Seqwater - Report on the operation of Somerset and Wivenhoe Dam - October to December 2010

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OCTOBER - DECEMBER 2010
FLOOD EVENTS

REPORT ON THE OPERATION OF SOMERSET DAM AND WIVENHOE DAM

MAY 2011

EXECUTIVE SUMMARY

Somerset Dam and Wivenhoe Dam are located in the Brisbane River Basin. The Dams are dual-purpose storages that provide urban water supplies (including drinking water) to South East Queensland, as well as flood mitigation benefits to areas potentially impacted by flood flows along the Brisbane River below Wivenhoe Dam.

October 2010 Flood Event

The October 2010 Flood Event impacted the Dams between Saturday 9 October 2010 and Tuesday 19 October 2010. The Event had an Annual Exceedance Probability (AEP) of less than 1 in 50 and can be categorised as a frequent flood event according to the Institution of Engineers Australia (Engineers Australia) national guidelines for the estimation of design flood characteristics (AR&R).

The flood was managed primarily to minimise disruption to rural life in the valleys of the Brisbane and Stanley Rivers. There were no known adverse impacts to urban areas downstream of Moggill as a result of the Flood Event.

Clear flood mitigation benefits provided by Wivenhoe Dam during the Event included preventing the inundation of Mt Crosby Weir Bridge and reducing the peak flow in the Brisbane River at Moggill from a potential flow of 3,000m^3/s to an actual flow of around 1,500m^3/s. Damage tables supplied by the Brisbane City Council indicate a flow of 3,000m^3/s at Moggill could cause damage in the Brisbane area exceeding $5 million.

December 2010 Flood Events

Three flood events impacted Somerset and Wivenhoe Dams between Monday 13 December 2010 and Sunday 2 January 2011. The December Flood Events had an Annual Exceedance Probability (AEP) of less than 1 in 10 and can also be categorised as frequent flood events according to the Institution of Engineers Australia (Engineers Australia) national guidelines for the estimation of design flood characteristics (AR&R).

The floods were managed primarily to minimise disruption to rural life in the valleys of the Brisbane and Stanley Rivers. There were no known adverse impacts to urban areas downstream of Moggill resulting from the Events.

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1. INTRODUCTION

1.1 Meaning of terms

In this report, the following terms are defined as below:

"**Act**" means the Water Supply (Safety and Reliability) Act 2008;

"**AEP**" means Annual Exceedance Probability, the probability of a specified event being reached or exceeded in any one year. This may be expressed as a ratio (e.g. 1 in Y) or a percentage;

"**Agency**" includes a person, a local government and a department of State government within the meaning of the *Acts Interpretation Act 1954*;

"**AHD**" means Australian Height Datum;

"**ALERT**" means Automated Local Evaluation in Real Time System, a system of monitoring and displaying rainfall and water level data. It is a combination of field stations, communications networks and data collection software;

"**AMTD**" means the Adopted Middle Thread Distance, which is the distance along the centre line of the mainstream from a junction, usually in kilometres;

"**ANSI**" means the American National Standards Institute;

"**AR&R**" means *Australian Rainfall and Run-off (Book 6),* The Institution of Engineers Australia (Engineers Australia) national guidelines for the estimation of design flood characteristics;

"**BoM**" means the Bureau of Meteorology;

"**Chairperson**" means the Chairperson of Seqwater;

"**Chief Executive**" means the Director-General of the Department of Environment and Resource Management or nominated delegate;

"**Controlled Document**" means a document subject to managerial control over its contents, distribution and storage. It may have legal and contractual implications;

"**Dams**" means Somerset Dam and Wivenhoe Dam;

"**Dam Crest Flood**" means the flood event which, when routed through the storage with the storage initially at Full Supply Level, results in the still water level in the storage reaching the lowest point in the dam embankment, excluding wind and wave effects;

"Dam Supervisor" means the senior on-site officer at Somerset or Wivenhoe Dam as the case may be;

"DERM" means the Queensland Government department, the Department of Environment and Resource Management;

"Duty Flood Operations Engineer" means the Senior Flood Operations Engineer or Flood Operations Engineer rostered on duty to be in charge of Flood Operations at the Dams;

"EL" means elevation in metres Australian Height Datum;

"Enviromon" is the Bureau of Meteorology data collection software used to collect and display rainfall and water level data;

"ERRTS" means Event Reporting Radio Telemetry System;

"Flood Event" is a situation where the Duty Flood Operations Engineer expects the water level in either of the Dams to exceed the Full Supply Level;

"FLOOD-Col" is the data collection software used in the Flood Operations Centre to collect and display rainfall and water level data;

"FLOOD-Ops" is the modelling software used in the Flood Operations Centre to model the runoff from the catchments;

"Flood Operations Centre" means the office location used by Flood Operations Engineers during a flood event to manage the event;

"Flood Operations Engineer" means a person designated to direct flood operations at the Dams in accordance with Section 2.4 of the Manual;

"Flood Operations Engineers" means the collective group of persons who individually have designation as either a **Flood Operations Engineer** or a **Senior Flood Operations Engineer**;

"**Flood Operations Manager**" means the Senior Flood Operations Engineer or Flood Operations Engineer designated responsibility for the overall management of the Flood Operations Centre leading up to or during a flood event;

"FSL" or "Full Supply Level" means the level of the water surface when the reservoir is at maximum operating level, excluding periods of flood discharge;

"Gauge" when referred to in (m) means river level referenced to AHD or a local datum, and when referred to in (m^3/s) means flow rate in cubic metres per second;

"IFD" means Intensity Frequency Duration and refers to the statistical analysis of rainfall intensities;

"Manual" or **"Manual of Operational Procedures for Flood Events at Wivenhoe Dam and Somerset Dam"** means the current version (Revision 7) of the Manual;

"m^3/s" means a rate of water flow being one cubic metre of water per second or 1,000 litres of water per second;

"OOA" means 'out of action' in relation to the operation of a rainfall or river height gauge that provides catchment data;

"Operating Target Line" means the Wivenhoe/Somerset Operating Target Line from Strategy S2 of the Manual;

"Power Station" means the Wivenhoe pumped storage hydro-electric power station associated with Wivenhoe Dam and Splityard Creek Dam;

"Protocol" means draft Communication Protocol prepared by DERM to ensure information is effectively communicated to the public during flood events impacting Somerset Dam and Wivenhoe Dam;

"QPF" means Quantitative Precipitation Forecast provided by the Bureau of Meteorology and is an estimate of the predicted rainfall in millimetres, usually in the next 24 hours;

"RTFM" means Real Time Flood Model and is a combination of Flood-Col, Flood-Ops and other ancillary software;

"SD" means State Datum, which is a level height datum that is different from AHD;

"Senior Flood Operations Engineer" means a person designated in accordance with Section 2.3 of the Manual under whose general direction the procedures in the Manual must be carried out;

"Seqwater" means the Queensland Bulk Water Supply Authority, trading as Seqwater;

"URBS" means Unified River Basin Simulator.

Note: Dam levels in this document represented as metres (m) are metres Australian Height Datum or (m AHD).

1.2 Background

Given the potential significant impact on downstream populations and property, it is imperative Somerset and Wivenhoe Dams are operated during flood events in accordance with clearly defined and pre-determined procedures. The current procedures are contained in Revision 7 of *The Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam* ("the Manual") that was gazetted in January 2010. The Manual is an approved flood mitigation manual under the *Queensland Water Supply (Safety and Reliability) Act 2008*. An understanding of the Manual is important when reading this Report.

The Manual requires the owner of Somerset and Wivenhoe Dams (currently Seqwater) to prepare a report after each flood event impacting the Dams. A flood event is defined as a situation where either Somerset and or Wivenhoe Dams exceed their Full Supply Level (FSL) and flood water releases are made. The report must contain details of the procedures followed during the flood event, the reasons why those procedures were used and other pertinent information. Seqwater must forward the report to the Director-General of the Department of Environment and Resource Management (DERM). These reports are normally required within six weeks of the end of the Event. However, given the large number flood events experienced during the 2010/11 wet season and the requirements of the Flood Commission of Inquiry, DERM extended the deadline for this report until 31 May 2011.

This document comprises the required report relating to the four flood events that impacted Somerset and Wivenhoe Dams between October 2010 and December 2010.

2. EVENT MOBILISATION AND STAFFING

2.1 Event Mobilisation

The Flood Operations Centre was mobilised well before gate opening trigger levels were reached at the Dams during each flood event. This allowed the Flood Operations Centre to be well prepared for the events and provided time for the Dam Operators to prepare the dam sites for the releases and undertake all operational checks. The table below details the date and time of each mobilisation time in relation to the commencement of flood releases.

Flood Event	Mobilisation Time	Flood Release Commencement
October 2010	06:30 - 09 October 2010	19:00 - 09 October 2010
Early December 2010	07:00 - 11 December 2010	12:30 - 13 December 2010
Mid December 2010	10:00 - 17 December 2010	18:00 - 17 December 2010
Late December 2010	05:30 - 25 December 2010	09:00 - 26 December 2010

The following actions were undertaken as soon as mobilisation occurred:

- 24/7 staffing commenced at the Flood Operations Centre, generally with at least one Duty Flood Operations Engineer and one trained Flood Officer present (normally two persons);
- 24/7 staffing commenced at the Dams, generally with two trained Dam Operators present;
- Flood Operations Engineers were called back early from annual leave to assist with the management of the events.

The Flood Operations Centre and Dams continued to be staffed on this basis until event de-mobilisation.

2.2 Flood Operations Centre Staffing

The tables below detail Flood Operations Centre staffing during each flood event. Each table has been compiled in accordance with the confirmed Event Roster.

OCTOBER EVENT			
Shift start time	**Shift finish time**	**Flood Operations Engineer**	**Flood Officer**
Sat 09/10/10 07:00	Sat 09/10/10 19:00	Rob Ayre	Ken Price, Kim Hang
Sat 09/10/10 19:00	Sun 10/10/10 07:00	John Tibaldi	Al Navruk
Sun 10/10/10 07:00	Sun 10/10/10 19:00	Terry Malone	Bill Stephens

OCTOBER EVENT			
Shift start time	**Shift finish time**	**Flood Operations Engineer**	**Flood Officer**
Sun 10/10/10 19:00	Mon 11/10/10 07:00	John Ruffini	David Pokarier
Mon 11/10/10 07:00	Mon 11/10/10 19:00	Rob Ayre, Terry Malone	Peter MacTaggart
Mon 11/10/10 19:00	Tue 12/10/10 07:00	John Tibaldi	Sean Fleming
Tue 12/10/10 07:00	Tue 12/10/10 19:00	Terry Malone	Ken Price
Tue 12/10/10 19:00	Wed 13/10/10 07:00	Rob Ayre	Mark Tan
Wed 13/10/10 07:00	Wed 13/10/10 19:00	John Ruffini	Al Navruk
Wed 13/10/10 19:00	Thu 14/10/10 07:00	Terry Malone	John West
Thu 14/10/10 07:00	Thu 14/10/10 19:00	John Tibaldi	David Pokarier
Thu 14/10/10 19:00	Fri 15/10/10 07:00	John Ruffini	Neville Ablitt
Fri 15/10/10 07:00	Fri 15/10/10 19:00	Rob Ayre	Sean Fleming
Fri 15/10/10 19:00	Sat 16/10/10 07:00	John Tibaldi	Peter McTaggart
Sat 16/10/10 07:00	Sat 16/10/10 19:00	Terry Malone	Louw Van Blerk
Sat 16/10/10 19:00	Sun 17/10/10 07:00	Rob Ayre	Lisa Cecchi
Sun 17/10/10 07:00	Sun 17/10/10 19:00	John Ruffini	Kim Hang
Sun 17/10/10 19:00	Mon 18/10/10 07:00	Terry Malone	Bill Stephens
Mon 18/10/10 07:00	Mon 18/10/10 19:00	John Tibaldi	John West
Mon 18/10/10 19:00	Tue 19/10/10 07:00	John Ruffini	Ken Price
Tue 19/10/10 07:00	Tue 19/10/10 09:15	Terry Malone	Mark Tan

OCTOBER EVENT			
Shift start times	**Shift finish times**	**Wivenhoe Dam Operators**	**Somerset Dam Operators**
Sat 09/10/10 07:00	Sat 09/10/10 19:00	Matt O'Reilly Graham Keegan	Agg Dagan Adam Weller
Sat 09/10/10 19:00	Sun 10/10/10 07:00	Doug Grigg Russel Titmarsh	Graham Francis Ray Ballinger
Sun 10/10/10 07:00	Sun 10/10/10 19:00	Matt O'Reilly Mark Granzien	Agg Dagan Adam Weller
Sun 10/10/10 19:00	Mon 11/10/10 07:00	Doug Grigg Graham Keegan	Graham Francis Ray Ballinger
Mon 11/10/10 07:00	Mon 11/10/10 19:00	Matt O'Reilly Darren Varley	Agg Dagan Adam Weller
Mon 11/10/10 19:00	Tue 12/10/10 07:00	Doug Grigg Garry Ludlow	Graham Francis Ray Ballinger

OCTOBER EVENT			
Shift start times	**Shift finish times**	**Wivenhoe Dam Operators**	**Somerset Dam Operators**
Tue 12/10/10 07:00	Tue 12/10/10 19:00	Matt O'Reilly Mark Granzien	Agg Dagan Adam Weller
Tue 12/10/10 19:00	Wed 13/10/10 07:00	Doug Grigg Graham Keegan	Graham Francis Ray Ballinger
Wed 13/10/10 07:00	Wed 13/10/10 19:00	Matt O'Reilly Russel Titmarsh	Agg Dagan Adam Weller
Wed 13/10/10 19:00	Thu 14/10/10 07:00	Doug Grigg Graham Keegan	Graham Francis Phil Jordan
Thu 14/10/10 07:00	Thu 14/10/10 19:00	Matt O'Reilly Darren Varley	Agg Dagan Ray Ballinger
Thu 14/10/10 19:00	Fri 15/10/10 07:00	Doug Grigg Garry Ludlow	Graham Francis Adam Weller
Fri 15/10/10 07:00	Fri 15/10/10 19:00	Matt O'Reilly Mark Granzien	Agg Dagan Ray Ballinger
Fri 15/10/10 19:00	Sat 16/10/10 07:00	Doug Grigg Garry Ludlow	Agg Dagan
Sat 16/10/10 07:00	Sat 16/10/10 19:00	Matt O'Reilly Russel Titmarsh	Graham Francis Ray Ballinger
Sat 16/10/10 19:00	Sun 17/10/10 07:00	Doug Grigg Graham Keegan	Agg Dagan Adam Weller
Sun 17/10/10 07:00	Sun 17/10/10 19:00	Matt O'Reilly Darren Varley	Graham Francis Ray Ballinger
Sun 17/10/10 19:00	Mon 18/10/10 07:00	Doug Grigg Mark Granzien	Agg Dagan Adam Weller
Mon 18/10/10 07:00	Mon 18/10/10 19:00	Matt O'Reilly Russel Titmarsh	Graham Francis Ray Ballinger
Mon 18/10/10 19:00	Tue 19/10/10 07:00	Doug Grigg Graham Keegan	Agg Dagan Adam Weller
Tue 19/10/10 07:00	Tue 19/10/10 19:00	Matt O'Reilly	Graham Francis

EARLY DECEMBER EVENT			
Shift start times	**Shift finish times**	**Flood Operations Engineer**	**Flood Officer**
Mon 13/12/10 07:00	Mon 13/12/10 19:00	Terry Malone	
Mon 14/12/10 19:00	Tue 14/12/10 07:00	John Tibaldi	

EARLY DECEMBER EVENT			
Shift start times	**Shift finish times**	**Flood Operations Engineer**	**Flood Officer**
Tue 14/12/10 07:00	Tue 14/12/10 19:00	Terry Malone	Bill Stephens
Tue 14/12/10 19:00	Wed 15/12/10 07:00	John Tibaldi	
Wed 15/12/10 07:00	Wed 15/12/10 19:00	John Ruffini	David Pokarier
Wed 15/12/10 19:00	Thu 16/12/10 07:00	John Tibaldi	
Thu 16/12/10 07:00	Thu 16/12/10 10:30	Terry Malone	John West

EARLY DECEMBER EVENT			
Shift start times	**Shift finish times**	**Wivenhoe Dam Operators**	**Somerset Dam Operators**
Mon 13/12/10 11:00	Mon 13/12/10 19:00	Doug Grigg Mark Granzien	Graham Francis Graham Keegan
Mon 13/12/210 19:00	Tue 14/12/10 07:00	Matt O'Reilly Garry Ludlow	Agg Dagan Phil Jordan
Tue 14/12/10 07:00	Tue 14/12/10 19:00	Doug Grigg Mark Granzien	Graham Francis Graham Keegan
Tue 14/12/10 19:00	Wed 15/12/10 07:00	Matt O'Reilly Garry Ludlow	Agg Dagan Phil Jordan
Wed 15/12/10 07:00	Wed 15/12/10 19:00	Doug Grigg Russel Titmarsh	Graham Francis Graham Keegan
Wed 15/12/10 19:00	Thu 16/12/10 07:00	Matt O'Reilly Graham Keegan	Agg Dagan Adam Weller
Thu 16/12/10 07:00	Thu 16/12/10 10:00	Doug Grigg Russel Titmarsh	Graham Francis Ray Ballinger

MID DECEMBER EVENT			
Shift start times	**Shift finish times**	**Flood Operations Engineer**	**Flood Officer**
Fri 17/12/10 16:00	Sat 18/12/10 07:00	John Ruffini	Neville Ablitt
Sat 18/12/10 07:00	Sat 18/12/10 19:00	John Tibaldi	Bill Stephens
Sat 18/12/10 19:00	Sun 19/12/10 07:00	Terry Malone	Kim Hang
Sun 19/12/10 07:00	Sun 19/12/10 19:00	Rob Ayre	Al Navruk
Sun 19/12/10 19:00	Mon 20/12/10 07:00	John Tibaldi	Mark Tan
Mon 20/12/10 07:00	Mon 20/12/10 19:00	John Ruffini	John West
Mon 20/12/10 19:00	Tue 21/12/10 07:00	Rob Ayre	Louw Van Blerk

MID DECEMBER EVENT			
Shift start times	**Shift finish times**	**Flood Operations Engineer**	**Flood Officer**
Tue 21/12/10 07:00	Tue 21/12/10 19:00	Terry Malone	David Pokarier
Tue 21/12/10 19:00	Wed 22/12/10 07:00	John Ruffini	Bill Stephens
Wed 22/12/10 07:00	Wed 22/12/10 19:00	Terry Malone	Kim Hang
Wed 22/12/10 19:00	Thu 23/12/10 07:00	John Tibaldi	Al Navruk
Thu 23/12/10 07:00	Thu 23/12/10 19:00	Rob Ayre	Neville Ablitt
Thu 23/12/10 19:00	Fri 24/12/10 07:00	John Tibaldi	Mark Tan
Fri 24/12/10 07:00	Fri 24/12/10 15:00	John Ruffini	John West

MID DECEMBER EVENT			
Shift start times	**Shift finish times**	**Wivenhoe Dam Operators**	**Somerset Dam Operators**
Fri 17/12/10 07:00	Fri 17/12/10 19:00	Doug Grigg	Agg Dagan on-call
Fri 17/12/10 19:00	Sat 18/12/10 07:00	Matt O'Reilly Graham Keegan	Agg Dagan on-call
Sat 18/12/10 07:00	Sat 18/12/10 19:00	Doug Grigg Mark Granzien	Agg Dagan on-call
Sat 18/12/10 19:00	Sun 19/12/10 07:00	Matt O'Reilly Graham Keegan	Graham Francis on-call
Sun 19/12/10 07:00	Sun 19/12/10 19:00	Doug Grigg Col Gillam	Graham Francis on-call
Sun 19/12/10 19:00	Mon 20/12/10 07:00	Matt O'Reilly Graham Keegan	Graham Francis on-call
Mon 20/12/10 07:00	Mon 20/12/10 19:00	Doug Grigg Mark Granzien	Graham Francis Ray Ballinger
Mon 20/12/10 19:00	Tue 21/12/10 07:00	Matt O'Reilly Graham Keegan	Agg Dagan Brent Billington
Tue 21/12/10 07:00	Tue 21/12/10 19:00	Doug Grigg Russel Titmarsh	Graham Francis Ray Ballinger
Tue 21/12/10 19:00	Wed 22/12/10 07:00	Matt O'Reilly Col Gillam	Agg Dagan Brent Billington
Wed 22/12/10 07:00	Wed 22/12/10 19:00	Doug Grigg Russel Titmarsh	Graham Francis Ray Ballinger
Wed 22/12/10 19:00	Thu 23/12/10 07:00	Matt O'Reilly Col Gillam	Agg Dagan Brent Billington

MID DECEMBER EVENT			
Shift start times	**Shift finish times**	**Wivenhoe Dam Operators**	**Somerset Dam Operators**
Thu 23/12/10 07:00	Thu 23/12/10 19:00	Doug Grigg Russel Titmarsh	Graham Francis Ray Ballinger
Thu 23/12/10 19:00	Fri 24/12/10 07:00	Matt O'Reilly Graham Keegan	Agg Dagan Adam Weller
Fri 24/12/10 07:00	Fri 24/12/10 19:00	Doug Grigg Col Gillam	Graham Francis Ray Ballinger

LATE DECEMBER EVENT			
Shift start times	**Shift finish times**	**Flood Operations Engineer**	**Flood Officer**
Sun 26/12/10 07:00	Sun 26/12/10 19:00	Rob Ayre	Al Navruk
Sun 26/12/10 19:00	Mon 27/12/10 07:00	John Tibaldi	Kim Hang
Mon 27/12/10 07:00	Mon 27/12/10 19:00	Terry Malone	David Pokarier
Mon 27/12/10 19:00	Tue 28/12/10 07:00	John Tibaldi	Neville Ablitt
Tue 28/12/10 07:00	Tue 28/12/10 19:00	Terry Malone	Louw Van Blerk
Tue 28/12/10 19:00	Wed 29/12/10 07:00	John Ruffini	John West
Wed 29/12/10 07:00	Wed 29/12/10 19:00	Terry Malone	Mark Tan
Wed 29/12/10 19:00	Thu 30/12/10 07:00	Rob Ayre	Al Navruk
Thu 30/12/10 07:00	Thu 30/12/10 19:00	Terry Malone	Kim Hang
Thu 30/12/10 19:00	Fri 31/12/10 07:00	John Ruffini	David Pokarier
Fri 31/12/10 07:00	Fri 31/12/10 19:00	Terry Malone	Neville Ablitt
Fri 31/12/10 19:00	Sat 01/01/11 07:00	John Ruffini	Louw Van Blerk
Sat 01/01/11 07:00	Sat 01/01/11 19:00	Terry Malone	John West
Sat 01/01/11 19:00	Sun 02/01/11 07:00	Rob Ayre	Mark Tan
Sun 02/01/11 07:00	Sun 02/01/11 09:45	Terry Malone	Al Navruk

LATE DECEMBER EVENT			
Shift start times	**Shift finish times**	**Wivenhoe Dam Operators**	**Somerset Dam Operators**
Sun 26/12/10 07:00	Sun 26/12/10 19:00	Doug Grigg Graham Keegan	Graham Francis Ray Ballinger
Sun 26/12/10 19:00	Mon 27/12/10 07:00	Matt O'Reilly Col Gillam	Agg Dagan Adam Weller

LATE DECEMBER EVENT			
Shift start times	**Shift finish times**	**Wivenhoe Dam Operators**	**Somerset Dam Operators**
Mon 27/12/10 07:00	Mon 27/12/10 19:00	Doug Grigg Russel Titmarsh	Graham Francis Ray Ballinger
Mon 27/12/10 19:00	Tue 28/12/10 07:00	Matt O'Reilly Col Gillam	Agg Dagan Adam Weller
Tue 28/12/10 07:00	Tue 28/12/10 19:00	Doug Grigg Russel Titmarsh	Graham Francis Ray Ballinger
Tue 28/12/10 19:00	Wed 29/12/10 07:00	Matt O'Reilly Col Gillam	Agg Dagan Adam Weller
Wed 29/12/10 07:00	Wed 29/12/10 19:00	Doug Grigg Mark Granzien	Graham Francis Ray Ballinger
Wed 29/12/10 19:00	Thu 30/12/10 07:00	Matt O'Reilly Col Gillam	Agg Dagan Adam Weller
Thu 30/12/10 07:00	Thu 30/12/10 19:00	Doug Grigg Russel Titmarsh	Graham Francis Ray Ballinger
Thu 30/12/10 19:00	Fri 31/12/10 07:00	Matt O'Reilly Col Gillam	Agg Dagan Adam Weller
Fri 31/12/10 07:00	Fri 31/12/10 19:00	Doug Grigg Mark Granzien	Chris Hine (Graham Francis on-call)
Fri 31/12/10 19:00	Sat 01/01/11 07:00	Matt O'Reilly Col Gillam	Adam Weller (Graham Francis on-call)
Sat 01/01/11 07:00	Sat 01/01/11 19:00	Doug Grigg Russel Titmarsh	Chris Hine (Graham Francis on-call)
Sat 01/01/11 19:00	Sun 02/01/11 07:00	Matt O'Reilly Mark Granzien	Adam Weller (Graham Francis on-call)
Sun 02/01/11 07:00	Sun 02/01/11 19:00	Doug Grigg Col Gillam	Chris Hine (Graham Francis on-call)

3. EVENT CONDITIONS

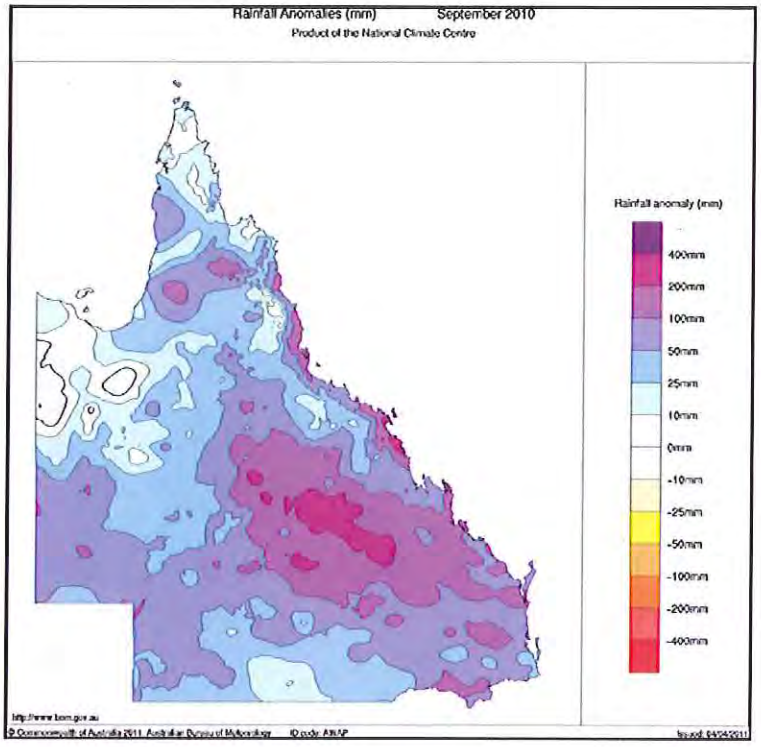
3.1 Introduction

For the purposes of this section of the report, the designated start date of each event has been taken as the commencement of modelling which may be earlier than the time the Flood Operations Centre was mobilised. This is to account for antecedent conditions and any rainfall which occurred prior to mobilisation of the Flood Operations Centre. These start dates are shown in the following table:

Event	Designated Start Date
October 2010	06/10/2010 09:00
Early December 2010	01/12/2010 09:00
Mid December 2010	16/12/2010 09:00
Late December 2010	24/12/2010 09:00

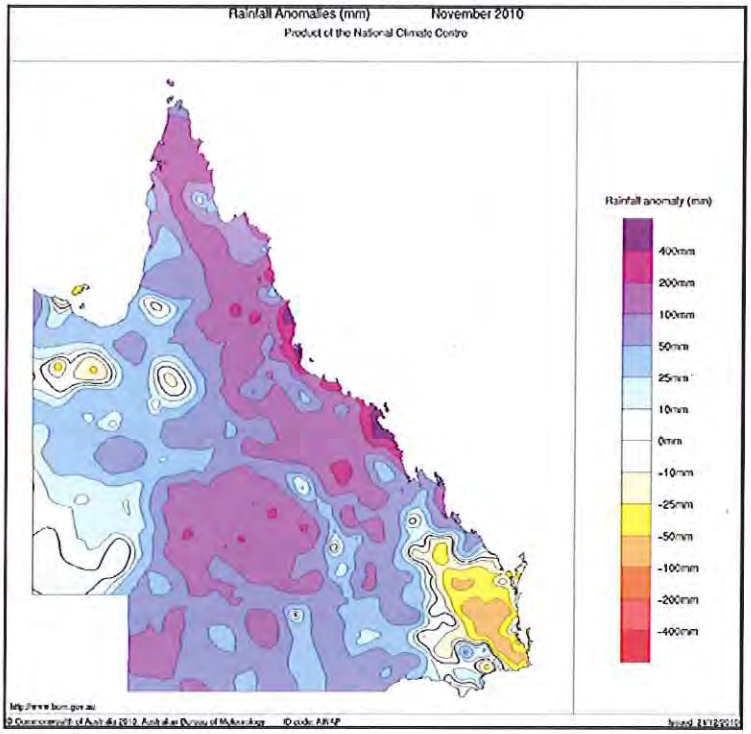
3.2 Pre Event Conditions – October Event

In the four weeks prior to the start of the October Event on Wednesday 6 October 2010, rainfall in South East Queensland had been above the September average by between approximately 50mm to100mm as demonstrated in the following diagram. As a result, the Dam catchments were relatively wet.



3.3 Pre Event Conditions – December Events

In the four weeks prior to the start of the Early December Event on Wednesday 1 December 2010, rainfall in South East Queensland had been just below the November average by between approximately 25mm to 50mm as indicated in the diagram below. This led to a slight drying out of the catchments.

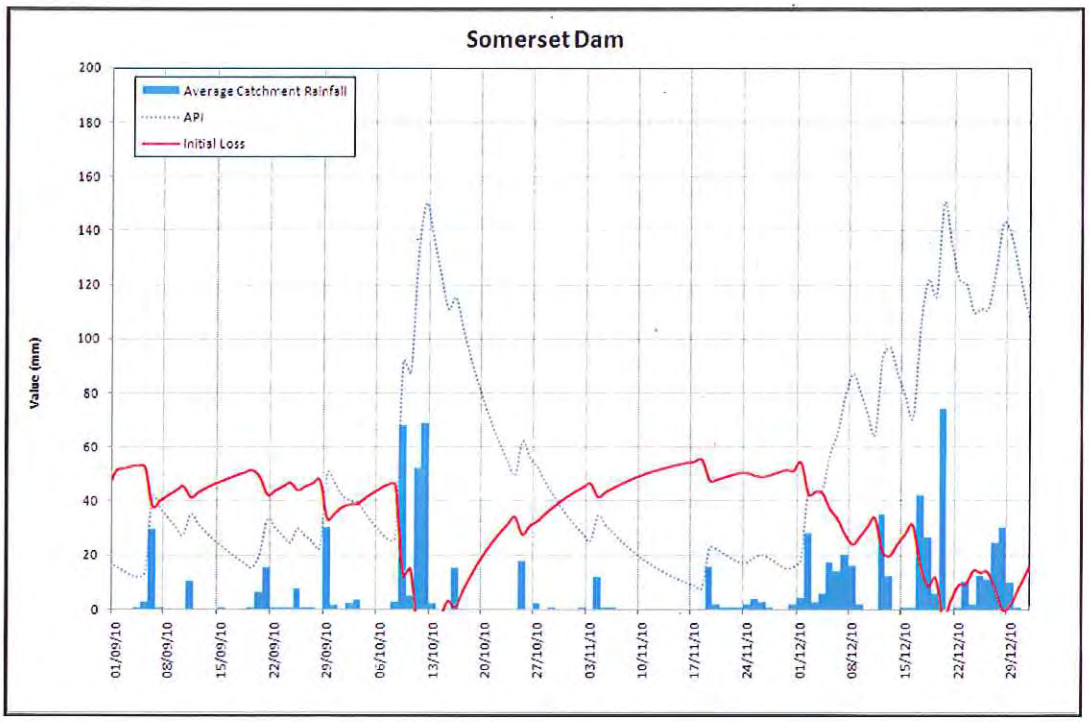


3.4 Antecedent Conditions

In the lead up to the October event, the Antecedent Precipitation Index (API) for the Stanley River to Somerset Dam was oscillating between 20mm and 40mm indicating that the catchment was reasonably wet. Initial loss was estimated to be about 45mm at the start of the October event. Historically, the Upper Brisbane to Wivenhoe catchment is much drier than the Stanley River catchment; however, at the start of the October event it was in a slightly drier state than the Stanley catchment, with a higher API and an estimated initial loss of 40mm to 50mm.

By the end of November 2010, the Somerset and Wivenhoe Dam catchments had dried out. APIs were approximately 10mm to 20mm and initial losses recovered to be as high as 50mm to 60mm by the start of December 2010. The APIs and initial loss estimates at the commencement of each of the flood events between October and December is shown below.

The following diagrams and tables highlight the change in initial loss and API over this four month period.


Somerset Dam
Average Catchment Rainfall
API
Initial Loss
Value (mm)
200
180
160
140
120
100
80
60
40
20
0
01/09/10
08/09/10
15/09/10
22/09/10
29/09/10
06/10/10
13/10/10
20/10/10
27/10/10
03/11/10
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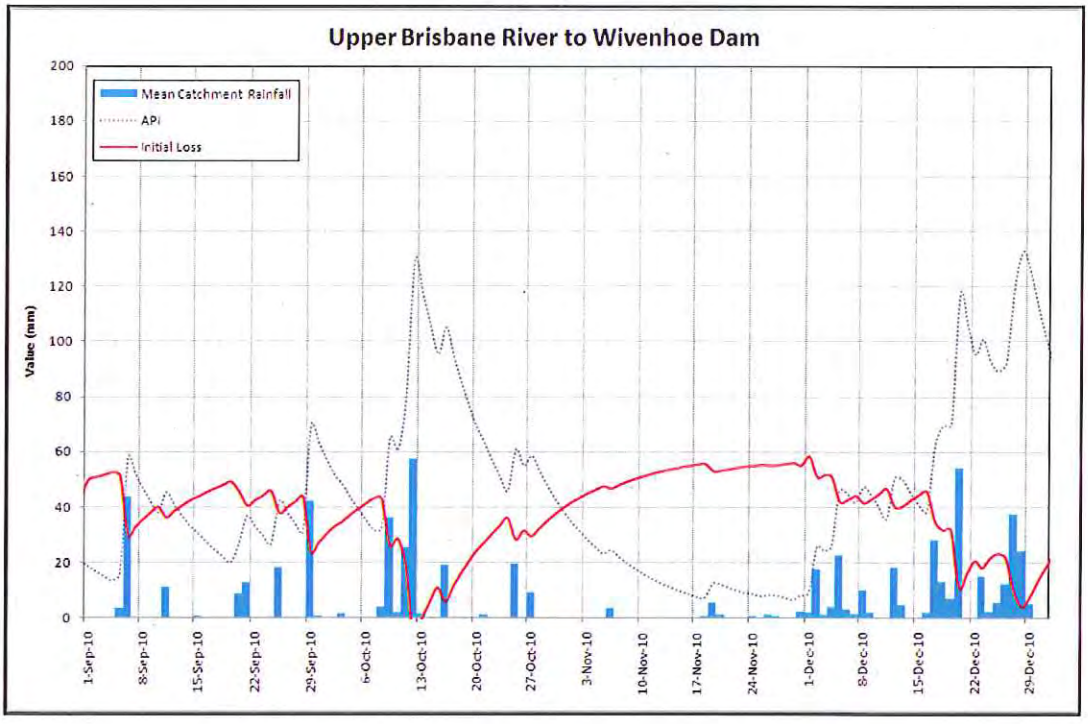
08/12/10
15/12/10
22/12/10
29/12/10


Upper Brisbane River to Wivenhoe Dam
Mean Catchment Rainfall
API
Initial Loss
Value (mm)
200
180
160
140
120
100
80
60
40
20
0
1-Sep-10
8-Sep-10
15-Sep-10
22-Sep-10
29-Sep-10
6-Oct-10
13-Oct-10
20-Oct-10
27-Oct-10
3-Nov-10
10-Nov-10
17-Nov-10
24-Nov-10
1-Dec-10
8-Dec-10
15-Dec-10
22-Dec-10
29-Dec-10

Event Start Date	Somerset Dam		Wivenhoe Dam	
	Estimated Initial Loss	Starting Level (FSL 99.0)	Estimated Initial Loss	Starting Level (FSL 67.0)
	mm	m AHD	mm	m AHD
06/10/2010	45	99.02	42	67.06
01/12/2010	54	99.06	58	67.01
16/12/2010	31	99.07	46	67.10
24/12/2010	14	99.10	22	67.12

4. DATA COLLECTION SYSTEM PERFORMANCE AND EVENT DATA

4.1 Introduction

A real time flood monitoring and forecasting system has been established to monitor rainfall and water levels in the Dam catchments and to provide adequate, accurate and timely information for informed decision-making. Field stations consisting of rainfall and water level gauges use the Event Reporting Radio Telemetry System (ERRTS) to communicate data to the Flood Operations Centre.

More than one gauge may be located at an individual field station. Water level gauges are often located at the Department of Environment and Resource Management (DERM) gauging stations. DERM is responsible for the maintenance of the water level gauges and Seqwater for the ERRTS equipment.

Rainfall gauges consist of a standard tipping bucket. Water level gauges vary in type and model but include shaft encoders, wet pressure transducers and dry pressure transducers. At a rainfall gauge, an event is defined as the tip of the bucket. At a water level rainfall gauge, an event is defined as an incremental increase or decrease in water level.

When an event is triggered at a gauge, data is transmitted via VHF radio through a series of redundant radio repeaters to the Flood Operations Centre and other data collection centres. Each signal has a unique identification number which is relayed to computer hardware platform serial port via a decoder when it arrives at the Flood Operations Centre base station. It is then time stamped, read, decoded, accepted or rejected, filtered, validated before being stored in a gauge database in the Centre's FLOOD-Col and Enviromon databases. Redundant base stations at Mineral House and the Land Centre in Brisbane's CBD are synchronised with the Flood Operations Centre database.

The FLOOD-Col and Enviromon databases contain gauge details including:

- Gauge name;
- ALERT number;
- Type of gauge;
- Calibration information;
- Alarm thresholds;
- Rating curve information, if applicable.

Both FLOOD-Col and Enviromon allow filtered gauge data to be viewed in either a text or graphical format. Information that can be viewed or edited includes height, discharge, rainfall pluviographs, rainfall hyetographs, lake levels and Dam volumes. Applications are also available for viewing groups of gauges.

The combination of ERRTS field stations, rainfall gauges and water level gauges, radio network and data collection software is referred to as an ALERT system. ALERT, or Automated Local Evaluation in Real Time System, has become a standard for flood warning systems in Australia

and the United States of America, and is widely used by the Bureau of Meteorology (BoM) and other flood warning agencies throughout the world.

The modelling software used to analyse and produce forecast runoff is called FLOOD-Ops. This software extracts data from the FLOOD-Col database, calculates areal rainfalls and generates runoff hydrographs. Model parameters can be adjusted and forecast rainfall included as an *option* while results can be displayed and imported into gate operation models.

The ALERT system, FLOOD-Ops and ancillary software make up the Real Time Flood Model (RTFM).

4.2 Field station descriptions

Seqwater operates 75 rain gauges and 71 river gauge field stations within and around the Brisbane River Basin. Of these 146 sites, 129 operate under the ALERT system and the remaining 17 operate as telephone telemeter gauging stations, but are not directly available in the operational suite.

Manual gauge board readings are taken at Somerset and Wivenhoe Dams to confirm the ALERT data received from these sites. These manual observations form the basis of gate operations.

In addition to the Seqwater owned and operated network, the Flood Operations Centre also has access to the Enviromon system, which collects data from an additional 225 rain gauges and nearly 200 water level gauges throughout South East Queensland. This extensive network of rain and water level gauges ensures the Flood Operations Centre always has access to the most up-to-date information during flood events.

Most of the water level data contained in this report was collected via the Seqwater ALERT network. Manual observations of gauge boards at Somerset and Wivenhoe Dams were collected via email and telephone during the event. These gauge board observations provided the basis for all decisions relating to gate operations at the Dams.

It should be noted that data from the ALERT network is operational data and has not been validated.

Rainfall stations and water level network locations are shown in the Figures below.


Legend
Rainfall Monitoring Stations
Duplicated Rainfall Station
Catchment Boundaries
CEDAR POCKET DAM HW
LAKE MACDONALD DAM
TOP OF BRISBANE
MOOLOOLABIN DAM
MAPPA DAM
MOOLOOLAH
ANNA
MT STANLEY
BARCOON DAM TW
COOYAR CREEK
EWEN MADDOCK DAM
LOCKYER
WEST BELLTHORPE
LINDFIELD
YARRAMAN
PEACHESTER
FERNVALE
BLACKBUTT
DEVON HILLS
WOODFORD
KILCOY
BOAT MOUNTAIN
WESTVALE
MT BINGA
GREGOR CK
HAZELDEAN
ST AUBYN
NUKINBAMBA
MT MEE
TOOGOOLAWAH
SOMERSET DAM HW
CABOOLBAH
ROSENTRETERS BRIDGE
BAXTERS CREEK
BAYBORO TREATMENT WORKS
CROWS NEST
CREAM BROOK DAM
KLUYERS LOOKOUT
LAKE KURWONGBAH
PETRIE
REDBANK CREEK
NORTH PINE DAM
MT PISGHEY
MT GLORIOUS
DRAPERS CROSSING
SANDFORD
O'REILLY'S WEIR
WIVENHOE TW
ATKINSON DAM
BAVAGES CROSSING
ENOGGERA DAM
LYONS BRIDGE
LOWOOD
BRISBANE CITY
LAKE MANCHESTER
LAKE CLARENDON
TOOWOOMBA
GLENORE GROVE
MT CROSBY
INDOOROOPILLY
LESLIE HARRISON DAM
HELIDON
GATTON
ROCHEDALE SOUTH
BURBANK
WOODHILL
PRIESTDALE
BILL GUNN DAM
TENTHILL
ROSEWOOD
WALLOON
MT COTTON WEST
BIGHOUND WEIR HW
KUSS ROAD
ARSERLEY
LITTLE EGYPT
HAYESVILLE
WEST WOODSTOCK
THORNTON
ADAMS BRIDGE
WARRIPOOL
KALBAR WEIR HW
BROMELTON DAM
MT CASTLE
TAROME
MINDOORIBAN DAM
BROMELTON WEIR HW TW
MOOGERAH DAM HW
NINGE DAM
LITTLE NERANG DAM
MARCOOM DAM HW
MARCOOM TW
WILSONS PEAK
NORTH
0
30
60
Kilometres


Legend
River Stations
Duplicated River Stations
Catchment Boundaries
GYMPIE WEIR TM
CEDAR POCKET DAM HW
DAGUN POCKET TM
LAKE MACDONALD DAM
BORUMBA DAM HW TM
COOLOOLABIN DAM
TINAPA DAM
BARCOON DAM TW
GOOYAR CREEK
EWEN MADDOCK DAM
LEVILLE
PEACHESTER
DEVON HILLS
KILCOY CREEK
WOOCOPAD
BOAT MOUNTAIN
GREGOR CK
ROSENTRETERS BRIDGE
BOWENBET DAM HW
BAXTERS CREEK
DAYBORO TREATMENT WORKS
KOBBLE
LAKE KURWONGBAH
NORTH PINE DAM
PETRIE
CRESSBROOK DAM
DRAPERS CROSSING
WIVENHOE DAM HW
SPLITYARD CREEK DAM
WIVENHOE TW
WHYTE ISLAND
BUARABA CREEK
O'REILLY'S WEIR
DIVERSION CHANNEL
ATKINSON DAM
SAVAGES CROSSING
ENOGGERA DAM
LYONS BRIDGE
LOWOOD PUMP STN
BRISBANE CITY
LAKE CLARENDON
LAKE MANCHESTER
OLEWORK GROVE
BURTONS BRIDGE
BOB BIRDS HUT
MT CROSBY
JINDALEE
LEslie HARRISON DAM
HELIDON
CLARENDON PUMP STATION
KHOLO BRIDGE
GATTON TM
GATTON
BIGGELL
BILL GUPPI DAM
TENTHILL
BROWNS ROUND WEIR HW
BERYL'S LAGOON
KUSS ROAD
ROSEWOOD
ABERFELDY
CHURCHBANK WEIR TM
HARRISVILLE
McLEAN PUMP STN
ADAMS BRIDGE
WARRPOOL
KALBAR WEIR HW
BROMELTON DAM
TOOHILLS CROSSING TM
MYWOODRAH DAM
BROMELTON WEIR HW TM
BOOGUBAH DAM HW
HINZE DAM
LITTLE KERANG DAM
MAROON DAM HW
MAROON TW
NORTH
0
30
60
Kilometres

4.3 October Event – Overview

The October Flood Event has a designated start date of 09:00, Wednesday 6 October 2010.. Dam releases during this event commenced on Saturday 9 October 2010 and concluded on Tuesday 19 October 2010.

The October 2010 Flood Event was a relatively significant event. The peak outflow from Wivenhoe Dam during the event was in the order of 1,500m^3/s. Accordingly, comprehensive rainfall and water level data has been reported to allow a detailed assessment of the event to be undertaken.

4.4 October Event – Base Rainfall Data

The following rainfall tables and maps show the daily rainfall recorded in the Brisbane River Basin during the October Event. On the maps, "None" signifies that no rainfall reports were received from the station during the period and figures in red also indicate errors in the data.

Rainfall in 24 hours to 09:00										
ALERT ID	Station	7 Oct	8 Oct	9 Oct	10 Oct	11Oct	12 Oct	13 Oct	Total	Comment
6775	Peachester									OOA
6714	Ferris Knob	0	8	91	16	103	103	2	323	
6705	Woodford-P	0	2	87	8	78	73	4	252	
6702	Woodford-B	0	2	87	8	76	69	4	246	
6600	Kilcoy	0	2	74	3	41	81	1	202	
6593	Somerset Dam HW-P	0	8	76	7	68	211	4	374	Double counting
6590	Somerset Dam HW-B	0	5	49	4	41	129	2	230	
6602	Top of Brisbane	0	2	15	0	8	21	0	46	
6540	Yarraman	0	2	39	0	4	15	1	61	
6542	Cooyar Ck	0	2	29	0	6	30	0	67	
6717	Linville	0	3	52	3	28	67	0	153	
6708	Devon Hills	0	2	58	2	17	63	0	142	
6529	St Aubyns	0	2	47	0	3	10	2	64	
6621	Nukinenda	0	23	38	0	9	31	2	103	
6520	Boat Mountain	0	3	54	1	7	53	0	118	
6514	Gregor Ck-P	0	5	44	1	21	72	1	144	
6517	Gregor Ck-B	0	5	48	2	21	80	0	156	
6596	Crows Nest	0	12	38	1	2	25	3	81	
6780	Perseverance	0	0	27	0	5	24	1	57	
6782	Ravensbourne	0	4	55	4	32	83	9	187	
6523	Cressbrook Dam	0	14	36	0	8	30	0	88	
6553	Rosentretters Br	0	3	32	1	11	55	0	102	
6604	Toogoolawah	0	1	42	1	9	66	4	123	
6574	Caboonbah	0	17	38	3	28	112	1	199	

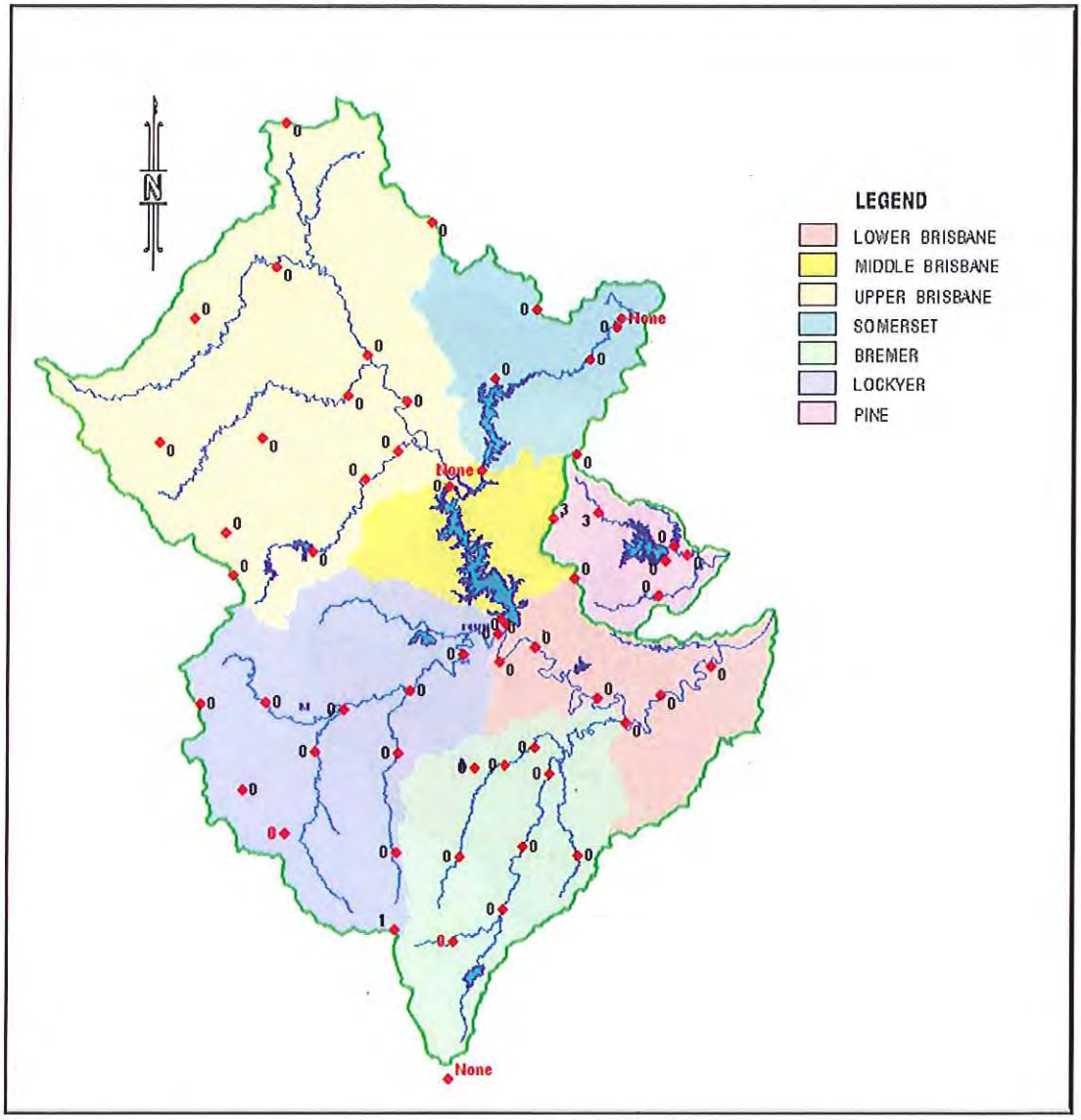
Rainfall in 24 hours to 09:00										
ALERT ID	Station	7 Oct	8 Oct	9 Oct	10 Oct	11Oct	12 Oct	13 Oct	Total	Comment
6636	Wivenhoe Dam HW-B	0	0	23	1	64	58	0	146	
6643	Wivenhoe Dam TW-P	0	0	24	1	70	62	0	157	
6641	Wivenhoe Dam TW-B	0	0	26	1	67	63	0	157	
6598	Toowoomba	0	3	18	2	8	27	0	58	
6526	Helidon	0	2	16	2	14	36	0	70	
6617	Little Egypt	0	8	13	2	12	22	2	59	
6606	West Woodbine									Did not work
6565	Tenthill	0	7	15	1	20	22	3	68	
6577	Gatton	0	6	21	1	27	36	2	93	
6619	Mt Castle	1	1	36	6	68	47	9	168	
6615	Thornton	0	1	12	2	50	29	12	106	
6583	Showground Weir	0	5	15	1	39	24	1	85	
6556	Glenore Grove	0	1	15	2	30	24	1	73	
6633	Lyons Br-P	0	1	21	2	39	29	0	92	
6630	Lyons Br-B	0	1	23	1	42	31	0	98	
6568	O'Reillys Weir	0	0	23	1	58	48	0	130	
6646	Lowood-B	0	0	23	0	56	33	0	112	
6649	Lowood-P	0	1	21	1	79	36	1	139	
6559	Savages Crossing	0	0	25	1	100	49	0	175	
1730	Lake Manchester	0	0	21	5	125	28	2	181	
6751	Mt Crosby	0	0	13	4	101	21	3	142	
2059	Colleges Crossing	0	1	14	6	68	12	5	106	
6580	Adams Br	0	2	18	2	44	23	4	93	
2192	Franklyn Vale									OOA
2065	Grandchester	0	3	20	3	31	24	10	91	
6736	Kuss Rd	0	0	22	3	49	22	6	102	
2068	Tallegalla	0	1	10	3	43	17	4	78	
6733	Rosewood	0	0	16	2	51	26	2	97	
6550	Five Mile Bridge	0	1	22	3	59	24	1	110	
6623	Tarome-P	0	0	17	4	28	9	0	58	
6562	Kalbar Weir	0	0	18	3	27	5	0	53	
6571	Harrisville	0	0	24	4	38	9	2	77	
6651	Greens Road	0	1	22	3	52	15	1	94	
6739	Washpool	0	3	18	2	51	11	1	86	
2062	Peak Crossing	0	0	21	3	46	8	3	81	
2055	Loamside	0	0	4	3	12	9	9	37	
2160	One Mile Br	0	1	15	4	37	16	4	77	
2040	Churchill	0	7	4	2	44	0	0	57	
2035	Brassall (Hancock Br)	0	2	5	1	18	0	0	26	
2106	Lyons	0	0.4	0	0.2	0.9	1.4	0.7	3.6	Under reading

Rainfall in 24 hours to 09:00										
ALERT ID	Station	7 Oct	8 Oct	9 Oct	10 Oct	11Oct	12 Oct	13 Oct	Total	Comment
2145	Ripley	0	2	9	2	1	1	2	17	Under reading
2050	Bundamba (Barclay St)	0	0	11	2	61	16	1	91	
2045	Bundamba (Hanlon St)	0	0	8	4	64	10	1	87	
6754	Moggill-P	0	2	10	6	59	18	3	98	
2150	Opossum	0	7	9	5	58	19	2	100	
2116	Carole Park	0	11	11	6	72	19	5	124	
1518	Wacol	0	8	13	6	67	19	6	119	
2102	Jingle Downs	0	3	12	5	64	14	2	100	
2104	Greenbank (Thompson Rd)	0	11	12	7	90	16	3	139	
2108	Forestdale (Johnson Rd)	9	38	12	11	35	7	7	119	
2114	Calamvale	18	84	14	8	82	23	5	234	
1736	Inala	1	22	12	5	74	20	4	138	
2020	Corinda High	0	22	13	6	84	20	7	152	
2138	Mt Gravatt	3	33	5	9	34	0	0	84	
1548	Holland Pk West	0	51	22	5	91	16	5	190	
1554	East Brisbane	0	60	22	7	88	23	3	203	
1836	Eight Mile Plains	0	54	16	7	90	23	6	196	
1803	Wishart	0	44	19	7	92	17	9	188	
1706	Carindale	0	56	24	7	76	16	4	183	
1596	Camp Hill	0	72	26	8	87	23	2	218	
1830	Mansfield	1	19	23	8	85	13	4	153	
1739	Lytton	0	34	47	16	99	30	5	231	
1527	Hemmant	0	37	35	10	80	19	3	184	
2141	Ransome	0	31	28	12	67	12	3	153	
1755	Manly	0	14	45	15	67	9	2	152	
1742	Pullenvale	0	19	19	6	116	30	8	198	
1515	Kenmore Hills	0	13	19	7	132	26	4	201	
6730	Jindalee	0	17	15	6	84	24	7	153	
1749	Toowong	0	11	23	5	110	21	5	175	
6748	Brisbane City	0	42	23	6	90	22	6	189	
1507	Three Ways	0	3	30	8	192	64	6	303	
1718	Gold Ck Res	0	11	27	7	144	44	7	240	
1533	Enoggera Dam	0	8	33	7	133	37	6	224	
1512	Mt Coot-tha	0	5	26	6	118	29	5	189	
1578	Alderley	0	42	35	7	135	31	5	255	
1524	Bowen Hills	0	59	31	7	115	29	6	247	
2285	Steiglitz Wharf	0	7	14	20	71	2	2	116	
2086	Marburg	0	0	12	5	48	3	3	71	
2074	Stokes Crossing	0	2	18	3	53	27	5	108	
2080	Spressers Bridge	2	2	22	3	34	27	7	97	

Rainfall in 24 hours to 09:00										
ALERT ID	Station	7 Oct	8 Oct	9 Oct	10 Oct	11Oct	12 Oct	13 Oct	Total	Comment
2083	Rosewood WWTP									OOA
2071	Churchbank Weir	0	2	19	3	25	13	2	64	
2077	Greys Plains Rd	0	1	17	2	51	25	7	103	
1837	Wynnum Bowls	0	25	46	14	64	11	3	163	
1838	Luggage Point	0	36	45	11	93	27	7	219	
1840	Chandler	0	25	19	8	63	9	6	130	
1841	Bulimba	0	85	28	9	93	25	5	245	
6585	Sandy Creek Road	0	1	21	2	11	43	1	79	
6588	Upper Sandy Creek	0	2	51	4	41	73	2	173	
2089	Harrisville-B	0	1	20	3	39	9	3	75	
2092	Rosewood-B	0	0	9	4	19	0	0	32	
2095	Bellbird Park	0	7	13	5	69	19	5	118	
2011	Buaraba	0	3	34	4	35	82	2	160	
2006	Hays Landing	0	0	27	2	76	70	0	175	
2004	Pohlman Range	0	8	81	5	32	107	1	233	
5356	Mt Alford	0	0	0	0	0	0.2	0		Did not work
6656	Bill Gunn Dam	0	1	17	2	49	26	2	97	
6658	Lake Clarendon Dam	0	3	25	3	35	41	1	108	
6555	Atkinson Dam	0	1	36	2	44	57	0	140	
6624	Moogerah Dam	0	0	19	3	29	10	0	61	
6609	Monsildale	0	1	33	1	13	44	1	93	
6612	Mt Stanley	0	1	44	3	14	50	1	113	
6607	Lindfield	0	0	85	16	77	123	1	302	
6603	Blackbutt	0	22	50	0	13	51	2	138	
6601	Mt Binga	0	2	70	1	7	22	4	106	
6613	Hazeldean	0	1	56	3	36	105	1	202	
6614	Westvale	0	2	66	4	43	108	1	224	
6605	Eskdale									Not yet installed
6611	Redbank Creek	0	14	50	3	19	57	1	144	
6100	Mt Mowbullan	0	4	66	1	5	9	4	89	
6427	Maleny	0	29	150	40	163	120	5	507	
5425	Hume Lane	0	25	101	7	107	89	0	329	
6400	Bald Knob	0	27	129	25	106	79	1	367	
6716	West Bellthorpe	0	1	79	27	98	119	3	327	
6701	Mt Mee-B	0	3	90	13	94	173	12	385	
6690	Mt Mee-P	0	3	90	13	94	173	12	385	
6680	Mt Glorious-P	0	5	67	10	179	182	12	455	
5423	Landsborough	0	31	107	28	117	68	2	353	
6608	Jimna	0	9	38	4	38	65	1	155	
2194	Wilsons Peak	0	1	30	10	26	21	4	92	

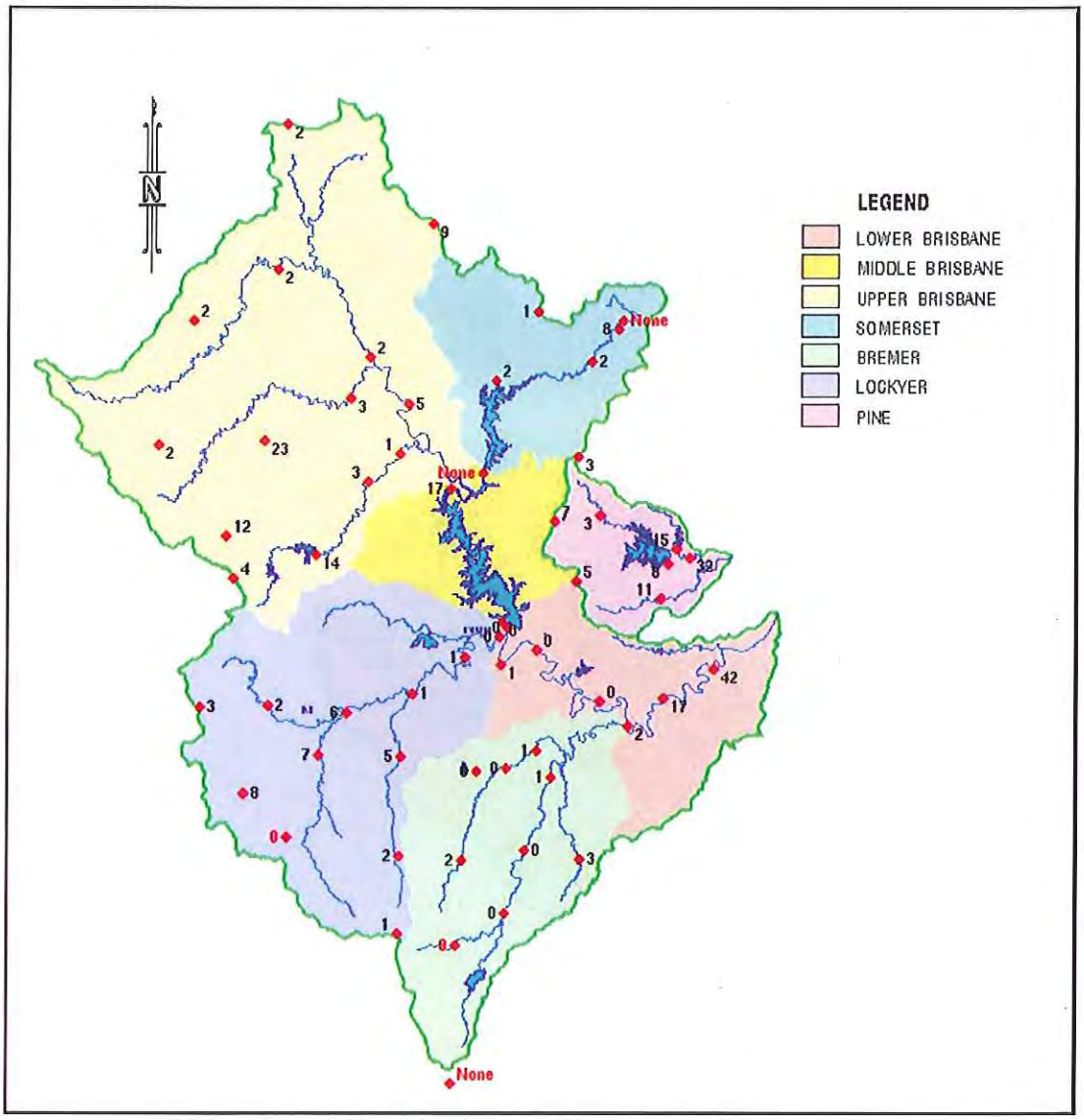
Rainfall in 24 hours to 09:00										
ALERT ID	Station	7 Oct	8 Oct	9 Oct	10 Oct	11Oct	12 Oct	13 Oct	Total	Comment
6774	Wilsons Peak-P									OOA

Rainfall in 24 hours to 09:00 07/10/2010



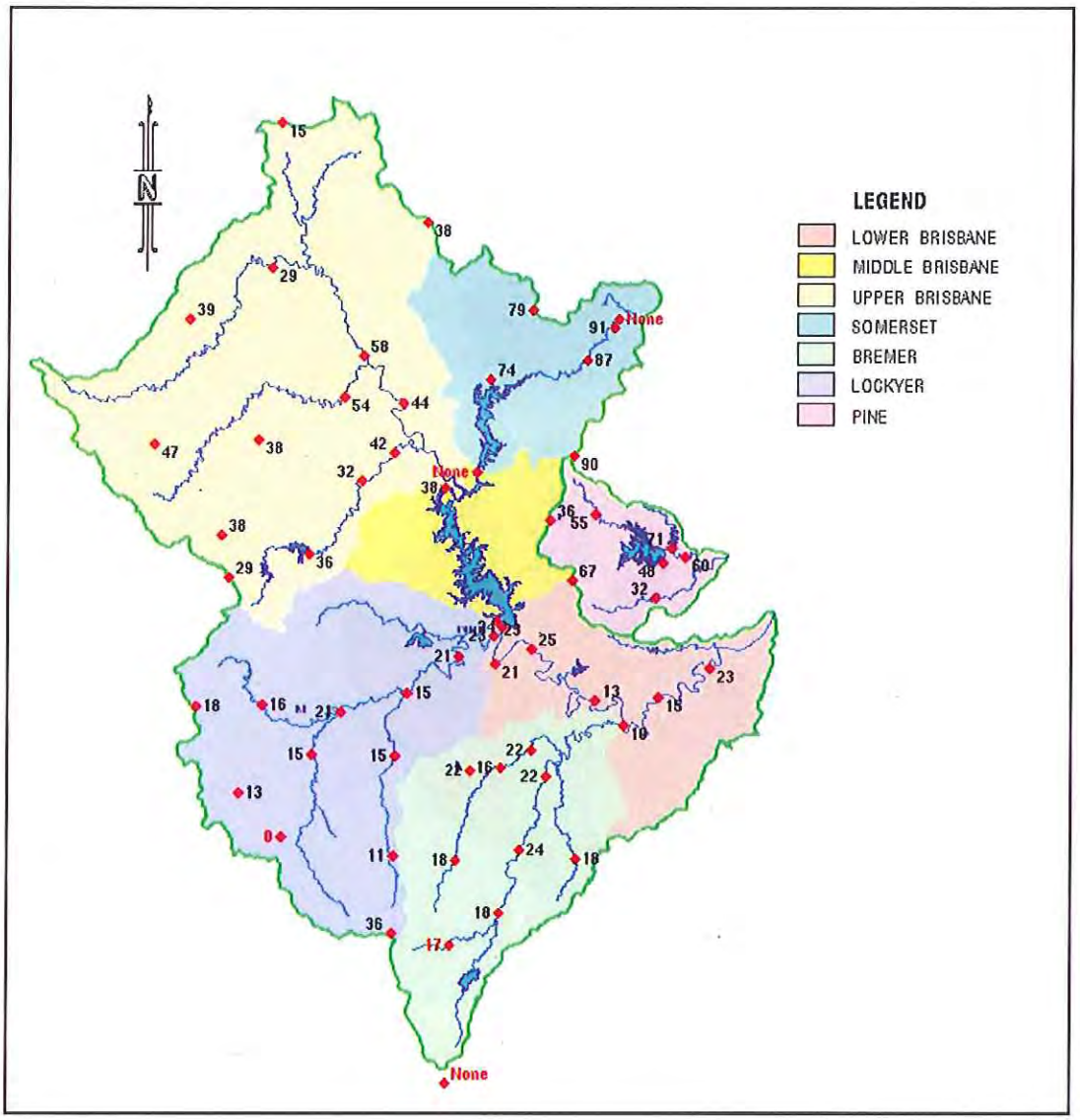
In the 24 hours to 09:00 on Thursday 7 October 2010, only small rainfall totals, generally less than 3mm, were recorded throughout the region.

Rainfall in 24 hours to 09:00 08/10/2010



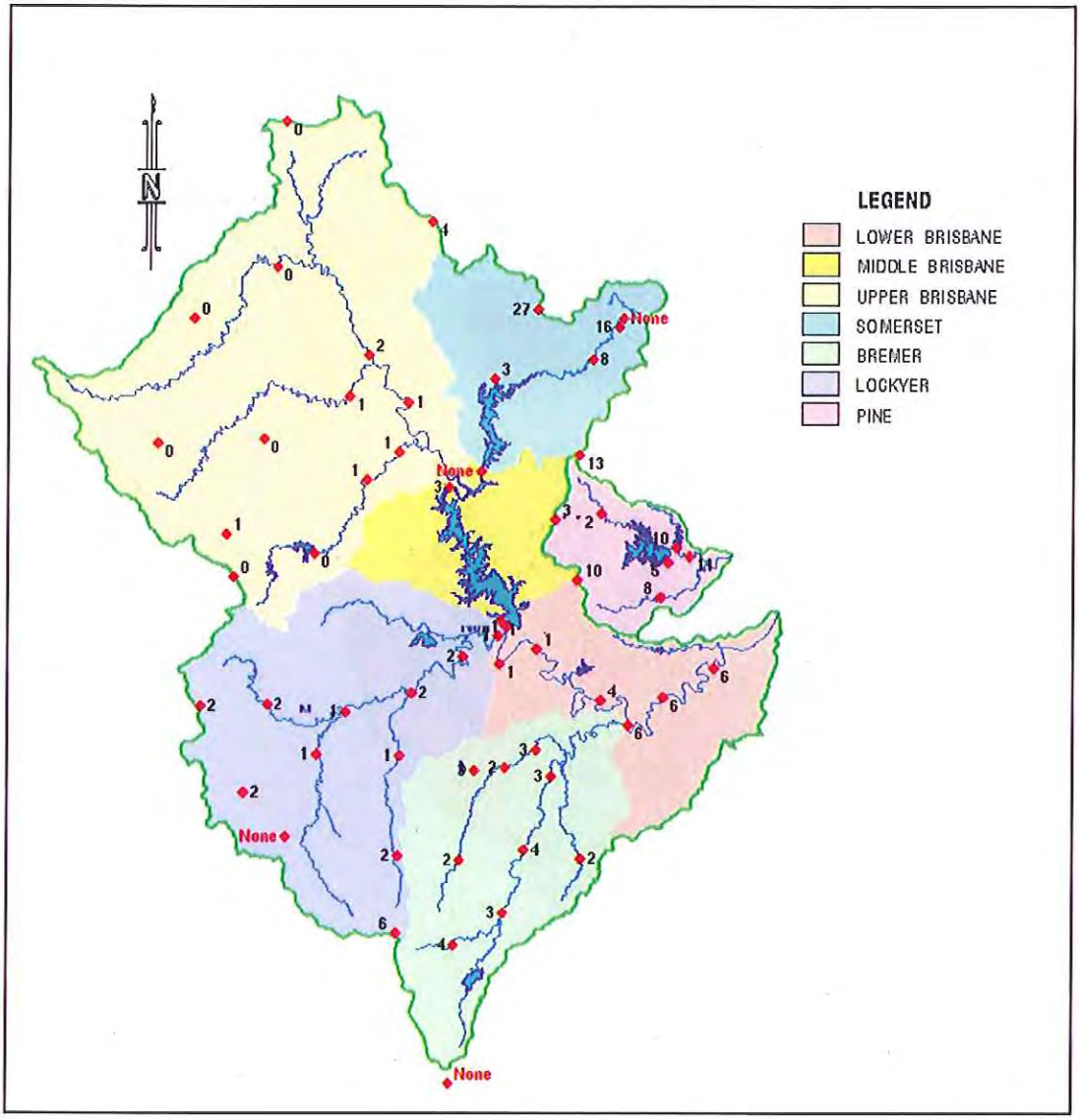
In the 24 hours to 09:00 on Friday 8 October 2010, isolated falls of up to 25mm were recorded in the Emu Creek catchment, upstream of Wivenhoe Dam. Elsewhere through the region, falls were generally below 10mm.

Rainfall in 24 hours to 09:00 09/10/2010



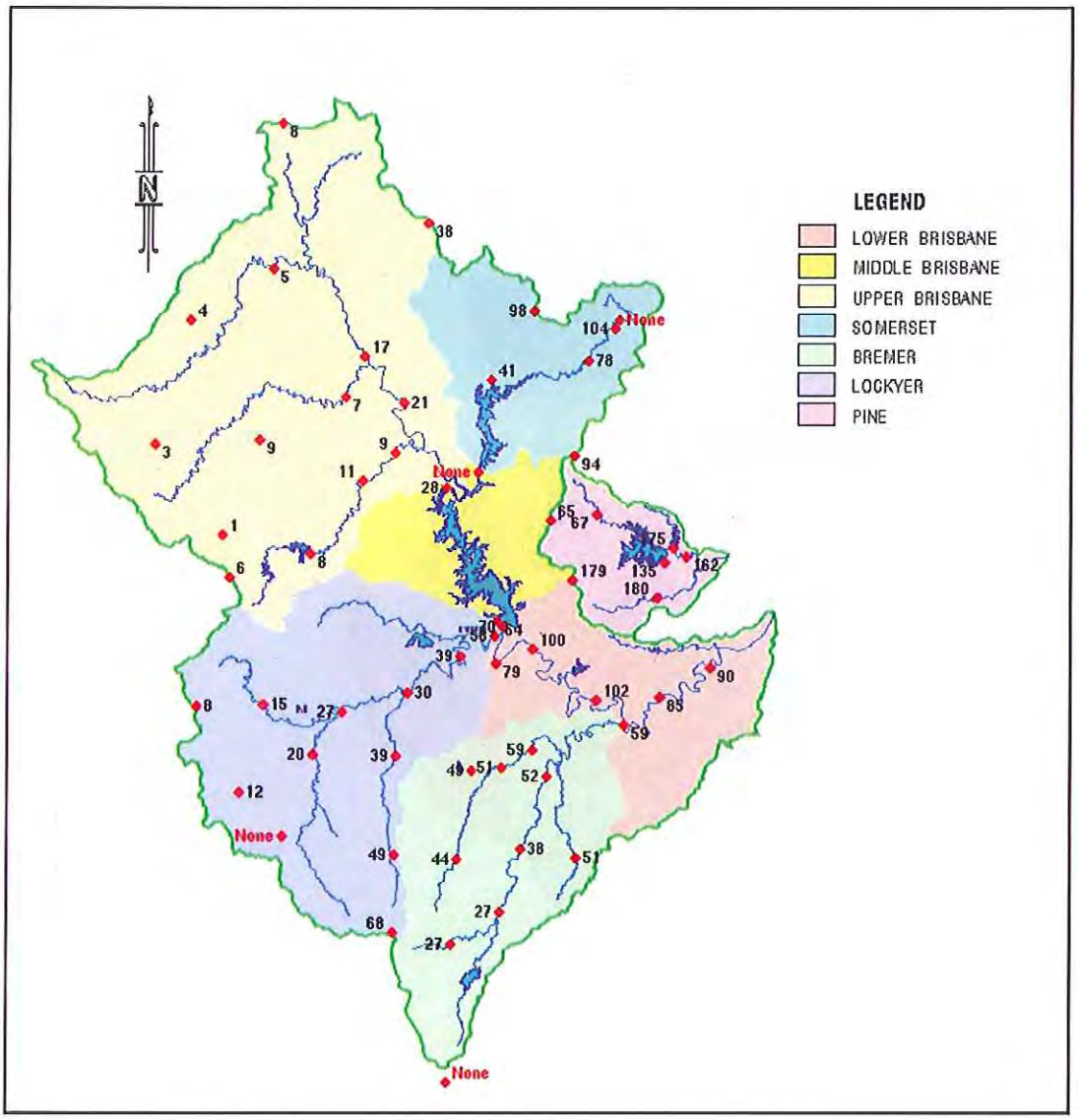
Compared with the previous 24 hour period, rainfall generally increased throughout the region in the 24 hours to 09:00 on Saturday 9 October 2010. The highest recorded rainfall in the period occurred in the upper reaches of the Stanley River, with widespread 40mm to 60mm of rainfall recorded in the Brisbane River upstream of Wivenhoe. In catchments downstream of Wivenhoe Dam, falls were generally below 25mm.

Rainfall in 24 hours to 09:00 10/10/2011



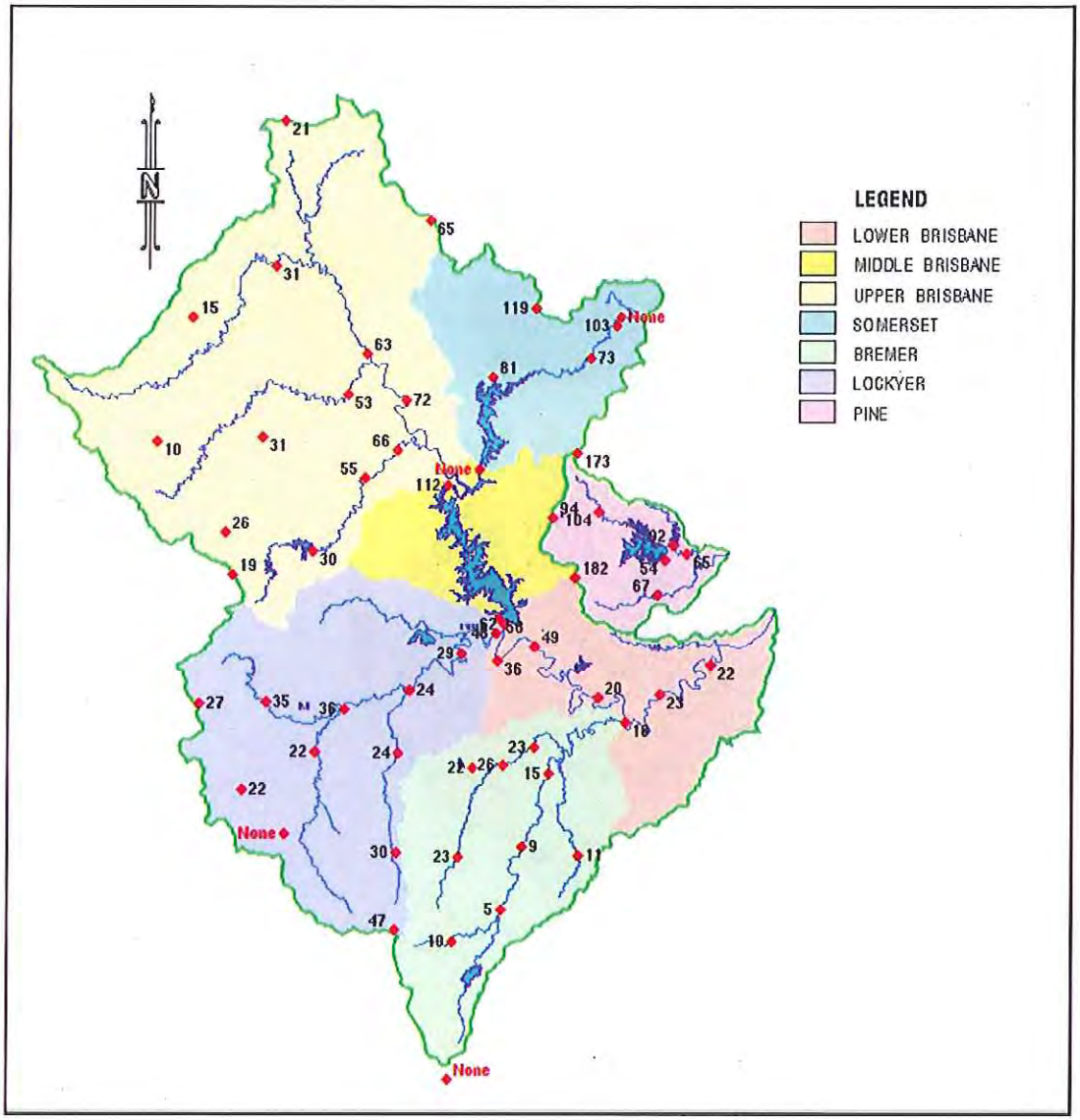
Rain generally eased in the 24 hours to 09:00 on Sunday 10 October 2010, with a few higher falls in the headwaters of the Stanley River.

Rainfall in 24 hours to 09:00 11/10/2010



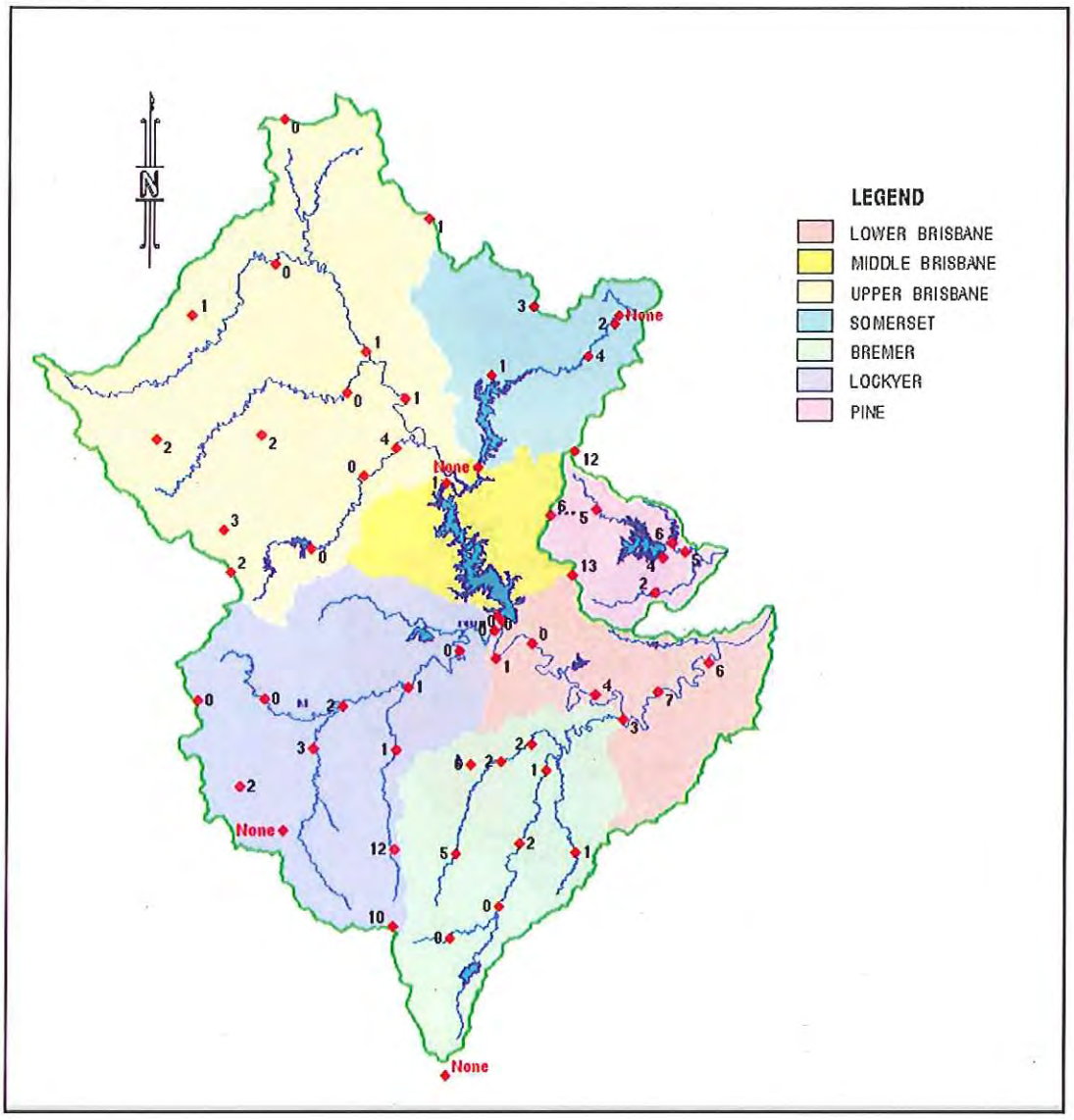
In the 24 hours to 09:00 on Monday 11 October 2010, rainfall was widespread with the heaviest rainfall recorded in the headwaters of the Stanley River, in the North Pine catchment and in the Brisbane River below Wivenhoe Dam. Rainfall totals of up to 180mm were recorded in these areas. Totals in the Brisbane River upstream of Wivenhoe Dam were generally below 20mm, however, rainfall in the Lockyer and Bremer catchments of up to 60mm was also recorded in the period.

Rainfall in 24 hours to 09:00 12/10/2010



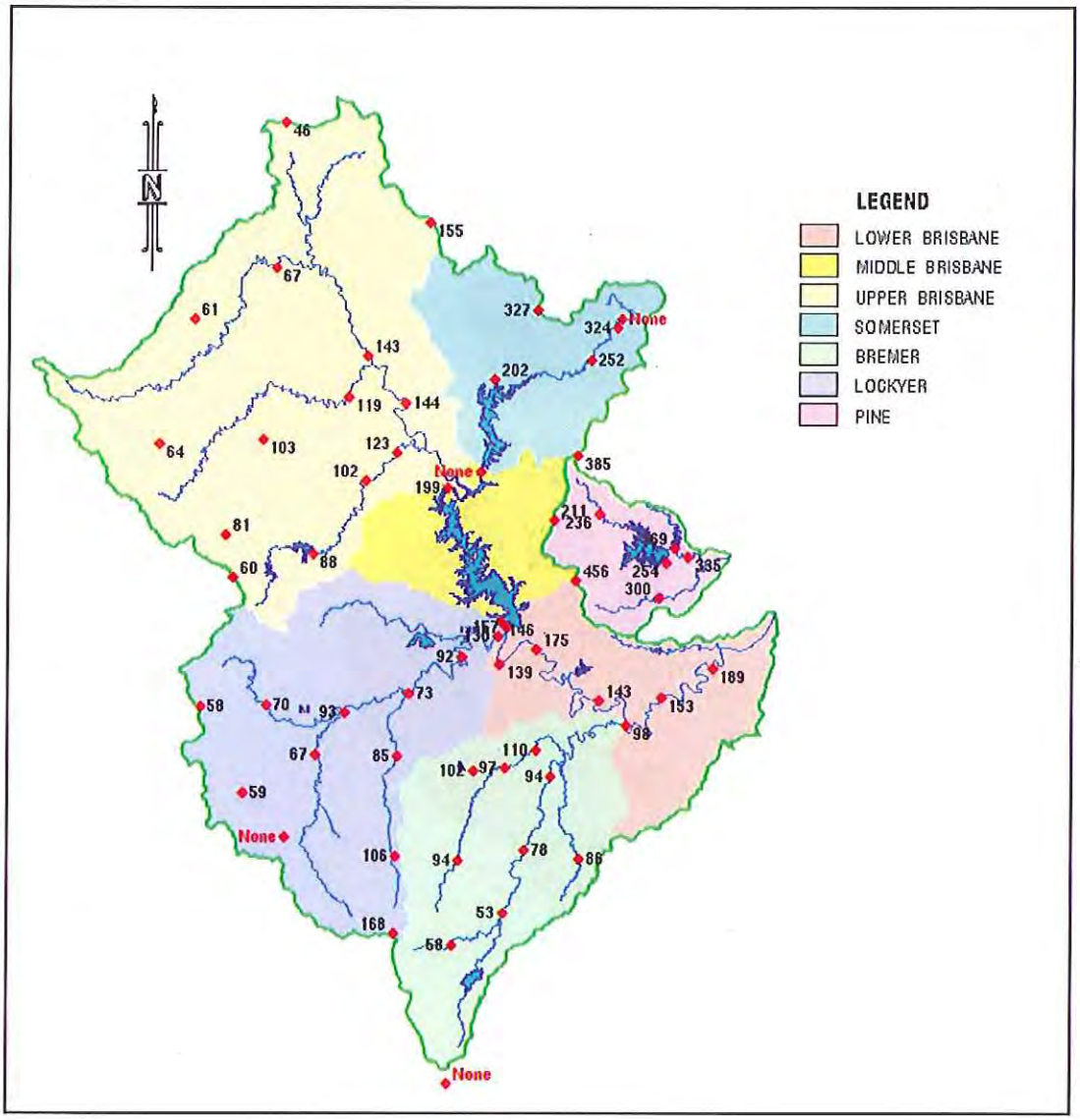
Heavy rain continued throughout the region in the 24 hours to 09:00 on Tuesday 12 October, especially high in the Stanley River and North Pine catchments with totals again of up to 180mm recorded. Elsewhere in the region, rainfall totals in the Upper Brisbane River were heaviest in the lower part of the catchment, while totals in catchments downstream of Wivenhoe Dam were generally below 40mm.

Rainfall in 24 hours to 09:00 13/10/2010



In the 24 hours to 09:00 on Wednesday 13 October 2010, rain generally eased through the region.

Rainfall in six days to 09:00 13/10/2010



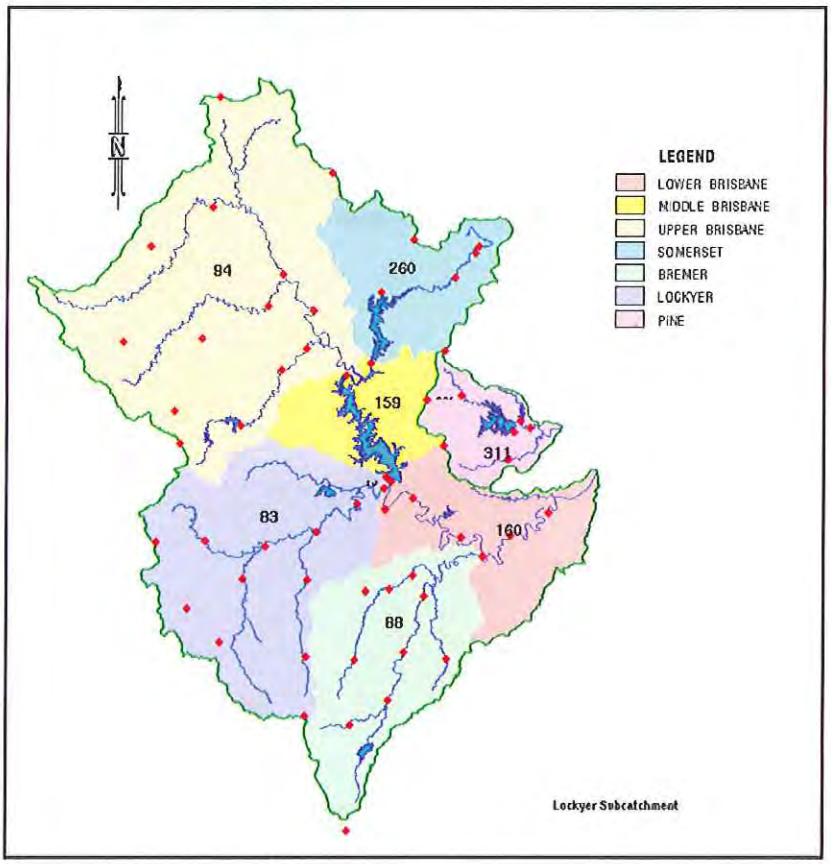
The highest totals were recorded in the headwater areas of the Stanley River and along the D'Aguilar Range from Mt Mee to Mt Glorious. Elsewhere through the Stanley, Upper Brisbane and Mid Brisbane catchments, rainfall totals – while still significant – were half those recorded at elevated stations.

The period of heaviest rainfall was in the 48 hours up to 09:00 on Sunday 10 October 2010. Similar heavy rainfall was recorded in the Lockyer and Bremer catchments where the totals over the period tended to be more uniform. In the Lower Brisbane region, rainfall totals in urban areas were half of those recorded around the towns of Fernvale and Lowood.

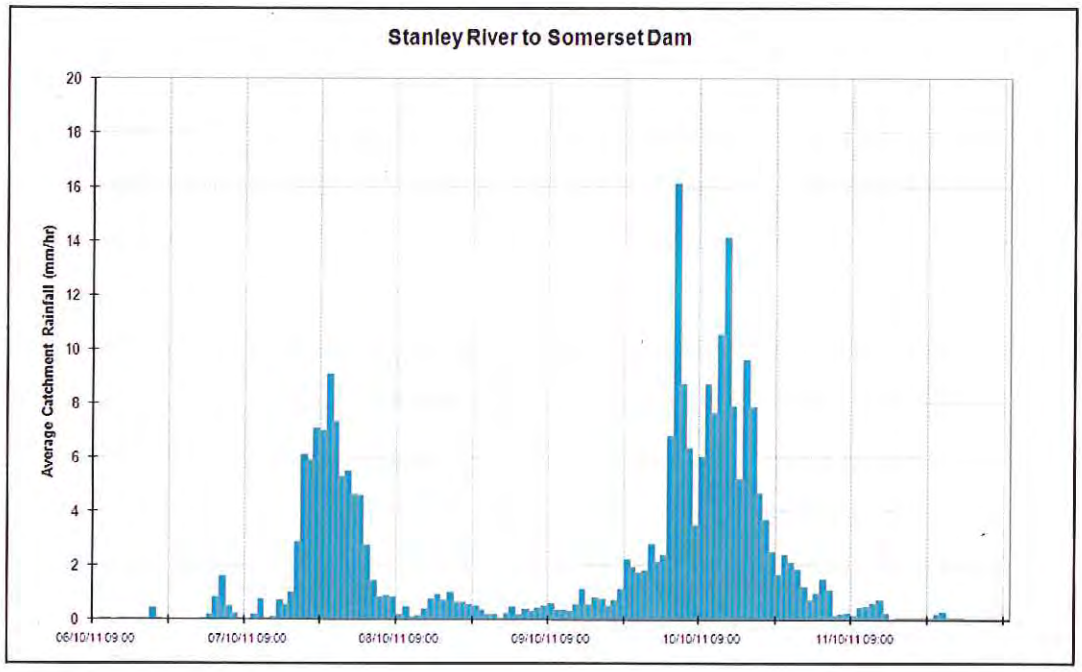
4.5 October Event – Average Catchment Rainfall

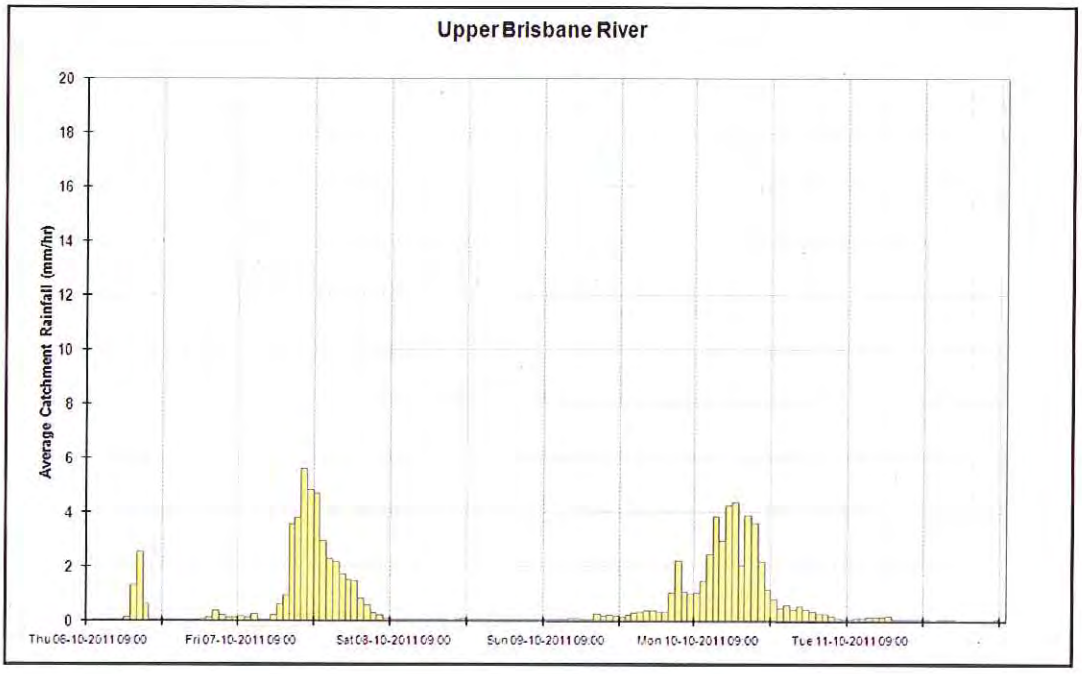
The average rainfall for each sub catchment in the Brisbane basin is determined by a applying a weighting to the rainfall depth at each available station within the sub catchment. The Upper Brisbane catchment excludes the Somerset catchment and is represented by a weighted average of the Upper and Middle Brisbane catchments. A summary of catchment average rainfall for the October Event is shown in the table and map below.

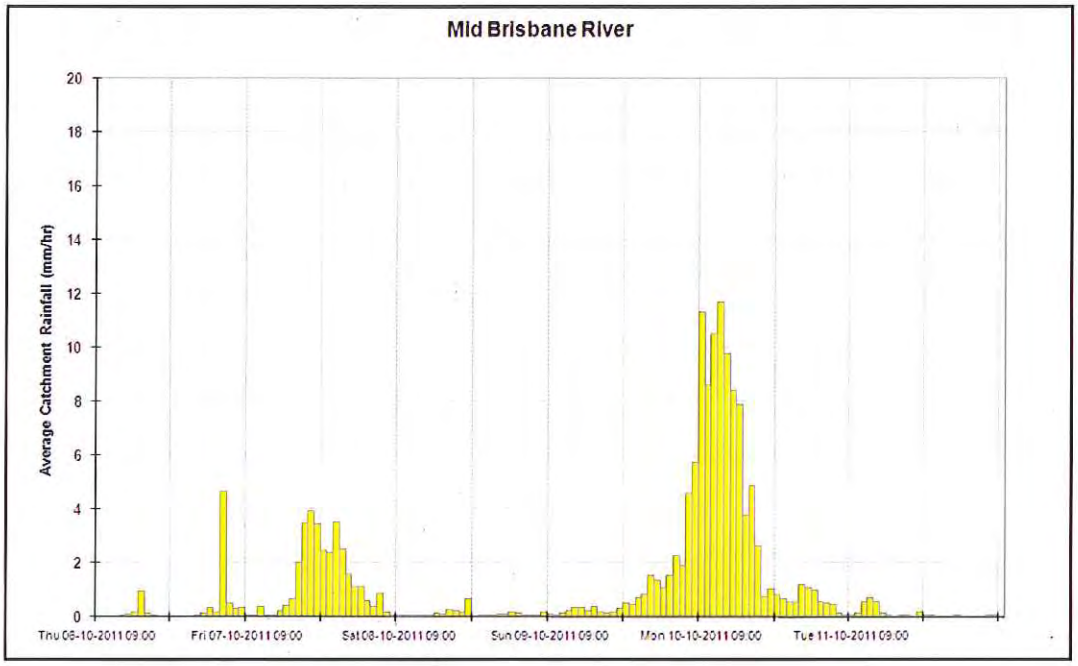
Period Ending 09:00	Stanley		Upper Brisbane		Lockyer		Bremer		Lower	
	Period	Σ	Period	Σ	Period	Σ	Period	Σ	Period	Σ
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
06/10/2010	4	4	7	7	4	4	1	1	13	13
07/10/2010	76	80	37	44	18	23	19	20	20	32
08/10/2010	11	90	1	45	2	24	3	24	5	37
09/10/2010	70	160	17	62	28	52	45	68	86	123
10/10/2010	97	257	47	109	28	80	17	85	32	156
11/10/2010	3	260	1	110	3	83	3	88	4	160
12/10/2010	0	260	0	110	0	83	0	88	0	160
13/10/2010	0	260	0	110	0	83	0	88	0	160
14/10/2010	0	260	0	110	0	83	0	88	0	160

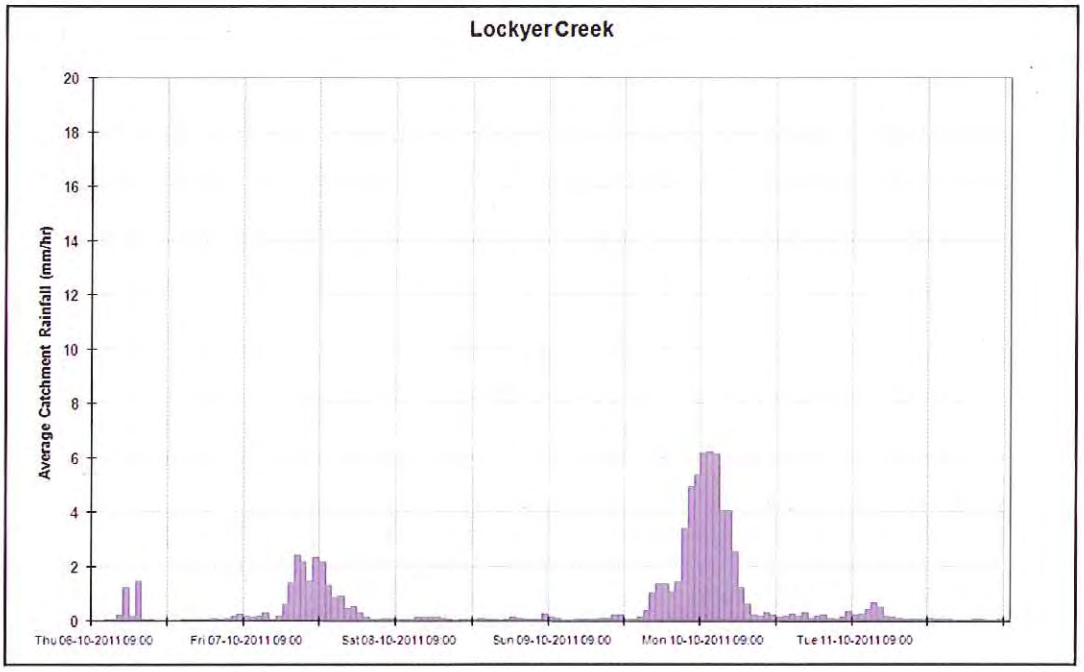


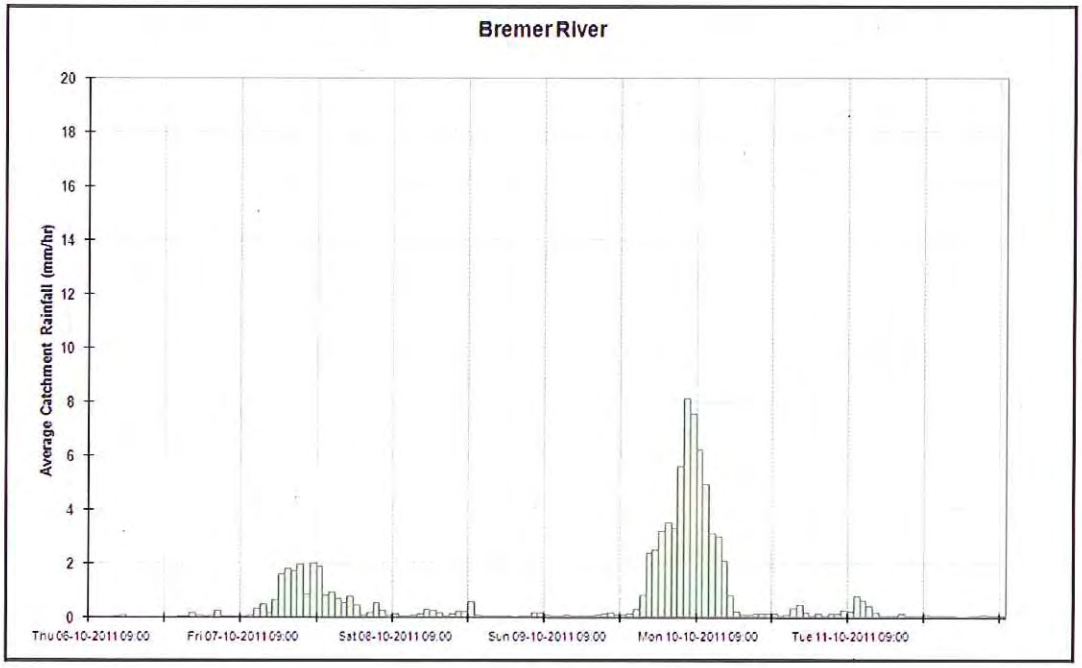
Following are the catchment average rainfall hyetographs for the October Event. These hyetographs do not necessarily reflect the localised, high intensity rainfall that was recorded throughout the Basin at various times and locations. Catchment rainfalls can include hourly intensities at individual stations which are up to five times the catchment average.

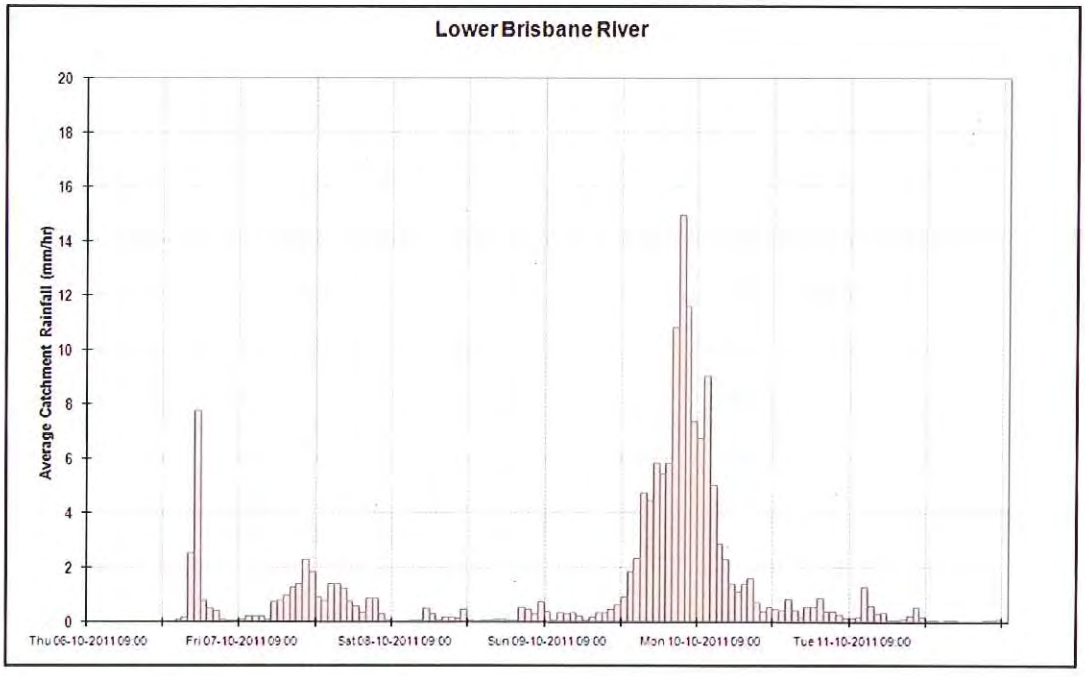





Mid Brisbane River
Average Catchment Rainfall (mm/hr)
20
18
16
14
12
10
8
6
4
2
0
Thu 06-10-2011 09:00
Fri 07-10-2011 09:00
Sat 08-10-2011 09:00
Sun 09-10-2011 09:00
Mon 10-10-2011 09:00
Tue 11-10-2011 09:00


Lockyer Creek
Average Catchment Rainfall (mm/hr)
20
18
16
14
12
10
8
6
4
2
0
Thu 06-10-2011 09:00
Fri 07-10-2011 09:00
Sat 08-10-2011 09:00
Sun 09-10-2011 09:00
Mon 10-10-2011 09:00
Tue 11-10-2011 09:00


Bremer River
Average Catchment Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
Thu 06-10-2011 09:00
Fri 07-10-2011 09:00
Sat 08-10-2011 09:00
Sun 09-10-2011 09:00
Mon 10-10-2011 09:00
Tue 11-10-2011 09:00


Lower Brisbane River
Average Catchment Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
Thu 06-10-2011 09:00
Fri 07-10-2011 09:00
Sat 08-10-2011 09:00
Sun 09-10-2011 09:00
Mon 10-10-2011 09:00
Tue 11-10-2011 09:00

The average catchment rainfall graphs clearly show two distinct bursts of rainfall during the October Event:

- A short low intensity period in the 12 hours to approximately 06:00 on Thursday 7 October 2010, and;
- A longer more intense period of rainfall over a 36 hour period ending in the early hours of Monday 10 October 2010.

4.6 October Event – Event Water Levels

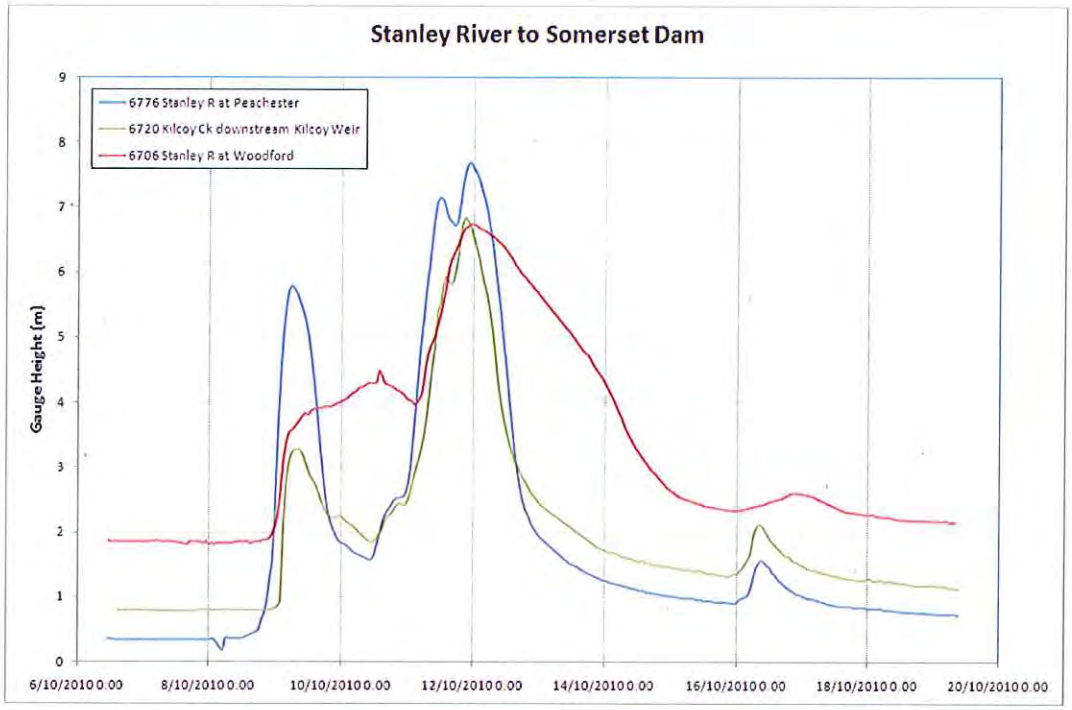
The table below shows the peak water levels reached at selected gauges during this Event.

STATION	DATE/TIME	PEAK FLOW (m3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
PEACHESTER	11/10/2010 22:00			7.68
WOODFORD	11/10/2010 22:00			6.73
KILCOY	11/10/2010 21:00			6.83
SOMERSET DAM INFLOW	11/10/2010 12:00	2,860	286,000	
SOMERSET DAM OUTFLOW	12/10/2010 04:00	1,140	285,000	101.37
COOYAR CK	16/10/2010 06:00			3.43
LINVILLE	11/10/2010 21:00			5.18
DEVON HILLS	12/10/2010 00:00			6.21
BOAT MT	09/10/2010 19:00			3.12
GREGOR CK	11/10/2010 21:00			6.79
ROSENTRETTERS	12/10/2010 02:00			3.32
WIVENHOE DAM INFLOW	11/10/2010 16:00	2,980	628,000	
WIVENHOE DAM OUTFLOW	14/10/2010 04:00	1,490	623,000	69.61
HELIDON	13/10/2010 02:00			1.04
TENTHILL	16/10/2010 14:00			1.62
GATTON	12/10/2010 09:00			4.43
MULGOWIE				
SHOWGROUND WEIR	12/10/2010 04:00			4.87
WARREGO HWY				
GLENORE GROVE	12/10/2010 13:00			5.14
LYONS BRIDGE	12/10/2010 10:00			7.43
RIFLE RANGE RD				
BUARABA CK	12/10/2010 00:00			7.45
OREILLYS WEIR	14/10/2010 07:00			11.28
LOWOOD PUMP STATION	14/10/2010 09:00			9.99
SAVAGES CROSSING	14/10/2010 10:00			10.59
BURTONS BRIDGE				
LAKE MANCHESTER				

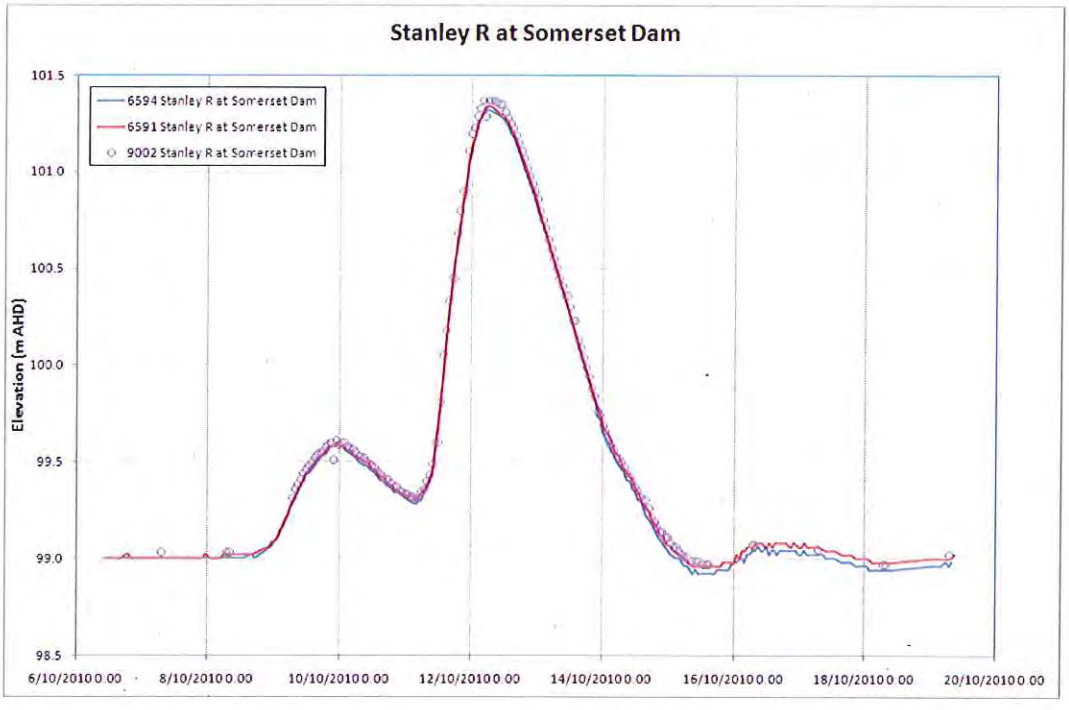
STATION	DATE/TIME	PEAK FLOW (m3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
KHOLO BRIDGE				
MT CROSBY WEIR	14/10/2010 21:00			11.38
COLLEGES CROSSING				
ADAMS BRIDGE	11/10/2010 02:00			3.18
STOKES CROSSING	11/10/2010 16:00			3.60
SPRESSERS BRIDGE	11/10/2010 22:00			3.13
KUSS RD	11/10/2010 18:00			6.75
WWTP	13/10/2010 16:00			2.25
ROSEWOOD	11/10/2010 22:00			5.36
FIVE MILE BRIDGE	12/10/2010 02:00			5.63
WALLOON				
MOOGERAH DAM	06/10/2010 09:00			154.91
JUNCTION WEIR				75.95
HARRISVILLE	11/10/2010 23:00			2.05
CHURCHBANK WEIR	12/10/2010 07:00			0.59
GREENS RD	12/10/2010 10:00			4.42
AMBERLEY				
PEAK CROSSING	11/10/2010 02:00			2.43
LOAMSIDE	09/10/2010 11:00			5.83
ONE MILE BRIDGE	12/10/2010 01:00			10.67
HANCOCKS BRIDGE	12/10/2010 08:00			6.81
IPSWICH	07/10/2010 13:00			2.25
MOGGILL	15/10/2010 19:00			2.56
JINDALEE				
BRISBANE	11/10/2010 12:00			1.58
BAR	11/10/2010 12:00			1.35

4.7 October Event – Height Hydrographs

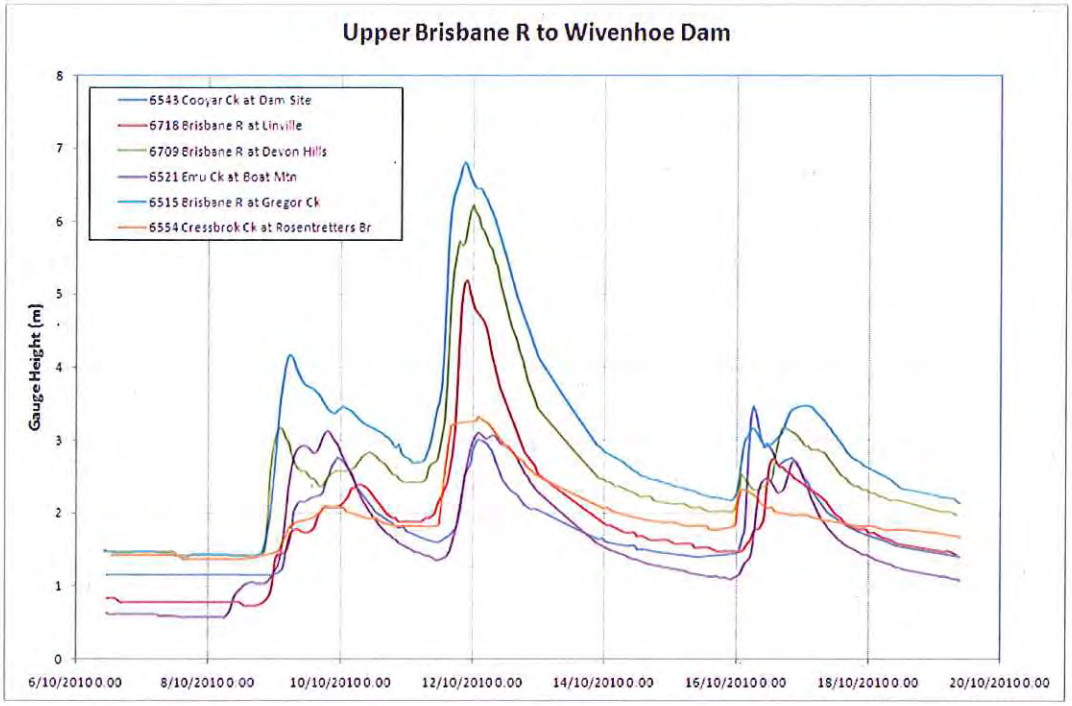
Height hydrographs for selected key stations within the Brisbane River Basin are plotted below. During the Event, basic data-checking is carried out by Duty Technical Assistants.



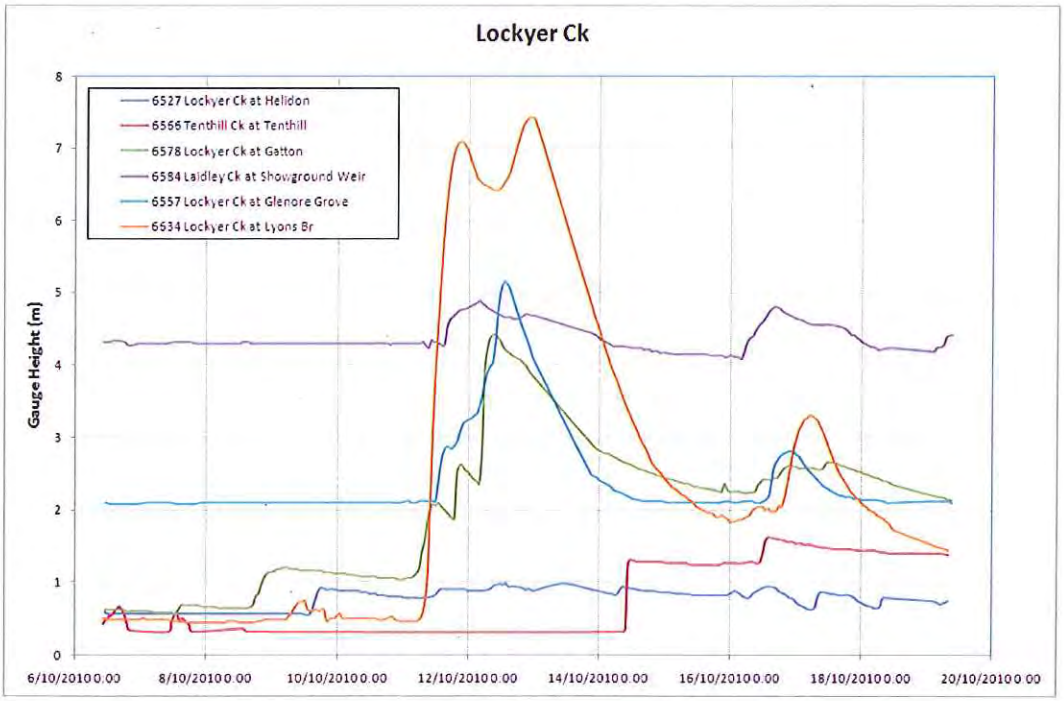
The three gauges illustrated above, worked well during the event. The Stanley River at Woodford is a key gauging station.



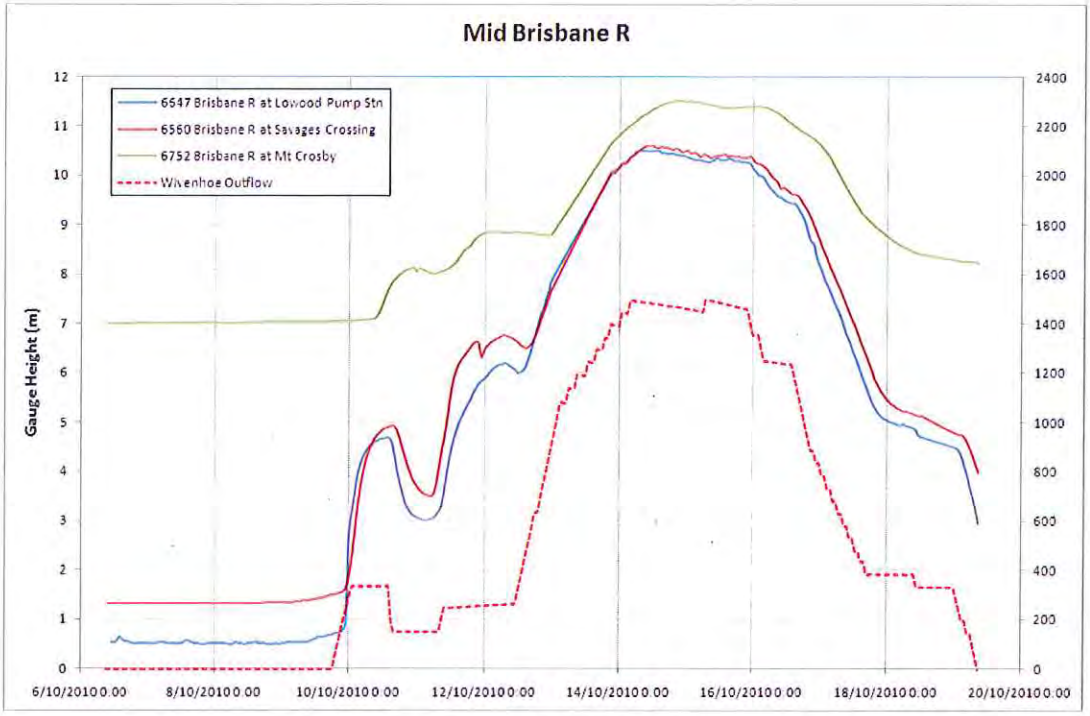
The two automatic gauges appear to have slightly under-read the rainfall when compared with the manual readings. However, this difference did not have impact upon dam operations.



The key gauge at Gregors Creek represents nearly 75% of the catchment to the Dam. All gauges upstream of Wivenhoe Dam appear to have worked well during the event.



Most of gauges in Lockyer Creek worked well during the Event with the exception of Tenthill during the early stages. The Tenthill gauge was repaired during the Event.



Lowood Pump Station is located just downstream from the junction of the Brisbane River and Lockyer Creek. Further downstream, the Savages Crossing ALERT gauge slaves off the DERM water level station.

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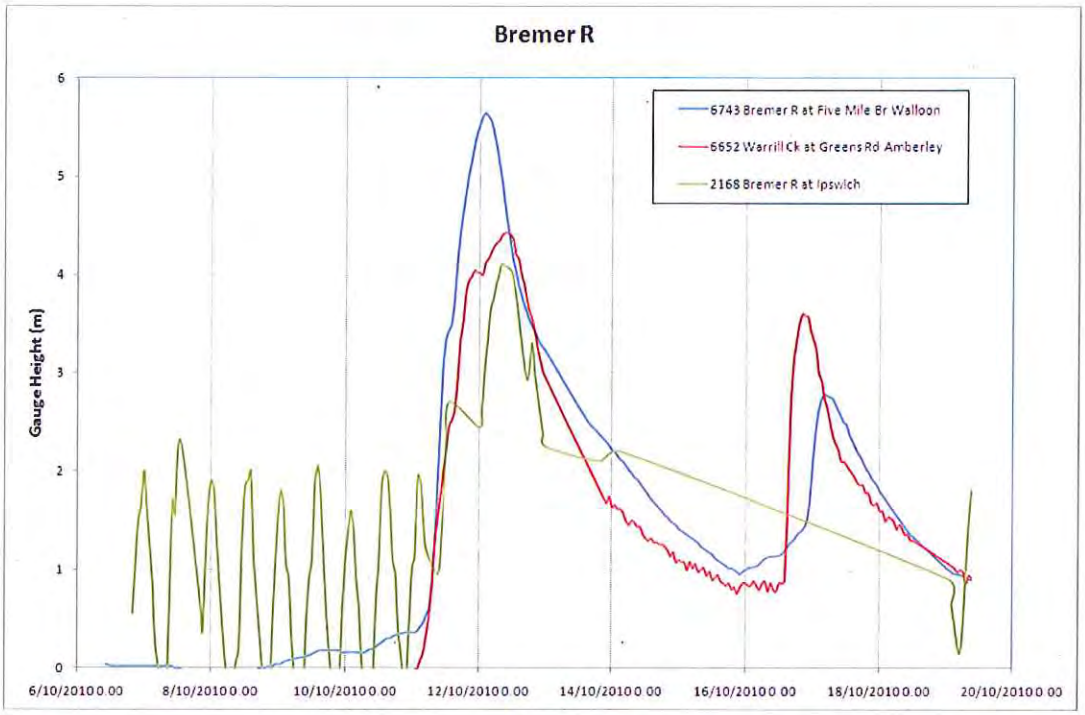
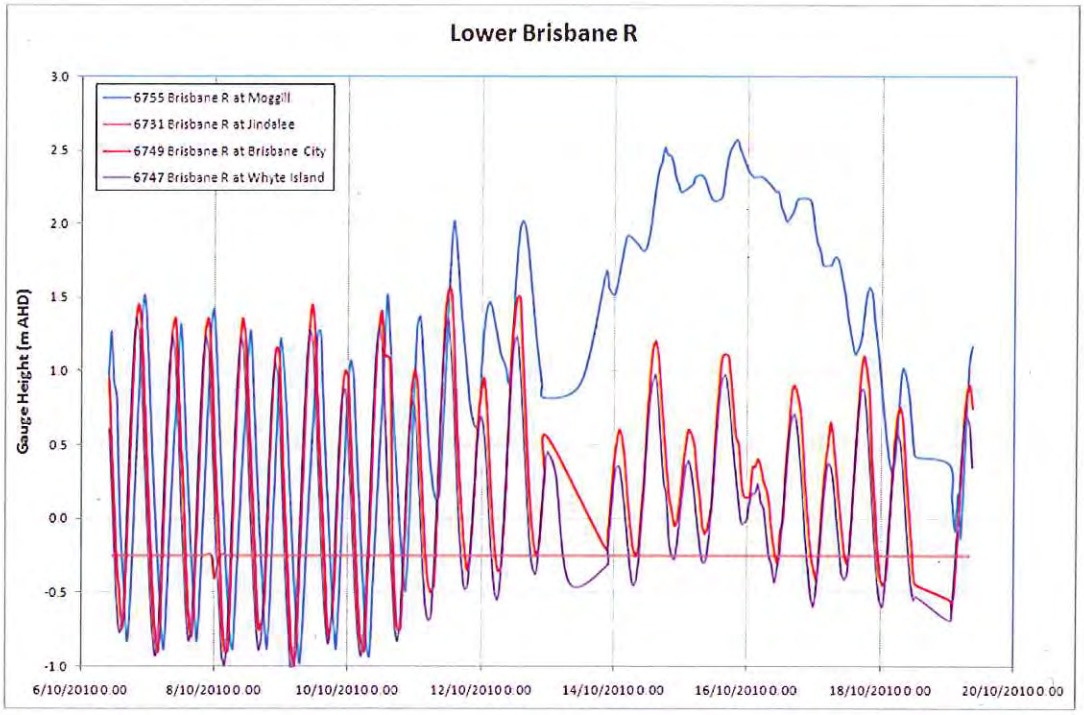
The DERM water level station is considered to be a more accurate representation of the combined Lockyer and Brisbane flow than the upstream station at Lowood.

These gauges, as well as the gauge at Mt Crosby, appear to have worked well during the event.



Walloon and Amberley are key gauging stations and appear to have worked well during the Event. As illustrated above, the Bremer River at David Trumpy Bridge is affected by backwater.

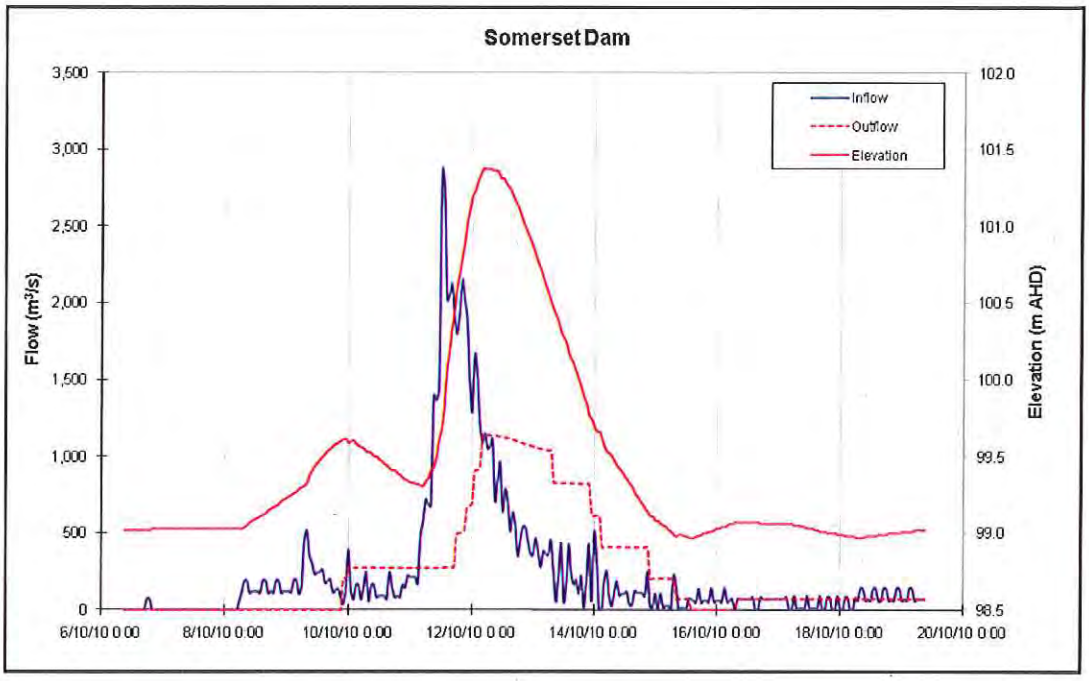


The lower Brisbane River gauges are affected by tidal influences, however, they still appear to have worked well during the Event.

4.8 October Event – Dam Inflows and Outflows

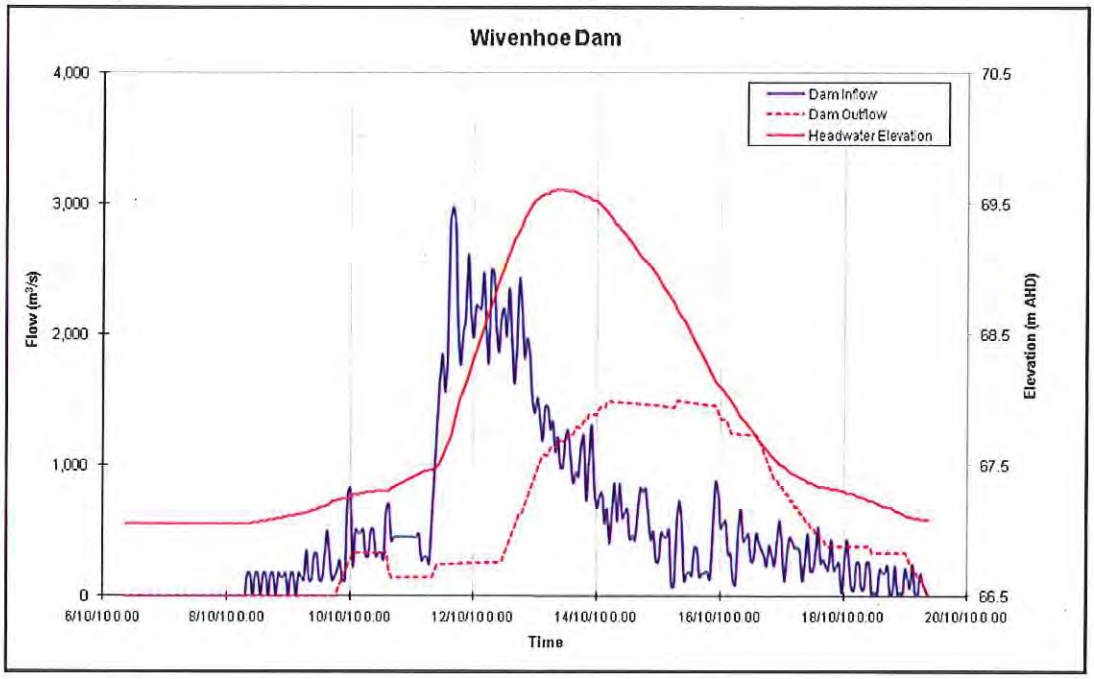
The inflows and outflows from Somerset and Wivenhoe Dams are shown in the table and figures below. Note that the Wivenhoe figures include Somerset outflows and the inflow to the Dams has been estimated by reverse routing which tends to be mathematically unstable, hence the sawtooth appearance of the inflows in the graphs below.

STATION	DATE/TIME	PEAK FLOW (m^3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
SOMERSET DAM INFLOW	11/10/2010 12:00	2,860	286,000	
SOMERSET DAM OUTFLOW	12/10/2010 04:00	1,140	285,000	101.37
WIVENHOE DAM INFLOW	11/10/2010 16:00	2,980	628,000	
WIVENHOE DAM OUTFLOW	14/10/2010 04:00	1,490	623,000	69.61



The inflow into Somerset Dam is characterised by a single peak of approximately 2,860m^3/s at 12:00 on Monday 11 October 2010. The peak of the outflow of 1,135m^3/s occurred at 14:00 on Tuesday 12 October 2010.

Somerset Dam reached its maximum water level of 101.37m AHD early in the morning of Tuesday 12 October.



Similarly to Somerset Dam, the inflow into Wivenhoe Dam is characterised by a single peak of approximately 3,000m^3/s on the afternoon of Monday 11 October 2010. The peak of the outflow of 1,493m^3/s occurred three days later in the early hours of Thursday 14 October 2010.

Wivenhoe Dam reached its maximum water level of 69.61m AHD at 04:00 on Thursday 14 October 2010.

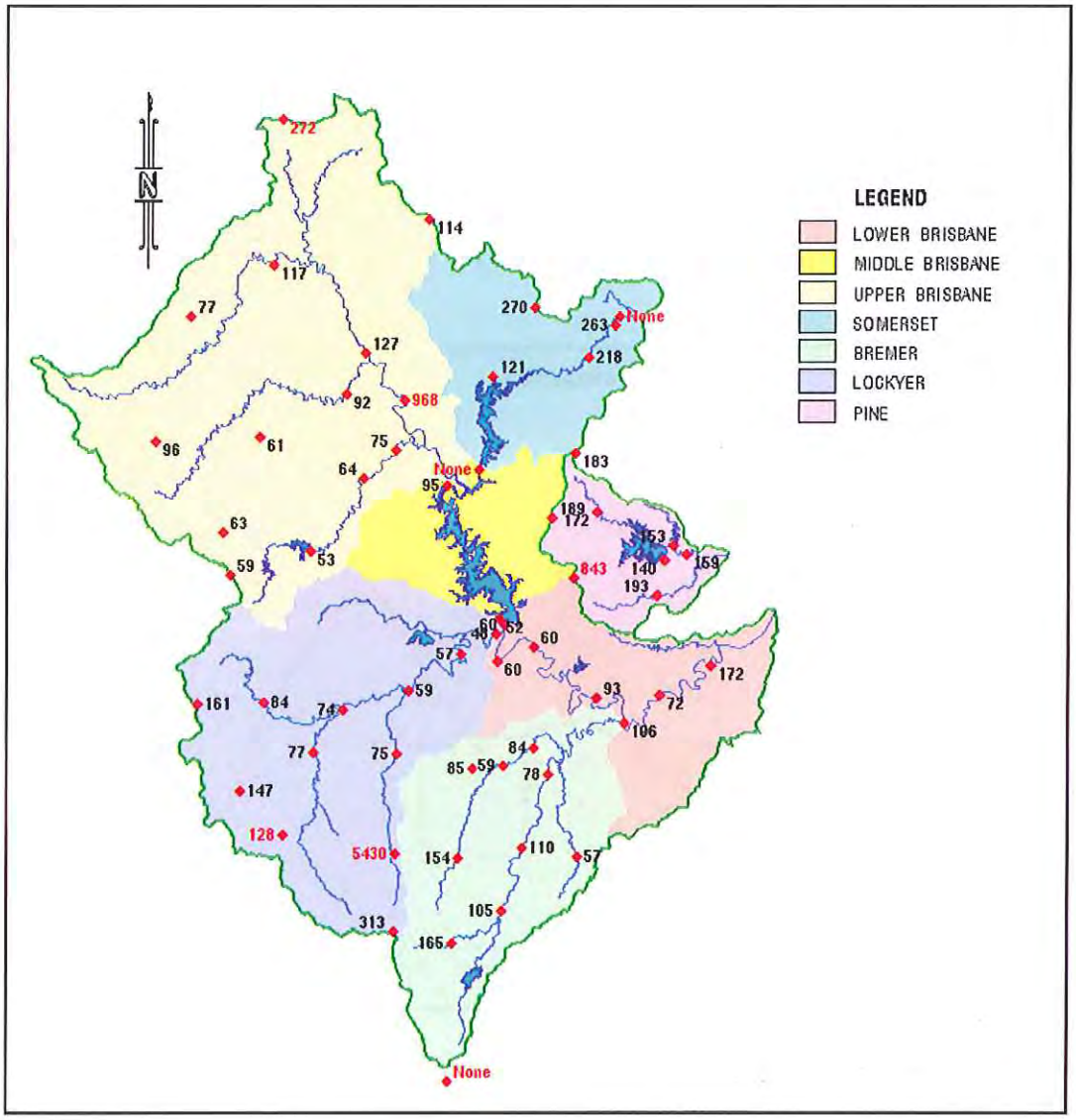
4.9 Early December Event – Overview

The early December Event has a designated start date of 09:00 on Wednesday 1 December 2010 for the purposes of providing event data. Dam releases for the Event commenced on Monday 13 December 2010 and concluded on Thursday 16 December 2010.

Only small releases from Somerset and Wivenhoe Dams occurred during this period. Accordingly, only basic rainfall and water level data has been reported for this time as comprehensive data is of little value in assessing the Event.

4.10 Early December Event – Rainfall

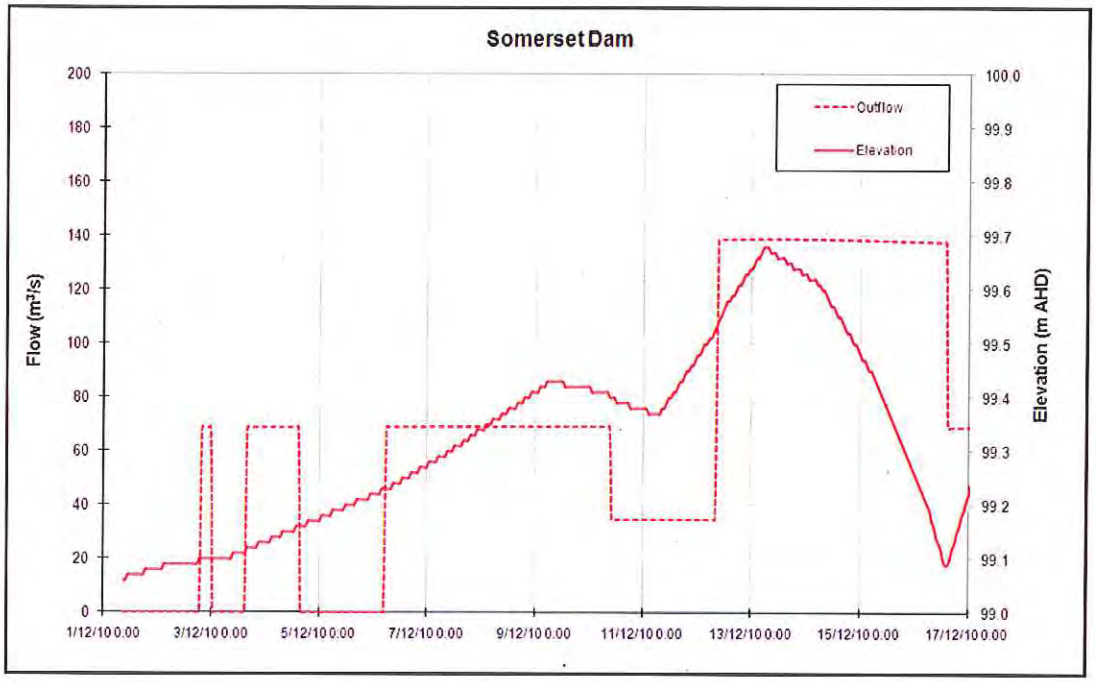
Rainfall in the Brisbane River catchment during this event was of low intensity and scattered throughout the Basin. The diagram below summarises the 15 days of rainfall from 09:00 on Wednesday 1 December 2011.



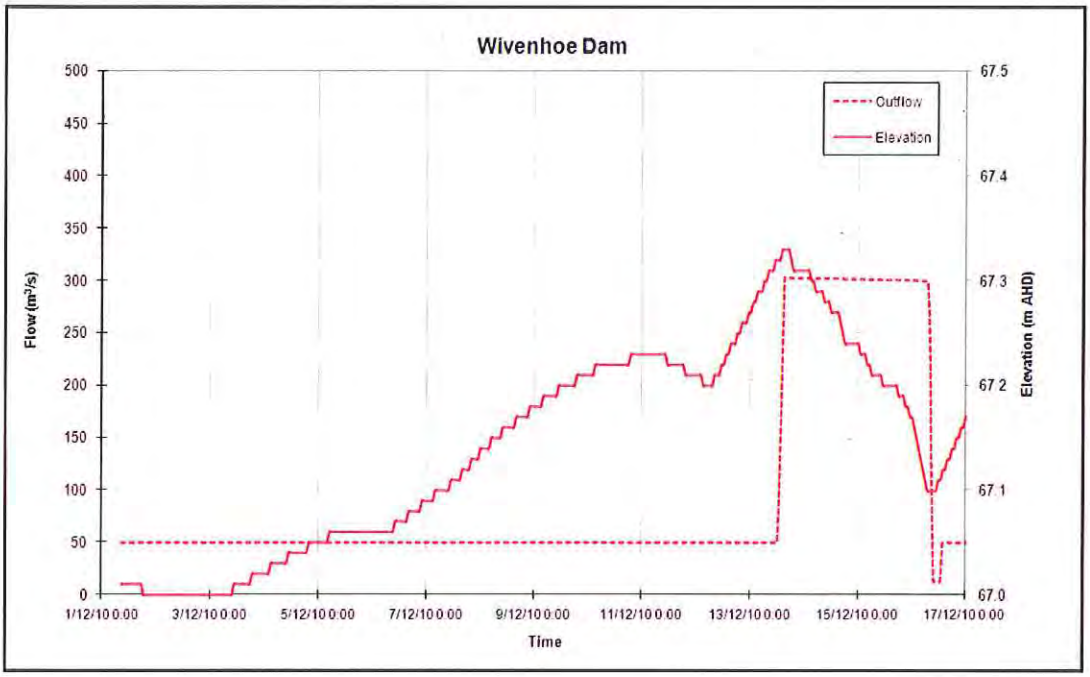
4.11 Early December Event – Dam Inflows and Outflows

The inflows and outflows from Somerset and Wivenhoe Dams are outlined in the table and figures below. Note, the Wivenhoe figures include Somerset outflows and the inflow to the dams has been estimated by reverse routing.

STATION	DATE/TIME	PEAK FLOW (m^3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
SOMERSET DAM INFLOW	13/12/2010 02:00	280	107,000	
SOMERSET DAM OUTFLOW	13/12/2010 14:00	140	93,000	99.68
WIVENHOE DAM INFLOW	13/12/2010 15:00	400	113,000	
WIVENHOE DAM OUTFLOW	13/12/2010 15:00	300	127,000	67.33



In the afternoon of Monday 13 December, Somerset Dam reached its maximus water left of 99.68mm AHD. The corresponding outflow from the Dam was $140m^3/s$.



At 15:00 on Monday 13 December, Wivenhoe Dam's maximum water level of 67.33m AHD was reached, with a corresponding release of 300m^3/s.

4.12 Mid December Event – Overview

The Mid December Event has a designated start date of 09:00 16 December 2010 for the purposes of providing event data. The Event's dam releases commenced on Friday 17 December 2010 and concluded on Friday 24 December 2010.

The Mid December Event was a relatively significant event with the peak outflow from Wivenhoe Dam in the order of 1,500m^3/s. Accordingly, comprehensive rainfall and water level data has been reported to allow a detailed assessment of the event.

4.13 Mid December Event – Base Rainfall Data

The following rainfall tables and maps show the daily event rainfall recorded in the Brisbane River Basin. On the maps "None" signifies no rainfall reports were received from the station during the period. Figures in red also indicate errors in the data.

Rainfall in 24 hours to 09:00											
ALERT ID	Station	17 Dec	18 Dec	19 Dec	20 Dec	21 Dec	22 Dec	23 Dec	24 Dec	Total	Comment
6775	Peachester										OOA
6714	Ferris Knob	36	7	4	55	0	0	10	2	114	
6705	Woodford-P	50	26	3	91	0	1	11	4	186	

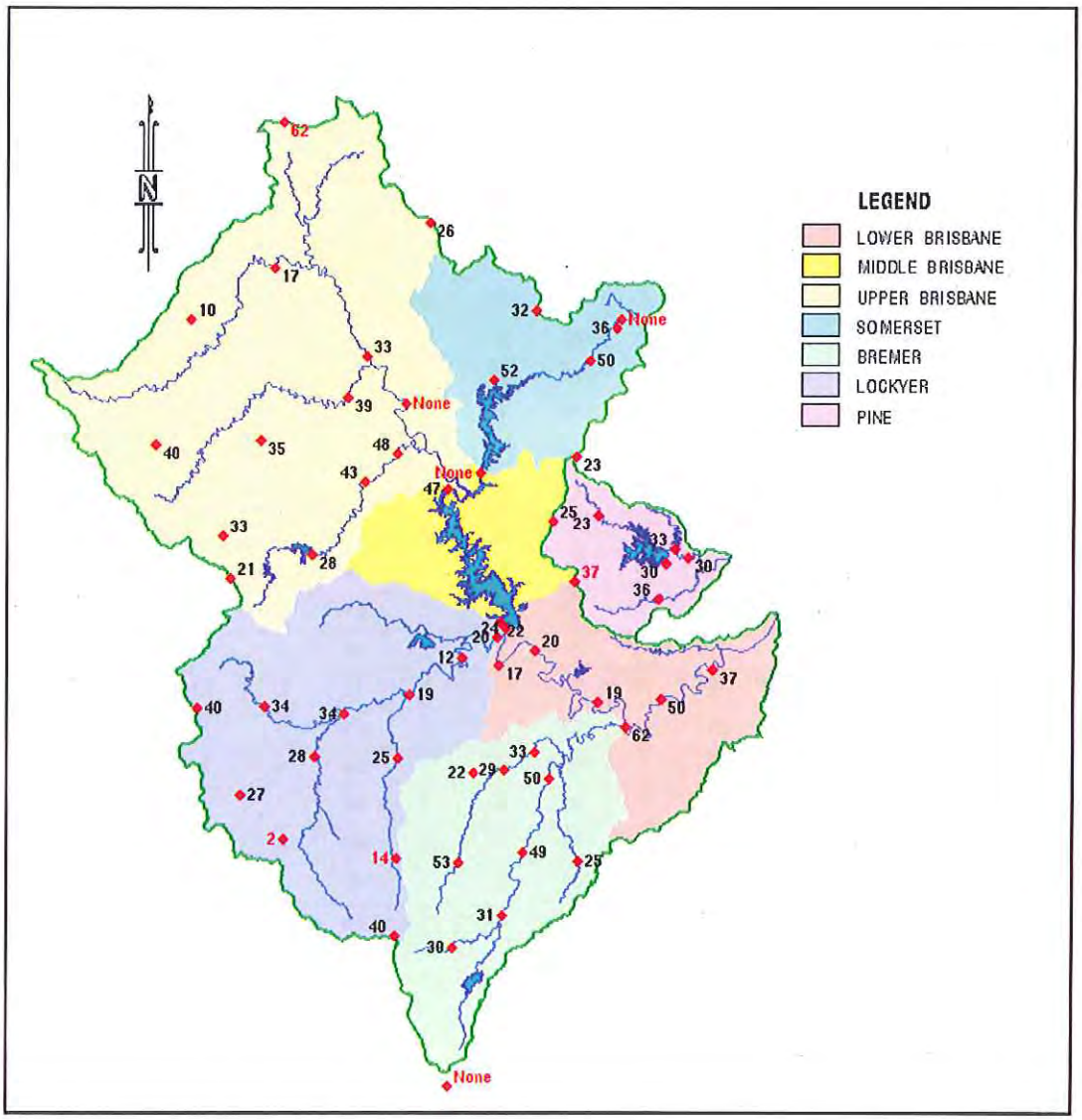
Rainfall in 24 hours to 09:00											
ALERT ID	Station	17 Dec	18 Dec	19 Dec	20 Dec	21 Dec	22 Dec	23 Dec	24 Dec	Total	Comment
6702	Woodford-B	50	26	3	91	0	1	11	4	186	
6600	Kilcoy	52	35	0	77	0	0	7	0	171	
6593	Somerset Dam HW-P	54	36	8	104	0	0	20	0	222	Double counting
6590	Somerset Dam HW-B	27	18	5	51	0	0	10	0	111	
6602	Top of Brisbane	43	3	7	46	0	0	12	0	111	
6540	Yarraman	10	15	3	51	0	0	19	5	103	
6542	Cooyar Ck	17	1	27	83	0	0	11	0	139	
6717	Linville	19	8	15	94	0	0	13	0	149	
6708	Devon Hills	33	8	2	93	0	0	13	1	150	
6529	St Aubyns	40	5	2	50	0	0	29	17	143	
6621	Nukinenda	35	19	1	47	1	0	13	20	136	
6520	Boat Mountain	39	12	1	54	0	1	16	4	127	
6514	Gregor Ck-P	25	24	1	79	0	0	13	1	143	
6517	Gregor Ck-B										OOA
6596	Crows Nest	33	10	2	45	0	0	23	7	120	
6780	Perseverance	0	0	9	6	2	2	2	0	21	Under reading
6782	Ravensbourne	66	5	4	43	0	0	27	6	151	
6523	Cressbrook Dam	28	8	2	40	0	0	14	7	99	
6553	Rosentretters Br	43	11	1	41	0	0	16	1	113	
6604	Toogoolawah	48	15	2	45	1	0	14	1	126	
6574	Caboonbah	47	16	2	48	0	0	15	0	128	
6636	Wivenhoe Dam HW-B	22	0	4	43	0	0	19	0	88	
6643	Wivenhoe Dam TW-P	24	0	3	44	0	0	20	0	91	
6641	Wivenhoe Dam TW-B	25	0	3	46	0	0	19	1	94	
6598	Toowoomba	40	4	8	36	0	0	10	2	100	
6526	Helidon	33	3	11	36	0	0	34	1	118	
6617	Little Egypt	27	1	18	35	0	0	20	1	102	
6606	West Woodbine	6	1	18	39	1	0	44	1	110	
6565	Tenthill	28	5	0	1	0	0	42	0	76	
6577	Gatton	34	1	8	38	0	0	45	1	127	
6619	Mt Castle	40	4	7	39	0	0	52	6	148	
6615	Thornton	14	0	9	31	0	0	37	1	92	
6583	Showground Weir	25	2	6	35	0	0	26	2	96	
6556	Glenore Grove	19	1	8	40	0	0	22	2	92	
6633	Lyons Br-P	12	0	3	37	0	0	16	1	69	
6630	Lyons Br-B	13	0	2	42	0	0	17	1	75	
6568	O'Reillys Weir	20	0	3	42	0	0	17	1	83	
6646	Lowood-B	18	0	5	43	0	0	16	1	83	

Rainfall in 24 hours to 09:00											
ALERT ID	Station	17 Dec	18 Dec	19 Dec	20 Dec	21 Dec	22 Dec	23 Dec	24 Dec	Total	Comment
6649	Lowood-P	17	0	4	39	0	0	14	0	74	
6559	Savages Crossing	20	0	3	42	0	0	22	0	87	
1730	Lake Manchester	26	0	3	44	0	0	19	0	92	
6751	Mt Crosby	19	0	4	39	0	0	13	0	75	
2059	Colleges Crossing	30	0	10	50	0	0	15	0	105	
6580	Adams Br	53	8	13	30	0	0	23	1	128	
2192	Franklyn Vale										OOA
2065	Grandchester	34	2	5	42	0	0	22	3	108	
6736	Kuss Rd	22	0	5	30	0	0	16	1	74	
2068	Tallegalla	35	0	16	40	0	0	21	0	112	
6733	Rosewood	29	1	6	32	0	0	21	1	90	
6550	Five Mile Bridge	33	0	11	35	0	0	20	0	99	
6623	Tarome-P	30	1	5	41	0	0	23	23	123	
6562	Kalbar Weir	31	1	5	31	0	0	22	3	93	
6571	Harrisville	49	5	15	34	0	0	17	2	122	
6651	Greens Road	50	2	10	38	0	0	20	1	121	
6739	Washpool	25	3	19	35	0	0	16	0	98	
2062	Peak Crossing	36	7	17	40	0	0	16	0	116	
2055	Loamside	39	4	10	39	0	0	22	0	114	
2160	One Mile Br	43	0	12	43	0	0	15	0	113	
2040	Churchill	37	1	12	39	0	0	14	0	103	
2035	Brassall (Hancock	41	1	10	33	0	0	9	0	94	
2106	Lyons										OOA
2145	Ripley	10	2	0	2	0	0	0	0	14	Under reading
2050	Bundamba (Barclay)	49	0	13	42	0	0	14	0	118	
2045	Bundamba (Hanlon)	44	0	8	17	0	0	5	0	74	
6754	Moggill-P	62	0	9	41	0	0	13	0	125	
2150	Opossum	39	1	10	38	0	0	10	0	98	
2116	Carole Park	61	1	8	57	0	0	12	0	139	
1518	Wacol	73	0	8	49	1	21	10	0	162	
2102	Jingle Downs	12	1	10	34	0	0	9	1	67	
2104	Greenbank	15	6	9	48	0	0	10	0	88	
2108	Forestdale	8	5	14	29	1	1	6	0	64	
2114	Calamvale	19	0	9	65	0	0	9	1	103	
1736	Inala	16	0	8	60	0	1	8	0	93	
2020	Corinda High	53	0	2	58	0	1	12	0	126	
2138	Mt Gravatt	10	2	2	41	4	2	7	0	68	
1548	Holland Park West	43	2	3	56	3	0	11	0	118	
1554	East Brisbane	39	0	7	57	1	0	12	0	116	
1836	Eight Mile Plains	26	0	12	65	0	1	9	0	113	

Rainfall in 24 hours to 09:00											
ALERT ID	Station	17 Dec	18 Dec	19 Dec	20 Dec	21 Dec	22 Dec	23 Dec	24 Dec	Total	Comment
1803	Wishart	22	0	4	56	0	1	8	0	91	
1706	Carindale	29	0	7	55	0	0	11	0	102	
1596	Camp Hill	38	0	9	55	4	1	11	0	118	
1830	Mansfield	24	1	3	55	1	3	8	1	96	
1739	Lytton	32	0	7	50	0	1	14	0	104	
1527	Hemmant	30	0	8	43	6	6	14	0	107	
2141	Ransome	20	0	11	55	0	1	16	0	103	
1755	Manly	21	0	8	46	1	0	15	0	91	
1742	Pullenvale	47	0	3	60	0	1	12	0	123	
1515	Kenmore Hills	33	1	7	59	0	1	12	4	117	
6730	Jindalee	50	0	2	50	0	0	10	0	112	
1749	Toowong	43	1	5	65	0	1	16	0	131	
6748	Brisbane City	37	0	9	50	0	0	12	0	108	
1507	Three Ways	26	0	4	65	0	1	15	0	111	
1718	Gold Ck Res	23	0	3	69	19	0	15	0	129	
1533	Enoggera Dam	20	0	5	61	0	0	13	2	101	
1512	Mt Coot-tha	28	0	9	58	1	1	14	0	111	
1578	Alderley	21	0	5	56	0	0	14	0	96	
1524	Bowen Hills	27	4	7	51	1	0	14	0	104	
2285	Steiglitz Wharf	17	44	12	55	0	0	14	0	142	
2086	Marburg	34	1	11	36	0	0	17	1	100	
2074	Stokes Crossing	38	1	20	37	0	0	21	3	120	
2080	Spressers Bridge	30	1	9	37	0	0	23	1	101	
2083	Rosewood WWTP	27	0	7	34	0	0	21	1	90	
2071	Churchbank Weir	32	1	0	1	0	0	0	1	35	Under reading
2077	Greys Plains Rd	23	4	17	34	0	0	32	1	111	
1837	Wynnum Bowls	22	0	6	43	0	1	14	0	86	
1838	Luggage Point	31	1	7	49	0	0	9	1	98	
1840	Chandler	20	1	4	54	1	1	11	0	92	
1841	Bulimba	39	0	9	59	0	1	14	0	122	
6585	Sandy Creek Road	30	0	9	38	0	0	42	0	119	
6588	Upper Sandy Creek	43	2	9	46	0	0	42	4	146	
2089	Harrisville-B	48	4	16	36	0	0	18	2	124	
2092	Rosewood-B	31	1	7	37	1	0	24	1	102	
2095	Bellbird Park	21	2	12	47	0	0	13	1	96	
2011	Buaraba	23	0	3.4	44	0	0	30.3	2.9	103.6	
2006	Hays Landing	19.4	0.4	1.8	56.2	0	0	27	0.4	105.2	
2004	Pohlman Range	26	29	0.4	86.2	0	0	17.6	0.6	159.8	
5356	Mt Alford										Did not work
6656	Bill Gunn Dam	11	9	3	10	8	9	27	3	80	

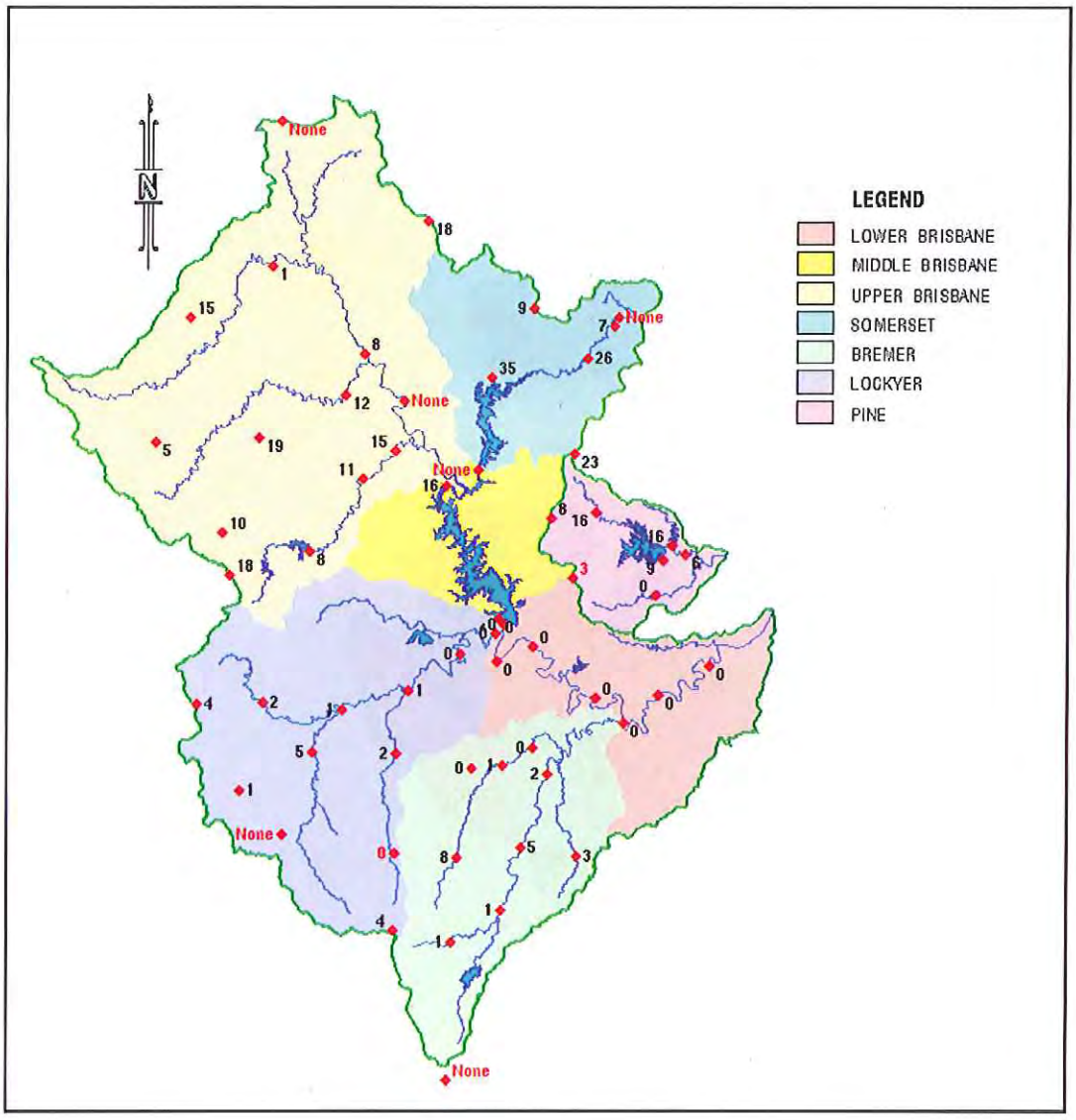
Rainfall in 24 hours to 09:00											
ALERT ID	Station	17 Dec	18 Dec	19 Dec	20 Dec	21 Dec	22 Dec	23 Dec	24 Dec	Total	Comment
6658	Lake Clarendon Dam	19	4	8	43	0	0	38	3	115	
6555	Atkinson Dam	8	0	4	44	0	0	22	1	79	
6624	Moogerah Dam	26	2	6	45	0	0	26	13	118	
6609	Monsildale	28	7	25	52	0	0	14	2	128	
6612	Mt Stanley	25	14	27	116	0	0	15	1	198	
6607	Lindfield	25	4	5	101	0	1	11	5	152	
6603	Blackbutt	15	8	3	60	0	0	19	6	111	
6601	Mt Binga	34	19	2	62	0	0	28	15	160	
6613	Hazeldean	51	61	0	77	0	0	25	1	215	
6614	Westvale	0	8	1	77	0	0	13	0	99	
6605	Eskdale										Not yet installed
6611	Redbank Creek	56	7	3	47	0	0	15	9	137	
6100	Mt Mowbullan	21	2	0	1	0	0	0	2	26	
6427	Maleny	33	18	20	83	0	0	16	12	182	
5425	Hume Lane	35	8	5	66	0	1	21	3	139	
6400	Bald Knob	39	8	10	64	0	1	16	4	142	
6716	West Bellthorpe	32	9	5	57	0	1	10	11	125	
6701	Mt Mee-B	23	23	2	63	0	1	23	4	139	
6690	Mt Mee-P	23	23	2	63	0	0	24	3	138	
6680	Mt Glorious-P	28	3	2	65	0	0	38	1	137	
5423	Landsborough	67	7	12	74	0	2	36	4	202	
6608	Jimna	26	18	30	54	0	2	8	1	139	
2194	Wilsons Peak	10	0	1	34	0	0	55	10	110	
6774	Wilsons Peak-P										OOA

Rainfall in 24 hours to 09:00 17/12/2010



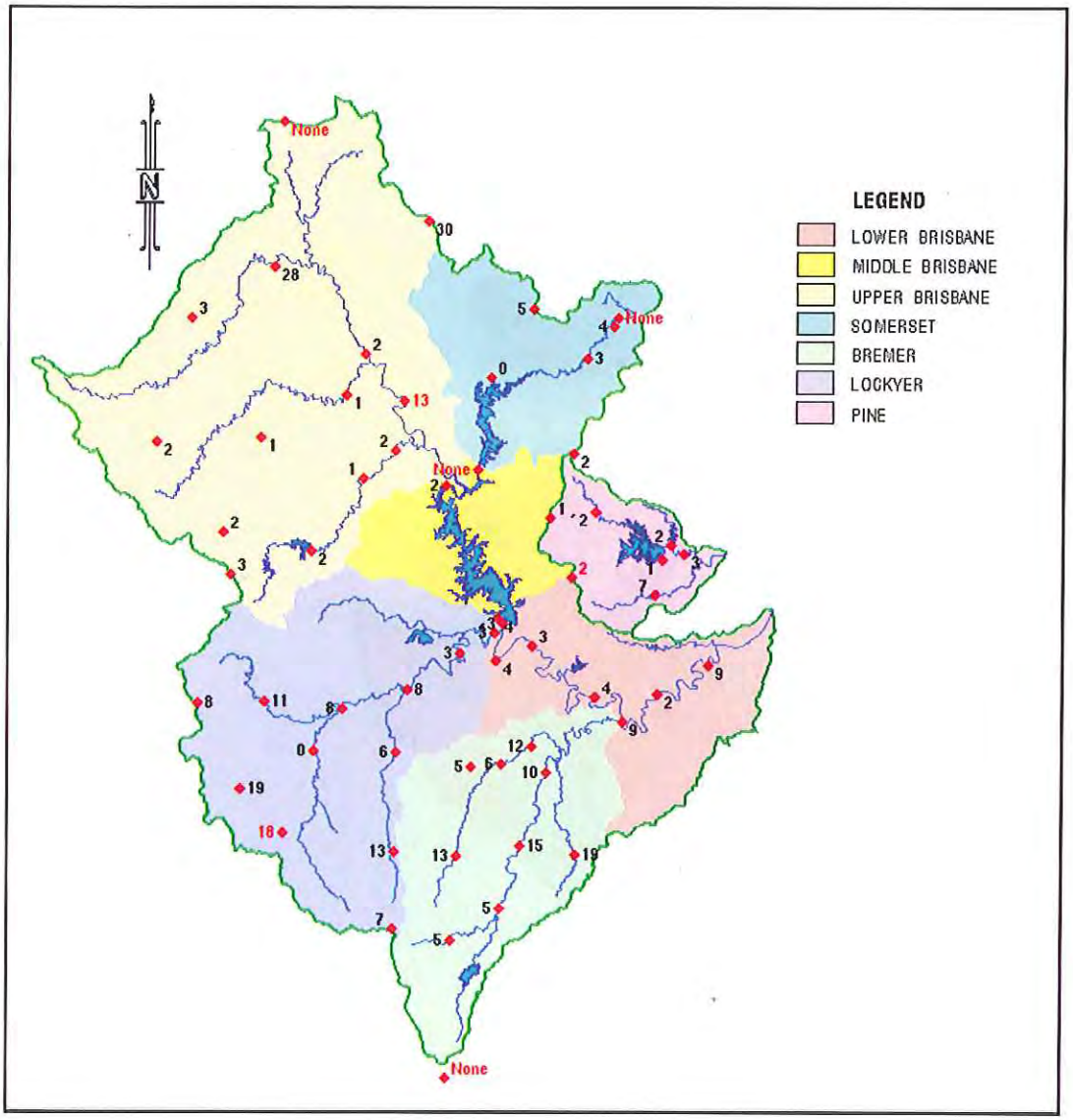
In the 24 hours to 09:00 on Friday 17 December 2010, widespread rainfall was recorded throughout the Brisbane River catchment, with falls of up to 50mm recorded.

Rainfall in 24 hours to 09:00 18/12/2010



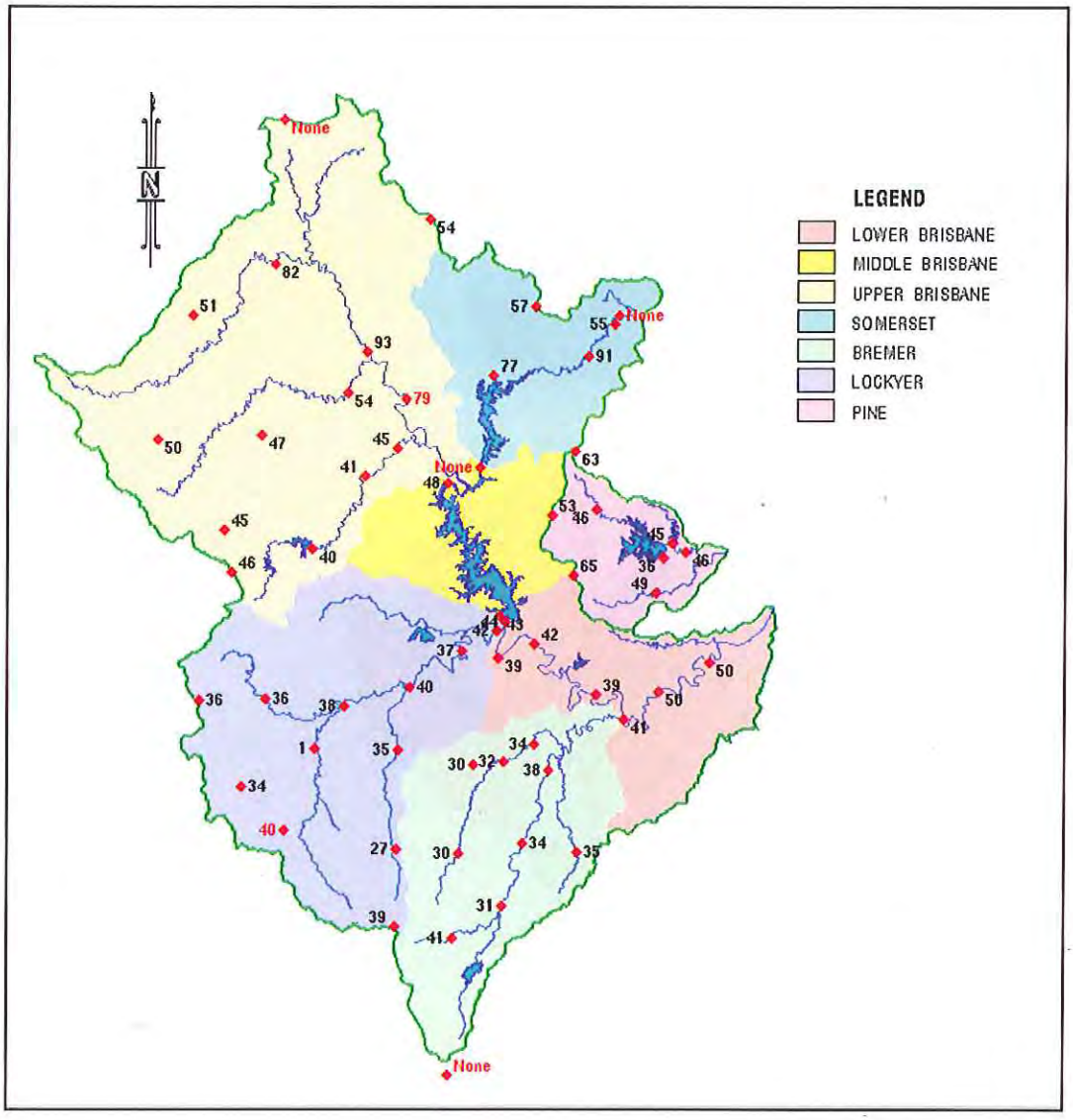
In the 24 hours to 09:00 on Saturday 18 December 2010, rainfall had generally eased, especially in the catchments downstream of Wivenhoe, however isolated falls of up to 35mm were recorded around Kilcoy.

Rainfall in 24 hours to 09:00 19/12/2010



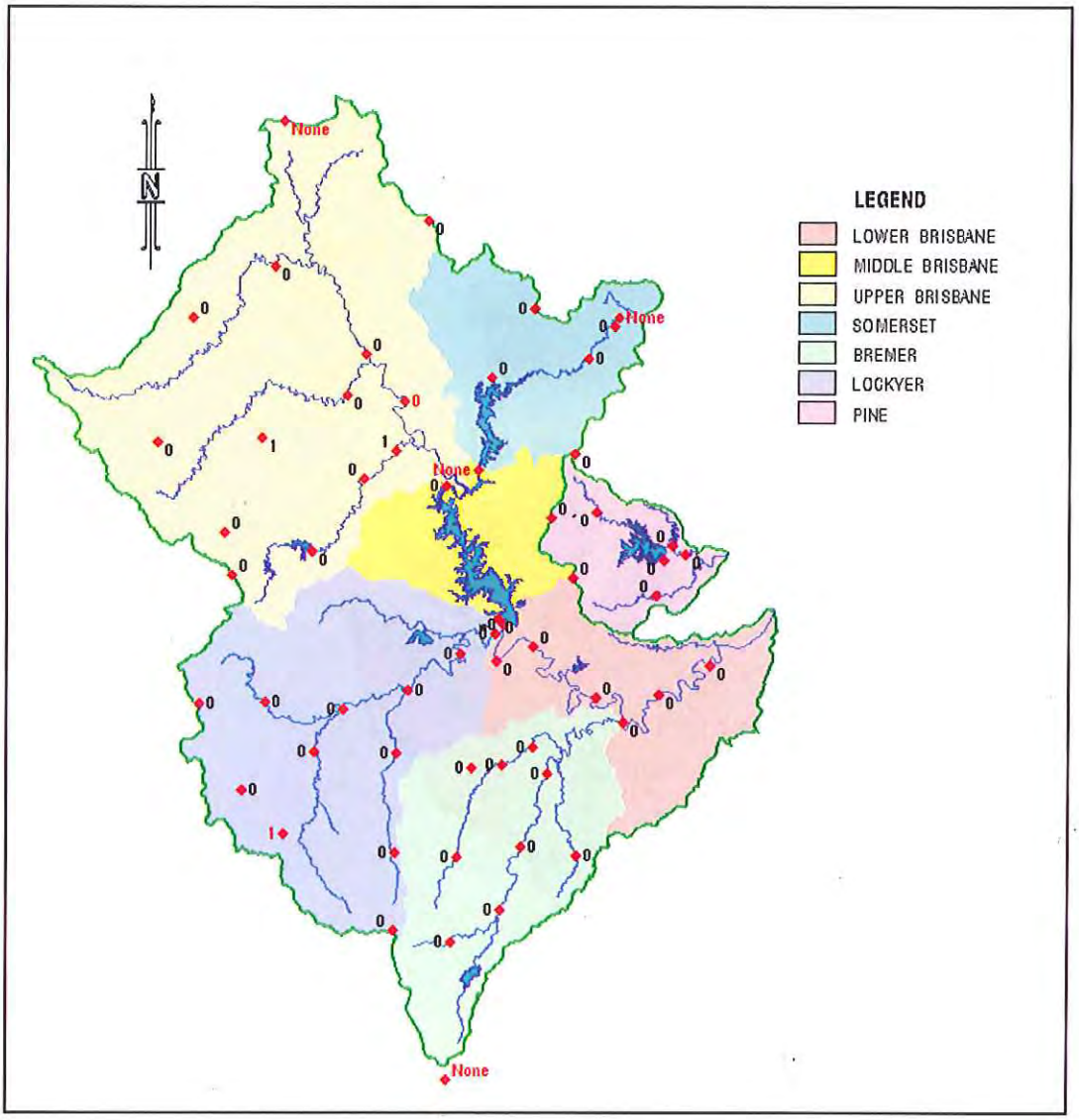
Only light rain was recorded throughout the region in the 24 hours to 09:00 on Sunday 19 December. Isolated higher totals of up to 30mm were recorded in the Stanley River catchment.

Rainfall in 24 hours to 09:00 20/12/2011



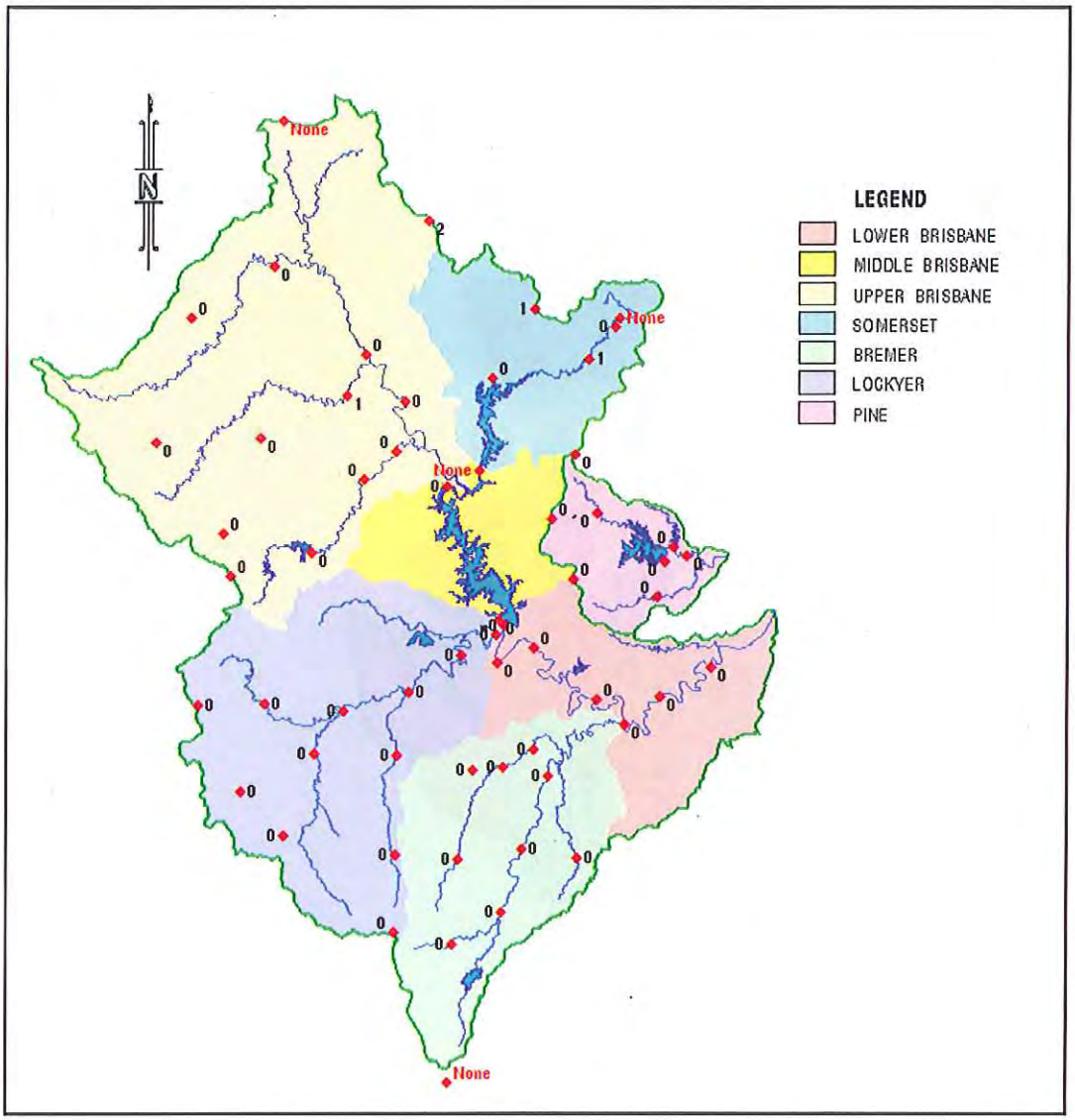
Rainfall in the 24 hours to 09:00 on Monday 20 December was more widespread and much heavier than the rainfall during the previous 24 hour period. Falls of up to 91mm were recorded in the Stanley catchment. In the Upper Brisbane catchment, widespread falls of between 40mm to 90mm were recorded. Downstream of Wivenhoe Dam, falls were generally less, ranging from between 35mm to 50mm.

Rainfall in 24 hours to 09:00 21/12/2010



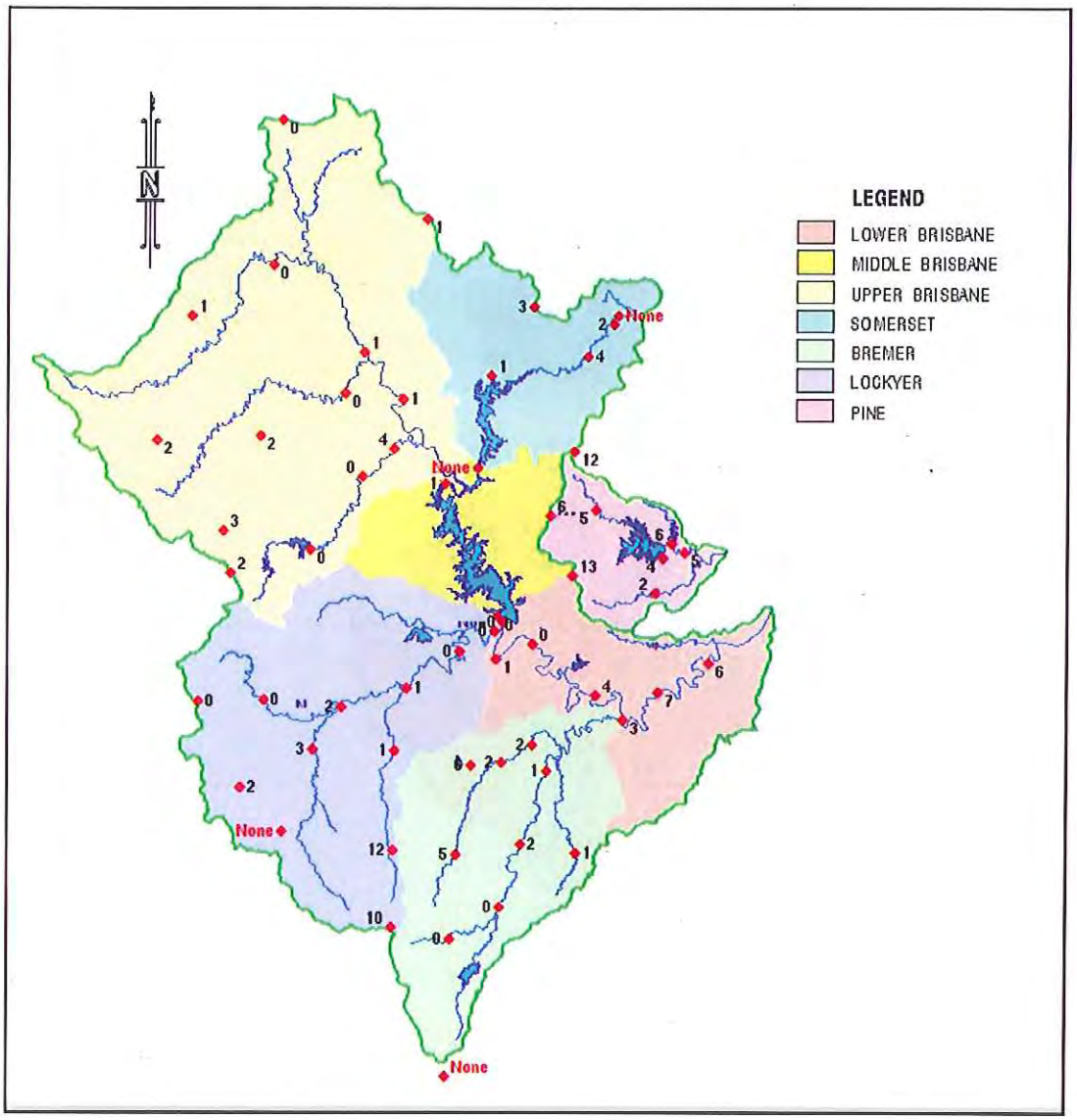
No significant rainfall was recorded in the region in the 24 hours to 09:00 on Tuesday 21 December 2010.

Rainfall in 24 hours to 09:00 22/12/2011



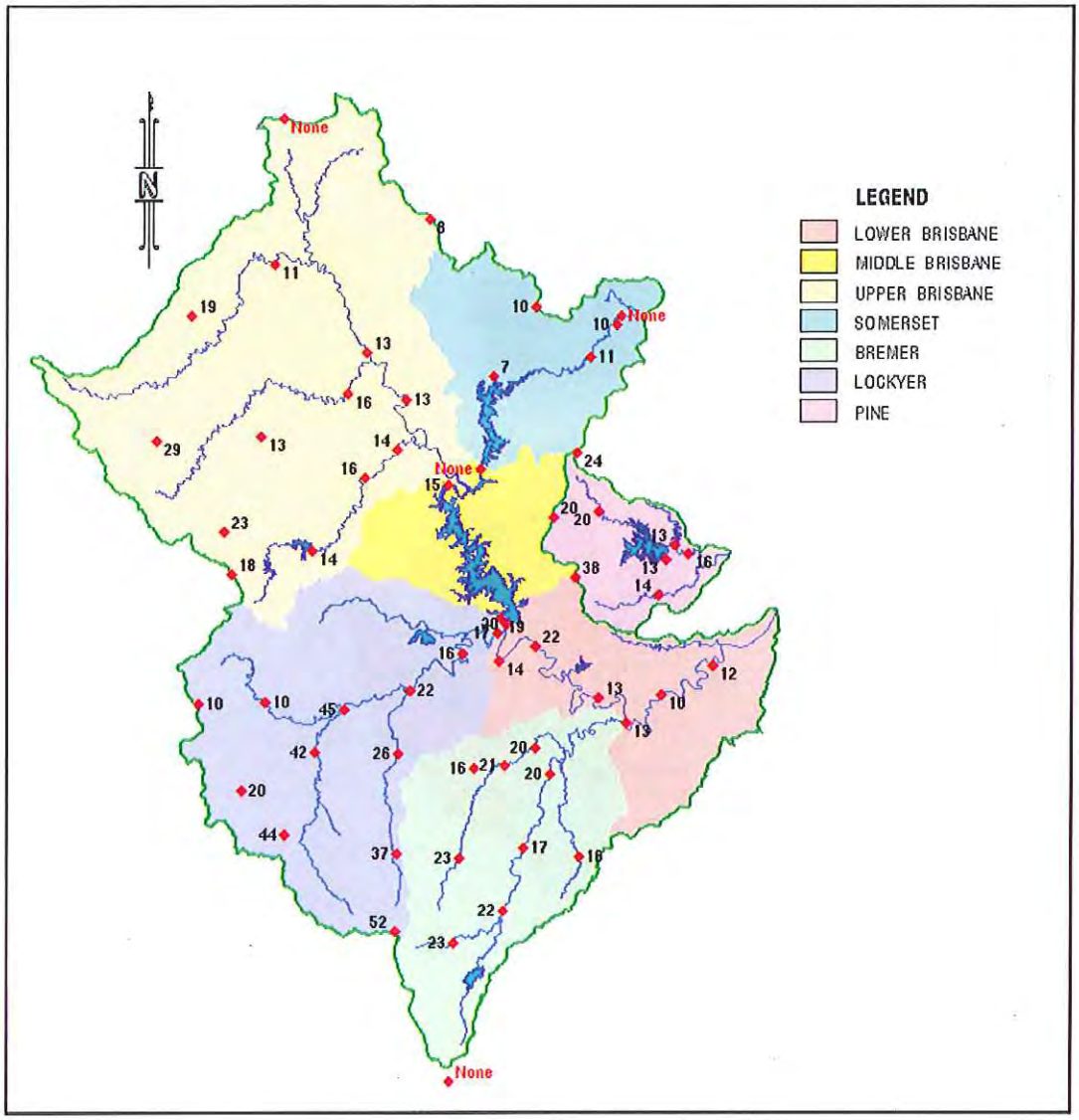
No significant rainfall was recorded in the region in the 24 hours to 09:00 on Wednesday 22 December 2010.

Rainfall in 24 hours to 09:00 23/12/2010



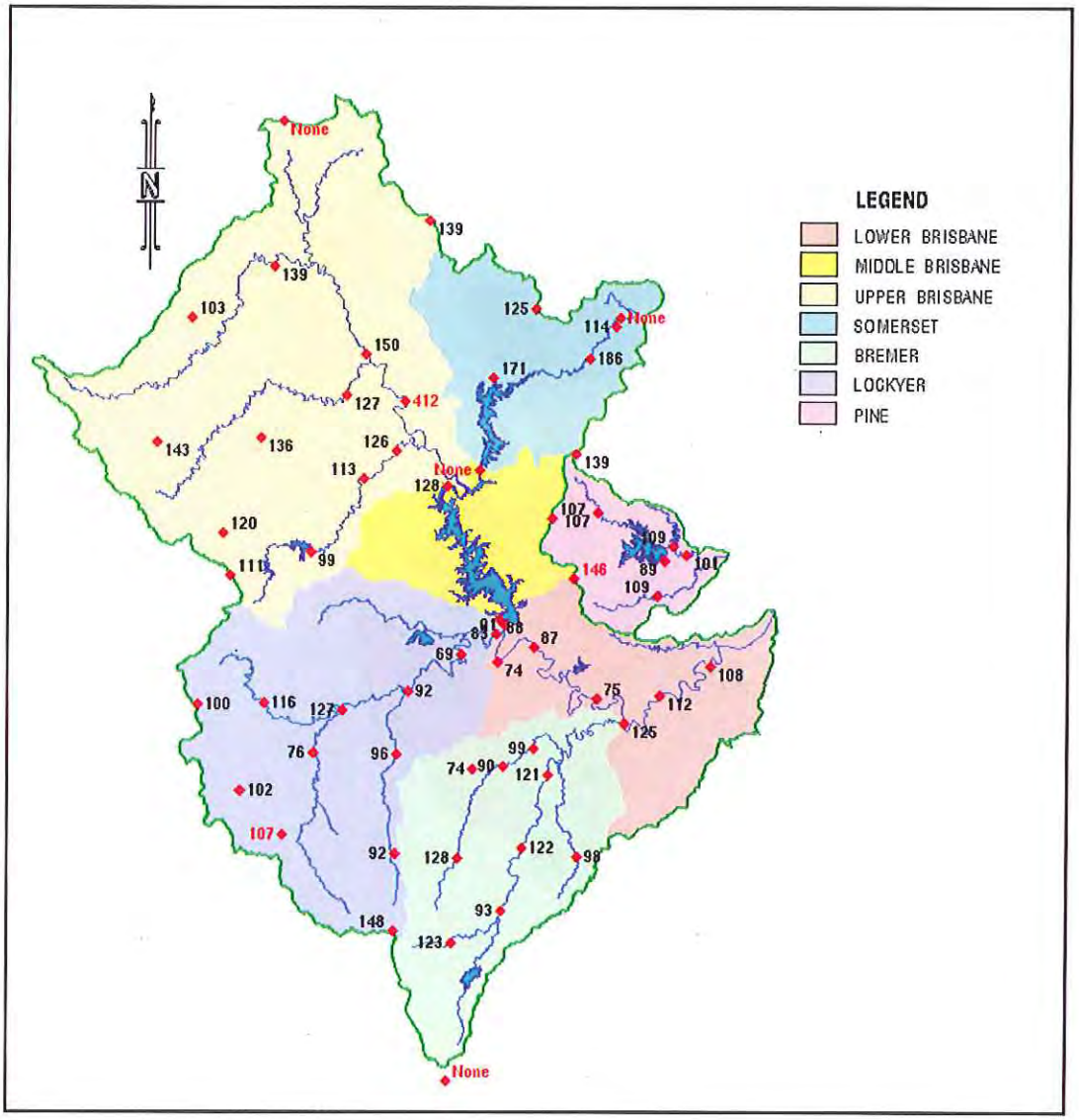
In the 24 hours to 09:00 on Thursday 23 December, rainfall totals were generally less than 10mm.

Rainfall in 24 hours to 09:00 24/12/2010



In the 24 hours to 09:00 on Friday 24 December, rainfall recommenced with widespread totals ranging from 10mm to 50mm. The highest totals in this period were recorded in the Lockyer Creek catchment.

Rainfall in eight days to 09:00 24/12/2010



The map above shows the distribution of rainfall during the eight day period to 09:00 on Friday 24 December 2010.

The highest totals were recorded in the headwater areas of the Stanley River. In the Upper Brisbane catchment, the rain was widespread with event totals of between 100mm and 150mm. In Lockyer Creek, event totals ranged from 70mm in the lower reaches to nearly 150mm in the headwaters of Laidley Creek. Totals in the Bremer and Lower Brisbane catchments were generally in the range of between 75mm to 125mm.

4.14 Mid December Event – Average Catchment Rainfall

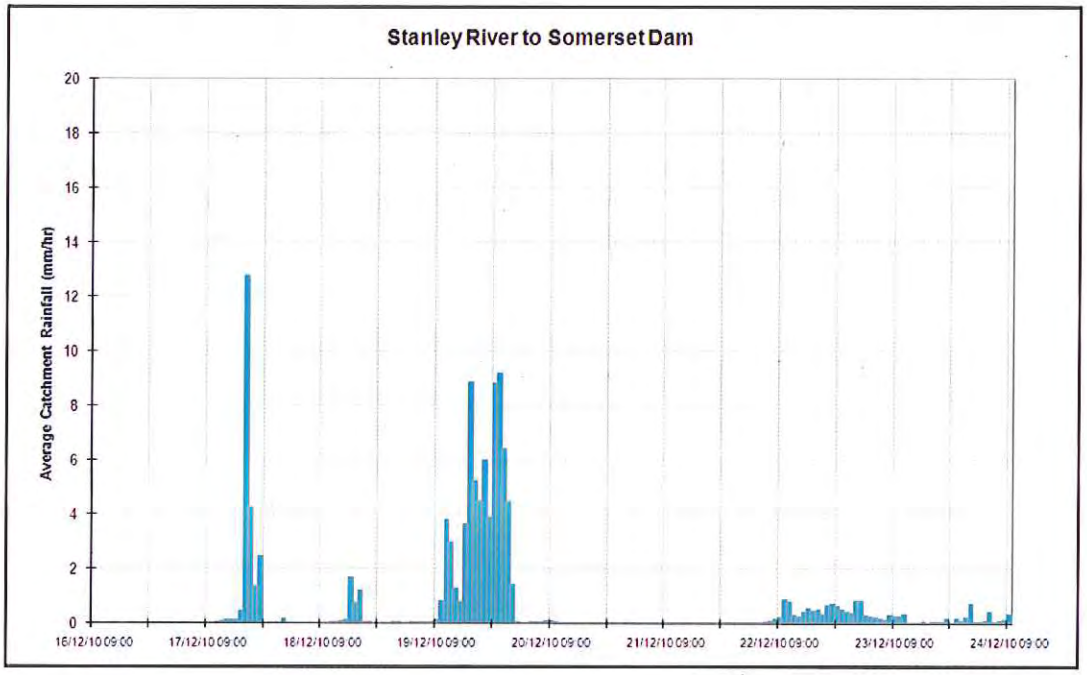
Average rainfall for each sub catchment in the Brisbane Basin is determined by applying a weighting to the rainfall depth at each available station within the sub catchment. The Upper Brisbane catchment excludes the Somerset catchment and is a weighted average of the Upper and Middle Brisbane catchments. A summary of catchment average rainfall for the Mid December Event is shown in the table and figure below.

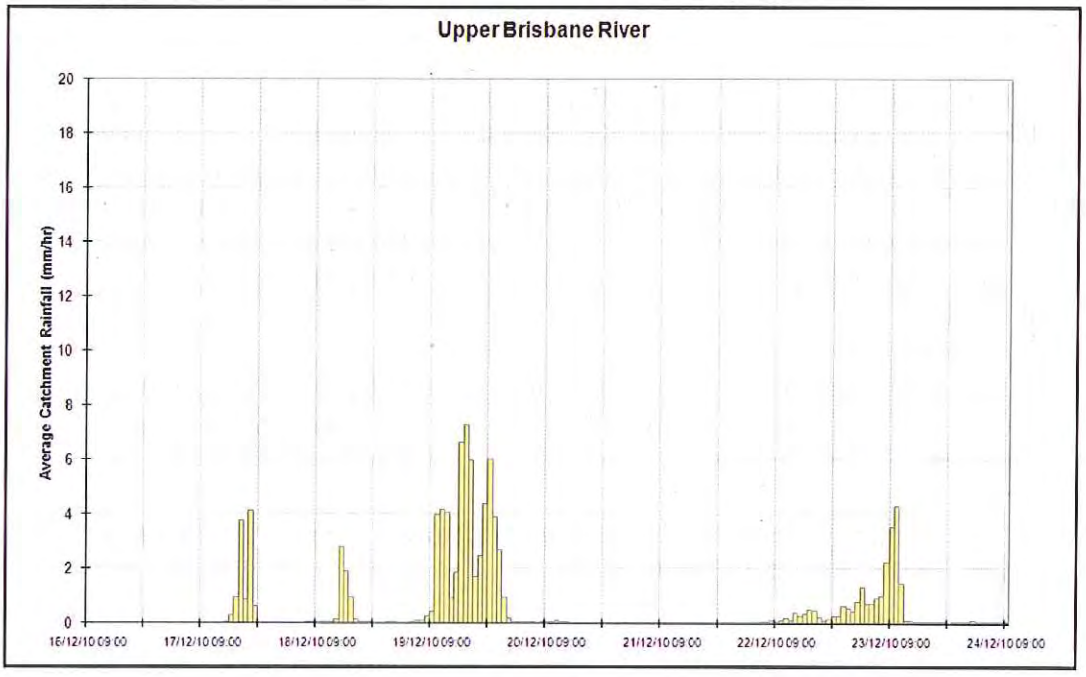
Period Ending 09:00	Stanley		Upper Brisbane		Lockyer		Bremer		Lower	
	Period	Σ	Period	Σ	Period	Σ	Period	Σ	Period	Σ
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
17/12/2010	0	0	0	0	0	0	0	0	0	0
18/12/2010	22	22	11	11	2	2	3	3	0	0
19/12/2010	4	27	6	17	9	11	10	14	6	6
20/12/2010	73	99	54	71	34	45	34	48	44	51
21/12/2010	0	99	0	71	0	45	1	49	0	51
22/12/2010	1	100	0	71	0	45	6	55	0	51
23/12/2010	11	111	0	71	27	72	29	84	14	65
24/12/2010	3	115	0	71	4	76	13	97	0	65

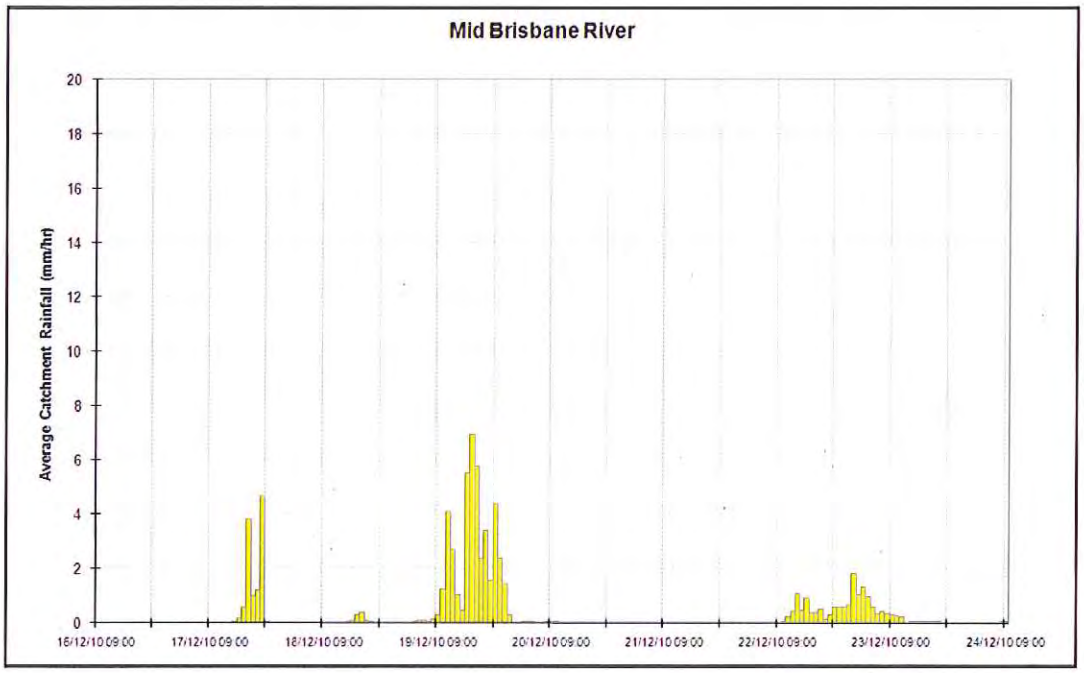
The catchment average rainfalls for the Mid December Event are included on the following pages. These hyetographs do not necessarily reflect the localised high intensity rainfall that was recorded across the Basin at various times and locations. Catchment rainfalls can include hourly intensities at individual stations which are up to five times the catchment average.

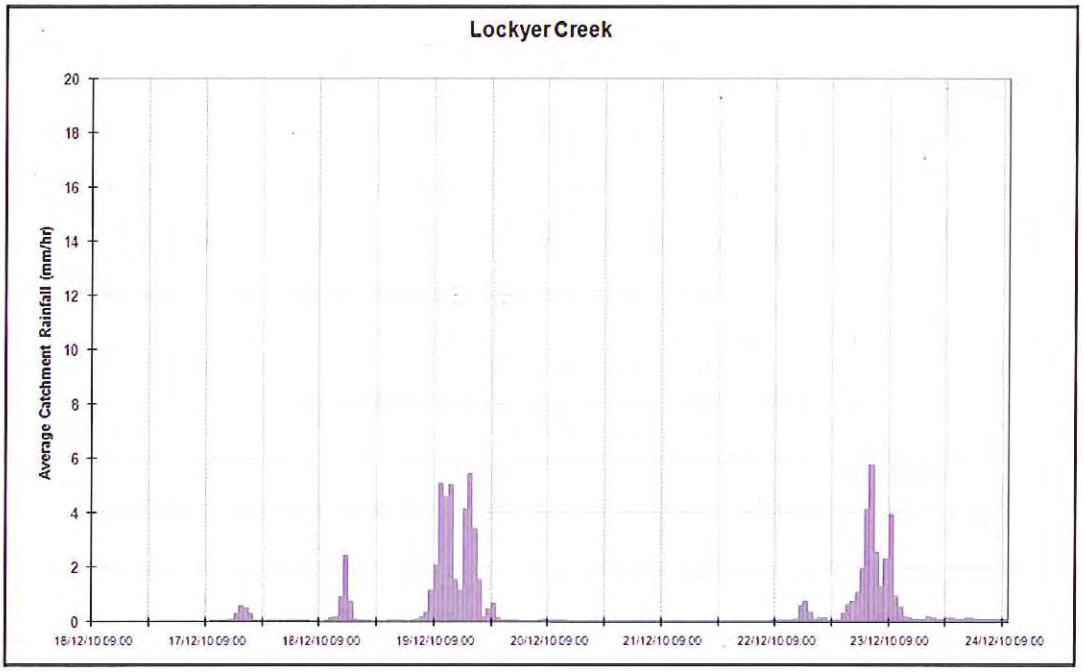
The hyetographs clearly show two to three distinct bursts of rainfall during the Event that can be described as follows:

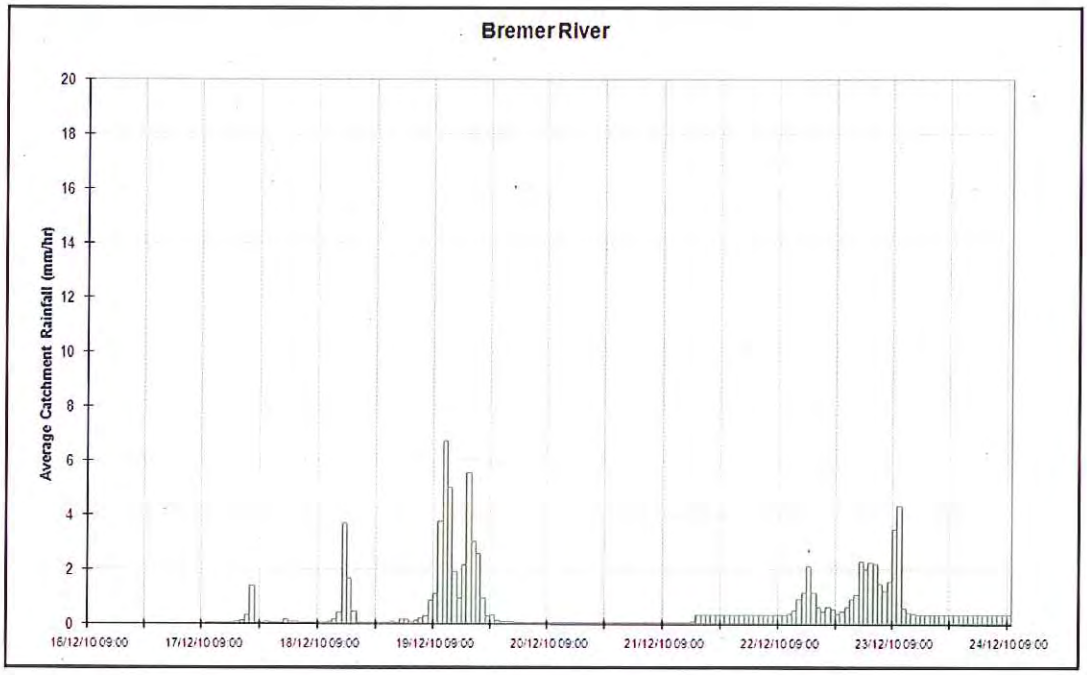
- A short intense period in the 12 hours to approximately 18:00 on Friday 17 December, concentrated in the Stanley catchment with less rainfall in the Upper Brisbane catchment;
- Longer and more widespread of rainfall over a 12 to 18 hour period ending late on Sunday 19 December 2010, and;
- A period of widespread low intensity rainfall in the 24-hour period ending approximately 09:00 on Thursday 23 December 2010.

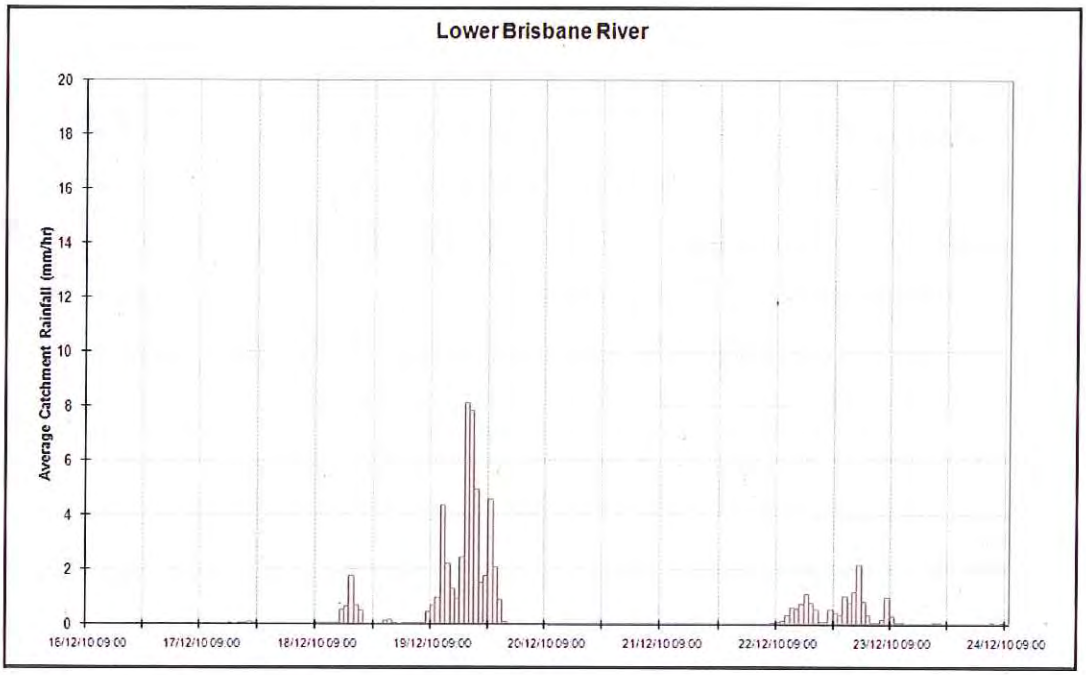

Stanley River to Somerset Dam
Average Catchment Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
16/12/10 09:00
17/12/10 09:00
18/12/10 09:00
19/12/10 09:00
20/12/10 09:00
21/12/10 09:00
22/12/10 09:00
23/12/10 09:00
24/12/10 09:00


Upper Brisbane River
Average Catchment Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
16/12/10 09:00
17/12/10 09:00
18/12/10 09:00
19/12/10 09:00
20/12/10 09:00
21/12/10 09:00
22/12/10 09:00
23/12/10 09:00
24/12/10 09:00


Mid Brisbane River
Average Catchment Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
16/12/10 09:00
17/12/10 09:00
18/12/10 09:00
19/12/10 09:00
20/12/10 09:00
21/12/10 09:00
22/12/10 09:00
23/12/10 09:00
24/12/10 09:00


Lockyer Creek
Average Catchment Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
16/12/10 09:00
17/12/10 09:00
18/12/10 09:00
19/12/10 09:00
20/12/10 09:00
21/12/10 09:00
22/12/10 09:00
23/12/10 09:00
24/12/10 09:00


Bremer River
Average Catchment Rainfall (mm/hr)
20
18
16
14
12
10
8
6
4
2
0
16/12/10 09:00
17/12/10 09:00
18/12/10 09:00
19/12/10 09:00
20/12/10 09:00
21/12/10 09:00
22/12/10 09:00
23/12/10 09:00
24/12/10 09:00


Lower Brisbane River
Average Catchment Rainfall (mm/hr)
20
18
16
14
12
10
8
6
4
2
0
16/12/10 09:00
17/12/10 09:00
18/12/10 09:00
19/12/10 09:00
20/12/10 09:00
21/12/10 09:00
22/12/10 09:00
23/12/10 09:00
24/12/10 09:00

4.15 Mid December Event – Event Water Levels

The table below shows the peak water levels reached at selected gauges during this Event.

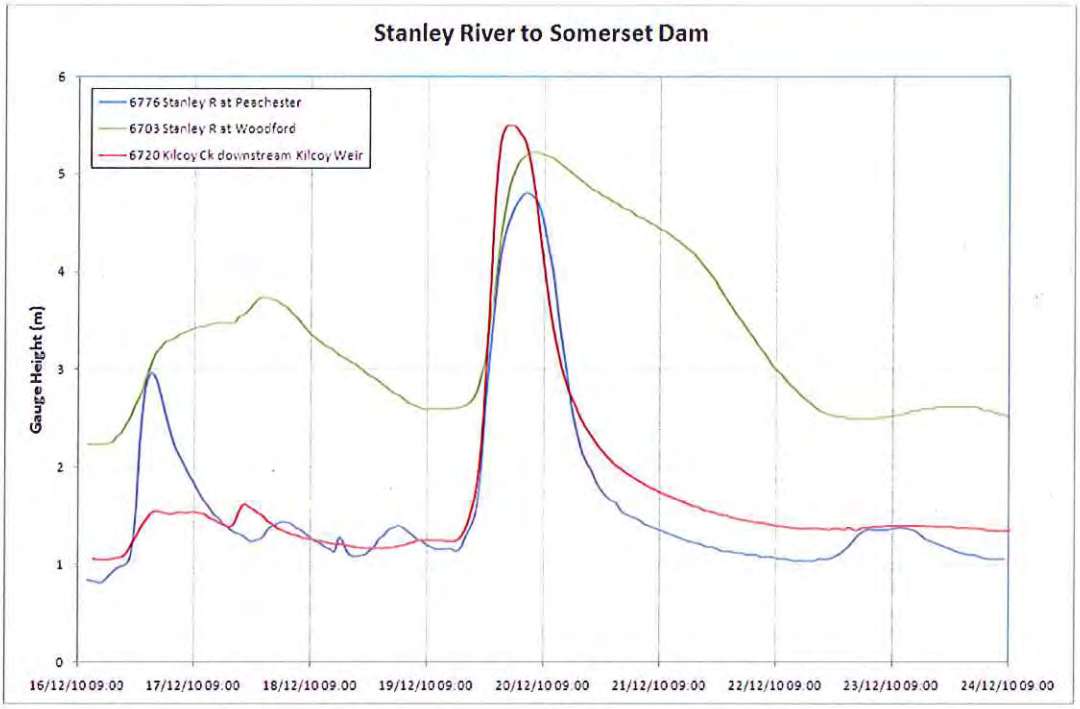
STATION	DATE/TIME	PEAK FLOW (m^3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
PEACHESTER	20/12/2010 05:00			4.81
WOODFORD	20/12/2010 06:00			5.22
KILCOY	20/12/2010 02:00			5.50
SOMERSET DAM INFLOW	20/12/2010 02:00	1,040	145,000	
SOMERSET DAM OUTFLOW	20/12/2010 14:00	410	136,000	100.42
COOYAR CK	20/12/2010 01:00			5.53
LINVILLE	20/12/2010 02:00			6.23
DEVON HILLS	20/12/2010 03:00			6.81
BOAT MT	20/12/2010 08:00			5.00
GREGOR CK	20/12/2010 06:00			7.58
ROSENTRETTERS	20/12/2010 06:00			2.72
WIVENHOE DAM INFLOW	20/12/2010 12:00	1,880	374,000	
WIVENHOE DAM OUTFLOW	21/12/2010 19:00	1,460	328,000	68.24
HELIDON	16/12/2010 22:00			4.91
TENTHILL	23/12/2010 13:00			3.76
GATTON	20/12/2010 04:00			10.05
MULGOWIE				
SHOWGROUND WEIR	23/12/2010 16:00			6.06
WARREGO HWY	24/12/2010 00:00			4.85
GLENORE GROVE	20/12/2010 08:00			9.60
LYONS BRIDGE	20/12/2010 16:00			11.38
RIFLE RANGE RD	20/12/2010 18:00			11.04
BUARABA CK	20/12/2010 22:00			4.22
OREILLYS WEIR	21/12/2010 23:00			11.12
LOWOOD PUMP STATION	22/12/2010 00:00			10.25
SAVAGES CROSSING	22/12/2010 04:00			10.34
BURTONS BRIDGE	22/12/2010 08:00			8.54
LAKE MANCHESTER	20/12/2010 11:00			51.21
KHOLO BRIDGE	17/12/2010 22:00			4.61
MT CROSBY WEIR	22/12/2010 14:00			11.20
COLLEGES CROSSING	22/12/2010 16:00			8.96
ADAMS BRIDGE	16/12/2010 17:00			4.38
STOKES CROSSING	16/12/2010 20:00			4.23
SPRESSERS BRIDGE	17/12/2010 03:00			3.20
KUSS RD	19/12/2010 23:00			6.86
WWTP	20/12/2010 02:00			7.13
ROSEWOOD	20/12/2010 03:00			5.33

STATION	DATE/TIME	PEAK FLOW (m^3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
FIVE MILE BRIDGE	20/12/2010 08:00			5.48
WALLOON	20/12/2010 09:00			6.43
MOOGERAH DAM	20/12/2010 02:00			155.54
JUNCTION WEIR	19/12/2010 16:00			77.01
HARRISVILLE	20/12/2010 07:00			4.94
CHURCHBANK WEIR	20/12/2010 06:00			1.85
GREENS RD	20/12/2010 16:00			5.28
AMBERLEY	20/12/2010 12:00			6.06
PEAK CROSSING	20/12/2010 02:00			2.54
LOAMSIDE	20/12/2010 12:00			3.13
ONE MILE BRIDGE	20/12/2010 13:00			12.14
HANCOCKS BRIDGE	20/12/2010 13:00			8.31
IPSWICH	20/12/2010 13:00			3.96
MOGGILL	22/12/2010 13:00			2.97
JINDALEE	22/12/2010 11:00			1.86
BRISBANE	23/12/2010 11:00			1.83
BAR	23/12/2010 11:00			1.65

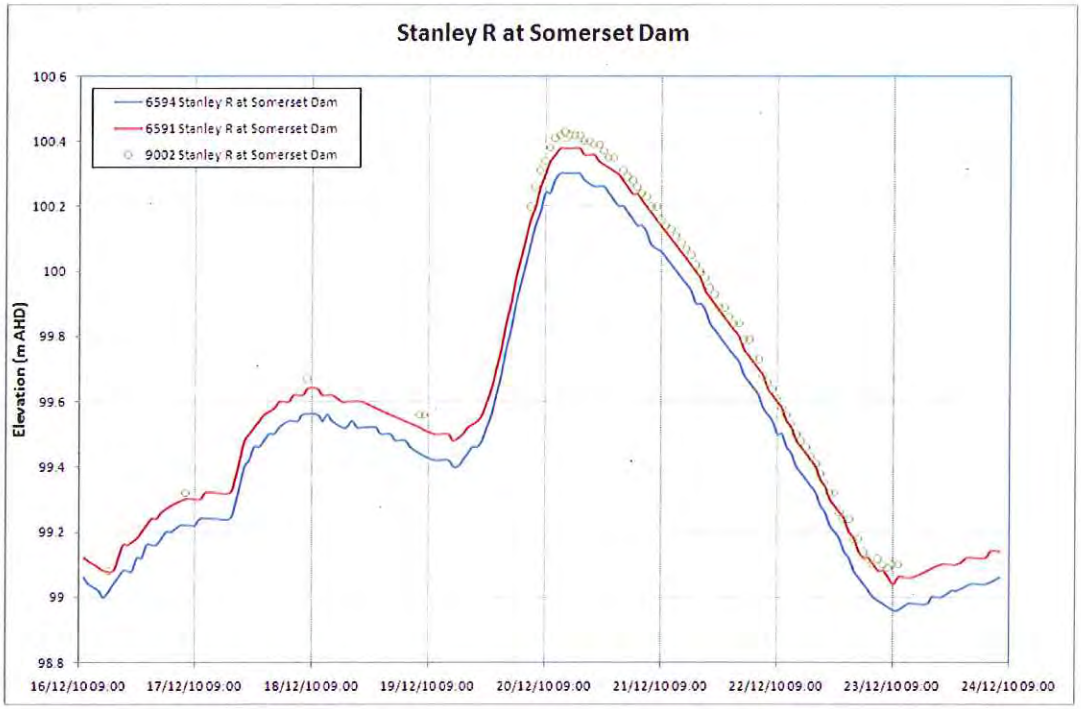
4.16 Mid December Event – Height Hydrographs

Height hydrographs for selected key stations within the Brisbane River Basin are plotted below. During the Event, basic data checking is carried out by the Duty Technical Assistants.

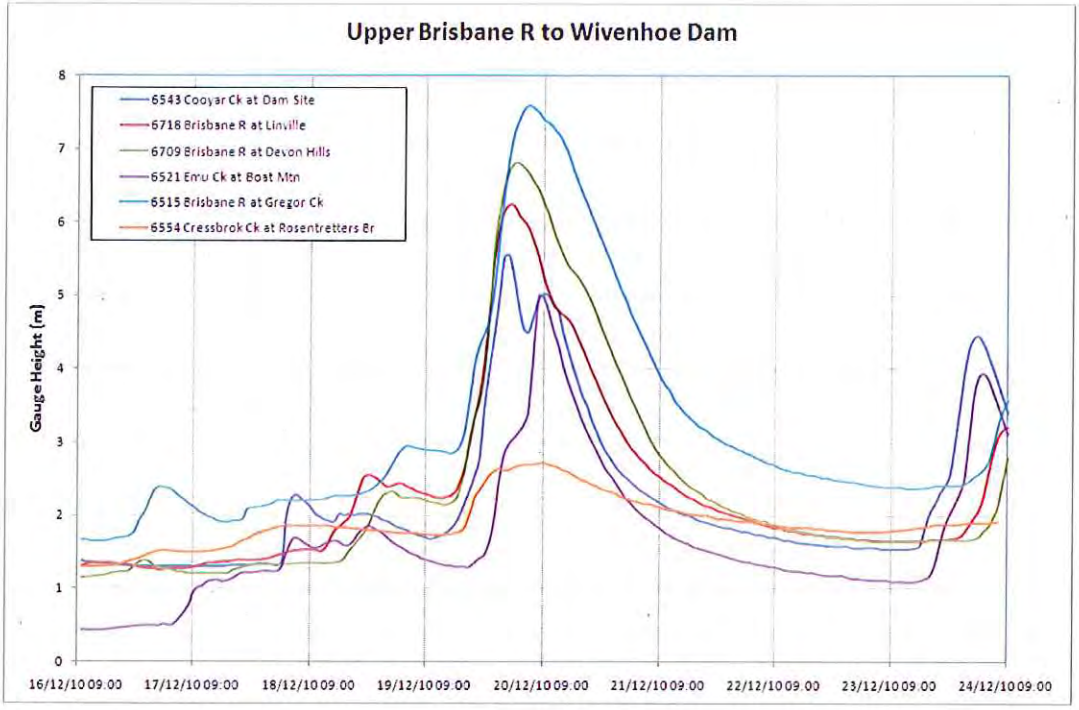
There are three gauges upstream of Somerset Dam which are monitored during floods. Each of these gauges appears to have worked well during the Event. The Stanley River at Woodford is a key gauging station upstream of Somerset Dam, even though it only represents approximately 20% of the Dam's catchment.



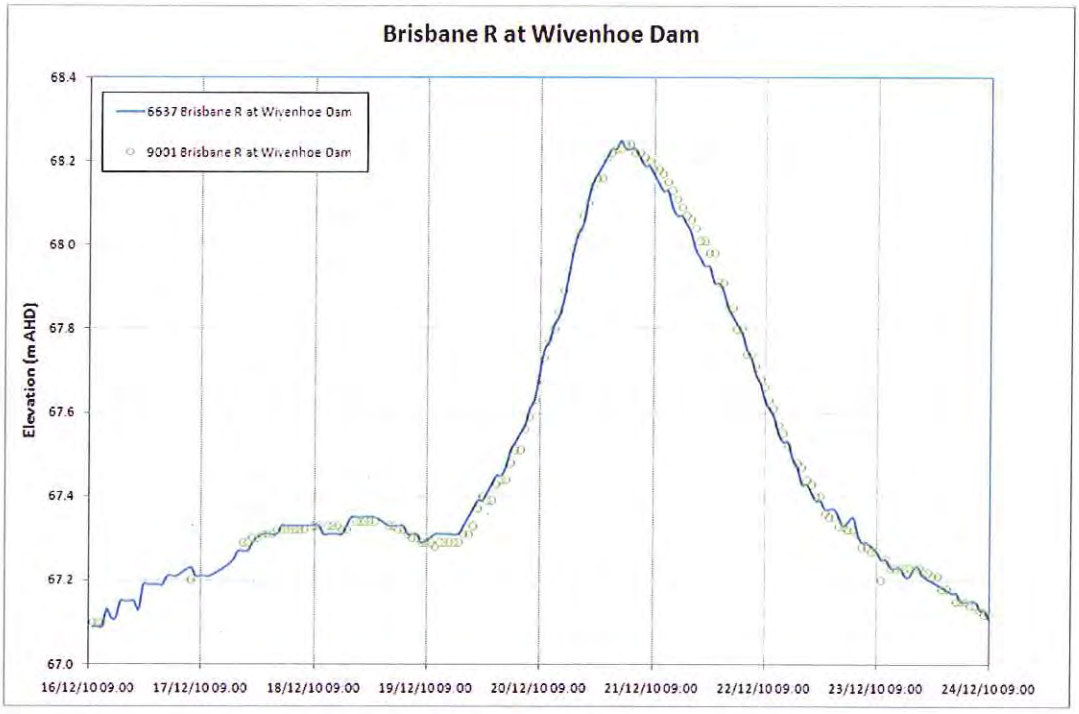
The three gauges worked well during the Event. The Stanley River at Woodford is a key station even though it only represents about 20% of the Dam's catchment.



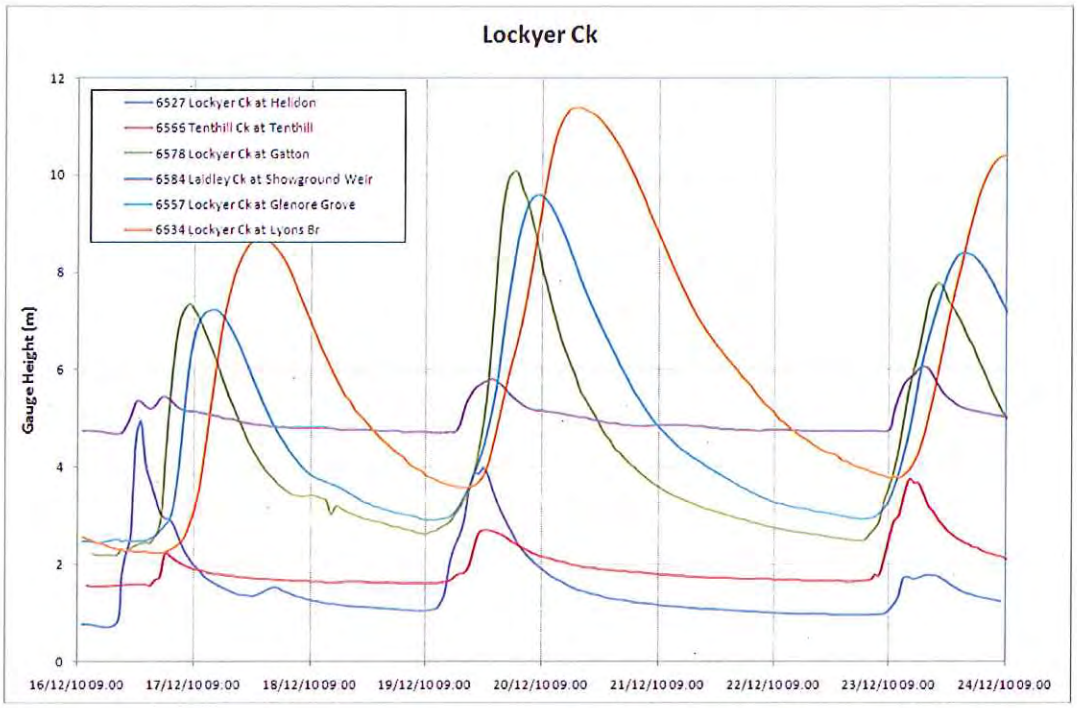
The two automatic gauges appear to have slightly under read when compared with the manual gauge board readings, however, this difference did not have impact upon dam operations.



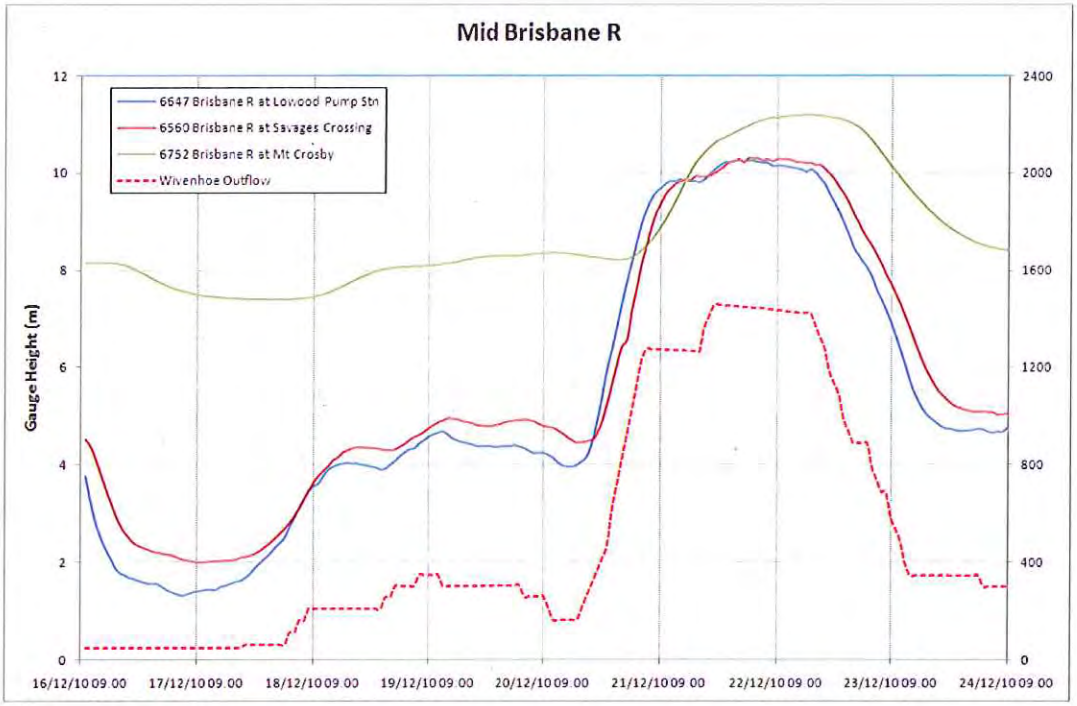
The key gauge at Gregors Creek represents almost 75% of the Dam's catchment. These gauges appear to have worked well during the event.



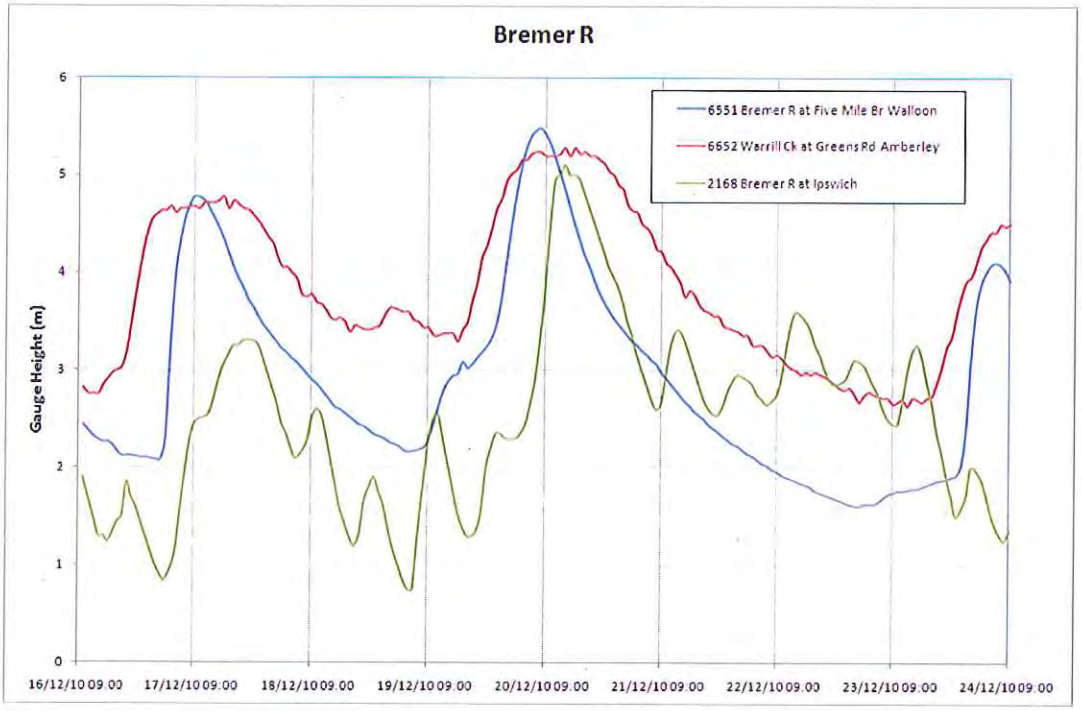
This gauge was installed just prior to the Event and appears to have worked well during the Event.



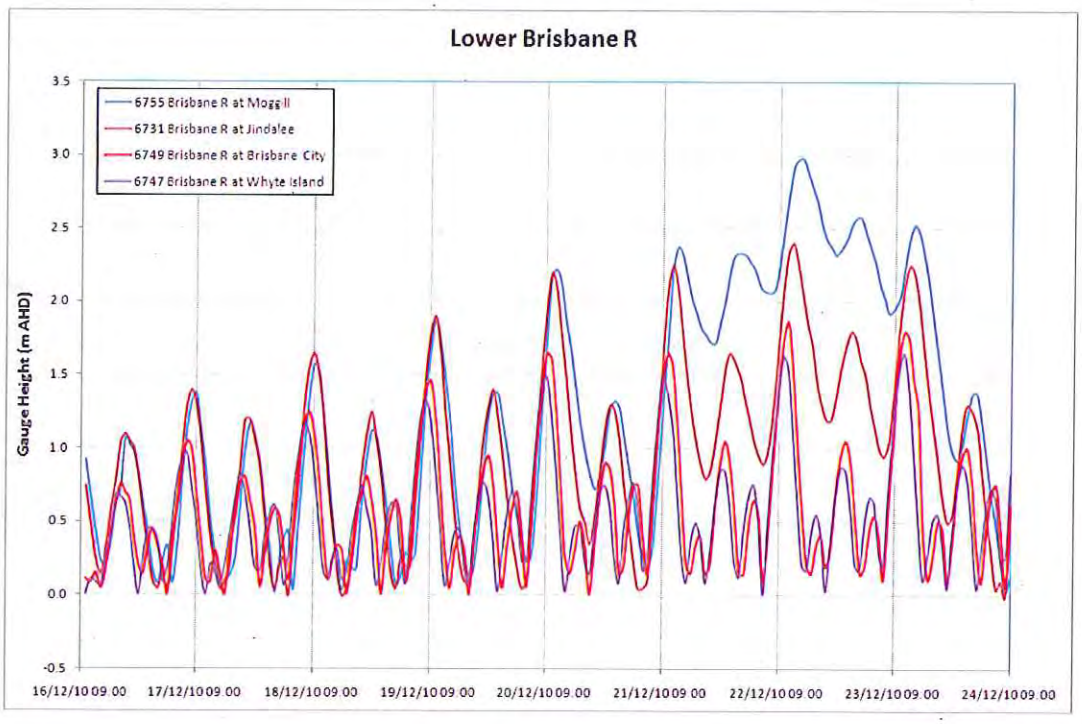
Each of the gauges shown above worked well during the Event.



Each of the gauges shown above worked well during the Event.



Each of the gauges shown above worked well during the Event. The Bremer River at David Trumpy Bridge (Ipswich) is affected by backwater from the Brisbane River.

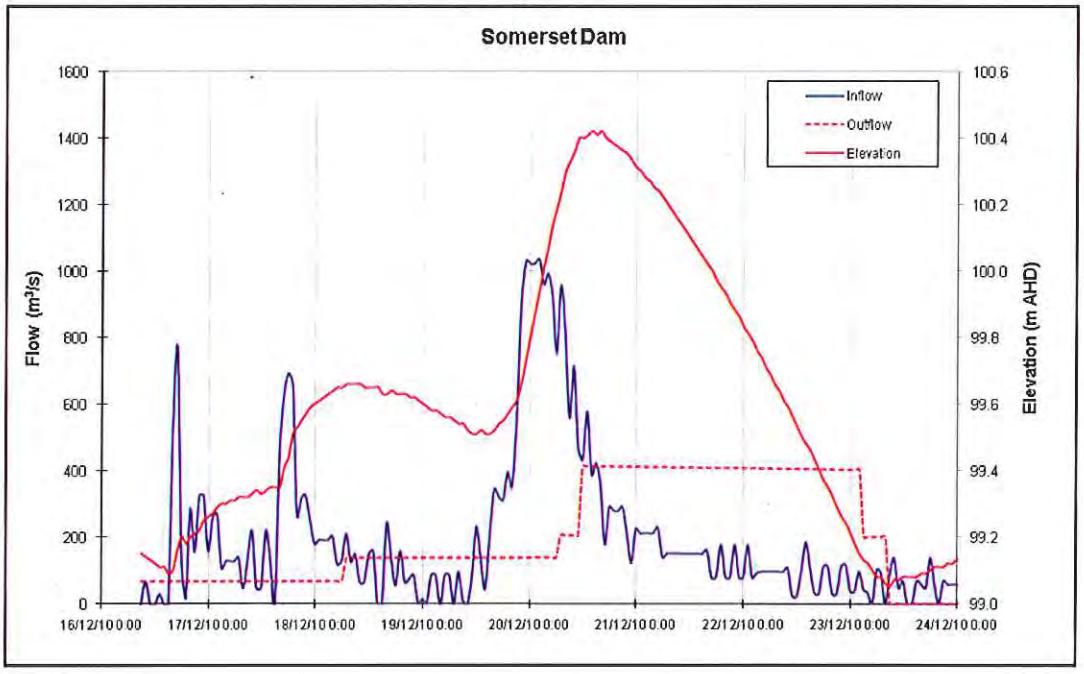


Each of the gauges shown above worked well during the Event. These gauges are affected by tidal influences.

4.17 Mid December Event – Dam Inflows and Outflows

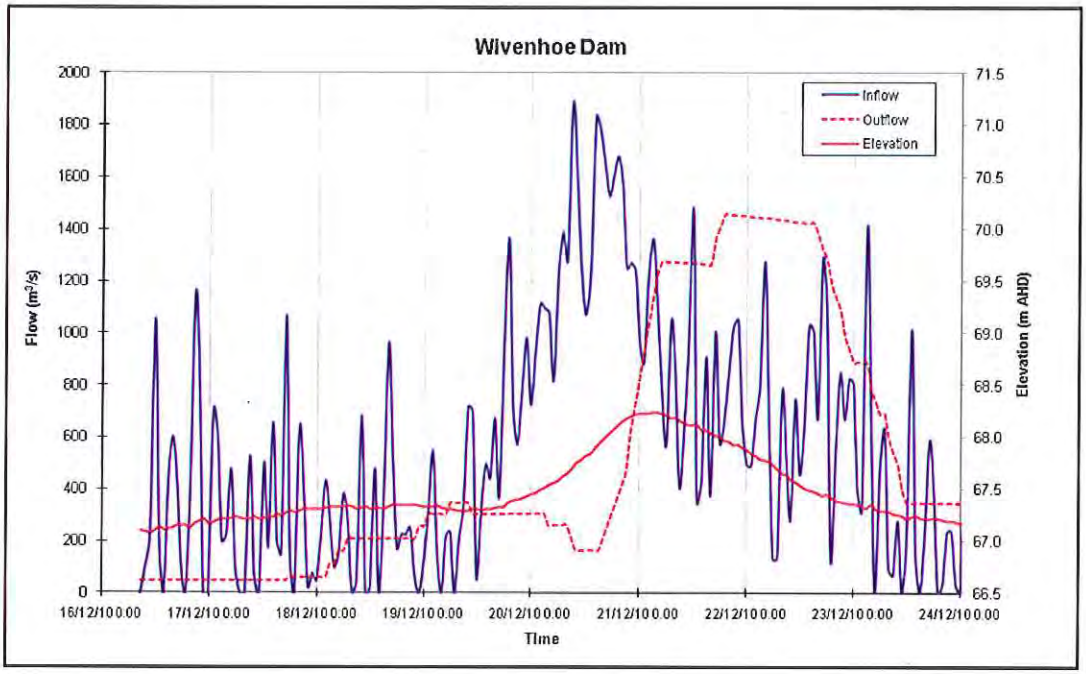
The inflows and outflows from Somerset and Wivenhoe Dams are outlined in the table and figures below. Note that the Wivenhoe figures include Somerset outflows. The inflow to the Dams has been estimated by reverse routing.

STATION	DATE/TIME	PEAK FLOW (m^3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
SOMERSET DAM INFLOW	20/12/2010 02:00	1,040	145,000	
SOMERSET DAM OUTFLOW	20/12/2010 14:00	410	136,000	100.42
WIVENHOE DAM INFLOW	20/12/2010 12:00	1,880	390,000	
WIVENHOE DAM OUTFLOW	21/12/2010 19:00	1,460	358,000	68.24



The Somerset Dam inflow is characterised by a series of small peaks between Thursday 16 and Monday 20 December. The largest peak of approximately 1,000m^3/s occurred late on Monday 20 December 2010.

In the afternoon of Monday 20 December, Somerset Dam reached its maximum water level of 100.42m AHD. The peak outflow from Somerset Dam during the Event was slightly more than 400m^3/s.



Similar to Somerset Dam, the inflow into Wivenhoe Dam is characterised by a series of small peaks between Thursday 16 and Monday 20 December. The largest peak of approximately 1,800m^3/s occurred late on Monday 20 December 2010. The peak outflow of 1460m^3/s occurred approximately 24 hours later on the evening of Tuesday 21 December 2010.

Wivenhoe Dam reached its maximum water level of 68.24m AHD at 19:00 on Tuesday 21 December 2010.

4.18 Late December Event – Overview

The Late December 2010 Flood Event has a designated start date of 09:00 on Friday 24 December 2010 for the purposes of providing event data. Dam releases during the Event commenced on Sunday 26 December 2010 and concluded on Sunday 2 January 2011.

The Late December Event was a relatively significant event with peak outflow from Wivenhoe Dam during the event in the order of 1,500m^3/s. Accordingly, comprehensive rainfall and water level data has been reported to allow for a detailed assessment.

4.19 Late December Event – Base Rainfall Data

The following rainfall tables and maps show the daily rainfall recorded in the Brisbane River Basin during this Event. In the maps "None" signifies no rainfall reports were received from the station during the period. Figures in red also indicate errors in the data.

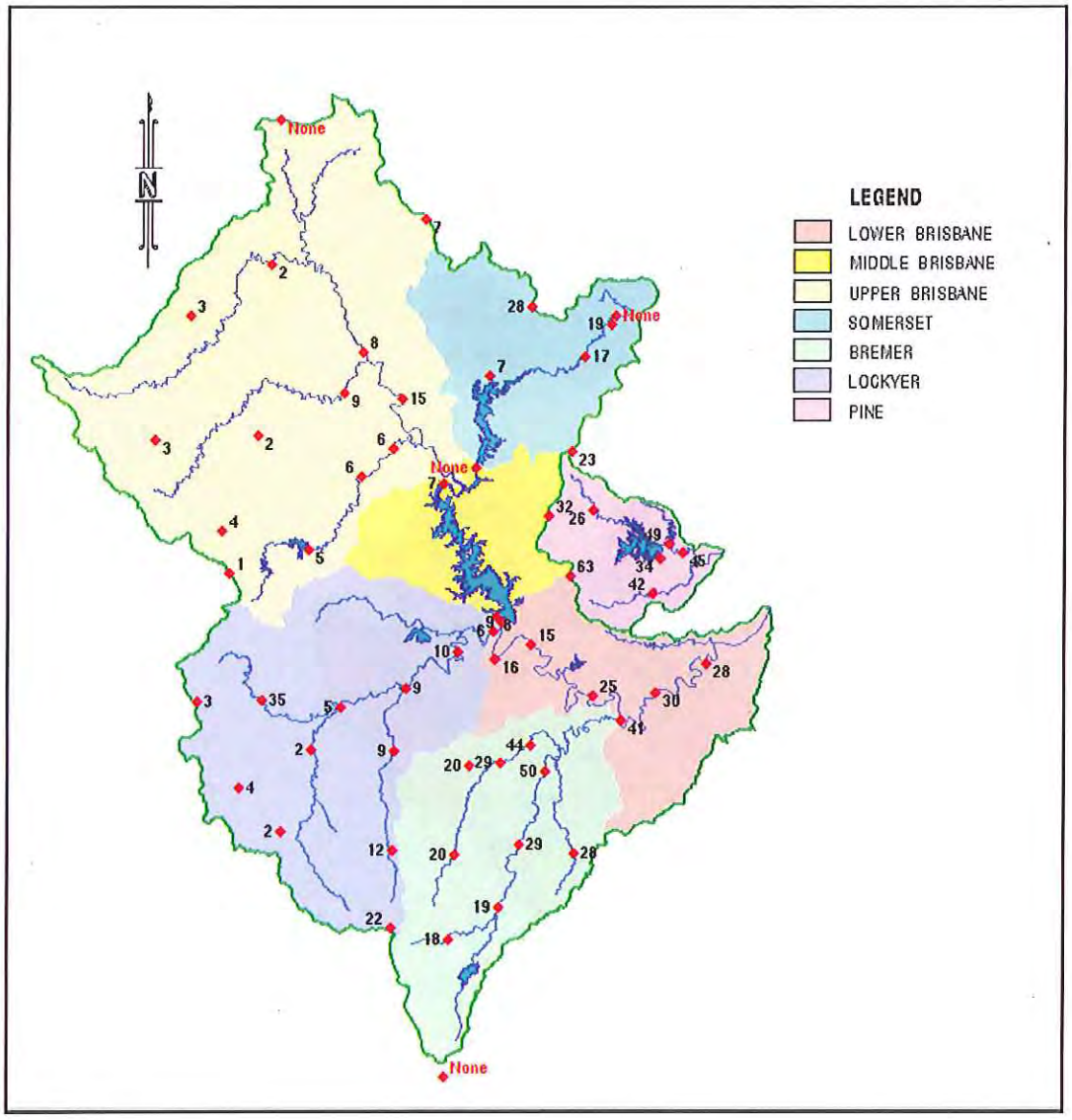
Rainfall in 24 hours to 09:00											
ALERT ID	Station	26 Dec	27 Dec	28 Dec	29 Dec	30 Dec	31 Dec	01 Jan	02 Jan	Total	Comment
6775	Peachester										Out of action
6714	Ferris Knob	10	20	34	25	1	0	6	20	135	
6705	Woodford-P	14	25	33	12	1	0	1	29	132	
6702	Woodford-B	14	25	33	12	1	0	1	29	132	
6600	Kilcoy	7	18	25	7	1	0	1	10	106	
6593	Somerset Dam HW-P	18	76	44	6	0	0	2	12	178	Double counting
6590	Somerset Dam HW-B	9	38	22	3	0	0	1	6	89	
6602	Top of Brisbane	2	10	36	10	0	0	0	6	76	
6540	Yarraman	11	39	19	1	1	0	0	7	89	
6542	Cooyar Ck	15	35	27	6	0	0	0	8	97	
6717	Linville	16	38	33	14	0	0	1	3	113	
6708	Devon Hills	20	33	33	13	0	0	1	10	118	
6529	St Aubyns	9	42	12	0	0	0	0	8	77	
6621	Nukinenda	12	37	5	2	0	0	0	2	61	
6520	Boat Mountain	20	38	27	5	0	0	0	3	102	
6514	Gregor Ck-P	15	33	28	7	0	0	0	5	104	
6517	Gregor Ck-B										Out of action
6596	Crows Nest	9	51	11	1	0	0	0	2	82	
6780	Perseverance	0	3	2	2	0	0	0	17	34	
6782	Ravensbourne	11	57	11	4	0	0	0	17	118	
6523	Cressbrook Dam	6	42	13	0	0	0	0	1	67	
6553	Rosentretters Br	9	37	12	1	0	0	0	3	68	
6604	Toogoolawah	12	43	20	3	0	0	0	5	90	
6574	Caboonbah	11	37	22	3	0	0	0	6	91	
6636	Wivenhoe Dam HW-B	8	40	20	0	0	0	0	0	76	
6643	Wivenhoe Dam TW-P	8	42	24	0	0	0	0	1	87	
6641	Wivenhoe Dam TW-B	8	41	23	0	0	0	0	1	81	
6598	Toowoomba	13	64	38	0	0	0	0	8	127	
6526	Helidon	14	68	29	1	0	0	0	6	120	
6617	Little Egypt	9	61	43	0	0	0	0	2	126	
6606	West Woodbine	11	62	54	0	0	0	0	2	132	
6565	Tenthill	10	56	20	0	0	0	0	6	94	
6577	Gatton	11	55	16	2	0	0	0	8	102	
6619	Mt Castle	28	78	71	0	0	0	0	27	227	
6615	Thornton	20	75	44	0	0	0	0	11	168	
6583	Showground Weir	13	56	18	0	0	0	0	2	105	
6556	Glenore Grove	8	49	8	0	0	0	0	2	83	
6633	Lyons Br-P	7	47	11	0	0	0	0	2	77	

Rainfall in 24 hours to 09:00											
ALERT ID	Station	26 Dec	27 Dec	28 Dec	29 Dec	30 Dec	31 Dec	01 Jan	02 Jan	Total	Comment
6630	Lyons Br-B	8	51	12	1	0	0	0	1	84	
6568	O'Reillys Weir	8	46	24	0	0	0	0	0	84	
6646	Lowood-B	12	52	18	0	0	0	0	2	96	
6649	Lowood-P	9	46	12	0	0	0	0	3	87	
6559	Savages Crossing	10	44	25	0	0	0	0	3	97	
1730	Lake Manchester	9	52	26	0	0	0	0	5	124	
6751	Mt Crosby	8	45	26	1	0	0	0	4	109	
2059	Colleges Crossing	24	55	34	0	0	0	0	4	159	
6580	Adams Br	14	81	36	0	0	0	0	2	159	
2192	Franklyn Vale										Out of action
2065	Grandchester	24	77	21	1	0	0	0	6	151	
6736	Kuss Rd	14	60	16	0	0	0	0	2	113	
2068	Tallegalla	23	71	17	0	0	0	0	6	152	
6733	Rosewood	13	60	16	0	0	0	0	2	122	
6550	Five Mile Bridge	12	56	18	0	0	0	0	2	136	
6623	Tarome-P	19	76	64	0	0	0	0	9	187	
6562	Kalbar Weir	17	73	35	0	0	0	0	6	150	
6571	Harrisville	14	73	34	0	0	0	0	1	151	
6651	Greens Road	10	55	13	0	0	0	0	0	135	
6739	Washpool	15	68	23	0	0	0	0	1	135	
2062	Peak Crossing	12	61	27	0	0	0	0	0	140	
2055	Loamside	10	59	13	0	0	0	0	0	140	
2160	One Mile Br	9	55	21	0	0	0	0	1	156	
2040	Churchill	9	52	21	1	0	0	0	0	131	
2035	Brassall (Hancock	2	34	18	0	0	0	0	4	111	
2106	Lyons										Out of action
2145	Ripley	0	0	4	0	0	0	0	1	10	Under reading
2050	Bundamba (Barclay	9	49	18	0	0	0	0	1	136	
2045	Bundamba (Hanlon	6	35	16	0	0	0	0	1	94	
6754	Moggill-P	12	40	24	0	0	0	0	4	121	
2150	Opossum	12	45	19	0	0	0	0	2	130	
2116	Carole Park	10	55	25	1	4	0	1	1	165	
1518	Wacol	11	23	27	1	0	0	0	4	124	
2102	Jingle Downs	14	54	20	0	0	0	0	5	145	
2104	Greenbank	21	62	18	0	0	0	0	6	173	
2108	Forestdale	18	56	0	0	5	2	1	0	135	
2114	Calamvale	19	60	21	1	0	0	1	4	175	
1736	Inala	9	58	25	0	0	0	0	3	171	
2020	Corinda High	18	48	25	0	0	0	0	4	146	
2138	Mt Gravatt	9	37	0	0	0	0	3	3	105	

Rainfall in 24 hours to 09:00											
ALERT ID	Station	26 Dec	27 Dec	28 Dec	29 Dec	30 Dec	31 Dec	01 Jan	02 Jan	Total	Comment
1548	Holland Pk West	25	37	27	1	0	0	0	6	145	
1554	East Brisbane	14	44	32	0	0	0	0	2	129	
1836	Eight Mile Plains	16	72	26	0	0	0	0	6	186	
1803	Wishart	9	65	29	0	0	0	1	4	169	
1706	Carindale	33	63	31	1	0	0	1	6	192	
1596	Camp Hill	23	40	33	0	0	0	1	4	156	
1830	Mansfield	9	33	34	0	0	0	2	8	138	
1739	Lytton	8	49	52	1	0	0	2	18	172	
1527	Hemmant	10	36	22	2	0	0	3	6	111	
2141	Ransome	11	64	34	1	0	0	1	9	167	
1755	Manly	12	53	51	1	0	0	1	8	173	
1742	Pullenvale	13	53	21	0	0	0	1	12	138	
1515	Kenmore Hills	8	32	26	0	0	0	1	8	120	
6730	Jindalee	22	47	15	0	0	0	0	3	122	
1749	Toowong	8	63	32	1	0	0	1	3	145	
6748	Brisbane City	7	53	27	1	0	0	1	5	122	
1507	Three Ways	19	65	26	3	0	0	3	26	201	
1718	Gold Ck Res	13	63	29	2	0	0	2	21	176	
1533	Enoggera Dam	8	61	28	3	0	0	2	14	163	
1512	Mt Coot-tha	8	59	30	1	0	0	1	14	179	
1578	Alderley	9	36	33	2	0	0	2	8	135	
1524	Bowen Hills	7	35	35	1	0	0	1	8	116	
2285	Steiglitz Wharf	16	85	62	0	0	0	1	2	184	
2086	Marburg	14	56	17	0	1	0	0	1	117	
2074	Stokes Crossing	16	77	34	0	0	0	0	2	162	
2080	Spressers Bridge	18	70	19	0	0	0	0	2	141	
2083	Rosewood WWTP	16	68	15	0	0	0	0	2	138	
2071	Churchbank Weir	0	1	1	0	0	0	1	0	4	Under reading
2077	Greys Plains Rd	22	91	39	0	0	0	0	5	188	
1837	Wynnum Bowls	8	52	52	0	0	0	1	8	158	
1838	Luggage Point	7	20	55	1	0	0	3	11	133	
1840	Chandler	9	36	28	0	0	0	1	7	124	
1841	Bulimba	7	40	36	1	0	0	1	8	125	
6585	Sandy Creek Road	12	69	24	1	0	0	0	11	118	
6588	Upper Sandy Creek	15	67	13	4	0	0	0	10	129	
2089	Harrisville-B	15	77	31	0	0	0	0	2	156	
2092	Rosewood-B	15	69	18	0	0	0	0	3	140	
2095	Bellbird Park	14	51	18	0	0	0	0	3	132	
2011	Buaraba	10.2	58.9	13	0.1	0	0	0	7.2	105	
2006	Hays Landing	8.9	44	26.6	1.1	0	0	0.2	3.2	95.8	

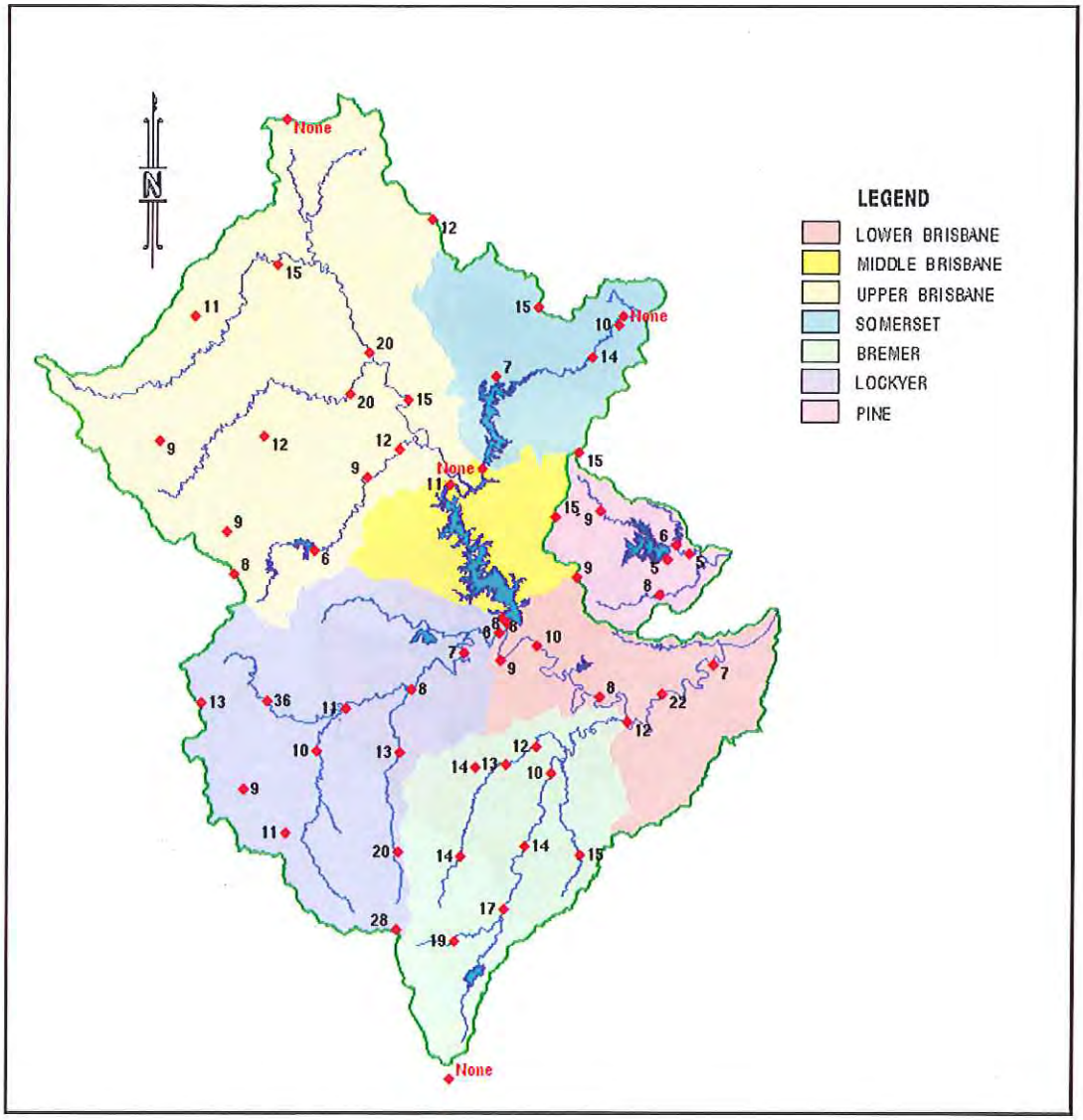
Rainfall in 24 hours to 09:00											
ALERT ID	Station	26 Dec	27 Dec	28 Dec	29 Dec	30 Dec	31 Dec	01 Jan	02 Jan	Total	Comment
2004	Pohlman Range	14	32.5	32.2	8.5	0.2	0	0.6	12.2	116.9	
5356	Mt Alford										Did not work
6656	Bill Gunn Dam	15	61	18	1	0	0	0	5	117	
6658	Lake Clarendon Dam	11	65	12	2	0	0	0	6	104	
6555	Atkinson Dam	9	56	11	0	0	0	0	4	89	
6624	Moogerah Dam	18	78	66	0	0	0	0	9	199	
6609	Monsildale	13	27	47	14	0	0	1	5	114	
6612	Mt Stanley	23	37	41	11	0	0	0	4	137	
6607	Lindfield	12	30	37	17	0	0	8	11	130	
6603	Blackbutt	18	37	27	4	0	0	1	18	121	
6601	Mt Binga	10	44	10	1	0	0	0	9	78	
6613	Hazeldean	12	37	38	3	0	0	0	13	116	
6614	Westvale	10	23	31	2	0	9	0	0	83	
6605	Eskdale										Not yet installed
6611	Redbank Creek	10	51	11	1	0	0	0	8	103	
6100	Mt Mowbullan	13	70	22	0	1	0	0	12	140	
6427	Maleny	16	19	45	55	4	0	22	34	257	
5425	Hume Lane	7	21	31	24	0	0	0	8	110	
6400	Bald Knob	11	20	52	51	2	0	14	25	234	
6716	West Bellthorpe	15	31	37	39	1	0	10	8	171	
6701	Mt Mee-B	15	29	42	11	0	0	4	16	145	
6690	Mt Mee-P	15	29	42	11	0	0	4	16	145	
6680	Mt Glorious-P	9	59	38	11	0	0	6	48	234	
5423	Landsborough	9	23	61	35	0	0	17	19	205	
6608	Jimna	12	26	35	15	0	0	2	9	132	
2194	Wilsons Peak	22	85	72	1	0	0	0	19	213	
6774	Wilsons Peak-P	0	0	0	0	7	13	2	0	22	Under reading

Rainfall in 24 hours to 09:00 25/12/2010



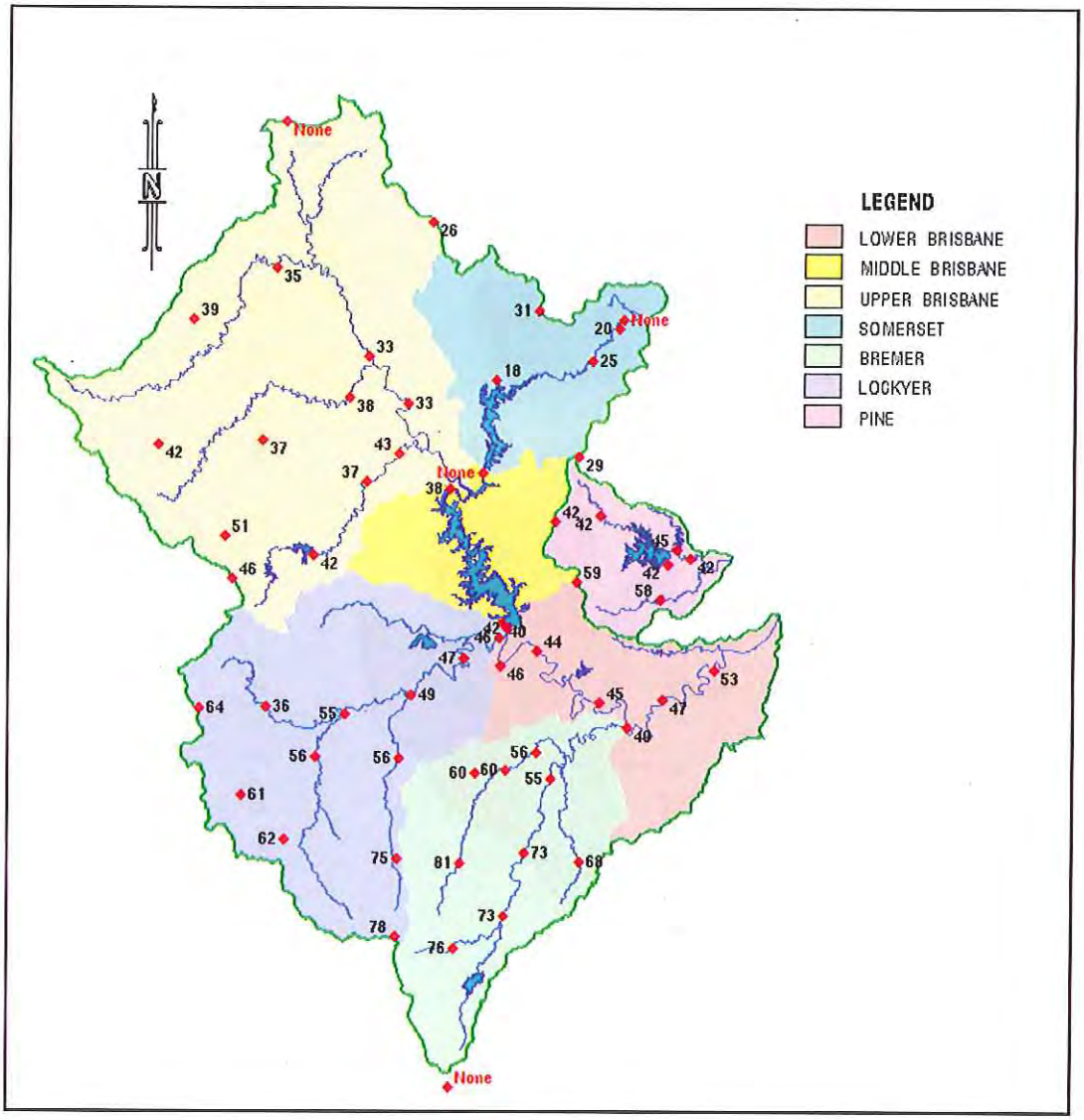
In the 24 hours to 09:00 on Saturday 25 December 2010, rainfall recorded in the Basin tended to be generally less than 10mm. Isolated higher totals of up to 30mm were recorded in the Stanley catchment and falls of up to 50mm were recorded in the Bremer system.

Rainfall in 24 hours to 09:00 26/12/2010



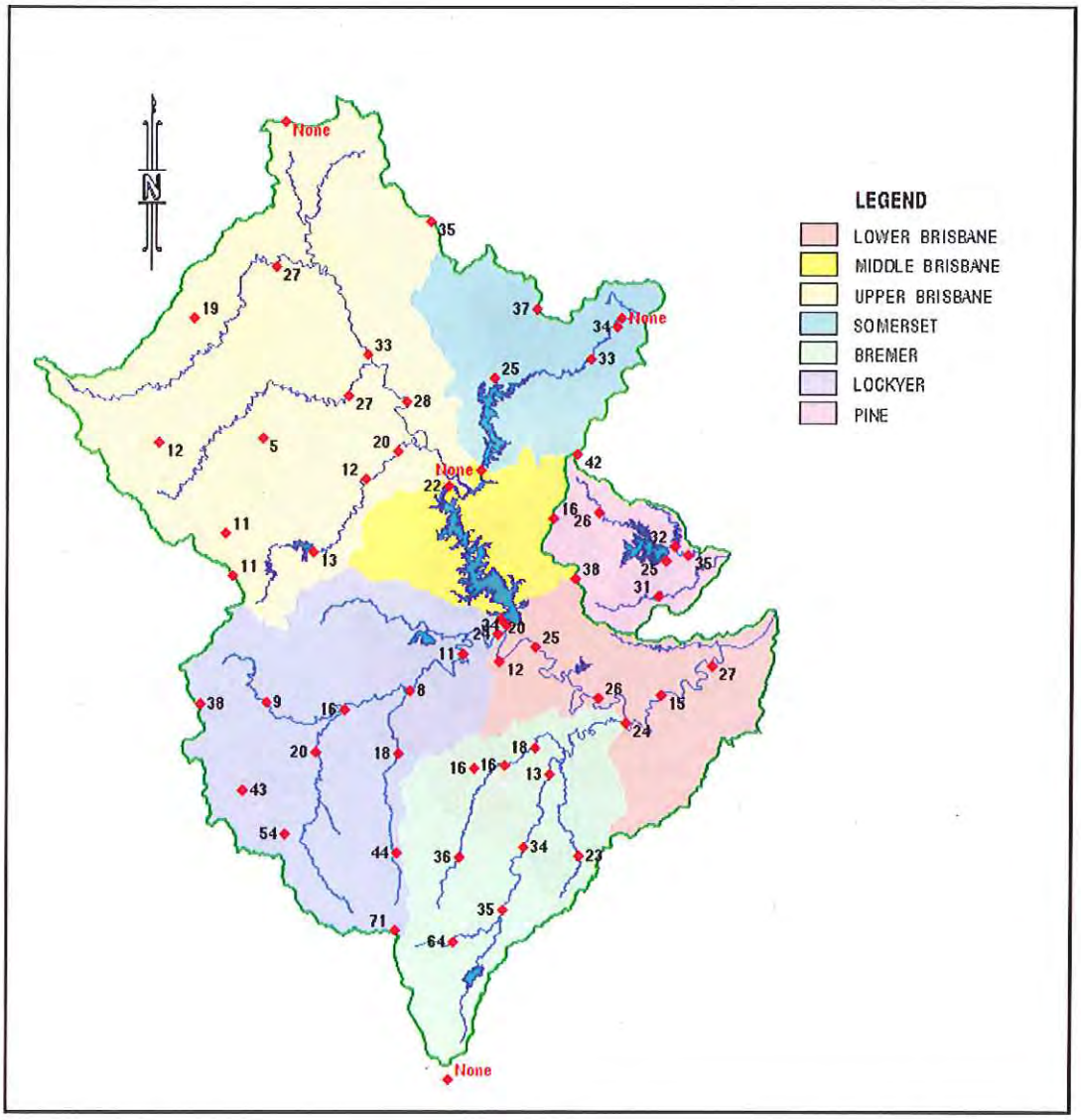
In the 24 hours to 09:00 on Saturday 18 December 2010, widespread rainfall occurred however generally less than 25mm was recorded throughout the region.

Rainfall in 24 hours to 09:00 27/12/2010



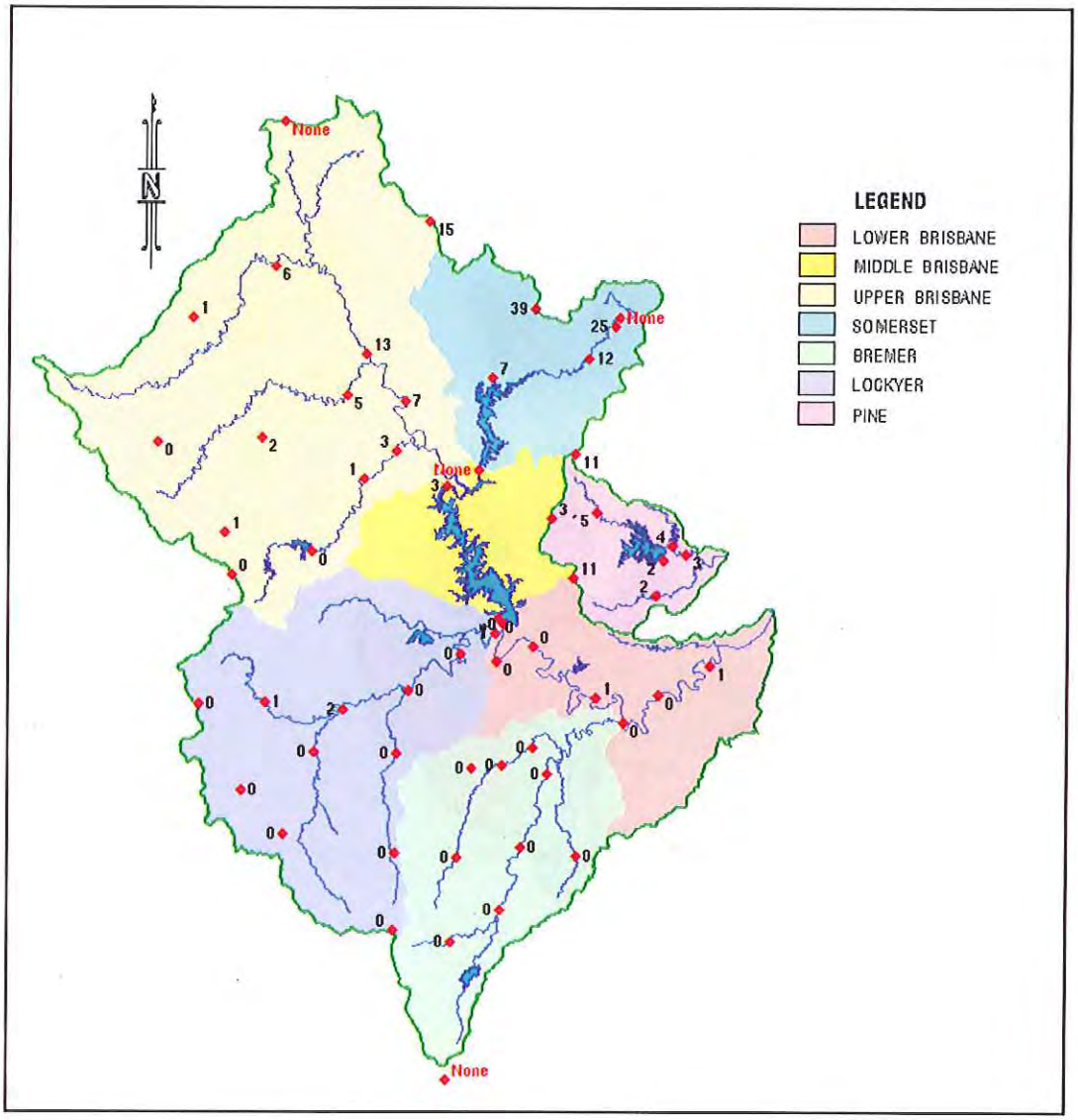
Rainfall was widespread throughout the Basin in the 24 hours to 09:00 on Monday 27 December. The highest totals were recorded in the Lockyer and Bremer systems and falls in the Stanley catchment and Upper Brisbane catchment ranged from between 20mm to 50mm.

Rainfall in 24 hours to 09:00 28/12/2011



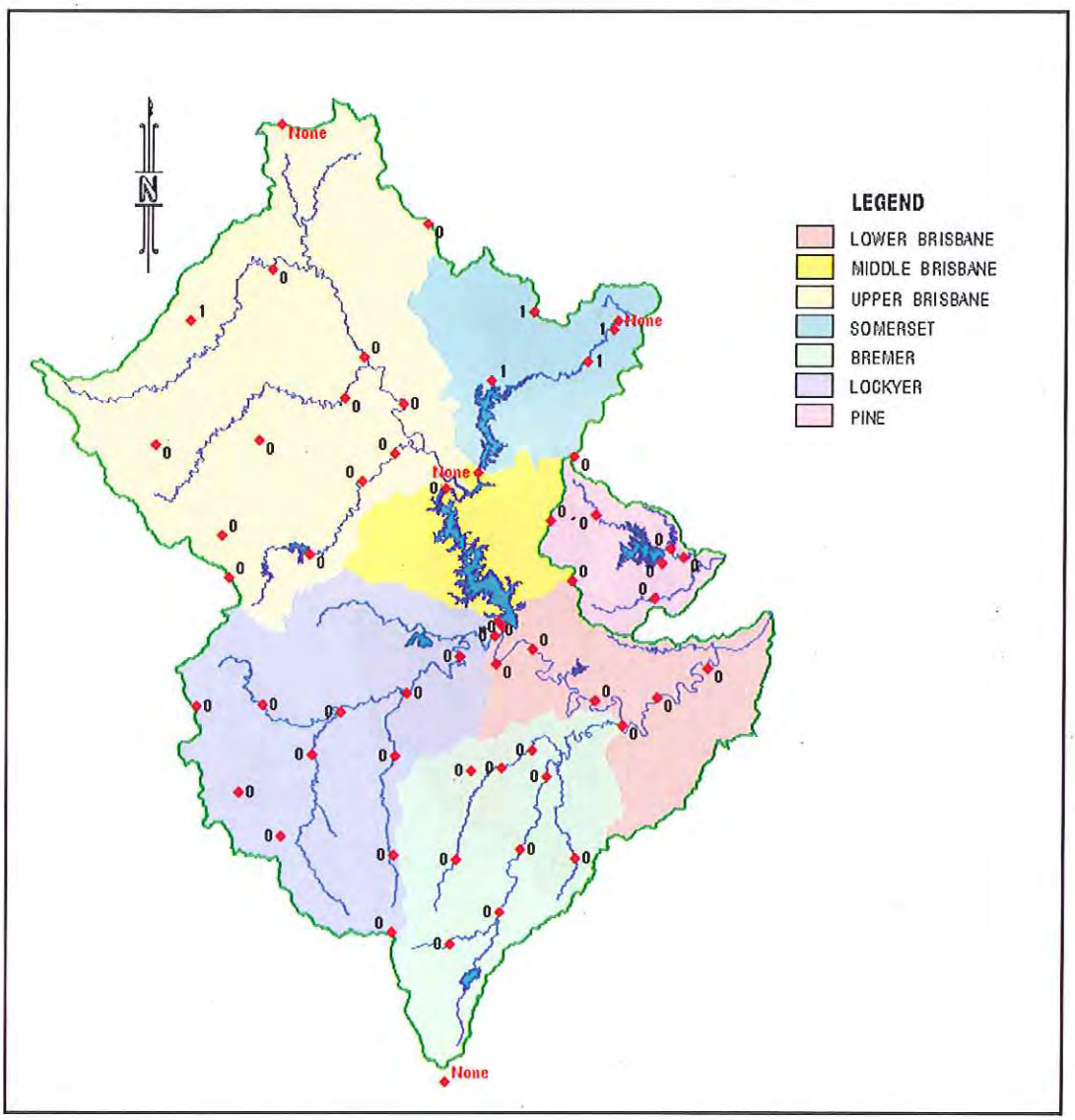
Compared to the previous 24 hour period, rainfall in the 24 hours to 09:00 on Tuesday 28 December was similarly widespread, with the higher totals recorded in the Stanley and the Upper Brisbane catchments. Isolated heavy falls occurred in the headwaters of Tenthill and Warrill Creeks.

Rainfall in 24 hours to 09:00 29/12/2010



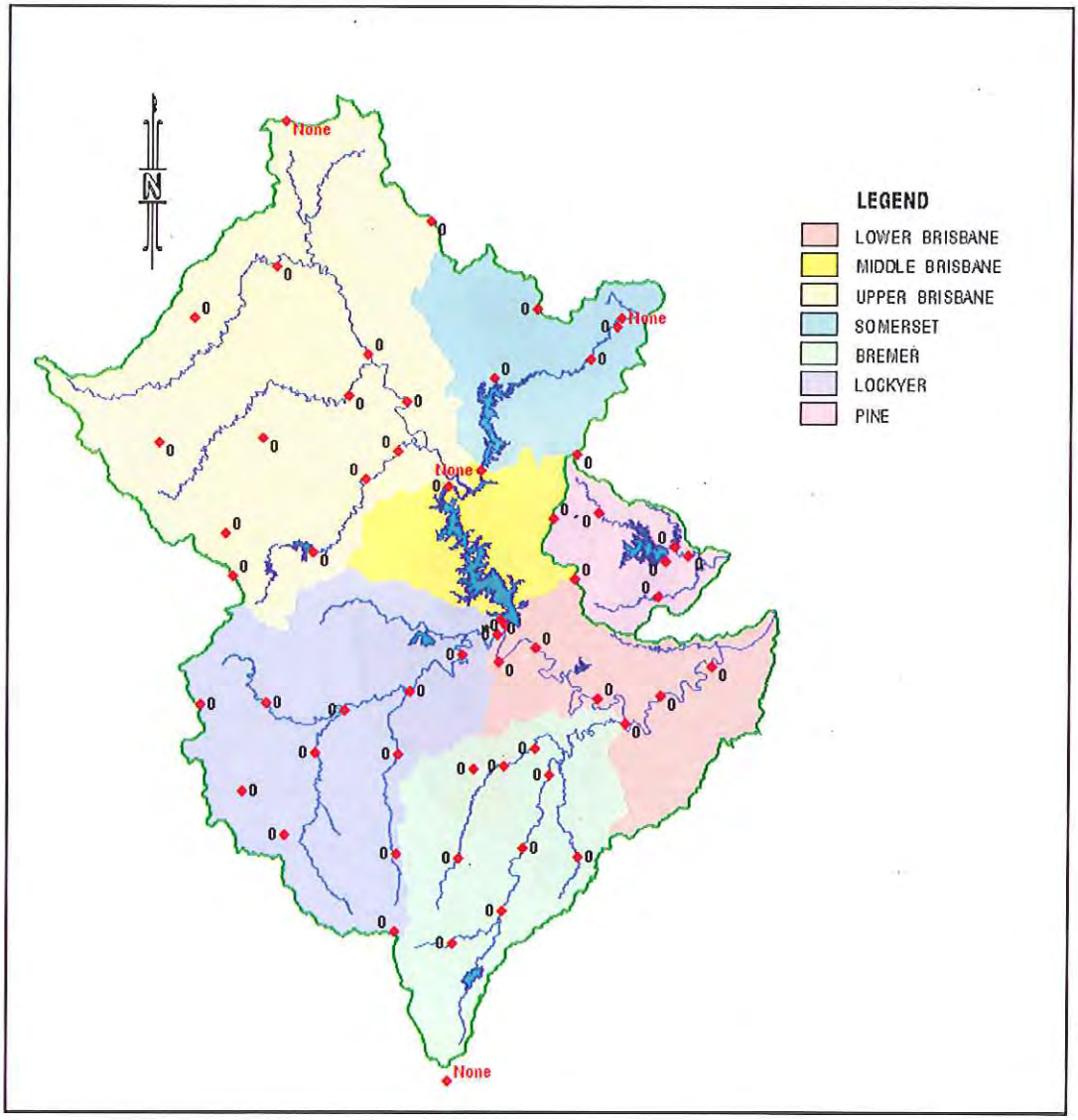
Rainfall in the Basin was generally insignificant in the 24 hours to 09:00 on Wednesday 29 December although some isolated heavier falls up to 40mm were recorded in the Stanley River catchment.

Rainfall in 24 hours to 09:00 30/12/2011



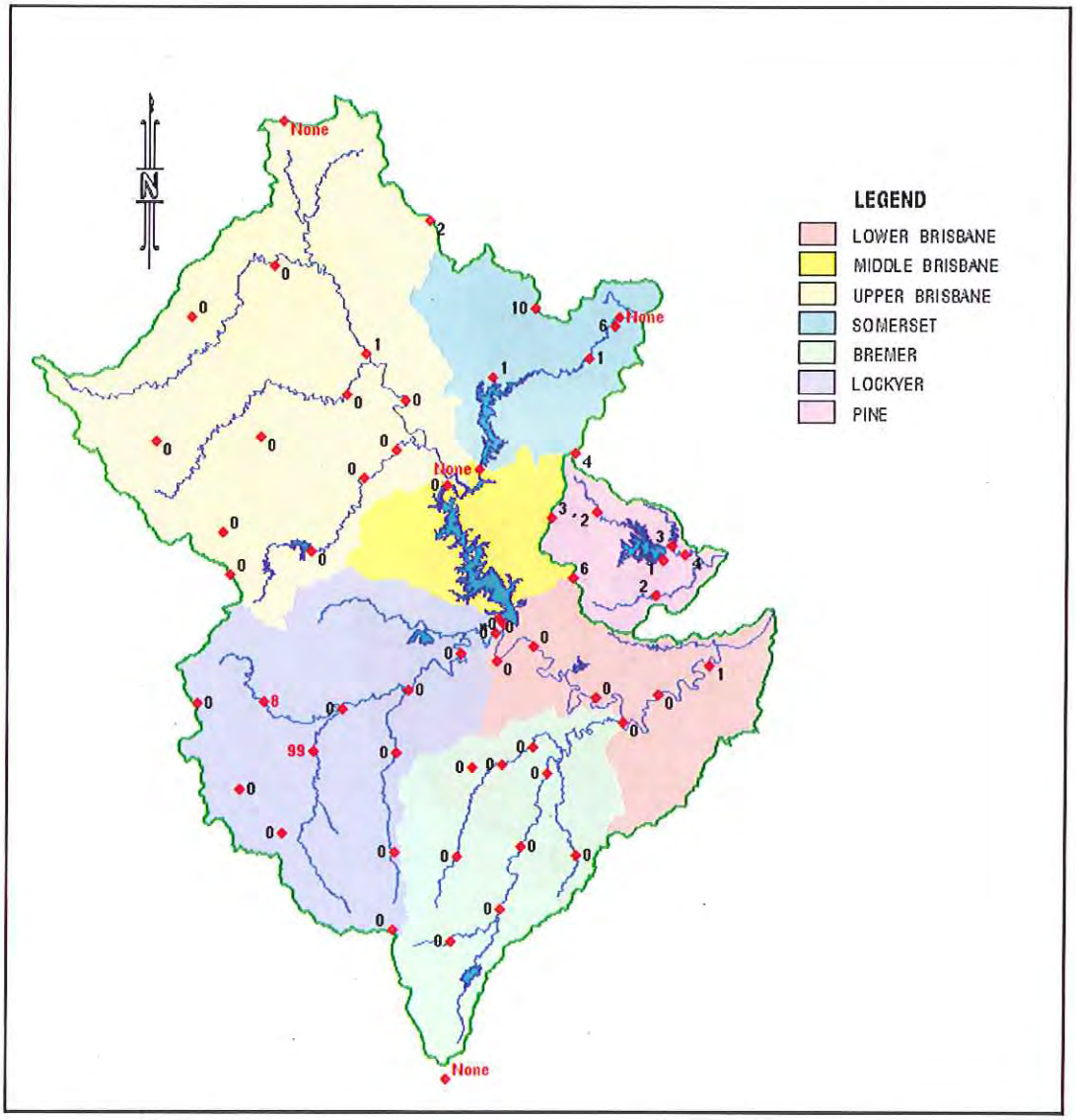
No significant rainfall was recorded in the region in the 24 hours to 09:00 on Thursday 30 December 2010.

Rainfall in 24 hours to 09:00 31/12/2010



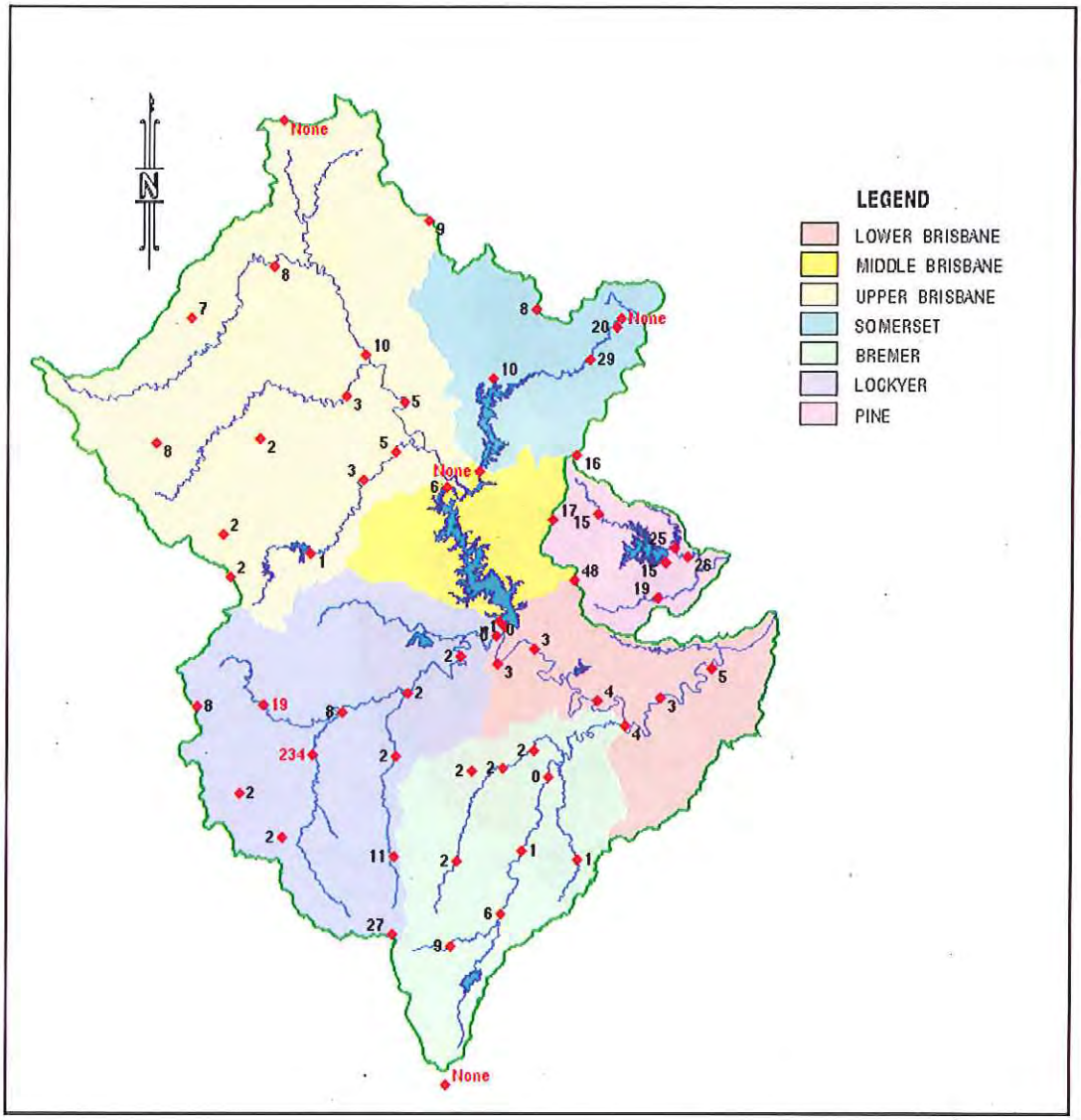
In the 24 hours to 09:00 on Friday 31 December, there was no rainfall recorded in the Basin.

Rainfall in 24 hours to 09:00 01/01/2011



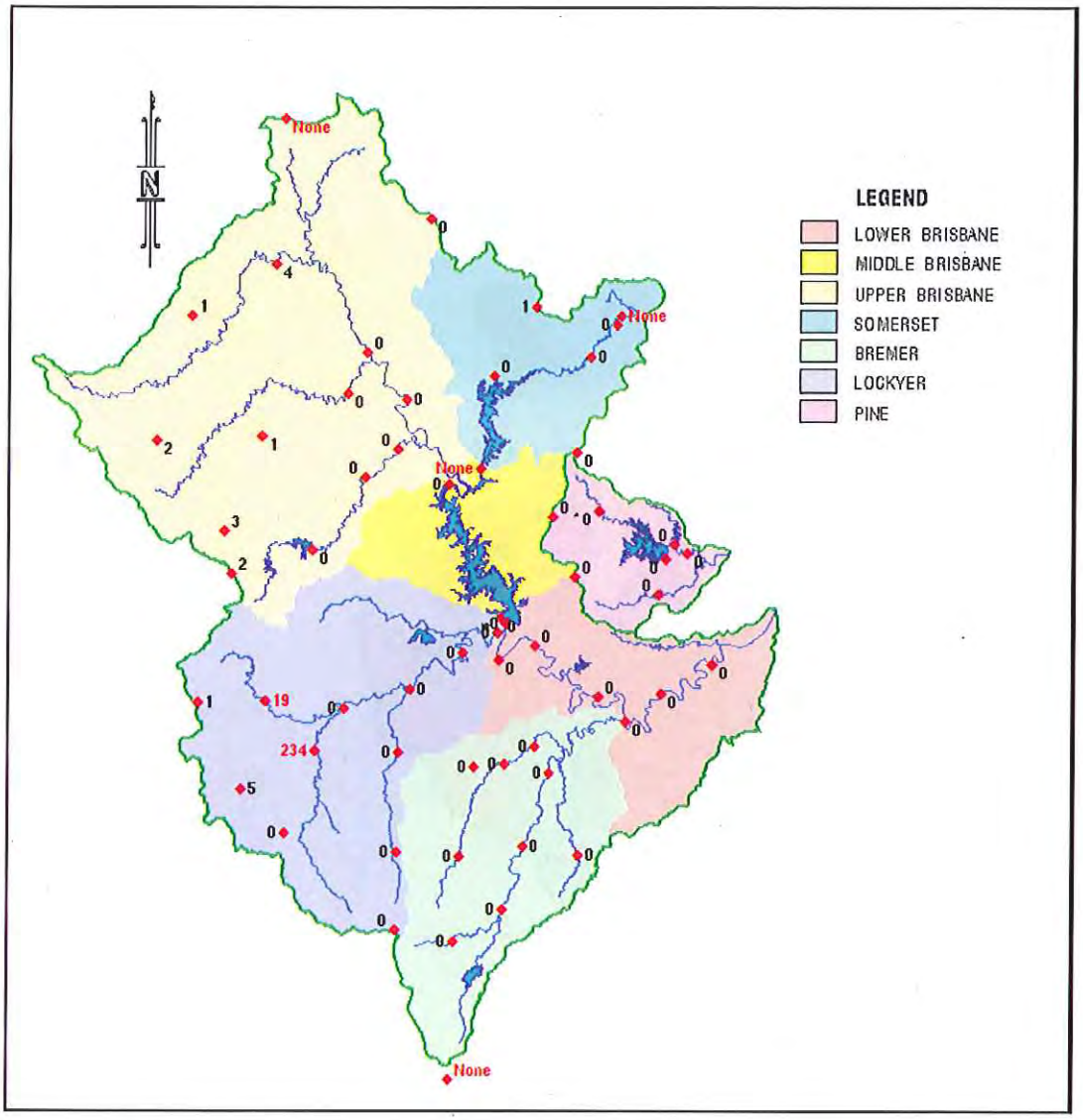
In the 24 hours to 09:00 on Saturday 1 January 2011, only isolated falls of up to 10mm were recorded in the Stanley catchment. There was no significant rainfall recorded elsewhere in the region.

Rainfall in 24 hours to 09:00 02/01/2011



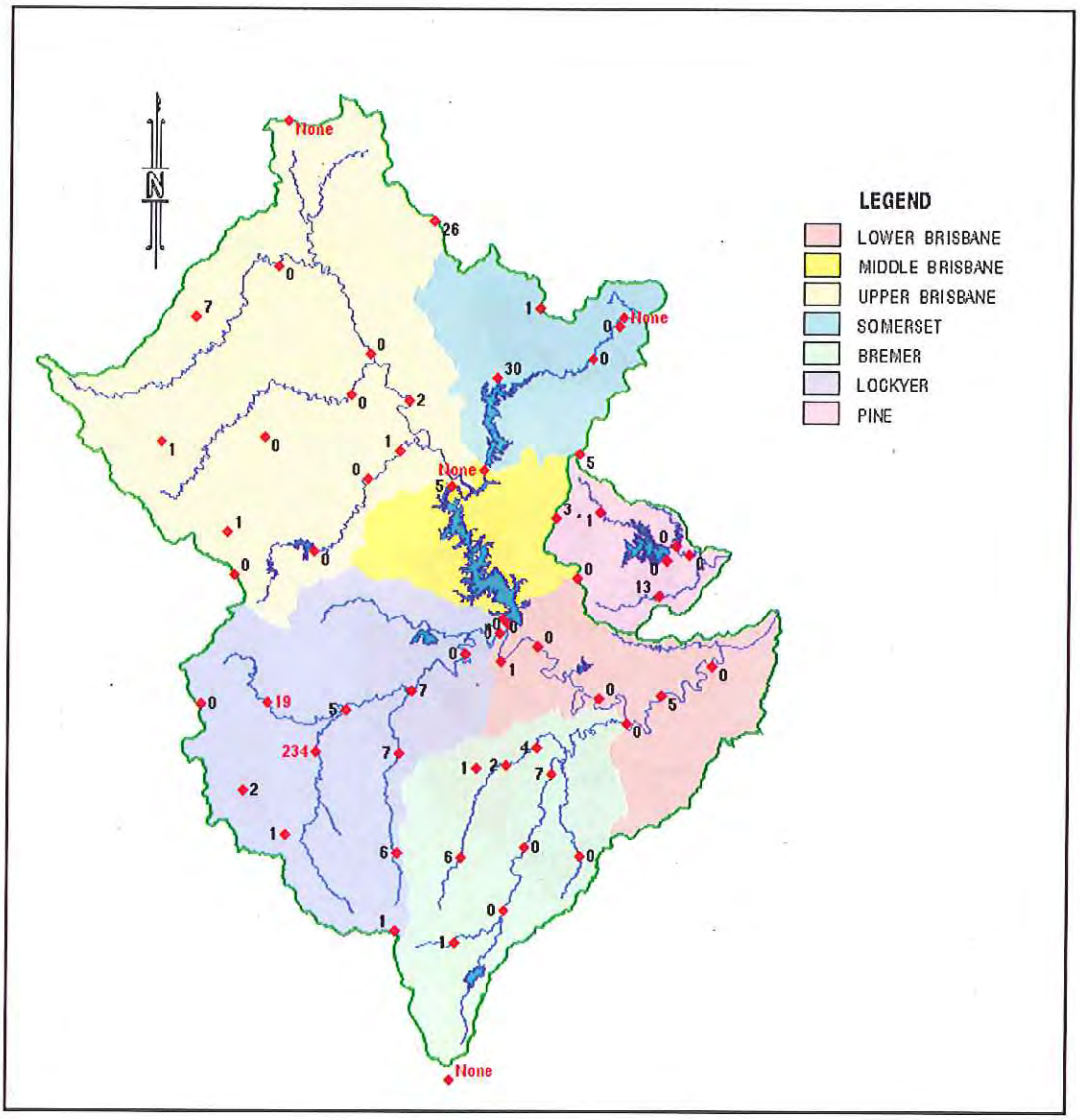
Only light rain was recorded in the Basin in the 24 hours to 09:00 on Sunday 2 January 2011. Higher totals of up to 50mm were recorded in the headwaters of the Stanley and Pine Rivers.

Rainfall in 24 hours to 09:00 03/01/2011



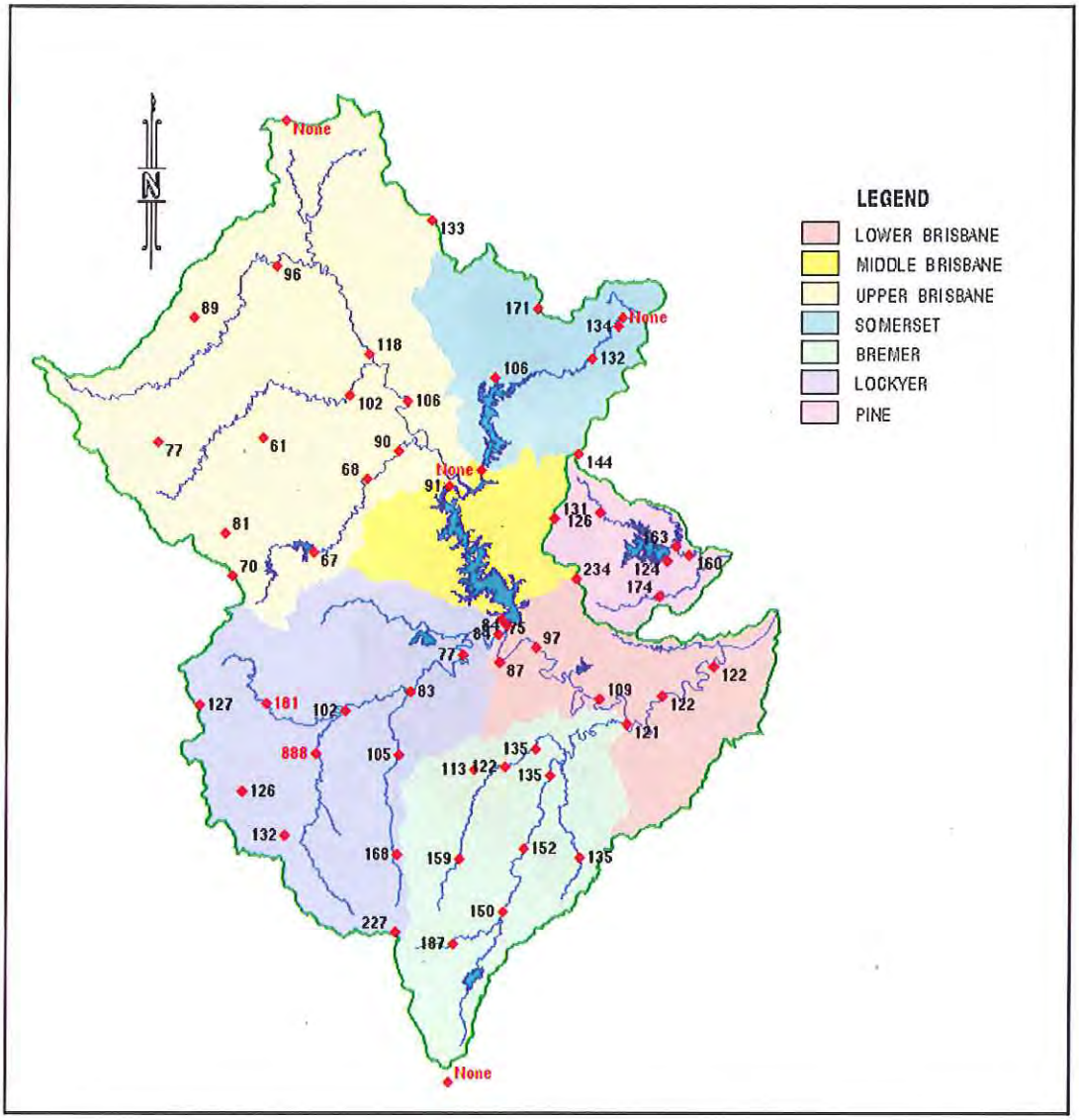
There was no significant rainfall recorded in the Basin in the 24 hours to 09:00 on Monday 3 January 2011.

Rainfall in 24 hours to 09:00 04/01/2011



There was no significant rainfall recorded in the Basin in the 24 hours to 09:00 Tuesday 4 January 2011 however some isolated falls were recorded in the Stanley catchment at Kilcoy and Jimna during the period.

Rainfall in 11 days to 09:00 04/01/2011



The map above shows the rainfall distribution during the 11-day period to 09:00 on Tuesday 4 January 2011.

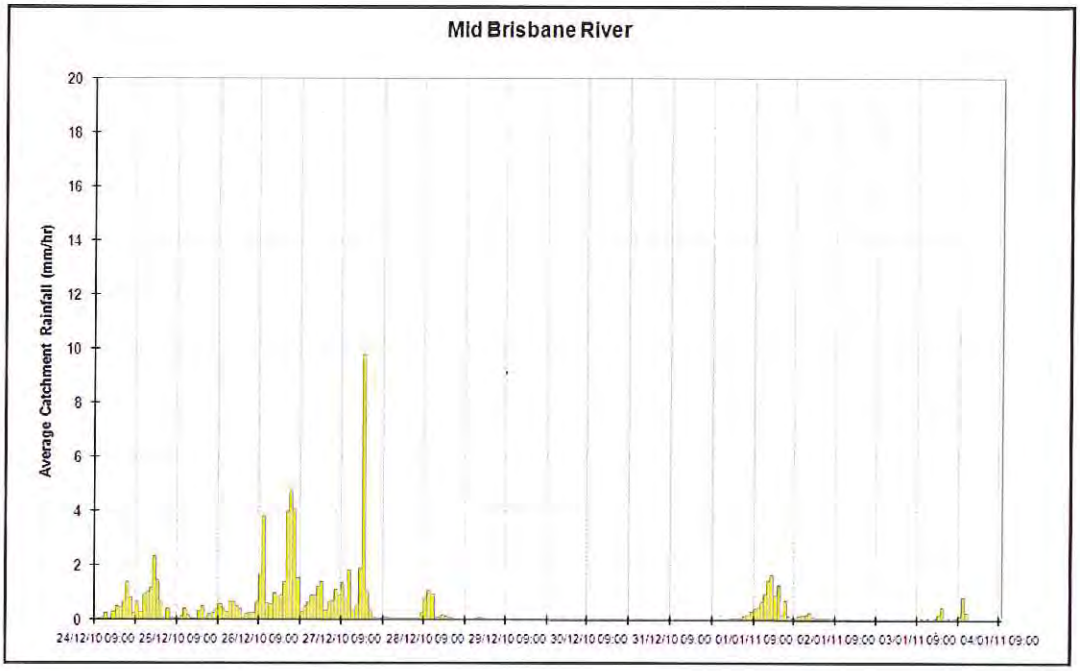
The highest rainfall totals were recorded in the headwater areas of Laidley Creek in the Lockyer system and around Mt Glorious near the junction of the Brisbane and Pine Basins. Rainfall was widespread in the Stanley River, with Event totals of between 100mm and 170mm recorded. In the Upper Brisbane catchment, the highest totals of up to 120mm were recorded in the mid reaches around Devon Hills. Totals in Lockyer Creek ranged from between 80mm in the lower reaches to almost 230mm in the headwaters of Laidley Creek. Totals in the Bremer and Lower Brisbane catchments were generally in the range of between 90mm to 150mm.

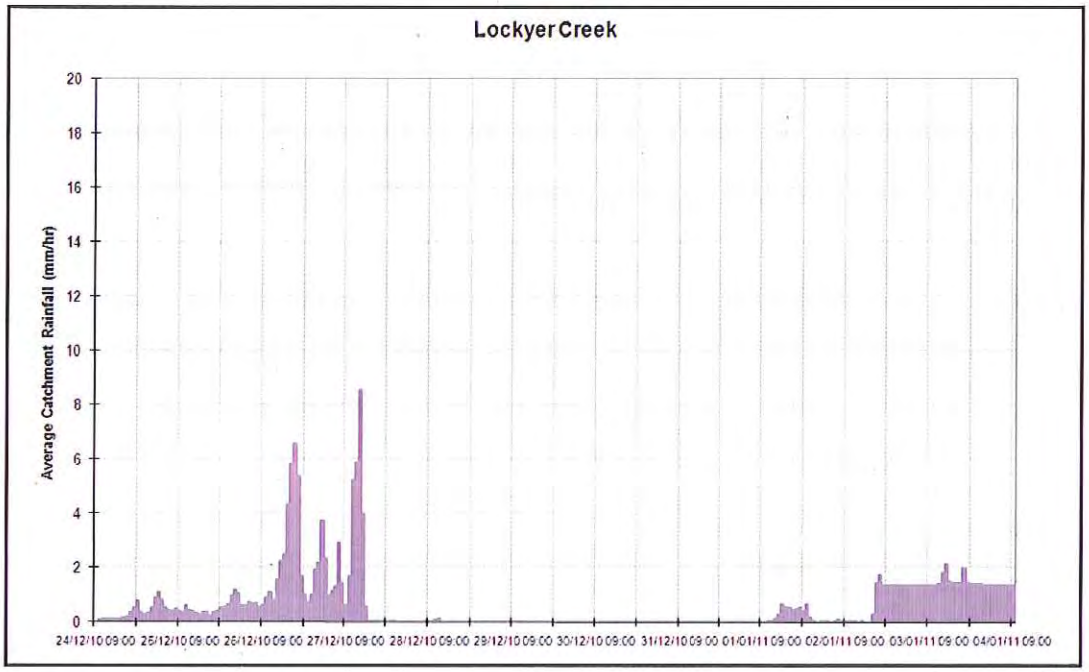
4.20 Late December Event – Average Catchment Rainfall

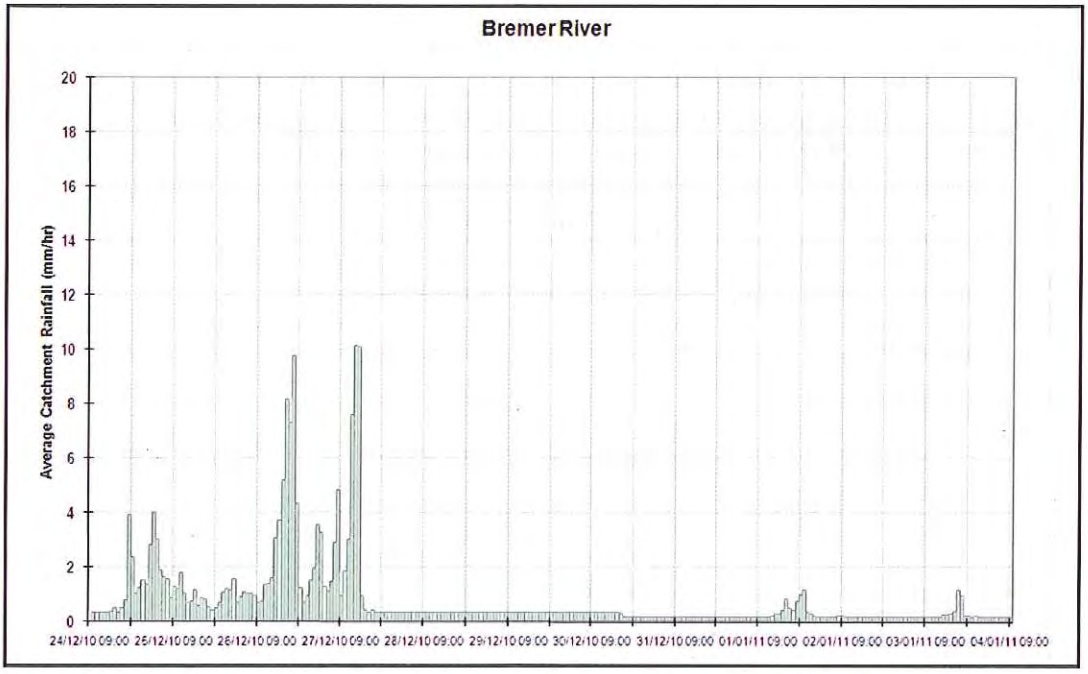
Average rainfall for each sub catchment in the Brisbane basin is determined byb applying a weighting to the rainfall depth at each available station within the sub catchment. The Upper Brisbane catchment excludes the Somerset catchment and is a weighted average of the Upper and Middle Brisbane catchments. A summary of catchment average rainfall for the Late December Event is shown in the table and figure below.

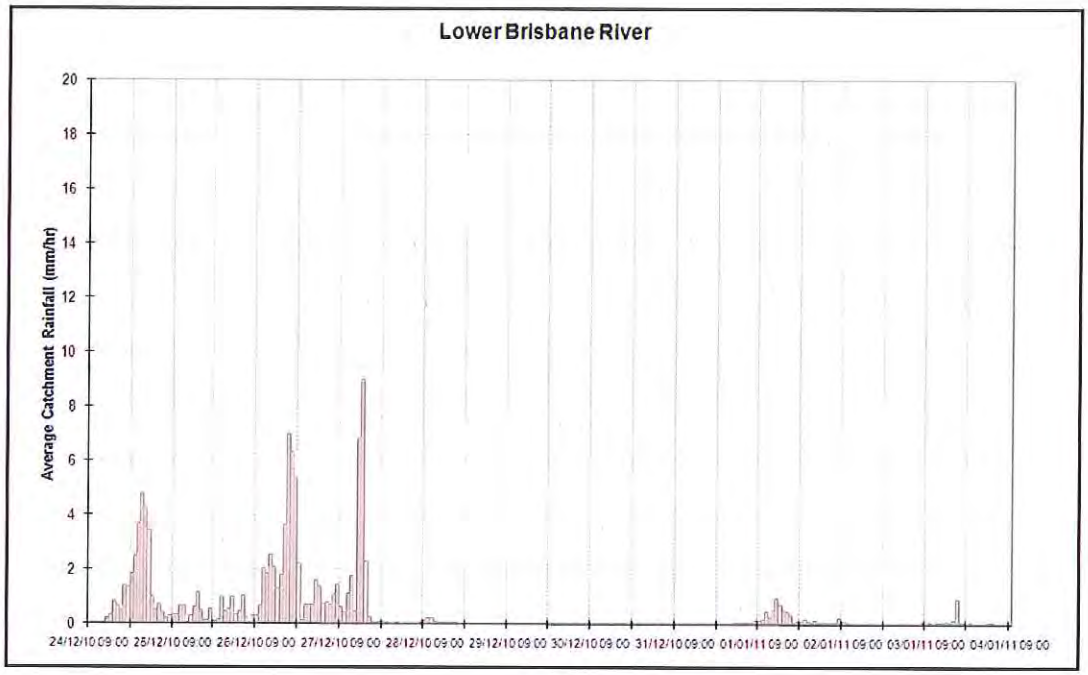
Period Ending 09:00	Stanley		Upper Brisbane		Lockyer		Bremer		Lower	
	Period	Σ	Period	Σ	Period	Σ	Period	Σ	Period	Σ
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
25/12/2010	16	16	7	7	10	10	33	33	30	30
26/12/2010	12	28	12	19	14	24	23	56	11	41
27/12/2010	28	56	37	56	55	79	73	128	48	89
28/12/2010	33	90	20	76	26	105	40	169	23	112
29/12/2010	17	107	4	80	0	105	8	177	1	112
30/12/2010	1	107	0	80	0	105	8	185	0	112
31/12/2010	0	107	0	80	0	105	6	191	0	112
01/01/2011	4	111	0	80	0	105	5	195	0	113
02/01/2011	15	126	0	80	5	111	9	204	6	118
03/01/2011	0	126	0	80	23	134	5	209	0	119
04/01/2011	10	136	0	80	35	169	7	216	1	120

The catchment average rainfall for the Late December Event is shown on the following pages. These hyetographs do not necessarily reflect the localised high intensity rainfall that was recorded throughout the Basin at various times and locations. Catchment rainfalls can include hourly intensities at individual stations which are up to five times the catchment average.




Lockyer Creek
Average Catchment Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
24/12/10 09:00
25/12/10 09:00
26/12/10 09:00
27/12/10 09:00
28/12/10 09:00
29/12/10 09:00
30/12/10 09:00
31/12/10 09:00
01/01/11 09:00
02/01/11 09:00
03/01/11 09:00
04/01/11 09:00


Bremer River
Average Catchment Rainfall (mm/hr)
0
2
4
6
8
10
12
14
16
18
20
24/12/10 09:00
25/12/10 09:00
26/12/10 09:00
27/12/10 09:00
28/12/10 09:00
29/12/10 09:00
30/12/10 09:00
31/12/10 09:00
01/01/11 09:00
02/01/11 09:00
03/01/11 09:00
04/01/11 09:00



4.21 Late December Event - Event Water Levels

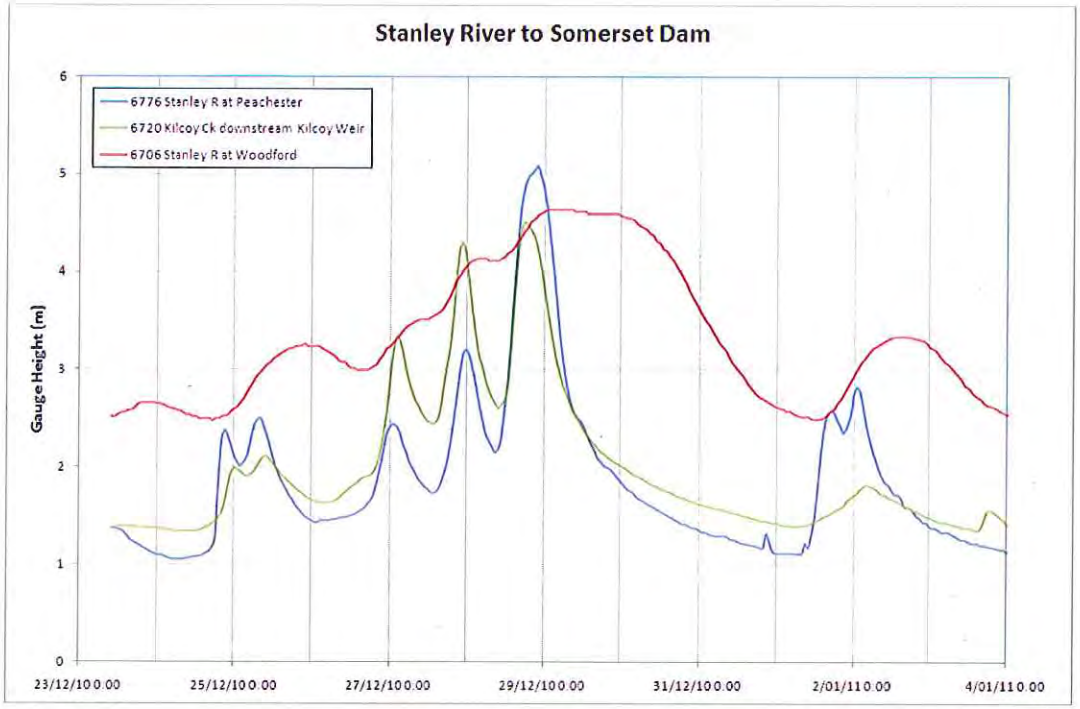
The table below shows the peak water levels reached at selected gauges during this event

STATION	DATE/TIME	PEAK FLOW (m^3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
PEACHESTER	28/12/2010 21:00			5.08
WOODFORD	29/12/2010 01:00			4.64
KILCOY	28/12/2010 18:00			4.50
SOMERSET DAM INFLOW	27/12/2010 17:00	700	126,000	
SOMERSET DAM OUTFLOW	29/12/2010 04:00	820	129,000	99.98
COOYAR CK	27/12/2010 18:00			6.97
LINVILLE	27/12/2010 22:00			6.09
DEVON HILLS	28/12/2010 01:00			6.62
BOAT MT	27/12/2010 20:00			5.58
GREGOR CK	28/12/2010 03:00			7.71
ROSENTRETTERS	27/12/2010 17:00			3.38
WIVENHOE DAM INFLOW	27/12/2010 16:00	2,200	513,000	
WIVENHOE DAM OUTFLOW	31/12/2010 03:00	1,590	481,000	69.93
HELIDON	27/12/2010 16:00			5.49
TENTHILL	27/12/2010 17:00			8.59
GATTON	27/12/2010 19:00			13.61
MULGOWIE	23/12/2010 09:00			1.72
SHOWGROUND WEIR	27/12/2010 20:00			9.33
WARREGO HWY	28/12/2010 02:00			6.37

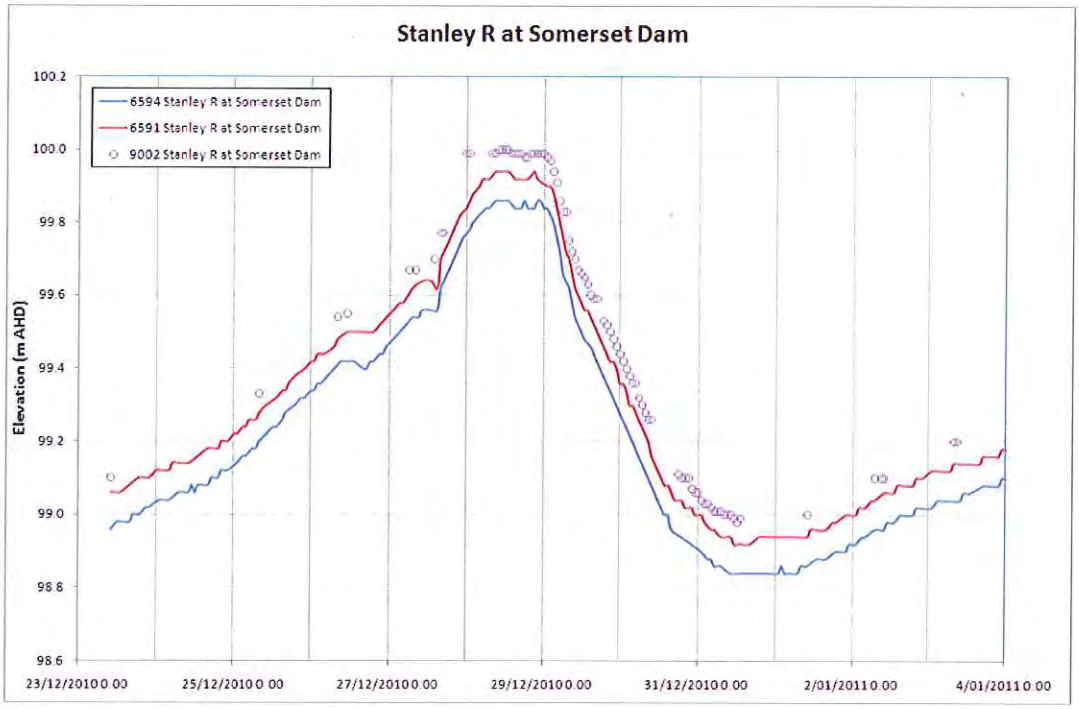
STATION	DATE/TIME	PEAK FLOW (m^3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
GLENORE GROVE	27/12/2010 22:00			14.48
LYONS BRIDGE	28/12/2010 11:00			15.87
RIFLE RANGE RD	28/12/2010 13:00			15.88
BUARABA CK	28/12/2010 16:00			9.70
OREILLYS WEIR	29/12/2010 00:00			12.28
LOWOOD PUMP STATION	30/12/2010 05:00			10.77
SAVAGES CROSSING	30/12/2010 10:00			10.80
BURTONS BRIDGE	30/12/2010 11:00			8.78
L MANCHESTER	27/12/2010 23:00			51.55
KHOLO BRIDGE	30/12/2010 19:00			3.08
MT CROSBY WEIR	30/12/2010 18:00			11.62
COLLEGES CROSSING	30/12/2010 18:00			9.46
ADAMS BRIDGE	27/12/2010 17:00			4.67
STOKES CROSSING	27/12/2010 19:00			4.64
SPRESSERS BRIDGE	27/12/2010 18:00			3.77
KUSS RD	27/12/2010 00:00			7.42
WWTP	27/12/2010 02:00			7.65
ROSEWOOD	27/12/2010 04:00			6.08
FIVE MILE BRIDGE	27/12/2010 09:00			6.98
WALLOON	27/12/2010 11:00			8.02
MOOGERAH DAM	27/12/2010 18:00			157.12
JUNCTION WEIR	27/12/2010 18:00			79.91
HARRISVILLE	27/12/2010 22:00			5.76
CHURCHBANK WEIR	28/12/2010 03:00			2.80
GREENS RD	28/12/2010 11:00			7.29
AMBERLEY	28/12/2010 12:00			8.24
PEAK CROSSING	27/12/2010 02:00			4.19
LOAMSIDE	27/12/2010 07:00			5.58
ONE MILE BRIDGE	28/12/2010 08:00			15.73
HANCOCKS BRIDGE	28/12/2010 08:00			12.88
IPSWICH	27/12/2010 17:00			8.53
MOGGILL	27/12/2010 17:00			3.26
JINDALEE	27/12/2010 16:00			2.45
BRISBANE	23/12/2010 11:00			1.83
BAR	23/12/2010 11:00			1.65

4.22 Late December Event – Height Hydrographs

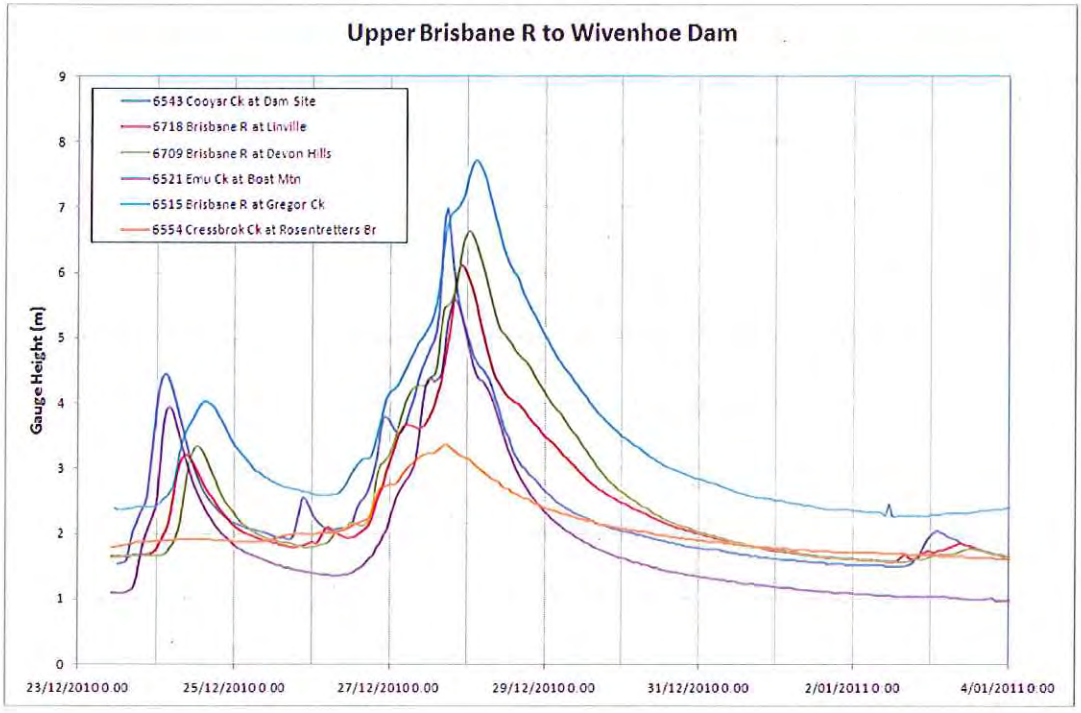
Height hydrographs for selected key stations within the Brisbane River Basin are plotted below. During the Event, basic data checking is carried out by the Duty Technical Assistants.



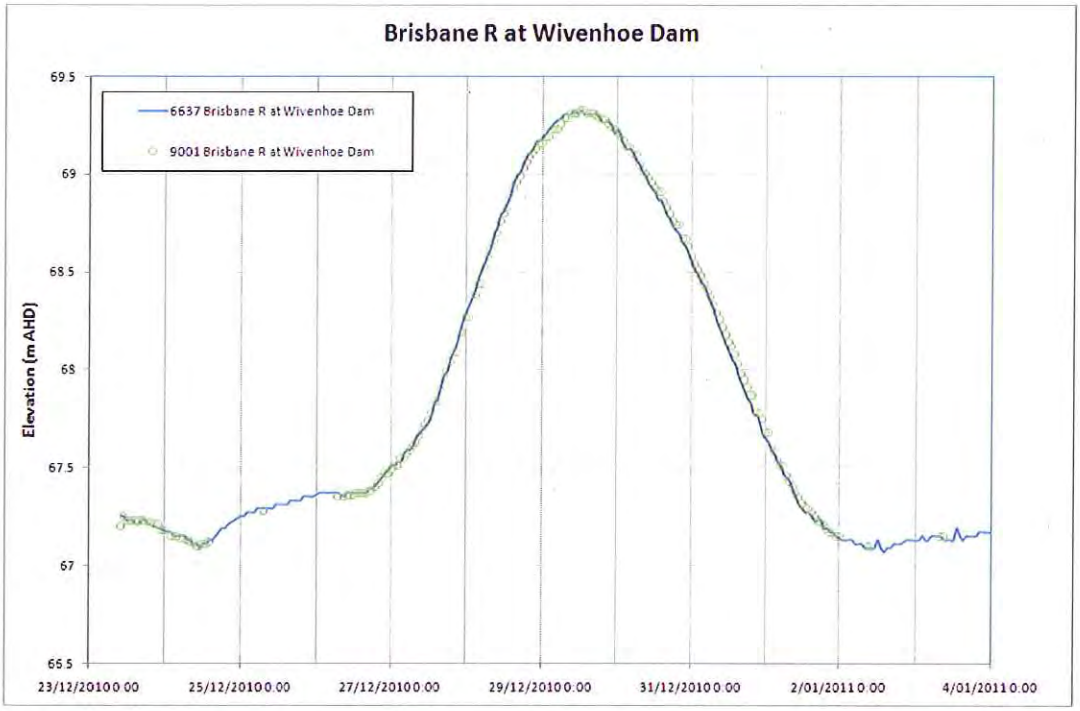
There are three gauges upstream of Somerset Dam which are monitored during flood events. Each of the three gauges appears to have worked well during the Event.



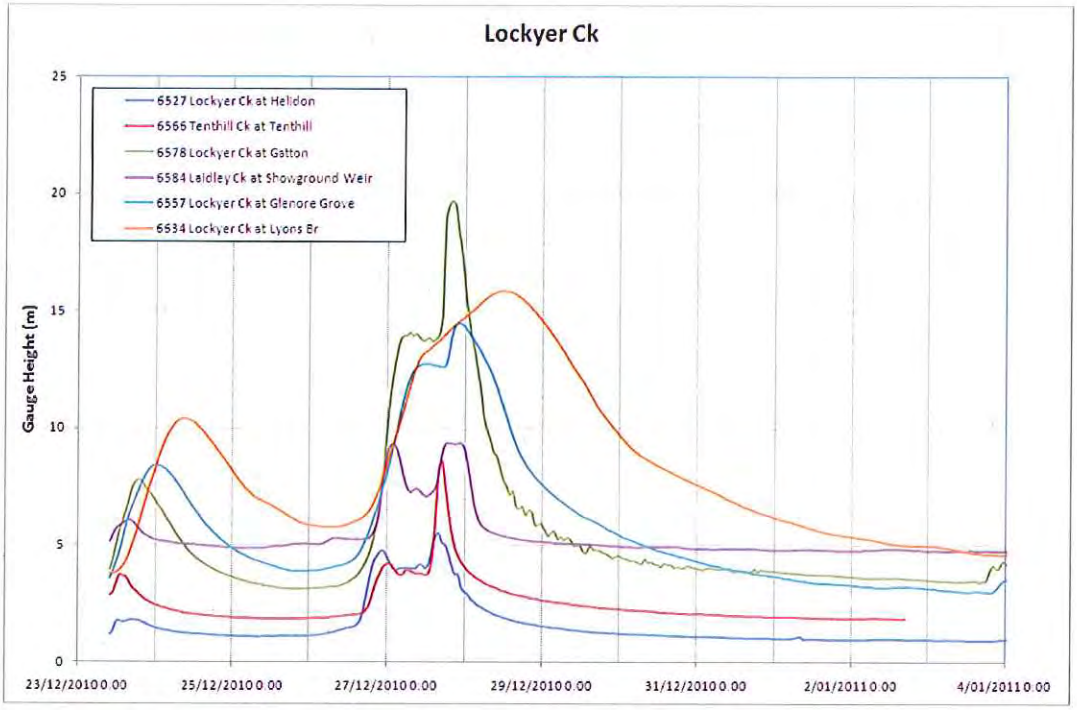
The two automatic gauges shown above appear to have slightly under read when compared with the manual gauge board readings. This difference did not have impact dam operations.



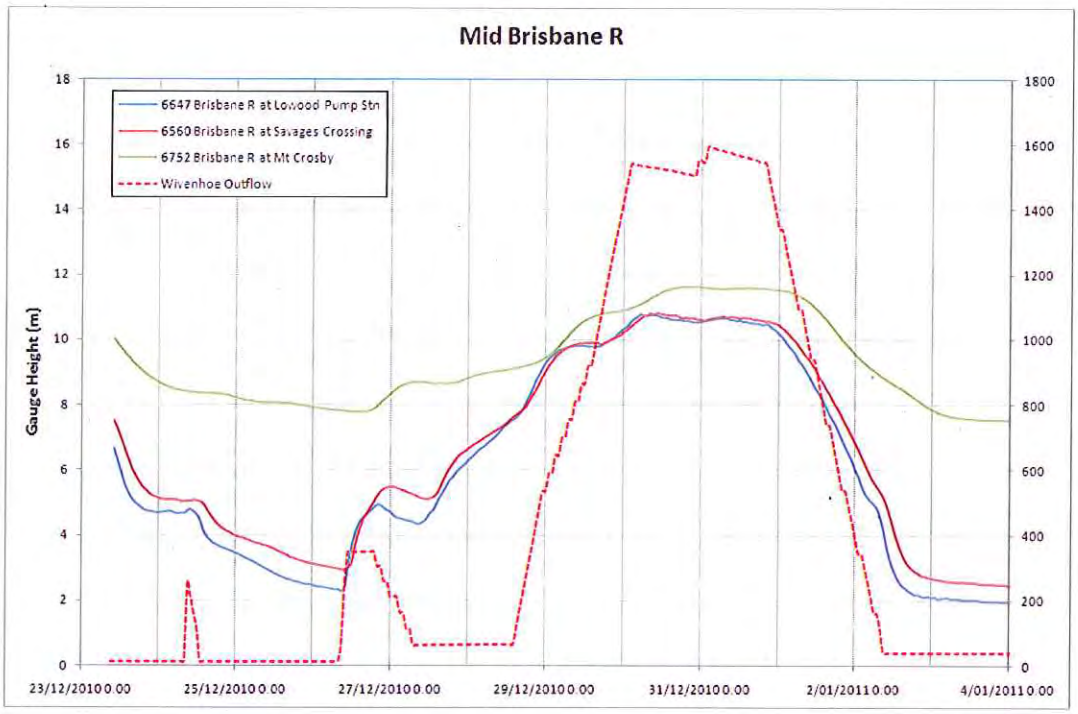
The gauges shown above appear to have worked well during the Event.



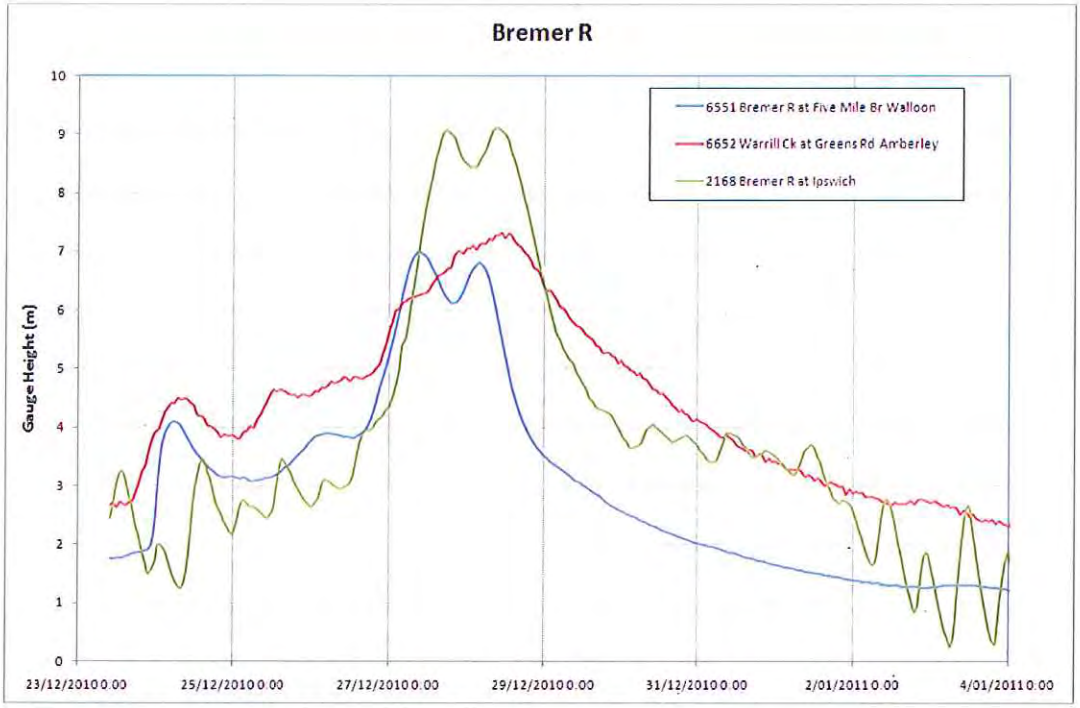
The gauges shown above appear to have worked well during the Event.



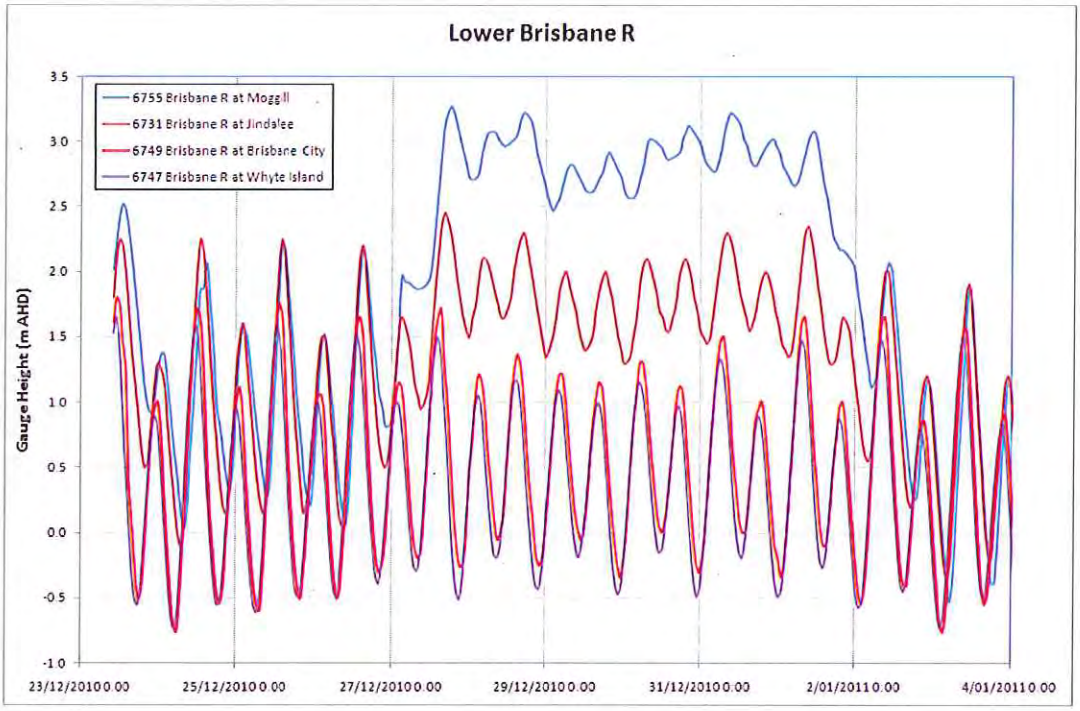
The gauges shown above appear to have worked well during the Event.



The gauges shown above appear to have worked well during the Event.



The gauges shown above appear to have worked well during the Event. The Bremer River at David Trumpy Bridge (Ipswich) is affected by backwater from the Brisbane River.

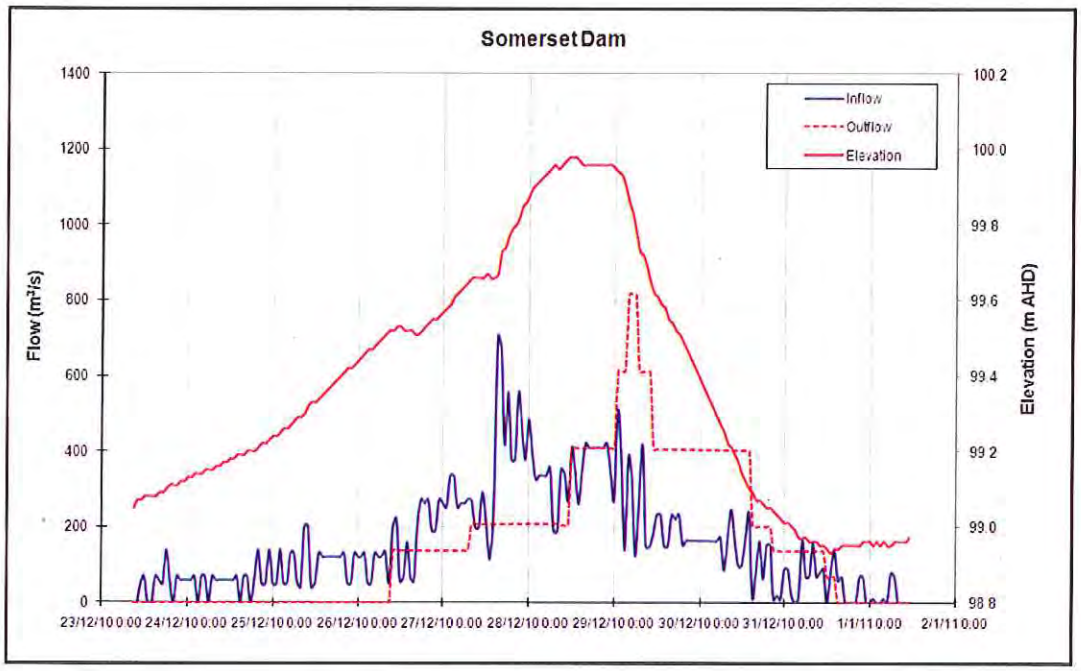


The gauges shown above appear to have worked well during the Event. These gauges are affected by tides.

4.23 Late December Event – Dam Inflows and Outflows

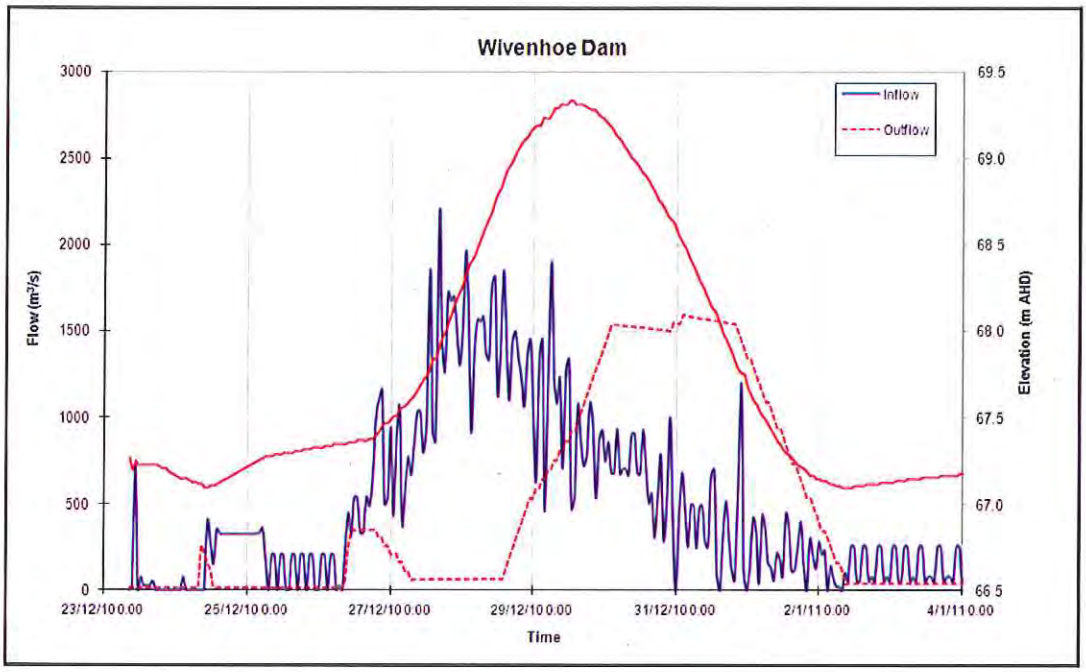
The inflows and outflows from Somerset and Wivenhoe Dams are outlined in the table and figures below. Note that the Wivenhoe figures include Somerset outflows. The inflow to the dams has been estimated by reverse routing.

STATION	DATE/TIME	PEAK FLOW (m^3/s)	FLOOD VOLUME (ML)	GAUGE HEIGHT (m)
SOMERSET DAM INFLOW	27/12/2010 17:00	700	126,000	
SOMERSET DAM OUTFLOW	29/12/2010 04:00	820	129,000	99.98
WIVENHOE DAM INFLOW	27/12/2010 16:00	2,200	513,000	
WIVENHOE DAM OUTFLOW	31/12/2010 03:00	1,590	481,000	69.93



The inflow into Somerset Dam is characterised by a series of small peaks of approximately 700m^3/s on Monday 27 December. The peak outflow of 820m^3/s occurred almost 36 hours later.

At 04:00 on Wednesday 29 December Somerset Dam reached its maximum water level of 99.98m AHD.



Similarly to Somerset, the inflow into Wivenhoe Dam is characterised by a relatively small flood peak of approximately 2,200m^3/s on the afternoon of Monday 27 December 2010. The peak of the outflow of 1,540m^3/s occurred close to 24 hours later on the evening of Friday 31 December 2010.

Wivenhoe Dam reached its maximum water level of 68.24m AHD at 19:00 on Tuesday 21 December 2010.

4.24 Other Data Sources

Other decision-making support tools examined and considered in conjunction with the modelling results included:

- 24-hour Quantitative Precipitation Forecasts (QPF) for North Pine, Somerset and Wivenhoe Dams provided by BoM twice daily, in the morning and afternoon.
- Weather radar (available via the BoM website and refreshed every 10 minutes).
- SILO Meteograms Forecast Rainfall (based on the BoM ACCESS Mode and available via the BoM Registered User Service).
- Interactive Weather and Wave Forecast Rainfall Maps (based on the BoM ACCESS Model and available via the BoM web site).
- Water and the Land Forecast Rainfall (based on an ensemble of several numerical weather prediction models and available via the BoM web site).

- Severe Weather Warnings issued by BoM.
- Flood Model Results (available via the BoM Registered User Service).
- Enviromon, the BoM replacement software for FloodCol. This includes all available ALERT stations in South East Queensland, including a large number of non-Seqwater stations.

The QPFs, received via fax and email, are considered to be the primary forecast tool. QPFs are provided by the BoM to give specific forecast information in relation to the dam catchment areas. Additionally, the data provided can be directly included in the Real Time Flood Model (RTFM). To a lesser extent, the information provided by SILO can also be included in the RTFM.

During the Event, detailed discussions were held with the BoM Flood Warning Centre. These discussions centred on model results as well as actual and projected inflows and outflows from dams. Similar discussions were held with Brisbane City Council (BCC). The details of these discussions can be found in the Event Log.

In addition to the sources listed above, the Department of Environment and Resource Management web sites were inspected to compare heights and flows at selected gauging stations.

5. FLOOD MODEL VALIDITY AND PERFORMANCE

5.1 Background

A real-time flood monitoring and forecasting system is used to monitor rainfall and water levels in the Dam catchments and to provide adequate, accurate and timely information to inform decision-making.

As the real-time rainfall and river height data is received in the Flood Operations Centre, a RTFM is used to estimate likely Dam inflows and evaluate a range of possible inflow scenarios based on forecast and recorded rainfall in the Dam catchments. It comprises a suite of hydrologic computer models that process real-time data. This data is used by Flood Operations Engineers to operate the Dams during flood events, in accordance with the Manual. The Manual's objectives and procedures ensure Dam releases are optimised in order to minimise the impact of flooding.

5.2 System description

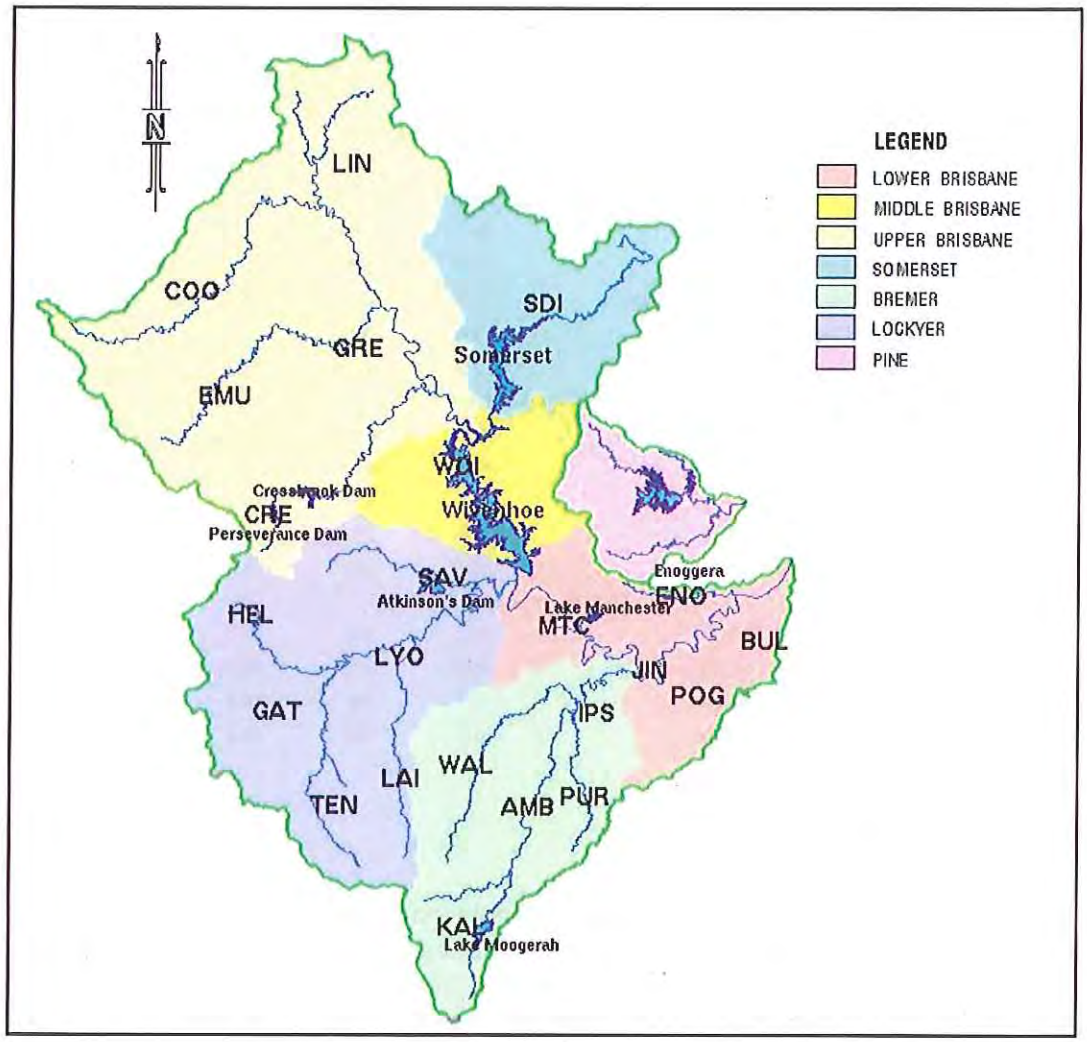
The current RTFM was developed in 1994 as part of the *Brisbane River and Pine River Flood Study, (DNR, 1994)* and consists of two integrated modules:

- FLOOD-Col;
- FLOOD-Ops.

FLOOD-Col is the data capture module, while FLOOD-Ops is the data analysis module of the RTFM. The RTFM:

- Automatically and continuously collects, filters and stores rainfall and water level data in real time;
- Assigns temporal and spatial distributions of actual and forecast rainfall for extension into the future;
- Evaluates the spatial and temporal distribution of antecedent catchment soil moisture conditions on a daily basis;
- Performs hydrologic routing of stream flows in an integrated environment;
- Provides estimates of storage performance and resulting downstream releases;
- Prepares summary output in textual and graphical format for storage operation and resulting downstream flood levels and flows.

The Flood-Ops component of the RTFM consists of a series of linked WT42 models as shown in the figure below.



Relevant statistics and model parameters relating to each Region as defined in the RTFM are shown in the table below.

Region Code	Stream gauge	AMTD (km)	Area (km^2)	Distance to outlet (km)	Model Parameters	
					Kc	m
Upper Brisbane River						
COO	Cooyar Creek at Dam site	12.2	980	28.1	43.6	0.8
LIN	Brisbane River at Linville	282.4	1,061	23.2	20.6	0.8
EMU	Emu Creek at Boat Mountain	9.3	913	42.1	37.2	0.8
CRE	Cressbrook Creek at Cressbrook Dam	58.6	317	15.9	34.3	0.8
GRE	Brisbane River at Gregors Creek	251.7	973	25.0	20.1	0.8
Stanley River						
SDI	Stanley River at Somerset Dam	7.2	1,328	42.6	60.3	0.8
Middle Brisbane River						
WDI	Brisbane River at Wivenhoe Dam	150.4	1,429	49.1	108.5	0.8

Region Code	Stream gauge	AMTD (km)	Area (km^2)	Distance to outlet (km)	Model Parameters	
					Kc	m
SAV	Brisbane River at Savages Crossing	130.8	728	43.7	40.0	0.8
MTC	Brisbane River at Mt Crosby Weir	90.8	358	31.3	47.0	0.8
	Lockyer Creek					
HEL	Lockyer Creek at Helidon	96.6	377	23.8	15.0	0.8
TEN	Tenthill Creek at Tenthill	14.6	465	37.7	19.0	0.8
LAI	Laidley Creek at Showground Weir	17.6	285	23.6	42.1	0.8
GAT	Lockyer Creek at Gatton	72.0	706	27.7	61.9	0.8
LYO	Lockyer Creek at Lyons Bridge	27.2	602	30.2	53.9	0.8
	Bremer River					
WAL	Bremer River at Walloon	37.2	626	30.3	44.0	0.8
KAL	Warrill Creek at Kalbar	49.7	469	21.8	34.0	0.8
AMB	Warrill Creek at Amberley	8.7	449	25.0	35.0	0.8
PUR	Purga Creek at Loamside	6.8	223	23.6	49.0	0.8
IPS	Bremer River at Ipswich	16.9	265	23.4	15.7	0.8
	Lower Brisbane River					
JIN	Brisbane River at Jindalee	49.1	390	21.0	29.4	0.8
POG	Brisbane River at Port Office Gauge	22.7	339	36.9	19.3	0.8
ENO	Enoggera Creek at Junction	0.0	82	16.4	9.1	0.8
BUL	Bulimba Creek at Junction	0.0	130	18.8	10.5	0.8

5.3 Model Performance

During floods, model outputs are compared with data from gauging stations in real time to assess their accuracy. Ultimately, the models' performance is measured by how well they estimate the volume of water flowing into the Dams. Therefore, a comparison of the modelled water level with the gauge board readings taken during the event is considered to be the best way to assess model performance.

While all models are run and flows generated at numerous locations during events, only the performance of the models at Somerset and Wivenhoe Dams is reported here.

During events, initial loss is adjusted to match the initial rise in the recorded water level at a particular location. Continuing loss rates were altered to ensure the overall shape and volume of the Flood Event was being matched to an acceptable level.

The scale factor allows the Flood Operations Engineer to interactively upscale or downscale the inflows to the Dams. Ideally, this should be 1.0 however values with +/-10% are considered acceptable.

5.4 October Event – Model Performance

The table below shows the adopted model parameters for the October 2010 Flood Event.

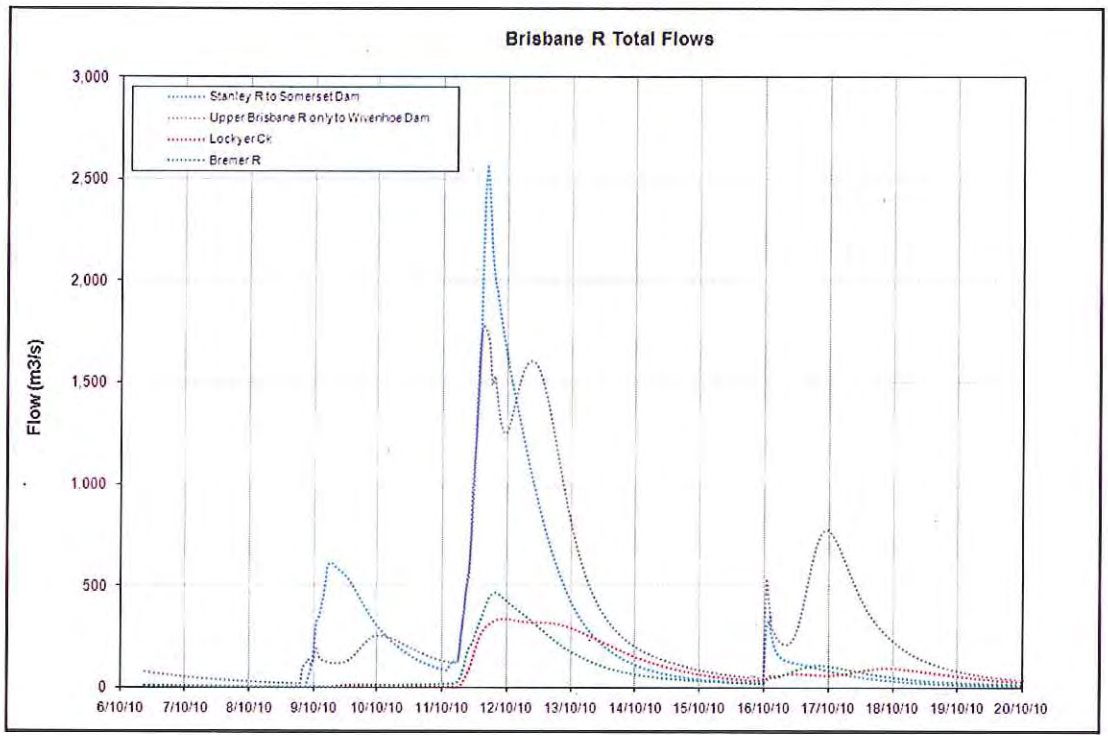
ADOPTED MODEL PARAMETERS – OCTOBER 2010

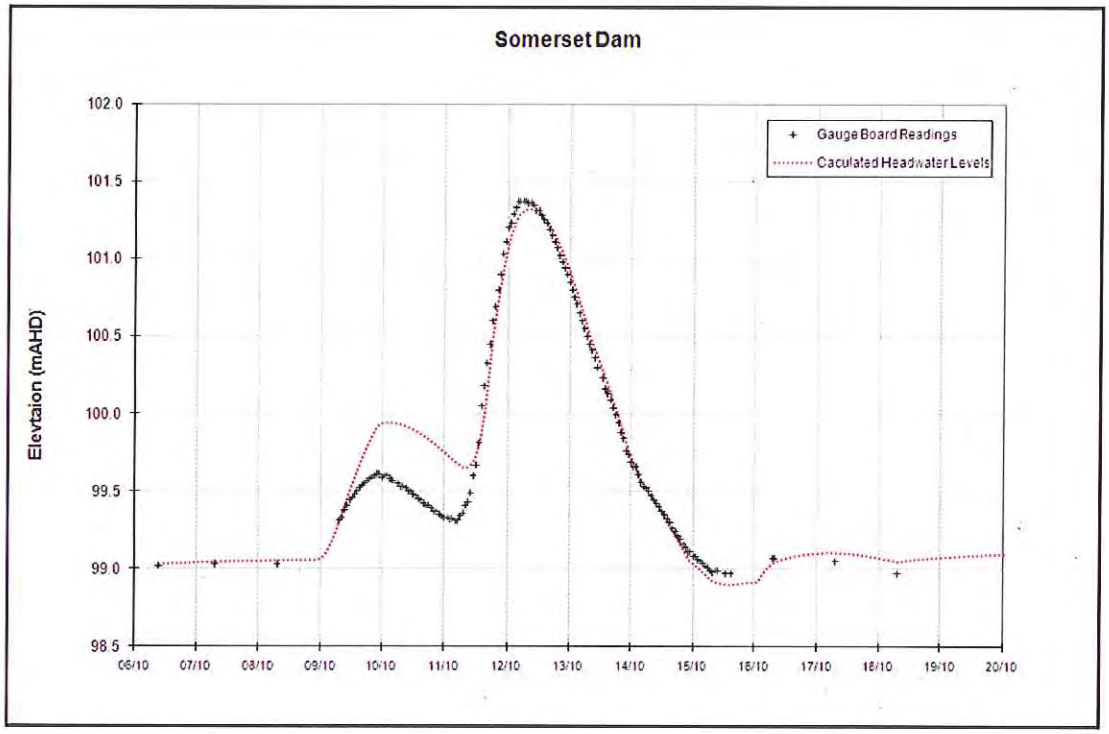
Region code	Initial loss (mm)	Continuing Loss (mm/hr)	K_c	m	Baseflow BR	Baseflow BC	Baseflow BM	Scale Factor
Stanley River to Somerset Dam								
SDI	25	2.2	60.3	0.8	0.975	0.002	1.0	**1.40**
Upper Brisbane River to Wivenhoe Dam								
COO	40	1.0	43.6	0.8	0.975	0.002	1.0	0.95
LIN	35	1.0	20.6	0.8				
EMU	35	1.0	37.2	0.8				
CRE	35	2.0	34.3	0.8				
GRE	30	1.9	20.1	0.8				
WDI	20	1.8	108.5	0.8				

The modelled flows at the key locations of Somerset Dam, Wivenhoe Dam, Lockyer Creek and Bremer River are shown in the table and figures below. Adopted initial losses were slightly lower than those assessed by the API model. Adopted continuing loss rates are within normally acceptable ranges.

The figures on the following pages and the table below contains calculated values which may not be exactly the same as those determined post-flood and reported in the Event Data section of this report.

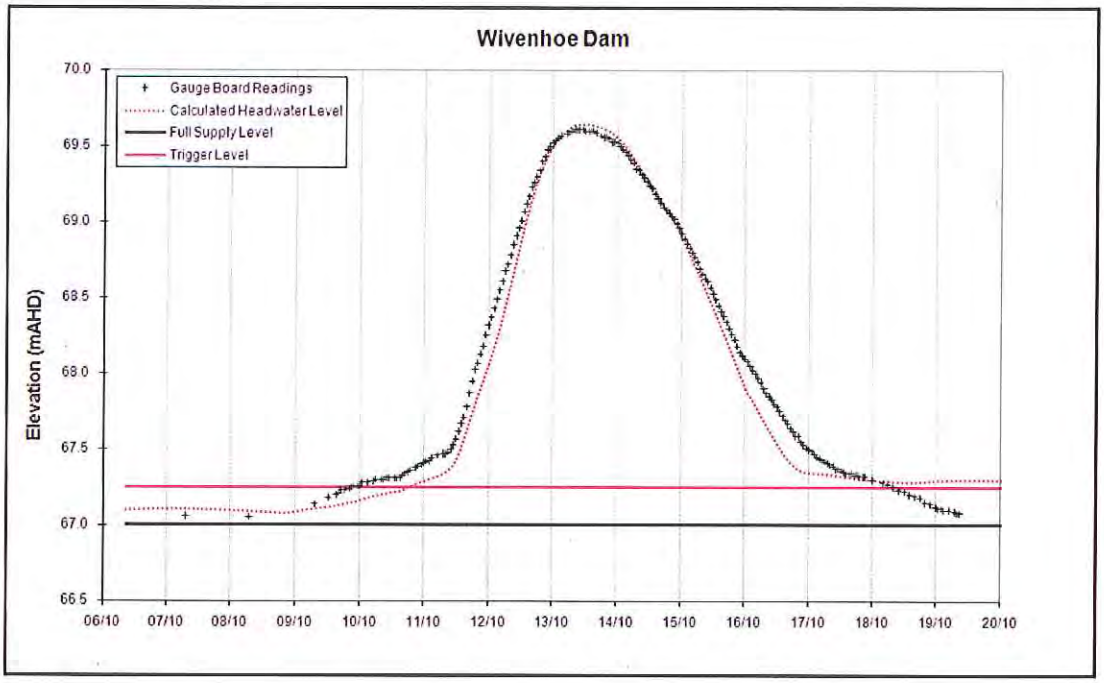
Location	Calculated	Date/Time	Value	Unit
Somerset Dam	Peak Inflow	11/10/2010 16:00	2,556	m3/s
	Peak Water Level	12/10/2010 08:00	101.32	m AHD
	Inflow Volume		281,963	ML
	Peak Outflow	12/10/2010 08:00	1,127	m3/s
	Outflow Volume		278,345	ML
Wivenhoe Dam	Peak Inflow	12/10/2010 09:00	2,729	m3/s
	Peak Water Level	13/10/2010 12:00	69.65	m AHD
	Inflow Volume		663,818	ML
	Peak Outflow	14/10/2010 04:00	1,508	m3/s
	Outflow Volume		933,116	ML
Lowood	Peak Flow including Wivenhoe	14/10/2010 10:00	1,638	m3/s
	Peak Flow excluding Wivenhoe	12/10/2010 05:00	335	m3/s
Moggill	Peak Flow including Wivenhoe	15/10/2010 02:00	1,667	m3/s
	Peak Flow excluding Wivenhoe	12/10/2010 14:00	565	m3/s





Initially the model overestimates the inflow to Somerset Dam and, as a result, overestimates the initial rise in the water level. This suggests the adopted initial loss was slightly too low.

Additionally, the adopted scale factor suggests the rainfall input is also low. However, timing of the peaks is reasonable which suggests the adopted model routing parameters are appropriate.



Overall, as reflected in the modelled water levels, the shape and volume of the inflow to Wivenhoe Dam appears to be satisfactory. The timing of the modelled rising limb of the water level is late, suggesting the storage factors (Kc and/or m) could be slightly reduced to produce a "better fit". Additionally, the recession falls away too quickly suggesting there is more runoff late in the Event from either unrecorded rainfall or additional baseflow. The adopted scale factor is within tolerable limits while modelled water levels are within 10mm of actual water levels over the entire Event.

Generally, the hydrologic models have satisfactorily reproduced the inflows to Somerset and Wivenhoe Dams during this Event.

5.5 Early December Event – Model Performance

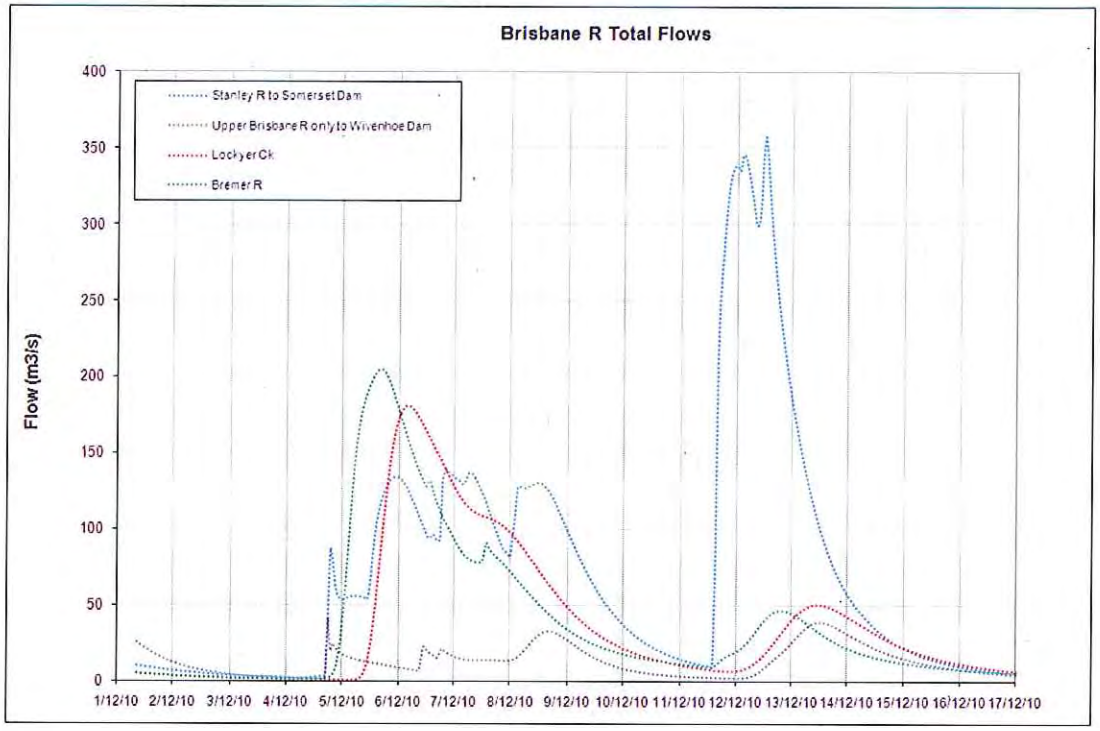
The table below shows the adopted model parameters for the Early December 2010 Event.

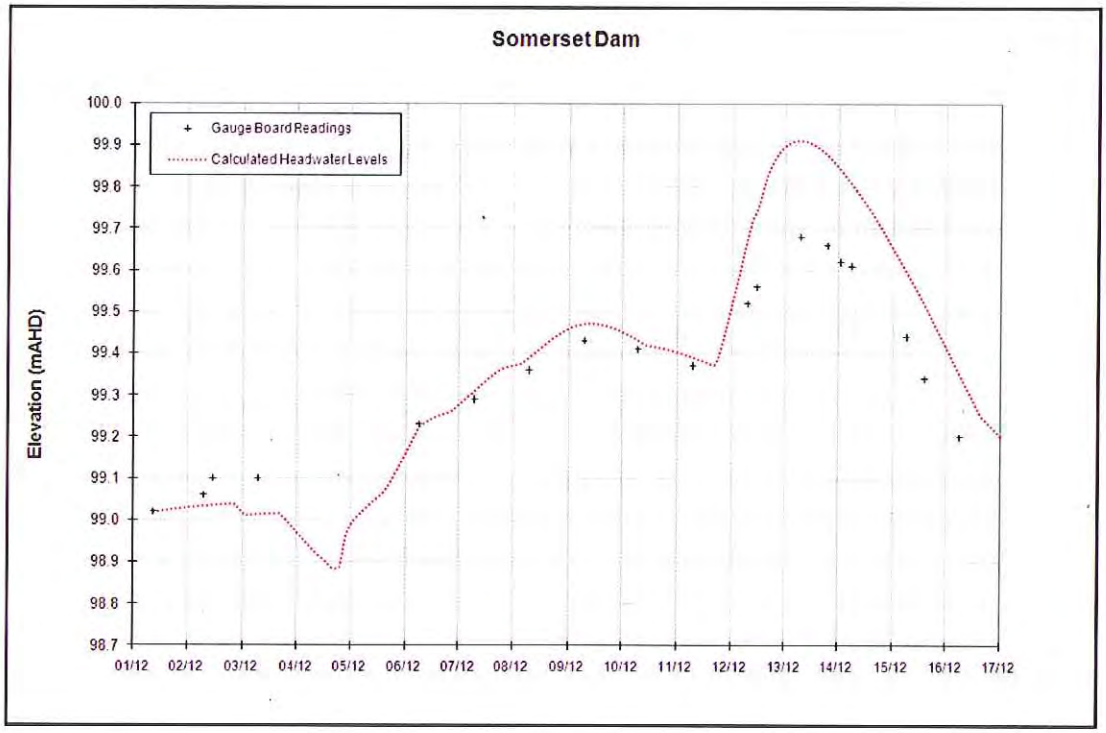
ADOPTED MODEL PARAMETERS – EARLY DECEMBER 2010								
Region code	Initial loss (mm)	Continuing Loss (mm/hr)	K_c	m	Baseflow			Scale Factor
					BR	BC	BM	
Stanley River to Somerset Dam								
SDI	45	1.7	60.3	0.8	0.975	0.002	1.0	0.95
Upper Brisbane River to Wivenhoe Dam								
COO	70	5.2	43.6	0.8	0.975	0.004	1.0	0.80
LIN	110	2.0	20.6	0.8				
EMU	70	5.2	37.2	0.8				
CRE	70	5.2	34.3	0.8				
GRE	100	2.0	20.1	0.8				
WDI	45	3.0	108.5	0.8				
Stanley River to Somerset Dam								
SDI	45	1.7	60.3	0.8	0.975	0.002	1.0	0.95

The modelled flows at the key locations of Somerset Dam, Wivenhoe Dam, Lockyer Creek and Bremer River are shown in the following table and figures. The figures in the table below are calculated values and may not be exactly the same as those determined post-flood and reported in the Event Data section of this report.

The early December inflows were relatively small. Modelling of small events tends to be more uncertain than in large events due to the sensitivity of the model to rainfall inputs and the fact that models have been primarily calibrated on larger floods. Adopted initial losses are much higher than those assessed by the API model. Adopted continuing loss rates are within normally acceptable ranges.

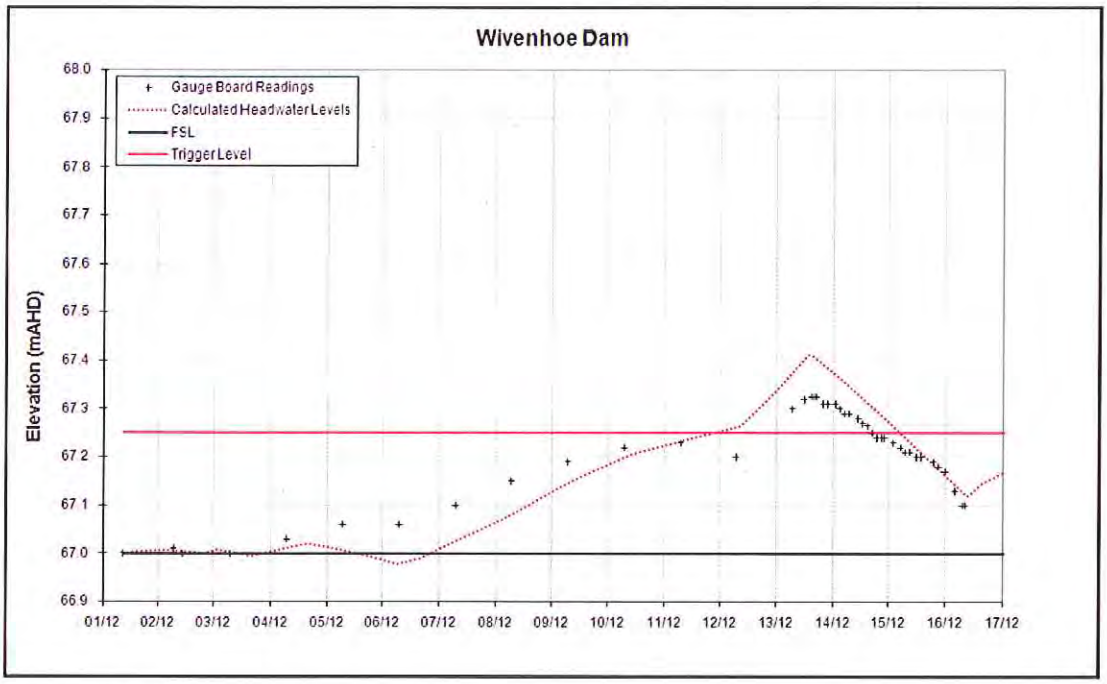
Location	Calculated	Date/Time	Value	Unit
Somerset Dam	Peak Inflow	12/12/2010 12:00	358	m^3/s
	Peak Water Level	13/12/2010 06:00	99.89	m AHD
	Inflow Volume		98,532	ML
	Peak Outflow	13/12/2010 06:00	139	m^3/s
	Outflow Volume		93,026	ML
Wivenhoe Dam	Peak Inflow	13/12/2010 12:00	178	m^3/s
	Peak Water Level	13/12/2010 14:00	67.35	m AHD
	Inflow Volume		111,218	ML
	Peak Outflow	13/12/2010 15:00	291	m^3/s
	Outflow Volume		96,470	ML
Lowood	Peak Flow including Wivenhoe	13/12/2010 21:00	340	m^3/s
	Peak Flow excluding Wivenhoe	06/12/2010 10:00	181	m^3/s
Moggill	Peak Flow including Wivenhoe	14/12/2010 13:00	355	m^3/s
	Peak Flow excluding Wivenhoe	06/12/2010 23:00	273	m^3/s





The performance of the model in estimating inflows to Somerset Dam is considered satisfactory although the modelled water level is approximately 200mm high at the peak of the Event. This

has no significant impact on operational decisions. The inflow scale factor is within acceptable limits and the timing of the modelled inflow suggests routing parameters are appropriate. Modelled water levels are within 100mm of actual recordings over the entire Event.



Generally, the hydrologic models have satisfactorily reproduced the inflows to Somerset and Wivenhoe Dams during this Event, within the acceptable ranges of loss and routing parameters.

Overall, the model satisfactorily demonstrated the inflow to Wivenhoe Dam, especially considering the relatively small size of the Event. The routing parameters and scale factors adopted are also within acceptable tolerances.

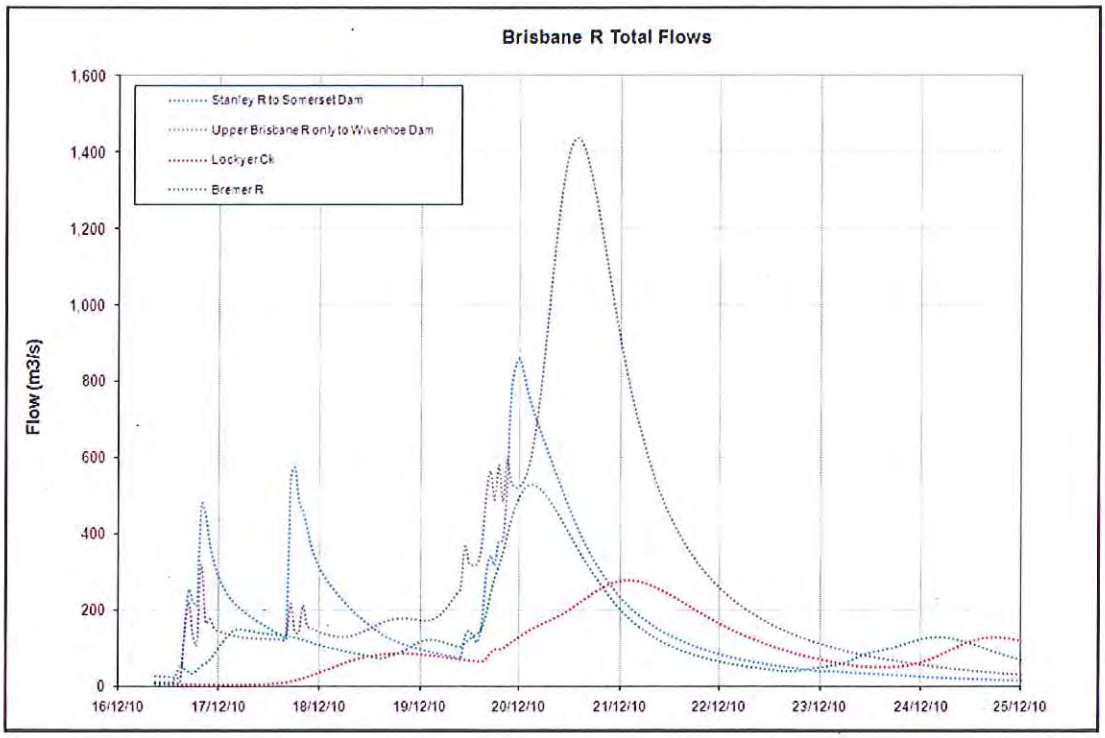
5.6 Mid December Event – Model Performance

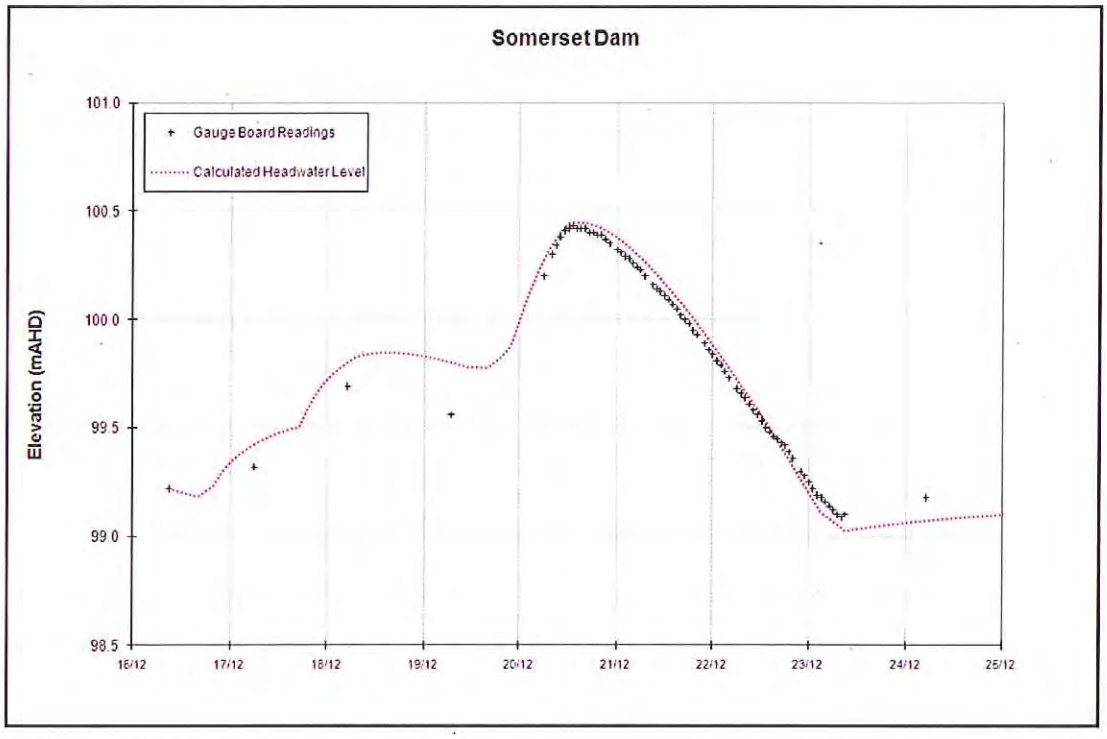
The table below shows the adopted model parameters for the Mid December 2010 Flood Event.

ADOPTED MODEL PARAMETERS – MID DECEMBER 2010								
Region code	Initial loss (mm)	Continuing Loss (mm/hr)	K_c	m	Baseflow			Scale Factor
					BR	BC	BM	
Stanley River to Somerset Dam								
SDI	10	1.5	60.3	0.8	0.975	0.005	1.0	1.0
Upper Brisbane River to Wivenhoe Dam								
COO	30	3.0	43.6	0.8	0.975	0.005	1.0	1.0
LIN	25	3.0	20.6	0.8				
EMU	30	2.0	37.2	0.8				
CRE	30	3.0	34.3	0.8				
GRE	25	3.0	20.1	0.8				
WDI	10	3.0	108.5	0.8				

The modelled flows at the key locations of Somerset Dam, Wivenhoe Dam, Lockyer Creek and Bremer River are shown in the table and figures below. Adopted initial losses were 20mm lower in the Stanley and 10-15mm lower in the Upper Brisbane than those assessed by the API model while adopted continuing loss rates are within normally acceptable ranges. The figures in the table below are calculated values and may not be exactly the same those determined post-flood and reported in the Event Data section of this report.

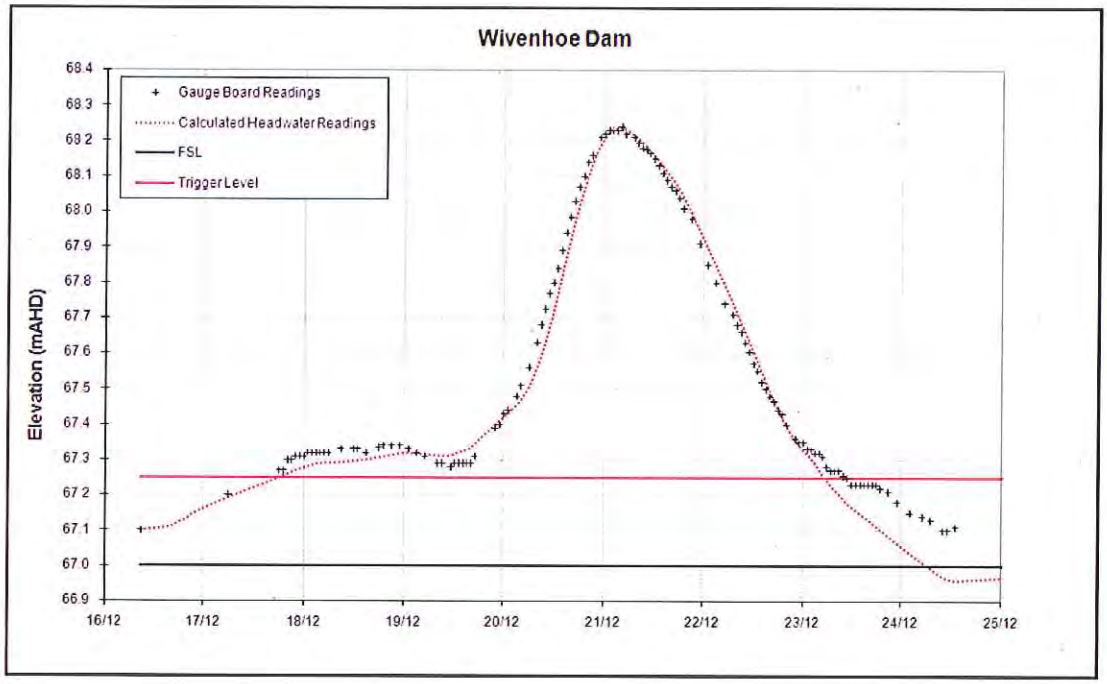
Location	Calculated	Date/Time	Value	Unit
Somerset Dam	Peak Inflow	20/12/2010 00:00	856	m^3/s
	Peak Water Level	20/12/2010 14:00	100.45	m AHD
	Inflow Volume		133,320	ML
	Peak Outflow	20/12/2010 14:00	413	m^3/s
	Outflow Volume		155,656	ML
Wivenhoe Dam	Peak Inflow	20/12/2010 14:00	1,847	m^3/s
	Peak Water Level	21/12/2010 03:00	68.24	m AHD
	Inflow Volume		450,885	ML
	Peak Outflow	21/12/2010 19:00	1,462	m^3/s
	Outflow Volume		372,666	ML
Lowood	Peak Flow including Wivenhoe	22/12/2010 01:00	1,658	m^3/s
	Peak Flow excluding Wivenhoe	21/12/2010 08:00	278	m^3/s
Moggill	Peak Flow including Wivenhoe	22/12/2010 17:00	1,697	m^3/s
	Peak Flow excluding Wivenhoe	20/12/2010 03:00	605	m^3/s





Initially the model overestimates the inflow to Somerset Dam and, as a result, overestimates the initial rise in the water level. This suggests the adopted initial loss may be too low. The adopted scale factor of 1.00 suggests the rainfall input is accurate. The timing of the peaks is accurate

which suggests the adopted model routing parameters are appropriate.



Overall, the shape and volume of the inflow appears to be satisfactory. The timing of the modelled water level on the rising limb is a little late however it is within acceptable tolerances. This suggests the storage factors (Kc and/or m) are also appropriate. Additionally, the recession falls away too quickly suggesting there is more runoff late in the Event from either unrecorded rainfall or additional baseflow. Modelled water levels are within 100mm of actual recordings over the entire Event.

Generally, the hydrologic models have satisfactorily reproduced the inflows to Somerset and Wivenhoe Dams during this Event, within acceptable loss and routing parameter ranges.

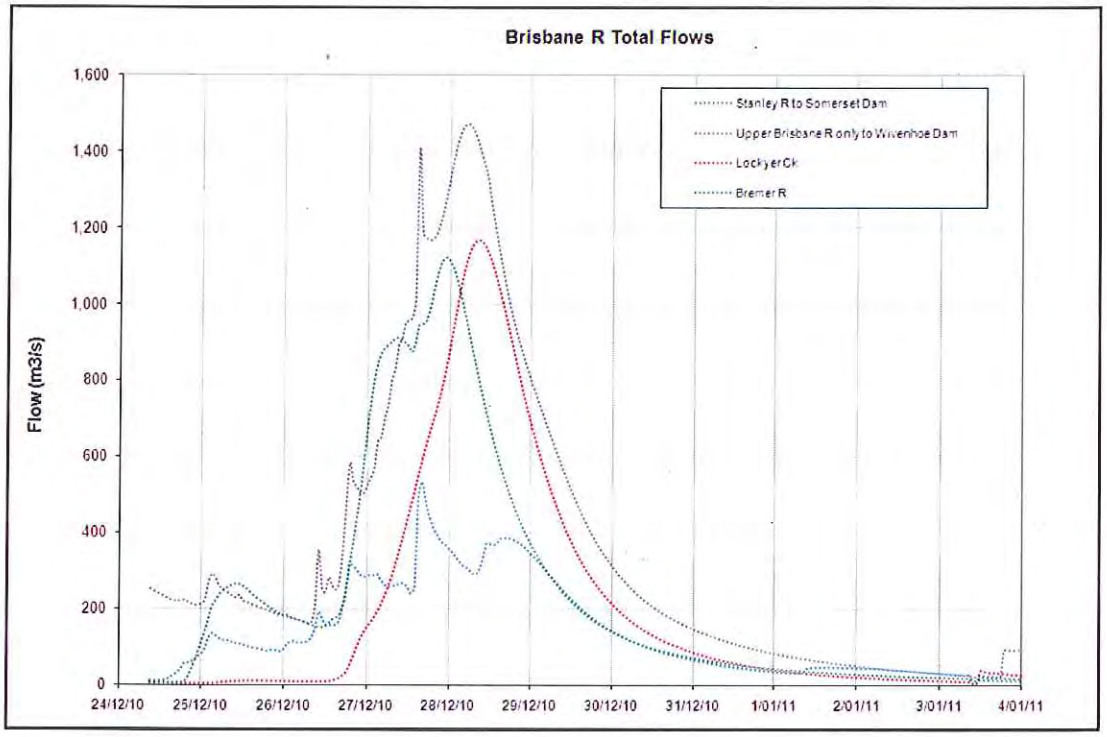
5.7 Late December Event – Model Performance

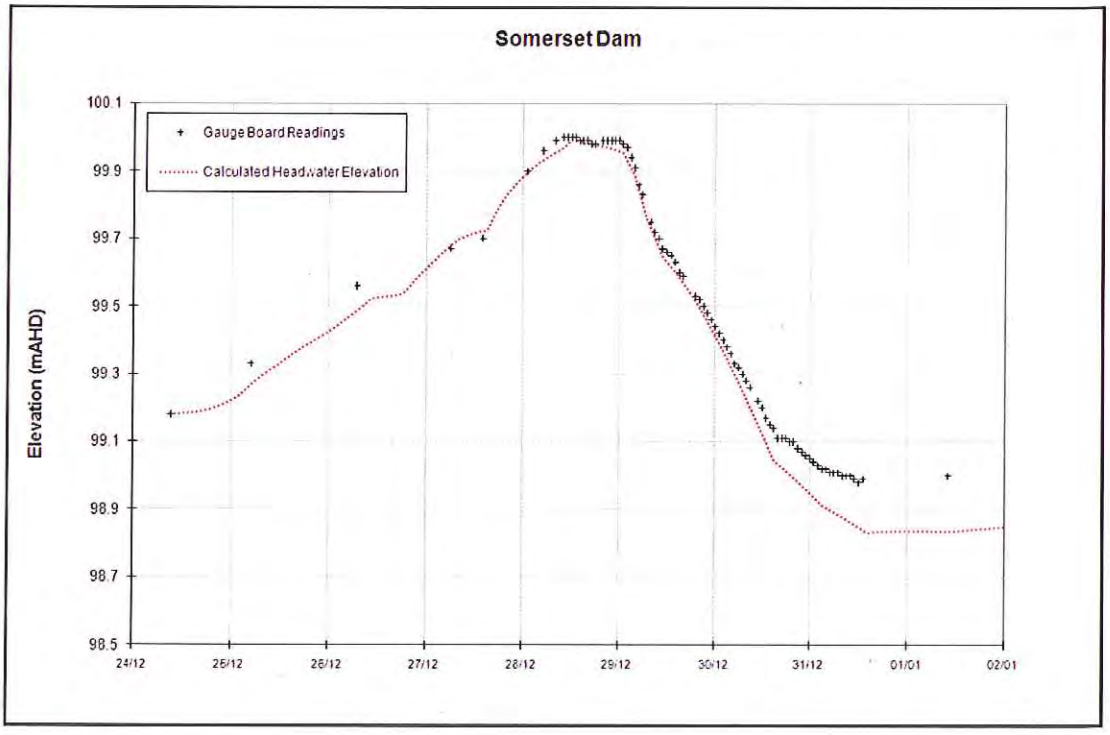
The table below shows the adopted model parameters for the Late December 2010 Flood Event.

ADOPTED MODEL PARAMETERS – LATE DECEMBER 2010								
Region code	Initial loss (mm)	Continuing Loss (mm/hr)	K_c	m	Baseflow			Scale Factor
					BR	BC	BM	
Stanley River to Somerset Dam								
SDI	10	0.3	60.3	0.8	0.975	0.005	1.0	1.00
Upper Brisbane River to Wivenhoe Dam								
COO	15	0.3	43.6	0.8	0.975	0.005	1.0	1.00
LIN	25	0.3	20.6	0.8				
EMU	10	0.3	37.2	0.8				
CRE	10	0.8	34.3	0.8				
GRE	10	1.5	20.1	0.8				
WDI	10	0.8	108.5	0.8				

The modelled flows at the key locations of Somerset Dam, Wivenhoe Dam, Lockyer Creek and Bremer River are shown in the table and figures below. Adopted initial losses were 5 -10mm lower than those assessed by the API model, however, adopted continuing loss rates are within normally acceptable ranges. The figures in the following table are calculated values and may not be exactly the same those determined post-flood and reported in the Event Data section of this report.

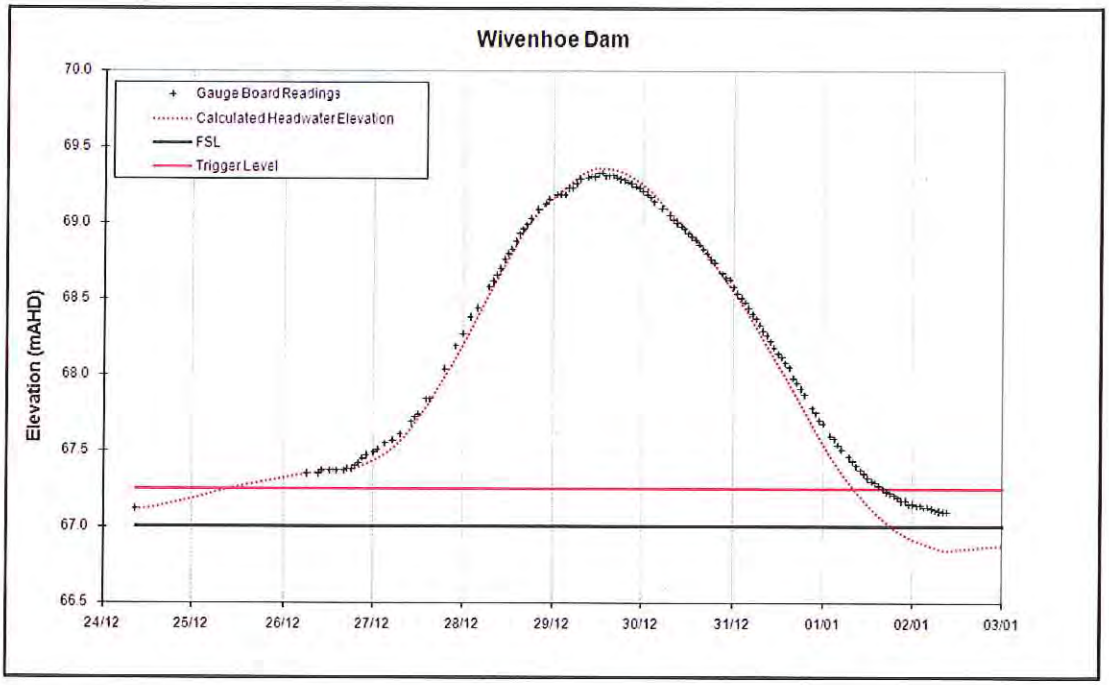
Location	Calculated	Date/Time	Value	Unit
Somerset Dam	Peak Inflow	27/12/2010 16:00	532	m^3/s
	Peak Water Level	28/12/2010 12:00	99.99	m AHD
	Inflow Volume		127,072	ML
	Peak Outflow	29/12/2010 04:00	818	m^3/s
	Outflow Volume		151,854	ML
Wivenhoe Dam	Peak Inflow	28/12/2010 05:00	1,681	m^3/s
	Peak Water Level	29/12/2010 13:00	69.36	m AHD
	Inflow Volume		555,822	ML
	Peak Outflow	31/12/2010 02:00	1,591	m^3/s
	Outflow Volume		488,992	ML
Lowood	Peak Flow including Wivenhoe	30/12/2010 08:00	1,739	m^3/s
	Peak Flow excluding Wivenhoe	28/12/2010 14:00	1,168	m^3/s
Moggill	Peak Flow including Wivenhoe	31/12/2010 00:00	1,808	m^3/s
	Peak Flow excluding Wivenhoe	29/12/2010 05:00	1,453	m^3/s





Initially the model overestimates the inflow to Somerset Dam and, as a result, overestimates the initial rise in water level. This suggests the adopted initial loss is too low. Additionally, the adopted scale factor suggests the rainfall input is also low. However, timing of the peaks is

reasonable which suggests the adopted model routing parameters are appropriate. Modelled water levels are within 100mm of actual levels over the entire duration of the Event.



Overall, the shape and volume of the inflow is satisfactory. The timing of the modelled water level is accurate suggesting the storage factors (Kc and/or m) are appropriate, as well as the loss and scale parameters. The recession falls away too quickly suggesting there is more runoff late in the Event from either unrecorded rainfall or additional baseflow. Modelled water levels are generally within 100m of actual recorded levels over the critical periods up to and well after the peak of the flood.

5.8 Conclusion

The performance of the hydrologic models during these Events is considered to be satisfactory given modelled water levels are within acceptable limits to the observed water levels at the Dams during the Events. There may be scope for further investigation of loss and routing parameters in smaller events. Additionally, the parameters in the baseflow model could be refined to better match the modelled recessions.

6. MANAGEMENT STRATEGIES FOR THE FLOOD EVENT

6.1 October 2010 Flood Event

The table below shows the mobilisation time and flood event commencement time for the October 2010 Flood Event.

Flood Event	Mobilisation Time	Flood Release Commencement
October 2010	06:30 - 09 October 2010	19:00 - 09 October 2010

The October 2010 Flood Event impacted Somerset and Wivenhoe Dams between Saturday 9 October 2010 and Tuesday 19 October 2010. The Event had an Annual Exceedance Probability [AEP] of less than 1 in 50 and can be categorised as a frequent flood event according to the Institution of Engineers Australia (Engineers Australia) national guidelines for the estimation of design flood characteristics (AR&R). .

The inflow into Somerset Dam during the Event is characterised by a single peak of approximately 2,860m^3/s at 12:00 on Monday 11 October 2010. The peak of the outflow of 1,135m^3/s occurred at 14:00 on Tuesday 12 October 2010 while the Dam's maximum water level of 101.37m AHD was also reached in the early morning of the same day.

Similarly, the inflow into Wivenhoe Dam is characterised by a single peak of approximately 3,000m^3/s on the afternoon of Monday 11 October 2010. The peak of the outflow of 1,493m^3/s occurred three days later in the early hours of Thursday 14 October 2010. At 04:00 on the same day, Wivenhoe Dam's maximum water level of 69.61m AHD was also reached.

Relevant event statistics are shown in the table below:

Location	Calculated	Date/Time	Value	Unit
Somerset Dam	Peak Inflow	11/10/2010 16:00	2,556	m3/s
	Peak Water Level	12/10/2010 08:00	101.32	m AHD
	Inflow Volume		281,963	ML
	Peak Outflow	12/10/2010 08:00	1,127	m3/s
	Outflow Volume		278,345	ML
Wivenhoe Dam	Peak Inflow	12/10/2010 09:00	2,729	m3/s
	Peak Water Level	13/10/2010 12:00	69.65	m AHD
	Inflow Volume		663,818	ML
	Peak Outflow	14/10/2010 04:00	1,508	m3/s
	Outflow Volume		933,116	ML
Lowood	Peak Flow including Wivenhoe	14/10/2010 10:00	1,638	m3/s
	Peak Flow excluding Wivenhoe	12/10/2010 05:00	335	m3/s
Moggill	Peak Flow including Wivenhoe	15/10/2010 02:00	1,667	m3/s
	Peak Flow excluding Wivenhoe	12/10/2010 14:00	565	m3/s

Generally, the hydrologic models appear to have satisfactorily reproduced the inflows to Somerset and Wivenhoe Dams during this Event. This flood was managed primarily to minimise disruption to rural life in the valleys of the Brisbane and Stanley Rivers. There were no known adverse impacts to urban areas downstream of Moggill as a result of the Flood Event.

Strategy W1 was used to manage the event at Wivenhoe Dam until the dam level exceeded 68.5m AHD, then Strategy W3 was used because the conditions for using Strategy W2 could not be satisfied. Strategy S2 was used to manage the event at Somerset Dam.

Clear flood mitigation benefits provided by Wivenhoe Dam during the Event included preventing the inundation of Mt Crosby Weir Bridge and reducing the peak flow in the Brisbane River at Moggill from a potential flow of 3,000m^3/s to an actual flow of around 1,500m^3/s. Damage tables supplied by the Brisbane City Council indicate a flow of 3,000m^3/s at Moggill could cause damage in the Brisbane area with a repair cost exceeding $5 million.

6.2 December 2010 Flood Events

The table below shows the mobilisation times and flood event commencement times for each of the December 2010 Flood Events.

Flood Event	Mobilisation Time	Flood Release Commencement
Early December 2010	07:00 - 11 December 2010	12:30 - 13 December 2010
Mid December 2010	10:00 - 17 December 2010	18:00 - 17 December 2010
Late December 2010	05:30 - 25 December 2010	09:00 - 26 December 2010

The Flood Operations Centre and the dams were appropriately staffed on a 24/7 basis from Event mobilisation to Event conclusion.

The Late December Event was the largest of the three flood events during this month, and had a similar peak inflow to and outflow from Wivenhoe Dam as the October 2010 Event. The Somerset Dam peak inflows and outflows across the three events were however significantly smaller than the October Event.

Across the three Events at Somerset Dam, the peak inflow was 1,000m^3/s and the peak outflow 820m^3/s. Across the three Events at Wivenhoe Dam, the peak inflow was 2,200m^3/s and the peak outflow 1,540m^3/s.

The December 2010 Flood Events impacted the Dams between Monday 13 December 2010 and Sunday 2 January 2011. The Events had an Annual Exceedance Probability [AEP] of less than 1 in 10 and can also be categorised as frequent flood events according to the Institution of Engineers Australia (Engineers Australia) national guidelines for the estimation of design flood characteristics (AR&R). .

Relevant event statistics are shown in the table below:

EARLY DECEMBER EVENT				
Location	**Calculated**	**Date/Time**	**Value**	**Unit**
Somerset Dam	Peak Inflow	12/12/2010 12:00	358	m^3/s
	Peak Water Level	13/12/2010 06:00	99.89	m AHD
	Inflow Volume		98,532	ML
	Peak Outflow	13/12/2010 06:00	139	m^3/s
	Outflow Volume		93,026	ML
Wivenhoe Dam	Peak Inflow	13/12/2010 12:00	178	m^3/s
	Peak Water Level	13/12/2010 14:00	67.35	m AHD
	Inflow Volume		111,218	ML
	Peak Outflow	13/12/2010 15:00	291	m^3/s
	Outflow Volume		96,470	ML
Lowood	Peak Flow including Wivenhoe	13/12/2010 21:00	340	m^3/s
	Peak Flow excluding Wivenhoe	06/12/2010 10:00	181	m^3/s
Moggill	Peak Flow including Wivenhoe	14/12/2010 13:00	355	m^3/s
	Peak Flow excluding Wivenhoe	06/12/2010 23:00	273	m^3/s

MID DECEMBER EVENT				
Location	**Calculated**	**Date/Time**	**Value**	**Unit**
Somerset Dam	Peak Inflow	20/12/2010 00:00	856	m^3/s
	Peak Water Level	20/12/2010 14:00	100.45	m AHD
	Inflow Volume		133,320	ML
	Peak Outflow	20/12/2010 14:00	413	m^3/s
	Outflow Volume		155,656	ML
Wivenhoe Dam	Peak Inflow	20/12/2010 14:00	1,847	m^3/s
	Peak Water Level	21/12/2010 03:00	68.24	m AHD
	Inflow Volume		450,885	ML
	Peak Outflow	21/12/2010 19:00	1,462	m^3/s
	Outflow Volume		372,666	ML
Lowood	Peak Flow including Wivenhoe	22/12/2010 01:00	1,658	m^3/s
	Peak Flow excluding Wivenhoe	21/12/2010 08:00	278	m^3/s
Moggill	Peak Flow including Wivenhoe	22/12/2010 17:00	1,697	m^3/s
	Peak Flow excluding Wivenhoe	20/12/2010 03:00	605	m^3/s

LATE DECEMBER EVENT				
Location	**Calculated**	**Date/Time**	**Value**	**Unit**
Somerset Dam	Peak Inflow	27/12/2010 16:00	532	m^3/s
	Peak Water Level	28/12/2010 12:00	99.99	m AHD
	Inflow Volume		127,072	ML
	Peak Outflow	29/12/2010 04:00	818	m^3/s
	Outflow Volume		151,854	ML
Wivenhoe Dam	Peak Inflow	28/12/2010 05:00	1,681	m^3/s
	Peak Water Level	29/12/2010 13:00	69.36	m AHD
	Inflow Volume		555,822	ML
	Peak Outflow	31/12/2010 02:00	1,591	m^3/s
	Outflow Volume		488,992	ML
Lowood	Peak Flow including Wivenhoe	30/12/2010 08:00	1,739	m^3/s
	Peak Flow excluding Wivenhoe	28/12/2010 14:00	1,168	m^3/s
Moggill	Peak Flow including Wivenhoe	31/12/2010 00:00	1,808	m^3/s
	Peak Flow excluding Wivenhoe	29/12/2010 05:00	1,453	m^3/s

Generally, it appears the hydrologic models satisfactorily reproduced the inflows to Somerset and Wivenhoe Dams during this Event. The flood events were managed primarily to minimise disruption to rural life in the valleys of the Brisbane and Stanley Rivers. There were no known adverse impacts to urban areas downstream of Moggill as a result of the December Events.

Strategy W1 was used to manage the events at Wivenhoe Dam until the dam level exceeded 68.5m AHD, then Strategy W3 was used because the conditions for using Strategy W2 could not be satisfied. Strategy S2 was used to manage the events at Somerset Dam.

7. CONCLUSIONS AND RECOMMENDATIONS

Seqwater is required to report on the effectiveness of the operational procedures contained in the Manual after each flood event. Generally the Manual's procedures were able to be applied very effectively during the October 2010 and the December 2010 Flood Events.

The October and December Events were of a scale that allowed the Manual's procedures to be used to safely contain the floods within the Dam. Any significant downstream urban damage was prevented, while the impact on rural areas downstream of the Dams was minimised.

Seqwater received a number of complaints from various stakeholders downstream of the Dams during and after the October and December Flood Events. Stakeholders suggested more water should be retained in the Dams during flood events to further minimise rural impacts (particularly in relation to bridge closures). Seqwater believes adopting this approach could potentially increase the risk of significant impacts occurring to urban areas below Moggill in a large flood event, and therefore does not recommend this approach be adopted.

Overall, the Manual continues to be an appropriate document to guide operational decision-making for flood events of the size experienced in October 2010 and December 2010.