Report

on

Technical Review

Dalby, Chinchilla, Miles, Jandowae, Wandoan and Tara Flood Reports

Professor James Ball	University of Technology Sydney
Dr Bill Weeks	formerly Department of Transport & Main Roads (QLD)
Dr Ian Brodie	University of Southern Queensland

31 March 2014

Contents

Background

At its Ordinary meeting held 18 September 2013, Western Downs Regional Council appointed an independent panel to review the Draft 2013 Riverine Flood Study.

The objective of the Technical Review Panel (Panel), comprising independent experts in the field of hydrology and hydraulic modelling, was to review and consider the key issues and assumptions In the Draft 2013 Riverine Flood Study.

The Panel members were:

- Professor James Ball — University of Technology Sydney
- Dr Bill Weeks — Department of Transport & Main Roads (QLD)
- Dr Ian Brodie — University of Southern Queensland

The Panel was facilitated by David Murray – CDM Smith Australia.

Following a workshop held on 12th and 13th October 2013, the Technical Review Panel recommended additional work to clarify the uncertainty and provide more confidence in the finally adopted 1: 100 AEP design flood flow and flood levels.

The Progress Update Report dated 21 October 2013 is attached in Appendix A.

Subsequently Water Technologies (WT) was requested to undertake the additional work and final reports were issued by WT as follows:

- Dalby Flood Study, Detailed Technical Report, March 2014 (issued 7 March 2014);
- Chinchilla Flood Study, Detailed Technical Report, March 2014 (issued 7 March 2014);
- Miles Flood Study, Detailed Technical Report, March 2014 (issued 7 March 2014); and
- Jandowae, Wandoan and Tara Flood Study, Detailed Technical Report, March 2014 (issued 7 March 2014).

This report summarises the outcomes of the Panel review of those reports.

Review Methodology

David Murray / Bill Weeks met two occasions in December 2013 and January 2014 with Water Technologies to review progress to date. Issues discussed and raised at each meeting were subsequently discussed with James Ball and Ian Brodie by teleconference.

The full Panel met on the 3rd and 12th February 2014 with Water Technologies to review progress to date. James Ball attended by teleconference. Panel feedback was provided at each of the meetings.

The final Panel meeting was held on 19 March 2014 to review Water Technologies final reports listed above. James Ball attended by teleconference. The Panel identified a number of issues that were

not clear and requested clarification of these on 20 March 2014. The clarifications were provided on 27 March 2014 and are attached in Appendix B.

It should be noted that in undertaking the review the Panel did not undertake any independent analyses and the review is based on the results provided by WT and an independent assessment of the data provided during the community engagement process.

Council advised that the stormwater modelling was not included in the Terms of Reference for the Panel and as such this work was not reviewed.

Summary of Review

The latest set of reports from WT as listed above have provided an improvement in both the results and also in the means of presentation compared to the previous versions published in 2012 and 2013.

The consideration of the historical floods has allowed a better understanding of the flood frequency and thereby a more reliable set of design flood events. This is especially the case in Dalby, Chinchilla and Miles, where the available data was more extensive.

The mapping of land use change has led to a clearer understanding of a portion of the change in flood levels, which was not clear in the original reports. The flood levels in the towns does not depend solely on the flood inflows, it also depends on the floodplain conditions. This is especially the case for Dalby, where floodplain development between 1981 and 2013 and then into the future to the ultimate level of development has an obvious impact on flood levels.

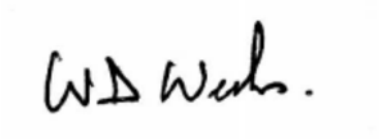
Notwithstanding the Panel still had concerns with the March 2014 reports as presented that required further explanation and or clarification. The clarifications provided by WT on 27 March 2014 satisfactorily addressed these concerns.

Based on the information presented in the final reports as listed above and clarifications provided on 27 March 2014, the Panel believes that the methodologies and assumptions are appropriate and the resulting flows and levels are reasonable estimates.

To avoid confusion, the Panel suggests that the final reports as listed above should be revised to incorporate the clarifications provided by WT on 27 March 2014.

The Panel also noted inconsistencies between various sections in most of the reports. Again to avoid confusion, the Panel suggest that the final report be revised to correct these inconsistencies.

Professor James Ball
University of Technology Sydney



Dr Bill Weeks
Department of Transport & Main Roads (QLD)

Dr Ian Brodie
University of Southern Queensland

Appendix A

Technical Review

Draft 2013 Riverine Flood Study

Progress Update

Professor James Ball	University of Technology Sydney
Dr Bill Weeks	Department of Transport & Main Roads (QLD)
Dr Ian Brodie	University of Southern Queensland

21 October 2013

Contents

Appendices

Background

At its Ordinary meeting held 18 September 2013, Western Downs Regional Council appointed an independent panel to review the Draft 2013 Riverine Flood Study.

The objective of the Technical Review Panel (Panel), comprising independent experts in the field of hydrology and hydraulic modelling, was to review and consider the key issues and assumptions In the Draft 2013 Riverine Flood Study. Based on this review, the Panel was to provide Council with advice and recommendations as to the accuracy of the suggested 1:100 AEP defined flood event for the towns of Dalby, Chinchilla, Miles, Wandoan, Tara and Jandowae.

The detailed Terms of Reference are shown in Appendix A.

The Panel members were:

- Professor James Ball — University of Technology Sydney
- Dr Bill Weeks — Department of Transport & Main Roads (QLD)
- Dr Ian Brodie — University of Southern Queensland

The Panel was facilitated by David Murray – CDM Smith Australia.

Review Methodology

A review workshop (including an aerial inspection of the Dalby and Chinchilla catchments) was held at Dalby on the 12th and 13th October 2013. The workshop was attended by:

Technical Review Panel

Professor James Ball	University of Technology Sydney
Dr Bill Weeks	Department of Transport & Main Roads (QLD)
Dr Ian Brodie	University of Southern Queensland

Facilitator

David Murray	CDM Smith

Technical Advisors

Dr Richard Walton	Water Technology- (Draft 2013 Riverine Flood Study)
Shannon Dooland	SKM (2007 Flood Study)

Note: BMT WBM provided a written update to their peer review for consideration by the Panel.

Administration support was provided by Angela Stirling from Western Downs Regional Council.

Prior to the workshop all Panel members were provided with copies of relevant reports by Dr Richard Walton on behalf of Water Technology. Following an initial review of these reports panel members provided a list of questions / discussions points to be addressed at the workshop.

The workshop program involved Dr Richard Walton presenting key aspects of the Draft 2013 Riverine Flood Study, including background, methodologies and assumptions for both the hydrological and hydraulic modelling to the Panel. Issues, concerns and clarifications were discussed as they arose.

The Panel wishes to acknowledge the professionalism of both Dr Richard Walton and Shannon Dooland in providing honest and frank input into the discussions.

Summary of Workshop Outcomes

The determination of flood levels for the towns depends critically on the calculation of design inflow flood hydrographs, and this was the main focus of the review. The calculation of flood hydrology has relied on a number of different approaches and the review has considered these differences and reached an agreement on some additional work to consider these differences and move towards a result that is consistent with all available data.

The study relies on Regional Flood Frequency methodologies (including the recently completed but not reported ARFF method) and has also assessed Design Rainfall methods. All of these methods are appropriate but the resulting 1:100 AEP peak design flows range from 1200m^3/s to 2100m^3/s at Dalby.

This is a quite large variation and is an indication of the significant uncertainty in the data and the inherent uncertainty in the alternative approaches for estimation of the design flood.

The Panel believes that the 2100m^3/s flow is the result of a relatively arbitrary (visual) fit of uncertain data and hence the panel does not have sufficient confidence to endorse that figure. Similarly, the panel does not have sufficient confidence to endorse any other value at this stage.

The Panel notes that the study does not appear to put much weight on historical data such as the 1981 flood event in Dalby. While this data is not definite for stream discharges, the flood levels can be regarded as a good indication of historical flood risk because such data can have a relatively high degree of certainty. For example the 1981 flood peak level at Patrick Street Bridge and its occurrence (ie the highest flood of record in 100 years) is relatively certain. In addition it was noted that the 1:100 year rainfall is similar to the 1981 rainfall.

A more detailed analysis of historical data will provide greater certainty around the assumptions and interpretation and as such provide more confidence in the outcome. In noting this, the Panel is not implying that the 1981 event is the 1:100 AEP. It is quite conceivable that the 1:100 AEP flood will be higher.

Similar comments are applicable for the Chinchilla 1:100 AEP estimate. The suggested flow in the study is significantly higher than the 1942 flood peak. The panel therefore believes that further analysis of historical data is warranted.

It was also noted that the Flood Frequency Analysis at Gil Weir misinterpreted the analysis of low flows and a low flow censored analysis should be rerun using a better approach for handling the years containing censored flows. The panel expects that the resulting 1:100 AEP peak flow will be lower at this site.

The Panel noted that the 2D hydraulic model at Dalby was not calibrated to the 1981 flood event. Currently, the predicted flood heights for the 1981 event from the model are higher than those recorded. The implication is that, regardless of the adopted 1:100 AEP peak flow, the hydraulic model will over estimate the resulting peak flood heights.

The Panel considers it essential that the 2D model be calibrated to the 1981 event.

While the Panel has no specific comment regarding Miles, Wandoan, Tara and Jandowae, it notes that the peak flow estimates for these towns should be reviewed following the completion of the recommended further work.

Recommended Further Work

The Panel recommends that the following additional work be undertaken to clarify the uncertainty and provide more confidence in the finally adopted 1: 100 AEP design flood flow and flood levels.

1. Historical Data

    - More historical data is required for Dalby and Chinchilla.
    - All anecdotal data and archived information (newspaper articles etc) should be included but concerns as to its validity should be clearly noted.
    - The Panel suggest that this task can be outsourced to a local resident to obtain the data.

2. 1981 hydraulic model calibration using joint RAFTS/MikeFlood

    - Calibrate on the 1981 flood and re run 2011 flood.
    - The Panel believes that this is integral to the study.
    - Results may remove the issue of variations in north and south Dalby.
    - This flood model can then be used to calculate flood discharges for the historical floods which have been recorded at the Patrick Street gauge. These flood discharges can then be applied to a flood frequency analysis to allow a better estimate of design flood flows.

3. Low flow censored Flood Frequency Analysis at Patrick Street gauges plus other sites using calibrated MikeFlood generated flows

    - This will provide confidence and clarify the AEP of the 1981 event eg 1 in 40.

- Railway line to be used as a point of intercept.
- This should not be undertaken until 1 and 2 are completed since the flood discharges calculated from the hydraulic model and the observed flood levels will be needed.

4. Flood Frequency Analysis at Gill Weir

    - Low flow censoring analysis should be re run on full 80 years.

5. Runoff Production/Unit Area for Regional Catchments

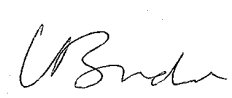
    - This will provide an alternative view of regional flood characteristics.
    - By looking at the relationship between the peak runoff production (Q_{peak} per unit area) and the 72hr 1% AEP design rainfall for different catchments it should be possible to identify those catchments that are hydrologically different.

6. Low flow censored flood frequency analysis at Chinchilla using calibrated MikeFlood generated flows.

7. This review has concentrated on Dalby and Chinchilla, since these are the towns with more complete data sets. However once these results have been revised, the regional results can be applied to the other towns, to update these results also

Professor James Ball
University of Technology Sydney

Dr Bill Weeks
Department of Transport & Main Roads (QLD)



Dr Ian Brodie
University of Southern Queensland

Appendix A - Terms of Reference

WESTERN DOWNS REGIONAL COUNCIL

Riverine Flood Studies Technical Review Panel

TERMS OF REFERENCE

The Riverine Flood Studies - Technical Review Panel has been appointed by Western Downs Regional Council at its Ordinary Meeting held 18 September 2013.

PURPOSE

The purpose of the Technical Review Panel (hereinafter called the Panel) is to convene external scientific expert representatives to review and deliberate on key issues and assumptions and provide information, advice and recommendations to Council on the Draft 2013 Riverine Flood Studies and its accuracy as a one (1) in 100 defined flood event.

OBJECTIVE

The key objectives of the panel are:

- to provide professional scientific advice on and assess the hydrological and hydraulic modelling component of the Draft 2013 Flood Studies:
  - assess hydrological methods used for the Towns of Dalby, Chinchilla, Miles, Wandoan, Tara and Jandowae;
  - work together with other members of the Review Panel to:
    - provide one consolidated list of recommended changes (if changes are required);
    - allow Water Technology (WT) to incorporate changes (as and if required); and
    - provide one final combined statement on the Studies' acceptability (once changes are incorporated, if required);
  - assess the:
    - suitability and applicability of the adopted methodology on all six towns;
    - application of the methodologies used in all six towns;
    - suitability and applicability of assumptions used in all models;
    - consider options for alternative development or justification for assumptions used; and
    - generic risk and uncertainty around various models/assumptions, etc;
  - tasks:
    - review documentation/reports;
    - prior to the technical workshop:
      - liaise with WT and Council with questions/points of clarification/requests for additional information prior to and during the workshop;
      - participate in a teleconference prior to the workshop if required; and
      - provide a list of questions/concerns/discussion topics to Council/WT prior to the workshop to allow preparation time;
    - attend a one to one and a half day workshop in Dalby;

- attend a brief drive around Dalby and Chinchilla to familiarise Members with the landscape including:
  - Mocatta's Corner;
  - Railway line along Blaxland Road;
  - Myall Creek/Patrick Street Gauge;
  - Branch Creek drain;
  - Chinchilla Township;
  - Rocky Creek Catchment; and
  - Charleys Creek Catchment
- provide one consolidated list (from the Panel) of recommended changes (if changes are required); and
- provide one final combined Findings Report (from the Panel) on the Studies' acceptability (once any recommended changes are incorporated).

POWERS

The Panel is established as an Advice Committee, to provide information, advice and recommendations to Western Downs Regional Council on Draft 2013 Flood Studies pertaining to Western Downs Regional Council.

Whilst the Panel may provide advice to Council, such advice will form recommendations to Council only, and therefore the Panel does not hold decision making powers to direct the strategic policy, planning or operations of Council, and is not able to commit Council resources.

MEMBERSHIP

(a) The Western Downs Regional Council Riverine Flood Studies - Technical Review Panel will consist of three (3) panel members as follows:

- Professor James Ball - Associate Professor UTS
- Dr Bill Weeks - Director (Hydraulics) - Department of Transport and Main Roads, Queensland
- Additional Member to be advised

(b) The Panel workshop shall also be attended by Technical Advisers:

- Dr Richard Walton - Water Technology - Author of 2012/13 WDRC Flood Reports
- Jo Tinnion - BMTWBM - Peer Reviewer
- Shannon Dooland - SKM - 2007 Myall Creek Study Author

(c) There will be no Chairperson or Deputy Chairperson on the Panel.

(d) Council will provide a Facilitator for the Panel who shall provide co-ordination of issues and administrative services, and maintain order and direction of the Panel discussion.

(e) Members of the Panel are not authorised to make public or media comment on behalf of Council.

(f) Council's Infrastructure Services General Manager or nominee will provide appropriate advice and administrative support to assist the Panel to meet its obligations.

TENURE OF PANEL AND MEMBERSHIP

The Western Downs Regional Council Riverine Flood Studies - Technical Review Panel is established for the term of one Panel workshop and development of one Findings Report.

ROLES AND RESPONSIBILITIES

Facilitator

The Facilitator will:

- be responsible for co-ordinating the meetings, agenda, minutes, notes, actions and reports;
- brief Council as required, and provide feedback on relevant Council decisions to the panel;
- ensure the meeting remains focussed and encourage contribution from all members; and
- ensure a consensus position is reached at the conclusion of the workshop (or after additional investigation is complete).

All Panel Members

Members will:

- participate fully and be productive and professional members of the Panel;
- put forward professional and scientific views related to the Objectives above;
- work well in a Panel environment and abide by normal meeting protocols;
- abide by media protocols;
- have no formal authority or delegated powers from Council under the *Local Government Act 2009;*
- raise any issues related to conflict of interest with the Facilitator as soon as possible;
- attend meetings;
- not disclose, make improper use or take advantage of any restricted information that they may have access to as a Member of the Panel;
- act in an ethical and professional manner in consideration of issues and the provision of advice to the Panel and Council; and
- act in accordance with these Terms of Reference.

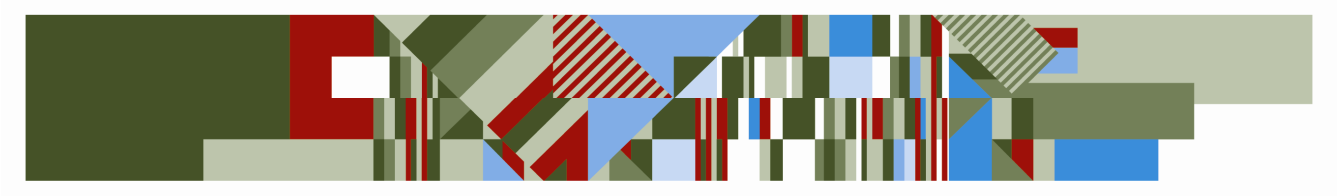
MEETING ADMINISTRATION AND PROTOCOL

Administrative Support

Staff from the Infrastructure Services Department of Western Downs Regional Council will provide administrative and secretarial support to the Panel. Staff will:

- prepare and distribute agendas and minutes;
- provide reports and background information as necessary for discussions; and
- ensure an appropriate level of involvement of technical and professional staff at meetings.

Day to day contact with Council will be through Council's Infrastructure Services General Manager.



Quorum

The Panel will only convene if all members are available.

Frequency of Meetings

There will only be one formal meeting with the date to be confirmed by agreement, but prior to 18 October 2013. Council will be responsible for providing a suitable venue.

Agendas, Minutes and Reporting

Panel meetings must have an agenda and record of proceedings.

The Western Downs Regional Council Riverine Flood Studies - Technical Review Panel must submit a report of findings of its meeting to Council.

Meeting Procedures

Unless otherwise provided in these Terms of Reference, the Advisory Panel will not adopt formal meeting procedures, as the meeting shall be a workshop.

Decisions

- Decisions shall be by consensus.
- Should a consensus not be able to be reached, further investigations will be undertaken until one is reached.
- Should, after further investigation, a consensus not be able to be reached, a report will be prepared and submitted to Council listing:
    - the agreed positions; and
    - items not able to be agreed upon.

Conflicts of Interest

For the purposes of this clause:

> A Member has a ***conflict of interest*** in an issue if there is a conflict between the Member's private interest and the public interest that may lead to a decision that is contrary to the public interest or professional standards.

Council Officers

Council's Officers must abide by Council's Code of Conduct in relation to conflicts of interest.

Open to the Public

The workshop will not be open to the public and will be attended only by those Members, Technical Advisers, Facilitator and Administrative Staff member.

CONFIDENTIAL MATTERS

A person who is or has been a Member of an Advisory Panel must not make improper use of information acquired as a Member to:

- gain, directly or indirectly, a financial advantage for the person or someone else;
- harm the Local Government; or
- release information that the person knows, or should reasonably know, is information that is confidential.

INFORMATION PRIVACY

Western Downs Regional Council, including Advisory Committees appointed by Council, is subject to the *Information Privacy Act 2009* (IP Act). Members are advised that personal information of an individual must be handled in accordance with the Information Privacy Principles of the IP Act.

DISPUTES, COMPLAINTS AND GRIEVANCES

All disputes, complaints and grievances will be handled in accordance with Western Downs Regional Council's Policies and procedures.

REMOVAL FROM OFFICE/RESIGNATION FROM THE PANEL

Council may remove a Member from the Panel if the Member is unable or unwilling to operate within these Terms of Reference and any relevant Policy, procedure or guidelines of Western Downs Regional Council.

A Panel Member may, by notice in writing addressed to the Committee, resign his/her office as a Member.

WESTERN DOWNS REGIONAL COUNCIL

Riverine Flood Studies
Technical Review Panel

ACCEPTANCE OF TERMS OF REFERENCE

I, _____ agree to be a Member of the Western Downs Regional Council Riverine Flood Studies - Technical Review Panel and agree to abide by the conditions outlined in the Terms of Reference for the Panel.

I agree that all media communications regarding activities of the Panel will be via the Mayor or Chief Executive Officer.

I understand that the Western Downs Regional Council Riverine Flood Studies - Technical Review Panel is purely a consultative Panel to Council that is designed to discuss key issues and make recommendations to Council as it pertains to the stated purpose of the Panel. I understand however, that final decisions will be made by the Western Downs Regional Council and that individual members and the Panel do not hold decision making powers to direct the strategic policy, planning or operations of Council, and are not able to commit Council resources.

I consent to my personal information by way of my being a member of the Western Downs Regional Council Riverine Flood Studies - Technical Review Panel or contributed by myself at a Panel meeting, being publicly available and being transferred outside of Australia by means of being published on Council's website.

I understand that I may terminate my membership of the Panel by giving written notice to the Panel. I also understand that my membership of the Panel may be terminated should a breach of these Terms of Reference occur.

Signed: _____

Dated: _____

Appendix B

Our Ref: 1431-16-78-v01

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

ABN: 60 093 377 283
ACN: 093 377 283

24 March 2014

Mr David Murray
CDM Smith
21 McLachlan Street
Fortitude Vale QLD 4006

Via email: MurryKD@cdmsmith.com

Dear David,

The following sections present additional information in response to the TRP's request for clarification to the Dalby, Chinchilla, Miles and Jandowae, Tara and Wandoan Reports.

In summary, following subsequent discussions and requests to clarify the changes (and the basis for the changes) that have been made since the previously issued study reports (Nov 2012) and the current reports (March 2014) it is proposed that a new section be added to each of the reports to address the differences between the Nov 2012 report and the March 2014 report.

In the time available, it has not been possible to modify the reports as issued. The details below can be inserted into the documents in a subsequent revision.

If you have any queries, please do not hesitate to call.

For and on behalf of

Water Technology Pty Ltd

Steve Clark

Director

KEY POINTS FOR CLARIFICATION

i) Given the reduced Q100 discharge at Dalby, why has the predicted flood level (at Patrick Street for example) increased? Note this discussion should not just be restricted to Patrick Street but other key locations (with substantial increase in water levels) as well.

> *It is proposed that the following text (adjusted to appropriately reference figures tables etc) be added as a new Section 12 to the Dalby Report*

The predicted flood surface as reported in the March 2014 report is in fact slightly lower (0.01m) in the vicinity of the Patrick St gauge than that reported in the Nov 2012 report. There are two reasons why the comparison between flood surfaces and reported levels is complex. These are firstly, that the reporting locations (for "Patrick St") have changed between Nov 2012 and March 2014 reports and secondly the change in flow splits based on the additional modelling at Mocatta's corner. These are discussed in more detail below:

a) Change in reporting location

"Section 3.3 Stream Gauges" of the March 2014 report discusses the relative location of the two Patrick St gauges (the Patrick St Bridge gauge and the Patrick St TM gauge). Figure 3.3 of the report shows the relative locations.

- The Nov 2012 report presented a Q100 (2,100m^3/s) level of 343.70m AHD level at the Patrick St TM gauge.

- The March 2014 report presents a Q100 (1,760m^3/s) level of 343.80m AHD at the Patrick St Bridge gauge. The corresponding Q100 level at the Patrick St TM gauge is 343.69m AHD (this was not presented in the report). The flood surface as reported in the March 2014 report is approximately 0.01m lower in the vicinity of the Patrick St gauge when compared to the flood surface as reported in the Nov 2012 report.

- Please note that the proximity of two gauges in such close proximity which are often used interchangeably has been a significant cause of confusion for some time and that it has taken considerable effort to differentiate between the two gauge records. For example, we have had extensive communications with BoM regarding where they report their flood levels and we understand that the BoM use the two locations interchangeably.

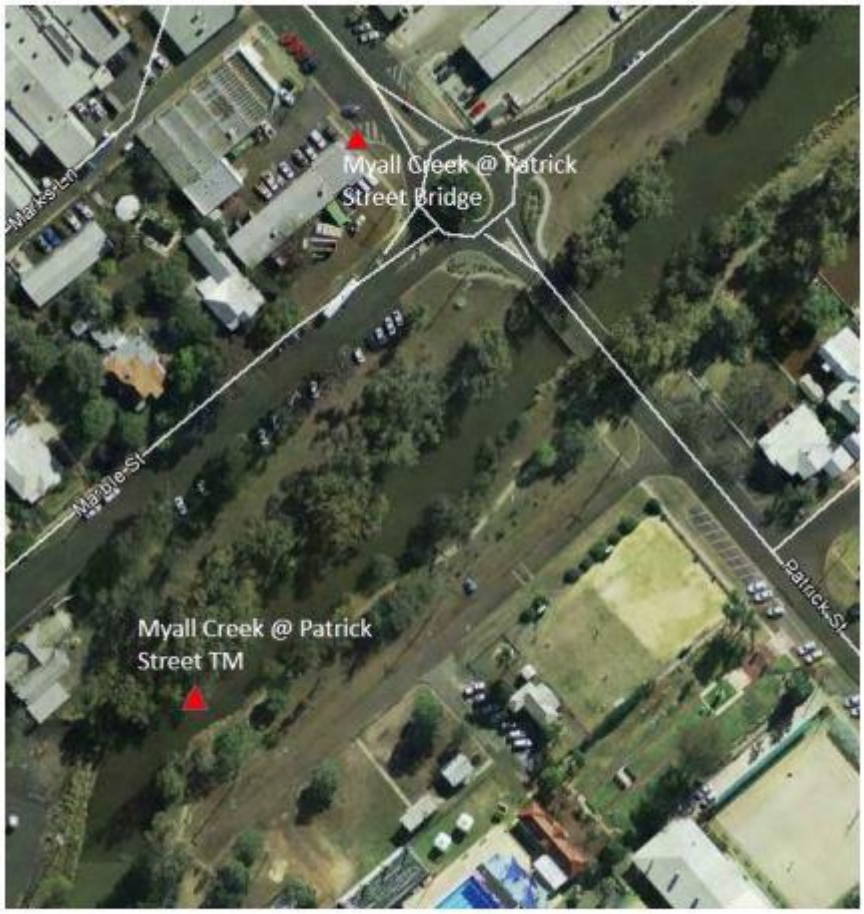


Figure 3.3 **Dalby Stream Gauging Stations**

b) Mocatta's corner flow split

The additional modelling undertaken for the Mocatta's corner area has resulted in a change in flow distribution upstream of Dalby. This is discussed in section 10.2.1 in the report. Previously a flow of 28% flowing to the west and 72% flowing to the south was adopted for all flows. Table 10.2 and Appendix I present the results of the additional investigations which have results in adjusted flow splits (varying across the range of design events considered) used in the modelling reported in the March 2014 report.

The effect of this adjusted flow split has been to increase the proportion of flow flowing through the CBD. There is a corresponding decrease in the proportion of flow flowing over the railway line and to the southern flowpath.

When considering the drop in Q100 flow from 2,100m^3/s to 1,760m^3/s, for the Patrick St Bridge vicinity, an increase in the proportion of flows reaching the CBD area has counteracted somewhat the reduction in overall flow. For the southern overland flow path, the reduction in both overall Q100 flow and the proportion of flow has meant drops in predicted Q100 level of up to 0.3m.

Attached is a figure presenting the difference in predicted water surface level for the Q100 event as reported in Nov 2012 and as reported in March 2014. The areas shown as yellow/red are areas where levels have increased (in the March 2014 report, compared to the Nov 2012 report). This is due to the change in flow distribution from Mocatta's corner "overshadowing" the decrease in the overall Q100 flow. The areas shaded green are areas

where there are reductions in level caused by both the change in flow distribution from Mocatta's corner and the reduction in the overall Q100 flow.

Depending on the requirements for future reporting, additional discussion (as above) could be added to a future revision of the report.

ii) Q10 discharge at Dalby has reduced substantially (by >50%). Is this due to a revision to the 2011 flood discharge? Further explanation of the underlying reason for the change is required

It is proposed that the following text (adjusted to appropriately reference figures tables etc) be added as a new Section 12 to the Dalby Report

The substantial change in Q10 discharge is due to the revised Flood Frequency Analysis (discussed in Section 8 of the report). The previous figure was based on the regional flood frequency approach. Comparison of the recorded data with the FLIKE Flood Frequency Analysis (Figure 8.6) and the results of the regional flood frequency approach indicated that the FLIKE results were a better match for the available data.

iii) Why has the historical flood data available at Miles (Section 2.7) not been used in joint calibration of the models?

It is proposed that the following text (adjusted to appropriately reference figures tables etc) be added to Section 2.7 of the Miles Report

This was attempted, but the significant uncertainty in the available data meant that there was little confidence in the results of the "calibration". The uncertainty was associated with:

a) lack of sub-daily rainfall data within the Miles catchment,
b) very limited peak water level data, and
c) uncertainty regarding what peak water level data was available. In particular, with regard to the Warrego Highway, it is not clear whether the BoM WL data at the Warrego Hwy are flood peaks; or a level when it was convenient/possible to walk down to the bridge and take a reading.

ADDITIONAL POINTS FOR CLARIFICATION

1) Historical data – need to include both together with simple mud maps of changing design levels wrt historical levels

It is proposed that the following text and figures be added to the new Section 12 of the Dalby Report

For selected points in the catchment, Figures 1a and 1b a comparison of:

- 1981 levels as observed,
- Levels that could be expected if the 1981 flood was experienced with ultimate levels of development as per the planning scheme,
- The study team's best estimate of 1893 levels (corresponding to a discharge of 3,300m^3/s)
- The 1 in 100 AEP event levels as presented in the November 2012 report,
- The 1 in 100 AEP event levels as presented in the March 2014 (this current) report,

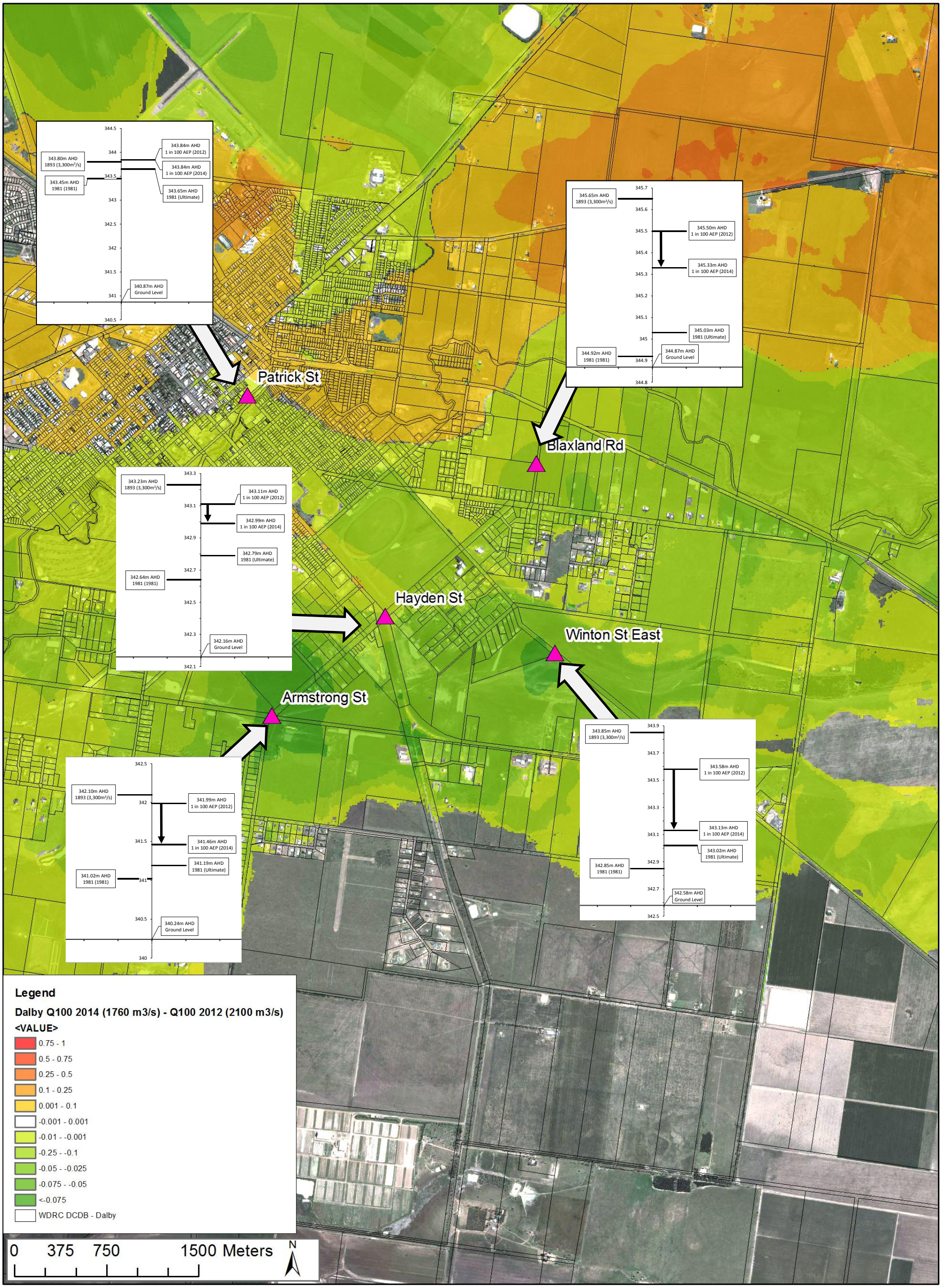
Figure 1a presents these points superimposed on a map showing the difference between the Nov 2012 1 in 100 AEP flood surface and the March 2014 1 in 100 AEP flood surface.

Figure 1b presents the same information, but superimposed on the March 2014 1 in 100 AEP flood surface.

2) Need to reconcile changed flood flows with previous estimates

3) Need to reconcile changes in flood levels with both previous estimates and previous reports

A summary of differences between the November 2012 and March 2014 results (both levels and flows) are presented below. These will be incorporated in the relevant documents as indicated below.



SUBJECT: **TRP COMMENTS – INTERNAL USE ONLY**

1431-16-76-v01
21 March 2014

Figure 1a. Dalby 1 in 100 AEP (2012 -2014) with Comparison Points

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

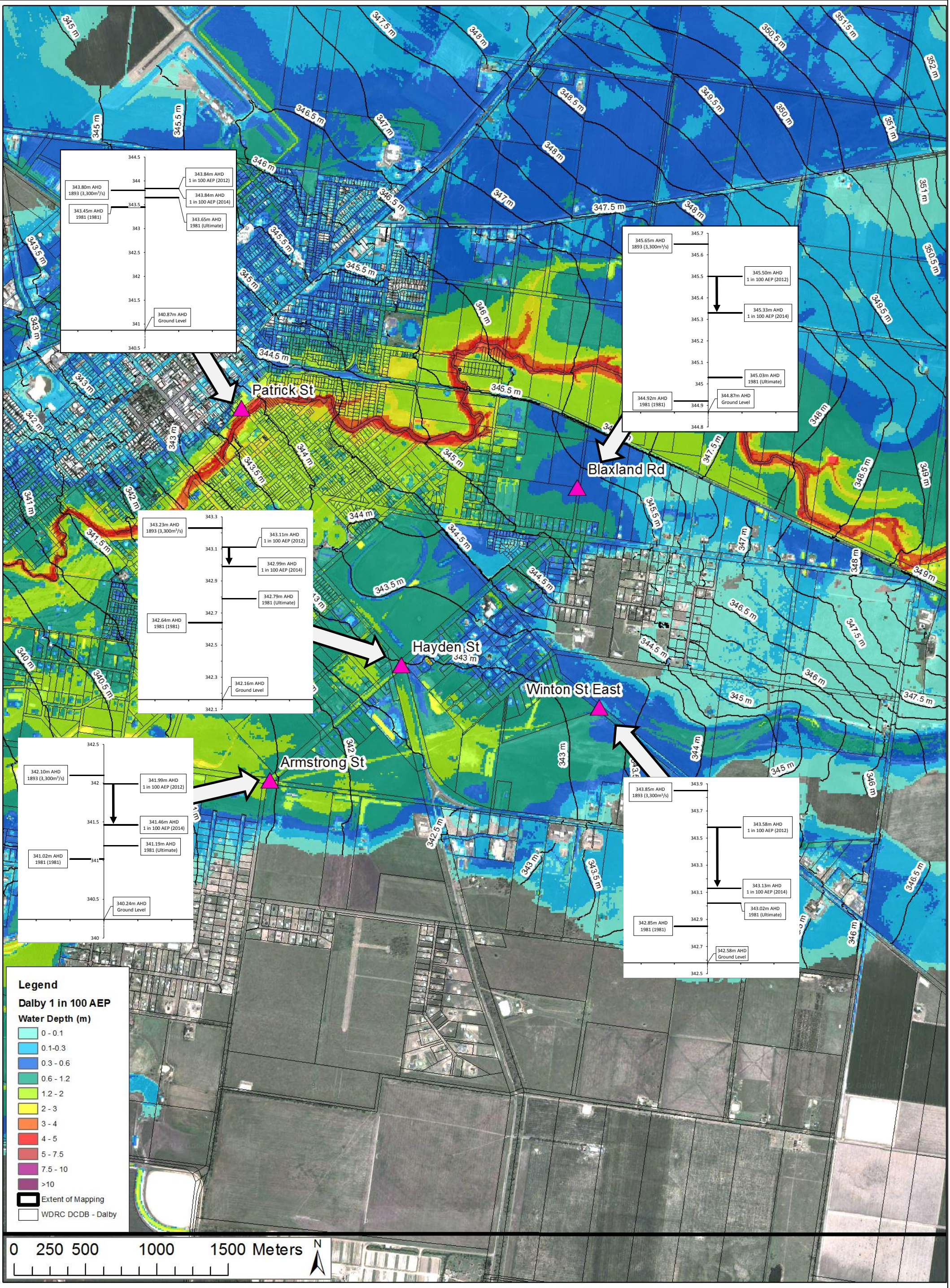


Figure 1b. Dalby 1 in 100 AEP with Comparison Points

Dalby Flow and Level Comparison

It is proposed that the following text and figures be added to the new Section 12 of the Dalby Report

Following release of the November 2012 report, a substantial amount of additional data gathering and analysis was undertaken with respect to Myall Creek at Dalby.

More specifically:

- Additional flood level information was gathered,
- Further investigations of the 1893 event were undertaken,
- On the basis of new LIDAR data, detailed investigations of the flow distribution upstream of Dalby (at Mocatta's Corner) was undertaken,
- A revised Flood Frequency Analysis using the latest available techniques (as currently being developed through the revision of Australian Rainfall and Runoff).

This additional data and additional analysis has resulted in changes (decreases) in the design flows and corresponding levels for Myall Creek through Dalby.

Tables 1 and 2 below present comparisons of the design flows and associated levels for Myall Creek as presented in the Nov 2012 report and this current report.

Table 1 Comparison between Adopted Flows in 2012 and 2014 Report at Myall Creek, Dalby

AEP (1 in x) or historic event	Adopted Discharge - 2012 Report (m3/s)	Adopted Discharge - 2014 Report (m3/s)
10	640	210
20	1000	440
50	1580	1010
100	2100	1760

Table 2 Comparison between Adopted Levels in 2012 and 2014 Report at Patrick St Gauge, Dalby

AEP (1 in x)	Adopted Levels - 2012 Report (m AHD)	Adopted Levels - 2014 Report (m AHD)
10	343.13	342.36
20	343.40	342.91
50	343.71	343.45
100	343.86	343.85

As a result of the additional data gathering and the revised analysis, the 1 in 100 AEP design discharge previously proposed for Myall Creek at Dalby has decreased by approximately 20%. There have been proportionally larger decreases in the smaller design events. Previously the magnitude of the smaller design events was estimated using a regional flood frequency scaling analysis. The updated estimates are based on an updated Flood Frequency Analysis using the latest available techniques (available through the FLIKE software package).

Note that the impacts of the decrease in design flows and the changes in floodplain flow distribution are not distributed uniformly across the floodplain.
[Include the discussion above regarding changes in reporting location and the impact of the Mocatta's corner flow splits and the figures showing historic vs design levels]

It is also worth noting that the predicted 1 in 100 AEP levels are universally lower than the study team's best estimates of the likely levels experienced during the 1893 event.

Chinchilla Flow and Level Comparison

It is proposed that the following text (adjusted to appropriately reference figures tables etc) be added as a new Section 6 to the Chinchilla Report

Following release of the November 2012 report, a substantial amount of additional data gathering and analysis was undertaken with respect to Charley's Creek at Chinchilla.

More specifically:

- Significant quantities of additional flood level information was gathered through the efforts of WDRC officers and the community,
- Through further consultation with the community, new gauge records (at the railway) were identified resulting in a significantly longer flow record (the earliest records available previously was in 1969 whereas the gauge record has now been extended back to the 1893 event). Although BoM are aware of the existence of this gauge, the gauge records are not available through their standard data retrieval processes.
- A revised Flood Frequency Analysis using the latest available techniques (as currently being developed through the revision of Australian Rainfall and Runoff) was undertaken on the extended gauge record.

This additional data and the corresponding Flood Frequency Analysis has resulted in a significant decrease in the design flows and corresponding levels for Charleys Creek through Chinchilla.

Tables 1 and 2 below present comparisons of the design flows and associated levels for Charleys Creek as presented in the Nov 2012 report and this current report.

Table 3 Comparison between Adopted Flows in 2012 and 2014 Report at Charley's Creek, Chinchilla

AEP (1 in x)	Adopted Discharge - 2012 Report (m3/s)	Adopted Discharge - 2014 Report (m3/s)
10	1060	350
20	1710	880
50	2900	1580
100	4130	2100

Table 4 Comparison between Adopted Levels in 2012 and 2014 Report at Middle St Gauge, Chinchilla

AEP (1 in x)	Adopted Levels - 2012 Report (m AHD)	Adopted Levels - 2014 Report (m AHD)
10	302.46	301.43
20	303.05	302.27

AEP (1 in x)	Adopted Levels - 2012 Report (m AHD)	Adopted Levels - 2014 Report (m AHD)
50	303.86	302.99
100	304.48	303.40

The significant reduction in design flows is a result of the revised Flood Frequency Analysis.

In contrast to Dalby where the reduction in design levels associated with the reduction in design inflows for Myall Creek were not uniformly distributed across the floodplain, the reduction in design flows for Charleys Creek at Chinchilla has produced a corresponding reduction in design level.

Miles Flow and Level Comparison

It is proposed that the following text (adjusted to appropriately reference figures tables etc) be added as a new Section 6 to the Miles Report

Following release of the November 2012 report, a substantial amount of additional data gathering and analysis was undertaken with respect to Dogwood Creek at Miles.

More specifically:

- additional flood level information was gathered through the efforts of WDRC officers and the community,
- In particular, through the community consultation process, a gauge record (Dogwood Creek at the Warrego Highway) was provided. Prior to this, records were available back to 1949 whereas the Warrego Highway record provided data back to 1918,
- A new Flood Frequency Analysis using the latest available techniques (as currently being developed through the revision of Australian Rainfall and Runoff) was undertaken on the Warrego Highway record.

This additional data and new Flood Frequency analysis has resulted in a significant decrease in the design flows and corresponding levels for Dogwood Creek at Miles for the 1 in 100 AEP event smaller changes for the 1 in 10, 20 and 50 AEP events.

Tables 1 and 2 below present comparisons of the design flows and associated levels for Dogwood Creek as presented in the Nov 2012 report and this current report.

Table 5 Comparison between Adopted Flows in 2012 and 2014 Report at Dogwood Creek, Warrego Highway (Miles)

AEP (1 in x)	Adopted Discharge - 2012 Report (m3/s)	Adopted Discharge - 2014 Report (m3/s)
10	920	910
20	1480	1410
50	2510	2180
100	3620	2810

Table 6 Comparison between Adopted Levels in 2012 and 2014 Report at Warrego Highway, Miles

AEP (1 in x)	Adopted Levels - 2012 Report (m AHD)	Adopted Levels - 2014 Report (m AHD)
10	299.00	298.85
20	299.95	299.76
50	301.12	300.65
100	302.03	301.20

As for Miles, the reduction in design flows for Dogwood Creek at Miles has produced a corresponding reduction in design levels.

Jandowae, Wandoan and Tara Flow and Level Comparison

It is proposed that the following text (adjusted to appropriately reference figures tables etc) be added as a new Section 6 to the Jandowae, Tara and Wandoan Report

Following release of the November 2012 report, a substantial amount of additional data gathering and analysis was undertaken for the area, but unlike Dalby, Chinchilla and Miles, there was not a substantial increase in available data at Jandowae, Wandoan and Tara.

However, through discussion with members of the community and council officers, some modifications were made to the methodology used to calculate design flows for Jandowae, Wondoan and Tara. On the basis that the catchments were similar, design discharge estimates for Jandowae and Tara were based on scaled discharge estimates for Dalby. The catchment to Wandoan was considered to be most similar to the catchment to Miles, so scaled design discharge estimates for Miles were used for Wandoan.

This revised approach has lead to the design flows and corresponding levels for Jandowae, Wandoan and Tara as outlined in Tables 7 to 12 below. As a general comment, design discharges and associated levels have reduced through this process.

Table 7 Comparison between Adopted Flows in 2012 and 2014 Report at Jandowae

AEP (1 in x)	Adopted Discharge - 2012 Report (m3/s)	Adopted Discharge - 2014 Report (m3/s)
10	170	60
20	280	120
50	500	290
100	740	500

Table 8 Comparison between Adopted Flows in 2012 and 2014 Report at Bridge on High St, Jandowae

AEP (1 in x)	Adopted Levels - 2012 Report (m AHD)	Adopted Levels - 2014 Report (m AHD)
10	357.98	357.52
20	358.16	357.87
50	358.38	358.20
100	358.55	358.40

Table 9 Comparison between Adopted Flows in 2012 and 2014 Report at Wandoan

AEP (1 in x)	Adopted Discharge - 2012 Report (m3/s)	Adopted Discharge - 2014 Report (m3/s)
10	330	300
20	530	470
50	920	730
100	1340	950

Table 10 Comparison between Adopted Flows in 2012 and 2014 Report at Bridge on Roche Creek Rd, Wandoan

AEP (1 in x)	Adopted Levels - 2012 Report (m AHD)	Adopted Levels - 2014 Report (m AHD)
10	244.01	243.88
20	244.32	244.11
50	244.80	244.42
100	245.21	244.66

Table 11 Comparison between Adopted Flows in 2012 and 2014 Report at Tara

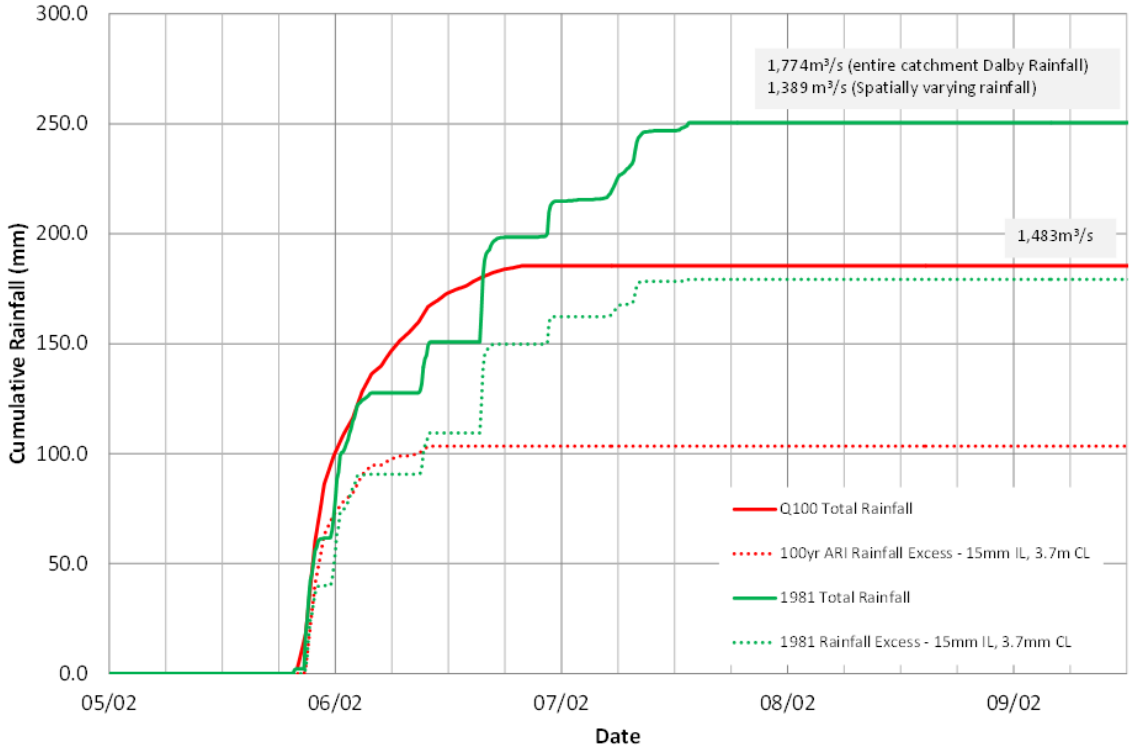
AEP (1 in x)	Adopted Discharge - 2012 Report (m3/s)	Adopted Discharge - 2014 Report (m3/s)
10	120	40
20	200	90
50	350	200
100	510	360

Table 12 Comparison between Adopted Levels in 2012 and 2014 Report at Overflow on Sara St, Tara

AEP (1 in x)	Adopted Levels - 2012 Report (m AHD)	Adopted Levels - 2014 Report (m AHD)
10	309.83	309.62
20	309.98	309.76
50	310.20	310.01
100	310.37	310.37

4) Need to reconcile design rainfalls with historical estimates, i.e. differences in applied rainfall load

Further detail can be provided, but some discussion with regard to the 1981 event comparison to the 1 in 100 AEP event is presented in Section 7.2 of the Dalby report.



5) Are the flood levels presented "design flood levels" or "flood planning levels"? What was shown in previous reports

It is understood that Western Downs Regional Council are/have adopted the 1 in 100 AEP event as the Defined Flood Event (DFE) in terms of the planning scheme. In the November 2012 report, the DFE was defined as the Q100 + an allowance for 1°C climate change (5% increase in rainfall intensity). For the purposes of the March 2014 report, the climate change allowance not included and the DFE has been defined as the AEP 1 in 100 event.

An appropriate freeboard allowance (300mm has previously been adopted) should be added for planning levels

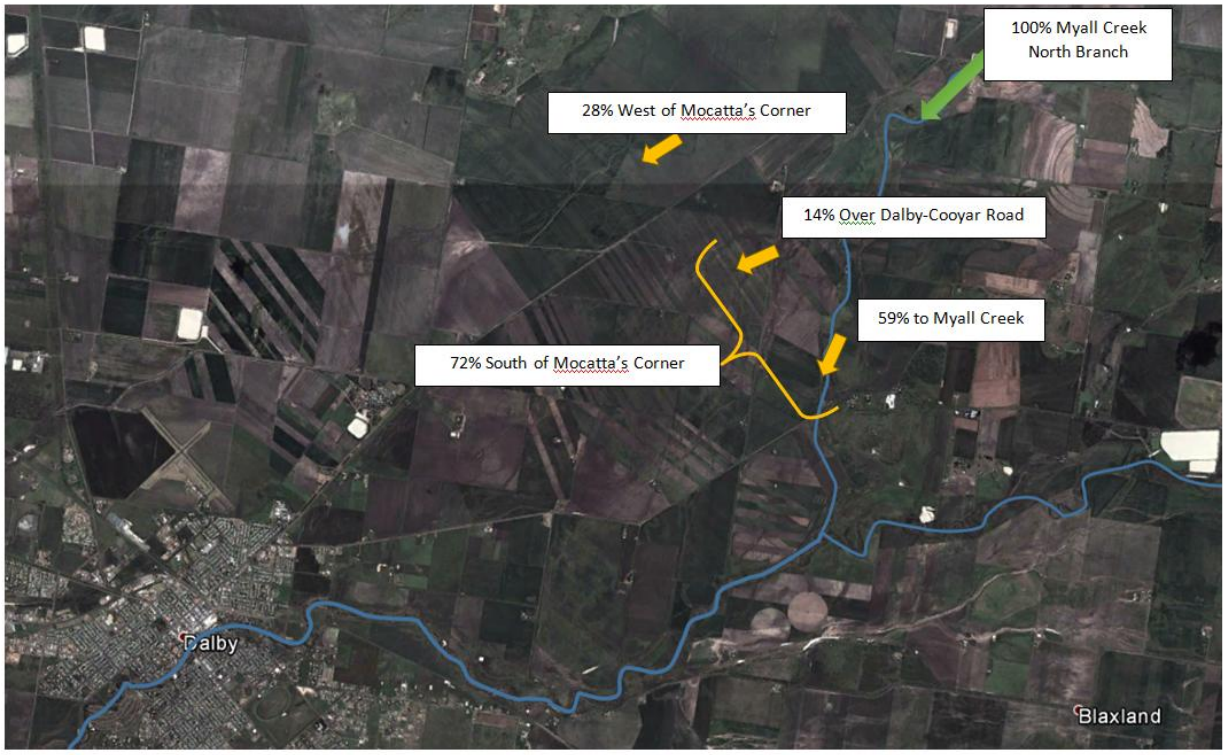
6) Need to justify low flow censoring – why pick the selected flow

An annual series of flows is not available at the Patrick St gauge as only flows that register as a "flood" are recorded. Consequently there is significant uncertainty regarding the frequency of occurrence of the lower flows present in the gauge record.

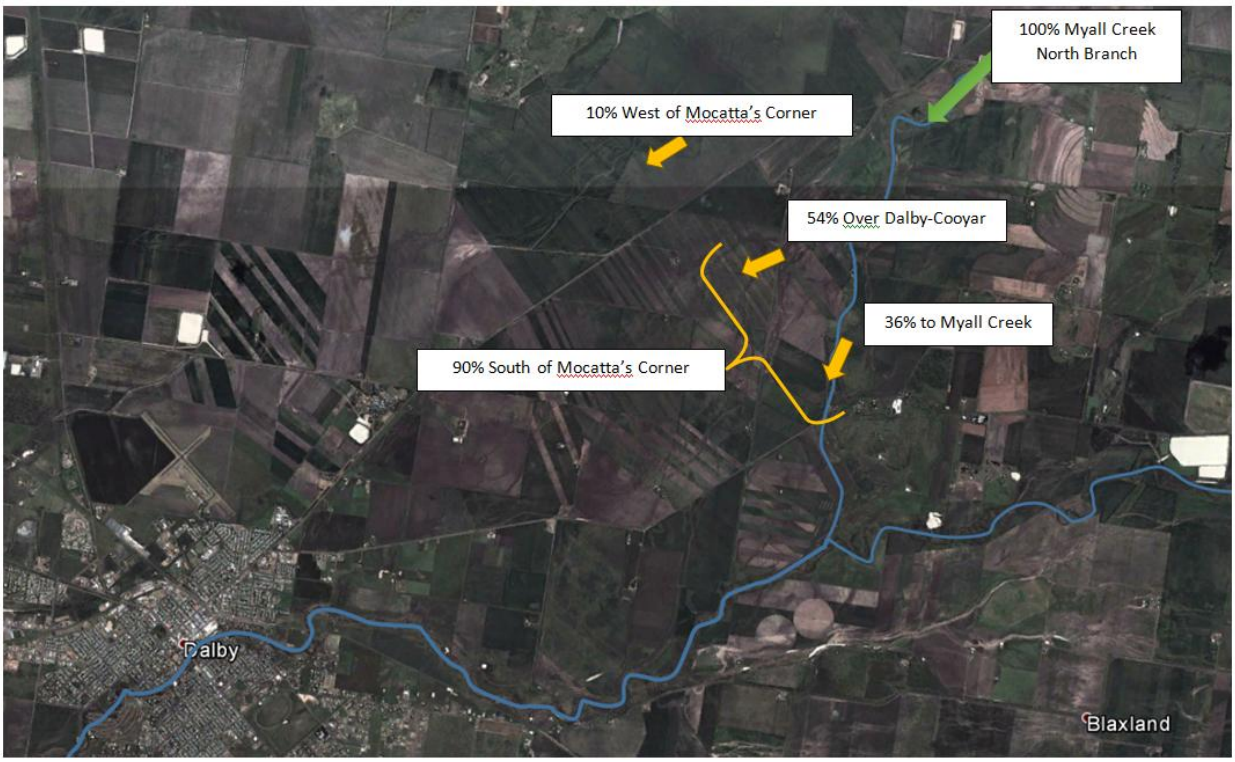
Through sensitivity testing, a value of 236m^3/s was adopted as the threshold value for low flow censoring within FLIKE. Adopting this value produced the best fit (as indicated by the confidence limits) of the available data.

7) Mocatta Flow Split

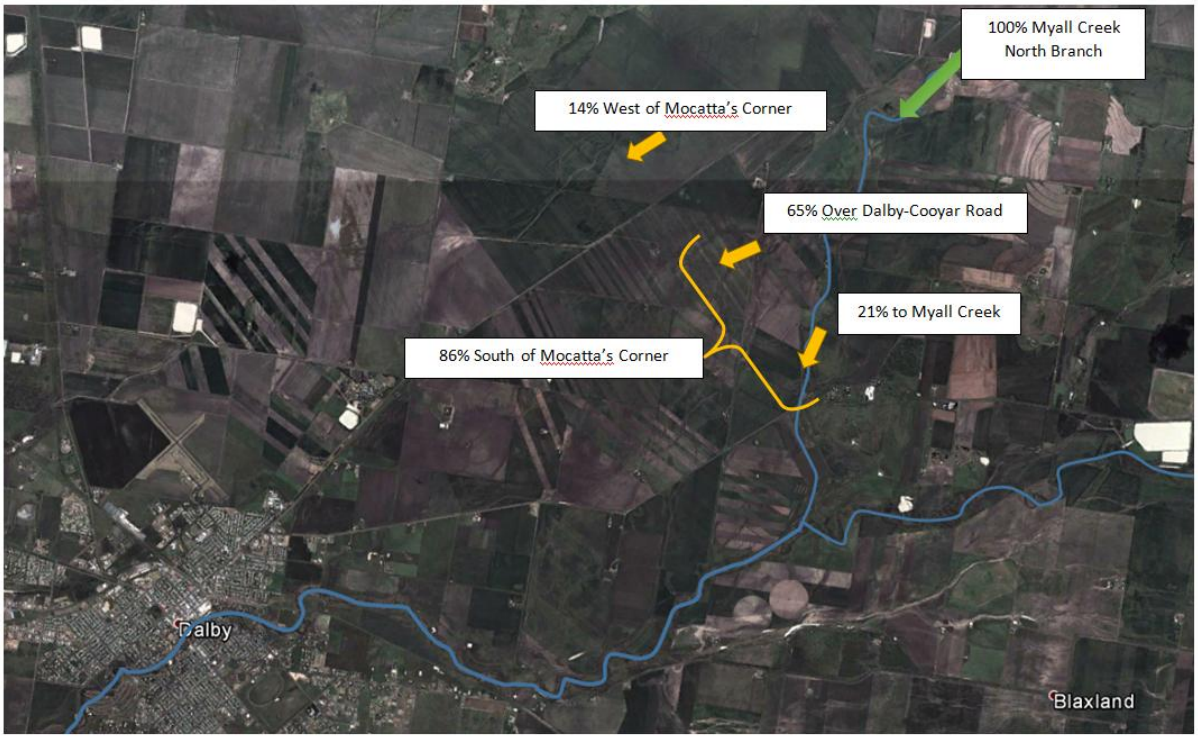
There is a discussion in Section 10.2 and Appendix I of the report. Figures below provide an indication of the changes in flow distribution between November 2012 and March 2014.



2012 Flood Splits (both Q10 and Q100)



2014 Flood Splits (Q10)



2014 Flood Splits (Q100)

8) **Executive summary includes a layout of the report which is not replicated within the report – the exec sum should stand independent of the report and vice versa.**

The additional material from the Executive Summary will be added to the text of the introduction.

Chinchilla, Miles, Jandowae, Wandoan and Tara

9) **Section inconsistencies need to be clarified – section 4.4 states no calibration was undertaken (i.e. no modelling) but other sections are focused on modelling**

Reference to the Design Rainfall Technique will be removed from the Hydrology Section of the Miles report.

10) **Methodology needs to include discussion of FFA and RFFE approaches as well as the catchment modelling approach.**

Additional explanation with regards to the FFA and RFFE approaches will be added to the relevant sections of the reports.

11) **Executive Summary contains mention of Technical Review Committee – the TRC needs to be independent**

Mention of the TRP can be removed from all versions of the report.

12) **In Miles report, section 2.8 refers to modelled roughness but the need for modelling has not been discussed yet**

The text from Section 2.8 of the Miles report can be incorporated within "Section 6 Riverine Flood Analysis". New text will be inserted in Section 2.8 to the effect of "The ultimate development maps were used to represent hydraulic roughness for planning purposes."

13) **In Miles, section 2.9 needs to be part of the methodology not prior to discussion of the methodology**

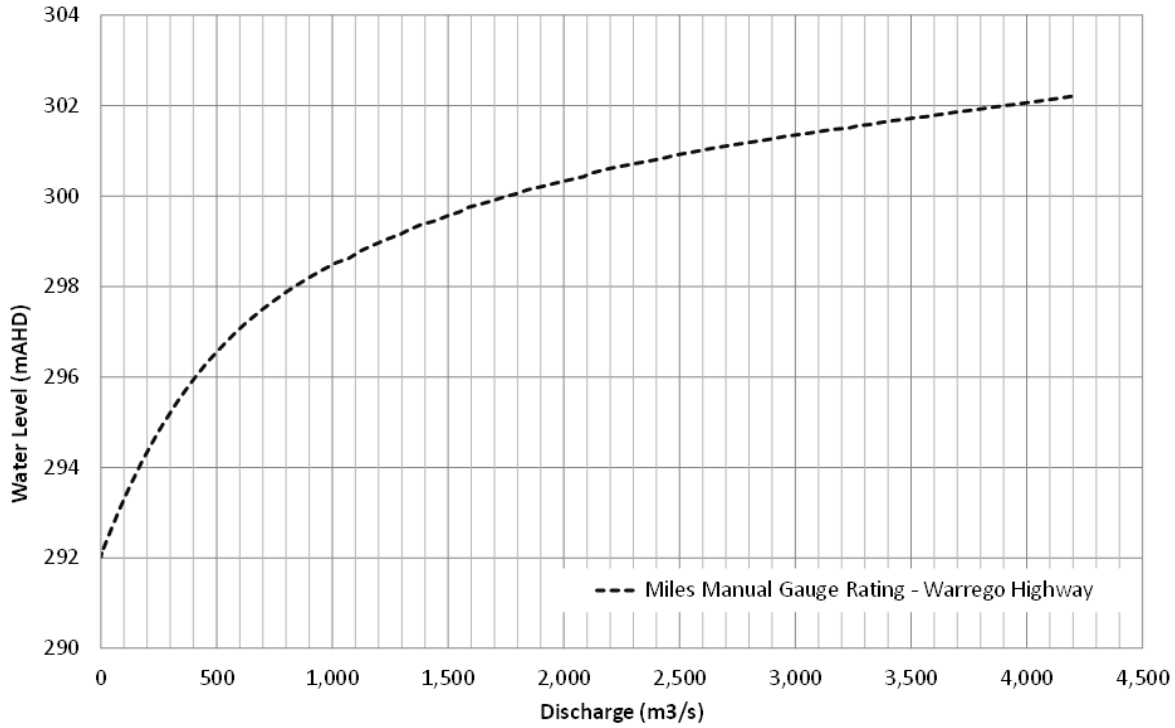
The text from section 2.9 can be incorporated in the methodology section. This comment applies to the other reports as well.

14) **A number of figures need CLs included.**

This can be provided.

15) **Derived rating curve in Miles needs to be included.**

The rating curve for Miles is included below. This will be included in the Miles report as Figure 4-3.



16) **Executive summary includes a layout of the report which is not replicated within the report – the exec sum should stand independent of the report and vice versa.**

The additional material from the Executive Summary will be added to the text of the introduction.