Bulimba Creek Flood Study
Volume 1 of 2

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Bulimba Creek Flood Study

Volume 1 of 2

Prepared by Brisbane City Council's, City Projects Office

October 2014

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Brisbane City Council

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Document Control: CA14/972456

Issue No.	Date of Issue	Amdt	Prepared By (Author/s)		Reviewed By		Approved for Issue (Project Director)
			Initials	RPEQ Number and Signature	Initials	RPEQ Number and Signature	Initials
Report A – Issue 1	June 2011	2	CPG		EC		EC
Report A – Issue 2	**Oct 2014**		**CPG**	9410	**EC**	10498	**EC**
Report B – Issue 1	June 2011	2	CPG		EC		EC
Report B – Issue 2	**Oct 2014**		**CPG**	9410	**EC**	10498	**EC**
Report C – Issue 1	June 2011		CPG		EC		EC
Report C – Issue 2	**Oct 2014**		**CPG**	9410	**EC**	10498	**EC**
Report D – Issue 1	April 2008		RM		EC		KM
Report D – Issue 2	June 2011		CPG		EC		EC
Report D – Issue 3	**Oct 2014**		**CPG**	9410	**EC**	10498	**EC**
Report E – Issue 1	Nov 2007		SG		EC		KM
Report E – Issue 2	June 2011		SG		CPG		EC
Report E – Issue 3	**Oct 2014**		**SG**	14036	**CPG**	9410	**EC**
Report F – Issue 1	June 2011	1	CPG		EC		EC
Report F – Issue 2	**Oct 2014**		**CPG**	9410	**EC**	10498	**EC**
Report G – Issue 1	Jul 2013		MG		EC		EC
Report G – Issue 2	**Oct 2014**		**MG**	**09266**	**EC**	10498	**EC**

Bulimba Creek Flood Study

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Executive Summary

Introduction

Bulimba Creek is one of Brisbane's major creek systems. Its catchment covers an area of 125 km^2 and includes a number of Brisbane's southern and eastern suburbs. Bulimba is the second largest of Brisbane's creeks with only Oxley Creek being larger with an area of 258 km2. The creek originates at an elevation of approximately 70m AHD (Australian Height Datum) in Stretton, northwest of the Gateway Motorway. It then flows through the suburbs of Runcorn, Sunnybank, Macgregor, Eight Mile Plains, Wishart, Mansfield, Carindale, Carina and Tingalpa before discharging into the Brisbane River at Murarrie. The majority of the main channel remains in a relatively natural state.

The tributaries of Bulimba Creek are only partly retained in their natural condition with many sections being heavily modified. The main tributaries and their respective catchment areas are listed below. A catchment location map of Bulimba Creek and its main tributaries is shown in **Figure 1**.

Tributary	**Catchment Area(km^2)**
Mimosa Creek	6.8
Bulimba Creek East Arm	14.8
Newnham Road Tributary (no formal name)	3.8
Spring Creek	5.0
Salvin Creek	5.4
Phillips Creek	4.2
Tingalpa Channel (no formal name)	13.2
Hemmant Channel (no formal name)	6.9
Lindum Creek	4.8

The Bulimba Creek Catchment is long and narrow, with a steeper gradient in its upper reaches and flatter/wider flood plains in the lower reaches. The lower reaches of the Creek meander extensively and are tidally influenced.

Most of the catchment is residentially developed with some industrial and commercial zones though some rural and bushland areas also exist. There are frequent transport crossings of the main waterway including road and rail bridges, pedestrian/bikeway bridges and causeways.

Records of flood levels along Bulimba Creek have been collected since the 1960s. A major flood study was prepared in the early 1990s to estimate flood discharges and likely flood levels and extents. Since this time more comprehensive records of additional flooding and catchment rainfall have been collected to be used in developing and calibrating more refined flood models.

Much of the Bulimba Creek flood plain has been developed in recent years and consequently has benefitted from modern knowledge and standards around flooding. However there are some areas adjacent to Bulimba Creek waterway and its tributaries that were developed before current standards were in place and consequently may be flood liable. Potential options to reduce flooding have been looked at in previous flood studies and are reconsidered in this report.

Study Objectives

The present flood study was undertaken to:

1. Review and update the existing hydrology and hydraulic models
2. Calibrate and verify hydrology and hydraulic models so that these are capable of regenerating recorded flood levels to an acceptable accuracy
3. Undertake design event modelling and provide peak flood levels and flood discharges for design floods with Average Recurrence Intervals (ARI) of 2, 5, 10, 20, 50 and 100 years using Duration Independent Storms (DIS)
4. Identify the areas subject to flooding and review potential flood mitigation options as recommended in previous flood studies
5. Collate results/findings of flood modelling undertaken previously with HEC-RAS hydraulic model on selected tributaries: Newnham Road Tributary, Phillips and Salvin Creeks (Lindum Creek, Spring Creek, Hemmant Channel and Tingalpa Channel are not included in this report).

Study Elements

The Bulimba Creek Flood Study 2011(BCFS, 2011) was carried out in several stages, which form separate reports within this document:

Report A:	Model Calibration
Report B:	Design Event Modelling
Report C:	Flood Mitigation Assessment
Report D:	Newnham Road Tributary Flood Investigation
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Report A – Model Calibration

The Bulimba Creek Flood Study Model Calibration Report describes:

- the development of a hydrological model using the WBNM computer package for the Bulimba Creek Catchment to estimate flood discharges, and the calibration of this model against available hydrographical information
- the development and calibration of a hydraulic model using the MIKE11 computer package for Bulimba Creek, East Arm of Bulimba Creek and Mimosa Creek to reproduce recorded flood heights and estimated flood discharges to an acceptable accuracy.

Hydrological and hydraulic model calibrations involve simulating recorded rainfall data for historical rainfall events through the developed hydrology and hydraulic models. Selection of model parameters for the catchment was undertaken such that the models could reproduce the recorded flood level information for the historical events to an acceptable accuracy.

Model calibration was undertaken using recorded rainfall data for March 1992, January 1994 and March 2001 storms. Model verification was made using November 2004 and May 1996 storm events. Appendices C, D and E summarise the details of the historical rainfall events, results of the model calibration and verification, and boundary conditions adopted for the MIKE11 hydraulic model respectively.

Report B - Design Event Modelling

The models described in the Calibration Report were used to derive a range of design flood information (i.e. flood levels, flows, velocities) for the 2, 5, 10, 20, 50 and 100 year ARI event for the selected Bulimba Creek waterways.

The Design Event Modelling Report summarises the procedure adopted in modelling design events and in predicting flood levels and discharges. Duration Independent Storm temporal patterns were used in the hydrology model WBNM to obtain the rainfall-runoff for the catchment in each design event. Hydraulic modelling was performed assuming ultimate catchment development conditions and considering the existence of waterway corridors. It assumes that revegetation of the creek overbank, for 15m on each side (known as a Minimum Riparian Corridor: MRC[1]), would occur in the future and development would take place up to the Waterway Corridor extent.

Results of the Design Event Analysis are tabulated in **Appendix I** while Flood Inundation plots are included in Bulimba Creek Flood Study **Volume 2**. Hydraulic Structure Reference Sheets (HSRS) are included in **Appendix J**. HSRS describes the details of the structures modelled in the MIKE11 model including their hydraulic properties.

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[1] Minimum Riparian Corridor (MRC): Land and Vegetation within and directly adjacent to the waterway is defined as the riparian corridor. MRC is the width that needed for the waterway to preserve its ecological and hydrological standards in maintaining the waterway health. It provides habitat to terrestrial and aquatic organisms, traps sediments and nutrients to improve water quality, helps to increase bank stability.

Report C - Flood Mitigation Assessment

Flood Mitigation Options

When examining the flooding areas of Bulimba Creek it can be seen how successful modern town planning has been in keeping recent development away from the creek corridors and above the Defined Flood[2] level. However, there are areas subdivided in an earlier age when standards were different. When the standards change, it is impractical to re-develop the city and these areas exist as liable to flooding.

Flood liable areas adjacent to Bulimba Creek and its tributaries were identified using the results of the design event analysis. Flood mitigation options recommended in previous flood studies were examined and possible future mitigation measures were considered.

The *Bulimba Creek Flood Study*, 1992 (BCFS, 1992) included investigation into critical flooding areas of Bulimba Creek and recommended seven potential flood mitigation options out of twenty-one options initially identified. These recommendations were made on the basis of conceptual benefit /cost analysis only.

The BCFS, 1992 recommended the following flood mitigation options:

1. Upgrading of Cleveland Rail bridge crossing
2. Construction of an overflow channel (above the tidal influence area) just downstream of the Gateway Arterial.
3. Construction of flood protection levees in Altandi Street at Sunnybank
4. Deweeding of Mimosa Creek from downstream of Klump Road to the confluence with Bulimba Creek
5. Construction of flood protection levees and associated pumping stations around Fursden Road, Wood Avenue, Grey Street, Billan Street and part of Caravan Park.
6. Construction of a detention basin in Toohey Forest Park on Mimosa Creek.
7. Construction of detention basin in Mt Gravatt Park on Mimosa Creek.

However, only the first five options were finally included in BCFS, 1992 as the preferred flood mitigation options.

Findings

The majority of the flood affected properties are located in the Mimosa Creek Catchment in Macgregor and is due partly to the back up of flood water from Bulimba Creek. There also exist clusters of flood affected dwellings adjacent to Bulimba Creek in the vicinity of:

- Altandi and Coultis Street in Sunnybank Hills
- Fursden Road, Wood Avenue, Gray and Billan Streets in Carina
- Boundary and Hamilton Streets in Tingalpa.

[2] Defined Flood Event (DFE): The flood event adopted by Local government for the management of development in the particular locality. Generally 1 in 100 year Average Recurrence Interval (ARI) flood event has been accepted as the preferred DFE

The above flood liable locations were identified in the BCFS, 1992 as were the recommended mitigation measures listed above. Out of the proposed mitigation measures, the Cleveland Rail Bridge widening was undertaken in 1993/94 and de-weeding was carried out on Mimosa Creek to facilitate faster discharge of floodwaters.

The other listed options however, were not recommended and not implemented for the following reasons.

1. Levees are usually only effective in situations where the timing difference between flood peaks from the major waterway and the local catchment (i.e. the catchment that drains to the levee on the protected side) are significant. This allows flood waters from the local catchment to leave the levee-protected area before the major waterway flood arrives. As the Bulimba Creek Catchment is relatively small with only a minor difference in the timing of creek and local flood peaks, a levee in this situation runs the risk of causing greater flooding due to local flows not being able to escape prior to the main flood arriving. Consequently, levees are not an effective flood mitigation measure for Bulimba Creek.

   Levees may promote an unrealistic expectation of flood immunity to residents if the system fails through blockage to the drainage or malfunctioning of the dewatering system. Furthermore, levees cannot be designed to eliminate all flood events and failure would result in significant property damage and an unacceptable risk to life.

2. Proposed detention basins to mitigate flooding in Mimosa Creek in Toohey Forest Park and Mt Gravatt Park displayed incompatibility with environmental rules and community expectations. These detention basins were also considered to increase the flood risk on the community living immediately downstream with the potential for dam break type scenarios to occur. Therefore detention basins were not recommended in the BCFS, 1992 study and are still not identified as a viable option.

3. Construction of an additional overflow (high level) channel downstream of the Gateway Arterial crossing would not be very effective in the proposed location due to the lack of hydraulic gradient in this part of Bulimba Creek. Additionally, such a scheme has the potential to increase flooding downstream as it lowers the natural retention of the flood. This channel would also require regular maintenance including vegetation management, and erosion and sediment control. The necessity of undertaking an archaeological survey had also been identified in the BCFS, 1992.

As with many areas across Brisbane, a long-term, strategic approach would be more effective in delivering flood mitigation for Bulimba Creek. Many buildings are nearing the end of their life-cycle and redevelopment of these areas should be undertaken using current flood planning standards. Future flood mitigation measures would be mostly based on non-structural measures with appropriate land use planning controls, flood-proofed construction techniques and community awareness campaigns helping to minimise flooding and damages during a flood.

Report D - Newnham Road Tributary Flood Investigation

The Newnham Road Tributary Flood Study involved the hydraulic analysis of the waterway from its confluence with Bulimba Creek upstream to adjacent Kentish Street (see **Figure 1.2**), using the HEC-RAS software for steady flow conditions. The purpose of this study is to determine flood levels for the open section of the waterway, which is approximately 1.9km in length.

The HEC-RAS model developed for this study updated an existing HEC-RAS model developed in 2003. Cross section information was based on ground survey data from both a BCC survey of 2001 and private development survey of 2002. Additional information was obtained from Airborne Laser Scanning (ALS) data (2002) and field measurements.

Flow data was obtained from the Bulimba Creek hydrologic model (WBNM), with modification to inflow location points as necessary to account for the coarseness of that model. Calibration of the HEC-RAS hydraulic model was not undertaken due to the lack of recorded flood information. The creek contains a number of physical structures including 11 crossings, 3 drop-structures and a Stormwater Quality Improvement Device (SQID).

Design event modelling was undertaken for the 2, 5, 10, 20, 50 and 100 year ARI events with the inclusion of a Minimum Riparian Corridor (MRC). Peak flood levels for all design events are included in **Appendix I-2**.

Report E - Phillips Creek Flood Investigation

The study involved the establishment of a HEC-RAS hydraulic model to determine flood levels and flooding characteristics for the reach of Phillips Creek from Birdwood Road down to Creek Road, (see **Figure 1.3**) a length of approximately 1.6km.

The section of Phillips Creek immediately upstream of Creek Road was re-aligned in 1984 and 1988 in connection with property development. Within this reach, the creek passes through road crossings at Anzac Road and Gallipoli Road.

Downstream of Creek Road the waterway has been piped underneath the Carindale Shopping Centre and Old Cleveland Road. The waterway passes through a Stormwater Quality Improvement Device (SQID) downstream of Old Cleveland Road and then into Bulimba Creek. Modelling of this complex section of waterway downstream of Creek Road was not included in the investigation.

Cross-section data for the study was based on the ground survey of December 2006 and BCC Airborne Laser Scanning (ALS) data (2002).

Design event modelling was undertaken for the 2, 5, 10, 20, 50 and 100 year ARI events. The Rational Method was used to determine the peak flow data used in the steady state HEC-RAS model. A waterway corridor and Minimum Riparian Corridor (MRC) were incorporated into the HEC-RAS modelling. Peak flood levels and discharges for all design events are tabulated in **Appendix I-2**.

Report F - Salvin Creek Flood Investigation

The flood investigation undertaken involved the establishment of a HEC-RAS model for the Salvin Creek main branch and Glengariff tributary (Refer **Figure 1.4**).

Salvin Creek comprises a main reach which flows from Cavendish Road down to the confluence with Bulimba Creek, and a tributary (Glengariff Tributary) which flows from the Pine Mountain quarry and joins the main reach approximately halfway along its course near Glengariff Street.

A HEC-RAS model was initially developed in 2003 with cross section information based on ground survey of 2001 and 2003. In 2004, additional cross sections were extracted from the ALS data of 2002 to extend the Main Reach from Glenheaton Court to the Bulimba Creek confluence. It was further refined and updated in 2007 and 2009.

Calibration of the HEC-RAS hydraulic model was not undertaken due to the unavailability of recorded information. Design event modelling was undertaken for the 2, 5, 10, 20, 50 and 100 year ARI events. The Bulimba Creek WBNM hydrology model provided the flow inputs to the steady state HEC-RAS model.

Peak flood levels and discharges for all design events are tabulated in **Appendix I-2**.

Report G: Rare & Extreme Events including Climate Change Analysis

Councils Flood study procedure now requires estimating flooding extents and flood hazard areas for rare to extreme flood events, which included 200, 500, 2000 year ARI events and the Probable Maximum flood (PMF). Modelling of the Climate Variability scenarios for 2050 and 2100 are also required to quantify the impacts of climate change.

Hydrology and hydraulic modelling of the Bulimba Creek with 200, 500 and 2000 year ARI events and also the Probable Maximum flood were undertaken in 2012/2013. An Addendum report was included in to the Bulimba Creek Flood Study including these investigations: "Extreme Events and Climate Change Analysis".

Bulimba Creek Catchment

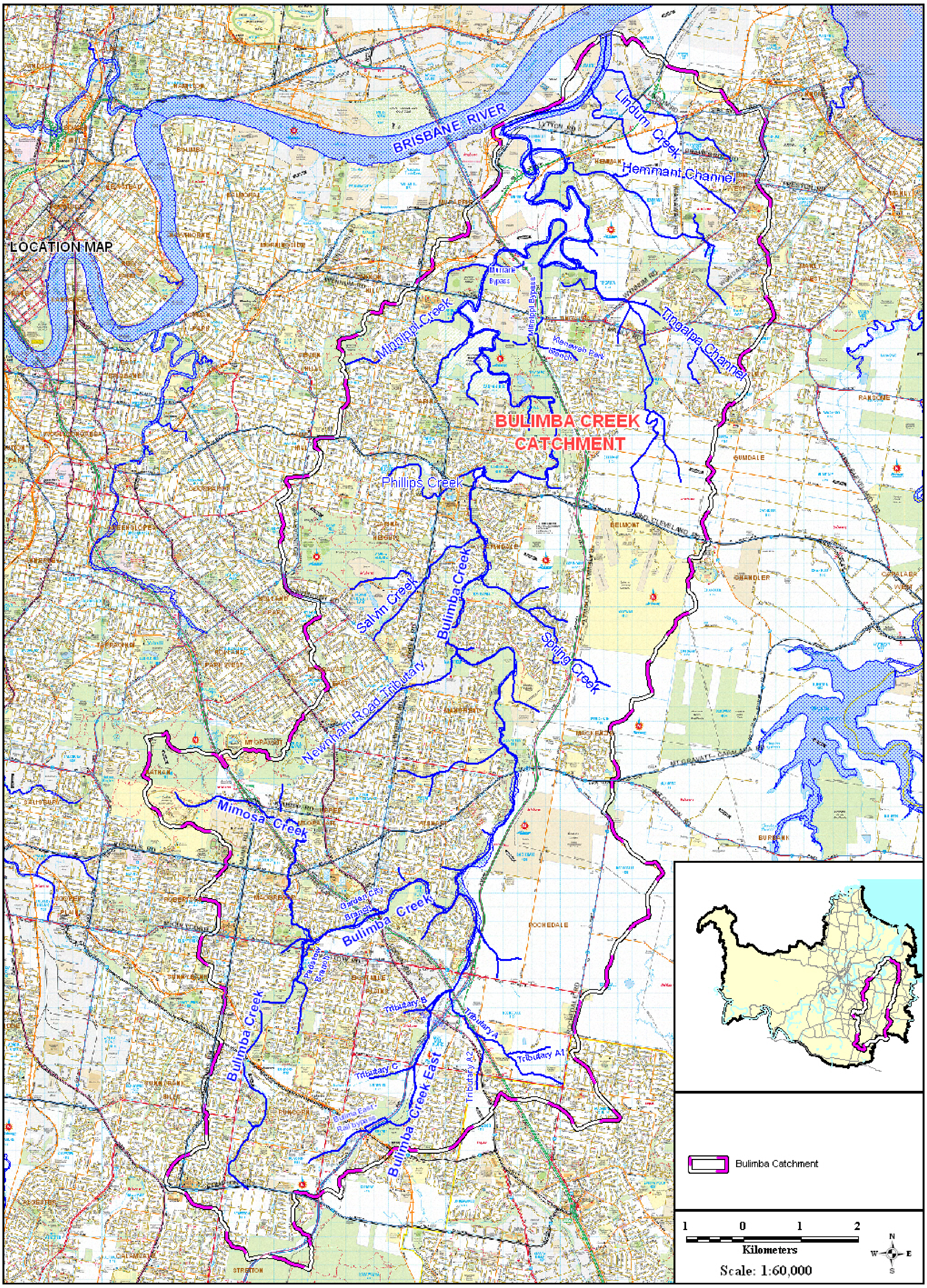

Figure 1-Bulimba Creek Catchment Location Map

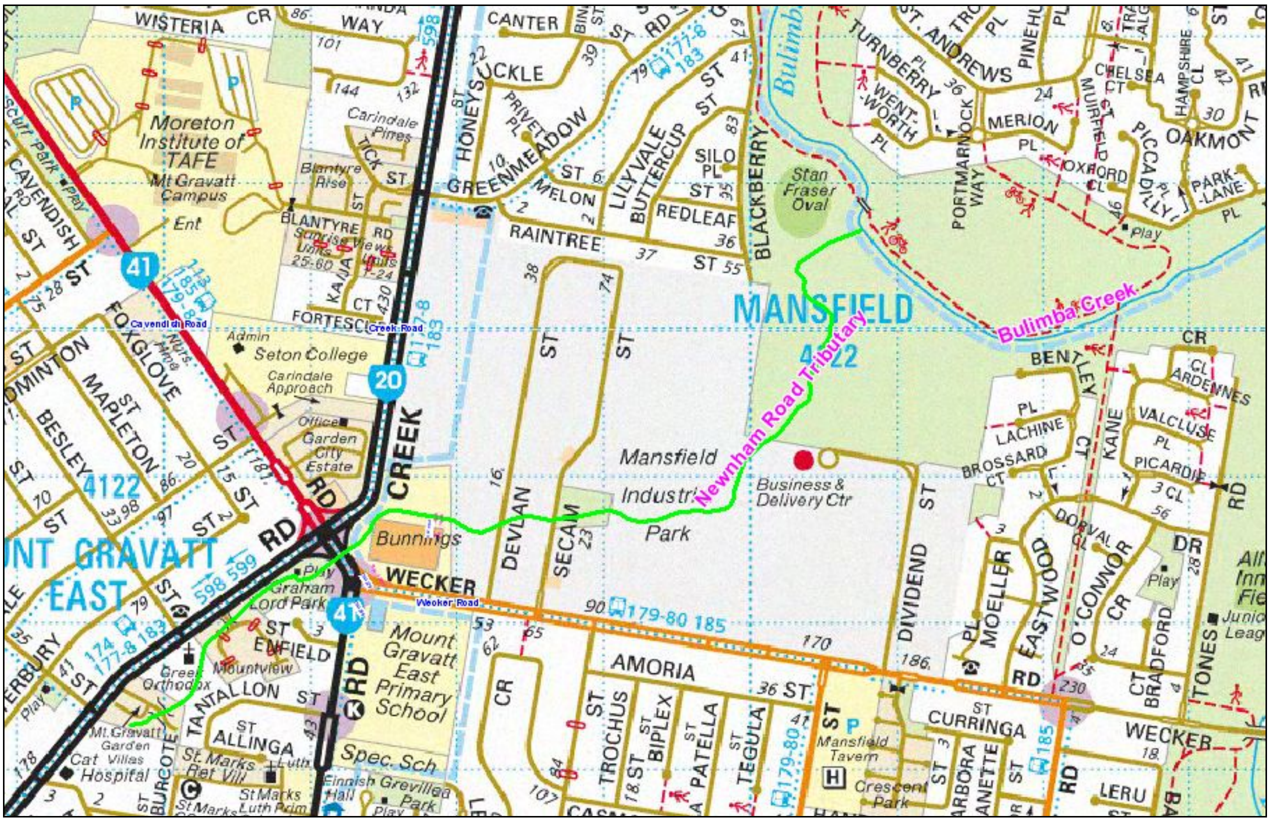

Figure 1.2: Newnham Road Tributary Location Map

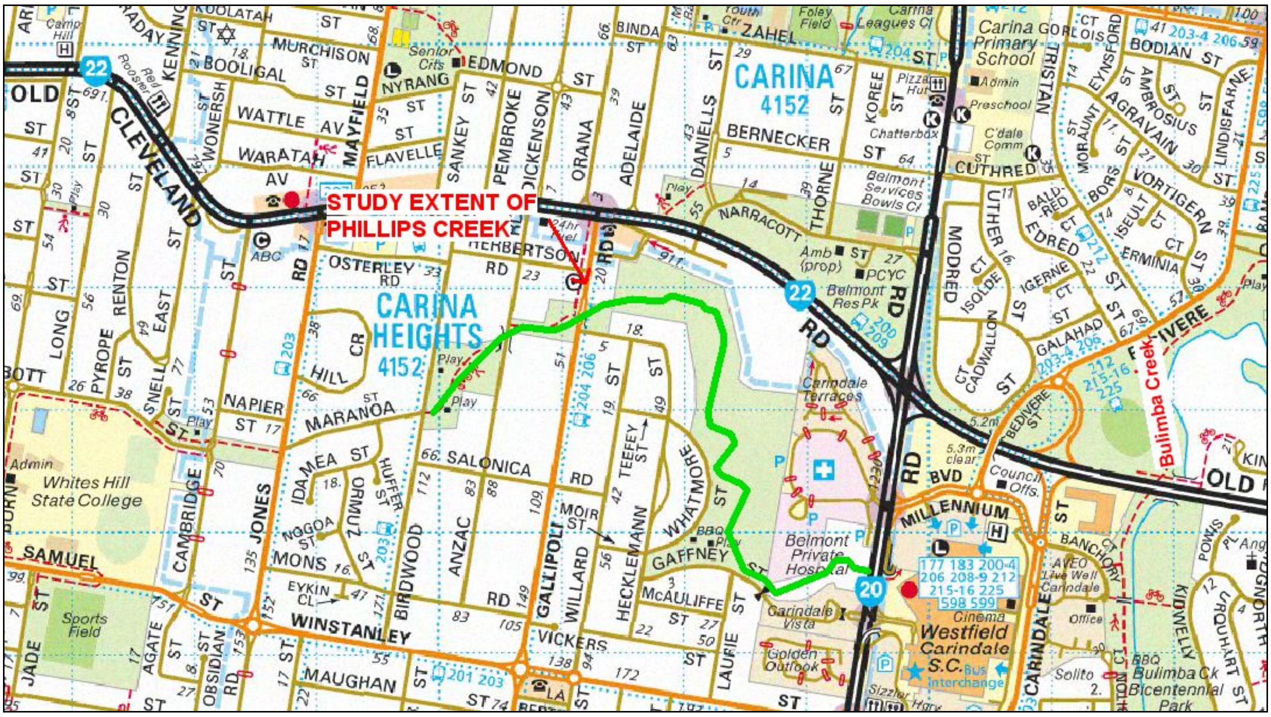

Figure 1.3: Phillips Creek Location Map

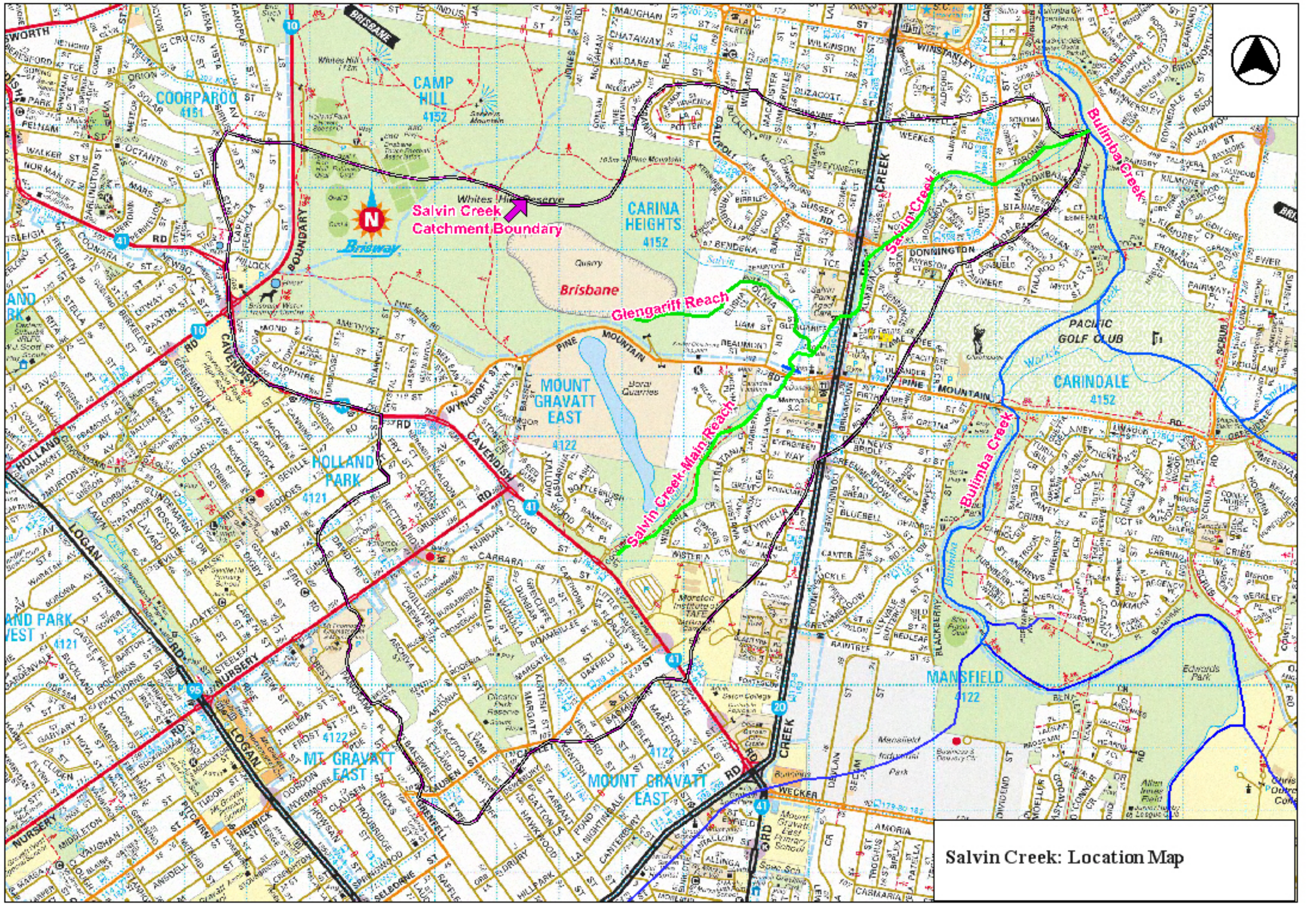

Figure 1.4: Salvin Creek Location Map

Bulimba Creek Flood Study

Report A – Model Calibration

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October 2014

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1.0 Introduction

The aim of the *Bulimba Creek Flood Study 2011*(BCFS, 2011) has been to review, update and extend the available hydrology and hydraulic models for the creek allowing revised flood discharges and flood levels to be estimated and flooding issues to be detailed.

The *Bulimba Creek Flood Study* - *Report A: Model Calibration* describes the development of the current hydrological model using the Watershed Bounded Network Model (WBNM) software, its calibration against available hydrographical information and its application in estimating flood discharges. It also describes the development of the MIKE11 hydraulic model and its calibration. These calibrated models have been used to derive peak flood discharges and levels for a range of design flood events from the 2 year Average Recurrence Interval (ARI) to 100 year ARI, for the Bulimba Creek catchment. These results are included in *Report B: Design Event Modelling*.

2.0 Catchment Description

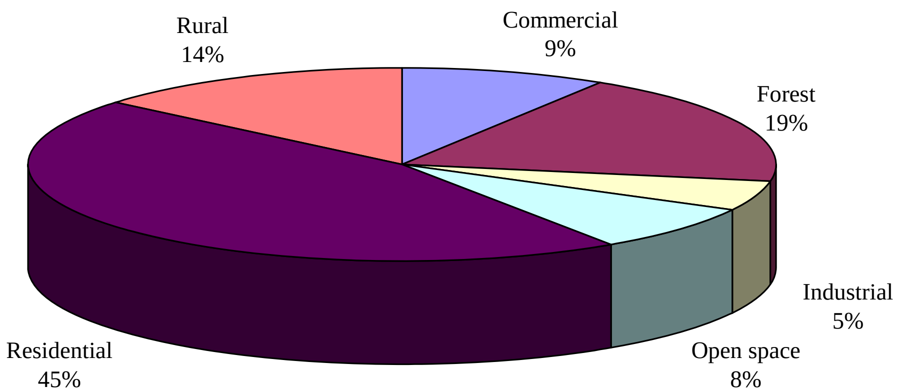
Bulimba Creek is a tributary of the Brisbane River and has a catchment area of 125km^2. It flows through Brisbane's Southern and Eastern suburbs and merges with the Brisbane River downstream of the Gateway Bridge at Murarrie. Tributaries to Bulimba Creek include (listed from upper to lower catchment) Mimosa Creek, Bulimba Creek East, Newnham Creek, Spring Creek, Salvin Creek, Phillips Creek, Tingalpa and Hemmant channels and Lindum Creek. The location of the Bulimba Creek Catchment is shown in **Figure 2.1.** The catchment areas serviced by each tributary are listed in **Table 2.1**.

Table 2.1: Catchment Areas of Selected Tributaries

Item	**Tributary**	**Area(Km^2)**
1	Mimosa Creek	6.8
2	Bulimba Creek East Arm	14.8
3	Newnham Creek	3.8
4	Spring Creek	5.0
5	Salvin Creek	5.4
6	Phillips Creek	4.2
7	Tingalpa Channel (no formal name)	13.2
8	Hemmant Channel (no formal name)	6.9
9	Lindum Creek	4.8

The main branch of Bulimba Creek, the East Arm, and the Mimosa Creek tributary are moderately steep in their upper reaches. The main branch flattens out in the lower sections and meanders as it nears the confluence with Brisbane River. The lower portion of Bulimba Creek is tidal and consists of wetlands and wide floodplains.

Most of the catchment is residentially developed with some rural, bushland, commercial and industrial zoning. Waterway corridors exist along all waterways within the catchment with a significant amount of open space and park along the main creek corridor. **Figure 2.2** shows the break-up of present land use types.



There are a number of highly modified sections of creek (i.e. having been channelised or diverted). These areas are located between Compton Road and Beenleigh Road on the main branch and in the vicinity of the Beenleigh rail line and the Gateway Motorway on the Bulimba East Arm.

Numerous hydraulic structures exist across Bulimba Creek and its tributaries, including road, pedestrian, bikeway, rail and motorway crossings; services crossings; and flow control structures. The majority of hydraulic structures are included in the hydraulic model.

Bulimba Creek Flood Study

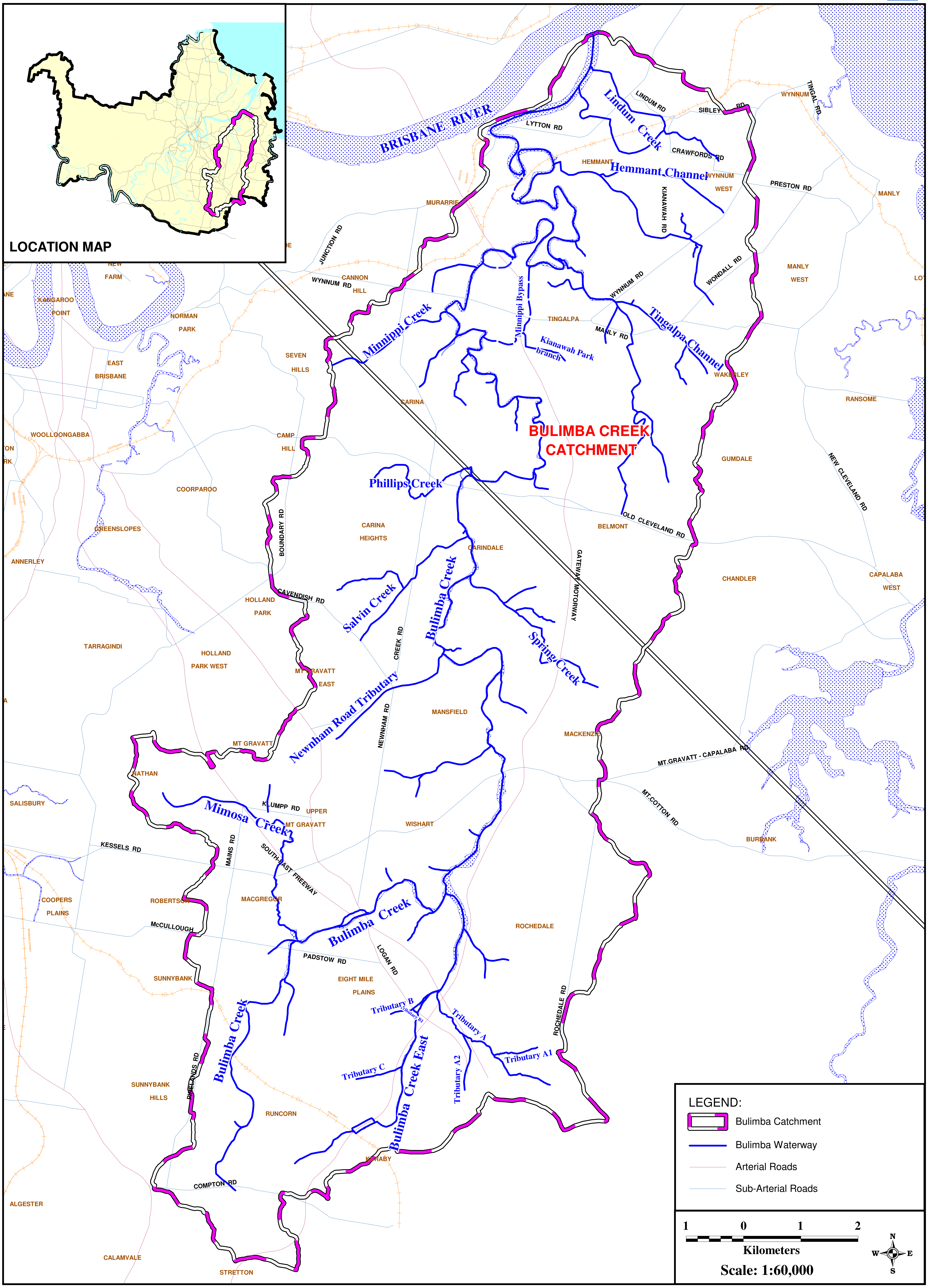


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Figure 2.1 Location Map of Bulimba Creek

3.0 Previous Studies on Bulimba Creek

A number of studies have been commissioned and completed for Bulimba Creek and its tributaries. These studies provide valuable information on the creek's topography, hydrology, hydraulics and flood mitigation potential. A brief summary of these reports is provided below.

3.1 Gateway Arterial Road: Lower Bulimba Creek Hydraulic Study (1985)

In 1985 Gutteridge Haskins & Davey (GHD) Pty Ltd undertook a hydraulic study to assess the impact of the Gateway Motorway project. The study was prepared by GHD for Crooks Michell Peacock Stewart Pty Ltd, Queensland on behalf of Main Roads Department (QMRD), Brisbane, Qld.

As a part of the study, cross-sections were surveyed in the lower reaches of Bulimba Creek. These cross sections were available for use in hydraulic models prepared by the Brisbane City Council.

3.2 Bulimba Creek Flood Study (1992)

Brisbane City Council commissioned Connell Wagner to undertake the Bulimba Creek Flood Study in 1992. Key outcomes of the study were the development of a calibrated hydrologic model (RORB) and hydraulic model (RUBICON) for the catchment. Mimosa Creek and the uppermost reaches of the main branch and East Arm tributary were modelled in separate HEC-2 models. A range of flood mitigation options were investigated and costed.

Survey data for the study was obtained from Council ground surveys taken between 1980 and 1991, and the GHD study on *Gateway Arterial Road: Lower Bulimba Creek Hydraulic Study (1985)*.

The RORB model was calibrated against a Water Resources Commission gauge at Wecker Road using data obtained between 1971 and 1990. The RUBICON model was calibrated against recorded flood levels from six major events that occurred between 1971 and 1984 at several locations throughout the catchment.

3.3 Master Drainage Plan and Flood Study: Hemmant-Wynnum West Area (1997)

Brisbane City Council commissioned the *Master Drainage Plan and Flood Study: Hemmant-Wynnum West Area* (1997) to assess flooding and water quality concerns and review flood regulation lines within the portion of the Bulimba Creek catchment serviced by the Hemmant channel. A detailed RAFTS hydrology model was developed while hydraulic modelling for that study was performed using MIKE11. Flood mitigation strategies were investigated as part of the study.

3.4 Bulimba Creek: Catchment Management Plan (1998)

The *Bulimba Creek Catchment Management Plan* was developed by Council. It included a hydrological analysis of the catchment and considered a range of flow detention devices within the catchment. Initially, a RORB hydrological model was created using parameters derived from the 1992 *Bulimba Creek Flood Study*. The RORB model was later converted to the Unified River Basin Simulation Model (URBS) hydrology model format.

3.5 Bulimba Creek (East) Catchment: Stormwater Management Plan (2001)

Council undertook the *Bulimba Creek (East) Catchment Stormwater Management Plan* (SMP) to evaluate flooding, drainage, water quality and environmental conditions within the Bulimba Creek East catchment. The hydrology model used for this study was developed using WBNM, and hydraulic modelling was completed using MIKE11. An important element of the SMP was the definition of updated flood inundation and flood regulation lines which accounted for the construction of the Gateway Motorway through that part of the catchment. Other key outcomes of the study were a water quality analysis and a preliminary revegetation strategy.

3.6 Gumdale to Tingalpa Stormwater Management Plan (1998)

The *Gumdale to Tingalpa Stormwater Management Plan* was prepared in 1998 to evaluate flooding, drainage, water quality and environmental conditions within that part of the catchment. The hydrology model was developed using RAFTS software while hydraulic modelling was completed using MIKE11. Key outcomes of the study were defining flood inundation and flood regulation lines and a broad revegetation strategy.

4.0 Available Data

4.1 Hydrologic Data

4.1.1 Rainfall Data

A number of pluviograph stations exist within and adjacent to the Bulimba Creek catchment. Details of these stations are summarised in **Table 4.1** and their locations are shown on **Figure 4.1**. Most of the pluviograph stations have only been installed in recent years and widespread data is only available for floods that were associated with May 1996, March 2001 and November 2004 rainfall events. These storms were concentrated in the upper part of the catchment. The selection of rainfall events for model calibration and verification is discussed further in **Section 6: Model Calibration**.

Table 4.1: Pluviograph Information

Station ID	Location	Operation Period	Rainfall data availability				
			16/03/92 Event	19/01/94 Event	01/05/96 Event	09/03/01 Event	07/11/04 Event
BMR138	Griffith University, Mt Gravatt	Feb 1989 to current	*	*	*	*	*
P_R029	Perrin Creek, Balmoral Works Depot, Morningside	Nov 1991 to Oct 2005	*		*	*	*
W_R521	Wynnum Creek, Pine Street Works Depot, Wynnum	Jan 1994 to Feb 2001		*	*		
BMR527	Doughboy Parade, Hemmant	Jan 1994 to current		*	*	*	*
BMR706	Old Cleveland Road, Carindale	Jan 1994 to current		*	*	*	*
NMR548	Joachim Street, Holland Park	Feb 1994 to current		*			
NMR833	Cnr Cavendish & Boundary Roads, Coorparoo	Feb 1994 to Dec 2004			*	*	*
BMR709	School Road, Rochedale	Feb 1994 to Jan 2000			*		
BMR830	Merion Place, Carindale	Feb 1994 to current			*	*	*
BMR803	Greenwood Street, Wishart	Feb 1994 to current			*		*
NMR596	Norman Creek, Tarana St at Camp Hill	Mar 1998 to current				*	*
LTR141	Lota Creek, Rickertt Road, Ransome	Jun 1999 to current					*
OXR114	Oxley Creek, Calamvale Telstra, Calamvale	Feb 1989 to current	*	*		*	*
S_R205	Scrubby Creek- Gowan Road, Calamvale (Logan CC)	Feb 1999 to current					*
LTR755	Lota Creek, Harman Rec Reserve, Manly	Nov 1999 to current					*
BMR836	Bulimba Creek, Gagarra Street, Eight Mile Plains	Jan 2000 to current					*
W_R837	Wynnum Bowls Club, Wynnum	Oct 2001 to current					*
SLR210	Millers Road, Underwood (Logan CC)	-					*

Bulimba Creek Flood Study

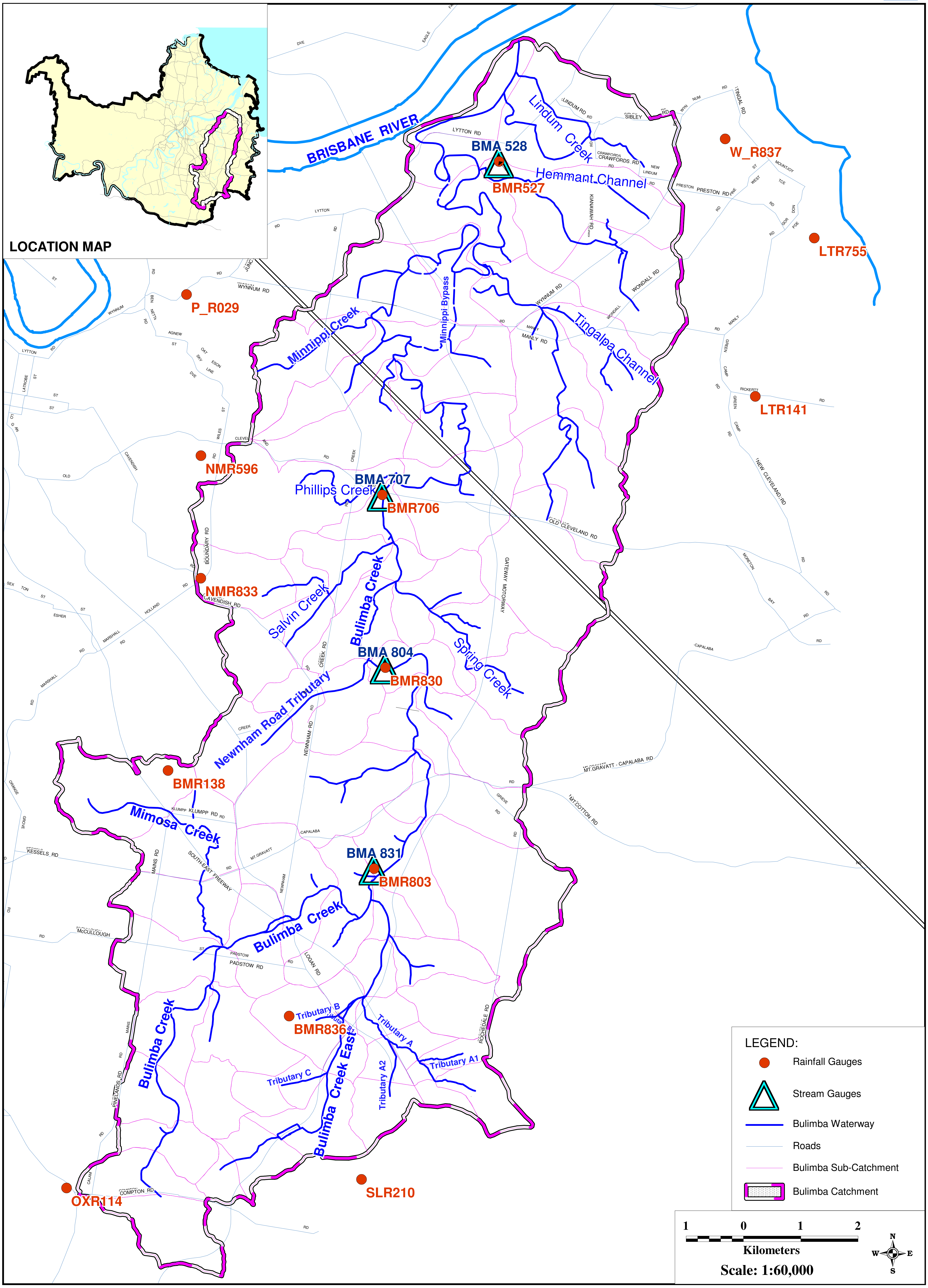

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Figure 4.1: Rainfall Gauges (Pluviograph) and Stream Gauge Locations in Bulimba Catchment

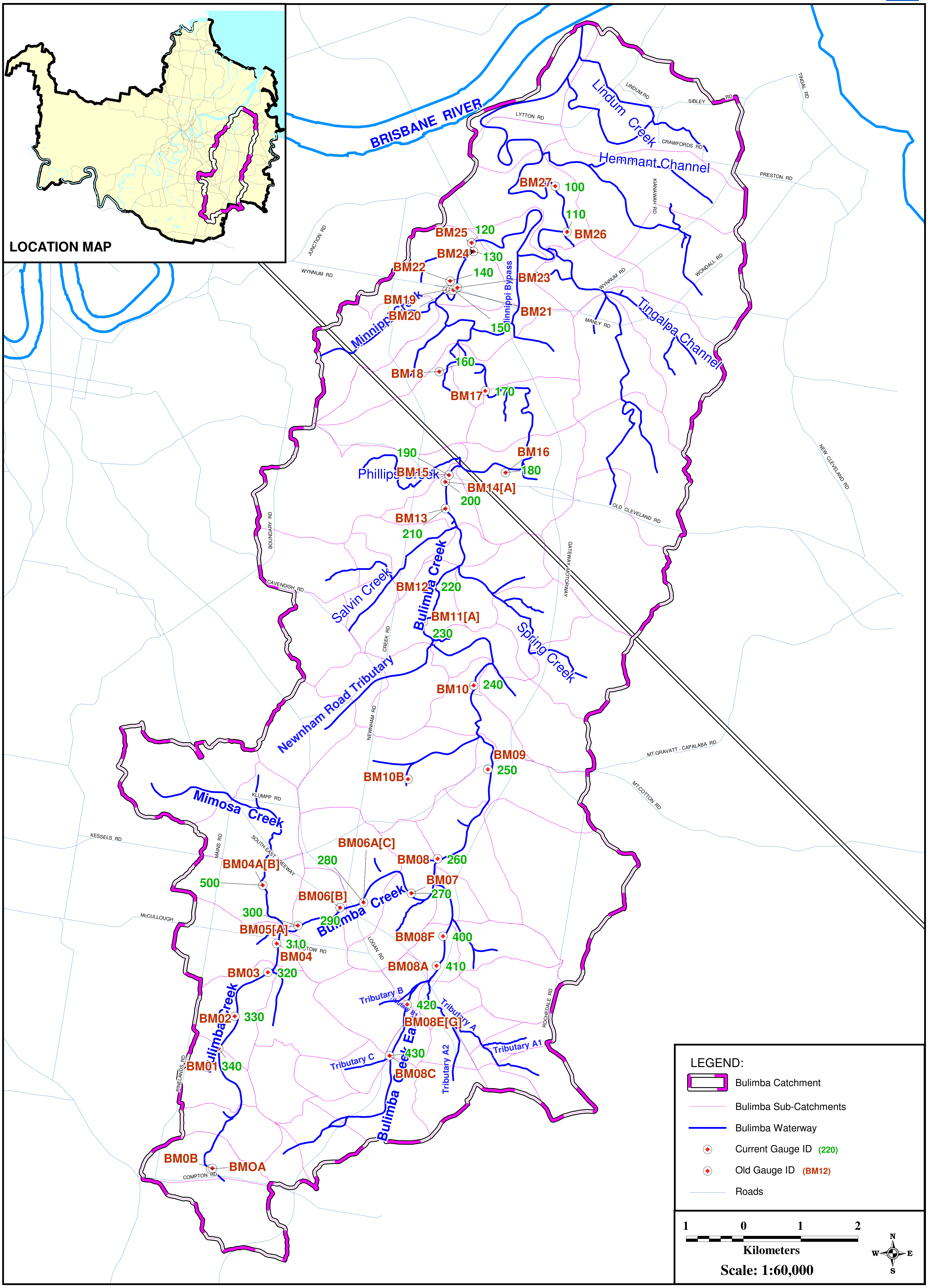

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Figure 4.2 : Maximum Height Gauge Locations in Bulimba Catchment

4.1.2 Stream Height Data

Continuous Stream Height Gauges

The stream height of Bulimba Creek has been measured since 1971. The earliest records came from a continuous stream height gauge located approximately 1km downstream of the Wecker Road, Mansfield crossing. The Water Resources Commission (WRC) operated this gauge until 1996. In 1994, Council installed another gauge on the opposite side (i.e. in the right bank) of Bulimba Creek at Merion Place, Carindale. The records from these two gauges provide the longest continuous stream height record for Bulimba Creek. Since 1994, Council has installed a number of other continuous stream height gauges in the Bulimba Creek catchment. Details of the locations of all these gauges are provided in **Table 4.2** and their locations are shown on **Figure 4.2.**

Table 4.2: Stream Gauge Information

Station ID	Location	Operating Period
WRC	Wecker Road Gauge, Mansfield	July 1971 to 1996
BMA831	Merion Place, Carindale	February 1994 to current
BMA528	Doughboy Parade, Hemmant	January 1994 to current
BMA707	Old Cleveland Road, Carindale	January 1994 to current
BMA804	Greenwood Street, Wishart	February 1994 to current

The Department of Natural Resources and Water (DNRW) provided stream height data for the Wecker Road gauge for the period prior to 1994. The levels were taken from gauge zero, which equates to 5.165m Australian Height Datum (AHD). Out of the available stream height gauging stations, only the Wecker Road/Merion Place gauging stations provide recorded data for all events considered for model calibration and validation. **Table 4.3** lists the recorded peak flood levels at the stream gauges for flood events since 1992. These records were used in the calibration and verification stage of both the hydrologic and hydraulic models.

Table 4.3: Recorded Flood Levels (m AHD) at Stream Gauges

Gauging Station	MIKE11 Chainage (m)	Recorded Flood levels in mAHD				
		Calibration Events			Verification Events	
		March 1992	January 1994	March 2001	May 1996	November 2004
BMA804 – Greenwood Street, Wishart	8570			NR	22.49	22.77
WRC Gauge – Wecker Road	13965	10.65	10.08			
BMA831 – Merion Place, Carindale	13965			11.99	11.32	11.58
BMA707 – Old Cleveland Road, Carindale	17870		4.87	6.83	6.05	6.03
BMA528 – Doughboy Parade, Hemmant	34440			1.75	NR	NR

NR – No Record

Maximum Stream Height Gauges

Council also operates gauges that record only the maximum height of flooding at selected locations. These are called Maximum Height Gauges (MHGs) and have been installed at a number of places in Bulimba Creek. Maximum Height Gauge readings are available for flooding events since 1976.

Currently, there are twenty-six MHGs on the main branch of Bulimba Creek, five gauges on the East branch and one gauge on Mimosa Creek. **Table 4.4** provides details of the MHG locations and recorded data are listed in **Table D1** in **Appendix D**. **Figure 4.2** shows the location of the MHGs with new and old gauge identification numbers. The availability of MHG data for each storm event was adopted as one of the criteria in selecting calibration events.

Table 4.4: Maximum Height Gauges Locations

MHG Name		M11 Model Chainage(M)	AMTD(M)	Location Information
New	Old			
Bulimba Upstream Extension				
Closed	BM0B	175	39700	Compton Road D/S
Bulimba Creek Main Branch				
340	1	1800	37165	Beenleigh Road U/S
330	2	2470	36495	Daw Road
320	3	3765	35200	Kimmax Street
310	4	4260	34705	Padstow Road U/S
300	5	4780	34185	Bleasby Road
290	6	5615	33350	Pacific Motorway U/S
280	6A	5985	32980	Logan Road D/S
270	7	7420	31545	Kavanagh Road
260	8	8555	30410	Greenwood Street
250	9	10575	28390	Mt Gravatt-Capalaba Road U/S
240	10	12320	26645	Wecker Road D/S
230	11	14845	24120	Dewdrop Street
220	12	15600	23365	Pine Mountain Road D/S
210	13	17370	21595	Winstanley Street D/S
200	14	17810	21155	Old Cleveland Road U/S
190	15	18025	20940	Old Cleveland Road D/S
180	16	19165	19800	Scrub Road Footbridge U/S
170	17	22305	16660	Fursden Road
160	18	23165	15800	Wood Avenue
Closed	19	25515	13450	Wynnum Road U/S 1
Closed	20	25565	13400	Wynnum Road U/S 2
150	21	25865	13100	Wynnum Road U/S 3
Closed	23	25915	13050	Verdun Street
140	22	26015	12950	Wynnum Road D/S
130	24	26640	12325	Murarrie Road U/S

MHG Name		M11 Model Chainage(M)	AMTD(M)	Location Information
New	Old			
120	25	26780	12185	Murarrie Road D/S
110	26	31165	7800	Fleming Road
100	27	32110	6855	Gross Avenue
Bulimba Creek East Branch				
430	8C	2700	3580	Underwood Road U/S
420	8B/E	3725	2555	Logan Road U/S
410	8A	4600	1680	Miles Platting Road U/S
Closed	8D	5000	1280	Gateway Arterial on ramp
400	8F	5045	1235	Daydream Place
Mimosa Creek				
500	BM4A	2718	56170	Parkway St D/S

4.2 Topographic data

4.2.1 Existing data

Topographic data used for this study was taken from the hydrology and hydraulic studies undertaken prior to 2000. Data for the study was obtained primarily from three other previous studies as stated below (for further details refer to **Section 3**). The topographic data retrieved from these three studies were supplemented by Airborne Laser Scanning (ALS) survey information available in the BCC GIS database.

- *Gateway Arterial Road: Lower Bulimba Creek Hydraulic Study* (1985) provided some surveyed cross section data of the lower reaches of Bulimba Creek (downstream of Old Cleveland Road). That cross section information was adopted in the *Bulimba Creek Flood Study* (1992).
- *Bulimba Creek Flood Study* (1992) included surveyed cross sectional data of Bulimba Creek obtained by Council between 1980 and 1991. This cross section data was extracted from the RUBICON hydraulic model. One constraint in the use of this existing model data is that the extent of modifications to the original survey data is unknown.
- *Bulimba Creek (East Arm) Hydraulic Analysis* (1999) contained a MIKE11 model of the east branch of Bulimba Creek, modelled between Persse Road, Runcorn and Miles Platting Road, Rochedale. Topographic data was taken from the *Bulimba Creek Flood Study* (1992) with some new survey data collected for the study.

The floodplain in the lower reaches of Bulimba Creek, especially downstream of the Gateway Arterial, is very flat. Consequently there is insufficient data to determine accurately the level at which floodwaters break out of the main creek and flow across the floodplain and the resulting flood depths on the floodplain. Therefore, cross-sections extracted from the ALS data were used in combination with existing cross-section information to obtain relevant ground levels.

4.2.2 Aerial photography and ALS surveys

Aerial images taken between 2001 and 2007 are available in the Council's GIS database. These images were helpful in defining existing development within the catchment. In conjunction with site inspections, aerial photographs were used to determine the hydraulic roughness parameters and stages of development as related to hydrologic and hydraulic model details. Aerial images were also helpful in the identification of hydraulic structure locations and their details.

ALS survey data was also used to verify cross section information sourced from previous modelling work. This was done by extracting ALS cross sections and comparing them with modelled data. In several instances significant differences were identified prompting modification of the sections based on ALS data.

4.2.3 New Survey Data

New survey data was acquired at several locations along the creek. Additional cross sections were surveyed to enable the model of Bulimba Creek main branch to be extended up to Compton Road and also to introduce topographic changes in the vicinity of the concrete weir located adjacent Brandon Road.

The Council had conducted cross section surveys for the construction of two new hydraulic structures in 2005/2006 on the Bulimba creek. In addition there were a few cross sections surveyed by the consultant Cardno in conjunction with the Eastern Bus-way Project. These details were also used in this study.

Specifically, new survey data was available in the following locations:

- Bulimba Creek main branch crossing at Logan Road (upstream and downstream, 2005/06)
- Craig Street footbridge over Bulimba Creek (2006)
- in the vicinity of Old Cleveland Road bridge (upstream & downstream) on Bulimba Creek (2006)
- upstream & downstream of the concrete weir located downstream of Brandon Road (2006)
- between Nemies Road and Compton Road (2006).

4.3 Hydraulic structures

As-constructed drawings and design plans of existing bridges and culverts on Bulimba Creek and its tributaries were obtained from Council records, Department of Main Roads and Queensland Railways. These plans provided additional topographic and structure information, which was included in the hydraulic model. The total number of hydraulic structures modelled in the MIKE11 model is sixty. These crossing structures include:

- 18 road bridges
- 8 foot/bikeway bridges
- 2 railway bridges
- 31 sets of road culverts
- 1 concrete weir.

5.0 Hydrologic and Hydraulic Modelling

5.1 Introduction

Hydrology and hydraulic models were developed for the Bulimba Creek catchment in the present study. The hydrology model simulates the rainfall-runoff in the catchment and derives the outflows from each sub-catchment. The hydraulic model analyses the movement of floodwaters through the creek branches and hydraulic structures to identify the general flow behaviour and resulting flood depths.

The WBNM (2003 version 1.03, June 2005) hydrologic model was selected to model the Bulimba Creek catchment and further information on the model including model theory is available at the web site http://www.uow.edu.au/eng/cme/research/wbnm.html.

The MIKE11 (DHI version 2005) hydraulic model was used to assess the hydraulic behaviour of Bulimba Creek. This model can simulate steady flow as well as unsteady flow behaviour in creeks. Further information on the model is available at the web site http://www.dhigroup.com.

5.2 Hydrologic model set up

A WBNM hydrologic model was developed for the full Bulimba Creek catchment. The subcatchment layout adopted in the RORB hydrology model of the 1992 *Bulimba Creek Flood Study* formed the basis for the development of the new sub-catchment layout for the WBNM hydrologic model.

The Bulimba Creek catchment was divided into 76 smaller catchments for use with the WBNM hydrologic model. The natural topography of the catchment, location of hydraulic structures along the creek and major roads running through the catchment influenced the identification of subcatchment boundaries. Of the 76 sub-catchment areas, the main branch of Bulimba Creek contains 53, the East branch contains 20 and Mimosa Creek contains the remaining 3. Subcatchment areas, their centroid and outlet coordinates were determined with the help of Councils GIS data. The Bulimba Creek subcatchment layout adopted in the WBNM model is shown in **Figure 5.1**.

Land use information from Brisbane City Plan (2000), was used to determine existing fractions of imperviousness for each subcatchment (together with aerial photography). The impervious fraction values of sub-catchments were determined in accordance with **Table 4.05.1** of the *Queensland Urban Drainage Manual* (DNRW, 2007). The impervious fractions adopted for each category of land development is listed in **Table 5.1**.

Computed details of subcatchment areas, centroid and outlet coordinates of subcatchments for the WBNM hydrology model are provided in **Table A1** (**Appendix A**). The relative proportions of development in each subcatchment for the existing and ultimate land use also provided in **Table A2** (**Appendix A**).

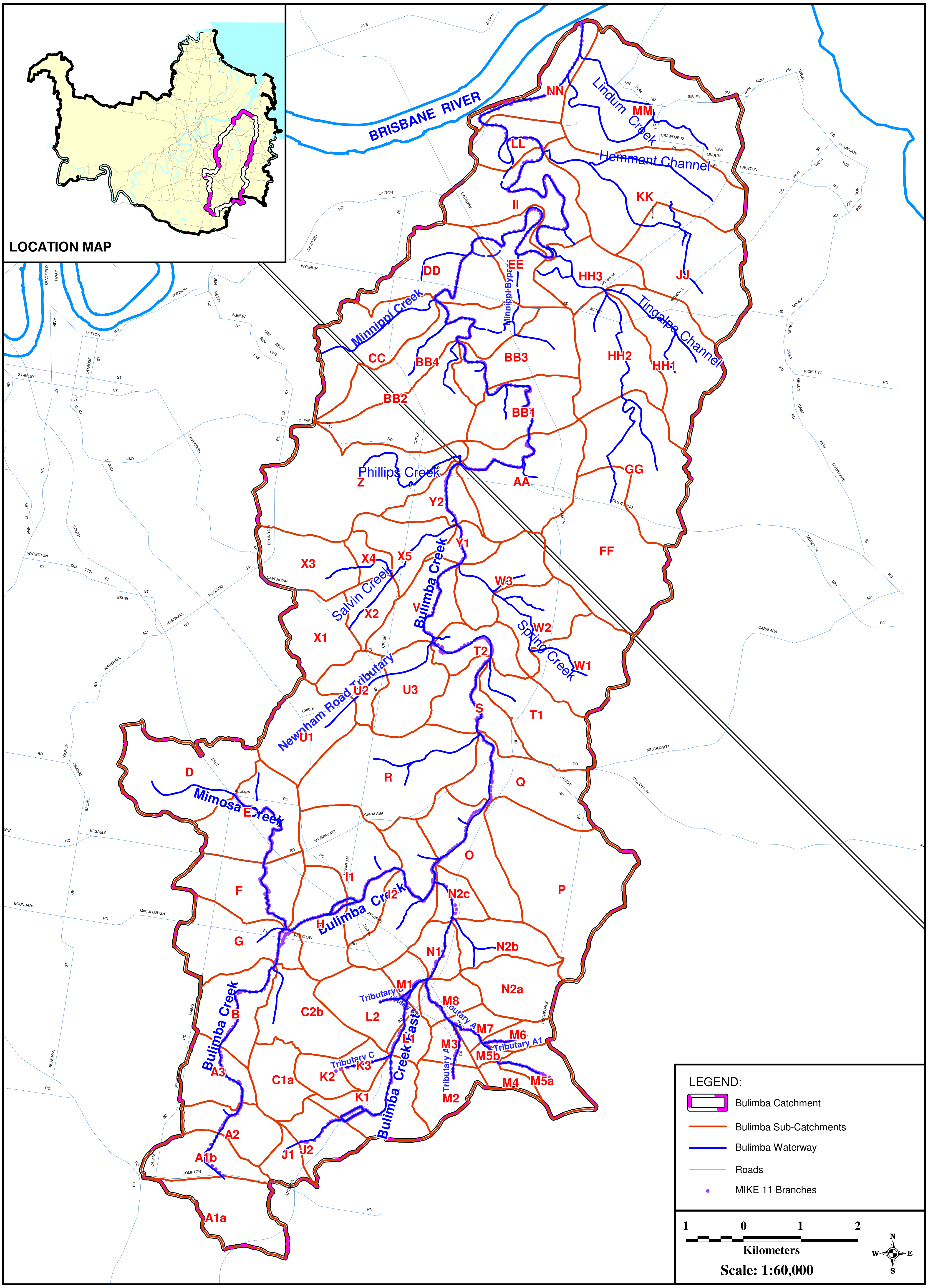

Figure 5.1: Sub-catchment Layout Adopted in the Hydrologic Model (WBNM) for Bulimba Creek

Table 5.1: Adopted Fraction Impervious Vs Development Category

Land development type	Fraction impervious
Roads	1.00
Commercial and Industrial	0.90
Medium Density Residential (excluding Roads)	0.70
Low –Medium Density Residential (excluding Roads)	0.55
Low Density Residential	0.40
Rural residential	0.20
Open Space, Parks, etc.	0.00

In a WBNM model rainfall losses may be modelled as loss rate (initial and continuing loss), runoff proportion, Horton Loss equation, or time varying loss. Numerous hydrologic investigations within Brisbane catchments have found that the initial/continuing loss model as the most appropriate for our climatic conditions, land use and topography. This method was therefore adopted for the current study.

5.3 Hydraulic model set up (Bulimba Main Branch, East Arm and Mimosa Creek)

5.3.1 Overview

The hydraulic model for this flood study was developed using the one-dimensional software MIKE11 (2005 version). The Bulimba Creek system was modelled as three main branches; namely Bulimba main branch, Bulimba East Arm and Mimosa Creek. Tributaries of Bulimba Creek that meet the main channel downstream of the Logan Road crossings, except the East Arm, were not included in the MIKE11 hydraulic model for a variety of reasons. Some had no surveyed cross section data (e.g. Spring Creek) whilst others had been modelled previously in conjunction with other major studies (i.e. Tingalpa Channel, Hemmant Channel). Three of the tributaries (Newnham, Salvin and Phillips Creeks) have previously been modelled using alternate modelling software. Detailed assessments of these three creeks are included in **Reports D**, **E** and **F** of this flood study.

5.3.2 Main Branch

The main branch of Bulimba Creek had previously been modelled from Nemies Road, Runcorn to the confluence with Brisbane River. In the current study, the main branch of the MIKE11 hydraulic model was extended up to Compton Road. **Figure 5.2** shows the Bulimba Creek model schematic layout. Detailed information of the branches that were included in the MIKE11 model is provided in **Table 5.2**. Inflow points used to input the estimated catchment runoff hydrographs for each branch are shown in **Figure 5.3**.

New surveyed cross sections were used;

- between Nemies Road and Compton Road along the upstream-extended section of Bulimba Creek
- in the vicinity of the Brandon Road weir, where five new surveyed cross sections were included
- in Bulimba Creek and Garden City Branch at the Logan Road culverts
- to the north and south of Old Cleveland Road (OCR) and also at Craig Street footbridge.

The Murarrie and Minnippi bypass branches were modelled as regular branches by introducing some cross sections extracted from ALS data.

In the lower reaches of Bulimba Creek where it meanders extensively (**Figure 5.1**), cross sections that were obtained from the GHD model (refer **Section 3.1**) intersect the creek at more than one location (e.g. 46GHD, 46BGHD and 46CGHD). At these locations, the cross-sections were divided into a number of segments representing the main channel and a portion of the floodplain. Links between the various segments of the full cross sections (e.g. 46GHD_AB, 46GHD_BC etc) were then introduced, as link channels in the network file, to allow cross flow between segments when floodwaters exceed the bank-full capacity of the creek. Cross section model chainages and their sources are provided in **Table A2** (**Appendix A**). The cross section layout used in MIKE11 model is shown in **Figures B-1** to **B-9** in **Appendix B.**

5.3.3 East Arm

As discussed in **Section 4.2**, the MIKE11 (version 1999B) model developed in the Stormwater Management Plan (SMP) for the Bulimba Creek (East) Catchment (BCC, 2001), was incorporated into the Bulimba Creek current MIKE11 model. This model extended from Persse Road to Miles Platting Road. In the finalisation of the current MIKE11 model, the Bulimba East catchment SMP model data was checked against existing topographic data and coordinates were updated to match aerial photography maps.

The downstream extent of the SMP study model for Bulimba Creek East was located just downstream of Miles Platting Road. The East Arm branch was extended to the confluence with Bulimba Creek with this model update by adding cross sections sourced from the RUBICON model (1992) and ALS data.

5.3.4 Mimosa Creek

The Mimosa Creek branch is also represented in the MIKE11 model, extending from its confluence with the Bulimba main branch, near Padstow Road, upstream to Klumpp Road in Mount Gravatt. Cross section information for the MIKE 11 model was extracted from the HEC-2 model (refer **Section 3.2**), which was originally developed for the Bulimba Creek Flood Study (1992).

5.3.5 Hydraulic Structures

A list of the structures (bridges & culverts) modelled in the MIKE11 model is provided in **Table A3** (**Appendix A**). Modelling information for bridges and culverts was taken from the Council’s GIS database and construction drawings as described in **Section 4.3**. In modelling the bridges in the MIKE11 model, bridge geometry was represented as irregular shaped culverts and weir combinations, with a Manning’s roughness (n) equivalent to the creek channel roughness at that location.

The hydraulic structure details included in the SMP study MIKE11 model for Bulimba Creek East Arm at Beenleigh Road were updated to match with the HEC-RAS model developed in 2004. That HEC-RAS model was developed to assess the hydraulic impact of the Beenleigh-East Rail upgrade project (BCC, 2004). There were also a few irregularities in relation to the structure lengths and upstream and downstream cross section locations for a few structures. These details were corrected in the MIKE11 model.

5.3.6 Model Parameters

Manning's roughness values were originally determined from site inspections and aerial photographs and adopted in the MIKE11 model. These values were slightly adjusted during the model calibration process.

Table 5.2: Bulimba Creek MIKE11 Model Branch Details

Branch	Description	Branch length (m)	Cross section ID
Bulimba - Main branch	Bulimba Creek - Main branch extends from Nemies Road, Runcorn to the Brisbane River confluence at Murarrie.	38965	BM
Bulimba - Upstream extension	Bulimba Creek - Main Branch from Compton Road crossing to Nemies Road in Runcorn.	935	BM
Mimosa Creek	Extends from Klumpp Road in Mt Gravatt to the confluence with Bulimba Creek at Macgregor.	3880	MI
Padstow	Bulimba Creek splits upstream of Padstow Road in Sunnybank and merges after crossing Padstow Road (before the Mimosa Creek merges with the main creek).	375	BM
Garden_City	Bulimba Creek flow splits just upstream of the Pacific Motorway near Garden City and merges with main creek just downstream of Logan Road.	658	BM
Minnippi bypass	Overland flow path from Minnippi Parklands flowing underneath the Gateway Arterial and joining Bulimba Creek further downstream of Wynnum Road in Tingalpa.	2004	BM
Murarrie bypass	Overland flow path that passes through the Brisbane Polo Grounds and crossing Murarrie Road and the Gateway Arterial.	650	MU
Bulimba_East_Arm	East Branch of Bulimba Creek, that starts from Persse Road Runcorn and extends to the confluence with the Main Branch at Rochedale.	6280	BE
Tributary A (Trib_A)	East arm tributary modeled from Underwood Road and joins East arm just upstream of the Pacific Motorway	3021	---
Tributary A_1 (Trib_A_1)	Minor tributaries of East Arm - Tributary A, modeled from Rochedale Road to its meeting point with Tributary A, located downstream of School Road	750	---
Tributary A_2 (Trib_A_2)	Minor tributaries of East Arm - Tributary A, modeled from Underwood Road to its meeting point with Tributary A upstream of Pacific Motorway	1042	---
Tributary B (Trib_B)	Tributary of East Arm, modeled from Bordeaux Street to its merging with Tributary A, downstream of Logan Road.	492	---
Tributary C (Trib_C)	Tributary of East arm modeled downstream of Warrigal Road and join East arm upstream of Underwood Road.	1120	---
Clev_Rail	Overland flow path that splits up lower reaches of Bulimba Creek at Hemmant recreation reserve. It crosses Port of Brisbane Motorway and meets the main creek at Hemmant after crossing the Cleveland Railway.	Link channel	---
Kianawah Park branch	Canal that joins Minnippi by pass downstream ME culverts	1006	
Bulimba East rail bypass	Flow split up at Beenleigh Road Rail and Gateway crossing	520	
45GHD_us1, 45GHD_us2, 45GHD_ds, 46GHD_ds	Overland flow paths in lower reaches of Bulimba Creek downstream of the Gateway Motorway and besides cross section 45GHD and 46GHD	Link channel	---

Bulimba Creek Flood Study

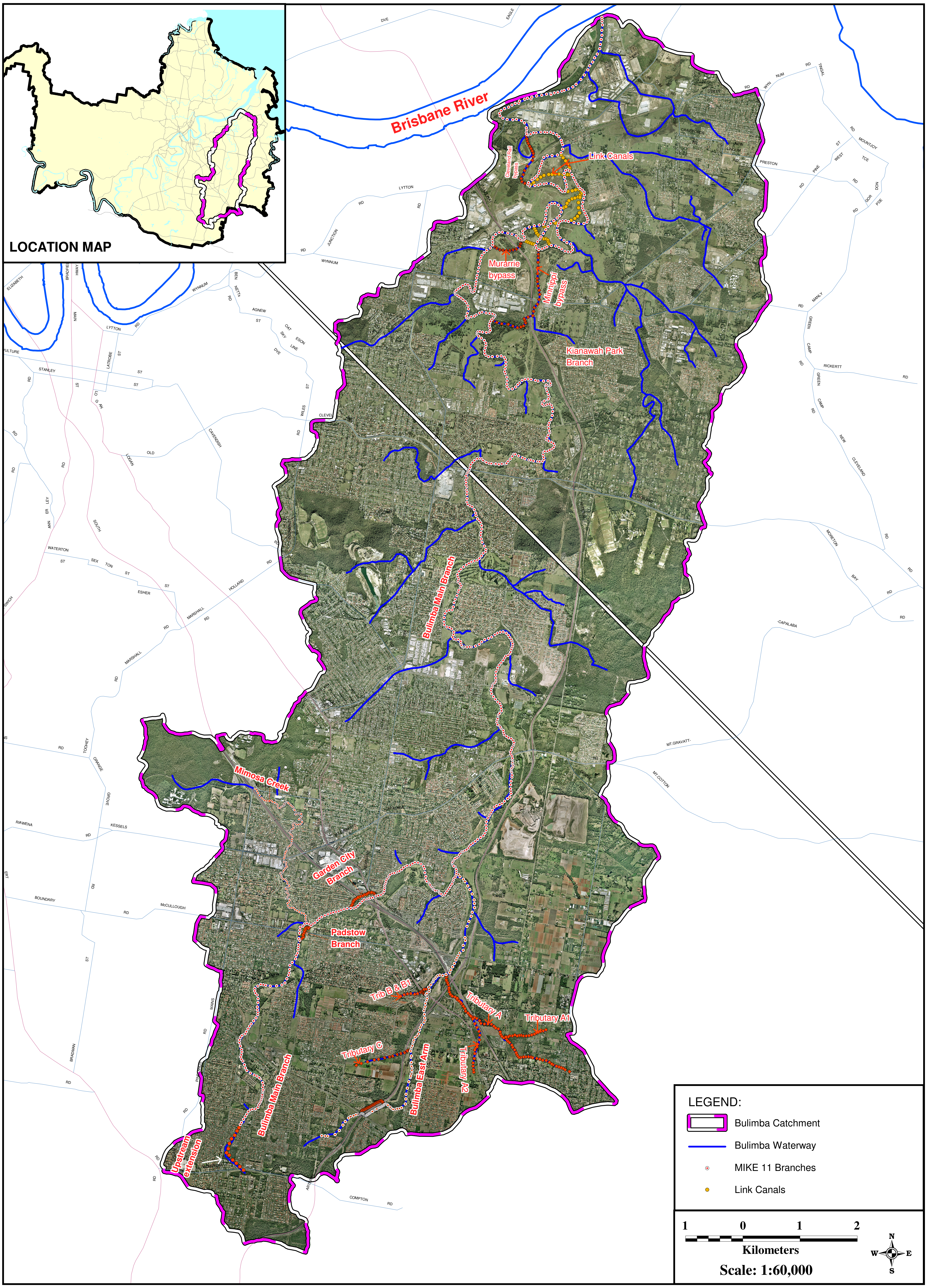

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Figure 5.2: Bulimba Creek- MIKE11 Model Layout

Bulimba Creek Flood Study

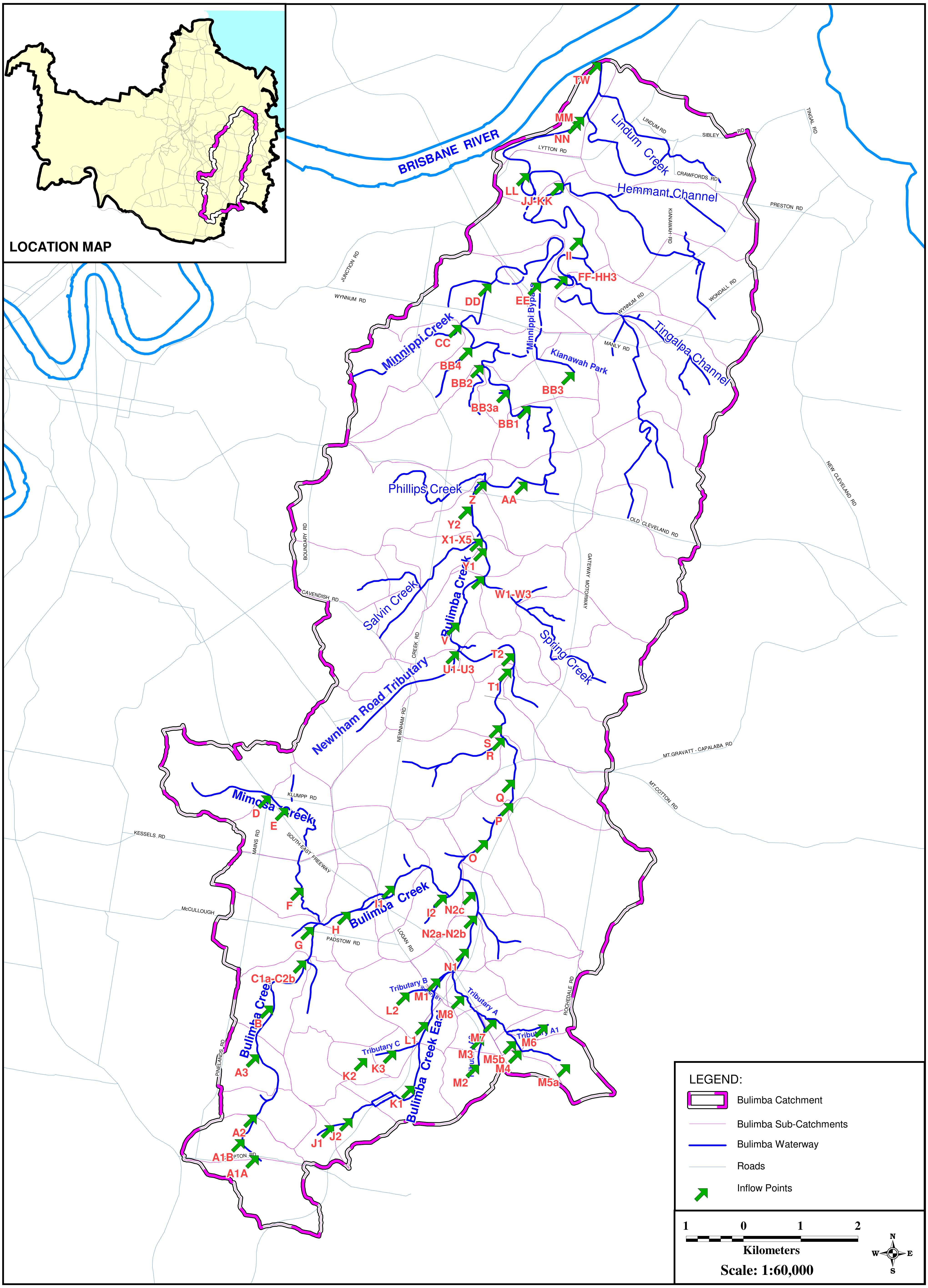

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Figure 5.3: Inflow Points for MIKE11 Model

6.0 Model Calibration

6.1 Selection of Calibration and Verification Events

Significant rainfall events have been recorded in the Bulimba Creek catchment in 1992, 1994, 1996, 2001 and 2004. Pluviograph data, stream gauge and MHG levels were available for these events for the selection of model calibration and verification purposes. Availability of pluviograph data for each of these events are listed in **Table 4.1** (**Section 4.1.1**).

All these events were short duration storms with the exception of the 1996 event where rainfall continued for nearly seven days resulting in multiple flood peaks. Only a few pluviograph records were available for the events that occurred in the early nineties. There was more pluviograph station data coverage for recent rainfall events. All available rainfall records were reviewed to identify the events suitable for calibration.

The events selected for calibration and verification are shown in **Table 4.3.** These events cover the periods listed below and provide sufficient information. The cumulative depths of recorded rainfall in these events are plotted in **Figures C1 - C5** (**Appendix C**).

Calibration Events

- 16-17 March 1992 (modelled for 30 hours from 16/03/1992 00:00:00am)
- 19-20 January 1994 (modelled for 45 hours from 19/01/1994 02:00:00 am)
- 9-10 March 2001 (modelled for 24 hours from 09/03/2001 12:00:00 noon)

Verification Events

- 30 April to 07 May 1996 (modelled for 192 hours from 30/04/1996 00:00:00am)
- 7 November 2004 (modelled for 24 hours from 07/11/2004 00:00:00am)

The availability of rainfall and stream height gauging data for each event is summarised in the **Table 6.1** below.

The availability of recorded rainfall (pluviograph) readings, peak water level data and MHG records were used as a basis for this selection of flood events for model calibration and verification. Out of the three events selected for calibration, two events possess MHG data for the full length of the Bulimba Creek system, and continuous water level records at two gauging stations during the events. One of the verification events possesses MHG readings for the full length of Bulimba Creek.

Table D1 (**Appendix D**) lists the MHG readings recorded for these events.

The required tolerance between recorded and calculated flood levels for an acceptable level of calibration and verification is:

- Continuous stream gauge recorded flood levels: 150mm (+ or -)
- Maximum height gauge records: 300mm (+ or -).

Table 6.1: Rainfall & Stream Height Data used for Calibration & Verification Events

Pluviograph stations used to obtain rainfall data for calibration and verification events					
Pluviograph Station Name	**Calibration Events**			**Verification Events**	
	March 1992	**January 1994**	**March 2001**	**May 1996**	**November 2004**
BMR138 Griffith University, Mt Gravatt	☒	☒	☒	☒	☒
P_R029 Balmoral Depot, Morningside	☒	No data	☒	☒	☒
OXR114 Calamvale Telstra, Calamvale	☒	☒	☒	No data	☒
Coorparoo – (Older station) Cavendish/Boundary Roads		☒			
BMR527 Doughboy Pde, Hemmant		☒	☒	☒	☒
BMR706 Carindale shopping centre		☒	☒	☒	☒
WRSR521 Pine St works depot, Wynnum		☒	No data	☒	No data
NMR833- Coorparoo Cavendish/Boundary Roads			☒	☒	☒
BMR830 Merion Place, Carindale			☒	☒	☒
BMR836 Gagarra Street, Eight Mile Plains			☒		☒
NMR596 Tarana St Park, Camp Hill			☒		☒
BMR803 Bulimba Creek -Greenwood St, Wishart					☒
W_R837 Wynnum Bowls Club, Wynnum					☒
LTR141 Rickertt Road, Ransome					☒
SLR210 Millers Road, Underwood					☒
Stream Gauge Data Used for Calibration and Verification Events					
Stream Height Gauge	**Calibration Events**			**Verification Events**	
	March 1992	**January 1994**	**March 2001**	**May 1996**	**November 2004**
Wecker Road **DPI** Gauge	☒	☒			
Merion Place - **BMA831**			☒	☒	☒
Old Cleveland Road - **BMA707**		☒	☒	☒	☒
Doughboy Parade - **BMA528**			☒		
Greenwood Street - **BMA804**				☒	☒
Maximum Height Gauges (Refer Table D1-Appendix D)	**22** Readings Whole catchment	**12** Readings upper catchment up to OCR	**31** Readings Whole catchment	**31** Readings Whole catchment	**20** Readings upper catchment to Scrub Road

6.2 Methodology

6.2.1 Hydrologic Model Calibration

The WBNM hydrological model for the Bulimba Creek catchment was developed using available topographical data as described in **Section 4.2**. Model parameters were reviewed as recommended in the WBNM manual (2005). Muskingum parameters adopted in the flow path block of the existing WBNM model had been determined by undertaking a Muskingum analysis. This analysis was reviewed in the consistency-checking phase of the hydraulic model development and is discussed in **Section 6.5**. Muskingum parameters adopted for the model are listed in **Table 6.2**.

Table 6.2: Muskingum Parameters

Branch	Muskingum Parameters	
	K (hours)	X
Bulimba Creek: Compton Road to East arm confluence	3.20	0.45
Bulimba Creek: East arm confluence to Wecker Road	1.50	0.44
Bulimba Creek: Wecker Road to Old Cleveland Road	2.10	0.38
Bulimba Creek: Old Cleveland Road to Brisbane River confluence	12.50	0.34
Bulimba Creek East Arm	2.35	0.31
Mimosa Creek	1.40	0.45

The Muskingum K (channel lag) parameter for each reach was used to obtain an average stream velocity to enable the lag time for each WBNM subcatchment to be calculated. The calculated channel lag time and Muskingum parameter-x for each subcatchment were then input into the WBNM model.

Rainfall Distribution

The rainfall data from various pluviograph stations were assigned to the subcatchments in the WBNM model using a Thiessen polygon distribution. These distributions are shown in **Figure C6–C10** (**Appendix C**).

Rainfall Losses: Initial and continuing

Initial and continuing losses[3] for each rainfall event were determined. Initial loss values were adjusted to achieve the best fit of the start of the rising limb of the discharge hydrograph. Continuous loss values were selected to match the shape and timing of the peak of the hydrograph. Adopted loss rates for calibration events and verification events are listed in **Table 6.3: Initial and Continuous Losses**.

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[3] Initial loss occurs prior to surface runoff commencing while continuous loss occurs during throughout the event. Both are dependent on a variety of catchment characteristics including soil infiltration properties.

Table 6.3: Initial and Continuous Losses

Storm Event	Initial loss (mm)		Continuous loss rate (mm/h)
	Pervious	Impervious	
March 1992	20	10	0.0
January 1994	55	50	1.0
May 1996	20	10	1.0
March 2001	80	70	1.2
November 2004	50	30	1.2

Calibration

Having run the hydrologic model (WBNM) with one of the calibration events, peak flood levels were compared with those recorded at stream gauging stations. Discharge hydrograph obtained from the WBNM model result file for each gauge location was converted to a stage hydrograph using the rating curve in obtaining the corresponding peak flood level. The model parameters were adjusted and the model was re-run with the same recorded event until the model had produced recorded flood levels within acceptable tolerances.

This procedure was repeated with other calibration events with further adjustments to model parameters. The calibration of the model was achieved by fine-tuning of model parameters until that could reproduce results representing general flow behaviour observed in the catchment. The calibrated hydrologic model results were then confirmed by modelling selected verification events. Further adjustments were made at the consistency checking phase (**Section 6.5**) with the hydraulic model.

6.2.2 Hydraulic Model Calibration

Discharge hydrographs obtained from the hydrologic model for calibrated events were used to run the hydraulic model with preliminary model parameters, which included roughness values that were based on the site inspections and aerial photography. Modelled flood levels at the gauged locations were then compared with recorded flood levels to check that they fell within the specified tolerances listed in **Section 6.1**. Alterations were made to the roughness values as required.

During the calibration and verification process, recorded flood hydrographs at continuous stream gauging stations for each event were compared with the modelled stage hydrograph as shown in **Figures D1-D16 in Appendix D**. In addition to the comparison with recorded flood levels, the shape and timing of the peak of the hydrograph was also examined to ensure a reasonable match. Roughness values adopted in the MIKE11 model are listed in **Table 6.4.**

Downstream Model Boundary

Adopted tide data for each calibration event at the Bulimba Creek confluence with the Brisbane River at Pinkenba were determined using the relevant editions of Queensland Tide Tables. These details are plotted in **Figures E1–E5** in **Appendix E: Downstream Boundary Levels Adopted for Calibration and Verification Events**.

Table 6.4: Manning's Roughness (n) Values used in the MIKE11 Model

Waterway	Manning's 'n'
Bulimba Creek	
Nemies Road to Brandon Road weir	0.085
Brandon Road weir to Logan Road	0.09–0.10
Logan Road to Greenwood Street	0.08–0.09
Greenwood Street to Wecker Road	0.065–0.07
Wecker Road to Greenmeadow Street	0.07–0.075
Greenmeadow Street to Old Cleveland Road	0.06–0.065
Old Cleveland Road to Scrub Road	0.05–0.06
Scrub Road to Minnippi Parklands	0.04–0.05
Minnippi Parklands to Boundary Road	0.035
Boundary Road to confluence with Brisbane River	0.03
Mimosa Creek	
Klumpp Road to Hoad Street	0.07–0.08
Hoad Street to Pacific Motorway	0.08–0.10
Pacific Motorway to Sheraton Street	0.07–0.075
Sheraton Street to Bulimba Creek confluence	0.09
Bulimba Creek East Arm	
Persse Road to Beenleigh Road crossing	0.095–0.09
Beenleigh Road to Railway Bridge crossing	0.055
North of Railway bridge to Gateway Motorway crossing	0.090–0.095
North of Gateway Motorway crossing to Logan Road	0.09–0.08
North of Logan Road to Pacific Motorway crossing	0.08–0.07
North of Pacific Motorway to Bulimba Creek confluence	0.08–0.09
Other branches	
Garden City branch	0.09
Padstow branch	0.08–0.09
Bulimba -East Rail bypass	0.10
Tributary A in Bulimba East Arm	0.08
Tributary A1 in Bulimba East Arm	0.08
Tributary A2 in Bulimba East Arm	0.08
Tributary B in Bulimba East Arm	0.06–0.08
Tributary B1 in Bulimba East Arm	0.08
Murarrie bypass branch	0.045
Minnippi bypass branch	0.09

Rating Curves

As listed in **Section 4.2**, survey data used in the hydraulic models were generally 10-20 years old and surveyed cross sections were not available at stream gauge or MHG locations; therefore interpolated cross sections were used at these locations. This involved estimating the actual gauge location from available topographical data and interpolating cross sections from the old survey data.

Rating curves were developed for the gauging stations at Greenwood Street, Merion Place, Wecker Road and Old Cleveland Road, using flood levels and discharge results (obtained from the hydraulic model) and existing or interpolated cross sections. These rating curves were used to convert the discharge hydrographs calculated by the WBNM model into stage hydrographs. A rating curve was not derived for the Doughboy Parade gauging station as this gauge is tidal.

The Greenwood Street and Merion Place gauges are located in relatively steep reaches of Bulimba Creek and these sites are generally independent of downstream water levels. The Old Cleveland Road gauge is located further downstream in a flatter reach, just above the extent of tidal influence. A rock bar just downstream of the gauge increases the creek invert level from approximately 0.0 to 1.5m AHD, thereby limiting the upstream end of the tidal prism. The gauge is not subject to tidal influence.

6.3 Calibration Results

Good agreement between recorded and calculated flood levels was achieved for the three calibration events considered. Recorded and modelled flood levels at continuous stream gauge locations for these events are listed in **Table 6.5** below. Recorded flood levels for all five events considered at Merion Place gauging station and prior to that, Wecker Road provided good calibration for all events with the exception of the May 1996 (verification) event. The Old Cleveland Road gauging station recorded levels for all events except March 1992 event. This station gave good calibration with MIKE11 results for the March 2001 and November 2004 events while the other two events provided 300mm tolerances. Greenwood Street gauging station recorded data for the May 1996 and November 2004 events, the latter providing a good match with the modelled results. Details of calibration and verification results for each event are discussed in detail below.

A comparison of recorded MHG levels with peak flood levels calculated by the MIKE11 hydraulic model is provided in **Table D1** (**Appendix D)**. The calculated peak flood levels were generally within 300mm of the recorded level across the five calibrations and verification events considered.

Table 6.5: Calibration and Verification Results at Continuous Gauging Sites

Event	Merion Place		Old Cleveland Road		Greenwood Street	
	Rec. (m AHD)	**MIKE11** (m AHD)	**Rec.** (m AHD)	**MIKE11** (m AHD)	**Rec.** (m AHD)	**MIKE11** (m AHD)
March 1992	**10.65**	**10.60**	**NR**	5.59	**NR**	21.78
January 1994	**10.08**	**9.94**	4.87	5.13	**NR**	21.38
May 1996	11.32	11.06	6.12	5.75	22.49	22.10
March 2001	**11.99**	**11.97**	**6.83**	**6.78**	**NR**	22.87
November 2004	**11.58**	**11.52**	**6.03**	**6.05**	**22.77**	**22.63**

Results in **bold** indicate results that match specified tolerances NR: not recorded

6.3.1 March 1992 Event

Rainfall data were available from four pluviograph stations. Two of these stations are located within the Bulimba Creek catchment (as shown in **Figure C06**, **Appendix C**). Stream gauge records were only available at Wecker Road gauging station for this event. MHG records were available at seventeen sites in Bulimba Creek as listed in **Table D1** (**Appendix D**) while only at one site in Mimosa Creek.

The best calibration was achieved in the March 1992 event, with almost all calculated flood peaks falling within 300mm of recorded MHG readings (except at two locations) and within 150mm at Wecker Road stream gauge.

Peak flood discharge profiles obtained from the WBNM hydrological model for this event were converted into water levels using the derived rating curves at gauging stations. The derived peak level also matched well with that of the recorded peak at the Wecker Road gauging station. Timing of the stage hydrograph was also acceptable. **Table 6.5** shows the recorded and modelled flood levels for calibration events at stream gauging stations. **Figure D1: March 1992 Event** (**Appendix D**) displays stage hydrographs at Wecker Road gauging station for modelled and recorded results for that event while **Figure D2** (**Appendix D**) shows the peak water level profile along Bulimba Creek.

6.3.2 January 1994 event

Rainfall data was available from seven pluviograph stations (as shown in **Figure C07, Appendix C**). Continuous stream gauge records were available at Wecker Road and Old Cleveland Road gauging stations. MHG readings were available at ten sites in Bulimba Creek extending up to Old Cleveland Road and one in Mimosa Creek.

The Wecker Road gauge levels matched the modelled flood levels of both MIKE11 and WBNM, while the modelled flood level for the Old Cleveland Road gauge was 260mm higher than that recorded (refer **Table 6.4**). Modelled flood levels were within the acceptable tolerances of the recorded MHG levels (including the Mimosa Creek MHG) with the exception of two sites. **Figure D3** and **D4** (**Appendix D**) show stage hydrographs at Wecker Road and Old Cleveland Road gauging stations while **Figure D5** (**Appendix D**) shows the peak water level along Bulimba Creek for January 1994 event. The modelled flood peak occurs slightly earlier than that of the recorded.

6.3.3 March 2001 Event

Rainfall data was available from nine pluviograph stations (as shown in **Figure C09**, Error! Reference source not found.). Stream gauge records were available at Merion Place and Old Cleveland Road gauging stations. MHG readings were available at seventeen sites in Bulimba Creek, three sites in Bulimba East Arm and at one site in Mimosa Creek.

MIKE11 and WBNM results were within the specified tolerances of the recorded levels at both stream gauge stations. Out of the twenty two MHG site readings available, eighteen were well within the 300mm tolerances (including the three Bulimba Creek East arm and Mimosa Creek MHG readings). **Figure D6** and **D7** (**Appendix D**) show stage hydrographs at Merion Place and Old Cleveland Road gauging stations while **Figure D8** (**Appendix D**) shows the peak flood level along Bulimba Creek.

6.4 Model Verification

Model verification provides a means of checking the calibrated model parameters. Verification events were selected in a similar way to calibration events. Two rainfall events were selected for verification: November 2004 and May 1996. Model verification also displayed satisfactory results between the calculated and recorded flood levels for the two events as discussed below.

6.4.1 November 2004 Event

This rainfall event mainly covered the upper part of the catchment. Stream gauge records were available at the three gauging stations in Bulimba Creek. Rainfall records were available from fifteen pluviograph stations (as shown in **Figure C10**, **Appendix C**). MHG readings were available at fourteen MHGs in Bulimba Creek, four in Bulimba East arm and one in Mimosa Creek.

Merion Place gauging station gave a good match for both MIKE11 and WBNM results. At the Old Cleveland Road and Greenwood Street gauging stations, MIKE11 model results were within acceptable tolerances of recorded results. WBNM model results were slightly higher than the specified limits. Of all the MHG readings, twelve in Bulimba Creek, three in Bulimba Creek East arm and the Mimosa Creek MHG were within the acceptable tolerances. **Figure D9 - D11** (**Appendix D**) show stage hydrographs at Merion Place, Greenwood Street and Old Cleveland Road gauging stations while **Figure D12** (**Appendix D**) shows the peak water level along Bulimba Creek. There is a slight delay in the modelled peak flood level at all three gauging stations compared to recorded peak flood levels.

6.4.2 May 1996 Event

This is the only long duration event of the five considered events for calibration/verification of the Bulimba Creek models. Rainfall records were available from ten pluviograph stations (as shown in **Figure C08**, **Appendix C**). Stream gauge records were available at the three sites in Bulimba Creek; modelled results were slightly lower than the specified limits. WBNM model results at Old Cleveland Road gauge matched well with recorded results. MHG readings were available at most of the MHG sites and seventeen were within the specified limits in Bulimba Creek. Two MHG readings were available at Bulimba Creek East Arm with modelled results falling within the acceptable limits. The Mimosa Creek MHG also gave acceptable results. **Figure D13 - D15** (**Appendix D**) show stage hydrographs at Merion Place, Greenwood Street and Old Cleveland Road gauging stations while **Figure D16** (**Appendix D**) shows the peak flood level along Bulimba Creek.

6.5 Hydrology and Hydraulic Model Consistency Checking

To check the reliability of estimated flood discharge characteristics from the hydrologic and hydraulic models, consistency checks are required at selected locations. Peak values, timing and shape of discharge hydrographs obtained from hydrology and hydraulic models are compared in this process. Model parameters adopted in relation to channel routing (i.e. Muskingum parameters) in the hydrology model may be adjusted in the consistency checking.

Channel routing can be performed in a number of ways in WBNM, including non-linear routing, time delay and Muskingum routing. Muskingum routing provides the highest level of consistency between hydraulic and hydrologic models and was therefore chosen for the Bulimba Creek WBNM model. The MIKE11 model that accompanies this investigation contains detailed topographical data for the channels, which link the subcatchments within the Bulimba Creek main channel. By analysing the hydrograph routing presence in the hydraulic model, it is possible to derive the Muskingum parameters X and K, which can be used within the hydrologic model to provide consistent channel routing characteristics.

To determine the Muskingum parameters used in the WBNM model, the MIKE11 hydraulic model was divided into five reaches, based on the channel slope and creek roughness. These reaches were:

- Bulimba Creek East Branch – Persse Rd to Bulimba Creek confluence
- Bulimba Creek – Nemies Road to Bulimba Creek East confluence
- Bulimba Creek – Bulimba Creek East confluence to Wecker Road
- Bulimba Creek – Wecker Road to Old Cleveland Road
- Bulimba Creek – Old Cleveland Road to mouth.

A parabolic hydrograph was routed through the MIKE11 model along each of these reaches. The flow hydrograph at the upstream and downstream limits of each reach was analysed to determine the Muskingum parameters (K and X) for that reach. These parameters were then input into the WBNM model for the relevant sub-catchments. Hydrographs produced by the WBNM model were then compared with those of the MIKE11 model focussing on the peak flow rate and timing of peaks at the above locations. This procedure was repeated by adjusting K and X to achieve a reasonable match of peaks and timing between both models. In this way, a consistent amount of channel routing was employed in both models, thus providing consistency between the models.

The Muskingum analysis was repeated several times during the model calibration process to ensure both models were using a consistent amount of channel routing. The final set of parameters adopted for the WBNM model is listed in **Table 6.2: Muskingam Parameters**. Plots of Muskingum weighted flow against storage for determination of X and K for the five reaches listed above are provided in **Figures F1 - F5** in **Appendix F**.

7.0 References

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Bulimba Creek Flood Study

Report B – Design Event Modelling

Prepared by Brisbane City Council's, City Projects Office

October 2014

BRISBANE CITY

Dedicated to a better Brisbane

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LIST OF APPENDICES

1.0 Introduction

The calibrated hydrology and hydraulic models discussed in the *Bulimba Creek Flood Study – Report A: Model Calibration* were used to derive design flood levels, discharges and velocities for Bulimba Creek, Mimosa Creek and Bulimba Creek-East Arm including its tributaries. The *Bulimba Creek Flood Study – Report B: Design Event Modelling* follows on from the Calibration Report, presenting the methodology and results of the design event analyses.

Design events modelled for Bulimba Creek include the 2, 5, 10, 20, 50 and 100 year average recurrence interval (ARI) storm events using Duration Independent Storms (DIS) and the results are presented in **Appendix I**. Hydraulic structure reference sheets are also included as **Appendix J**.

2.0 Model Data

2.1 Design Rainfall

2.1.1 Duration Independent Storms (DIS)

To derive design storm events for Bulimba Creek catchment, the duration-independent storm (DIS) event was employed. This method of DIS analysis was developed by Morris (1996) and involves the use of a single temporal pattern for all design storm durations. The synthetic events contain the maximum likely rainfall for any given design storm duration (up to 24 hours).

The DIS is generated for a given recurrence interval using the intensity-frequency-duration (IFD) curves presented for Brisbane in the *Australian Rainfall & Runoff* (Pilgrim (ed) 1987). For each ARI event a synthetic single storm temporal pattern is built by combining the worst burst of rainfall extracted from points on the IFD chart. The derived temporal pattern for each ARI event is then applied to the catchment using the hydrology model (WBNM) developed in the calibration phase and peak discharges are extracted at nominated locations. A flood frequency analysis is then undertaken for the catchment using the recorded rainfall data for the region to derive the peak discharges for each ARI event at the nominated locations. A factor, which is to be applied in the hydrology model, is then derived for each ARI event by comparing the peak discharges in the flood frequency analysis curve. The methodology adopted is discussed further in **Section 3.1 and 3.2.**

2.2 Tail Water Conditions

The mean high water springs (MHWS) water level was used as the constant downstream tidal boundary at Hemmant for the design event modelling. A constant tide level of 1.00m AHD was adopted for all design events.

2.3 Topographic Data and Structure Details

As described in the calibration report, existing cross section data and some recently surveyed cross sections were included in the MIKE11 hydraulic model. Existing cross section data was taken from the RUBICON model developed for the Bulimba Creek Flood Study,1992 (BCFS,1992). New survey data was available for Bulimba Creek main branch in the vicinity of:

- Brandon Road weir
- Logan Road culverts
- Craig Street footbridge
- Old Cleveland Road Bridge

New cross sections were extracted from the Airborne Laser Scanning (ALS) survey data when ground survey was not available. These sections were mainly used in the Murarrie bypass, Minnippi bypass and Kianawah Park branch in the MIKE11 model. Cross section data for Mimosa Creek was extracted from the HEC-2 model developed in the (BCFS,1992). A few of these cross sections were extended as required using ALS data and included in the MIKE11 hydraulic model.

Details of structures for inclusion in the MIKE11 model were obtained from the 'as constructed' drawings. Bridges were modelled as irregular shaped culverts with the Manning's roughness coefficient equivalent to the creek bed roughness at that location. Hydraulic Structure Reference Sheets which provide structure geometry details and flood information were prepared for the modelled structures**.**

2.4 Land Use

Ultimate catchment development conditions within Bulimba Creek Catchment as set out in *Brisbane City Plan (BCC 2000)* were assumed in estimating design flood levels. Land use planning maps for Brisbane City including the Rochedale Master Plan, were used to calculate the percentage of impervious surface areas within individual sub catchments for use in the hydrology model. Impervious fractions for particular land development categories were obtained from **Table 4.05.1** in the *Queensland Urban Drainage Manual* (QUDM), second edition, 2007.

3.0 Hydrologic Modelling

3.1 Design Event Scenarios

The term likely to be adopted to define design event terminology will be described soon with the release of AR&R update and the following recommendation is expected:

- Annual Exceedance Probability (AEP) is to be used (in lieu of ARI) when an annual maximum frequency series has been utilised to derive the data being used.
- Average Recurrence Interval (ARI) is to be used (in lieu of AEP) when a peak over threshold (POT) frequency series has been utilised to derive the data being used.

The design rainfall data provided in AR&R effectively represents the results of a frequency analysis of the POT series rainfall data.

In this study the term ARI is used and the equivalent AEP definition for each design events are given in **Table 3.1**. The relationship between ARI and AEP can be expressed by the following equation:

AEP = 1 – exp (-1 / ARI)

Table 3.1: ARI and AEP

ARI (Year)	AEP (%)
2	50
5	20
10	10
20	5
50	2
100	1
200	0.5
500	0.2
2000	0.05

In the study, design event analysis is referred to the analysis of those flood events having ARI of 2, 5, 10, 20, 50 and 100 years. AR&R defines flooding events having ARIs 200, 500 and 2000 years as rare events and analysis of those events are included in **Report G**.

3.2 Design Event Model Setup

Design event modelling was based on ultimate development conditions within the catchment. Changes to the extent and degree of development in the catchment are quantified using the percentage of impervious surface area associated with each sub-catchment. The hydrologic model (WBNM) was modified using impervious fractions that represent ultimate catchment development. The impervious fractions adopted in the hydrologic model are listed in **Table A1** of **Appendix A.**

As mentioned in **Section 2.1.1**, the DIS methodology requires that a factor be applied to the DIS temporal pattern to ensure consistency between the calculated peak flood discharge for each design event (i.e. 2 to 100 year ARI) and that derived through a Flood Frequency Analysis (FFA) which uses an annual maximum flow series derived from historic rainfall. A complex procedure was adopted to determine these factors for each design ARI event. This procedure is discussed below.

3.3 Flood Frequency Analysis

Recorded rainfall data (pluviograph) are available for the Brisbane CBD from 1911 onwards. Eleven rainfall events were extracted from each year (from 1911, for 91 years) with each event covering a 72 hour period, containing the most intense burst of rainfall for nominated durations of 30 minutes, 1, 2, 3, 4, 6, 12, 18, 24, 36 and 48 hours. These selected eleven events from each year were analysed using the calibrated Bulimba Creek WBNM hydrologic model with existing catchment urbanisation to estimate peak flood discharges for each event in each sub-catchment.

Following the extraction of peak discharges, the annual peak discharge for each sub-catchment for each data year was tabulated. Flood frequency analysis on the annual maximum series was then undertaken at a number of selected locations within the Bulimba Creek Catchment.

The selected locations (**Figure 5.1 in Report A**) were:

- Nemies Road (subcatchment A1)
- Turnmill Street (subcatchment F)
- Padstow Road downstream (subcatchment G)
- Greenwood Street (subcatchment O)
- Old Cleveland Road (subcatchment Y2)

The estimated peak discharges were plotted to produce frequency distributions using Weibull plotting positions. The line of best fit was determined for each plot and corresponding peak discharges were estimated for the 2, 5, 10, 20, 50 and 100 year ARI events. Flood frequency analysis plots are included in **Figures G1 - G5 (Appendix G**). The estimated flood discharges for each ARI event from the flood frequency analyses at the five locations listed above are shown in **Table 3.2**.

Table 3.2: Flood discharges obtained from flood frequency analysis

ARI (years)	Flood Discharge (m^3/sec): Flood Frequency Analysis				
	Nemies Road (A1)	Turnmill Street (F)	Padstow Road (G)	Greenwood Street (O)	Old Cleveland Road (Y2)
100	87.1	125	188.1	558.4	601.8
50	77.6	111	168.8	499.8	537.0
20	65.2	93	143.1	422.2	453.3
10	55.9	80	123.3	362.3	390.8
5	46.5	67	102.8	302.3	328.4
2	33.3	49	73.2	215.6	241.4

3.4 Derivation of Duration Independent Storms

Duration Independent Storms (DIS) were developed for given ARI events using intensity-frequency-duration (IFD) curves for Brisbane based on *Australian Rainfall & Runoff* (Pilgrim (ed) 1987). Initially, the DISs were analysed with the calibrated WBNM hydrology model for each ARI event, and peak discharges were extracted at the five locations, where flood frequency analysis were undertaken (refer **Section 3.3**).

The analyses found that peak discharges produced by the DIS events were higher than those of the flood frequency analysis discharges. DIS events were subsequently factored until the peak discharges at the selected locations were found to be comparable to those derived from the flood frequency analysis. Factored Duration Independent Storms (FDIS) were then used in estimating design event discharges at all locations. DIS factors adopted for each ARI event, estimated peak discharges using un-factored DISs (UDIS) and FDIS and the percentage difference between FDIS and FFA are listed in **Table 3.3**: .

3.4.1 Factored DIS Discharges

The comparison of discharges obtained from the flood frequency analysis (**Table 3.2**) and factored DIS discharges (**Table 3.3**:) for each ARI event shows good agreement at Nemies Road, Turnmill Street, Greenwood Street and Old Cleveland Road. Therefore, the results in **Table 3.2** indicate that the factored DIS temporal patterns may be used in the WBNM hydrology model to estimate design flow hydrographs. Hydrology model discharges obtained for these factored storms at the five sub-catchment locations are also included in flood frequency analysis plots in **Figures G1 - G5 (Appendix G**). .

3.4.2 Design Event Hydrographs

The run-off hydrographs obtained from the hydrology model using the factored DIS with the ultimate catchment development condition were used as inflow hydrographs to the MIKE11 hydraulic model as described in the next chapter. In this analysis with DIS for each design event initial and continuous losses were adopted as zero. Peak flow discharges obtained from the WBNM hydrology model for design events 2, 5, 10, 20, 50 and 100 year ARI at sub-catchment outlets are included in **Table H1** in **Appendix H.**

Table 3.3: Factored DIS discharges & Comparison with FFA Discharges

	Comparison of Discharge(m^3/sec): Resulted from FFA & Factored DIS					
ARI (years)	**100**	**50**	**20**	**10**	**5**	**2**
Factor applied (%)	85	85	86	87	84	80
	Nemies Road					
UDIS	102.7	90.8	75.8	64.7	56.2	42.8
FDIS	87.3	77.1	65.2	56.2	47.2	34.2
FFA	87.1	77.6	65.2	55.9	46.5	33.8
Difference(%)	-0.23	0.64	0.00	-0.54	-1.51	-1.18
	Turnmill Street					
UDIS	148.2	131.0	109.1	93.0	80.8	61.3
FDIS	126.0	111.3	93.8	81.0	67.9	49.0
FFA	125.0	111.0	93.0	80.0	67.0	49.0
Difference(%)	-0.80	-0.27	-0.86	-1.25	-1.34	0.00
	Padstow Road					
UDIS	217.9	191.6	159.0	135.0	116.8	87.7
FDIS	185.3	163.0	136.7	117.5	98.3	70.4
FFA	188.1	168.8	143.1	123.3	102.8	73.1
Difference(%)	1.49	3.44	4.47	4.70	4.38	3.69
	Greenwood Street					
UDIS	658.8	580.8	481.9	410.1	355.2	267.2
FDIS	560.0	493.6	414.5	356.8	298.4	213.8
FFA	558.4	499.8	422.2	362.3	302.3	215.6
Difference(%)	-0.29	1.24	1.82	1.52	1.29	0.83
	Old Cleveland Road					
UDIS	719.7	635.1	528.1	448.4	388.4	291.3
FDIS	611.7	539.8	454.2	390.1	326.3	233.1
FFA	601.8	537.0	453.3	390.8	328.4	241.4
Difference(%)*	-1.65	-0.52	-0.20	0.18	0.64	3.44
* : Percentage difference between FFA and FDIS discharge						

4.0 Hydraulic Modelling

4.1 Design Event Model Setup

The MIKE11 model developed in the calibration stage was adopted for design event modelling, with appropriate modifications, to represent the design event modelling situation. The modelling scenario adopted is based on the existence of waterway corridors with riparian vegetation and is described in detail in **Section 4.2** and **4.3** below. Cross sections in the MIKE11 model were altered to include:

- Minimum (vegetated) Riparian Corridor (MRC) widths
- Waterway Corridors: the effective flood storage and flow conveyance widths were altered to match the waterway corridor limits.

Design inflows for each event were obtained from the hydrology model for the ultimate catchment development condition and applied to the MIKE 11 model as node boundaries and point discharges.

4.2 Waterway Corridors

Waterway corridors are an integral part of the Council's Planning Scheme for Brisbane and are described in the Brisbane City Plan (2000) as:

> *"The corridors along a waterway indicated on the Planning Scheme maps. These corridors are defined by:*
>
> - *A flood regulation line (FRL)*
> - *A local plan environmental corridor or a waterway corridor (WC)*
> - *A waterway corridor defined in a stormwater management plan*
> - *A waterway corridor defined in a waterway management plan.*
>
> *If more than one of these is available for a particular waterway, the largest applies.*
>
> *If there is no FRL described in a local plan, SMP or WMP, a 30m distance measured on each side from the centre line of the waterway,"* would apply (BCC 2000, vol. 1, ch.3, p.75).

These corridors identify zones where water flow, water quality, ecology and open space, and recreational and amenity values are to be preserved and/or managed in an ecologically sustainable manner.

The presence of waterway corridors[4] has been incorporated in the MIKE11 model by superimposing the corridor extents over each model cross section and incorporating vertical walls to exclude the conveyance and/or storage characteristics of the watercourse beyond the limits of the waterway corridor. Essentially, this practice assumes that filling and development will ultimately occur beyond the boudary of the waterway corridors.

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[4] The location of the majority of waterway corridors along major creeks coincides with that of flood regulation lines. Where the waterway corridor is wider than the FRL, modelling has been based on the width of the FRL only.

4.3 Minimum Riparian Corridor

Vegetation, which exists along the banks of a watercourse, is known as riparian vegetation. It is a key contributor to waterway health acting as a buffer between the waterway and the adjacent lands. A well-vegetated riparian zone can improve water quality by filtering overland flow and reducing erosion along creek banks. Shady trees protect vulnerable organisms from extremes of temperature; root systems and woody debris become habitat for fauna; and organic matter sustains aquatic food webs. Vegetation also provides habitat and forage for fauna and adds to a waterway's recreational value.

This study calculates anticipated flood levels assuming a minimum vegetated riparian corridor width along the entire creek system. The hydraulic investigation does not in any way imply that Council is planning to establish a minimum riparian vegetated corridor width in the creek catchment. The minimum riparian vegetated corridor is modelled solely in recognition that at some specified time in the future, revegetation may occur, either through natural regeneration or as a result of human planting programs. The results of this modelling are intended to ensure that the habitable floor levels of developments within the flood plain take account of possible future revegetation.

Minimum riparian corridors have been applied to main branches of all reaches modelled in the hydraulic model. The minimum riparian corridor was simulated as dense vegetation by applying a 'Manning's n' value of 0.15, extending from the top of the low flow banks for a minimum width of 15m on both sides of the creek. Where there was no obvious low flow channel, the vegetation was applied at the anticipated 2 year ARI flood level on the basis that this size event is generally contained within the bed and banks of the creek. Where the existing Manning's n value of the cross section in the vicinity of the MRC was higher than 0.15, the existing value was not altered.

4.4 Downstream Boundary for the hydraulic model

The standard procedure in deriving the Creek design flood levels is to adopt a Mean High Water Spring (MHWS) level of about 1m AHD as the downstream boundary level to the hydraulic model. In the design events analysis a constant water level of 1m AHD at the Brisbane River was adopted as the tail water level for the MIKE11 hydraulic model. The coincident flood of Brisbane River was not considered in the analysis as the study was aimed to identify the impact only from the Creek flooding.

4.5 Results

4.5.1 Flood Levels

Modelled design event flood levels along the Bulimba Creek, Mimosa Creek and Bulimba Creek-East Arm and a few of its tributaries were obtained using the MIKE11 hydraulic model. In addition flood levels are reported for the Garden City, Padstow, Kianawah Park, Minnippi and Murarrie bypass branches on Bulimba Creek. Flood information for three other main tributaries: Newnham Road Tributary, Philips Creek and Salvin Creek are derived from three separate flood studies and are included as **Reports D, E** and **F**. Estimated peak flood levels for ultimate catchment development conditions, with the presence of minimum riparian corridors and waterway corridors/flood regulation lines, are included in **Table I1** of **Appendix I**.

Corresponding peak flood discharges for the design events are tabulated in **Table I2** of **Appendix I**. Flood Inundation Extents have been included in Bulimba Creek Flood Study **Volume 2** for the 2, 5, 10, 20, 50 and 100 year ARI events.

Minimum Energy (ME) culverts under the Gateway Motorway south of Wynnum Road were modelled in the Minnippi bypass branch in the MIKE11 hydraulic model. Flow through these culverts during large flood events may result in higher tail water levels to the Kianawah Park branch, which joins the Minnippi bypass branch immediately downstream of the Gateway Motorway. Therefore flood levels in Kianawah Park branch may be affected by backwater in the Minnippi bypass branch.

4.5.2 Hydraulic Structure Reference Sheets

The hydraulic structures (bridges and culverts) modelled in the hydraulic model, and their details are presented in **Appendix J**. These sheets describe the modelled structure geometry and its associated hydraulic characteristics assuming ultimate catchment development conditions. The geometry details of the bridges and culverts were taken from the records of Brisbane City Council, Department of Main Roads and Queensland Rail engineering drawings.

In each hydraulic structure reference sheet, a table displays the hydraulic characteristics of the structure as derived from the MIKE11 hydraulic model for the 2 year to 100 year ARI event. These details include peak flow rate, peak flood level upstream of the structure and afflux and peak flow velocity through the structure for each ARI event. A recent photograph of the structures is also included with most sheets.

5.0 References

Pilgrim, DH (ed) 1987, *Australian Rainfall & Runoff - A Guide to Flood Estimation*, Institution of Engineers, Australia, Barton, ACT.

BCC 1992, *Bulimba Creek Flood Study*, prepared by Connell Wagner for Brisbane City Council, Brisbane.

Morris, K. J (1996), *Interpolating Fixed Return Period Flooding Along a Stream of Varying Response.* Presented at the 10th Queensland Hydrology Symposium, University of Queensland, 26-27 November 1996.

BCC 2000, *Brisbane City Plan 2000*, Brisbane City Council, Brisbane.

DNRW 2007, *Queensland Urban Drainage Manual*, Volume 1, Second Edition.

Bulimba Creek Flood Study

Report C – Flood Mitigation Assessment

Prepared by Brisbane City Council's, City Projects Office

October 2014

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1.0 Introduction

Bulimba Creek waterway, its Eastern Branch and Mimosa Creek were modelled using the MIKE11 hydraulic model as described in **Reports A** & **B** of this flood study. This model was developed to derive design flood levels and inundation maps for the 2, 5, 10, 20, 50 and 100 year ARI events. Separate HEC-RAS (steady state) models were also developed for three other tributaries of Bulimba Creek namely, Newnham Road Tributary, Salvin and Philips Creek Catchments. Design event modelling results including inundation maps were examined to identify flood liable areas in the Bulimba Creek Catchment.

When examining the flood liable areas of Bulimba Creek it can be seen how successful modern town planning has been in keeping the recent development away from the Creek corridors and above the defined flood line. However there are areas subdivided in an earlier age when standards were different. It is not possible to re-subdivide the city when these standards change and therefore some areas still exist as flood liable.

The *Bulimba Creek Flood Mitigation Assessment* report, 2011 comments on the possible flood mitigation measures that could be applied to the Bulimba Creek Catchment and some of its tributaries. This study specifically reconsiders the validity of the mitigation proposals recommended in the previous Bulimba Creek Flood Study (BCC, 1992) and comments on their applicability.

2.0 Flooding in Bulimba Creek

2.1 Assessment of Key Flooding Areas in Bulimba Creek

Inundation maps and peak flood levels have been used to identify areas where significant flood damage could occur in Bulimba Creek catchment. The results of this assessment are presented in **Table 2.1**. The identified areas were then cross referenced with the flood mitigation recommendations from the Bulimba Creek Flood Study, (BCFS) 1992.

Table 2.1: Possible flood affected areas in Bulimba Creek

Item	**Flood Affected Area**	**Tributary/Creek**	**Number of Properties Flooded in a "100 year" ARI event**
1	Kianawah Park south of Wynnum Road -Tingalpa	Bulimba Creek	Between 20 and 50
2	Hamilton Street and Boundary Streets North of Wynnum Road - Tingalpa	Bulimba Creek	Between 20 and 50
3	Fursden Road and surroundings in Carina	Bulimba Creek	Between 50 and 100
4	Altandi / Naldi Street in Sunny Bank	Bulimba Creek	Less than 20
5	Springfield Street	Mimosa Creek	Between 50 and 100
6	Upstream of Kessels Road	Mimosa Creek	Between 50 and 100
7	Brandon Road weir (435m downstream of Brandon Road culvert crossing)	Bulimba Creek	Less than 10

2.2 Possible Reasons for Flooding

The advancement of reliable flood estimation methods has enabled flood risk to properties and the community to be reduced through effective floodplain management strategies. As a result "Development Standards" based on design flood levels requiring floor levels to be above the 100 year flood were first introduced in the 1980's. Developments that were either constructed prior to that time or been approved but not constructed were not subject to these standards and may have been built to lower levels.

Formal Subdivision and Development Guidelines were not adopted within the Brisbane City limits until 1997. Significant development occurred in Bulimba Creek Catchment after this time with most having being built above the defined flood levels using flood information from the BCFS, 1992. Thus, the appropriate design flood immunity has been provided with most of these developments. This has been a good example of Council's town planning controls providing an effective pro-active flood mitigation measure. However, there still exist flood liable areas where development had occurred prior to the introduction of flood control planning measures.

3.0 Potential Flood Mitigation Measures

3.1 Background

Flood mitigation activities are aimed at reducing flood impacts on the community and the environment. The mitigation measures are generally categorised as **non-structural** or **structural**.

Non-structural measures rely on non-constructed activities including flood warning systems, education schemes, planning controls and vegetation maintenance.

Structural initiatives involve constructed modification to the creek/catchment that aims to lower flood levels. These techniques include:

- Increasing the size of the creek channel
- Increasing the channel "smoothness" or reducing roughness
- Increasing the channel flow capacity by minimising constrictions.

These methods improve the flood conveyance capacity and lower flood levels.

An alternative is to increase the flood storage capacity (volume) of the floodplain as this tends to attenuate the peak flow rate in the creek and thus reduce flood levels.

However, in lowering flood levels, care is required to ensure that flooding is not simply transferred to another location. For example, lowering flood levels by improving flood capacity in an upstream portion of a creek reduces flood storage. This may cause increased flooding downstream. Alternatively increasing flood storage by adding a detention basin will increase flood levels upstream of the basin with the potential to cause the problem that is sought to be avoided.

3.1.1 Non-Structural Measures

Non-Structural activities aim to minimise flood damage by reducing flood risk. The following actions are non-structural mitigation measures:

- **Flood forecasting and warning systems**: Such systems would help to identify impending storms and keep the community ready to take appropriate action and precautionary measures to reduce their flood damage. The Bureau of Meteorology operates flood forecasting on large river systems. There is no such flood warning system developed for any creek at this time. The "flash flooding"[5] nature of Bulimba Creek (i.e. short time between rainfall and resultant flood) makes this service not viable at present.

- **Flood Education by awareness campaigns**: Flood education would help to raise community awareness of possible problems, future impacts and actions that should be taken in a flood situation to help an individual reduce their own flood damage. As a first step individuals can get information from a property-based "Be FloodWise Property Report". This is provided by the Brisbane City Council at no cost to residents.

[5] The Bureau of Meteorology web site (http://www.bom.gov.au/) defines "flash flooding" as that results from relatively short intense bursts of rainfall i.e. Thunderstorms. It can deposit exceptional amounts of water over a small area within that short period. Flooding occurs when soil absorption, runoff and drainage system cannot adequately disperse that intense rainfall. It is difficult to provide effective warning systems because of their rapid onset.

- **Land use controls**: These include adopting appropriate zoning controls, policies and guidelines to keep new development above the relevant flood levels.
- **Purchase of Flood Affected Properties**: Purchase of properties with low flood immunity removes the damage altogether. A voluntary Home Purchase Scheme has been operational in Brisbane since 2006 to purchase properties with low flood immunity.
- **Creek Channel Maintenance**: Creek channel maintenance involves removal or trimming plant growth that may cause partial blockage to flood flows. Growth of exotic vines and other vegetation may lower the flood carrying capacity of a creek and may cause increased flooding.

3.1.2 Structural Mitigation Options

These options adopt constructed alterations to the creek to directly reduce the depth of floodwater. Possible structural flood mitigation options are listed below.

a. Improvements to Creek Channel to increase flow capacity

The creek flow capacity can be increased by widening, realigning (removal of bends) or deepening the waterway and by clearing channel bed and bank obstructions. Such improvements tend to increase the flow velocity and result in carrying the flow at a lower flood level.

However consideration needs to be given to two aspects of such a solution:

- The lower flood depth also reduces flood storage and thus may have the effect of increased flood flows and levels downstream
- The higher velocities may cause erosion problems. The creek's stable regime may be disrupted. If this is likely then the design must include measures to re-stabilise the channel. In the past this was achieved by extensive (and expensive) maintenance plans and rock and concrete bank stabilization measures. Current environmental requirements render such measures unfavourable and natural channels are preferred.

During major flooding events in natural creek systems, the majority of flow is carried by the floodplain. Therefore to reduce flooding using works in the main channel, extensive modifications are required. This involves destruction of riparian habitats raising significant environmental concerns. Thus main channel widening is now rarely carried out.

b. Improvements to Creek Floodplains to Increase Flow Capacity

This is an expensive option unless the land is in public ownership as the costs associated with the acquisition of land are likely to be high. Publicly owned land, provided it is extensive enough to carry out a suitable scheme, may offer viable flood mitigation options.

c. Improvements at Bridge Crossings

Some older bridge crossings were designed without the current consideration of potential flood impacts. Some of these bridges may be altered to reduce the flood impact. These works may include improving flow alignment of the approaching water and reshaping of wing walls and pier leading edges. Replacing the entire bridge generally only occurs if there is a need to realign or otherwise upgrade the road as the cost of replacement most likely far outweighs the flood benefits derived.

d. Floodplain Bypass

Flood bypass canals may have been built or occur naturally within a creek system and may help to reduce flooding by providing additional waterway area. These flow paths increase the area available to store and convey floodwaters, and facilitate fast release of flood waters from the area of concern, thereby lowering flood levels.

A bypass floodway may help in the case of a meandered creek where it takes longer to drain floodwaters to the mouth. Opportunities for the construction of a bypass floodway depend on the site topography, geotechnical properties of soil, hydraulic characteristics, environmental and ecological considerations of the site, availability of land and future maintenance requirements.

A concern associated with this option is the likelihood of transferring the flood problem from one area to another as a result of the bypass. If there are already flooded areas near the downstream end of the bypass the acceleration of the flow tends to increase flood levels.

Bulimba Creek has a low flood gradient in the area downstream of Wynnum Road that has been proposed as a channel bypass area in the previous BCFS. A lack of hydraulic grade would make the channel ineffective in transferring large volumes of flood water.

e. Detention Basins

A detention basin is a small scale reservoir which provides temporary storage of flood waters. These systems attenuate floods by storing flood waters in the basin thereby reducing peak flows and flood levels. They are normally located in an upstream location of the catchment and regulate the release of flow downstream.

Detention basins have inherent disadvantages requiring substantial land for flood storage, which results in inundating land that was not previously flooded. There is also the potential, in long duration or multiple peak rainfall events, for the basin to be filled to its full capacity in the early parts of the storm. The basin is then rendered ineffective for flood mitigation purposes for the remainder of the storm event. Detention basins may change the existing environmental system of the creek both upstream and downstream of the basin location.

f. Levees

Levees are constructed barrier walls which exclude part of a floodplain from a flood event in protecting properties within the excluded area. Levee heights and formation levels are determined on a variety of factors which include; physical limitations of the site, availability of funds, the condition of the development that requires flood immunity and environmental considerations.

Levees may also promote an unrealistic expectation of flood immunity to residents if the associated drainage system fails to operate effectively in a flooding event. There are two main problems with levees particularly on small creek systems like Bulimba creek:

1. Rainfall that collects on the protected side of the levee is unable to escape as the natural flow path to the main watercourse is obstructed and accumulates behind the levee. There is a reliance on the functioning of any drainage system through the levee to operate effectively during a flood event. The drainage system may however be compromised by blockage or the malfunctioning of any dewatering pumps if present (eg: due to unforseen circumstances like power failure).

2. Levees cannot be designed to eliminate all flood events. There is always the possibility of overtopping once flooding exceeds the design capacity of the levee. A flood event that can overtop the levee may occur or the levee could collapse or otherwise breach due to inadvertent tampering. When this occurs flooding of the isolated area would be much faster than if the levee did not exist. Behind a levee such flooding would be unexpected and that would result in an unacceptable risk to life and significant property damage. Loss of life has a much higher probability in such a situation and therefore levees are not a recommended mitigation measure.

g. Flood Proofing to Existing Structures

Flood proofing involves raising existing structures above the designated flood level or replacing the flood affected walls and flooring with flood tolerant materials. This will not stop flooding but will reduce flood damage to the building structure and those contents that are raised above flood level. This method is available to the home owner at the home owner’s expense.

3.1.3 Flood Mitigation Justification

All flood mitigation schemes undergo a process to evaluate the cost effectiveness of the scheme. The cost of the scheme, including the initial construction cost and any ongoing maintenance cost, is compared to the savings that could be gained in reducing both direct and indirect flood damage cost in all future floods expected during the life of the mitigation scheme. In addition, environmental consequences are assessed. A mitigation project that is viable on economic grounds, where reduction in flood damage is greater than the cost of the scheme, can fail the test if environmental damages are unacceptable.

3.2 Flood Mitigation Measures Recommended by Previous Studies

Flood mitigation measures were investigated in the BCFS, 1992. This study initially identified twenty-one flood mitigation options and preliminary benefit /cost analyses were undertaken to select seven potentially feasible options. These seven measures are described in **Table 3.1** below. In the BCFS, 1992 these options were assessed against a set of environmental rules[6] to determine their acceptability. Subsequently two options involving the construction of detention basins in environmentally sensitive areas were abandoned. The remaining five options were recommended of these, two have been completed. The other three, after further consideration, were ruled out on environmental amenity and safety grounds.

[6] Connell Wagner, 1992: Section G lists these rules and implications on flood mitigation.

Table 3.1: Flood Mitigation options recommended in BCFS, 1992

Item	Mitigation Option	Status
1	Cleveland Rail bridge crossing upgrade to a larger opening.	Completed in 1994.
2	Flood protection levees near Altandi and Coultis Streets Sunnybank.	Not adopted as levees are now not considered as a viable mitigation measure in Brisbane to reduce residential flooding (See 3.1.2.f)
3	Construction of detention basin in Toohey Forest Park on Mimosa Creek. It requires constructing 150m long bund to a maximum height of 6m on Mimosa Creek, north of the Griffith university's eastern access road. This would inundate 6.5 to 7 ha of forest for periods of one day.	Not adopted. Incompatible with environment and community requirements.
4	De-weeding of Mimosa Creek from east of Klump Road to the confluence with Bulimba Creek. The aim is to increase flood carrying capacity without widespread clearing, excavation and channelization of the Creek.	Completed in 2008
5	Construction of flood protection bunds and associated pumping stations around Fursden Road. Levees were recommended in Billan Street, Wood Avenue, lower lying areas of Fursden Road and adjacent Caravan park off Creek Road. (Bunds of 2.5m maximum height with gentle side slopes). Flood gates and pumping stations are proposed for draining local stormwater.	Not adopted. (Refer 3.1.2.f & Item 2 above).
6	Construction of detention basin in Mt Gravatt Park. That involved constructing a bund to a maximum height of 7m adjacent to Clair Waux College and Hoad Street with a spillway. During a flood about 7 ha of land would be inundated up to a day.	Not adopted. Incompatible with environmental and community requirements.
7	Construct an overflow channel (above the tidal influence) just downstream of the Gateway Arterial. Construction of 200m wide, 350m long channel to bypass meandered section of Bulimba Creek was recommended to benefit properties at Fleming Road to north of Wynnum Road and around Greenslade Street in Tingalpa.(UBD ref. map 162: D6 to C5).	Not adopted. It is not recommended as an effective option as discussed in 3.1.2.d. Requirement for an archeological survey and vegetation management issues were identified in BCFS, 1992. It would also increase the tidal prism at Highest Astronomical Tide levels.

4.0 Conclusion

Structural and non-structural flood mitigation opportunities in Bulimba Creek catchment have been assessed. The BCFS, 1992 had investigated some favourable flood mitigation schemes for Bulimba Creek Catchment and recommended seven mitigation options. Introduction of detention basins for flood mitigation in Bulimba Creek was rejected due to the incompatibility with environmental and community requirements.

Of the remaining five recommended options, possible mitigation schemes (item 1 and 4) have already been undertaken as discussed in **Table 3.1**. Schemes which did not proceed were mainly due to environmental, amenity or safety concerns.

Introduction of bypass canals as flood mitigation measures were not recommended as it is foreseeable that this would transfer the problems downstream to where flooding already exists. Construction of levees has inherent safety risks. More effective non-structural options for Bulimba Creek are available as discussed.

Non-structural methods of flood mitigation for the remaining flood affected properties in Bulimba Creek are ongoing. Rebuilding or redevelopment of these properties will ultimately lead to reduced flood impacts.

Town Planning and building controls are the primary mechanism to effectively reduce flood impacts in the Bulimba Creek Catchment.

5.0 References

BCC 1992, *Bulimba Creek Flood Study*, prepared by Connell Wagner for Brisbane City Council, Brisbane.

CSIRO 1999, *Flood Plain Management in Australia: Best Practice Principles & Guidelines*, CSIRO Publishers.

BTRE 2002, *Report 106: Benefits of Flood Mitigation in Australia*, BTRE Publishers.

DIPNR 2005, *Floodplain Development Manual*, New South Wales Government.

DNRW 2007, *Queensland Urban Drainage Manual*, Volume 1, Second Edition.

Bulimba Creek Flood Study

Report D – Newnham Road Tributary Flood Investigation

Prepared by Brisbane City Council's, City Projects Office

October 2014

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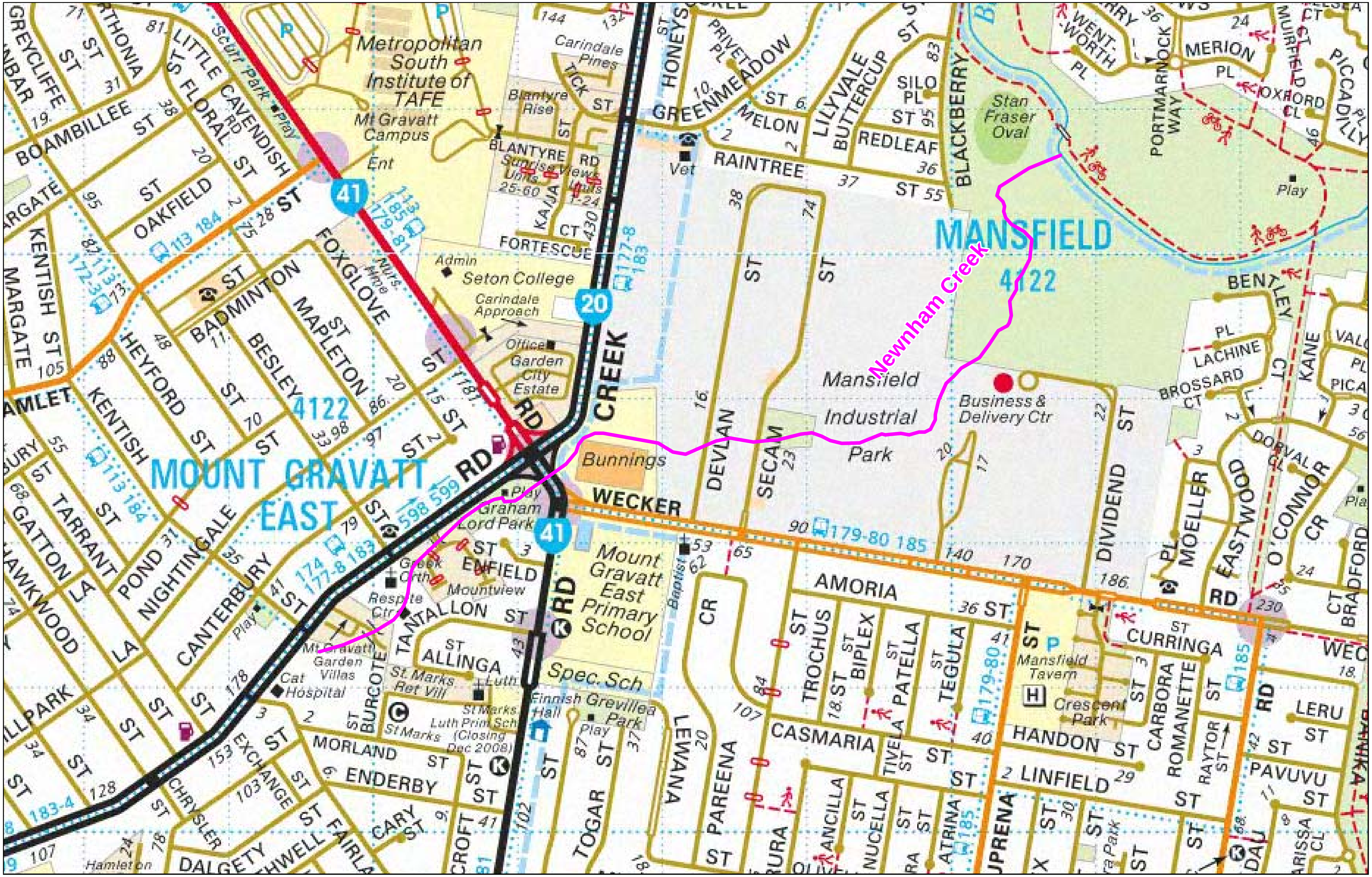
1.0 Introduction

Newnham Road Tributary (Newnham Creek) is a small tributary of Bulimba Creek located in Mansfield on Brisbane's south side. The Newnham Road Tributary Flood Study involves the hydraulic analysis of the waterway from its confluence with Bulimba Creek to upstream at 215 Creek Road. The study involves the establishment of a HEC-RAS hydraulic model to determine flood levels for the open section of the waterway. The flooding results from this study will be used as the basis for flood level advice to the public. Flooding events considered are the 2, 5, 10, 20, 50 and 100 year ARI events.

Figure 1.1 indicates the locality of the creek and the extents of the open waterway for which the model has been created.



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Newnham Creek Locality Plan
Figure 1.1

2.0 Catchment Hydrology

2.1 Catchment Description

The Newnham Road tributary catchment forms part of the greater Bulimba Creek Catchment and includes areas within the suburbs of Mansfield and Mt Gravatt East. The contributing catchment area of Newnham Creek to the confluence with Bulimba Creek is approximately 3.8 km^2. A portion of the catchment in the Mt Gravatt area is forested, whereas the remaining areas are urban residential and commercial, with some industrial sectors at the lower end.

2.2 Creek Characteristics

The open-channel section of Newnham Creek is approximately 1.9km in length. Upstream of the open channel sections is piped drainage. This piped drainage services the surrounding residential and commercial areas.

Newnham Road tributary contains 11 crossings, three drop-structures and a Stormwater Quality Improvement Device (SQID). A description of the location of each of these structures is given in **Table 3.1**.

At the 215 Creek Road development the waterway is an engineered rock-lined channel. After the development it becomes a trapezoidal concrete-lined channel until downstream of 285 Creek Road where an unlined channel begins. The unlined channel continues to Bunnings Warehouse where it becomes a concrete-lined channel for the length of the Bunnings Warehouse bridges, before reverting back to an unlined channel after the downstream bridge. This unlined channel continues until the confluence with Bulimba Creek and is generally not maintained with large areas of tall reeds and heavy vegetation. The trapezoidal concrete-lined channel section features three hydraulic drop-structures.

The main channel base width varies from approximately 3m (in the concrete-lined channel) to 10m (in the rock-lined and natural channel areas) and the depth varies from approximately 2 to 4m in both channels. The average bed slope of the creek within the study area is approximately 1.0 % (1 in 100).

2.3 Discharge Calculations

The discharges used in the HEC-RAS model were obtained from a combination of flow data adopted in the previous HEC-RAS model developed by Brisbane City Council in 2001 and the 215, Creek Road Development HEC-RAS model. These discharges represent the expected Ultimate Conditions of the catchment.

The previous BCC model had only one flow change location for the entire length of creek. From review of the layout of the contributing stormwater drainage network it was apparent that there were a number of significant inflow locations along the length of the drain and that the previous BCC model was excessively conservative. Additional flow change locations were added to the current model to further distribute the flow along the length of creek being modelled (refer to **Figure 2.1**).

The design peak discharges adopted are shown in **Table 2.1.**

Table 2.1: Adopted Peak Discharge

HEC-RAS Chainage (m)	Discharge (m^3/s)					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
1880	26.2	35.0	38.7	42.0	48.3	60.6
1790	31.3	42.6	48.2	52.0	58.4	68.7
1753	31.3	43.7	52.1	61.6	69.6	80.7
1591	31.3	44.7	55.9	63.6	80.8	92.6
1366	35.3	50.4	63.0	71.8	91.1	104.5
918	39.2	56.1	70.2	79.9	101.4	116.3
621	43.2	61.8	77.3	88.0	111.7	128.2

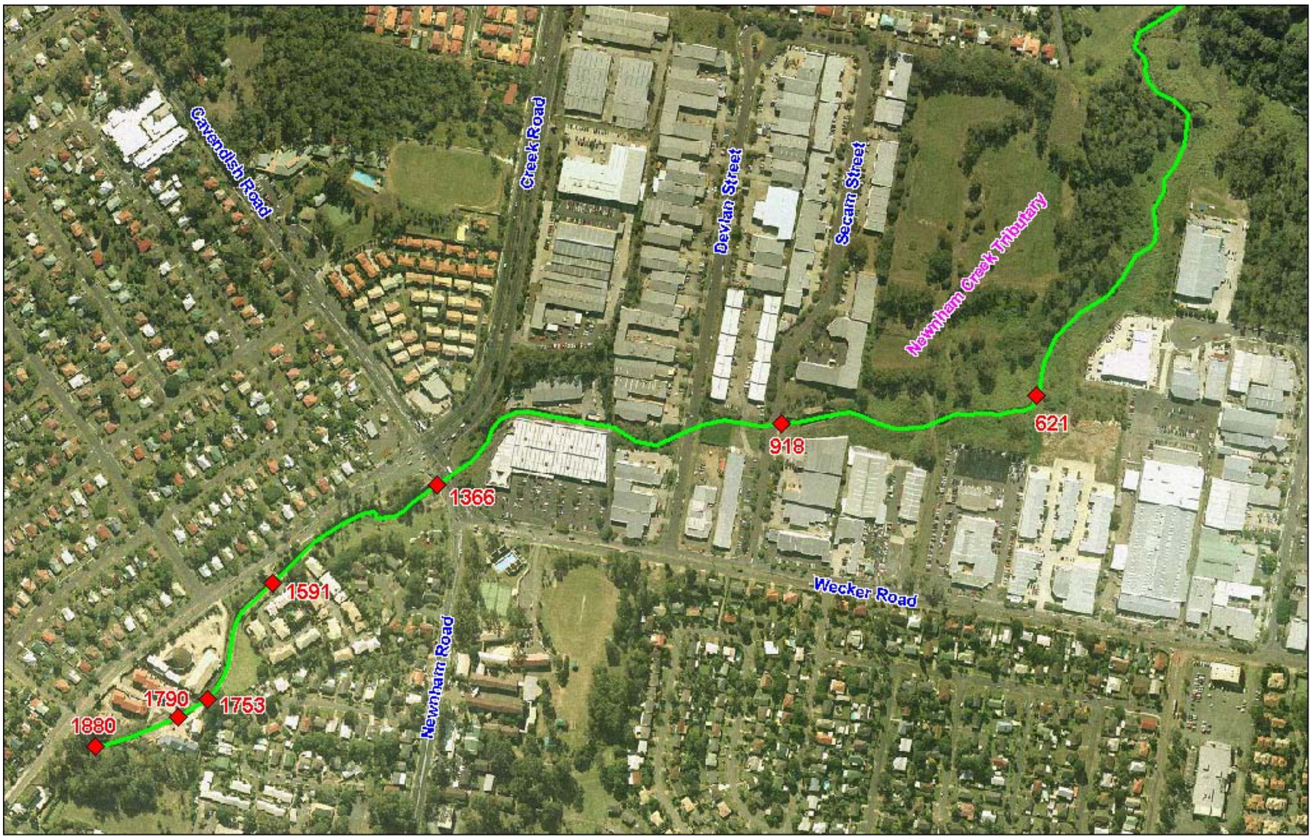


Figure 2.1: Newnham Creek Catchment Minor Inflow Points (Showing HEC-RAS Chainage)

3.0 Hydraulic Modelling

3.1 General

The hydraulic analysis was undertaken using the HEC-RAS (Version 3.1.3) hydraulic modelling software for steady flow conditions. **Section 3.2** details the setup and assumptions used in the modelling. The modelling results are presented in **Section 3.3**.

3.2 HEC-RAS Model Setup

3.2.1 Cross Sections

The HEC-RAS model for the 1.9 km study reach was comprised of 77 cross-sections, as shown in **Figure 3.1**. The cross-sectional data used in the model was obtained from the following sources:

- Extracted from the existing BCC and 215 Creek Road models;
- Extracted from DTMs (Digital Terrain Models) made using BCC Airborne Laser Scanning (ALS) data, with modification made to the in-channel dimensions
- Measurements taken during site visits to the area
- Design drawings of the concrete-lined trapezoidal channel and SQID structure

Cross sections were interpolated within HEC-RAS at locations where the channel shape varied linearly between cross sections. The source data used in each cross section is detailed in the HEC-RAS model.

3.2.2 Minimum Vegetated Riparian Corridor

The vegetation along a waterway is called riparian vegetation. It is a key contributor to waterway health, acting as a buffer between the waterway and adjacent lands. A well vegetated riparian zone can improve water quality by filtering overland flow and reducing erosion along creek banks. Shady trees protect vulnerable organisms from extremes of temperature; root systems and woody debris become habitat for fauna; and organic matter sustains aquatic food webs. Vegetation also provides habitat and forage for fauna and adds to a waterway's recreational value. However, many hydrological/hydraulic studies have shown that increasing vegetation densities within a floodplain increases anticipated flood levels. To date this perspective has discouraged the revegetation of riparian vegetation, especially in areas known to be 'potentially flood sensitive' under existing vegetation densities. However, the *Waterway Management Plan* (BCC, 2003c) process allows the hydrological and ecological impacts of riparian revegetation to be assessed and managed in an integrated manner.

This study calculates anticipated flood levels assuming a Minimum Vegetated Riparian Corridor (MRC) width along the entire creek system. This hydraulic investigation does not in any way imply that Council is planning to establish a width in the Newnham Creek Catchment. The MRC is modelled solely in recognition that at some unspecified time in the future, revegetation may occur, either through natural regeneration or as a result of human planting programs. The results of this modelling are intended to ensure that the habitable floor levels of developments within the floodplain take account of possible future revegetation. This type of forward planning is supported by *Guidelines for Flood Regulation Line and Minimum Fill Level Assessment* (BCC, 1994).

A MRC was incorporated into the HEC-RAS modelling. A Manning's 'n' value of 0.15 was used to represent the MRC, which typically incorporates the main channel plus a distance of 15m either side of the top of bank. The MRC is only modelled downstream of the SQID on Secam Street. This is due to the remainder of the channel being largely concrete-lined with industrial and residential developments adjacent the channel.

3.2.3 Manning's 'n'

For areas outside the MRC, the Manning's 'n' values were obtained with reference to a site inspection, aerial photography and hydraulic roughness literature as per *BCC Natural Channel Design Guidelines* (BCC, 2003). The Manning's 'n' values used were as follows:

- In-channel Areas:
  - Concrete-lined Channels, n = 0.015
  - Natural Channel, n = 0.040
  - Engineered Channel with Rock Protection, n = 0.040
  - Channel Area Immediately Downstream of Drop Structures, n = 0.06
- Overbank Areas:
  - Combined Grassed/Paved Regions, n = 0.025
  - Concrete Areas, n = 0.015
  - Road Areas, n = 0.016
  - Shrubs and Scattered Trees – Light Density, n = 0.045
  - Shrubs and Scattered Trees – Light to Medium Density, n = 0.06

The Manning's 'n' values downstream of the hydraulic drop structures were increased from 0.015 to 0.06 to simulate the turbulent and unstable water profile that is expected to occur from this structure. The Manning's 'n' values return to 0.015 for the concrete-lined channel shortly after hydraulic drop structures.

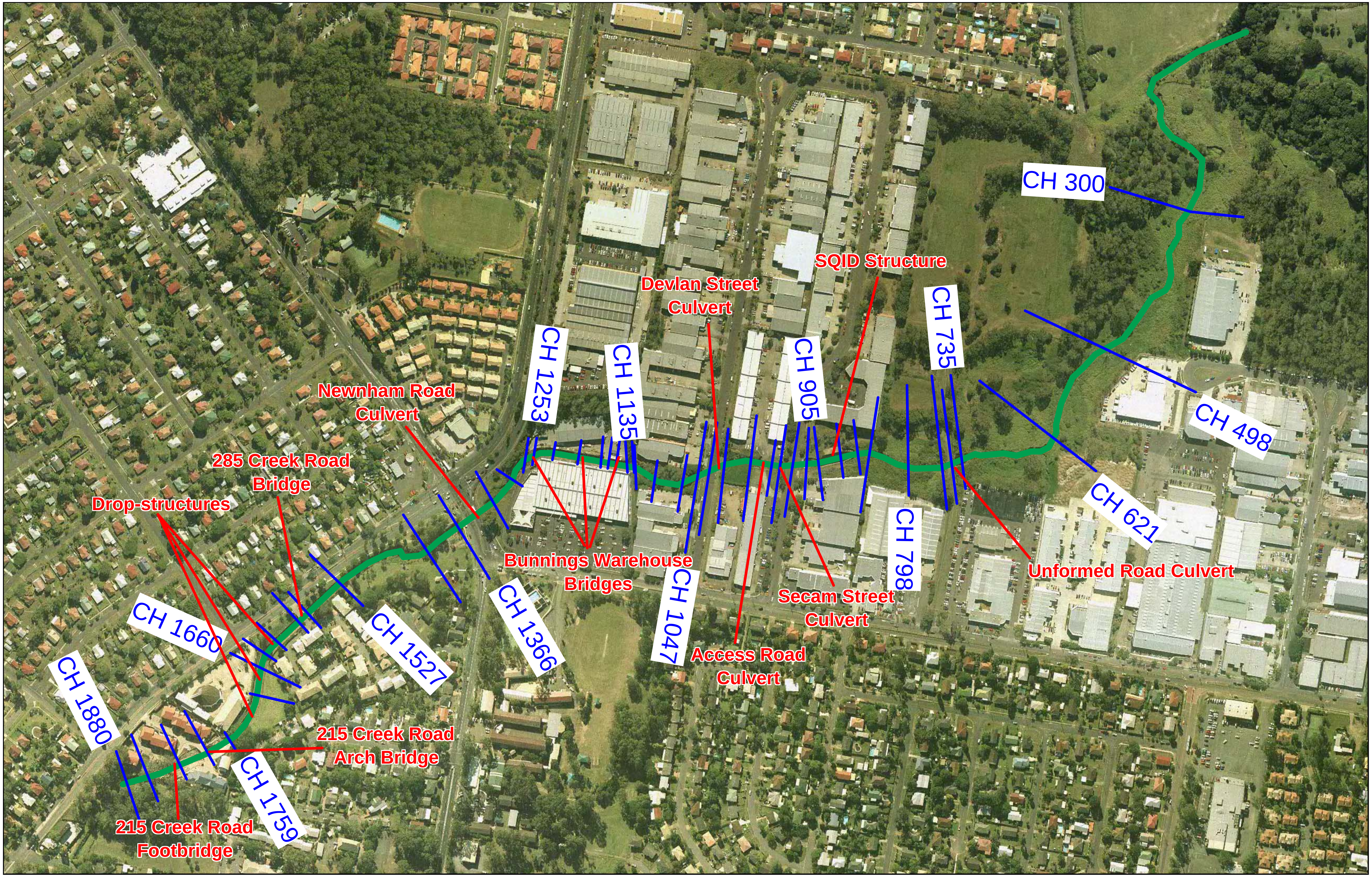
3.2.4 Hydraulic Structures

Within the model there are 15 hydraulic structures (6 bridges, 5 culverts, 3 drop-structures and 1 SQID). The configuration of each of the structures is given below in **Table 3.1**.

Table 3.1: Hydraulic Structure Details

HEC-RAS Chainage (m)	Structure	Configuration
749.0	Unformed Road structure	5 x ∅1650 mm piped culvert. Sizes and invert levels were assumed due to lack of survey and design information.
871.0	Secam Street SQID	Cross-sections from ‘as constructed’ drawings. Refer to plan W10273/2.
934.0	Secam Street structure	3 / 2400 x 2400 mm RCBCs.
959.0	Access Road structure	5 x ∅1800 mm piped culvert.
1029.0	Devlan Street structure	5 x ∅1800 mm piped culvert.
1248.0 1160.0 1130.0	3 Bunnings Warehouse structures	3 x 10m Bridges. Sizes and invert levels were based on hand measurements.
1345.0	Newnham Road structure	4 x ∅1800 mm piped culvert.
1583.0	285 Creek Road structure	1 x 20m Bridge.
1752.9 1690.0 1643.0	3 drop-structures between 215 Creek Road and 285 Creek Road;	Cross-sections from ‘design’ drawings. Refer to plans W8357/5, W8357/10 and W8357/11.
1785.4	215 Creek Road structure	1 x 20m Arch Bridge. Sizes and invert levels were based on hand measurements.
1831.0	215 Creek Road structure	1 x 10m Footbridge. Sizes and invert levels were based on hand measurements.

The cross-sections at Chainages 1253 and 1243 have been aligned parallel and positioned upstream and downstream of the crossing. As the alignment of the crossing is not perpendicular to the flow direction, the “skew” option was used in the HEC-RAS model to reduce the cross-sectional area. For hydraulic structures containing handrails, full blockage of the handrail was assumed in the model.



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HEC-RAS Cross-section Layout
Figure 3.1

3.2.5 Boundary Conditions

Peak discharge was used as the upstream boundary condition at Chainage 1880. A number of "flow change" locations were added to represent the increase in discharge in the downstream direction due to lateral inflows over the 1.9 km length of creek.

At the downstream boundary a "known water level" was used for each ARI event. The adopted values are shown in **Table 3.2**, these flood levels were extracted from the MIKE11 model after its calibration and verification against historic events.

Table 3.2: Downstream Tailwater Level

Design ARI	Flood level (m AHD)
2 year	10.09 (2 year ARI event in Bulimba Creek)
5 year	10.09 (2 year ARI event in Bulimba Creek)
10 year	10.56 (5 year ARI event in Bulimba Creek)
20 year	10.83 (10 year ARI event in Bulimba Creek)
50 year	11.09 (20 year ARI event in Bulimba Creek)
100 year	11.42 (50 year ARI event in Bulimba Creek)

3.3 Modelling Results

3.3.1 General

The HEC-RAS model was run for the 2, 5, 10, 20, 50 and 100 year ARI events. The complete tabulated results are shown in **Appendix I-2** and the flood level and velocity results are discussed separately in **Sections 3.3.2** and **3.3.3** respectively.

From the results, it is apparent that the bank full discharge of the main channel is quite variable and ranges from less than 2 year ARI to the 100 year ARI. The reach predominantly contains sub-critical flows for the full range of ARI events modelled. However, super critical flow is present at the drop structures in the concrete-lined trapezoidal channel.

The results show that during the 2 year and 5 year ARI events, hydraulic jumps occur at drop-structures 1 and 2. This may not happen in reality but the hydraulic jumps have minimal effect on the calculated flood levels.

3.3.2 Flood levels

The flood level results for the six ARI events modelled are shown in **Table 3.3.** The bracketed figures represent the head loss at the hydraulic structure. The respective flood inundation plots for each ARI event are shown in Bulimba Creek Flood Study **Volume 2**.

Table 3.3: Flood Level Results

HEC-RAS Chainage	Flood Water Level (m AHD)					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
1880.0	24.1	24.4	24.4	24.5	24.6	24.9
1873.0	24.1	24.3	24.4	24.5	24.6	24.8
1866.0	24.0	24.2	24.3	24.3	24.5	24.8
1860.0	23.7	24.0	24.2	24.3	24.5	24.8
1854.0	23.7	24.0	24.2	24.3	24.5	24.8
1847.0	23.7	24.0	24.2	24.3	24.5	24.8
1841.0	23.6	24.0	24.2	24.3	24.5	24.8
1834.0	23.6	24.0	24.1	24.3	24.4	24.7
215 Creek Road Footbridge	(0.0)	(-0.1)	(0.0)	(-0.1)	(0.0)	(-0.1)
1828.0	23.6	23.9	24.1	24.2	24.4	24.6
1821.0	23.6	23.9	24.1	24.2	24.3	24.6
1815.0	23.6	23.9	24.1	24.2	24.3	24.6
1808.0	23.6	23.9	24.1	24.2	24.3	24.6
1802.0	23.6	23.9	24.1	24.2	24.3	24.6
1795.0	23.5	23.9	24.1	24.2	24.3	24.6
1790.0	23.4	23.6	23.8	23.8	24.0	24.2
1789.0	23.1	23.3	23.4	23.5	23.7	24.1
1788.8	22.8	23.3	23.5	23.8	24.0	24.3
215 Creek Road Arch Bridge	(-0.1)	(-0.2)	(-0.2)	(-0.2)	(-0.2)	(-0.3)
1782.0	22.7	23.1	23.3	23.6	23.8	24.0
1777.0	22.7	23.2	23.4	23.6	23.8	24.1
1771.0	22.7	23.2	23.4	23.6	23.8	24.1
1765.0	22.7	23.1	23.4	23.6	23.8	24.1
1759.0	22.7	23.1	23.4	23.6	23.8	24.1
1753.0	22.4	22.8	23.0	23.1	23.2	23.4
Drop Structure 1						
1752.9	22.6	23.0	23.1	23.3	23.4	23.6
1690.1	21.9	22.5	22.7	22.8	23.0	23.1
Drop Structure 2						
1690.0	20.1	20.4	20.7	20.9	21.1	21.3
1660.0	21.4	21.8	22.3	22.5	22.7	22.9
1643.1	20.7	21.2	22.1	22.2	22.5	22.6
Drop Structure 3						
1643.0	20.8	21.4	22.3	22.4	22.6	22.7
1625.6	20.4	21.3	22.2	22.3	22.6	22.7
1591.0	20.1	21.2	22.2	22.3	22.5	22.6
285 Creek Road Access Bridge	(-0.4)	(-1.2)	(-0.5)	(-0.4)	(-1.3)	(-0.9)
1576.0	19.7	20.0	20.7	20.9	21.2	21.7
1526.6	19.6	20.1	20.4	20.6	20.8	21.0
1411.0	19.3	19.9	20.1	20.2	20.4	20.6
1366.0	19.2	19.8	20.1	20.2	20.5	20.6
Newnham Road	(-1.2)	(-1.5)	(-1.5)	(-1.4)	(-0.8)	(-0.5)

HEC-RAS Chainage	Flood Water Level (m AHD)					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
Culvert						
1317.0	18.0	18.3	18.6	18.8	19.7	20.1
1282.0	17.8	18.3	18.6	18.9	19.7	20.0
1253.0	17.9	18.4	18.7	18.9	19.7	20.1
Bunnings Warehouse Bridge (U/S)	(-0.2)	(-0.2)	(-0.2)	(-0.2)	(-0.4)	(-0.4)
1243.0	17.7	18.2	18.5	18.7	19.3	19.7
1219.0	17.7	18.2	18.5	18.7	19.2	19.7
1190.0	17.7	18.2	18.5	18.7	19.2	19.8
1164.0	17.8	18.2	18.5	18.7	19.3	19.8
Bunnings Warehouse Bridge (Middle)	(0.1)	(0.0)	(0.0)	(0.0)	(-0.1)	(-0.3)
1156.0	17.7	18.2	18.5	18.7	19.3	19.5
1147.0	17.7	18.1	18.4	18.5	19.0	19.3
1135.0	17.7	18.2	18.4	18.6	19.1	19.3
Bunnings Warehouse Bridge (D/S)	(0.0)	(0.0)	(0.0)	(0.0)	(-0.3)	(-0.3)
1127.0	17.7	18.2	18.4	18.6	18.8	19.0
1125.0	17.7	18.1	18.4	18.6	18.8	19.1
1099.0	17.1	17.9	18.1	18.2	18.4	18.5
1066.0	17.0	17.9	18.1	18.2	18.4	18.5
1047.0	17.0	17.9	18.1	18.2	18.5	18.6
Devlan Street Culvert	(-0.7)	(-1.1)	(-1.0)	(-1.0)	(-1.1)	(-1.1)
1013.0	16.3	16.8	17.1	17.2	17.4	17.5
982.0	16.2	16.8	17.0	17.1	17.3	17.4
Access Road Culvert	(-0.5)	(-0.5)	(-0.5)	(-0.4)	(-0.4)	(-0.4)
948.0	15.7	16.3	16.5	16.7	16.9	17.0
Secam Street Culvert	(-0.3)	(-0.6)	(-0.6)	(-0.7)	(-0.6)	(-0.6)
918.0	15.4	15.7	15.9	16.0	16.3	16.4
905.0	15.4	15.7	15.9	16.1	16.3	16.5
904.9	15.4	15.8	16.0	16.1	16.3	16.5
879.0	15.4	15.7	15.9	16.1	16.3	16.4
SQID Inline Weir	(-0.1)	(0.0)	(0.0)	(-0.1)	(-0.1)	(0.0)
870.0	15.3	15.7	15.9	16.0	16.2	16.4
845.0	15.3	15.7	15.8	16.0	16.2	16.3
798.0	15.1	15.5	15.6	15.7	15.9	16.0
759.0	15.0	15.3	15.5	15.5	15.7	15.8
Unformed Road Culvert	(-1.1)	(-1.1)	(-1.1)	(-1.0)	(-1.1)	(-1.1)
735.0	13.9	14.2	14.4	14.5	14.6	14.7
621.0	12.7	12.9	13.1	13.2	13.4	13.5
498.0	12.0	12.3	12.4	12.5	12.7	12.8
300.0	10.1	10.1	10.6	10.8	11.1	11.4

Inundation and flood immunity levels for each of the structures are given below in **Table 3.4**.

Table 3.4: Structure Inundation and Flood Immunity Levels

Structure Name	Deck Level (m) AHD	Flood Immunity (ARI)	Inundation Over Deck Level (m)					
			2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
Unformed Road Culvert	15.00	2-yr	*0.00*	0.31	0.45	0.53	0.67	0.75
Secam Street Culvert	16.00	2-yr	*-0.32*	0.30	0.54	0.67	0.89	1.02
Access Road Culvert	16.20	< 2-yr	0.04	0.59	0.80	0.91	1.11	1.23
Devlan Street Culvert	17.48	2-yr	*-0.51*	0.38	0.63	0.75	0.97	1.09
Bunnings D/S Bridge	18.74	20-yr	*-1.04*	*-0.57*	*-0.33*	*-0.19*	0.32	0.59
Bunnings Middle Bridge	18.99	20-yr	*-1.24*	*-0.75*	*-0.47*	*-0.29*	0.31	0.80
Bunnings U/S Bridge	19.70	20-yr	*-1.82*	*-1.30*	*-0.98*	*-0.76*	0.04	0.38
Newnham Road Culvert	19.51 (south entrance)	2-yr	*-1.22*	0.32	0.56	0.68	0.97	1.12
285 Creek Road Bridge	22.00	5-yr	*-1.86*	*-0.76*	0.18	0.30	0.52	0.64
215 Creek Road Arch Bridge	24.40	>100-yr	*-1.57*	*-1.11*	*-0.86*	*-0.61*	*-0.39*	*-0.07*
215 Creek Road Footbridge	24.80	>100-yr	*-1.18*	*-0.84*	*-0.67*	*-0.55*	*-0.38*	*-0.06*

Note: The figures in Italics indicate the flood water level below the deck level

There are four locations where in theory a hydraulic jump occurs within the trapezoidal concrete-lined channel. As expected, three of these locations are at the hydraulic drop structures. The fourth location is at the downstream end of the concrete-lined channel where the channel type changes from concrete-lined to the less efficient natural channel. The modelling shows that the hydraulic jumps will generally be 'flooded' out due to the turbulence of the water across the jump. This will result in a more stable water level profile. The longitudinal profile from the hydraulic model is shown in **Figure 3.2**.

3.3.3 Inundation Mapping

The flood immunity at various locations can be observed from the flood inundation plots presented in Bulimba Creek Flood Study **Volume 2**. It should be noted that the elevation data used as the basis for the inundation mapping is dated to 2009. It does not necessarily accurately depict the present day surface elevations at the upstream development (215 Creek Road) where construction was completed after 2009.

The flood inundation plots show that the 215 Creek Road development experiences inundation during the 50 year and 100 year ARI events. Creek Road is inundated during the 10, 20, 50 and 100 year ARI events, with similar results at the Newnham Road intersection. The Bunnings Warehouse main carpark is flooded during the 100 year ARI event while the rear goods storage area shows inundation during the 50 and 100 year ARI events. Further downstream, Secam and Devlan Streets show inundation during events larger than a 2 year ARI. Downstream of the SQID all flooding is confined to open space reserve and no properties are affected.

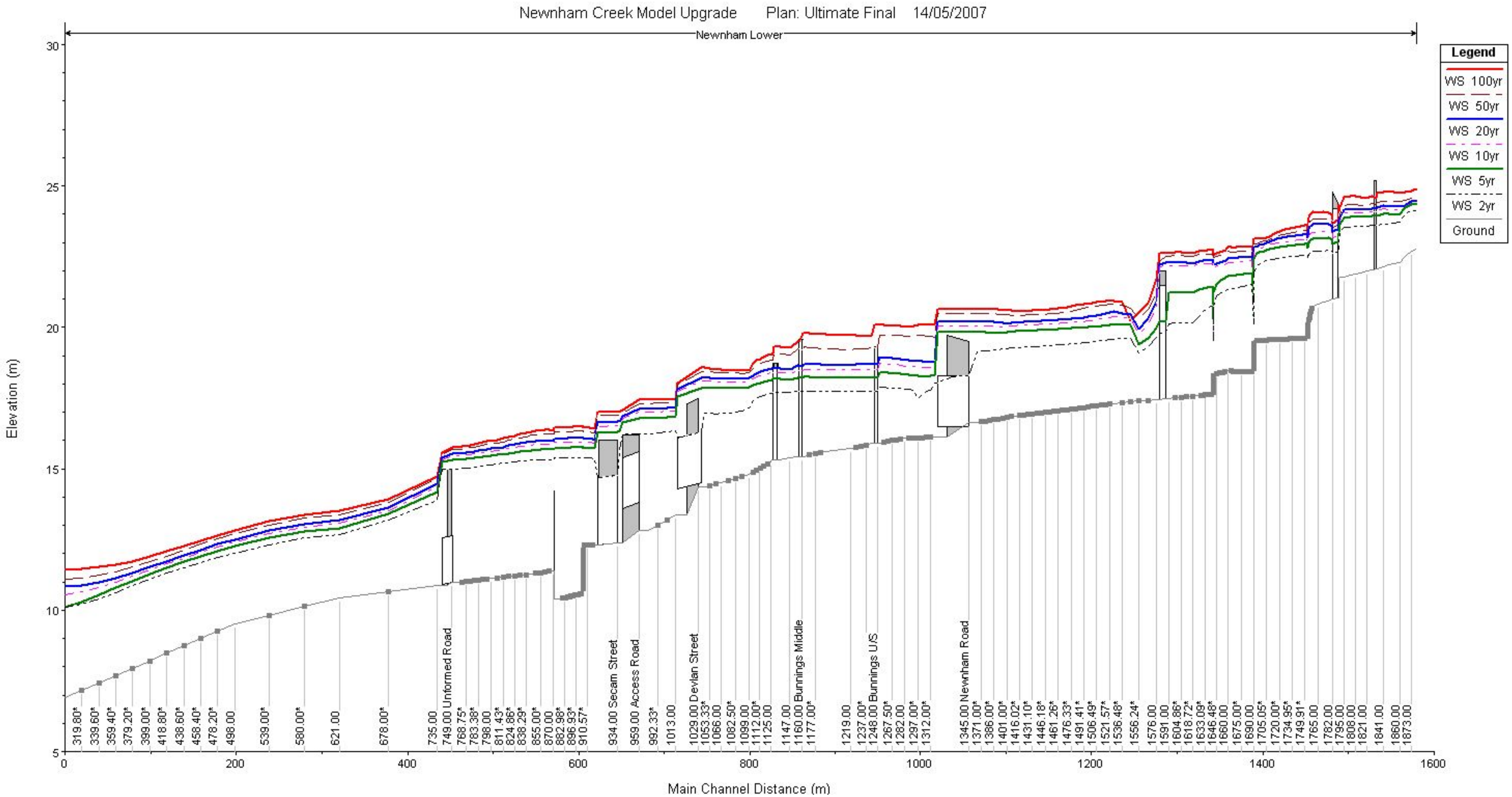

Figure 3.2: HECRAS model -Longitudinal Flood Profile

3.3.4 Velocities

Table 3.5 indicates the peak average velocities within the main channel for the length of creek modelled.

Table 3.5: Velocity Results

HEC-RAS Chainage (m)	Average Velocity (m/s)					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
1880.0	2.1	2.1	2.2	2.2	2.1	1.9
1873.0	1.9	2.0	2.1	2.1	2.1	2.0
1866.0	2.2	2.3	2.4	2.4	2.3	2.1
1860.0	2.9	2.8	2.7	2.5	2.4	2.1
1854.0	2.7	2.6	2.3	2.2	2.1	1.9
1847.0	2.4	2.2	2.0	1.8	1.7	1.5
1841.0	2.2	1.9	1.7	1.6	1.5	1.4
1834.0	2.0	2.0	1.9	1.9	1.9	1.7
215 Creek Road Footbridge						
1828.0	1.8	1.9	1.8	1.8	1.8	1.8
1821.0	1.8	1.9	1.9	2.0	2.0	2.0
1815.0	1.7	1.8	1.8	1.8	1.8	1.8
1808.0	1.6	1.6	1.6	1.6	1.5	1.4
1802.0	1.5	1.4	1.4	1.5	1.4	1.3
1795.0	1.5	1.5	1.5	1.5	1.6	1.5
1790.0	2.3	2.5	2.7	2.7	2.9	3.0
1789.0	3.2	3.5	3.6	3.7	3.7	3.4
1788.8	1.8	1.9	1.9	1.9	1.9	2.0
215 Creek Road Arch Bridge						
1782.0	1.9	2.1	2.1	2.1	2.2	2.3
1777.0	1.5	1.5	1.5	1.4	1.4	1.5
1771.0	1.5	1.4	1.4	1.3	1.3	1.4
1765.0	1.4	1.4	1.4	1.3	1.3	1.4
1759.0	1.4	1.4	1.4	1.3	1.3	1.3
1753.0	2.5	2.8	3.0	3.3	3.5	3.8
Drop Structure 1						
1752.9	1.7	1.9	2.1	2.4	2.5	2.7
1690.1	3.7	3.5	3.6	3.8	3.9	4.1
Drop Structure 2						
1690.0	6.8	6.9	6.9	6.9	6.9	7.0
1660.0	1.7	1.8	1.6	1.7	1.6	1.6
1643.1	3.7	3.7	2.5	2.8	2.7	3.0
Drop Structure 3						
1643.0	2.2	1.9	1.3	1.4	1.4	1.5
1625.6	2.8	1.9	1.1	1.2	1.2	1.2
1591.0	3.0	2.3	1.6	1.8	1.9	2.1
285 Creek Road Access Bridge						
1576.0	4.2	4.8	3.8	3.8	4.1	3.3
1526.6	2.1	2.1	2.0	1.9	1.7	1.7
1411.0	1.4	1.5	1.7	1.8	1.9	1.9

HEC-RAS Chainage (m)	Average Velocity (m/s)					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
1366.0	1.6	0.8	0.7	0.7	0.6	0.6
Newnham Road Culvert						
1317.0	2.8	3.4	3.5	3.6	3.0	2.5
1282.0	2.2	2.4	2.6	2.7	2.4	2.5
1253.0	1.5	1.6	1.7	1.8	1.7	1.7
Bunnings Warehouse Bridge (U/S)						
1243.0	2.1	2.3	2.5	2.6	2.7	2.7
1219.0	1.9	2.2	2.5	2.6	2.8	2.5
1190.0	1.8	2.1	2.4	2.5	2.6	2.3
1164.0	1.6	1.9	2.2	2.3	2.2	2.0
Bunnings Warehouse Bridge (Middle)						
1156.0	1.7	1.9	2.2	2.3	2.3	2.3
1147.0	1.9	2.2	2.5	2.7	2.9	2.9
1135.0	1.6	1.9	2.2	2.4	2.6	2.6
Bunnings Warehouse Bridge (D/S)						
1127.0	1.6	1.9	2.2	2.4	2.8	3.0
1125.0	1.8	2.0	2.2	2.3	2.6	2.7
1099.0	3.0	2.5	2.8	3.0	3.4	3.8
1066.0	1.9	1.5	1.7	1.8	2.1	2.3
1047.0	1.0	0.9	1.0	1.0	1.0	1.1
Devlan Street Culvert						
1013.0	0.9	1.0	1.2	1.3	1.5	1.6
982.0	1.3	1.3	1.4	1.5	1.6	1.7
Access Road Culvert						
948.0	0.8	0.8	0.9	0.9	1.0	1.0
Secam Street Culvert						
918.0	1.1	1.4	1.6	1.7	1.9	2.1
905.0	0.6	0.7	0.9	0.9	1.1	1.2
904.9	0.3	0.4	0.5	0.6	0.7	0.8
879.0	0.6	0.8	0.9	1.0	1.2	1.3
SQID Inline Weir						
870.0	1.2	1.4	1.6	1.7	1.9	2.1
845.0	0.6	0.7	0.8	0.9	1.0	1.1
798.0	0.7	0.8	0.8	0.9	1.0	1.1
759.0	0.7	0.7	0.8	0.9	1.0	1.1
Unformed Road Culvert						
735.0	1.0	1.1	1.2	1.2	1.3	1.4
621.0	0.4	0.5	0.5	0.5	0.6	0.6
498.0	0.9	0.9	1.0	1.0	1.1	1.1
300.0	0.6	0.9	0.7	0.6	0.6	0.6

The velocities are quite varied along the length of the study reach. This is predominantly because of the many different channel types and the presence of numerous hydraulic structures; such as weirs, drop structures, bridges and culverts.

The engineered rock-lined channel within the residential development at 215 Creek Road (Ch.1880 to Ch.1759) contains velocities ranging from approximately 1.3 m/s to 2.3 m/s. A 0.7 m drop in the channel invert level, upstream of the Arch Bridge, causes a spike in velocities. At this location the velocities reach up to 3.7 m/s. The flow is predominantly sub-critical within this reach of the creek.

Within the trapezoidal concrete-lined channel (Ch.1753 to Ch.1527), there are numerous spikes in the velocity profile due to the presence of the hydraulic drop structures at the Chainages 1752.9, 1690 and 1643. As a result, the velocities range from approximately 1.4m/s to 7.0m/s.

Within the short length of natural channel between the concrete-lined channels (Ch.1527 to Ch.1282), the velocities are generally back to below 2m/s, apart from immediately downstream of the Newnham Road Culvert. The flow is almost entirely sub-critical within this length of creek.

The next section of Newnham Creek consists of a concrete-lined channel (Ch.1282 to Ch.1127). The velocities in this section are slightly higher than those in the natural channel segment, ranging from approximately 1.5m/s to 2.9m/s. The flow in this section is sub-critical.

The final section consists of natural channel and is the longest reach of the creek (Ch.1125 to Ch.300). The velocities here are lower, ranging from approximately 0.5m/s to 1.4m/s. There is a spike in velocities at the SQID structure, with increases up to 2.3m/s. All flow in this section is sub-critical.

4.0 Conclusion

BCC City Design Flood Management have undertaken hydraulic modelling of Newnham Creek using HEC-RAS (Version 3.1.3) for steady flow conditions. The hydraulic modelling assumed the presence of Minimum Riparian Corridor (MRC) from immediately downstream of the Secam Street Stormwater Quality Improvement Device (SQID) to the confluence with Bulimba Creek.

The new model was created using the previous BCC HEC-RAS model combined with the 215 Creek Road Development model (containing field survey taken in 2002) and updated with Airborne Laser Scanning (ALS) data and hand measurements taken during site visits. The extents of the model were from immediately upstream of the 215 Creek Road residential development to the confluence with Bulimba Creek. The model incorporated 15 hydraulic structures (6 bridges, 5 culverts, 3 drop-structures and 1 SQID device).

The results of the hydraulic modelling indicate that:

- The Access Road has a very low flooding immunity, overtopping in the 2 year ARI event;
- Secam Street, Devlan Street, Newnham Road and the Unformed Road have low flooding immunity, all being overtopped in the 5 year ARI event;
- The 285 Creek Road Access Bridge has average flooding immunity, being only overtopped in the 10 year ARI event;
- The Up Stream (U/S) , Middle and Down Stream (D/S) Bunnings Warehouse Bridges (Ch. 1248, 1160 and 1131 respectively) have high flooding immunity, with the deck only overtopped in the 50 year ARI event;
- The 215 Creek Road Footbridge and Arch Bridge have flood immunities greater than 100 year ARI.

The flood inundation plots show that:

- The 215 Creek Road development exhibits inundation during the 50 year and 100 year ARI events;
- Creek Road is inundated during the 10, 20, 50 and 100 year ARI events, with similar results at the Newnham Road intersection;
- The Bunnings Warehouse main carpark is flooded during the 100 year ARI event while the rear storage area shows inundation during the 50 and 100 year ARI events;
- Secam and Devlan Streets show inundation during events larger than a 2 year ARI; and
- Downstream of the SQID all flooding is confined to open space reserve and no properties are affected.

The velocities are quite varied along the length of the study reach in all events. This is predominantly because of the effects of hydraulic drop-structures, concrete-lined and natural channels and the MRC. The minimum velocity, which is in the vicinity of 0.4 m/s, occurs in the SQID structure. The maximum velocity, which is in the vicinity of 7.0 m/s, occurs in the trapezoidal concrete-lined channel in the 100 year ARI event at the hydraulic drop structure located at Ch. 1690.

5.0 References

Waterway Management Plan (BCC, 2003c.)

Guidelines for Flood Regulation Line and Minimum Fill Level Assessment (BCC, 1994).

BCC Natural Channel Design Guidelines (BCC, 2003).

Bulimba Creek Flood Study

Report E – Phillips Creek Flood Investigation

Prepared by Brisbane City Council's, City Projects Office

October 2014

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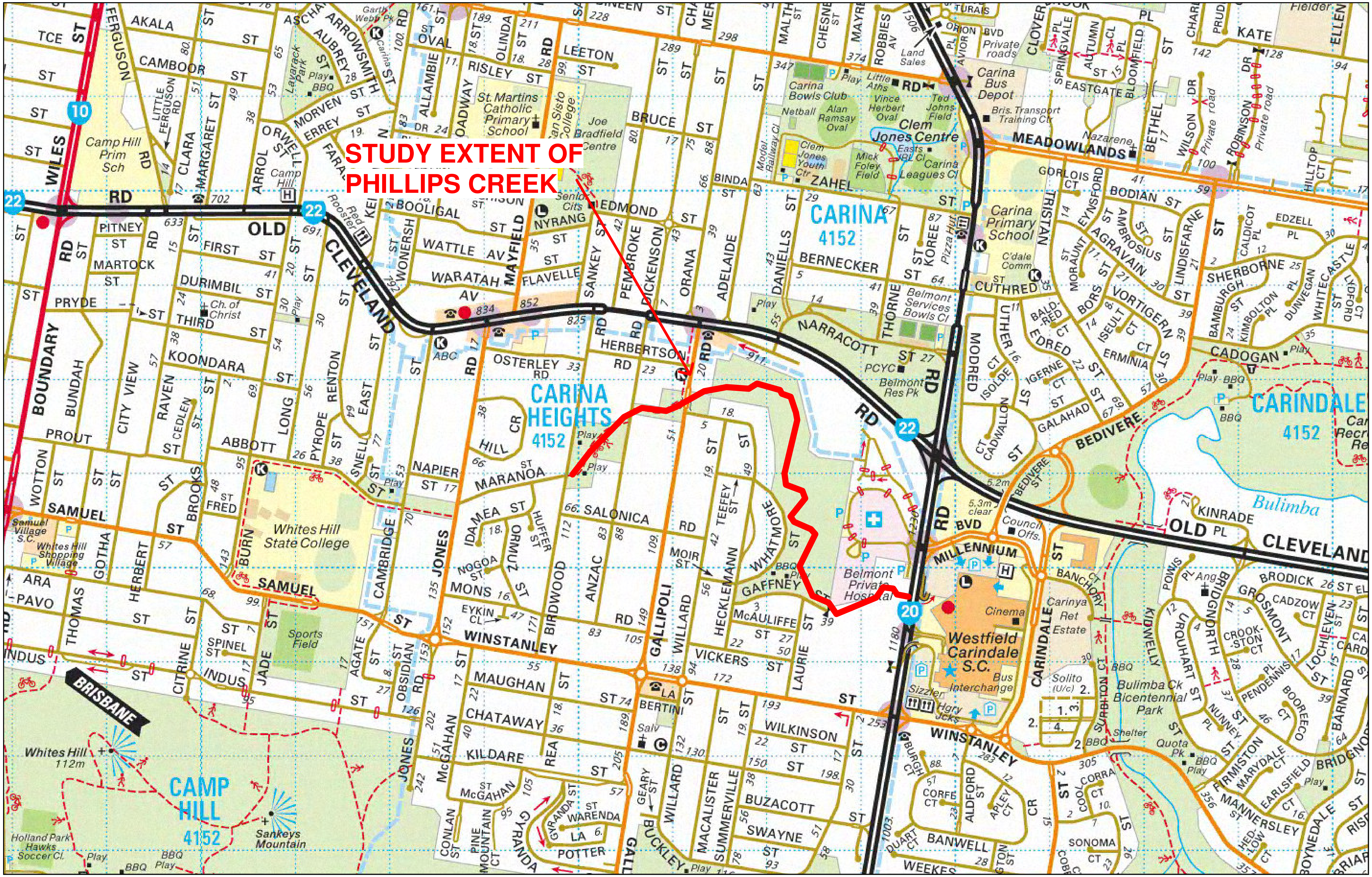
1.0 Introduction

The investigation involves the hydraulic analysis of the waterway section of Phillips Creek between Birdwood Road and Creek Road. The study involves the establishment of a HEC-RAS hydraulic model to determine flood levels and flooding characteristics. Flooding events from the 2 year ARI to the 100 year ARI have been considered.

Historically, there has not been a hydraulic model for Phillips Creek. However, early in 2007 a HEC-RAS model was created to assess the flooding impacts of two bikeway bridges in the vicinity of Creek Road. The hydraulic model used in this investigation extended from Creek Road to Gallipoli Road.

For this investigation, the HEC-RAS model was extended further from Gallipoli Road to Birdwood Road. Upstream of Birdwood Road the old creek channel is piped. **Figure 1.1** indicates the locality of the creek and the extent of the waterway for which the model has been created.



G:\Proj07\070411_Philips_Creek_Model\FloodManagement\MapInfo\Figure 1.1

GDA

webmap

Locality Plan
Figure 1.1

2.0 Catchment Hydrology

2.1 Catchment Description

The Phillips Creek Catchment forms part of the greater Bulimba Creek Catchment and includes areas within the suburbs of Camp Hill and Carina. The contributing catchment area to Creek Road is approximately 3.6km^2 and is indicated in **Figure 2.1**. The catchment falls from an elevation of 110m AHD at Whites Hill Reserve to approximately 5.7m AHD at the upstream side of Creek Road. The catchment is effectively developed and a significant portion of the upper catchment is forested, whereas the middle and lower sections are predominantly urban residential, with some green space adjacent the waterway.

2.2 Creek Characteristics

Hydraulic modelling of Phillips Creek has been undertaken using HEC-RAS (Version 3.1.3) for steady flow conditions, to a total length of approximately 1.6 kms as a part of this investigation. The main channel width varies from approximately 10 to 20m and the depth varies from approximately 2 to 4m. The average bed slope of the creek within the study area is 0.6 % (1 in 167).

The analysed section of the Philips Creek waterway extended immediately downstream of Birdwood Road to the upstream side of Creek Road. Within this reach, the creek passes through two road crossings. The first crossing is at Anzac Road and the second at Gallipoli Road. Further downstream there are two proposed bikeway bridges, one across Phillips Creek and the other across a tributary channel. The creek forms part of a large valley and there are no distinctive floodplains associated with the creek.

Upstream of Gallipoli Road, the creek is in a somewhat natural condition and flows through open space parkland with private properties at close proximity on both sides. The over-banks are characterised by maintained grassed areas with scattered large trees.

Downstream of Gallipoli Road, the creek is heavily vegetated with weeds, shrubs and established trees. The low flow channel meanders within the overall creek cross-section within this reach of the creek.

The section of Phillips Creek immediately upstream of Creek Road within the Belmont Specialist Centre property was re-aligned in 1984, as part of a development approval. The creek was effectively straightened and was considerably shortened, increasing the gradient of the creek. The creek was further re-aligned in 1998, again as part of development within this property.

Downstream of Creek Road the waterway has been piped underneath the Carindale Shopping Centre and Old Cleveland Road. Downstream of Old Cleveland Road the waterway passes through a Stormwater Quality Improvement Device (SQID) then on to Bulimba Creek. Modelling of this complex section of waterway downstream of Creek Road was outside the scope of this investigation.

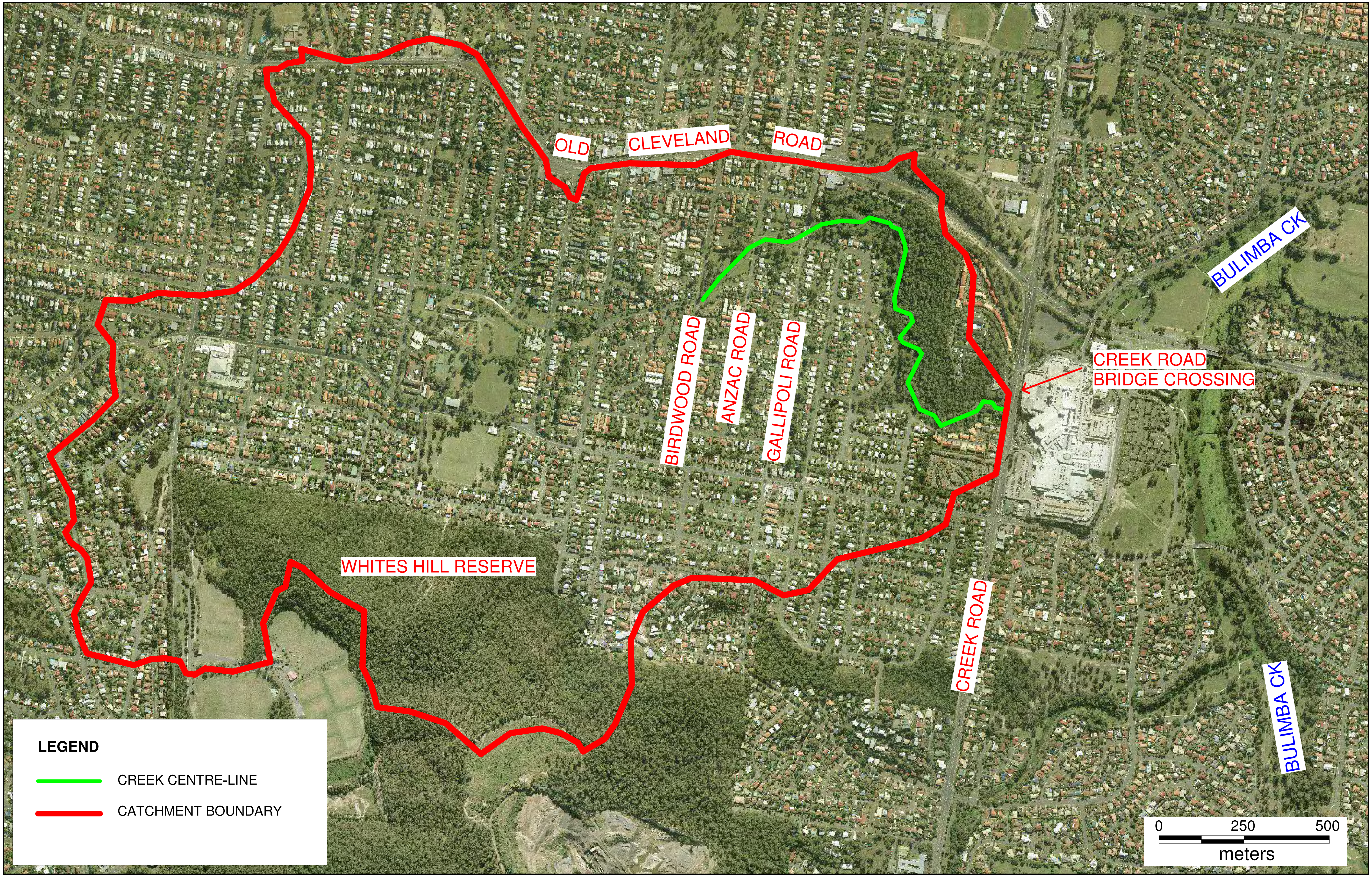
2.3 Discharge Calculations

The Rational Method was used to determine the peak discharge at three locations along the 1.6 km creek length. The peak discharge was used as input into the steady state HEC-RAS model. As calibration data is not available for this creek it wasn't deemed necessary to undertake more rigorous analysis involving hydrologic modelling. Calculations were undertaken for the 2, 5, 10, 20, 50 and 100 year ARI events and were based on "Ultimate" catchment conditions according to the current City Plan (2000). The calculations assumed an impervious area percentage of approximately 35%.

The input parameters and results of the Rational Method calculations are shown in **Table 2.1.** Further details of these calculations are presented in **Appendix K**.

Table 2.1: Adopted Peak Discharge

Location	Catchment Area (ha)	t_c (mins)	Discharge (m^3/s)					
			2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
At Anzac Road	275.0	38.7	30.5	44.1	53.5	65.4	85.1	99.4
At Gallipoli Road	285.8	40.0	30.6	45.2	54.3	66.0	86.4	101.0
At Creek Road	361.4	51.0	34.1	49.9	60.2	73.8	96.8	113.0



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GDA webmap

Phillips Creek Catchment Upstream of Creek Road
Figure 2.1

3.0 Hydraulic Modelling

3.1 General

The hydraulic analysis was undertaken using the HEC-RAS (Version 3.1.3) hydraulic modelling software. Steady flow conditions were used as it was considered that flood storage effects and attenuation due to hydraulic structures would be minimal. Also, this methodology was consistent with previous modelling undertaken for the bikeway bridges.

There are no hydrometric records for Phillips Creek; therefore the model was unable to be verified against historical storm events.

Section 3.2 details the set-up and assumptions used in the modelling. The modelling results are presented in **Section 3.3**.

3.2 HEC-RAS Model Set-up

3.2.1 Cross Sections

The HEC-RAS model for the 1.6 km length of creek was comprised of 21 cross-sections, as shown in **Figure 3.1**.

The cross-section data for the modelling was obtained from the following sources:

- From Chainages 4 to 966, the cross-sectional data was primarily obtained from December 2006 field survey spot levels
- From Chainages 119 and 125, the cross-sectional data was obtained from a DTM (Digital Terrain Model) of the December 2006 field survey.
- From Chainages 1066 to 1580, the cross-sectional data was obtained from a combination of December 2006 field survey spot levels and BCC Airborne Laser Scanning (ALS) data.

The HEC-RAS model extents are from immediately downstream of Birdwood Road (Chainage 1580) to immediately upstream of Creek Road (Chainage 4).

3.2.2 Waterway Corridor

A waterway corridor was incorporated into the HEC-RAS modelling. The waterway corridor was taken from the most recent regulatory information from City Plan (2000) and is also indicated in **Figure 3.1**.

3.2.3 Manning’s ‘n’

A Manning’s ‘n’ value of 0.15 was used to represent the Minimum Riparian Corridor (MRC), which typically represents a distance of 15m either side of the bank of the main channel.

For areas outside the MRC, the Manning’s ‘n’ values were obtained with reference to a site inspection, aerial photography and hydraulic roughness literature. A Manning’s ‘n’ value of 0.05 was generally

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webmap

HEC-RAS Cross-section Layout
Figure 3.1

used for the main channel. Upstream of Gallipoli Road, Manning's 'n' values between 0.03 to 0.06 were used to represent the over-bank areas. Downstream of Gallipoli Road a value of 0.08 was used to represent the over-bank areas.

3.2.4 Hydraulic Structures

Within the study area, there are three crossings over Phillips Creek:

- At Anzac Road (Chainage 1387) the structure consists of a 5 / ∅ 1800 mm piped culvert.
- At Gallipoli Road (Chainage 1234) the structure also consists of a 5 / ∅ 1800 mm piped culvert.
- At Chainage 122 there is a proposed low-level bikeway bridge, which has been included in the model.

The cross-sections at Chainages 119, 125, 1222, 1246, 1377 and 1396 have been aligned parallel and positioned upstream / downstream of the crossings. As the alignment of all three crossings is not perpendicular to the flow direction, the skew option was used in HEC-RAS model to reduce the cross-sectional area. All hydraulic structures were modelled assuming full blockage of the handrail and the Energy Equation results were adopted.

3.2.5 Boundary Conditions

At Chainage 1580 of the HEC-RAS model the upstream boundary condition was represented by the peak discharge. To represent lateral inflows along the 1.6km length of creek, the flow was increased in the downstream direction at these locations.

At the downstream boundary a known water level was used for each ARI event. The adopted values are shown in **Table 3.1** and were obtained from the *Draft Design Report for the Phillips Creek Sewer Stabilisation Works* (2001), which investigated a section of the creek upstream of Creek Road. The 20 year ARI event flood level was not available, so it was interpolated at this location. As the creek has a reasonable longitudinal bed slope, any accuracy limitations with selection of the tail water level will only influence flood levels locally upstream of Creek Road.

Table 3.1: Downstream Tail water Level

Design ARI	Flood level (m AHD)
2 year	8.4
5 year	9.2
10 year	9.5
20 year	9.8
50 year	10.2
100 year	10.6

3.3 Modelling Results

3.3.1 General

The HEC-RAS model was run for the 2 year to 100 year ARI events. The complete tabulated results are shown in **Appendix I-2** and the flood level and velocity results are discussed separately in **Sections 3.3.2** and **3.3.3** respectively. **Section 3.3.4** shows a comparison between the current 100 year ARI level used for flood planning purposes and the results of this study.

From the results, it is apparent that the bank full discharge of the main channel of the creek is less than the 2 year ARI and the flow is sub-critical for the full range of ARI events modelled.

3.3.2 Flood levels

The flood level results for the six ARI events modelled are shown in **Table 3.2** and graphically in **Figure 3.2**. The respective flood inundation plot for each ARI event is shown in Bulimba Creek Flood Study **Volume 2**.

Table 3.2: Flood Level Results

Chainage	Floodwater Level (m AHD)					
	2 year ARI	**5 year ARI**	**10 year ARI**	**20 year ARI**	**50 year ARI**	**100 year ARI**
1580	17.71	18.34	18.70	19.03	19.38	19.59
1533	17.50	18.24	18.64	18.99	19.36	19.57
1464	17.38	18.22	18.64	19.00	19.37	19.59
1396	17.23	18.12	18.54	18.89	19.24	19.44
Anzac Rd Culvert	Minimum level for overtopping ~ 17.60 m AHD					
1377	16.83	17.27	17.46	17.66	17.97	18.17
1329	16.70	17.17	17.37	17.58	17.91	18.12
1246	16.12	16.77	17.00	17.24	17.60	17.83
Gallipoli Rd Culvert	Minimum level for overtopping ~ 16.05 m AHD					
1222	15.74	16.06	16.24	16.46	16.87	17.14
1130	14.54	14.90	15.04	15.19	15.40	15.53
1066	13.99	14.35	14.52	14.72	14.99	15.15
966	13.44	13.72	13.86	14.00	14.24	14.39
861	13.08	13.41	13.58	13.76	14.04	14.22
718	12.30	12.56	12.69	12.84	13.07	13.21
554	11.42	11.69	11.84	12.00	12.25	12.40
417	10.98	11.25	11.40	11.56	11.80	11.93
374	10.34	10.59	10.71	10.88	11.08	11.24
328	10.09	10.35	10.49	10.68	10.99	11.24
214	9.13	9.59	9.82	10.09	10.46	10.81
125	8.79	9.40	9.67	9.96	10.36	10.74
Proposed Bridge	Minimum level for overtopping ~ 8.25 m AHD					
119	8.72	9.36	9.64	9.94	10.34	10.72
4	8.40	9.20	9.50	9.80	10.20	10.60

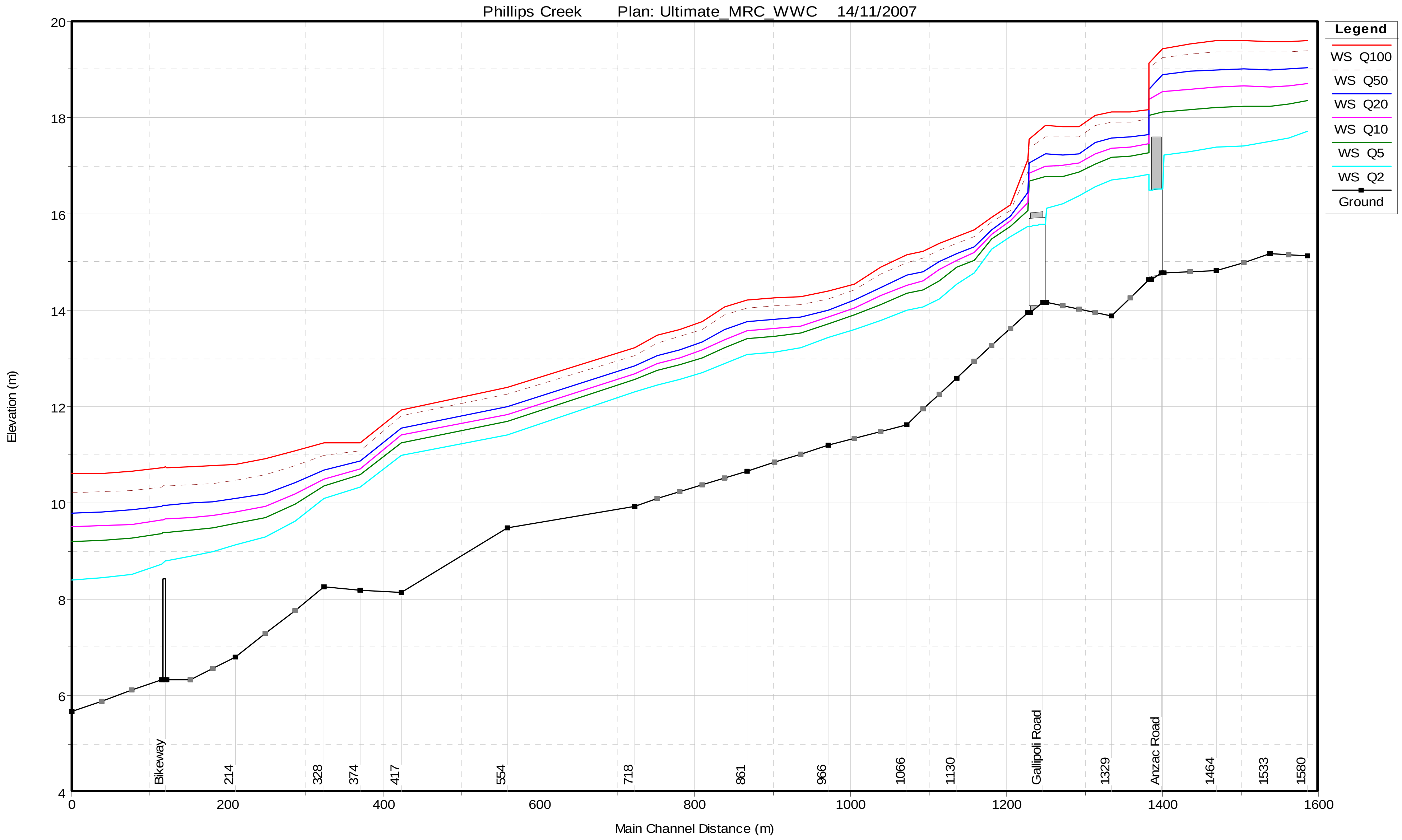

Figure 3.2: Longitudinal Flood Profile

From these results, it is apparent that:

- Both Anzac Road and Gallipoli Road culvert crossings have very low flooding immunity.
- Anzac Road has flood immunity of between 2 year to 5 year ARI and Gallipoli Road has flood immunity of approximately 2 year ARI.
- Anzac Road is inundated by approximately 0.50m in the 5 year ARI event and 1.85m in the 100 year ARI event.
- Gallipoli Road is inundated by approximately 0.7m in the 5 year ARI event and 1.80m in the 100 year ARI event.

The proposed low-level bikeway bridge at Chainage 122 is inundated by all ARI events modelled. In the 2 year ARI event the bridge is inundated by approximately 0.55m and in the 100 year ARI event by approximately 2.5m.

3.3.3 Velocities

Table 3.3 indicates the peak average velocities within the main channel for the length of creek modelled.

Table 3.3: Velocity Results

Chainage	Main Channel Peak Average Velocity (m/s)					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
1580	1.8	1.8	1.9	2.0	2.2	2.4
1533	1.5	1.4	1.4	1.5	1.6	1.8
1464	1.1	0.9	0.8	0.9	0.9	1.0
1396	1.3	1.2	1.2	1.3	1.5	1.6
Anzac Rd Culvert						
1377	1.1	1.3	1.4	1.6	1.8	1.9
1329	1.2	1.2	1.2	1.2	1.3	1.3
1246	1.7	1.4	1.3	1.3	1.3	1.3
Gallipoli Rd Culvert						
1222	1.4	1.7	1.9	2.1	2.2	2.2
1130	1.8	1.7	1.7	1.7	1.8	1.9
1066	1.4	1.6	1.8	1.8	1.8	1.9
966	1.5	1.8	2.0	2.2	2.3	2.4
861	0.9	1.0	1.1	1.1	1.3	1.3
718	1.9	2.2	2.4	2.6	2.9	3.1
554	1.8	2.0	2.1	2.1	2.3	2.4
417	1.4	1.6	1.7	1.9	2.1	2.2
374	2.9	3.1	3.3	3.4	3.6	3.6
328	1.7	1.8	1.8	1.8	1.9	1.8
214	1.6	1.7	1.8	1.9	2.0	2.0
125	1.5	1.3	1.3	1.3	1.4	1.4
Proposed Bridge						
119	1.6	1.3	1.3	1.4	1.4	1.4
4	1.0	1.0	1.0	1.1	1.2	1.2

There is a wide range of velocities along the length of the study reach. The minimum velocity, which is in the vicinity of 0.83m/s, occurs at Chainage 1464 in the 10 year ARI event. The maximum velocity, which is in the vicinity of 3.63m/s, occurs at Chainage 374 in the 100 year ARI event.

During an inspection of the site it was observed that downstream of Gallipoli Road there were a number of locations where erosion was occurring on the outside of bends within the main channel. Whilst bank erosion is a natural occurrence in creek systems, the degree of bank erosion would suggest that the creek has still to reach equilibrium conditions. One of these locations is in the vicinity of Chainage 966 and another is in the vicinity of Chainage 214. Excessively high velocities are not reflected in the HEC-RAS results at these locations. This is most likely because the modelling doesn't consider the current conditions, but rather considers the future flood planning scenario (MRC and waterway corridor) where velocities would be lower than existing.

3.3.4 Comparison with Current Flood Planning Level

As there is no existing hydraulic model for the creek, the current 100 year ARI levels used for flood planning purposes are based on the highest recorded flood level[7] plus 0.7m. A comparison between this level and the Ultimate 100 year ARI level determined as part of this study is shown in **Figures 3.3** and **3.4**.

From **Figure 3.3** it is apparent that the current level used for 100 year ARI flood planning purposes is significantly above the Ultimate 100 year ARI level; at some locations the difference is up to 1.1m. This difference is most likely very conservative as the current level used for 100 year ARI flood planning purposes incorporates a significant degree of interpolation between recorded debris marks. However, in terms of flood inundation extents, there is very little difference. This is because areas adjacent the creek are relatively steep and therefore a vertical change in flood level does not translate to a significant increase in lateral flooding extents.

[7] Recorded flood levels measured from debris marks. No Maximum Height Gauges are present within the catchment.

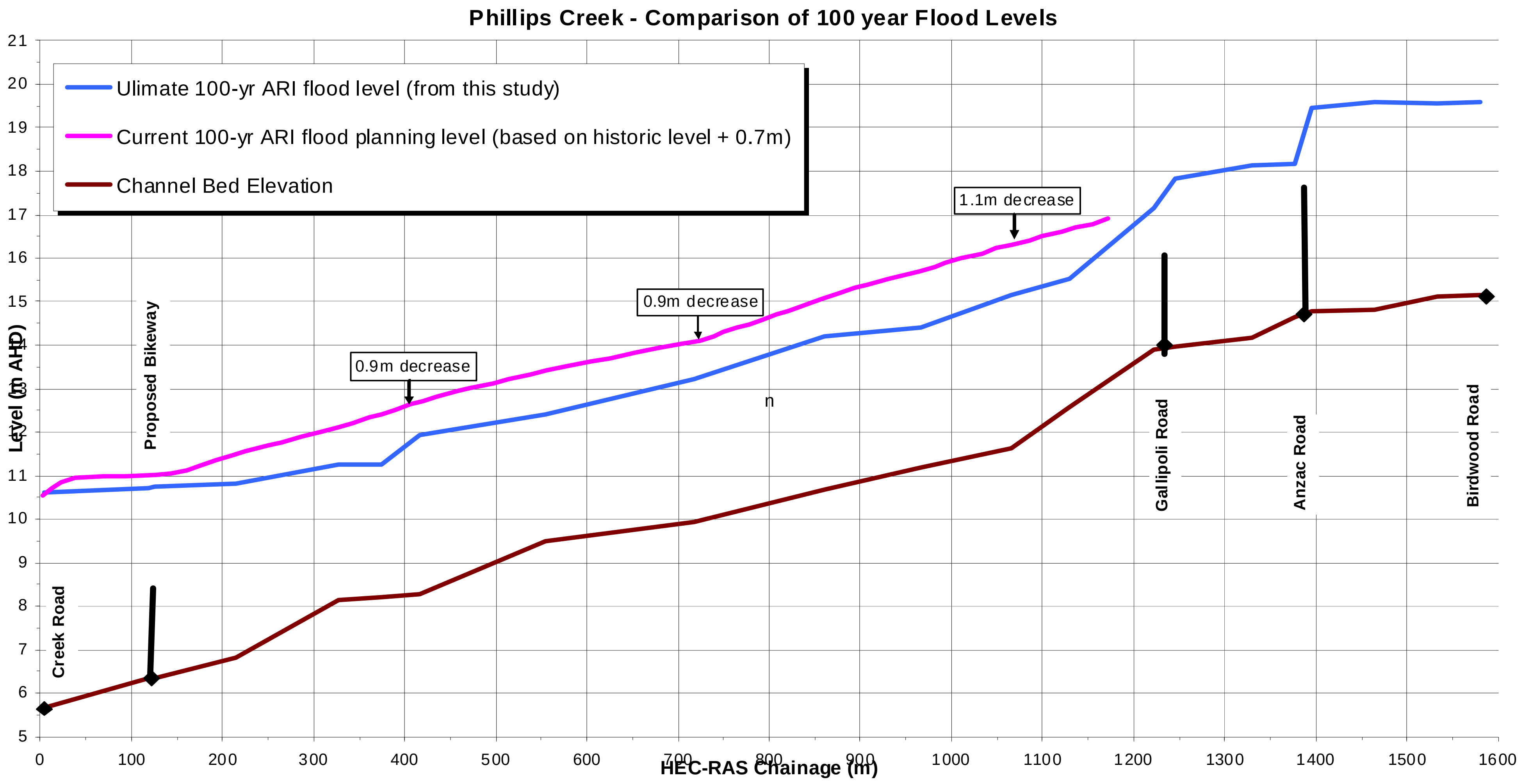

Figure 3.3: Comparison of 100 year ARI Flood Levels

G:\Proj07\070411_Philips_Creek_Model\FloodManagement\MapInfo\100yr Inundation Comparison

Figure 3.4: Comparison of 100-yr Flood Inundation Extents

4.0 Conclusion

Hydraulic modelling of Phillips Creek has been undertaken using HEC-RAS (Version 3.1.3) for steady flow conditions. The hydraulic modelling assumed the presence of both a waterway corridor and Minimum Riparian Corridor (MRC). The model was created predominantly from field survey undertaken in December 2006. Hydrologic calculations were undertaken using the Rational Method, assuming ultimate catchment development to the current Brisbane City Plan (2000). The model extended from immediately downstream of Birdwood Road to immediately upstream of Creek Road, approximately 1.6 km. The location was shown in **Figure 1.1**.

The model incorporated road crossings at Anzac Road and Gallipoli Road together with a proposed bikeway crossing located near Creek Road. The results of the hydraulic modelling indicate that both road crossings have very low flooding immunity. At Anzac Road the flood immunity is between 2 year to 5 year ARI and at Gallipoli Road the flood immunity is approximately 2 year ARI. The proposed low-level bikeway bridge is inundated by all ARI events modelled. There are a number of properties with low flood immunity in the immediate vicinity of the Anzac and Gallipoli Road crossings, as shown in the flood inundation maps in Bulimba Creek Flood Study **Volume 2**.

The current 100 year ARI flood level used for flood planning purposes is significantly higher than the 100 year ARI flood level determined in this study. At some locations the difference is up to 1.1m. The flood levels currently used for flood planning purposes are derived from interpolation between records from the highest recorded creek flooding. While the flood level difference may seem large, there is very little difference in flood inundation extents as areas adjacent the creek are relatively steep, and a vertical change in flood level does not translate to a significant increase in lateral flood extents.

5.0 References

BCC 2000, *Brisbane City Plan 2000*, Brisbane City Council, Brisbane.

Draft Design Report for the Phillips Creek Sewer Stabilisation Works (2001).

Bulimba Creek Flood Study

Report F – Salvin Creek Flood Investigation

Prepared by Brisbane City Council's, City Projects Office

October 2014

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1.0 Introduction

Salvin Creek is a small tributary of Bulimba Creek located in Brisbane's southern suburbs as indicated in **Figure 1.1**. The creek catchment comprises an area of 5.4 km^2. The Salvin Tributary junction with Bulimba Creek is in the vicinity of Meadowbank Street in Carindale. The Creek consists of two main branches:

- The main reach merges with Bulimba Creek near Meadowbank Street, Carindale and extends upstream to Cavendish Road, Mt Gravatt East.
- The Glengariff reach separates from the main reach just upstream of Creek Road near Glengariff Street, Mt Gravatt East and extends upstream to the quarry located within Whites Hill Reserve, north of Pine Mountain Road.

Salvin Creek flows with a steep gradient and crosses Tristania Street and Pine Mountain Road in Mt Gravatt East, and Creek Road and Donnington Street (2 crossings) in Carindale.

The Salvin Creek Flood Investigation includes the hydraulic analysis of both the main and Glengariff reaches. The study involves the establishment of a HEC-RAS hydraulic model to determine flood levels for the 2, 5, 10, 20, 50 and 100 year ARI design events for the waterway. The flood levels derived from this study will be used as the basis in updating the Council's design flood level records.

Figures 1.1 and 1.2 indicate the locality of the creek and the extent of the open waterway for which the hydraulic model has been created.

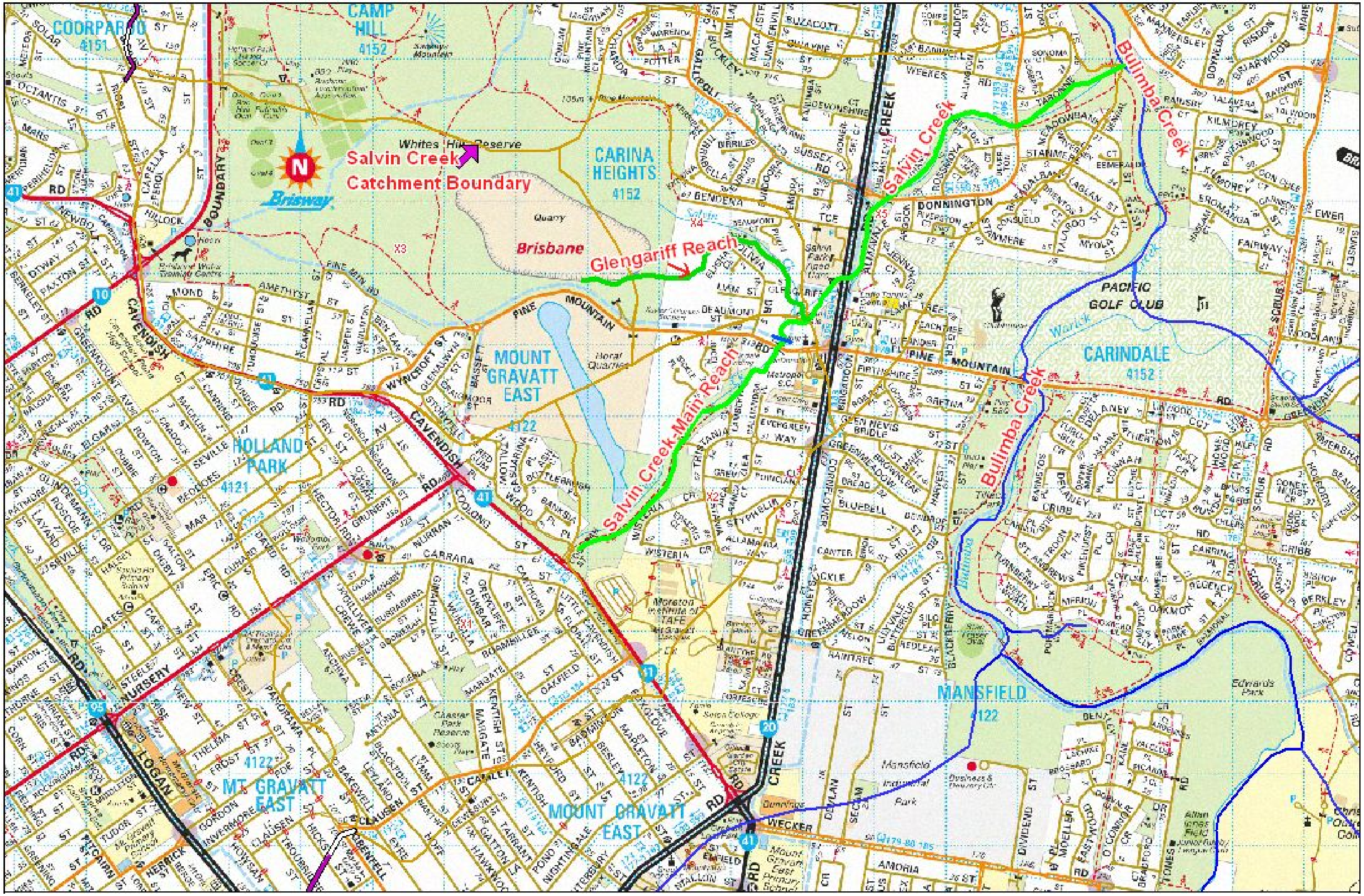

Figure 1.1: Salvin Creek Location Map

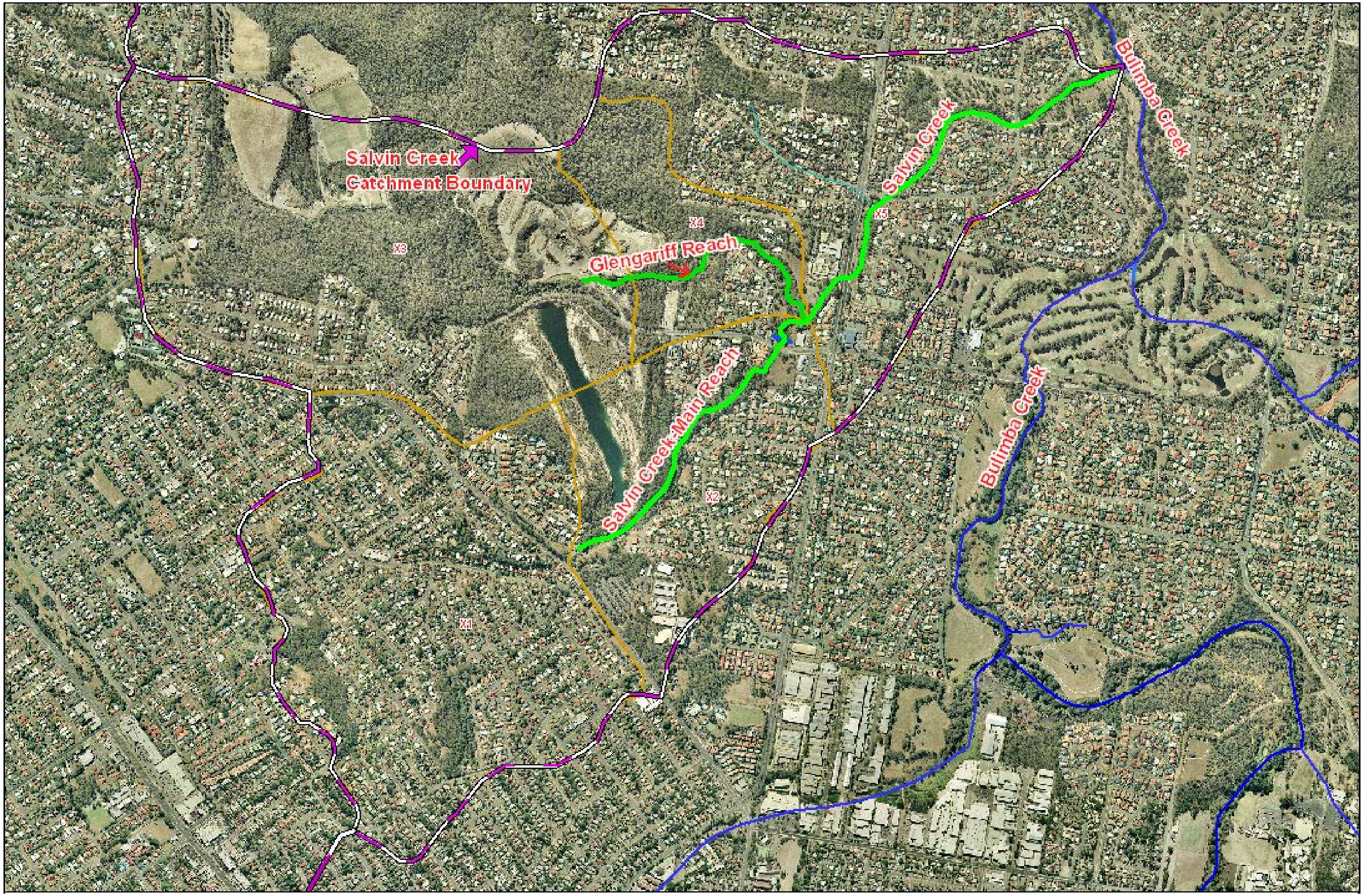

Figure 1.2: Salvin Creek Location Map with Aerial Image (2008)

2.0 Catchment Hydrology

2.1 Catchment Description

The Salvin Creek Catchment forms part of the Bulimba Creek Catchment and is located within the suburbs of Mt Gravatt East, Holland Park, Carina Heights and Carindale. The contributing catchment area of Salvin Creek up to the confluence with Bulimba Creek is approximately 5.4 km^2, of which almost 2.0 km^2 feeds the Glengariff Tributary. A portion of the catchment within the Glengariff tributary is forested as part of the Whites Hill Reserve in Carina Heights. The remaining parts of catchment are occupied by the urban residential and commercial developments. **Figure 1.2** shows the extent of the Salvin Creek Catchment.

2.2 Creek Characteristics

The main reach of Salvin Creek begins immediately west of Cavendish Road, Mt Gravatt East. At this point, catchment runoff exits as pipe drainage from the road crossing at an elevation of approximately 40 m AHD and flows for nearly 2.7 km to reach Bulimba Creek.

The Glengariff tributary originates in the Whites Hill Reserve at an elevation of about 70 m AHD. The bed gradient of the Glengariff tributary is steeper than the main reach of the Salvin Creek. The average bed slope of the creek within the study area is approximately 1.0 % (1 in 100). The length of this reach considered for modelling is nearly 1 km.

The Creek has been divided into upper and lower reaches for the purpose of modelling in the HEC-RAS hydraulic (steady flow) model. The Upper reach is defined as that part of the creek located between Cavendish Road and its junction with the Glengariff tributary, and has a length of about 1.2 km. The remainder of the main reach up to Bulimba Creek is named as the Lower reach and it occupies a length of about 1.5 km.

2.3 Discharge Calculations

The WBNM hydrologic model developed for the entire Bulimba Creek Catchment was used to derive design event flows for Salvin Creek Catchment. Details of the extracted flow rates are listed in **Table 2.1** below.

Within the WBNM model the Salvin Creek Catchment contains five sub-catchments; two of these are located in the Glengariff reach, two in the Upper reach and the other in the Lower reach. Flow rates generated by the WBNM hydrologic model for 2, 5, 10, 20, 50 and 100 year ARI events were extracted and adopted in the HEC-RAS model.

In reviewing the layout of contributing stormwater drainage network within the Salvin Creek Catchment, it was apparent that there were more than two main inflow locations along the length of the upper and lower reaches. Therefore additional flow change locations were added to the Lower reach of the model to further distribute the flow along the length of creek being modelled.

Table 2.1: Adopted Peak Discharge used in HEC-RAS Model

HEC-RAS Chainage (m)	Inflow location (cross section)	WBNM sub catchment ID	Ultimate Development Catchment Discharge (m^3/sec)					
			2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
Upper Reach								
2130	SC110	X_1	16.9	23.9	30	35.5	43.1	49.3
1930	SC100	X_2	24.1	34.5	43.3	51.6	62.5	71.6
Glengariff Reach								
910	SC1040	X_3	12.8	19.1	24.5	29.3	36.1	41.6
510	SC1020	X_4	17.1	25.5	32.6	38.8	48.1	55.5
Lower Reach								
913	ALS-2	X_1-X_4	35.6	49.5	59.4	69.2	82.6	92
865	SC1040	20% X_5	38.7	53.8	64.6	77.5	90	107.4
486	SC1020	60% X_5	46.6	64.6	77.5	90	107.5	125.5

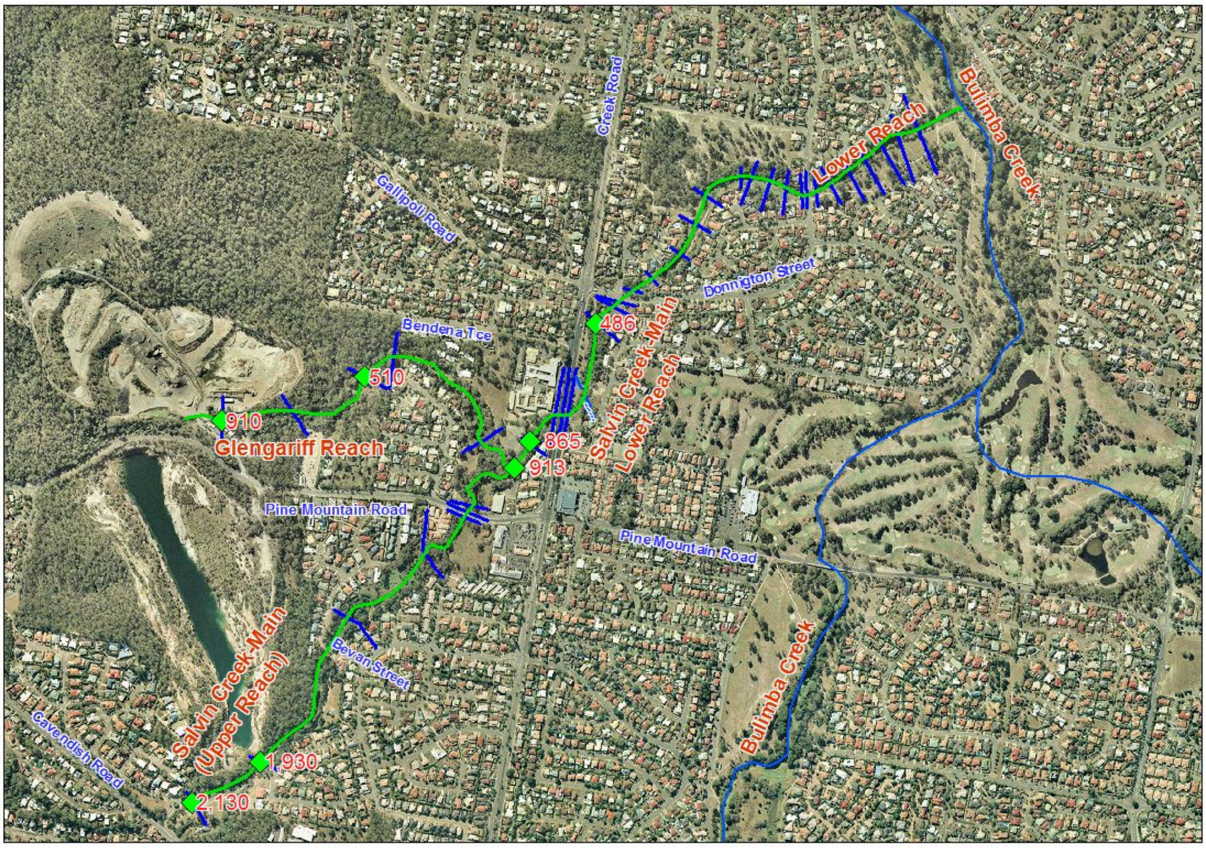

Figure 2.1: Salvin Creek Catchment Inflow Points (with HEC-RAS Chainage)

3.0 Hydraulic Modelling

3.1 General

The hydraulic analysis was undertaken using the HEC-RAS (Version 3.1.3) hydraulic modelling software for steady flow conditions. **Section 3.2** details the set-up and assumptions used in the modelling. The modelling results are presented in **Section 3.3**.

No recorded stream levels exist in the catchment and therefore model calibration was not undertaken.

3.2 HEC-RAS Model Setup

The Salvin Creek main reach and Glengariff reach were both modelled in HEC-RAS to the extents described in **Section 2.2**. As mentioned above the main reach is divided into Upper and Lower reaches, with the separation point being the confluence with the Glengariff reach. In the HEC-RAS model reported in this study the main reach of Salvin Creek was extended from Glenheaton Court, Carindale down to the confluence with Bulimba Creek.

Salvin Creek has one bridge crossing and four culvert crossings and all of them are located in the main reach. A description of the location of each of these structures is given in **Section 3.2.4**.

3.2.1 Cross Sections

Cross section survey was undertaken in the main reach of Salvin Creek in March 2001 to enable the development of an earlier HEC-RAS model. A total of 18 cross-sections were surveyed in the main reach from immediately downstream of Cavendish Road to Glenheaton Court. A further 12 sections were extracted in 2004 from the ALS data (2002) to enable the lower reach to be extended downstream to the Bulimba Creek confluence.

Five cross sections were surveyed for the Glengariff reach in July 2000. An additional five cross sections were extracted in association with this Salvin Creek study from the ALS data (2002).

The reach lengths between each cross section were measured and chainages assigned to each cross section with zero chainage representing the most upstream cross section. Interpolated cross sections were introduced into the upper reach of Salvin Creek using the function supplied within HEC-RAS. These were placed at locations where the channel shape varied linearly between cross sections.

The locations of the model cross sections are shown in **Figure 3.1: Salvin Creek - HECRAS Model Cross Section Layout**. The cross section identifiers adopted for the survey, location descriptions and chainages (where appropriate) are included in **Table 3.1**.

3.2.2 Minimum Vegetated Riparian Corridor (MRC)

The vegetation along the edge of a waterway is called riparian vegetation i.e. it is the vegetation attached to the creek. It is a key contributor to waterway health, acting as a buffer between the waterway and adjacent lands. A well-vegetated riparian zone can improve water quality by filtering overland flow and reducing erosion along creek banks. Shady trees protect vulnerable organisms from extremes of temperature; root systems and woody debris become habitat for fauna; and organic matter sustains aquatic food webs. Vegetation also provides habitat and forage for fauna and adds to a waterway's recreational value. The *Waterway Management Plan* (BCC, 2003c) process allows the hydrological and ecological impacts of riparian revegetation to be assessed and managed in an integrated manner.

This study calculates anticipated flood levels assuming a MRC width along the entire creek system. This hydraulic investigation does not in any way imply that Council is planning to establish a minimum riparian vegetated corridor width in the Salvin Creek Catchment. The minimum vegetated riparian corridor is modelled solely in recognition that at some unspecified time in the future, revegetation may occur, either through natural regeneration or as a result of human planting programs. The results of this modelling are intended to ensure that the habitable floor levels of developments within the floodplain take account of possible future revegetation. This type of forward planning is supported by *Guidelines for Flood Regulation Line and Minimum Fill Level Assessment* (BCC, 1994).

A MRC was incorporated into the HEC-RAS modelling by increasing the hydraulic roughness parameters in the riparian zone. A Manning's 'n' value of 0.15 was used to represent the MRC, which typically incorporates a distance of 15m either side of the top of the creek bank.

3.2.3 Manning's Roughness (n)

For areas outside the MRC, the Manning's 'n' values were obtained from site inspections conducted in March 2001, aerial photography and hydraulic roughness literature. A significant variation in Manning's values was found along each tributary. Following the observation of debris collected at crossings in the storm event in March 2001, it was considered reasonable to assume that bridge or culvert handrails would be blocked during a storm event, irrespective of their size. **Table 3.1: Mannings' Roughness - Salvin Creek** lists the Manning's roughness values chosen for Salvin Creek.

Table 3.1: Manning's Roughness – Salvin Creek

Chainage (m)	Cross Section ID	Location Description	Manning's Roughness Value		
			Left overbank	Main channel	Right overbank
Upper Reach					
2130	SC110	Downstream of Cavendish Road	0.08	0.045	0.08
1930	SC100	Adjacent to Wisteria Crescent	0.08	0.035	0.08
1610	Culverts	Bevan Street Bridge Crossing	0.08	0.05	0.08
1515	SC90	North of Bevan Street	0.08	0.045	0.08
1275	SC80	South of Pine Mountain Road	0.08	0.035	0.08
1145	SC70	South of Pine Mountain Road	0.08	0.035	0.08
1144	SC60	Pine Mountain Road weir profile	N/A	N/A	N/A
1115	SC50	North of Pine Mountain Road	0.12	0.06	0.06
1103	SC50-	South of Pine Mountain Road	0.12	0.06	0.06
1095	SC50-	DS of Energy dissipater	0.12	0.035	0.06
1035	ALS-1	South of Glengariff merging point	0.10	0.04	0.10
Lower Reach					
913	ALS-2	48m US of SC40	0.10	0.04	0.1
865	SC40	Upstream of Creek Road	0.08	0.035	0.08
797	ALS-4	Upstream of Creek Road	0.10	0.035	0.10
767	SC30	Upstream of Creek Road	0.10	0.035	0.10
736	SC20	Creek Road weir profile	N/A	N/A	N/A
735	SC10	Downstream of Creek Road	0.03	0.045	0.08
670	ALS-5	Downstream of Creek Road	0.06	0.04	0.01
486	CS1	South of Donnington Street	0.03	0.04	0.06
430	CS2	South of Donnington Street	0.03	0.06	0.06
420	ALS	1m upstream Donnington Street	0.03	0.03	0.06
419.5		Donnington Street culvert	N/A	N/A	N/A
385	ALS-6	Downstream of Donnington Street	0.06	0.045	0.06
348	CS3	North of Donnington Street	0.035	0.045	0.035
257	CS4	Adjacent to 11 Norham Court	0.035	0.045	0.035
175	CS5	Adjacent to 15 Norham Court	0.035	0.05	0.035
100	CS6	N-W of Glenheaton Court	0.08	0.05	0.08
0	CS7	N-E of Glenheaton Court	0.08	0.05	0.08
-20	RS-1	20m DS of CS7	0.13	0.06	0.13
-66	RS-2	66m DS of CS7	0.13	0.06	0.13
-108	RS-3	108m DS of CS7	0.13	0.06	0.13
-146	RS-3.5	146m DS of CS7	0.13	0.06	0.13
-153	RS-4	183m DS of CS7,US Donnington	0.13	0.06	0.13
-181	RS-6	181m DS of CS7,DS Donnington	0.13	0.06	0.13
-187	RS-6.5	187m DS of CS7	0.13	0.06	0.13

Chainage (m)	Cross Section ID	Location Description	Manning's Roughness Value		
			Left overbank	Main channel	Right overbank
-226	RS-7	226m DS of CS7	0.13	0.06	0.13
-280	RS-8	280m DS of CS7	0.13	0.06	0.13
-329	RS-9	396m DS of CS7	0.13	0.06	0.13
-381	RS-10	381m DS of CS7	0.13	0.06	0.13
-428	RS-11	428 m DS of CS7	0.13	0.06	0.13
-479	RS-12	479m DS of CS7	0.13	0.06	0.13
Glengariff Tributary					
910	SC1040	Adjacent to Pine Mountain Road	0.08	0.06	0.08
730	SC1030	White Hill Reserve	0.08	0.06	0.08
510	SC1020	White Hill Reserve	0.08	0.06	0.08
410	SC1010	End of Olivia Drive	0.08	0.045	0.08
90	SC1000	Adjacent to Glengariff Street	0.10	0.045	0.10
40	ALS-3	North of Pine Mountain Road	0.08	0.035	0.08

3.2.4 Hydraulic Structures

Within the model there are five hydraulic structures: one bridge and four culverts and are modelled in the main branch of Salvin Creek. **Table 3.2** contains the configuration details of each of these structures.

Table 3.2: Hydraulic Structure Details

HEC-RAS Chainage (m)	Structure	Configuration
Salvin Creek: Upper Reach		
1609	Bevan Street culverts	3 / 3300 x 1500mm RCBCs (Plan no. WP1081)
1144	Pine Mountain Road culverts	3 / 2700 x 1800mm RCBCs (Plan no. W9418)
Salvin Creek: Lower Reach		
736	Creek Road Bridge	Four span (18m total) concrete bridge
419.5	Donnington Street culverts (No.1)	3 / 3600 x 2400mm RCBCs (W5674 S04B)
-5	Donnington Street culverts (No.2)	3 / 6000 x 3500mm RCBCs

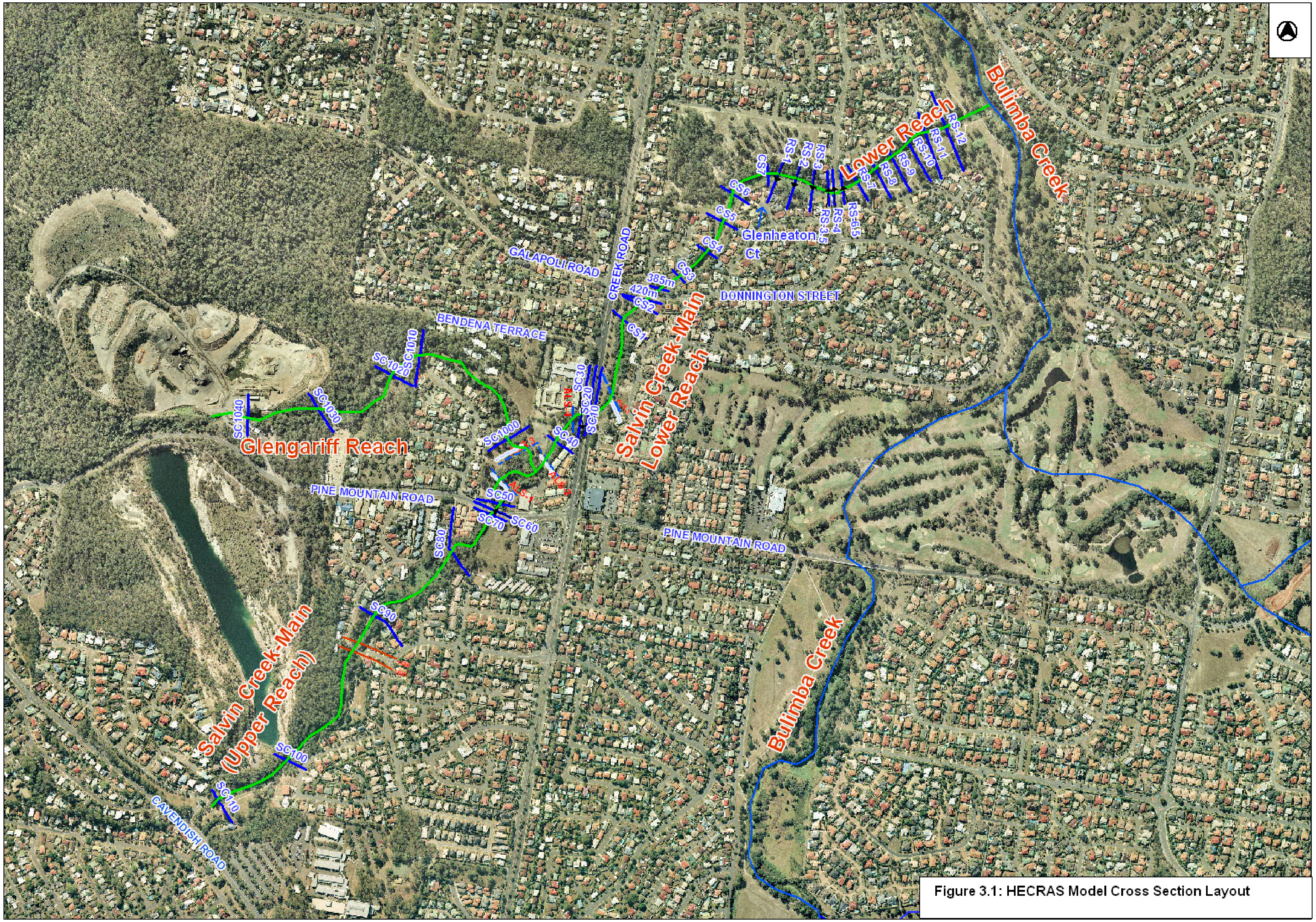

Figure 3.1: HEC-RAS Model Cross Section Layout

3.2.5 Boundary Conditions

Peak discharges were obtained from the WBNM hydrologic model of Bulimba Creek and used as the upstream boundary conditions in the HEC-RAS model. These discharges were applied to the Upper Reach at chainage 2130 and at chainage 910 in the Glengariff Reach. Flow change locations as listed in **Table 2.1** were introduced into the model to represent the increase in discharge in the downstream direction.

At the downstream boundary of the HEC-RAS model a known water level was used for all ARI events modelled. The adopted values correspond to the 2, 5, 10, 20, 50 and 100 year ARI design flood level respectively from Bulimba Creek at its confluence with Salvin Creek (i.e. at model cross section BM60).

3.3 Modelling Results

3.3.1 General

The HEC-RAS model was run for the 2, 5, 10, 20, 50 and 100 year ARI events. The complete table of extracted HEC-RAS model results for each event are shown in **Appendix I-2.** The flood level and velocity results are discussed separately in **Sections 3.3.2** and **3.3.3** respectively.

From the results, it is apparent that the bank full capacity of the main channel is quite variable and ranges from less than the 2 year ARI discharge to the 100 year ARI discharge.

3.3.2 Flood Levels

The peak flood levels obtained from HEC-RAS model results for the 2, 5, 10, 20, 50 and 100 year ARI events are given in **Table 3.3** and presented graphically in **Figure 3.2 and 3.3**. The corresponding flood inundation plots for each ARI event are provided in Bulimba Creek Flood Study **Volume 2**.

The tail water level adopted for the HEC-RAS modelling was that corresponding to the 2 to 100 year ARI event design flood levels obtained from Bulimba Creek MIKE11 model. Therefore, design flood levels and flow velocities in the lower reach of Salvin Creek near the confluence with Bulimba Creek would be dominated by Bulimba Creek flooding.

3.3.3 Flow Velocities

The average velocities along the reach at the surveyed cross sections for each event are presented in **Table 3.4**. The variability in channel velocity results is significant and this may reflect a lack of accuracy in the model due to the limited availability of surveyed channel cross sections. Design flow velocities exceed 3m/s in several locations. Possible explanations for these are as follows:

- Immediately downstream of Creek Road the flow is restricted to a narrow section
- Approaching Creek Road, Glengariff Tributary has a steeper gradient and that meets the main reach about 180m upstream of the Creek Road crossing. From there the flow constricts to a narrow section
- 170m downstream of Donnington Street there is a sharp drop in bed levels and narrowing section at this location.

The main reach of the Salvin Creek consists of natural channel and shows average velocities that appear reasonable along most of the channel (up to 3.1 m/s for the 100 year ARI event). However there appears to be higher velocities at the junction where main reach meets with the Glengariff reach. There is an energy dissipating device upstream of this location. The velocities are quite varied adjacent to the structure and reduce as it flows along the Creek. Glengariff reach shows higher velocities at the start of the reach (2.85 m/s) due to the steep gradient, but these reduce as it flows along the reach.

Table 3.3: Flood Level Results

HEC-RAS Chainage (m)	Peak Water Surface Level (m AHD) - Ultimate Catchment Development					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
Upper Reach						
2130	26.42	26.74	26.97	27.16	27.40	27.58
1930	25.70	26.04	26.27	26.46	26.69	26.86
1610	21.34	21.75	22.06	22.44	22.63	22.78
1609	**Bevan Street Culverts**					
1595	20.64	20.90	21.08	21.23	21.40	21.53
1515	20.05	20.33	20.49	20.63	20.79	20.90
1275	18.40	18.60	18.74	18.85	19.19	19.36
1145	17.49	17.96	18.32	18.64	19.13	19.31
1144	**Pine Mountain Road Culverts**					
1115	16.2	16.47	16.67	16.89	17.09	17.22
1103	16.07	16.3	16.44	16.56	16.69	16.86
1095	16.06	16.31	16.47	16.62	16.78	16.92
1035	15.85	16.08	16.22	16.36	16.53	16.69
Lower Reach						
913	14.47	14.69	14.83	14.95	15.12	15.27
865	13.86	14.17	14.37	14.79	14.94	15.13
797	13.29	13.64	13.85	14.53	14.66	14.79
767	13.28	13.63	13.84	14.52	14.64	14.77
736	**Creek Road Bridge**					
735	12.72	12.97	13.11	13.3	13.7	13.85
670	12.57	12.83	12.97	13.18	13.66	13.82
486	11.4	11.9	12.35	12.78	13.49	13.63
430	11.22	11.71	12.2	12.68	13.43	13.57
420	11.21	11.7	12.19	12.66	13.4	13.52
419.5	**Donnington Street Culverts No.1**					
385	10.85	11.19	11.39	11.56	11.82	12.02
348	10.69	11.01	11.22	11.4	11.66	11.87
257	9.83	10.13	10.31	10.46	10.68	10.86
175	9.47	9.79	9.99	10.15	10.4	10.62
100	9.22	9.54	9.74	9.91	10.17	10.39
0	8.89	9.16	9.33	9.49	9.73	9.94
-1(-20)	8.68	8.91	9.07	9.2	9.45	9.67
-2(-66)	8.26	8.57	8.79	8.97	9.28	9.55
-3(-108)	8.14	8.45	8.68	8.86	9.19	9.46
-3.5(-146)	7.63	8.06	8.33	8.53	8.91	9.19
-4(-153)	7.75	8.12	8.38	8.57	8.93	9.21

HEC-RAS Chainage (m)	Peak Water Surface Level (m AHD) - Ultimate Catchment Development					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
-154	**Donnington Street Culverts No. 2**					
-6.0(-181)	7.61	7.93	8.16	8.31	8.63	8.87
-6.5(-187)	7.57	7.89	8.11	8.26	8.6	8.85
-7(-226)	7.35	7.66	7.9	8.04	8.43	8.7
-8(-280)	7.14	7.47	7.75	7.93	8.38	8.67
-9(-329)	6.89	7.3	7.63	7.87	8.34	8.64
-10(-381)	6.73	7.23	7.59	7.83	8.32	8.62
-11(-428)	6.59	7.17	7.54	7.82	8.31	8.61
-12(-479)	6.4	7.1	7.5	7.8	8.3	8.6
Glengariff Reach						
910	23.93	24.11	24.20	24.28	24.40	24.52
730	22.28	22.52	22.72	22.87	23.05	23.15
510	20.05	20.28	20.34	20.38	20.48	20.60
410	18.92	19.23	19.43	19.57	19.71	19.81
90	15.87	16.17	16.39	16.56	16.8	16.96
40	15.49	15.72	15.84	15.96	16.09	16.24

Table 3.4: Channel Velocities

HEC-RAS Chainage	Peak Average Flow Velocity (m/s)					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
Upper Reach						
2130	0.8	0.8	0.9	0.9	0.9	0.9
1930	1.4	1.5	1.6	1.7	1.8	1.8
1610	1.1	1.1	1.2	1.2	1.3	1.4
1609	**Bevan Street Culverts**					
1595	1.9	2.1	2.2	2.4	2.6	2.7
1515	1.8	2.0	2.2	2.4	2.6	2.8
1275	2.4	2.6	2.7	2.8	2.4	2.4
1145	1.0	1.1	1.1	1.1	1.0	1.1
1144	**Pine Mountain Road Culvert**					
1115	1.6	1.2	2.2	2.2	2.4	2.6
1103	1.8	2.2	2.5	2.8	3.1	3.2
1095	1.6	1.8	2	2.2	2.3	2.5
1035	1.7	2	2.2	2.3	2.5	2.5
Lower Reach						
913	2.9	3.1	3.3	3.5	3.6	3.8
865	1.5	1.5	1.6	1.4	1.5	1.7
797	2.4	2.6	2.7	2.1	2.3	2.6
767	1.7	1.9	2.0	1.7	1.9	2.1
736	**Creek Road Bridge**					
735	1.7	1.9	2.2	2.3	2.3	2.5
670	1.2	1.4	1.5	1.6	1.4	1.5
486	2.5	2.2	1.6	1.2	0.9	0.9
430	1.3	1.4	1.4	1.2	1.1	1.2
420	1.3	1.4	1.3	1.3	1.3	1.4
419.5	**Donnington Street Culvert No. 1**					
385	1.5	1.7	1.9	2.1	2.3	2.5
348	1.7	1.9	2.1	2.2	2.3	2.3
257	2.2	2.4	2.6	2.8	3.0	3.1

HEC-RAS Chainage	Peak Average Flow Velocity (m/s)					
	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
175	1.3	1.4	1.5	1.6	1.7	1.7
100	1.0	1.1	1.1	1.2	1.3	1.3
0	1.0	1.1	1.2	1.3	1.4	1.5
-20	1.6	1.9	2.0	2.1	2.1	2.1
-66	1.5	1.5	1.5	1.5	1.5	1.5
-108	1.0	1.1	1.2	1.2	1.3	1.3
-146	2.5	2.2	2.2	2.2	2.1	2.1
-153	1.3	1.4	1.5	1.6	1.7	1.8
-154	**Donnington Street Culvert No. 2**					
-181	1.1	1.3	1.5	1.6	1.7	1.8
-187	1.3	1.5	1.6	1.7	1.8	1.8
-226	1.6	1.7	1.7	1.8	1.8	1.8
-280	1.2	1.3	1.3	1.2	1.1	1.1
Glengariff Reach						
910	1.4	1.8	2.1	2.4	2.7	2.9
730	1.5	1.4	1.4	1.4	1.5	1.6
510	1.6	1.8	2.1	2.4	2.7	2.6
410	2.3	2.3	2.1	2.0	2.0	2.0
90	1.5	1.6	1.7	1.7	1.8	1.9
40	2.0	2.4	2.7	2.9	3.2	3.3

3.3.4 Inundation Mapping

The flood inundation plots provided in Bulimba Creek Flood Study **Volume 2** indicate the flood extent at various locations along the watercourse. However, the elevation data for the region is based on ALS data obtained in 2009 and may not depict the current surface elevations.

3.3.5 Hydraulic Structures

Model results for the crossings of Salvin Creek are provided in **Table 3.5: Structure Flood Immunity Results.**

Table 3.5: Structure Flood Immunity Results

Structure	Upstream 100 year ARI Flood Level (m AHD)	Afflux[1.] (m)	Road Flood Immunity (ARI)	Peak Structure Velocity (m/s)
Bevan Street	22.78	1.25	>20 year	3.8
Pine Mountain Road	19.31	1.93	>20 year	4.3
Creek Road	14.77	0.92	100 year	2.14
Donnington Street No.1	13.52	1.5	>20 year	4.05
Donnington Street No.2	9.21	0.34	100 year	2.4

1. Measured as the difference between flood levels immediately upstream and downstream of the structure.

Flows within the structures are predominantly sub-critical for the full range of ARI events modelled. However, super-critical flow is present at the Pine Mountain Road culverts located in the Upper Reach due to the presence of a drop structure immediately downstream of the culvert.

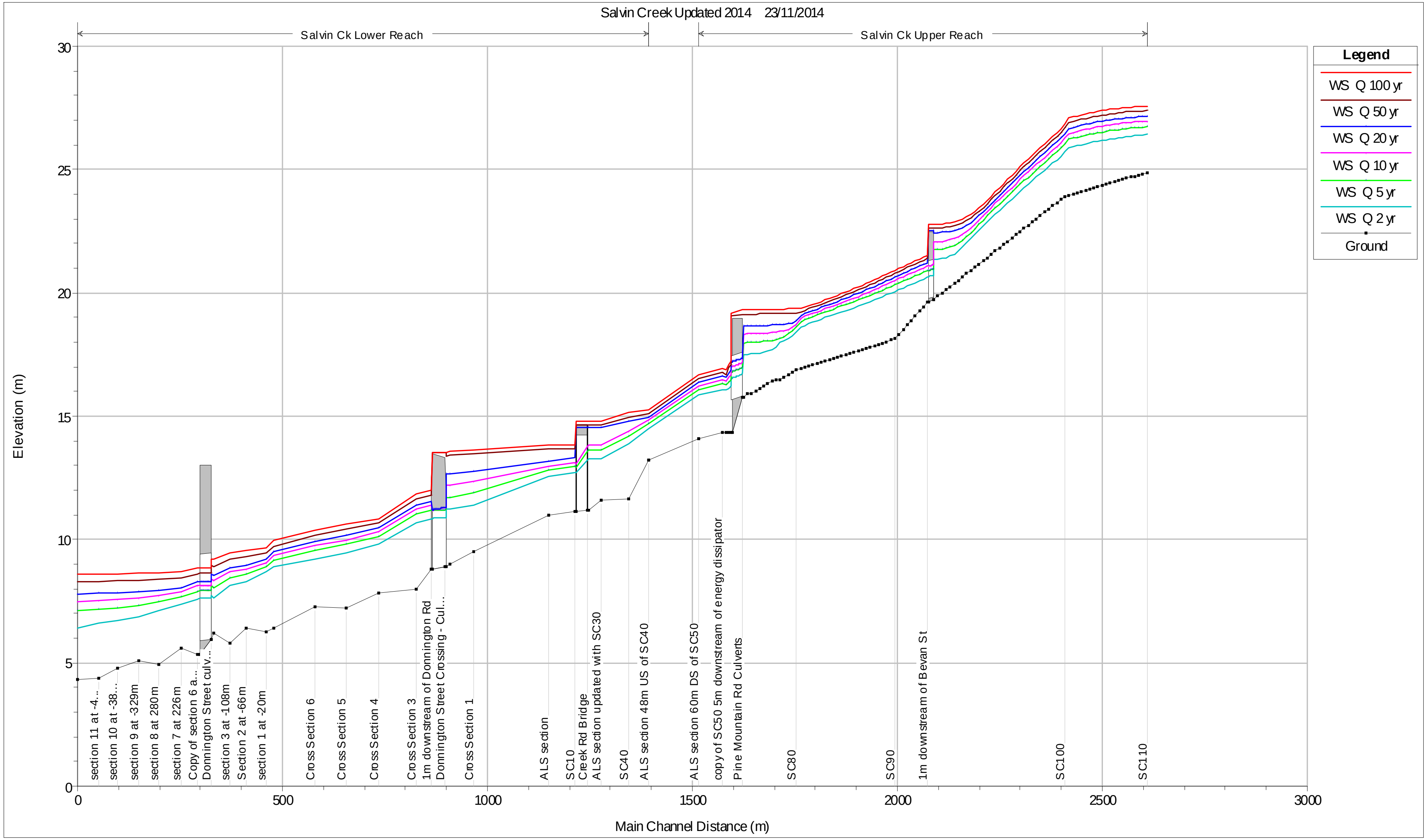

Figure 3.2: Upper & Lower Reaches - Longitudinal Flood Profile obtained from HEC-RAS model

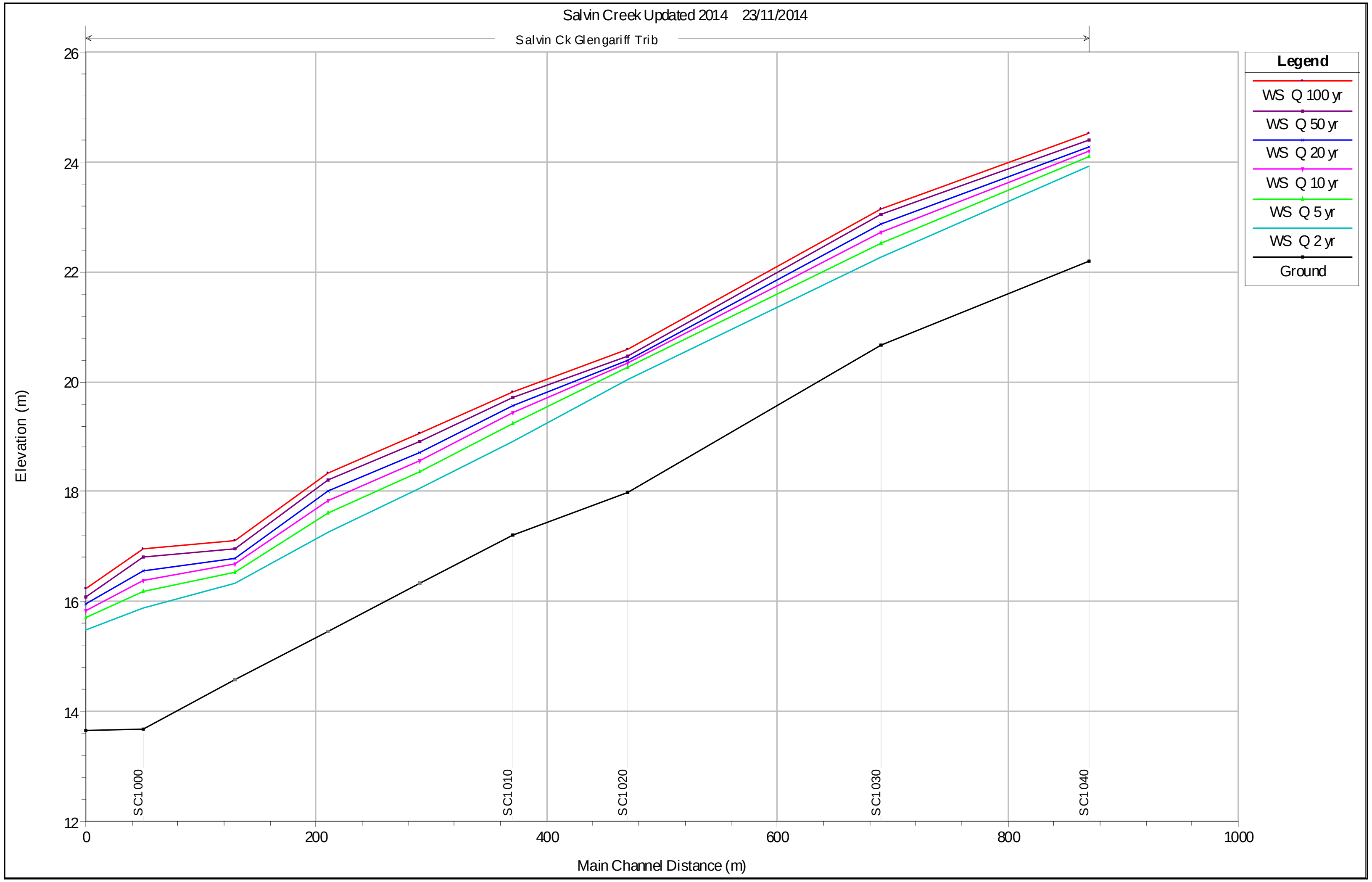

Figure 3.3: Glengariff Reach - Longitudinal Flood Profile obtained from HEC-RAS Model

4.0 Conclusion

Hydraulic modelling of Salvin Creek has been undertaken using HEC-RAS (Version 3.1.3): steady flow conditions. The HEC-RAS model was created using the surveyed cross sections of 2001/2002 together with extracted cross sections from ALS data of 2002. The hydraulic modelling assumed the presence of Minimum Vegetated Riparian Corridor (MRC) for both the Main and Glengariff reaches.

The HEC-RAS model developed for Salvin Creek in 2001 up to Glenheaton Court was extended to the Bulimba Creek confluence in 2004. In 2009, with the present study, this model was reviewed and refined by adding additional ALS (2002) cross sections.

The model incorporates five (5) hydraulic structures, a bridge and 4 culverts. Flow data used in the HEC-RAS model was obtained from the Bulimba Creek hydrology model WBNM (2001).

The results of the hydraulic modelling indicate that:

- The culvert crossings of Pine Mountain Road, Bevan Street and Donnington Street (culvert No.1) have the flood immunity approximately up to a 20 year ARI event;
- The Creek Road Bridge has the flood immunity for 50 year ARI event
- The Donnington Street culvert No.2 crossing (upstream) has the flood immunity approximately up to 100 year ARI.

In addition, the velocities are quite varied along the length of the study reach in all events. This is predominantly because of the effects of hydraulic drop-structures, steeper gradients and natural channels and the MRC.

The flood inundation plots show that:

- Minor inundation can be expected at the Creek Road and the Pine Mountain Road crossings during 100 year ARI event;
- A few properties adjacent to Lower Reach would experience minor flooding in the 50 year and 100 year ARI events,
- Glengariff reach flooding is mostly contained within the waterway corridor.

5.0 References

Waterway Management Plan (BCC, 2003c).

Guidelines for Flood Regulation Line and Minimum Fill Level Assessment (BCC, 1994).

Bulimba Creek Flood Study

Report G – Extreme Event and Climate Change Analysis

Prepared by Brisbane City Council's, City Projects Office

October 2014

BRISBANE CITY

Dedicated to a better Brisbane

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1.0 Introduction

1.1 Catchment Overview

Bulimba Creek is one of Brisbane's major creek systems. Its catchment covers an area of 125 km2 and includes a number of Brisbane's southern and eastern suburbs. The creek originates at an elevation of approximately 70m AHD (Australian Height Datum) in Stretton, northwest of the Gateway Motorway. It then flows through the suburbs of Runcorn, Sunnybank, Macgregor, Eight Mile Plains, Wishart, Mansfield, Carindale, Carina and Tingalpa before discharging into the Brisbane River at Murarrie. The majority of the main channel has remained in a relatively natural state. The tributaries of Bulimba Creek are only partly retained in their natural condition with many sections heavily modified be development.

1.2 Study Background

In 2010, the Bulimba Creek Flood Study was completed. Hydrological and hydraulic models were developed and used to determine flood levels, discharges and velocities in Bulimba Creek and its tributaries for design events of 2, 5, 10, 20, 50 and 100 years ARI. The hydraulic model of Bulimba Creek is a one-dimensional DHI MIKE 11 model representing Bulimba Creek, the East Arm of Bulimba Creek and Mimosa Creek.

Council's Natural Environment, Water and Sustainability (NEWS) Branch required longer term planning horizons to be considered in their program of flood studies by considering extreme flood events and potential climate change impacts. At this time, State Planning Policy 3/11 (now superseded by the Coastal Protection State Planning Regulatory Provision) and the Inland Flood Study (DERM, 2010) had provided guidance on assessing the potential impacts on communities and development of projected climate change effects, including sea level rise and increased rainfall intensities.

The SPP 3/11 outlined the following factors to be used by local government to determine planning levels for appropriate planning horizons (2050, 2070 and 2100):

- A sea-level rise factor of 0.8 metres;
- An increase in the maximum cyclone intensity by 10 per cent; and
- Where a relevant storm-tide inundation assessment has not been completed in relation to a proposed development, the coastal hazard area is taken to be all land between high water mark and a minimum default 100-year Design Storm Tide Event level of 1.5 metres above the level of Highest Astronomical Tide for all developments in SEQ.

The Inland Flooding Study outlines the rationale for adopting an interim methodology for assessing flooding risk in Queensland:

1. *The proposed methodology is to factor a 5 per cent increase in rainfall intensity at Annual Exceedance Probabilities (AEP) of 1% (100 yr ARI), 0.5% (200 yr ARI) and 0.2% (500 yr ARI) per degree of global temperature increase for all rainfall events recommended in SPP 1/03 for the location and design of new development.*
2. *The following temperatures and timeframes should be used for the purposes of applying the climate change factor in Recommendation 1:*
    - *a) 2C by 2050*
    - *b) 3C by 2070*
    - *c) 4C by 2100*

1.3 Study Objectives

For this study, two planning horizons, 2050 and 2100, were considered. Based on the guidance outlined above, additional model scenarios were simulated in the models and mapped, as shown in **Table 1-1**.

Table 1-1: Modelled Extreme Event and Climate Change Events

Timeframe	Floodplain Conditions	Design Event	Rainfall Intensity Increase	Tailwater Boundary
Extreme events				
Current	Ultimate Conditions	200-year-ARI	-	MHWS
Current	Ultimate Conditions	500-year-ARI	-	MHWS
Current	Existing Conditions	2000-year-ARI	-	MHWS
Current	Existing Conditions	Probable Maximum	-	MHWS
Climate change events				
2050	Existing Conditions	100-year ARI	10% increase	MHWS + 0.3m
	Ultimate Conditions	100-year ARI	10% increase	MHWS + 0.3m
	Ultimate Conditions	200-year ARI	10% increase	MHWS + 0.3m
2100	Existing Conditions	100-year ARI	20% increase	MHWS + 0.8m
	Ultimate Conditions	100-year ARI	20% increase	MHWS + 0.8m
	Ultimate Conditions	200-year ARI	20% increase	MHWS + 0.8m
	Ultimate Conditions	500-year ARI	20% increase	MHWS + 0.8m

This report presents the methodology adopted and results of the additional assessment. It should be read in conjunction with the ‘Bulimba Creek Flood Study’ report (November, 2010).

1.4 Report Scope (limitations)

This assessment of extreme flood events and climate change has been based on the hydrologic and hydraulic models developed within the Bulimba Creek Flood Study (2010) without modification, except as described within this report.

The methodology described for representing ultimate conditions has made reference to the modelled 100 year ARI flood levels. The methodology considers creek flooding only. Low lying areas may also be subject to storm tide flood impacts, which have not been considered within this assessment and associated topographic modifications.

The flood mapping presented in this report represents flooding within Bulimba Creek, the East Arm of Bulimba Creek and Mimosa Creek only. Consideration of local stormwater or overland flooding has not been made. Flooding may continue beyond the truncated flood extents shown. The results of this assessment should not be used without reference to this report and the Bulimba Creek Flood Study report and an understanding of the modelling extents.

When considering the study outputs, it is important to recognise the limitations of mapping flood extents from a one-dimensional hydraulic model. Flood levels are assumed to vary linearly between cross sections and the representation of flooding in overbank areas is inherently constrained by the simplified method.

2.0 Rare and Extreme Event Analysis

2.1 Overview

There was a requirement to consider the 200 year, 500 year, 2000 year ARI and Probable Maximum Flood (PMF) events. The following additional scenarios were modelled using the WBNM and DHI MIKE 11 models developed in the 2010 flood study.

Table 2-1: Modelled Extreme Events

Timeframe	Floodplain Conditions	Design Event	Storm Duration	Tailwater Boundary
Current	Ultimate Conditions	200-year-ARI	DIS – 9hr	MHWS
Current	Ultimate Conditions	500-year-ARI	DIS – 9hr	MHWS
Current	Existing Conditions	2000-year-ARI	DIS – 9hr	MHWS
Current	Existing Conditions	Probable Maximum	GSDM – 6hr	MHWS

2.2 Hydrologic Modelling

For the extreme events assessment the WBNM model was used unmodified. Land use parameters from the 2010 flood study were adopted unchanged and represented ultimate catchment development, based on projected planning schemes, for all scenarios.

For the 200, 500 and 2000 year ARI events, the rainfall depths and intensities were determined in accordance with the CRC-FORGE methodology. A number of flood studies considering rare to extreme events were being delivered simultaneously by City Projects Office. As the major Brisbane catchments are similarly sized, the rainfall data was extracted for a ‘typical’ catchment size of 60 km2 located at the north-west part of Brisbane. To confirm suitability of the method, the rainfall depths across the Brisbane Region were compared and were found to vary by less than 10%.

To avoid running multiple storm patterns for different storm durations, a Duration Independent Storm (DIS) approach was adopted. The duration independent synthetic storm for a given average recurrence interval contains the highest intensity bursts of rainfall for all durations. Therefore, one rainfall event can be applied to the entire catchment to determine the peak discharge at all points along a waterway, rather than the large number of rainfall temporal patterns representing the range of standard storm durations presented in AR&R. The temporal pattern is built up to reflect the extreme rainfall depths published by the BoM. International research has demonstrated that as storm rainfall depths increase for short duration storms, the rainfall intensity becomes more uniform. For this reason, the multi-peaked temporal patterns for the 100 year ARI event from AR&R were not considered suitable for the analysis of the more extreme events. For more information on the DIS methodology refer to the paper 'Interpolating Fixed Return Period Flooding Along a Stream of Varying Response' (Morris, K, 1996).

For the Bulimba Creek analysis, a 9 hour super storm was developed in 30 min blocks to represent a number of shorter extreme events. The total rainfall depth was set equal to the 9 hour CRC-FORGE depth. Shorter durations than 30 minutes were not considered. The pattern developed is representative of the 30, 60, 90, 120, 180, 360 and 540 minute storm bursts.

The Probable Maximum Precipitation rainfall depth was derived in accordance with the Generalised Short Duration Method (GSDM). For the tropical and subtropical coastal areas it is recommended that this method is to be used to estimate the PMP for catchment areas up to 1000 km2 and for durations up to 6 hours. For consistency across the Brisbane area, an average catchment size of 60 km2 and moisture adjustment factor of 0.85 was adopted.

An initial loss of 0 mm and a continuing loss rate of 0 mm/h was adopted. This is consistent with the standard methodology for ultimate development scenario modelling.

2.3 Hydraulic Modelling

The 2010 study involved the development of a one-dimensional (1D) MIKE 11 model. The model was used for this study unmodified, except as discussed in this section. In order to simulate large and extreme flood events, some modifications were required to ensure cross sections extended beyond flood extents and appropriately represented floodplain conditions in their ultimate state. Further explanation is provided below.

2.3.1 Floodplain Conditions

Traditionally, flood studies have generally considered design events up to and including the 100 year ARI event. This was considered the key event for flood impact assessment and planning purposes. For planning studies, the hydraulic model was developed to represent 'existing' conditions and 'ultimate' conditions. The objective of modelling 'ultimate' conditions is to consider future plans for the watercourse when defining development planning levels, including:

- Minimum riparian corridor (MRC) requirements **-** i.e. the riparian zone is assumed to be vegetated with a corresponding higher Manning's 'n' value
- Floodplain 'filling' outside of the waterway corridor – i.e. full development up to the waterway corridor is assumed, effectively removing that portion of the floodplain when assessing flood levels

The inclusion of waterway corridors within the hydraulic model has typically been simulated by 'walling off' the zone outside of the waterway corridor, as shown in **Figure 2-1**.

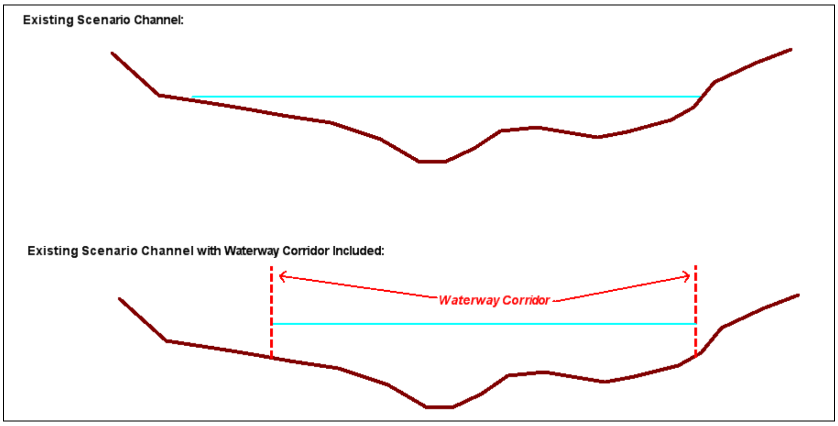

Figure 2-1: Implementation of Waterway Corridor using 'Walling Off' Method

2.3.2 Alteration to Cross sections

The method described in the previous section is satisfactory when simulating 2 to 100 year ARI design flood events. However, when simulating the 200 and 500 year ARI 'ultimate' design events, prior experience has shown that the waterway corridor 'walls' results in conservatively high water levels and stability issues in some hydraulic modelling software packages. For this study, the following method for simulating the waterway corridor was adopted for these events:

- Extend cross sections using BCC ALS data (2009) to sufficiently contain the anticipated PMF flood extents, under existing floodplain conditions (i.e. no MRC defined and no floodplain filling)
- Take the 'ultimate' case 100 year ARI DIS flood levels from the previous study and add 300mm development freeboard (development level)
- In areas outside the waterway corridor fill the floodplain to the development level, as shown in **Figure 2-2**.

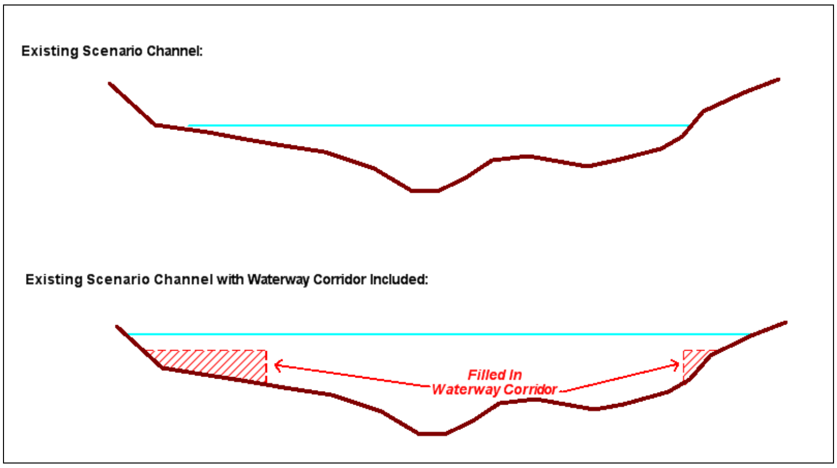

Figure 2-2: Implementation of Waterway Corridor using 'Filling' Method

The 2000 year ARI and PMF events utilised the 'existing' case model, with cross sections extended only.

2.3.3 Alteration to Structures

The models developed within the 2010 study were suitable for modelling up to the 100 year ARI design flood. To model the extreme flood events, some modification to the representation of hydraulic structures was required to maintain model accuracy and stability. This included the addition of weir sections (if previously not included) to represent overtopping, increased width of weir sections and/or removal of structures which do not incur significant head loss under extreme conditions.

2.4 Results and Mapping

Tabulated results and mapping for these extreme events can be found in the Appendices of the original Extreme Event and Climate Change Analysis Addendum Report to the Bulimba Creek Draft Flood Study.

3.0 Climate Change Sensitivity Analysis

3.1 Overview

The following climate change scenarios were modelled in accordance with industry guidance valid at the time.

Table 3-1: Modelled Climate Change Events

Timeframe	Floodplain Conditions	Design Event	Rainfall Intensity Increase	Tailwater Boundary
2050	Existing Conditions	100-year ARI	10% increase	MHWS + 0.3m
	Ultimate Conditions	100-year ARI	10% increase	MHWS + 0.3m
	Ultimate Conditions	200-year ARI	10% increase	MHWS + 0.3m
2100	Existing Conditions	100-year ARI	20% increase	MHWS + 0.8m
	Ultimate Conditions	100-year ARI	20% increase	MHWS + 0.8m
	Ultimate Conditions	200-year ARI	20% increase	MHWS + 0.8m
	Ultimate Conditions	500-year ARI	20% increase	MHWS + 0.8m

3.2 Hydrologic Modelling

For the climate change assessment the WBNM model from the 2010 investigation was used unmodified. Land use parameters were adopted unchanged and represented ultimate catchment development, based on projected planning schemes, for all scenarios.

Rainfall intensity factors were applied to account for climate change, as per the recommendations made in the Inland Flooding Study; 10% for the 2050 planning horizon and 20% for the 2100 planning horizon. The WBNM hydrological model was used to simulate these scenarios and the results extracted at the hydraulic model boundaries.

3.3 Hydraulic Modelling

The scaled inflow hydrographs were applied to the 'existing' and 'ultimate' case MIKE 11 models to represent climate change conditions. In addition, tailwater levels were increased by 0.3 and 0.8 metres for the years of 2050 and 2100 respectively.

3.4 Climate Change Results and Mapping

Tabulated results for these extreme events can be found in the Appendices of the original Extreme Event and Climate Change Analysis Addendum Report to the Bulimba Creek Draft Flood Study.

4.0 Discussion

The extreme event and climate change analyses have considered a range of flood events and varying topographic conditions representing the floodplain in its existing state and under a fully developed ‘ultimate’ state. The outputs are planning tools providing an indication of where flooding could occur and do not represent a specific flood event.

The objective of this assessment is to enable planners and decision makers to consider:

- The full flood risk profile when planning development and infrastructure or preparing for disaster response
- The impact of climate change predictions on the flood risk profile

The following observations are made from the mapped outputs in response to these objectives:

- The general flooding characteristics of Bulimba Creek do not change significantly within the range of floods considered. The peak levels vary by up to approximately 2.3 m between the 100 year ARI and 2000 year ARI events implying greater depths of inundation and more hazardous conditions. However, the flood extents do not vary significantly between events with no new significant areas of flooding or major flow paths introduced during the less frequent events. This was demonstrated in the initial flood study and has been demonstrated again by the extreme events analysis. A comparison of the 100 year ARI and 2000 year ARI results shows only marginal changes in the flood extent.
- The extreme 200 year ARI and 500 year ARI floods increase peak flood levels by up to approximately 1 m and 1.3 m respectively, when compared to the 100 year ARI event.
- More hazardous conditions on the major roads are introduced with the less frequent flood events. Consider needs to be given to the potential magnitude of an event when deciding on appropriate routes of access/egress.
- For the 100 year ARI event, peak flood levels increase by up to 1.4 m for the 2100 planning horizon, indicating increased depths of flooding and potentially more hazardous conditions. On average within Bulimba Creek, the increase is in the order of 0.5 m.

5.0 References

City Projects Office - Brisbane City Council '*Bulimba Creek Flood Study*' Draft Report, November 2010.

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Pilgrim, DH, (ed*), Australian Rainfall & Runoff - A Guide to Flood Estimation*, Institution of Engineers, Australia, Barton, ACT, 1987.

Appendices

Appendix A Catchment Details used in Hydrologic & Hydraulic Models

Table A1: Subcatchment Details for Hydrologic Model WBNM

ID	Catchment Centroid (GDA94)		Area (km^2)	Fraction Impervious (%)		Catchment Outlet (GDA94)	
	Easting	Northing		Existing	Ultimate	Easting	Northing
A1a	506,407.81	6,945,141.50	1.75	42.0	61.5	506,534.03	6,945,859.92
A1b	506,237.81	6,946,194.50	1.30	42.0	61.5	506,459.56	6,946,615.67
A2	506,691.25	6,946,596.50	1.13	42.0	61.9	506,856.51	6,947,150.39
A3	506,444.16	6,947,685.00	1.19	42.0	62.0	506,465.37	6,948,149.08
B	506,755.56	6,948,695.00	1.56	33.9	47.4	507,443.73	6,949,540.62
C1a	507,579.12	6,947,548.50	1.08	41.5	59.2	507,362.65	6,948,153.54
C2b	508,092.91	6,948,736.00	1.73	41.5	59.2	507,443.73	6,949,540.62
D	505,948.47	6,952,918.00	2.76	46.3	52.7	506,741.74	6,952,511.86
E	506,959.53	6,952,217.00	2.15	45.8	64.9	507,252.76	6,951,308.65
F	506,813.91	6,950,850.50	1.9	52.9	66.3	507,719.70	6,950,132.25
G	506,811.75	6,949,968.00	1.99	53.4	64.1	507,719.70	6,950,132.25
H	508,232.16	6,950,266.00	1.56	55.7	68.7	508,694.17	6,950,589.05
I1	508,752.88	6,951,087.50	2.37	44.2	62.4	509,628.92	6,951,214.87
I2	509,495.84	6,950,787.00	2.1	44.2	62.4	510,236.01	6,951,333.96
J1	507,672.16	6,946,245.00	0.49	20.0	74.6	507,848.63	6,946,434.07
J2	507,993.12	6,946,327.00	0.99	50.0	68.2	508,605.64	6,946,848.61
K1	508,968.12	6,947,247.00	1.58	42.0	46.2	509,457.01	6,947,986.81
K2	508,354.53	6,947,603.50	0.57	30.0	57.4	508,609.28	6,947,733.13
K3	508,986.94	6,947,800.50	0.47	25.0	40.8	509,448.81	6,947,969.50
L1	509,782.81	6,948,271.00	0.45	10.0	52.0	509,708.25	6,948,546.89
L2	509,142.78	6,948,650.00	1.47	35.0	63.2	509,658.78	6,948,992.15
M1	509,707.13	6,949,218.00	0.45	40.0	74.0	510,085.29	6,949,261.88
M2	510,509.66	6,947,228.50	0.98	20.0	75.0	510,561.00	6,947,804.03
M3	510,483.59	6,948,173.50	0.45	40.0	81.0	510,450.73	6,948,604.66
M4	511,551.62	6,947,499.00	0.32	20.0	74.0	511,339.36	6,947,826.63
M5a	512,192.75	6,947,531.50	1.01	30.0	67.0	511,339.36	6,947,826.63
M5b	511,246.41	6,947,971.00	0.17	30.0	79.0	511,043.04	6,948,202.46
M6	511,679.22	6,948,332.50	0.46	30.0	55.0	511,074.20	6,948,166.93
M7	511,108.94	6,948,440.00	0.47	30.0	67.0	510,532.15	6,948,519.64
M8	510,507.09	6,948,926.00	0.67	30.0	71.0	510,085.29	6,949,261.88
N1	510,215.06	6,949,785.50	0.66	50.0	73.5	510,519.92	6,950,306.09
N2a	511,581.59	6,949,133.00	1.4	5.0	68.4	510,942.36	6,949,481.33
N2b	511,497.41	6,949,876.50	1.13	5.0	60.2	510,519.92	6,950,306.09
N2c	510,650.28	6,950,796.50	0.61	5.0	40.6	510,271.29	6,950,977.45
O	510,831.44	6,951,469.00	1.97	22.1	53.3	511,185.85	6,952,353.83
P	512,443.66	6,950,867.50	4.38	24.7	50.6	511,185.85	6,952,353.83
Q	511,726.41	6,952,747.00	2.04	33.8	70.4	510,994.61	6,953,618.91
R	509,417.38	6,952,828.50	3.75	52.0	68.1	510,987.28	6,953,581.41
S	511,007.34	6,954,035.00	1.33	42.0	39.8	511,187.73	6,954,866.27
T1	512,005.72	6,953,916.00	1.91	42.0	49.3	511,205.19	6,954,900.71
T2	511,029.31	6,955,031.00	1.06	42.0	49.2	510,179.46	6,955,166.09
U1	507,993.12	6,953,530.00	1.86	42.0	55.9	508,821.44	6,954,171.81

ID	Catchment Centroid (GDA94)		Area (km²)	Fraction Impervious (%)		Catchment Outlet (GDA94)	
	Easting	Northing		Existing	Ultimate	Easting	Northing
U2	508,944.44	6,954,345.00	0.86	33.9	69.0	509,360.98	6,954,678.06
U3	509,803.53	6,954,357.50	1.51	53.7	70.4	510,179.46	6,955,166.09
V	509,910.94	6,955,790.50	1.55	45.0	59.4	510,645.21	6,956,540.00
W1	512,814.06	6,954,777.00	2.00	5.0	26.0	511,923.24	6,955,007.76
W2	512,104.94	6,955,438.50	1.48	25.0	55.0	511,269.03	6,956,028.17
W3	511,431.81	6,956,254.00	1.52	10.0	44.0	510,645.21	6,956,540.00
X1	508,241.78	6,955,266.00	1.45	42.8	60.3	508,688.75	6,955,474.69
X2	509,128.28	6,955,683.50	0.75	41.2	57.7	509,481.10	6,956,324.83
X3	508,019.88	6,956,557.00	1.6	18.2	27.8	508,897.16	6,956,486.27
X4	509,074.47	6,956,648.00	0.41	25.6	25.3	509,492.54	6,956,392.05
X5	509,701.56	6,956,687.00	1.19	36.6	55.0	510,612.15	6,957,228.09
Y1	510,719.19	6,956,915.00	0.51	30.0	40.0	510,613.05	6,957,223.58
Y2	510,255.94	6,957,632.50	0.94	50.0	62.6	510,705.74	6,958,272.22
Z	508,940.81	6,957,976.00	4.21	41.2	54.9	510,705.74	6,958,272.22
AA	511,739.31	6,957,989.00	3.08	21.3	43.1	511,878.07	6,958,800.09
BB1	511,779.41	6,959,191.50	1.77	25.0	42.0	511,144.09	6,959,564.94
BB2	509,540.31	6,959,436.00	2.34	46.0	48.0	510,641.50	6,960,417.16
BB3	512,138.77	6,960,461.08	1.26	38.0	52.0	511,675	6,960,991.51
BB3a	511,237.35	6,959,906.2	0.86	20.0	25.0	510,631.14	6,960,426.36
BB4	510,096.69	6,960,073.50	2.30	42.0	42.0	510,221.82	6,961,146.38
CC	509,219.56	6,960,141.50	2.22	27.5	44.5	510,221.82	6,961,146.38
DD	510,181.19	6,961,667.50	2.38	43.4	56.4	511,002.87	6,962,222.50
EE	511,641.50	6,961,778.00	1.31	31.8	49.0	512,184.97	6,961,891.82
FF	513,227.69	6,956,774.50	3.99	3.0	11.0	513,307.66	6,958,239.68
GG	513,707.78	6,958,205.00	3.05	18.4	12.0	513,519.47	6,959,475.78
HH1	514,235.41	6,960,009.50	2.44	24.0	38.0	513,195.83	6,961,305.56
HH2	513,457.50	6,960,182.50	2.27	48.0	66.0	513,195.83	6,961,305.56
HH3	512,947.78	6,961,572.00	1.41	12.5	40.0	512,195.39	6,962,047.85
II	511,642.47	6,962,815.00	2.57	27.2	50.0	512,137.66	6,963,751.80
JJ	514,555.22	6,961,594.00	3.18	30.1	57.7	513,829.58	6,962,450.35
KK	513,895.38	6,962,958.00	3.74	25.0	38.8	512,134.06	6,963,725.28
LL	511,684.03	6,963,883.00	1.02	60.1	63.9	511,121.52	6,964,234.66
MM	513,857.69	6,964,464.50	4.82	30.7	68.6	512,584.21	6,964,911.37
NN	512,331.44	6,964,809.50	1.28	60.0	83.3	512,790.58	6,965,980.99
Total			124.9	33.37%	43.88%		

Table A2: Cross section details of MIKE-11 model

Creek Branch	MIKE11 Chainage(m)	AMTD equivalent (m)	Cross section ID	Details (source)
BULIMBA	0	38965		
BULIMBA	10	38955	BM 214	RUBICON model
BULIMBA	17	38948	Nemies_Rd	RUBICON model
BULIMBA	40	38925	Copy of BM214	RUBICON model
BULIMBA	120	38845	BM213	RUBICON model
BULIMBA	215	38750	BM212	RUBICON model
BULIMBA	355	38610	BM211	RUBICON model
BULIMBA	370	38595	Brandon Rd	RUBICON model
BULIMBA	385	38580	Copy of BM211	RUBICON model
BULIMBA	470	38495	BM 209	RUBICON model
BULIMBA	540	38425	BM 208	RUBICON model
BULIMBA	600	38365	BM 207	RUBICON model
BULIMBA	740	38225	BM 206	RUBICON model
BULIMBA	800	38165	BR_1	Survey 2006
BULIMBA	810	38155	Brandon Rd DS weir	Survey 2006
BULIMBA	825	38140	BR_2	Survey 2006
BULIMBA	840	38125	BM 205	RUBICON model
BULIMBA	890	38075	BR_3	Survey 2006
BULIMBA	905	38060	BR_4	Survey 2006
BULIMBA	942	38023	BR_5	Survey 2006
BULIMBA	960	38005	BR_5 copy	Survey 2006
BULIMBA	990	37975	Copy BM 204	RUBICON model
BULIMBA	1075	37890	BM 203	RUBICON model
BULIMBA	1160	37805	BM 202	RUBICON model
BULIMBA	1300	37665	BM 201	RUBICON model
BULIMBA	1365	37600	BM 200	RUBICON model
BULIMBA	1545	37420	BM 199	RUBICON model
BULIMBA	1670	37295	BM 198	RUBICON model
BULIMBA	1800	37165	BM340-MHG	Interpolated
BULIMBA	1830	37135	BM 197	RUBICON model
BULIMBA	1845	37120	Beenleigh Road weir	RUBICON model/ALS
BULIMBA	1860	37105	Copy of BM 197	RUBICON model
BULIMBA	1900	37065	BM195-I	Interpolated
BULIMBA	1940	37025	BM 194	RUBICON model
BULIMBA	1960	37005	Copy of BM 194	RUBICON model
BULIMBA	2045	36920	BM 192	RUBICON model
BULIMBA	2115	36850	Copy of BM 191	RUBICON model
BULIMBA	2117	36848	St Lawrence FBridge	ALS
BULIMBA	2125	36840	BM 191	RUBICON model
BULIMBA	2255	36710	BM190	RUBICON model
BULIMBA	2370	36595	Copy of BM188-6	RUBICON model
BULIMBA	2375	36590	Altandi_St_FB_weir	ALS
BULIMBA	2380	36585	BM188-6 ALS	ALS
BULIMBA	2470	36495	BM188-2 ALS	ALS
BULIMBA	2500	36465	BM188-1 ALS	ALS
BULIMBA	2670	36295	BM187	RUBICON model
BULIMBA	2785	36180	BM186	RUBICON model
BULIMBA	2985	35920	BM185	RUBICON model
BULIMBA	3165	35800	BM184	RUBICON model
BULIMBA	3295	35670	BM183	RUBICON model
BULIMBA	3435	35530	BM182	RUBICON model

Creek Branch	MIKE11 Chainage(m)	AMTD equivalent (m)	Cross section ID	Details (source)
BULIMBA	3625	35340	BM181	RUBICON model
BULIMBA	3765	35200	MHG-320	Interpolated
BULIMBA	3800	35165	BM180	RUBICON model
BULIMBA	3960	35005	BM179	RUBICON model
BULIMBA	3965	35000	Malbon_St_FB_weir	RUBICON model/ALS
BULIMBA	3970	34995	Copy of BM179	RUBICON model
BULIMBA	4150	34815	BM178	RUBICON model
BULIMBA	4260	34705	BM177-MHG310	RUBICON model
BULIMBA	4320	34645	BM177A	ALS
BULIMBA	4385	34580	BM176-US	RUBICON model/ALS
BULIMBA	4415	34550	BM176_DS	RUBICON model/ALS
BULIMBA	4460	34505	BM 175	RUBICON model
BULIMBA	4515	34450	Bm175-174	RUBICON model
BULIMBA	4590	34375	BM 174	RUBICON model
BULIMBA	4700	34265	BM174A	RUBICON model/ALS
BULIMBA	4765	34200	BM174B	ALS
BULIMBA	4780	34185	BM173- MHG300	RUBICON model
BULIMBA	4785	34180	Blesby_Rd_FB_weir	RUBICON model/ALS
BULIMBA	4790	34175	Copy of BM 173	RUBICON model
BULIMBA	4905	34060	BM172	RUBICON model
BULIMBA	4995	33970	BM171	RUBICON model
BULIMBA	5120	33845	BM170	RUBICON model
BULIMBA	5285	33680	BM169	RUBICON model
BULIMBA	5405	33560	BM168	RUBICON model
BULIMBA	5520	33445	BM167	RUBICON model
BULIMBA	5615	33350	CopyBM 167-MHG290	RUBICON model/ALS
BULIMBA	5715	33250	Copy BM 165	RUBICON model/ALS
BULIMBA	5730	33235	BM165	RUBICON model
BULIMBA	5785	33180	SurveyXs-5	Logan Rd survey 2006
BULIMBA	5845	33120	SurveyXs-4	Logan Rd survey 2006
BULIMBA	5902	33063	SurveyXs-3	Logan Rd survey 2006
BULIMBA	5918	33047	SurveyXs-2	Logan Rd survey 2006
BULIMBA	5935	33030	BM158_Xs-1	Logan Rd survey 2006
BULIMBA	5985	32980	HEC2937-MHG280	HECRAS model-Bikeway
BULIMBA	6050	32915	BM157	RUBICON model
BULIMBA	6160	32805	BM156	RUBICON model
BULIMBA	6240	32725	BM155	RUBICON model
BULIMBA	6340	32625	BM154	RUBICON model
BULIMBA	6450	32515	BM153_ALS	ALS
BULIMBA	6650	32315	BM151	RUBICON model
BULIMBA	6860	32105	BM149	RUBICON model
BULIMBA	6930	32035	BM148-BM147	Survey Craig street
BULIMBA	6935	32030	Survey_Xsec	Craig_St Foot Bridge_weir
BULIMBA	6945	32020	Copy of BM148	RUBICON model
BULIMBA	6985	31980	BM148	RUBICON model
BULIMBA	7185	31780	BM146	RUBICON model
BULIMBA	7420	31545	BM144	RUBICON model
BULIMBA	7490	31475	BM143	RUBICON model
BULIMBA	7600	31365	ALS-142	ALS section
BULIMBA	7735	31230	BM141	RUBICON model
BULIMBA	7915	31050	BM139	RUBICON model
BULIMBA	7985	30980	BM138	RUBICON model
BULIMBA	8070	30895	BM137	RUBICON model

Creek Branch	MIKE11 Chainage(m)	AMTD equivalent (m)	Cross section ID	Details (source)
BULIMBA	8200	30765	BM136	RUBICON model
BULIMBA	8325	30640	BM135	RUBICON model
BULIMBA	8475	30490	BM134	RUBICON model
BULIMBA	8555	30410	MHG-260	Interpolated
BULIMBA	8570	30395	BM132	Gauge BMA 804
BULIMBA	8780	30185	BM131	RUBICON model
BULIMBA	8840	30125	BM130	RUBICON model
BULIMBA	8950	30015	BM129	RUBICON model
BULIMBA	9115	29850	BM127	RUBICON model
BULIMBA	9215	29750	BM126	RUBICON model
BULIMBA	9365	29600	BM126a	ALS
BULIMBA	9530	29435	BM126b	ALS
BULIMBA	9670	29295	BM122	RUBICON model
BULIMBA	9765	29200	BM121	RUBICON model
BULIMBA	9890	29075	BM119	RUBICON model
BULIMBA	9920	29045	BM118	RUBICON model
BULIMBA	10100	28865	BM117	RUBICON model
BULIMBA	10205	28760	BM116	RUBICON model
BULIMBA	10315	28650	BM115	RUBICON model
BULIMBA	10400	28565	BM114	RUBICON model
BULIMBA	10510	28455	BM112	RUBICON model
BULIMBA	10575	28390	BM111-MHG250	Interpolated
BULIMBA	10685	28280	BM110	RUBICON model
BULIMBA	10725	28240	BM110-copy	RUBICON model
BULIMBA	10875	28090	BM108	RUBICON model
BULIMBA	10965	28000	BM107	RUBICON model
BULIMBA	11095	27870	BM106	RUBICON model
BULIMBA	11255	27710	BM104	RUBICON model
BULIMBA	11515	27450	BM102	RUBICON model
BULIMBA	11620	27345	BM101	RUBICON model
BULIMBA	11695	27270	BM100	RUBICON model
BULIMBA	11820	27145	BM99	RUBICON model
BULIMBA	11910	27055	BM98	RUBICON model
BULIMBA	12035	26930	BM97	RUBICON model
BULIMBA	12135	26830	BM97copy	RUBICON model
BULIMBA	12155	26810	BM97copy	RUBICON model
BULIMBA	12215	26750	BM94	RUBICON model
BULIMBA	12320	26645	MHG240	ALS section
BULIMBA	12385	26580	BM93	RUBICON model
BULIMBA	12505	26460	Copy_BM90	RUBICON model
BULIMBA	12690	26275	Copy-BM90	RUBICON model
BULIMBA	12820	26145	BM88	RUBICON model
BULIMBA	13140	25825	BM87	RUBICON model
BULIMBA	13440	25525	BM84	RUBICON model
BULIMBA	13530	25435	BM83	RUBICON model
BULIMBA	13670	25295	BM81	RUBICON model
BULIMBA	13765	25200	BM80	RUBICON model
BULIMBA	13910	25055	BM78	RUBICON model
BULIMBA	13965	25000	Copy_BM78_BMA831	RUBICON/Gauge BMA 831
BULIMBA	14115	24850	BM77	RUBICON model
BULIMBA	14360	24605	BM76	RUBICON model
BULIMBA	14460	24505	BM75	RUBICON model
BULIMBA	14625	24340	BM74-BM72	ALS

Creek Branch	MIKE11 Chainage(m)	AMTD equivalent (m)	Cross section ID	Details (source)
BULIMBA	14785	24180	BM72	RUBICON model
BULIMBA	14845	24120	BM71-MHG-230	RUBICON model/ALS
BULIMBA	14960	24005	BM70	RUBICON model
BULIMBA	15160	23805	BM69	RUBICON model
BULIMBA	15340	23625	BM67	RUBICON model
BULIMBA	15460	23505	BM66	RUBICON model
BULIMBA	15540	23425	Copy_Bm66	RUBICON model
BULIMBA	15570	23395	BM64 copy	RUBICON model
BULIMBA	15585	23380	BM64	RUBICON model/ALS
BULIMBA	15600	23365	BM64-MHG250	RUBICON model
BULIMBA	15790	23175	BM63	RUBICON model
BULIMBA	15965	23000	BM62	RUBICON model
BULIMBA	16015	22950	BM61	RUBICON model
BULIMBA	16190	22775	BM60	RUBICON model
BULIMBA	16390	22575	BM 59	RUBICON model
BULIMBA	16435	22530	BM59_mod	RUBICON model\ALS
BULIMBA	16445	22520	Meadowbank St FB	RUBICON model/ALS
BULIMBA	16455	22510	BM 55-mod	RUBICON model/ALS
BULIMBA	16680	22285	BM57-mod	RUBICON model/ALS
BULIMBA	16785	22180	BM56	RUBICON model
BULIMBA	17080	21885	BM 55-mod	RUBICON model
BULIMBA	17240	21725	BM55-54	ALS
BULIMBA	17300	21665	BM54	RUBICON model
BULIMBA	17338	21627	Winstanly_St_weir	RUBICON model
BULIMBA	17355	21610	CD09	Cardno Survey data
BULIMBA	17540	21425	BM52	RUBICON model
BULIMBA	17765	21200	CD07	Cardno Survey data
BULIMBA	17850	21115	BM50-49_BMA707	RUBICON model/BMA707
BULIMBA	17920	21045	CD06	Cardno Survey data
BULIMBA	17960	21005	CD05	Cardno Survey data
BULIMBA	18025	20940	CD04	MHG: BM190
BULIMBA	18065	20900	BM47-mod	RUBICON model
BULIMBA	18110	20855	BM46-mod	RUBICON model
BULIMBA	18320	20645	CD02	Cardno Survey data
BULIMBA	18495	20470	BM44 mod	ALS
BULIMBA	18690	20275	BM43-mod	ALS
BULIMBA	18995	19970	BM42-mod	ALS
BULIMBA	19165	19800	BM42-mod_MHG180	RUBICON model/ALS
BULIMBA	19195	19770	Copy of BM41	RUBICON model
BULIMBA	19205	19760	Scrub Rd FB_weir	RUBICON model/ALS
BULIMBA	19215	19750	BM41-mod	RUBICON model/ALS
BULIMBA	19375	19590	BM5GHD	RUBICON model
BULIMBA	19640	19325	Bm5GHD	RUBICON model
BULIMBA	20050	18915	BM7GHD	RUBICON model
BULIMBA	20260	18705	BM8GHDcopy	RUBICON model
BULIMBA	20270	18695	Meadowlands_weir	RUBICON model/ALS
BULIMBA	20290	18675	Bm8GHD	RUBICON model/LBCFS
BULIMBA	20510	18455	BM9GHD	RUBICON model/LBCFS
BULIMBA	20850	18115	Bm37	RUBICON model
BULIMBA	21090	17875	BM17GHD	RUBICON model/LBCFS
BULIMBA	21555	17410	BM18GHD	RUBICON model/LBCFS
BULIMBA	21875	17090	BM18GHDcopy	RUBICON model/LBCFS
BULIMBA	21885	17080	Preston_Rd_FBweir	RUBICON model/ALS

Creek Branch	MIKE11 Chainage(m)	AMTD equivalent (m)	Cross section ID	Details (source)
BULIMBA	21895	17070	BM19_GHD	RUBICON model/LBCFS
BULIMBA	22305	16660	MHG170	Interpolated
BULIMBA	22775	16190	BM23GHD	RUBICON model/LBCFS
BULIMBA	23165	15800	MHG160	Interpolated
BULIMBA	23285	15680	BM10GHD	RUBICON model
BULIMBA	23600	15365	BM11GHD	RUBICON model
BULIMBA	24695	14370	BM13a	ALS/LBCFS
BULIMBA	24890	14075	BM13GHD	RUBICON model/LBCFS
BULIMBA	25515	13450	MHG19-old	Interpolated
BULIMBA	25565	13400	MHG20-old	Interpolated
BULIMBA	25865	13100	BM26_MHG150	RUBICON model
BULIMBA	25885	13080	Wynnum_Rd_weir	ALS
BULIMBA	25905	13060	Copy of BM 26	RUBICON model
BULIMBA	26015	12950	MHG140	Interpolated
BULIMBA	26145	12820	BM24	RUBICON model
BULIMBA	26365	12600	BM23	RUBICON model
BULIMBA	26620	12345	BM 22	RUBICON model
BULIMBA	26710	12255	Copy of BM22	RUBICON model
BULIMBA	26730	12235	Murarrie_Rd_weir	ALS
BULIMBA	26750	12215	Copy of BM22	RUBICON model
BULIMBA	26780	12185	MHG120	ALS
BULIMBA	26940	12025	Copy of BM22	RUBICON model
BULIMBA	26990	11975	Copy BM42AGHD	RUBICON model/LBCFS
BULIMBA	27100	11865	BM42A-mod	ALS/LBCFS
BULIMBA	27300	11665	BM42AGHD copy	RUBICON model/LBCFS
BULIMBA	27355	11610	BM42AGHD	RUBICON model/LBCFS
BULIMBA	27755	11210	BM43AGHD	RUBICON model/LBCFS
BULIMBA	28025	10940	BM44AGHD	RUBICON model/LBCFS
BULIMBA	28815	10150	BM44BGHD	RUBICON model/LBCFS
BULIMBA	29075	9890	BM43BGHD	RUBICON model/LBCFS
BULIMBA	29730	9235	BM43CGHD	RUBICON model/LBCFS
BULIMBA	30635	8330	BM43CGHD	RUBICON model/LBCFS
BULIMBA	31600	7365	BM45GHD	RUBICON model/LBCFS
BULIMBA	32110	6855	BM46CGHD_MHG100	RUBICON model/LBCFS
BULIMBA	32355	6610	BM46BGHD	RUBICON model/LBCFS
BULIMBA	33330	5635	BM46AGHD	RUBICON model/LBCFS
BULIMBA	34300	4665	Copy BM52 GHD	RUBICON model/LBCFS
BULIMBA	34490	4475	Copy BM52 GHD	RUBICON model/LBCFS
BULIMBA	34510	4455	BM52 GHD	RUBICON model/LBCFS
BULIMBA	34700	4265	Copy BM52 GHD	RUBICON model/LBCFS
BULIMBA	35260	3705	BM7	RUBICON model
BULIMBA	35670	3295	BM6	RUBICON model
BULIMBA	35690	3275	Copy BM6	RUBICON model
BULIMBA	35785	3180	BM 48	RUBICON model
BULIMBA	36370	2595	BM 4	RUBICON model
BULIMBA	37040	1925	BM3	RUBICON model
BULIMBA	37465	1500	BM2_copy	Interpolated
BULIMBA	38070	895	BM 2	RUBICON model
BULIMBA	38610	355	BM 1	RUBICON model
Bulimba_US_extension	**0**	39900	Copy BM222	Survey 2006
Bulimba_US_extension	65	39835	BM 222	Survey 2006
Bulimba_US_extension	175	39725	BM 221	Survey 2006
Bulimba_US_extension	270	39630	BM220	Survey 2006

Creek Branch	MIKE11 Chainage(m)	AMTD equivalent (m)	Cross section ID	Details (source)
Bulimba_US_extension	415	39485	BM219	Survey 2006
Bulimba_US_extension	560	39340	BM218	Survey 2006
Bulimba_US_extension	736	39164	BM217	Survey 2006
Bulimba_US_extension	900	39000	BM216	Survey 2006
Bulimba_US_extension	935	38965		End of branch
BULIMBA_EAST				
BULIMBA_EAST	60	6220	BE289	SMP Study:2001
BULIMBA_EAST	170	6110	BE288	SMP Study:2001
BULIMBA_EAST	250	6030	BE287	SMP Study:2001
BULIMBA_EAST	388	5892	BE286	SMP Study:2001
BULIMBA_EAST	525	5755	BE285	SMP Study:2001
BULIMBA_EAST	612	5668	BE284	SMP Study:2001
BULIMBA_EAST	660	5620	HEC2146	HECRAS model-Railway
BULIMBA_EAST	708	5572	BE283	SMP Study:2001
BULIMBA_EAST	755	5525	HEC2030	HECRAS model-Railway
BULIMBA_EAST	799	5481	Copy of BE283	SMP Study:2001
BULIMBA_EAST	815	5465	BE282US	SMP Study:2001
BULIMBA_EAST	835	5445	BE281DS	SMP Study:2001
BULIMBA_EAST	840	5440	BE280	SMP Study:2001
BULIMBA_EAST	844	5436	BE279HEC	HECRAS model-Railway
BULIMBA_EAST	852	5428	BE278	SMP Study:2001
BULIMBA_EAST	875	5405	BE277-HEC	HECRAS model-Railway
BULIMBA_EAST	946	5334	BE 277-HEC DS	HECRAS model-Railway
BULIMBA_EAST	956	5324	BE277-A	ALS section
BULIMBA_EAST	978	5302	Copy BE277-A	ALS section
BULIMBA_EAST	981	5299	XS-7450	SMP Study:2001
BULIMBA_EAST	991	5289	XS-7460	SMP Study:2001
BULIMBA_EAST	1011	5269	Xs-7480	SMP Study:2001
BULIMBA_EAST	1031	5249	XS-7500	SMP Study:2001
BULIMBA_EAST	1051	5229	XS-7520	SMP Study:2001
BULIMBA_EAST	1071	5209	XS-7540	SMP Study:2001
BULIMBA_EAST	1091	5189	XS-7560	SMP Study:2001
BULIMBA_EAST	1111	5169	Xs-7580	SMP Study:2001
BULIMBA_EAST	1131	5149	Xs-7600	SMP Study:2001
BULIMBA_EAST	1151	5129	Xs-7620	SMP Study:2001
BULIMBA_EAST	1171	5109	XS-7640	SMP Study:2001
BULIMBA_EAST	1191	5089	XS-7660	SMP Study:2001
BULIMBA_EAST	1211	5069	XS-7680	SMP Study:2001
BULIMBA_EAST	1231	5049	Xs-7700	SMP Study:2001
BULIMBA_EAST	1251	5029	XS-7720	SMP Study:2001
BULIMBA_EAST	1271	5009	XS-7740	SMP Study:2001
BULIMBA_EAST	1291	4989	XS-7760	SMP Study:2001
BULIMBA_EAST	1311	4969	Xs-7780	SMP Study:2001
BULIMBA_EAST	1331	4949	XS-7800	SMP Study:2001
BULIMBA_EAST	1341	4939	Xs-7810	SMP Study:2001
BULIMBA_EAST	1355	4925	BE273	SMP Study:2001
BULIMBA_EAST	1498	4782	BE 272	SMP Study:2001
BULIMBA_EAST	1565	4715	BE272	SMP Study:2001
BULIMBA_EAST	1600	4680	BE271_ALS	ALS section
BULIMBA_EAST	1730	4550	BE270	SMP Study:2001
BULIMBA_EAST	1915	4365	BE269	SMP Study:2001
BULIMBA_EAST	2020	4260	BE268	SMP Study 2011
BULIMBA_EAST	2145	4135	BE267	SMP Study:2001

Creek Branch	MIKE11 Chainage(m)	AMTD equivalent (m)	Cross section ID	Details (source)
BULIMBA_EAST	2245	4035	BE 266	SMP Study:2001
BULIMBA_EAST	2410	3870	BE265	SMP Study:2001
BULIMBA_EAST	2500	3780	BE264	SMP Study:2001
BULIMBA_EAST	2605	3675	BE263	SMP Study:2001
BULIMBA_EAST	2765	3515	BE 262	SMP Study:2001
BULIMBA_EAST	2767	3513	Underwood Rd_weir	ALS section
BULIMBA_EAST	2785	3495	BE 261	SMP Study:2001
BULIMBA_EAST	2990	3290	BE259	SMP Study:2001
BULIMBA_EAST	3200	3080	BE258	SMP Study:2001
BULIMBA_EAST	3320	2960	BE257	SMP Study:2001
BULIMBA_EAST	3425	2855	Copy BE257	SMP Study:2001
BULIMBA_EAST	3490	2790	BE256	SMP Study:2001
BULIMBA_EAST	3670	2610	BE255	SMP Study:2001
BULIMBA_EAST	3695	2585	Copy-BE255	SMP Study:2001
BULIMBA_EAST	3725	2555	BE255_mod	ALS section
BULIMBA_EAST	3735	2545	Copy BE254	SMP Study:2001
BULIMBA_EAST	3745	2535	BE254	SMP Study:2001
BULIMBA_EAST	3785	2495	BE253	SMP Study:2001
BULIMBA_EAST	3810	2470	interpolated	SMP Study:2001
BULIMBA_EAST	3925	2392	BE251	SMP Study:2001
BULIMBA_EAST	4020	2392	BE250	SMP Study:2001
BULIMBA_EAST	4110	2170	BE249	SMP Study:2001
BULIMBA_EAST	4230	2050	BE248	SMP Study:2001
BULIMBA_EAST	4300	1980	BE247	SMP Study:2001
BULIMBA_EAST	4360	1920	Copy BE247	SMP Study:2001
BULIMBA_EAST	4419	1861	BE246	SMP Study:2001
BULIMBA_EAST	4507	1773	BE246A_ALS	ALS section
BULIMBA_EAST	4602	1678	BCFS 4612	RUBICON model
BULIMBA_EAST	4638	1642	Copy BCFS 4612	RUBICON model
BULIMBA_EAST	4656	1624	BE244	SMP Study:2001
BULIMBA_EAST	4660	1620	ALS	ALS section
BULIMBA_EAST	4695	1585	BCFS 4665	RUBICON model
BULIMBA_EAST	4730	1550	BCFS 4685	RUBICON model
BULIMBA_EAST	4750	1530	BCFS 4705	RUBICON model
BULIMBA_EAST	4870	1410	BE241	RUBICON model/ALS
BULIMBA_EAST	4980	1300	BE240	RUBICON model/ALS
BULIMBA_EAST	5050	1230	BE239	RUBICON model/ALS
BULIMBA_EAST	5175	1105	BE238	RUBICON model/ALS
BULIMBA_EAST	5330	950	BE236	RUBICON model/ALS
BULIMBA_EAST	5470	810	BE235	RUBICON model/ALS
BULIMBA_EAST	5712	568	BE232	RUBICON model/ALS
BULIMBA_EAST	5810	470	BE231	RUBICON model/ALS
BULIMBA_EAST	5895	385	BE230	RUBICON model/ALS
BULIMBA_EAST	5975	305	BE229	RUBICON model/ALS
BULIMBA_EAST	6055	225	BE228	RUBICON model/ALS
BULIMBA_EAST	6135	145	BE227	RUBICON model/ALS

Creek Branch	MIKE11 Chainage (m)	Cross Section ID	Details (Source)
BULIMBA_EAST Railbypass			
BULIMBA_EAST Railbypass	33	BE 276	SMP Study:2001/ALS
BULIMBA_EAST Railbypass	144	BE275	SMP Study:2001/ALS
BULIMBA_EAST Railbypass	226	BE 274	SMP Study:2001/ALS
BULIMBA_EAST Railbypass	347	BE 273 US	SMP Study:2001/ALS
BULIMBA_EAST Railbypass	443	BE273 DS	SMP Study:2001/ALS
BULIMBA_EAST Railbypass	488	BE 273A	ALS
BULIMBA_EAST Railbypass	520		End of branch
TRIB_A			
TRIB_A	100	Copy of ALS1	ALS
TRIB_A	320	ALS1	ALS
TRIB_A	600	ALS2	ALS
TRIB_A	950	BE-1060	SMP Study:2001/ALS
TRIB_A	1400	BE-1040	SMP Study:2001/ALS
TRIB_A	1770	BE-1030	SMP Study:2001/ALS
TRIB_A	2070	BE-1020	SMP Study:2001/ALS
TRIB_A	2125	CSI-1	Interpolated
TRIB_A	2235	BE -1010	SMP Study:2001/ALS
TRIB_A	2535	BE-1005-ALS	SMP Study:2001/ALS
TRIB_A	2555	BE-1005-ALS	SMP Study:2001/ALS
TRIB_A	2735	Copy of BE1005	SMP Study:2001/ALS
TRIB_A	2765	BE1000	SMP Study:2001/ALS
TRIB_A	2935	BE1000_modified	SMP Study:2001/ALS
TRIB_A	3015	BE1000-modified	SMP Study:2001/ALS
TRIB_A1			
TRIB_A1	280	A1-1050	SMP Study:2001/ALS
TRIB_A1	500	ALS-1	ALS section
TRIB_A1	720	ALS-2	ALS section
TRIB_A1	750	ALS-3	ALS section
TRIB_A2			
TRIB_A2	80	SMP-1	SMP Study:2001/ALS
TRIB_A2	475	SMP-2	SMP Study:2001/ALS
TRIB_A2	690	SMP-3	SMP Study:2001/ALS
TRIB_A2	1035	SMP-4	SMP Study:2001/ALS
TRIB_A2	1042	SMP-5	SMP Study:2001/ALS
TRIB_B			
TRIB_B	1055	BE2030	SMP Study:2001/ALS
TRIB_B	1075	Copy of BE2030	SMP Study:2001/ALS
TRIB_B	1215	BE2020	SMP Study:2001/ALS
TRIB_B	1340	Copy of BE2020	SMP Study:2001/ALS
TRIB_B	1394	BE2010	SMP Study:2001/ALS
TRIB_B	1432	BE2000	SMP Study:2001/ALS
TRIB_B	1492		End of branch
TRIB_C			
TRIB_C	10	BE-3050	SMP Study:2001/ALS
TRIB_C	390	BE-3040	SMP Study:2001/ALS
TRIB_C	545	BE-3030	SMP Study:2001/ALS
TRIB_C	665	BE-3020	SMP Study:2001/ALS
TRIB_C	810	BE-3010	SMP Study:2001/ALS
TRIB_C	1000	BE3000	SMP Study:2001/ALS
TRIB_C	1005	Copy BE-3000	SMP Study:2001/ALS
TRIB_C	1100	Copy BE3000	SMP Study:2001/ALS
TRIB_C	1110	ALS-C1	ALS

Creek Branch	MIKE11 Chainage (m)	Cross Section ID	Details (Source)
TRIB_C	1120	ALS-C2	ALS
TRIB_B1	1000	ALS-B1	ALS
TRIB_B1	1002	ALS-B2	ALS
TRIB_B1	1020	ALS-B3	ALS
TRIB_B1	1055	ALS-B4	ALS
TRIB_B1	1140	ALS-B5	ALS
TRIB_B1	1145	ALS-B5	End of branch
PADSTOW			
PADSTOW	32	BM177	RUBICON model
PADSTOW	105	BM177-176ALS	RUBICON model /ALS
PADSTOW	175	BM176-US-ALS	RUBICON model /ALS
PADSTOW	205	BM176-DS-ALS	RUBICON model /ALS
PADSTOW	258	BM175	RUBICON model
PADSTOW	325	BM175-174ALS	RUBICON model /ALS
PADSTOW	352	BM174	RUBICON model
PADSTOW	375		End of Branch
GARDEN_CITY			
GARDEN_CITY	5285	BM169	RUBICON model
GARDEN_CITY	5405	BM168	RUBICON model
GARDEN_CITY	5510	BM167	RUBICON model
GARDEN_CITY	5615	Copy BM167	RUBICON model
GARDEN_CITY	5715	Copy BM165	RUBICON model
GARDEN_CITY	5730	Bm165	RUBICON model
GARDEN_CITY	5785	XS5	Logan-survey
GARDEN_CITY	5850	XS4	Logan-survey
GARDEN_CITY	5935	Copy XS4	Logan-survey
GARDEN_CITY	5938	Copy XS4	End of branch
MIMOSA Creek			
MIMOSA	5	Mi 40_Hecras	Mimosa HECRAS model
MIMOSA	96	Mi 40a_ALS	ALS
MIMOSA	200	Mi39	Mimosa HECRAS model
MIMOSA	330	MI38	Mimosa HECRAS model
MIMOSA	484	Mi37	Mimosa HECRAS model
MIMOSA	506	Mi36	Mimosa HECRAS model
MIMOSA	558	Mi35	Mimosa HECRAS model
MIMOSA	660	Mi34	Mimosa HECRAS model
MIMOSA	696	Mi33	Mimosa HECRAS model
MIMOSA	811	Mi32	Mimosa HECRAS model
MIMOSA	952	Mi31	Mimosa HECRAS model
MIMOSA	1037	Copy of Mi31	Mimosa HECRAS model
MIMOSA	1186	Mi29	Mimosa HECRAS model
MIMOSA	1302	Mi28	Mimosa HECRAS model
MIMOSA	1322	Mi27	Mimosa HECRAS model
MIMOSA	1366	Mi26	Mimosa HECRAS model
MIMOSA	1439	Mi25	Mimosa HECRAS model
MIMOSA	1549	Mi24	Mimosa HECRAS model
MIMOSA	1588	Mi23	Mimosa HECRAS model
MIMOSA	1719	Mi22	Mimosa HECRAS model
MIMOSA	1738	Mi21-2	Mimosa HECRAS model
MIMOSA	1752	Mi21-1	Mimosa HECRAS model
MIMOSA	1762	Mi20_	Mimosa HECRAS model
MIMOSA	1882	Mi19	Mimosa HECRAS model
MIMOSA	1892	Mi19-4	Mimosa HECRAS model

Creek Branch	MIKE11 Chainage (m)	Cross Section ID	Details (Source)
MIMOSA	1964	Mi19-1	Mimosa HECRAS model
MIMOSA	2023	Mi18	Mimosa HECRAS model
MIMOSA	2086	Mi17	Mimosa HECRAS model
MIMOSA	2133	Mi16	Mimosa HECRAS model
MIMOSA	2224	Mi15	Mimosa HECRAS model
MIMOSA	2248	Mi13-3	Mimosa HECRAS model
MIMOSA	2255	Kessels_Road weir	ALS
MIMOSA	2284	Mi13-2	Mimosa HECRAS model
MIMOSA	2325	Mi13	Mimosa HECRAS model
MIMOSA	2516	Mi12	Mimosa HECRAS model
MIMOSA	2635	Mi11	Mimosa HECRAS model
MIMOSA	2664	Mi10-2	Mimosa HECRAS model
MIMOSA	2718	Mi9	Mimosa HECRAS model
MIMOSA	2828	Mi8	Mimosa HECRAS model
MIMOSA	2955	Mi7	Mimosa HECRAS model
MIMOSA	3069	Mi6	Mimosa HECRAS model
MIMOSA	3221	Mi5	Mimosa HECRAS model
MIMOSA	3388	Mi4	Mimosa HECRAS model
MIMOSA	3496	Mi3	Mimosa HECRAS model
MIMOSA	3585	Mi2	Mimosa HECRAS model
MIMOSA	3801	Mi1	Mimosa HECRAS model
MIMOSA	3890		End of Mimosa Creek
MINNIPPI BYPASS			
MINNIPPI bypass	80	ALS1	ALS
MINNIPPI bypass	125	Minnippi_new1	ALS
MINNIPPI bypass	230	Minnippi_new2	ALS
MINNIPPI bypass	400	Minnippi_new3	ALS
MINNIPPI bypass	542	Minnippi_new4	ALS
MINNIPPI bypass	650	Minnippi_new5	ALS
MINNIPPI bypass	720	new_A	ALS
MINNIPPI bypass	710	Stanton Rd	ALS
MINNIPPI bypass	730	New_B	ALS
MINNIPPI bypass	745	Minnippi_new6-US	ALS
MINNIPPI bypass	748	Gateway Motorway	
MINNIPPI bypass	810	Minnippi_new7-DS	RUBICON model
MINNIPPI bypass	825	New_E	RUBICON model
MINNIPPI bypass	860	New_G	ALS
MINNIPPI bypass	870	New_7a	ALS
MINNIPPI bypass	945	Minnippi_new8	RUBICON model
MINNIPPI bypass	1015	BM31GHD_modified	RUBICON model
MINNIPPI bypass	1115	Minnippi-6_ALS	ALS
MINNIPPI bypass	1125	Wynnum Road weir	ALS
MINNIPPI bypass	1150	BM 31GHD-copy	RUBICON model
MINNIPPI bypass	1310	BM36_GHD	RUBICON model
MINNIPPI bypass	1560	Minnippi_new11	ALS
MINNIPPI bypass	1850	BM 42B_GHD	RUBICON model
MINNIPPI bypass	2004	BM42BGHD	RUBICON model
MURARRIE Bypass			
MURARRIE bypass	20	MU1_ALS	ALS section
MURARRIE bypass	**160**	New_MU2_ALS	ALS section
MURARRIE bypass	**275**	New_MU3_ALS	ALS section
MURARRIE bypass	**310**	Copy_new_MU3	ALS section
MURARRIE bypass	**390**	New_MU5_ALS	ALS section

Creek Branch	MIKE11 Chainage (m)	Cross Section ID	Details (Source)
MURARRIE bypass	**470**	Mu_6_ALS	ALS section
MURARRIE bypass	**475**	Gateway culverts	
MURARRIE bypass	**545**	MU_7_ALS	ALS section
MURARRIE bypass	**595**	MU_9_ALS	ALS section
MURARRIE bypass	**640**	MU5_ALS	ALS section
MURARRIE bypass	**650**		End of branch
KIANAWAH PARK Branch			
KIANAWAK PARK Branch	**0**	WY-1 ALS	ALS section
KIANAWAK PARK Branch	**48**	WY-1 ALS	ALS section
KIANAWAK PARK Branch	**210**	WY-2 ALS	ALS section
KIANAWAK PARK Branch	**260**	WY-3 ALS	ALS section
KIANAWAK PARK Branch	**340**	WY-4 ALS	ALS section
KIANAWAK PARK Branch	**430**	WY-5 ALS	ALS section
KIANAWAK PARK Branch	**530**	WY-6 ALS	ALS section
KIANAWAK PARK Branch	**660**	WY-7 ALS	ALS section
KIANAWAK PARK Branch	**780**	WY-8 ALS	ALS section
KIANAWAK PARK Branch	**860**	WY-9 ALS	ALS section
KIANAWAK PARK Branch	**945**	WY-10 ALS	ALS section
KIANAWAK PARK Branch	**985**	WY-11 ALS	ALS section
KIANAWAK PARK Branch	**1006**	End	ALS section
ALS: Airborne Laser Scanning data 2002			

Table A3: Hydraulic Structures included in the MIKE11 model

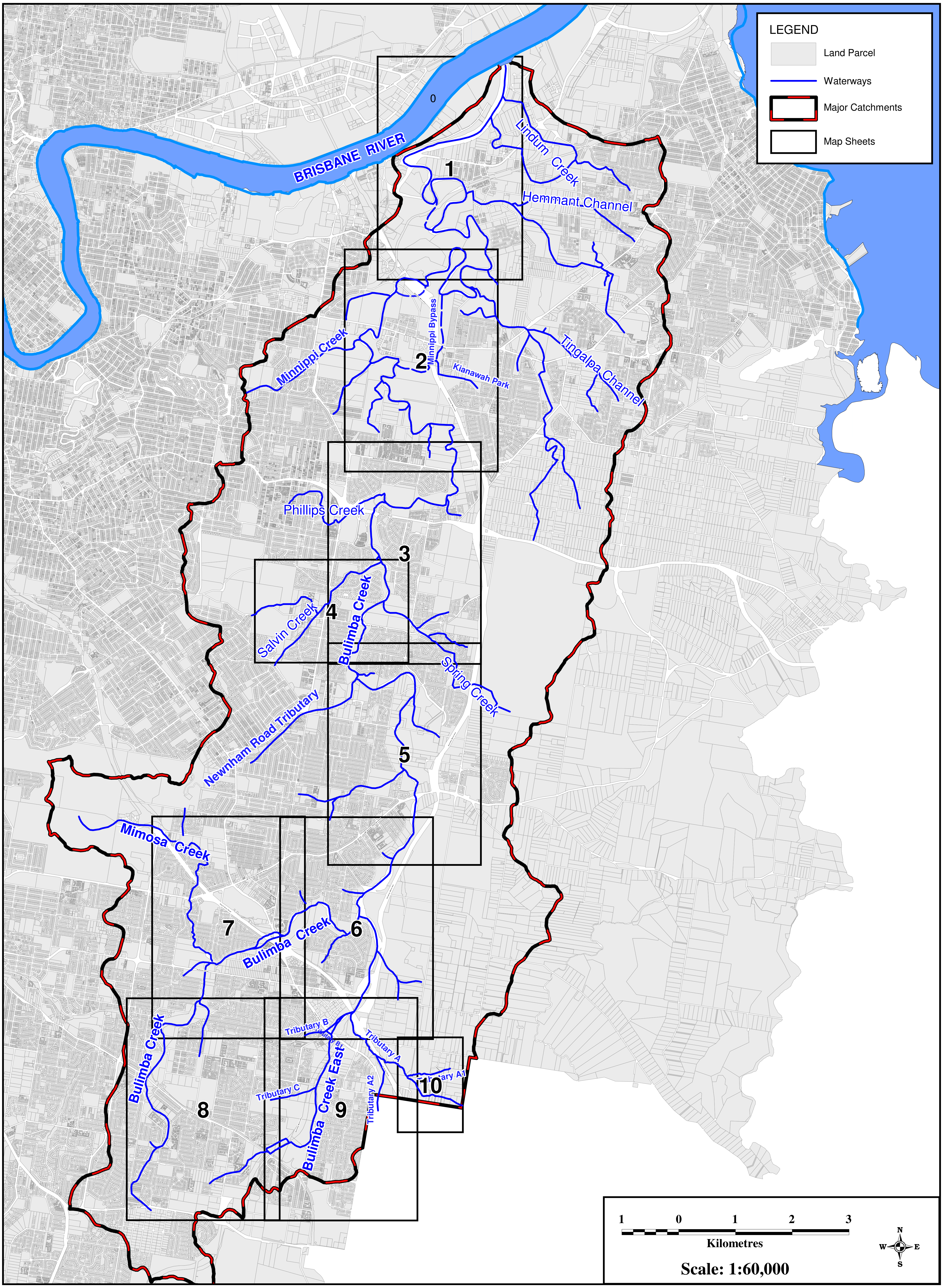
No.	Location	Branch	Chainage	Structure
1	Nemies Road	Bulimba Creek	17	Box culverts(8 / 1.5 x1.5)
2	Brandon Road	Bulimba Creek	370	Box culverts(4 / 2.7 x0.9)
3	Beenleigh Road	Bulimba Creek	1845	Box culverts(4 / 3.6 1.2)
4	Beenleigh Road	Bulimba Creek	1950	Bridge
5	StLawrences Foot Bridge	Bulimba Creek	2117	Foot Bridge
6	Altandi Sreet Foot Bridge	Bulimba Creek	2375	Foot Bridge
7	Malbon Street Foot Bridge	Bulimba Creek	3965	Foot Bridge
8	Padstow Road	Bulimba Creek	4390	Box culverts(7 / 3.35x2.2)
9	Padstow Road No.2	Bulimba Creek	177	Box culverts(3 / 3 x2.1)
10	Blesby Road Foot Bridge	Bulimba Creek	4785	Foot Bridge
11	South-East Freeway	Bulimba Creek	5625	Box culverts(5 / 3.1x3.1)
12	South-East Freeway No. 2	Garden City branch	5620	Box culverts(2 / 3.1x3.1)
13	Logan Road	Bulimba Creek	5790	Box culverts (5 / 3x 3)
14	Logan Road No.2	Garden City branch	5790	Box culverts(2 / 3x3)
15	Craig Street Foot Bridge	Bulimba Creek	6935	Foot Bridge
16	Mt Gravatt CapalabaRoad	Bulimba Creek	10702	Bridge
17	Wecker Road Bridge	Bulimba Creek	12139	Bridge
18	Pine Mountain Road	Bulimba Creek	15555	Bridge
19	Meadowbanks St FootBridge	Bulimba Creek	16445	Foot Bridge
20	Winstanly St	Bulimba Creek	17338	Bridge
21	Old Cleveland Road	Bulimba Creek	17935	Bridge
22	Scrub Road Foot Bridge	Bulimba Creek	19205	Foot Bridge
23	Meadowlands Road	Bulimba Creek	20270	Bridge
24	Preston Road foot Bridge	Bulimba Creek	21885	Foot Bridge
25	Wynnum Road	Bulimba Creek	25885	Bridge
26	Murarrie Road	Bulimba Creek	26730	Bridge
27	Cleveland-Rail	Bulimba Creek	34500	Bridge
28	Lytton Road	Bulimba Creek	35680	Bridge
29	Wynnum Road Minnippi	Minnippi branch	1125	Bridge
30	Beenleigh Road-South	Bulimba Creek east	820	Box culverts (4 / 1.65x 0.6)
31	Beenleigh Road rail	Bulimba Creek east	845	Box culverts(10 / 1.5x1.15)
32	Beenleigh Road-Gateway	Bulimba Creek east	876	Pipe culverts (3 / 2.4dia.)
33	Underwood Road	Bulimba Creek east	2767	Box culverts (4 / 3.7x 1.8)
34	Gateway Motorway	Bulimba Creek east	3330	Bridge
35	Logan Road (box culvert)	Bulimba Creek east	3748	Box culverts (2 / 2.4x2.4)
36	Logan Road pipe culvert	Bulimba Creek east	3748	Pipe culverts (4 / 2.4dia.)
37	Pacific Motorway	Bulimba Creek east	4305	Box culverts (5 / 3.05x2.7)
38	Eight_Mile_Plains	Bulimba Creek east	4608	Bridge
39	Miles Platting Road	Bulimba Creek east	4660	Bridge

No.	Location	Branch	Chainage	Structure
40	Gateway on-off_ramp	Bulimba Creek east	5010	Bridge
41	Nagel Street Bridge	Mimosa Creek	1739	Bridge
42	Mimosa Creek at Pacific Motorway	Mimosa Creek	1895	Box culverts (3 / 3x2.7)
43	Kessels Road	Mimosa Creek	2255	Bridge
44	Parkway Street	Mimosa Creek	2648	Bridge
45	School Road to Freeway	Tributary A	2072	Box culverts(3 / 3.1x2.1)
46	South-east Freeway-off ramp	Tributary A	2545	Box culverts(9 / 2.4x1.8)
47	Gateway Motorway	Tributary A	2805	Box culverts (3 / 3.3dia.)
48	Gateway Motorway No.2	Tributary A	2805	Box culverts (3 / 3.5 dia.)
49	Dance Court No.1	Tributary B	1062	Box culverts(3 / 3.65x1.5)
5	Dance Court No.2	Tributary B	1062	Box culverts(1 / 3.65x1.7)
51	Logan Road-Trib B	Tributary B	1361	Box culverts(1 / 3x2.6)
52	Gateway in TribC	Tributary C	1008	Pipe culverts (4 / 2.7dia.)
53	Gaskell Street	Tributary B1	1030	Box culverts(3 / 3x1.5)
54	Gateway Motorway culvert	Minnippi	770	Box culverts (6 / 3 x 3)
55	Gateway Motorway Bridge	Bulimba Creek	26950	Bridge (via duct)
56	Gateway Motorway culverts	Murarrie	475	Box culverts (9 / 2x1.6)

Table A4: Manning's Roughness (n) Values used in the MIKE11 Model

Waterway	Manning's 'n'
Bulimba Creek	
Nemies Road to Brandon Road weir	0.085
Brandon Road weir to Logan Road	0.09–0.1
Logan Road to Greenwood Street	0.08–0.09
Greenwood Street to Wecker Road	0.065–0.07
Wecker Road to Green meadow Street	0.07–0.075
Green meadow Street to Old Cleveland Road	0.06–0.065
Old Cleveland Road to Scrub Road	0.05–0.06
Scrub Road to Minnippi Parklands	0.04–0.05
Minnippi Parklands to Boundary Road	0.035
Boundary Road to confluence with Brisbane River	0.03
Mimosa Creek	
Klumpp Road to Hoad Street	0.07–0.08
Hoad Street to Pacific Motorway	0.08–0.10
Pacific Motorway to Sheraton Street	0.07–0.075
Sheraton Street to Bulimba Creek confluence	0.09
Bulimba Creek East Arm	
Persse Road to upstream of Beenleigh Road	0.095–0.09
Beenleigh Road to downstream of railway bridge	0.055
Railway bridge downstream to Gateway Motorway downstream	0.090–0.095
Gateway Motorway downstream to Logan Road	0.09–0.08
Logan Road to Pacific Motor way upstream	0.08–0.07
Pacific Motorway to Bulimba Creek confluence	0.08–0.09
Other Branches	
Garden City branch	0.09
Padstow branch	0.08–0.09
Bulimba -East Left arm	0.1
Tributary A in Bulimba East Arm	0.08
Tributary A1 in Bulimba East Arm	0.08
Tributary A2 in Bulimba East Arm	0.08
Tributary B in Bulimba Eat Arm	0.06–0.08
Tributary B1 in Bulimba Eat Arm	0.08
Murarrie Bypass branch	0.045
Minnippi Bypass branch	0.09

Appendix B MIKE11 Model Cross Section Layout



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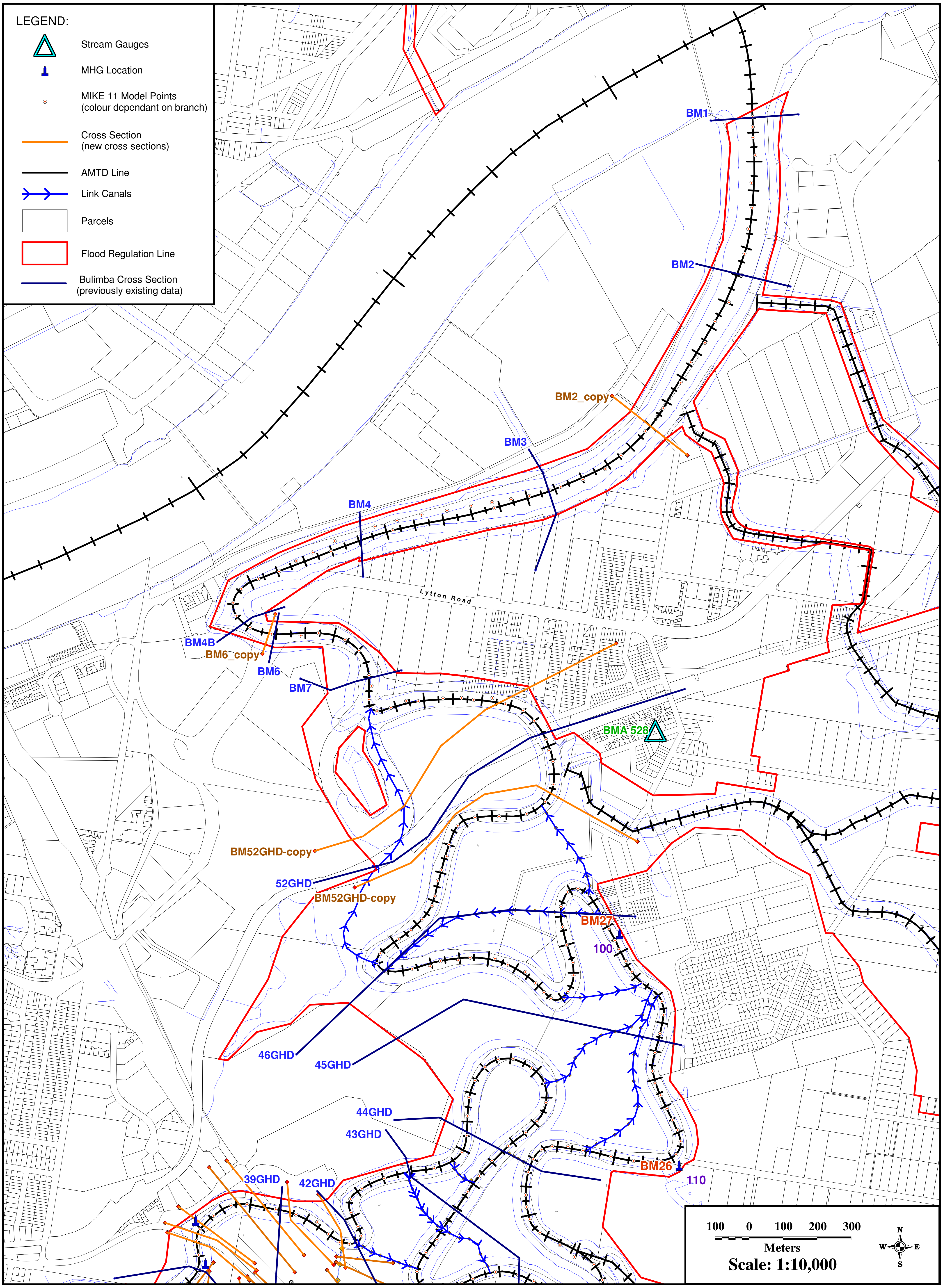
MIKE 11 Model Layout - Key Map
Map Sheet B

Bulimba Creek Flood Study



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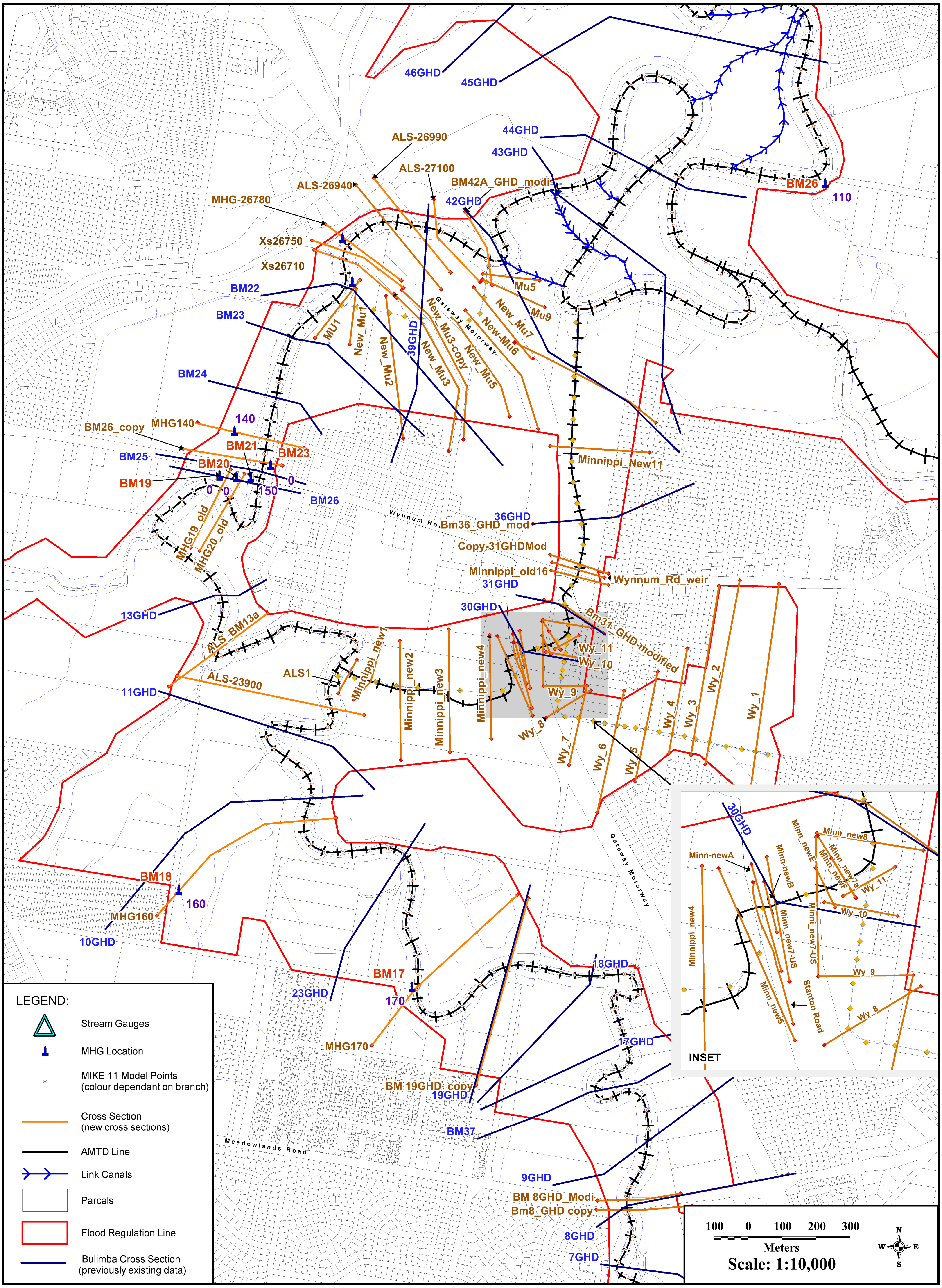
MIKE 11 Model Layout
Map Sheet B1



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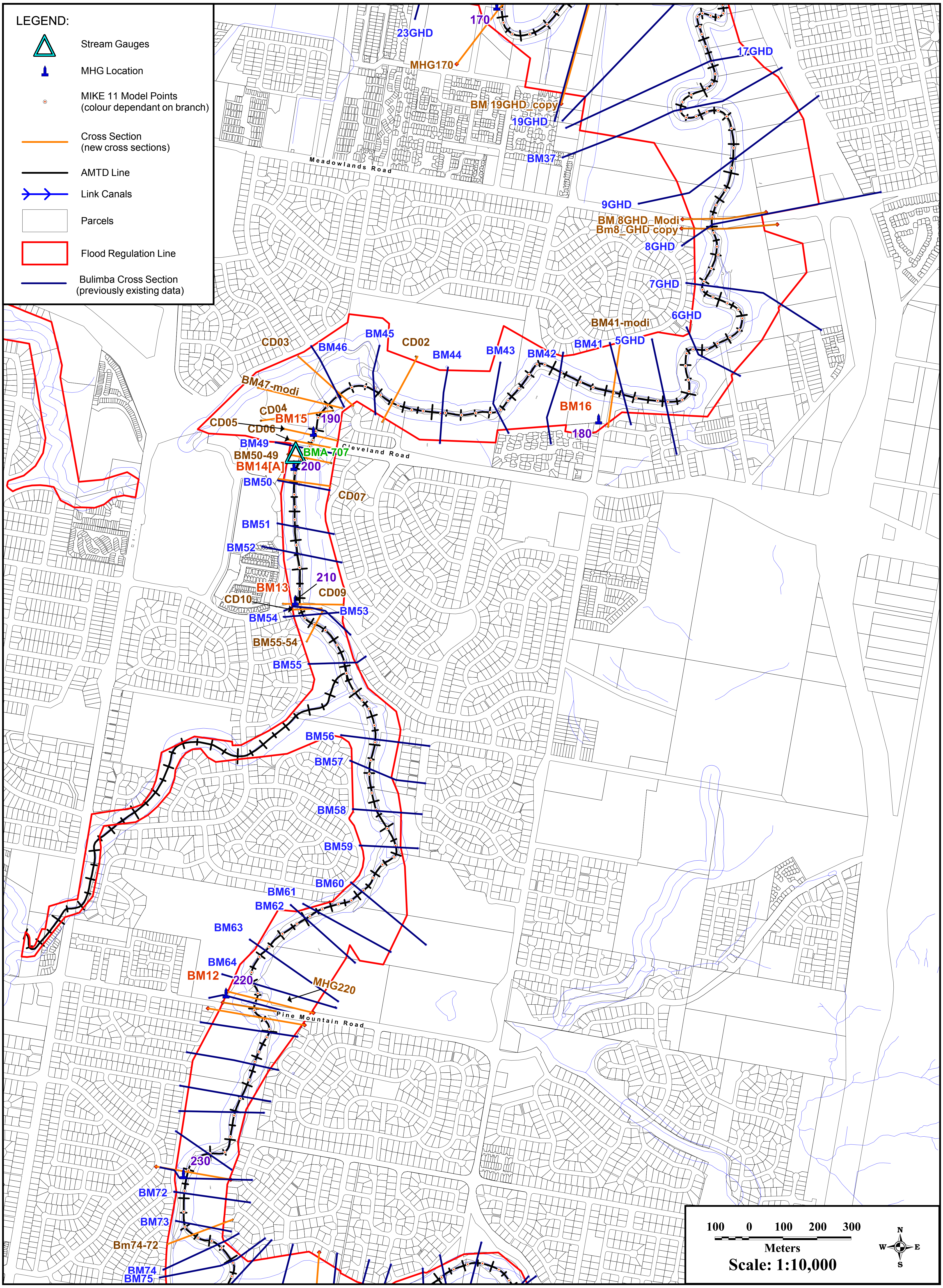
MIKE 11 Model Layout

Map Sheet B2

Bulimba Creek Flood Study



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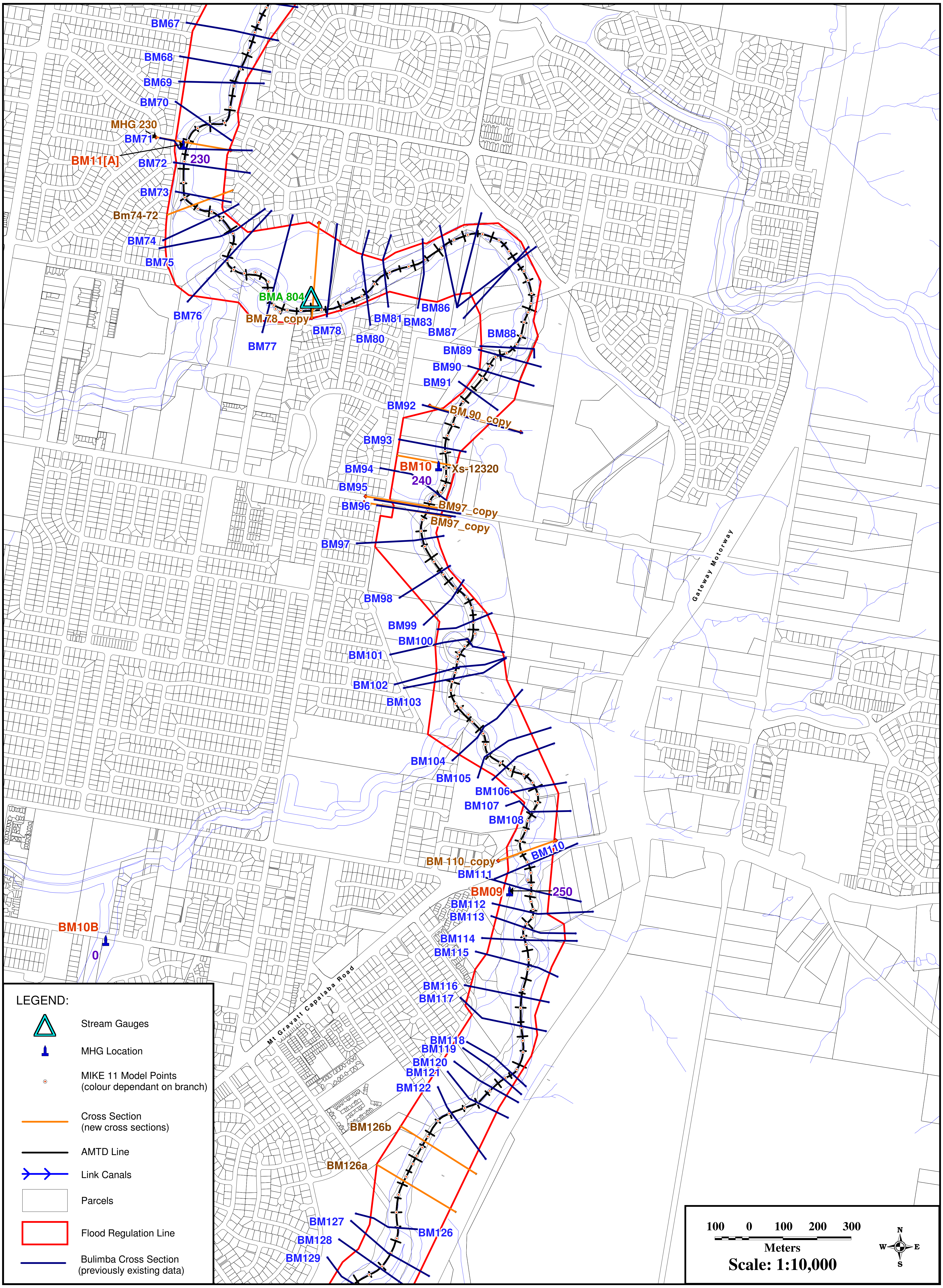
"While every care is taken by Brisbane City Council (BCC) and Department of Natural Resources and Mines (NRM) to ensure the accuracy of this data, BCC and NRM jointly and severally make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which may be incurred as a result of data being inaccurate or incomplete in any way and for any reason."

Based on Data provided with the permission of the Department of Natural Resources and Mines (NRM): Cadastral Data (Jan / 2002)

MIKE 11 Model Layout

Map Sheet B3

Bulimba Creek Flood Study



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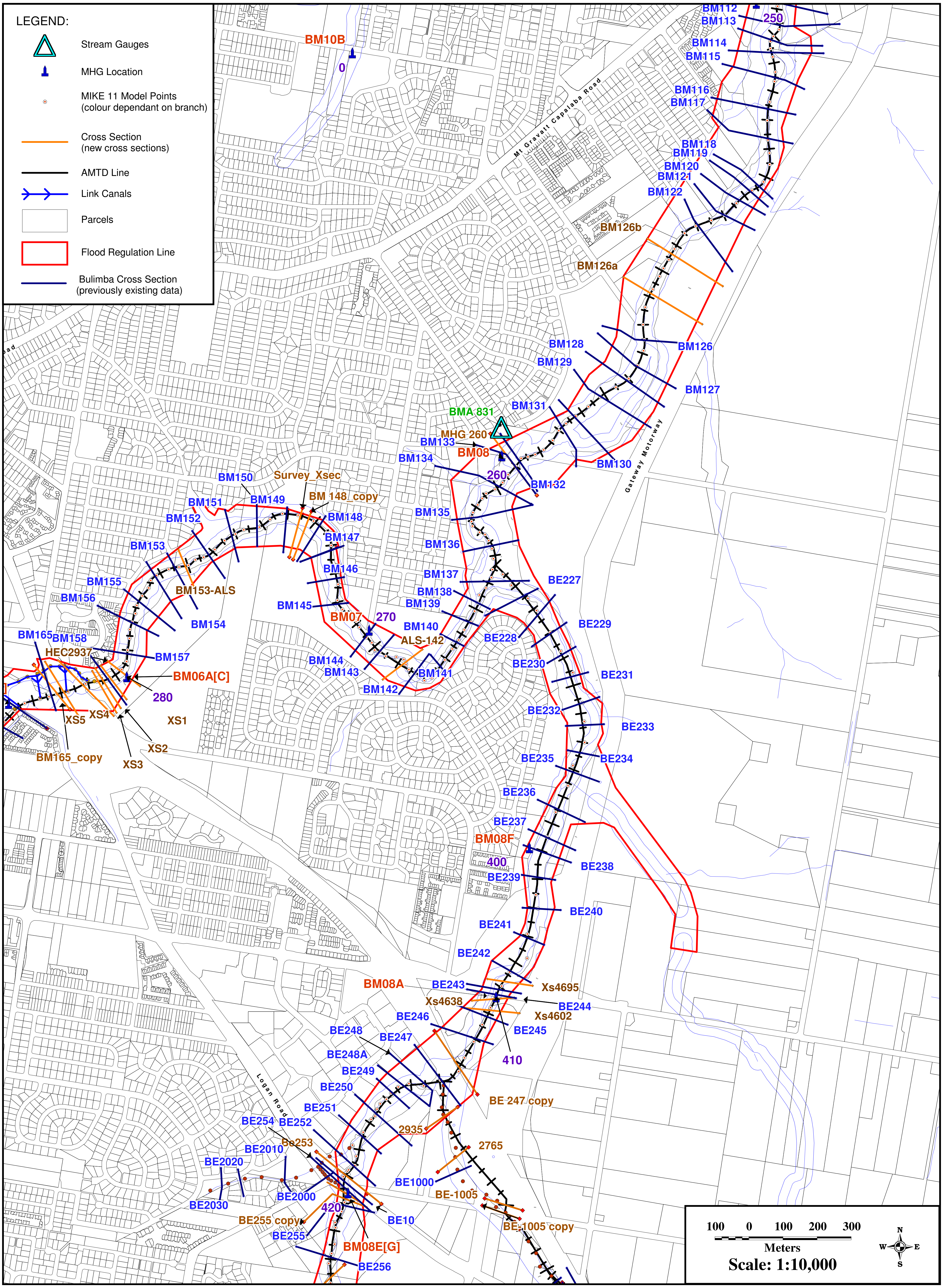
MIKE 11 Model Layout

Map Sheet B5

Bulimba Creek Flood Study



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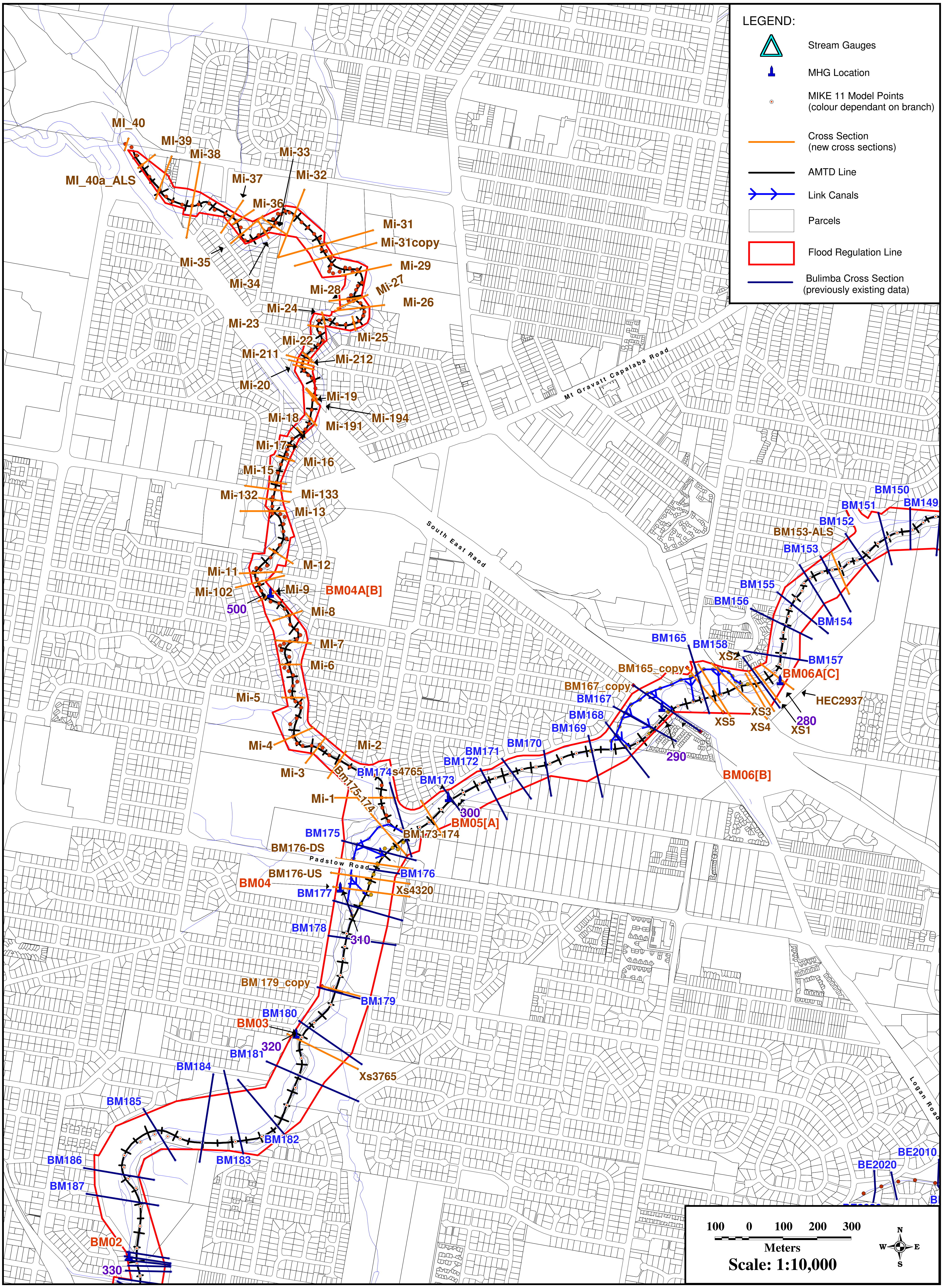
Qasco

webmap

MIKE 11 Model Layout
Map Sheet B6

Bulimba Creek Flood Study



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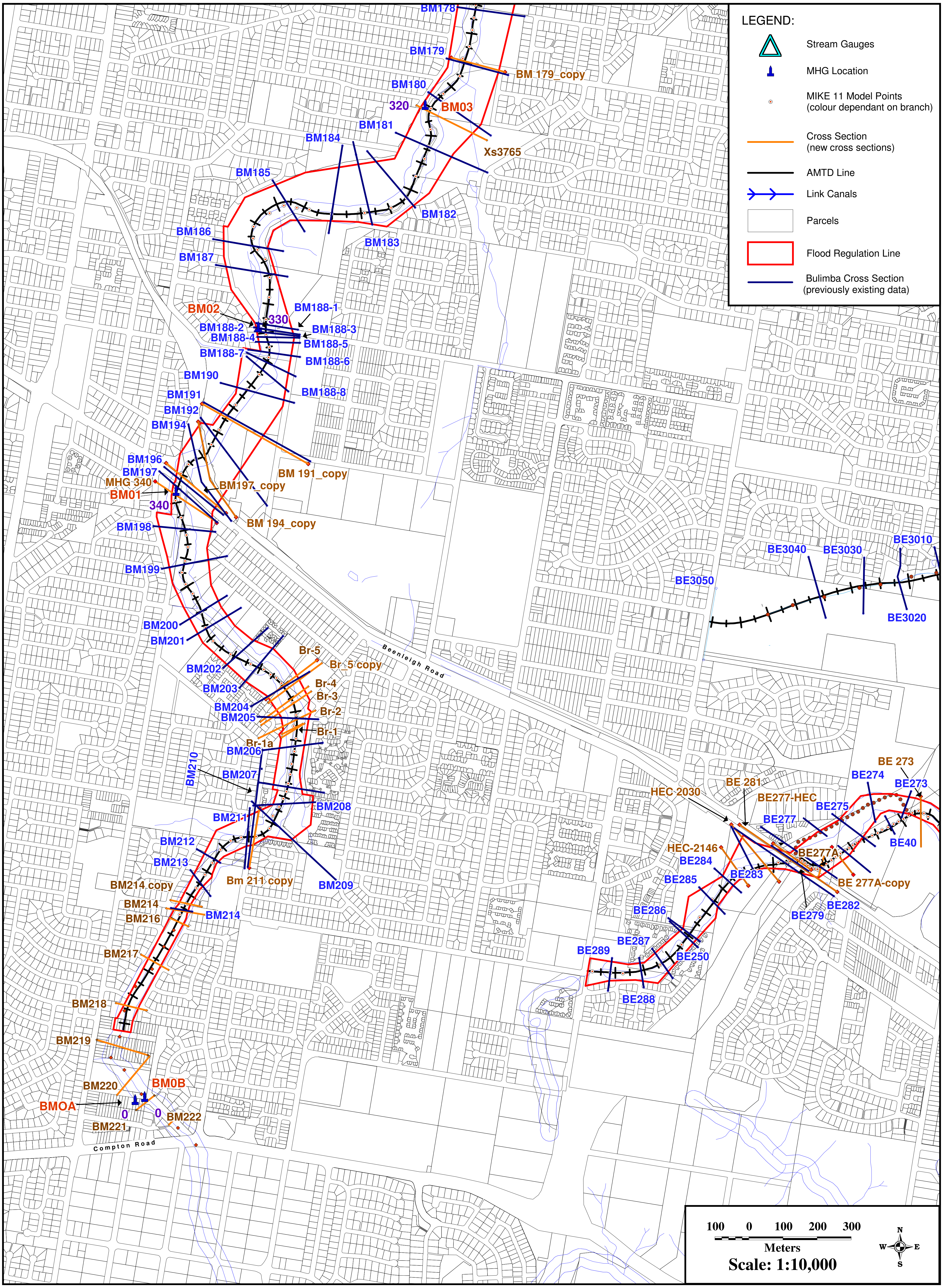
Qasco

webmap

MIKE 11 Model Layout
Map Sheet B7

Bulimba Creek Flood Study



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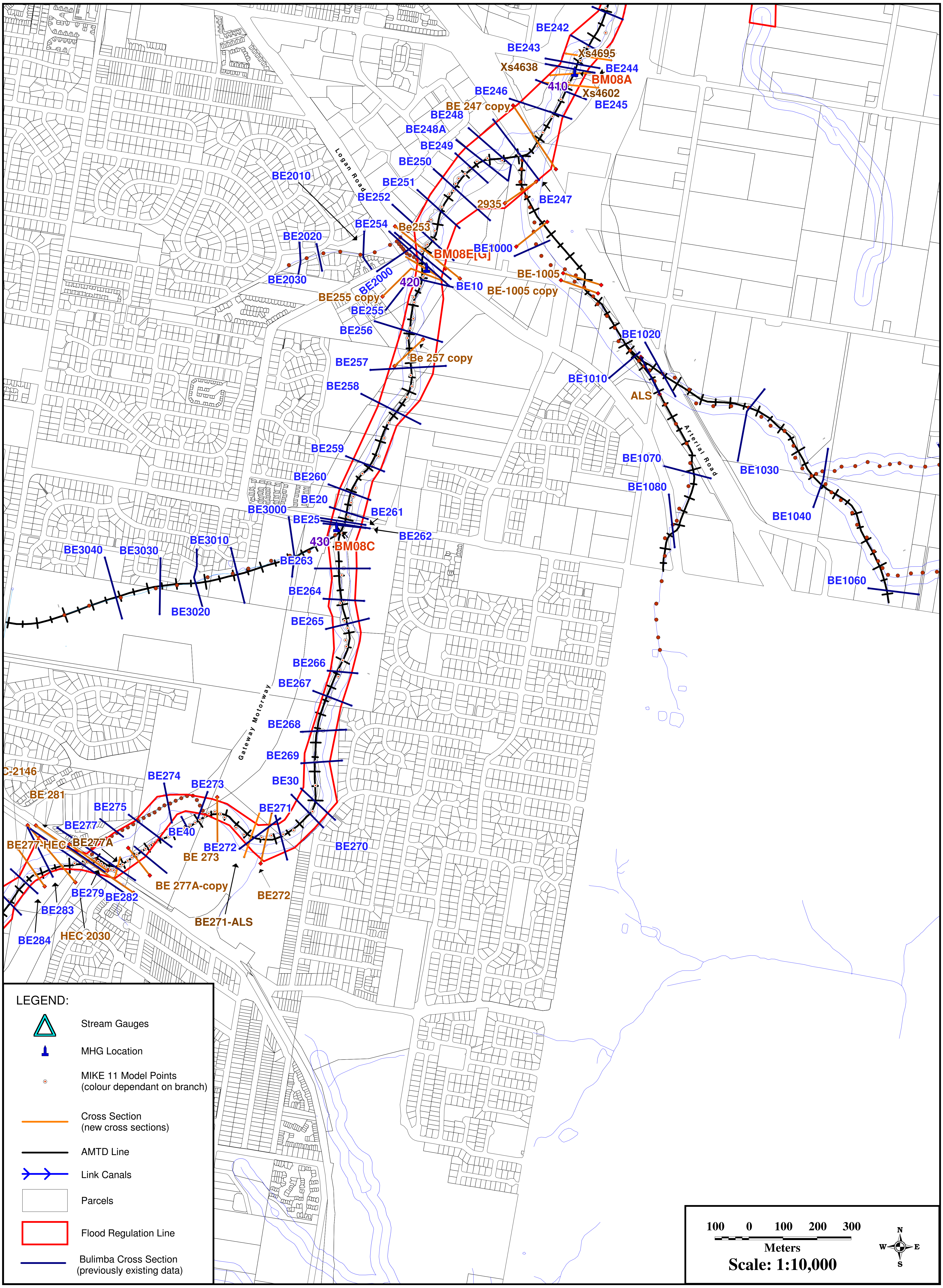
Qasco
webmap

MIKE 11 Model Layout
Map Sheet B8



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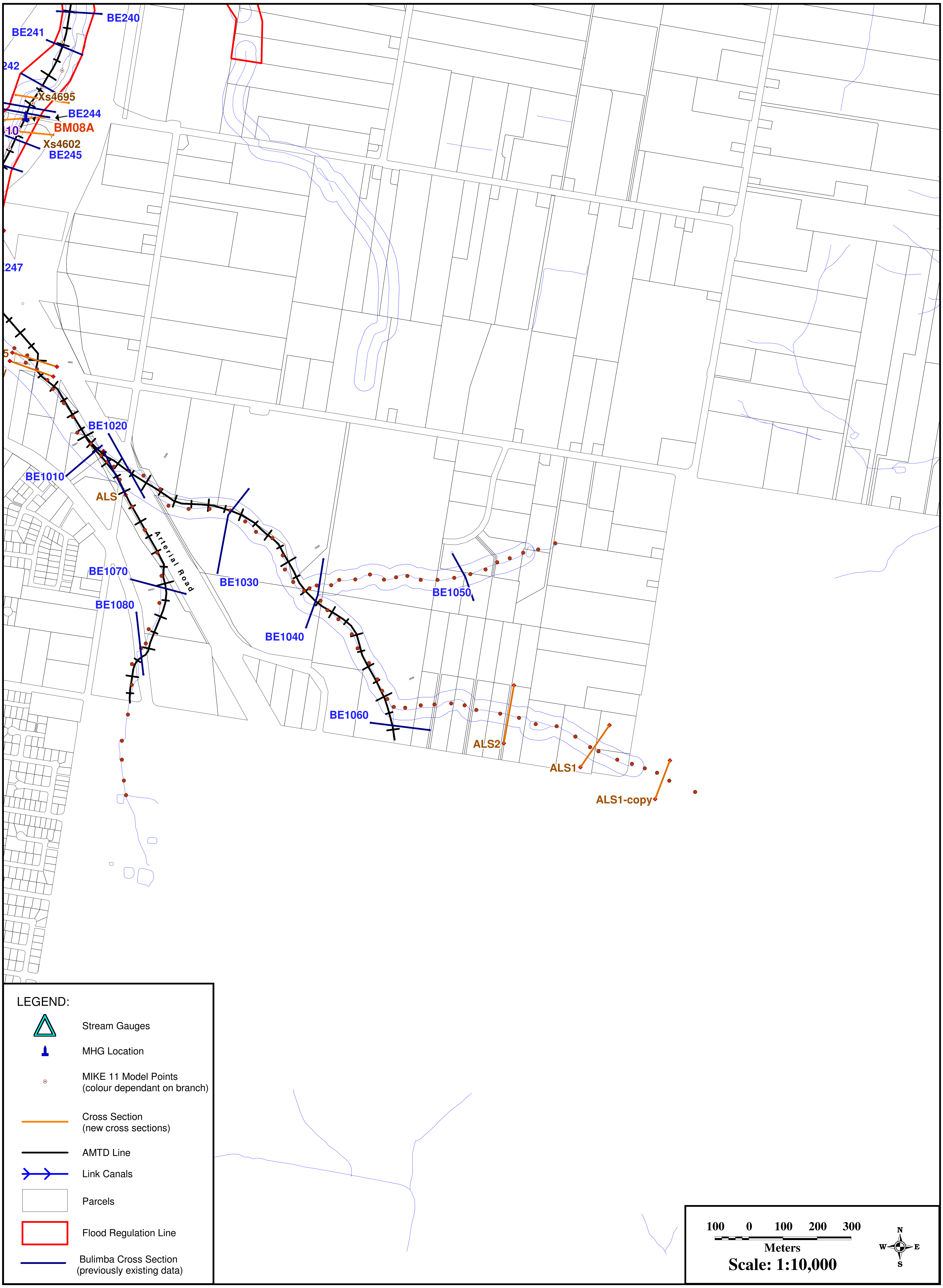
Qasco
webmap

MIKE 11 Model Layout

Map Sheet B9



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MIKE 11 Model Layout

Map Sheet B10

Appendix C Cumulative Rainfall & Rainfall Distribution Adopted for Calibration/Verification events

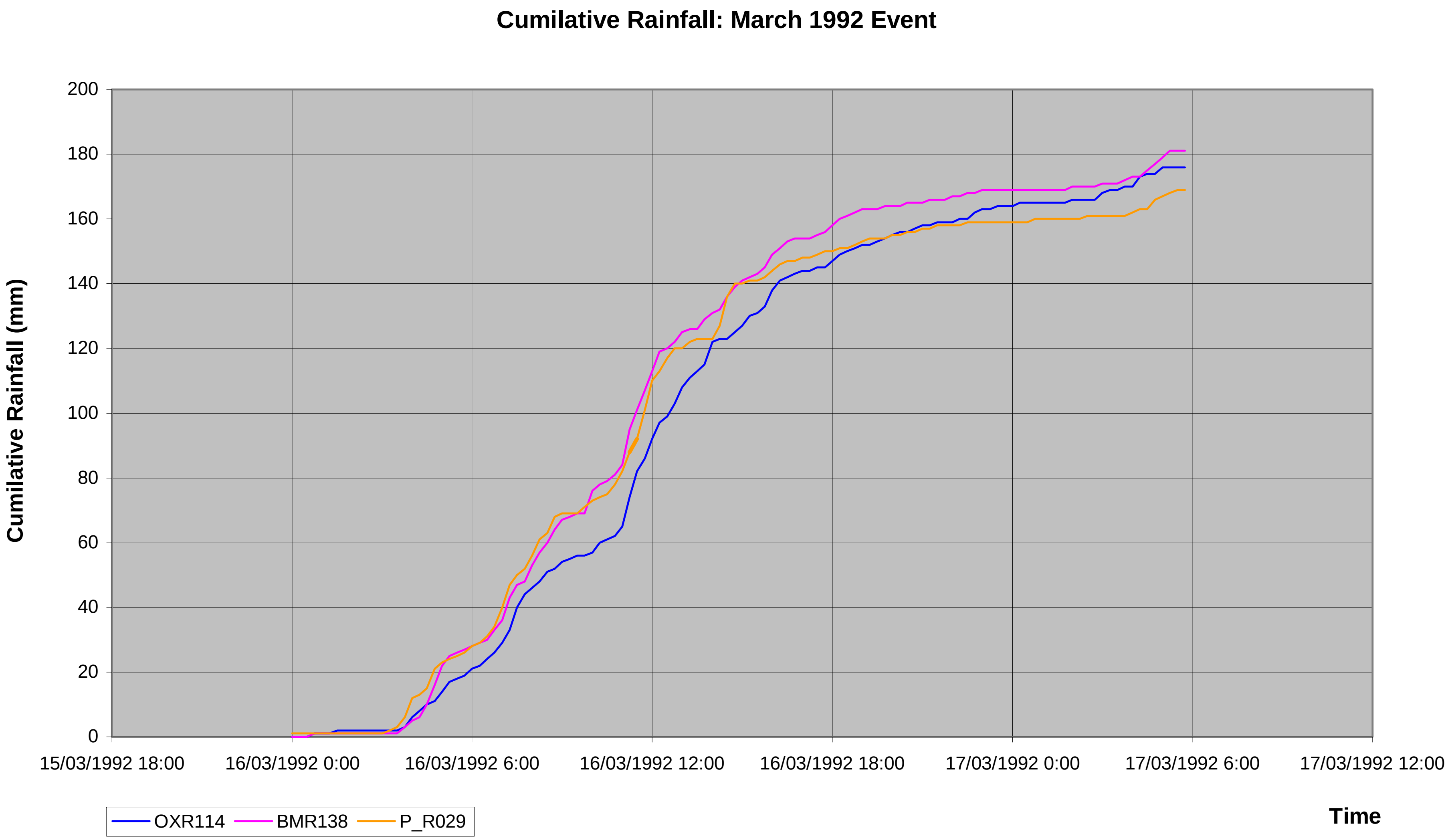


Figure C1: Cumulative rainfall for March 1992 event

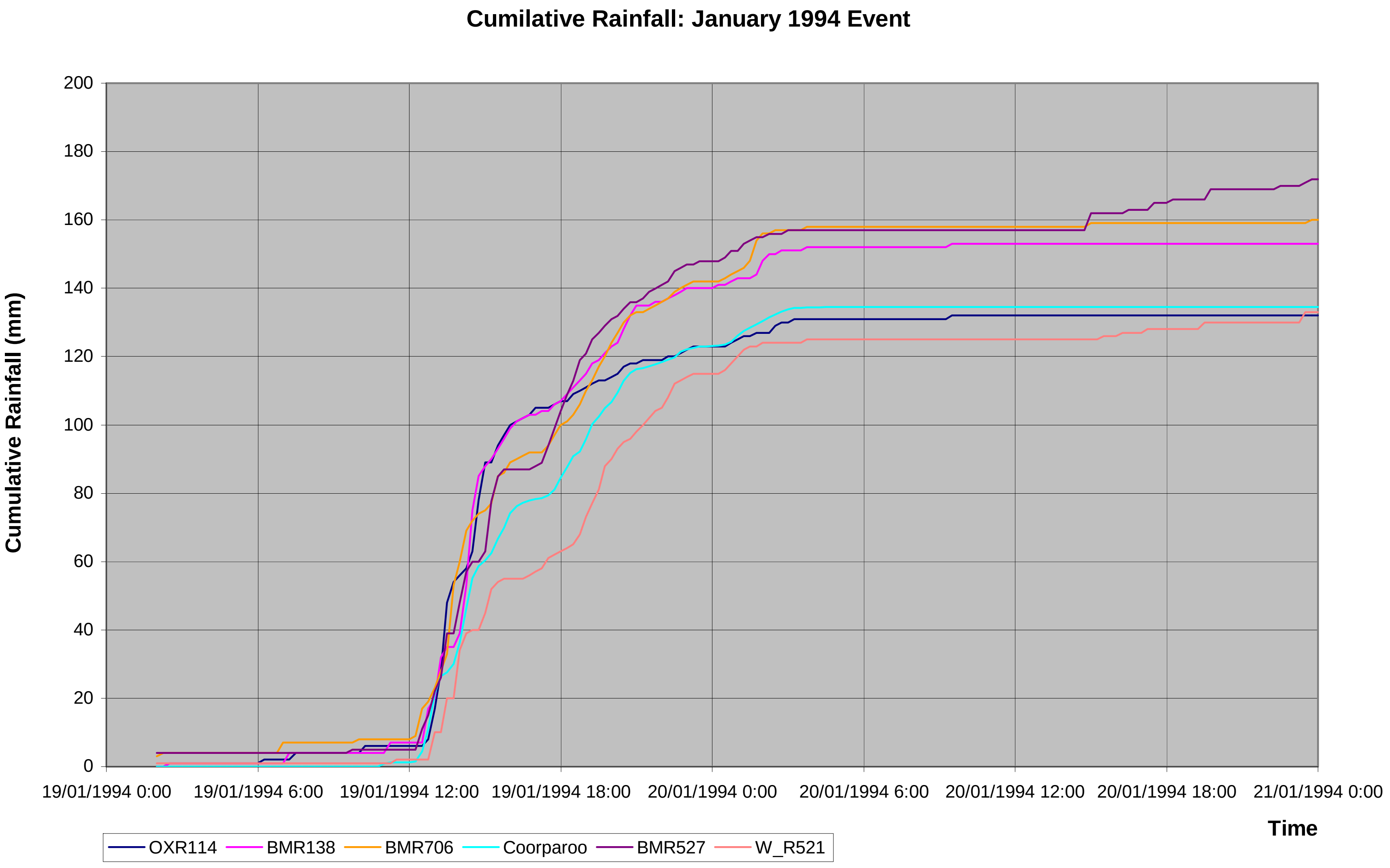


Figure C2: Cumulative rainfall for January 1994 event

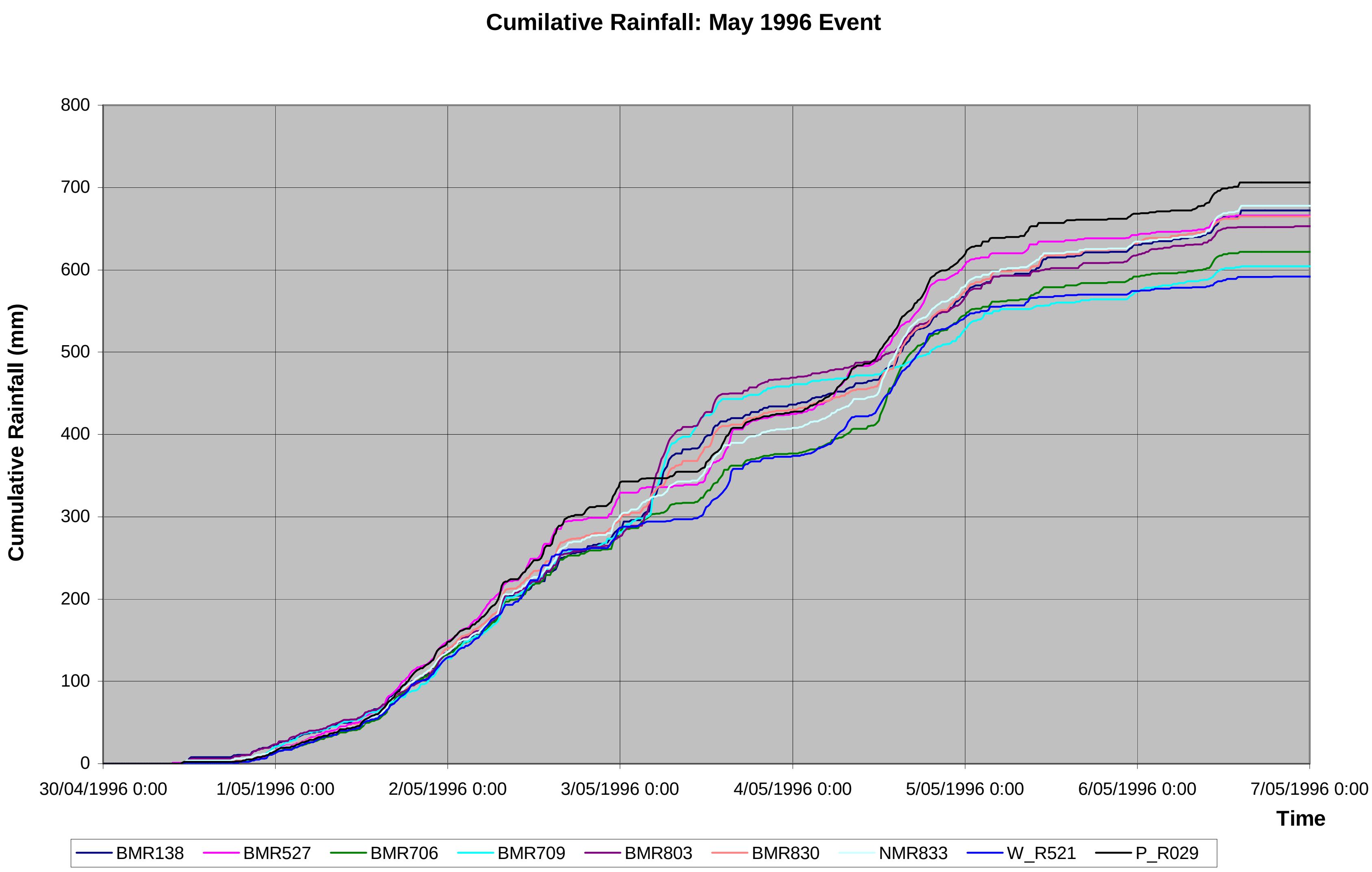


Figure C3: Cumulative rainfall for May 1996 event

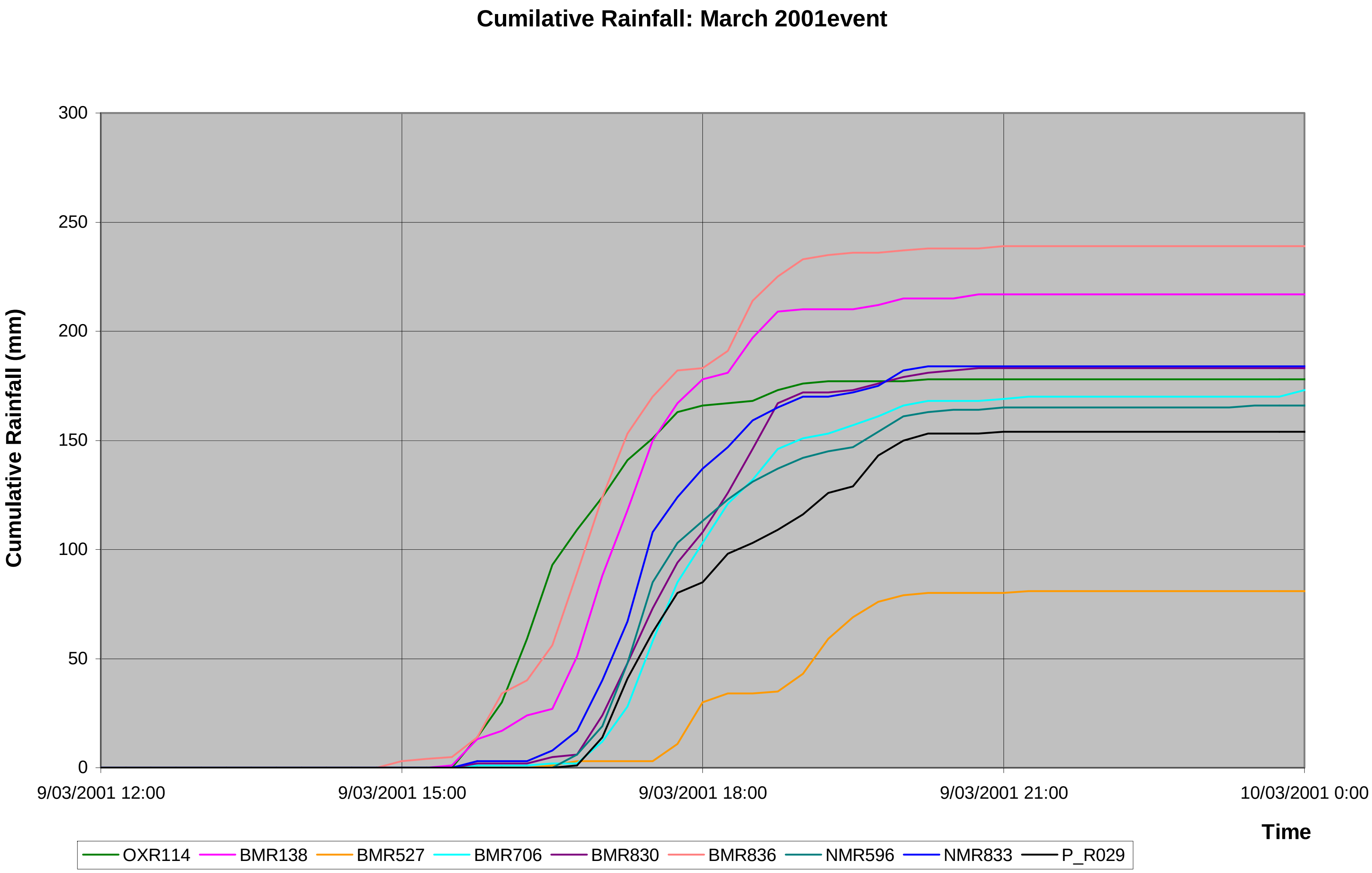


Figure C4: Cumulative rainfall for March 2001 event

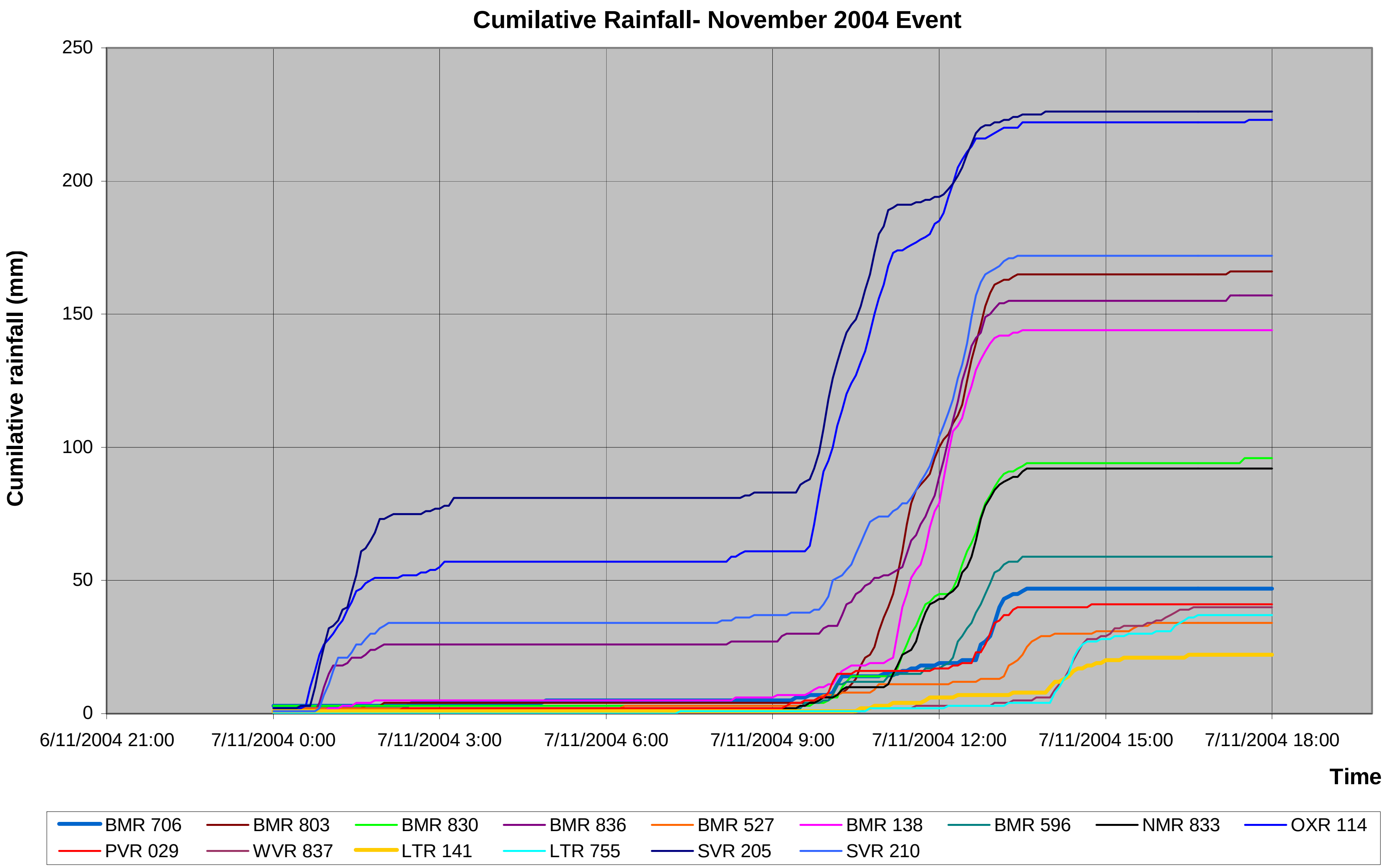


Figure C5: Cumulative rainfall for November 2004 event

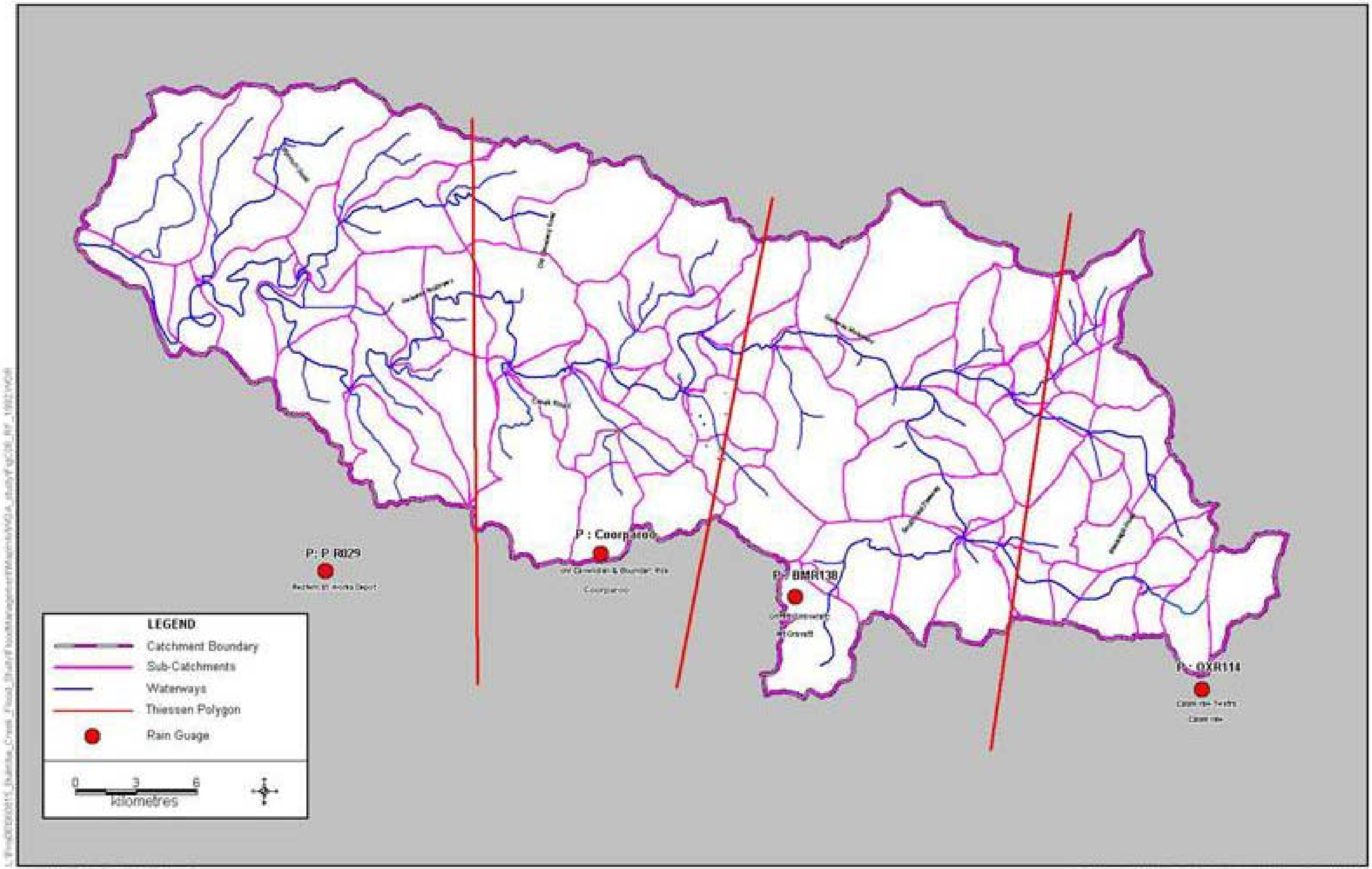


Figure C6: Rainfall Distribution March 1992 Event

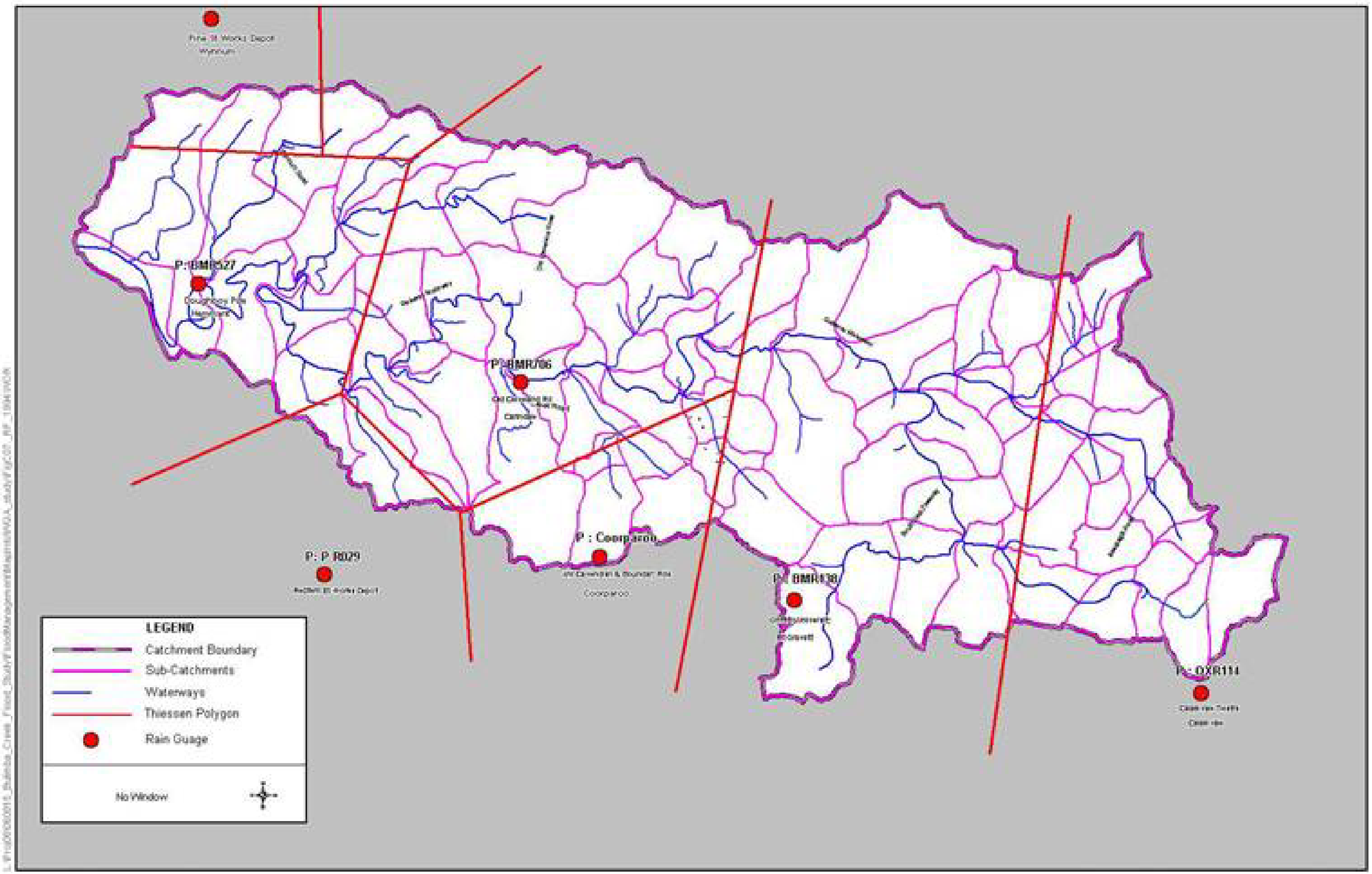


Figure C7: Rainfall Distribution January 1994 Event

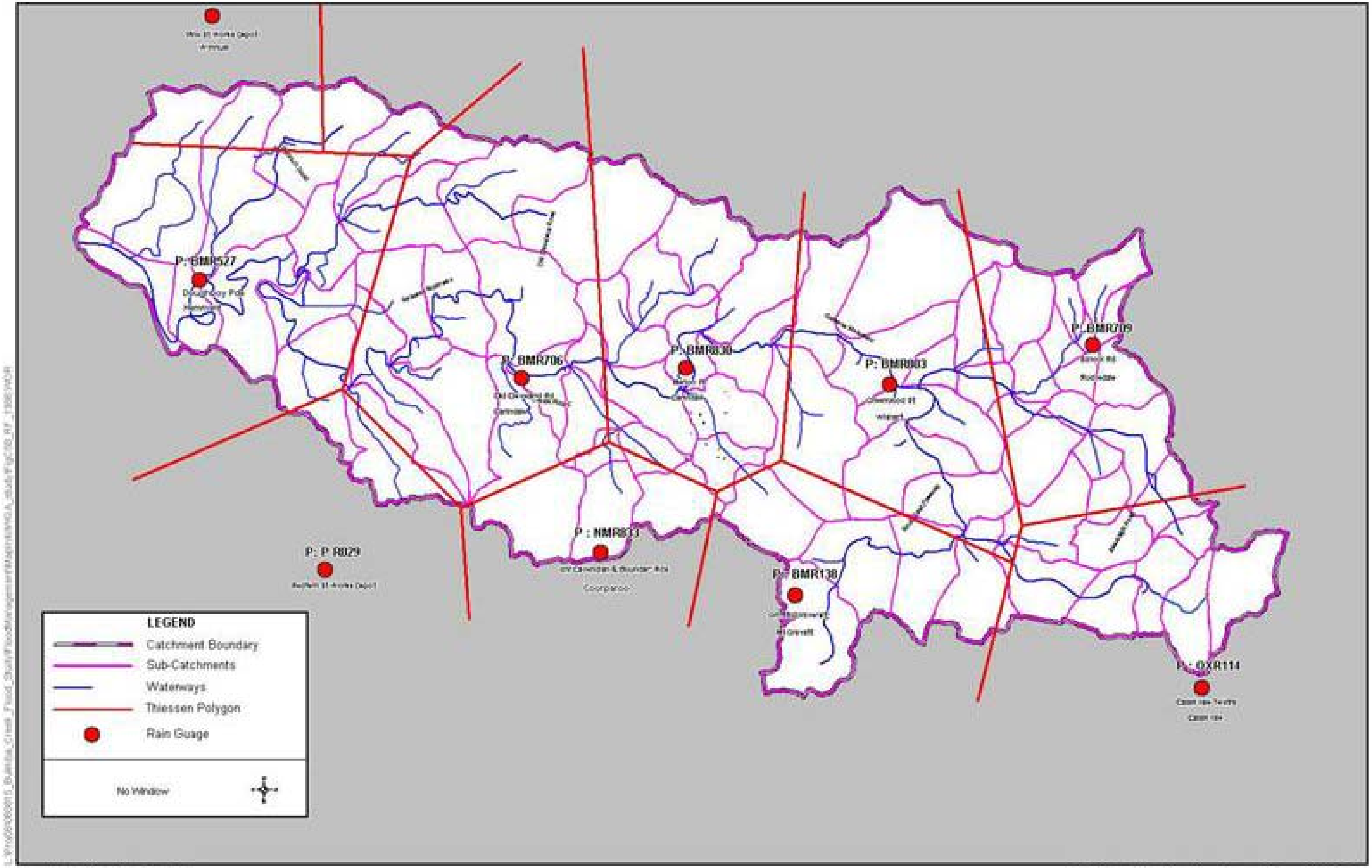


Figure C8: Rainfall Distribution May 1996 Event

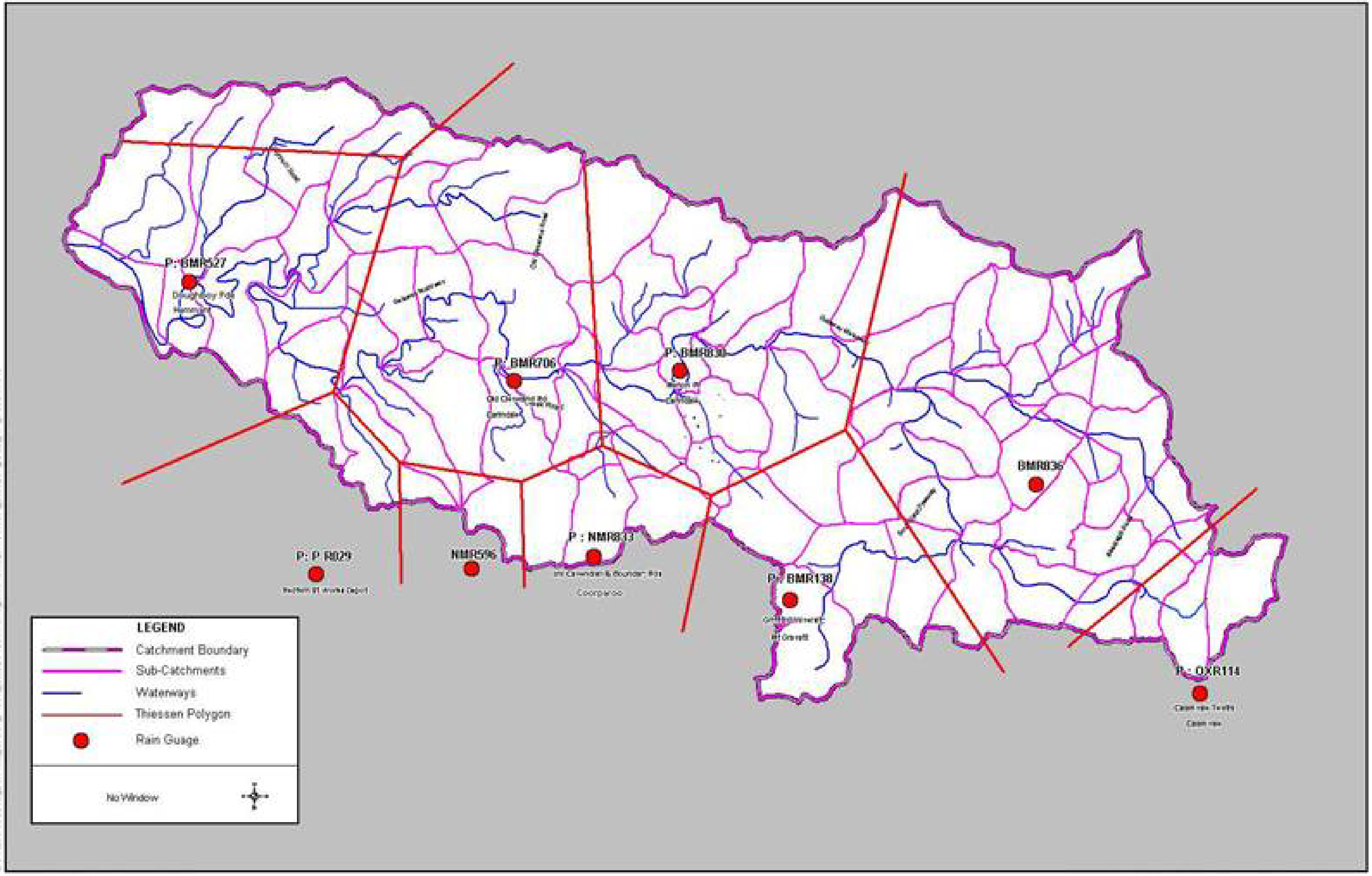


Figure C9: Rainfall Distribution March 2001 Event

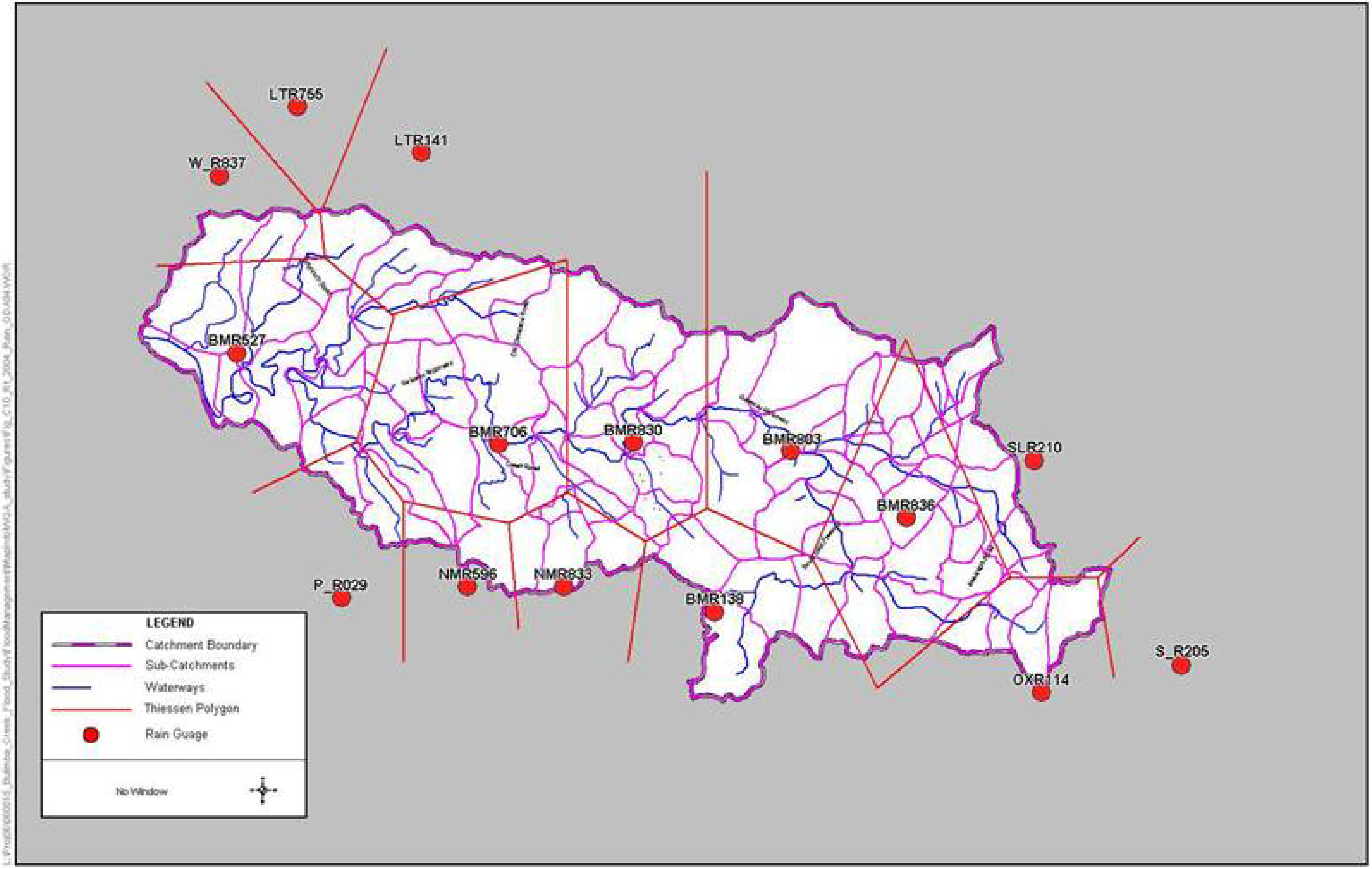


Figure C10: Rainfall Distribution November 2004 Event

Appendix D MIKE11 Flood Levels & Peak Water Level Plots for Calibration/Verification Events

D1 MIKE11 flood levels for calibration/verification events

Table D1: MHG and stream gauge records comparison with hydraulic model results for calibration and verification events

Calibration results		Location	MIKE11 Chainage (m)	March 1992 event (17/03/1992)			January 1994 event (19/01/1994)			May 1996 event (3/05/1996)			March 2001 event (01/03/2001)			November 2004 event (4/11/2004)			
MHG No.																			
New ID	Old ID			MIKE11 Calc.	Gauge Rec. (m AHD)	Diff. (m)	MIKE11 Calc.	Gauge Rec. (m AHD)	Diff. (m)	MIKE11 Calc.	Gauge Rec. (m AHD)	Diff. (m)	MIKE11 Calc.	Gauge Rec. (m AHD)	Diff. (m)	MIKE 11 Calc.	Gauge Rec. (m AHD)	Diff. (m)	Average
		Bulimba Creek Main Branch																	
340	1	Beenleigh Road U/S	1800	46.19	46.48	-0.29	46.25	46.97	-0.72	46.68	46.84	-0.16	47.03	47.20	-0.17	47.26	46.96	0.30	-0.21
330	2	Daw Road	2470	43.67	43.82	-0.15	43.66	---	---	43.9	44.05	-0.15	44.14	44.53	-0.39	44.21	44.36	-0.15	-0.21
320	3	Kimmax Street	3765	36.8	---	---	36.68	37.16	-0.48	37.22	37.36	-0.14	37.58	37.72	-0.14	37.67	37.75	-0.08	-0.21
310	4	Padstow Road U/S	4260	33.78	33.86 *	-0.08	33.67	---	---	34.09	34.50 *	0.41*	34.89	35.05	-0.16	34.81	35.15	-0.34	-0.19
300	5	Bleasby Road	4780	32.59	32.29 *	0.30*	32.4	32.41	-0.01	32.83	33.21	-0.38	33.85	33.82 #	0.03*	33.65	33.25	0.35	0.00
290	6	South East Freeway U/S	5615	28.9	28.50	0.40	28.63	28.57	0.06	29.5	29.57	-0.07	31.84	---	---	30.98	30.56	0.42	0.20
280	6A	Logan Road D/S	5985	28.31	---	---	28	---	---	28.77	---	---	30.11	29.22 #	0.89*	29.85	---	---	---
	7	Kavanagh Road	7420	24.26	---	---	23.9	---	---	24.72	24.69	0.03	25.95	25.69	0.26	25.61	---	---	0.14
260	8	Greenwood Street	8555	21.86	21.57	0.29	21.42	21.61	-0.19	22.16	22.41	-0.25	22.93	22.84 #	0.16*	22.65	22.69	-0.04	-0.05
BMA804		**Greenwood Street (BMA804)**	8570	**21.78**	---	---	**21.38**	---	---	**22.1**	22.50	-0.40	22.87	---	---	**22.63**	22.77	-0.14	-0.27
250	9	Mt Grav-Capalaba Road U/S	10575	16.42	16.18	0.24	15.86	---	---	16.9	17.34	-0.44	18.03	18.19 #	0.16*	17.63	17.91	-0.28	-0.16
240	10	Wecker Road D/S	12320	13.5	13.17 *	0.33*	12.9	12.77 *	0.13*	13.88	14.15	-0.27	14.97	15.44 #	0.47*	14.51	14.50	0.01	-0.13
BMA831		**Merion Place (BMA831)**	13965	**10.6**	10.65	-0.05	**9.94**	10.08	-0.14	**11.06**	11.32	-0.26	11.97	11.99	-0.02	**11.52**	11.58	-0.06	-0.11
230	11	Dewdrop Street	14845	9.42	9.32	0.10	8.96	8.79	0.17	9.76	10.06	-0.30	10.52	10.70 #	---	10.10	10.19	-0.09	-0.03
220	12	Pine Mountain Road D/S	15600	8.35	7.86 *	---	7.9	7.42 *	0.48*	8.6	8.65	-0.05	9.64	10.09 #	---	9.01	8.69	0.32	0.14
210	13	Winstanley Street D/S	17370	6.36	6.13	0.23	5.88	5.89	-0.01	6.55	6.93	-0.38	7.60	8.00 #	---	6.96	---	---	-0.05
200	14	Old Cleveland Road U/S	17810	5.66	---	---	5.28	---	---	5.82	6.11	-0.29	6.85	7.01	-0.16	6.20	6.09	0.11	-0.11
BMA707		**Old Cleveland Rd (BMA707)**	17850	**5.59**	---	---	**5.13**	4.87	0.26	**5.74**	6.06	-0.32	**6.78**	6.83	-0.05	**6.12**	6.03	0.02	0.00
190	15	Old Cleveland Road D/S	18025	5.26	**5.08**	0.18	4.81	4.88	-0.07	5.48	5.85	-0.37	6.33	>6.76	---	5.68	5.7#	---	-0.07
180	16	Scrub Road Footbridge U/S	19165	4.71	---	---	4.10	---	---	4.82	5.09	-0.27	5.65	5.77	-0.12	4.99	4.96	0.03	-0.09
170	17	Fursden Road	22305	3.6	---	---	3.00	---	---	3.6	3.81	-0.21	3.96	4.11	-0.15	3.51	---	---	-0.18
160	18	Wood Avenue	23165	3.32	*2.99*	0.33	2.68	---	---	3.3	3.49	-0.19	3.65	3.70	-0.05	3.14	---	---	0.03
Closed	19	Wynnum Road U/S 1	25515	2.93	2.81	0.12	2.34	---	---	2.92	3.41	-0.49	3.23	3.54	-0.31	2.73	---	---	-0.23
Closed	20	Wynnum Road U/S 2	25565	2.92	2.75	0.17	2.3	---	---	2.9	3.30	-0.40	3.19	3.42	-0.23	2.66	---	---	-0.15
150	21	**Wynnum Road U/S 3**	25865	2.86	2.66	0.20	2.28	---	---	2.88	3.18	-0.30	3.13	3.26	-0.13	2.62	2.52	0.10	-0.03
Closed	23	Verdun Street	25915	2.75	2.58	0.17	2.23	---	---	2.75	2.98	-0.23	2.97	---	---	2.55	---	---	-0.03
140	22	Wynnum Road D/S	26015	2.71	2.63	0.08	2.2	---	---	2.71	2.98	-0.27	2.92	3.10	-0.18	2.51	---	---	-0.12
130	24	Murarrie Road U/S	26640	2.48	2.40	0.08	2.02	---	---	2.5	2.90	-0.40	2.62	2.78	-0.16	2.31	---	---	-0.16
120	25	Murarrie Road D/S	26780	2.47	2.36	0.11	1.98	---	---	2.42	2.60	-0.18	2.52	2.67	-0.15	2.30	---	---	-0.11
110	26	Fleming Road	31165	1.92	---	---	1.48	---	---	1.97	1.99	-0.02	1.98	1.82	0.16	1.69	---	---	0.07
100	27	Gross Avenue	32110	1.8	---	---	1.35	---	---	1.84	1.92	-0.08	1.82	1.70	0.12	1.57	---	---	0.02
BMA528		**Stream Gauge (BMA528)**	34400	**1.62**	---	---	1.05	---	---	1.65	1.75	-0.10	1.60	1.48	0.12	1.31	---	---	0.01
		Average (m)				0.12			-0.11			-0.24			-0.09			0.03	-0.08
		Bulimba Creek East Branch																	
430	8C	Underwood Road U/S	2700	37.96	---	---	36.94	---	---	37.7	37.89	-0.19	38.74	39.04	-0.30	38.74	39.11	-0.37	-0.29
420	8B/E	Logan Road U/S	3725	31.97	---	---	31.57	---	---	31.83	---		32.71	33.99 #	1.44*	33.3	33.43	-0.13	-0.13
410	8A	Miles Platting Road U/S	4600	28.42	28.31 *	0.11	28.05	---	---	28.6	---	---	29.51	29.78	-0.27	29.15	29.43	-0.28	-0.15
Closed	8D	Gateway Arterial On-Ramp	5000	27.17	---	---	26.81	---	---	27.35	27.42	-0.07	28.20	---	---	27.87	---	---	-0.07
400	8F	Daydream Place	5045	27	---	---	26.71	---	---	27.2	---	---	27.96	27.95	0.01	27.65	27.6	0.05	0.03
		Average (m)				-0.11						-0.13			-0.19			-0.18	-0.12
Closed	BM0B	Noraville Street-Bulimba creek	65	60.28	---	---	60.41	---	---	60.54	---	---	60.56	60.77	-0.25	60.67	---	---	-0.25
500	BM4A(B)	Mimosa-Parkway St DS	2718	38.43	38.28	0.15	38.4	38.2	-0.20	38.42	38.37	0.05	39.40	40.37#	0.97#	38.93	38.38	0.76	0.29

Rec.	Recorded Maximum Height Gauge level (mAHD)	33.86 *	Recorded flood level obtained prior to existing structure being in place.
Calc.	Calculated water level at this location (mAHD)	15.44 #	Maximum Height Gauge overtopped or destroyed. Peak flood level obtained from debris mark.
Diff.	Difference between recorded and calculated peak flood level (m)	>6.76	Maximum Height Gauge overtopped. Peak flood level estimated from nearby gauges.
		-0.38	Difference between recorded and calculated flood level is greater than 300mm.

D2 Peak water level plots for calibration/verification events

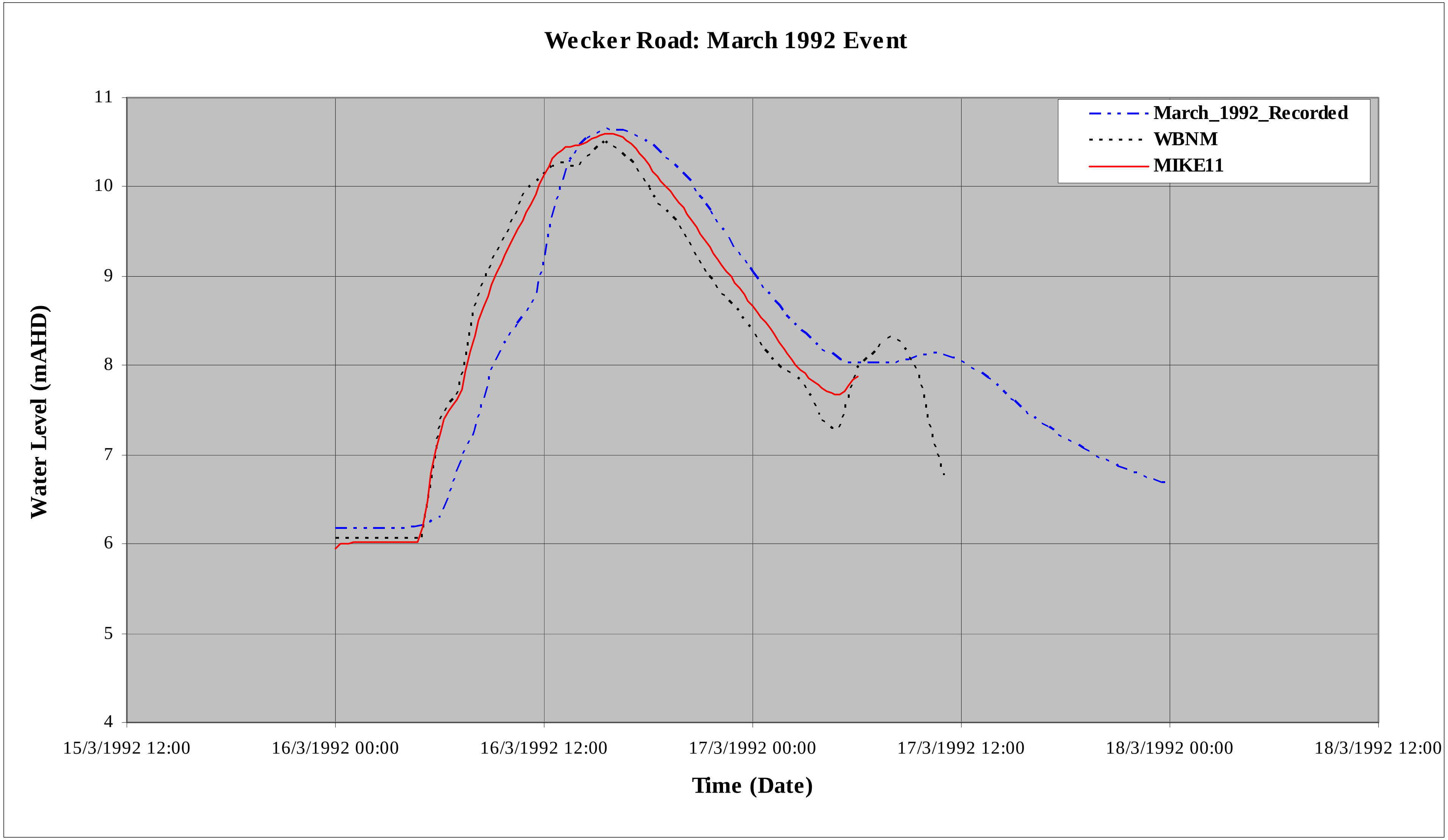


Figure D1: March 1992 event

Bulimba Creek :Flood Profile Verification with Stream Gauge & MHG Records for March 1992 Event

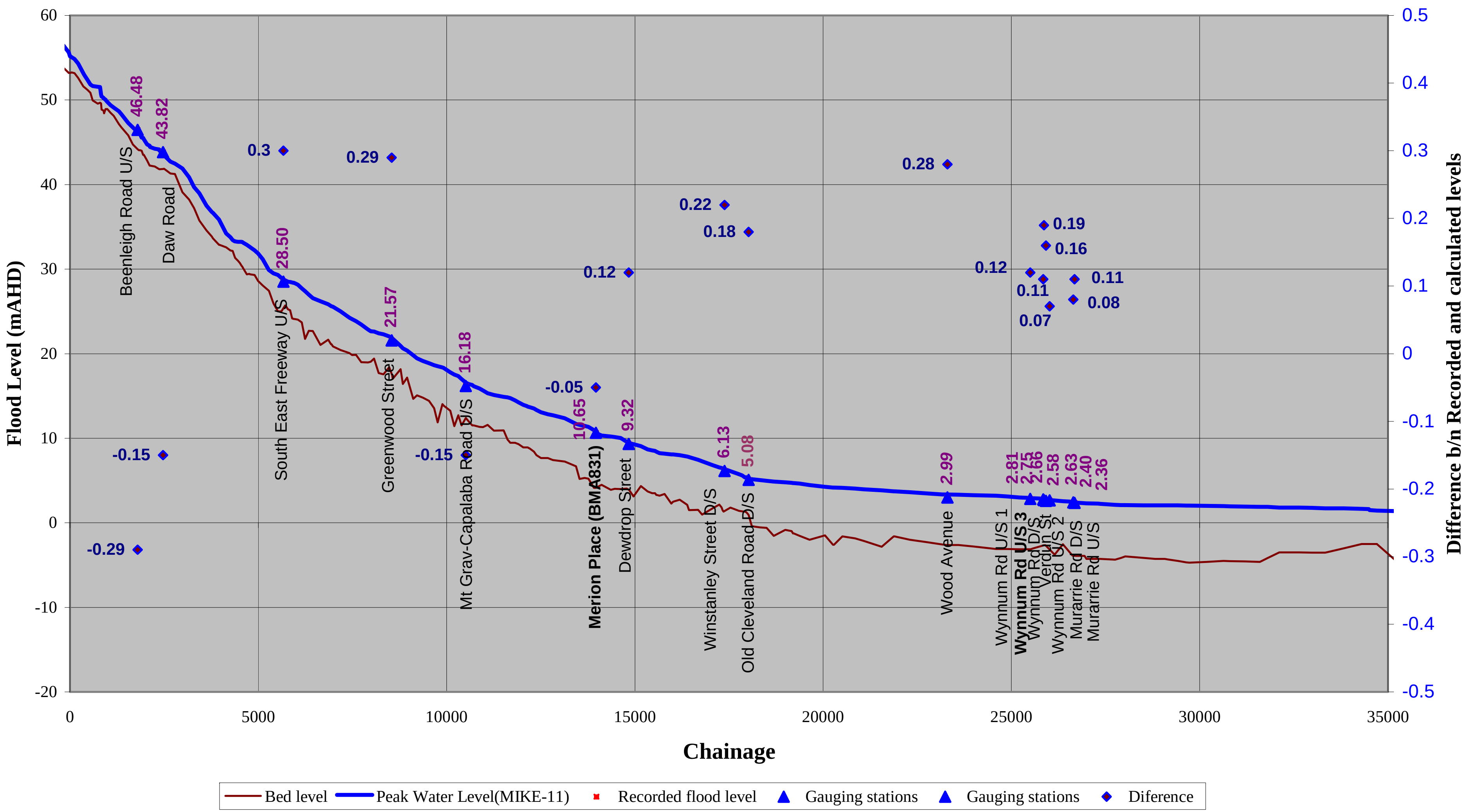


Figure D2: Bulimba Creek Peak Water level profile for March 1992 event

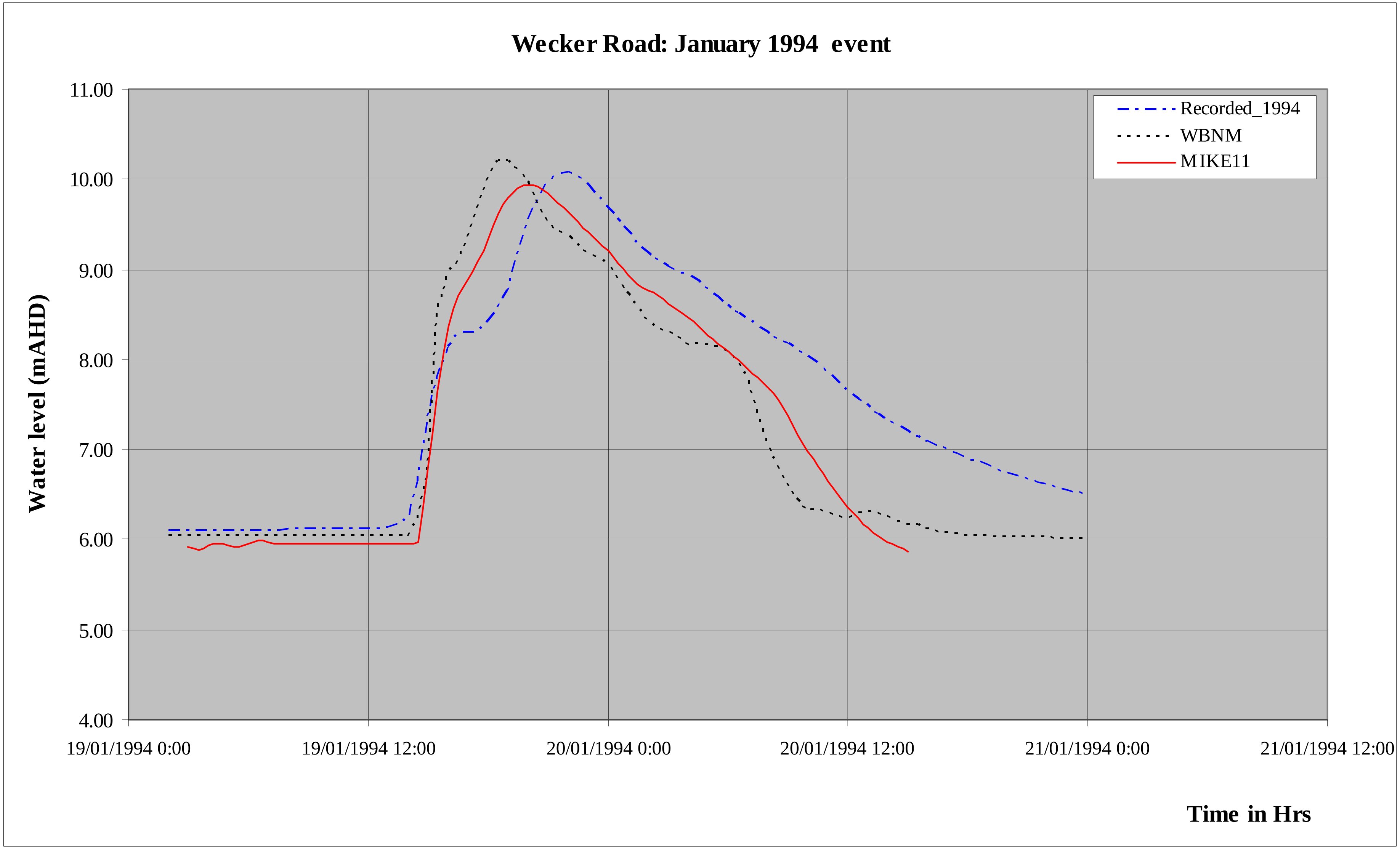


Figure D3: Wecker Road Gauging Station-January 1994 Event

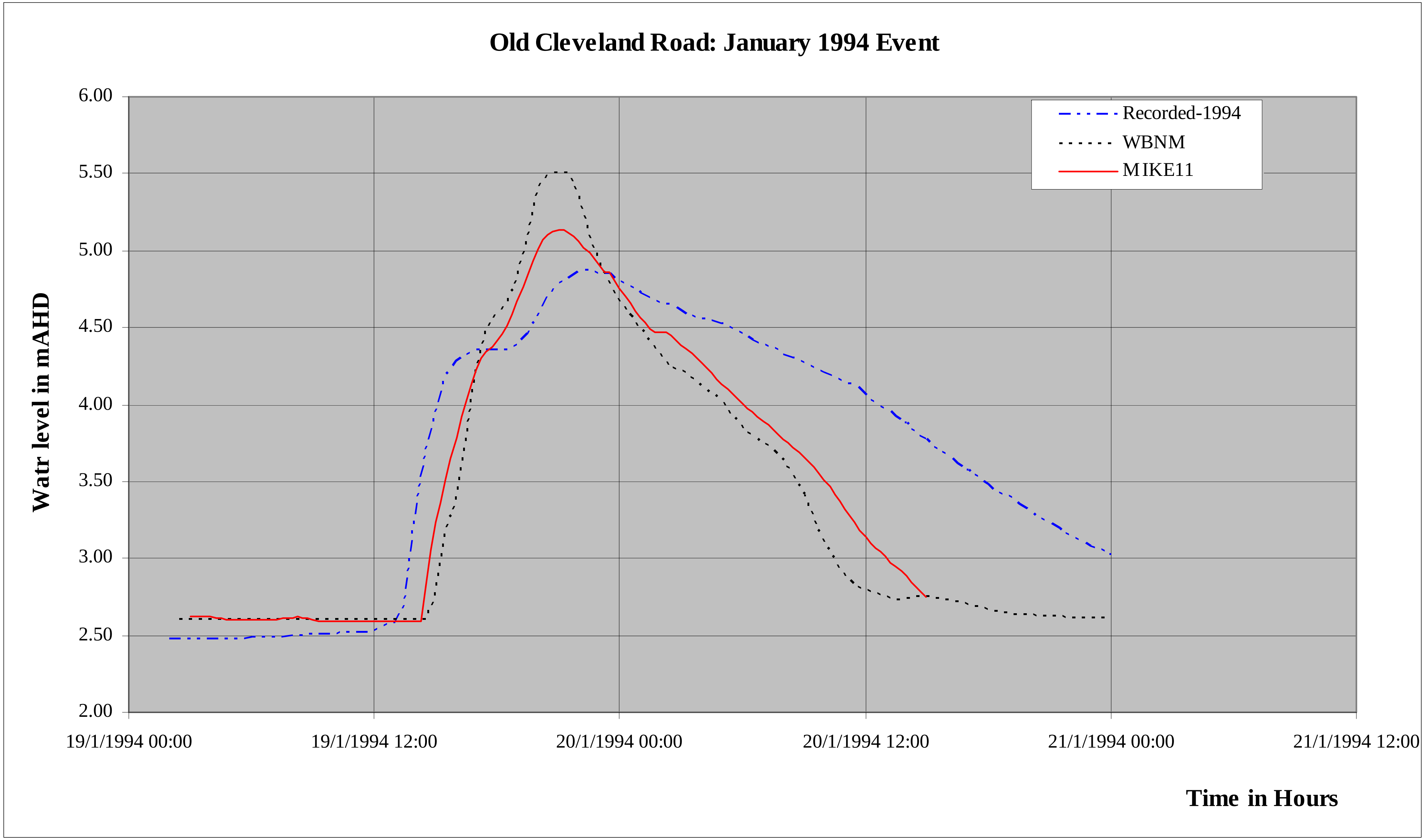


Figure D4: Old Cleveland Road: January 1994 event

Bulimba Creek: Flood Profile Verification with Stream Gauge & MHG Records for January 1994 Event

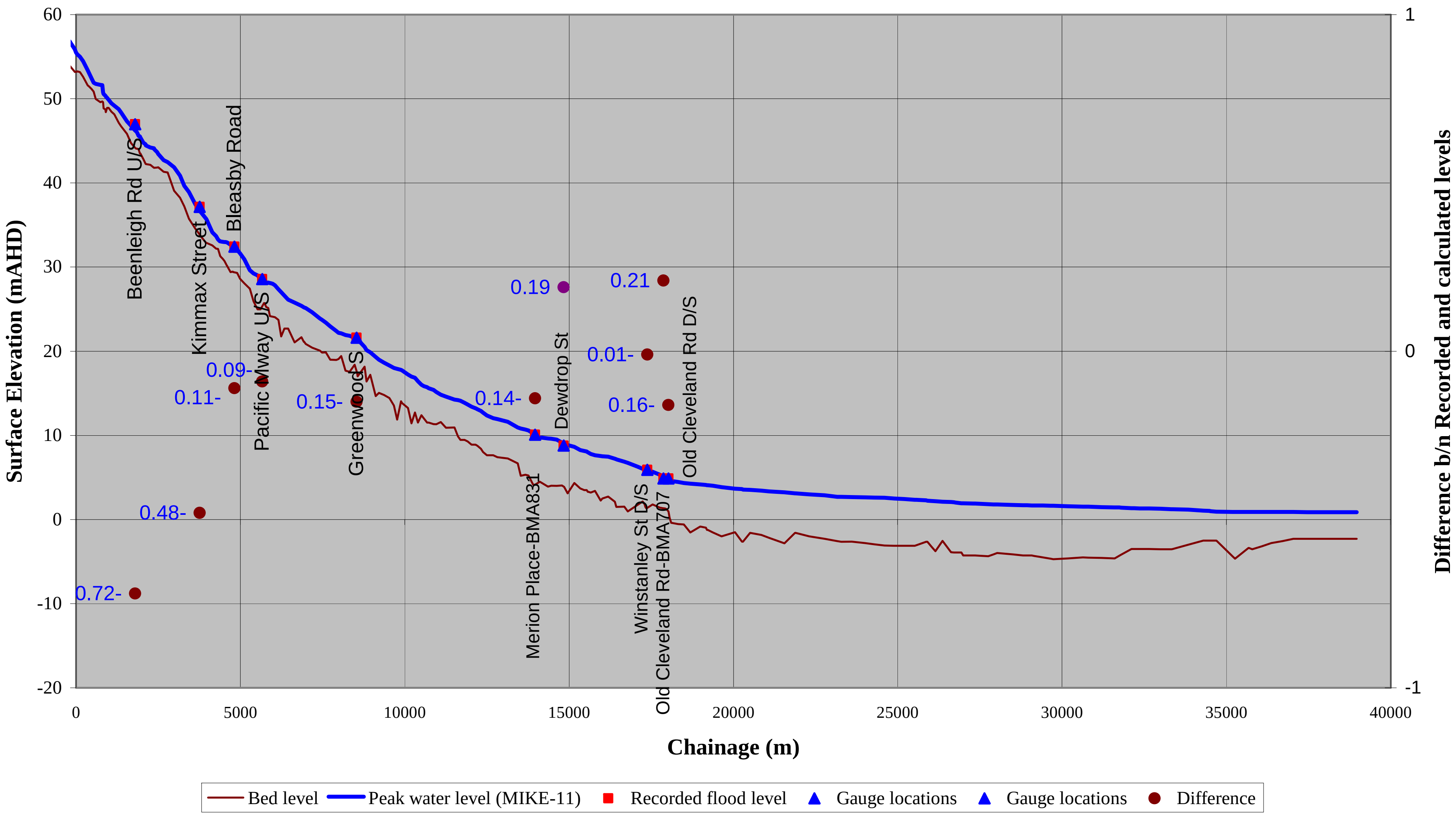


Figure D5: January 1994 Event-Peak Water Level along Bulimba Creek

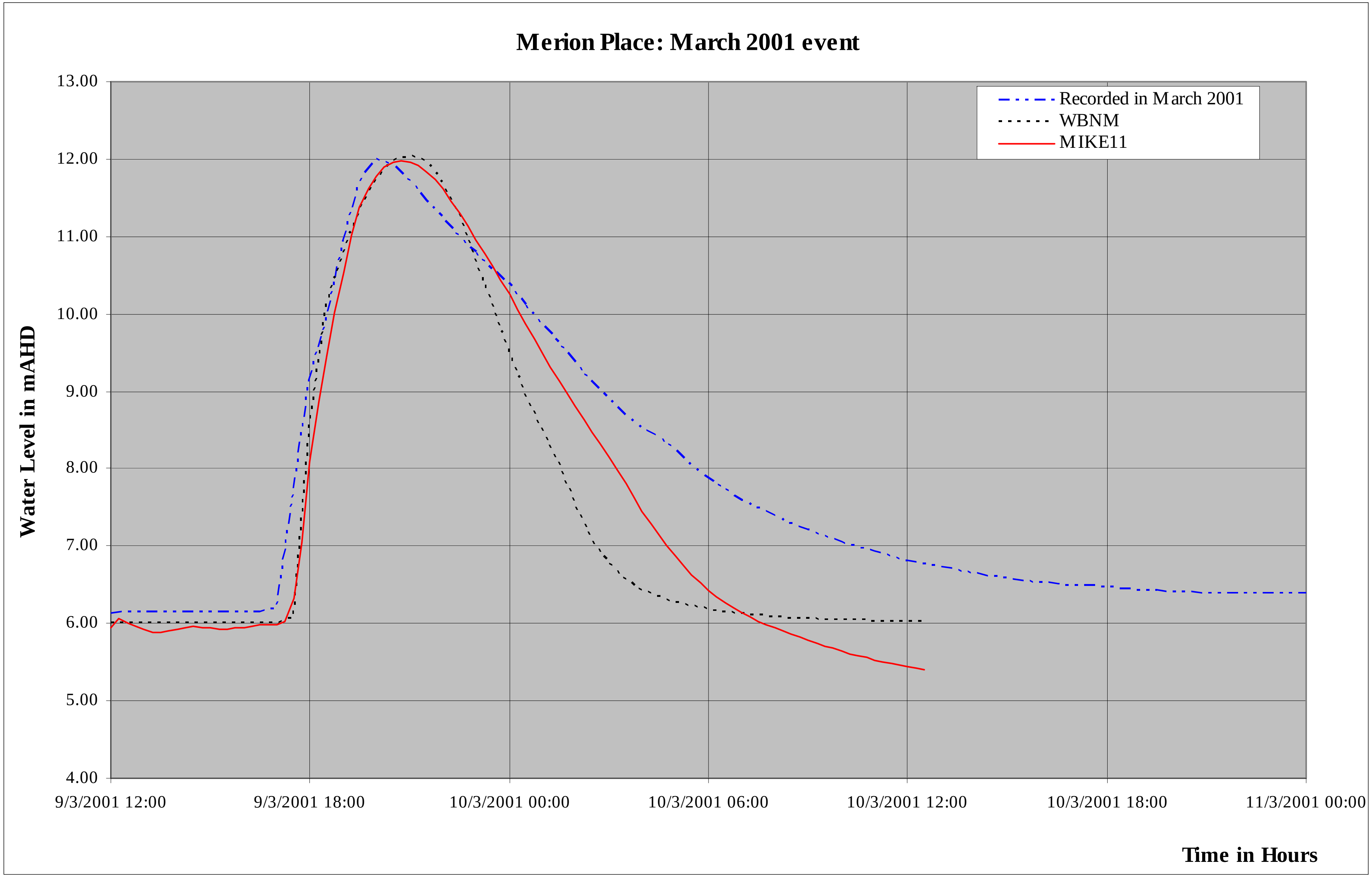


Figure D6: Merion Place Gauging Station-2001 Event

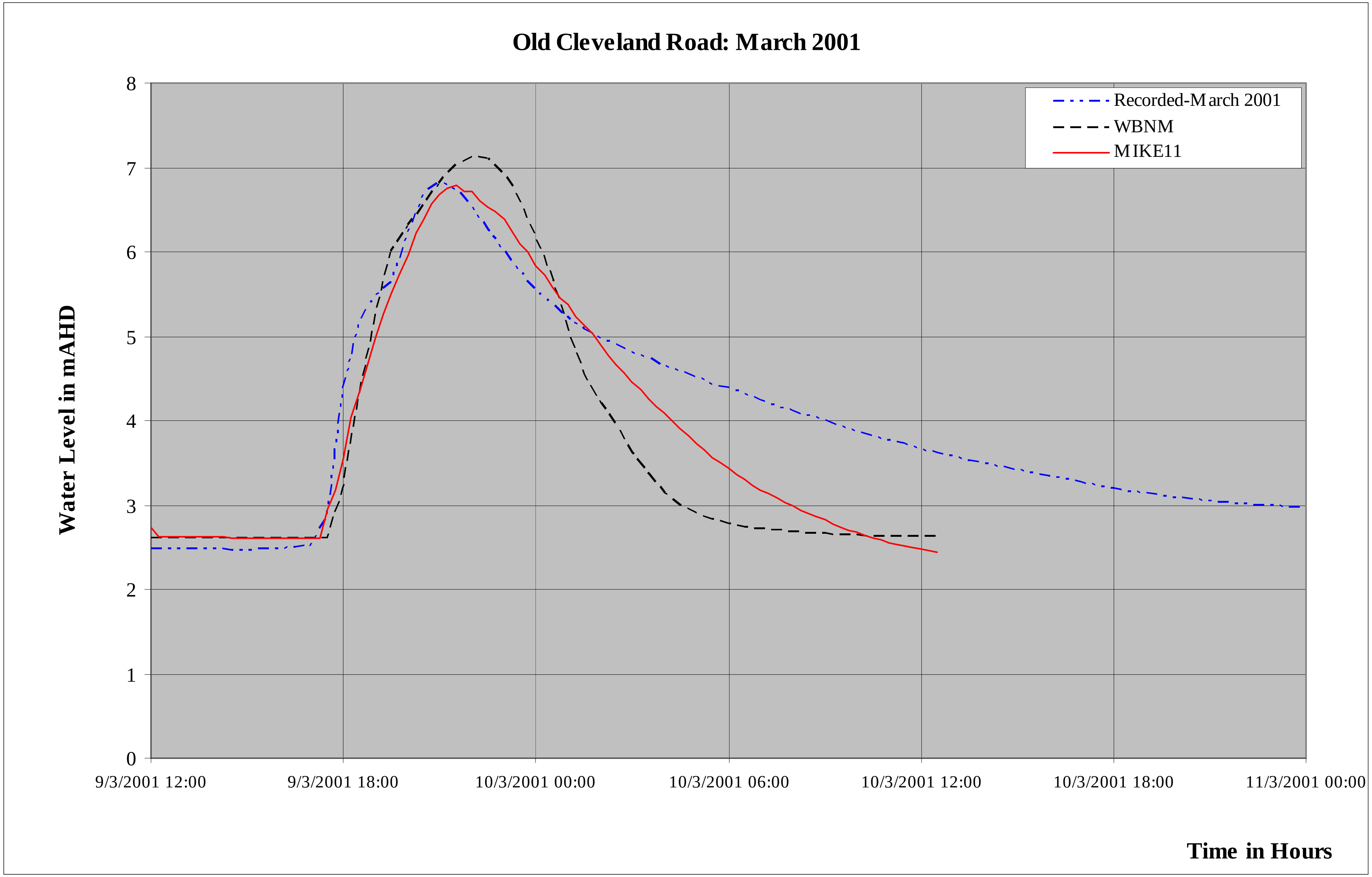


Figure D7: Old Cleveland Gauging Station-March 2001 event

Bulimba Creek : Flood Profile Verification with Stream Gauge & MHG Records for March 2001 Event

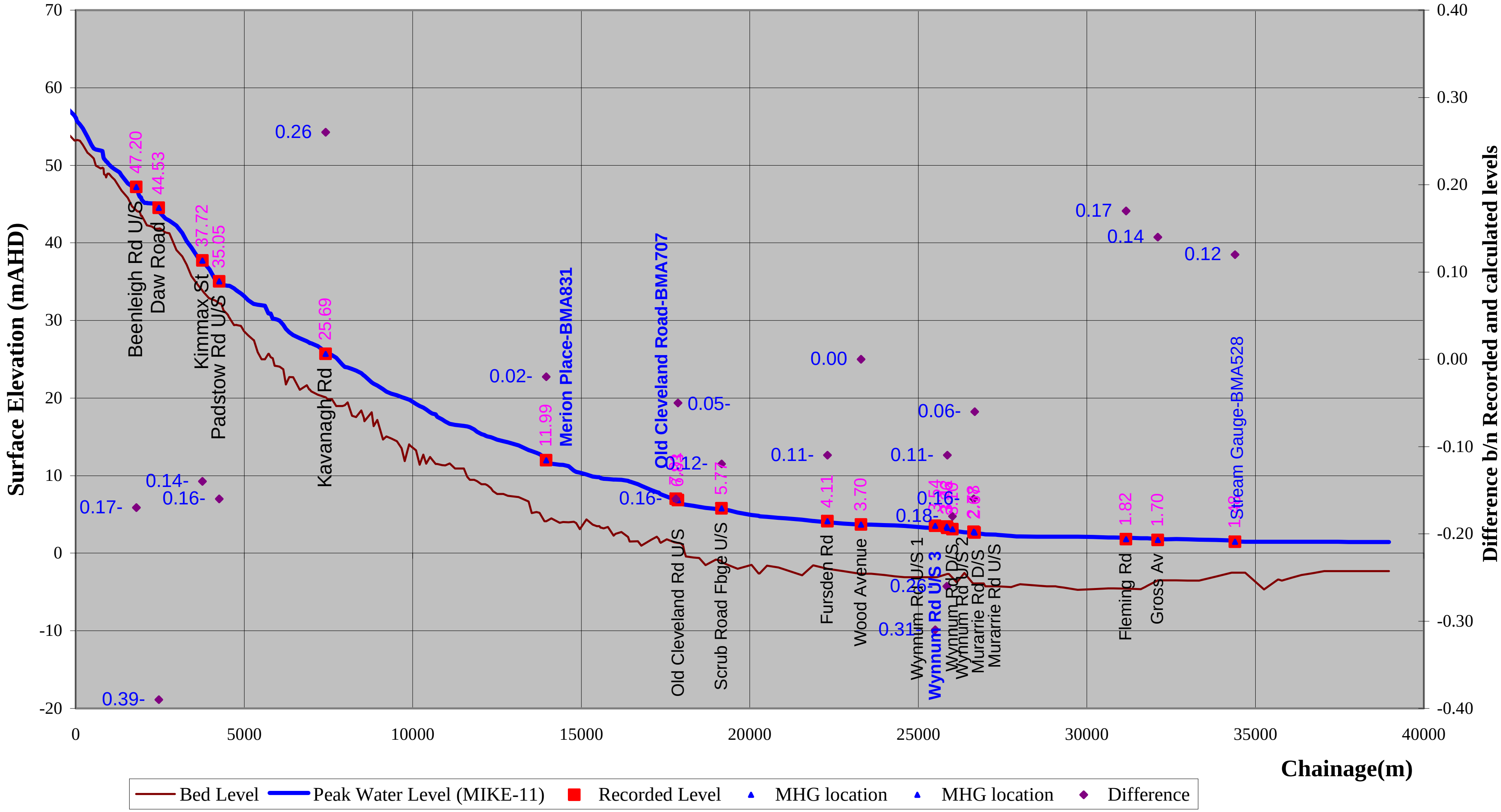


Figure D8: March 2001 Event-Peak Water Level- Bulimba Creek

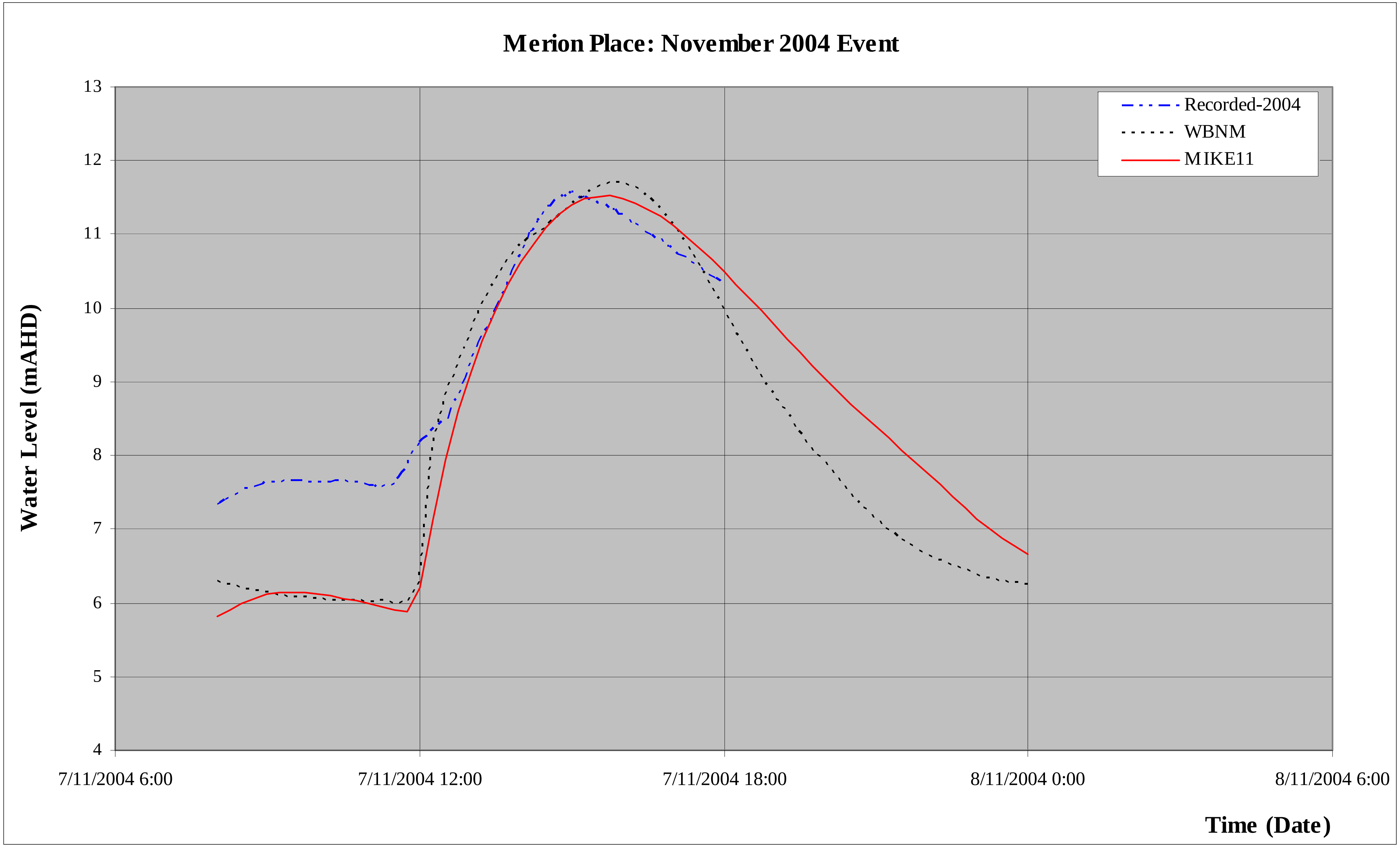


Figure D9: Merion Place-November 2004 Event

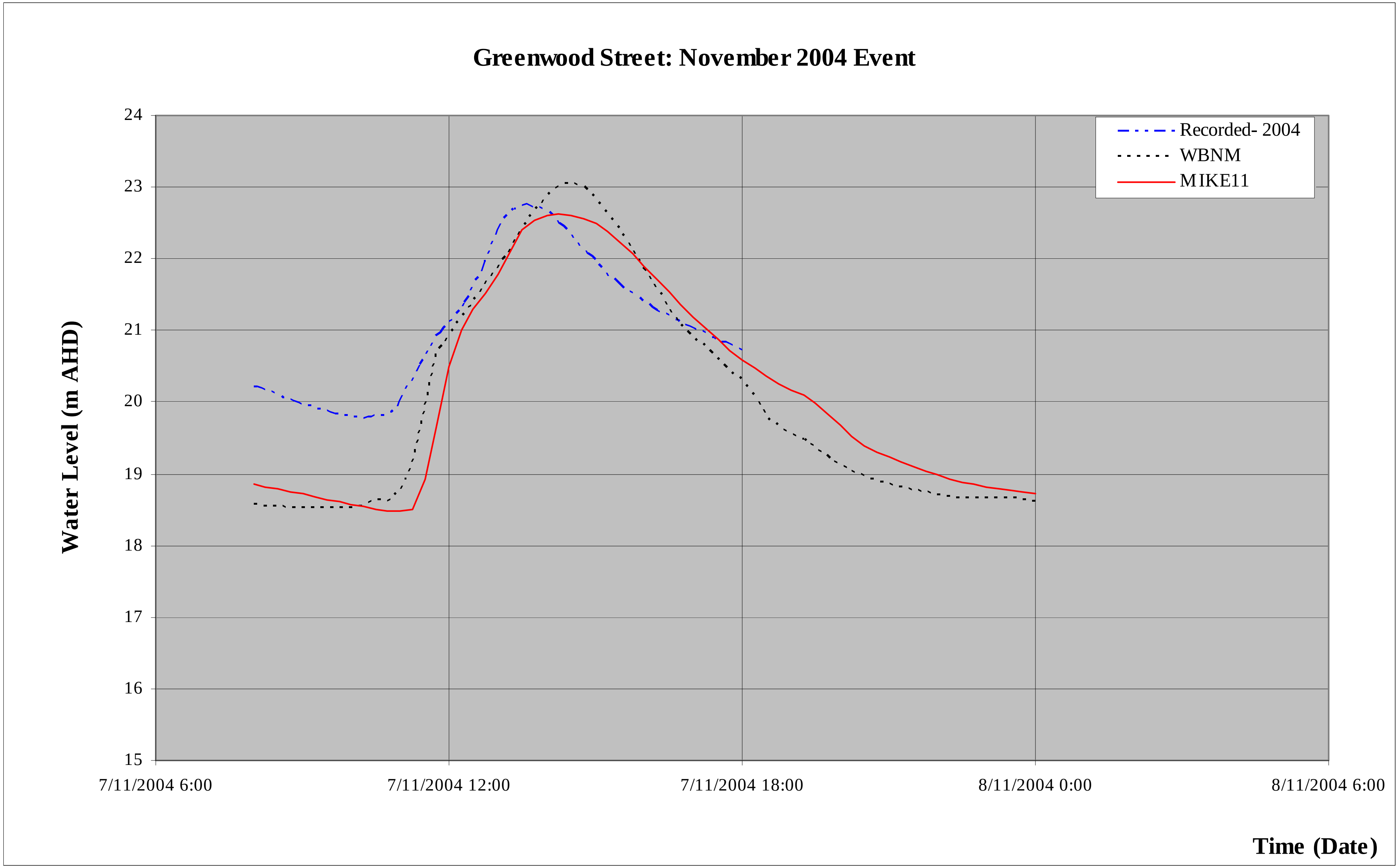


Figure D10: Greenwood Street-November 2004 event

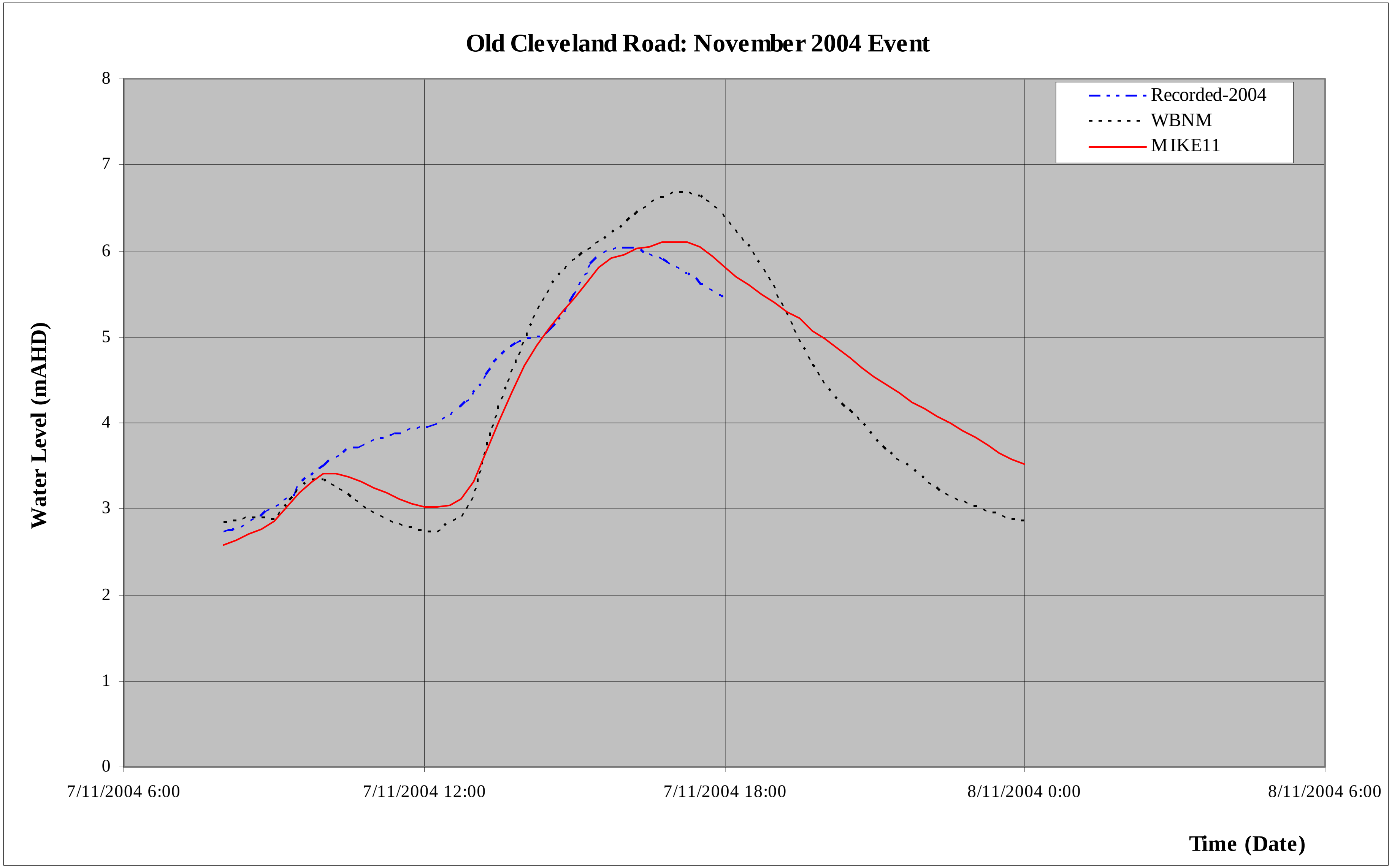


Figure D11: Old Cleveland Road-November 2004 Event

Bulimba Creek: Flood Profile Verification with Stream Gauge & MHG Records for November 2004 event

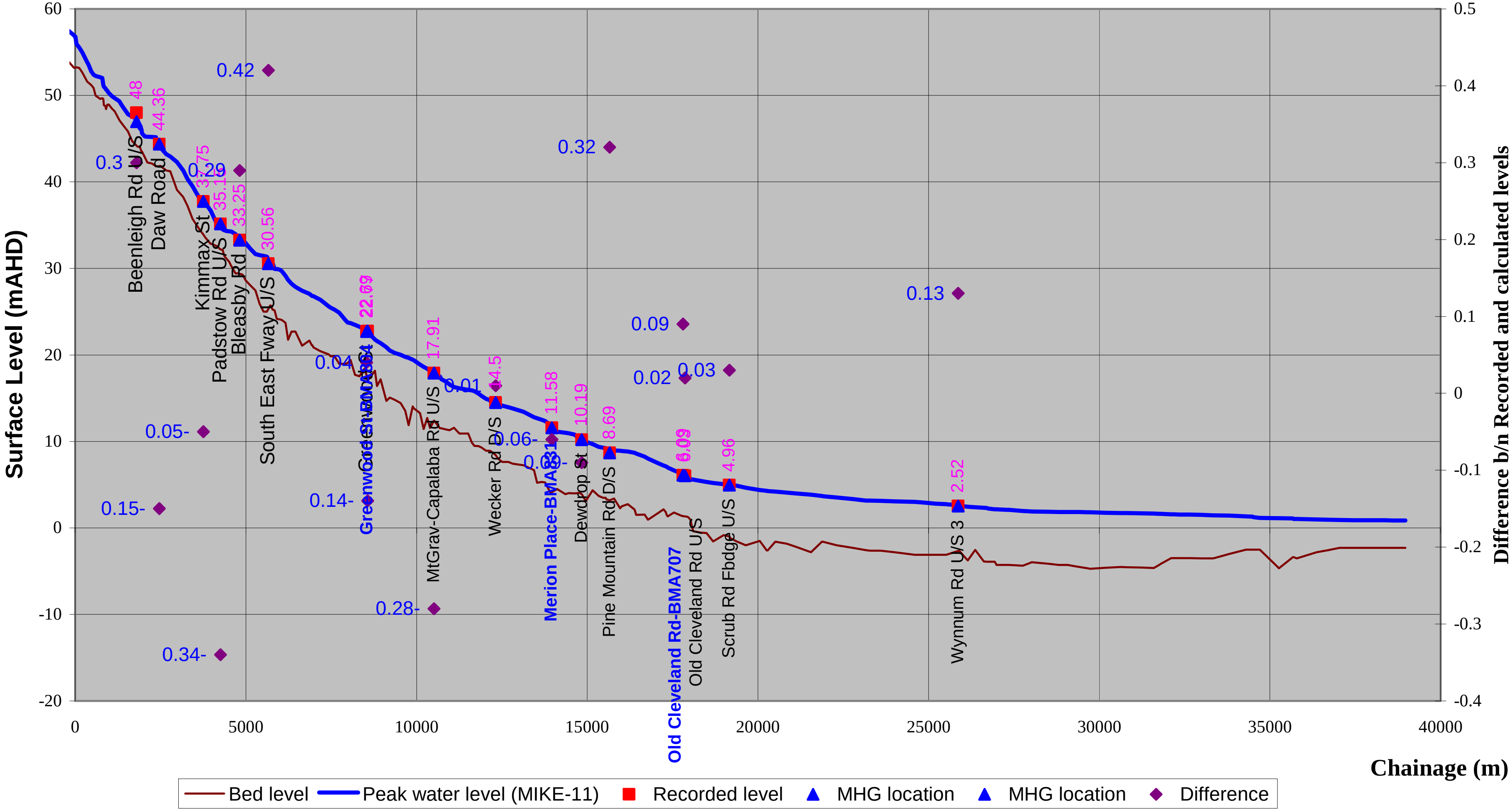


Figure D12: Peak Water Level in Bulimba Creek-November 2004 Event

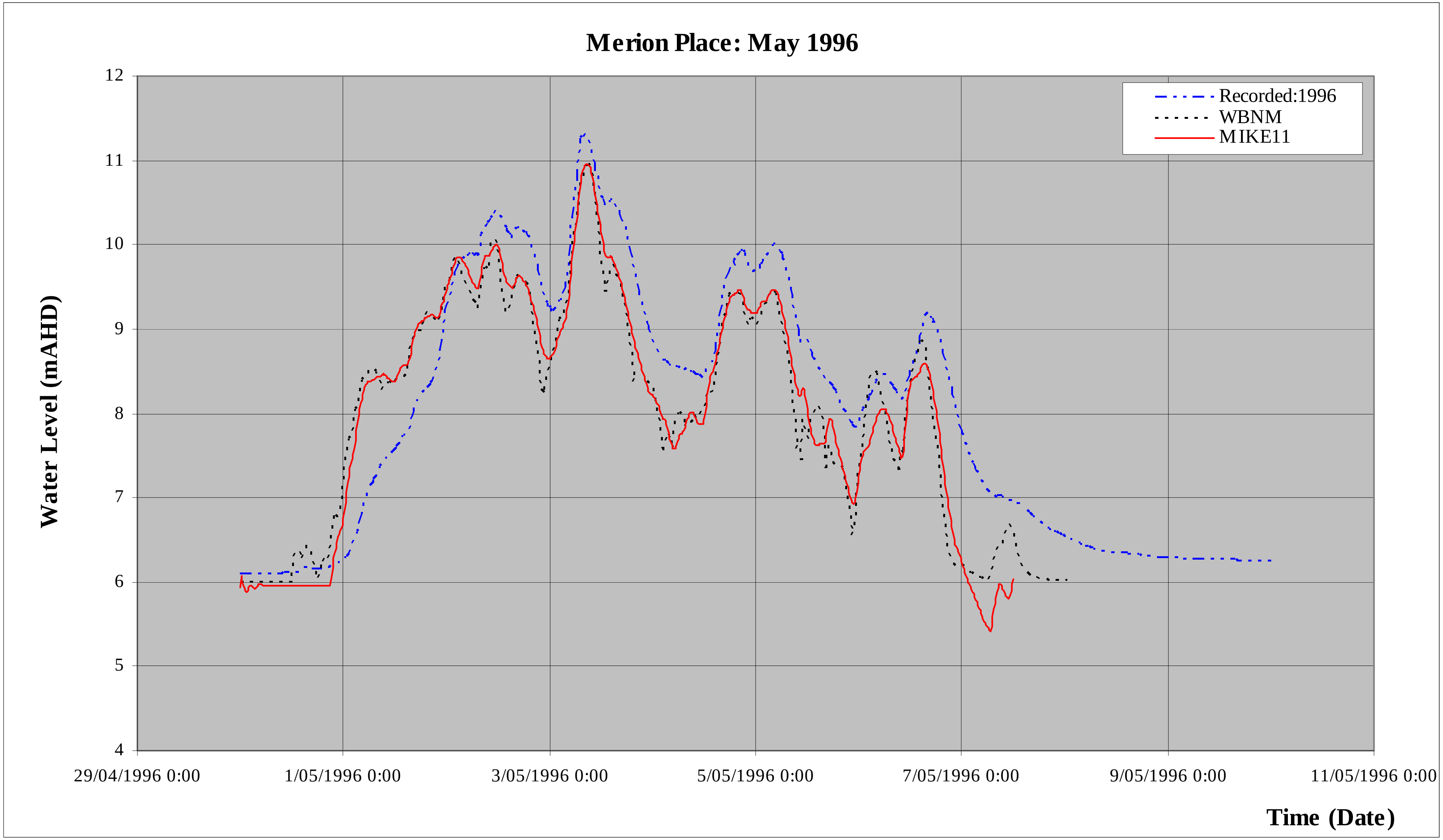


Figure D13: Merion Place- May 1996 Event

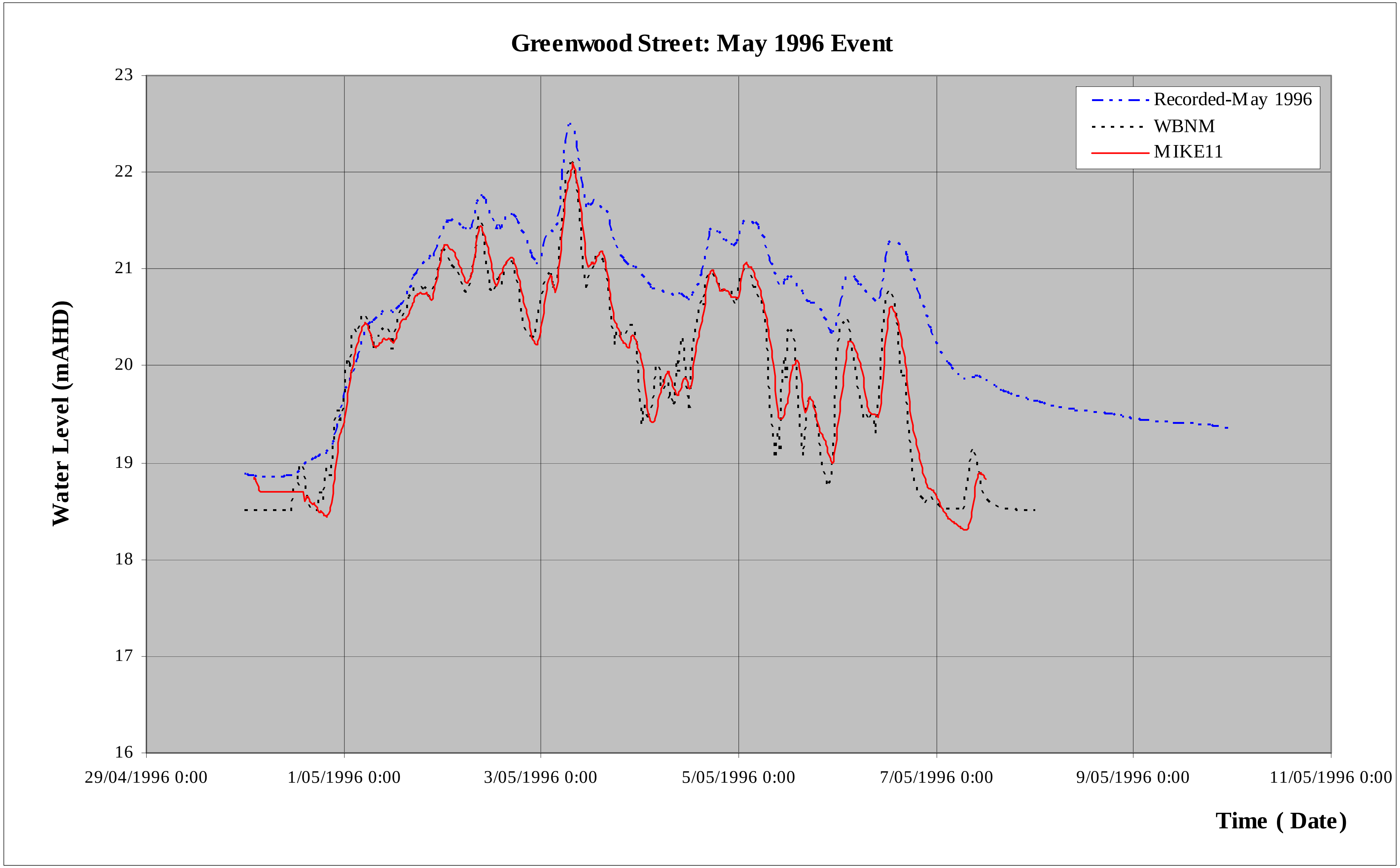


Figure D14: Greenwood Street-May 1996 Event

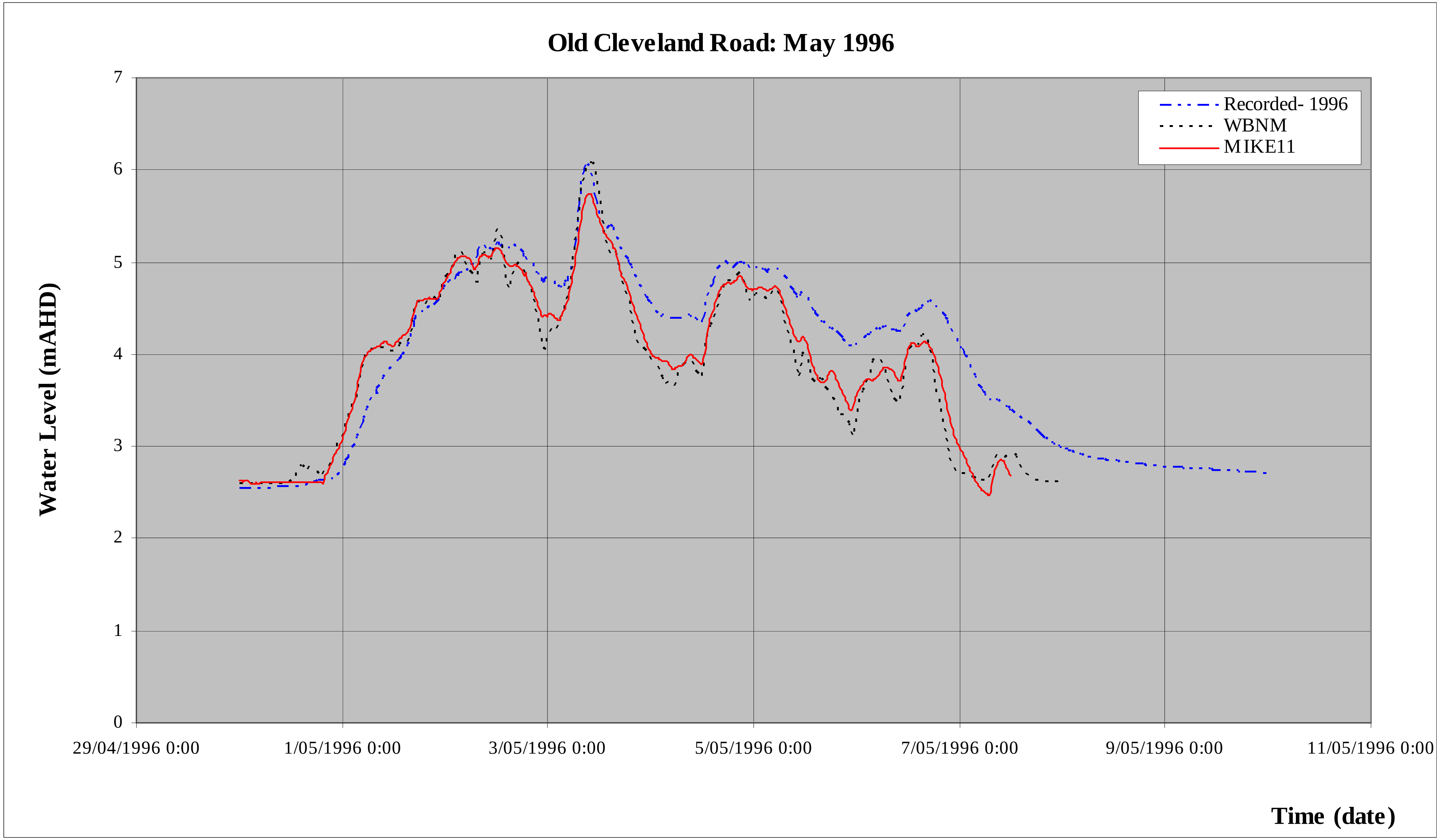


Figure D15: Old Cleveland Road-May 1996 Event

Bulimba Creek:Flood Profile Comparison with Stream Gauge & MHG Records for May 1996 event

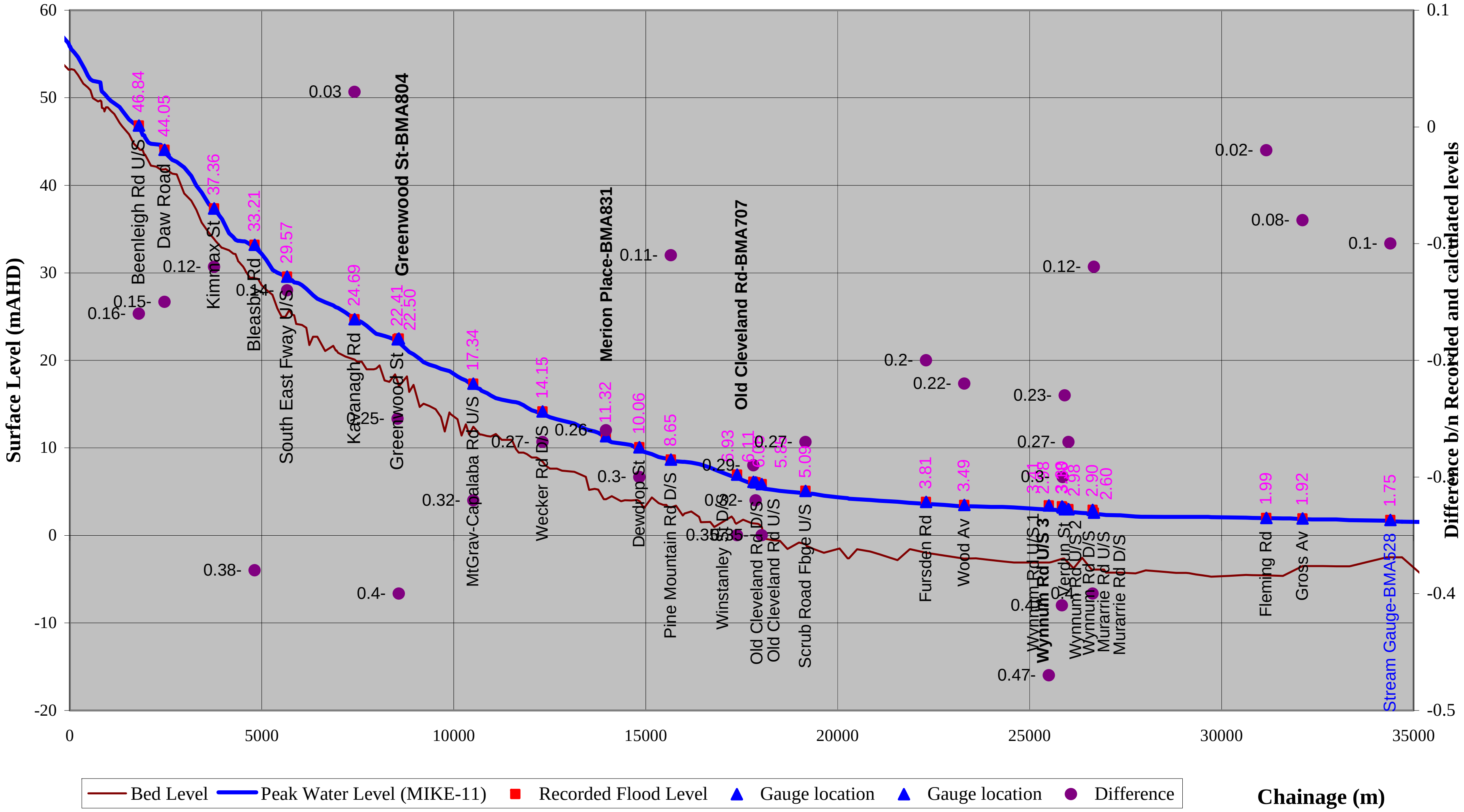


Figure D16: May 1996 Event-Peak Water level in Bulimba Creek

Appendix E Downstream Boundary Levels Adopted for Calibration/Verification Events

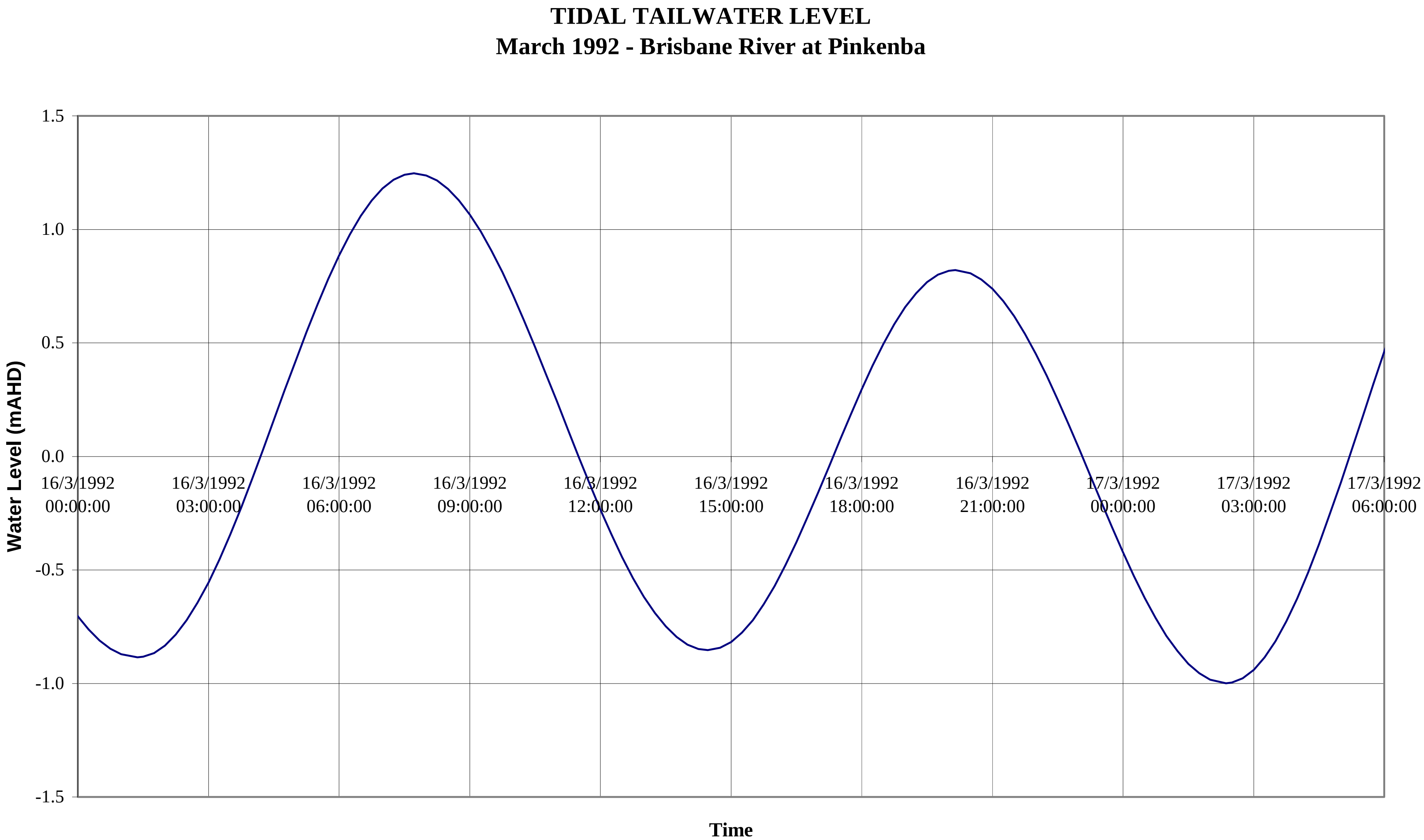


Figure E1: Tidal tail water level at Pinkenba for March 1992 event

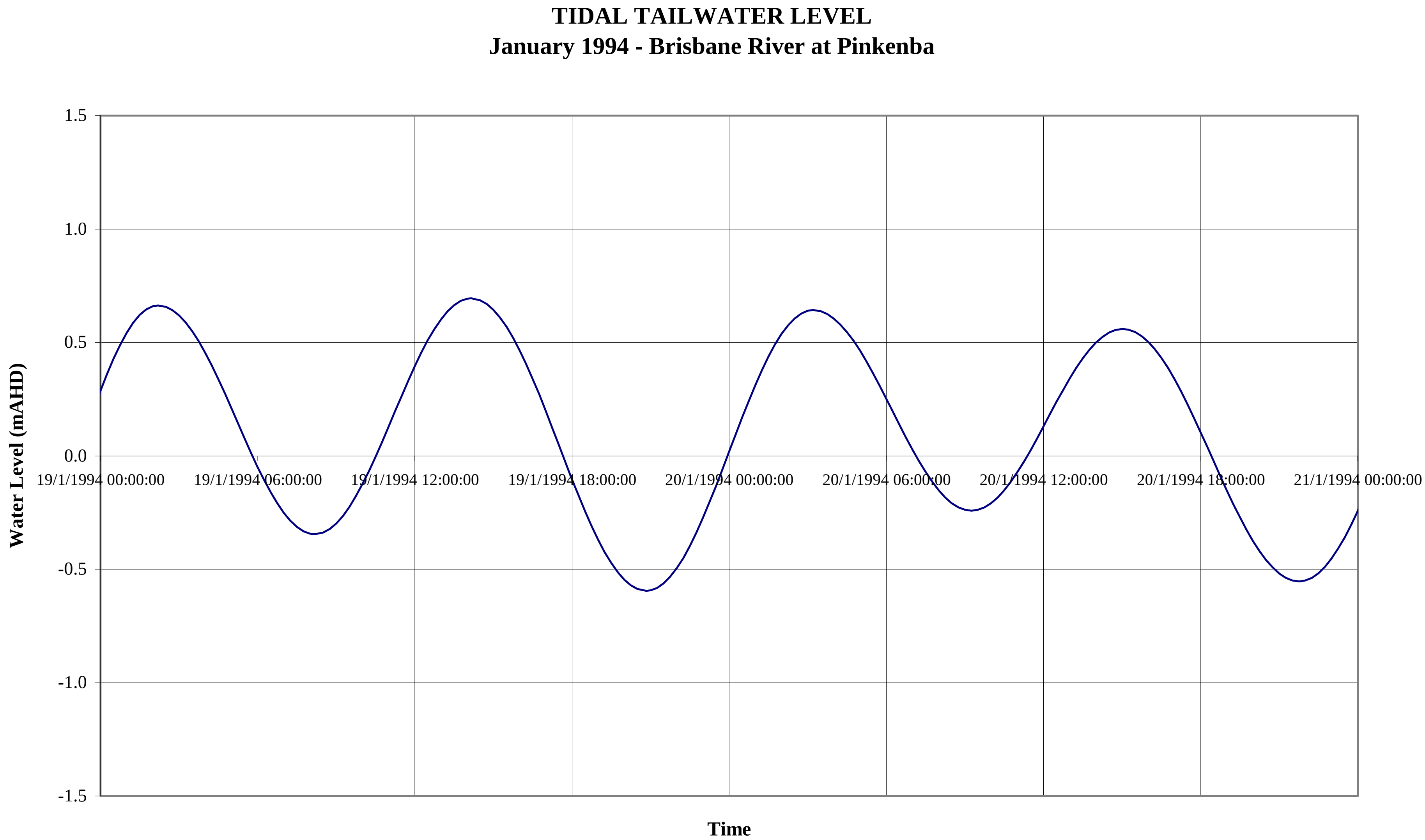


Figure E2: Tidal tail water level at Pinkenba for January 1994 Event

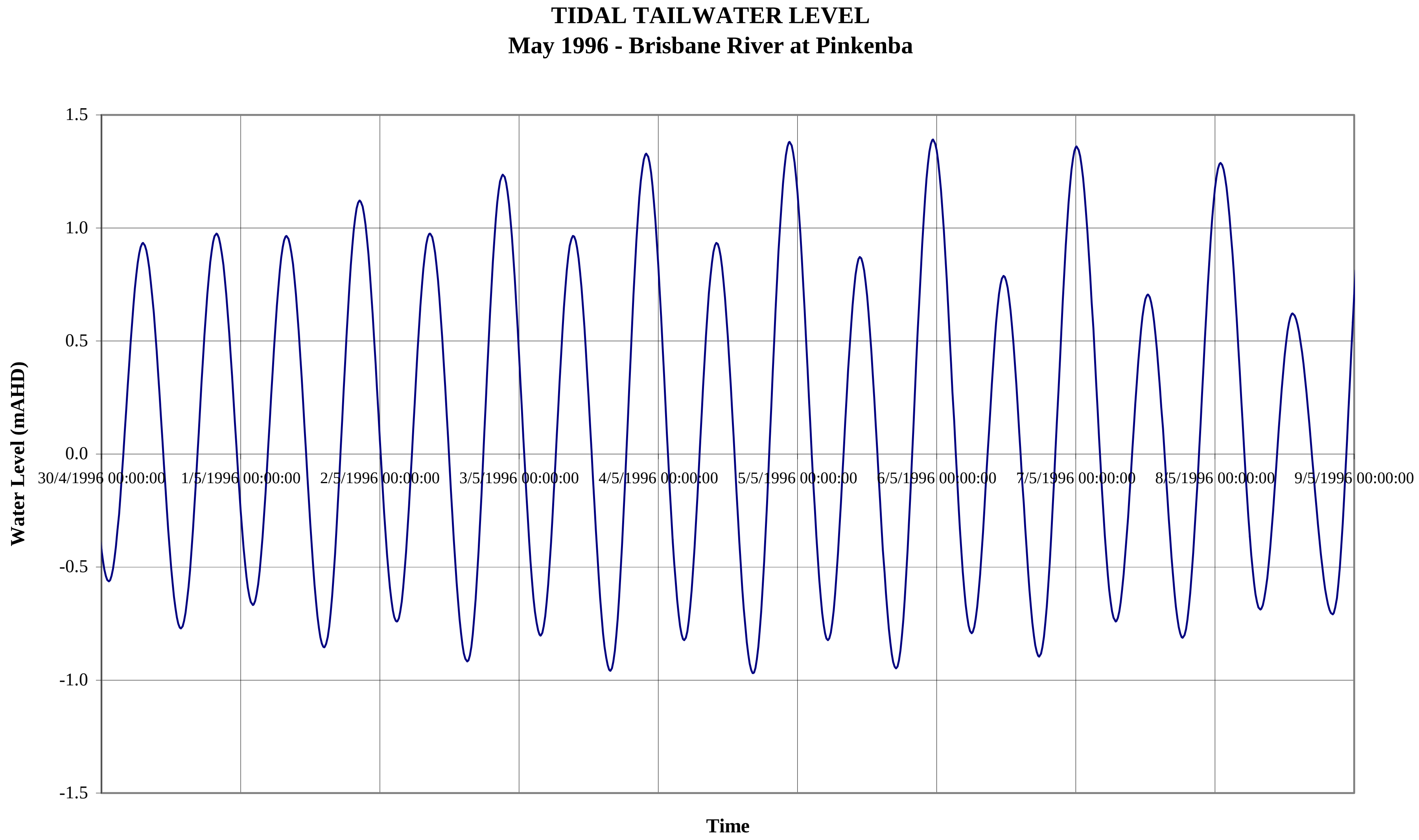


Figure E3: Tidal tail water level at Pinkenba - May 1996 Event

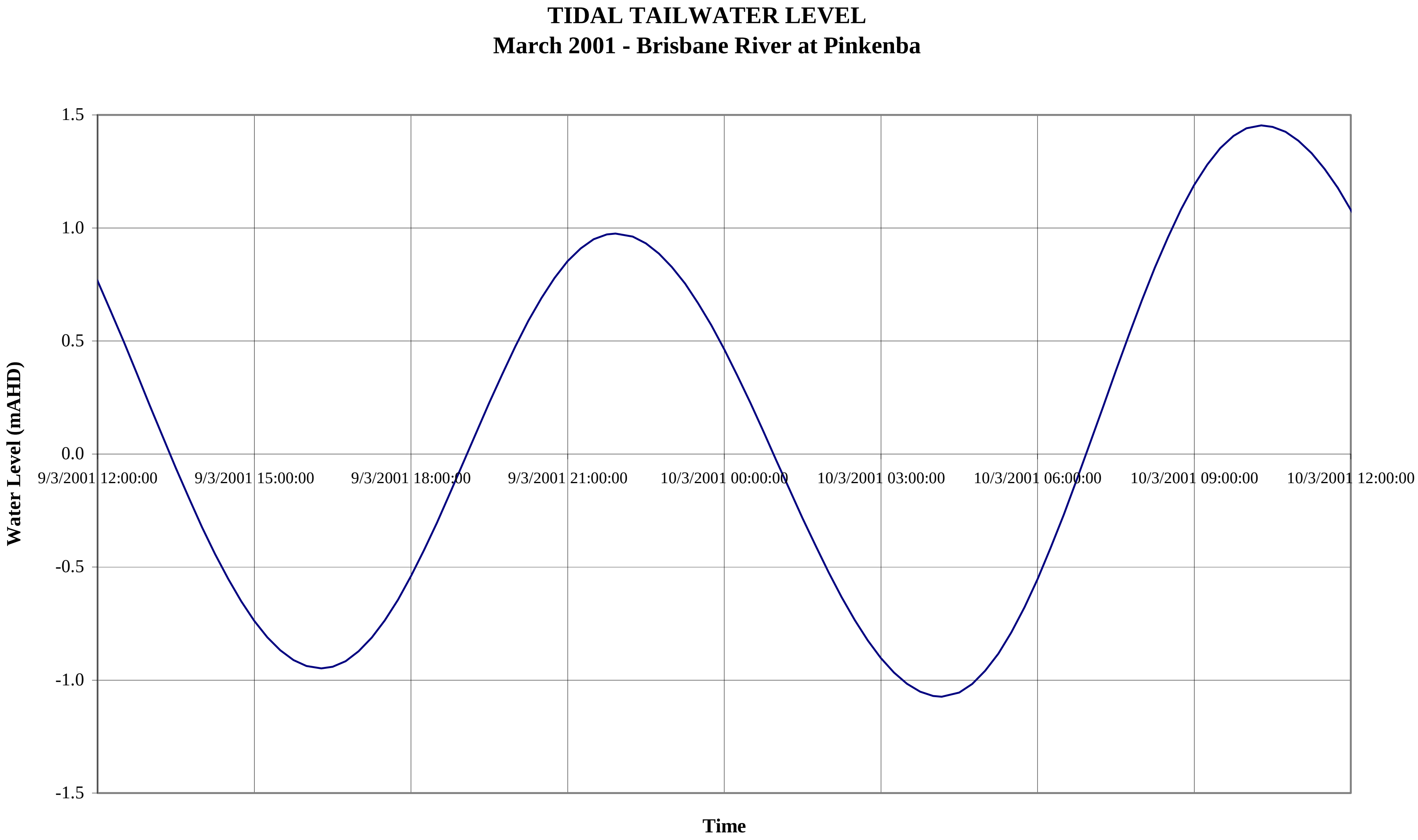


Figure E4: Tidal tail water level at Pinkenba - March 2001 Event

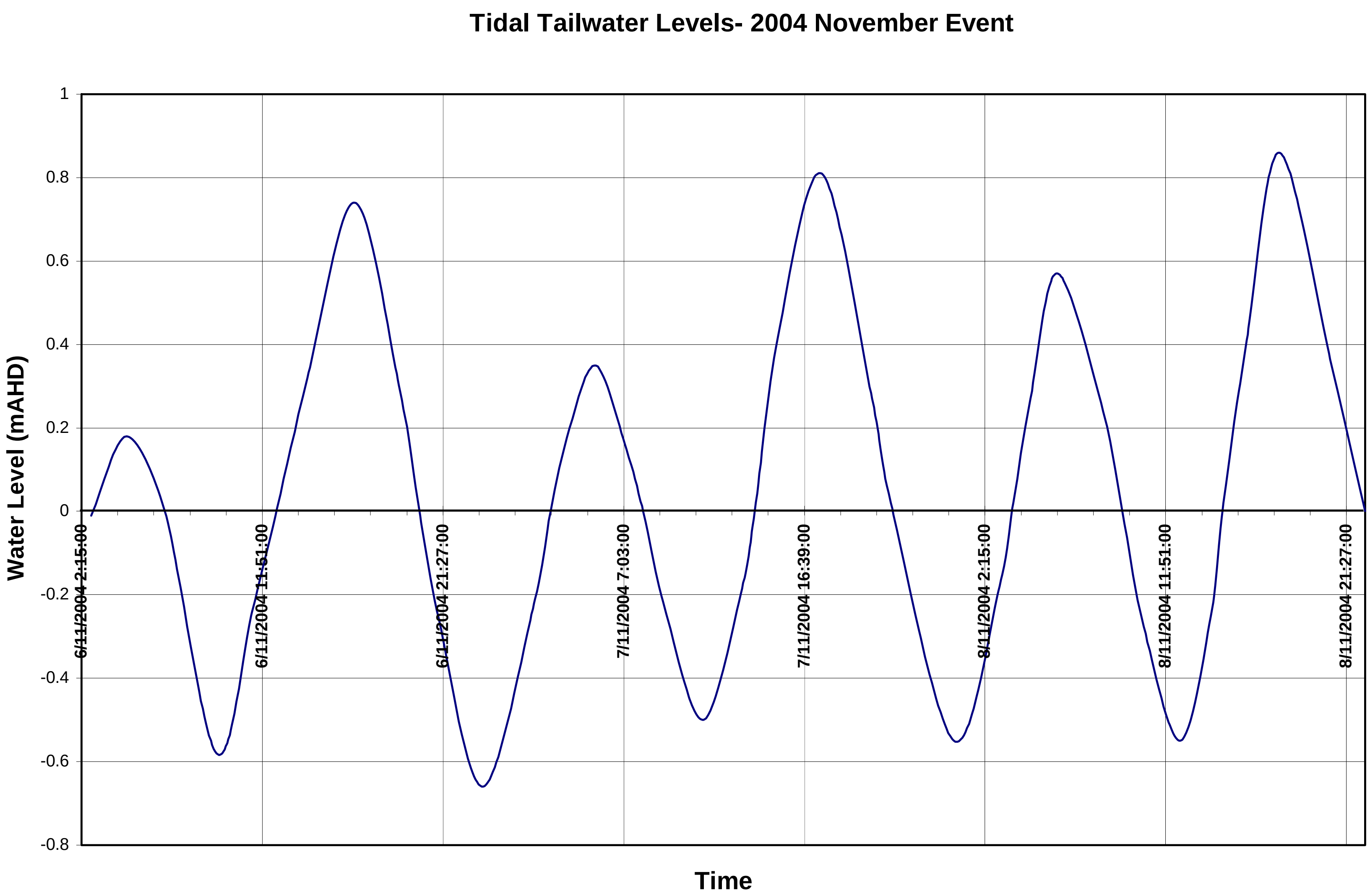


Figure E5: Tidal tail water level: November 2004 event

Appendix F Muskingum Analysis

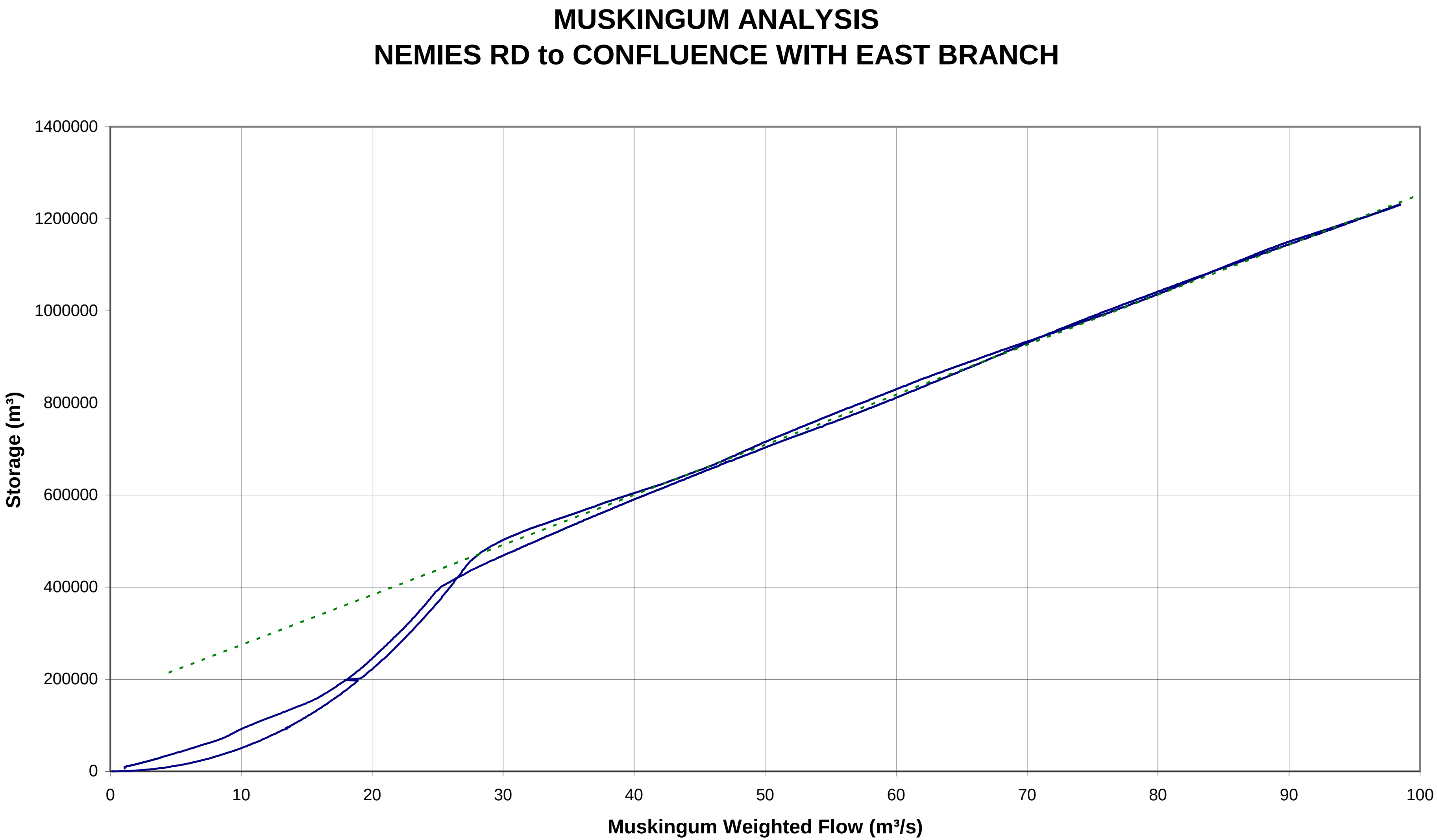


Figure F1: Muskingam analysis for Bulimba Creek: Nemies Road to confluence with East Arm

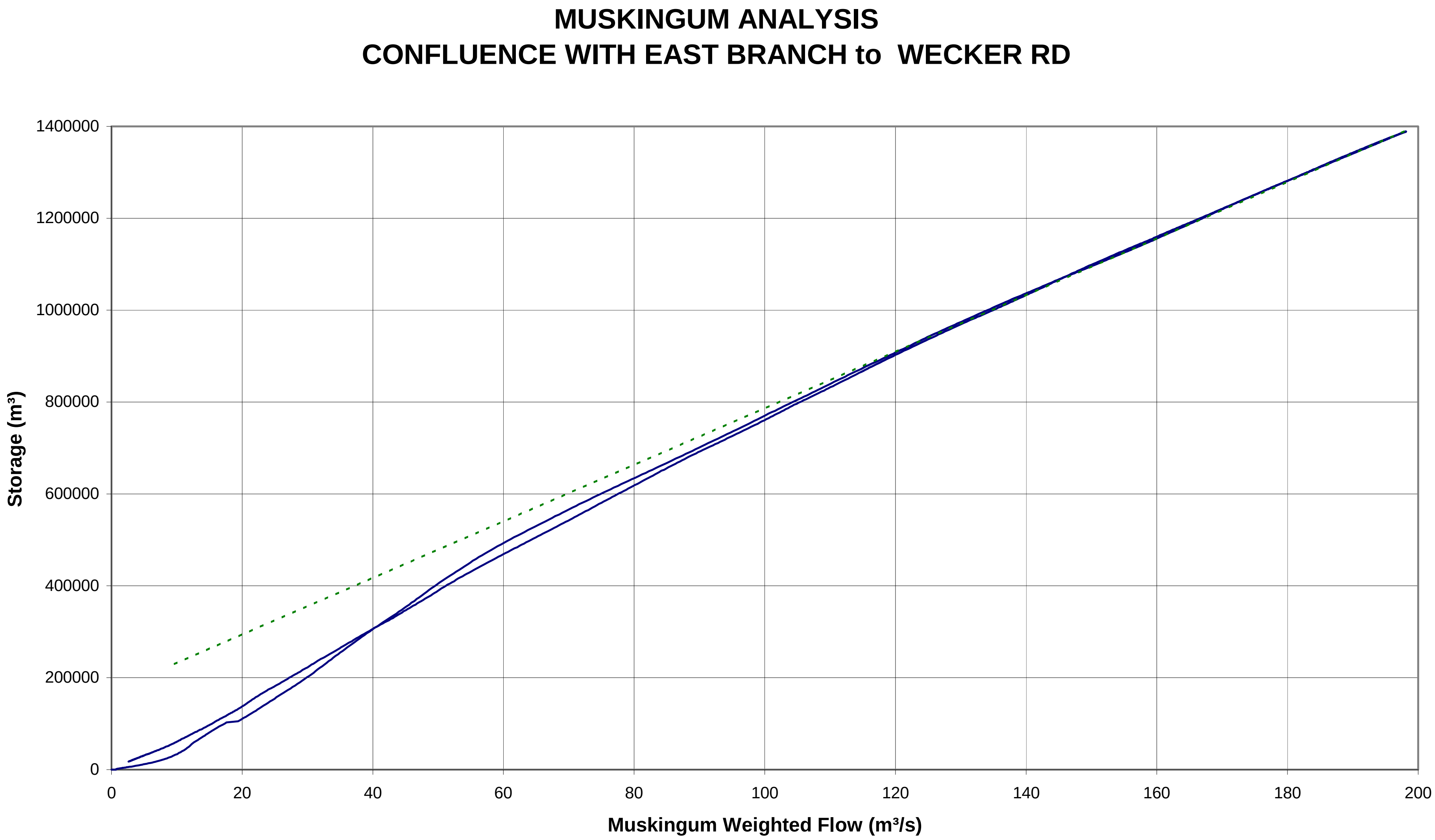


Figure F2: Muskingam Analysis-Bulimba Creek from East arm confluence to Wecker Road

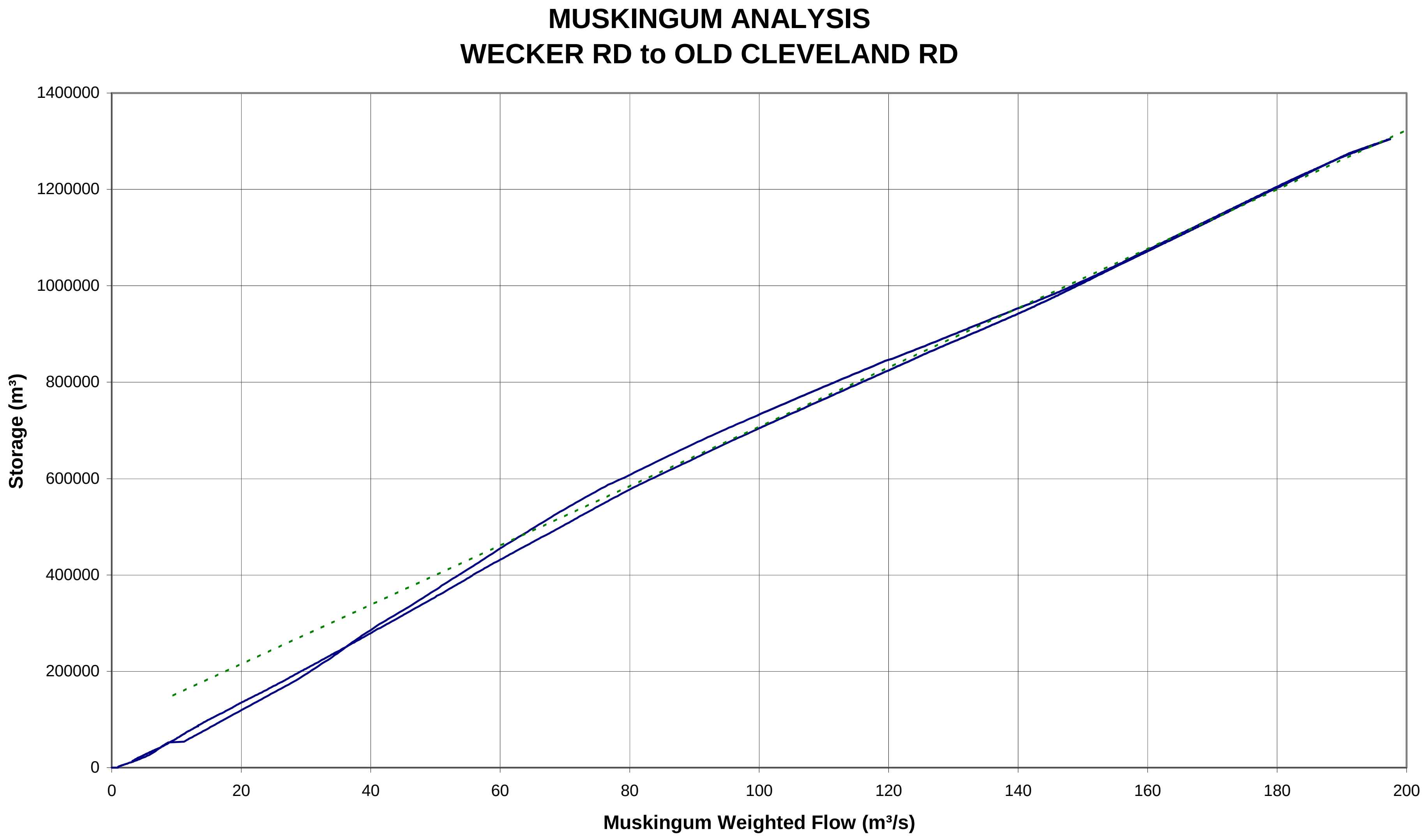


Figure F3: Muskingam Analysis-Bulimba Creek from Wecker Road to Old Cleveland Road

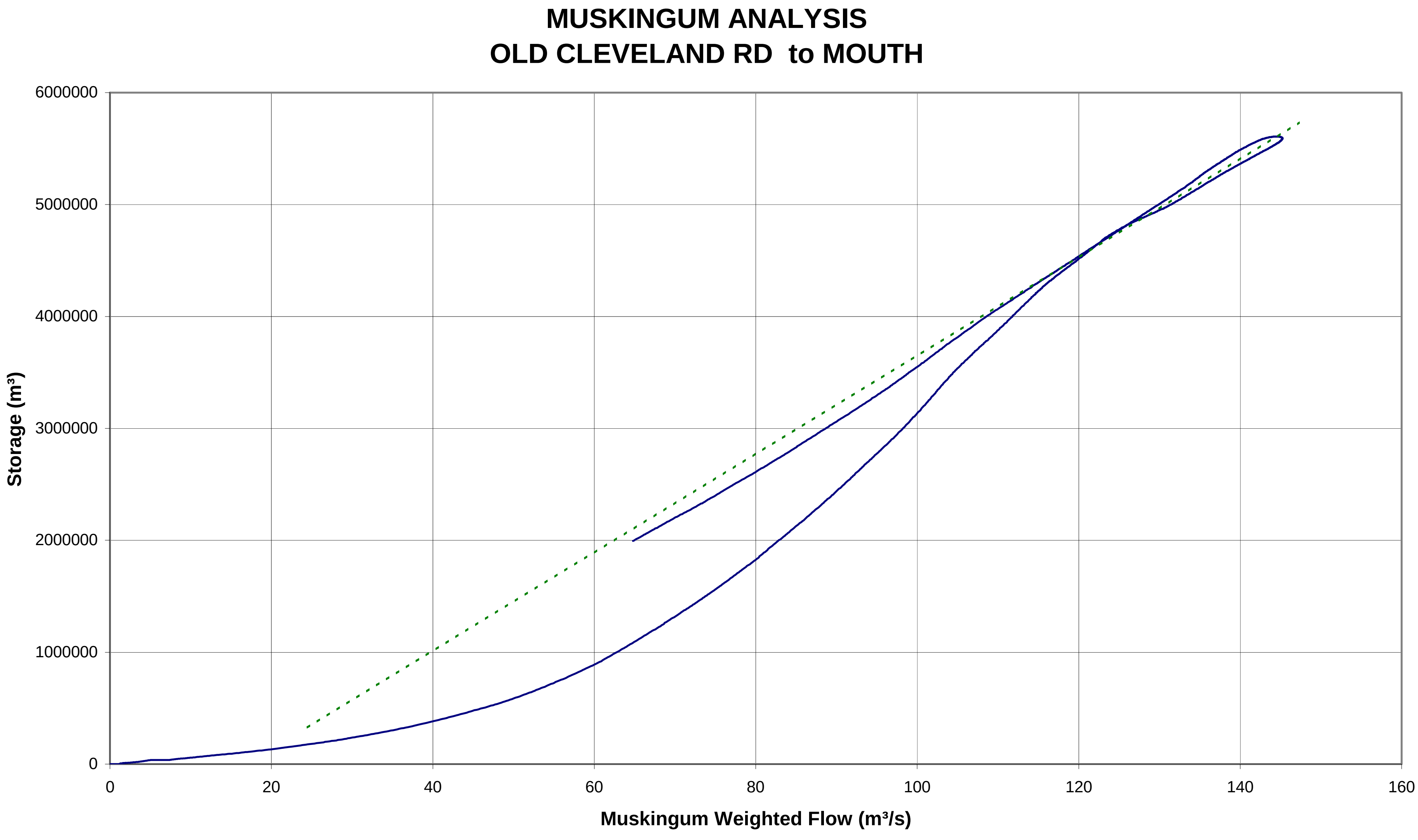


Figure F4: Muskingam Analysis for Bulimba Creek from Old Cleveland Road to Mouth

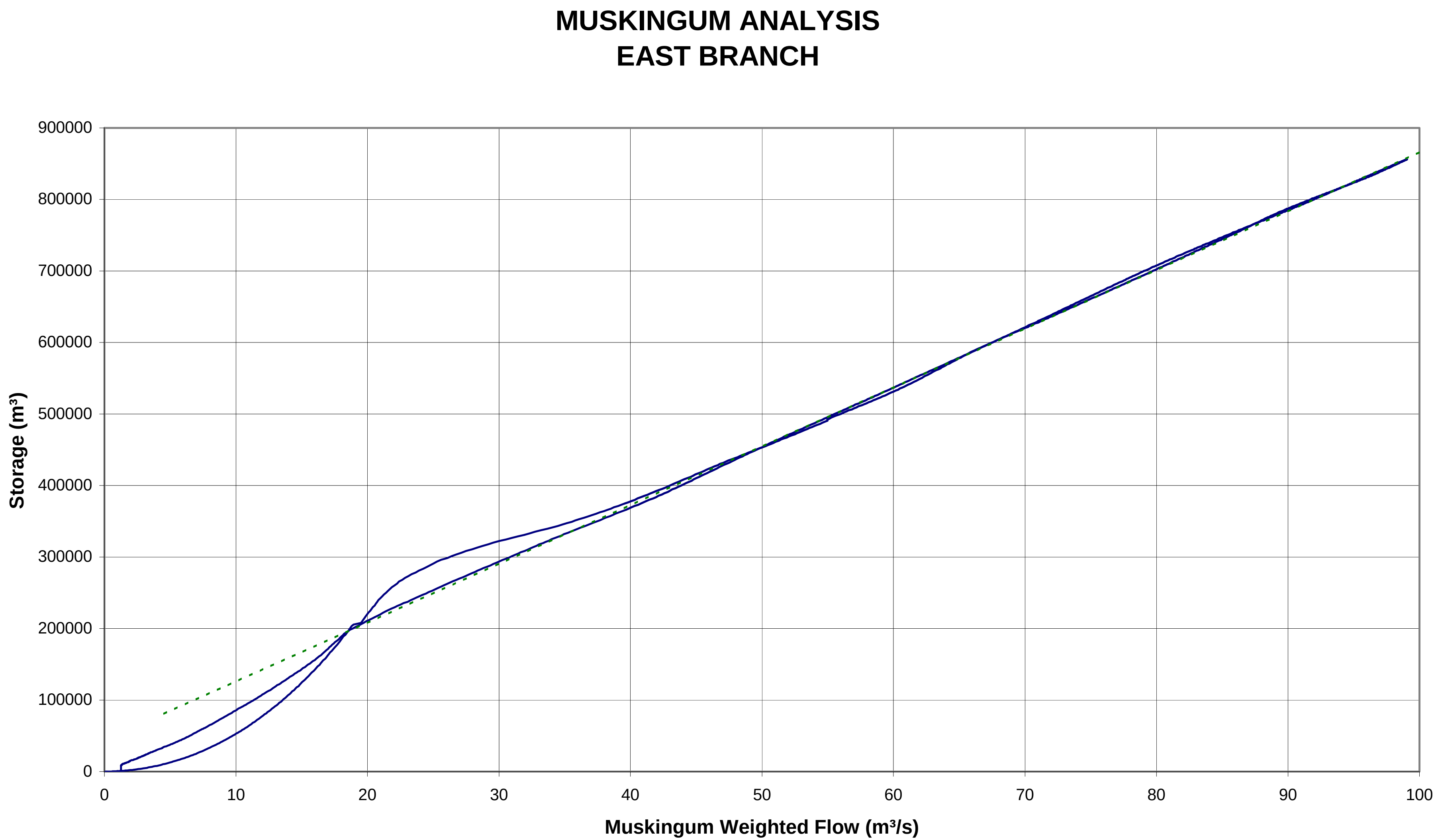


Figure F5: Muskingam Analysis-Bulimba Creek East Branch

Appendix G Flood Frequency Analysis

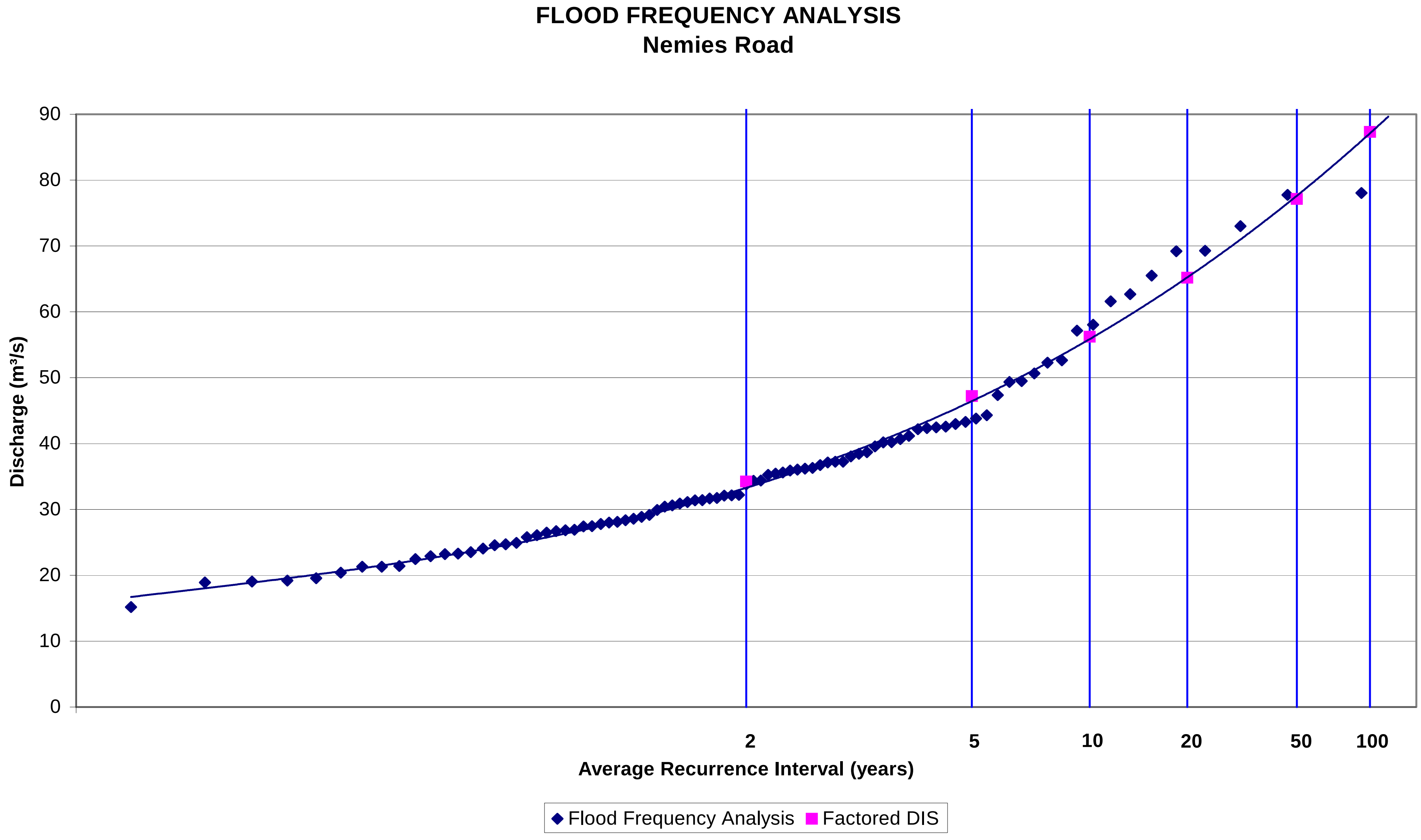


Figure G1- Annual Peak Discharge Comparison at Nemies Road

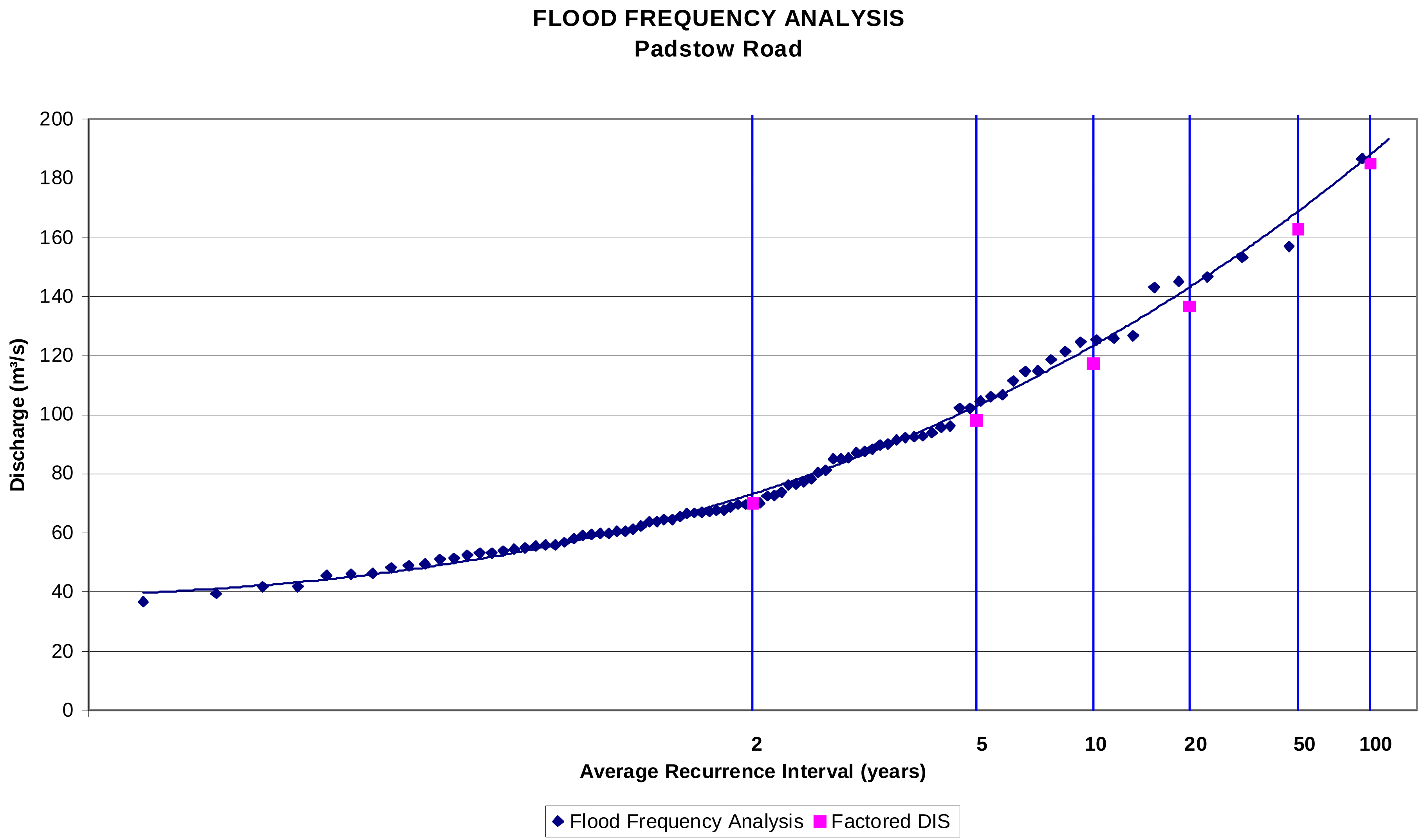


Figure G2- Annual Peak Discharge Comparison at Padstow Road

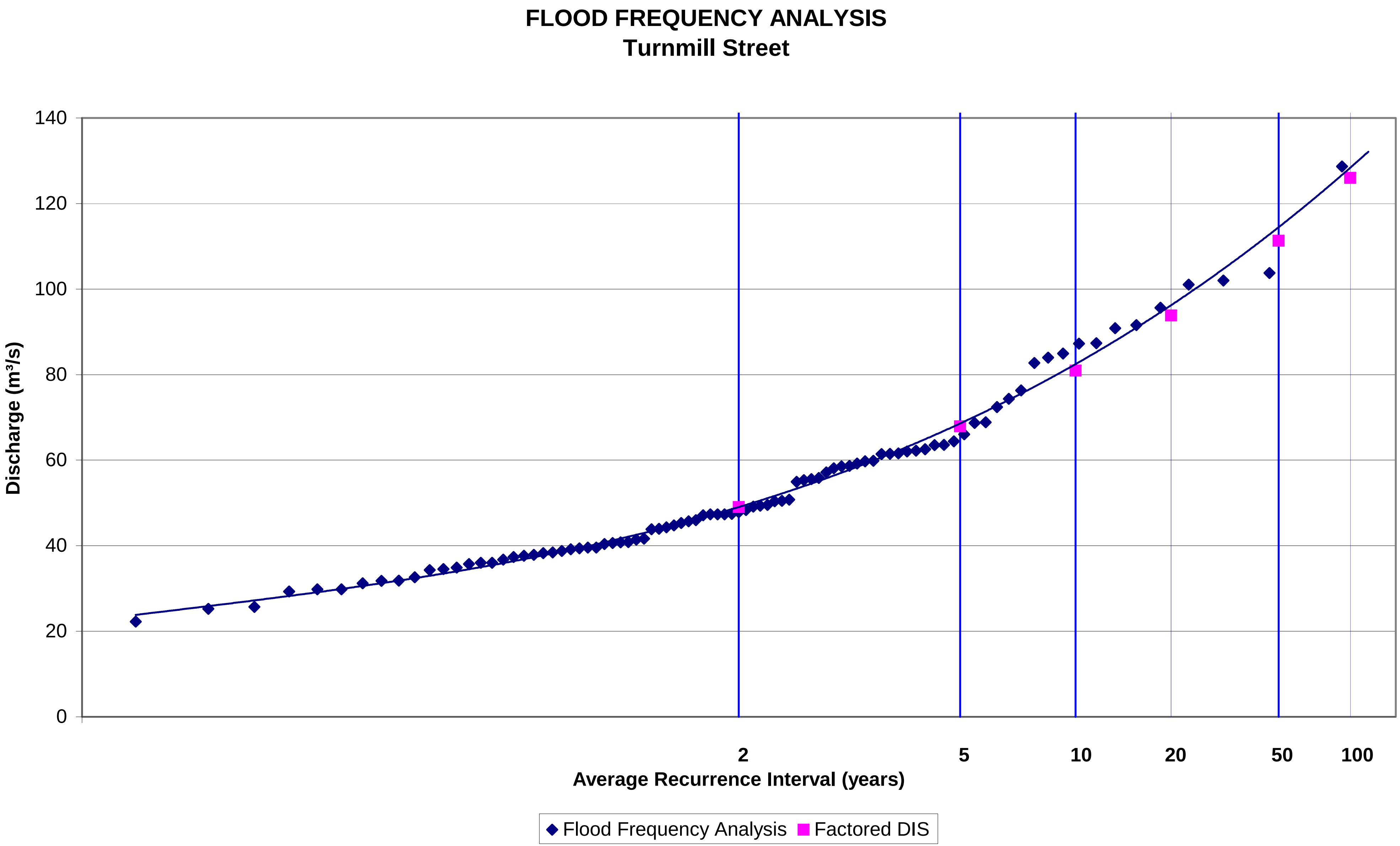


Figure G3- Annual Peak Discharge Comparison at Turnmill Street

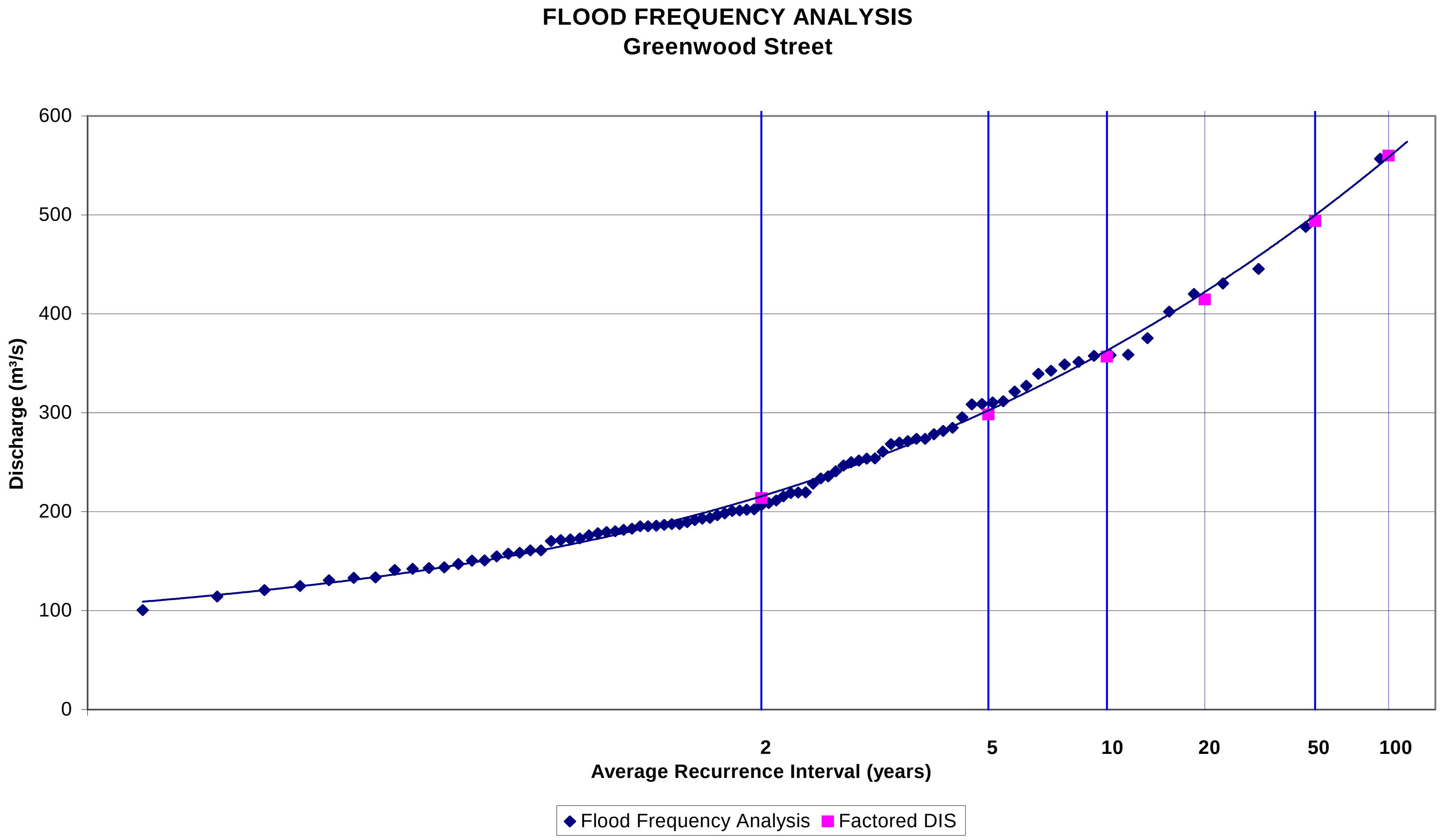


Figure G4- Annual Peak Discharge Comparison at Greenwood Street

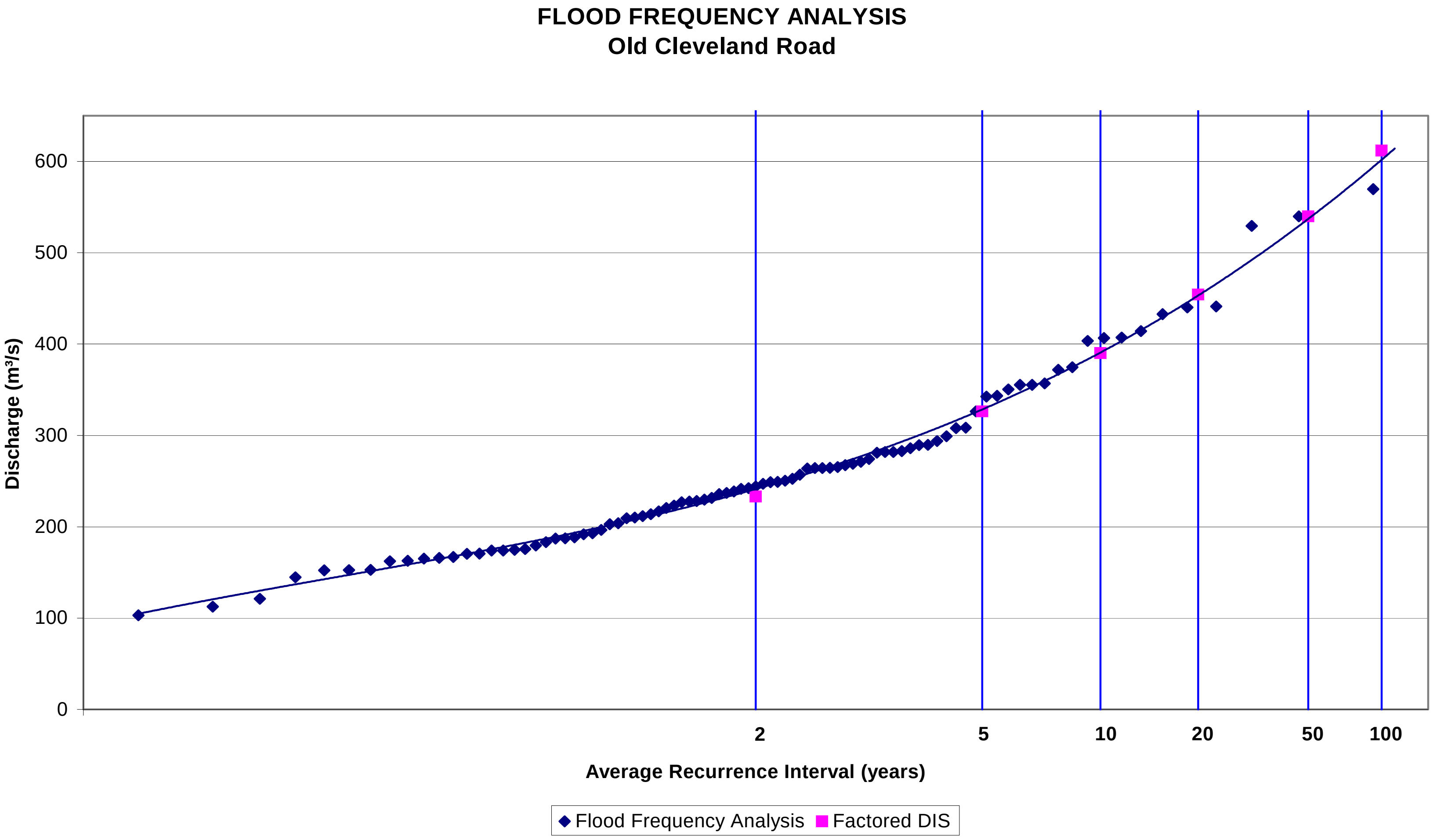


Figure G5- Annual Peak Discharge Comparison at Old Cleveland Road

Appendix H Design Peak Flood Discharges at Sub- catchment Outlets

Table H1: Peak flow discharges at each sub-catchment outlet for design events (from WBNM hydrology model)

Sub-catchment ID	Peak flood Discharge at each sub-catchment outlet (m3./sec)					
	100yr	50yr	20yr	10yr	5yr	2yr
A1a	60.3	56.5	47.7	41.4	34.8	24.2
A1b	86.6	77.6	65.5	56.6	47.5	33.9
A2	103.4	92.4	77.9	67.1	56.2	39.8
A3	115.5	101.7	85.7	73.8	61.7	44.4
B	121.5	106.6	89.6	77.2	64.5	46.5
C1a	39.5	36.9	31.2	27.1	22.8	15.9
C2b	78.1	67.7	57.2	49.3	41.2	30.2
D	88.3	83.0	70.1	60.8	51.1	35.3
E	109.9	94.6	80.0	69.0	57.8	42.9
F	125.2	109.0	92.0	79.3	66.4	48.6
G	183.7	160.0	134.4	115.5	96.3	69.3
H	307.0	266.7	224.1	192.8	160.9	116.7
I1	316.3	276.1	231.7	199.5	166.5	120.0
I2	322.0	282.4	237.0	204.1	170.3	122.2
J1	21.7	20.2	17.1	14.9	12.6	8.9
J2	48.8	41.5	35.1	30.3	25.5	19.2
K1	65.9	57.4	48.5	41.6	34.8	25.3
K2	21.8	20.3	17.1	14.8	12.5	8.7
K3	30.2	27.0	22.8	19.6	16.4	11.6
L1	98.8	86.6	73.0	62.7	52.5	37.8
L2	120.3	105.9	89.1	76.5	63.9	45.7
M1	124.0	109.3	92.0	79.0	66.0	47.2
M2	41.7	38.9	33.1	28.8	24.4	17.2
M3	46.6	43.0	36.5	31.6	26.6	18.6
M4	11.2	10.4	8.7	7.5	6.3	4.3
M5a	34.1	31.8	26.8	23.2	19.4	13.4
M5b	49.3	44.6	37.5	32.4	27.1	19.1
M6	17.8	16.6	14.0	12.1	10.1	7.1
M7	66.4	59.7	50.3	43.3	36.2	25.5
M8	114.1	102.0	86.1	74.2	62.2	44.3
N1	230.7	201.8	169.9	146.1	122.1	88.1
N2a	33.2	31.0	25.7	22.1	18.3	12.2
N2b	52.5	45.0	37.5	31.9	26.3	18.7
N2c	267.5	234.8	197.3	169.7	141.8	102.0
O	557.7	488.7	410.4	353.4	295.1	212.0
P	97.2	91.1	76.2	65.6	54.6	36.9
Q	581.0	510.7	429.0	369.2	308.3	220.9
R	119.4	112.4	95.1	82.6	69.5	48.1
S	587.2	516.3	434.0	373.3	312.1	223.4
T1	61.2	57.3	48.3	41.9	35.2	24.3
T2	583.8	513.4	431.7	371.4	310.5	222.0

Sub-catchment ID	Peak flood Discharge at each sub-catchment outlet (m^3./sec)					
	100yr	**50yr**	**20yr**	**10yr**	**5yr**	**2yr**
U1	61.3	57.4	48.5	42.0	35.3	24.4
U2	74.5	66.3	56.0	48.3	40.5	29.0
U3	90.4	78.8	66.5	57.1	47.8	34.6
V	586.3	516.2	434.0	373.1	311.8	222.4
W1	52.1	48.7	40.8	35.1	29.3	19.9
W2	63.0	54.7	45.7	39.1	32.4	23.0
W3	80.3	70.1	58.6	50.1	41.5	29.4
X1	50.3	47.1	39.7	34.5	29.0	20.1
X2	54.0	47.5	40.1	34.5	28.9	20.7
X3	42.9	40.0	33.5	28.8	24.0	16.3
X4	46.2	39.7	33.2	28.5	23.7	17.0
X5	99.0	86.7	72.7	62.4	52.0	37.1
Y1	600.6	528.8	444.9	382.5	319.8	228.5
Y2	611.1	538.6	453.1	389.3	325.4	232.2
Z	120.7	113.5	95.8	83.0	69.7	47.9
AA	606.8	534.7	449.6	386.4	322.9	230.4
BB1	593.5	522.6	439.3	377.6	315.5	224.7
BB2	69.6	65.2	54.9	47.5	39.8	27.4
BB3	589.3	518.9	436.3	374.9	313.3	223.1
BB4	586.8	516.6	434.4	373.3	311.9	222.1
CC	64.8	60.7	51.1	44.2	37.0	25.4
DD	584.2	514.3	432.6	371.6	310.4	221.0
EE	565.3	497.5	418.4	359.3	300.1	213.6
FF	71.5	62.5	51.7	44.0	36.2	24.5
GG	89.7	78.0	64.7	54.8	45.1	31.3
HH1	60.0	56.1	46.9	40.4	33.6	22.8
HH2	89.7	78.5	65.2	55.7	46.2	32.1
HH3	119.3	104.5	87.0	74.5	61.7	43.4
II	559.7	492.5	414.7	355.9	297.3	211.7
JJ	98.1	92.2	77.8	67.5	56.7	39.1
KK	109.0	94.6	79.5	68.3	57.0	41.4
LL	558.6	491.5	414.1	355.3	296.7	211.4
MM	155.2	146.5	124.0	107.8	90.9	62.9
NN	547.6	481.9	406.1	348.4	291.0	207.3

Appendix I Anticipated Peak Design Flood Levels & Flood Discharges

Table I1: Estimated Peak Design Flood Levels for Bulimba Creek

Branch name & cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
Bulimba Creek:Compton Road to Nemies Road								
Start	**0**	**39900**	60.86	61.07	61.18	61.28	61.40	61.45
BM222	**65**	**39835**	60.63	60.82	60.91	61.00	61.11	61.14
Bm221	**175**	**39725**	60.23	60.41	60.50	60.58	60.68	60.71
BM220	**270**	**39630**	59.72	59.85	59.94	60.02	60.12	60.19
BM219	**415**	**39485**	58.94	59.11	59.24	59.36	59.51	59.66
BM218	**560**	**39340**	58.02	58.23	58.38	58.52	58.67	58.86
BM217	**736**	**39164**	57.19	57.50	57.69	57.86	58.05	58.23
BM216	**900**	**39000**	56.45	56.96	57.21	57.41	57.64	57.86
End	**935**	**38965**	56.17	56.79	57.05	57.26	57.50	57.73
Bulimba Creek-Main Branch		**Bulimba Creek-Main Branch**						
BM214	**0**	**38965**	56.17	56.79	57.05	57.26	57.50	57.73
BM 214	**10**	**38955**	56.15	56.77	57.04	57.25	57.49	57.71
Nemies Road	**17**	**38948**	**Nemies Road Culverts**					
BM214 copy	**40**	**38925**	55.69	55.97	56.14	56.29	56.48	56.66
BM213	**120**	**38845**	55.33	55.54	55.68	55.79	55.94	56.08
BM212	**215**	**38750**	54.80	55.00	55.11	55.22	55.35	55.47
BM211	**355**	**38610**	53.64	53.84	53.93	54.00	54.09	54.17
Brandon Road	**370**	**38595**	**Brandon Road Culverts**					
BM211 copy	**385**	**38580**	53.40	53.65	53.76	53.84	53.94	54.03
BM 209	**470**	**38495**	52.60	52.78	52.89	52.98	53.09	53.17
BM 208	**540**	**38425**	52.20	52.36	52.47	52.61	52.77	52.86
BM 207	**600**	**38365**	52.05	52.23	52.35	52.45	52.63	52.74
BM 206	**740**	**38225**	51.88	52.06	52.18	52.28	52.44	52.58
BR_1	**800**	**38165**	51.79	51.96	52.07	52.17	52.32	52.45
Brandon Road	**805**	**38160**	**Brandon Road downstream weir**					
BR_2	**825**	**38140**	51.03	51.21	51.32	51.41	51.51	51.63
BM 205	**840**	**38125**	50.82	51.02	51.14	51.23	51.35	51.47
BR_3	**890**	**38075**	50.60	50.80	50.91	51.00	51.12	51.25
BR_4	**905**	**38060**	50.52	50.71	50.81	50.90	51.01	51.14
BR_5	**942**	**38023**	50.36	50.54	50.63	50.72	50.82	50.93
BR_5 copy	**960**	**38005**	50.26	50.43	50.53	50.61	50.71	50.81
BM 204 copy	**990**	**37975**	50.09	50.26	50.34	50.42	50.52	50.62
BM 203	**1075**	**37890**	49.66	49.84	49.95	50.06	50.18	50.28
BM 202	**1160**	**37805**	49.40	49.59	49.73	49.85	49.98	50.09
BM 201	**1300**	**37665**	49.00	49.19	49.34	49.47	49.61	49.71
BM 200	**1365**	**37600**	48.61	48.79	48.92	49.05	49.20	49.31
BM 199	**1545**	**37420**	47.55	47.72	47.80	47.89	48.03	48.14
BM 198	**1670**	**37295**	46.95	47.23	47.40	47.55	47.71	47.86
BM340-MHG	**1800**	**37165**	46.60	46.99	47.22	47.39	47.58	47.74
BM 197	**1830**	**37135**	46.57	46.97	47.21	47.38	47.57	47.72
Beenleigh Road	**1845**	**37120**	**Beenleigh Road Weir**					
BM 197 Copy	**1860**	**37105**	46.12	46.30	46.44	46.55	46.69	46.81
BM195-I	**1900**	**37065**	45.78	45.97	46.13	46.26	46.42	46.56
BM 194	**1940**	**37025**	45.74	45.91	46.05	46.18	46.34	46.49

Branch name & cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
BM 194 copy	**1960**	**37005**	45.54	45.62	45.68	45.74	45.81	45.88
BM 192	**2045**	**36920**	44.88	45.01	45.14	45.29	45.49	45.63
BM 191 copy	**2115**	**36850**	44.62	44.89	45.07	45.24	45.47	45.62
St Lawrence Foot Bridge	**2117**	**36848**	**St Lawrence Foot-Bridge and Weir**					
Bm 191	**2125**	**36840**	44.60	44.88	45.06	45.24	45.46	45.61
BM190	**2255**	**36710**	44.47	44.83	45.02	45.20	45.44	45.58
BM188-6 copy	**2370**	**36595**	44.36	44.76	44.96	45.14	45.38	45.52
Altandi Street Foot Bridge	**2375**	**36590**	**Altandi Street Foot Bridge and Weir**					
BM188-6	**2380**	**36585**	44.12	44.34	44.49	44.61	44.80	44.98
BM188-2 ALS	**2470**	**36495**	43.84	44.04	44.17	44.29	44.47	44.64
BM188-1 ALS	**2500**	**36465**	43.60	43.79	43.91	44.02	44.20	44.37
BM187	**2670**	**36295**	42.88	43.05	43.18	43.30	43.45	43.61
BM186	**2785**	**36180**	42.64	42.80	42.93	43.04	43.17	43.31
BM185	**2985**	**35980**	42.01	42.16	42.27	42.37	42.49	42.59
BM184	**3165**	**35800**	40.96	41.11	41.21	41.30	41.41	41.51
BM183	**3295**	**35670**	39.84	40.04	40.16	40.26	40.41	40.54
BM182	**3435**	**35530**	39.07	39.24	39.37	39.48	39.63	39.77
BM181	**3625**	**35340**	37.61	37.83	37.99	38.11	38.27	38.41
BM320-MHG	**3765**	**35200**	36.79	37.06	37.25	37.40	37.57	37.72
BM180	**3800**	**35165**	36.64	36.92	37.12	37.28	37.46	37.61
BM179	**3960**	**35005**	35.90	36.14	36.31	36.46	36.61	36.73
Malbon Street Foot Bridge	**3965**	**35000**	**Malbon Street Foot Bridge and Weir**					
BM179 copy	**3970**	**34995**	35.77	36.04	36.23	36.41	36.55	36.68
BM178	**4150**	**34815**	34.27	34.52	34.71	34.92	35.17	35.35
BM177-MHG310	**4260**	**34705**	33.84	34.15	34.36	34.60	34.91	35.13
ALS	**4320**	**34645**	33.48	33.87	34.08	34.32	34.65	34.92
LC	**4375**	**34590**	33.29	33.76	33.97	34.21	34.56	34.84
BM176modified with ALS	**4385**	**34580**	33.29	33.75	33.97	34.20	34.55	34.84
Padstow Road	**4390**	**34575**	**Padstow Road Culverts and Weir**					
BM176_DS	**4415**	**34550**	33.28	33.74	33.96	34.18	34.49	34.72
BM 175	**4460**	**34505**	33.25	33.72	33.94	34.15	34.45	34.68
BM175-174	**4515**	**34450**	33.24	33.71	33.93	34.14	34.44	34.67
Mimosa Merge	**4555**	**34410**	33.23	33.71	33.92	34.14	34.43	34.66
Padstow Merge	**4575**	**34390**	33.21	33.68	33.89	34.11	34.39	34.62
BM 174	**4590**	**34375**	33.14	33.60	33.81	34.02	34.30	34.52
BM174A	**4700**	**34265**	32.83	33.28	33.49	33.70	33.98	34.21
BM174B	**4765**	**34200**	32.65	33.08	33.28	33.48	33.75	33.97
BM173- MHG300	**4780**	**34185**	32.61	33.04	33.24	33.45	33.73	33.96
Blesby Road Foot Bridge	**4785**	**34180**	**Blesby Road Footbridge & Weir**					
BM 173 copy	**4790**	**34175**	32.59	33.03	33.23	33.44	33.71	33.93
BM172	**4905**	**34060**	32.21	32.65	32.86	33.09	33.38	33.63
BM171	**4995**	**33970**	31.79	32.24	32.45	32.69	33.01	33.30
BM170	**5120**	**33845**	31.12	31.55	31.76	32.02	32.45	32.85
Garden City connection	**5280**	**33685**	29.94	30.45	30.75	31.16	31.81	32.34
BM169	**5285**	**33680**	29.91	30.43	30.73	31.15	31.80	32.33

Branch name & cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
BM168	**5405**	**33560**	29.54	30.14	30.52	30.99	31.70	32.25
BM167	**5520**	**33445**	29.31	29.94	30.35	30.87	31.62	32.19
CopyBM 167-MHG290	**5615**	**33350**	28.99	29.70	30.15	30.74	31.54	32.13
South-East Freeway	**5625**	**33340**	**South East Freeway culverts**					
BM 165 copy	**5715**	**33250**	28.74	29.39	29.79	30.24	30.72	30.98
BM165	**5730**	**33235**	28.72	29.38	29.77	30.23	30.70	30.97
SurveyXs-5	**5785**	**33180**	28.58	29.26	29.70	30.18	30.67	30.94
Logan Road	**5790**	**33175**	**Logan Road Culverts and Weir**					
SurveyXs-4	**5845**	**33120**	28.46	29.02	29.30	29.56	29.88	30.12
SurveyXs-3	**5902**	**33063**	28.41	28.96	29.25	29.51	29.84	30.09
SurveyXs-2	**5918**	**33047**	28.40	28.95	29.23	29.50	29.83	30.08
BM158_Xs-1	**5935**	**33030**	28.38	28.93	29.22	29.48	29.82	30.07
Garden City Branch start	**5938**	**33027**	28.38	28.93	29.22	29.48	29.82	30.07
HEC2937-MHG280	**5985**	**32980**	28.30	28.85	29.14	29.40	29.73	29.99
BM157	**6050**	**32915**	28.13	28.66	28.94	29.20	29.55	29.81
BM156	**6160**	**32805**	27.68	28.20	28.47	28.71	29.04	29.30
BM155	**6240**	**32725**	27.34	27.84	28.11	28.35	28.68	28.94
BM154	**6340**	**32625**	26.94	27.44	27.71	27.95	28.28	28.55
BM153_ALS	**6450**	**32515**	26.48	27.03	27.31	27.56	27.90	28.18
BM151	**6650**	**32315**	26.09	26.63	26.91	27.16	27.49	27.77
BM149	**6860**	**32105**	25.69	26.20	26.47	26.71	27.04	27.30
BM148-BM147	**6930**	**32035**	25.48	25.96	26.24	26.47	26.80	27.07
CraigStreet Foot Bridge	**6935**	**32030**	**Craig Street Foot Bridge and Weir**					
BM148 copy	**6945**	**32020**	25.44	25.92	26.19	26.43	26.75	27.02
BM148	**6985**	**31980**	25.39	25.87	26.14	26.38	26.70	26.97
BM146	**7185**	**31780**	24.97	25.44	25.72	25.97	26.31	26.59
BM144	**7420**	**31545**	24.26	24.81	25.14	25.41	25.77	26.05
BM143	**7490**	**31475**	24.09	24.66	24.99	25.27	25.63	25.91
ALS-142	**7600**	**31365**	23.81	24.42	24.77	25.05	25.42	25.71
BM141	**7735**	**31230**	23.42	24.04	24.41	24.70	25.07	25.38
BM139	**7915**	**31050**	22.85	23.35	23.68	23.94	24.26	24.53
BM138	**7985**	**30980**	22.67	23.15	23.47	23.72	24.03	24.29
BM137	**8070**	**30895**	22.62	23.10	23.41	23.66	23.97	24.23
BM136	**8200**	**30765**	22.42	22.90	23.21	23.45	23.76	24.02
BM135	**8325**	**30640**	22.28	22.74	23.04	23.26	23.56	23.80
BM134	**8475**	**30490**	22.04	22.46	22.74	22.95	23.21	23.44
MHG-BM260	**8555**	**30410**	21.83	22.23	22.50	22.69	22.94	23.16
BM132	**8570**	**30395**	21.79	22.19	22.45	22.65	22.89	23.10
BM131	**8780**	**30185**	20.91	21.29	21.54	21.73	21.98	22.19
BM130	**8840**	**30125**	20.57	20.99	21.28	21.50	21.78	22.02
BM129	**8950**	**30015**	20.31	20.75	21.04	21.27	21.58	21.83
BM127	**9115**	**29850**	19.75	20.21	20.52	20.77	21.09	21.35
BM126	**9215**	**29750**	19.38	19.85	20.17	20.43	20.77	21.03
BM126a	**9365**	**29600**	19.09	19.58	19.91	20.18	20.52	20.79
BM126b	**9530**	**29435**	18.85	19.38	19.73	20.00	20.36	20.64
BM122	**9670**	**29295**	18.61	19.16	19.51	19.79	20.16	20.45

Branch name & cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
BM121	9765	29200	18.48	19.01	19.35	19.63	19.98	20.26
BM119	9890	29075	18.36	18.87	19.20	19.46	19.80	20.07
BM118	9920	29045	18.29	18.79	19.11	19.37	19.71	19.98
BM117	10100	28865	17.72	18.22	18.54	18.81	19.15	19.43
BM116	10205	28760	17.45	17.96	18.29	18.56	18.91	19.19
BM115	10315	28650	17.27	17.76	18.09	18.35	18.71	18.98
BM114	10400	28565	16.93	17.46	17.81	18.10	18.47	18.76
BM112	10510	28455	16.51	17.05	17.41	17.72	18.11	18.43
BM111-MHG250	10575	28390	16.36	16.91	17.27	17.58	17.98	18.31
BM110	10685	28280	16.23	16.78	17.14	17.45	17.85	18.17
Mt Gravatt Capalaba Road	10702	28263	**Mt Gravatt Capalaba Road Bridge**					
BM110 copy	10725	28240	16.09	16.59	16.92	17.19	17.54	17.81
BM108	10875	28090	15.84	16.32	16.64	16.90	17.24	17.51
BM107	10965	28000	15.62	16.09	16.40	16.65	16.99	17.27
BM106	11095	27870	15.19	15.69	16.02	16.30	16.66	16.96
BM104	11255	27710	15.00	15.53	15.88	16.17	16.55	16.86
BM102	11515	27450	14.75	15.33	15.69	16.00	16.40	16.72
BM101	11620	27345	14.69	15.27	15.64	15.95	16.34	16.67
BM100	11695	27270	14.62	15.19	15.55	15.86	16.25	16.56
BM99	11820	27145	14.35	14.91	15.26	15.55	15.94	16.24
BM98	11910	27055	14.09	14.62	14.97	15.26	15.63	15.93
BM97	12035	26930	13.80	14.33	14.68	14.97	15.34	15.65
BM97copy	12135	26830	13.65	14.19	14.54	14.83	15.20	15.51
Wecker Road Bridge	12139	26826	**Wecker Road Bridge and Weir**					
BM97copy	12155	26810	13.60	14.12	14.47	14.76	15.13	15.44
BM94	12215	26750	13.50	14.04	14.38	14.68	15.05	15.36
BM94-93	12320	26645	13.30	13.88	14.24	14.54	14.93	15.24
BM93	12385	26580	13.12	13.72	14.09	14.40	14.80	15.11
BM90 copy	12505	26460	12.83	13.45	13.83	14.14	14.54	14.86
BM90	12690	26275	12.55	13.21	13.60	13.92	14.32	14.65
BM88	12820	26145	12.41	13.06	13.45	13.77	14.17	14.49
BM87	13140	25825	12.06	12.70	13.07	13.38	13.76	14.07
BM84	13440	25525	11.40	12.09	12.48	12.80	13.19	13.49
BM83	13530	25435	11.29	11.97	12.35	12.67	13.05	13.35
BM81	13670	25295	11.16	11.81	12.18	12.48	12.85	13.13
BM80	13765	25200	11.05	11.69	12.06	12.34	12.70	12.97
BM78	13910	25055	10.69	11.32	11.68	11.96	12.31	12.58
BM78 copy	13965	25000	10.36	10.96	11.31	11.61	11.98	12.27
BM77	14115	24850	10.11	10.66	11.00	11.29	11.66	11.95
BM76	14360	24605	10.01	10.57	10.90	11.20	11.57	11.86
BM75	14460	24505	9.96	10.52	10.86	11.15	11.52	11.81
BM74-BM72	14625	24340	9.85	10.40	10.73	11.02	11.37	11.66
BM72	14785	24180	9.48	9.98	10.28	10.55	10.89	11.16
BM71-MHG-230	14845	24120	9.35	9.85	10.16	10.43	10.78	11.06
BM70	14960	24005	9.20	9.70	10.01	10.28	10.63	10.93

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
BM69	**15160**	**23805**	8.88	9.33	9.62	9.89	10.24	10.54
BM67	**15340**	**23625**	8.51	8.99	9.32	9.61	9.99	10.31
BM66	**15460**	**23505**	8.38	8.89	9.23	9.54	9.93	10.25
BM66 copy	**15540**	**23425**	8.32	8.84	9.19	9.50	9.90	10.22
Pine Mountain Road	**15555**	**23410**	**Pine Mountain Road Bridge and Weir**					
BM64 copy	**15570**	**23395**	8.24	8.76	9.10	9.41	9.82	10.14
BM64-MHG250	**15600**	**23365**	8.18	8.70	9.05	9.36	9.77	10.09
BM64	**15660**	**23305**	8.09	8.64	9.01	9.32	9.73	10.06
BM63	**15790**	**23175**	7.98	8.56	8.94	9.27	9.68	10.01
BM62	**15965**	**23000**	7.88	8.49	8.88	9.21	9.63	9.96
BM61	**16015**	**22950**	7.85	8.47	8.86	9.19	9.61	9.95
BM60	**16190**	**22775**	7.69	8.34	8.75	9.10	9.54	9.88
BM59	**16390**	**22575**	7.45	8.13	8.55	8.92	9.37	9.72
BM59 mod	**16435**	**22530**	7.38	8.06	8.48	8.85	9.30	9.65
Meadow Sreett Foot Bridge	**16445**	**22520**	**Meadow Street Foot Bridge and Weir**					
Bm55-mod	**16455**	**22510**	7.37	8.04	8.46	8.83	9.28	9.63
BM57-mod	**16680**	**22285**	7.06	7.72	8.13	8.50	8.93	9.27
BM56	**16785**	**22180**	6.91	7.56	7.97	8.33	8.77	9.11
Bm55-mod	**17080**	**21885**	6.45	7.08	7.48	7.84	8.26	8.59
BM55-54	**17240**	**21725**	6.19	6.83	7.23	7.58	7.99	8.32
BM54	**17300**	**21665**	6.14	6.77	7.16	7.51	7.92	8.25
CD10	**17325**	**21640**	6.10	6.72	7.12	7.47	7.88	8.20
Winstaly Street Bridge	**17338**	**21627**	**Winstanly Street Foot Bridge and Weir**					
CD09	**17355**	**21610**	6.08	6.66	7.03	7.37	7.79	8.13
BM52	**17540**	**21425**	5.82	6.35	6.71	7.03	7.44	7.76
CD07	**17765**	**21200**	5.46	5.98	6.34	6.66	7.09	7.39
BM50-49-ALS	**17850**	**21115**	5.28	5.83	6.19	6.49	6.88	7.22
CD06	**17920**	**21045**	5.04	5.56	5.93	6.26	6.65	6.95
Old Cleveland Road	**17935**	**21030**	**Old Cleveland Road bridge and Weir**					
CD05	**17960**	**21005**	5.04	5.55	5.94	6.26	6.63	6.92
CD04	**18025**	**20940**	4.86	5.46	5.83	6.17	6.58	6.90
BM47-mod	**18065**	**20900**	4.78	5.41	5.79	6.13	6.54	6.87
BM46-mod	**18110**	**20855**	4.75	5.37	5.76	6.10	6.49	6.84
CD02	**18320**	**20645**	4.64	5.25	5.62	5.96	6.36	6.70
BM44 mod	**18495**	**20470**	4.53	5.13	5.51	5.84	6.25	6.57
BM43-mod	**18690**	**20275**	4.44	5.03	5.39	5.72	6.12	6.44
BM42-mod	**18995**	**19970**	4.32	4.89	5.25	5.56	5.95	6.26
BM41-mod	**19165**	**19800**	4.24	4.81	5.16	5.48	5.86	6.17
BM41 copy	**19195**	**19770**	4.22	4.79	5.14	5.45	5.83	6.14
Scrub Road Foot Bridge	**19205**	**19760**	**Scrub Road Foot Bridge and Weir**					
BM41	**19215**	**19750**	4.21	4.78	5.13	5.45	5.82	6.14
BM5GHD	**19375**	**19590**	4.14	4.70	5.04	5.35	5.72	6.03
BM6GHD	**19640**	**19325**	3.97	4.48	4.80	5.09	5.43	5.72
Bm7GHD	**20050**	**18915**	3.78	4.27	4.56	4.82	5.13	5.40
BM8GHD copy	**20260**	**18705**	3.72	4.19	4.47	4.72	5.03	5.30

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
Meadowlands Road Bridge	**20270**	**18695**	**Meadowlands Road bridge and Weir**					
Bm8GHD	**20290**	**18675**	3.71	4.17	4.44	4.67	4.93	5.15
BM9GHD	**20510**	**18455**	3.68	4.14	4.40	4.62	4.87	5.08
BM37	**20850**	**18115**	3.58	4.04	4.29	4.50	4.75	4.96
BM17GHD	**21090**	**17875**	3.50	3.95	4.21	4.42	4.68	4.88
BM18GHD	**21555**	**17410**	3.35	3.80	4.06	4.29	4.56	4.78
BM19GHDcopy	**21875**	**17090**	3.22	3.67	3.93	4.17	4.46	4.69
Preston Road Foot Bridge	**21885**	**17080**	**Preston Road Foot bridge and Weir**					
BM19_GHD	**21895**	**17070**	3.21	3.66	3.92	4.16	4.45	4.68
MHG170	**22305**	**16660**	3.09	3.52	3.77	4.01	4.31	4.54
BM23GHD	**22775**	**16190**	2.95	3.37	3.62	3.86	4.16	4.40
MHG160	**23165**	**15800**	2.85	3.26	3.52	3.76	4.07	4.32
BM10GHD	**23285**	**15680**	2.84	3.25	3.51	3.75	4.06	4.31
BM11GHD	**23600**	**15365**	2.81	3.22	3.48	3.72	4.03	4.27
ALS23900	**23900**	**15065**	2.79	3.20	3.45	3.69	4.00	4.25
Minnippi_connection	**24000**	**14965**	2.78	3.19	3.45	3.69	4.00	4.25
BM13a	**24695**	**14270**	2.69	3.11	3.37	3.61	3.92	4.17
BM13GHD	**24890**	**14075**	2.64	3.05	3.30	3.54	3.85	4.10
MHG19-old	**25515**	**13450**	2.49	2.88	3.12	3.35	3.65	3.88
MHG20-old	**25565**	**13400**	2.49	2.87	3.11	3.34	3.64	3.87
BM26_MHG150	**25865**	**13100**	2.43	2.81	3.05	3.28	3.58	3.81
Wynnum Road Weir	**25885**	**13080**	**Wynnum Road bridge and weir**					
BM 26 copy	**25905**	**13060**	2.37	2.71	2.92	3.11	3.37	3.57
MHG-140	**26015**	**12950**	2.33	2.66	2.87	3.06	3.32	3.52
BM24	**26145**	**12820**	2.29	2.60	2.80	2.98	3.23	3.42
BM23	**26365**	**12600**	2.23	2.52	2.71	2.89	3.13	3.31
Murrarie connection	**26550**	**12415**	2.19	2.47	2.66	2.84	3.08	3.26
BM22	**26620**	**12345**	2.18	2.47	2.65	2.83	3.07	3.25
BM22 copy	**26710**	**12255**	2.17	2.45	2.63	2.81	3.05	3.23
Murarrie Road Weir	**26730**	**12235**	**Murarrie Road bridge and weir**					
BM22 copy	**26750**	**12215**	2.12	2.38	2.54	2.71	2.94	3.13
MHG-120	**26780**	**12185**	2.11	2.37	2.54	2.70	2.93	3.12
BM22 copy	**26940**	**12025**	2.09	2.35	2.51	2.67	2.89	3.08
Gateway Motorway	**26950**	**12015**	**Gateway Motorway**					
BM42AGHD copy	**26990**	**11975**	2.07	2.31	2.48	2.64	2.87	3.07
BM42A-mod	**27100**	**11865**	2.06	2.31	2.47	2.63	2.85	3.05
BM42AGHD copy	**27300**	**11665**	2.04	2.27	2.43	2.58	2.79	2.98
Murrarie_connection	**27305**	**11660**	2.04	2.27	2.43	2.58	2.79	2.98
BM42AGHD	**27355**	**11610**	2.03	2.26	2.41	2.56	2.77	2.96
BM43AGHD	**27755**	**11210**	1.93	2.14	2.29	2.44	2.65	2.85
LC	**27912**	**11053**	1.90	2.11	2.26	2.41	2.62	2.82
BM44AGHD	**28025**	**10940**	1.89	2.11	2.25	2.40	2.62	2.81
BM44BGHD	**28815**	**10150**	1.85	2.08	2.23	2.39	2.60	2.80
LC	**28855**	**10110**	1.85	2.08	2.23	2.39	2.60	2.80
LC	**28930**	**10035**	1.85	2.08	2.24	2.40	2.61	2.81
BM43BGHD	**29075**	**9890**	1.84	2.08	2.24	2.40	2.62	2.82

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
LC	**29150**	**9815**	1.84	2.08	2.24	2.40	2.62	2.82
LC	**29325**	**9640**	1.84	2.08	2.24	2.40	2.62	2.83
LC	**29420**	**9545**	1.84	2.08	2.24	2.40	2.62	2.83
LC	**29652**	**9313**	1.82	2.07	2.23	2.40	2.62	2.82
BM43CGHD	**29730**	**9235**	1.82	2.07	2.23	2.39	2.61	2.82
BM43CGHD	**30635**	**8330**	1.75	2.02	2.18	2.35	2.57	2.78
LC	**30800**	**8165**	1.73	1.99	2.15	2.32	2.55	2.75
BM45GHD	**31600**	**7365**	1.65	1.92	2.09	2.27	2.50	2.71
LC	**31740**	**7225**	1.64	1.90	2.08	2.26	2.49	2.71
BM46CGHD	**32110**	**6855**	1.57	1.83	2.01	2.20	2.45	2.67
BM46BGHD	**32355**	**6610**	1.54	1.82	2.00	2.19	2.44	2.66
LC	**32650**	**6315**	1.55	1.82	2.01	2.19	2.44	2.66
BM46AGHD	**33330**	**5635**	1.48	1.77	1.97	2.16	2.42	2.64
BM52 GHD copy	**34300**	**4665**	1.40	1.72	1.92	2.12	2.38	2.61
BM52 GHD copy	**34490**	**4475**	1.40	1.70	1.91	2.11	2.37	2.60
Cleveland Rail Bridge	**34500**	**4465**	**Cleveland Road Bridge and Weir**					
BM52 GHD	**34510**	**4455**	1.34	1.62	1.80	1.99	2.22	2.43
BM52 GHD copy	**34700**	**4265**	1.28	1.57	1.76	1.95	2.20	2.41
BM52 GHD	**35260**	**3705**	1.26	1.49	1.66	1.84	2.08	2.29
BM52 GHD copy	**35670**	**3295**	1.22	1.42	1.57	1.73	1.94	2.13
Lytton Road	**35680**	**3285**	**Lytton Road Bridge and Weir**					
BM6 copy	**35690**	**3275**	1.19	1.36	1.50	1.64	1.83	2.00
BM48	**35785**	**3180**	1.17	1.33	1.46	1.59	1.77	1.94
Bm4	**36370**	**2595**	1.14	1.27	1.37	1.48	1.64	1.79
BM3	**37040**	**1925**	1.09	1.19	1.27	1.35	1.47	1.59
BM2_copy	**37465**	**1500**	1.08	1.14	1.20	1.26	1.36	1.46
BM2	**38070**	**895**	1.04	1.07	1.11	1.15	1.21	1.27
BM1	**38610**	**355**	1.02	1.03	1.05	1.06	1.09	1.12
Brisbane River Boundry	**38965**	**0**	1.00	1.00	1.00	1.00	1.00	1.00
Bulimba-East Branch								
BE289	**0**	**6280**	55.58	55.71	55.77	55.83	55.90	55.93
BE289	**60**	**6220**	55.50	55.62	55.69	55.75	55.82	55.85
BE288	**170**	**6110**	54.48	54.64	54.70	54.76	54.83	54.84
BE287	**250**	**6030**	53.58	53.64	53.70	53.76	53.84	53.93
BE286	**388**	**5892**	52.91	53.09	53.19	53.27	53.38	53.39
BE285	**525**	**5755**	52.01	52.11	52.19	52.27	52.35	52.47
BE284	**612**	**5668**	51.07	51.16	51.23	51.29	51.35	51.44
HEC2146	**660**	**5620**	50.43	50.51	50.56	50.61	50.67	50.74
BE283	**708**	**5572**	50.13	50.22	50.27	50.32	50.38	50.44
HEC2030	**755**	**5525**	49.95	50.10	50.17	50.22	50.29	50.34
BE283 copy	**799**	**5481**	49.93	50.08	50.15	50.20	50.27	50.32
BE282US	**815**	**5465**	49.91	50.07	50.14	50.19	50.26	50.31

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
Beenleigh Road Culverts	**820**	**5460**	**Beenleigh Road culverts and weir**					
BE281DS	**835**	**5445**	49.49	49.80	49.95	50.07	50.22	50.27
BE280	**840**	**5440**	49.52	49.80	49.95	50.07	50.22	50.27
Beenleigh Rail Culverts			**Beenleigh Rail Culverts**					
BE279HEC	**844**	**5436**	49.52	49.80	49.95	50.07	50.22	50.27
BE278	**852**	**5428**	49.14	49.44	49.65	49.88	50.12	50.20
BE277-HEC	**875**	**5405**	49.12	49.42	49.64	49.87	50.11	50.19
Beenleigh Road Culvert-2	**876**	**5404**	**Beenleigh Road Pipe Culvert and Weir**					
BE_Rail bypass	**930**	**5350**	48.09	48.29	48.39	48.48	48.57	48.68
BE277-HEC DS	**946**	**5334**	48.07	48.27	48.37	48.45	48.55	48.66
BE277-A	**956**	**5324**	48.08	48.28	48.38	48.47	48.56	48.67
BE277-A copy	**978**	**5302**	48.07	48.26	48.36	48.45	48.54	48.65
XS-7450	**981**	**5299**	48.06	48.26	48.37	48.45	48.55	48.66
XS-7460	**991**	**5289**	48.04	48.24	48.34	48.43	48.53	48.64
Xs-7480	**1011**	**5269**	48.00	48.20	48.31	48.39	48.49	48.60
XS-7500	**1031**	**5249**	47.96	48.16	48.27	48.36	48.45	48.57
XS-7520	**1051**	**5229**	47.92	48.13	48.23	48.32	48.42	48.53
XS-7540	**1071**	**5209**	47.89	48.10	48.20	48.29	48.39	48.50
XS-7560	**1091**	**5189**	47.86	48.07	48.17	48.26	48.36	48.47
Xs-7580	**1111**	**5169**	47.84	48.04	48.15	48.23	48.33	48.44
Xs-7600	**1131**	**5149**	47.81	48.01	48.11	48.20	48.29	48.40
Xs-7620	**1151**	**5129**	47.76	47.97	48.07	48.15	48.25	48.36
XS-7640	**1171**	**5109**	47.70	47.90	48.00	48.09	48.19	48.29
XS-7660	**1191**	**5089**	47.57	47.76	47.86	47.94	48.03	48.14
XS-7680	**1211**	**5069**	47.33	47.54	47.64	47.73	47.83	47.94
Xs-7700	**1231**	**5049**	47.22	47.43	47.53	47.61	47.71	47.81
XS-7720	**1251**	**5029**	47.09	47.28	47.37	47.45	47.54	47.64
XS-7740	**1271**	**5009**	46.89	47.06	47.14	47.21	47.30	47.39
XS-7760	**1291**	**4989**	46.66	46.82	46.91	46.98	47.07	47.16
Xs-7780	**1311**	**4969**	46.46	46.65	46.74	46.81	46.91	47.00
XS-7800	**1331**	**4949**	46.38	46.55	46.64	46.72	46.82	46.90
Xs-7810	**1341**	**4939**	46.36	46.54	46.63	46.71	46.81	46.90
BE273	**1355**	**4925**	46.34	46.51	46.60	46.68	46.78	46.87
BE_Rail Bypass	**1380**	**4900**	46.29	46.44	46.53	46.61	46.71	46.80
BE272	**1498**	**4782**	45.85	45.95	46.01	46.08	46.17	46.23
BE272	**1565**	**4715**	45.38	45.49	45.56	45.63	45.71	45.77
BE271_ALS	**1600**	**4680**	45.23	45.35	45.42	45.49	45.56	45.64
BE270	**1730**	**4550**	44.40	44.61	44.72	44.81	44.93	45.03
BE269	**1915**	**4365**	43.64	43.89	44.03	44.15	44.31	44.43
BE268	**2020**	**4260**	43.01	43.30	43.46	43.59	43.77	43.91
BE267	**2145**	**4135**	42.38	42.61	42.75	42.87	43.02	43.14
BE266	**2245**	**4035**	41.77	41.92	42.02	42.11	42.23	42.32
BE265	**2410**	**3870**	40.56	40.70	40.78	40.87	40.97	41.06
BE264	**2500**	**3780**	40.00	40.14	40.20	40.27	40.35	40.42
BE263	**2605**	**3675**	38.78	38.99	39.10	39.20	39.42	39.53
BE262	**2765**	**3515**	37.25	37.63	37.89	38.15	38.59	38.73
Underwood Road Culverts	**2767**	**3513**	**Underwood Road Culverts and Weir**					
BE261	**2785**	**3495**	37.22	37.56	37.78	37.98	38.43	38.59

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
BE259	**2990**	**3290**	36.56	36.86	37.04	37.20	37.38	37.56
BE258	**3200**	**3080**	35.30	35.64	35.82	35.97	36.12	36.29
BE257	**3320**	**2960**	34.59	34.93	35.11	35.24	35.36	35.50
Gateway Motorway Culverts	**3330**	**2950**	**Gateway Motorway Culverts and Weir**					
BE257 copy	**3425**	**2855**	34.58	34.91	35.09	35.22	35.35	35.49
BE256	**3490**	**2790**	34.28	34.58	34.76	34.89	35.01	35.13
BE255	**3670**	**2610**	32.75	32.97	33.12	33.24	33.41	33.60
BE255 copy	**3695**	**2585**	32.41	32.63	32.79	32.94	33.15	33.38
BE255 copy -mod	**3725**	**2555**	31.76	32.06	32.32	32.57	32.88	33.19
Trib_B_start	**3726**	**2554**	31.75	32.08	32.35	32.59	32.89	33.20
BE254 copy	**3735**	**2545**	31.69	32.08	32.37	32.66	32.96	33.23
BE254	**3745**	**2535**	31.68	32.08	32.36	32.67	32.98	33.26
Logan Road Culvert	**3748**	**2532**	**Logan Road Culvert and Weir**					
BE253	**3785**	**2495**	31.15	31.43	31.62	31.81	32.04	32.22
Interpolated	**3810**	**2470**	31.14	31.43	31.62	31.80	32.02	32.21
Trib_B_end	**3888**	**2392**	31.11	31.39	31.58	31.77	31.99	32.18
BE251	**3925**	**2355**	31.06	31.34	31.53	31.73	31.96	32.14
Be250	**4020**	**2260**	30.76	31.06	31.30	31.53	31.80	32.00
BE249	**4110**	**2170**	30.26	30.70	31.05	31.35	31.65	31.85
BE248	**4230**	**2050**	30.08	30.59	30.97	31.30	31.60	31.81
Trib A_DS	**4284**	**1996**	30.07	30.58	30.97	31.29	31.60	31.80
BE247	**4300**	**1980**	30.04	30.56	30.96	31.28	31.59	31.80
Pacific Motorway Culverts	**4305**	**1975**	**Pacific Motorway Culverts**					
BE247 copy	**4360**	**1920**	29.74	30.04	30.21	30.39	30.64	30.86
BE246	**4419**	**1861**	29.45	29.79	29.98	30.17	30.42	30.66
BE246A-ALS	**4507**	**1773**	28.99	29.34	29.53	29.73	30.01	30.26
Old4612	**4602**	**1678**	28.51	28.86	29.04	29.28	29.63	29.92
Eight Mile Plains Bridge	**4608**	**1672**	**Eight Mile Plains Busway Access Road Bridge and Weir**					
Copy Old 4612	**4638**	**1642**	28.15	28.57	28.81	29.06	29.39	29.69
BE244	**4656**	**1624**	28.09	28.51	28.75	28.99	29.33	29.63
Miles Platting Road Bridge	**4660**	**1620**	**Miles Platting Road Bridge and Weir**					
Old 4665	**4695**	**1585**	28.04	28.43	28.65	28.87	29.17	29.44
Old 4685	**4730**	**1550**	27.90	28.27	28.47	28.68	28.96	29.22
Old 4705	**4750**	**1530**	27.89	28.27	28.49	28.70	28.99	29.25
BE241	**4870**	**1410**	27.65	28.02	28.23	28.45	28.74	29.00
BE240	**4980**	**1300**	27.33	27.72	27.95	28.18	28.48	28.76
Gateway Off-ramp	**5010**	**1270**	**Gateway Off-ramp Bridge and Weir**					
BE239	**5050**	**1230**	27.09	27.42	27.60	27.79	28.03	28.24
BE238	**5175**	**1105**	26.76	27.08	27.26	27.45	27.69	27.90
BE236	**5330**	**950**	25.97	26.35	26.55	26.74	27.02	27.24
BE235	**5470**	**810**	24.98	25.47	25.73	25.95	26.27	26.53
BE232	**5712**	**568**	24.08	24.50	24.74	24.96	25.26	25.52
BE231	**5810**	**470**	23.79	24.20	24.44	24.66	24.95	25.21
BE230	**5895**	**385**	23.45	23.85	24.10	24.32	24.63	24.88
BE229	**5975**	**305**	23.14	23.58	23.85	24.09	24.40	24.66

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
BE228	**6055**	**225**	22.91	23.39	23.68	23.93	24.24	24.51
BE227	**6135**	**145**	22.75	23.23	23.54	23.79	24.10	24.36
BE227	**6280**	**0**	22.62	23.10	23.41	23.66	23.97	24.23
Tributary A			**Tributary A**					
ALS1-copy	**0**		51.96	52.32	52.47	52.60	52.76	52.82
ALS1-copy	**100**		51.71	52.06	52.20	52.31	52.45	52.65
ALS1	**320**		50.81	51.07	51.18	51.33	51.48	51.67
ALS2	**600**		46.69	46.88	47.03	47.16	47.35	47.58
BE-1060	**950**		44.85	45.02	45.08	45.13	45.19	45.27
BE-1040	**1400**		41.05	41.19	41.28	41.37	41.46	41.52
BE-1030	**1770**		37.23	37.45	37.58	37.71	37.87	38.04
BE-1020	**2070**		34.79	35.16	35.45	35.75	36.09	36.54
School Road	**2072**		**School Road to Freeway Culverts and Weir**					
interpolated	**2125**		34.71	35.00	35.18	35.33	35.52	35.68
Interpolated	**2163**		34.66	34.95	35.13	35.28	35.47	35.62
BE-1010	**2235**		34.20	34.52	34.72	34.89	35.09	35.25
BE-1005	**2535**		32.19	32.60	32.90	33.19	33.57	33.77
Freeway Off-ramp	**2545**		**Freeway Off-ramp Culverts and Weir**					
BE-1005	**2555**		32.12	32.51	32.74	32.96	33.25	33.45
BE1005 copy	**2735**		31.17	31.52	31.76	32.04	32.38	32.66
BE1000	**2765**		30.47	30.98	31.38	31.78	32.19	32.50
Gateway Motor way	**2805**		**Gateway Motorway Culverts and Weir**					
BE1000 modified	**2935**		30.42	30.92	31.30	31.65	31.98	32.19
BE1000 modified	**3015**		30.09	30.60	30.99	31.32	31.64	31.84
BE1000 modified	**3021**		30.07	30.58	30.97	31.29	31.60	31.80
Tributary A1			**Tributary A1**					
A1-1050	**0**		49.72	50.01	50.16	50.28	50.42	50.47
A1-1050	**280**		48.91	49.11	49.21	49.30	49.42	49.43
ALS	**500**		44.50	44.65	44.74	44.83	44.94	44.96
ALS	**720**		41.06	41.20	41.30	41.38	41.48	41.54
ALS	**750**		41.05	41.19	41.28	41.37	41.46	41.52
Tributary A2			**Tributary A2**					
TRIB_A2	**0**		44.93	45.07	45.13	45.18	45.25	45.27
SMP	**80**		44.55	44.66	44.72	44.76	44.82	44.83
SMP	**475**		40.27	40.36	40.44	40.51	40.59	40.71
SMP	**690**		38.69	38.80	38.87	38.92	38.99	39.08
SMP	**1035**		34.66	34.96	35.13	35.29	35.47	35.63
SMP	**1042**		34.66	34.95	35.13	35.28	35.47	35.62
Tributary B			**Tributary B**					
BE2030	**1000**		36.12	36.37	36.51	36.80	36.88	36.91
BE2030	**1055**		35.09	35.44	35.63	35.71	35.99	36.04
Dance Court 1	**1062**		**Dance Court Culvert and Weir**					
BE2030 copy	**1075**		34.56	34.85	34.98	35.07	35.21	35.24
BE2020	**1215**		34.33	34.51	34.61	34.69	34.78	34.83
BE2020 copy	**1340**		33.36	33.51	33.64	33.74	33.84	33.96
Interpolated	**1360**		33.27	33.41	33.52	33.62	33.72	33.84

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	**5 yr**	**10yr**	**20 yr**	**50 yr**	**100 yr**
Logan Road Culverts	**1361**		**Logan Road Culverts and Weir**					
BE2010	**1394**		32.92	33.02	33.09	33.15	33.23	33.35
BE2000	**1432**		31.16	31.43	31.61	31.79	32.01	32.19
BE2000	**1492**		31.11	31.39	31.58	31.77	31.99	32.18
Tributary C			**Tributary C**					
BE-3050	**0**		49.14	49.23	49.27	49.31	49.36	49.37
BE-3050	**10**		49.09	49.15	49.19	49.23	49.28	49.34
BE-3040	**390**		46.73	46.86	46.94	47.00	47.08	47.13
BE-3030	**545**		45.48	45.57	45.64	45.70	45.77	45.80
BE-3020	**665**		44.29	44.41	44.49	44.57	44.66	44.74
BE-3010	**810**		42.62	42.75	42.84	42.92	43.02	43.10
BE3000	**1000**		39.21	39.37	39.47	39.56	39.65	39.73
BE-3000 copy	**1005**		38.50	38.50	38.50	38.55	38.95	39.11
Gateway Culvert	**1008**		**Gateway Pipe Culvert and Weir**					
BE3000 copy	**1100**		37.58	37.97	38.22	38.48	38.90	39.04
ALS	**1110**		37.58	37.98	38.22	38.49	38.91	39.05
ALS	**1120**		37.58	37.97	38.22	38.48	38.91	39.04
Tributary B1			**Tributary B1**					
ALS	**1000**		33.27	33.41	33.52	33.62	33.72	33.84
ALS	**1002**		33.17	33.30	33.42	33.51	33.61	33.74
ALS	**1020**		31.99	32.19	32.37	32.62	32.92	33.23
ALS	**1055**		31.75	32.08	32.35	32.60	32.90	33.21
ALS	**1140**		31.75	32.08	32.35	32.59	32.89	33.22
ALS	**1145**		31.75	32.08	32.35	32.59	32.89	33.20
Padstow Branch			**Padstow Branch**					
BM177	**0**		34.27	34.52	34.71	34.92	35.17	35.35
BM177	**32**		34.21	34.47	34.66	34.88	35.14	35.32
BM177-176ALS	**105**		33.89	34.25	34.52	34.79	35.08	35.26
BM176-US-ALS	**175**		33.52	34.10	34.43	34.74	35.04	35.23
Padstow Road			**Padstow Road Culverts and Weir**					
BM176-DS-ALS	**205**		33.42	33.82	34.01	34.20	34.46	34.68
BM175	**258**		33.37	33.79	33.97	34.17	34.44	34.67
BM175-174ALS	**325**		33.27	33.72	33.92	34.13	34.41	34.64
BM174	**352**		33.23	33.70	33.91	34.12	34.40	34.63
BM175	**375**		33.21	33.68	33.89	34.11	34.39	34.62
Garden City			**Garden City Branch**					
BM169	**5280**		29.94	30.45	30.75	31.16	31.81	32.34
BM169	**5285**		29.94	30.44	30.74	31.16	31.81	32.34
BM168	**5405**		29.78	30.26	30.54	30.99	31.70	32.25
BM167	**5510**		29.43	29.99	30.35	30.86	31.61	32.19
BM165 copy	**5615**		29.09	29.81	30.24	30.80	31.57	32.16
BM165 copy	**5715**		28.80	29.37	29.78	30.24	30.72	30.98
Bm165	**5730**		28.76	29.35	29.77	30.23	30.72	30.97
XS5-Logan Road survey	**5785**		28.51	29.18	29.66	30.16	30.67	30.92

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	5 yr	10yr	20 yr	50 yr	100 yr
Logan Road	**5790**		**Logan Road culverts**					
XS4-logan-survey	**5850**		28.43	28.98	29.27	29.54	29.90	30.20
XS4 copy	**5935**		28.38	28.93	29.22	29.48	29.82	30.08
XS4 copy	**5938**		28.38	28.93	29.22	29.48	29.82	30.07
Mimosa Creek			**Mimosa Creek**					
Start of model	**0**	**58880**	54.81	55.08	55.22	55.35	55.51	55.56
Mi 40_Hecras	**5**	**58875**	54.79	55.06	55.20	55.32	55.47	55.53
Mi 40a	**96**	**58784**	54.32	54.55	54.67	54.77	54.91	54.95
Mi39	**200**	**58680**	53.60	53.75	53.88	54.00	54.14	54.25
MI38	**330**	**58550**	52.68	52.89	53.03	53.15	53.29	53.44
Mi37	**484**	**58396**	51.23	51.63	51.57	51.69	51.83	52.01
Mi36	**506**	**58374**	50.98	51.33	51.30	51.42	51.57	51.74
Mi35	**558**	**58322**	50.55	50.93	50.90	51.02	51.17	51.32
Mi34	**660**	**58220**	49.88	50.30	50.27	50.38	50.52	50.64
Mi33	**696**	**58184**	49.64	50.10	50.07	50.18	50.31	50.45
Mi32	**811**	**58069**	48.95	49.56	49.49	49.65	49.83	49.97
Mi31	**952**	**57928**	48.33	48.85	48.77	48.94	49.14	49.24
Mi31-copy	**1037**	**57843**	47.88	48.33	48.27	48.42	48.61	48.71
Mi29	**1186**	**57694**	46.79	47.31	47.26	47.41	47.60	47.76
Mi28	**1302**	**57578**	46.02	46.71	46.63	46.83	47.07	47.28
Mi27	**1322**	**57558**	45.88	46.62	46.54	46.75	46.99	47.21
Mi26	**1366**	**57514**	45.78	46.54	46.45	46.67	46.91	47.13
Mi25	**1439**	**57441**	45.58	46.32	46.24	46.45	46.69	46.89
Mi24	**1549**	**57331**	44.86	45.64	45.53	45.78	46.01	46.19
Mi23	**1588**	**57292**	44.68	45.48	45.37	45.62	45.86	46.04
Mi22	**1719**	**57161**	44.11	44.82	44.75	44.97	45.21	45.36
Mi21-2	**1738**	**57142**	43.95	44.64	44.57	44.82	45.11	45.27
Nagel Street Bridge	**1739**	**57141**	**Nagel Street Bridge and Weir**					
Mi21-1	**1752**	**57128**	43.85	44.49	44.44	44.61	44.92	45.11
Mi20	**1762**	**57118**	43.74	44.40	44.35	44.53	44.82	45.02
Mi19	**1882**	**56998**	43.10	43.77	43.71	43.92	44.23	44.48
Mi19-4	**1892**	**56988**	43.07	43.75	43.68	43.89	44.20	44.45
Pacific Motorway Culverts	**1895**	**56985**	**Pacific Motorway Culverts**					
Mi19-1	**1964**	**56916**	42.67	43.21	43.24	43.42	43.65	43.85
Mi18	**2023**	**56857**	42.42	42.85	42.93	43.10	43.31	43.51
Mi17	**2086**	**56794**	41.96	42.40	42.48	42.67	42.89	43.08
Mi16	**2133**	**56747**	41.59	42.12	42.21	42.43	42.68	42.89
Mi15	**2224**	**56656**	40.95	41.46	41.54	41.78	42.06	42.26
Mi13-3	**2248**	**56632**	40.81	41.34	41.43	41.70	41.99	42.19
Kessels Road Bridge	**2255**	**56625**	**Kessels Road Bridge and weir**					
Mi13-2	**2284**	**56596**	40.77	41.27	41.35	41.54	41.75	41.93
Mi13	**2325**	**56555**	40.65	41.13	41.21	41.39	41.60	41.77
Mi12	**2516**	**56364**	39.62	40.05	40.13	40.32	40.55	40.74
Mi11	**2635**	**56245**	38.87	39.33	39.42	39.62	39.87	40.07
Parkway Street Bridge	**2648**	**56232**	**Parkway Street bridge and weir**					
Mi10-2	**2664**	**56216**	38.79	39.19	39.28	39.45	39.67	39.84

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	**5 yr**	**10yr**	**20 yr**	**50 yr**	**100 yr**
Mi9	**2718**	**56162**	38.59	38.95	39.03	39.20	39.40	39.57
Mi8	**2828**	**56052**	37.88	38.29	38.39	38.59	38.81	38.97
Mi7	**2955**	**55925**	37.40	37.90	38.03	38.23	38.47	38.62
Mi6	**3069**	**55811**	37.06	37.56	37.68	37.86	38.08	38.24
Mi5	**3221**	**55659**	36.49	36.97	37.09	37.26	37.44	37.61
Mi4	**3388**	**55492**	35.79	36.29	36.44	36.64	36.88	37.07
Mi3	**3496**	**55384**	35.41	35.86	36.01	36.22	36.46	36.65
Mi2	**3585**	**55295**	35.08	35.48	35.61	35.80	36.02	36.19
Mi1	**3801**	**55079**	33.96	34.38	34.52	34.70	34.94	35.12
Bulimba Main merge	**3880**	**55000**	33.23	33.71	33.92	34.14	34.43	34.66
Minnippi Bypass Branch			**MinnippiBypass Branch**					
Start	**0**		2.78	3.19	3.45	3.69	4.00	4.25
Minnippi_new1	**80**		2.78	3.16	3.40	3.64	3.96	4.22
Minnippi_new2	**125**		2.78	3.15	3.40	3.64	3.96	4.21
Minnippi_new3	**230**		2.77	3.12	3.36	3.61	3.94	4.19
Minnippi_new4	**400**		2.77	3.05	3.31	3.58	3.92	4.18
Minnippi_new5	**542**		2.76	3.00	3.27	3.55	3.90	4.17
ALS	**650**		2.76	2.97	3.26	3.54	3.89	4.16
Stanton Road	**710**		**Stanton Road overflow**					
New_A	**720**		2.56	2.95	3.22	3.47	3.77	3.98
New_B	**730**		2.24	2.93	3.20	3.45	3.75	3.96
Minnippi_new6-US	**745**		2.24	2.93	3.20	3.45	3.76	3.97
Gateway Motorway	**748**		**Gateway Motorway Culverts**					
Minnippi_new7-DS	**810**		2.24	2.93	3.19	3.41	3.66	3.85
New_E	**825**		2.24	2.92	3.18	3.40	3.65	3.83
New_G	**860**		2.23	2.90	3.15	3.38	3.62	3.81
New_7a	**870**		2.01	2.88	3.14	3.36	3.62	3.80
Minnippi_new8	**945**		1.92	2.61	2.88	3.13	3.42	3.62
BM31GHD-mod	**1015**		1.87	2.43	2.71	2.99	3.32	3.53
BM31GHD-mod	**1115**		1.85	2.31	2.60	2.89	3.25	3.47
Wynnum Road			**Wynnum Road Bridge**					
BM31-GHD copy	**1150**		1.85	2.22	2.41	2.58	2.78	2.96
BM36GHD copy	**1310**		1.84	2.16	2.34	2.51	2.72	2.91
Minnippi_new11	**1560**		1.84	2.11	2.28	2.45	2.67	2.86
BM42BGHD	**1850**		1.84	2.09	2.25	2.41	2.64	2.84
BM42BGHD	**2004**		1.84	2.08	2.24	2.40	2.62	2.83
Murrarie Bypass			**Murrarie Bypass Branch**					
ALS	**0**		2.19	2.47	2.66	2.84	3.08	3.26
MU1_ALS	**20**		2.19	2.47	2.65	2.83	3.08	3.26
ALS	**35**		2.18	2.46	2.65	2.82	3.07	3.24
New_MU2_ALS	**160**		2.17	2.46	2.64	2.82	3.06	3.24
New_MU3_ALS	**275**		2.16	2.45	2.64	2.82	3.06	3.24
Murrarie Road	**280**		**Murarrie Road Bridge**					
Copy_new_MU3	**310**		2.16	2.45	2.63	2.81	3.06	3.23
New_MU5_ALS	**390**		2.15	2.44	2.63	2.81	3.05	3.23

Branch name & Cross section ID	MIKE11 Chainage (m)	AMTD(m)	Design Event flood levels (Ultimate) in mAHD					
			2 yr	**5 yr**	**10yr**	**20 yr**	**50 yr**	**100 yr**
Mu_6_ALS	**470**		2.13	2.43	2.62	2.80	3.05	3.23
Gateway M'way	**475**		**Gateway M'way ME Culverts**					
MU_7_ALS	**545**		2.06	2.29	2.44	2.59	2.80	2.99
MU_9_ALS	**595**		2.05	2.29	2.44	2.59	2.80	2.99
MU5_ALS	**640**		2.04	2.27	2.43	2.58	2.79	2.98
End of branch	**650**		2.04	2.27	2.43	2.58	2.79	2.98
Bulimba East Rail Bypass			**Bulimba East Rail Bypass**					
BE276	**0**		48.09	48.29	48.39	48.48	48.57	48.68
BE276	**33**		48.00	48.22	48.32	48.41	48.50	48.60
BE275	**144**		47.80	47.80	47.80	47.80	47.84	47.94
BE274	**226**		46.94	47.05	47.21	47.36	47.53	47.70
BE273 US	**347**		46.86	46.95	47.13	47.28	47.46	47.62
BE273 DS	**443**		46.56	46.61	46.75	46.86	46.98	47.10
BE273A	**488**		46.39	46.44	46.53	46.61	46.73	46.82
BE273A	**520**		46.29	46.44	46.53	46.61	46.71	46.80
Kianawah Park Branch			**Kianawah Park Branch**					
	0		2.67	2.81	2.89	3.09	3.33	3.50
WY-1 ALS	**48**		2.65	2.77	2.87	3.09	3.33	3.50
WY-2 ALS	**210**		2.56	2.66	2.87	3.09	3.33	3.50
WY-3 ALS	**260**		2.55	2.65	2.87	3.09	3.33	3.50
WY-4 ALS	**340**		2.51	2.63	2.87	3.09	3.33	3.50
WY-5 ALS	**430**		2.48	2.63	2.87	3.09	3.33	3.50
WY-6 ALS	**530**		2.47	2.63	2.87	3.09	3.33	3.50
WY-7 ALS	**660**		2.44	2.63	2.87	3.09	3.33	3.50
WY-8 ALS	**780**		2.40	2.63	2.87	3.09	3.33	3.50
WY-9 ALS	**860**		2.27	2.63	2.87	3.09	3.33	3.50
WY-10 ALS	**945**		2.13	2.62	2.87	3.09	3.33	3.50
WY-11 ALS	**985**		1.99	2.62	2.89	3.13	3.42	3.63
End	**1006**		1.94	2.62	2.89	3.13	3.42	3.63

Appendix I-2 Anticipated Peak Design Flood Levels & Flood Discharges

Table I2: Estimated Peak Design Flood Discharges

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
Bulimba Creek:Compton Road to Nemies Road								
0	39900	Start	25.8	37.1	44.0	50.6	59.7	63.7
65	39835	BM222	25.0	36.2	43.0	49.5	58.5	62.2
175	39725	Bm221	22.9	34.2	40.9	47.3	56.1	59.2
270	39630	BM220	20.3	31.5	37.8	43.9	52.3	54.6
415	39485	BM219	29.2	38.3	46.5	54.5	65.2	73.3
560	39340	BM218	38.0	48.5	57.4	66.2	77.8	94.9
736	39164	BM217	38.9	51.2	60.4	69.4	81.5	97.4
900	39000	BM216	39.1	53.3	63.3	72.9	85.8	99.9
935	38965	End	47.5	64.9	77.8	89.8	105.3	124.2
Bulimba Creek-Main Branch								
0	38965	Start	47.5	64.9	77.8	89.8	105.3	124.2
10	38955	BM 214	46.0	62.6	74.5	86.1	101.4	118.8
17	**38948**		**Nemies Road Culverts**					
40	38925	BM214 copy	46.6	63.60	75.7	87.5	103.2	120.7
120	38845	BM213	45.4	62.65	74.6	86.3	101.8	118.5
215	38750	BM212	45.7	63.78	76.0	88.0	104.0	120.7
355	38610	BM211	38.8	57.66	69.1	80.3	95.4	108.3
370	**38595**		**Brandon Road Culverts**					
385	38580	BM211-copy	44.9	65.9	79.1	92.1	109.4	125.7
470	38495	BM 209	40.3	60.3	73.0	85.7	102.3	115.1
540	38425	BM 208	41.5	57.9	70.5	83.5	100.4	111.6
600	38365	BM 207	43.9	58.5	71.6	85.3	103.4	114.5
740	38225	BM 206	41.4	55.3	65.0	73.8	86.8	100.4
800	38165	BR_1	41.2	55.4	65.2	74.1	85.9	100.9
805	**38160**		**Weir downstream of Brandon _Road**					
825	38140	BR_2	41.8	56.5	66.5	75.7	87.8	103.1
840	38125	BM 205	45.1	61.1	72.1	82.3	95.6	112.1
890	38075	BR_3	40.8	55.9	66.0	75.2	87.3	102.2
905	38060	BR_4	44.4	61.0	72.1	82.4	95.9	112.2
942	38023	BR_5	41.3	57.3	67.7	77.4	90.0	105.1
960	38005	BR_5copy	43.4	60.5	71.5	81.9	95.5	111.4
990	37975	BM204	44.0	61.8	73.2	83.9	97.9	114.1
1075	37890	BM 203	40.6	59.0	70.2	80.8	94.8	110.1
1160	37805	BM 202	40.6	58.5	70.6	82.2	97.5	112.8
1300	37665	BM 201	40.2	53.0	63.8	76.1	92.4	106.3
1365	37600	BM 200	44.0	58.7	71.0	85.2	104.2	120.1
1545	37420	BM 199	46.1	63.8	74.8	88.3	109.4	125.4
1670	37295	BM 198	45.0	63.7	75.8	87.3	103.7	118.7
1800	37165	BM340-MHG	41.8	57.7	71.7	84.7	100.5	116.4
1830	37135	BM 197	43.1	58.7	73.9	87.7	104.6	121.0
1845	**37120**		**Beenleigh Road weir**					
1860	37105	BM 197 Copy	43.4	58.9	74.1	88.4	105.8	122.4
1900	37065	BM195-I	43.1	58.9	72.9	87.6	105.3	121.9
1940	37025	BM 194	42.4	58.4	70.6	85.8	103.8	120.2
1960	37005	BM194 copy	44.3	61.3	74.2	90.3	109.3	126.4

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	**5 year**	**10 year**	**20 year**	**50 year**	**100 year**
1960	37005	BM 194 copy	44.3	61.3	74.2	90.3	109.3	126.4
2045	36920	BM 192	42.6	59.3	69.9	84.7	102.1	117.6
2115	36850	BM 191 copy	40.6	55.4	65.9	75.5	91.5	105.4
2117	**36848**	**St Lawrences Foot Bridge**						
2125	36840	BM 191	43.9	59.8	71.3	82.4	100.0	115.2
2255	36710	BM190	40.5	53.2	64.4	75.7	91.0	107.8
2370	36595	BM188-6 copy	38.4	51.9	62.2	71.8	87.1	104.4
2375	**36590**	**Altandi Street Foot Bridge & Weir**						
2380	36585	BM188-6	40.8	55.4	66.3	77.2	94.7	113.2
2470	36495	BM188-2	42.2	57.8	69.4	80.5	99.2	118.8
2500	36465	BM188-1	45.2	62.0	74.5	87.9	108.3	129.4
2670	36295	BM187	43.6	59.8	72.5	84.4	102.5	123.2
2785	36180	BM186	44.3	60.3	73.6	86.1	103.0	123.5
2985	35980	BM185	43.8	59.4	72.3	85.5	103.1	119.2
3165	35800	BM184	43.1	59.5	71.2	84.9	103.3	120.6
3295	35670	BM183	43.3	60.0	72.1	84.9	104.0	122.3
3435	35530	BM182	43.8	60.0	72.7	84.3	104.0	123.1
3625	35340	BM181	43.6	59.1	72.3	84.3	102.1	121.5
3765	35200	MHG320	43.1	58.5	71.2	83.8	100.3	118.8
3800	35165	BM180	45.5	62.0	76.0	89.4	107.4	127.6
3960	35005	BM179	48.9	67.5	82.7	97.9	118.5	140.5
3970	34995	BM179 copy	50.7	70.0	86.4	102.2	124.4	147.3
4150	34815	BM178	50.4	70.5	85.9	102.3	125.1	145.6
4150	34815	BM179	21.4	29.6	37.2	46.4	57.6	63.7
4260	34705	BM177	21.3	29.7	37.5	46.3	58.0	64.5
4320	34645	BM177A	21.3	29.8	37.7	46.3	58.1	64.9
4375	34590	LC	21.5	29.9	37.8	46.3	58.3	65.2
4385	34580	BM176_US	21.5	30.0	37.9	49.2	71.5	87.3
4415	34550	BM176_DS	21.6	30.1	38.0	49.3	71.6	87.5
4460	34505	BM 175	35.5	51.1	60.4	70.8	84.2	99.9
4515	34450	BM175-174	33.3	47.9	56.6	66.3	82.1	65.3
4555	34410	LC	32.0	45.2	53.6	62.8	82.6	87.1
4555	34410	LC	66.7	100.2	117.5	142.1	181.6	87.3
4575	34390	LC	66.6	100.1	117.4	142.0	181.5	99.7
4575	34390	LC	89.3	134.5	160.0	189.1	232.7	97.9
4590	34375	BM 174	89.3	134.5	160.0	189.1	232.7	98.5
4700	34265	BM173-BM174	89.3	134.1	159.9	189.2	232.6	214.2
4765	34200	Interpolated	89.3	134.1	159.9	189.2	232.6	214.1
4780	34185	BM173	89.3	134.1	159.9	189.2	232.6	270.3
4785	**34180**	**Blesby Road Foot Bridge & Weir**						
4790	34175	BM 173 copy	89.3	134.1	159.9	189.2	232.6	270.2
4905	34060	BM172	89.3	134.3	159.9	189.2	232.5	270.0
4995	33970	BM171	89.2	134.4	159.8	189.1	232.3	269.7
5120	33845	BM170	90.6	136.5	162.6	192.3	235.9	273.5
5280	33685	LC	92.4	139.1	166.0	195.9	239.6	277.7

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
5280	33685	LC	70.0	99.0	112.3	130.9	156.8	178.9
5285	33680	BM169	70.0	99.0	112.3	130.9	156.8	178.8
5405	33560	LC	69.8	98.7	111.8	130.0	155.3	177.2
5405	33560	LC	69.8	102.6	121.7	138.9	162.3	181.9
5520	33445	BM167	69.8	102.2	121.3	138.1	161.1	180.7
5520	33445	LC	69.8	102.2	121.3	134.3	151.3	168.2
5615	33350	LC	69.8	101.9	121.2	133.6	151.0	168.1
5615	33350	LC	69.8	101.9	121.2	140.4	171.7	199.1
5715	33250	LC	69.8	101.4	121.1	140.1	171.5	199.0
5715	33250	LC	69.8	100.1	119.2	139.9	174.4	196.3
5730	33235	BM165	69.8	100.1	119.1	139.9	174.3	196.2
5785	33180	LC	69.7	100.1	119.0	139.7	174.2	196.1
5785	33180	LC	69.7	100.1	119.0	136.0	147.6	150.1
5845	33120	Xsec4	69.7	100.0	118.8	135.7	147.2	148.9
5902	33063	Xsec3	69.7	99.9	118.7	135.7	147.0	148.6
5918	33047	Xsec2	69.7	99.8	118.7	135.7	147.0	148.6
5935	33030	Xsec1	69.6	99.8	118.8	135.7	147.1	148.7
5938	33027	Garden City	69.6	99.8	118.8	135.7	147.1	148.8
5938	33027	Garden City	91.8	136.4	163.3	191.4	233.0	271.4
5985	32980	HEC2937	91.8	136.3	163.3	191.5	233.2	271.3
6050	32915	BM157	91.8	136.3	163.4	191.5	233.4	271.0
6160	32805	BM156	94.3	139.9	168.0	196.8	239.7	279.2
6240	32725	BM155	96.2	142.5	171.7	200.7	244.6	285.1
6340	32625	BM154	96.2	142.4	171.5	200.7	244.5	284.6
6450	32515	BM153_ALS	96.1	142.2	171.4	200.7	244.6	284.0
6650	32315	BM151	96.0	141.7	171.4	200.6	244.4	284.0
6860	32105	BM149	96.0	141.6	171.2	200.6	242.2	282.4
6930	32035	BM148-BM147	98.0	141.1	171.2	199.1	250.4	298.1
6935	**32030**	**Craig Street Foot Bridge &Weir**						
6945	32020	BM148 copy	97.4	141.3	171.2	199.3	248.2	295.0
6985	31980	BM148	96.2	141.8	171.1	200.2	246.3	284.0
7185	31780	BM146	95.8	141.5	170.9	199.8	243.5	283.7
7420	31545	BM144	95.9	141.3	170.8	200.0	243.4	283.4
7490	31475	BM143	95.9	141.3	170.9	200.1	243.3	283.3
7600	31365	ALS-142	97.5	143.4	173.9	203.6	247.1	287.8
7735	31230	BM141	99.4	146.1	177.6	207.9	252.3	293.4
7915	31050	BM139	99.8	146.6	178.2	208.5	253.1	293.7
7985	30980	BM138	100.0	147.1	178.7	209.0	253.6	294.3
8070	30895	BM137	100.9	148.3	179.8	210.1	254.7	295.6
8070	30895	Bulimba East	181.5	255.4	313.2	362.9	434.3	500.6
8200	30765	BM136	181.1	255.2	312.8	362.7	434.2	500.5
8325	30640	BM135	180.6	254.9	312.4	362.5	434.1	500.3
8475	30490	BM134	179.9	254.4	311.8	362.2	433.8	500.0
8555	30410	MHG 260	179.5	254.2	311.5	362.0	433.6	499.8
8570	30395	BM132	179.5	254.1	311.4	362.0	433.5	499.8

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
8780	30185	BM131	179.1	253.1	310.2	361.1	432.7	498.8
8840	30125	BM130	179.1	252.9	310.3	360.7	432.3	498.3
8950	30015	BM129	179.1	253.0	310.3	359.9	431.1	496.9
9115	29850	BM127	181.4	256.5	314.5	364.9	436.7	502.7
9215	29750	BM126	182.5	258.4	316.7	367.7	440.1	506.8
9365	29600	BM126a	181.3	257.5	315.7	366.9	439.7	506.5
9530	29435	BM126b	180.1	256.1	314.0	365.5	438.8	505.9
9670	29295	BM122	180.0	255.4	313.0	364.3	438.1	505.2
9765	29200	BM121	179.9	255.5	313.1	363.8	437.6	504.7
9890	29075	BM119	179.7	255.6	313.3	363.9	437.0	503.8
9920	29045	BM118	181.0	257.4	315.5	366.5	440.1	507.4
10100	28865	BM117	188.2	268.1	328.5	382.0	458.4	528.4
10205	28760	BM116	187.6	267.9	328.3	382.0	457.2	527.2
10315	28650	BM115	186.9	267.6	328.0	381.8	457.3	526.5
10400	28565	BM114	188.1	269.2	330.1	384.4	460.6	529.9
10510	28455	BM112	189.7	271.2	332.7	387.8	464.7	534.2
10575	28390	BM111	189.7	271.0	332.5	387.6	464.6	534.3
10685	28280	BM110	189.7	270.5	332.0	387.2	464.4	534.2
10702	**28263**		**Mt Gravatt Capalaba Road**					
10725	28240	BM110 copy	189.7	270.4	331.8	387.1	464.3	534.2
10875	28090	BM108	189.6	269.8	331.0	386.4	463.9	533.8
10965	28000	BM107	189.4	269.9	330.5	386.0	463.6	533.5
11095	27870	BM106	189.1	269.7	330.1	385.0	462.8	532.8
11255	27710	BM104	189.9	271.9	333.1	388.2	466.8	537.5
11515	27450	BM102	192.9	277.2	340.0	397.2	476.6	549.3
11620	27345	BM101	193.2	277.3	340.4	398.1	477.2	549.8
11695	27270	BM100	193.0	276.9	340.1	397.9	477.2	548.9
11820	27145	BM99	192.7	276.2	339.6	397.5	477.1	548.2
11910	27055	BM98	192.5	276.2	339.2	397.2	477.0	548.2
12035	26930	BM97	191.9	276.1	338.2	396.5	476.5	547.9
12135	26830	BM97copy	191.3	275.8	337.6	395.6	475.9	547.4
12139	**26826**		**Wecker Road Bridge**					
12155	26810	BM97copy	191.2	275.7	337.6	395.4	475.8	547.3
12215	26750	BM94	191.2	275.5	337.5	394.8	475.3	547.0
12320	26645	BM94-93	191.0	274.9	337.1	394.0	474.5	546.3
12385	26580	BM93	190.8	274.5	336.9	393.8	473.9	545.7
12505	26460	BM90 copy	190.2	273.6	336.2	393.5	472.7	544.6
12690	26275	BM90	188.8	272.4	334.9	392.6	471.5	542.5
12820	26145	BM88	188.8	273.1	335.3	393.6	473.1	543.5
13140	25825	BM87	190.3	275.5	338.0	396.9	478.3	549.8
13440	25525	BM84	189.4	274.5	338.0	396.8	478.2	550.6
13530	25435	BM83	189.3	274.4	337.5	396.6	477.6	550.2
13670	25295	BM81	189.1	274.2	337.0	396.4	476.9	549.7

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
13765	25200	BM80	189.0	274.1	336.6	396.2	476.4	549.3
13910	25055	BM78	188.8	273.7	335.8	395.6	476.4	548.3
13965	25000	BM78 copy	188.7	273.6	335.8	395.3	476.3	547.8
14115	24850	BM77	187.9	272.4	335.2	393.8	475.5	546.6
14360	24605	BM76	190.1	276.2	339.9	400.3	483.5	556.7
14460	24505	BM75	191.1	278.0	342.0	403.3	486.9	560.9
14625	24340	BM74-BM72	190.9	277.8	341.4	403.0	486.1	560.4
14785	24180	BM72	190.7	277.6	340.9	402.8	485.5	560.0
14845	24120	BM71	190.6	277.4	340.8	402.6	485.1	559.7
14960	24005	BM70	190.3	277.1	340.8	402.2	484.9	559.2
15160	23805	BM69	191.0	277.6	341.9	403.3	486.8	560.5
15340	23625	BM67	191.5	278.2	342.6	403.8	488.1	561.3
15460	23505	BM66	191.2	277.9	341.9	402.9	487.4	560.7
15540	23425	BM66 copy	191.0	277.6	341.4	402.7	487.0	560.6
15555	**23410**	**Pine Mountain_Road Bridge**						
15570	23395	BM64 copy	190.9	277.5	341.3	402.6	486.8	560.5
15600	23365	BM64-MHG25	190.9	277.5	341.2	402.6	486.6	560.4
15660	23305	BM64	190.7	277.3	340.9	402.4	486.3	560.2
15790	23175	BM63	190.1	276.7	339.9	401.9	485.4	559.7
15965	23000	BM62	189.9	275.8	339.2	401.1	484.1	559.1
16015	22950	BM61	189.8	275.5	339.2	400.9	484.2	558.9
16190	22775	BM60	192.4	279.6	344.3	407.1	492.7	568.7
16390	22575	BM59	195.3	284.4	350.2	414.5	502.3	580.2
16435	22530	BM59 mod	195.2	284.4	350.1	414.3	502.3	580.1
16445	**22520**	**Meadowbank Stree Foot Bridge and Weir**						
16455	22510	Bm55-mod	195.2	284.3	350.1	414.3	502.3	580.1
16680	22285	BM57-mod	194.8	284.1	349.7	413.7	502.3	579.4
16785	22180	BM56	194.9	284.1	349.6	414.1	502.7	579.4
17080	21885	Bm55-mod	198.8	290.0	357.1	424.3	514.9	594.2
17240	21725	BM55-54	200.6	293.1	360.8	429.8	521.0	601.6
17300	21665	BM54	200.6	293.0	360.8	430.1	521.2	601.4
17325	21640	CD10	200.6	293.0	360.8	430.2	521.3	601.3
17338	**21627**	**Winstanly Street Weir**						
17355	21610	CD09	200.6	293.0	360.8	430.3	521.5	601.4
17540	21425	BM52	200.7	293.6	360.9	431.5	522.0	602.1
17765	21200	CD07	200.4	291.5	367.1	436.5	531.2	602.8
17850	21115	BM50-49-ALS	204.2	292.1	369.0	446.8	533.3	601.8
17920	21045	CD06	251.1	359.7	454.5	440.1	573.3	598.3
17960	21005	CD05	241.7	343.9	434.3	421.5	541.9	598.0
18025	20940	CD04	199.4	290.6	366.8	433.4	539.9	602.9
18065	20900	BM47-mod	199.1	295.6	372.2	444.6	528.5	603.8
18110	20855	BM46-mod	199.0	297.0	373.4	443.3	523.0	602.0
18320	20645	CD02	201.7	297.3	363.3	436.5	526.0	607.9

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
18495	20470	BM44 mod	203.6	296.9	366.5	439.7	534.8	613.8
18690	20275	BM43-mod	203.3	295.5	366.0	438.4	530.9	613.5
18995	19970	BM42-mod	202.2	294.8	364.7	435.3	527.4	611.4
19165	19800	BM42-mod	204.0	298.0	367.9	439.2	534.3	618.0
19195	19770	BM41 copy	204.3	298.6	368.7	439.9	535.4	619.2
19205	**19760**		**Scrub Road Foot Bridge & weir**					
19215	19750	BM41-mod	204.2	298.5	368.6	439.8	535.3	619.0
19375	19590	BM5GHD	203.5	298.0	368.1	438.1	533.3	617.9
19640	19325	Bm5GHD	202.7	297.2	367.1	436.8	532.5	616.8
20050	18915	BM7GHD	200.7	295.0	364.7	435.0	530.8	613.9
20260	18705	BM8GHD copy	199.8	293.8	363.6	433.8	529.4	611.9
20270	**18695**		**Meadowlands Road Bridge**					
20290	18675	Bm8GHD	199.8	293.7	363.5	433.6	529.2	611.6
20510	18455	BM9GHD	198.5	292.2	361.8	431.8	527.1	608.9
20850	18115	BM37	195.2	287.3	356.4	427.0	521.1	602.5
21090	17875	BM17GHD	193.0	284.0	352.9	423.7	516.9	597.6
21555	17410	BM18GHD	189.2	278.3	346.4	416.3	508.8	587.6
21875	17090	BM18GHDcopy	188.4	276.5	344.5	414.5	506.0	585.3
21885	**17080**		**Preston Road Foot Bridge & Weir**					
21895	17070	BM19_GHD	188.4	276.4	344.4	414.3	505.9	585.1
22305	16660	ALS mod	185.8	271.9	338.9	407.3	496.9	574.1
22775	16190	BM23GHD	183.8	268.6	334.0	401.4	488.4	564.8
23165	15800	ALS mod	180.9	264.6	328.8	394.8	480.1	554.6
23285	15680	BM10GHD	179.3	262.7	326.2	391.9	475.9	549.9
23600	15365	BM11GHD	176.2	258.8	321.5	385.8	469.0	541.7
23900	15065	ALS-23900	173.4	255.7	317.7	381.2	463.2	535.4
24000	14965	Minnippi merge	172.4	254.7	316.4	379.3	461.0	532.9
24000	14965	Minnippi merge	166.3	231.8	277.4	324.5	390.5	451.1
24695	14270	BM13GHD-mod	163.5	227.6	272.7	318.9	384.8	446.2
24890	14075	BM13GHD	163.6	227.7	273.0	319.2	385.3	446.9
25515	13450	MHG19-old	164.0	228.3	273.7	320.2	386.6	449.3
25565	13400	MHG20-old	163.9	228.2	273.6	320.1	386.4	449.1
25865	13100	BM26	163.4	227.4	272.8	318.9	385.1	447.9
25885	**13080**	**Wynnum Road Bridge & Weir**						
25905	13060	BM 26 copy	163.3	227.3	272.7	318.8	384.9	447.7
26015	12950	MHG-140	163.1	227.1	272.3	318.5	384.4	447.2
26145	12820	BM24	163.0	226.9	272.0	318.1	383.9	446.6
26365	12600	BM23	162.8	226.3	271.3	317.2	382.8	445.4
26550	12415	Murrarie connect	163.2	226.9	272.0	317.7	383.8	446.9
26550	12415	Murrarie connect	135.6	182.9	217.5	254.6	316.2	371.7
26620	12345	BM22	135.8	183.1	217.7	254.9	316.6	372.1
26710	12255	BM22 copy	135.6	182.9	217.4	254.5	316.1	371.3
26730	**12235**		**Murarrie Road Bridge & Weir**					
26750	12215	BM22 copy	135.6	182.8	217.3	254.4	316.0	371.0

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	**5 year**	**10 year**	**20 year**	**50 year**	**100 year**
26780	12185	MHG-120	135.4	182.8	216.7	253.9	314.9	370.3
26940	12025	BM22 copy	135.2	182.6	216.4	253.6	314.3	369.6
26990	11975	BM42AGHD cop	135.2	182.5	216.3	253.5	314.1	369.3
27100	11865	BM42A-mod	135.1	182.4	216.1	253.2	313.7	368.8
27300	11665	BM42AGHD cop	135.0	182.2	215.8	252.8	313.1	367.9
27305	11660	Murrarie_connec	135.0	182.2	215.8	252.8	313.1	367.9
27305	11660	Murrarie_connec	161.7	224.9	268.5	313.5	377.3	439.8
27355	11610	BM42AGHD	161.7	224.9	268.5	313.4	377.1	439.5
27355	11610	LC	142.0	178.4	201.2	223.8	253.9	283.3
27755	11210	BM43AGHD	141.8	178.0	200.7	222.9	252.7	281.2
27755	11210	LC	125.5	146.2	158.0	169.8	186.5	203.1
27912	11053	BM44AGHD	125.4	146.0	157.7	169.5	186.0	202.5
27912	11053	LC	78.3	76.2	77.2	80.9	90.3	103.0
28025	10940	BM44AGHD	78.2	76.1	77.0	80.7	90.0	102.7
28815	10150	BM44BGHD	73.7	73.1	72.4	71.7	70.4	69.5
29075	9890	BM43BGHD	81.5	80.3	79.5	78.6	76.8	75.3
29730	9235	BM43CGHD	92.7	96.0	101.0	108.9	123.9	139.3
30635	8330	BM44CGHD	102.1	111.9	121.1	133.5	154.7	176.6
30635	8330	LC	152.4	208.2	244.8	281.0	331.5	378.4
31600	7365	BM45GHD	145.2	185.8	210.3	233.8	266.1	296.5
31740	7225	45GHD_US2	145.2	185.4	209.6	232.7	264.6	294.5
31740	7225	LC	150.7	204.2	238.9	272.6	319.1	362.3
32110	6855	BM46CGHD	161.2	198.2	216.2	230.8	249.5	266.2
32110	6855	BM46CGHD	153.6	177.5	189.5	201.3	216.9	228.6
32355	6610	BM46BGHD	142.8	141.0	135.1	130.9	130.2	129.6
32355	6610	BM46BGHD	147.9	150.9	145.6	136.1	134.3	134.0
32650	6315	45GHD_DS1	147.4	149.7	144.1	136.2	135.6	135.3
32650	6315	45GHD_DS1	155.3	193.2	215.8	234.7	263.4	291.1
33330	5635	BM46AGHD	154.4	189.9	210.8	227.3	253.4	279.8
33330	5635	BM46AGHD	156.4	201.4	230.3	254.7	290.9	326.6
34300	4665	BM52 GHD copy	155.7	195.9	220.8	241.4	271.7	299.5
34300	4665	BM52 GHD copy	168.7	244.8	296.1	345.8	413.8	474.1
34490	4475	BM52 GHD copy	172.7	250.1	302.3	353.4	422.8	484.6
34500	4465	**Cleveland Rail Bridge**						
34510	4455	BM52 GHD	176.3	255.1	308.4	360.7	431.5	495.0
34700	4265	BM52 GHD	175.5	253.7	306.7	358.6	428.8	491.7
35260	3705	BM7	173.5	252.0	306.5	360.5	434.2	500.7
35670	3295	BM6	173.5	252.1	306.5	360.4	434.2	500.6
35690	3275	BM6-copy	173.5	252.1	306.5	360.4	434.2	500.6
35785	3180	BM48	173.5	252.1	306.5	360.4	434.2	500.6
36370	2595	Bm4	173.5	252.1	306.5	360.4	434.2	500.6
37040	1925	BM3	175.5	254.8	309.8	364.3	438.6	505.7
37465	1500	BM2_copy	176.9	256.7	312.1	367.1	441.8	509.4
38070	895	BM2	176.9	256.7	312.1	367.1	441.8	509.4
38340	625		176.9	256.7	312.1	367.1	441.8	509.4
38610	355	BM1	176.9	256.7	312.1	367.1	441.8	509.4
38965	0	End of branch	176.9	256.7	312.1	367.1	441.8	509.4

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
Bulimba Creek East								
0	6280	BE289	9.4	13.1	15.5	17.8	20.9	22.6
60	6220	BE289	8.4	12.2	14.4	16.6	19.6	20.9
170	6110	BE288	6.7	10.5	12.6	14.6	17.4	17.9
250	6030	BE287	7.0	9.3	11.2	13.1	15.6	16.9
388	5892	BE286	13.6	18.0	21.7	25.4	30.3	33.2
525	5755	BE285	20.6	25.9	30.5	35.2	42.4	50.2
612	5668	BE284	21.2	27.2	32.1	36.8	42.7	52.0
660	5620	HEC2146	21.4	27.8	32.7	37.5	43.6	52.7
708	5572	BE283	21.5	28.2	33.2	38.1	44.2	52.9
755	5525	HEC2030	20.7	28.0	33.3	38.4	44.5	52.4
799	5481	BE283 copy	18.9	27.3	33.2	38.5	44.5	51.3
815	5465	BE282US	18.1	27.0	33.1	38.5	44.5	50.7
820	5460	**Beenleigh Road East Culverts**						
835	5445	BE281DS	17.9	26.4	32.6	37.3	44.2	49.8
840	5440	BE280	17.6	26.2	32.5	36.9	44.0	49.5
844	5436	BE279HEC	17.2	25.9	32.3	36.6	44.0	49.4
845	5435	**Beenleigh Rail Culverts**						
852	5428	BE278	17.6	24.8	31.0	35.4	43.5	48.8
875	5405	BE277-HEC	18.2	23.8	27.9	32.7	42.5	47.3
876	5404	**Beenleigh Road Pipe Culvert**						
930	5350	Bulima_East_Ra	18.2	23.9	28.0	32.2	41.9	46.6
930	5350	Bulima_East_Ra	17.9	22.9	26.4	29.8	37.2	40.7
946	5334	BE277-HEC DS	17.9	22.9	26.4	29.7	37.0	40.5
956	5324	BE277-A	17.9	22.9	26.4	29.6	36.9	40.3
978	5302	BE277-A copy	17.9	23.0	26.5	29.3	36.6	39.9
981	5299	XS-7450	17.9	23.0	26.5	29.3	36.6	39.9
991	5289	XS-7460	17.9	23.0	26.5	29.4	36.3	39.6
1011	5269	Xs-7480	17.9	23.1	26.6	29.5	35.8	38.9
1031	5249	XS-7500	17.9	23.2	26.7	29.6	35.2	38.3
1051	5229	XS-7520	17.8	23.2	26.7	29.7	34.6	37.7
1071	5209	XS-7540	17.8	23.3	26.8	29.8	34.0	37.9
1091	5189	XS-7560	17.7	23.3	26.9	29.9	33.4	38.1
1111	5169	Xs-7580	17.7	23.3	26.9	30.0	33.5	38.3
1131	5149	Xs-7600	17.6	23.4	27.0	30.1	33.7	38.5
1151	5129	Xs-7620	17.5	23.4	27.0	30.1	33.9	38.6
1171	5109	XS-7640	17.5	23.4	27.1	30.2	34.0	38.8
1191	5089	XS-7660	17.4	23.5	27.1	30.3	34.2	39.0
1211	5069	XS-7680	17.4	23.5	27.1	30.4	34.3	39.1
1231	5049	Xs-7700	17.3	23.5	27.2	30.4	34.4	39.2
1251	5029	XS-7720	17.3	23.5	27.2	30.4	34.5	39.3
1271	5009	XS-7740	17.2	23.5	27.2	30.5	34.5	39.3
1291	4989	XS-7760	17.2	23.5	27.2	30.5	34.6	39.4
1311	4969	Xs-7780	17.1	23.4	27.2	30.5	34.7	39.4
1331	4949	XS-7800	16.9	23.4	27.1	30.5	34.7	39.5

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
1341	4939	Xs-7810	16.8	23.3	27.1	30.5	34.7	39.4
1355	4925	BE273	16.6	23.2	27.0	30.4	34.7	39.4
1380	4900	Bulima_East_Ra	16.3	23.0	26.9	30.4	34.7	39.4
1380	4900	Bulimba East Le	16.0	22.9	26.9	30.9	36.7	42.3
1498	4782	BE272	16.4	21.6	25.9	30.0	36.2	41.4
1565	4715	BE272	16.6	21.9	25.6	29.2	35.5	40.4
1600	4680	BE271_ALS	16.6	22.0	25.7	29.3	34.9	39.6
1730	4550	BE270	16.1	22.2	26.0	29.7	34.4	39.6
1915	4365	BE269	19.8	28.5	33.9	39.1	46.4	53.5
2020	4260	BE268	22.0	32.1	38.4	44.5	53.2	61.3
2145	4135	BE267	22.4	31.8	38.2	44.5	53.5	61.7
2245	4035	BE266	22.6	31.5	38.0	44.4	53.6	61.8
2410	3870	BE265	22.7	31.2	37.4	44.0	53.6	61.8
2500	3780	BE264	22.6	31.5	37.2	43.7	53.4	61.6
2605	3675	BE263	22.4	31.7	37.6	43.2	53.0	61.2
2696	3584	Trib_C	22.3	31.9	37.9	43.8	52.7	60.9
2696	3584	Trib_C	29.6	41.2	49.8	57.6	69.3	80.4
2765	3515	BE262	29.7	40.6	48.9	57.6	69.2	80.4
2767	**3513**		**Underwood Road Culverts**					
2785	3495	BE261	29.7	40.7	49.0	57.6	69.2	80.4
2990	3290	BE259	29.8	41.2	49.6	58.0	68.8	80.1
3200	3080	BE258	31.4	44.2	53.3	61.9	71.6	83.5
3320	2960	BE257	32.0	45.6	55.1	63.9	73.5	87.6
3330	**2950**		**Gateway Motorway Culverts**					
3425	2855	BE257 copy	31.4	45.4	55.0	63.7	73.2	85.1
3490	2790	BE256	30.9	45.1	54.8	63.4	73.2	85.4
3670	2610	BE255	31.3	44.2	54.0	62.3	73.5	85.8
3695	2585	BE255 copy	31.3	44.1	53.9	62.2	73.5	85.9
3725	2555	BE255 copy -mo	31.4	44.0	53.7	62.0	73.6	85.9
3726	2554	Trib_B1	31.4	44.0	53.7	62.1	72.7	85.5
3726	2554	Trib_B2	32.8	48.1	59.4	69.7	98.5	92.4
3735	2545	BE254 copy	32.9	47.9	59.2	69.5	92.4	90.4
3745	2535	BE254	33.0	47.6	58.9	69.2	75.4	90.5
3748	**2532**		**Logan Road Culvert**					
3785	2495	BE253	33.0	47.5	58.4	68.7	82.1	95.2
3810	2470	interpolated	33.1	47.6	58.2	68.3	81.0	95.3
3888	2392	Trib_B	33.2	48.0	58.2	68.2	80.3	93.4
3888	2392	Trib_B	40.2	56.3	67.8	78.4	91.2	104.8
3925	2355	BE251	40.3	56.5	67.5	78.0	90.8	104.3
4020	2260	Be250	41.2	57.9	68.7	78.9	91.7	106.2
4110	2170	BE249	41.8	58.6	69.1	79.2	94.1	109.0
4230	2050	BE248	41.0	58.0	70.3	81.1	96.7	111.5
4284	1996	Trib_A	42.3	60.5	74.3	84.8	99.5	113.1
4284	1996	Trib_A	80.3	109.1	128.1	148.3	177.2	205.5
4300	1980	BE247	79.9	108.8	127.4	147.5	176.6	205.0

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
4360	1920	BE247 copy	78.7	108.6	126.6	146.0	174.0	201.8
4419	1861	BE246	79.0	108.5	126.9	146.4	173.6	199.9
4507	1773	BE246A-ALS	79.2	108.3	127.0	146.6	173.9	200.1
4602	1678	Old_4612	79.4	108.5	127.2	146.7	174.3	200.6
4608	**1672**		**Eight Mile Plains Bridge**					
4638	1642	Copy Old 4612	79.4	108.6	127.2	146.7	174.3	200.7
4656	1624	BE244	79.5	108.6	127.2	146.7	174.3	200.8
4660	**1620**		**Miles Platting Road Bridge & Weir**					
4695	1585	Old 4665	79.5	108.6	127.2	146.7	174.3	200.8
4730	1550	Old 4685	79.5	108.6	127.2	146.7	174.3	200.8
4750	1530	Old 4705	79.5	108.6	127.2	146.7	174.3	200.8
4870	1410	BE241	80.6	110.2	129.0	148.5	176.7	203.6
4980	1300	BE240	81.5	111.7	130.5	150.0	178.7	206.1
5010	1270		**Gateway Off-ramp**					
5050	1230	BE239	81.3	111.6	130.3	149.6	178.4	205.8
5175	1105	BE238	80.9	111.4	129.9	148.8	177.7	205.1
5330	950	BE236	80.2	111.1	129.3	147.8	176.6	203.9
5470	810	BE235	84.0	116.6	135.8	155.1	185.2	213.9
5712	568	BE232	90.0	125.8	146.8	167.4	199.5	230.2
5810	470	BE231	89.8	125.2	146.1	166.6	198.3	228.8
5895	385	BE230	90.9	126.4	147.6	168.3	200.2	230.8
5975	305	BE229	91.8	127.3	148.8	169.7	201.9	232.5
6055	225	BE228	91.6	126.3	147.8	169.4	201.7	231.7
6135	145	BE227	91.2	125.8	147.4	169.0	201.3	231.3
6280	0	BE227	90.3	125.0	146.4	168.1	200.3	230.1
Tributary A								
0		ALS1-copy	16.8	23.8	28.2	32.4	38.2	40.9
100		ALS1-copy	14.8	21.2	24.7	28.1	32.9	34.4
320		ALS1	12.7	18.4	21.2	23.7	27.3	32.9
600		ALS2	13.6	17.4	21.0	24.3	28.5	33.3
950		BE-1060	16.4	22.2	26.6	30.5	35.6	40.9
1400		BE-1040	18.0	25.4	31.3	36.7	43.8	48.9
1400		Trib_A1	22.3	32.0	39.4	46.5	55.8	63.3
1770		BE-1030	25.8	34.8	41.3	49.1	59.7	66.9
2070		BE-1020	25.4	35.4	42.8	50.1	59.3	67.7
2072			**School Road**					
2125		interpolated	26.1	36.6	44.4	51.9	61.5	70.1
2163		Trib_A2	27.3	38.4	46.6	54.5	64.7	73.7
2163		Trib_A2	42.4	57.6	69.1	80.4	95.0	109.3
2235		BE-1010	40.4	55.3	66.4	77.3	90.9	104.9
2535		BE-1005	43.2	60.0	72.2	84.1	99.7	115.5
2545			**Freeway Offramp**					
2555		BE-1005	43.3	60.2	72.5	84.4	100.1	116.0

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	**5 year**	**10 year**	**20 year**	**50 year**	**100 year**
2735		BE1005 copy	42.3	59.0	71.1	82.5	97.2	112.8
2765		BE1000	42.2	58.8	70.8	82.0	96.5	112.0
2805			**Gateway Motor way**					
2935		BE1000 modified	41.8	57.9	69.3	78.6	92.8	108.2
3015		BE1000 modified	41.8	57.4	68.6	77.3	91.3	106.5
3021		BE1000 modified	41.7	57.4	68.5	77.3	91.2	106.3
Tributary A1								
0		A1-1050	7.9	11.2	13.3	15.3	18.1	19.5
280		A1-1050	5.8	9.1	11.0	12.8	15.3	15.8
500		ALS	6.0	8.1	9.8	11.5	13.8	15.0
720		ALS	5.3	6.8	8.3	9.9	12.0	14.6
750		ALS	5.0	6.6	8.1	9.8	12.0	14.4
Tributary A2								
0		TRIB_A2	17.2	24.4	28.8	33.0	38.9	41.6
80		SMP	15.1	22.4	26.6	30.7	36.3	38.3
475		SMP	17.8	22.4	26.3	30.5	36.9	43.6
690		SMP	20.2	26.8	31.7	36.4	42.3	51.1
1035		SMP	15.9	23.6	28.8	33.7	40.2	44.4
1042		SMP	15.6	23.0	28.2	33.0	39.4	43.3
Tributary B								
1000		BE2030	22.6	32.3	38.3	44.0	52.0	55.5
1055		BE2030	21.6	31.2	37.0	39.9	49.9	53.3
1062			**Dance Court 1**					
1075		BE2030 copy	21.1	30.7	36.5	39.2	49.2	52.4
1215		BE2020	17.4	26.7	32.5	37.1	44.4	46.3
1340		BE2020 copy	18.1	23.9	29.0	33.6	39.5	45.6
1360		Interpolated	18.3	23.4	28.4	32.9	38.7	45.9
1360		BE2010	10.7	12.4	13.7	15.0	17.0	20.3
1361			**Logan Road culverts**					
1394		BE2000	10.9	12.2	13.3	14.8	16.8	20.8
1432		BE2001	10.9	12.3	13.5	15.0	17.0	20.9
1492		BE2001	10.7	12.1	13.2	14.7	16.7	20.5
Tributary C								
0		BE-3050	9.7	13.7	16.3	18.7	22.1	23.8
10		BE-3050	9.4	13.4	16.0	18.3	21.7	23.3
390		BE-3040	6.8	9.6	11.6	13.5	16.0	18.3
545		BE-3030	6.5	9.1	11.0	13.0	15.6	17.3
665		BE-3020	8.2	11.3	13.8	16.4	19.7	22.3
810		BE-3010	10.1	14.3	17.4	20.6	24.8	28.7
1000		BE3000	10.2	14.1	17.2	20.3	24.4	28.1
1005		BE-3000 copy	10.2	14.1	17.2	20.3	24.4	28.0
1008			**Gateway Motorway Culverts**					
1100		BE3000 copy	10.3	14.3	16.9	19.6	23.4	26.9
1110		ALS	10.3	14.3	17.0	19.7	23.0	26.7
1120		End Trib C	10.4	14.3	17.0	19.8	22.8	26.8

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
Tributary B1								
1000		ALS	7.5	11.1	14.7	18.0	21.6	25.6
1002		ALS	7.5	11.1	14.7	18.0	21.6	25.6
1020		ALS	7.6	11.2	14.5	17.8	21.2	25.5
1055		ALS	7.6	11.3	14.5	17.6	20.4	24.9
1140		ALS	7.0	10.4	12.9	15.0	16.5	19.7
1145		ALS	6.9	10.3	12.8	14.7	16.1	19.2
Padstow Branch								
0		BM177	29.0	41.0	48.8	55.9	67.6	82.2
32		BM177	28.9	41.0	48.6	55.8	67.7	81.9
105		BM177-176ALS	28.7	41.2	48.5	55.5	68.1	82.6
140		LC	28.8	41.3	48.8	55.4	68.2	82.9
140		LC	28.8	41.3	48.8	52.9	55.2	60.9
175		BM176-US-ALS	28.9	41.4	49.1	53.4	55.3	61.2
177			**Padstow Road culverts**					
205		BM176-DS-ALS	29.0	41.5	49.3	53.7	55.6	61.6
205		LC	29.0	41.5	49.3	53.7	55.6	61.6
258		BM175	29.2	41.8	49.7	54.4	56.5	62.3
258		LC	29.2	41.8	49.7	54.4	56.5	65.2
325		BM175-174ALS	29.6	42.1	50.2	55.1	57.5	66.0
352		BM174	29.8	42.3	50.4	55.4	57.9	66.2
375		BM175	29.9	42.4	50.5	55.6	58.2	66.4
Garden City Branch								
5280		BM169	23.2	40.1	55.1	66.7	84.7	101.2
5285		BM169	23.1	40.1	55.1	66.6	84.6	101.1
5405		BM168	23.1	39.9	54.9	65.4	82.8	98.8
5405		LC	23.1	36.0	44.6	56.9	76.4	94.7
5510		BM167	23.1	35.8	44.2	56.3	75.9	94.4
5510		LC	23.1	35.8	44.4	60.9	86.1	107.2
5615		BM167 copy	23.1	35.7	43.8	60.0	85.4	106.8
5615		LC	23.1	35.7	43.6	52.8	64.1	75.0
5715		Bm165_copy	22.9	35.5	43.6	52.5	63.7	74.8
5715		LC	22.8	36.8	45.2	52.6	61.1	77.9
5730		Bm165	22.9	36.8	45.2	52.5	61.0	77.9
5785		XS5	22.9	36.8	45.2	52.4	60.8	77.8
5850		XS4	22.9	36.7	45.2	52.3	60.8	77.5
5850		LC	22.9	36.7	45.2	57.0	88.5	125.6
5935		XS4 copy	22.9	36.6	45.2	57.0	88.7	125.3
5938		End	22.9	36.7	45.2	57.0	88.7	125.3

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
Mimosa Creek								
0		Mi 40_Hecras	35.3	51.1	60.7	70.0	82.9	88.2
5		Mi 40_Hecras	35.2	51.0	60.6	69.9	82.7	88.0
96		Mi 40a	32.3	48.3	57.7	66.8	79.3	83.9
200		Mi39	29.2	43.1	52.1	60.8	73.0	76.2
330		MI38	30.6	39.2	46.7	53.9	64.6	77.5
484		Mi37	42.5	69.8	65.3	75.9	91.4	109.1
506		Mi36	44.3	74.3	68.0	78.9	95.2	113.6
558		Mi35	44.8	71.8	69.3	80.3	95.2	114.7
660		Mi34	45.3	74.1	71.4	82.7	97.7	116.2
696		Mi33	45.1	74.7	71.8	83.2	98.3	116.4
811		Mi32	42.3	75.6	71.8	83.9	99.4	115.5
952		Mi31	38.9	73.1	68.0	80.6	96.5	108.7
1037		Mi31-copy	39.6	70.3	64.6	77.3	93.3	103.2
1186		Mi29	39.6	66.5	63.8	73.3	86.0	101.3
1302		Mi28	38.4	67.0	63.9	73.9	87.3	102.1
1322		Mi27	38.0	67.0	63.7	73.9	87.4	102.1
1366		Mi26	36.7	66.8	63.2	73.7	87.6	102.0
1439		Mi25	36.0	66.4	62.3	73.3	87.7	101.8
1549		Mi24	36.4	65.4	61.0	72.6	87.5	101.4
1588		Mi23	36.5	64.9	60.3	72.2	87.4	101.1
1719		Mi22	36.7	63.1	58.4	70.9	86.7	100.3
1738		Mi21-2	36.7	62.8	58.5	70.5	86.5	100.0
1739			**Nagel Street Bridge**					
1752		Mi21-1	36.7	62.7	58.6	70.2	86.1	99.6
1762		Mi20	36.7	62.6	58.6	70.1	85.9	99.3
1882		Mi19	36.6	62.3	59.6	68.5	83.2	95.8
1892		Mi19-4	36.6	62.4	59.7	68.7	83.0	95.5
1895			**Pacific Motorway**					
1964		Mi19-1	36.4	62.8	60.0	69.2	81.7	94.4
2023		Mi18	38.4	63.0	63.8	73.7	87.9	100.7
2086		Mi17	40.5	63.2	67.8	78.4	94.4	108.3
2133		Mi16	40.3	63.4	67.9	78.7	93.2	107.7
2224		Mi15	39.9	63.5	68.0	79.1	93.7	108.5
2248		Mi13-3	39.8	63.5	68.1	79.2	94.0	108.8
2255			**Kessels Road Bridge**					
2284		Mi13-2	39.6	63.4	68.0	79.3	94.4	109.2
2325		Mi13	39.3	63.4	68.0	79.4	94.7	109.6
2516		Mi12	39.1	62.9	67.7	79.3	95.3	110.5
2635		Mi11	39.4	62.3	67.2	78.8	95.3	110.6
2648			**Parkway Street Bridge**					
2664		Mi10-2	39.5	62.1	67.1	78.7	95.3	110.6
2718		Mi9	39.6	61.9	66.9	78.6	95.3	110.5
2828		Mi8	39.6	60.7	66.0	77.9	94.8	110.1
2955		Mi7	43.0	65.3	71.7	84.9	104.0	121.0
3069		Mi6	45.8	70.3	77.2	91.3	112.3	130.8

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
3221		Mi5	44.8	70.4	77.8	90.6	110.8	129.4
3388		Mi4	44.0	69.5	77.7	91.1	108.9	125.9
3496		Mi3	44.2	68.5	77.3	91.2	109.7	126.1
3585		Mi2	44.3	67.7	77.0	91.1	110.0	126.7
3801		Mi1	44.2	67.5	75.5	90.2	110.0	127.3
3890		Mi2	44.0	67.5	75.0	89.8	109.6	127.0
Minnippi Bypass Branch								
0		ALS-1	6.5	23.6	39.5	54.3	72.4	84.4
80		Minnippi_new1	6.3	23.5	39.3	53.8	71.5	83.2
125		Minnippi_new2	6.2	23.4	39.1	53.5	71.0	82.6
230		Minnippi_new3	5.8	23.2	38.5	52.3	69.4	80.6
400		Minnippi_new4	4.5	22.8	37.1	50.0	66.1	76.5
542		Minnippi_new5	2.9	22.5	36.2	48.8	64.3	74.7
650		Stanton_RD	2.8	22.3	35.8	48.3	63.7	74.0
720		new_A	2.8	22.2	35.7	48.1	63.4	73.8
730		new_B	2.8	22.2	35.7	48.1	63.4	73.8
745		Minnippi_new6-	2.8	22.2	35.7	48.1	63.4	73.8
748		**Gateway Motorway Culverts**						
810		Minnippi_new7-	2.8	22.2	35.7	48.1	63.3	73.7
825		new_E	2.8	22.2	35.7	48.1	63.3	73.7
860		new_G	4.1	22.2	35.7	48.1	63.3	73.7
870		new_7a	4.6	22.2	35.7	48.1	63.3	73.7
945		Minnippi_new8	5.3	20.2	32.2	43.2	57.2	67.3
1015		BM31GHD_mod	5.3	20.2	32.1	43.2	57.2	67.3
1115		Minnippi16_ALS	5.2	20.2	32.1	43.1	57.1	67.2
1125			**Wynnum Road Bridge**					
1150		BM 31GHD-copy	5.2	20.2	32.0	43.0	57.0	67.1
1310		BM36_GHD	5.0	20.1	31.8	42.7	56.5	66.4
1560		Minnippi_new11	4.4	20.1	31.5	42.1	55.4	64.9
1850		BM 42B_GHD	3.5	20.2	31.1	41.4	54.1	63.0
2004		BM42BGHD	3.7	20.4	31.2	41.0	53.5	62.1
Murarrie Bypass Branch								
0			27.6	44.2	54.5	64.9	71.0	75.6
20		MU1_ALS	27.6	44.2	54.5	64.9	70.9	75.5
35		New_MU1	27.6	44.2	54.5	64.8	70.8	75.3
160		New_MU2_ALS	27.4	43.8	54.0	64.1	69.2	74.3
275		New_MU3_ALS	27.1	43.3	53.5	63.1	67.5	73.6
310		Copy_new_MU3	27.0	43.2	53.4	62.8	66.9	73.3
390		New_MU5_ALS	26.9	43.1	53.1	62.1	65.9	73.0
470		Mu_6_ALS	26.9	42.9	53.0	61.5	65.2	72.7
Gateway Motorway Culverts								
545		MU_7_ALS	26.8	42.9	52.9	61.2	64.8	72.3
595		MU_9_ALS	26.8	42.8	52.9	61.0	64.6	72.1
640		MU5_ALS	26.8	42.8	52.8	60.9	64.4	72.0
650			26.8	42.8	52.8	60.9	64.4	72.0

MIKE11 Chainage	AMTD(m)	Cross section ID	MIKE11 Model Peak Discharges (m^3/s)					
			2 year	5 year	10 year	20 year	50 year	100 year
Bulimba East Rail Bypass								
0		Start	0.28	1.03	1.67	2.40	4.71	5.97
33		BE276	0.25	1.09	1.76	2.54	3.88	5.33
144		BE275	0.11	1.07	1.90	2.85	4.21	5.85
226		BE274	0.21	0.76	1.50	2.39	3.72	5.14
347		BE273 US	0.32	0.58	1.12	1.77	2.81	4.08
443		BE273 DS	0.33	0.51	1.09	1.78	2.90	4.19
488		BE273A	0.32	0.55	1.13	1.84	3.00	4.31
520		End	0.32	0.64	1.23	1.95	3.13	4.48
Kianawah Park Branch								
0			18.07	25.98	30.90	35.59	42.13	45.06
48		WY-1 ALS	16.28	24.44	29.22	34.12	40.49	43.02
210		WY-2 ALS	11.92	15.93	18.66	22.46	27.22	32.01
260		WY-3 ALS	11.25	14.99	18.02	21.34	25.40	30.89
340		WY-4 ALS	10.10	13.88	16.77	20.01	24.09	28.84
430		WY-5 ALS	8.76	12.47	15.15	17.98	21.71	25.42
530		WY-6 ALS	7.97	10.50	12.71	14.81	17.81	20.30
660		WY-7 ALS	6.19	8.36	9.75	10.87	12.34	13.65
780		WY-8 ALS	5.48	7.05	7.87	8.75	9.84	10.72
860		WY-9 ALS	5.35	6.72	7.49	8.12	8.84	9.49
945		WY-10 ALS	5.34	6.69	7.43	8.02	8.82	9.30
985		WY-11 ALS	5.33	6.69	7.43	8.01	8.81	9.29
1006		End	5.33	6.68	7.42	8.01	8.81	9.28
Link Canals								
0		42GHD_AB	19.98	46.97	67.92	90.52	124.34	157.87
175		42GHD_AB	19.98	46.97	67.92	90.52	124.34	157.87
0		43GHD_AB	16.66	32.41	43.29	53.57	66.55	78.88
186		43GHD_AB	16.66	32.41	43.29	53.57	66.55	78.88
0		43GHD_BC	9.37	15.75	17.10	18.15	18.76	20.00
191		43GHD_BC	9.37	15.75	17.10	18.15	18.76	20.00
0		44GHD_AB	48.93	70.81	81.14	88.63	95.70	100.83
74		44GHD_AB	48.93	70.81	81.14	88.63	95.70	100.83
0		44GHD_BC	51.83	98.16	125.11	148.58	177.29	202.24
58		44GHD_BC	51.83	98.16	125.11	148.58	177.29	202.24
0		45GHD_US1	19.89	48.87	70.73	93.03	123.60	151.64
465		45GHD_US1	19.89	48.87	70.73	93.03	123.60	151.64
0		45GHD_US2	5.54	19.07	29.52	40.07	54.63	67.87
560		45GHD_US2	5.54	19.07	29.52	40.07	54.63	67.87
0		45GHD_DS1	9.62	56.55	96.06	137.94	196.70	250.42
190		45GHD_DS1	9.62	56.55	96.06	137.94	196.70	250.42
0		46GHD_AB	2.01	12.57	20.18	28.10	38.33	47.27
621		46GHD_AB	2.01	12.57	20.18	28.10	38.33	47.27
0		46GHD_BC	8.26	21.27	27.56	30.84	32.66	37.74
99		46GHD_BC	8.26	21.27	27.56	30.84	32.66	37.74
0		46GHD_DS	13.04	48.98	75.34	104.47	142.19	174.67
294		46GHD_DS	13.04	48.98	75.34	104.47	142.19	174.67
0		CLEV_RAIL	0.30	1.87	4.12	7.05	11.80	16.77
939		CLEV_RAIL	0.30	1.87	4.12	7.05	11.80	16.77

HEC-RAS Plan: Salvin 2014_Rev

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	2130	Q 2 yr	16.90	24.88	26.42		26.46	0.004176	0.81	20.91	22.27	0.27
Upper Reach	2130	Q 5 yr	23.90	24.88	26.74		26.77	0.003881	0.84	28.61	27.63	0.25
Upper Reach	2130	Q 10 yr	30.00	24.88	26.97		27.01	0.003280	0.87	35.81	34.23	0.24
Upper Reach	2130	Q 20 yr	35.50	24.88	27.16		27.20	0.002918	0.90	42.86	39.52	0.23
Upper Reach	2130	Q 50 yr	43.10	24.88	27.40		27.44	0.002593	0.93	53.08	50.19	0.22
Upper Reach	2130	Q 100 yr	49.30	24.88	27.58		27.62	0.002337	0.94	63.61	63.75	0.21
Upper Reach	2120.*	Q 2 yr	16.90	24.83	26.40		26.43	0.001376	0.83	20.46	21.43	0.27
Upper Reach	2120.*	Q 5 yr	23.90	24.83	26.72		26.75	0.001187	0.86	27.76	24.48	0.26
Upper Reach	2120.*	Q 10 yr	30.00	24.83	26.95		26.99	0.001027	0.89	34.09	29.54	0.25
Upper Reach	2120.*	Q 20 yr	35.50	24.83	27.14		27.19	0.000913	0.92	40.21	34.04	0.24
Upper Reach	2120.*	Q 50 yr	43.10	24.83	27.38		27.43	0.000824	0.96	48.89	39.46	0.23
Upper Reach	2120.*	Q 100 yr	49.30	24.83	27.56		27.61	0.000773	0.99	56.26	43.51	0.23
Upper Reach	2110.*	Q 2 yr	16.90	24.78	26.38		26.42	0.001515	0.83	20.30	20.84	0.27
Upper Reach	2110.*	Q 5 yr	23.90	24.78	26.70		26.74	0.001325	0.87	27.41	23.69	0.26
Upper Reach	2110.*	Q 10 yr	30.00	24.78	26.94		26.98	0.001201	0.90	33.31	26.61	0.25
Upper Reach	2110.*	Q 20 yr	35.50	24.78	27.13		27.18	0.001072	0.93	38.82	30.36	0.24
Upper Reach	2110.*	Q 50 yr	43.10	24.78	27.37		27.42	0.000959	0.97	46.57	35.07	0.24
Upper Reach	2110.*	Q 100 yr	49.30	24.78	27.55		27.60	0.000897	1.00	53.12	38.53	0.23
Upper Reach	2100.*	Q 2 yr	16.90	24.74	26.37		26.40	0.001657	0.84	20.20	20.35	0.27
Upper Reach	2100.*	Q 5 yr	23.90	24.74	26.69		26.73	0.001465	0.88	27.16	23.03	0.26
Upper Reach	2100.*	Q 10 yr	30.00	24.74	26.93		26.97	0.001368	0.91	32.87	25.02	0.25
Upper Reach	2100.*	Q 20 yr	35.50	24.74	27.12		27.17	0.001256	0.94	37.98	27.74	0.25
Upper Reach	2100.*	Q 50 yr	43.10	24.74	27.36		27.41	0.001116	0.98	45.07	31.81	0.24
Upper Reach	2100.*	Q 100 yr	49.30	24.74	27.54		27.59	0.001039	1.01	51.03	34.87	0.24
Upper Reach	2090.*	Q 2 yr	16.90	24.69	26.35		26.39	0.001803	0.84	20.12	19.93	0.27
Upper Reach	2090.*	Q 5 yr	23.90	24.69	26.67		26.71	0.001609	0.89	26.97	22.48	0.26
Upper Reach	2090.*	Q 10 yr	30.00	24.69	26.91		26.95	0.001515	0.92	32.55	24.36	0.25
Upper Reach	2090.*	Q 20 yr	35.50	24.69	27.11		27.15	0.001447	0.95	37.47	25.90	0.25
Upper Reach	2090.*	Q 50 yr	43.10	24.69	27.35		27.40	0.001299	0.98	44.09	29.39	0.24
Upper Reach	2090.*	Q 100 yr	49.30	24.69	27.53		27.58	0.001202	1.01	49.62	32.10	0.24
Upper Reach	2080.*	Q 2 yr	16.90	24.64	26.33		26.37	0.001988	0.84	20.06	19.58	0.27
Upper Reach	2080.*	Q 5 yr	23.90	24.64	26.65		26.69	0.001790	0.89	26.81	22.01	0.26
Upper Reach	2080.*	Q 10 yr	30.00	24.64	26.89		26.94	0.001699	0.93	32.29	23.79	0.25
Upper Reach	2080.*	Q 20 yr	35.50	24.64	27.09		27.14	0.001629	0.96	37.11	25.27	0.25
Upper Reach	2080.*	Q 50 yr	43.10	24.64	27.33		27.38	0.001531	0.99	43.44	27.58	0.25
Upper Reach	2080.*	Q 100 yr	49.30	24.64	27.51		27.57	0.001417	1.02	48.65	29.97	0.24
Upper Reach	2070.*	Q 2 yr	16.90	24.59	26.31		26.35	0.002101	0.84	20.02	19.27	0.26
Upper Reach	2070.*	Q 5 yr	23.90	24.59	26.64		26.68	0.001909	0.90	26.69	21.59	0.26
Upper Reach	2070.*	Q 10 yr	30.00	24.59	26.87		26.92	0.001824	0.94	32.07	23.30	0.25
Upper Reach	2070.*	Q 20 yr	35.50	24.59	27.07		27.12	0.001758	0.96	36.80	24.71	0.25
Upper Reach	2070.*	Q 50 yr	43.10	24.59	27.31		27.36	0.001703	1.00	42.98	26.43	0.25
Upper Reach	2070.*	Q 100 yr	49.30	24.59	27.50		27.55	0.001606	1.03	47.96	28.34	0.25
Upper Reach	2060.*	Q 2 yr	16.90	24.54	26.29		26.32	0.002290	0.85	20.00	19.00	0.26
Upper Reach	2060.*	Q 5 yr	23.90	24.54	26.61		26.66	0.002097	0.90	26.60	21.24	0.26
Upper Reach	2060.*	Q 10 yr	30.00	24.54	26.85		26.90	0.002016	0.94	31.90	22.88	0.25
Upper Reach	2060.*	Q 20 yr	35.50	24.54	27.05		27.10	0.001952	0.97	36.55	24.23	0.25
Upper Reach	2060.*	Q 50 yr	43.10	24.54	27.29		27.35	0.001902	1.01	42.61	25.88	0.25
Upper Reach	2060.*	Q 100 yr	49.30	24.54	27.48		27.53	0.001862	1.04	47.46	27.13	0.25
Upper Reach	2050.*	Q 2 yr	16.90	24.49	26.26		26.30	0.002446	0.85	19.98	18.77	0.26
Upper Reach	2050.*	Q 5 yr	23.90	24.49	26.59		26.63	0.002256	0.90	26.52	20.93	0.26
Upper Reach	2050.*	Q 10 yr	30.00	24.49	26.83		26.88	0.002182	0.94	31.75	22.50	0.25
Upper Reach	2050.*	Q 20 yr	35.50	24.49	27.03		27.08	0.002123	0.98	36.34	23.80	0.25
Upper Reach	2050.*	Q 50 yr	43.10	24.49	27.27		27.33	0.002080	1.02	42.29	25.39	0.25
Upper Reach	2050.*	Q 100 yr	49.30	24.49	27.46		27.51	0.002044	1.05	47.05	26.59	0.25
Upper Reach	2040.*	Q 2 yr	16.90	24.45	26.24		26.27	0.002646	0.85	19.96	18.56	0.26
Upper Reach	2040.*	Q 5 yr	23.90	24.45	26.57		26.61	0.002455	0.90	26.46	20.65	0.25
Upper Reach	2040.*	Q 10 yr	30.00	24.45	26.81		26.86	0.002386	0.95	31.62	22.17	0.25
Upper Reach	2040.*	Q 20 yr	35.50	24.45	27.01		27.06	0.002331	0.98	36.15	23.42	0.25
Upper Reach	2040.*	Q 50 yr	43.10	24.45	27.25		27.30	0.002295	1.03	42.01	24.95	0.25
Upper Reach	2040.*	Q 100 yr	49.30	24.45	27.43		27.49	0.002263	1.06	46.69	26.10	0.25
Upper Reach	2030.*	Q 2 yr	16.90	24.40	26.21		26.25	0.002814	0.85	19.94	18.37	0.26
Upper Reach	2030.*	Q 5 yr	23.90	24.40	26.54		26.58	0.002624	0.91	26.39	20.39	0.25
Upper Reach	2030.*	Q 10 yr	30.00	24.40	26.78		26.83	0.002565	0.95	31.50	21.86	0.25
Upper Reach	2030.*	Q 20 yr	35.50	24.40	26.98		27.03	0.002515	0.99	35.97	23.07	0.25
Upper Reach	2030.*	Q 50 yr	43.10	24.40	27.22		27.28	0.002489	1.03	41.74	24.55	0.25
Upper Reach	2030.*	Q 100 yr	49.30	24.40	27.41		27.47	0.002462	1.06	46.34	25.66	0.25
Upper Reach	2020.*	Q 2 yr	16.90	24.35	26.18		26.22	0.002985	0.85	19.91	18.20	0.26
Upper Reach	2020.*	Q 5 yr	23.90	24.35	26.51		26.56	0.002793	0.91	26.33	20.17	0.25
Upper Reach	2020.*	Q 10 yr	30.00	24.35	26.76		26.80	0.002741	0.96	31.39	21.59	0.25
Upper Reach	2020.*	Q 20 yr	35.50	24.35	26.96		27.01	0.002696	0.99	35.80	22.77	0.25
Upper Reach	2020.*	Q 50 yr	43.10	24.35	27.20		27.25	0.002680	1.04	41.49	24.19	0.25
Upper Reach	2020.*	Q 100 yr	49.30	24.35	27.38		27.44	0.002658	1.07	46.03	25.27	0.25
Upper Reach	2010.*	Q 2 yr	16.90	24.30	26.15		26.19	0.003168	0.85	19.87	18.04	0.26
Upper Reach	2010.*	Q 5 yr	23.90	24.30	26.49		26.53	0.002974	0.91	26.26	19.96	0.25
Upper Reach	2010.*	Q 10 yr	30.00	24.30	26.73		26.77	0.002932	0.96	31.27	21.35	0.25
Upper Reach	2010.*	Q 20 yr	35.50	24.30	26.93		26.98	0.002894	1.00	35.64	22.48	0.25

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	2010.*	Q 50 yr	43.10	24.30	27.17		27.22	0.002888	1.04	41.25	23.87	0.25
Upper Reach	2010.*	Q 100 yr	49.30	24.30	27.35		27.41	0.002873	1.08	45.73	24.91	0.25
Upper Reach	2000.*	Q 2 yr	16.90	24.26	26.12		26.15	0.003360	0.85	19.82	17.90	0.26
Upper Reach	2000.*	Q 5 yr	23.90	24.26	26.45		26.50	0.003162	0.91	26.20	19.78	0.25
Upper Reach	2000.*	Q 10 yr	30.00	24.26	26.70		26.74	0.003130	0.96	31.16	21.12	0.25
Upper Reach	2000.*	Q 20 yr	35.50	24.26	26.90		26.95	0.003098	1.00	35.49	22.23	0.25
Upper Reach	2000.*	Q 50 yr	43.10	24.26	27.14		27.19	0.003105	1.05	41.03	23.57	0.25
Upper Reach	2000.*	Q 100 yr	49.30	24.26	27.32		27.38	0.003097	1.08	45.45	24.59	0.25
Upper Reach	1990.*	Q 2 yr	16.90	24.21	26.08		26.12	0.003614	0.86	19.74	17.77	0.26
Upper Reach	1990.*	Q 5 yr	23.90	24.21	26.42		26.46	0.003402	0.92	26.10	19.60	0.25
Upper Reach	1990.*	Q 10 yr	30.00	24.21	26.66		26.71	0.003378	0.97	31.02	20.91	0.25
Upper Reach	1990.*	Q 20 yr	35.50	24.21	26.86		26.91	0.003351	1.01	35.31	21.99	0.25
Upper Reach	1990.*	Q 50 yr	43.10	24.21	27.11		27.16	0.003370	1.06	40.78	23.29	0.25
Upper Reach	1990.*	Q 100 yr	49.30	24.21	27.29		27.35	0.003369	1.09	45.14	24.28	0.26
Upper Reach	1980.*	Q 2 yr	16.90	24.16	26.04		26.08	0.003840	0.86	19.64	17.64	0.26
Upper Reach	1980.*	Q 5 yr	23.90	24.16	26.39		26.43	0.003609	0.92	25.99	19.44	0.25
Upper Reach	1980.*	Q 10 yr	30.00	24.16	26.63		26.68	0.003592	0.97	30.87	20.72	0.25
Upper Reach	1980.*	Q 20 yr	35.50	24.16	26.83		26.88	0.003570	1.01	35.12	21.76	0.25
Upper Reach	1980.*	Q 50 yr	43.10	24.16	27.07		27.13	0.003602	1.06	40.52	23.03	0.26
Upper Reach	1980.*	Q 100 yr	49.30	24.16	27.25		27.31	0.003608	1.10	44.83	23.99	0.26
Upper Reach	1970.*	Q 2 yr	16.90	24.11	26.00		26.04	0.004037	0.87	19.52	17.44	0.26
Upper Reach	1970.*	Q 5 yr	23.90	24.11	26.35		26.39	0.003840	0.92	25.86	19.28	0.25
Upper Reach	1970.*	Q 10 yr	30.00	24.11	26.59		26.64	0.003832	0.98	30.70	20.53	0.26
Upper Reach	1970.*	Q 20 yr	35.50	24.11	26.79		26.84	0.003817	1.02	34.90	21.55	0.26
Upper Reach	1970.*	Q 50 yr	43.10	24.11	27.03		27.09	0.003863	1.07	40.24	22.78	0.26
Upper Reach	1970.*	Q 100 yr	49.30	24.11	27.21		27.28	0.003878	1.11	44.50	23.72	0.26
Upper Reach	1960.*	Q 2 yr	16.90	24.06	25.96		26.00	0.004238	0.87	19.39	17.23	0.26
Upper Reach	1960.*	Q 5 yr	23.90	24.06	26.31		26.35	0.004092	0.93	25.70	19.13	0.26
Upper Reach	1960.*	Q 10 yr	30.00	24.06	26.55		26.60	0.004092	0.98	30.49	20.35	0.26
Upper Reach	1960.*	Q 20 yr	35.50	24.06	26.75		26.80	0.004082	1.02	34.66	21.35	0.26
Upper Reach	1960.*	Q 50 yr	43.10	24.06	26.99		27.05	0.004145	1.08	39.93	22.55	0.26
Upper Reach	1960.*	Q 100 yr	49.30	24.06	27.17		27.24	0.004167	1.12	44.13	23.46	0.26
Upper Reach	1950.*	Q 2 yr	16.90	24.02	25.92		25.96	0.004495	0.88	19.24	17.02	0.26
Upper Reach	1950.*	Q 5 yr	23.90	24.02	26.26		26.31	0.004415	0.94	25.51	18.99	0.26
Upper Reach	1950.*	Q 10 yr	30.00	24.02	26.51		26.56	0.004419	0.99	30.26	20.18	0.26
Upper Reach	1950.*	Q 20 yr	35.50	24.02	26.71		26.76	0.004412	1.03	34.39	21.16	0.26
Upper Reach	1950.*	Q 50 yr	43.10	24.02	26.94		27.01	0.004489	1.09	39.59	22.33	0.26
Upper Reach	1950.*	Q 100 yr	49.30	24.02	27.13		27.19	0.004520	1.13	43.74	23.22	0.26
Upper Reach	1940.*	Q 2 yr	16.90	23.97	25.87		25.91	0.004699	0.89	19.08	16.81	0.27
Upper Reach	1940.*	Q 5 yr	23.90	23.97	26.22		26.26	0.004715	0.95	25.27	18.85	0.26
Upper Reach	1940.*	Q 10 yr	30.00	23.97	26.46		26.51	0.004720	1.00	29.99	20.01	0.26
Upper Reach	1940.*	Q 20 yr	35.50	23.97	26.66		26.71	0.004714	1.04	34.08	20.97	0.26
Upper Reach	1940.*	Q 50 yr	43.10	23.97	26.90		26.96	0.004807	1.10	39.21	22.10	0.26
Upper Reach	1940.*	Q 100 yr	49.30	23.97	27.08		27.15	0.004845	1.14	43.31	22.98	0.26
Upper Reach	1930	Q 2 yr	24.10	23.92	25.70		25.81	0.019559	1.42	17.01	15.94	0.44
Upper Reach	1930	Q 5 yr	34.50	23.92	26.04		26.16	0.020247	1.52	22.66	17.87	0.43
Upper Reach	1930	Q 10 yr	43.30	23.92	26.27		26.40	0.020924	1.61	26.98	19.19	0.43
Upper Reach	1930	Q 20 yr	51.60	23.92	26.46		26.61	0.021316	1.68	30.71	20.08	0.43
Upper Reach	1930	Q 50 yr	62.50	23.92	26.69		26.85	0.021779	1.77	35.37	21.14	0.44
Upper Reach	1930	Q 100 yr	71.60	23.92	26.86		27.03	0.022136	1.83	39.09	21.95	0.44
Upper Reach	1920.*	Q 2 yr	24.10	23.79	25.53		25.64	0.013785	1.46	16.47	15.75	0.46
Upper Reach	1920.*	Q 5 yr	34.50	23.79	25.86		25.99	0.014112	1.57	21.96	17.69	0.45
Upper Reach	1920.*	Q 10 yr	43.30	23.79	26.09		26.23	0.014496	1.66	26.11	18.97	0.45
Upper Reach	1920.*	Q 20 yr	51.60	23.79	26.28		26.43	0.014589	1.73	29.75	19.86	0.45
Upper Reach	1920.*	Q 50 yr	62.50	23.79	26.50		26.67	0.014725	1.82	34.29	20.92	0.45
Upper Reach	1920.*	Q 100 yr	71.60	23.79	26.67		26.85	0.014847	1.89	37.91	21.74	0.46
Upper Reach	1910.*	Q 2 yr	24.10	23.66	25.40		25.50	0.013927	1.47	16.42	15.75	0.46
Upper Reach	1910.*	Q 5 yr	34.50	23.66	25.72		25.85	0.014293	1.58	21.85	17.69	0.45
Upper Reach	1910.*	Q 10 yr	43.30	23.66	25.94		26.08	0.014613	1.67	25.92	18.91	0.46
Upper Reach	1910.*	Q 20 yr	51.60	23.66	26.13		26.28	0.014714	1.75	29.52	19.82	0.46
Upper Reach	1910.*	Q 50 yr	62.50	23.66	26.35		26.52	0.014860	1.84	34.01	20.89	0.46
Upper Reach	1910.*	Q 100 yr	71.60	23.66	26.52		26.70	0.014990	1.90	37.60	21.71	0.46
Upper Reach	1900.*	Q 2 yr	24.10	23.53	25.25		25.37	0.013937	1.47	16.36	15.76	0.46
Upper Reach	1900.*	Q 5 yr	34.50	23.53	25.57		25.70	0.014380	1.59	21.71	17.71	0.46
Upper Reach	1900.*	Q 10 yr	43.30	23.53	25.79		25.94	0.014618	1.68	25.71	18.86	0.46
Upper Reach	1900.*	Q 20 yr	51.60	23.53	25.98		26.14	0.014728	1.76	29.28	19.78	0.46
Upper Reach	1900.*	Q 50 yr	62.50	23.53	26.20		26.37	0.014886	1.85	33.73	20.86	0.47
Upper Reach	1900.*	Q 100 yr	71.60	23.53	26.36		26.55	0.015027	1.92	37.28	21.69	0.47
Upper Reach	1890.*	Q 2 yr	24.10	23.40	25.11		25.23	0.014136	1.48	16.29	15.76	0.46
Upper Reach	1890.*	Q 5 yr	34.50	23.40	25.43		25.56	0.014658	1.60	21.54	17.72	0.46
Upper Reach	1890.*	Q 10 yr	43.30	23.40	25.64		25.79	0.014779	1.70	25.49	18.82	0.47
Upper Reach	1890.*	Q 20 yr	51.60	23.40	25.83		25.99	0.014894	1.78	29.03	19.74	0.47
Upper Reach	1890.*	Q 50 yr	62.50	23.40	26.04		26.22	0.015061	1.87	33.43	20.84	0.47
Upper Reach	1890.*	Q 100 yr	71.60	23.40	26.21		26.40	0.015212	1.94	36.94	21.67	0.47
Upper Reach	1880.*	Q 2 yr	24.10	23.27	24.97		25.08	0.013999	1.49	16.22	15.78	0.47

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	1880.*	Q 5 yr	34.50	23.27	25.28		25.41	0.014497	1.61	21.37	17.68	0.47
Upper Reach	1880.*	Q 10 yr	43.30	23.27	25.49		25.64	0.014609	1.71	25.29	18.78	0.47
Upper Reach	1880.*	Q 20 yr	51.60	23.27	25.68		25.84	0.014732	1.79	28.79	19.72	0.47
Upper Reach	1880.*	Q 50 yr	62.50	23.27	25.89		26.07	0.014910	1.89	33.15	20.82	0.48
Upper Reach	1880.*	Q 100 yr	71.60	23.27	26.05		26.25	0.015072	1.96	36.61	21.66	0.48
Upper Reach	1870.*	Q 2 yr	24.10	23.13	24.83		24.94	0.014152	1.49	16.17	15.80	0.47
Upper Reach	1870.*	Q 5 yr	34.50	23.13	25.13		25.27	0.014605	1.63	21.22	17.63	0.47
Upper Reach	1870.*	Q 10 yr	43.30	23.13	25.35		25.50	0.014731	1.73	25.10	18.75	0.48
Upper Reach	1870.*	Q 20 yr	51.60	23.13	25.53		25.69	0.014865	1.81	28.57	19.70	0.48
Upper Reach	1870.*	Q 50 yr	62.50	23.13	25.74		25.92	0.015061	1.90	32.88	20.82	0.48
Upper Reach	1870.*	Q 100 yr	71.60	23.13	25.90		26.10	0.015242	1.97	36.30	21.67	0.49
Upper Reach	1860.*	Q 2 yr	24.10	23.00	24.69		24.80	0.014181	1.50	16.10	15.83	0.47
Upper Reach	1860.*	Q 5 yr	34.50	23.00	24.98		25.12	0.014582	1.64	21.06	17.60	0.48
Upper Reach	1860.*	Q 10 yr	43.30	23.00	25.20		25.35	0.014724	1.74	24.91	18.74	0.48
Upper Reach	1860.*	Q 20 yr	51.60	23.00	25.37		25.54	0.014873	1.82	28.34	19.70	0.48
Upper Reach	1860.*	Q 50 yr	62.50	23.00	25.58		25.77	0.015091	1.92	32.60	20.83	0.49
Upper Reach	1860.*	Q 100 yr	71.60	23.00	25.74		25.94	0.015295	1.99	35.97	21.68	0.49
Upper Reach	1850.*	Q 2 yr	24.10	22.87	24.54		24.66	0.014404	1.51	16.01	15.87	0.48
Upper Reach	1850.*	Q 5 yr	34.50	22.87	24.84		24.97	0.014722	1.65	20.90	17.58	0.48
Upper Reach	1850.*	Q 10 yr	43.30	22.87	25.05		25.20	0.014875	1.75	24.72	18.73	0.49
Upper Reach	1850.*	Q 20 yr	51.60	22.87	25.22		25.39	0.015038	1.84	28.11	19.70	0.49
Upper Reach	1850.*	Q 50 yr	62.50	22.87	25.43		25.62	0.015281	1.93	32.31	20.85	0.50
Upper Reach	1850.*	Q 100 yr	71.60	22.87	25.58		25.79	0.015514	2.01	35.63	21.70	0.50
Upper Reach	1840.*	Q 2 yr	24.10	22.74	24.40		24.51	0.014509	1.51	15.91	15.90	0.48
Upper Reach	1840.*	Q 5 yr	34.50	22.74	24.69		24.83	0.014720	1.66	20.74	17.56	0.49
Upper Reach	1840.*	Q 10 yr	43.30	22.74	24.89		25.05	0.014892	1.77	24.52	18.73	0.49
Upper Reach	1840.*	Q 20 yr	51.60	22.74	25.07		25.24	0.015076	1.85	27.87	19.72	0.50
Upper Reach	1840.*	Q 50 yr	62.50	22.74	25.27		25.47	0.015355	1.95	32.01	20.87	0.50
Upper Reach	1840.*	Q 100 yr	71.60	22.74	25.42		25.63	0.015630	2.03	35.26	21.73	0.51
Upper Reach	1830.*	Q 2 yr	24.10	22.61	24.25		24.37	0.014690	1.53	15.80	15.89	0.49
Upper Reach	1830.*	Q 5 yr	34.50	22.61	24.54		24.68	0.014875	1.68	20.58	17.55	0.49
Upper Reach	1830.*	Q 10 yr	43.30	22.61	24.74		24.90	0.015068	1.78	24.31	18.74	0.50
Upper Reach	1830.*	Q 20 yr	51.60	22.61	24.91		25.09	0.015277	1.87	27.62	19.74	0.50
Upper Reach	1830.*	Q 50 yr	62.50	22.61	25.11		25.31	0.015603	1.97	31.69	20.90	0.51
Upper Reach	1830.*	Q 100 yr	71.60	22.61	25.26		25.48	0.015935	2.05	34.86	21.77	0.52
Upper Reach	1820.*	Q 2 yr	24.10	22.48	24.10		24.22	0.014714	1.54	15.66	15.86	0.49
Upper Reach	1820.*	Q 5 yr	34.50	22.48	24.38		24.53	0.014929	1.69	20.40	17.55	0.50
Upper Reach	1820.*	Q 10 yr	43.30	22.48	24.59		24.75	0.015150	1.80	24.08	18.76	0.51
Upper Reach	1820.*	Q 20 yr	51.60	22.48	24.76		24.94	0.015393	1.89	27.34	19.77	0.51
Upper Reach	1820.*	Q 50 yr	62.50	22.48	24.95		25.15	0.015787	2.00	31.33	20.94	0.52
Upper Reach	1820.*	Q 100 yr	71.60	22.48	25.10		25.32	0.016124	2.08	34.41	21.77	0.53
Upper Reach	1810.*	Q 2 yr	24.10	22.35	23.95		24.07	0.014931	1.55	15.52	15.83	0.50
Upper Reach	1810.*	Q 5 yr	34.50	22.35	24.23		24.38	0.015165	1.71	20.21	17.56	0.51
Upper Reach	1810.*	Q 10 yr	43.30	22.35	24.43		24.60	0.015413	1.82	23.84	18.79	0.51
Upper Reach	1810.*	Q 20 yr	51.60	22.35	24.60		24.78	0.015700	1.91	27.04	19.81	0.52
Upper Reach	1810.*	Q 50 yr	62.50	22.35	24.79		24.99	0.016188	2.02	30.92	20.98	0.53
Upper Reach	1810.*	Q 100 yr	71.60	22.35	24.93		25.15	0.016349	2.11	33.93	21.66	0.54
Upper Reach	1800.*	Q 2 yr	24.10	22.22	23.80		23.92	0.014754	1.57	15.39	15.82	0.51
Upper Reach	1800.*	Q 5 yr	34.50	22.22	24.08		24.23	0.015014	1.72	20.03	17.58	0.52
Upper Reach	1800.*	Q 10 yr	43.30	22.22	24.27		24.45	0.015300	1.83	23.61	18.83	0.52
Upper Reach	1800.*	Q 20 yr	51.60	22.22	24.44		24.63	0.015650	1.93	26.74	19.86	0.53
Upper Reach	1800.*	Q 50 yr	62.50	22.22	24.62		24.83	0.016062	2.05	30.51	20.92	0.54
Upper Reach	1800.*	Q 100 yr	71.60	22.22	24.76		24.99	0.016141	2.14	33.47	21.55	0.55
Upper Reach	1790.*	Q 2 yr	24.10	22.09	23.65		23.78	0.014930	1.58	15.27	15.83	0.51
Upper Reach	1790.*	Q 5 yr	34.50	22.09	23.92		24.08	0.015230	1.74	19.86	17.63	0.52
Upper Reach	1790.*	Q 10 yr	43.30	22.09	24.12		24.29	0.015579	1.85	23.38	18.90	0.53
Upper Reach	1790.*	Q 20 yr	51.60	22.09	24.27		24.47	0.016028	1.95	26.42	19.93	0.54
Upper Reach	1790.*	Q 50 yr	62.50	22.09	24.45		24.67	0.016216	2.08	30.10	20.81	0.55
Upper Reach	1790.*	Q 100 yr	71.60	22.09	24.59		24.83	0.016283	2.17	33.03	21.44	0.56
Upper Reach	1780.*	Q 2 yr	24.10	21.96	23.50		23.63	0.014962	1.59	15.14	15.85	0.52
Upper Reach	1780.*	Q 5 yr	34.50	21.96	23.77		23.92	0.015324	1.75	19.67	17.69	0.53
Upper Reach	1780.*	Q 10 yr	43.30	21.96	23.95		24.13	0.015777	1.87	23.11	18.97	0.54
Upper Reach	1780.*	Q 20 yr	51.60	21.96	24.11		24.31	0.016134	1.98	26.06	19.88	0.55
Upper Reach	1780.*	Q 50 yr	62.50	21.96	24.28		24.51	0.016204	2.11	29.69	20.69	0.56
Upper Reach	1780.*	Q 100 yr	71.60	21.96	24.42		24.67	0.016257	2.20	32.58	21.32	0.57
Upper Reach	1770.*	Q 2 yr	24.10	21.82	23.34		23.47	0.015196	1.61	15.01	15.88	0.53
Upper Reach	1770.*	Q 5 yr	34.50	21.82	23.61		23.77	0.015641	1.77	19.47	17.76	0.54
Upper Reach	1770.*	Q 10 yr	43.30	21.82	23.79		23.97	0.016250	1.90	22.80	19.04	0.55
Upper Reach	1770.*	Q 20 yr	51.60	21.82	23.94		24.14	0.016301	2.01	25.69	19.75	0.56
Upper Reach	1770.*	Q 50 yr	62.50	21.82	24.12		24.35	0.016348	2.14	29.27	20.56	0.57
Upper Reach	1770.*	Q 100 yr	71.60	21.82	24.25		24.51	0.016382	2.23	32.12	21.18	0.58
Upper Reach	1760.*	Q 2 yr	24.10	21.69	23.19		23.32	0.015307	1.62	14.87	15.94	0.54
Upper Reach	1760.*	Q 5 yr	34.50	21.69	23.45		23.61	0.015894	1.79	19.23	17.85	0.55
Upper Reach	1760.*	Q 10 yr	43.30	21.69	23.62		23.81	0.016312	1.93	22.45	18.92	0.57
Upper Reach	1760.*	Q 20 yr	51.60	21.69	23.77		23.98	0.016279	2.04	25.31	19.61	0.57
Upper Reach	1760.*	Q 50 yr	62.50	21.69	23.95		24.19	0.016290	2.17	28.86	20.42	0.58

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	1760.*	Q 100 yr	71.60	21.69	24.08		24.34	0.016298	2.26	31.68	21.05	0.59
Upper Reach	1750.*	Q 2 yr	24.10	21.56	23.03		23.17	0.015437	1.64	14.73	16.01	0.54
Upper Reach	1750.*	Q 5 yr	34.50	21.56	23.28		23.45	0.016268	1.82	18.95	17.94	0.57
Upper Reach	1750.*	Q 10 yr	43.30	21.56	23.45		23.65	0.016318	1.96	22.09	18.76	0.58
Upper Reach	1750.*	Q 20 yr	51.60	21.56	23.60		23.82	0.016193	2.07	24.96	19.46	0.58
Upper Reach	1750.*	Q 50 yr	62.50	21.56	23.78		24.02	0.016156	2.19	28.48	20.28	0.59
Upper Reach	1750.*	Q 100 yr	71.60	21.56	23.92		24.18	0.016130	2.29	31.29	20.92	0.60
Upper Reach	1740.*	Q 2 yr	24.10	21.43	22.87		23.01	0.015815	1.65	14.57	16.10	0.56
Upper Reach	1740.*	Q 5 yr	34.50	21.43	23.11		23.29	0.016517	1.85	18.64	17.79	0.58
Upper Reach	1740.*	Q 10 yr	43.30	21.43	23.28		23.48	0.016489	1.99	21.74	18.59	0.59
Upper Reach	1740.*	Q 20 yr	51.60	21.43	23.43		23.66	0.016194	2.09	24.64	19.31	0.59
Upper Reach	1740.*	Q 50 yr	62.50	21.43	23.61		23.86	0.016091	2.22	28.15	20.15	0.60
Upper Reach	1740.*	Q 100 yr	71.60	21.43	23.75		24.02	0.016023	2.31	30.96	20.79	0.60
Upper Reach	1730.*	Q 2 yr	24.10	21.30	22.71		22.85	0.016217	1.68	14.36	16.20	0.57
Upper Reach	1730.*	Q 5 yr	34.50	21.30	22.94		23.12	0.016602	1.89	18.29	17.59	0.59
Upper Reach	1730.*	Q 10 yr	43.30	21.30	23.11		23.32	0.016472	2.03	21.37	18.41	0.60
Upper Reach	1730.*	Q 20 yr	51.60	21.30	23.27		23.50	0.015851	2.11	24.40	19.17	0.60
Upper Reach	1730.*	Q 50 yr	62.50	21.30	23.45		23.71	0.015659	2.24	27.93	20.04	0.60
Upper Reach	1730.*	Q 100 yr	71.60	21.30	23.59		23.87	0.015541	2.33	30.76	20.70	0.61
Upper Reach	1720.*	Q 2 yr	24.10	21.17	22.54		22.69	0.016570	1.71	14.12	16.28	0.59
Upper Reach	1720.*	Q 5 yr	34.50	21.17	22.77		22.96	0.016489	1.92	17.97	17.38	0.60
Upper Reach	1720.*	Q 10 yr	43.30	21.17	22.94		23.16	0.016178	2.05	21.08	18.23	0.61
Upper Reach	1720.*	Q 20 yr	51.60	21.17	23.12		23.35	0.015090	2.12	24.33	19.07	0.60
Upper Reach	1720.*	Q 50 yr	62.50	21.17	23.30		23.56	0.014837	2.24	27.91	19.96	0.60
Upper Reach	1720.*	Q 100 yr	71.60	21.17	23.44		23.72	0.014691	2.33	30.76	20.65	0.61
Upper Reach	1710.*	Q 2 yr	24.10	21.04	22.37		22.52	0.016511	1.74	13.87	16.10	0.60
Upper Reach	1710.*	Q 5 yr	34.50	21.04	22.60		22.79	0.016270	1.95	17.71	17.17	0.61
Upper Reach	1710.*	Q 10 yr	43.30	21.04	22.78		23.00	0.015639	2.07	20.93	18.08	0.61
Upper Reach	1710.*	Q 20 yr	51.60	21.04	22.97		23.20	0.013994	2.11	24.50	19.03	0.59
Upper Reach	1710.*	Q 50 yr	62.50	21.04	23.16		23.41	0.013720	2.22	28.15	19.96	0.60
Upper Reach	1710.*	Q 100 yr	71.60	21.04	23.30		23.57	0.013580	2.31	31.03	20.67	0.60
Upper Reach	1700.*	Q 2 yr	24.10	20.91	22.20		22.36	0.016660	1.77	13.62	15.90	0.61
Upper Reach	1700.*	Q 5 yr	34.50	20.91	22.43		22.63	0.016019	1.97	17.52	16.97	0.62
Upper Reach	1700.*	Q 10 yr	43.30	20.91	22.63		22.85	0.014964	2.07	20.92	17.96	0.61
Upper Reach	1700.*	Q 20 yr	51.60	20.91	22.85		23.06	0.012742	2.07	24.94	19.06	0.58
Upper Reach	1700.*	Q 50 yr	62.50	20.91	23.04		23.28	0.012519	2.18	28.64	20.03	0.58
Upper Reach	1700.*	Q 100 yr	71.60	20.91	23.18		23.44	0.012421	2.27	31.57	20.76	0.59
Upper Reach	1690.*	Q 2 yr	24.10	20.78	22.03		22.19	0.016418	1.80	13.41	15.71	0.62
Upper Reach	1690.*	Q 5 yr	34.50	20.78	22.28		22.48	0.015138	1.97	17.49	16.80	0.62
Upper Reach	1690.*	Q 10 yr	43.30	20.78	22.49		22.70	0.013613	2.04	21.18	17.92	0.60
Upper Reach	1690.*	Q 20 yr	51.60	20.78	22.74		22.94	0.010988	2.00	25.74	19.21	0.55
Upper Reach	1690.*	Q 50 yr	62.50	20.78	22.93		23.16	0.010874	2.12	29.51	20.21	0.56
Upper Reach	1690.*	Q 100 yr	71.60	20.78	23.07		23.32	0.010848	2.20	32.48	20.97	0.57
Upper Reach	1680.*	Q 2 yr	24.10	20.65	21.86		22.03	0.016041	1.81	13.28	15.52	0.63
Upper Reach	1680.*	Q 5 yr	34.50	20.65	22.14		22.33	0.013845	1.95	17.72	16.71	0.60
Upper Reach	1680.*	Q 10 yr	43.30	20.65	22.37		22.57	0.012016	1.99	21.76	17.98	0.58
Upper Reach	1680.*	Q 20 yr	51.60	20.65	22.65		22.84	0.009201	1.91	26.97	19.49	0.52
Upper Reach	1680.*	Q 50 yr	62.50	20.65	22.84		23.05	0.009224	2.03	30.82	20.54	0.53
Upper Reach	1680.*	Q 100 yr	71.60	20.65	22.99		23.21	0.009282	2.12	33.84	21.32	0.54
Upper Reach	1670.*	Q 2 yr	24.10	20.51	21.71		21.87	0.014699	1.80	13.36	15.37	0.62
Upper Reach	1670.*	Q 5 yr	34.50	20.51	22.02		22.20	0.011814	1.89	18.30	16.74	0.58
Upper Reach	1670.*	Q 10 yr	43.30	20.51	22.27		22.46	0.009934	1.90	22.76	18.19	0.54
Upper Reach	1670.*	Q 20 yr	51.60	20.51	22.58		22.75	0.007339	1.80	28.63	19.94	0.48
Upper Reach	1670.*	Q 50 yr	62.50	20.51	22.77		22.96	0.007482	1.92	32.56	21.02	0.49
Upper Reach	1670.*	Q 100 yr	71.60	20.51	22.92		23.12	0.007452	2.01	35.70	22.38	0.50
Upper Reach	1660.*	Q 2 yr	24.10	20.38	21.58		21.74	0.012560	1.75	13.80	15.27	0.59
Upper Reach	1660.*	Q 5 yr	34.50	20.38	21.93		22.09	0.009604	1.79	19.31	16.94	0.53
Upper Reach	1660.*	Q 10 yr	43.30	20.38	22.20		22.36	0.007984	1.79	24.19	18.58	0.50
Upper Reach	1660.*	Q 20 yr	51.60	20.38	22.53		22.68	0.005807	1.68	30.68	20.57	0.44
Upper Reach	1660.*	Q 50 yr	62.50	20.38	22.72		22.89	0.005856	1.80	34.81	22.49	0.45
Upper Reach	1660.*	Q 100 yr	71.60	20.38	22.87		23.05	0.005766	1.89	38.22	24.24	0.45
Upper Reach	1650.*	Q 2 yr	24.10	20.25	21.49		21.62	0.009285	1.63	14.77	15.25	0.53
Upper Reach	1650.*	Q 5 yr	34.50	20.25	21.86		22.00	0.007161	1.66	20.78	17.34	0.48
Upper Reach	1650.*	Q 10 yr	43.30	20.25	22.15		22.29	0.006005	1.66	26.05	19.17	0.46
Upper Reach	1650.*	Q 20 yr	51.60	20.25	22.50		22.62	0.004225	1.56	33.24	22.32	0.39
Upper Reach	1650.*	Q 50 yr	62.50	20.25	22.69		22.83	0.004223	1.68	37.76	24.74	0.40
Upper Reach	1650.*	Q 100 yr	71.60	20.25	22.84		23.00	0.004240	1.78	41.52	26.50	0.41
Upper Reach	1640.*	Q 2 yr	24.10	20.12	21.43		21.54	0.006578	1.49	16.22	15.34	0.46
Upper Reach	1640.*	Q 5 yr	34.50	20.12	21.81		21.93	0.005381	1.52	22.65	17.97	0.43
Upper Reach	1640.*	Q 10 yr	43.30	20.12	22.11		22.23	0.004568	1.53	28.32	20.30	0.41
Upper Reach	1640.*	Q 20 yr	51.60	20.12	22.47		22.58	0.003068	1.44	36.50	24.89	0.35
Upper Reach	1640.*	Q 50 yr	62.50	20.12	22.67		22.79	0.003157	1.57	41.53	27.31	0.36
Upper Reach	1640.*	Q 100 yr	71.60	20.12	22.81		22.95	0.003228	1.67	45.68	29.14	0.37
Upper Reach	1630.*	Q 2 yr	24.10	19.99	21.39		21.48	0.004575	1.34	18.01	15.93	0.40
Upper Reach	1630.*	Q 5 yr	34.50	19.99	21.78		21.88	0.003952	1.39	24.87	18.87	0.39

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	1630.*	Q 10 yr	43.30	19.99	22.08		22.18	0.003239	1.40	31.17	22.67	0.36
Upper Reach	1630.*	Q 20 yr	51.60	19.99	22.46		22.55	0.002210	1.34	40.60	27.77	0.31
Upper Reach	1630.*	Q 50 yr	62.50	19.99	22.65		22.76	0.002333	1.47	46.19	30.36	0.32
Upper Reach	1630.*	Q 100 yr	71.60	19.99	22.80		22.92	0.002427	1.56	50.86	33.49	0.33
Upper Reach	1620.*	Q 2 yr	24.10	19.86	21.36		21.43	0.003261	1.20	20.09	16.82	0.35
Upper Reach	1620.*	Q 5 yr	34.50	19.86	21.76		21.84	0.002861	1.26	27.56	21.17	0.34
Upper Reach	1620.*	Q 10 yr	43.30	19.86	22.07		22.15	0.002300	1.29	34.84	25.79	0.31
Upper Reach	1620.*	Q 20 yr	51.60	19.86	22.45		22.53	0.001644	1.24	45.69	32.14	0.27
Upper Reach	1620.*	Q 50 yr	62.50	19.86	22.64		22.73	0.001774	1.37	52.34	37.05	0.29
Upper Reach	1620.*	Q 100 yr	71.60	19.86	22.79		22.89	0.001866	1.47	58.06	40.85	0.30
Upper Reach	1610	Q 2 yr	24.10	19.73	21.34	20.46	21.40	0.002326	1.07	22.45	18.32	0.31
Upper Reach	1610	Q 5 yr	34.50	19.73	21.75	20.66	21.81	0.001921	1.14	31.05	24.57	0.29
Upper Reach	1610	Q 10 yr	43.30	19.73	22.06	20.80	22.13	0.001627	1.19	39.50	29.63	0.28
Upper Reach	1610	Q 20 yr	51.60	19.73	22.44	20.93	22.51	0.001210	1.16	53.01	41.16	0.25
Upper Reach	1610	Q 50 yr	62.50	19.73	22.63	21.11	22.71	0.001318	1.28	61.40	44.83	0.26
Upper Reach	1610	Q 100 yr	71.60	19.73	22.78	21.25	22.87	0.001391	1.36	68.15	46.42	0.27
Upper Reach	1609		Culvert									
Upper Reach	1595	Q 2 yr	24.10	19.63	20.64		20.81	0.008302	1.85	13.01	14.12	0.62
Upper Reach	1595	Q 5 yr	34.50	19.63	20.90		21.11	0.007839	2.06	16.76	14.79	0.62
Upper Reach	1595	Q 10 yr	43.30	19.63	21.08		21.33	0.007730	2.23	19.58	16.53	0.62
Upper Reach	1595	Q 20 yr	51.60	19.63	21.23		21.51	0.007750	2.38	22.14	18.07	0.63
Upper Reach	1595	Q 50 yr	62.50	19.63	21.40		21.73	0.007752	2.56	25.45	20.54	0.65
Upper Reach	1595	Q 100 yr	71.60	19.63	21.53		21.90	0.007822	2.71	28.22	22.62	0.66
Upper Reach	1585.*	Q 2 yr	24.10	19.44	20.56		20.73	0.007885	1.83	13.14	13.98	0.60
Upper Reach	1585.*	Q 5 yr	34.50	19.44	20.82		21.03	0.007474	2.04	16.92	14.61	0.60
Upper Reach	1585.*	Q 10 yr	43.30	19.44	21.00		21.25	0.007431	2.21	19.73	16.50	0.61
Upper Reach	1585.*	Q 20 yr	51.60	19.44	21.15		21.44	0.007456	2.36	22.30	18.41	0.63
Upper Reach	1585.*	Q 50 yr	62.50	19.44	21.32		21.65	0.007507	2.55	25.67	21.20	0.64
Upper Reach	1585.*	Q 100 yr	71.60	19.44	21.45		21.82	0.007615	2.70	28.51	23.46	0.65
Upper Reach	1575.*	Q 2 yr	24.10	19.25	20.48		20.65	0.007558	1.82	13.27	13.86	0.59
Upper Reach	1575.*	Q 5 yr	34.50	19.25	20.75		20.96	0.007195	2.02	17.09	14.50	0.59
Upper Reach	1575.*	Q 10 yr	43.30	19.25	20.93		21.18	0.007231	2.19	19.88	16.53	0.61
Upper Reach	1575.*	Q 20 yr	51.60	19.25	21.08		21.36	0.007251	2.35	22.48	18.91	0.62
Upper Reach	1575.*	Q 50 yr	62.50	19.25	21.25		21.58	0.007356	2.55	25.94	22.08	0.63
Upper Reach	1575.*	Q 100 yr	71.60	19.25	21.37		21.74	0.007505	2.70	28.86	24.51	0.65
Upper Reach	1565.*	Q 2 yr	24.10	19.07	20.41		20.58	0.007285	1.80	13.42	13.74	0.58
Upper Reach	1565.*	Q 5 yr	34.50	19.07	20.68		20.89	0.006983	2.00	17.25	14.40	0.58
Upper Reach	1565.*	Q 10 yr	43.30	19.07	20.86		21.11	0.007076	2.18	20.02	16.76	0.60
Upper Reach	1565.*	Q 20 yr	51.60	19.07	21.01		21.29	0.007110	2.34	22.68	19.61	0.61
Upper Reach	1565.*	Q 50 yr	62.50	19.07	21.18		21.50	0.007270	2.54	26.26	23.22	0.63
Upper Reach	1565.*	Q 100 yr	71.60	19.07	21.30		21.67	0.007461	2.70	29.28	25.80	0.64
Upper Reach	1555.*	Q 2 yr	24.10	18.88	20.34		20.50	0.007099	1.78	13.53	13.60	0.57
Upper Reach	1555.*	Q 5 yr	34.50	18.88	20.62		20.82	0.006869	1.99	17.38	14.32	0.58
Upper Reach	1555.*	Q 10 yr	43.30	18.88	20.79		21.03	0.006978	2.17	20.13	17.32	0.59
Upper Reach	1555.*	Q 20 yr	51.60	18.88	20.94		21.22	0.007055	2.33	22.89	20.59	0.60
Upper Reach	1555.*	Q 50 yr	62.50	18.88	21.10		21.43	0.007269	2.54	26.62	24.64	0.62
Upper Reach	1555.*	Q 100 yr	71.60	18.88	21.22		21.59	0.007513	2.70	29.74	27.49	0.64
Upper Reach	1545.*	Q 2 yr	24.10	18.69	20.27		20.43	0.007000	1.77	13.61	13.45	0.56
Upper Reach	1545.*	Q 5 yr	34.50	18.69	20.55		20.75	0.006852	1.98	17.45	14.25	0.57
Upper Reach	1545.*	Q 10 yr	43.30	18.69	20.72		20.96	0.006965	2.17	20.24	18.11	0.59
Upper Reach	1545.*	Q 20 yr	51.60	18.69	20.87		21.15	0.007088	2.33	23.11	22.01	0.60
Upper Reach	1545.*	Q 50 yr	62.50	18.69	21.03		21.36	0.007361	2.54	27.03	26.51	0.62
Upper Reach	1545.*	Q 100 yr	71.60	18.69	21.15	20.69	21.51	0.007646	2.71	30.31	30.08	0.64
Upper Reach	1535.*	Q 2 yr	24.10	18.50	20.20		20.36	0.007002	1.77	13.64	13.29	0.56
Upper Reach	1535.*	Q 5 yr	34.50	18.50	20.48		20.68	0.006960	1.98	17.45	14.21	0.57
Upper Reach	1535.*	Q 10 yr	43.30	18.50	20.65		20.89	0.007067	2.17	20.31	19.22	0.59
Upper Reach	1535.*	Q 20 yr	51.60	18.50	20.79		21.07	0.007233	2.34	23.35	23.86	0.60
Upper Reach	1535.*	Q 50 yr	62.50	18.50	20.95		21.28	0.007566	2.56	27.52	29.26	0.63
Upper Reach	1535.*	Q 100 yr	71.60	18.50	21.07	20.62	21.44	0.007844	2.72	31.19	34.44	0.64
Upper Reach	1525.*	Q 2 yr	24.10	18.32	20.13		20.29	0.007123	1.77	13.60	13.10	0.56
Upper Reach	1525.*	Q 5 yr	34.50	18.32	20.41		20.61	0.007135	1.99	17.38	14.79	0.57
Upper Reach	1525.*	Q 10 yr	43.30	18.32	20.58		20.82	0.007307	2.19	20.36	20.78	0.59
Upper Reach	1525.*	Q 20 yr	51.60	18.32	20.72		21.00	0.007510	2.36	23.64	26.62	0.61
Upper Reach	1525.*	Q 50 yr	62.50	18.32	20.87	20.42	21.20	0.007842	2.57	28.32	33.92	0.63
Upper Reach	1525.*	Q 100 yr	71.60	18.32	20.99	20.56	21.36	0.008053	2.73	32.57	38.76	0.65
Upper Reach	1515	Q 2 yr	24.10	18.13	20.05		20.22	0.007400	1.79	13.44	12.80	0.56
Upper Reach	1515	Q 5 yr	34.50	18.13	20.33		20.53	0.007532	2.01	17.21	15.70	0.58
Upper Reach	1515	Q 10 yr	43.30	18.13	20.49		20.74	0.007772	2.22	20.35	23.26	0.60
Upper Reach	1515	Q 20 yr	51.60	18.13	20.63	20.20	20.92	0.007979	2.39	24.06	30.98	0.62
Upper Reach	1515	Q 50 yr	62.50	18.13	20.79	20.37	21.12	0.008261	2.60	29.40	37.80	0.64
Upper Reach	1515	Q 100 yr	71.60	18.13	20.90	20.50	21.27	0.008474	2.75	34.05	42.78	0.65
Upper Reach	1505.*	Q 2 yr	24.10	18.08	19.98		20.14	0.007377	1.79	13.46	12.93	0.56
Upper Reach	1505.*	Q 5 yr	34.50	18.08	20.25		20.46	0.007528	2.01	17.26	15.76	0.58
Upper Reach	1505.*	Q 10 yr	43.30	18.08	20.42		20.67	0.007765	2.21	20.35	23.09	0.60
Upper Reach	1505.*	Q 20 yr	51.60	18.08	20.55		20.84	0.007916	2.38	24.02	30.68	0.62

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	1505.*	Q 50 yr	62.50	18.08	20.71		21.03	0.008008	2.56	29.37	36.83	0.63
Upper Reach	1505.*	Q 100 yr	71.60	18.08	20.83	20.45	21.18	0.008063	2.68	34.01	41.21	0.64
Upper Reach	1495.*	Q 2 yr	24.10	18.02	19.91		20.07	0.007028	1.79	13.49	13.07	0.56
Upper Reach	1495.*	Q 5 yr	34.50	18.02	20.18		20.38	0.007195	2.00	17.31	15.84	0.58
Upper Reach	1495.*	Q 10 yr	43.30	18.02	20.34		20.59	0.007428	2.20	20.36	23.00	0.60
Upper Reach	1495.*	Q 20 yr	51.60	18.02	20.48		20.76	0.007588	2.37	23.96	30.48	0.62
Upper Reach	1495.*	Q 50 yr	62.50	18.02	20.63		20.96	0.007695	2.55	29.19	36.17	0.63
Upper Reach	1495.*	Q 100 yr	71.60	18.02	20.75	20.38	21.10	0.007770	2.69	33.66	40.20	0.64
Upper Reach	1485.*	Q 2 yr	24.10	17.97	19.84		20.00	0.007007	1.78	13.52	13.21	0.56
Upper Reach	1485.*	Q 5 yr	34.50	17.97	20.11		20.31	0.007197	1.99	17.36	15.95	0.58
Upper Reach	1485.*	Q 10 yr	43.30	17.97	20.27		20.51	0.007435	2.20	20.39	23.02	0.61
Upper Reach	1485.*	Q 20 yr	51.60	17.97	20.40		20.68	0.007600	2.37	23.93	30.37	0.62
Upper Reach	1485.*	Q 50 yr	62.50	17.97	20.56		20.88	0.007716	2.55	29.10	35.89	0.64
Upper Reach	1485.*	Q 100 yr	71.60	17.97	20.67	20.30	21.02	0.007794	2.68	33.48	39.62	0.65
Upper Reach	1475.*	Q 2 yr	24.10	17.92	19.77		19.93	0.006668	1.78	13.56	13.36	0.56
Upper Reach	1475.*	Q 5 yr	34.50	17.92	20.04		20.24	0.006872	1.98	17.42	16.10	0.59
Upper Reach	1475.*	Q 10 yr	43.30	17.92	20.20		20.44	0.007102	2.19	20.43	23.16	0.61
Upper Reach	1475.*	Q 20 yr	51.60	17.92	20.33		20.61	0.007269	2.36	23.94	30.40	0.62
Upper Reach	1475.*	Q 50 yr	62.50	17.92	20.48	20.08	20.80	0.007397	2.54	29.06	35.83	0.64
Upper Reach	1475.*	Q 100 yr	71.60	17.92	20.60	20.23	20.95	0.007482	2.68	33.37	39.33	0.65
Upper Reach	1465.*	Q 2 yr	24.10	17.87	19.71		19.87	0.006642	1.77	13.60	13.52	0.56
Upper Reach	1465.*	Q 5 yr	34.50	17.87	19.97		20.17	0.006869	1.98	17.49	16.27	0.59
Upper Reach	1465.*	Q 10 yr	43.30	17.87	20.13		20.37	0.007104	2.18	20.49	23.34	0.61
Upper Reach	1465.*	Q 20 yr	51.60	17.87	20.26		20.54	0.007276	2.35	23.97	30.49	0.63
Upper Reach	1465.*	Q 50 yr	62.50	17.87	20.41		20.73	0.007414	2.54	29.04	35.93	0.64
Upper Reach	1465.*	Q 100 yr	71.60	17.87	20.52	20.16	20.87	0.007499	2.67	33.32	39.27	0.65
Upper Reach	1455.*	Q 2 yr	24.10	17.82	19.64		19.80	0.006639	1.77	13.63	13.67	0.57
Upper Reach	1455.*	Q 5 yr	34.50	17.82	19.90		20.10	0.006897	1.97	17.53	16.43	0.59
Upper Reach	1455.*	Q 10 yr	43.30	17.82	20.06		20.30	0.007134	2.18	20.52	23.56	0.61
Upper Reach	1455.*	Q 20 yr	51.60	17.82	20.19		20.46	0.007309	2.35	23.98	30.63	0.63
Upper Reach	1455.*	Q 50 yr	62.50	17.82	20.34		20.65	0.007451	2.53	29.02	36.12	0.65
Upper Reach	1455.*	Q 100 yr	71.60	17.82	20.45	20.10	20.80	0.007530	2.67	33.28	39.34	0.66
Upper Reach	1445.*	Q 2 yr	24.10	17.76	19.58		19.73	0.006337	1.77	13.65	13.83	0.57
Upper Reach	1445.*	Q 5 yr	34.50	17.76	19.84		20.03	0.006615	1.97	17.57	16.60	0.59
Upper Reach	1445.*	Q 10 yr	43.30	17.76	19.99		20.23	0.006843	2.17	20.55	23.84	0.61
Upper Reach	1445.*	Q 20 yr	51.60	17.76	20.11		20.39	0.007018	2.34	23.99	30.85	0.63
Upper Reach	1445.*	Q 50 yr	62.50	17.76	20.26		20.58	0.007168	2.53	29.00	36.40	0.65
Upper Reach	1445.*	Q 100 yr	71.60	17.76	20.37	20.02	20.72	0.007246	2.67	33.25	39.53	0.66
Upper Reach	1435.*	Q 2 yr	24.10	17.71	19.51		19.67	0.006346	1.76	13.68	13.99	0.57
Upper Reach	1435.*	Q 5 yr	34.50	17.71	19.77		19.97	0.006654	1.96	17.61	16.81	0.59
Upper Reach	1435.*	Q 10 yr	43.30	17.71	19.92		20.16	0.006883	2.17	20.59	24.17	0.62
Upper Reach	1435.*	Q 20 yr	51.60	17.71	20.04		20.32	0.007060	2.34	24.03	31.07	0.64
Upper Reach	1435.*	Q 50 yr	62.50	17.71	20.19		20.51	0.007218	2.53	29.00	36.78	0.65
Upper Reach	1435.*	Q 100 yr	71.60	17.71	20.30	19.96	20.65	0.007286	2.66	33.27	39.84	0.66
Upper Reach	1425.*	Q 2 yr	24.10	17.66	19.45		19.61	0.006058	1.76	13.71	14.17	0.57
Upper Reach	1425.*	Q 5 yr	34.50	17.66	19.71		19.90	0.006378	1.96	17.65	17.06	0.60
Upper Reach	1425.*	Q 10 yr	43.30	17.66	19.85		20.09	0.006597	2.16	20.65	24.59	0.62
Upper Reach	1425.*	Q 20 yr	51.60	17.66	19.98		20.25	0.006771	2.33	24.08	31.35	0.64
Upper Reach	1425.*	Q 50 yr	62.50	17.66	20.12	19.76	20.44	0.006934	2.52	29.03	37.20	0.66
Upper Reach	1425.*	Q 100 yr	71.60	17.66	20.23	19.89	20.58	0.006997	2.66	33.32	40.24	0.67
Upper Reach	1415.*	Q 2 yr	24.10	17.61	19.39		19.55	0.006063	1.75	13.75	14.36	0.57
Upper Reach	1415.*	Q 5 yr	34.50	17.61	19.64		19.84	0.006408	1.95	17.69	17.35	0.60
Upper Reach	1415.*	Q 10 yr	43.30	17.61	19.79		20.03	0.006625	2.16	20.73	25.12	0.62
Upper Reach	1415.*	Q 20 yr	51.60	17.61	19.91		20.18	0.006801	2.33	24.17	31.72	0.64
Upper Reach	1415.*	Q 50 yr	62.50	17.61	20.05	19.70	20.37	0.006963	2.52	29.12	37.53	0.66
Upper Reach	1415.*	Q 100 yr	71.60	17.61	20.16	19.83	20.51	0.007019	2.65	33.44	40.76	0.67
Upper Reach	1405.*	Q 2 yr	24.10	17.56	19.33		19.49	0.005784	1.75	13.79	14.56	0.57
Upper Reach	1405.*	Q 5 yr	34.50	17.56	19.58		19.78	0.006132	1.95	17.74	17.67	0.60
Upper Reach	1405.*	Q 10 yr	43.30	17.56	19.73		19.96	0.006337	2.15	20.81	25.70	0.62
Upper Reach	1405.*	Q 20 yr	51.60	17.56	19.84		20.12	0.006508	2.32	24.28	32.13	0.64
Upper Reach	1405.*	Q 50 yr	62.50	17.56	19.99	19.64	20.30	0.006669	2.51	29.22	37.92	0.66
Upper Reach	1405.*	Q 100 yr	71.60	17.56	20.09	19.77	20.44	0.006721	2.65	33.58	41.35	0.67
Upper Reach	1395.*	Q 2 yr	24.10	17.50	19.28		19.43	0.005806	1.74	13.83	14.77	0.57
Upper Reach	1395.*	Q 5 yr	34.50	17.50	19.52		19.71	0.006167	1.94	17.79	18.10	0.60
Upper Reach	1395.*	Q 10 yr	43.30	17.50	19.66		19.90	0.006369	2.15	20.92	26.39	0.63
Upper Reach	1395.*	Q 20 yr	51.60	17.50	19.78		20.05	0.006542	2.31	24.40	32.63	0.65
Upper Reach	1395.*	Q 50 yr	62.50	17.50	19.92	19.58	20.23	0.006700	2.51	29.37	38.41	0.66
Upper Reach	1395.*	Q 100 yr	71.60	17.50	20.03	19.71	20.37	0.006740	2.64	33.78	42.04	0.67
Upper Reach	1385.*	Q 2 yr	24.10	17.45	19.22		19.37	0.005854	1.74	13.85	14.98	0.58
Upper Reach	1385.*	Q 5 yr	34.50	17.45	19.46		19.65	0.006226	1.94	17.81	18.75	0.61
Upper Reach	1385.*	Q 10 yr	43.30	17.45	19.60		19.83	0.006427	2.14	20.99	27.06	0.63
Upper Reach	1385.*	Q 20 yr	51.60	17.45	19.71		19.98	0.006602	2.31	24.50	33.12	0.65
Upper Reach	1385.*	Q 50 yr	62.50	17.45	19.85	19.52	20.17	0.006754	2.50	29.49	38.93	0.67
Upper Reach	1385.*	Q 100 yr	71.60	17.45	19.96	19.66	20.30	0.006776	2.63	33.97	42.80	0.68
Upper Reach	1375.*	Q 2 yr	24.10	17.40	19.16		19.31	0.005624	1.74	13.86	15.20	0.58

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	1375.*	Q 5 yr	34.50	17.40	19.40		19.59	0.005981	1.94	17.84	19.41	0.61
Upper Reach	1375.*	Q 10 yr	43.30	17.40	19.54		19.77	0.006173	2.14	21.07	27.76	0.63
Upper Reach	1375.*	Q 20 yr	51.60	17.40	19.65		19.92	0.006344	2.31	24.60	33.65	0.65
Upper Reach	1375.*	Q 50 yr	62.50	17.40	19.79	19.47	20.10	0.006488	2.50	29.60	39.51	0.67
Upper Reach	1375.*	Q 100 yr	71.60	17.40	19.90	19.60	20.24	0.006501	2.63	34.16	43.99	0.68
Upper Reach	1365.*	Q 2 yr	24.10	17.35	19.10		19.26	0.005696	1.74	13.87	15.43	0.58
Upper Reach	1365.*	Q 5 yr	34.50	17.35	19.34		19.53	0.006047	1.94	17.87	20.17	0.61
Upper Reach	1365.*	Q 10 yr	43.30	17.35	19.47		19.71	0.006236	2.14	21.17	28.60	0.64
Upper Reach	1365.*	Q 20 yr	51.60	17.35	19.59		19.86	0.006408	2.31	24.73	34.29	0.66
Upper Reach	1365.*	Q 50 yr	62.50	17.35	19.72	19.41	20.03	0.006541	2.50	29.79	40.22	0.67
Upper Reach	1365.*	Q 100 yr	71.60	17.35	19.83	19.54	20.17	0.006539	2.62	34.46	45.81	0.68
Upper Reach	1355.*	Q 2 yr	24.10	17.30	19.05		19.20	0.005485	1.74	13.88	15.67	0.59
Upper Reach	1355.*	Q 5 yr	34.50	17.30	19.28		19.47	0.005799	1.93	17.91	21.00	0.62
Upper Reach	1355.*	Q 10 yr	43.30	17.30	19.41		19.65	0.005977	2.13	21.29	29.53	0.64
Upper Reach	1355.*	Q 20 yr	51.60	17.30	19.53	19.22	19.79	0.006144	2.30	24.89	35.02	0.66
Upper Reach	1355.*	Q 50 yr	62.50	17.30	19.66	19.36	19.97	0.006264	2.49	30.01	41.05	0.68
Upper Reach	1355.*	Q 100 yr	71.60	17.30	19.77	19.48	20.11	0.006242	2.62	34.87	47.82	0.69
Upper Reach	1345.*	Q 2 yr	24.10	17.24	18.99		19.15	0.005597	1.74	13.86	15.91	0.59
Upper Reach	1345.*	Q 5 yr	34.50	17.24	19.22		19.41	0.005878	1.93	17.95	21.86	0.62
Upper Reach	1345.*	Q 10 yr	43.30	17.24	19.35		19.59	0.006049	2.13	21.41	30.53	0.64
Upper Reach	1345.*	Q 20 yr	51.60	17.24	19.46		19.73	0.006218	2.30	25.04	35.81	0.66
Upper Reach	1345.*	Q 50 yr	62.50	17.24	19.60	19.31	19.91	0.006322	2.49	30.25	42.19	0.68
Upper Reach	1345.*	Q 100 yr	71.60	17.24	19.71	19.43	20.04	0.006237	2.60	35.41	49.67	0.69
Upper Reach	1335.*	Q 2 yr	24.10	17.19	18.93		19.09	0.005759	1.75	13.80	16.12	0.60
Upper Reach	1335.*	Q 5 yr	34.50	17.19	19.16		19.35	0.006006	1.94	17.94	22.62	0.63
Upper Reach	1335.*	Q 10 yr	43.30	17.19	19.29		19.52	0.006161	2.14	21.48	31.48	0.65
Upper Reach	1335.*	Q 20 yr	51.60	17.19	19.40		19.67	0.006330	2.30	25.14	36.64	0.67
Upper Reach	1335.*	Q 50 yr	62.50	17.19	19.53	19.26	19.84	0.006416	2.49	30.47	44.11	0.69
Upper Reach	1335.*	Q 100 yr	71.60	17.19	19.65	19.37	19.98	0.006228	2.59	36.04	51.56	0.69
Upper Reach	1325.*	Q 2 yr	24.10	17.14	18.88		19.03	0.005662	1.76	13.71	16.33	0.61
Upper Reach	1325.*	Q 5 yr	34.50	17.14	19.10		19.29	0.005836	1.94	17.92	23.43	0.64
Upper Reach	1325.*	Q 10 yr	43.30	17.14	19.23		19.46	0.005960	2.14	21.55	32.25	0.66
Upper Reach	1325.*	Q 20 yr	51.60	17.14	19.34		19.61	0.006127	2.31	25.25	37.58	0.68
Upper Reach	1325.*	Q 50 yr	62.50	17.14	19.47	19.20	19.78	0.006177	2.49	30.78	46.26	0.69
Upper Reach	1325.*	Q 100 yr	71.60	17.14	19.59	19.31	19.92	0.005882	2.57	36.84	53.77	0.68
Upper Reach	1315.*	Q 2 yr	24.10	17.09	18.81		18.97	0.005941	1.78	13.56	16.50	0.63
Upper Reach	1315.*	Q 5 yr	34.50	17.09	19.04		19.24	0.006028	1.95	17.86	24.19	0.64
Upper Reach	1315.*	Q 10 yr	43.30	17.09	19.17		19.40	0.006110	2.14	21.60	33.10	0.66
Upper Reach	1315.*	Q 20 yr	51.60	17.09	19.27	19.01	19.54	0.006277	2.31	25.34	38.66	0.68
Upper Reach	1315.*	Q 50 yr	62.50	17.09	19.41	19.15	19.72	0.006242	2.48	31.22	48.19	0.69
Upper Reach	1315.*	Q 100 yr	71.60	17.09	19.54	19.25	19.86	0.005811	2.55	37.91	56.80	0.68
Upper Reach	1305.*	Q 2 yr	24.10	17.03	18.75		18.92	0.005976	1.81	13.35	16.62	0.64
Upper Reach	1305.*	Q 5 yr	34.50	17.03	18.98		19.18	0.005936	1.97	17.76	24.91	0.66
Upper Reach	1305.*	Q 10 yr	43.30	17.03	19.11		19.34	0.005949	2.15	21.64	34.07	0.67
Upper Reach	1305.*	Q 20 yr	51.60	17.03	19.21	18.96	19.48	0.006114	2.32	25.43	40.25	0.69
Upper Reach	1305.*	Q 50 yr	62.50	17.03	19.35	19.11	19.66	0.005963	2.48	31.79	50.56	0.70
Upper Reach	1305.*	Q 100 yr	71.60	17.03	19.49	19.21	19.80	0.005401	2.52	39.32	58.93	0.67
Upper Reach	1295.*	Q 2 yr	24.10	16.98	18.68		18.85	0.006495	1.85	13.01	16.61	0.67
Upper Reach	1295.*	Q 5 yr	34.50	16.98	18.91		19.11	0.006288	1.99	17.55	25.37	0.67
Upper Reach	1295.*	Q 10 yr	43.30	16.98	19.05	18.80	19.28	0.006179	2.17	21.61	35.15	0.68
Upper Reach	1295.*	Q 20 yr	51.60	16.98	19.15	18.91	19.42	0.006341	2.34	25.49	42.42	0.70
Upper Reach	1295.*	Q 50 yr	62.50	16.98	19.29	19.06	19.59	0.005981	2.46	32.58	53.61	0.70
Upper Reach	1295.*	Q 100 yr	71.60	16.98	19.44	19.17	19.74	0.005233	2.48	41.12	61.84	0.66
Upper Reach	1285.*	Q 2 yr	24.10	16.93	18.59		18.78	0.007088	1.95	12.36	16.27	0.71
Upper Reach	1285.*	Q 5 yr	34.50	16.93	18.83		19.05	0.006779	2.06	16.88	24.33	0.71
Upper Reach	1285.*	Q 10 yr	43.30	16.93	18.96	18.76	19.22	0.006459	2.22	20.97	35.30	0.71
Upper Reach	1285.*	Q 20 yr	51.60	16.93	19.07	18.86	19.35	0.006559	2.39	24.90	43.46	0.73
Upper Reach	1285.*	Q 50 yr	62.50	16.93	19.24	19.00	19.53	0.005664	2.45	33.60	56.66	0.70
Upper Reach	1285.*	Q 100 yr	71.60	16.93	19.40	19.12	19.68	0.004775	2.43	43.26	64.85	0.65
Upper Reach	1275	Q 2 yr	24.10	16.88	18.40		18.68	0.011308	2.38	10.13	13.99	0.89
Upper Reach	1275	Q 5 yr	34.50	16.88	18.60	18.56	18.94	0.012517	2.58	13.36	17.69	0.95
Upper Reach	1275	Q 10 yr	43.30	16.88	18.74	18.71	19.11	0.012747	2.72	16.01	22.37	0.97
Upper Reach	1275	Q 20 yr	51.60	16.88	18.85	18.83	19.26	0.011414	2.82	19.26	32.91	0.94
Upper Reach	1275	Q 50 yr	62.50	16.88	19.19	18.95	19.48	0.005618	2.43	35.00	59.42	0.69
Upper Reach	1275	Q 100 yr	71.60	16.88	19.36	19.07	19.63	0.004505	2.37	46.12	68.00	0.63
Upper Reach	1265.*	Q 2 yr	24.10	16.80	18.26	18.22	18.57	0.013097	2.46	9.80	14.45	0.95
Upper Reach	1265.*	Q 5 yr	34.50	16.80	18.46	18.45	18.81	0.013812	2.63	13.12	18.33	0.99
Upper Reach	1265.*	Q 10 yr	43.30	16.80	18.59	18.58	18.98	0.013372	2.79	15.53	19.36	0.99
Upper Reach	1265.*	Q 20 yr	51.60	16.80	18.78	18.68	19.14	0.009519	2.67	20.35	32.12	0.86
Upper Reach	1265.*	Q 50 yr	62.50	16.80	19.17	18.83	19.41	0.004176	2.22	39.13	60.35	0.60
Upper Reach	1265.*	Q 100 yr	71.60	16.80	19.35		19.58	0.003426	2.18	50.86	69.03	0.56
Upper Reach	1255.*	Q 2 yr	24.10	16.70	18.17		18.43	0.011429	2.26	10.66	16.17	0.89
Upper Reach	1255.*	Q 5 yr	34.50	16.70	18.34	18.30	18.66	0.012307	2.52	13.70	18.74	0.94
Upper Reach	1255.*	Q 10 yr	43.30	16.70	18.53	18.42	18.85	0.009412	2.51	17.25	19.91	0.85
Upper Reach	1255.*	Q 20 yr	51.60	16.70	18.75	18.52	19.04	0.006298	2.37	23.20	35.59	0.72
Upper Reach	1255.*	Q 50 yr	62.50	16.70	19.19		19.36	0.002588	1.89	45.24	63.28	0.49

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	1255.*	Q 100 yr	71.60	16.70	19.38		19.53	0.002101	1.84	57.65	70.42	0.45
Upper Reach	1245.*	Q 2 yr	24.10	16.60	18.05	18.00	18.31	0.012549	2.28	10.58	17.07	0.92
Upper Reach	1245.*	Q 5 yr	34.50	16.60	18.22	18.17	18.54	0.012069	2.50	13.77	18.65	0.93
Upper Reach	1245.*	Q 10 yr	43.30	16.60	18.47		18.75	0.007498	2.34	18.55	20.83	0.76
Upper Reach	1245.*	Q 20 yr	51.60	16.60	18.73	18.40	18.97	0.004972	2.18	26.30	40.41	0.63
Upper Reach	1245.*	Q 50 yr	62.50	16.60	19.17		19.33	0.002326	1.84	49.42	61.78	0.46
Upper Reach	1245.*	Q 100 yr	71.60	16.60	19.35		19.51	0.002054	1.85	60.82	67.84	0.44
Upper Reach	1235.*	Q 2 yr	24.10	16.50	17.99		18.19	0.008770	2.01	12.01	17.92	0.78
Upper Reach	1235.*	Q 5 yr	34.50	16.50	18.17		18.43	0.008466	2.26	15.27	18.43	0.79
Upper Reach	1235.*	Q 10 yr	43.30	16.50	18.45		18.67	0.005452	2.11	20.62	22.30	0.65
Upper Reach	1235.*	Q 20 yr	51.60	16.50	18.72		18.92	0.003591	1.99	28.98	39.72	0.55
Upper Reach	1235.*	Q 50 yr	62.50	16.50	19.16		19.31	0.001819	1.72	52.33	61.58	0.41
Upper Reach	1235.*	Q 100 yr	71.60	16.50	19.34		19.48	0.001652	1.74	63.73	68.05	0.40
Upper Reach	1225.*	Q 2 yr	24.10	16.50	17.80	17.78	18.07	0.013888	2.34	10.31	17.39	0.97
Upper Reach	1225.*	Q 5 yr	34.50	16.50	18.10		18.34	0.007650	2.20	15.71	18.32	0.76
Upper Reach	1225.*	Q 10 yr	43.30	16.50	18.41		18.61	0.004766	2.01	21.93	25.87	0.60
Upper Reach	1225.*	Q 20 yr	51.60	16.50	18.70		18.87	0.003089	1.88	31.86	43.32	0.51
Upper Reach	1225.*	Q 50 yr	62.50	16.50	19.16		19.28	0.001571	1.62	56.85	62.86	0.38
Upper Reach	1225.*	Q 100 yr	71.60	16.50	19.34		19.46	0.001442	1.65	68.54	68.74	0.37
Upper Reach	1215.*	Q 2 yr	24.10	16.40	17.69	17.63	17.94	0.011475	2.21	10.89	17.21	0.89
Upper Reach	1215.*	Q 5 yr	34.50	16.40	18.07		18.26	0.005313	1.96	17.58	18.30	0.64
Upper Reach	1215.*	Q 10 yr	43.30	16.40	18.39		18.56	0.003494	1.82	24.77	30.22	0.52
Upper Reach	1215.*	Q 20 yr	51.60	16.40	18.69		18.84	0.002354	1.73	36.23	47.11	0.44
Upper Reach	1215.*	Q 50 yr	62.50	16.40	19.16		19.26	0.001265	1.51	61.76	61.88	0.34
Upper Reach	1215.*	Q 100 yr	71.60	16.40	19.33		19.44	0.001189	1.55	73.20	67.93	0.33
Upper Reach	1205.*	Q 2 yr	24.10	16.30	17.63		17.83	0.008435	1.98	12.17	17.15	0.75
Upper Reach	1205.*	Q 5 yr	34.50	16.30	18.05		18.20	0.004360	1.76	19.62	18.43	0.54
Upper Reach	1205.*	Q 10 yr	43.30	16.30	18.38		18.52	0.003025	1.67	27.22	30.75	0.45
Upper Reach	1205.*	Q 20 yr	51.60	16.30	18.68		18.81	0.002137	1.60	38.93	46.45	0.39
Upper Reach	1205.*	Q 50 yr	62.50	16.30	19.15		19.25	0.001210	1.42	64.60	62.39	0.31
Upper Reach	1205.*	Q 100 yr	71.60	16.30	19.33		19.43	0.001151	1.46	76.25	68.20	0.31
Upper Reach	1195.*	Q 2 yr	24.10	16.20	17.58		17.75	0.005705	1.80	13.42	16.90	0.64
Upper Reach	1195.*	Q 5 yr	34.50	16.20	18.03		18.16	0.002889	1.63	21.19	18.18	0.48
Upper Reach	1195.*	Q 10 yr	43.30	16.20	18.37		18.49	0.002167	1.57	29.46	33.51	0.41
Upper Reach	1195.*	Q 20 yr	51.60	16.20	18.67		18.79	0.001563	1.51	42.16	47.61	0.36
Upper Reach	1195.*	Q 50 yr	62.50	16.20	19.15		19.23	0.000922	1.36	68.22	61.89	0.29
Upper Reach	1195.*	Q 100 yr	71.60	16.20	19.33		19.42	0.000892	1.41	79.56	66.27	0.29
Upper Reach	1185.*	Q 2 yr	24.10	16.10	17.56		17.69	0.004448	1.56	15.45	17.13	0.52
Upper Reach	1185.*	Q 5 yr	34.50	16.10	18.02		18.13	0.002870	1.47	23.54	19.30	0.41
Upper Reach	1185.*	Q 10 yr	43.30	16.10	18.36		18.46	0.002165	1.43	33.25	36.64	0.36
Upper Reach	1185.*	Q 20 yr	51.60	16.10	18.67		18.77	0.001609	1.39	46.30	46.84	0.32
Upper Reach	1185.*	Q 50 yr	62.50	16.10	19.15		19.22	0.000988	1.26	72.12	61.90	0.26
Upper Reach	1185.*	Q 100 yr	71.60	16.10	19.33		19.40	0.000964	1.31	83.52	66.18	0.26
Upper Reach	1175.*	Q 2 yr	24.10	16.00	17.55		17.65	0.002583	1.40	17.23	17.12	0.45
Upper Reach	1175.*	Q 5 yr	34.50	16.00	18.00		18.10	0.001846	1.36	25.67	23.51	0.37
Upper Reach	1175.*	Q 10 yr	43.30	16.00	18.35		18.44	0.001335	1.34	36.59	38.17	0.33
Upper Reach	1175.*	Q 20 yr	51.60	16.00	18.67		18.75	0.001025	1.31	49.97	47.19	0.29
Upper Reach	1175.*	Q 50 yr	62.50	16.00	19.14		19.21	0.000663	1.22	75.77	60.65	0.25
Upper Reach	1175.*	Q 100 yr	71.60	16.00	19.32		19.39	0.000661	1.27	86.89	64.98	0.25
Upper Reach	1165.*	Q 2 yr	24.10	15.90	17.53		17.61	0.002862	1.28	18.79	17.24	0.39
Upper Reach	1165.*	Q 5 yr	34.50	15.90	17.99		18.07	0.002349	1.27	27.69	24.86	0.33
Upper Reach	1165.*	Q 10 yr	43.30	15.90	18.34		18.42	0.001766	1.27	38.65	38.57	0.30
Upper Reach	1165.*	Q 20 yr	51.60	15.90	18.66		18.74	0.001366	1.24	52.42	47.92	0.27
Upper Reach	1165.*	Q 50 yr	62.50	15.90	19.14		19.20	0.000884	1.14	78.46	59.80	0.22
Upper Reach	1165.*	Q 100 yr	71.60	15.90	19.32		19.38	0.000881	1.19	89.51	64.49	0.23
Upper Reach	1155.*	Q 2 yr	24.10	15.90	17.51		17.58	0.002478	1.19	20.23	17.01	0.35
Upper Reach	1155.*	Q 5 yr	34.50	15.90	17.97		18.05	0.002129	1.21	29.05	25.20	0.31
Upper Reach	1155.*	Q 10 yr	43.30	15.90	18.33		18.41	0.001627	1.21	40.47	37.85	0.28
Upper Reach	1155.*	Q 20 yr	51.60	15.90	18.65		18.72	0.001286	1.20	53.87	46.10	0.25
Upper Reach	1155.*	Q 50 yr	62.50	15.90	19.14		19.19	0.000854	1.11	79.57	59.65	0.21
Upper Reach	1155.*	Q 100 yr	71.60	15.90	19.31		19.37	0.000856	1.16	90.65	65.92	0.22
Upper Reach	1145	Q 2 yr	24.10	15.78	17.49	16.56	17.54	0.004493	0.98	24.49	17.28	0.26
Upper Reach	1145	Q 5 yr	34.50	15.78	17.96	16.74	18.01	0.004184	1.05	34.07	27.40	0.25
Upper Reach	1145	Q 10 yr	43.30	15.78	18.32	16.88	18.38	0.003428	1.07	45.93	37.81	0.23
Upper Reach	1145	Q 20 yr	51.60	15.78	18.64	17.00	18.70	0.002865	1.07	59.50	46.58	0.22
Upper Reach	1145	Q 50 yr	62.50	15.78	19.13	17.14	19.18	0.001983	1.01	85.47	61.78	0.19
Upper Reach	1145	Q 100 yr	71.60	15.78	19.31	17.26	19.36	0.001989	1.05	97.30	70.60	0.19
Upper Reach	1144		Culvert									
Upper Reach	1115	Q 2 yr	24.10	14.36	16.20	15.46	16.33	0.007149	1.62	15.31	13.52	0.41
Upper Reach	1115	Q 5 yr	34.50	14.36	16.47	15.71	16.67	0.008683	1.95	19.15	14.13	0.45
Upper Reach	1115	Q 10 yr	43.30	14.36	16.67	15.89	16.91	0.009877	2.20	21.92	14.55	0.49
Upper Reach	1115	Q 20 yr	51.60	14.36	16.89	16.06	17.13	0.009078	2.24	30.45	25.07	0.47
Upper Reach	1115	Q 50 yr	62.50	14.36	17.09	16.31	17.36	0.009652	2.44	35.48	26.72	0.49
Upper Reach	1115	Q 100 yr	71.60	14.36	17.22	16.48	17.53	0.010323	2.61	39.08	28.09	0.51

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper Reach	1109.*	Q 2 yr	24.10	14.36	16.14	15.46	16.28	0.008056	1.68	14.53	13.39	0.43
Upper Reach	1109.*	Q 5 yr	34.50	14.36	16.39	15.71	16.60	0.010035	2.05	18.02	13.95	0.49
Upper Reach	1109.*	Q 10 yr	43.30	14.36	16.57	15.89	16.84	0.011631	2.32	20.49	14.34	0.53
Upper Reach	1109.*	Q 20 yr	51.60	14.36	16.72	16.06	17.04	0.012908	2.55	22.69	14.67	0.56
Upper Reach	1109.*	Q 50 yr	62.50	14.36	16.97	16.31	17.29	0.011742	2.60	32.34	25.70	0.54
Upper Reach	1109.*	Q 100 yr	71.60	14.36	17.08	16.48	17.44	0.012815	2.80	35.29	26.66	0.57
Upper Reach	1103	Q 2 yr	24.10	14.36	16.07	15.46	16.23	0.009253	1.76	13.69	9.15	0.46
Upper Reach	1103	Q 5 yr	34.50	14.36	16.30	15.71	16.54	0.012028	2.18	16.68	13.74	0.53
Upper Reach	1103	Q 10 yr	43.30	14.36	16.44	15.89	16.75	0.014503	2.50	18.68	14.06	0.58
Upper Reach	1103	Q 20 yr	51.60	14.36	16.56	16.06	16.95	0.016732	2.78	20.38	14.32	0.63
Upper Reach	1103	Q 50 yr	62.50	14.36	16.69	16.31	17.18	0.019772	3.13	22.29	14.61	0.69
Upper Reach	1103	Q 100 yr	71.60	14.36	16.86	16.48	17.34	0.018510	3.17	29.62	24.79	0.67
Upper Reach	1095	Q 2 yr	24.10	14.36	16.06		16.18	0.002318	1.55	15.56	12.75	0.45
Upper Reach	1095	Q 5 yr	34.50	14.36	16.31		16.47	0.002758	1.81	20.03	20.08	0.51
Upper Reach	1095	Q 10 yr	43.30	14.36	16.47		16.67	0.003113	1.99	23.47	21.49	0.53
Upper Reach	1095	Q 20 yr	51.60	14.36	16.62		16.85	0.003386	2.15	26.61	22.70	0.55
Upper Reach	1095	Q 50 yr	62.50	14.36	16.78		17.06	0.003714	2.34	30.51	24.11	0.57
Upper Reach	1095	Q 100 yr	71.60	14.36	16.92		17.23	0.003875	2.47	33.98	25.31	0.58
Upper Reach	1035	Q 2 yr	24.10	14.07	15.85		16.00	0.004301	1.70	17.46	27.83	0.51
Upper Reach	1035	Q 5 yr	34.50	14.07	16.08	15.66	16.26	0.004443	1.95	24.10	31.47	0.54
Upper Reach	1035	Q 10 yr	43.30	14.07	16.22	15.86	16.44	0.004758	2.16	28.85	34.84	0.57
Upper Reach	1035	Q 20 yr	51.60	14.07	16.36	15.99	16.60	0.004740	2.29	33.88	36.27	0.58
Upper Reach	1035	Q 50 yr	62.50	14.07	16.53	16.14	16.80	0.004738	2.45	40.08	38.17	0.58
Upper Reach	1035	Q 100 yr	71.60	14.07	16.69	16.25	16.96	0.004462	2.51	46.93	49.99	0.58
Lower Reach	913	Q 2 yr	35.60	13.22	14.47	14.47	14.89	0.017620	2.87	12.41	15.04	1.01
Lower Reach	913	Q 5 yr	49.50	13.22	14.69	14.69	15.19	0.015686	3.13	15.92	16.58	0.98
Lower Reach	913	Q 10 yr	59.40	13.22	14.83	14.83	15.38	0.014589	3.29	18.51	19.35	0.97
Lower Reach	913	Q 20 yr	69.20	13.22	14.95	14.95	15.55	0.014131	3.45	20.90	20.15	0.97
Lower Reach	913	Q 50 yr	82.60	13.22	15.12	15.12	15.78	0.013404	3.64	24.25	21.52	0.96
Lower Reach	913	Q 100 yr	96.00	13.22	15.27	15.27	15.98	0.012865	3.81	27.65	25.40	0.96
Lower Reach	865	Q 2 yr	39.00	11.66	13.86	13.51	13.97	0.003352	1.51	26.72	31.53	0.51
Lower Reach	865	Q 5 yr	54.00	11.66	14.17	13.68	14.28	0.002355	1.54	36.53	32.27	0.45
Lower Reach	865	Q 10 yr	65.00	11.66	14.37	13.77	14.49	0.002006	1.57	43.16	32.77	0.42
Lower Reach	865	Q 20 yr	78.00	11.66	14.79	13.87	14.89	0.001193	1.44	57.91	38.45	0.34
Lower Reach	865	Q 50 yr	90.00	11.66	14.94	13.96	15.06	0.001203	1.53	63.87	39.05	0.35
Lower Reach	865	Q 100 yr	108.00	11.66	15.13	14.08	15.26	0.001265	1.67	71.33	39.66	0.36
Lower Reach	797	Q 2 yr	39.00	11.60	13.29	13.00	13.59	0.009788	2.41	16.19	13.35	0.70
Lower Reach	797	Q 5 yr	54.00	11.60	13.64	13.27	13.98	0.008957	2.56	21.07	14.72	0.68
Lower Reach	797	Q 10 yr	65.00	11.60	13.85	13.44	14.22	0.008507	2.67	25.01	22.15	0.68
Lower Reach	797	Q 20 yr	78.00	11.60	14.53	13.63	14.75	0.003443	2.13	47.79	39.89	0.46
Lower Reach	797	Q 50 yr	90.00	11.60	14.66	13.80	14.91	0.003702	2.30	52.90	45.56	0.48
Lower Reach	797	Q 100 yr	108.00	11.60	14.79	14.05	15.10	0.004291	2.57	58.49	51.67	0.52
Lower Reach	767	Q 2 yr	39.00	11.19	13.28	12.48	13.43	0.002107	1.67	23.32	15.12	0.43
Lower Reach	767	Q 5 yr	54.00	11.19	13.63	12.75	13.81	0.002254	1.87	28.81	16.50	0.45
Lower Reach	767	Q 10 yr	65.00	11.19	13.84	12.92	14.05	0.002360	2.00	32.43	17.35	0.47
Lower Reach	767	Q 20 yr	78.00	11.19	14.52	13.11	14.67	0.001330	1.72	45.42	22.60	0.39
Lower Reach	767	Q 50 yr	90.00	11.19	14.64	13.27	14.82	0.001503	1.86	48.33	24.08	0.42
Lower Reach	767	Q 100 yr	108.00	11.19	14.77	13.50	15.00	0.001814	2.09	51.95	75.55	0.47
Lower Reach	736		Bridge									
Lower Reach	735	Q 2 yr	39.00	11.12	12.72	12.12	12.86	0.004031	1.65	23.69	16.62	0.44
Lower Reach	735	Q 5 yr	54.00	11.12	12.97	12.32	13.16	0.004673	1.94	27.84	16.64	0.48
Lower Reach	735	Q 10 yr	65.00	11.12	13.11	12.45	13.35	0.005268	2.15	30.19	16.66	0.51
Lower Reach	735	Q 20 yr	78.00	11.12	13.30	12.61	13.58	0.005591	2.34	33.35	16.68	0.53
Lower Reach	735	Q 50 yr	90.00	11.12	13.70	12.73	13.96	0.004277	2.25	40.00	16.73	0.46
Lower Reach	735	Q 100 yr	108.00	11.12	13.85	12.92	14.18	0.005141	2.54	42.46	16.75	0.51
Lower Reach	670	Q 2 yr	39.00	11.00	12.57	11.96	12.65	0.002030	1.23	31.91	29.30	0.36
Lower Reach	670	Q 5 yr	54.00	11.00	12.83	12.12	12.93	0.001962	1.38	39.72	30.92	0.37
Lower Reach	670	Q 10 yr	65.00	11.00	12.97	12.23	13.09	0.002060	1.50	44.09	31.79	0.38
Lower Reach	670	Q 20 yr	78.00	11.00	13.18	12.34	13.30	0.001928	1.58	51.34	37.92	0.38
Lower Reach	670	Q 50 yr	90.00	11.00	13.66	12.44	13.75	0.001038	1.36	72.34	52.61	0.29
Lower Reach	670	Q 100 yr	108.00	11.00	13.82	12.59	13.93	0.001141	1.50	80.42	57.30	0.31
Lower Reach	486	Q 2 yr	47.00	9.50	11.40	11.12	11.71	0.017926	2.46	19.12	15.76	0.71
Lower Reach	486	Q 5 yr	65.00	9.50	11.90	11.39	12.12	0.011898	2.19	34.84	39.51	0.55
Lower Reach	486	Q 10 yr	78.00	9.50	12.35	11.70	12.46	0.005731	1.61	55.57	49.17	0.36
Lower Reach	486	Q 20 yr	90.00	9.50	12.78	11.88	12.85	0.002884	1.19	76.65	51.76	0.25
Lower Reach	486	Q 50 yr	109.00	9.50	13.49	12.07	13.54	0.001179	0.87	111.66	56.17	0.16
Lower Reach	486	Q 100 yr	126.00	9.50	13.63	12.22	13.69	0.001256	0.93	119.15	57.98	0.17
Lower Reach	430	Q 2 yr	47.00	8.98	11.22	10.09	11.31	0.002935	1.29	36.37	20.44	0.31
Lower Reach	430	Q 5 yr	65.00	8.98	11.71	10.33	11.81	0.002645	1.39	46.94	22.65	0.30
Lower Reach	430	Q 10 yr	78.00	8.98	12.20	10.48	12.29	0.001916	1.35	61.69	57.93	0.27
Lower Reach	430	Q 20 yr	90.00	8.98	12.68	10.62	12.75	0.001285	1.24	84.25	71.45	0.23
Lower Reach	430	Q 50 yr	109.00	8.98	13.43	10.82	13.49	0.000744	1.09	120.04	79.33	0.18
Lower Reach	430	Q 100 yr	126.00	8.98	13.57	10.98	13.64	0.000852	1.19	126.84	80.33	0.19
Lower Reach	420	Q 2 yr	47.00	8.90	11.21	10.00	11.29	0.000911	1.25	37.56	20.39	0.29
Lower Reach	420	Q 5 yr	65.00	8.90	11.70	10.24	11.80	0.000848	1.36	47.97	22.61	0.29

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Lower Reach	420	Q 10 yr	78.00	8.90	12.19	10.40	12.28	0.000631	1.33	58.62	57.65	0.26
Lower Reach	420	Q 20 yr	90.00	8.90	12.66	10.53	12.75	0.000489	1.31	68.96	71.22	0.24
Lower Reach	420	Q 50 yr	109.00	8.90	13.40	10.73	13.48	0.000355	1.28	85.18	78.93	0.21
Lower Reach	420	Q 100 yr	126.00	8.90	13.52	10.90	13.63	0.000425	1.43	88.00	80.03	0.23
Lower Reach	419.5		Culvert									
Lower Reach	385	Q 2 yr	47.00	8.80	10.85	9.82	10.96	0.001745	1.47	32.05	24.92	0.33
Lower Reach	385	Q 5 yr	65.00	8.80	11.19	10.05	11.34	0.001997	1.74	37.39	26.91	0.36
Lower Reach	385	Q 10 yr	78.00	8.80	11.39	10.20	11.58	0.002170	1.92	40.68	28.13	0.38
Lower Reach	385	Q 20 yr	90.00	8.80	11.56	10.33	11.78	0.002321	2.07	43.45	37.24	0.40
Lower Reach	385	Q 50 yr	109.00	8.80	11.82	10.53	12.09	0.002520	2.29	47.55	37.62	0.43
Lower Reach	385	Q 100 yr	126.00	8.80	12.02	10.70	12.33	0.002700	2.48	50.81	37.92	0.45
Lower Reach	348	Q 2 yr	47.00	8.01	10.69		10.83	0.009953	1.70	31.44	23.91	0.43
Lower Reach	348	Q 5 yr	65.00	8.01	11.01		11.19	0.010704	1.91	39.61	25.88	0.44
Lower Reach	348	Q 10 yr	78.00	8.01	11.22		11.42	0.011144	2.05	45.09	27.11	0.45
Lower Reach	348	Q 20 yr	90.00	8.01	11.40		11.62	0.011457	2.16	49.97	28.17	0.45
Lower Reach	348	Q 50 yr	109.00	8.01	11.66		11.90	0.011575	2.29	58.47	37.38	0.46
Lower Reach	348	Q 100 yr	126.00	8.01	11.87		12.11	0.011108	2.34	66.59	37.70	0.45
Lower Reach	257	Q 2 yr	47.00	7.83	9.83		10.07	0.006879	2.21	25.12	26.38	0.60
Lower Reach	257	Q 5 yr	65.00	7.83	10.13		10.42	0.006654	2.43	33.44	27.74	0.61
Lower Reach	257	Q 10 yr	78.00	7.83	10.31		10.64	0.006659	2.60	38.44	28.55	0.62
Lower Reach	257	Q 20 yr	90.00	7.83	10.46		10.82	0.006728	2.76	42.65	29.22	0.63
Lower Reach	257	Q 50 yr	109.00	7.83	10.68		11.09	0.006750	2.96	49.18	30.22	0.64
Lower Reach	257	Q 100 yr	126.00	7.83	10.86		11.31	0.006825	3.14	54.61	31.03	0.65
Lower Reach	175	Q 2 yr	47.00	7.21	9.47		9.55	0.004930	1.26	42.18	35.51	0.33
Lower Reach	175	Q 5 yr	65.00	7.21	9.79		9.88	0.005190	1.39	53.94	37.20	0.33
Lower Reach	175	Q 10 yr	78.00	7.21	9.99		10.09	0.005196	1.47	61.34	38.24	0.33
Lower Reach	175	Q 20 yr	90.00	7.21	10.15		10.26	0.005164	1.55	67.67	39.12	0.34
Lower Reach	175	Q 50 yr	109.00	7.21	10.40		10.53	0.005092	1.65	78.00	46.44	0.34
Lower Reach	175	Q 100 yr	126.00	7.21	10.62		10.75	0.004814	1.71	89.74	63.70	0.34
Lower Reach	100	Q 2 yr	47.00	7.25	9.22	8.37	9.26	0.002827	0.98	60.94	49.90	0.25
Lower Reach	100	Q 5 yr	65.00	7.25	9.54	8.55	9.58	0.002898	1.06	77.15	51.47	0.25
Lower Reach	100	Q 10 yr	78.00	7.25	9.74	8.65	9.79	0.002882	1.12	87.57	52.43	0.25
Lower Reach	100	Q 20 yr	90.00	7.25	9.91	8.74	9.96	0.002848	1.18	96.55	53.24	0.26
Lower Reach	100	Q 50 yr	109.00	7.25	10.17	8.86	10.23	0.002766	1.25	110.55	54.47	0.26
Lower Reach	100	Q 100 yr	126.00	7.25	10.39	8.95	10.46	0.002757	1.33	123.24	60.42	0.26
Lower Reach	0	Q 2 yr	47.00	6.42	8.89	7.81	8.94	0.003465	0.95	49.22	31.58	0.24
Lower Reach	0	Q 5 yr	65.00	6.42	9.16	8.01	9.23	0.004350	1.12	57.83	32.63	0.27
Lower Reach	0	Q 10 yr	78.00	6.42	9.33	8.12	9.41	0.004912	1.23	63.53	33.31	0.28
Lower Reach	0	Q 20 yr	90.00	6.42	9.49	8.21	9.57	0.005364	1.31	68.61	33.90	0.29
Lower Reach	0	Q 50 yr	109.00	6.42	9.73	8.36	9.83	0.005859	1.42	76.99	34.85	0.30
Lower Reach	0	Q 100 yr	126.00	6.42	9.94	8.48	10.05	0.006181	1.49	84.48	35.69	0.31
Lower Reach	-1	Q 2 yr	47.00	6.25	8.68		8.82	0.009771	1.64	28.58	27.75	0.52
Lower Reach	-1	Q 5 yr	65.00	6.25	8.91		9.09	0.010103	1.85	35.17	29.37	0.54
Lower Reach	-1	Q 10 yr	78.00	6.25	9.07		9.26	0.010165	1.96	39.70	30.38	0.55
Lower Reach	-1	Q 20 yr	90.00	6.25	9.20		9.42	0.010024	2.05	43.97	31.31	0.55
Lower Reach	-1	Q 50 yr	109.00	6.25	9.45		9.67	0.009019	2.10	51.88	32.78	0.53
Lower Reach	-1	Q 100 yr	126.00	6.25	9.67		9.90	0.008106	2.13	59.26	33.91	0.51
Lower Reach	-2	Q 2 yr	47.00	6.40	8.26	7.85	8.38	0.009181	1.49	31.45	34.14	0.50
Lower Reach	-2	Q 5 yr	65.00	6.40	8.57	8.02	8.69	0.006937	1.52	45.35	52.14	0.45
Lower Reach	-2	Q 10 yr	78.00	6.40	8.79	8.13	8.90	0.005508	1.51	56.83	54.73	0.41
Lower Reach	-2	Q 20 yr	90.00	6.40	8.97	8.23	9.08	0.004736	1.52	66.88	56.52	0.39
Lower Reach	-2	Q 50 yr	109.00	6.40	9.28	8.37	9.39	0.003586	1.50	85.28	60.39	0.35
Lower Reach	-2	Q 100 yr	126.00	6.40	9.55	8.50	9.65	0.002991	1.50	101.67	64.56	0.33
Lower Reach	-3	Q 2 yr	47.00	5.82	8.14		8.18	0.002323	0.98	47.72	34.28	0.27
Lower Reach	-3	Q 5 yr	65.00	5.82	8.45		8.51	0.002352	1.10	58.89	36.60	0.28
Lower Reach	-3	Q 10 yr	78.00	5.82	8.68		8.75	0.002243	1.16	67.45	38.68	0.27
Lower Reach	-3	Q 20 yr	90.00	5.82	8.86		8.94	0.002197	1.22	74.73	39.63	0.27
Lower Reach	-3	Q 50 yr	109.00	5.82	9.19		9.27	0.001980	1.26	88.11	41.66	0.27
Lower Reach	-3	Q 100 yr	126.00	5.82	9.46		9.55	0.001857	1.30	99.60	43.70	0.26
Lower Reach	-3.5	Q 2 yr	47.00	6.22	7.63		7.95	0.027397	2.47	19.01	21.98	0.85
Lower Reach	-3.5	Q 5 yr	65.00	6.22	8.06		8.31	0.015193	2.23	29.15	25.20	0.66
Lower Reach	-3.5	Q 10 yr	78.00	6.22	8.33		8.57	0.011362	2.16	36.15	26.30	0.59
Lower Reach	-3.5	Q 20 yr	90.00	6.22	8.53		8.77	0.010024	2.17	41.44	27.11	0.56
Lower Reach	-3.5	Q 50 yr	109.00	6.22	8.91		9.13	0.007491	2.10	51.95	28.64	0.50
Lower Reach	-3.5	Q 100 yr	126.00	6.22	9.19		9.42	0.006412	2.09	60.42	29.82	0.47
Lower Reach	-4	Q 2 yr	47.00	5.96	7.75	6.81	7.83	0.003103	1.25	37.67	24.00	0.31
Lower Reach	-4	Q 5 yr	65.00	5.96	8.12	7.01	8.22	0.002965	1.40	46.39	25.46	0.32
Lower Reach	-4	Q 10 yr	78.00	5.96	8.38	7.14	8.49	0.002852	1.49	52.35	26.51	0.32
Lower Reach	-4	Q 20 yr	90.00	5.96	8.57	7.25	8.70	0.002895	1.58	56.79	27.29	0.32
Lower Reach	-4	Q 50 yr	109.00	5.96	8.93	7.42	9.07	0.002685	1.67	65.17	28.76	0.32
Lower Reach	-4	Q 100 yr	126.00	5.96	9.21	7.56	9.37	0.002615	1.76	71.66	29.89	0.32
Lower Reach	-5		Culvert									
Lower Reach	-6	Q 2 yr	47.00	5.34	7.61	6.42	7.68	0.002096	1.13	41.48	23.57	0.26
Lower Reach	-6	Q 5 yr	65.00	5.34	7.93	6.63	8.03	0.002404	1.34	48.36	24.58	0.29

HEC-RAS Plan: Salvin 2014_Rev (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Lower Reach	-6	Q 10 yr	78.00	5.34	8.16	6.77	8.27	0.002526	1.47	53.15	25.28	0.30
Lower Reach	-6	Q 20 yr	90.00	5.34	8.31	6.88	8.44	0.002764	1.60	56.37	25.76	0.31
Lower Reach	-6	Q 50 yr	109.00	5.34	8.63	7.05	8.78	0.002753	1.72	63.31	26.99	0.32
Lower Reach	-6	Q 100 yr	126.00	5.34	8.87	7.19	9.04	0.002840	1.84	68.42	28.17	0.33
Lower Reach	-6.5	Q 2 yr	47.00	5.34	7.57		7.66	0.003361	1.29	36.43	22.49	0.32
Lower Reach	-6.5	Q 5 yr	65.00	5.34	7.89		8.00	0.003783	1.49	43.76	23.82	0.35
Lower Reach	-6.5	Q 10 yr	78.00	5.34	8.11		8.24	0.003886	1.58	49.22	24.76	0.36
Lower Reach	-6.5	Q 20 yr	90.00	5.34	8.26		8.41	0.004195	1.70	52.98	25.39	0.38
Lower Reach	-6.5	Q 50 yr	109.00	5.34	8.60		8.76	0.003992	1.77	61.73	26.84	0.37
Lower Reach	-6.5	Q 100 yr	126.00	5.34	8.85		9.02	0.004004	1.84	68.52	28.07	0.38
Lower Reach	-7	Q 2 yr	47.00	5.58	7.35		7.47	0.006984	1.55	30.33	25.05	0.45
Lower Reach	-7	Q 5 yr	65.00	5.58	7.66		7.81	0.006653	1.69	38.41	26.75	0.45
Lower Reach	-7	Q 10 yr	78.00	5.58	7.90		8.05	0.005991	1.73	45.03	29.66	0.44
Lower Reach	-7	Q 20 yr	90.00	5.58	8.04		8.21	0.006126	1.84	49.49	34.13	0.45
Lower Reach	-7	Q 50 yr	109.00	5.58	8.43		8.59	0.004598	1.79	64.30	41.61	0.40
Lower Reach	-7	Q 100 yr	126.00	5.58	8.70		8.86	0.003985	1.81	75.99	47.77	0.38
Lower Reach	-8	Q 2 yr	47.00	4.92	7.14	6.24	7.21	0.003229	1.17	40.26	28.74	0.31
Lower Reach	-8	Q 5 yr	65.00	4.92	7.47	6.44	7.55	0.003072	1.28	54.96	75.56	0.32
Lower Reach	-8	Q 10 yr	78.00	4.92	7.75	6.57	7.83	0.002556	1.27	69.77	77.39	0.29
Lower Reach	-8	Q 20 yr	90.00	4.92	7.93	6.67	8.00	0.002179	1.23	95.13	78.41	0.28
Lower Reach	-8	Q 50 yr	109.00	4.92	8.38	6.83	8.43	0.001400	1.13	130.92	80.53	0.23
Lower Reach	-8	Q 100 yr	126.00	4.92	8.67	6.97	8.72	0.001197	1.12	154.28	81.89	0.21
Lower Reach	-9	Q 2 yr	47.00	5.06	6.89	6.29	6.99	0.005945	1.48	36.15	84.59	0.42
Lower Reach	-9	Q 5 yr	65.00	5.06	7.30	6.50	7.39	0.003729	1.39	59.85	94.16	0.35
Lower Reach	-9	Q 10 yr	78.00	5.06	7.63	6.65	7.70	0.002522	1.29	79.70	97.01	0.30
Lower Reach	-9	Q 20 yr	90.00	5.06	7.87	6.79	7.90	0.001324	1.01	139.57	98.55	0.22
Lower Reach	-9	Q 50 yr	109.00	5.06	8.34	7.01	8.37	0.000836	0.92	187.17	101.63	0.18
Lower Reach	-9	Q 100 yr	126.00	5.06	8.64	7.12	8.66	0.000722	0.91	217.31	103.53	0.17
Lower Reach	-10	Q 2 yr	47.00	4.80	6.73	5.99	6.77	0.002704	0.97	59.53	78.75	0.28
Lower Reach	-10	Q 5 yr	65.00	4.80	7.23	6.19	7.26	0.001376	0.85	96.62	102.41	0.21
Lower Reach	-10	Q 10 yr	78.00	4.80	7.59	6.30	7.61	0.000955	0.80	123.87	107.99	0.18
Lower Reach	-10	Q 20 yr	90.00	4.80	7.83	6.39	7.85	0.000720	0.75	171.18	111.17	0.16
Lower Reach	-10	Q 50 yr	109.00	4.80	8.32	6.51	8.34	0.000476	0.70	229.11	122.37	0.14
Lower Reach	-10	Q 100 yr	126.00	4.80	8.62	6.60	8.63	0.000415	0.70	265.83	124.26	0.13
Lower Reach	-11	Q 2 yr	47.00	4.39	6.59	5.78	6.64	0.003110	1.09	57.65	121.52	0.31
Lower Reach	-11	Q 5 yr	65.00	4.39	7.17	6.01	7.20	0.001308	0.91	103.15	132.14	0.21
Lower Reach	-11	Q 10 yr	78.00	4.39	7.54	6.20	7.57	0.000901	0.85	133.85	136.80	0.18
Lower Reach	-11	Q 20 yr	90.00	4.39	7.82	6.31	7.83	0.000379	0.60	251.59	137.83	0.12
Lower Reach	-11	Q 50 yr	109.00	4.39	8.31	6.43	8.32	0.000266	0.56	320.31	139.72	0.10
Lower Reach	-11	Q 100 yr	126.00	4.39	8.61	6.53	8.62	0.000244	0.57	362.24	140.97	0.10
Lower Reach	-12	Q 2 yr	47.00	4.33	6.40	5.75	6.46	0.003948	1.16	50.88	108.24	0.34
Lower Reach	-12	Q 5 yr	65.00	4.33	7.10	5.95	7.13	0.001345	0.85	96.80	116.93	0.21
Lower Reach	-12	Q 10 yr	78.00	4.33	7.50	6.06	7.52	0.000913	0.78	125.91	127.67	0.18
Lower Reach	-12	Q 20 yr	90.00	4.33	7.80	6.15	7.81	0.000314	0.50	260.56	145.83	0.11
Lower Reach	-12	Q 50 yr	109.00	4.33	8.30	6.29	8.31	0.000222	0.48	342.09	170.83	0.09
Lower Reach	-12	Q 100 yr	126.00	4.33	8.60	6.43	8.61	0.000202	0.50	394.15	178.26	0.09

HEC-RAS Plan: Salvin 2014_Rev River: Salvin Ck Reach: Glengariff Trib

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Glengariff Trib	910	Q 2 yr	12.80	22.20	23.93	23.41	24.04	0.007815	1.42	8.99	8.59	0.44
Glengariff Trib	910	Q 5 yr	19.10	22.20	24.10	23.64	24.27	0.011207	1.81	10.53	9.10	0.54
Glengariff Trib	910	Q 10 yr	24.50	22.20	24.20	23.81	24.44	0.014685	2.14	11.42	9.39	0.62
Glengariff Trib	910	Q 20 yr	29.30	22.20	24.28	23.94	24.58	0.017590	2.41	12.18	9.62	0.68
Glengariff Trib	910	Q 50 yr	36.10	22.20	24.40	24.12	24.77	0.020852	2.71	13.31	9.96	0.75
Glengariff Trib	910	Q 100 yr	41.60	22.20	24.52	24.25	24.94	0.021465	2.85	14.60	10.33	0.77
Glengariff Trib	730	Q 2 yr	12.80	20.66	22.28	22.11	22.36	0.011239	1.47	16.20	40.45	0.51
Glengariff Trib	730	Q 5 yr	19.10	20.66	22.52	22.25	22.59	0.007663	1.44	26.31	41.83	0.44
Glengariff Trib	730	Q 10 yr	24.50	20.66	22.72	22.33	22.78	0.005943	1.42	34.71	42.94	0.40
Glengariff Trib	730	Q 20 yr	29.30	20.66	22.87	22.39	22.93	0.005175	1.43	41.37	43.81	0.38
Glengariff Trib	730	Q 50 yr	36.10	20.66	23.05	22.48	23.11	0.004732	1.47	49.31	44.82	0.37
Glengariff Trib	730	Q 100 yr	41.60	20.66	23.15	22.54	23.22	0.004914	1.56	53.63	45.35	0.38
Glengariff Trib	510	Q 2 yr	17.10	17.99	20.05		20.17	0.009091	1.57	10.92	12.28	0.53
Glengariff Trib	510	Q 5 yr	25.50	17.99	20.28		20.44	0.011909	1.79	15.76	30.73	0.59
Glengariff Trib	510	Q 10 yr	32.60	17.99	20.34	20.05	20.56	0.016721	2.13	17.74	35.75	0.68
Glengariff Trib	510	Q 20 yr	38.80	17.99	20.38	20.25	20.67	0.021079	2.41	19.41	39.12	0.75
Glengariff Trib	510	Q 50 yr	48.10	17.99	20.48	20.44	20.82	0.025021	2.65	23.51	46.43	0.80
Glengariff Trib	510	Q 100 yr	55.50	17.99	20.60	20.60	20.91	0.023597	2.63	30.25	67.36	0.75
Glengariff Trib	410	Q 2 yr	17.10	17.21	18.92	18.61	19.18	0.010612	2.25	7.76	9.84	0.67
Glengariff Trib	410	Q 5 yr	25.50	17.21	19.23	19.19	19.45	0.008205	2.25	20.20	63.14	0.60
Glengariff Trib	410	Q 10 yr	32.60	17.21	19.43		19.59	0.006196	2.09	33.39	71.90	0.53
Glengariff Trib	410	Q 20 yr	38.80	17.21	19.57		19.70	0.005146	1.99	43.90	77.57	0.49
Glengariff Trib	410	Q 50 yr	48.10	17.21	19.72		19.83	0.004725	1.99	55.54	80.17	0.47
Glengariff Trib	410	Q 100 yr	55.50	17.21	19.81		19.92	0.004619	2.01	63.32	81.86	0.47
Glengariff Trib	330.*	Q 2 yr	17.10	16.33	18.07		18.32	0.010892	2.21	7.74	7.64	0.69
Glengariff Trib	330.*	Q 5 yr	25.50	16.33	18.36	18.09	18.68	0.011061	2.54	10.65	12.63	0.71
Glengariff Trib	330.*	Q 10 yr	32.60	16.33	18.56	18.35	18.92	0.011096	2.74	13.87	23.40	0.72
Glengariff Trib	330.*	Q 20 yr	38.80	16.33	18.70	18.55	19.09	0.010909	2.85	18.34	38.59	0.73
Glengariff Trib	330.*	Q 50 yr	48.10	16.33	18.90	18.83	19.27	0.009931	2.91	27.02	47.81	0.70
Glengariff Trib	330.*	Q 100 yr	55.50	16.33	19.06	18.95	19.40	0.008724	2.89	34.95	53.43	0.67
Glengariff Trib	250.*	Q 2 yr	17.10	15.45	17.27		17.49	0.009707	2.07	8.27	8.08	0.65
Glengariff Trib	250.*	Q 5 yr	25.50	15.45	17.60		17.87	0.009030	2.30	11.52	12.06	0.65
Glengariff Trib	250.*	Q 10 yr	32.60	15.45	17.83	17.44	18.13	0.008499	2.44	14.77	16.15	0.64
Glengariff Trib	250.*	Q 20 yr	38.80	15.45	18.00	17.63	18.32	0.008050	2.56	18.10	22.20	0.64
Glengariff Trib	250.*	Q 50 yr	48.10	15.45	18.21	17.83	18.57	0.007858	2.74	22.81	23.26	0.64
Glengariff Trib	250.*	Q 100 yr	55.50	15.45	18.34	18.01	18.73	0.007939	2.88	26.41	31.67	0.66
Glengariff Trib	170.*	Q 2 yr	17.10	14.57	16.33		16.59	0.013023	2.24	7.64	8.29	0.74
Glengariff Trib	170.*	Q 5 yr	25.50	14.57	16.54		16.91	0.016169	2.69	9.47	9.18	0.85
Glengariff Trib	170.*	Q 10 yr	32.60	14.57	16.68	16.60	17.15	0.018282	3.03	10.81	10.49	0.91
Glengariff Trib	170.*	Q 20 yr	38.80	14.57	16.78	16.76	17.34	0.019821	3.30	11.93	11.76	0.96
Glengariff Trib	170.*	Q 50 yr	48.10	14.57	16.95	16.95	17.60	0.019391	3.57	14.16	14.46	0.97
Glengariff Trib	170.*	Q 100 yr	55.50	14.57	17.10	17.10	17.78	0.018127	3.69	16.46	16.91	0.96
Glengariff Trib	90	Q 2 yr	17.10	13.69	15.87		15.98	0.004474	1.46	14.50	31.83	0.45
Glengariff Trib	90	Q 5 yr	25.50	13.69	16.17		16.29	0.003759	1.58	24.95	37.03	0.43
Glengariff Trib	90	Q 10 yr	32.60	13.69	16.39		16.51	0.003417	1.66	33.34	40.72	0.42
Glengariff Trib	90	Q 20 yr	38.80	13.69	16.56		16.69	0.003184	1.71	40.62	43.67	0.41
Glengariff Trib	90	Q 50 yr	48.10	13.69	16.80		16.93	0.002933	1.79	51.48	48.73	0.40
Glengariff Trib	90	Q 100 yr	55.50	13.69	16.96		17.10	0.002815	1.85	59.65	50.74	0.40
Glengariff Trib	40	Q 2 yr	17.10	13.65	15.49	15.17	15.69	0.007212	1.96	8.71	9.05	0.64
Glengariff Trib	40	Q 5 yr	25.50	13.65	15.72	15.44	16.00	0.008883	2.35	10.87	10.10	0.72
Glengariff Trib	40	Q 10 yr	32.60	13.65	15.84	15.64	16.21	0.010793	2.68	12.14	10.67	0.80
Glengariff Trib	40	Q 20 yr	38.80	13.65	15.96	15.79	16.38	0.011495	2.87	13.51	11.25	0.84
Glengariff Trib	40	Q 50 yr	48.10	13.65	16.09	16.00	16.62	0.013141	3.20	15.03	12.24	0.90
Glengariff Trib	40	Q 100 yr	55.50	13.65	16.24	16.14	16.79	0.012613	3.31	17.18	18.59	0.90

Appendix J Hydraulic Structure Reference Sheets

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**NEMIES ROAD, RUNCORN**

DATE OF SURVEY: Nov 1989	UBD REF: 220 P11
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM214	CHAINAGE (m): 17

STRUCTURE DESCRIPTION: ROAD CULVERT

STRUCTURE SIZE 8 / 1500 x 1500 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 53.57
UPSTREAM OBVERT LEVEL: 55.07

DOWNSTREAM INVERT LEVEL: 53.46
For culverts give floor level.
DOWNSTREAM OBVERT LEVEL: 54.96
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 21

LENGTH OF CULVERT BARREL AT OBVERT (m): 21

TYPE OF LINING: Sloping concrete channel
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 21
LOWEST POINT OF WEIR (m AHD): 56.5

(In direction of flow, ie. distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flex beam guardrail, tubular galvanised monowills handrail, Height: 57.5

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A
PLAN NUMBER: W5684S2

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**NEMIES ROAD, RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	56.3	75.5	131.8	57.7	1050	18	23.5	4.2	2.4
50	38.2	73.5	111.7	57.45	1010	18	17.6	4.1	2.2
20	23.9	71.0	94.8	57.25	955	18	12.7	3.9	1.9
10	13.7	68.3	82.0	57.03	895	18	8.9	3.8	1.6
5	4.4	64.4	68.8	56.77	800	18	4.6	3.6	1.0
2	0.0	50.9	50.9	56.15	460	18	0.0	2.8	0.0

Looking upstream towards Compton Rd

Looking downstream towards Beenleigh Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**BRANDON ROAD, RUNCORN**

DATE OF SURVEY: Nov 1989	UBD REF: 220 Q10
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM211	CHAINAGE (m): 370

STRUCTURE DESCRIPTION: ROAD CULVERT

STRUCTURE SIZE 4 / 2700 x 900 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 51.6 UPSTREAM OBVERT LEVEL: 52.5

DOWNSTREAM INVERT LEVEL: 51.5 DOWNSTREAM OBVERT LEVEL: 52.4
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 20

LENGTH OF CULVERT BARREL AT OBVERT (m): 20

TYPE OF LINING: Stone pitched wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 20 LOWEST POINT OF WEIR (m AHD): 53

(In direction of flow, ie. distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m, Handrails: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flexi-beam guardrail (refer to WS 18-2.3), tubular galvanised monowills handrail, Height: 54.0

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: Sep-1997 PLAN NUMBER: W10258

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**BRANDON ROAD, RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	113.6	24.8	138.4	54.17	140	9.7	48.2	2.5	2.4
50	95.2	24.7	119.9	54.1	149	9.7	42.4	2.5	2.3
20	77.0	24.8	101.8	54	157	9.7	36.1	2.5	2.2
10	58.6	24.8	83.4	53.93	163	9.7	29.1	2.5	2.1
5	45.6	24.7	70.3	53.84	188	9.7	23.9	2.5	2.0
2	24.3	24.6	48.9	53.64	240	9.7	14.6	2.4	1.8

Looking upstream towards Gowan Rd

Looking downstream towards Beenleigh Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**BEENLEIGH ROAD, RUNCORN**

DATE OF SURVEY: Nov 1989	UBD REF: 220 P5
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM197	CHAINAGE(m): 1845

STRUCTURE DESCRIPTION: ROAD CULVERT

STRUCTURE SIZE 4 / 3600 x 1200 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 44.5 UPSTREAM OBVERT LEVEL: 45.7

DOWNSTREAM INVERT LEVEL: 44.4 DOWNSTREAM OBVERT LEVEL: 45.6
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 20

LENGTH OF CULVERT BARREL AT OBVERT (m): 20

TYPE OF LINING: Shotcrete
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 20 LOWEST POINT OF WEIR (m AHD): 46.63

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail (refer STD. W.M.S.30) Height upstream: 46.16, downstream: 45.8

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: W6203

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**BEENLEIGH ROAD, RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	64.1	63.7	123.6	47.72	915	17.3	27.9	3.7	2.3
50	42.3	62.3	104.6	47.57	877	17.3	22.7	3.6	2.1
20	32.2	60.3	92.5	47.38	827	17.3	17.2	3.5	1.9
10	20.0	57.9	77.9	47.21	770	17.3	12.4	3.4	1.6
5	7.0	54.8	61.8	46.97	674	17.3	7.0	3.2	1.2
2	0.0	45.2	45.2	46.57	447	17.3	0.0	2.4	0.0

Looking downstream towards Altandi St

Looking upstream towards Nemies Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**BEENLEIGH ROAD (RAIL), RUNCORN**

DATE OF SURVEY:	UBD REF: 220 P5
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM194	CHAINAGE (m): 1950
STRUCTURE DESCRIPTION: BRIDGE	
STRUCTURE SIZE 2 Spans, 55m OAL For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths	
UPSTREAM INVERT LEVEL: 43.6 DOWNSTREAM INVERT LEVEL: 43.55 For culverts give floor level.	UPSTREAM OBVERT LEVEL: 47.4 DOWNSTREAM OBVERT LEVEL: 47.35 For bridges give bed level
For Culverts LENGTH OF CULVERT BARREL AT INVERT (m): 8 LENGTH OF CULVERT BARREL AT OBVERT (m): 8 TYPE OF LINING: Compacted selected fill (e.g. concrete, stones, brick, corrugated iron)	
IS THERE A SURVEYED WEIR PROFILE? N If yes give details ie. Plan number and/or survey book number. Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.	
WEIR WIDTH (m): 8 (In direction of flow, ie. Distance from u/s face to d/s face)	LOWEST POINT OF WEIR (m AHD): 49.85 PIER WIDTH:1.2m
HEIGHT OF GUARDRAILS: No handrails/guardrails on bridge DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: No handrails/guardrails on bridge	
The following should also be provided. Wingwall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels. For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.	
CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: N/A HAS THE STRUCTURE BEEN UPGRADED? If yes, explain type and date of upgrade. Include plan number and location if applicable. ADDITIONAL COMMENTS: BRIDGE UNDERGOING WORK AT TIME OF REPORT	

CREEK	**BULIMBA CREEK**
LOCATION	**BEENLEIGH ROAD (RAIL), RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	129.0	129.0	46.49	608	44.9	0.0	3.0	0.0
50	0.0	111.5	111.5	46.34	537	41.0	0.0	2.9	0.0
20	0.0	92.2	92.2	46.18	442	39.2	0.0	2.4	0.0
10	0.0	77.9	77.9	46.05	364	36.4	0.0	2.1	0.0
5	0.0	62.9	62.9	45.91	289	32.9	0.0	1.9	0.0
2	0.0	45.2	45.2	45.74	203	17.3	0.0	2.6	0.0


Looking upstream towards Beenleigh Rd


Looking downstream towards Altandi St

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**ST LAWRENCE'S FOOT BRIDGE, SUNNYBANK**

DATE OF SURVEY: Nov 1989	UBD REF: 220 P4
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM191	CHAINAGE (m): 2117

STRUCTURE DESCRIPTION: FOOT BRIDGE

STRUCTURE SIZE Single span, 12m Total length
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 42.3

UPSTREAM OBVERT LEVEL: 44.6

DOWNSTREAM INVERT LEVEL: 42.25
For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 44.55
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m):

LENGTH OF CULVERT BARREL AT OBVERT (m):

TYPE OF LINING: Compacted selected fill
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
Eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 3

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 44.2

PIER WIDTH: N/A (Single span)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail (refer STD. W.M.S.30)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	BULIMBA CREEK
LOCATION	**ST LAWRENCE'S FOOTBRIDGE, SUNNYBANK**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	113.3	17.0	130.3	45.6	6	17.5	311.1	1.1	1.7
50	95.6	16.4	112.0	45.47	7	17.6	267.8	1.1	1.6
20	78.9	18.1	97.0	45.24	6	17.6	205.1	1.1	1.7
10	65.3	18.4	83.7	45.07	7	17.6	159.2	1.1	1.7
5	52.3	18.3	70.6	44.89	8	17.6	107.7	1.1	1.1
2	30.2	18.9	49.1	44.62	13	17.4	19.0	1.1	1.1

Looking upstream towards Beenleigh Rd

Looking downstream towards Altandi St

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**ALTANDI STREET, RUNCORN**

DATE OF SURVEY: Nov 1989	UBD REF: 220 Q3
AERIAL PHOTO No:	STRUCTURE ID: B0070
BCC XS No: BM188-6	CHAINAGE (m): 2375

STRUCTURE DESCRIPTION: FOOT BRIDGE

STRUCTURE SIZE 3 / 12m spans
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 41.82 UPSTREAM OBVERT LEVEL: 43.82

DOWNSTREAM INVERT LEVEL: 41.82 DOWNSTREAM OBVERT LEVEL: 43.82
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m):

LENGTH OF CULVERT BARREL AT OBVERT (m):

TYPE OF LINING: Compacted selected fill
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 4 LOWEST POINT OF WEIR (m AHD): 44.2

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 600mm

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Standard R.H.S. footbridge (refer W.M.S. 105/3) Height: 45.1

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1984 PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**ALTANDI STREET, RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	57.4	58.5	115.9	45.52	541	27.2	25.3	2.2	2.3
50	37.4	58.2	95.6	45.38	578	27.2	16.4	2.1	2.3
20	22.3	55.6	77.9	45.14	528	27.2	10.8	2.0	2.1
10	14.4	52.9	67.3	44.96	474	27.2	7.6	2.0	1.9
5	7.6	47.8	55.3	44.76	414	27.2	4.7	1.6	1.1
2	30.6	40.1	70.7	44.36	240	27.2	0.9	1.5	0.8

Looking downstream towards Cresswell St

Looking upstream towards Beenleigh Road

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**MALBON STREET, SUNNYBANK**

DATE OF SURVEY: Nov 1989	UBD REF: 201 B19
AERIAL PHOTO No:	STRUCTURE ID: B1330
BCC XS No: BM179	CHAINAGE (m): 3965

STRUCTURE DESCRIPTION: FOOTBRIDGE

STRUCTURE SIZE Single span, 16.2m
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 32.92 UPSTREAM OBVERT LEVEL: 35.63

DOWNSTREAM INVERT LEVEL: 32.92 DOWNSTREAM OBVERT LEVEL: 35.63
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m):

LENGTH OF CULVERT BARREL AT OBVERT (m):

TYPE OF LINING: Grouted stone pitching
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 4 LOWEST POINT OF WEIR (m AHD): 35.51

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: N/A (Single span)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Standard welded (refer W.M.S. 105/2) Height: 36.9

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1983 PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**MALBON STREET, SUNNYBANK**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	122.6	36.5	154.4	36.72	44	24.8	49.7	1.5	2.5
50	97.8	36.8	134.6	36.6	56	24.8	42.1	1.5	2.3
20	76.5	37.9	114.3	36.46	52	24.8	35.1	1.5	2.2
10	56.6	37.8	94.4	36.31	82	24.8	28.6	1.5	2.0
5	37.3	36.3	73.5	36.14	103	24.8	21.5	1.5	1.8
2	15.3	36.2	51.4	35.9	131	24.8	11.9	1.5	1.3

Looking from downstream of the Bridge

Looking from upstream of the Bridge

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**PADSTOW ROAD, SUNNYBANK**

DATE OF SURVEY: Nov 1989	UBD REF: 201 B17
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM176	CHAINAGE (m): 4390

STRUCTURE DESCRIPTION: ROAD CULVERT 'B'

STRUCTURE SIZE 7 / 3350 x 2200 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 31.6 UPSTREAM OBVERT LEVEL: 33.8

DOWNSTREAM INVERT LEVEL: 31.5 DOWNSTREAM OBVERT LEVEL: 33.7
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 24

LENGTH OF CULVERT BARREL AT OBVERT (m): 24

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 24 LOWEST POINT OF WEIR (m AHD): 35.2

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.8m, handrails 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Post-and-rail guardrail, galvanised balustrade handrail. Height upstream: 37.3, downstream: 37.2

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: W10394

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**PADSTOW ROAD, SUNNYBANK**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	87.1	87.1	34.83	114	51.6	0.0	1.7	0.0
50	0.0	70.8	70.8	34.55	65	51.6	0.0	1.4	0.0
20	0.0	48.4	48.4	34.2	24	51.6	0.0	1.0	0.0
10	0.0	38.1	38.1	33.97	12	51.6	0.0	0.7	0.0
5	0.0	29.6	29.6	33.75	10	50.5	0.0	0.7	0.0
2	0.0	21.4	21.4	33.29	10	40.4	0.0	0.7	0.0

Looking from downstream

Looking from upstream

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK – PADSTOW BRANCH**
LOCATION	**PADSTOW ROAD (2), SUNNYBANK**

DATE OF SURVEY: Nov 1989	UBD REF: 201 B17
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM176	CHAINAGE(m): 177

STRUCTURE DESCRIPTION: ROAD CULVERT 'C'

STRUCTURE SIZE 3 / 3000 x 2100 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 31.3

UPSTREAM OBVERT LEVEL: 33.4

DOWNSTREAM INVERT LEVEL: 31.2
For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 33.3
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 24

LENGTH OF CULVERT BARREL AT OBVERT (m): 24

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 24

LOWEST POINT OF WEIR (m AHD): 35

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m, Handrails: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flex beam guardrail, tubular galvanised balustrade handrail. Height: 37.0

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: W10394

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**PADSTOW ROAD (2), SUNNYBANK**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	7.9	55.4	63.6	35.23	547	18.9	7.2	2.9	1.1
50	0.9	55.7	57.0	35.04	587	18.9	1.2	2.9	0.8
20	0.0	53.7	53.7	34.74	542	18.9	0.0	2.8	0.0
10	0.0	48.9	48.9	34.43	424	18.9	0.0	2.6	0.0
5	0.0	41.2	41.2	34.1	281	18.9	0.0	2.2	0.0
2	0.0	28.8	28.8	33.52	103	18.9	0.0	1.5	0.0

Looking from downstream

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**BLEASBY ROAD, MACGREGOR**

DATE OF SURVEY: Nov 1989	UBD REF: 201 D16
AERIAL PHOTO No:	STRUCTURE ID: B0215
BCC XS No: BM173	CHAINAGE (m): 4785

STRUCTURE DESCRIPTION: FOOTBRIDGE

STRUCTURE SIZE Single span, 8.7m OAL
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 29.45

UPSTREAM OBVERT LEVEL: 31.2

DOWNSTREAM INVERT LEVEL: 29.4
For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 31.15
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m):

LENGTH OF CULVERT BARREL AT OBVERT (m):

TYPE OF LINING: Stone pitched wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 4.2

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 30.4

PIER WIDTH: N/A (Single span)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail,
Height: 32.53

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1993 PLAN NUMBER: W9181

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**BLEASBY ROAD, MACGREGOR**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	258.6	12.2	260.8	33.96	32	14.2	196.8	0.8	3.2
50	223.6	12.5	236.1	33.73	19	14.2	196.8	0.9	3.2
20	183.7	12.5	196.2	33.45	11	14.2	191.7	0.9	3.1
10	153.7	12.3	166.0	33.24	11	14.2	162.2	0.9	3.2
5	123.2	12.5	135.7	33.04	13	14.2	130.5	0.9	3.2
2	80.2	12.2	92.3	32.61	21	14.2	80.1	0.9	1.2

Looking towards upstream

Looking towards downstream

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**SOUTH-EAST FREEWAY, MACGREGOR**

DATE OF SURVEY:	UBD REF: 201 G15
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM167	CHAINAGE (m): 5625

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 5 / 3100 x 3100 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 26.88 UPSTREAM OBVERT LEVEL: 30.0

DOWNSTREAM INVERT LEVEL: 26.5 DOWNSTREAM OBVERT LEVEL: 29.6
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 54

LENGTH OF CULVERT BARREL AT OBVERT (m): 54

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 54 LOWEST POINT OF WEIR (m AHD): N/A

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: Upstream: 4m, downstream: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Upstream: Steel-posted, wooden acoustic barrier fence, height 4m, downstream: concrete wall, height 1m

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: MRD182428

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**SOUTH-EAST FREEWAY, MACGREGOR**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	199.1	199.1	32.13	1146	48.1	0.0	4.1	0.0
50	0.0	171.7	171.7	31.54	820	48.1	0.0	3.9	0.0
20	0.0	140.3	140.3	30.74	499	48.1	0.0	3.9	0.0
10	0.0	121.2	121.2	30.14	358	46.0	0.0	3.6	0.0
5	0.0	99.6	99.6	29.7	305	40.3	0.0	3.6	0.0
2	0.0	69.9	69.9	28.98	244	29.7	0.0	3.5	0.0

Looking upstream towards Padstow Rd

Looking downstream towards Logan Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**GARDEN CITY BRANCH**
LOCATION	**SOUTH-EAST FREEWAY (2), MACGREGOR**

DATE OF SURVEY:	UBD REF: 201 G15
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM167	CHAINAGE (m): 5620

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 2 / 3100 x 3100 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 27.25

UPSTREAM OBVERT LEVEL: 30.35

DOWNSTREAM INVERT LEVEL: 26.85
For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 29.95
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 52

LENGTH OF CULVERT BARREL AT OBVERT (m): 52

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 52

LOWEST POINT OF WEIR (m AHD): N/A

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Upstream: none, downstream: flexi-beam guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: MRD182428

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**GARDEN CITY BRANCH**
LOCATION	**SOUTH-EAST FREEWAY (2), MACGREGOR**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	74.0	74.0	32.16	1003	19.2	0.0	4.1	0.0
50	0.0	63.3	63.3	31.57	722	19.2	0.0	3.9	0.0
20	0.0	52.1	52.1	30.8	473	19.0	0.0	3.9	0.0
10	0.0	43.0	43.0	30.3	394	16.4	0.0	3.9	0.0
5	0.0	35.2	35.2	29.8	377	13.6	0.0	3.8	0.0
2	0.0	22.3	22.3	28.98	245	10.2	0.0	3.3	0.0

Looking upstream towards Padstow Rd

Looking downstream towards Logan Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**LOGAN ROAD, MACGREGOR**

DATE OF SURVEY: Nov 1989	UBD REF: 201 H15
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM165	CHAINAGE (m): 5790
STRUCTURE DESCRIPTION: CULVERT	
STRUCTURE SIZE 5 / 3000 x 3000 box culverts For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths	
UPSTREAM INVERT LEVEL: 25.26 DOWNSTREAM INVERT LEVEL: 25.15 For culverts give floor level.	UPSTREAM OBVERT LEVEL: 28.26 DOWNSTREAM OBVERT LEVEL: 28.15 For bridges give bed level
For Culverts LENGTH OF CULVERT BARREL AT INVERT (m): 47.6 LENGTH OF CULVERT BARREL AT OBVERT (m): 47.6 TYPE OF LINING: Precast concrete wing walls (e.g. concrete, stones, brick, corrugated iron)	
IS THERE A SURVEYED WEIR PROFILE? If yes give details ie. Plan number and/or survey book number. Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.	Survey book 6340 / 28
WEIR WIDTH (m): 47.6 (In direction of flow, ie. Distance from u/s face to d/s face)	LOWEST POINT OF WEIR (m AHD): 30.9
HEIGHT OF GUARDRAILS: 0.5m, Handrail: 1m DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail, flexi beam guardrail	
The following should also be provided. Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels. For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.	
CONSTRUCTION DATE OF CURRENT STRUCTURE: N./A	PLAN NUMBER: MRD182429
HAS THE STRUCTURE BEEN UPGRADED? N If yes, explain type and date of upgrade. Include plan number and location if applicable. ADDITIONAL COMMENTS:	

CREEK	**BULIMBA CREEK**
LOCATION	**LOGAN ROAD, MACGREGOR**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	1.2	150.0	151.2	30.94	823	45.0	2.2	3.3	0.6
50	0.0	147.6	147.6	30.67	791	45.0	0.0	3.3	0.0
20	0.0	135.9	135.9	30.18	617	45.0	0.0	3.0	0.0
10	0.0	119.0	119.0	29.7	396	45.0	0.0	2.6	0.0
5	0.0	97.2	97.2	29.26	246	45.0	0.0	2.2	0.0
2	0.0	69.7	69.7	28.58	117	45.0	0.0	1.6	0.0

Looking downstream towards Kavanagh Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**GARDEN CITY BRANCH**
LOCATION	**LOGAN ROAD (2), MACGREGOR**

DATE OF SURVEY: Nov 1989	UBD REF: 201 H15
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM165	CHAINAGE (m): 5790

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 2 / 3000 x 3000 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 24.98 UPSTREAM OBVERT LEVEL: 27.98

DOWNSTREAM INVERT LEVEL: 24.8 DOWNSTREAM OBVERT LEVEL: 27.8
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 30

LENGTH OF CULVERT BARREL AT OBVERT (m): 30

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 30 LOWEST POINT OF WEIR (m AHD): 30.5

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Steel-posted, wooden acoustic barrier fence, Height 4m

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: MRD182429

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**GARDEN CITY**
LOCATION	**LOGAN ROAD (2), MACGREGOR**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	21.8	56.7	78.5	30.92	713	18.0	15.6	3.2	1.4
50	3.7	56.5	60.2	30.67	769	18.0	4.3	3.1	0.9
20	0.0	51.8	51.8	30.16	625	18.0	0.0	2.9	0.0
10	0.0	44.5	44.5	29.66	390	18.0	0.0	2.5	0.0
5	0.0	37.2	37.2	29.18	200	18.0	0.0	2.1	0.0
2	0.0	22.3	22.3	28.51	90	18.0	0.0	1.2	0.0

Logan Road culvert in Garden City branch: looking from upstream

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**CRAIG STREET FOOTBRIDGE, WISHART**

DATE OF SURVEY: Nov 1989	UBD REF: 201 L13
AERIAL PHOTO No:	STRUCTURE ID: B9851
BCC XS No: BM148	CHAINAGE (m): 6935

STRUCTURE DESCRIPTION: FOOT BRIDGE

STRUCTURE SIZE 2 Span, 38.6m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 21.3 UPSTREAM OBVERT LEVEL: 26

DOWNSTREAM INVERT LEVEL: 21.2 DOWNSTREAM OBVERT LEVEL: 25.9
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m):

LENGTH OF CULVERT BARREL AT OBVERT (m):

TYPE OF LINING: Grouted stone pitching
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 28
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 3 LOWEST POINT OF WEIR (m AHD): 25.3

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 600mm

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Rectangular galvanised frame, galvanised balustrade handrail, height: Height avg. 26.49 (cambered bridge)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 06-10-2006 PLAN NUMBER: W12453

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**CRAIG ST FOOTBRIDGE, WISHART**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	205.0	192.4	397.4	27.06	48	130.5	121.6	2.4	2.1
50	122.0	174.8	296.9	26.79	47	130.5	81.9	2.4	2.1
20	108.7	144.2	252.9	26.47	42	130.5	55.0	2.4	2.2
10	62.7	126.1	188.8	26.24	42	130.5	28.8	2.4	2.1
5	28.3	259.6	287.9	25.96	39	122.7	20.7	2.4	3.1
2	1.6	97.5	99.1	25.48	38	86.2	1.6	2.4	1.8

Looking downstream towards Craig St

Looking upstream towards Kavanagh Road

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**MT. GRAVATT – CAPALABA ROAD, ROCHEDALE**

DATE OF SURVEY: Dec 1987	UBD REF: 202 A5
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM110	CHAINAGE (m): 10702

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 4 / 14m spans: 56m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 11.52

UPSTREAM OBVERT LEVEL: 19.1 varies

DOWNSTREAM INVERT LEVEL: 11.52
For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 19.a varies
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 20

LENGTH OF CULVERT BARREL AT OBVERT (m): 20

TYPE OF LINING: Grouted stone pitching
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 15A
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 20
(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 19.5

PIER WIDTH: 1m

HEIGHT OF GUARDRAILS: 0.8m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Post-and-rail guardrail, Height 18.5

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: W5952

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**MT GRAVATT-CAPALABA ROAD, ROCHEDALE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	534.2	534.2	18.17	356	187.5	0.0	2.9	0.0
50	0.0	464.4	464.4	17.85	309	174.6	0.0	2.7	0.0
20	0.0	387.2	387.2	17.45	260	158.5	0.0	2.5	0.0
10	0.0	332.0	332.0	17.14	223	146.2	0.0	2.3	0.0
5	0.0	273.9	273.9	16.78	186	131.9	0.0	1.6	0.0
2	0.0	189.8	189.8	16.22	138	108.2	0.0	1.8	0.0

Looking upstream towards Stackpole Street

Looking downstream towards Ham Road

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**WECKER ROAD, MANSFIELD**

DATE OF SURVEY: Dec 1987	UBD REF: 181 R20
AERIAL PHOTO No:	STRUCTURE ID: B2810
BCC XS No: BM97	CHAINAGE (m): 12139
STRUCTURE DESCRIPTION: ROAD BRIDGE	
STRUCTURE SIZE (3 / 17m + 2 / 15m) spans, 81m Total For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths	
UPSTREAM INVERT LEVEL: 8.9 DOWNSTREAM INVERT LEVEL: 8.9 For culverts give floor level.	UPSTREAM OBVERT LEVEL: 15.4 varies DOWNSTREAM OBVERT LEVEL: 15.4 varies For bridges give bed level
For Culverts LENGTH OF CULVERT BARREL AT INVERT (m): 14 LENGTH OF CULVERT BARREL AT OBVERT (m): 14 TYPE OF LINING: Grouted stone pitching (e.g. concrete, stones, brick, corrugated iron)	
IS THERE A SURVEYED WEIR PROFILE? If yes give details ie. Plan number and/or survey book number. Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.	Survey book 6340 / 15A
WEIR WIDTH (m): 14 (In direction of flow, ie. Distance from u/s face to d/s face)	LOWEST POINT OF WEIR (m AHD): 14.2 PIER WIDTH: ≈ 450mm
HEIGHT OF GUARDRAILS: 0.8m, Handrail: 1m DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Monowills painted balustrade handrail, painted post-and-rail guardrail (refer to details W9520 DRG. No. 31 & 32 A – handrail & DRG. No. 33 - guardrail)	
The following should also be provided. Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels. For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.	
CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1995 PLAN NUMBER: W9520 HAS THE STRUCTURE BEEN UPGRADED? N If yes, explain type and date of upgrade. Include plan number and location if applicable. ADDITIONAL COMMENTS:	

CREEK	**BULIMBA CREEK**
LOCATION	**WECKER ROAD, MANSFIELD**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	117.6	437.3	554.9	15.51	70	310.4	50.1	1.5	2.4
50	63.7	414.7	478.5	15.2	71	293.4	29.9	1.5	2.1
20	24.6	372.3	396.9	14.83	73	266.0	14.4	1.4	1.7
10	7.1	331.7	338.8	14.54	72	242.3	5.5	1.4	1.3
5	0.1	278.4	278.4	14.19	67	214.9	0.1	1.3	1.0
2	0.0	191.3	191.3	13.65	55	169.9	0.0	1.3	0.0

Looking upstream towards Mt Gravatt-Capalaba Rd

Looking downstream towards Pine Mountain Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**PINE MOUNTAIN ROAD, MANSFIELD**

DATE OF SURVEY:	UBD REF: 181 N13
AERIAL PHOTO No:	STRUCTURE ID: B0905
BCC XS No: BM66	CHAINAGE (m): 15555

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE (3 / 20m + 4 / 17.8m) spans, 131.2m Total

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 3.45

UPSTREAM OBVERT LEVEL: 10.9

DOWNSTREAM INVERT LEVEL: 3.42

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 10.9

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 14

LENGTH OF CULVERT BARREL AT OBVERT (m): 14

TYPE OF LINING: Grouted stone pitching

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 14

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): N/A

PIER WIDTH: 500mm

HEIGHT OF GUARDRAILS: 0.8m, Handrails: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Monowills painted balustrade handrail, painted post-and-rail guardrail - Refer to DRG. 42 & 43 in plan W9587

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1996 PLAN NUMBER: W9587

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**PINE MOUNTAIN ROAD, MANSFIELD**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	560.4	560.4	10.22	84	390.1	0.0	1.4	0.0
50	0.0	486.9	486.9	9.9	83	352.1	0.0	1.4	0.0
20	0.0	402.7	402.7	9.5	87	300.6	0.0	1.4	0.0
10	0.0	341.4	341.4	9.2	84	261.7	0.0	1.3	0.0
5	0.0	279.3	279.3	8.6	81	220.1	0.0	1.3	0.0
2	0.0	190.9	190.9	8.32	78	158.3	0.0	1.2	0.0

Looking upstream towards Gateway Motorway

Looking downstream towards Creek Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**MEADOWBANK STREET FOOTBRIDGE, CARINDALE**

DATE OF SURVEY: Dec 1987	UBD REF: 181 Q10
AERIAL PHOTO No:	STRUCTURE ID: B3090
BCC XS No: BM59	CHAINAGE (m): 16445

STRUCTURE DESCRIPTION: FOOT BRIDGE

STRUCTURE SIZE 2 spans, 24m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 1.55 UPSTREAM OBVERT LEVEL: 5.8

DOWNSTREAM INVERT LEVEL: 1.53 DOWNSTREAM OBVERT LEVEL: 5.78
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m):

LENGTH OF CULVERT BARREL AT OBVERT (m):

TYPE OF LINING: Precast concrete
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 15A
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 5 LOWEST POINT OF WEIR (m AHD): 5.9

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Rectangular galvanised frame, galvanised balustrade handrail - Refer standard DRG. WMS 105/3

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1990 PLAN NUMBER: W8403

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**MEADOWBANK ST FOOTBRIDGE, CARINDALE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	522.8	70.4	593.2	9.64	14	52.0	404.4	1.4	1.6
50	447.0	69.8	516.8	9.29	14	52.0	360.3	1.3	1.7
20	361.9	69.8	431.6	8.85	14	52.0	304.5	1.3	1.6
10	297.9	69.8	367.8	8.47	15	52.0	260.4	1.3	1.6
5	235.4	68.8	304.2	8.06	15	52.0	211.1	1.3	1.6
2	144.2	69.8	214.0	7.38	19	52.0	131.8	1.3	1.6

Looking downstream towards Eromanga St

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**WINSTANLEY STREET, CARINDALE**

DATE OF SURVEY: Nov 1983	UBD REF: 181 P7
AERIAL PHOTO No:	STRUCTURE ID: B2170
BCC XS No: CD10	CHAINAGE (m): 17338

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 3 / 17m spans: 51m Total

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 1.83

UPSTREAM OBVERT LEVEL: 6.6

DOWNSTREAM INVERT LEVEL: 1.83

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 6.6

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 15

LENGTH OF CULVERT BARREL AT OBVERT (m): 15

TYPE OF LINING: Shotcrete

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 13

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 15

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 6.4

PIER WIDTH: 1100mm

HEIGHT OF GUARDRAILS: 0.8m, Handrails: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Monowills painted balustrade handrail, painted post-and-rail guardrail (refer DWG. 9512 – 138 &139)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1982 PLAN NUMBER: W9512

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**WINSTANLEY STREET, CARINDALE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	311.3	319.5	630.8	8.2	72	151.7	106.8	2.1	2.9
50	223.3	307.4	513.3	7.88	86	151.7	82.9	2.1	2.6
20	126.3	305.2	431.5	7.46	97	151.7	56.2	2.0	2.2
10	65.1	296.3	361.4	7.12	88	151.7	36.9	2.0	1.7
5	18.7	275.8	294.4	6.72	64	151.7	17.9	1.8	1.0
2	0.0	205.6	205.6	6.09	17	139.8	0.0	1.4	0.0

Looking downstream towards Cleveland Rd

Looking upstream towards Pine Mountain Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	BULIMBA
LOCATION	OLD CLEVELAND ROAD, CARINDALE

DATE OF SURVEY: Nov 1983	UBD REF: 181 P4
AERIAL PHOTO No:	STRUCTURE ID: B9204 & B9104
BCC XS No: CD06 – MODEL, BM48 - ACTUAL	CHAINAGE (m): 17935

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 7 Span, 84m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 1.8 UPSTREAM OBVERT LEVEL: 9.4

DOWNSTREAM INVERT LEVEL: 1.8 DOWNSTREAM OBVERT LEVEL: 9.4
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 15

LENGTH OF CULVERT BARREL AT OBVERT (m): 15

TYPE OF LINING: Grouted stone pitching
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 13
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
Eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 15 LOWEST POINT OF WEIR (m AHD): 10.5

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: UNKNOWN

HEIGHT OF GUARDRAILS: 0.8m, Handrails: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Monowills painted balustrade handrail, painted post-and-rail guardrail (Ref. B9204/9104)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1979/76 PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**OLD CLEVELAND ROAD, CARINDALE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	823.0	823.0	6.95	25	281.7	0.0	3.7	0.0
50	0.0	796.0	796.0	6.65	26	263.1	0.0	3.5	0.0
20	0.0	704.6	704.6	6.26	4	222.8	0.0	3.3	0.0
10	0.0	587.2	587.2	5.93	4	178.8	0.0	3.3	0.0
5	0.0	444.0	444.0	5.56	11	177.1	0.0	2.9	0.0
2	0.0	300.5	300.5	5.04	7	136.8	0.0	2.8	0.0

Looking upstream towards Winstanley St

Looking downstream towards Meadowlands Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**SCRUB ROAD FOOTBRIDGE, CARINDALE**

DATE OF SURVEY: Aug 1987	UBD REF: 182 B4
AERIAL PHOTO No:	STRUCTURE ID: B2360
BCC XS No: BM41	CHAINAGE (m): 19205

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 3 Span, 45.6m Total

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: -1.24 UPSTREAM OBVERT LEVEL: 4.4

DOWNSTREAM INVERT LEVEL: -1.24 DOWNSTREAM OBVERT LEVEL: 4.4

For culverts give floor level. For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m):

LENGTH OF CULVERT BARREL AT OBVERT (m):

TYPE OF LINING: Shotcrete

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 15

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 4 LOWEST POINT OF WEIR (m AHD): 2.05

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 400mm

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Rectangular galvanised frame, galvanised balustrade handrail - Refer DWG. WMS 105/38

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1989 PLAN NUMBER: W8258/4

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	BULIMBA CREEK
LOCATION	**SCRUB ROAD FOOTBRIDGE, CARINDALE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	514.4	116.2	630.5	6.14	8	127.3	549.6	0.9	1.1
50	426.1	109.3	535.4	5.83	9	172.2	486.5	0.8	1.1
20	339.5	100.2	435.9	5.45	8	127.2	412.4	0.8	1.1
10	275.0	94.9	369.8	5.14	8	127.2	353.9	0.8	1.1
5	212.5	88.1	300.7	4.79	8	127.2	294.7	0.7	1.1
2	128.4	78.5	206.9	4.22	8	125.5	205.6	0.7	1.5

Looking downstream towards Wright St

Looking upstream towards Meadowlands Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**MEADOWLANDS ROAD, CARINDALE**

DATE OF SURVEY: Dec 1987	UBD REF: 182 D2
AERIAL PHOTO No:	STRUCTURE ID: B2300
BCC XS No: BM8GHD	CHAINAGE (m): 20270

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 4 / 17 m spans; 68m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: -2.35 UPSTREAM OBVERT LEVEL: 5.5

DOWNSTREAM INVERT LEVEL: -2.35 DOWNSTREAM OBVERT LEVEL: 5.5
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 15

LENGTH OF CULVERT BARREL AT OBVERT (m): 15

TYPE OF LINING: Grouted stone pitching
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 15A
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 15 LOWEST POINT OF WEIR (m AHD): 5.35

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 750mm

HEIGHT OF GUARDRAILS: 0.8m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Painted balustrade handrail, painted post-and-rail guardrail (refer DRG. 1897/8-10)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1984 PLAN NUMBER: W4281

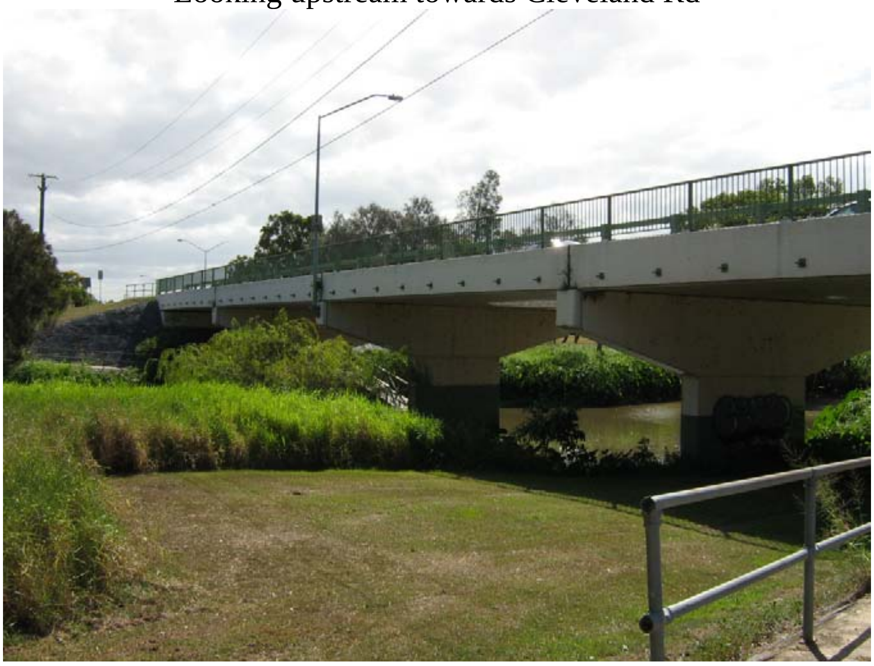
HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	BULIMBA CREEK
LOCATION	**MEADOWLANDS ROAD, CARINDALE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	611.8	611.8	5.3	152	253.4	0.0	2.4	0.0
50	0.0	529.4	529.4	5.03	98	247.9	0.0	2.2	0.0
20	0.0	433.7	433.7	4.72	54	237.9	0.0	1.8	0.0
10	0.0	363.8	363.8	4.47	31	227.3	0.0	1.6	0.0
5	0.0	294.9	294.9	4.19	16	213.0	0.0	1.4	0.0
2	0.0	199.9	199.9	3.72	9	185.3	0.0	1.1	0.0

Looking upstream towards Cleveland Rd



Looking downstream towards Gateway Motorway

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**PRESTON ROAD FOOTBRIDGE, CARINA**

DATE OF SURVEY:	UBD REF: 162 B19
AERIAL PHOTO No:	STRUCTURE ID: B1611
BCC XS No: BM19GHD	CHAINAGE (m): 21885

STRUCTURE DESCRIPTION: FOOT BRIDGE

STRUCTURE SIZE Single span, 16.7m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: -1.59 UPSTREAM OBVERT LEVEL: 2.1

DOWNSTREAM INVERT LEVEL: -1.59 DOWNSTREAM OBVERT LEVEL: 2.1
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m):

LENGTH OF CULVERT BARREL AT OBVERT (m):

TYPE OF LINING: Compacted selected fill
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 5 LOWEST POINT OF WEIR (m AHD): 1.55

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: N/A (Single span)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Rectangular painted handrail + tubular painted monowills handrail (Refer plan W9348)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1993 PLAN NUMBER: W9348

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**PRESTON ROAD FOOTBRIDGE, CARINA**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	554.3	46.6	601.0	4.69	8	56.9	981.3	0.8	1.4
50	475.1	46.9	496.0	4.46	8	56.9	838.8	0.8	1.4
20	387.0	47.6	434.6	4.17	8	56.9	667.6	0.8	1.4
10	312.5	48.2	360.7	3.93	8	56.9	534.2	0.8	1.4
5	243.7	47.8	291.5	3.67	8	56.9	398.4	0.8	1.4
2	147.8	46.5	194.3	3.22	9	56.9	203.3	0.8	1.5

Looking upstream towards Gateway Mwy

Looking downstream towards Wynnum Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**WYNNUM ROAD, MURRARIE**

DATE OF SURVEY: Nov 1983	UBD REF: 161 P12
AERIAL PHOTO No:	STRUCTURE ID: B2240/30
BCC XS No: BM26	CHAINAGE (m): 25885

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 3 spans- total length 45.7m Total

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: -2.66 UPSTREAM OBVERT LEVEL: 5

DOWNSTREAM INVERT LEVEL: -2.66 DOWNSTREAM OBVERT LEVEL: 5

For culverts give floor level. For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 25

LENGTH OF CULVERT BARREL AT OBVERT (m): 25

TYPE OF LINING: Shotcrete

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 13

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 25 LOWEST POINT OF WEIR (m AHD): 3.5

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 600mm

HEIGHT OF GUARDRAILS: 0.8m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Painted post-and-rail guardrail, painted balustrade handrail, height 6.176 (refer W5407 - 15A)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 1975/55 PLAN NUMBER: W5407

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**WYNNUM ROAD, MURRARIE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	13.7	434.8	448.5	3.81	242	200.7	11.1	2.2	1.2
50	1.5	379.2	380.6	3.58	211	189.7	1.7	2.0	0.9
20	0.0	318.8	318.8	3.28	164	177.3	0.0	1.8	0.0
10	0.0	272.7	272.7	3.2	132	167.2	0.0	1.6	0.0
5	0.0	227.7	227.7	2.7	101	156.5	0.0	1.5	0.0
2	0.0	163.4	163.4	2.43	59	139.9	0.0	1.2	0.0

Looking upstream towards Creek Rd

Looking downstream towards Murarrie Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**MURRARIE ROAD, MURRARIE**

DATE OF SURVEY: Nov 1983	UBD REF: 161 R9
AERIAL PHOTO No:	STRUCTURE ID: B1490
BCC XS No: BM22DS	CHAINAGE (m): 26730

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 3 / 15m spans, 45m OAL

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: -3.9

UPSTREAM OBVERT LEVEL: 2.6

DOWNSTREAM INVERT LEVEL: -3.9

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 2.6

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 15

LENGTH OF CULVERT BARREL AT OBVERT (m): 15

TYPE OF LINING: Compacted selected fill

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 13

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 15

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 2.36

PIER WIDTH: 760mm

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Galvanised post-and-rail guardrail, height 4.52 (refer DRG. W.M.S. 100/2A)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1985 PLAN NUMBER: W6759

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**MURRARIE ROAD, MURRARIE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	144.1	246.2	390.3	3.23	98	180.5	73.4	1.4	2.0
50	84.9	238.5	550.6	3.05	106	180.5	49.3	1.3	1.8
20	32.4	224.2	256.6	2.81	102	180.5	23.7	1.2	1.4
10	11.0	207.0	218.0	2.7	88	179.9	10.8	1.2	1.0
5	1.2	182.0	183.1	2.4	71	174.1	2.9	1.1	0.4
2	0.0	135.6	135.6	2.2	48	161.7	0.0	0.8	0.0

Looking upstream towards Queensport Rd

Looking upstream towards Wynnum Road from bridge

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA**
LOCATION	**GATEWAY VIADUCT, MURARRIE**

DATE OF SURVEY:	UBD REF: 162 A9
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: 39GHD	CHAINAGE (m): 26950

STRUCTURE DESCRIPTION: BRIDGE (viaduct)

STRUCTURE SIZE Multiple spans / 450m Total length
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: -3.7 UPSTREAM OBVERT LEVEL: 3.9

DOWNSTREAM INVERT LEVEL: -3.75 DOWNSTREAM OBVERT LEVEL: 3.85
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 40

LENGTH OF CULVERT BARREL AT OBVERT (m): 40

TYPE OF LINING: Compacted selected fill
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 40 LOWEST POINT OF WEIR (m AHD): N/A

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 1200mm

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete freeway wall guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: A04A -8002

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**GATEWAY BRIDGE, MURARRIE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	370.2	370.2	3.07	9	468.9	0.0	0.8	0.0
50	0.0	315.3	315.3	2.89	27	412.1	0.0	0.8	0.0
20	0.0	254.0	254.0	2.67	26	346.1	0.0	0.8	0.0
10	0.0	216.9	216.9	2.51	28	299.5	0.0	0.7	0.0
5	0.0	182.8	182.8	2.34	31	256.2	0.0	0.7	0.0
2	0.0	135.4	135.4	2.09	25	207.4	0.0	0.7	0.0

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**CLEVELAND – RAIL, CARINDALE**

DATE OF SURVEY:	UBD REF: 162 D2
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM52	CHAINAGE (m): 34500

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 7 Spans, 105m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: -2.5 UPSTREAM OBVERT LEVEL: 2.91

DOWNSTREAM INVERT LEVEL: -2.5 DOWNSTREAM OBVERT LEVEL: 2.91
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 15

LENGTH OF CULVERT BARREL AT OBVERT (m): 15

TYPE OF LINING: Shotcrete
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 15 LOWEST POINT OF WEIR (m AHD): 4

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 1000mm

HEIGHT OF GUARDRAILS: No handrails/guardrails on bridge

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: No handrails/guardrails on bridge

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: S20262

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**CLEVELAND-RAIL, CARINDALE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	484.9	482.2	2.6	175	272.5	0.0	1.8	0.0
50	0.0	422.8	422.8	2.37	152	254.7	0.0	1.7	0.0
20	0.0	353.6	353.6	2.11	126	233.9	0.0	1.5	0.0
10	0.0	302.2	302.2	1.91	106	217.5	0.0	1.4	0.0
5	0.0	250.3	250.3	1.7	85	201.9	0.0	1.2	0.0
2	0.0	172.9	172.9	1.39	53	178.6	0.0	1.0	0.0

Looking downstream towards Lytton Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK**
LOCATION	**LYTTON ROAD, HEMMANT**

DATE OF SURVEY: Nov 1983	UBD REF: 142 A20
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM6	CHAINAGE (m): 35680

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 3 / 25m spans; 75m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: -3.39 UPSTREAM OBVERT LEVEL: 2.8

DOWNSTREAM INVERT LEVEL: -3.39 DOWNSTREAM OBVERT LEVEL: 2.8
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 11

LENGTH OF CULVERT BARREL AT OBVERT (m): 11

TYPE OF LINING: Grouted stone pitching
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 13
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 11 LOWEST POINT OF WEIR (m AHD): N/A

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 600mm

HEIGHT OF GUARDRAILS: 0.8m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Galvanised balustrade handrail, galvanised post-and-rail guardrail (Ref. W5947), Height 6.643

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: W5947

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK**
LOCATION	**LYTTON ROAD, HEMMANT**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	501.0	501.0	2.12	122	281.2	0.0	1.8	0.0
50	0.0	434.3	434.3	1.94	107	268.4	0.0	1.6	0.0
20	0.0	360.8	360.8	1.72	89	253.7	0.0	1.4	0.0
10	0.0	306.4	306.4	1.57	74	243.8	0.0	1.3	0.0
5	0.0	252.3	252.3	1.42	58	233.9	0.0	1.1	0.0
2	0.0	173.8	173.8	1.22	35	221.0	0.0	0.8	0.0

Downstream bridge looking upstream towards Gateway Motorway

Looking upstream towards Gateway Motorway

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**MINNIPPI BRANCH**
LOCATION	**WYNNUM ROAD MINNIPPI, TINGALPA**

DATE OF SURVEY: Nov 1983	UBD REF: 162 C14
AERIAL PHOTO No:	STRUCTURE ID: B2220/1
BCC XS No: BM31GHD	CHAINAGE (m): 1125
STRUCTURE DESCRIPTION: BRIDGE	
STRUCTURE SIZE Single span, 14m Total For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths	
UPSTREAM INVERT LEVEL: 0.05 DOWNSTREAM INVERT LEVEL: 0.04 For culverts give floor level.	UPSTREAM OBVERT LEVEL: 3.3 DOWNSTREAM OBVERT LEVEL: 3.29 For bridges give bed level
For Culverts LENGTH OF CULVERT BARREL AT INVERT (m): 21 LENGTH OF CULVERT BARREL AT OBVERT (m): 21 TYPE OF LINING: Compacted selected fill (e.g. concrete, stones, brick, corrugated iron)	
IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 13 If yes give details ie. Plan number and/or survey book number. Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.	
WEIR WIDTH (m): 21 (In direction of flow, ie. Distance from u/s face to d/s face)	LOWEST POINT OF WEIR (m AHD): 3.3 PIER WIDTH: N/A (Single span)
HEIGHT OF GUARDRAILS: 0.5m concrete guardrail + 0.5m balustrade DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Galvanised balustrade handrail bolted to concrete guardrail - Refer DWG. W4282/16	
The following should also be provided. Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels. For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.	
CONSTRUCTION DATE OF CURRENT STRUCTURE: 1962/70 PLAN NUMBER: W4282/16 HAS THE STRUCTURE BEEN UPGRADED? N If yes, explain type and date of upgrade. Include plan number and location if applicable. ADDITIONAL COMMENTS: BRIDGE UNDERGOING WORK AT TIME OF REPORT	

CREEK	**MINNIPPI CREEK**
LOCATION	**WYNNUM ROAD MINNIPPI, TINGALPA**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	4.4	63.1	67.5	3.47	512	22.1	5.9	3.0	0.8
50	0.0	56.1	56.1	3.25	470	20.6	0.0	2.8	0.0
20	0.0	43.2	43.2	2.89	310	19.0	0.0	2.3	0.0
10	0.0	31.6	31.5	2.6	190	17.8	0.0	1.8	0.0
5	0.0	20.2	20.2	2.31	90	16.4	0.0	1.2	0.0
2	0.0	5.2	5.2	1.85	2	13.3	0.0	0.4	0.0

Looking downstream towards Gateway Mwy

Looking upstream towards Gateway Mwy

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**BEENLEIGH ROAD – SOUTH, RUNCORN**

DATE OF SURVEY:	UBD REF: 221 G10
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE282	CHAINAGE (m): 820

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 4 / 1650 x 600 box culverts

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 48.66 UPSTREAM OBVERT LEVEL: 49.26

DOWNSTREAM INVERT LEVEL: 48.63 DOWNSTREAM OBVERT LEVEL: 49.23

For culverts give floor level. For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 12

LENGTH OF CULVERT BARREL AT OBVERT (m): 12

TYPE OF LINING: Compacted selected fill

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 12 LOWEST POINT OF WEIR (m AHD): 49.7

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.75m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Double flexi-beam guardrail, tubular galvanised monowills handrail (Ref. G-10-39/14)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: G-10-39/14

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**BEENLEIGH ROAD - SOUTH, RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	47.2	11.6	58.8	50.31	38	4.0	47.9	2.8	1.5
50	41.1	11.9	53.0	50.25	39	4.0	41.2	2.7	1.5
20	33.1	10.5	43.6	50.19	119	4.0	21.7	2.7	1.5
10	24.8	11.2	36.0	50.14	192	4.0	17.5	2.7	1.4
5	18.4	11.2	29.6	50.07	267	4.0	13.9	2.7	1.3
2	8.2	11.2	19.5	49.9	420	4.0	7.6	2.9	1.2

Looking from downstream towards Besline St

Looking upstream towards Persse Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**BEENLEIGH ROAD – RAIL, RUNCORN**

DATE OF SURVEY:	UBD REF: 221 G10
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE279	CHAINAGE (m): 845

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 10 / 1500 x 1150 box culverts

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 48.63

UPSTREAM OBVERT LEVEL: 49.78

DOWNSTREAM INVERT LEVEL: 48.57

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 49.72

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 6

LENGTH OF CULVERT BARREL AT OBVERT (m): 6

TYPE OF LINING: Brick

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 6

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 49.85

PIER WIDTH: UNKNOWN

HEIGHT OF GUARDRAILS: No handrails/guardrails on bridge

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: No handrails/guardrails on bridge

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**BEENLEIGH ROAD - RAIL, RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	31.2	26.4	57.6	50.27	74	17.3	22.5	2.4	1.4
50	23.4	24.1	42.1	50.22	96	18.2	15.7	2.4	1.3
20	8.1	28.4	36.5	50.07	195	17.3	8.2	2.4	1.0
10	2.2	28.7	30.9	49.95	297	17.1	3.0	2.6	0.7
5	0.0	26.6	26.6	49.8	361	10.3	0.0	2.6	0.0
2	0.0	19.3	19.3	49.52	376	8.3	0.0	2.3	0.0

Looking downstream towards Gungurru Cr

Looking downstream towards Gungurru Cr

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**BEENLEIGH ROAD – GATEWAY, RUNCORN**

DATE OF SURVEY:	UBD REF: 221 G10
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE277	CHAINAGE (m): 876

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 3 / 2400 diameter pipe culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 47.41 UPSTREAM OBVERT LEVEL: 49.81

DOWNSTREAM INVERT LEVEL: 46.66 DOWNSTREAM OBVERT LEVEL: 49.09
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 55

LENGTH OF CULVERT BARREL AT OBVERT (m): 55

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? N
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 55 LOWEST POINT OF WEIR (m AHD): 49.8

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**BEENLEIGH ROAD - GATEWAY, RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	8.3	39.0	47.4	50.2	1548	10.1	6.5	3.9	1.3
50	5.1	37.4	42.5	50.11	1540	9.8	4.4	3.8	1.1
20	0.2	28.4	28.6	49.87	1392	9.1	0.3	3.6	0.6
10	0.0	30.3	30.3	49.64	1245	8.7	0.0	3.5	0.0
5	0.0	25.4	25.4	49.42	1132	7.8	0.0	3.3	0.0
2	0.0	18.2	18.2	49.11	1022	6.2	0.0	2.9	0.0

Looking downstream towards Gungurru Cr

Looking upstream towards Persse Rd

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**UNDERWOOD ROAD, EIGHT MILE PLAINS**

DATE OF SURVEY: Sep 1987

UBD REF: 221 K5

AERIAL PHOTO No:

STRUCTURE ID:

BCC XS No: BE262

CHAINAGE (m): 2767

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 4 / 3700 x 1800 box culverts

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 35.33

UPSTREAM OBVERT LEVEL: 37.13

DOWNSTREAM INVERT LEVEL: 35.21

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 37.01

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 17

LENGTH OF CULVERT BARREL AT OBVERT (m): 17

TYPE OF LINING: Compacted selected fill

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 18

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 17

LOWEST POINT OF WEIR (m AHD): 38.3

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flex beam guardrails (Ref. W8055)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: W8055

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**UNDERWOOD ROAD, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	28.4	62.1	90.6	38.73	167	26.6	17.4	2.3	1.7
50	14.3	62.1	76.4	38.59	160	26.4	11.2	2.3	1.3
20	0.0	57.6	57.6	38.15	164	26.6	0.0	2.2	0.0
10	0.0	51.2	51.2	37.89	107	26.6	0.0	1.9	0.0
5	0.0	42.5	42.5	37.63	65	26.6	0.0	1.6	0.0
2	0.0	29.7	29.7	37.24	26	26.6	0.0	1.2	0.0

Looking upstream towards Millers Road

Looking downstream towards Gaskell Street

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**GATEWAY MOTORWAY, EIGHT MILE PLAINS**

DATE OF SURVEY: Sep 1987	UBD REF: 221 L3
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE257	CHAINAGE (m): 3330

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 2 Spans, 40m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 32.17 UPSTREAM OBVERT LEVEL: 37.3

DOWNSTREAM INVERT LEVEL: 32.15 DOWNSTREAM OBVERT LEVEL: 37.28
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 40

LENGTH OF CULVERT BARREL AT OBVERT (m): 40

TYPE OF LINING: Compacted rock aggregate
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 18
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 40 LOWEST POINT OF WEIR (m AHD): 38

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: 700mm

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete freeway wall guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: 249804

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**GATEWAY MOTORWAY, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	87.9	87.9	35.5	13	73.9	0.0	1.3	0.0
50	0.0	75.6	75.6	35.36	13	68.4	0.0	1.1	0.0
20	0.0	63.9	63.9	35.24	14	61.6	0.0	1.0	0.0
10	0.0	55.1	55.1	35.1	16	55.9	0.0	1.0	0.0
5	0.0	45.6	45.6	34.93	17	49.3	0.0	0.9	0.0
2	0.0	32.0	32.0	34.59	16	38.8	0.0	0.8	0.0


Looking upstream towards Underwood Road


Looking downstream towards Gaskell Street

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**LOGAN ROAD (BOX CULVERT), EIGHT MILE PLAINS**

DATE OF SURVEY: Sep 1987	UBD REF: 221 L2
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE254	CHAINAGE(m): 3748

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 2 / 2400 x 2400 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 30.57 UPSTREAM OBVERT LEVEL: 32.97

DOWNSTREAM INVERT LEVEL: 30.37 DOWNSTREAM OBVERT LEVEL: 32.77
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 32

LENGTH OF CULVERT BARREL AT OBVERT (m): 32

TYPE OF LINING: Concrete channel
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 18
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 32 LOWEST POINT OF WEIR (m AHD): 33.7

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail, flex beam guardrail (Ref. W6088)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: W6088

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**LOGAN ROAD (BOX CULVERT), EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
								Structure	Weir
	Weir	Structure	Total (2-boxes)			Structure	Weir		
100	0.0	28.8	28.8	33.26	1037	7.5	0.0	4.0	0.0
50	0.0	24.4	24.4	32.98	943	6.7	0.0	3.8	0.0
20	0.0	19.9	19.9	32.67	860	5.8	0.0	3.5	0.0
10	0.0	16.0	16.0	32.36	742	5.0	0.0	3.2	3.1
5	0.0	12.6	12.6	32.08	648	4.3	0.0	3.0	0.0
2	0.0	7.8	7.8	31.68	533	3.1	0.0	2.5	0.0

Looking downstream towards Gateway Motorway

Looking upstream towards Gateway Motorway

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**LOGAN ROAD (PIPE CULVERT), EIGHT MILE PLAINS**

DATE OF SURVEY: Sep 1987	UBD REF: 221 L2
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE254	CHAINAGE (m): 3748

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 4 / 2400 diameter pipe culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 29.89 UPSTREAM OBVERT LEVEL: 32.29

DOWNSTREAM INVERT LEVEL: 29.77 DOWNSTREAM OBVERT LEVEL: 32.17
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 32

LENGTH OF CULVERT BARREL AT OBVERT (m): 32

TYPE OF LINING: Concrete channel
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 18
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 32 LOWEST POINT OF WEIR (m AHD): 33.7

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail, flex beam guardrail (Ref. W6088)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: W6088

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**LOGAN ROAD (PIPE CULVERT), EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total (3 pipes)			Structure	Weir	Structure	Weir
100	0.0	67.8	67.8	33.26	1037	17.7	0.0	4.5	0.0
50	0.0	60.2	60.2	32.98	943	14.6	0.0	4.2	0.0
20	0.0	51.8	51.8	32.67	860	13.4	0.0	3.9	0.0
10	0.0	43.8	43.8	32.36	742	12.2	0.0	3.6	0.0
5	0.0	36.3	36.3	32.08	648	10.8	0.0	3.4	0.0
2	0.0	25.6	25.6	31.68	533	8.6	0.0	3.0	0.0

Looking downstream towards Brandl Street

Looking upstream towards Gateway Motorway

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**PACIFIC MOTORWAY, EIGHT MILE PLAINS**

DATE OF SURVEY: Sep 1987	UBD REF: 201 M20
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE247	CHAINAGE (m): 4305

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 5 / 3050 x 2700 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 27.34 UPSTREAM OBVERT LEVEL: 30.04

DOWNSTREAM INVERT LEVEL: 27.25 DOWNSTREAM OBVERT LEVEL: 29.95
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 52

LENGTH OF CULVERT BARREL AT OBVERT (m): 52

TYPE OF LINING: Shotcrete
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 17
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 52 LOWEST POINT OF WEIR (m AHD): 30.95

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1.2m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flex beam guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**PACIFIC MOTORWAY, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	62.0	148.9	210.9	31.8	938	41.2	33.3	3.6	1.9
50	31.7	145.0	176.7	31.6	953	41.2	19.3	3.5	1.6
20	7.3	140.3	147.6	31.28	890	41.2	6.1	3.4	1.2
10	0.1	128.0	128.1	31.1	745	41.2	0.3	3.1	0.5
5	0.0	109.5	109.5	30.4	526	41.1	0.0	2.7	0.0
2	0.0	80.4	80.4	30	309	36.4	0.0	2.2	0.0

(No picture available)

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**EIGHT MILE PLAINS – PARK 'N' RIDE**

DATE OF SURVEY: Sep 1987

UBD REF: 201 N19

AERIAL PHOTO No:

STRUCTURE ID:

BCC XS No: BE245

CHAINAGE (m): 4608

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE 2 / 25m spans; 50m Total

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 26.6

UPSTREAM OBVERT LEVEL: 30.7

DOWNSTREAM INVERT LEVEL: 26.59

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 30.69

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 10

LENGTH OF CULVERT BARREL AT OBVERT (m): 10

TYPE OF LINING: Shotcrete

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 17

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 10

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 31.3

PIER WIDTH: UNKNOWN

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flexi beam guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	200.6	200.6	29.92	229	80.3	0.0	3.3	0.0
50	0.0	174.3	174.3	29.62	232	68.7	0.0	3.2	0.0
20	0.0	146.7	146.7	29.28	227	56.4	0.0	3.4	0.0
10	0.0	127.2	127.2	29.04	232	47.9	0.0	3.4	0.0
5	0.0	108.8	108.8	28.86	286	33.2	0.0	3.3	0.0
2	0.0	79.4	79.4	28.51	357	27.8	0.0	2.9	0.0

(No picture is available)

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	BULIMBA CREEK EAST
LOCATION	**MILES PLATTING ROAD, EIGHT MILE PLAINS**

DATE OF SURVEY: Sep 1987	UBD REF: 201 N19
AERIAL PHOTO No:	STRUCTURE ID: B9967
BCC XS No: BE244	CHAINAGE (m): 4660

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE Single span, 24m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 25.3 UPSTREAM OBVERT LEVEL: 31.5

DOWNSTREAM INVERT LEVEL: 25.28 DOWNSTREAM OBVERT LEVEL: 31.48
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 24

LENGTH OF CULVERT BARREL AT OBVERT (m): 24

TYPE OF LINING: Concrete block wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 17
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 24 LOWEST POINT OF WEIR (m AHD): 30.5

(In direction of flow, ie. Distance from u/s face to d/s face) PIER WIDTH: N/A (Single span)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete wall guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**MILES PLATTING ROAD, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	200.8	200.8	29.63	197	86.0	0.0	2.3	0.0
50	0.0	174.4	174.4	29.33	158	80.0	0.0	2.2	0.0
20	0.0	146.8	146.8	29	120	73.1	0.0	2.0	0.0
10	0.0	127.2	127.2	28.75	95	67.7	0.0	1.9	0.0
5	0.0	108.7	108.7	28.5	80	62.4	0.0	1.8	0.0
2	0.0	79.5	79.5	28.1	50	53.0	0.0	1.5	0.0

Looking downstream towards Daydream Place

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**BULIMBA CREEK EAST**
LOCATION	**GATEWAY ON-OFF RAMP, EIGHT MILE PLAINS**

DATE OF SURVEY: Sep 1987	UBD REF: 201 N18
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE240	CHAINAGE (m): 5010

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE: 2 / 15m spans; 30m Total

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 24.35

UPSTREAM OBVERT LEVEL: 29.2

DOWNSTREAM INVERT LEVEL: 24.33

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 29.18

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 30

LENGTH OF CULVERT BARREL AT OBVERT (m): 30

TYPE OF LINING: Grouted stone pitching

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE? Survey book 6340 / 17

If yes give details ie. Plan number and/or survey book number.

Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 30

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 29.7

PIER WIDTH: 600mm

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete freeway wall guardrail

The following should also be provided.

Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.

For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**BULIMBA CREEK EAST**
LOCATION	**GATEWAY ON-OFF RAMP, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	206.0	206.0	28.76	516	63.0	0.0	3.3	0.0
50	0.0	178.6	178.6	28.48	449	58.4	0.0	3.1	0.0
20	0.0	149.9	149.9	28.17	382	53.0	0.0	2.8	0.0
10	0.0	130.4	130.4	27.95	342	48.5	0.0	2.7	0.0
5	0.0	111.7	111.7	27.72	301	44.3	0.0	2.5	0.0
2	0.0	81.4	81.4	27.32	234	36.6	0.0	2.2	0.0

Looking upstream towards Miles Platting Road

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**MIMOSA CREEK**
LOCATION	**NAGLE STREET, MOUNT GRAVATT**

DATE OF SURVEY:	UBD REF: 201 B10
AERIAL PHOTO No:	STRUCTURE ID: B1520
BCC XS No: MI212	CHAINAGE (m): 1739

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE Single span, 8.4m Total
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 41.55
UPSTREAM OBVERT LEVEL: 44.1

DOWNSTREAM INVERT LEVEL: 41.5
For culverts give floor level.
DOWNSTREAM OBVERT LEVEL: 44.05
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 12

LENGTH OF CULVERT BARREL AT OBVERT (m): 12

TYPE OF LINING: Compacted selected fill
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 12
(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 44.49

PIER WIDTH: N/A (Single span)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Rectangular galvanised balustrade handrail (Ref. W1800), Height 46.9

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1971 PLAN NUMBER: W1800

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**MIMOSA CREEK**
LOCATION	**NAGLE STREET, UPPER MOUNT GRAVATT**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	43.0	60.5	103.5	45.27	165	29.3	22.1	2.3	2.0
50	26.0	60.6	86.8	45.11	190	29.3	15.4	2.3	1.8
20	6.3	64.2	70.5	44.82	205	29.3	5.4	2.3	1.2
10	0.8	60.0	60.8	44.62	140	29.3	1.1	2.3	0.7
5	0.0	50.9	50.9	44.35	126	27.3	0.0	2.3	0.0
2	0.0	36.4	36.4	43.95	100	20.0	0.0	2.3	0.0

Looking downstream towards South East Freeway

Looking upstream towards Klumpp Road

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**MIMOSA CREEK**
LOCATION	**PACIFIC MOTORWAY, UPPER MOUNT GRAVATT**

DATE OF SURVEY:	UBD REF: 201 A11
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: MI194	CHAINAGE (m): 1895

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 3 / 3000 x 2700+2 x 3000 x 1000 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 41.1 UPSTREAM OBVERT LEVEL: 43.8

DOWNSTREAM INVERT LEVEL: 40.9 DOWNSTREAM OBVERT LEVEL: 43.6
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 50

LENGTH OF CULVERT BARREL AT OBVERT (m): 50

TYPE OF LINING: Compacted selected fill + gabions
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 50 LOWEST POINT OF WEIR (m AHD): N/A

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m concrete guardrail + 2.5m acoustic barrier

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Steel posted acoustic barrier fence + concrete guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. Pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: MRD178308

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**MIMOSA CREEK**
LOCATION	**PACIFIC MOTORWAY, UPPER MOUNT GRAVATT**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	98.2	98.2	44.45	604	30.3	0.0	4.4	0.0
50	0.0	84.6	84.6	44.2	554	26.5	0.0	4.2	0.0
20	0.0	71.4	71.4	43.89	468	23.7	0.0	4.0	0.0
0	0.0	61.0	61.0	43.71	450	21.5	0.0	3.9	0.0
5	0.0	50.8	50.8	43.46	410	18.0	0.0	3.7	0.0
2	0.0	36.1	36.1	43.07	400	10.4	0.0	3.4	0.0

Looking downstream towards Kessels Road

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**MIMOSA CREEK**
LOCATION	**KESSELS ROAD**

DATE OF SURVEY:

UBD REF: 201 A12

AERIAL PHOTO No:

STRUCTURE ID:

BCC XS No: None

CHAINAGE (m): 2255

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE: 2 / 12m spans; 24m Total

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 38

UPSTREAM OBVERT LEVEL: 41.2

DOWNSTREAM INVERT LEVEL: 37.9

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 41.1

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 25

LENGTH OF CULVERT BARREL AT OBVERT (m): 25

TYPE OF LINING: Grouted stone pitching

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 25

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 41.71

PIER WIDTH: 600mm

HEIGHT OF GUARDRAILS: 0.85m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Rectangular painted balustrade handrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: W4324

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**MIMOSA CREEK**
LOCATION	**KESSELS ROAD, MACGREGOR**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	13.7	98.4	112.1	42.19	262	50.6	10.5	1.9	1.3
50	2.6	91.5	94.1	41.99	243	50.6	2.7	1.8	0.9
20	0.0	79.3	79.3	41.7	169	50.4	0.0	1.6	0.0
10	0.0	68.2	68.2	41.41	83	46.8	0.0	1.5	0.0
5	0.0	56.2	56.2	41.2	63	42.0	0.0	1.4	0.0
2	0.0	40.5	40.5	40.81	44	35.0	0.0	1.2	0.0

Kessels Road Bridge looking from downstream

Kessels Road bridge Looking from upstream

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**MIMOSA CREEK**
LOCATION	**PARKWAY STREET, MACGREGOR**

DATE OF SURVEY:	UBD REF: 201 A13
AERIAL PHOTO No:	STRUCTURE ID: B1580
BCC XS No: MI11	CHAINAGE (m): 2648

STRUCTURE DESCRIPTION: BRIDGE

STRUCTURE SIZE: 2 spans, 27.5m Total

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 36.4

UPSTREAM OBVERT LEVEL: 39.9

DOWNSTREAM INVERT LEVEL: 36.3

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 39.8

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 12

LENGTH OF CULVERT BARREL AT OBVERT (m): 12

TYPE OF LINING: Grouted stone pitching

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 12

(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 40

PIER WIDTH: 400mm

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised balustrade handrail (Refer DWG. in plan W3533)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: 01-07-1966 PLAN NUMBER: W3533

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**MIMOSA CREEK**
LOCATION	**PARKWAY STREET, MACGREGOR**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.2	110.3	110.5	40.07	230	46.6	0.3	2.4	0.8
50	0.0	95.3	95.3	39.87	200	43.2	0.0	2.2	0.0
20	0.0	78.8	78.8	39.62	170	40.7	0.0	2.0	0.0
10	0.0	67.4	67.4	39.43	140	36.0	0.0	1.9	0.0
5	0.0	56.1	56.1	39.22	120	32.5	0.0	1.7	0.0
2	0.0	39.5	39.5	38.87	80	26.7	0.0	1.5	0.0

Looking upstream towards Kessels Road

Looking downstream towards Padstow Road

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY A**
LOCATION	**SCHOOL ROAD TO FREEWAY, EIGHT MILE PLAINS**

DATE OF SURVEY:	UBD REF: 221 P3
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE1020	CHAINAGE (m): 2072

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 3 / 3100 x 2100 box culverts

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 32.96 UPSTREAM OBVERT LEVEL: 35.06

DOWNSTREAM INVERT LEVEL: 32.76 DOWNSTREAM OBVERT LEVEL: 34.86

For culverts give floor level. For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 52

LENGTH OF CULVERT BARREL AT OBVERT (m): 52

TYPE OF LINING: Concrete channel
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 52 LOWEST POINT OF WEIR (m AHD): 37.35

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail, flex beam guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: MRDGATEWAY

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**TRIBUTARY A**
LOCATION	**SCHOOL ROAD TO FREEWAY, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	67.6	67.6	36.54	868	19.5	0.0	3.5	0.0
50	0.0	59.2	59.2	36.09	573	19.5	0.0	3.0	0.0
20	0.0	50.0	50.0	35.75	413	19.5	0.0	2.6	0.0
10	0.0	42.8	42.8	35.45	270	19.5	0.0	2.2	0.0
5	0.0	35.3	35.3	35.16	160	19.4	0.0	1.8	0.0
2	0.0	25.4	25.4	34.79	80	16.8	0.0	1.5	0.0

Looking downstream towards South East Freeway

Looking upstream towards Priestdale Road

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY A**
LOCATION	**SOUTH-EAST FREEWAY OFFRAMP, EIGHT MILE PLAINS**

DATE OF SURVEY:	UBD REF: 221 N2
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE1005	CHAINAGE (m): 2545

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 9 / 2400 x 1800 box culverts

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 30.73

UPSTREAM OBVERT LEVEL: 32.53

DOWNSTREAM INVERT LEVEL: 30.56

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 32.36

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 17

LENGTH OF CULVERT BARREL AT OBVERT (m): 17

TYPE OF LINING: Shotcrete

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 17

LOWEST POINT OF WEIR (m AHD): 33.4

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete freeway wall guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**TRIBUTARY A**
LOCATION	**SOUTH-EAST FREEWAY OFFRAMP, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	20.3	95.9	116.2	33.77	316	38.9	15.9	2.5	1.3
50	4.2	95.9	100.1	33.57	327	38.9	5.1	2.5	0.8
20	0.0	84.5	84.5	33.19	235	38.9	0.0	2.2	0.0
10	0.0	72.6	72.6	32.9	158	38.9	0.0	1.9	0.0
5	0.0	60.3	60.3	32.6	98	38.5	0.0	1.9	0.0
2	0.0	43.4	43.4	32.19	71	31.2	0.0	1.8	0.0

(No photos available)

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY A**
LOCATION	**GATEWAY MOTORWAY, EIGHT MILE PLAINS**

DATE OF SURVEY:	UBD REF: 221 M1
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE1005	CHAINAGE (m): 2805

STRUCTURE DESCRIPTION: PIPE CULVERTS

STRUCTURE SIZE 2 / 3300 diameter
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 28.37 UPSTREAM OBVERT LEVEL: 31.67

DOWNSTREAM INVERT LEVEL: 27.88 DOWNSTREAM OBVERT LEVEL: 31.18
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 128

LENGTH OF CULVERT BARREL AT OBVERT (m):128

TYPE OF LINING: Shotcrete
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 128 LOWEST POINT OF WEIR (m AHD): 38.4

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete freeway wall guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: MRDGATEWAY

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**TRIBUTARY A**
LOCATION	**GATEWAY MOTORWAY, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total (from six culverts)			Structure	Weir	Structure	Weir
100	0.0	40.9	40.9	32.5	312	17.1	0.0	2.4	0.0
50	0.0	35.2	35.2	32.19	215	17.1	0.0	2.4	0.0
20	0.0	29.8	29.8	31.78	130	17.1	0.0	2.6	0.0
10	0.0	26.1	26.1	31.8	158	16.7	0.0	2.6	0.0
5	0.0	21.8	21.8	30.8	59	15.3	0.0	2.6	0.0
2	0.0	15.9	15.9	30.4	52	12.5	0.0	2.6	0.0

(No photos available)

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY A**
LOCATION	**GATEWAY MOTORWAY (2), EIGHT MILE PLAINS**

DATE OF SURVEY:	UBD REF: 221 M1
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE1005	AMTD (m): 2805

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 3 / 3500 diameter pipe culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 28.38
UPSTREAM OBVERT LEVEL: 31.88

DOWNSTREAM INVERT LEVEL: 27.88
For culverts give floor level.
DOWNSTREAM OBVERT LEVEL: 31.38
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 128

LENGTH OF CULVERT BARREL AT OBVERT (m): 128

TYPE OF LINING: Compacted rock aggregate
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 128
(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 38.4
PIER WIDTH: UNKNOWN

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete freeway wall guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A
PLAN NUMBER: MRDGATEWAY

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	TRIBUTARY A
LOCATION	**GATEWAY MOTORWAY (2), EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total (from 3 culverts)			Structure	Weir	Structure	Weir
100	0.0	69.9	69.9	32.5	316	28.9	0.0	2.4	0.0
50	0.0	60.3	60.3	32.19	326	28.9	0.0	2.4	0.0
20	0.0	51.3	51.3	31.78	235	28.7	0.0	2.4	0.0
10	0.0	44.4	44.4	31.38	158	27.1	0.0	2.5	0.0
5	0.0	36.9	36.9	30.98	98	24.3	0.0	2.7	0.0
2	0.0	27.0	27.0	30.47	71	19.7	0.0	2.6	0.0

(No photos available)

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY B**
LOCATION	**DANCE COURT NO. 1, EIGHT MILE PLAINS**

DATE OF SURVEY:	UBD REF: 221 K2
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE2030	CHAINAGE (m): 1062

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 2 / 3650 x 1500 box culverts

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 33.83 UPSTREAM OBVERT LEVEL: 35.33

DOWNSTREAM INVERT LEVEL: 33.7 DOWNSTREAM OBVERT LEVEL: 35.2

For culverts give floor level. For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 20

LENGTH OF CULVERT BARREL AT OBVERT (m): 20

TYPE OF LINING: Concrete channel + grouted stone pitching

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?

If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 20 LOWEST POINT OF WEIR (m AHD): 35.88

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail (Ref. W8983)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: Nov-1992 PLAN NUMBER: W8983

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**TRIBUTARY B**
LOCATION	**DANCE COURT NO.1, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total (from No.1&No.2)			Structure	Weir	Structure	Weir
100	3.0	33.5	36.5	36.04	798	9.4	3.2	3.6	0.9
50	1.5	32.2	33.6	35.98	778	9.2	1.9	3.5	0.8
20	0.0	26.3	26.3	35.71	645	8.0	0.0	3.3	0.0
10	0.0	24.7	24.7	35.63	640	7.7	0.0	3.2	0.0
5	0.0	20.8	20.8	35.44	584	6.8	0.0	3.0	0.0
2	0.0	14.4	14.4	35.09	528	5.3	0.0	2.7	0.0

Looking downstream towards Allara Place

Looking downstream – drop structure

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY B**
LOCATION	**DANCE COURT NO. 2, EIGHT MILE PLAINS**

DATE OF SURVEY:	UBD REF: 221 K2
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE2020	CHAINAGE (m): 1062

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 1 / 3650 x 1700 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 33.83 UPSTREAM OBVERT LEVEL: 35.53

DOWNSTREAM INVERT LEVEL: 33.7 DOWNSTREAM OBVERT LEVEL: 35.4
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 20

LENGTH OF CULVERT BARREL AT OBVERT (m): 20

TYPE OF LINING: Concrete channel
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 20 LOWEST POINT OF WEIR (m AHD): 35.88

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Tubular galvanised monowills handrail (Ref. W8983)

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: Nov-1992 PLAN NUMBER: W8983

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**TRIBUTARY B**
LOCATION	**DANCE COURT NO.2, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total (from No.3)			Structure	Weir	Structure	Weir
100	3.0	16.5	19.5	36.04	799	4.7	3.2	3.5	0.9
50	1.5	15.8	17.3	35.98	778	4.5	1.9	3.5	0.8
20	0.0	12.9	12.9	35.71	645	4.0	0.0	3.3	0.0
10	0.0	12.1	12.1	35.63	640	3.8	0.0	3.2	0.0
5	0.0	10.2	10.2	35.44	584	3.4	0.0	3.0	0.0
2	0.0	7.1	7.1	35.09	528	2.6	0.0	2.7	0.0

Looking upstream towards Bordeaux Street

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY B**
LOCATION	**LOGAN ROAD, EIGHT MILE PLAINS**

DATE OF SURVEY:	UBD REF: 221 L1
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: NIL	CHAINAGE (m): 1361

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 1 / 2.6 x 2.6
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 31.05
UPSTREAM OBVERT LEVEL: 33.65

DOWNSTREAM INVERT LEVEL: 31
For culverts give floor level.
DOWNSTREAM OBVERT LEVEL: 33.6
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 28

LENGTH OF CULVERT BARREL AT OBVERT (m): 28

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 28
LOWEST POINT OF WEIR (m AHD): 33.4

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flexi-beam guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A
PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	TRIBUTARY B
LOCATION	**LOGAN ROAD, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	4.8	15.6	20.4	33.84	485	5.9	3.9	2.9	1.2
50	1.8	15.2	17.0	33.72	480	5.6	1.7	2.8	1.0
20	1.5	14.7	16.1	33.62	469	5.5	1.5	2.8	1.0
10	0.5	13.9	14.4	33.52	436	5.4	0.6	2.7	0.9
5	0.0	12.8	12.8	33.41	382	5.2	0.0	2.6	0.0
2	0.0	11.3	11.3	33.27	344	4.9	0.0	2.3	0.0

Looking downstream towards South-East Freeway

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY C**
LOCATION	**GATEWAY, RUNCORN**

DATE OF SURVEY:	UBD REF: 221 J6
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE3000	CHAINAGE (m): 1008

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 4 / 2700 diameter pipe culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 36.9 UPSTREAM OBVERT LEVEL: 39.6

DOWNSTREAM INVERT LEVEL: 36.6 DOWNSTREAM OBVERT LEVEL: 39.3
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 90

LENGTH OF CULVERT BARREL AT OBVERT (m): 90

TYPE OF LINING: Shotcrete
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 90 LOWEST POINT OF WEIR (m AHD): 42

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete freeway wall guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**TRIBUTARY C**
LOCATION	**GATEWAY, RUNCORN**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	28.0	28.0	39.11	69	20.5	0.0	2.6	0.0
50	0.0	24.4	24.4	38.95	42	19.4	0.0	2.5	0.0
20	0.0	20.7	20.7	38.55	71	15.5	0.0	2.4	0.0
10	0.0	17.5	17.5	38.5	516	12.9	0.0	2.4	0.0
5	0.0	14.4	14.4	38.5	580	10.2	0.0	2.4	0.0
2	0.0	10.2	10.2	38.5	928	5.0	0.0	2.2	0.0

(No photo available)

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TRIBUTARY B1**
LOCATION	**GASKELL STREET, EIGHT MILE PLAINS**

DATE OF SURVEY:	UBD REF: 221 K2
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BE2000	CHAINAGE (m): 1030

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 3 / 3000 x 1500 box culverts

For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 31.3

UPSTREAM OBVERT LEVEL: 32.8

DOWNSTREAM INVERT LEVEL: 31.2

For culverts give floor level.

DOWNSTREAM OBVERT LEVEL: 32.7

For bridges give bed level

For Culverts

LENGTH OF CULVERT BARREL AT INVERT (m): 22

LENGTH OF CULVERT BARREL AT OBVERT (m): 22

TYPE OF LINING: Precast concrete wing walls

(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?

If yes give details ie. Plan number and/or survey book number.

Note: This section should be at the highest part of the road eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 22

LOWEST POINT OF WEIR (m AHD): 33.4

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 0.5m, Handrail: 1m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flex beam guardrail, galvanised mesh handrail

The following should also be provided.

Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.

For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N

If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**TRIBUTARY B1**
LOCATION	**GASKELL STREET, EIGHT MILE PLAINS**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	28.2	28.2	33.23	27	13.5	0.0	3.1	0.0
50	0.0	24.8	24.8	32.92	15	13.5	0.0	3.0	0.0
20	0.0	21.0	21.0	32.62	29	12.5	0.0	2.8	0.0
10	0.0	17.9	17.9	32.37	23	10.1	0.0	2.7	0.0
5	0.0	14.1	14.1	32.19	111	7.7	0.0	2.5	0.0
2	0.0	8.7	8.7	31.99	232	4.6	0.0	2.1	0.0

Looking upstream towards Gateway Motorway


Looking downstream towards Allara Place

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**MINNIPPI**
LOCATION	**GATEWAY MOTORWAY, TINGALPA**

DATE OF SURVEY:	UBD REF: 162 B15
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM30GHD	CHAINAGE (m): 748

STRUCTURE DESCRIPTION: MINIMUM ENERGY CULVERTS

STRUCTURE SIZE 6 / 3000 x 3000 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 1.0 UPSTREAM OBVERT LEVEL: 4.00

DOWNSTREAM INVERT LEVEL: 0.85 DOWNSTREAM OBVERT LEVEL: 3.85
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 60

LENGTH OF CULVERT BARREL AT OBVERT (m): 60

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 60 LOWEST POINT OF WEIR (m AHD): N/A

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 2m concrete guardrail + 2m acoustic barrier

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Flex beam guardrail, concrete guardrail + steel posted acoustic fence

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: A04B-3010

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**MINNIPPI BRANCH**
LOCATION	**GATEWAY MOTORWAY, TINGALPA**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	74.0	74.0	3.97	122	54.3	0.0	1.4	0.0
50	0.0	62.3	62.3	3.76	70	50.9	0.0	1.2	0.0
20	0.0	48.2	48.2	3.45	43	46.0	0.0	1.1	0.0
10	0.0	35.2	35.2	3.2	19	42.0	0.0	0.8	0.0
5	0.0	22.3	22.3	2.93	8	31.2	0.0	0.6	0.0
2	0.0	2.8	2.8	2.24	4	24.5	0.0	0.1	0.0

Looking downstream towards Creek Road

Looking from downstream

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**MURARRIE BRANCH**
LOCATION	**GATEWAY CULVERTS, MURARRIE**

DATE OF SURVEY:	UBD REF: 162 C14
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: 30GHD	Chainage (m): 475

STRUCTURE DESCRIPTION: MINIMUM ENERGY CULVERTS

STRUCTURE SIZE 11 / 2000 x 1600 box culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 1 UPSTREAM OBVERT LEVEL: 2.6

DOWNSTREAM INVERT LEVEL: 0.9 DOWNSTREAM OBVERT LEVEL: 2.5
For culverts give floor level. For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 34

LENGTH OF CULVERT BARREL AT OBVERT (m): 34

TYPE OF LINING: Precast concrete wing walls
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 34 LOWEST POINT OF WEIR (m AHD): 3

(In direction of flow, ie. Distance from u/s face to d/s face)

HEIGHT OF GUARDRAILS: 1.9m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Steel-posted chain-link fence

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A PLAN NUMBER: A04B-301C

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**MURARRIE BRANCH**
LOCATION	**GATEWAY CULVERTS, MURARRIE**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	10.9	66.5	77.4	3.23	250	35.2	11.3	1.9	1.0
50	0.3	65.3	65.4	3.05	238	35.2	0.7	1.9	0.7
20	0.0	61.5	61.5	2.8	209	35.2	0.0	1.8	0.0
10	0.0	53.1	53.1	2.65	174	32.0	0.0	1.7	0.0
5	0.0	43.0	43.0	2.43	136	28.9	0.0	1.5	0.0
2	0.0	26.9	26.9	2.13	77	24.0	0.0	1.1	0.0

Looking from upstream

Looking from further upstream (GUP construction)

HYDRAULIC STRUCTURE REFERENCE SHEET

CREEK	**TINGALPA BRANCH**
LOCATION	**DOWNSTREAM OF GATEWAY, TINGALPA**

DATE OF SURVEY:	UBD REF: 162 B15
AERIAL PHOTO No:	STRUCTURE ID:
BCC XS No: BM30GHD	CHAINAGE (m): 950

STRUCTURE DESCRIPTION: CULVERT

STRUCTURE SIZE 3 / 1200 diameter pipe culverts
For Culverts: Number of cells/pipes & sizes For Bridges: Number of Spans and their lengths

UPSTREAM INVERT LEVEL: 0.6
UPSTREAM OBVERT LEVEL: 1.8

DOWNSTREAM INVERT LEVEL: 0.42
For culverts give floor level.
DOWNSTREAM OBVERT LEVEL: 1.62
For bridges give bed level

For Culverts
LENGTH OF CULVERT BARREL AT INVERT (m): 25

LENGTH OF CULVERT BARREL AT OBVERT (m): 25

TYPE OF LINING: Shotcrete
(e.g. concrete, stones, brick, corrugated iron)

IS THERE A SURVEYED WEIR PROFILE?
If yes give details ie. Plan number and/or survey book number.
Note: This section should be at the highest part of the road
eg crown, kerb, hand rails guard rails whichever is higher.

WEIR WIDTH (m): 25
(In direction of flow, ie. Distance from u/s face to d/s face)

LOWEST POINT OF WEIR (m AHD): 3.85

PIER WIDTH: UNKNOWN

HEIGHT OF GUARDRAILS: 2m

DESCRIPTION OF ALL HAND AND GUARD RAILS AND
HEIGHTS TO TOP AND UNDERSIDE OF GUARD RAILS: Concrete freeway wall guardrail

The following should also be provided.
Wing wall/Headwall details, entrance details eg. pipe flush with embankment or projecting, socket or square end, entrance rounding, levels.
For bridges, details of piers and section under bridge including abutment details. Specify Survey Book No.

CONSTRUCTION DATE OF CURRENT STRUCTURE: N/A

PLAN NUMBER: N/A

HAS THE STRUCTURE BEEN UPGRADED? N
If yes, explain type and date of upgrade. Include plan number and location if applicable.

ADDITIONAL COMMENTS:

CREEK	**MINNIPPI CREEK**
LOCATION	**GATEWAY MOTORWAY, TINGALPA**

ARI (years)	DISCHARGE (m^3/s)			U/S WATER LEVEL (m AHD)	AFFLUX AT MAX FLOW (mm)	AREA (m^2)		VELOCITY (m/s)	
	Weir	Structure	Total			Structure	Weir	Structure	Weir
100	0.0	74.0	74.0	3.97	122	54.3	0.0	1.4	0.0
50	0.0	62.3	62.3	3.76	70	50.9	0.0	1.2	0.0
20	0.0	48.2	48.2	3.45	43	46.0	0.0	1.1	0.0
10	0.0	35.2	35.2	3.2	19	42.0	0.0	0.8	0.0
5	0.0	22.3	22.3	2.93	8	31.2	0.0	0.6	0.0
2	0.0	2.8	2.8	2.24	4	24.5	0.0	0.1	0.0

END

Appendix K: Rational Method Calculations

Creek Road Catchment	
Catchment Area	361 ha
Impervious Fraction	0.35
Overland Flow Length	200m
Piped Flow Length	3000m
Open Channel Flow Length	1600m
Overland Flow Time	20 mins
Piped Flow Time	17 mins
Open Channel Flow Time	13 mins
Total Time	51 mins

Creek Road Catchment			
ARI (yrs)	**C**	**I (mm/hr)**	**Q (m^3/s)**
2	0.65	52	34.1
5	0.73	68	49.9
10	0.77	78	60.2
20	0.81	91	73.8
50	0.88	109	96.8
100	0.92	122	113.0

Anzac Road Catchment	
Catchment Area	275 ha
Impervious Fraction	0.35
Overland Flow Length	200m
Piped Flow Length	3000m
Open Channel Flow Length	200m
Overland Flow Time	20 mins
Piped Flow Time	17 mins
Open Channel Flow Time	2 mins
Total Time	39 mins

Anzac Road Catchment			
ARI (yrs)	**C**	**I (mm/hr)**	**Q (m^3/s)**
2	0.65	61	30.5
5	0.73	79	44.1
10	0.77	91	53.5
20	0.81	106	65.4
50	0.88	126	85.1
100	0.92	141	99.4

Gallipoli Road Catchment	
Catchment Area	286 ha
Impervious Fraction	0.35
Overland Flow Length	200m
Piped Flow Length	3000m
Open Channel Flow Length	350m
Overland Flow Time	20 mins
Piped Flow Time	17 mins
Open Channel Flow Time	3 mins
Total Time	40 mins

Gallipoli Road Catchment			
ARI (yrs)	**C**	**I (mm/hr)**	**Q (m^3/s)**
2	0.65	59	30.6
5	0.73	78	45.2
10	0.77	89	54.3
20	0.81	103	66.0
50	0.88	123	86.4
100	0.92	138	101.0

Appendix L: Peer Review

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Memorandum

To	**Hanieh Zolfaghari**	From	**Trinity Graham**
Copy	**Brian Sexton** **Philippe Vienot**	Reference	**243999**
Date	**7 November 2014**	Pages (including this page)	**3**
Subject	**Peer Review of Bulimba Creek Flood Study**		

1 Introduction

This memorandum outlines the findings of the Peer Review that has been conducted by Aurecon of the hydrologic and hydraulic models from Brisbane City Council's Bulimba Creek Flood Study.

The Peer Review has been broken down into three sections each of which is discussed in this memorandum. These are:

- The WBNM hydrologic model
- The MIKE 11 hydraulic model of Bulimba Creek
- The HECRAS models of Philips, Salvin and Newnham Creeks

Note that the Peer Review process does not permit checking of each and every input/file/parameter, nor of the base data in terms of accuracy. Spot-checking has been carried out where necessary to cross-correlate the correct input of data, the accuracy of results, etc but this cannot definitively prove the model is error-free. Instead it seeks to appraise the general approach and robustness of the model such that it has been developed in line with current industry practices and standards.

2 WBNM hydrologic model

2.1 Overview

The hydrology of the catchment has been analysed using the WBNM software (Watershed Bounded Network Model). The model and the background data/approach have been reviewed by Aurecon based on the data provided, ie model files, GIS files and reports.

2.2 Summary of peer review findings

Generally speaking the WBNM model has been well built and is in line with industry standards in terms of its digitisation, coding and paramaterisation.

There were no fundamental errors uncovered within the model and it was found to be fit for purpose and conscientiously developed.

3 Bulimba Creek MIKE 11 hydraulic model

3.1 Overview

Bulimba Creek has been modelled using the one-dimensional MIKE 11 software package developed by DHI. The majority of the creek is suited to a 1D modelling approach although in reviewing the 1D network layout, it is possible that a 2D representation of the floodplain downstream of the Gateway

Motorway may provide more accurate predictions of flood behaviour in these reaches. Nevertheless it has been represented in a quasi-2D style by providing overflow link channels where necessary.

3.2 Summary of peer review findings

The model was thoroughly developed and no major errors were found during the review process. There were a number of minor aspects identified that were brought to the attention of Council including the following:

- All bridges have been modelled as culverts – this obviously limits the detail associated with representing bridge losses due to the inability to account for piers
- Cross-checks of irregular structures (typically bridges) against photographs shows incidences where the representation of the opening in MIKE 11 does not visually appear to match the image (eg Altandi Street). Similarly at this same location a Manning's n of 0.08 appears conservative
- It is observed that the Port of Brisbane Motorway has been omitted
- The splitting of lanes at Lytton Road (ie two bridges) does not appear to have been represented
- Some discharge instability is evident in results at a small number of locations, particularly chainage 17935. It is not observed to translate to large oscillations in water level however, eg circa chainage 17935

Overall the model has been developed in line with industry standards and guidelines, and appears to be reliable and robust based on a review of its outputs.

4 Salvin, Philips and Newnham Creek HECRAS models

4.1 Overview

The HEC-RAS models of Salvin, Philips and Newnham Creeks have been reviewed in a similar manner to that of the MIKE 11 model. The review focused on the general approach and robustness of the model, confirming its compliance with current industry practices and standards. The review included some standard details, however it could not extend to the site specific details that the project engineer accustomed with the site would be expected to integrate in the models.

4.2 Summary of peer review findings

In summary, it was found that the models were reasonably developed, with balanced resolution of all the different elements such as extents, topography, structures, boundary conditions and losses. The discretisation is in line with industry standards for the predictions of the design flood conditions along the creeks. A few small inconsistencies were spotted in the models but are not expected to significantly affect the model results.

A couple of potential issues have also been raised, which may have a greater consequence, related to the modelling of high flows over structures and the consistency of the design flows with the WBNM and MIKE 11 models:

- Most of the bridges have been modelled using only the standard step method for high flow conditions. This method is suitable when the bridge deck is only a small obstruction to the flow and the bridge opening is not acting as a pressurised orifice, or when the bridge is highly submerged. However these circumstances are rarely the ones tested in the model. Most of the structures appear to be significantly overtopped under high flow conditions while the downstream water levels do not submerge the deck. In these instances, the HEC-RAS Reference Manual (refer pages 5-27 and 5-28) recommends that the gate and weir method should be adopted. Without performing sensitivity tests, it is not known what influence this assumption would have the model predictions. It is therefore highly recommended that sensitivity tests are undertaken and model predictions updated if necessary

- For Salvin and Newnham Creeks, it was found that the design inflows used in the HEC-RAS models were significantly inconsistent with the design inflows used in the MIKE 11 at the same locations for the 1% AEP conditions. Interestingly, it is not the case for Philips Creek, which tends to further question the accuracy of the design inflows in the Salvin and Newnham Creeks HEC-RAS models. It is recommended that a review of the hydrologic inputs in the HEC-RAS models be undertaken to confirm the adequacy of the predictions

5 Concluding remarks

Aurecon has undertaken a comprehensive Peer Review of the hydrologic and hydraulic models associated with the Bulimba Creek Flood Study in line with Brisbane City Council's project brief requirements. The findings are summarised in this memorandum along with the accompanying Attachments. Overall the models and background methodology are, broadly speaking, sound and in line with current industry practices.

There are a number of areas identified that warrant discussion with and checking by Council, ie relating to apparent instabilities, potentially minor errors in input data, etc but these are not anticipated to significantly alter the findings/outputs of the flood study.

A further small number of questions have been raised to understand certain decisions in relation specifics of the modelling approach and selected parameters but these are not major issues and do not compromise the general accuracy or robustness of the models and their predictions. They mainly relate to subjective choices taken by the modeller/engineer, something which is commonplace in all models.

Accordingly, while clarification of the questions raised is recommended to complete the Peer Review process, the findings of the review show the flood study to be without any major flaws/errors in so far as can be ascertained through the review process (noting that this does not permit checking of each and every input, nor of the base data).

We trust that the information presented in this memorandum report is clear. However if there are any questions regarding its content please feel free to contact the undersigned.

Regards

Trinity Graham
Technical Director, Water Services
RPEQ 006645

Dedicated to a better Brisbane

MEMORANDUM

Brisbane City Council

Planning & Design Branch
Flood Management

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To:	**Natural Environment Water and Sustainability Branch (NEWS)**	Date:	**25/11/2014**
CC:	**Richard Yearsley -** Project Manager, NEWS		
From:	**Chandra Gunaratne –** Flood Engineer, Flood Mgmt **Evan Caswell** - Principal Engineer, Flood Managment		
Re:	**Bulimba Creek Hydrologic/Hydraulic Model Review**		

1.0 Introduction and Background

The Flood Management team had developed a hydrologic model using WBNM software and hydraulic model using MIKE11 software for the Bulimba Creek catchment in 2001-2003. As part of the Bulimba Creek Flood Study (BCFS), which was initiated in 2006/2007 detailed review and update of these models were undertaken focussing on the catchment area upstream of the Gateway Motorway.

In the BCFS, the MIKE11 model was extended to Compton Road and Mimosa Creek, which was not previously modelled, was also included in to the model. Design event modelling was undertaken with Duration Independent (DIS) storms and flood inundation extent maps were developed for the catchment.

Three of the Bulimba Creek tributaries namely Newnham Road tributary, Salvin Creek and Philips Creek were also modelled in HEC-RAS models as separate investigation studies by Flood Management since 2001. These investigation reports were also compiled in to the BCFS in 2010.

With reference to the current flood study procedure the consultant Aurecon was commissioned in September 2014 to undertake a peer review of the hydrologic and hydraulic models developed in BCFS. The findings of the peer review were summarised in a Memorandum dated 07/11/2014, submitted by Aurecon and it is referred to as Bulimba Creek Flood Study Peer Review “BCFSPR” in this document.

Brisbane City Council provided responses to the comments provided in the BCFSPR. Having acknowledged the outcome of the review undertaken by Aurecon, the following clarifications/responses need to be considered in conjunction with the recommendations of the Aurecon’s peer review.

This memorandum summarises the concerns listed in the BCFSPR and provides a response based on the adopted methodology in the BCFS. The BCFSPR is attached to this memorandum.

2.0 **Aurecon’s Peer Review Response**

The consultant carried out the peer review of the BCFS in three parts namely as WBNM model, MIKE11 model and HEC-RAS modelling of tributaries. They conducted the review based on the modelling background, approach and model input data.

2.1 General Comments

- Aurecon commented that the WBNM model was built in line with industry standards and fit for the purposes and conscientiously developed
- Hydraulic model MIKE11 was built in line with industry standards and guide lines and appeared reliable and robust based on the reviewed outputs. They also recommended the use of 2D modelling for the lower part of the catchment
- HEC-RAS models included with BCFS for Salvin Creek, Newnham Road Tributary and Philips Creek were also reviewed similar to the MIKE11 model. A couple of issues were raised with reference to these models.

2.2. Other comments

The comments on peer review findings made by the consultant are referred below and addressed with BCC responses:

Bulimba Creek WBNM Hydrologic Model

Ref. BCFSPR Section 2.2:

"Higher initial losses were applied for the 9th March 2001 and 4th November 2004 rainfall events":

BCC response:

Available rainfall records indicated that there was no continuing rainfall occurring in the catchment prior to these events and the catchment had been running dry for a while. Therefore high initial losses were needed to apply to match with the rising limb of the hydrograph with that of the recorded stream gauged data in the calibration process.

Bulimba Creek MIKE11 Hydraulic Model

Ref. BCFSPR Section 3.1: Overview

"It is possible that 2D representation of the floodplain downstream of the Gateway Motorway may provide more accurate predictions":

BCC response:

In the BCFS project scoping stage it was identified that the lower part of Bulimba Creek was meandered and flood plain could be best represented by a 2D-model. However it was expected that future flood model upgrade would be based on these considerations specifically when new surveyed topographical information for lower part of the catchment would be available.

Ref. BCFSPR Section 3.2: Summary of peer review findings

- "All bridges have been modelled as culverts":

BCC response: Modelling of bridges as culverts in MIKE11 model was discussed with DHI and they commented it as an acceptable method.

***Action**: Adopted modelling methodology was considered correct and no changes were made to the modelling of structures.*

- "Altandi Street Foot Bridge":

BCC response: It is accepted that the over bank opening area in the right bank is not considered in modelling. Flood immunity of this foot bridge is less than 2 year ARI event. The MIKE11 model was corrected to reflect the correct configuration. However the increase in flow area was not significant enough to change the estimated flood levels as the 2 year ARI event overtops the foot bridge. **T**here is no impact on flood levels.

***Action**: Model was updated and no changes were required to the report.*

- "Port of Brisbane Motorway has been omitted":

BCC response: The BCFS upgraded the existing hydraulic model and was mainly concerned on the catchment upstream of the Gateway Motorway. However the peak flood levels in the area where this bridge is located are dominated by storm surge and the Bridge is also in the shadow at the Rail Bridge that was included in the model. Therefore flooding impact of this bridge would be minimal.

***Action**: No changes to the model/report were made. Future model updates to include these structures.*

- "The splitting of lanes at Lytton Road (ie. Two bridges) does not appear to have been represented":

BCC response: Structures of this type are normally modelled as one structure due to the model limitations and lack of calibration data. This bridge has the flood immunity for 100 year ARI event with

1 mAHD as downstream boundary for the MIKE11 model. It is expected that there would be a minimal impact on flood levels for not representing bridge splitting.

***Action**: No changes to the model were made. Future model updates to consider these issues.*

- "Some discharge instability at chainage 17935…..":

BCC response: Instability existed at cross section 17935 was checked and resolved. No considerable impact on reported flood levels.

***Action**: MIKE11 model cross section at 17935 corrected. No changes were made to the report.*

Ref. BCFSPR Section 4.2: HEC-RAS Models- Philips Creek, Newnham Road Tributary and Salvin Creek-**: Summary of peer review findings**

- **Dot point one in Section 4.2**:

BCC response: As per the review recommendations, gate/weir method was tested and the bridge modelling results in Philips and Newnham Road Tributary HEC-RAS models were checked. No changes in peak flood levels were noted.

***Action:** Therefore no changes to the model and report were considered necessary.*

- **Dot point two in Section 4.2**:

BCC response: As these HEC-RAS models were developed separately and not as a part of the BCFS some inconsistencies exist when compare to discharges of the current WBNM model.

1. Salvin Creek HEC-RAS model was initially developed in 2003 and updated in 2007 and 2010. Flows used in the Salvin Creek model were obtained from the WBNM model developed in 2001. However some inconsistency of flows was noted for the lower reaches of the model. It should also be noted that total flow coming from the HEC-RAS model was not the routed flow, whereas the flow adopted in MIKE11 model at the Salvin Creek confluence was the routed flow obtained from WBNM model at the end of catchment. Therefore HEC-RAS flows were higher. Salvin Creek model input data will be reviewed and results will be updated if required.

   ***Action**: Model data was reviewed. Estimated of flood levels are somewhat conservative. No changes at present. Future model updates to visit these comments*.

2. Newnham Road Tributary HEC-RAS model was initially developed in 2002 and updated in 2007. Flows used in the model were obtained from the WBNM hydrology model developed in 2001. As recommended action would be taken to review the model input data and update results as required.

   ***Action**: Model data was reviewed. Estimated flood levels are slightly conservative. Future model updates to visit these comments and revise flood levels*.

3.0 Summary of Actions

Some of the above recommendations from the BCFSPR were reviewed and incorporated in the hydrologic and hydraulic models, however as model was in final stages at the time peer review was undertaken, it was determined that the remaining of the recommendations will be incorporated in the future revision of the study. Actions taken on the peer review comments made above are summarised in the table below:

Table 1: Actions taken on the peer review comments

Commented Item	Action
Bulimba Creek WBNM Hydrology model: **BCFSPR Section 2.2**	Rainfall records were reviewed and identified that losses applied are justifiable. No action required.
Bulimba Creek MIKE11 Hydraulic Model: **BCFSPR Section 3.1: Overview**	Future model updates to consider 2D-modelling of the lower catchment with new ground survey information
Bulimba Creek MIKE11 Hydraulic Model: **BCFSPR Section 3.2: Summary of peer review findings**	1. Bridge modelling: Adopted modelling methodology was considered correct and no changes were made to the modelling of structures. 2. Altandi Street Foot Bridge: MIKE11 model was updated and no changes were required to the report. 3. Port of Brisbane Motorway has been omitted: No changes to the model/report were made. Future model updates to include these structures. 4. The splitting of lanes at Lytton Road: No changes to the model were made. Future model updates to consider these issues. 5. Discharge instability at chainage 17935: MIKE11 model cross section at 17935 corrected. No changes were made to the report.
Section 4.2: HEC-RAS Models-Philips Creek, Newnham Road Tributary and Salvin Creek: Inconsistencies when compare to discharges of the current WBNM model	**Salvin Creek**: Model data was reviewed. Slightly conservative estimate of flood levels. Future model updates to visit these comments and update flood levels. **Newnham Road Tributary**: Model data was reviewed. Slightly conservative estimate of flood levels. No changes were made. Future model updates to visit these comments and revise flood levels.

4.0 **Conclusions**

The BCFSPR states that overall, the Bulimba Creek WBNM/MIKE11 models appear to have been developed using sound techniques and diligent application and is suitable for the purpose of this study.

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