# Appendices

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# Appendix A
# Infrastructure Data Assessment Report

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# Infrastructure Data Assessment Report

aurecon

Project No. 222767

# Project: Regional Floodplain Database Stage 3 Detailed Modelling: Package 1

## BCC Minor Basin Data Infrastructure Assessment Report

**Prepared for:**
Moreton Bay Regional Council
PO Box 159
Caboolture QLD 4510

**Report ref: 222767-001**
**4 August 2011**

Moreton Bay Regional Council

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# Regional Floodplain Database Stage 3 Detailed Modelling: Package 1

Date | 4 August 2011
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# Contents

# 1 Introduction

## 1.1 Study objective

Moreton Bay Regional Council (MBRC) is delivering a Regional Floodplain Database (RFD) in support of their flood risk management, considering emergency response, development control, strategic landuse and infrastructure planning. MBRC was recently formed under local government amalgamations and is responsible for Caboolture, Pine Rivers, Redcliffe and Bribie Island. The RFD project focuses on the northern sector as a key growth area for South-east Queensland.

The project is being funded by MBRC, Emergency Management Queensland (EMQ) and Emergency Management Australia (EMA) as part of the Natural Disaster Resilience Program and will provide:

- A comprehensive and consistent description of flood behaviour across the region
- Strategies for management of any flooding identified problems
- A system/process to store and manage this information and keep it up-to-date

***Stage 1*** of the project was completed in July 2010 and involved a number of sub-projects. These projects delivered consistent processes and protocols for the detailed hydrologic and hydraulic model development. A key sub-project involved the development of broadscale hydrodynamic models for each minor basin to provide general understanding of flooding mechanisms and allow prioritisation of data capture.

***Stage 2*** of the project involves the development of detailed hydrologic and hydraulic models for each minor basin.

***Stage 3*** (current stage) includes development of a further two detailed models. Stage 3 will then build on the detailed models and “add value” through assessment of flood damages and community resilience measures

## 1.2 Objective of Data Assessment Report

This report details the data infrastructure assessment and gap analysis for Package 1, Brisbane Coastal Creeks (as shown in Figure 1). This basin is largely urbanised, with only the upper reaches remaining forested. Flows are generally contained within the creek corridor or adjacent low lying land, with very little floodplain evident in this minor basin.

The structures within this basin are generally located in close proximity to urban areas and therefore they have the potential to impact upon flooding of these areas.

This report assesses the infrastructure and bathymetric data requirements for modelling of the Brisbane Coastal Creeks minor basin. It documents the results of the data gap analysis carried out for drainage infrastructure including bridges, culverts, detention basins and trunk drainage and also for below-water bathymetric details. The infrastructure has been prioritised according to the significance of location and potential impacts to the hydraulic model results. Following the gap analysis and the data prioritisation, a composite assessment of survey requirements has been undertaken.

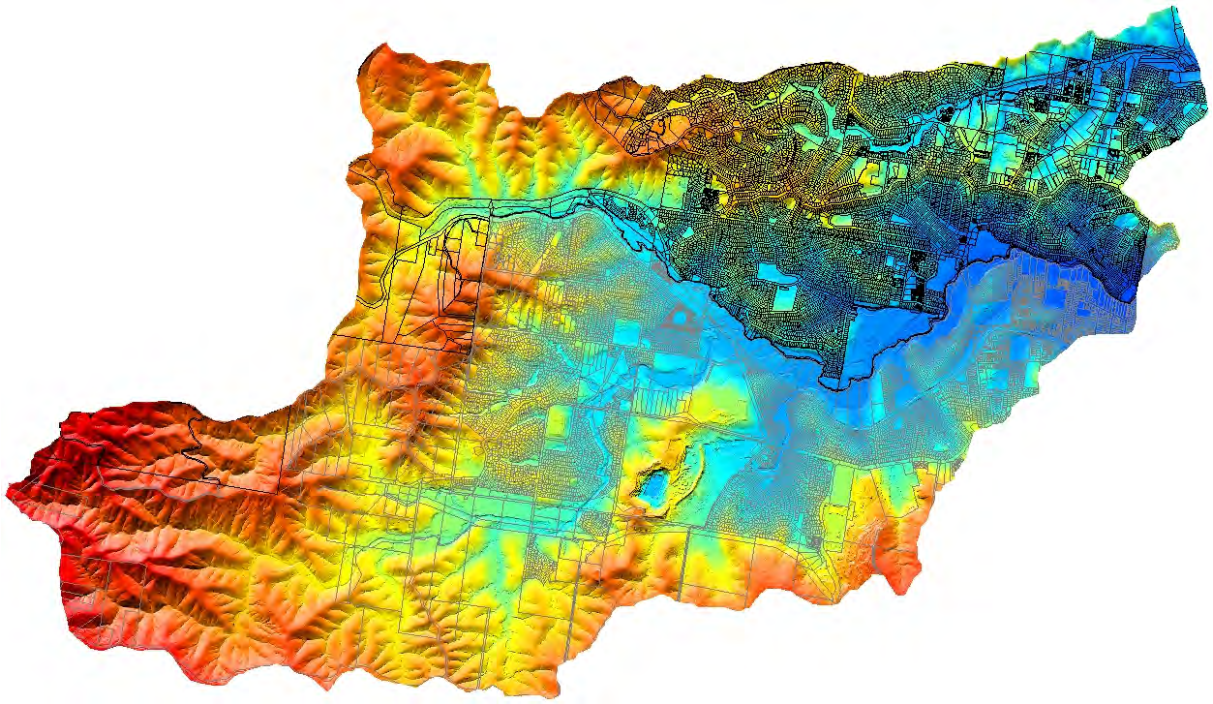

**Figure 1 | BCC Minor Basin**

# 2 Methodology

## 2.1 Data availability

Available data which was assessed includes:

- GIS file identifying locations of QR and TMR structure data to be provided "Stage3_QR_TMR_Structure_Locations"
- GIS file identifying locations of structures being surveyed by Council "Culvert_Survey"
- GIS file identifying structures inspected by Council "Structure_inspection"
- Microsoft PowerPoint file showing photos from structure inspection "20110714 Culvert Photo Album - BCC.ppt"
- GIS file of structures identified by as not having junctions in the existing hydrography layer "Structure_No_Junctions"
- GIS file of available stormwater data for Moreton Bay region (provided for Stage 2) "Storm_Water_Arcs" and "Storm_Water_Node"
- GIS file of available stormwater data for Brisbane City region "bm081657_sw_pipe"
- TUFLOW 2d_lfcsh_KED and 1d_nwk_KED GIS files, as modelled previously
- Structure drawings provided by Council
- BCC basin DEM
- BCC basin aerial images
- Brisbane City and Moreton Bay Region cadastral data

This data was reviewed to identify the locations of critical structures within the minor basin. These are presented in the Sections 3.1 to 3.5. Not all structures within the basin have been identified; however all structures on major waterways and the larger tributaries have been included.

## 2.2 Gap analysis

A gap analysis was undertaken to review the available data for each crossing and identify any data gaps, based on the critical data requirements presented in Sections 2.2.1 to 2.2.3. The available data is presented in Sections 3.1 to 3.5, as well as data gaps and the proposed capture methods to be employed in addressing these gaps. It is understood that Council does not wish to obtain further survey and the proposed capture methods have taken this into account. The site visit for this minor basin is yet to be undertaken; therefore it is possible that the required information can be captured during this site visit.

The DEM was also reviewed to assess how well the channels are represented.

### 2.2.1 Bridges

The critical information required for the hydraulic modelling of bridges includes:

- Deck surface/obvert levels and thickness
- Pier locations, dimensions, orientation to flow and pile arrangements
- Handrail location, height and extent
- Cross-section of the channel beneath the bridge

### 2.2.2 Culverts

The critical information required for the hydraulic modelling of culverts includes:

- Culvert shape
- Dimensions and number of barrels
- Culvert invert levels

### 2.2.3 Trunk drains

The trunk drainage data standard specifies that trunk drainage refers to “extended underground drainage systems which have a large open channel or stream feeding into them (ie stormwater pipe networks which are intended to convey flows from a major storm event)”.

The critical information required for the hydraulic modelling of trunk drainage includes:

- Pipe location, shape, dimensions, invert levels, length and number of barrels
- Stormwater pit/junction locations, type, dimensions and invert levels

### 2.2.4 Assumptions

A number of assumptions were made during the gap analysis:

- Complete TUFLOW ready datasets will be provided for the QR and TMR structures identified in “Stage3_QR_TMR_Structure_Locations”
- All required data will be provided for structures identified in Council’s “Culvert_Survey”
- No additional data will be provided for Council’s “Structure_inspection” structures – modelling of these structures is to be based upon the details provided in “20110714 Culvert Photo Album - BCC.ppt”

## 2.3 Prioritisation methodology

The structure data was prioritised into categories “A” and “B”, with Priority A structures being those required for the hydraulic modelling and Priority B structures being of less importance for the accurate modelling of the minor basin.

Prioritisation was based on the following criteria:

- Broadscale model flood extents – Structures within or nearby the 100 year ARI broadscale model flood extents were identified as Priority A structures. Conversely structures outside of these extents were considered to be less important and were identified as Priority B
- Previous modelling – Structures included in the previous modelling of this minor basin were generally identified as Priority A structures
- Structures identified in Council’s “Structure_inspection” – Generally these structures were categorised as Priority A
- Location of structure with Brisbane City area – Structures within the Brisbane City region are considered less important than those in the Moreton Bay region. Only key structures on the larger stream reaches within the Brisbane City region are identified as Priority A

# 3 Available data and gap analysis

## 3.1 Identified structures

All identified structures are shown in Figure 2. Blue dots represent Priority A structures and green dots represent Priority B structures. The GIS file “BCC_Hydraulic_Structures” provided with this report includes the details of the structures identified in Figure 2.

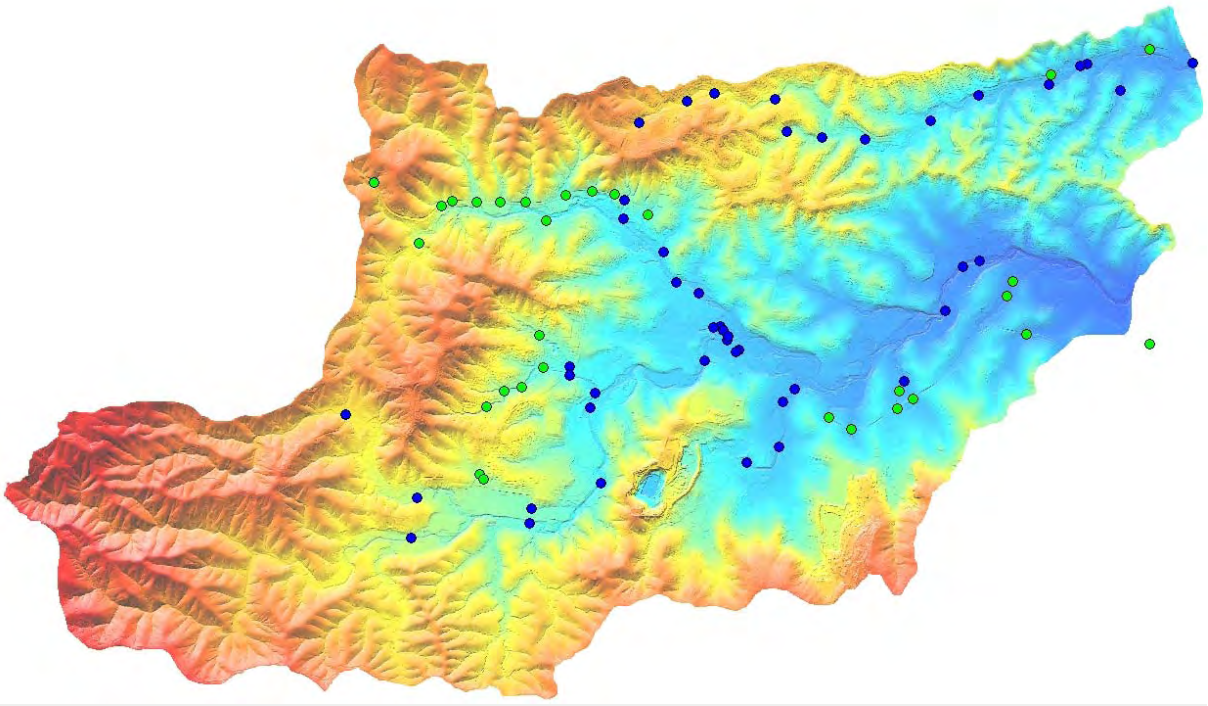

**Figure 2 | BCC minor basin structures**

## 3.2 Bridges

Table 1 shows all the bridges identified within the BCC minor basin, the available data for these bridges and the adopted structure priority.

**Table 1 Identified bridges and available bridge data**

| Waterway ID | Crossing Name | Available Data | Priority |
|---|---|---|---|
| KED_01_01913 | Dawson Parade | 2d_lfcsh_KED, Drawings | A |
| KED_01_01913 | Pedestrian (Jane St) | 2d_lfcsh_KED, Drawings | A |
| KED_01_06019 | Gordon Road | 2d_lfcsh_KED | A |
| KED_04_00000 | Samford Road | Stage3_QR_TMR_Structure_Locations | A |
| KED_04_00000 | Tramway Street | | A |
| KED_04_00000 | Ferny Grove Rail Line | Stage3_QR_TMR_Structure_Locations | A |
| KED_04_02038 | Upper Kedron Road | | A |
| KED_04_02038 | Pedestrian | | A |
| KED_04_03281 | Canvey Road | Structure_inspection | A |
| KED_10_00000 | Hogart Road | Structure_inspection | A |
| KED_16_00000 | Ross Road | Structure_inspection | A |
| KED_28_00000 | Samford Road | Stage3_QR_TMR_Structure_Locations | A |
| KED_28_00000 | Ferny Grove Rail Line | Stage3_QR_TMR_Structure_Locations | A |
| Beyond DS Bnd | Osborne Road | 2d_lfcsh_KED | B |
| Not on reach | Ferny Grove Rail Line | | B |

Of the Priority A structures, there are three bridges for which no data exists and one bridge for which data only exists in the 2d_lfcsh file from the previous modelling. The following approach is proposed for these structures:

- Bridges will be located based upon the aerial photographs
- Bridge deck levels will be assumed based upon the LiDAR data to either side of the structure
- Deck thickness can be assessed during a site visit
- Pier details can be assessed during a site visit
- Handrail details can be assessed during a site visit
- The bridge can be modelled using the existing surface levels in the LiDAR data, with no cross-section data specified

## 3.3 Culverts

Table 2 shows all the culverts identified within the BCC minor basin and the available data for these culverts.

**Table 2 Identified culverts and available culvert data**

| Waterway ID | Crossing Name | Available Data | Priority |
|---|---|---|---|
| CTC_01_00000 | Old Northern Road | Stage3_QR_TMR_Structure_Locations | A |
| CTC_01_01288 | Collins Road | | A |
| CTC_01_01385 | Collins Road | 1d_nwk_KED | A |
| CTC_01_01813 | John Street | | A |
| CTC_01_02688 | Francis Road | Culvert Survey, 2d_lfcsh_KED, Drawings | A |
| CTC_01_03455 | Bunya Road | 1d_nwk_KED | A |
| CTC_01_04319 | View Crescent | 1d_nwk_KED | A |
| CTC_01_05671 | Woodhill Road | 2d_lfcsh_KED, Drawings | A |
| CTC_01_06388 | Linkwood Drive | 2d_lfcsh_KED, Drawings | A |
| CTC_01_06685 | Woodtop Court | Culvert Survey, 2d_lfcsh_KED, Drawings | A |
| CTC_01_07207 | Ridgewood Court | Structure_inspection | A |
| CTC_02_00075 | Yingally Drive | 1d_nwk_KED | A |
| CTC_02_00461 | Woodhill Road | 1d_nwk_KED | A |
| CTC_04_00304 | Bennetts Road | 1d_nwk_KED | A |
| KED_01_00975 | Pedestrian | bm081657_sw_culvert | A |
| KED_01_06294 | Samford Road | 1d_nwk_KED | A |
| KED_04_00000 | Samford Road | bm081657_sw_culvert | A |
| KED_04_00000 | Ferny Grove Rail Line | Stage3_QR_TMR_Structure_Locations | A |
| KED_04_00000 | Samford Road | Stage3_QR_TMR_Structure_Locations | A |
| KED_04_00000 | Samford Road | Stage3_QR_TMR_Structure_Locations | A |
| KED_04_00000 | Ferny Grove Rail Line | Stage3_QR_TMR_Structure_Locations | A |
| KED_04_05168 | Millwood Place | Structure_inspection | A |
| KED_08_00000 | Canvey Road | Structure_inspection | A |
| KED_09_00000 | Woolshed Street | Structure_inspection | A |
| KED_09_00227 | Samford Road | Stage3_QR_TMR_Structure_Locations | A |
| KED_10_00000 | McAlroy Road | Structure_inspection | A |
| KED_11_00059 | Samford Road | Stage3_QR_TMR_Structure_Locations | A |
| KED_12_00000 | Selkirk Crescent | Structure_inspection | A |
| KED_14_00000 | Ross Road | Structure_inspection | A |
| KED_28_00000 | Avington Street | bm081657_sw_culvert | A |
| KED_28_01009 | Glengarry Road | Structure_inspection | A |
| KED_32_00000 | Duggan Street | Structure_inspection | A |

| Waterway ID | Crossing Name | Available Data | Priority |
|---|---|---|---|
| Not on reach | Ferny Grove Rail Line | | B |
| Not on reach | Samford Road | Stage3_QR_TMR_Structure_Locations | B |
| KED_03_00076 | Samford Road | Stage3_QR_TMR_Structure_Locations | B |
| KED_05_00166 | Samford Road | Stage3_QR_TMR_Structure_Locations | B |
| KED_01_08231 | Samford Road | Stage3_QR_TMR_Structure_Locations | B |
| KED_01_08231 | Samford Road | Stage3_QR_TMR_Structure_Locations | B |
| KED_05_00166 | Samford Road | Structure_inspection | B |
| KED_07_00155 | Samford Road | Structure_inspection | B |
| KED_01_07110 | Samford Road | Stage3_QR_TMR_Structure_Locations | B |
| KED_08_00000 | Cedar Creek Road | bm081657_sw_culvert | B |
| Not on reach | Ferny Grove Rail Line | bm081657_sw_culvert | B |
| KED_10_00404 | Selkirk Crescent | bm081657_sw_culvert | B |
| KED_34_00000 | House | bm081657_sw_culvert | B |
| Not on reach | Lanita Road | bm081657_sw_culvert | B |
| KED_01_09303 | Lanita Road | Structure_inspection | B |
| KED_34_00000 | Woking Street | | B |
| KED_32_00000 | Ferny Grove Rail Line | | B |
| KED_32_00000 | Ferny Grove Rail Line | | B |
| Not on reach | Ferny Grove Rail Line | | B |
| KED_08_00000 | | | B |
| KED_10_00404 | Selkirk Crescent | | B |
| KED_10_00404 | Selkirk Crescent | | B |
| KED_10_00404 | Selkirk Crescent | | B |
| KED_12_00000 | McGinn Road | | B |
| Not on reach | Samford Road | | B |
| Not on reach | Samford Road | | B |
| CTC_01_01385 | Collins Road | 1d_nwk_KED | B |
| Not on reach | Collins Road | 1d_nwk_KED | B |
| KED_32_00000 | | | B |

Of the Priority A structures, there are two without any existing data. The following approach is proposed for these structures:

- Culverts will be located based upon the aerial photographs
- Culvert dimensions will be measured during a site visit
- Culvert invert levels will be assumed based upon a measured depth from the road crest to the culvert obvert

## 3.4 Trunk underground drainage

No trunk underground drainage systems have been identified as being critical for the hydraulic modelling.

## 3.5 Detention basins

No detention basins have been identified as being critical for the hydraulic modelling.

## 3.6 Terrain

LiDAR data has been provided by Moreton Bay Regional Council and Brisbane City Council. In addition to the LiDAR data, to accurately model waterways, bathymetric information is generally required for significant perennial reaches. Within the BCC minor basin, whilst it is possible that the creek invert levels are not well represented in the LiDAR data, the creek channels themselves are well represented. The additional conveyance capacity which would be provided by accurate representation of the creek inverts is expected to be minimal; therefore it is not recommended that additional bathymetric data be captured for the BCC minor basin.

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# Appendix B
# Hydrography Review Report

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# Hydrography Review Report

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Project No. 222767

# Project: Regional Floodplain Database Stage 3 Detailed Modelling: Package 1

## BCC Minor Basin Hydrography Review Report

**Prepared for:**
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**Report ref: 222767-001**
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# Regional Floodplain Database Stage 3 Detailed Modelling: Package 1

Date | 3 August 2011
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***Stage 2*** of the project involves the development of detailed hydrologic and hydraulic models for each minor basin and is currently underway.

***Stage 3*** includes development of a further two detailed models (currently underway). Stage 3 will then build on the detailed models and "add value" through assessment of flood damages and community resilience measures.

## 1.2 Objective of Hydrography Review Report

This report details the hydrography review for Package 1 of Stage 3, covering the Brisbane Coastal Creeks (BCC) minor basin.

The term 'hydrography' describes the sub-catchment delineation, stream reach lines and junction locations and will form the basis of the hydrological model. The hydrography is required to support the following key objectives:

- Sufficiently define catchments to ensure accurate definition of contributing areas at key points of interest (urbanised areas, drainage control points, areas marked for future development)

- Support the hydraulic model objectives through appropriate flow reporting locations, noting the following:
  - The hydraulic model will apply inflow distributed across the sub-catchment, effectively “filling” the sub-catchment from the lowest point
  - The hydraulic model will advise on flood immunity of major roads accessing key urban areas

MBRC have provided initial sub-catchment boundaries, stream reaches and junctions (as shown in Figure 1). A review of the hydrography has been undertaken for each minor basin to ensure compliance with the above objectives

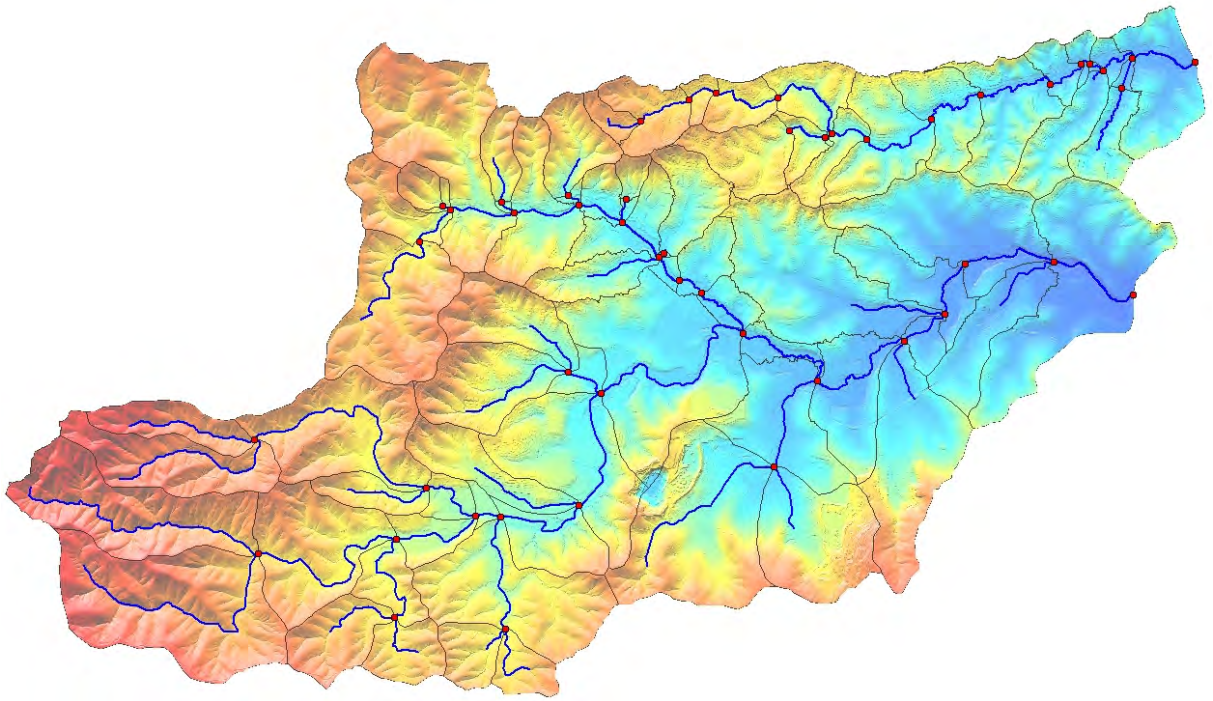

**Figure 1 | BCC Minor basin hydrography**

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# 2 Hydrography review

## 2.1 Minor basin appreciation

The Brisbane Coastal Creeks minor basin covers the upper ends of the Cabbage Tree Creek and Kedron Brook catchments. The northern portion of this minor basin lies within the Moreton Bay Region and the southern portion lies within the Brisbane City region, with the upper reaches of Kedron Brook running along the region divide.

This basin is largely urbanised, with only the upper reaches remaining forested. Flows are generally contained within the creek corridor or adjacent low lying land, with very little floodplain evident in this minor basin.

Comparison of the aerial photography, the 2006 Pine Rivers Planning Scheme and the 2000 City Plan for Brisbane show that, with the exception of one parcel of land in Upper Kedron, significant development is not proposed in any part of this minor basin.

Key areas of interest are those within the Moreton Bay Regional area, immediately adjacent to the creek corridors.

## 2.2 Stream connectivity

A review of the sub-catchment and reach network was undertaken with reference to the study objectives outlined in Section 1.2. At the downstream end of branch KED_04_05168 the reach location and connectivity does not appear to be consistent with the topographic data as shown in Figure 2. The pink line in Figure 2 shows a more appropriate location for this reach and its connection point. This pink line is included in the attached file “Proposed reach change”.

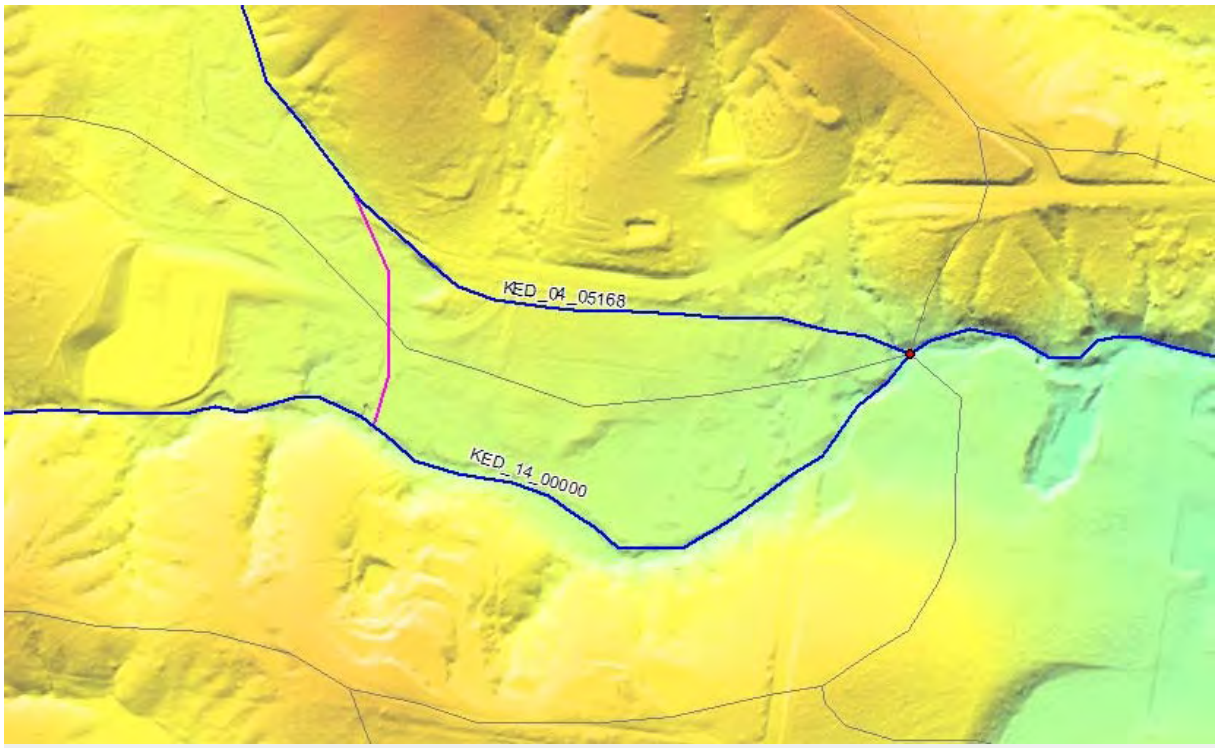


**Figure 2 | Connectivity issue**

## 2.3 Inclusion of floodplain structures

A review has been undertaken of the structures within the BCC minor basin and this is presented in the Data Infrastructure Assessment Report. Table 1 below includes a list of the structures which have been identified as “Priority A” for which no junction currently exists in the hydrography. New junctions will be required at these structure locations to ensure the contributing upstream catchment is correct. Note that this table does not include structures for which there are no reaches in the hydrography but for which it is intended to include the structures in the hydraulic modelling (eg on Samford Road and the Ferny Grove Rail line to the south-east of the Ferny Grove Railway Station). The locations of the junctions identified in Table 1 are included in the attached file “Junctions required”.

**Table 1| Structures for which no junction exists in the hydrography**

| WW_ID | Crossing Name | Description |
|---|---|---|
| KED_01_00975 | Pedestrian | Culvert |
| KED_01_01913 | Pedestrian (Jane St) | Bridge |
| KED_04_00000 | Samford Road | Bridge |
| KED_04_00000 | Ferny Grove Rail Line | Bridge |
| KED_04_00000 | Tramway Street | Bridge |
| KED_04_02038 | Upper Kedron Road | Bridge |
| KED_04_02038 | Pedestrian | Bridge |
| KED_04_03281 | Canvey Road | Bridge |
| KED_04_05168 | Millwood Place | Culvert |
| KED_08_00000 | Canvey Road | Culvert |

| WW_ID | Crossing Name | Description |
|---|---|---|
| KED_09_00000 | Woolshed Street | Culvert |
| KED_10_00000 | Hogart Road | Bridge |
| KED_10_00000 | McAlroy Road | Culvert |
| KED_14_00000 | Ross Road | Culvert |
| KED_16_00000 | Ross Road | Bridge |
| KED_28_00000 | Samford Road | Bridge |
| KED_28_00000 | Ferny Grove Rail Line | Bridge |
| KED_28_00000 | Avington Street | Culvert |
| KED_28_01009 | Glengarry Road | Culvert |
| KED_32_00000 | Duggan Street | Culvert |

## 2.4 Existing resolution/detail

Given the objectives of the RFD, the resolution of the defined hydrography is generally considered to be appropriate. The level of detail provided is sufficient to model the flood characteristics of the main Cabbage Tree Creek and Kedron Brook branches. There are a number of tributaries to these main branches which are not defined in the hydrography; however these branches would be considered local drainage networks and are beyond the scope of the RFD. An example of these tributaries is provided in Figure 3.

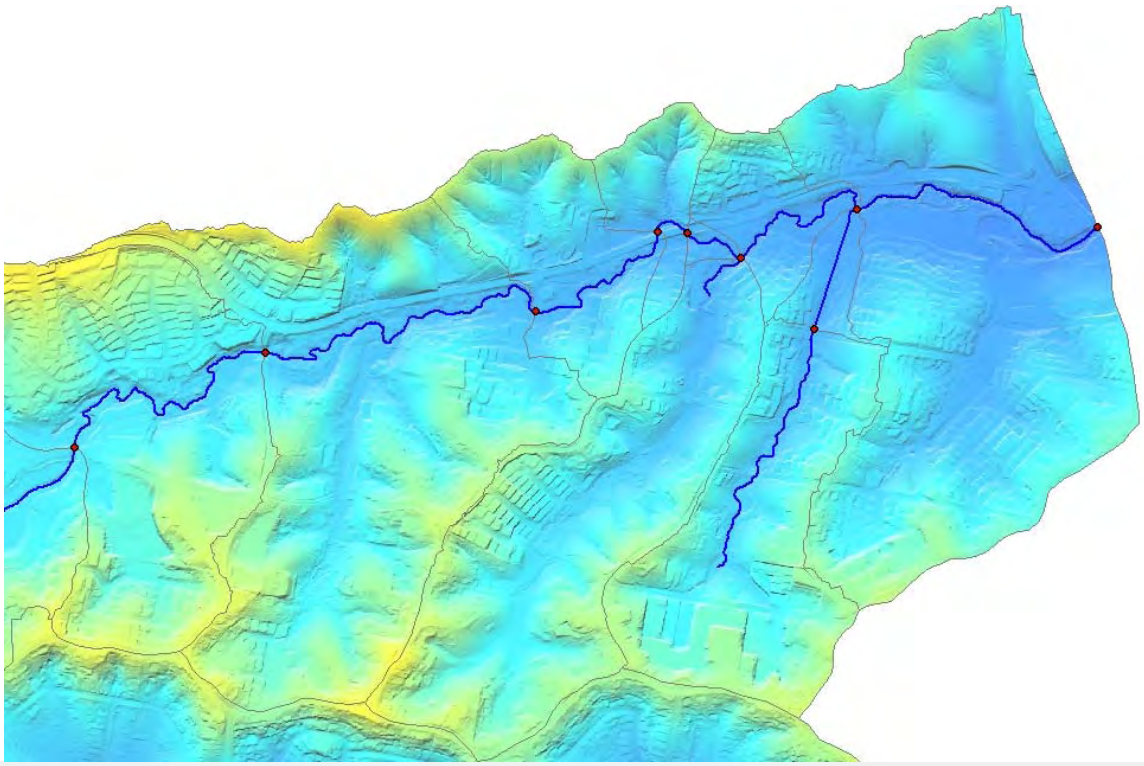

**Figure 3 | Hydrography resolution example**

One of the primary issues to be considered is the application of the inflow hydrographs using 2d_sa tables within the hydraulic model. If the 2d_sa table is defined to match the sub-catchment boundary, the inflow will be applied to the lowest point within the sub-catchment, with the following impacts:

- For a given sub-catchment, the flow will likely be applied at the junction and from there routed downstream within the creek/channel. Where a sub-catchment has its lowest point downstream of a structure, flows may be applied downstream of the structure. Where a sub-catchment has its primary area of interest in the upper reaches, the local inflows will bypass this area
- For the upper-most sub-catchments, there will be no flow routed through them from upstream sub-catchments. Where they are not urbanised or not of concern, the hydrography need not be modified

Similar to the approach that has been adopted with the PUM and BRI minor basins, it is proposed to modify a number of the 2d_sa boundaries in the hydraulic model to ensure that catchment inflows are being applied upstream of structures.

## 2.5 Future development

In the case of large areas of land being proposed for development, it would be recommended that sub-catchment delineation align with future development to allow the hydrologic and hydraulic models to be easily updated for “future land use” scenarios. However, based on a review of the 2006 Pine Rivers Planning Scheme and the 2000 City Plan for Brisbane it is anticipated land use changes will only occur within the Upper Kedron area and these will no significantly affect the existing hydrography definition.

# 3 Recommendations

Based on the issues discussed in the previous section, the hydrography changes in the following sections (3.1 to 3.3) are recommended.

## 3.1 Stream connectivity

It is recommended that the location of the downstream end of branch KED_04_05168 be modified as shown in Figure 2 to better match the flowpath shown in the topography.

## 3.2 Inclusion of floodplain structures

It is recommended that a junction should be included at each of the floodplain structures in Table 1 to ensure that the volume of flow calculated at each structure is accurate and to ensure consistency with the hydrography approach adopted for the detailed modelling.

## 3.3 Resolution/detail

The following recommendations are made with regard to the level of hydrographic detail provided:

- If a sub-catchment has its primary area of interest in the upper reaches, consideration should be given to further dividing the sub-catchment or alternatively, applying more than one 2d_sa table over the region (where flow would be distributed according to area)
- Where an upper-most sub-catchment is of interest, either the hydrography may be modified, or the 2d_sa table modified within the hydraulic model to ensure flow is routed through it

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# Appendix C
# Calibration and Validation Report(s)

# Appendix C
# Calibration and Validation Report(s)

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**Project:** Regional Floodplain Database Stage 3 Detailed Modelling: Package 1

BCC Calibration and Validation Feasibility Report

**Prepared for:** Moreton Bay Regional Council

**Project:** 222767-001

**22 September 2011**

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|---|---|---|---|
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# Contents

# 1. Introduction

## 1.1 Study objective

Moreton Bay Regional Council (MBRC) is delivering a Regional Floodplain Database (RFD) in support of their flood risk management, considering emergency response, development control, strategic land use and infrastructure planning. MBRC was recently formed under local government amalgamations and is responsible for Caboolture, Pine Rivers, Redcliffe and Bribie Island. The RFD project focuses on the northern sector as a key growth area for South-east Queensland.

The project is being funded by MBRC, Emergency Management Queensland (EMQ) and Emergency Management Australia (EMA) as part of the Natural Disaster Resilience Program and will provide:

- A comprehensive and consistent description of flood behaviour across the region
- Strategies for management of any flooding identified problems
- A system/process to store and manage this information and keep it up-to-date

***Stage 1*** of the project was completed in July 2010 and involved a number of sub-projects. These projects delivered consistent processes and protocols for the detailed hydrologic and hydraulic model development. A key sub-project involved the development of broadscale hydrodynamic models for each minor basin to provide general understanding of flooding mechanisms and allow prioritisation of data capture.

***Stage 2*** of the project involves the development of detailed hydrologic and hydraulic models for each minor basin and is currently underway.

***Stage 3*** includes development of a further two detailed models (currently underway). Stage 3 will then build on the detailed models and "add value" through assessment of flood damages and community resilience measures.

## 1.2 Objective of calibration and validation feasibility report

This report details the calibration and validation feasibility analysis for the Brisbane Coastal Creeks (BCC) minor basin. This minor basin covers the upper ends of the Cabbage Tree Creek and Kedron Brook catchments. The northern portion of this minor basin lies within the Moreton Bay Region and the southern portion lies within the Brisbane City region, with the upper reaches of Kedron Brook running along the region divide.

This basin is largely urbanised, with only the upper reaches remaining forested. Flows are generally contained within the creek corridor or adjacent low lying land, with very little floodplain evident in this minor basin within the Moreton Bay region. Representation of the creek channel capacity and the structures will be important to the accurate modelling of this catchment.

This report assesses the feasibility of carrying out calibration and validation for the hydrological and hydraulic modelling of the BCC minor basin based on the current and prospective availability of data.

# 2. Available data

## 2.1 Stream gauge data

Stream gauge data (recorded water level with respect to time) is essential to calibrating a hydrologic model. Recorded water levels are converted to discharges using derived rating curves and compared with hydrologic model predictions. Stream gauge data is also useful in calibrating a hydraulic model through comparisons of recorded and predicted water levels with time at the gauge location. Two stream gauges are located close to the downstream boundary of the BCC minor basin. The available data at these locations is presented in Table 1, Figure 1 and Figure 2. This data was sourced from Brisbane City Council for the period of record up to 31 December 2010. No rating curves are available for these gauges.

**Table 1 Stream Gauge Stations**

| Gauge Name | Gauge Owner/Data Source | Operational Start Date | Operational Finish Date |
|---|---|---|---|
| Collins Rd (Old Northern Rd) | Brisbane City Council | 27/6/94 | Still operational Data sourced up to 31/12/2010 |
| Osborne Rd | Brisbane City Council | 9/3/94 | Still operational Data sourced up to 31/12/2010 |

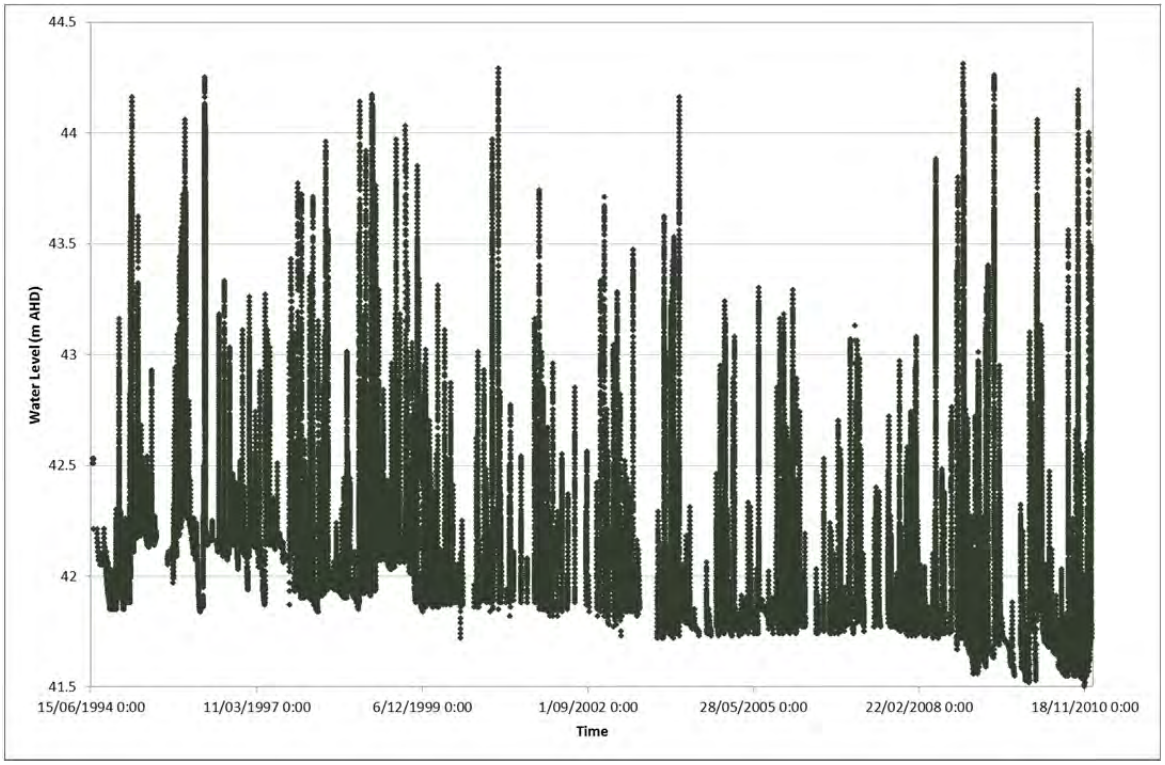


**Figure 1 Recorded Water Levels in Cabbage Tree Creek at Collins Road (Old Northern Road)**

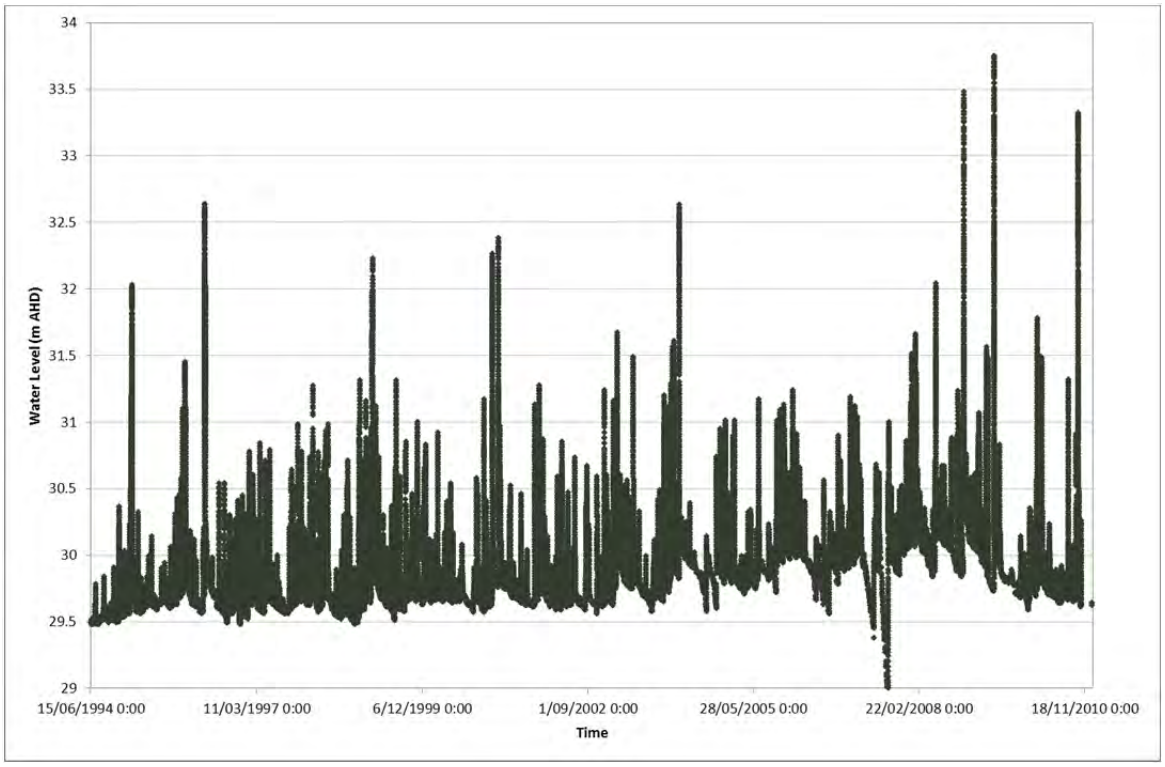


**Figure 2 Recorded Water Levels in Kedron Brook at Osborne Road**

Figure 1 shows that recorded water levels in Cabbage Tree Creek at Osborne Road have ranged between 41.5 and 44.3m AHD over the period of record. Water levels have exceeded 44.0m thirteen times and have exceeded 44.25m four times, with the peak recorded level occurring on 16 November 2008.

Figure 2 shows that, in the Kedron Brook catchment, the three largest events have occurred recently, with the recorded levels ranging between 29.0m and 33.75m AHD. The peak recorded level of 33.75m AHD occurred on 20 May 2009.

## 2.2 Rainfall data

Rainfall data is used to provide input to a hydrologic model regarding the amount, spatial variation and timing of rainfall during a storm event.

Rainfall station locations have been sourced from Moreton Bay Regional Council (MBRC) and the Bureau of Meteorology's (BoM) Water Resources Station Catalogue (WRSC). The gauge locations obtained from these sources are shown in Figure 3 and Figure 4 respectively. There are two types of rainfall stations:

- Alert station (or pluviometer) – rainfall is recorded in short duration intervals (as short as 6 minutes) providing rainfall patterns through the duration of a rainfall event
- Daily station – total rainfall during the course of a day is recorded (9am to 9am)

The alert stations and daily stations within the zone of influence have been provided in Table 2 and Table 3 respectively. The rainfall data has not yet been sourced for these stations.

Cedar Creek AL
South Pine River at Albany Creek
Cash's Crossing AL
Drapers Crossing Tm
Drapers Crossing AL
Cabbage Tree
South Pine River at Faheys Crossing
Zillmere(Pineapp
South Pine River
Zillmere P
Samford AL
Samford Csiro
Samford Kay Drive
Samford Village AL
Aspley(Stringybark Dr)AL
Aspley AL
Highvale
Everton Hills AL
Chermside A
Chermside Bowls Cl
Camp Mountain (Davison Road)
Ferny Hills AL
Ferny Hills Aust Woolshed
Ferny Hills State School
Kedron Brook at Osborne Road
Mitchelton AL
Keperra Country Golf Club
Ka
Ferny Grove Cedar Ck Rd
Stafford (Hayward St) Al
Gordon Park A
Alderley
Alderley Alert
Grange Bowling Club
Enoggera Army
Ashgrove Bowls Club
Bowen Hills Al
Three Ways AL
Enoggera Reservoir
Enoggera Dam AL
Gold Creek Reservoir AL

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0 3750 (m)

Scale 1:7 500 (m) (@ A3 size)

Projection: MGA Zone 56

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## Legend

Gauge Types

- Battery
- Rainfall Alert
- Rainfall Daily
- Rainfall non-alert (pluviometer)
- Water Level
- Water Level Non-Alert

WQ Event Monitoring Program

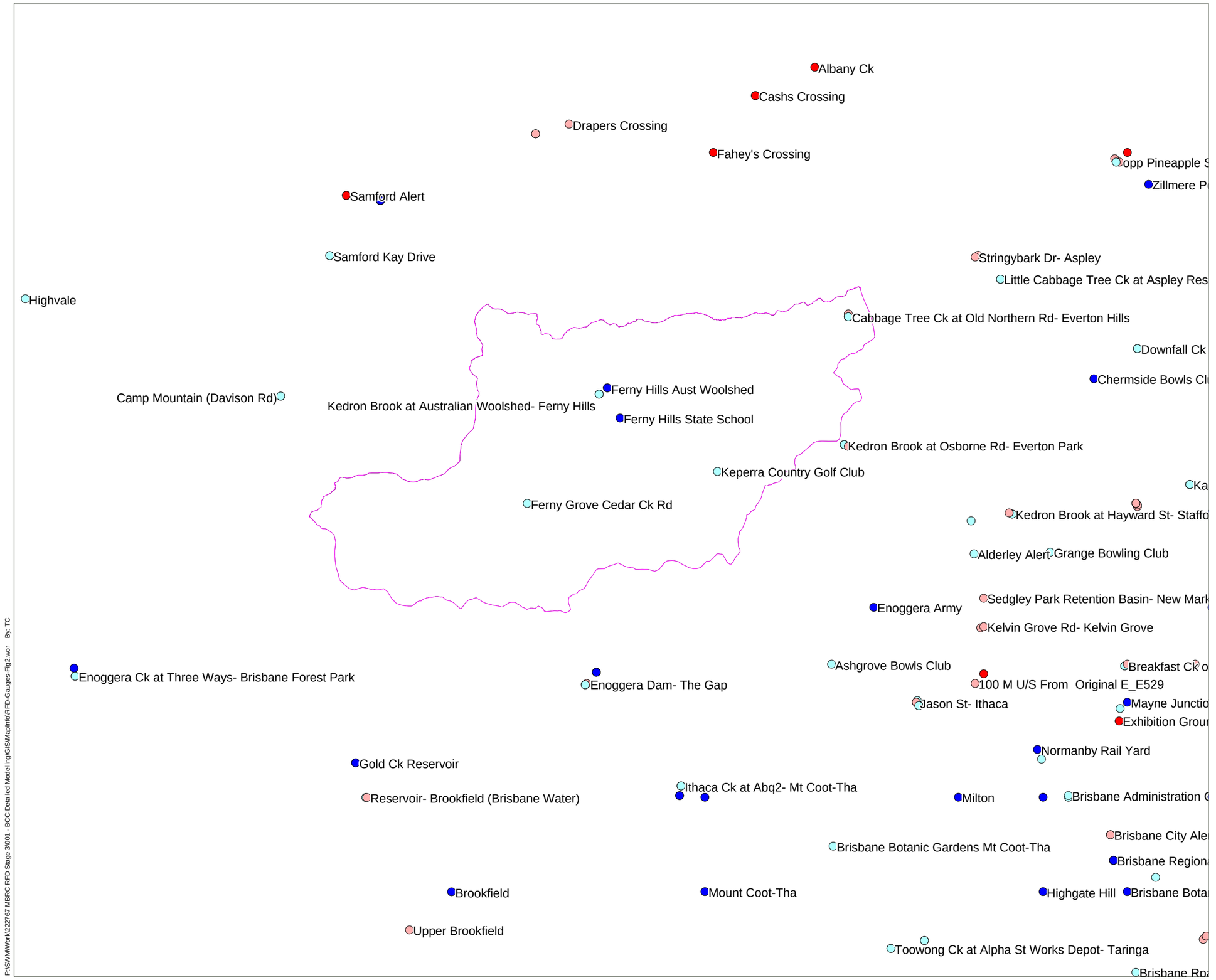
**Notes:**

**Date: 22/09/2011** **Version: 0**

# RFD Stage 3 Detailed Modelling

## Brisbane Coastal Creeks

## Figure 1: MBRC Gauge Data Locations

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0 3750 (m)

Scale 1:7 500 (m) (@ A3 size)

Projection: MGA Zone 56

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**Legend**

Water Resources Station Catalogue

- River Station - Operational
- River Station - Closed
- Rainfall Station - Operational
- Rainfall Station - Closed

**Notes:**

**Date: 22/09/2011** **Version: 0**

# RFD Stage 3 Detailed Modelling

## Brisbane Coastal Creeks

## Figure 2: WRSC Gauge Data Locations

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BCC020 BCC016 BCC017 BCC012 BCC013 BCC011 BCC010 BCC021 BCC031 310 BCC032 BCC001 BCC002 BCC019 BCC009 270 300 BCC033 BCC004 BCC014 BCC023 BCC025 BCC030 BCC005 BCC015 BCC026 BCC006 280 260 BCC028 BCC029 256 BCC027 290 250

## Legend

- Maximum Height Gauge Location
- ★ Historic Flood Mark Location

Notes:

Date: 22/09/2011 Version: 0

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0 2000 (m)

Scale 1:4 000 (m) (@ A3 size)

Projection: MGA Zone 56

# RFD Stage 3 Detailed Modelling

## Brisbane Coastal Creeks

## Figure 3: Historic Flood Mark Locations

**Table 2 Alert/Pluviograph Stations**

| Gauge Name | Gauge Owner/ Data Source | Operational Start Date | Operational Finish Date |
|---|---|---|---|
| Samford | SEQWC/BoM | April 1995 | Still operational |
| Samford Village | MBRC | Unknown | Unknown |
| Ferny Hills (Kedron Brook at Australian Woolshed) | BCC | June 1994 | March 2009 |
| Ferny Hills (Upper Kedron Recreational Reserve) | BCC | October 2009 | Still operational |
| Everton Hills (Cabbage Tree Creek at Old Northern Road) | BCC | May 1994 | Still operational |
| Mitchelton (Kedron Brook at Osborne Road) | BCC | March 1994 | Still operational |
| Enoggera Dam (Enoggera Creek at Enoggera Dam) | BCC | May 1994 | Still operational |

**Table 3 Daily Rainfall Stations**

| Gauge Name | Gauge Owner/Data Source | Operational Start Date | Operational Finish Date |
|---|---|---|---|
| Camp Mountain (Davison Road) | BoM | 1926 | Still operational |
| Ferny Grove Cedar Creek Road | BoM | February 1982 | Still operational |
| Ferny Hills State School | BoM | April 1964 | December 1973 |
| Keperra Country Golf Club | BoM | September 1972 | Still operational |
| Enoggera Reservoir | BoM | 1870 | November 1996 |

Table 2 and Table 3 show that daily rainfall records are available from 1870 onwards and pluviograph records are available since 1994 onwards.

## 2.3 Historic flood marks

Historical flood marks are an important part of calibrating a hydraulic model as they provide information regarding the variation in water levels across a floodplain. Table 4 presents the historic flood mark data which is available from MBRC and Table 5 presents the historic flood mark data which is available from Brisbane City Council. The data in both these tables is sorted by the date that the mark was recorded. Figure 5 shows the locations of these flood marks within the BCC minor basin.

**Table 4 MBRC Historical Flood Marks**

| Mark ID | Street | Suburb | Date | Recorded Level |
|---|---|---|---|---|
| BCC004 | Grove Avenue | Arana Hills | 1967 | 44.81 |
| BCC005 | Jane Street | Arana Hills | 1967 | 43.63 |
| BCC008 | Jane Street | Arana Hills | 1967 | 44.67 |
| BCC009 | Leslie Street | Arana Hills | 1967 | 48.81 |
| BCC010 | Bennetts Road | Everton Hills | 1967 | 55.81 |
| BCC011 | Bennetts Road | Everton Hills | 1967 | 46.42 |

| Mark ID | Street | Suburb | Date | Recorded Level |
|---|---|---|---|---|
| BCC012 | Bennetts Road | Everton Hills | 1967 | 47.98 |
| BCC013 | Bunya Road | Everton Hills | 1967 | 51.95 |
| BCC016 | Elizabeth Street | Everton Hills | 1967 | 48.31 |
| BCC017 | John Street | Everton Hills | 1967 | 50.43 |
| BCC020 | Peter Street | Everton Hills | 1967 | 49.20 |
| BCC021 | Timms Road | Everton Hills | 1967 | 59.61 |
| BCC022 | Timms Road | Everton Hills | 1967 | 59.94 |
| BCC023 | Ferny Way | Ferny Hills | 1967 | 55.74 |
| BCC025 | Illuta Avenue | Ferny Hills | 1967 | 52.83 |
| BCC033 | Samford Road | Ferny Hills | 1967 | 55.93 |
| BCC003 | Dawson Parade | Arana Hills | 1970 | 41.56 |
| BCC006 | Jane Street | Arana Hills | 1970 | 43.54 |
| BCC014 | Camelia Avenue | Everton Hills | 1970 | 34.88 |
| BCC028 | Kuringal Drive | Ferny Hills | 1970 | 48.68 |
| BCC001 | Dawson Parade | Arana Hills | 1972 | 41.77 |
| BCC015 | Camelia Avenue | Everton Hills | 1972 | 35.21 |
| BCC002 | Dawson Parade | Arana Hills | 1974 | 42.60 |
| BCC007 | Jane Street | Arana Hills | 1974 | 42.90 |
| BCC018 | Oleria Street | Everton Hills | 1974 | 37.47 |
| BCC019 | Oleria Street West | Everton Hills | 1974 | 41.01 |
| BCC024 | Ferny Way | Ferny Hills | 1974 | 56.21 |
| BCC026 | Illuta Avenue | Ferny Hills | 1974 | 51.14 |
| BCC027 | Kuringal Drive | Ferny Hills | 1974 | 50.40 |
| BCC029 | Kuringal Drive | Ferny Hills | 1974 | 50.78 |
| BCC030 | Kylie Avenue | Ferny Hills | 1974 | 47.42 |
| BCC031 | Palall Crescent | Ferny Hills | 1974 | 65.29 |
| BCC032 | Samford Road | Ferny Hills | 1974 | 57.22 |

**Table 5 Brisbane City Council Historical Flood Marks**

| Maximum Height Gauge | Street | Suburb | Date | Recorded Level |
|---|---|---|---|---|
| 290 | Kuringal Drive | Ferny Hills | 05-May-80 | 47.30 |
| 300 | Samford Rd | Ferny Grove | 05-May-80 | 55.87 |
| 290 | Kuringal Drive | Ferny Hills | 03-Nov-81 | 47.33 |
| 290 | Kuringal Drive | Ferny Hills | 20-Jan-82 | 46.78 |
| 290 | Kuringal Drive | Ferny Hills | 08-Apr-84 | 47.55 |
| 270 | Dawson Parade | Keperra | 04-Apr-88 | 40.22 |

| Maximum Height Gauge | Street | Suburb | Date | Recorded Level |
|---|---|---|---|---|
| 290 | Kuringal Drive | Ferny Hills | 04-Apr-88 | 47.40 |
| 300 | Samford Rd | Ferny Grove | 04-Apr-88 | 55.68 |
| 270 | Dawson Parade | Keperra | 21-Feb-92 | 40.80 |
| 300 | Samford Rd | Ferny Grove | 21-Feb-92 | 55.85 |
| 310 | Rangleigh Street | Ferny Grove | 17-Mar-92 | 59.90 |
| 270 | Dawson Parade | Keperra | 19-Jan-94 | 40.98 |
| 290 | Kuringal Drive | Ferny Hills | 19-Jan-94 | 47.39 |
| 300 | Samford Rd | Ferny Grove | 19-Jan-94 | 55.67 |
| 270 | Dawson Parade | Keperra | 03-May-96 | 40.27 |
| 290 | Kuringal Drive | Ferny Hills | 03-May-96 | 47.55 |
| 300 | Samford Rd | Ferny Grove | 03-May-96 | 55.77 |
| 310 | Rangleigh Street | Ferny Grove | 03-May-96 | 59.90 |
| 290 | Kuringal Drive | Ferny Hills | 09-Mar-01 | 47.12 |
| 290 | Kuringal Drive | Ferny Hills | 05-Mar-04 | 47.59 |
| 280 | Pearse Street | Keperra | 20-Nov-08 | 45.32 |
| 290 | Kuringal Drive | Ferny Hills | 20-Nov-08 | 48.27 |
| 300 | Samford Rd | Ferny Grove | 20-Nov-08 | 56.04 |
| 270 | Dawson Parade | Keperra | 20-May-09 | 40.60* |
| 280 | Pearse Street | Keperra | 20-May-09 | 45.46 |
| 290 | Kuringal Drive | Ferny Hills | 20-May-09 | 48.33 |
| 300 | Samford Rd | Ferny Grove | 20-May-09 | 55.80 |
| 310 | Rangleigh Street | Ferny Grove | 20-May-09 | 59.57* |
| 270 | Dawson Parade | Keperra | 11-Oct-10 | 40.95* |
| 280 | Pearse Street | Keperra | 11-Oct-10 | 45.21 |
| 290 | Kuringal Drive | Ferny Hills | 11-Oct-10 | 48.59 |
| 300 | Samford Rd | Ferny Grove | 11-Oct-10 | 56.20 |
| 310 | Rangleigh Street | Ferny Grove | 11-Oct-10 | 60.57* |

** Indicates debris-affected readings*

Table 4 shows that the historical flood marks available from MBRC all occurred prior to 1975. Table 5 shows that Brisbane City Council has five maximum height gauge locations along Kedron Brook and records for these gauges are available between 1980 and 2010.

# 3. Flood events

## 3.1 Possible events for calibration/validation

The data presented in Section 2 shows that coinciding stream gauge, rainfall and maximum height gauge records are available in the Kedron Brook catchment from 1994 onwards. There are four events in which data was recorded at more than one maximum height gauge. These events occurred in May 1996, November 2008, May 2009 and October 2011. These events are therefore the best possible events for calibration and/or validation in this catchment.

In the Cabbage Tree Creek catchment, flood marks are only available for events prior to installation of the Collins Road stream gauge.

Figure 6 below presents the time series data for the four Kedron Brook events. These have been overlain to show how the event characteristics (timing, volume etc) compare. The May 1996 event has the greatest volume, the longest duration and the smallest peak of the four events. The November 2008 event had a small initial peak, then a short duration second peak. The May 2009 event had the highest peak of the four events.

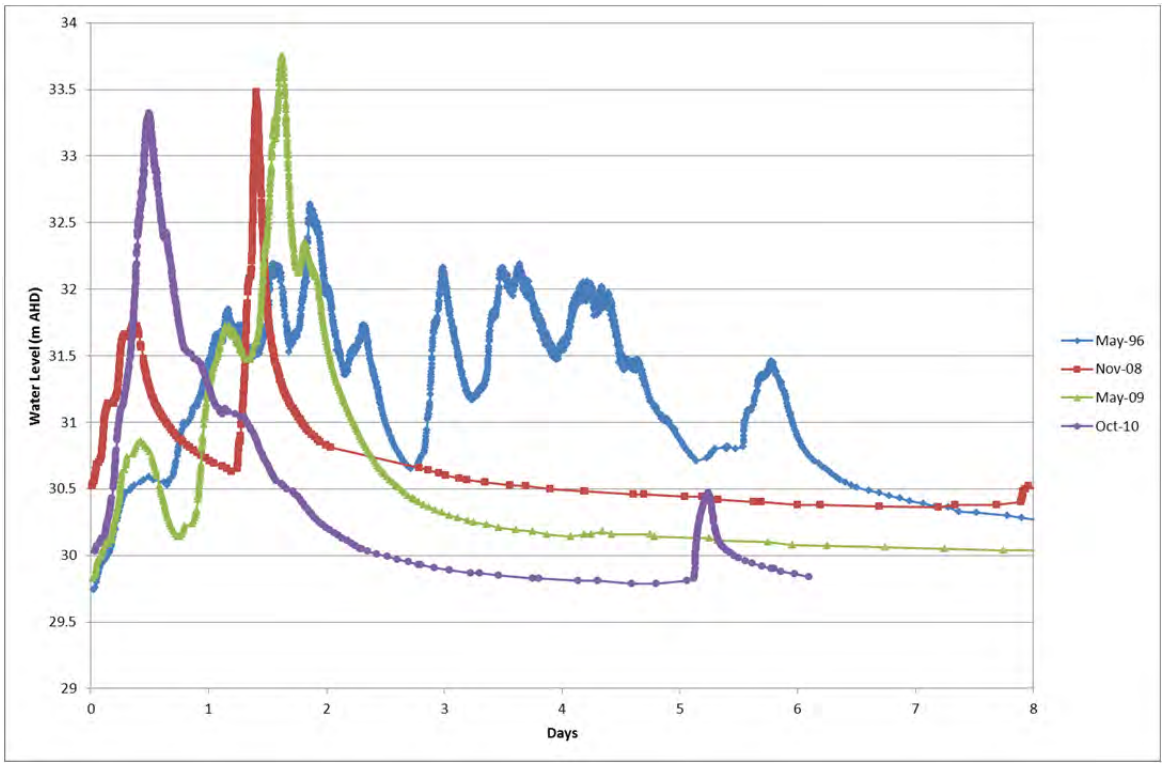


**Figure 6 Recorded Water Levels in Kedron Brook at Osborne Road**

Figure 7 shows the recorded water levels in the Cabbage Tree Creek for the same four events. These events all had a peak discharge of similar magnitude; however the 1996 event carried a much great volume of water and was a multi-peak event, similar to the same event in the Kedron Brook catchment.

Figure 8 shows a longitudinal profile of the recorded maximum height gauge levels along Kedron Brook. The readings for MHG 310 and MHG 270 were debris-affected for the May 2009 and October 2010 events.

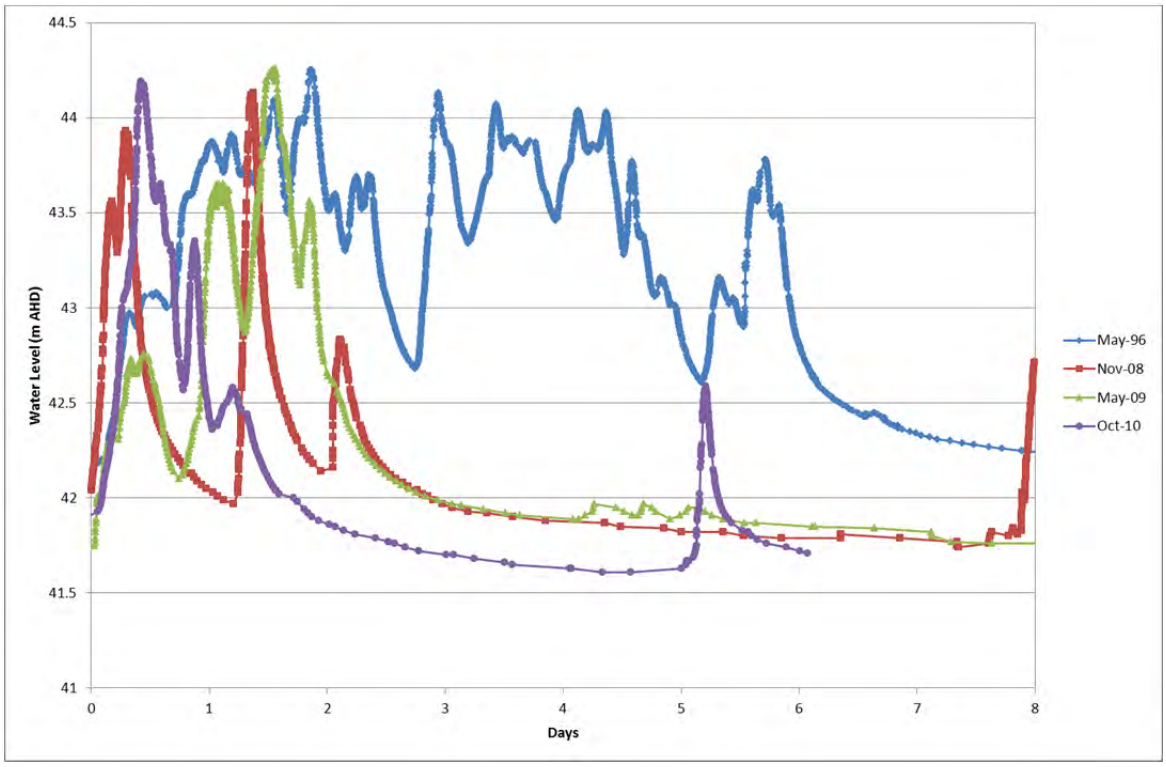


**Figure 7 Recorded Water Levels in Cabbage Tree Creek at Collins Road (Old Northern Road)**

Figure 8 shows that the May 1996 event is generally the smallest event. The other three events produced similar levels throughout the central part of the catchment. At MHG 270 and MHG 310, the May 1996 level is the only available level which is not debris-affected.

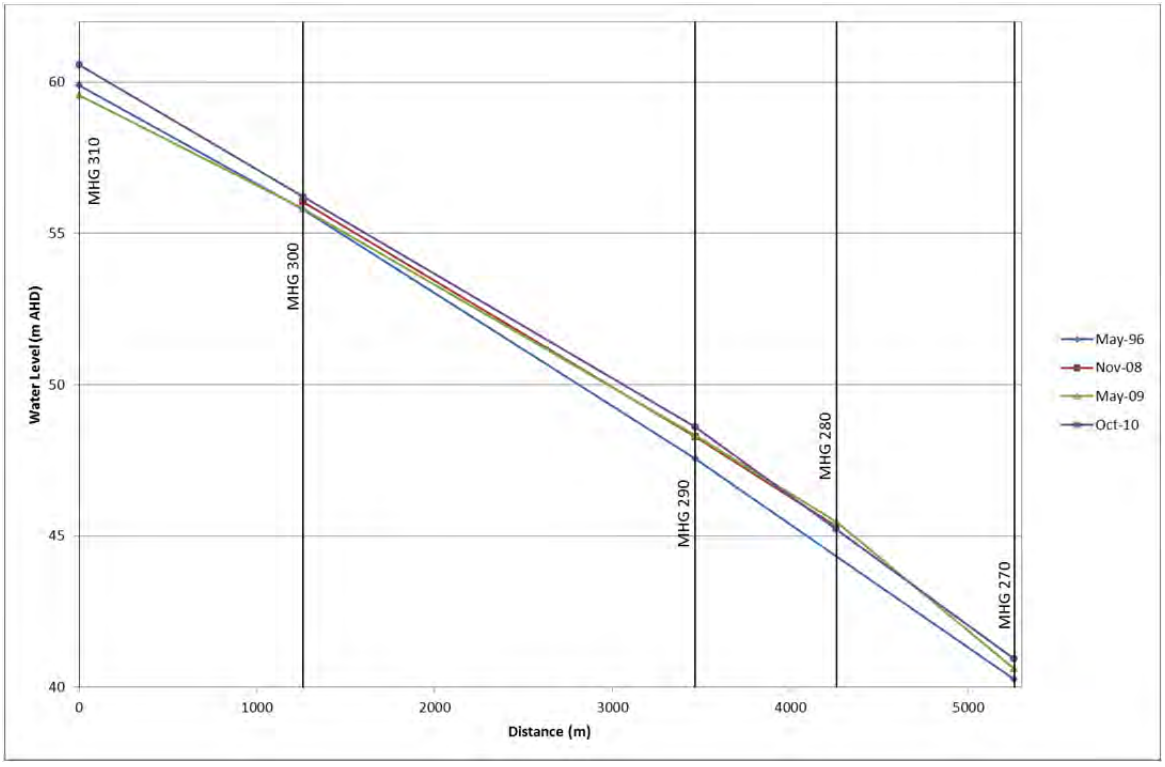


**Figure 8 Recorded Peak Water Levels in Kedron Brook**

## 3.2 Feasibility of calibration/validation

In order to achieve a good calibration it is desirable to have rainfall (pluviograph), stream gauge and recorded flood levels throughout a catchment.

For the Cabbage Tree Creek catchment:

- Rainfall data from the Ferny Hills and Everton Hills pluviograph stations is available from June 1994 onwards
- Stream gauge data for the Collins Road (Old Northern Road) stream gauge at the downstream boundary of the catchment is available from June 1994 onwards
- No recorded historical flood levels are available within the timeframes that rainfall and stream gauge data are available

For the Kedron Brook catchment:

- Rainfall (pluviograph) data is available from June 1994 onwards
- Stream gauge data for the Osborne Road stream gauge (approximately 600m downstream of the model area) is available from March 1994 onwards
- Recorded flood levels are available at 5 locations for the May 1996 event. Reliable (ie not debris-affected) recorded flood levels are available at three locations for the November 2008, May 2009 and October 2010 events

The lack of rating curves for these gauges would make stand-alone calibration of the hydrologic model impossible. With the available data, it would be possible to undertake a joint calibration of the hydrologic and hydraulic models at their downstream boundaries (if the downstream boundary of the Kedron Brook reach is moved to Osborne Road). It would also be possible to calibrate the predicted peak water levels in Kedron Brook to a few locations (maximum 5).

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**Project:** Regional Floodplain Database Stage 3 Detailed Modelling: Package 1: Brisbane Coastal Creeks (BCC)

Validation Report

**Reference:** 222767-001

**Prepared for:** Moreton Bay Regional Council

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**28 September 2012**

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| Author Signature | | Approver Signature | |
| Name | Talia Campbell | Name | Chris Russell |
| Title | Associate, Water Services | Title | Unit Manager |

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## Appendices



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# 1. Introduction

## 1.1 Study objective

Moreton Bay Regional Council (MBRC) is delivering a Regional Floodplain Database (RFD) in support of their flood risk management, considering emergency response, development control, strategic land use and infrastructure planning. MBRC is responsible for the areas of Caboolture, Pine Rivers, Redcliffe and Bribie Island. The RFD project focuses on the northern sector of the Council area as a key growth area for South-east Queensland.

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- A comprehensive and consistent description of flood behaviour across the region
- Strategies for management of any identified flooding problems
- A system/process to store and manage this information and keep it up-to-date

**Stage 1** of the project was completed in July 2010 and involved a number of sub-projects. These projects delivered consistent processes and protocols for the detailed hydrologic and hydraulic model development. A key sub-project involved the development of broadscale hydrodynamic models for each minor basin to provide general understanding of flooding mechanisms and allow prioritisation of data capture.

**Stage 2** of the project involves the development of detailed hydrologic and hydraulic models for each minor basin and is currently nearing completion.

**Stage 3** includes development of a further two detailed models (currently underway). Stage 3 will then build on the detailed models and "add value" through assessment of flood damages and community resilience measures.

## 1.2 Validation report objective

This report details the validation of the Brisbane Coastal Creeks (BCC) minor basin TUFLOW model. This minor basin covers the upper ends of the Cabbage Tree Creek and Kedron Brook catchments. The northern portion of this minor basin lies within the Moreton Bay Region and the southern portion lies within the Brisbane City region, with the upper reaches of Kedron Brook running along the region divide.

This basin is largely urbanised, with only the upper reaches remaining forested. Flows are generally contained within the creek corridor or adjacent low lying land, with very little floodplain evident in this minor basin within the Moreton Bay region.

Aurecon's Calibration and Validation Feasibility Report indicated that a standalone calibration of the hydrologic model would not be possible with the available data. Therefore, in conjunction with MBRC, it was decided to perform a joint validation exercise for the hydrologic and hydraulic models to a single historical event. MBRC determined that the BCC TUFLOW model should be validated to the October 2010 event.

# 2. Available data – October 2010 event

## 2.1 Rainfall data

Rainfall data is used to provide input to a hydrologic model regarding the quantity, spatial variation and timing of rainfall during a storm event. To represent the rainfall during the October 2010 event, rainfall records from four gauges were used. Rainfall records from alert station (or pluviometer gauges) were used. For these stations rainfall is recorded in short duration intervals (as short as 6 minutes) providing rainfall patterns throughout the duration of a rainfall event.

The four gauges used are listed in Table 1 and their locations can be seen in Figure A1. Data for all four gauges was sourced from Brisbane City Council and this data provides an adequate representation of rainfall across the catchment.

**Table 1 | Alert/pluviograph stations**

| Gauge name | Gauge owner/ data source | Station number |
|---|---|---|
| Ferny Hills (Upper Kedron Recreational Reserve) | BCC | 1545 |
| Everton Hills (Cabbage Tree Creek at Old Northern Road) | BCC | 1572 |
| Mitchelton (Kedron Brook at Osborne Road) | BCC | 1539 |
| Enoggera Dam (Enoggera Creek at Enoggera Dam) | BCC | 1533 |

The recorded cumulative rainfall depths in millimetres (mm) for these four gauges can be seen in Figure 1. This figure shows that there is limited rainfall preceding the rainfall event on 10 October 2012. On 10 October at around 8 pm there was a dramatic increase in the intensity of the rainfall which continued until approximately 12 pm on 11 October. During this period cumulative rain depths increased from 62 mm to 290 mm at the Upper Kedron Recreational Reserve gauge which is in near centre of the catchment area.

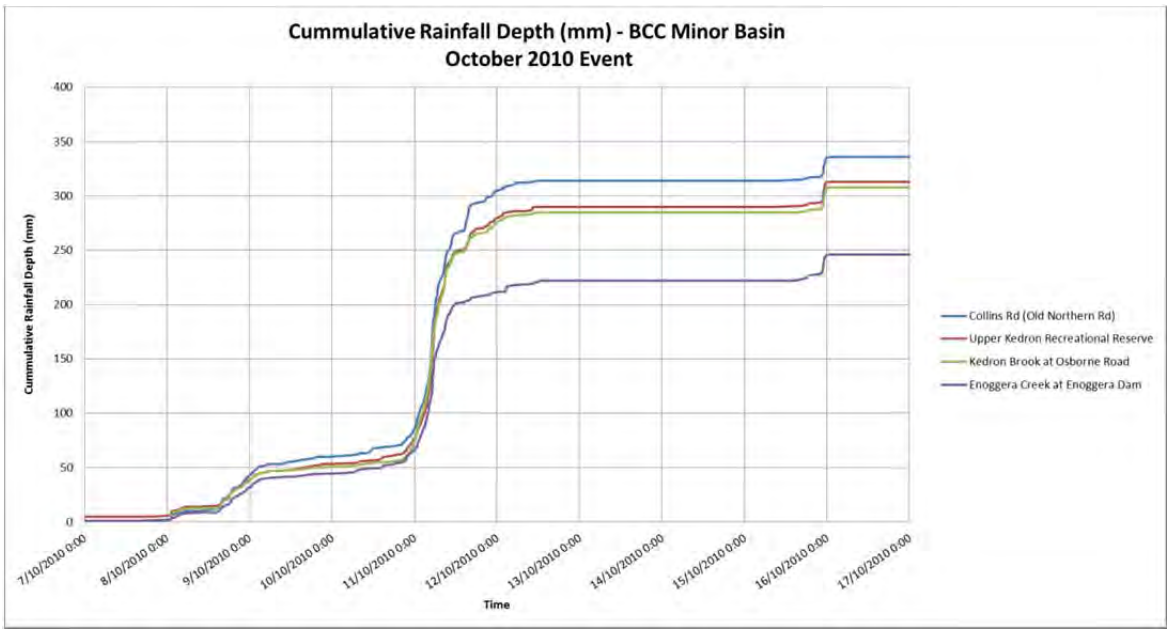


**Figure 1 | Cumulative rainfall depths (mm) BCC minor basin October 2010 event**

## 2.2 Stream gauge data

Stream gauge data (recorded water level with respect to time) can be used to calibrate a hydraulic model through comparisons of recorded and predicted water levels over time at the gauge location. Two stream gauges are located close to the downstream boundary of the BCC minor basin. The available data at these locations is presented in Table 2. This data was sourced from Brisbane City Council and no rating curves are available for these gauges.

**Table 2 | Stream gauge stations**

| Gauge name | Gauge owner/data source | Operational start date | Operational finish date |
|---|---|---|---|
| Collins Road (Old Northern Road) | Brisbane City Council | 27 June 1994 | Still operational Data sourced up to 31 December 2010 |
| Osborne Road | Brisbane City Council | 9 May 1994 | Still operational Data sourced up to 31 December 2010 |

## 2.3 Maximum height gauges

Spatial matching of peak water levels is an important part of calibrating a hydraulic model as this provides information regarding the variation in water levels across a floodplain. Brisbane City Council maintains a network of maximum height gauges across its regional area and six maximum height gauges are located in the upper Kedron Brook catchment. Table 3 presents the maximum height gauge data which is available from Brisbane City Council. Figure A1 displays the locations of these flood marks within the BCC minor basin.

**Table 3 | Brisbane City Council historical flood marks**

| Maximum height gauge No. | Street | Suburb | October 2010 event recorded level (m AHD) |
|---|---|---|---|
| 260 | Osborne Road | Keperra | 32.71 |
| 270 | Dawson Parade | Keperra | 40.95* |
| 280 | Pearse Street | Keperra | 45.21 |
| 290 | Kuringal Drive | Ferny Hills | 48.59 |
| 300 | Samford Road | Ferny Grove | 56.20 |
| 310 | Rangleigh Street | Ferny Grove | 60.57* |

* Indicates debris-affected readings

# 3. Modelling

## 3.1 Hydrologic model

To represent the rainfall in the hydrologic model, the rainfall records were discretised into five minute intervals. The base WBNM model as provided by MBRC was used in this assessment, with three additional sub-catchments added at the downstream end of Kedron Brook. These were added so the hydrologic and hydraulic model extents would match. The hydrologic model was run for the 48 hours from 8 pm on 8 October 2010 to 8 pm on 12 October 2010.

## 3.2 Hydraulic model

The BCC TUFLOW model for the validation modelling is consistent with the TUFLOW model set up for the design event assessment. The only modification was the addition of three SA inflows to represent the additional downstream Kedron Brook sub-catchments added into the hydrologic model. No other parameters were changed. The development of the hydraulic model will be outlined in the Modelling Quality Report.

# 4. Results

## 4.1 Hydrograph comparison at the river gauge locations

Figure 2 and Figure 3 present a comparison of recorded and modelled water levels at the Osborne Road gauge on Kedron Brook and the Collins Road (Old Northern Road) gauge on Cabbage Tree Creek. These figures show that the timing at both gauges compares very well between the recorded and modelled flood event. The model overestimates the peak water level by approximately 850 mm at the Osborne Road Gauge and 200 mm at the Collins Road Gauge.

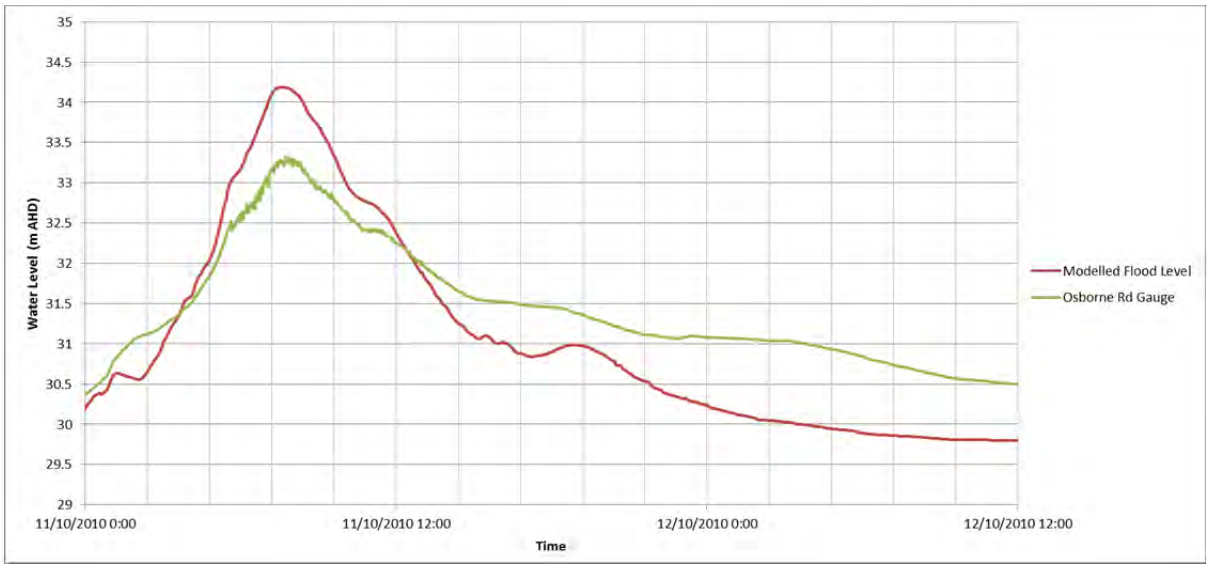


**Figure 2 | Recorded and modelled hydrograph at Osborne Road gauge**

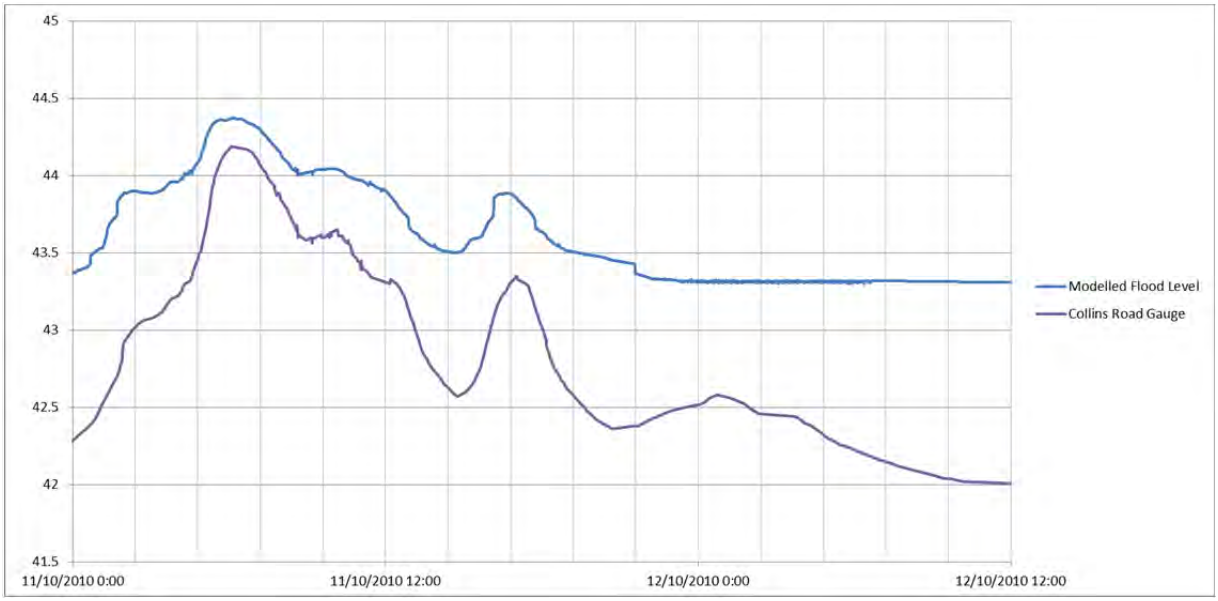


**Figure 3 | Recorded and modelled hydrograph at Old Northern Road gauge**

## 4.2 Maximum height gauges

Table 4 shows the recorded and modelled peak water levels at the six maximum gauges along Kedron Brook. Generally the model compares relatively well with the gauges and the flood extent of the event can be seen in Figure A2. Gauge 310 which is located on an upper reach of Kedron Brook shows a difference of approximately 500 mm which is most likely attributed to the fact that flood waters in this area are generally confined to a narrow channel. No bathymetric data has been included for this channel; therefore it is possible that the conveyance capacity in this reach of the creek is being underestimated in the model. The model at gauges 300, 290 and 280 are within 300 mm of the recorded levels. At Gauge 270 and 260 the model over predicts the flood levels. There appears to be a general trend for increasing overestimation of peak water levels towards the lower end of the model. Floodwaters in the lower reaches are also confined to the channel and as outlined previously, the conveyance capacity in these areas may be underestimated by the model.

**Table 4 | Model results compared to maximum height gauges**

| Maximum height gauge | Street | Recorded peak water level (m AHD) | Modelled peak water level (m AHD) | Difference (m) |
|---|---|---|---|---|
| 260 | Osborne Road | 32.71 | 33.93 | +1.22 |
| 270 | Dawson Parade | 40.95* | 41.56 | +0.61 |
| 280 | Pearse Street | 45.21 | 45.48 | +0.27 |
| 290 | Kuringal Drive | 48.59 | 48.51 | -0.08 |
| 300 | Samford Road | 56.20 | 56.26 | +0.06 |
| 310 | Rangleigh Street | 60.57* | 61.04 | +0.47 |

* Indicates debris-affected readings

Figure 4 presents a longitudinal plot of the recorded peak water levels against the modelled flood levels. This plot confirms that the model is predicting the recorded water levels relatively well, with the over estimation of peak water levels at the downstream end of the model.

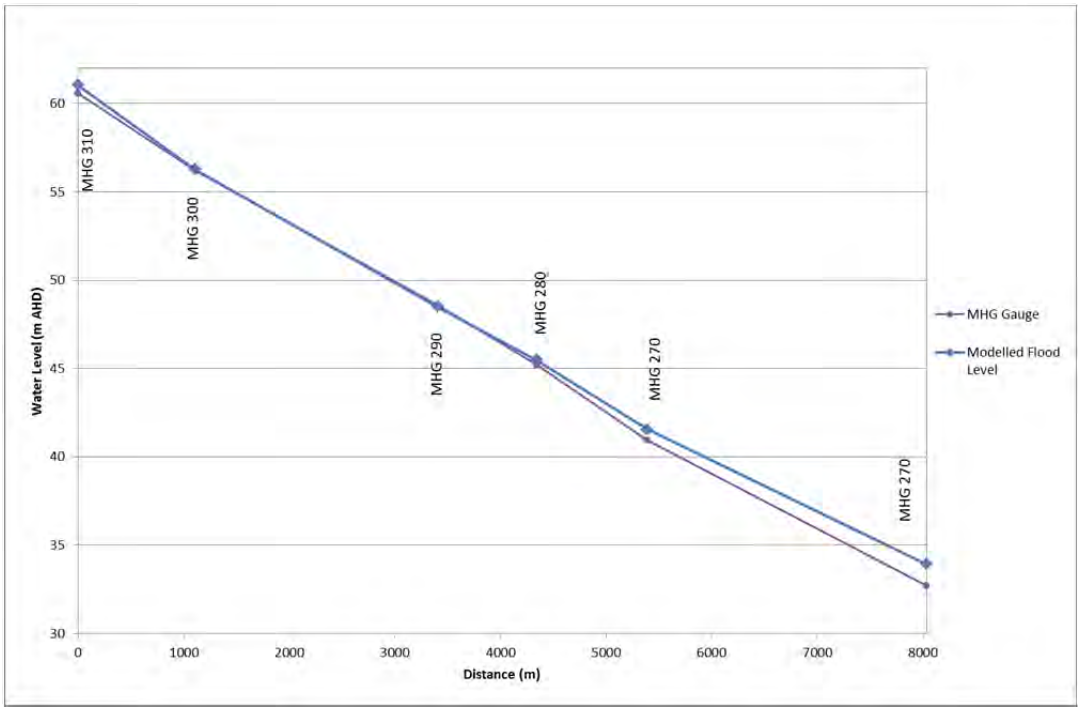


**Figure 4 | Comparison of maximum height gauge and modelled peak water levels**

The difference in recorded flood levels and the modelled flood levels are presented in Figure 5 below. The model is over predicting water levels.

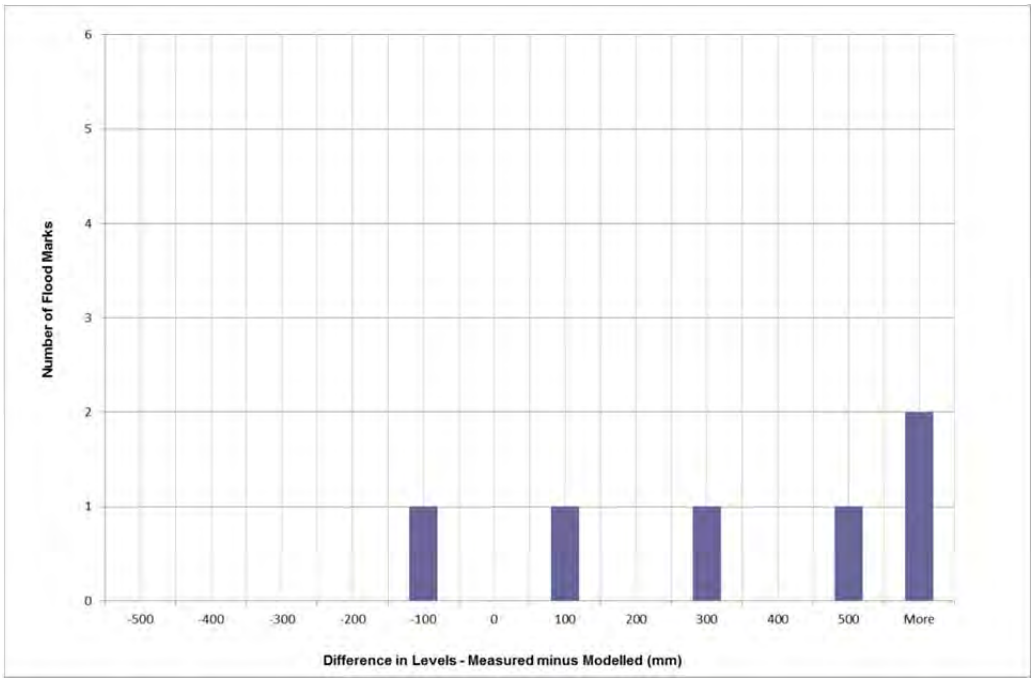


**Figure 5 | Height gauge histogram**

# 5. Discussion

The Brisbane Coastal Creeks model generally represents the timing and peak water levels of the October 2010 event well with an overestimation of peak water levels in the lower reaches. The Brisbane Coastal Creeks model covers only one minor basin in the Moreton Bay Region. Under the direction of Council, the catchments in this region have been modelled with a uniform approach, using a standard set of modelling parameters. This holistic approach does not encourage use of minor basin or catchment specific modelling parameters. For this reason it is considered that the validation results obtained for the BCC model are within acceptable limits.

# Appendices

# Appendix A
# Additional figures

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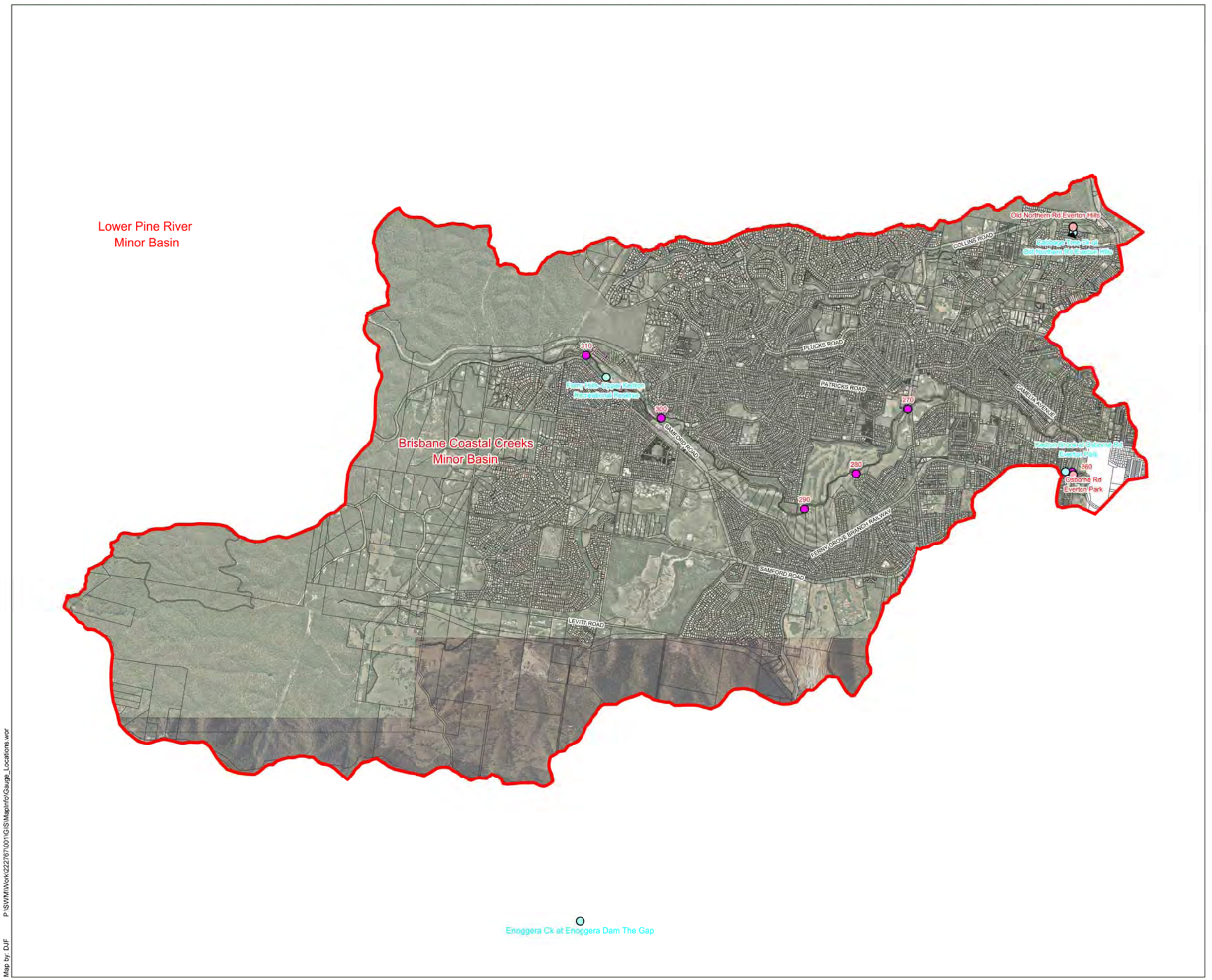


**Legend**

- Cadastre
- Minor Basin Boundaries
- River Station
- Maximum Height Gauge
- Rainfall Station

**Notes:**

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

Map by: DJF P:\SWM\Work\222767\001\GIS\MapInfo\Gauge_Locations.wor

A3 scale 1:40,000

0 1000 m 2,000 m

Date: 30/07/2012 Version: 0 Job No: 222767

Projection: MGA Zone 56

**RFD Detailed Modelling (BCC)**

**Figure A1: Gauge Locations**

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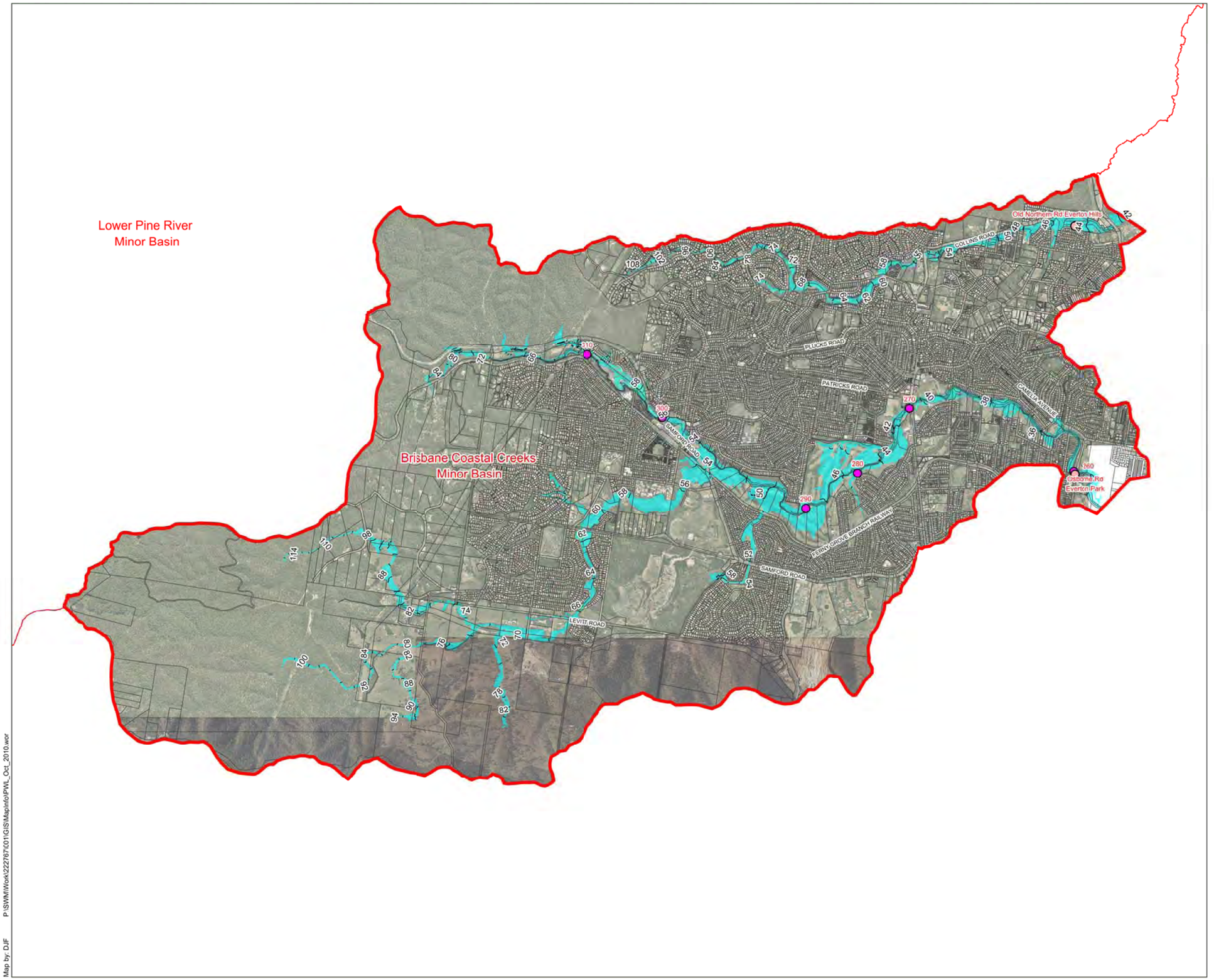


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**Legend**

- Cadastre
- Minor Basin Boundaries
- River Station
- Maximum Height Gauge
- Contour Lines (m AHD)
- Flood Extent

**Notes:**

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A3 scale 1:40,000

0 1000 m 2,000 m

Date: 30/07/2012 Version: 0 Job No: 222767

Projection: MGA Zone 56

**RFD Detailed Modelling (BCC)**

**Figure A2: October 2010 Event Peak Flood Extent**

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