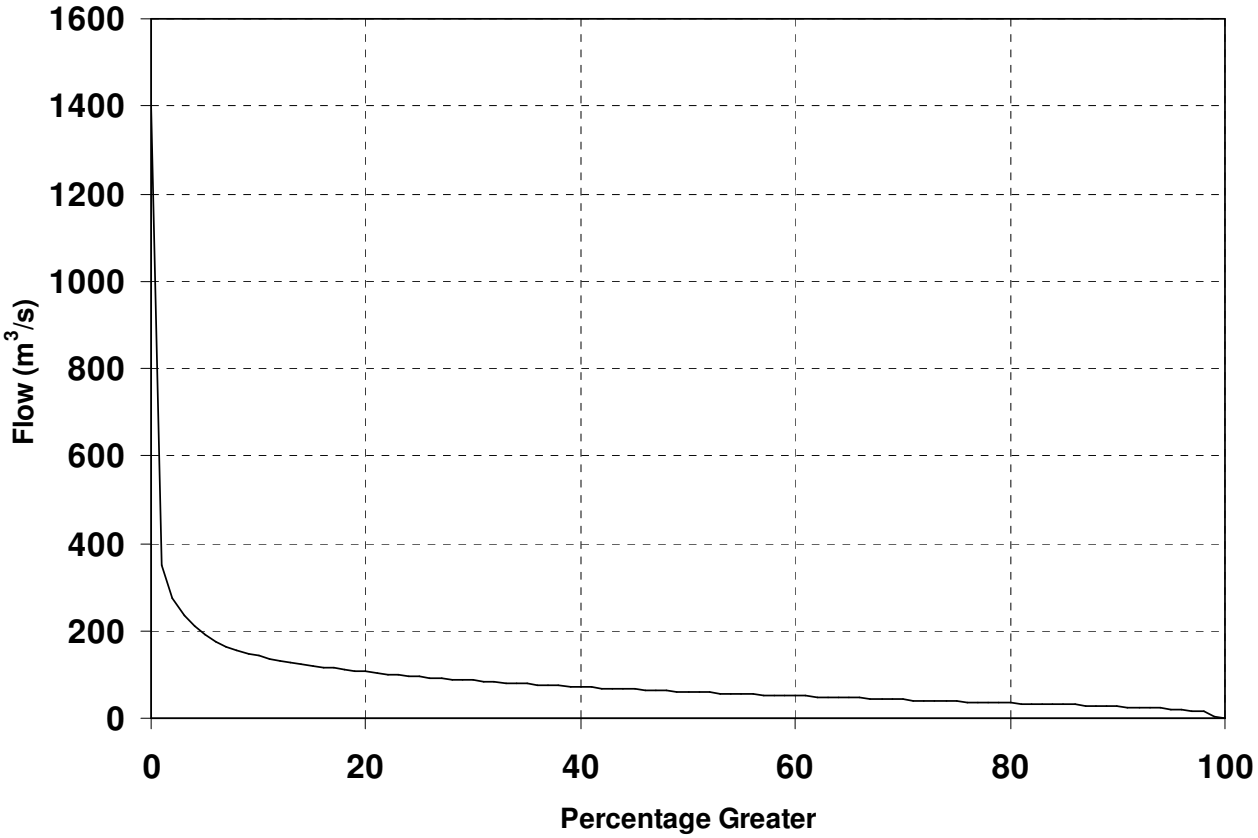

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	1398	350	275	235	210	190	176	165	157	149
10	142	137	132	128	124	120	117	114	111	109
20	106	104	101	99	97	95	93	91	89	88
30	86	84	83	81	79	78	77	75	74	73
40	72	71	69	68	67	66	65	64	63	62
50	61	60	59	58	57	56	55	54	53	52
60	51	50	49	48	48	47	46	45	44	43
70	43	42	41	40	39	39	38	37	36	35
80	35	34	33	32	31	31	30	29	28	27
90	27	26	25	24	23	22	20	17	16	3
100	2									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	2	78	61	1398

10.43 Monowai Inflow – 199540 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							12	8	8	22	18	14	14
1932	21	12	6	11	9	6	4	8	11	13	21	11	11
1933	11	23	18	28	27	4	8	13	15	22	12	14	16
1934	11	4	15	18	20	8	10	15	20	20	9	9	13
1935	29	6	15	11	12	9	5	11	4	18	8	10	12
1936	11	8	9	16	15	6	9	20	20	32	27	14	16
1937	19	11	11	20	13	5	9	7	8	7	11	8	11
1938	15	8	9	7	9	11	4	12	13	25	12	18	12
1939	15	17	4	15	11	16	8	6	14	10	18	21	13
1940	8	36	14	13	17	13	4	9	12	27	12	14	15
1941	14	11	10	13	16	10	9	4	12	9	27	9	12
1942	15	7	16	17	23	11	14	13	19	22	20	13	16
1943	12	17	17	17	12	10	7	5	10	11	14	10	12
1944	8	16	9	18	7	16	11	7	12	20	19	13	13
1945	16	16	28	18	9	5	6	14	15	12	33	13	15
1946	14	31	7	7	5	5	10	18	21	28	10	23	15
1947	9	8	4	4	10	15	8	10	19	16	13	10	10
1948	10	6	17	6	11	8	14	8	19	23	23	23	14
1949	9	25	20	21	7	4	17	13	9	21	9	16	14
1950	22	10	9	9	13	10	11	9	12	8	8	16	11
1951	5	5	5	8	7	4	21	6	16	15	19	10	10
1952	18	21	15	11	16	14	6	3	13	22	6	6	13
1953	2	3	10	21	11	6	10	13	18	7	19	18	12
1954	10	13	19	10	3	20	15	10	11	18	17	8	13
1955	14	15	13	9	18	14	5	11	17	8	15	11	13
1956	7	4	7	18	9	14	10	11	12	11	16	20	11
1957	18	10	9	16	19	11	14	9	7	19	35	29	16
1958	20	33	22	22	35	20	4	9	10	18	12	11	18
1959	5	11	8	9	8	18	9	5	21	11	22	11	11
1960	8	12	6	7	7	19	11	24	12	7	6	8	10
1961	3	5	8	13	11	14	16	16	10	15	19	6	11
1962	8	8	9	8	9	11	14	11	19	11	8	4	10
1963	12	8	7	7	12	12	9	13	11	14	17	8	11
1964	20	6	16	11	19	8	8	13	13	11	17	10	13
1965	5	5	7	6	18	19	10	6	20	18	19	11	12
1966	13	11	12	16	11	11	11	9	8	12	7	14	11
1967	7	10	8	23	15	6	5	11	8	12	24	20	12
1968	10	10	17	9	9	5	10	11	17	28	21	16	14
1969	9	6	11	14	8	10	12	13	15	18	5	12	11

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	7	8	8	15	5	7	18	15	27	16	9	13	12
1971	3	3	9	10	10	16	4	9	25	21	17	11	12
1972	9	7	20	15	14	16	14	7	31	14	15	7	14
1973	5	7	4	16	19	10	4	6	10	17	15	8	10
1974	5	8	4	5	7	14	18	8	9	12	8	4	9
1975	5	6	10	24	19	12	16	17	14	13	7	12	13
1976	7	6	5	4	13	22	14	11	7	10	15	8	10
1977	12	13	4	18	23	15	8	6	15	22	14	7	13
1978	8	5	6	9	15	7	14	22	14	16	13	10	12
1979	21	13	5	15	23	12	13	10	22	13	5	14	14
1980	19	14	11	7	16	23	12	29	27	16	18	6	16
1981	7	6	5	13	9	8	11	10	20	24	7	13	11
1982	16	10	8	9	24	9	12	20	10	20	39	13	16
1983	31	8	15	13	14	17	14	15	21	10	8	15	15
1984	21	10	7	16	16	13	9	15	13	23	10	12	14
1985	17	6	4	14	13	12	12	11	12	8	7	8	10
1986	13	17	10	15	14	22	17	15	16	21	10	11	15
1987	11	24	24	14	12	20	19	13	20	27	6	7	16
1988	9	16	9	9	12	19	19	18	26	41	22	8	17
1989	7	8	14	9	8	18	10	5	4	9	12	14	10
1990	10	5	5	14	28	16	11	7	9	16	6	21	12
1991	13	24	6	14	13	12	7	24	14	23	16	8	14
1992	9	15	17	11	10	7	19	16	10	17	12	9	13
1993	20	11	6	7	10	20	13	11	13	24	12	14	13
1994	16	10	10	14	19	13	23	21	16	12	31	13	17
1995	10	4	18	5	20	14	11	17	26	22	13	19	15
1996	10	8	5	14	17	21	12	11	15	27	16	11	14
1997	9	12	11	17	11	8	12	23	9	17	33	21	15
1998	8	19	23	23	9	16	11	15	21	26	7	10	16
1999	6	3	11	12	14	10	12	8	8	15	32	6	11
2000	6	10	6	9	22	24	11	9	16	25	7	25	14
2001	8	5	9	9	7	18	4	10	9	11	15	17	10
2002	8	7	14	7	10	24	10	15	29	14	17	22	15
2003	8	11	5	3	16	22	12	11	22	15	23	16	14
2004	15	18	13	9	17	25	7	11	16	10	16	11	14
2005	12	13	21	8	15	9	12	12	10	7	9	7	11
2006	23	5	10	12	8	8							11
Min.	2	3	4	3	3	4	4	3	4	7	5	4	9
Mean	12	11	11	13	14	13	11	12	15	17	15	13	13
Max.	31	36	28	28	35	25	23	29	31	41	39	29	18

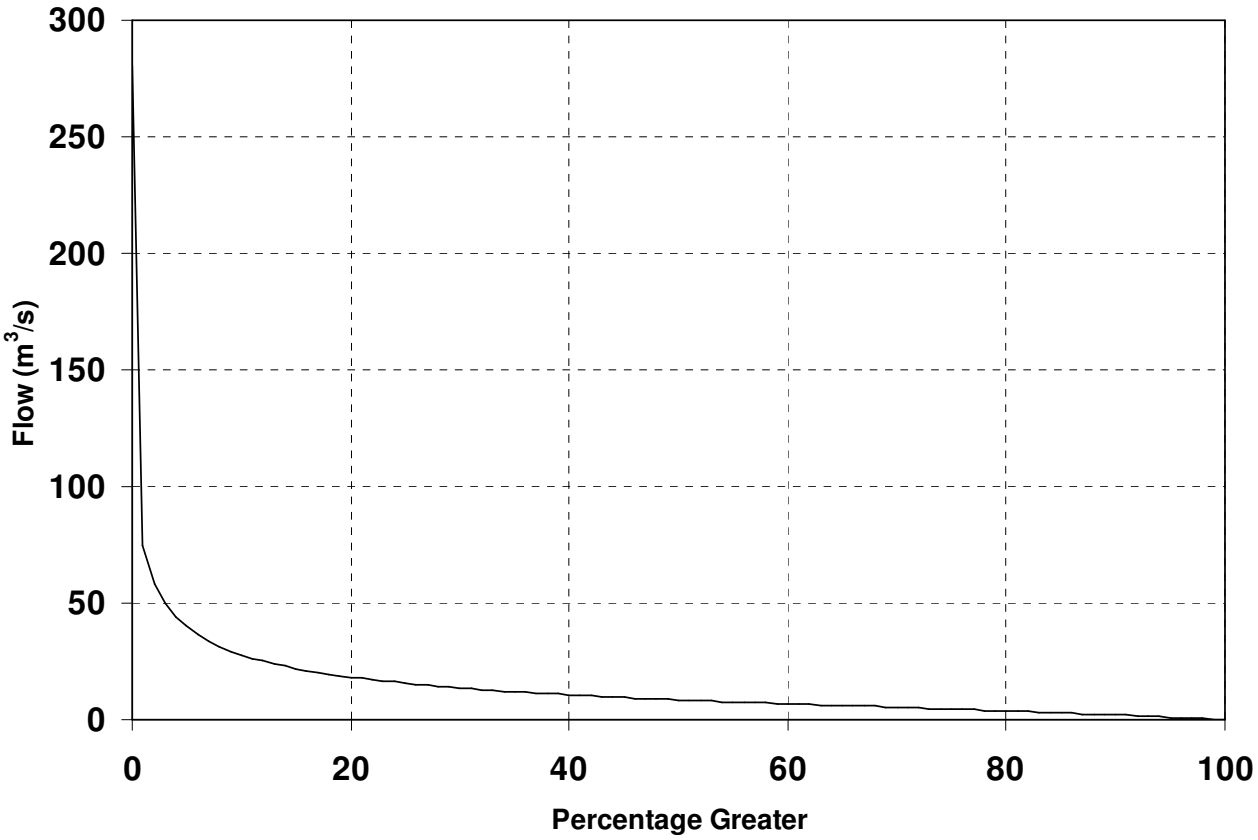

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	281	75	58	50	44	40	36	34	31	29
10	28	26	25	24	23	22	21	20	20	19
20	18	18	17	17	16	16	15	15	14	14
30	14	13	13	13	12	12	12	11	11	11
40	11	10	10	10	10	10	9	9	9	9
50	9	8	8	8	8	8	7	7	7	7
60	7	7	7	6	6	6	6	6	6	5
70	5	5	5	5	5	5	4	4	4	4
80	4	4	4	3	3	3	3	3	2	2
90	2	2	2	2	1	1	1	1	1	0
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	13	9	281

10.44 Wheao Outflow – 15462 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							12	14	15	15	14	13	14
1932	12	11	10	10	10	10	11	10	10	11	11	10	11
1933	10	10	11	11	12	12	12	12	13	12	11	10	11
1934	10	10	10	10	10	10	11	13	12	12	13	12	11
1935	11	11	11	10	11	15	17	18	18	17	19	18	15
1936	18	19	19	16	15	13	14	14	16	16	15	13	16
1937	14	13	12	11	13	14	12	11	11	10	10	10	12
1938	10	10	10	10	11	11	11	12	13	12	13	12	11
1939	12	11	10	10	10	10	10	11	14	13	11	12	11
1940	11	14	17	13	11	11	11	10	10	11	12	11	12
1941	11	11	11	11	10	10	11	12	13	16	17	15	12
1942	14	13	12	13	13	12	14	16	19	20	19	18	15
1943	15	12	11	10	10	11	16	17	18	20	19	16	15
1944	13	11	12	11	11	10	11	12	13	13	13	12	12
1945	14	14	14	13	13	13	14	15	17	18	18	15	15
1946	12	10	10	10	11	10	10	14	17	19	18	17	13
1947	14	12	10	10	10	10	14	14	15	17	17	14	13
1948	13	11	10	10	11	13	16	15	14	13	14	13	13
1949	12	11	10	10	13	14	15	15	14	12	11	11	12
1950	10	10	10	10	10	10	10	10	10	10	11	10	10
1951	10	10	10	10	10	10	11	11	11	10	12	13	11
1952	12	11	10	10	10	13	16	14	13	13	18	19	13
1953	18	16	13	11	12	15	18	18	17	17	15	14	15
1954	12	11	11	10	10	10	10	12	13	11	10	10	11
1955	10	10	10	10	10	11	12	14	14	14	13	12	12
1956	13	13	11	12	17	20	20	19	19	18	18	17	16
1957	16	14	12	11	11	11	13	11	11	11	11	11	12
1958	11	12	14	11	11	11	12	14	14	12	16	17	13
1959	19	17	17	18	16	16	16	15	13	15	15	14	16
1960	12	12	12	11	10	12	13	13	13	15	14	12	12
1961	11	11	11	10	10	10	11	11	11	11	11	11	11
1962	10	10	13	12	16	18	19	19	19	20	21	22	17
1963	19	17	15	13	11	12	16	15	17	16	13	12	15
1964	11	11	11	11	10	10	16	18	18	19	18	16	14
1965	15	18	17	15	13	13	14	16	15	13	14	13	15
1966	15	15	16	13	15	15	18	19	18	18	17	17	16
1967	16	19	17	14	13	12	12	14	16	14	15	16	15
1968	14	13	11	11	12	15	17	16	17	16	15	15	14
1969	15	16	14	12	12	11	11	11	12	11	10	11	12

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	11	10	10	10	10	12	12	17	19	21	20	17	14
1971	15	13	12	11	14	14	12	13	18	19	19	20	15
1972	18	15	17	14	14	13	15	14	15	14	12	11	14
1973	11	10	10	10	10	10	10	10	12	13	12	11	11
1974	10	10	10	11	10	12	16	19	18	17	17	17	14
1975	18	16	13	12	11	16	15	15	18	18	17	15	15
1976	16	18	16	14	14	13	14	16	16	17	16	14	15
1977	12	11	10	10	10	12	15	15	15	14	13	12	12
1978	11	10	10	10	10	10	10	10	11	10	12	11	10
1979	10	11	13	13	13	13	12	15	17	18	18	17	14
1980	17	15	14	14	13	13	14	14	17	15	13	15	15
1981	15	13	12	11	12	14	17	17	17	15	16	17	15
1982	16	14	13	12	12	12	11	11	11	11	10	10	12
1983	10	10	10	10	10	10	10	10	10	14	18	15	11
1984	12	12	13	12	11	10	11	11	12	11	11	12	11
1985	11	11	10	10	10	10	10	11	11	10	10	11	10
1986	15	12	11	10	10	11	11	13	14	14	13	12	12
1987	12	11	11	11	10	11	11	11	11	10	10	10	11
1988	10	10	10	10	10	10	11	14	18	18	17	17	13
1989	19	17	15	12	12	14	15	13	13	16	16	14	15
1990	13	12	12	11	12	12	12	17	15	16	18	16	14
1991	13	13	12	11	10	10	10	15	15	15	14	12	12
1992	11	11	11	10	10	10	11	16	16	15	13	16	13
1993	13	12	11	11	10	13	12	11	10	10	10	10	11
1994	10	10	9	10	10	10	13	18	15	17	18	16	13
1995	13	12	11	13	12	13	18	18	18	19	18	17	15
1996	16	14	13	14	15	15	16	17	18	16	14	14	15
1997	13	12	12	12	11	14	13	11	11	13	12	11	12
1998	10	10	10	10	10	10	19	19	18	18	17	15	14
1999	13	11	12	12	12	13	12	13	13	13	13	12	12
2000	12	12	11	11	11	11	11	12	13	13	13	13	12
2001	12	12	11	11	11	11	11	11	12	11	12	17	12
2002	12	12	11	11	11	12	17	13	11	11	11	12	12
2003	11	10	10	10	10	10	11	10	12	17	13	16	12
2004	16	13	14	12	11	15	18	19	19	19	20	15	16
2005	17	12	12	12	11	11	11	11	11	12	12	11	12
2006	11	12	11	11	12	13							12
Min.	10	10	9	10	10	10	10	10	10	10	10	10	10
Mean	13	12	12	11	11	12	13	14	14	15	14	14	13
Max.	19	19	19	18	17	20	20	19	19	21	21	22	17

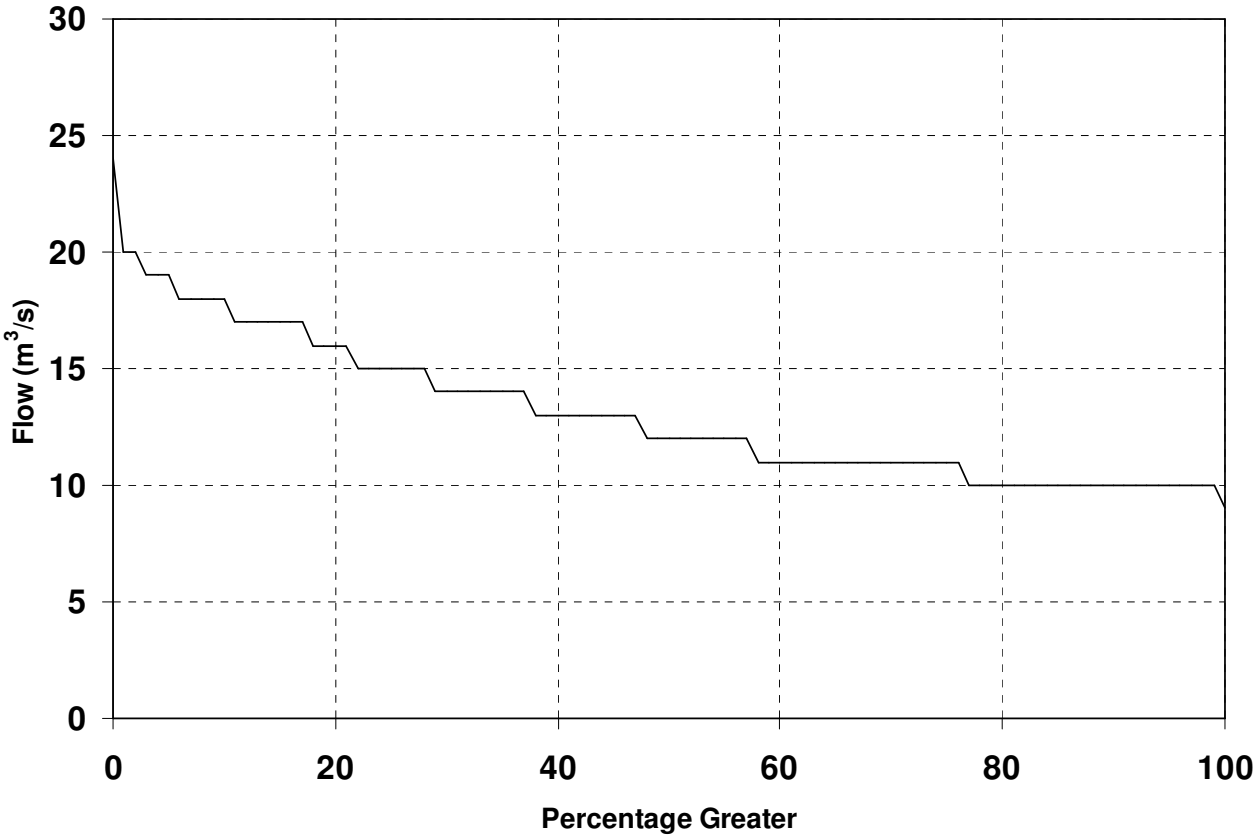

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	24	20	20	19	19	19	18	18	18	18
10	18	17	17	17	17	17	17	17	16	16
20	16	16	15	15	15	15	15	15	15	14
30	14	14	14	14	14	14	14	14	13	13
40	13	13	13	13	13	13	13	13	12	12
50	12	12	12	12	12	12	12	12	11	11
60	11	11	11	11	11	11	11	11	11	11
70	11	11	11	11	11	11	11	10	10	10
80	10	10	10	10	10	10	10	10	10	10
90	10	10	10	10	10	10	10	10	10	10
100	9									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	9	13	12	24

10.45 Patea Outflow – 34300 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							35	33	34	19	21	15	26
1932	7	10	5	9	8	30	14	10	6	24	5	1	11
1933	5	11	20	7	33	12	19	28	13	5	11	5	14
1934	1	13	4	10	9	17	29	27	13	21	20	9	14
1935	2	16	7	10	26	49	38	53	25	31	54	18	27
1936	34	52	17	20	15	12	35	31	33	23	22	14	26
1937	32	10	10	8	31	14	11	7	1	7	4	9	12
1938	8	28	1	26	10	11	16	28	21	8	26	14	16
1939	10	2	1	7	4	23	15	42	27	12	6	20	14
1940	27	36	16	7	10	7	2	6	7	19	27	4	14
1941	19	6	23	4	1	20	23	23	17	44	28	23	19
1942	16	14	18	18	23	7	48	32	61	41	20	27	27
1943	9	11	3	12	8	38	38	31	45	38	20	11	22
1944	4	18	16	9	12	13	23	27	23	24	9	20	16
1945	29	14	21	12	24	27	28	39	32	27	19	11	24
1946	7	3	8	21	15	5	20	53	37	34	29	11	20
1947	13	4	4	7	2	42	35	22	27	49	9	17	19
1948	16	2	1	16	38	26	41	26	13	43	28	7	21
1949	9	8	6	14	24	48	43	28	12	15	15	7	19
1950	1	12	1	8	5	12	12	18	15	12	28	7	11
1951	10	6	5	7	9	8	37	11	5	29	43	32	17
1952	13	15	2	9	13	52	31	22	11	25	59	44	25
1953	15	12	4	7	29	42	51	36	28	36	27	10	25
1954	5	5	12	7	7	13	14	26	21	2	4	14	11
1955	3	10	1	14	37	31	26	35	27	26	15	18	20
1956	19	11	1	32	25	55	49	45	23	40	33	30	30
1957	12	3	15	2	28	13	14	9	5	29	30	28	16
1958	5	28	14	1	16	19	26	41	9	12	17	48	20
1959	20	14	18	21	19	17	12	13	10	28	13	6	16
1960	4	23	6	1	8	29	30	25	30	14	8	1	15
1961	14	4	4	11	1	9	34	13	24	11	3	9	12
1962	15	6	26	17	26	39	30	37	39	51	40	36	30
1963	12	13	3	6	11	28	36	15	45	7	9	6	16
1964	12	8	21	1	2	6	43	42	43	49	20	33	24
1965	18	24	20	9	6	26	18	40	12	9	34	20	20
1966	18	23	15	14	21	25	39	24	27	13	18	25	22
1967	16	17	13	2	10	5	8	39	16	5	31	27	16
1968	5	4	1	5	18	36	21	21	11	26	12	16	15
1969	16	21	4	5	15	7	5	13	31	8	3	15	12

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	3	1	5	9	14	33	24	37	53	36	29	13	21
1971	18	19	2	2	16	26	14	30	49	53	35	24	24
1972	11	3	37	4	17	8	36	21	26	18	11	6	17
1973	9	2	3	2	10	17	2	22	31	7	19	12	11
1974	1	3	1	10	15	18	46	31	22	30	12	23	18
1975	17	1	7	9	31	19	17	24	25	40	9	2	17
1976	16	13	3	5	38	46	48	48	20	17	3	11	22
1977	7	9	6	4	35	51	38	38	27	13	11	7	21
1978	1	0	0	8	17	17	49	34	24	12	13	4	15
1979	1	7	8	14	36	4	14	29	23	32	14	16	17
1980	25	1	11	27	13	32	43	33	50	13	9	12	22
1981	1	2	2	7	5	38	35	35	19	26	5	11	16
1982	4	3	2	4	21	25	13	8	33	12	7	26	13
1983	6	1	1	15	25	7	13	14	35	28	21	5	14
1984	2	5	18	13	11	8	28	17	13	6	9	23	13
1985	10	4	8	8	4	28	15	13	17	9	9	24	12
1986	39	17	4	5	19	14	25	26	21	24	3	1	17
1987	12	2	7	25	14	13	14	4	12	23	6	29	14
1988	1	1	2	2	20	21	36	48	42	44	9	13	20
1989	8	16	2	2	17	50	30	11	20	40	11	9	18
1990	32	10	36	15	24	37	46	51	24	20	38	7	28
1991	6	14	1	18	5	12	25	57	20	16	4	1	15
1992	2	21	4	1	18	10	43	49	37	29	5	7	19
1993	9	1	1	10	21	31	6	3	16	10	9	7	10
1994	2	1	6	15	24	50	40	52	32	31	49	3	26
1995	1	3	15	43	21	51	54	30	41	41	29	25	30
1996	16	17	15	33	22	19	42	39	50	25	23	30	28
1997	13	12	4	6	10	14	10	14	20	19	14	13	12
1998	12	13	5	6	17	24	57	29	23	47	27	16	23
1999	15	2	11	1	20	35	28	38	18	3	21	16	17
2000	4	1	2	11	26	31	15	12	38	36	1	7	15
2001	1	2	1	2	11	20	14	46	2	15	40	37	16
2002	12	15	5	4	14	38	32	33	40	20	17	18	21
2003	4	2	1	6	18	38	48	3	41	38	17	22	20
2004	18	61	23	12	23	55	26	42	25	30	6	13	28
2005	14	1	7	9	31	23	33	16	14	44	2	18	18
2006	2	2	1	9	13	29							9
Min.	1	0	0	1	1	4	2	3	1	2	1	1	10
Mean	11	11	8	10	17	25	28	28	25	24	18	16	19
Max.	39	61	37	43	38	55	57	57	61	53	59	48	30

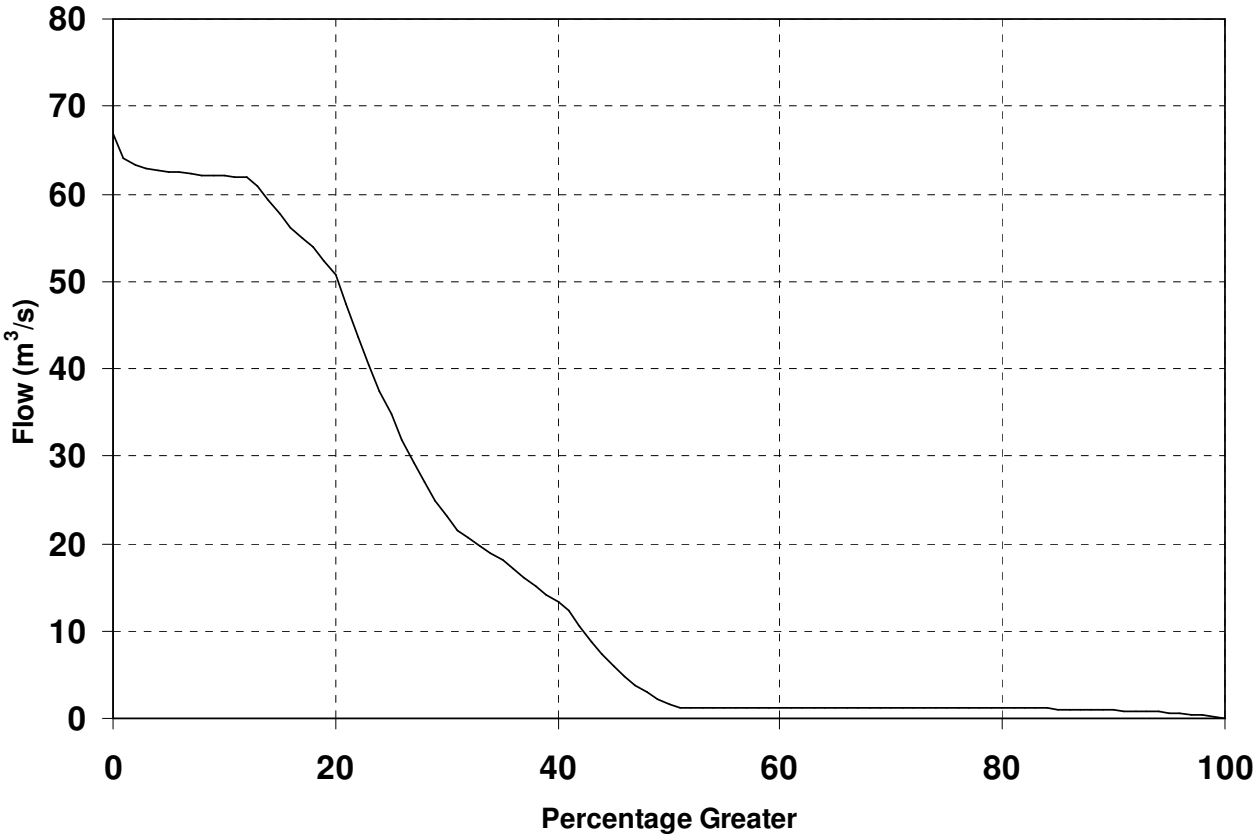

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	67	64	63	63	63	63	62	62	62	62
10	62	62	62	61	59	58	56	55	54	52
20	51	47	44	40	37	35	32	29	27	25
30	23	22	21	20	19	18	17	16	15	14
40	13	12	11	9	7	6	5	4	3	2
50	2	1	1	1	1	1	1	1	1	1
60	1	1	1	1	1	1	1	1	1	1
70	1	1	1	1	1	1	1	1	1	1
80	1	1	1	1	1	1	1	1	1	1
90	1	1	1	1	1	1	1	0	0	0
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	19	2	67

10.46 Highbank Outflow – 7968 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							25	23	24	19	8	5	17
1932	1	0	0	16	23	11	9	12	23	19	8	5	11
1933	1	0	0	15	22	12	14	16	22	19	8	5	11
1934	1	0	0	19	25	25	25	25	24	19	8	5	15
1935	1	0	1	15	25	25	24	21	20	19	8	5	14
1936	1	0	1	15	25	22	23	25	24	19	8	5	14
1937	1	0	1	15	25	25	23	9	10	18	8	5	12
1938	1	0	1	15	23	22	22	21	24	19	8	5	14
1939	1	0	0	9	12	20	14	14	24	19	8	5	11
1940	1	0	0	16	25	25	17	11	19	19	8	5	12
1941	1	0	1	15	25	25	25	25	24	19	8	5	14
1942	1	0	1	15	25	23	25	25	23	19	8	5	14
1943	1	0	1	19	23	23	24	18	23	19	8	5	14
1944	1	0	1	15	24	22	25	25	23	19	8	5	14
1945	1	0	1	15	25	23	21	24	24	19	8	5	14
1946	1	0	1	15	25	18	19	25	24	19	8	5	14
1947	1	0	0	11	10	20	23	23	24	19	8	5	12
1948	1	0	0	14	23	24	25	19	14	19	8	5	13
1949	1	0	1	16	23	25	25	25	23	18	8	4	14
1950	1	0	0	12	12	24	20	25	24	19	8	5	13
1951	1	0	0	15	14	26	25	25	24	20	20	20	16
1952	8	5	19	17	25	27	27	26	26	24	26	26	21
1953	21	25	23	26	27	26	25	22	25	25	23	21	24
1954	20	20	20	22	25	26	26	26	26	22	21	23	23
1955	17	21	22	17	26	22	24	26	22	23	16	15	21
1956	10	15	16	24	21	26	23	26	22	24	24	20	21
1957	0	0	12	25	15	25	26	26	25	23	20	19	18
1958	8	8	6	11	22	21	19	21	10	17	10	9	14
1959	0	6	12	21	25	23	24	24	16	11	0	0	14
1960	0	0	0	2	23	25	23	25	23	22	17	17	15
1961	9	8	1	17	22	24	24	24	23	14	9	9	15
1962	9	8	7	9	7	24	24	24	23	14	9	8	14
1963	7	5	3	8	12	23	23	23	23	14	6	8	13
1964	4	0	0	0	3	23	24	24	20	8	10	7	10
1965	7	10	4	20	23	23	23	23	22	11	18	9	16
1966	4	4	13	18	23	23	23	23	21	16	12	9	16
1967	4	1	0	9	14	23	23	22	20	14	17	11	13
1968	4	0	11	18	21	22	21	21	12	17	8	8	14
1969	5	0	0	1	11	23	22	22	18	1	1	11	10

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	12	3	12	14	22	22	22	20	17	0	0	0	12
1971	0	0	2	11	17	22	21	21	17	15	12	5	12
1972	3	3	6	16	5	20	20	20	15	15	9	11	12
1973	4	3	0	0	0	20	20	20	19	10	8	6	9
1974	4	11	18	17	20	19	20	20	19	18	13	4	15
1975	4	6	18	18	20	19	19	17	18	16	14	2	14
1976	5	2	1	10	15	19	19	19	16	9	0	0	10
1977	0	0	0	3	20	21	21	21	21	15	2	0	10
1978	0	0	1	16	25	25	25	25	24	23	15	13	16
1979	7	0	11	23	7	25	24	24	22	21	13	10	16
1980	13	0	0	0	21	25	25	25	14	5	14	11	13
1981	2	0	5	9	25	25	26	25	19	15	9	0	13
1982	0	0	0	15	9	24	25	25	15	17	9	4	12
1983	1	0	4	9	0	0	0	4	24	24	10	12	7
1984	5	0	0	6	23	26	27	26	17	0	1	4	11
1985	0	0	0	0	15	26	26	26	22	1	3	13	11
1986	4	0	20	16	17	26	26	27	26	25	12	4	17
1987	0	0	3	10	26	26	26	26	18	9	2	2	12
1988	0	0	0	0	12	25	26	26	11	1	0	0	8
1989	0	0	0	0	24	26	25	21	13	7	0	0	10
1990	0	0	0	0	6	26	25	26	22	13	8	1	11
1991	0	3	1	7	22	21	18	24	24	8	7	5	12
1992	4	0	0	0	12	16	19	25	25	25	9	7	12
1993	1	0	0	0	9	25	24	21	13	6	0	0	8
1994	0	0	0	0	2	26	26	26	15	21	2	0	10
1995	0	0	0	16	25	24	24	24	24	25	11	1	15
1996	0	13	18	21	2	24	23	25	17	5	4	0	13
1997	6	9	8	19	23	23	23	24	21	12	0	0	14
1998	0	0	4	0	20	25	25	25	24	19	8	5	13
1999	1	0	1	16	25	25	25	25	24	19	8	5	15
2000	1	0	1	15	25	25	25	25	24	19	8	5	15
2001	1	0	1	14	23	25	25	25	24	19	8	5	14
2002	1	0	1	15	25	23	25	23	12	10	9	1	12
2003	0	0	1	23	27	20	27	26	22	19	3	0	14
2004	0	2	1	2	5	26	27	22	24	23	1	0	11
2005	0	0	0	15	21	20	19	21	15	11	0	0	10
2006	0	0	0	5	26	26							10
Min.	0	0	0	0	0	0	0	4	10	0	0	0	7
Mean	3	3	4	12	19	23	23	22	21	16	9	7	13
Max.	21	25	23	26	27	27	27	27	26	25	26	26	24

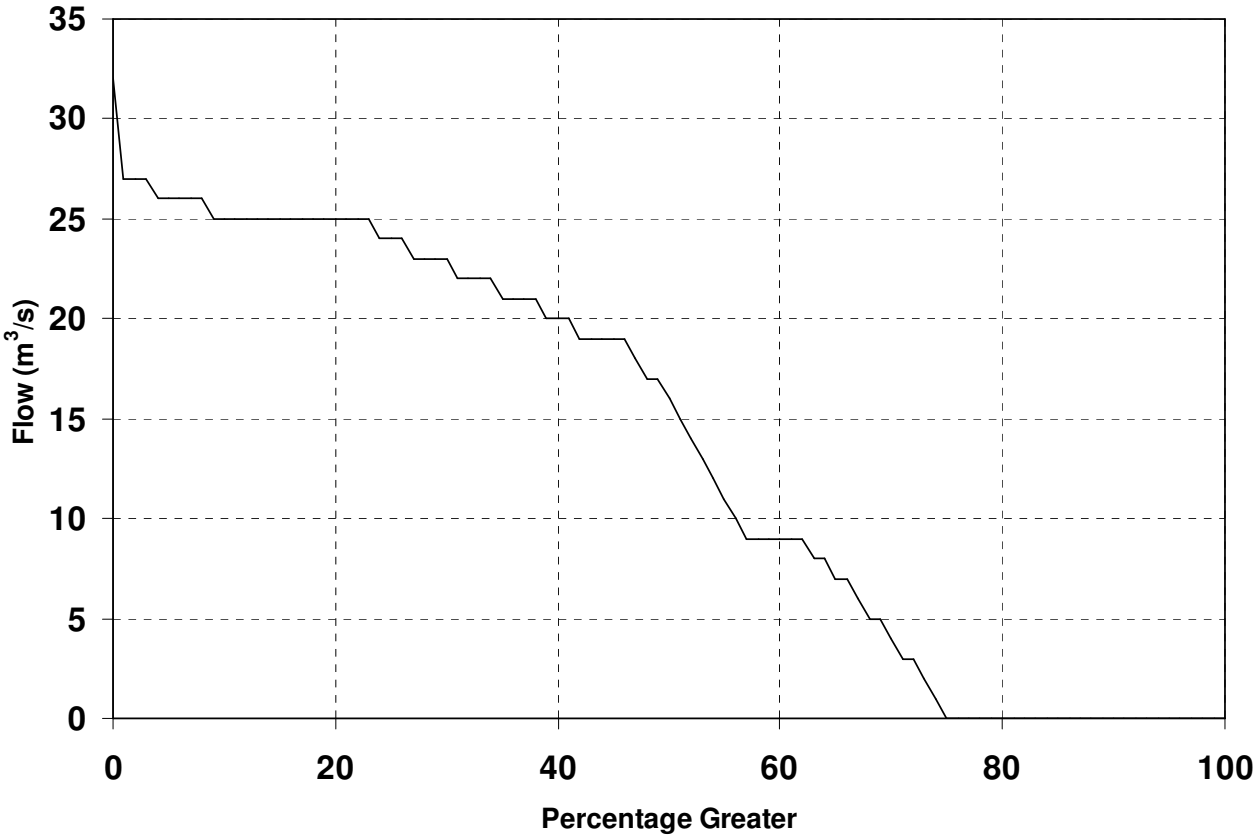

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	32	27	27	27	26	26	26	26	26	25
10	25	25	25	25	25	25	25	25	25	25
20	25	25	25	25	24	24	24	23	23	23
30	23	22	22	22	22	21	21	21	21	20
40	20	20	19	19	19	19	19	18	17	17
50	16	15	14	13	12	11	10	9	9	9
60	9	9	9	8	8	7	7	6	5	5
70	4	3	3	2	1	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	13	16	32

10.47 Kaimai Outflow – 14130 (Item: 1)

Flow (m^3/s)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1931							15	14	15	13	13	12	13
1932	10	9	8	10	9	14	11	10	11	13	10	9	10
1933	10	12	11	11	14	10	12	13	12	10	10	9	11
1934	8	9	8	9	10	12	14	12	11	13	13	11	11
1935	9	12	11	10	13	16	15	16	13	14	16	12	13
1936	15	16	12	12	12	11	14	14	14	13	13	11	13
1937	14	10	11	11	14	12	11	10	11	10	10	10	11
1938	9	12	7	13	11	12	12	13	13	10	13	12	11
1939	12	9	8	8	7	12	11	15	13	10	10	12	11
1940	12	15	12	9	10	11	10	10	11	13	13	10	11
1941	10	9	12	9	7	12	12	13	13	15	14	11	12
1942	11	11	10	12	13	10	16	14	18	15	12	13	13
1943	9	7	9	11	9	15	15	14	16	15	12	11	12
1944	9	10	11	10	11	10	12	13	13	12	11	12	11
1945	14	11	12	10	13	12	14	15	14	14	13	10	13
1946	9	7	9	12	11	11	12	17	15	15	14	11	12
1947	12	9	7	9	9	15	14	13	14	16	11	12	12
1948	11	7	7	10	15	13	15	13	12	15	14	11	12
1949	11	10	9	10	13	16	16	14	12	12	12	10	12
1950	8	11	7	8	10	11	11	12	12	11	13	10	10
1951	10	10	9	10	9	10	15	11	10	13	16	14	11
1952	11	12	8	9	11	17	14	13	11	13	18	16	13
1953	12	11	9	10	14	15	17	15	13	15	14	12	13
1954	10	9	10	9	11	11	12	13	13	10	10	11	11
1955	9	10	8	10	15	14	13	15	13	14	12	12	12
1956	12	10	8	14	13	18	17	16	13	15	14	14	14
1957	12	9	12	9	13	12	13	11	11	13	14	14	12
1958	10	14	12	9	12	13	13	15	11	11	12	17	12
1959	13	11	12	13	12	12	11	12	10	14	12	10	12
1960	8	13	9	8	10	14	13	13	14	12	11	9	11
1961	9	9	8	10	8	11	14	11	13	11	9	10	10
1962	11	9	13	12	14	16	14	15	15	17	15	15	14
1963	11	11	8	9	10	14	15	12	16	10	10	9	11
1964	11	9	12	8	9	10	16	15	16	16	13	14	13
1965	12	13	12	11	10	13	12	14	11	10	14	13	12
1966	12	12	11	10	12	12	15	13	14	11	12	13	12
1967	11	12	11	9	9	10	11	15	12	10	14	13	11
1968	9	9	7	8	10	15	13	13	12	13	12	12	11
1969	11	12	8	8	11	10	10	11	14	10	10	12	11

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1970	9	5	9	8	11	15	13	15	17	15	14	10	12
1971	12	11	9	8	11	13	11	14	16	17	14	13	13
1972	10	9	15	9	12	10	15	13	13	12	11	10	12
1973	10	8	9	7	11	12	9	13	14	10	12	11	10
1974	8	9	7	9	11	12	16	14	13	14	11	13	11
1975	12	8	9	10	13	15	14	15	15	15	13	11	13
1976	14	12	11	10	12	13	15	15	14	13	11	12	13
1977	11	10	9	8	12	16	15	14	13	13	11	11	12
1978	9	8	6	10	8	9	14	12	12	11	12	11	10
1979	8	11	13	11	13	11	11	14	13	15	14	12	12
1980	14	10	12	13	11	12	13	13	15	12	13	14	13
1981	11	10	10	10	11	15	15	14	13	13	14	13	12
1982	10	11	10	9	12	12	10	11	12	11	10	12	11
1983	9	8	8	11	11	11	11	11	13	16	13	12	11
1984	10	11	13	9	10	10	14	13	12	11	11	13	11
1985	11	9	9	9	9	13	12	11	12	10	11	13	11
1986	16	12	9	8	12	11	13	14	13	13	11	10	12
1987	11	8	11	12	11	11	10	11	12	13	11	13	11
1988	9	9	10	9	11	13	13	16	15	16	14	13	12
1989	15	13	10	9	11	15	13	11	12	17	13	11	13
1990	11	10	12	11	13	11	13	17	12	13	13	10	12
1991	10	12	9	10	10	9	13	16	15	13	11	10	12
1992	12	10	10	9	9	11	15	16	14	13	12	14	12
1993	10	9	9	9	11	14	10	10	10	10	12	10	10
1994	10	9	6	9	11	13	15	16	14	15	16	11	12
1995	10	11	12	15	12	14	17	14	15	15	14	14	14
1996	12	12	12	15	13	12	16	15	17	14	13	14	14
1997	11	11	9	10	10	12	11	11	12	13	12	11	11
1998	10	11	10	10	11	13	18	14	13	17	13	12	13
1999	11	9	10	10	12	13	13	13	13	11	15	12	12
2000	11	9	8	11	11	13	12	12	13	15	11	12	12
2001	10	12	9	9	13	11	11	12	10	12	14	16	12
2002	12	9	9	9	10	14	14	12	13	12	11	13	12
2003	9	8	9	8	11	12	11	10	14	15	12	13	11
2004	10	16	12	10	12	15	14	15	13	15	13	13	13
2005	13	10	10	7	11	11	13	11	12	16	9	13	11
2006	11	11	9	13	13	13							11
Min.	8	5	6	7	7	9	9	10	10	10	9	9	10
Mean	11	10	10	10	11	13	13	13	13	13	12	12	12
Max.	16	16	15	15	15	18	18	17	18	17	18	17	14

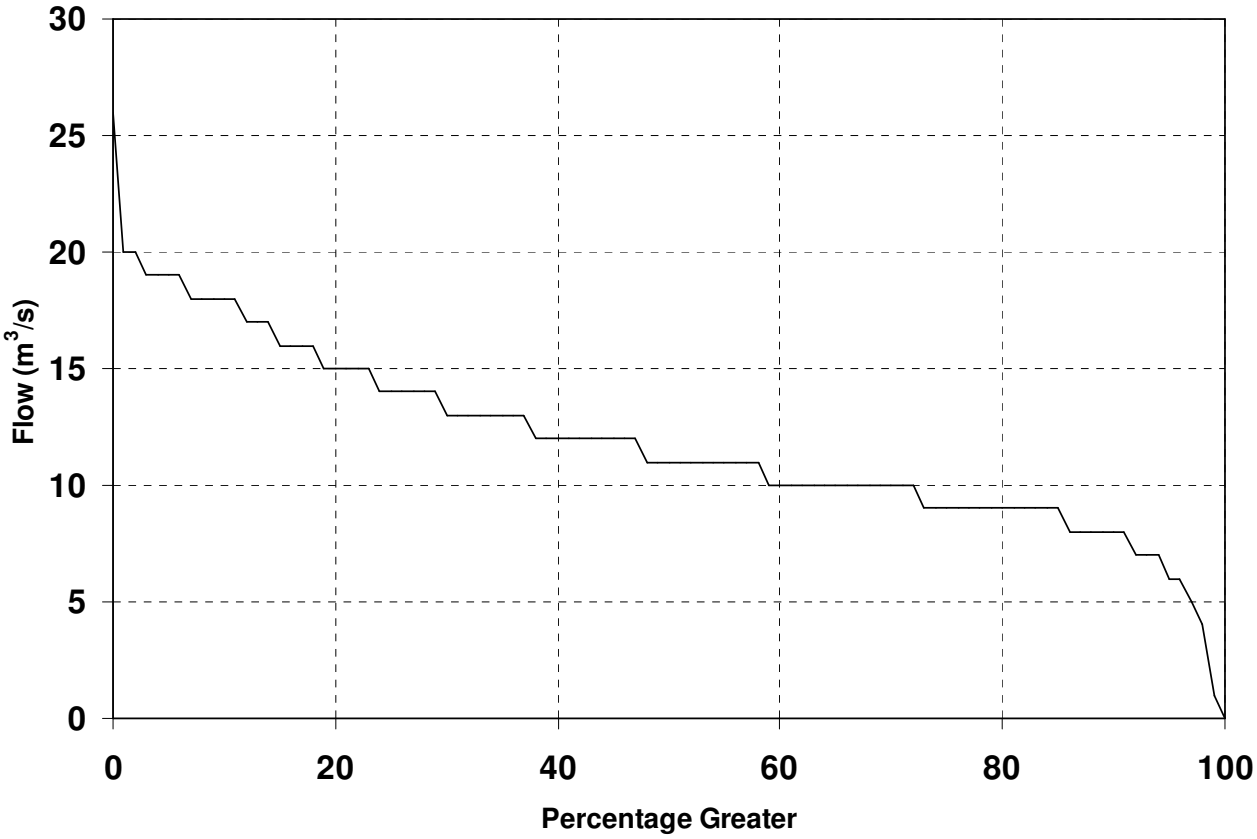

Figure depicting Percentage Exceedance graph.

Table Depicting Percentage Exceedance: Flow (m^3/s).

	0	1	2	3	4	5	6	7	8	9
0	26	20	20	19	19	19	19	18	18	18
10	18	18	17	17	17	16	16	16	16	15
20	15	15	15	15	14	14	14	14	14	14
30	13	13	13	13	13	13	13	13	12	12
40	12	12	12	12	12	12	12	12	11	11
50	11	11	11	11	11	11	11	11	11	10
60	10	10	10	10	10	10	10	10	10	10
70	10	10	10	9	9	9	9	9	9	9
80	9	9	9	9	9	9	8	8	8	8
90	8	8	7	7	7	6	6	5	4	1
100	0									

Note: 0% is the maximum flow and 100% is the minimum flow.

Summary Table: Flow (m^3/s)

Record Length	Minimum	Mean	Median	Maximum
Jul 1931 to Jun 2006	0	12	11	26

Spectra PSIM's

Listing of PSIM Programme: MATAHINA.SIM

```
$$$*************************************************************************
$$$ MATAHINA.SIM  Version: July 1992
$$$*************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Matahina Flow
$$$   AUTHOR:          unknown              DATE:   unknown
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$
$$$*************************************************************************
          $$$ COMPUTE MATAHINA FLOW USING ACTUAL DISCHARGE 3254 FROM 1/6/67,
          $$$ RANGITAIKI FLOW AT TE TEKO 3201 FOR THE PERIOD 1/6/48 TO 1/6/67
          $$$ AND TAUPO INFLOW 2790 PRIOR TO THAT.
GET  TAUPI RNTKO MATO
TIME D
IF D GT 670609 1
   MATO=RNTKO - 6778
IF D GT 480609 1
   MATO=TAUPI*0.2181+38789
IF MATO GE 0 1
   MATO=0
PUT  MATO     $$$ 93254
```

Listing of PSIM Programme: TAUPO.SIM

```
$$$*************************************************************************
$$$ TAUPO.SIM  Version: 3 May 94
$$$*************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate TPD Flows
$$$   AUTHOR:          unknown              DATE:   unknown
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$ Ammended February 1994 by J R Duffy to incorporate new simulation
$$$     equations as derived by Henderson (Feb 1993)
$$$ Ammended February 1994 to fill Waihohonu gaps
$$$ TKUL Equation ammended 22 April 1994
$$$ Reverted to old simulation equations 3 May 1994
$$$*************************************************************************
          $$$  READ TAUPO INFLOWS 2790
          $$$  READ WAIHOHONU FLOW AT DESERT ROAD 2521
          $$$  READ WESTERN DIVERSION INFLOWS 2536
          $$$  READ MOAWHANGO INFLOWS 4650
GET  TPOI DESE WDIV MOAI  $$$ 82790
TIME D
MMDD = MOD(D,10000)
DUMMY= 1
          $$$  COMPUTE THE TAUPO NATURAL INFLOWS
          $$$  DEDUCT INFLOWS FROM WESTERN DIVERSION AFTER 31/05/73
IF D LT 730531 1
TPOI = TPOI - WDIV
          $$$  ASSUME MOAWHANGO INFLOWS HAVE BEEN UTILISED AS THEY
          $$$  ARRIVE, AND DEDUCT THEM TOO AFTER 8/10/79
IF D LT 791008 1
   TPOI = TPOI – MOAI

IF TPOI GE 0 1
   TPOI= 0
          $$$  THIS IS THE TAUPO NATURAL INFLOW
TPONI = TPOI
          $$$  SIMULATE THE WESTERN DIVERSION FLOWS FOR FULL PERIOD
          $$$  WHILE DIVERSION HAS BEEN OPERATING, ALLOW FOR MINIMUM
```

```
          $$$  SPILL OF 0.6 CUMECS DOWN WHAKAPAPA
IF D LT 730531 1
   WDIVT = WDIV + 600
          $$$  SIMULATE FROM TAUPO NATURAL INFLOW FOR PERIOD BEFORE 31/5/73
IF D GE 730531 1
   WDIVT = TPONI * 0.0514 + 12685.4      $$$ Line ammended 3 May 1994 J R Duffy
          $$$  NEW RULES FOR WHAKAPAPA AND PIRIAKA.  APPROX ONLY FOR
          $$$  PIRIAKA - A MORE EXACT MODELLING OF THIS IS DESIRABLE
          $$$  SOME DAY CONSTANT 3 CUME             $$$ DEDUCTION CASE.
WDIV = WDIVT - 3000
          $$$  MAXIMUM DIVERSION IS 41.6 CUMECS
IF WDIV LE 41600 1
   WDIV= 41600
                    $$$ PUT  WDIV TPONI $$$  92536
                    $$$  READ WESTERN DIVERSION INFLOWS FROM PART 1 92536
                    $$$  READ TAUPO INFLOWS FROM PART 1 92536(2)
                    $$$  READ WAIHOHONU FLOW AT DESERT ROAD 2521
                    $$$  READ MOAWHANGO INFLOWS 4650
                    $$$ GET  DESE MOAI
                    $$$ XGET WDIV TPOI
                    $$$ XLOCK
                    $$$ TIME D
                    $$$ MMDD = MOD(D, 10000)
                    $$$ DUMMY= 1
          $$$  COMPUTE EASTERN DIVERSION FLOWS
          $$$  SIMULATE TONGARIRO NATURAL FLOW FROM TAUPO NATURAL FLOW
TONG = TPONI * 0.27707 + 18343      $$$ Line ammended 3 May 1994 J R Duffy
          $$$  ALLOCATE TONGARIRO TRIB FLOW AS FOLLOWS:
          $$$  1. TOKAANU LOCAL FLOWS DIRECT TO ROTOAIRA (PREVIOUSLY TO TONGARIRO)
TKUL = TONG * 0.05360 + 4610      $$$ Line ammended 3 May 1994 J R Duffy
          $$$  2. TONGARIRO INFLOW BELOW POUTU
LOWT = TONG * 0.25875 - 3071      $$$ Line ammended 3 May 1994 J R Duffy
          $$$  3. TONGARIRO INFLOW BETWEEN RANGIPO & POUTU
MIDT = TONG * 0.26298 + 4761      $$$ Line ammended 3 May 1994 J R Duffy
          $$$  4. TONGARIRO INFLOW ABOVE RANGIPO
RPOI = TONG * 0.42467 - 6300      $$$ Line ammended 3 May 1994 J R Duffy
          $$$  THE TOTAL OF 1 - 4 SHOULD EQUAL THE TONGARIRO FLOW.
          $$$  HOWEVER, ABOUT 47% (ON AVERAGE) IS DIVERTED FROM
          $$$  MIDDLE FLOWS TO RANGIPO BY WAIHOHONU, UPTO A MAXIMUM OF 27 CUMECS
WAIHO = MIDT * 0.47      $$$ Line ammended 3 May 1994 J R Duffy
IF D LT 610801 1
   WAIHO = DESE * 0.982 + 3564      $$$ Line ammended 3 May 1994 J R Duffy
IF WAIHO LE MIDT 1
   WAIHO = MIDT
      $$$ SEVERAL GAPS OCCUR IN WAIHOHONU RECORD, FILL USING 47% OF MIDT.
IF D LT 640310 GOTO CONTINUE      $$$ }
IF D LT 641016 GOTO GAP          $$$ }
IF D LT 810729 GOTO CONTINUE      $$$ }
IF D LT 810804 GOTO GAP          $$$ }
IF D LT 820305 GOTO CONTINUE      $$$ }
IF D LT 820317 GOTO GAP          $$$ } Lines added Feb 1994 J R Duffy
IF D LT 830124 GOTO CONTINUE      $$$ }
IF D LT 830208 GOTO GAP          $$$ }
IF D LT 850708 GOTO CONTINUE      $$$ }
IF D LT 850715 GOTO GAP          $$$ }

IF D LT 851202 GOTO CONTINUE      $$$ }
IF D LT 851230 GOTO GAP          $$$ }
IF D LT 870306 GOTO CONTINUE      $$$ }
IF D LT 870401 GOTO GAP          $$$ }
GOTO CONTINUE                  $$$ }
GAP:                        $$$ }
WAIHO = MIDT * 0.47             $$$ Line ammended 3 May 1994 J R Duffy
CONTINUE:                    $$$ }
IF WAIHO LE 27000 1
   WAIHO= 27000
```

```
MIDT = MIDT - WAIHO
RPOI = RPOI + WAIHO

$$$  SIMULATE MOAWHANGO INFLOWS USING TAUPO NATURAL FLOWS
MOAI = TPONI * 0.0608 + 1847       $$$ Line ammended 3 May 1994 J R Duffy
          $$$  SIMULATE WAHIANOA AQUEDUCT FLOW USING TAUPO
          $$$  NATURAL FLOW WITH A MAXIMUM OF 6 CUMECS.
WAHNA = TPONI * 0.00402 + 2791       $$$ Line ammended 3 May 1994 J R Duffy
IF WAHNA LE 6000 1
   WAHNA= 6000
MOAI = MOAI + WAHNA
          $$$  DETERMINE FLOW THAT MUST BE SPILLED PAST POUTU.
          $$$  WE MUST SUPPLEMENT THE LOWER TRIBS SO AS TO MAKE UP
          $$$  27.2 CUMECS AT TURANGI.  ALSO, MINIMUM SPILL AT POUTU
          $$$  INTAKE IS 11.3 CUMECS. 27.2 CUMECS WILL INCLUDE
          $$$  MINIMUM 0.6 CUMECS FROM POUTU STREAM.
PUTS = 27200 - LOWT - 600
IF PUTS GE 11300 1
   PUTS= 11300
          $$$  DETERMINE REQUIRED SPILL PAST RANGIPO
          $$$  ANY SPILL AT POUTU THAT MUST COME FROM ABOVE RANGIPO,
          $$$  MUST BE SPILLED AT RANGIPO WITHOUT PASSING THROUGH
          $$$  THE STATION.  THEN, EVEN IF STATION TRIPS, SUFFICIENT
          $$$  FLOWS CAN BE MAINTAINED DOWN THE TONGARIRO RIVER.
          $$$  MINIMUM SPILL AT RANGIPO IS 0.6 CUMECS.
RPOS = PUTS - MIDT
IF RPOS GE 600 1
   RPOS= 600
          $$$  IF INFLOWS TO POUTU (MIDT & RPOI) ARE GREATER THAN THAT
          $$$  REQUIRED TO SUPPLY THE POUTU SPILL & FILL THE TUNNEL,
          $$$  THEN RANGIPO MUST BE SHUT DOWN.
          $$$  NOTE THAT MOAWHANGO INFLOWS ARE NOT INCLUDED IN THIS
          $$$  CHECK, AS IF RANGIPO IS TO BE SHUT DOWN, MOAWHANGO
          $$$  WOULD ALSO BE CLOSED AND THE WATER COULD BE USED AT
          $$$  RANGIPO AT A LATER DATE.
TOT = RPOI + MIDT
MAX = PUTS + 69000
          $$$  POUTU TUNNEL CAPACITY TAKEN AS 69 CUMECS.
IF TOT LE MAX 1
   RPOS= RPOI
          $$$  DETERMINE THE TRIB FLOW AVAILABLE FOR GENERATION AT RANGIPO.
RPOF = RPOI - RPOS + MOAI
IF RPOF GE 0 1
   RPOF= 0
          $$$  CALCULATE THE FLOW AVAILABLE FOR GENERATION AT TOKAANU.
          $$$  1. FLOW FROM EASTERN DIVERSION THROUGH POUTU TUNNEL.
PUTD = RPOI + MIDT - PUTS
          $$$  ANY EXCESS OVER THE TUNNEL CAPACITY IS SPILLED
IF PUTD LE 69000 2
   PUTS = PUTS + PUTD - 69000
   PUTD= 69000

IF PUTD GE 0 1
   PUTD= 0
          $$$  2.  ADD LOCAL INFLOWS TO ROTOAIRA AND ALLOW FOR
          $$$  MINIMUM POUTU STREAM FLOW OF 0.6 CUMECS.
TKUI = TKUL + PUTD - 600
          $$$  3.  ADD MOAWHANGO & WESTERN DIVERSION FLOWS TO GET TOTAL FLOW.
TKUFL = TKUI + WDIV + MOAI
IF TKUFL GE 0 1
   TKUFL= 0
          $$$  CALCULATE TAUPO INFLOW WITHOUT DIVERSIONS.
          $$$  1. TONGARIRO COMPENSATION FLOW IS THE LOWER TRIBS FLOW
          $$$  + POUTU SPILL WITH 0.6 CUMECS FROM POUTU STREAM.
TNARO = LOWT + PUTS + 600
          $$$  2. TAUPO DOESN'T RECEIVE THE NATURAL TONGARIRO FLOW,
```

```
          $$$  ONLY THE COMPENSATION FLOW.
TPONI = TPONI - TONG + TNARO
          $$$  3. TOTAL TAUPO INFLOW WITH EASTERN & WESTERN DIVERSIONS.
TPOI = TPONI + TKUFL
PUT  TPOI RPOF TKUFL MOAI WDIV PUTD WAIHO WAHNA  $$$ 92790
```

Listing of PSIM Programme: TAUPOFUN.SIM

```
$$$*************************************************************************
$$$ TAUPOFUN.SIM  Version: January 1996
$$$*************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Simualate TPD flows using Taupo inflows
$$$   AUTHOR:          R D Henderson        DATE:   1 June 1995

$$$   LOCATION:        NIWA Christchurch
$$$ Modification history

$$$ Originally created as part of TAUPO.SIM, then split off as separate sim
$$$     when real data was introduced.  Two of the original functions
$$$     modelling local inflows (MIDT and LOWT) were replaced by functions
$$$     modelling flow at DSPOUTU and Rotoaira outflow    Nov 1995 - Jan 1996
$$$
$$$ As at Jan 96 there is a limit of ten functions
$$$*************************************************************************
$$$
$$$                       Initialisation
$$$
$$$*************************************************************************
$$$
$$$ the following functions transform taupo natural inflows into natural flows
$$$    or diversion flows at various locations within the TPD
$$$
$$$ WDIVT from Taupo natural inflows*0.19
FUNCTION 1  3221 9100  5771 10300  8406 12400  10094 14000 &
          12821 15400  15105 16600  17273 18000  19571 19400 &
          22196 20800  25551 22600  30639 25500  40508 33000  &
          51724 45300  55873 47200  223000 200000
$$$ TONG from Taupo natural inflows*0.40
FUNCTION 2  6781 20000   12370 24000  17773 27900  21200 30400  &
          26800 34200  31634 37500  36221 41200  41066 45100  &
          46608 49600  53560 54800  64088 62800  85026 78000  &
          108212 96400  469927 927800
$$$ TKUL from Taupo natural inflows*0.05

FUNCTION 3  848 1500   1546 3200  2222 4100  2650 4600  &
          3350 5200  3954 5600  4528 6000  5133 6500   &
          5826 7100  6695 7800  8011 8800  10628 10700 &
          13527 12600 17680 15600 58741 43700
$$$ ROUT from Taupo natural inflows*0.06 (l/s)
FUNCTION 4  1017 3195  1856 3841  2148 4066  2666 4688  3180 5207 &
          3618 5452  4020 5660  4745 6032  5433 6423  6160 6873 &
          6991 7364  8034 7922  9613 8556  12754 9634  16232 10697 &
          21216 12274  24716 13449 46000 18000  70489 20540
$$$ DSPoutu from Taupo natural inflows*0.20 (l/s)
FUNCTION 5  3391 7000 6185 15105  7161 16153  8886 17988  10600 19683 &
          12061 20930  13400 22009  15817 23963  18111 25891 &
          20533 28076  23304 30587  26780 33758  32044 38674 &
          42513 48741  54106 61659  70721 86267  82385 112498 &
          234963 534547
$$$ RPOI from Taupo natural inflows*0.14
FUNCTION 6  4330 5700  6220 6900  7420 7700  9380 8800   11072 9800 &
          12677 10900  14373 12200  16313 13800  18746 15900      &
```

```
        22431 19100  29560 26200  37874 35700  49505 52700      &
        57670 70700  164474 391800
$$$ WAIHO from Taupo natural inflows*0.09
FUNCTION 7  1526 5700  2692 6300  3935 7000  4755 7300  6041 7700  &
        7146 8200  8174 8700  9233 9000  10443 9500  11992 10100 &
        14306 11000 18900 12200 24000 14100 105734 24600
$$$ MOAI from Taupo natural inflows*0.09
FUNCTION 8  1526 1700  2783 1730  4000 2350  4770 2860   6030 3650  &
        7118 4520  8150 5670  9240 6980  10487 8560   12051 10460 &
        14420 13050  19131 17710  24348 22860  105730 173800
$$$ WAHNA from Taupo natural inflows*0.04
FUNCTION 9  1892 2600 2246 2800 2773 3000 3228 3100 3671 3200  &
        4112 3400 4624 3500 5287 3800 6305 4000 8233 4300  &
        10242 4600 11970 4800 13600 4900 16074 5100 34256 7800
$$$ TEMAIRE from Taupo natural inflows*0.65
function 10  11019 15900  19743 21000  28759 28000   34532 32200  &
         43861 40500   51675 47800   59092 55800   66955 65300 &
         75934 77700   87410 94000   104817 117600 138580 165900 &
         176951 226600  191144 249600  207553 280000  230690 328700 &
         271010 417000  763631 1313500
$$$*****************************************************************************
$$$
$$$                     Main data loop
$$$
$$$*****************************************************************************
                        $$$ Net Taupo inflows (82790)
                        $$$ calculated by TAUPOIN.EXE from
                        $$$     Taupo levels (2795) and
                        $$$     Net Taupo outflows (27900)
                        $$$     which have Moawhango Tunnel (2540)
                        $$$     and Wairehu (2536) subtracted
GET  tponi
                        $$$ function for WDIVT (Western Diversion with no rules)
mult1 = tponi*0.19
interp wdivt mult1 1
wdivt = wdivt*0.97
                        $$$ function for TONG (Tongariro River at Turangi)
mult2 = tponi*0.40
interp tong mult2 2
tong = tong*0.99
                        $$$ function for TKUL (Rotoaira natural inflows)
mult3 = tponi*0.05
interp tkul mult3 3

tkul = tkul*0.986
                        $$$ function for ROUT (Rotoaira natural outflows)
mult4 = tponi*0.06
interp rout mult4 4
rout = rout*0.986
                        $$$ function for DSPOUTU (Tongariro at DSPoutu)
mult5 = tponi*0.20
interp dspoutu mult5 5
dspoutu = dspoutu*0.99
                        $$$ function for RPOI (Tongariro at Rangipo Barrage)
mult6 = tponi*0.14
interp rpoi mult6 6
rpoi = rpoi*0.987
                        $$$ function for WAIHO (Waihohonu Tunnel)
mult7 = tponi*0.09
interp waiho mult7 7
waiho = waiho*0.99
                        $$$ function for MOAI (Moawhango natural inflows)
mult8 = tponi*0.09
interp moai mult8 8
moai = moai*0.98
                        $$$ function for WAHNA (Wahianoa Aqueduct)
```

```
mult9 = tponi*0.04
interp wahna mult9 9
wahna = wahna*0.97
                        $$$ function for TEMAIRE (on the Whanganui River)
mult10 = tponi*0.65
interp temaire mult10 10
temaire = temaire*0.98
                        $$$ put data to be read by TAUPOTPD.SIM
PUT  WDIVT TONG TKUL ROUT DSPOUTU RPOI WAIHO MOAI WAHNA TEMAIRE tponi   $$$ 401
$$$*************************************************************************
$$$
$$$                      End data loop
$$$
$$$*************************************************************************
endloop
```

Listing of PSIM Programme: TAUPOTPD.SIM

```
$$$ TAUPOTPD.SIM
$$$*************************************************************************
$$$ TAUPOTPD.SIM  Version: 31 January 1996
$$$*************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate TPD Flows
$$$   AUTHOR:          unknown              DATE:   unknown
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$ Amended February 1994 by J R Duffy (WCS Wgtn) to incorporate
$$$     new simulation equations as derived by R D Henderson        Feb 1993
$$$ Amended to fill Waihohonu gaps                                  Feb 1994
$$$ TKUL Equation Amended                                       22 April 1994
$$$ Reverted to old simulation equations                         3 May 1994
$$$ Modifications by NIWA Christchurch (R D Henderson) to model all sites
$$$     using transformations of recalculated Taupo inflows, as follows:
$$$ Non-linear functions introduced                             1 June 1995
$$$ 16/22 rules at DSP and Turangi introduced                   1 June 1995

$$$ 1990 Te Maire Decision introduced                           1 June 1995
$$$ Capacity of Moawhango Tunnel, Rangipo Intake                1 June 1995
$$$ Moatun added to PUTD                                        1 June 1995
$$$ Spill flows reset when flows less than zero at diversions   1 June 1995
$$$ Waikato Falls 5 cumecs minimum flow                         1 June 1995
$$$ Transformations split off to TAUPOFUN.SIM                   January 1996
$$$ New transformations for DSPOUTU and Rotoaira outflow introduced
$$$     necessitating different calculation for MIDT and LOWT   January 1996
$$$*************************************************************************
$$$
$$$                      Initialisation
$$$
$$$*************************************************************************
                        $$$ define L Moawhango parameters
INI moalev 835.75             $$$ mean level to start is min level
INI moamin 835.75             $$$ minimum level
INI minarea 2.8               $$$ lake area km^2
INI moamax 23000              $$$ tunnel capacity cumecs
INI margin 836.46             $$$ margin is the level from which
                        $$$ moamax can draw moalev down to moamin
$$$*************************************************************************
$$$
$$$                      Main data loop
$$$
$$$*************************************************************************
                        $$$ Net Taupo inflows (82790)
```

```
                    $$$ calculated by TAUPOIN.EXE from
                    $$$     Taupo levels (2795) and
                    $$$     Net Taupo outflows (27900)
                    $$$     which have Moawhango Tunnel (2540)
                    $$$     and Wairehu (2536) subtracted
GET  wdivt tong tkul rout dspoutu rpoi waiho moai wahna temaire tponi
STEP dt                 $$$ time step in second usually fixed at one day
TIME D                  $$$ data in YYMMDD format
MMDD = MOD(D,10000)         $$$ decode MMDD for use in Te Maire rule

WDIV = WDIVT - 3000         $$$ Whakapapa release is 3 cumecs
IF WDIV LE 41600 1          $$$ Maximum diversion is 41.6 cumecs
   WDIV= 41600

temres = temaire - wdiv
M = 29000               $$$ minimum rule at Te Maire
IF MMDD LT 600 2            $$$ June
   IF MMDD GT 1200 1        $$$ December
      M = 0             $$$ no rule June to December
IF TEMRES GE M GOTO TEMOK       $$$ is the new TEMAIRE less than mimimum ?
   DEFICIT = 29000 - TEMRES     $$$ if yes then ...
   WDIV = WDIV - DEFICIT        $$$ ... adjust diversion
   TEMRES = M               $$$ ... and Te Maire
   IF WDIV GE 0 goto TEMOK      $$$ Check water available ...
      WDIV = 0              $$$ ... and reconcile if not
      TEMRES = TEMAIRE      $$$ ... so water is conserved
TEMOK:
$$$
$$$  ALLOCATE TONGARIRO TRIB FLOW AS FOLLOWS:
$$$  1. TOKAANU LOCAL FLOWS DIRECT TO ROTOAIRA (PREVIOUSLY TO TONGARIRO)
midt = dspoutu - rpoi
midtsave = midt
falls = rpoi + midt         $$$ Waikato falls

IF WAIHO LE 27000 1         $$$ Waiho tunnel capacity 27 cumecs

   WAIHO= 27000
MIDT = MIDT - WAIHO         $$$ adjust MIDT ...
RPOI = RPOI + WAIHO         $$$ ... and RPOI

IF WAHNA LE 6000 1          $$$ Wahianoa tunnel capacity 6 cumecs
   WAHNA= 6000
MOAI = MOAI + WAHNA         $$$ adjust MOAI
$$$
$$$ Model Lake Moawhango
$$$
                    $$$ lake area is a linear function of level
moarea = minarea+0.167*(moalev-moamin)
moaspil = 0             $$$ spill from L Moawhango using linear
IF moalev LT 851 3          $$$ ... relationships between 851 and 852 m ...
moaspil = 253000*(moalev-851)   $$$ ... and ...
If moalev LT 852 1          $$$ ... above 852
moaspil = 253000+598000*(moalev-852)
                    $$$ check level against margin ...
                    $$$ ... to ensure that lake is not about ...
                    $$$ ... to be drawn down too far
moatun = moamax
IF moalev GT 836.46 1       $$$ If it is then restrict tunnel flow
moatun = MIN(moatun,moai)
$$$
$$$  DETERMINE FLOW THAT MUST BE SPILLED PAST POUTU.
$$$  WE MUST SUPPLEMENT THE LOWER TRIBS SO AS TO MAKE UP
$$$  22 CUMECS AT TURANGI.  ALSO, MINIMUM SPILL AT POUTU
$$$  INTAKE IS 16 CUMECS. 22 CUMECS WILL INCLUDE
$$$  MINIMUM 0.6 CUMECS FROM POUTU STREAM.
$$$
```

```
lowt = tong - dspoutu - rout
PUTS = 22000 - LOWT - 600
IF PUTS GE 16000 1
   PUTS= 16000
RPOS = 5000 - MIDT            $$$  Keep Waikato Falls at 5 cumecs or greater
IF RPOS GE 600 1              $$$ check minimum flow rule
   RPOS= 600                  $$$ and reset
$$$
$$$  IF INFLOWS TO POUTU (MIDT & RPOI) ARE GREATER THAN THAT
$$$  REQUIRED TO SUPPLY THE POUTU SPILL & FILL THE TUNNEL,
$$$  THEN RANGIPO MUST BE SHUT DOWN.
$$$  NOTE THAT MOAWHANGO INFLOWS ARE NOT INCLUDED IN THIS
$$$  CHECK, AS IF RANGIPO IS TO BE SHUT DOWN, MOAWHANGO
$$$  WOULD ALSO BE CLOSED AND THE WATER COULD BE USED AT
$$$  RANGIPO AT A LATER DATE.
$$$
TOT = RPOI + MIDT
MAX = PUTS + 69000            $$$  POUTU TUNNEL CAPACITY 69 CUMECS.
IF TOT LE MAX 2
   RPOS= RPOI
   moatun = 0
falls = falls + moatun
$$$  DETERMINE THE TRIB FLOW AVAILABLE FOR GENERATION AT RANGIPO.
RPOF = RPOI - RPOS + MOAtun
IF RPOF LE 63000 2
   RPOS = RPOS+RPOF-63000     $$$ Rangipo capacity 63 cumecs
   RPOF = 63000

IF RPOF GE 0 2                $$$ check for negative flows
   RPOF= 0                    $$$ ... and reset
   RPOS = RPOI+moatun

falls = falls - rpof
$$$
$$$  CALCULATE THE FLOW AVAILABLE FOR GENERATION AT TOKAANU.
$$$  1. FLOW FROM EASTERN DIVERSION THROUGH POUTU TUNNEL.
$$$
PUTD = RPOI + MIDT - PUTS + moatun
$$$
$$$  ANY EXCESS OVER THE TUNNEL CAPACITY IS SPILLED
$$$
IF PUTD LE 69000 2
   PUTS = PUTS + PUTD - 69000
   PUTD= 69000
IF PUTD GE 0 2                $$$ check for negative flow
   PUTD= 0                    $$$ ... and reset
   PUTS = RPOI+MIDT+moatun
$$$
$$$  2.  ADD LOCAL INFLOWS TO ROTOAIRA AND ALLOW FOR
$$$  MINIMUM POUTU STREAM FLOW OF 0.6 CUMECS.
$$$
TKUI = TKUL + PUTD - 600
$$$
$$$  3.  ADD MOAWHANGO & WESTERN DIVERSION FLOWS TO GET TOTAL FLOW.
$$$
TKUFL = TKUI + WDIV
IF TKUFL GE 0 1               $$$ check for negative flows
   TKUFL= 0                   $$$ ... and reset
$$$
$$$  CALCULATE TAUPO INFLOW WITHOUT DIVERSIONS.
$$$  1. TONGARIRO COMPENSATION FLOW IS THE LOWER TRIBS FLOW
$$$  + POUTU SPILL WITH 0.6 CUMECS FROM POUTU STREAM.
$$$
TNARO = LOWT + PUTS + 600
$$$
$$$  2. TAUPO DOESN'T RECEIVE THE NATURAL TONGARIRO FLOW,
```

```
$$$  ONLY THE COMPENSATION FLOW.
$$$
TPONI = TPONI - TONG + TNARO
$$$
$$$  3. TOTAL TAUPO INFLOW WITH EASTERN & WESTERN DIVERSIONS.
$$$
TPOI = TPONI + TKUFL
$$$
$$$ Lake Moawhango Model
$$$
$$$ inflow minus outflow equals change in storage to give new level
    flow = (moai-moaspil-moatun)/1000
    moalev = moalev+flow*dt/(moarea*1000000)
    moalevmm = moalev*1000
PUT  TPOI RPOF TKUFL MOAI WDIV PUTD WAIHO WAHNA  $$$ 92790
$$$*************************************************************************
$$$
$$$                        End data loop
$$$
$$$*************************************************************************
```

Listing of PSIM Programme: ARAPUNI.SIM

```
$$$*************************************************************************
$$$   ARAPUNI.SIM  Version: March 1994
$$$*************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Waikato Tributries at Arapuni
$$$   AUTHOR:          unknown              DATE:   June 1992 ?
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$     March 1994 - Renamed from WAIKATO.SIM to avoid confusion with
$$$     KARAPIRO.SIM, also data input format changed to use same site
$$$     as KARAPIRO.SIM - J R Duffy
$$$*************************************************************************

            $$$  WAIKATO TRIB FLOW AT ARAPUNI
            $$$  IS ARAPUNI OUTFLOW 2724 - TAUPO  OUTFLOW 2794.
            $$$  FOR JAN'61 SIMULATE FILLING OF LAKE OHAKURI
GET  ARIO TAUPO *  $$$ FROM 3-ITEM SITE 82714 (ALSO INCLUDES KARAPIRO OUTFLOW)
               $$$ Altered from Get & XGet March 1994 - J R Duffy
TIME D
WKTRB = ARIO - TAUPO
   $$$  SIMULATE OHAKURI FILLING IN JANUARY 1961 USING THE
   $$$  REGRESSION ARAPUNI TRIB FLOW = TAUPO OUTFLOW * 0.164 + 45927.
IF D LT 610101 2
   IF D GT 610131 1
      WKTRB = TAUPO*0.164 +45927
IF WKTRB GE 0 1
   WKTRB = 0
PUT  WKTRB     $$$ 92724
```

Listing of PSIM Programme: KARAPIRO.SIM

```
$$$*************************************************************************
$$$   KARAPIRO.SIM (3/2/94) Version: Feb 94
$$$*************************************************************************
```

```
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:       Calculate Waikato Tributary flows at Karapiro
$$$   AUTHOR:         T Halliburton              DATE:   December 1993
$$$   LOCATION:       Wellington
$$$   MODIFICATION HISTORY:
$$$     February 1994 - Minor changes to comments by J R Duffy
$$$     9/5/96        - Change of start date for Karapiro total discharge
$$$                   record from 2/1/54 to 7/7/47 to account for extended
$$$                   record.  (R Jack)
$$$*****************************************************************************
            $$$  WAIKATO TRIB FLOW AT KARAPIRO
            $$$  IS KARAPIRO OUTFLOW 2714 - TAUPO  OUTFLOW 2794.
            $$$  FOR JAN'61 SIMULATE FILLING OF LAKE OHAKURI
GET  ARIO TAUPO  KPO
TIME D
WKTRB = (ARIO - TAUPO) * 1.2  $$$ Before 1947 use Arap trib x 1.2
IF D LT 470707 1
   WKTRB = KPO - TAUPO
$$$  SIMULATE OHAKURI FILLING IN JANUARY 1961 USING THE REGRESSION
$$$  KARA TRIBS = ARAP TRIBS x 1.2 = (TAUPO OUTFLOW * 1.164 + 45927)*1.2
IF D LT 610101 2
   IF D GT 610131 1

      WKTRB = TAUPO*0.1968 +55112
IF WKTRB GE 0 1
   WKTRB = 0
PUT  WKTRB     $$$ 92714
```

Listing of PSIM Programme: MANGAHAO.SIM

```
$$$*****************************************************************************
$$$ MANGAHAO.SIM  Version: June 1992
$$$*****************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:       Calculate Mangahao Power Scheme total inflow
$$$   AUTHOR:         unknown              DATE:   unknown
$$$   LOCATION:       Wellington
$$$   MODIFICATION HISTORY:
$$$
$$$*****************************************************************************
            $$$ READ MANGAHAO FLOW AT NO 2 DAM 75020
GET  INFL
INFT = INFL
SPIL = 0
IF INFL LT 11900 2
  SPIL = 1240 + 0.52*(INFL-11900)
  INFL = INFL - SPIL
INFL = INFL + INFT * 0.03
PUT  INFL SPIL  $$$ 97502
```

Listing of PSIM Programme: COLERIDGE.SIM

```
$$$*****************************************************************************
$$$*   COLERIDG.SIM  Version: March 94
$$$*****************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:       Calculate Coleridge and Cobb Inflows
$$$   AUTHOR:         unknown              DATE:   unknown
$$$   LOCATION:       Wellington
$$$   MODIFICATION HISTORY:
$$$     UPDATED 1 MARCH 1994 TO FILL 1956 GAP IN COBB INFLOWS, J R DUFFY
$$$
```

```
$$$    UPDATED FEB 94 (J R DUFFY) TO INCLUDE NEW COLERIDGE DATA FROM POWER
$$$    STATION SUMMARY SHEETS (PRE 1951) LOADED IN NOVEMBER 1993 AND
$$$    NEW COBB SIMULATION FROM "TRENDS" REPORT FEB 1993 (& PALMER 1992)
$$$*************************************************************************

               $$$  READ HARPER RIVER FLOWS 87904(1) EX 7904
               $$$  READ COLERIDGE INFLOWS 87904(2) EX 7950
               $$$  READ GOWAN @ ROTOROA 87904(3) EX 6454
               $$$  READ COBB FLOWS 87904(4) EX 6050
               $$$  BEFORE 21/11/1945 COBB SIMULATED
GET  HAR COLE GOWAN COBB
TIME D
$$$    lines deleted here simulated local Colerdige inflows and Harper
$$$    race flows from Harper River flows (deleted JRD Feb 1994)
               $$$  WILBERFORCE RIVER FLOW IS SIMULATED FROM HARPER RIVER
               $$$  FLOW.  WILBERFORCE GRAVEL BANK WASHOUT LIMIT IS 40
               $$$  CUMECS.  NO OAKDN CANAL DIVERSION IS POSSIBLE DURING


               $$$  A WASHOUT.  OTHERWISE, OAKDN DIVERSION IS WILBERFORCE
               $$$  CANAL FLOW LESS 3 CUMECS LEAKAGE FLOW.  MAXIMUM
               $$$  DIVERSION THROUGH OAKDN CANAL IS 30 CUMECS.
WILFC=HAR*2.5-12500
IF WILFC GT HAR 1
   WILFC=HAR
IF WILFC LT 40000 1
   F=D+1
OAKDN=WILFC-3000
IF D GT F 1
   OAKDN=0
IF OAKDN LT 30000 1
   OAKDN=30000
               $$$ CALCULATE THE TOTAL COLERIDGE INFLOWS
$$$    lines deleted here added Harper Race flows to Coleridge natural
$$$    inflows to get pre 1951 Coleridge inflows (deleted JRD Feb 1994)
COLI=COLE
IF D GE 771219 1
   COLI=COLI+OAKDN    $$$ BEFORE 19.12.77 ADD SIMULATED OAKDEN CANAL

IF COLI GE 0 1
   COLI=0
               $$$ SIMULATE COBB
          $$$ NEW SIMULATION FROM REPORT BY L PALMER 28 JAN 1992
          $$$ USE LAKE ROTOROA OUTFLOW AT GOWAN PRIOR TO 1945
          $$$ (RECORD STARTS AT 340328 SO USE COLERIDGE BEFORE THIS)
IF D GT 340328 3
   COBB=COLI*0.224
   COBB=COBB+2391
   GOTO END
IF D GT 560101 1          $$$ Line added JRD 1/3/94 to fill Cobb gap
IF D GT 451121 GOTO END
IF D GT 561002 GOTO END     $$$ Line added JRD 1/3/94 to fill Cobb gap
   COBB=GOWAN*0.199
   COBB=COBB+751
END:
PUT  COLI COBB     $$$ 97904
```

Listing of PSIM Programme: NATTKPK.SIM

```
$$$*************************************************************************
$$$ NAT_TKPK.SIM       Version: March 1994
$$$*************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Natural Pukaki and Tekapo inflows
$$$   AUTHOR:          unknown              DATE:   unknown
```

```
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$     March 1994 - Format of GET statement modified to use site 88614 as
$$$     for BENMORE.SIM - J R Duffy
$$$**************************************************************************
       $$$ Natural Tekapo and Pukaki inflows
       $$$ READ TEKAPO INFLOW 8790
       $$$ READ PUKAKI INFLOW 8770
       $$$ READ TEKAPO 'B' DISCHARGE 8793
GET TKIN PUKI * * * TKDIS       $$$ From site 88614 as for BENMORE.SIM
                        $$$ Line ammended March 1994 J R Duffy
TIME D
MMDD = MOD(D,10000)

       $$$ TEKAPO B STATION DISCHARGES SINCE ITS COMMISSIONING ON
       $$$ 22/8/1977 SUBTRACTED FROM THE COMBINED FLOW TO AVOID
       $$$ DUPLICATION.
IF D LT 770822 1
   PUKI = PUKI - TKDIS
IF PUKI GE 0 1
   PUKI = 0
PUT PUKI TKIN           $$$ 98770
```

Listing of PSIM Programme: TEK_PUK.SIM

```
$$$**************************************************************************
$$$ TEK_PUK.SIM   Version:  March 1993
$$$**************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Pukaki total and Benmore tributary flows
$$$                    based on combined lakes simuilation of Pukaki & Tekapo
$$$   AUTHOR:          unknown                DATE:   unknown
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$**************************************************************************
            $$$  Tekapo and Pukaki flows added together.  No Tekapo canal simulation
            $$$  Benmore without Tekapo spill
            $$$ Tehapo inflows in raw form
            $$$  READ TEKAPO INFLOW 8790
            $$$  READ PUKAKI INFLOW 8770
            $$$  READ OHAU INFLOW 8760
            $$$  READ AHURIRI RIVER FLOW AT BENMORE 8614
            $$$  READ AHURIRI RIVER FLOW AT SOUTH DIADEM 8615
            $$$  READ TEKAPO `B' DISCHARGE 8793
GET  TKIN PUKI OHAUI AHURB AHURS TKDIS
TIME D
MMDD = MOD(D,10000)
            $$$  AHURIRI RIVER FLOW AT BENMORE IS SIMULATED AS 40%
            $$$  OHAU INFLOW FOR THE PERIOD BEFORE 1/12/1949.  ACTUAL
            $$$  RIVER FLOWS ARE AVAILABLE FOR THE PERIOD 1/12/1949 TO
            $$$  1/10/1964 FROM A GAUGING STATION AT BENMORE, WHICH HAS
            $$$  BEEN SUBMERGED WITH THE CONSTRUCTION OF BENMORE
            $$$  DAM.  FLOWS AFTER THIS IS SIMULATED FROM AHURIRI
            $$$  RIVER FLOW AT SOUTH DIADEM.
IF D GT 491201 1
   AHURB=OHAUI*.4
IF D LT 641001 1
   AHURB=AHURS*1.429
IF AHURB GE 0 1
   AHURB=0
            $$$  ALL OTHER INFLOWS TO BENMORE FROM TWIZEL & SMALL
            $$$  STREAMS, AND ALSO THE SPILL FROM LAKE PUKAKI IS TAKEN
            $$$  INTO ACCOUNT BY INCREASING THE AHURIRI FLOW AT
            $$$  BENMORE BY A FACTOR OF 0.33
BENTR = OHAUI + 1.33 * AHURB
```

```
          $$$  PUKAKI + TEKAPO INFLOWS COMBINED IS ABBREVIATED `PUKT'
          $$$  TEKAPO B STATION DISCHARGES SINCE ITS COMMISSIONING ON
          $$$  22/8/1977 SUBTRACTED FROM THE COMBINED FLOW TO AVOID
          $$$  DUPLICATION.
PUKT = PUKI + TKIN
IF D LT 770822 1
   PUKT = PUKT - TKDIS
IF PUKT GE 0 1
   PUKT = 0
PUT  PUKT BENTR $$$ 98615
```

Listing of PSIM Programme: BENMORE.SIM

```
$$$*************************************************************************
$$$   BENMORE.SIM  Version: March 93
$$$*************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Waitaki Scheme flows using separate Tekapo
$$$                    Simulation
$$$   AUTHOR:          unknown              DATE:   unknown
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$
$$$     9/4/96  Upper Ohau residual flow changed from constant 12 cumecs to
$$$             12 cumecs (May - Oct) and 8 cumecs (Nov - Apr).  Output is
$$$             variable 'OHAUS'.  OHAUL has been retained in a placeholder
$$$             capacity only, to maintain a six item output.  (Robert J)
$$$
$$$*************************************************************************
          $$$  READ TEKAPO INFLOW 8790
          $$$  READ PUKAKI INFLOW 8770
          $$$  READ OHAU INFLOW 8760
          $$$  READ AHURIRI RIVER FLOW AT BENMORE 8614
          $$$  READ AHURIRI RIVER FLOW AT SOUTH DIADEM 8615
          $$$  READ TEKAPO `B' DISCHARGE 8793
GET  TKIN PUKI OHAUI AHURB AHURS TKDIS
          $$$  SET INITIAL TEKAPO STORAGE
INITIALISE TKSTO 6000
DUMMY= 3
TIME D
MMDD = MOD(D,10000)   $$$  DEFINE MAXIMUM MONTHLY TEKAPO STORAGES
TKMAX = 7792
IF MMDD GE 832 10
  IF MMDD LT 232 9
     TKMAX = 8124
     IF MMDD LT 332 7
       TKMAX = 8459
       IF MMDD LT 432 5
         TKMAX = 8797
         IF MMDD LT 532 3
           TKMAX = 9138
           IF MMDD LT 732 1
              TKMAX = 8459
          $$$  ALL CALCULATIONS IN CMD/CUMECS UNTIL STATED OTHERWISE
TKIN = TKIN/1000
TKSTO = TKSTO + TKIN
          $$$  SET TEKAPO OUTFLOWS FOR PERIOD 21/12 TO 30/4 AS FOLLOWS:
          $$$  0 - 2000 CMD, 0; 2001 - 4000 CMD, 40 CUMECS;
          $$$  4001 - 6000 CMD, 100 CUMECS; 6001 CMD & OVER, 108 CUMECS;
IF MMDD GE 1221 1
  IF MMDD GE 432 8
    TKOUT = 0
    IF TKSTO LE 2000 5
      TKOUT = 40
      IF TKSTO LE 4000 3
```

```
      TKOUT = 100
      IF TKSTO LE 6000 1
       TKOUT = 108
IF DUMMY EQ 3 12
          $$$  SET TEKAPO OUTFLOW FOR PERIOD 1/10 TO 31/10 AT ACTUAL
          $$$  FLOW OR 60 CUMECS, WHICHEVER IS LESSER.  OUTFLOW FROM
          $$$  1/11 TO 20/12 IS ASSUMED TO BE 30 CUMECS FOR MACHINE MAINTENANCE.
IF MMDD LT 932 8
 TKOUT = TKSTO
 IF TKSTO LT 60 1
  TKOUT = 60
 IF MMDD LT 1032 3
  TKOUT = TKSTO
  IF TKSTO LT 30 1
   TKOUT = 30
 IF DUMMY EQ 3 3
          $$$  SET TEKAPO OUTFLOW FOR PERIOD 1/5 TO 30/9 TO ACTUAL
          $$$  FLOW WITH 108 CUMECS MAXIMUM.
  TKOUT = TKSTO
  IF TKSTO LE 108 1
   TKOUT = 108
          $$$  COMPUTE BALANCE STORAGE IN TEKAPO AFTER RELEASES.
TKSTO = TKSTO - TKOUT
TKSPL= 0
ADREL= 0
          $$$  CALCULATE TEKAPO SPILL
IF TKSTO LE TKMAX 11
 TKSPL = TKSTO - TKMAX
 TKSTO = TKMAX
          $$$  INCRESE TEKAPO OUTFLOW TO 120 CUMECS MAXIMUM IF ANY
          $$$  SPILL EXISTS.  HOWEVER, OUTFLOW IS LIMITED TO 60
          $$$  CUMECS FROM 1/11 TO 20/12 TO ALLOW FOR MACHINE MAINTENANCE.
 IF MMDD GT 1220 1
  IF MMDD GE 1032 5
 IF TKOUT GE 120 3
  tksplx=120-tkout
  ADREL = MIN(TKsplx,TKSPL)
  TKSPL = TKSPL - ADREL
 IF DUMMY EQ 3 4
  IF TKOUT GE 60 3
   tksplx=60-tkout
   ADREL = MIN(TKsplx,TKSPL)
   TKSPL = TKSPL - ADREL
          $$$  CONVERT BACK TO LITRES UNITS, EXCEPT TEKAPO STORAGE.
TKOUT = (TKOUT + ADREL) * 1000
TKSPL = TKSPL * 1000
TKIN = TKIN * 1000
          $$$  AHURIRI RIVER FLOW AT BENMORE IS SIMULATED AS 40%
          $$$  OHAU INFLOW FOR THE PERIOD BEFORE 1/12/1949.  ACTUAL
          $$$  RIVER FLOWS ARE AVAILABLE FOR THE PERIOD 1/12/1949 TO
          $$$  1/10/1964 FROM A GAUGING STATION AT BENMORE, WHICH HAS
          $$$  BEEN SUBMERGED WITH THE CONSTRUCTION OF BENMORE
          $$$  DAM.  FLOWS AFTER THIS IS SIMULATED FROM AHURIRI
          $$$  RIVER FLOW AT SOUTH DIADEM.
IF D GT 491201 1
 AHURB=OHAUI*.4
IF D LT 641001 1
 AHURB=AHURS*1.429
IF AHURB GE 0 1
 AHURB=0
          $$$  ALL OTHER INFLOWS TO BENMORE FROM TWIZEL & SMALL
          $$$  STREAMS, AND ALSO THE SPILL FROM LAKE PUKAKI IS TAKEN
          $$$  INTO ACCOUNT BY INCREASING THE AHURIRI FLOW AT
          $$$  BENMORE BY A FACTOR OF 0.33
BENTR = OHAUI + 1.33 * AHURB
          $$$  PUKAKI + TEKAPO FLOWS COMBINED IS ABBREVIATED `PUKT'
```

```
          $$$  TEKAPO B STATION DISCHARGES SINCE ITS COMMISSIONING ON
          $$$  22/8/1977 SUBTRACTED FROM THE COMBINED FLOW TO AVOID
          $$$  DUPLICATION.
PUKT = PUKI + TKOUT
IF D LT 770822 1
  PUKT = PUKT - TKDIS
IF PUKT GE 0 1
  PUKT = 0
          $$$  COMBINE TEKAPO SPILL WITH BENMORE INFLOW (BENMORE TOTAL TRIB)
BENTR = BENTR + TKSPL
                $$$ DEDUCT RESIDUAL FLOWS IN UPPER OHAU RIVER
OHAUS=OHAUI - 8000
IF MMDD GT 1031 2
  if mmdd le 430 1
    OHAUS=OHAUI - 12000
OHAUL = OHAUI          $$$ Dummy value to retain 6 item output
PUT  TKOUT PUKT OHAUI BENTR OHAUL OHAUS    $$$ 98614
```

Listing of PSIM Programme: WAITAKI.SIM

```
$$$**************************************************************************
$$$ WAITAKI.SIM (4/2/94)  Version: Feb 94
$$$**************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Waitaki Tributary flow at Waitaki PS
$$$   AUTHOR:          T S Halliburton              DATE:   Dec 1993
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$     Ammended February 1994 by J R Duffy to fill gaps in Pukaki outflow
$$$**************************************************************************

       $$$ INPUT SITE IS 88714, 5 ITEM SITE
GET TEKT PUKT TEKSP TKBGEN WTKTOT       $$$ Line ammended Feb 1994 J R Duffy
TIME D
$$$ SEVERAL GAPS OCCUR IN PUKAKI OUTFLOW RECORD, FILL USING
$$$ REGRESSION WITH TEKAPO OUTFLOW, CORRELATION COEFF r2=0.78
$$$ PUKAKI OUTFLOW = TEKAPO OUTFLOW x 2.106 - 38764
IF D LT 310401 GOTO CONTINUE       $$$ }
IF D LT 311024 GOTO GAP            $$$ }
IF D LT 311206 GOTO CONTINUE       $$$ }
IF D LT 320223 GOTO GAP            $$$ }
IF D LT 320405 GOTO CONTINUE       $$$ }
IF D LT 321107 GOTO GAP            $$$ } Lines added Feb 1994 J R Duffy
IF D LT 340501 GOTO CONTINUE       $$$ }
IF D LT 340609 GOTO GAP            $$$ }
IF D LT 351003 GOTO CONTINUE       $$$ }
IF D LT 351125 GOTO GAP            $$$ }
IF D LT 430923 GOTO CONTINUE       $$$ }
IF D LT 431217 GOTO GAP            $$$ }
GOTO CONTINUE                    $$$ }

GAP:                             $$$ Line added Feb 1994 J R Duffy
PUKT = (TEKT * 2.106) - 38764       $$$ Line added Feb 1994 J R Duffy

CONTINUE:                        $$$ Line added Feb 1994 J R Duffy
IF D GT 770822 1
   LAKE = PUKT + TEKT   $$$ Before Tekapo B
IF D LT 770822 1
   LAKE = PUKT + TEKSP    $$$ After Tekapo B
WTKTRB = WTKTOT - LAKE
IF WTKTRB GE 0 1
   WTKTRB = 0
PUT LAKE WTKTRB
```

Listing of PSIM Programme: ROXBURGH.SIM

```
$$$*****************************************************************************
$$$ ROXBURGH.SIM  Version: June 1992
$$$*****************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Clutha Tributary flow at Roxburgh
$$$   AUTHOR:          unknown              DATE:   unknown
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$*****************************************************************************
          $$$  READ ROXBURGH LAKE INFLOW 9110
GET  ROXTI
          $$$  READ LAKE HAWEA OUTFLOW 9174
XGET  HWEO
XLOCK
          $$$  SUBTRACT HAWEA OUTFLOW FROM ROXBURGH INFLOW TO OBTAIN
          $$$  CLUTHA RIVER TRIBUTARY FLOW AT ROXBURGH.
RXTRB=ROXTI-HWEO
IF RXTRB GE 0 1
   RXTRB= 0
PUT  RXTRB    $$$ 99110
```

Listing of PSIM Programme: ROXB1.SIM

```
$$$*****************************************************************************
$$$ ROXB1.SIM  Version: October 1996
$$$*****************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calc. Clutha Tributary flow at Roxburgh from 960201
$$$   AUTHOR:          P M Mitchell             DATE:   9 October 1996
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$ Modifications to calculation of site 99110 Roxburgh at Clutha Tributaries
$$$ as Roxburgh Inflow record not available from 960201. Roxburgh Tributaries
$$$ calculated from 960201 as (Chards Rd + Wanaka Outflow) * 1.10
$$$*****************************************************************************
XLOCK
          $$$  READ CHARDS RD FLOW 9013
GET  CHARDSRD
          $$$  READ LAKE WANAKA OUTFLOW 9154
XGET  WANAO
          $$$  ADDS (CHARDS RD FLOW TO WANAKA OUTFLOW) * 1.10 TO OBTAIN
          $$$  CLUTHA RIVER TRIBUTARY FLOW AT ROXBURGH.
RXTRB=(CHARDSRD+WANAO)*1.10
IF RXTRB GE 0 1
   RXTRB= 0
PUT  RXTRB    $$$ 99110
```

Listing of PSIM Programme: MANAPOUR.SIM

```
$$$*****************************************************************************
$$$ MANAPOUR.SIM  Version: March 1993
$$$*****************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Manapouri Local Inflows without Mararoa
$$$   AUTHOR:          unknown              DATE:   unknown

$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$
$$$*****************************************************************************
```

```
          $$$  No Mararoa
          $$$  READ TE ANAU INFLOW 9570
          $$$  READ TE ANAU OUTFLOW 9574
          $$$  READ MANAPOURI TOTAL INFLOW 9550
          $$$  READ MARAROA 9523
GET  TANUI TANUO MPRTI MARAI
          $$$  COMPUTE MANAPOURI TRIBUTARY FLOW BY SUBTRACTING
          $$$  TE ANAU OUTFLOW FROM MANAPOURI TOTAL INFLOW.
TIME D
IF D GT 320502 1
   MPRTI=TANUO*1.498+1972
MPRI=MPRTI-TANUO
IF D LT 690908 1       $$$ Changed from 760416 to 690908 7/3/94 JRD
   MPRI = MPRI - MARAI
IF MPRI GE 0 1
   MPRI= 0
PUT  MPRI  $$$ 99550
```

Listing of PSIM Programme: MANARED.SIM

```
$$$**************************************************************************
$$$ MANARED.SIM  Version: March 1993
$$$**************************************************************************
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:        Calculate Manapouri Local Inflows with Mararoa and
$$$                    possible water right reduction
$$$   AUTHOR:          unknown                DATE:   unknown
$$$   LOCATION:        Wellington
$$$   MODIFICATION HISTORY:
$$$
$$$     9/4/96  Modification of residual flow regime (R Jack)
$$$
$$$**************************************************************************
$$$ Manapouri local inflow with Mararoa and possible water right reduction
init flush 0
init recdate 0428
                  $$$  READ TE ANAU INFLOW 9570
                  $$$  READ TE ANAU OUTFLOW 9574
                  $$$  READ MANAPOURI TOTAL INFLOW 9550
                  $$$  READ MARAROA 9523
GET  TANUI TANUO MPRTI MARAI
                  $$$  COMPUTE MANAPOURI TRIBUTARY FLOW BY SUBTRACTING
                  $$$  TE ANAU OUTFLOW FROM MANAPOURI TOTAL INFLOW.
TIME D
mmdd=mod(D,10000)
IF D GT 19320502 1
   MPRTI=TANUO*1.498+1972
MPRI=MPRTI-TANUO
IF MPRI GE 0 1
   MPRI= 0
IF D GT 19690908 2
  $$$ Changed from 760416 to 690908 7/3/94 JRD
   MARAI = TANUI * 0.112
   MPRI = MPRI + MARAI
            $$$  SPILL MARAROA DIRTY WATER IF MARAROA FLOW > 40 CUMECS.
IF MARAI LT  40000 2
            resflow=marai
            goto resid

$$$ Minimum flow regime (modified 9/6/96, R Jack)
             resflow=16000
             if mmdd gt 1031 goto resid
              resflow=14000
```

```
                if mmdd gt 0930 goto resid
                 resflow=12000
                if mmdd gt 0430 goto resid
                resflow=14000
               if mmdd gt 0331 goto resid
               resflow=16000
resid:
MPRIT=MPRI
MPRI = MPRI - resflow

$$$ 150 cumec flushing discharge in Mar-May and Sep-Nov (added 9/4/96, R Jack)

$$$ Sep to Nov
PARTA:
if mmdd gt 1130 goto CloseA
if mmdd lt 0901 goto PARTB
  if flush eq 1 goto Recflow
    if MPRIT lt 150000 goto Recflow
      MPRI=MPRIT-150000
 $$$ residual flow included in discharge
      flush=1
goto next
CloseA:
flush=0

 $$$ Mar to May
PARTB:
if mmdd le 0531 2
flush=0
        $$$ 31/5 < date < 1/9
goto Recflow
if mmdd lt 0301 goto Recflow
  if flush eq 1 goto Recflow
    if MPRIT lt 150000 goto Recflow
      MPRI=MPRIT-150000
if recdate eq 0428 goto recflow
 $$$ residual flow included in discharge
      flush=1

$$$  Seven monthly flushing flows.  4th Sunday of each month is assumed to
$$$  occur on the 28th of each month.  (added 9/4/96, R Jack)

Recflow:
if mmdd lt 1031 2
recdate=0428
  $$$ recdate is the date the next discharge is to ...
goto NEXT
  $$$ occur on
if mmdd ne recdate goto NEXT
  MPRI=MPRIT-35000
  $$$ residual flow included in discharge
  recdate=recdate+100

NEXT:
PUT  MPRI
 $$$ 99552 with water right reduction
```

Listing of PSIM Programme: MANAWMAR.SIM

```
$$$*****************************************************************************
$$$ MANAWMAR.SIM  Version: March 1993
$$$*****************************************************************************
```

```
$$$   CALLED FROM:     PROCESS.SCR
$$$   FUNCTION:       Calculate Manapouri Local Inflows with Mararoa
$$$   AUTHOR:         unknown              DATE:   unknown
$$$   LOCATION:       Wellington
$$$   MODIFICATION HISTORY:
$$$
$$$*****************************************************************************
$$$ Manapouri local inflow with Mararoa.
                $$$  READ TE ANAU INFLOW 9570
                $$$  READ TE ANAU OUTFLOW 9574
                $$$  READ MANAPOURI TOTAL INFLOW 9550
                $$$  READ MARAROA 9523
GET  TANUI TANUO MPRTI MARAI
                $$$  COMPUTE MANAPOURI TRIBUTARY FLOW BY SUBTRACTING
                $$$  TE ANAU OUTFLOW FROM MANAPOURI TOTAL INFLOW.
TIME D
IF D GT 320502 1
   MPRTI=TANUO*1.498+1972
MPRI=MPRTI-TANUO
IF MPRI GE 0 1
   MPRI= 0
IF D GT 690908 2       $$$ Changed from 760416 to 690908 7/3/94 JRD
   MARAI = TANUI * 0.112
   MPRI = MPRI + MARAI
          $$$  SPILL MARAROA DIRTY WATER IF MARAROA FLOW > 40 CUMECS.
IF MARAI LT  40000 1
   MPRI = MPRI - MARAI
PUT  MPRI  $$$ 99551
```