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1 September 2011

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By Hand

Dear Madam

Seqwater – Response to Mr Babister's report

We refer to the Commission's letter of 3 August 2011 inviting our client's response to Mr Babister's report dated 28 July 2011. Our client's response is set out below.

1. Principal conclusion in Mr Babister's report

(a) We note Mr Babister was requested by the Commission to, amongst other things, examine the effect that the implementation of different release strategies would have had upon the flooding.

(b) Mr Babister concludes:[1]

> With the information available during their operations, and using the strategies defined by the Manual, [Mr Babister] believe[s] **the Flood Engineers achieved close to the best possible mitigation result for the January 2011 flood event**.

(c) Our client agrees with this conclusion. It is a strong endorsement of the performance of the flood engineers during the event. In our client's submission, Mr Babister's conclusion should be given significant prominence in the Commission's Final Report.

(d) It is also critical to note two matters.

(e) First, the majority of the alternate release strategies analysed by Mr Babister relied upon an impossible foreknowledge of the flood. Mr Babister openly accepts this[2] and ultimately concludes that "*generally such scenarios could not have been reasonably achieved with the information available at the time*".[3]

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[1] See paragraph 16 of Mr Babister's report.

[2] See paragraphs 73, 87, 89, 90, 97, 98 and 100 of Mr Babister's report.

[3] See paragraph 102 of Mr Babister's report.

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(f) Secondly, Mr Babister's different release strategies include strategies which were not permitted under the Manual. For example:

(A) Option A involves a transition to Strategy W4 at 4pm on Monday 10 January. Our client has previously submitted that the conditions for invoking Strategy W4 were only met early on Tuesday 11 January, at the time the flood engineers actually invoked the strategy;

(B) Option B involves the lake level commencing at 75% of Full Supply Level, which was not permitted under the Moreton ROP;

(C) Option C involves a discharge at the upper limit available under Strategy W3 at a time when to do so would not have given appropriate weight to lower level objectives. As Mr Babister says:

> It is important to note that enacting this scenario would have required the dam operators to increase Wivenhoe Dam outflow to around 1,800 m^3/s by 12am on 9 January, which is similar to the peak inflow that had been received into the dam until that time, and as such the only real mitigation being provided by the dam up until that point would have been to delay the flood peak rather than reducing it.[4]

(D) Option D ignores "*restrictions from the Manual on total flow at Moggill.*"[5]

(g) Accordingly, given Mr Babister has, with the full benefit of hindsight, analysed a range of operating scenarios which include scenarios not permitted under the Manual, his conclusion that the flood engineers achieved close the best possible mitigation result is also a strong endorsement of the strategies within the existing Manual.

(h) This is not to say the Manual should not be the subject of a long term review. It should, as our client proposed and the Commission has now recommended.

(i) But any suggestion that widespread urban inundation could have been avoided in January with changes to the existing Manual is simply not supported by the evidence. It is important to bear firmly in mind Mr Babister's evidence:

> "The procedures outlined in the Manual generally provide a reasonable balance between the objectives of preserving dam safety while mitigating the damage and disruption of flooding in downstream areas".[6]

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[4] Paragraph 87 of Mr Babister's report.

[5] Paragraph 66(e) of Mr Babister's report. It is also not correct to refer to Option D as an "optimised" release strategy. This is clear from Mr Malone's second statement, upon which Option D is based.

[6] Paragraph 137 of Mr Babister's report dated 11 May 2011.

2. Other conclusions in Mr Babister's report and Seqwater's response

In the paragraphs which follow, we identify a number of conclusions within Mr Babister's report which our client wishes to comment upon.

2.1 Extent to which Wivenhoe Dam releases contributed to peak flow

(a) Mr Babister's key conclusion is:

> Gauging at Jindalee during the event, and near the peak, indicates that peak flow was approximately 10,000m^3/s. **It is estimated that non-Wivenhoe Dam and Wivenhoe Dam flows were roughly equivalent contributors to this peak value flow.**[7]

(b) Seqwater does not agree.

(c) Modelling performed by SKM indicates that **non-Wivenhoe Dam flows were the greatest contributors to the peak value flow** (see Table 7-2 on page 55 of the SKM report "Joint Calibration of a Hydrologic and Hydrodynamic Model of the Lower Brisbane River" dated 24 June 2011).

(d) Following discussions between Mr Babister and SKM, SKM revised their report. SKM's new report is attached as **Annexure A**. Whilst there has been some minor adjustments to Table 7-2, SKM's modelling concludes that non-Wivenhoe Dam flows were the greatest contributors to the peak flow.

(e) The reason for the difference between SKM and Mr Babister is revealed in paragraphs 62 and 63 of Mr Babister's report. In order to model Case 3, which is the Wivenhoe Dam flows only case, Mr Babister artificially removes any storage provided by the Bremer River (that is, he effectively prevents flows from the Brisbane River entering the Bremer River). There is no sound reason for this approach when the scenario being modelled is one which assumes no flow in the lower catchments (and therefore the entire floodplain and lower tributaries are available to attenuate flows from Wivenhoe Dam).

(f) Mr Babister otherwise does not contradict the conclusions in the SKM report (see pages 58-59 of SKM's report).

(g) Those conclusions support the following findings:

(i) The existence and operation of the dams mitigated the flooding significantly, resulting in significantly lower flood levels, and significantly reduced inundation, than would otherwise have been experienced.

(ii) If no water had been released from Wivenhoe Dam during the January 2011 event, widespread urban inundation would have occurred in any event.

[7] Paragraph 8(d) of Mr Babister's report. A similarly worded conclusion appears in paragraph 64.

2.2 Comments regarding flood volume

(a) Mr Babister concludes that:

> The total volume discharged from Wivenhoe Dam between the 9th and 16th of January was 59% of total flow in the lower Brisbane River during this period. However, the bulk of this flood volume was released after the flood peak, thereby providing flood mitigation benefits.[8]

(b) It is unclear why Mr Babister has addressed the question of flood volume; as opposed to peak flow. The correct analysis, in terms of flood levels, is to analyse the proportion of the flood peak (not volume) that was released from Wivenhoe Dam (see the penultimate dot point of **Annexure B**, being SKM's response to Mr Babister's report). This has been addressed above in section 2.1.

(c) It is also unclear why Mr Babister has arbitrarily selected the period of 9-16 January 2011 for analysis. The flood event commenced on 6 January 2011 and ended on 19 January 2011.

(d) It is not controversial that 2,650,000 ML was released from Wivenhoe Dam during the flood event and that this volume was more than the runoff from the Lockyer and Bremer catchments. But this reflects nothing more than the proportion of rainfall that fell above and below Wivenhoe Dam. It says nothing about the relative contributions to peak flow which caused urban inundation.

(e) Indeed, as Mr Babister himself says, the majority of the volume from Wivenhoe Dam was released after the flood peak, demonstrating the flood mitigation effects of Wivenhoe Dam.

(f) Accordingly, it would be wrong to draw the inference from Mr Babister's opinion on this topic that 59% of the flooding in the lower Brisbane River resulted from Wivenhoe Dam releases (as has been speculated since Mr Babister's report was made public).

(g) In any event, Mr Babister's 59% analysis is in error, as he has failed to take into account the travel time from Wivenhoe Dam. Attached as **Annexure C** is a paper prepared by Mr Malone of Seqwater which demonstrates the error in Mr Babister's analysis.

2.3 Gate openings in Strategy W4

(a) Seqwater has requested that Mr Babister provide the gate openings he has modelled for his hypothetical scenario Option A (being the earlier invoking of Strategy W4). To date, these have not been provided. Seqwater requests that the Commission provide Mr Babister's gate openings for Seqwater's consideration.

[8] Paragraph 8(b) of Mr Babister's report.

(b) Seqwater notes ongoing media speculation that the rate of releases in Strategy W4 was "panicked". These allegations simply cannot stand in the face of the following conclusions in Mr Babister's report:

(i) First, that the gate openings deployed by the flood engineers were "*a reasonable rate of opening to balance the requirements under Strategy W4*".[9]

(ii) Secondly, that "*from around 10pm on 10 January 2011 onwards, when inflows into Wivenhoe Dam began to increase towards the second peak, the gate operations strategy adopted did not have a significant influence on flood severity downstream, and the strategy adopted by the flood engineers was towards the more effective end of the range of plausible scenarios.*"[10]

(c) Seqwater requests that the Commission make findings accordingly.

2.4 Mr Babister's Option C

(a) Mr Babister's Option C involves increasing releases under Strategy W3 to the upper allowable limit as soon as possible.[11]

(b) It will be recalled that this theme was pursued during the public hearings by Mr Rangiah on behalf of a group of residents at Fernvale.

(c) Mr Babister's key conclusion is:[12]

> Option C is a more plausible alternative scenario, although it too would have required a level of foreknowledge of the flood event a key decision points that was not available at the time. While modelling indicates this approach would have produced a benefit during the January 2011 flood, no operational procedure can produce the optimal outcome for all floods. The option C approach would generally produce beneficial outcomes in floods that are large enough to eventually trigger Strategy W4, but would probably be detrimental in moderate sized floods that remain in Strategy W3.

(d) Two matters should be noted:

(i) First, as Mr Babister notes, the option depends upon a level of foreknowledge of the flood event at key decision points that was not available at the time.

(ii) Secondly, Seqwater's analysis confirms Mr Babister's conclusion in paragraph 98 that such approach would probably be detrimental in moderate sized floods. In this regard, attached as **Annexure D** is Seqwater's analysis which demonstrates that for five earlier floods, implementing Option C would have produced a significantly worse result

[9] Paragraph 69 of Mr Babister's report.

[10] Paragraph 75 of Mr Babister's report.

[11] Paragraph 85 of Mr Babister's report.

[12] Paragraph 98 of Mr Babister's report.

than was encountered in following the Manual. For completeness, Mr Babister's Option D has also been modelled and it also produces a significantly worse outcome in these earlier flood events.

2.5 Some context for all of the suggested reductions in flood levels

(a) In Table 1 (page 3), Mr Babister identifies the modelled peak flood level difference relative to the modelled outcome of the January flood event.

(b) Seqwater cannot comment upon the accuracy of the modelled results for Option A without considering the gate openings used by Mr Babister (see paragraph 2.3(a) above).

(c) However, whilst Mr Babister has identified possible reductions in flood levels at various locations, it is important to note three matters.

(d) First, Mr Babister himself concludes that "*generally such scenarios could not have been reasonably achieved with the information available at the time*".[13]

(e) Secondly, Mr Babister's different release strategies include strategies which were not permitted under the Manual (see paragraph 1(f) above).

(f) Thirdly, it is appropriate to consider those reductions within the context of the overall flow at each location. Mr Babister's table has been reproduced below by SKM to show the reductions as a proportion of the pre-flood flow depth at each location.

	From Table 1, WMAwater Report					Estimated from MIKE-11 model results			
Location	Case 1	Option A	Option B	Option C	Option D	Option A	Option B	Option C	Option D
	Peak Level (mAHD)	Peak level difference c.f. Case 1 (m)				Peak level difference c.f. Case 1 (% of flow depth above pre-flood levels)*			
Moggill	17.6	-0.3 to 0.4	-0.7	-0.7	-0.9	-2% to 2%	-4%	-4%	-6%
Jindalee	13.1	-0.3 to 0.4	-0.6	-0.6	-0.8	-2% to 3%	-5%	-5%	-7%
Oxley	8.3	-0.2 to 0.3	-0.5	-0.5	-0.6	-3% to 4%	-7%	-7%	-8%
Brisbane Port Office	4.6	-0.1 to 0.3	-0.3	-0.3	-0.4	-2% to 7%	-8%	-8%	-10%

* Note: "pre-flood levels" denote flow in the river on 3rd January, prior to the rise of the flood.

2.6 Criticisms of SKM model

Seqwater notes and relies upon SKM's response to Mr Babister's report (**Annexure B**).

[13] See paragraph 102 of Mr Babister's report.

3. Further Submissions

We note the Commission has called for submissions from the public and the other parties in respect of Mr Babister's report. Please provide us with any submissions the Commission receives so that our client may consider them.

Our client is also proceeding on the basis that the Commission's Final Report will be provided in draft to our client for comment (as the Interim Report was). If this is not correct please let us know as our client wishes to make submissions as to the contents of the Final Report having regard to Mr Babister's modelling and SKM's modelling.

Yours faithfully

[redacted]

Michael Ilott
Partner
[redacted]

Annexure B – SKM's response to Mr Babister's report of 28 July 2011

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Michael Ilott
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25 August 2011

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VW06459

Dear Mr Ilott

Comments on "Review of Hydraulic Modelling Final Report" prepared by WMAwater for Queensland Flood Commission of Inquiry, July 2011

I am writing to provide comment on the above report. Attention is given only to those aspects of the report that we think detract from the main conclusions drawn.

Summary

The Commission of Inquiry appointed Mr Babister of WMAwater to review the hydrodynamic model issued by SKM on 24th June 2011. After some initial discussions with Mr Babister an adjustment was made to one of the model parameters. Hydrodynamic modelling is a complex process, and initial refinements such as this are quite normal. This particular refinement assisted with the model stability but had no material impact on the results.

A second version of the model was issued by SKM on 7th July 2011. This version was also reviewed by WMAwater against a range of standard metrics and was found to be well configured and calibrated; they concluded it was a suitable tool for assessing the alternative scenario being considered by the Commission of Inquiry.

The WMAwater review refers to "limitations" of the model; none of these relate to the suitability of the model for assessing the various scenarios, but rather refer to the additional work that would be desirable before the model was used as a flood forecasting tool. These recommendations for additional work were all clearly identified in the initial SKM report.

There are a number of comments in the WMAwater report that are misleading and/or over-stated, or else not relevant to the results presented. Overall we feel that these deficiencies distract the reader from the main conclusions reached, of which we are in agreement.

More detailed comments

The WMAwater review (Rev 2, dated 28 July 2011) describes how after initial discussion between WMAwater, Seqwater and SKM, the resistance type in Version 1 of the MIKE-11 model (SKM, issued 24 June 2011) was modified and the model recalibrated (SKM, issued 7 July 2011). The only difference between Version 1 and 2 of the MIKE 11 model was the change in the resistance type, including the concomitant re-calibration of the model.

It is to be noted that a good calibration was achieved with both models and it is clear from the results presented that the peak water levels for the various scenarios presented are not sensitive to the differences in resistance approach adopted. It is reasonable to state that the model refinement yielded an improvement in model stability and representation of modelled velocities, however these improvements have no impacts on the flood levels that were the subject of the WAMwater review.

The WMAwater review states that the "issues" with the Version 1 of the model are described as both "significant" (para 4) and "serious" (para 32). Given that the results of interest are unchanged between Version 1 and Version 2 of the model, it is considered that the WMAwater comments are over-stated and misleading.

There are several other areas where the WMAwater report creates an incorrect or misleading impression, or else are not relevant to the results presented. In brief:

- Paragraph 31 (and Figure 4) completely misrepresents the impact of changing resistance type on the model results. The resistance type of the cross-sections defines how roughness values are used to calculate conveyance, and therefore it must be expected that different values should apply when changing resistance types. Simply changing the resistance type without providing an associated change in the roughness values does not provide any insight into the accuracy of the model.

- Paragraphs 43 and 54: the suggestion that some cross-sections in the Brisbane River component of the model are subject to extrapolation error and thus over-predict water levels is erroneous. There are only 5 locations (out of a total of 273) where the modelled water levels exceed cross-section levels. At each of these locations, floodplain storage has been separately defined using other model branches, link channels or off-stream storages. As such, the model accounts for storage volume above the limits of the cross-section topography and there will be minimal, if any, water level over-prediction. While the final version of the report includes a subsequent note that moderates the preceding text, the overall messaging is poorly balanced and is thus misleading.

- Paragraphs 28c and 46: It is overstating the case to suggest that roughness values in the Version 1 model were 'artificially high'. The largest change in roughness values from Version 1 to Version 2 of the model occurred in the reach from the Port Office to Moreton Bay, where roughness decreased from 0.036 in Version 1 to 0.024 in Version 2. These values are within the published range (Version 1 roughness values were generally at the higher end of the expected ranges for the lower Brisbane River, and Version 2 values are well within the expected ranges).

- Paragraphs 28d, 55 and 56b: Comments regarding "excessive" run times or the event-specific nature of selected inputs are only relevant to the general utility of the model for real-time flood operations; they are completely irrelevant to the investigations reported on.

- Paragraph 52: SKM is strongly of the belief that the adopted approach represents a pragmatic and effective way to calibrate the lower reaches of the model in a manner that avoids artificial adjustment of the inflows. There is considerable complexity in the combined hydrologic and hydraulic rationale that underpins the approach taken, though suffice to say here that the approach made best use of the available information and provided the most appropriate way to calibrate the model and assess scenarios at the key gauges in the Lower Brisbane River.

- Paragraph 56(f): The recommendation to verify the model to further events is consistent with the conclusions made in the SKM technical report. Given the time constraints of the project, the focus was on modelling the January 2011 event, though subsequent modelling confirm that the adopted model parameters from calibration to the January 2011 event are likely to provide good matches to the recorded levels from other events.

- Paragraph 8(b), 59, & 93: While the statement that 59% of the flood volume passed through Wivenhoe Dam is strictly correct for the period between 9th and 16th of January, it needs to be recognised that an entirely different figure would be derived if a different period was selected. No justification is provided for the period adopted, and if there was an interest in the source of the flood volume then it would be more appropriate to consider the period between 9th and 20th January (ie the start and end of the entire flood hydrograph). That said, any such analysis merely reflects the proportion of rainfall that fell above and below the dam; however, in terms of *flood levels*, it is considered that there is more value in restricting comments to the proportion of the flood *peak* (not volume) that was released through the dam.

- Paragraph 6 (and elsewhere): The comments regarding the need to improve the representation of the Lockyer and Bremer rivers and verify the model to additional events are consistent with the recommendations in the SKM report and are supported.

It is recognised that WMAwater had limited time to review the model and associated reporting and then produce their substantial review report. However, it is considered that the above-mentioned issues have the potential to distract the reader from the key conclusions reached, and thus materially detract from the value of the review.

I would be happy to provide further information as required.

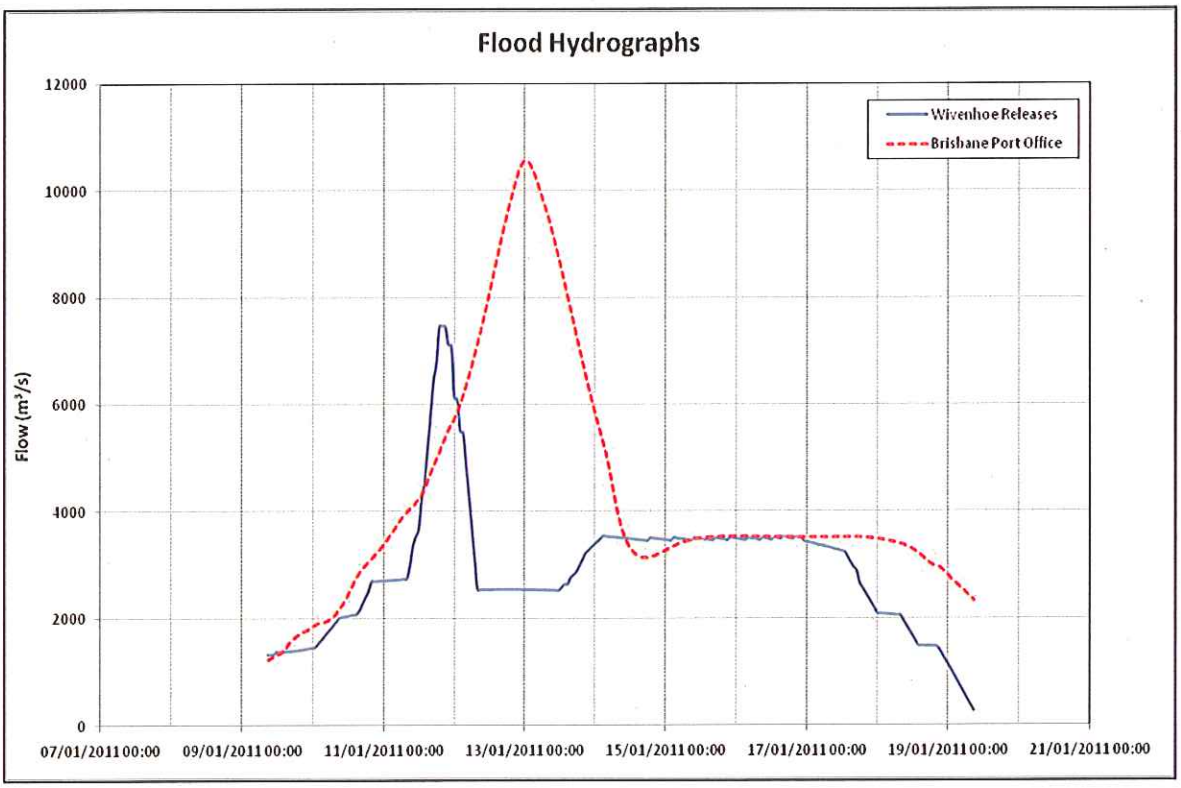
Yours sincerely

[redacted]

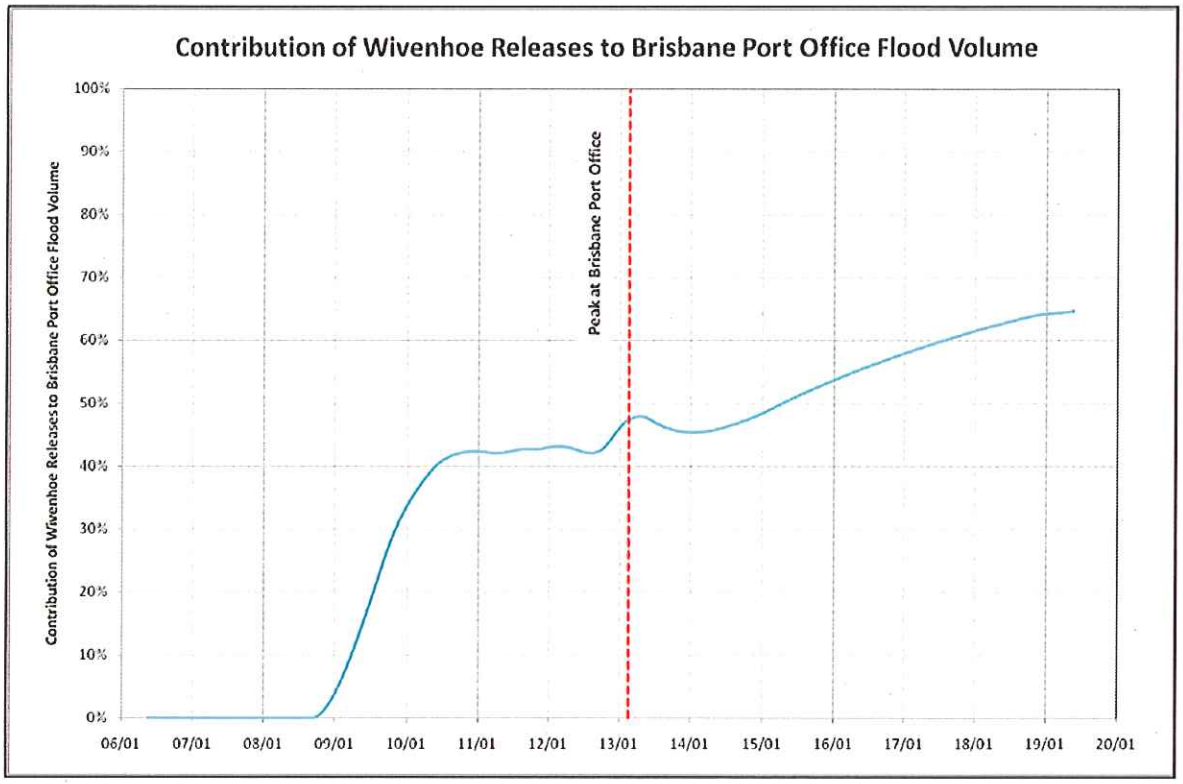
Dr Rory Nathan
Practice Leader Hydrology
[redacted]

Annexure C – T Malone analysis of Mr Babister's 59%

1. It has been suggested in Mr Babister's report that the total volume discharged from Wivenhoe Dam between the 09/01/2011 and 16/01/2011 was 59% of all the flow volume in the lower Brisbane River.
2. This figure overestimates the contribution of Wivenhoe because it ignores the travel time between Wivenhoe Dam and Brisbane Port Office.
3. Typically flood water takes approximately 27 hours to reach the Port Office from Wivenhoe.
4. Between 06/01/2011 09:00 and 13/01/2011 03:00, the time of the peak at the Brisbane Port Office, the estimate flood volume at the Port Office was about 1,700,000ML.



5. Twenty seven hours prior to this time, the volume released from Wivenhoe was only 860,000ML, just below 50% of the total at Brisbane Port Office as indicated on the figure below.



6. By the end of the event, the Wivenhoe releases amounted to 2,650,000ML of the total of estimated total of nearly 4,000,000ML at the Port Office gauge, equivalent to about 65% of the total flood volume at the Port Office.

Annexure D

The following table is based on the current Flood Damage Tables developed by the Brisbane City Council and does not consider flood impacts outside the Brisbane City Council area.

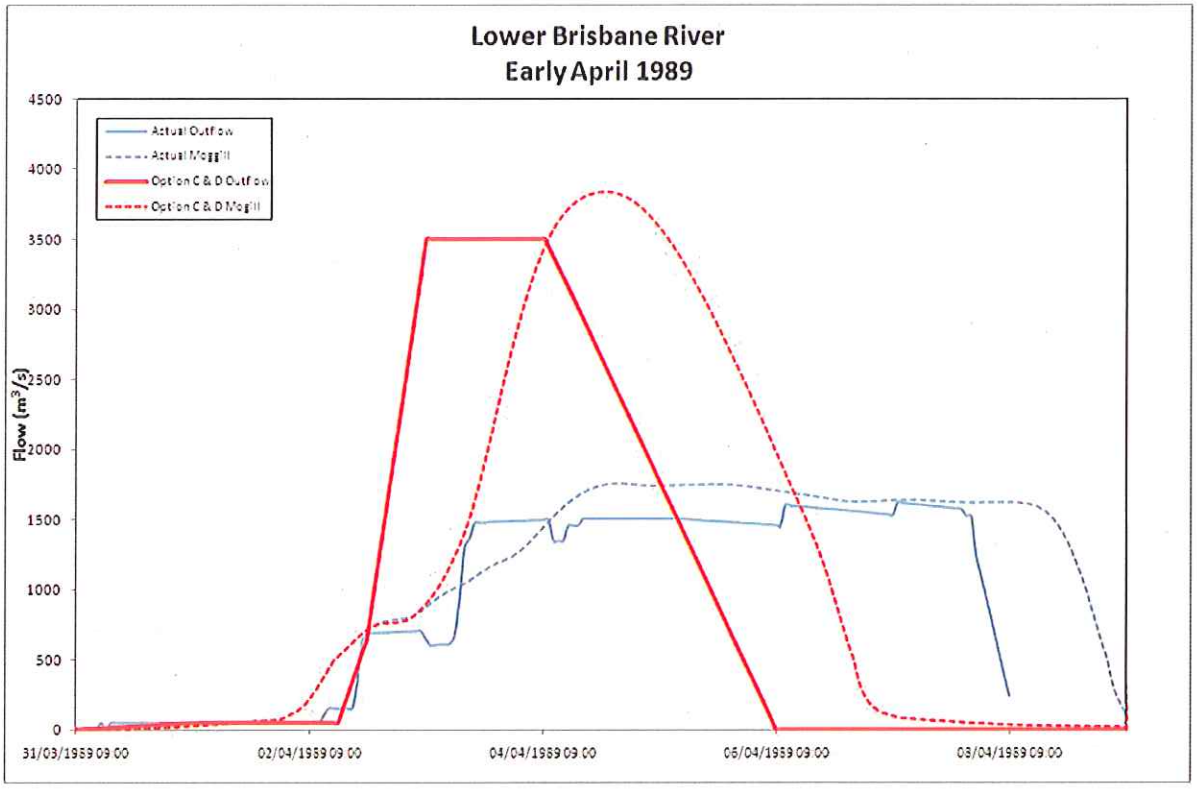
The table shows that the direct financial impact of an early release strategy (similar to that proposed in Options C and D of the WMAwater report) for five of the flood events that occurred in 1989, 1999 and 2010 would have approached $50 million per flood event (2010 dollars) in the Brisbane City Council area alone.

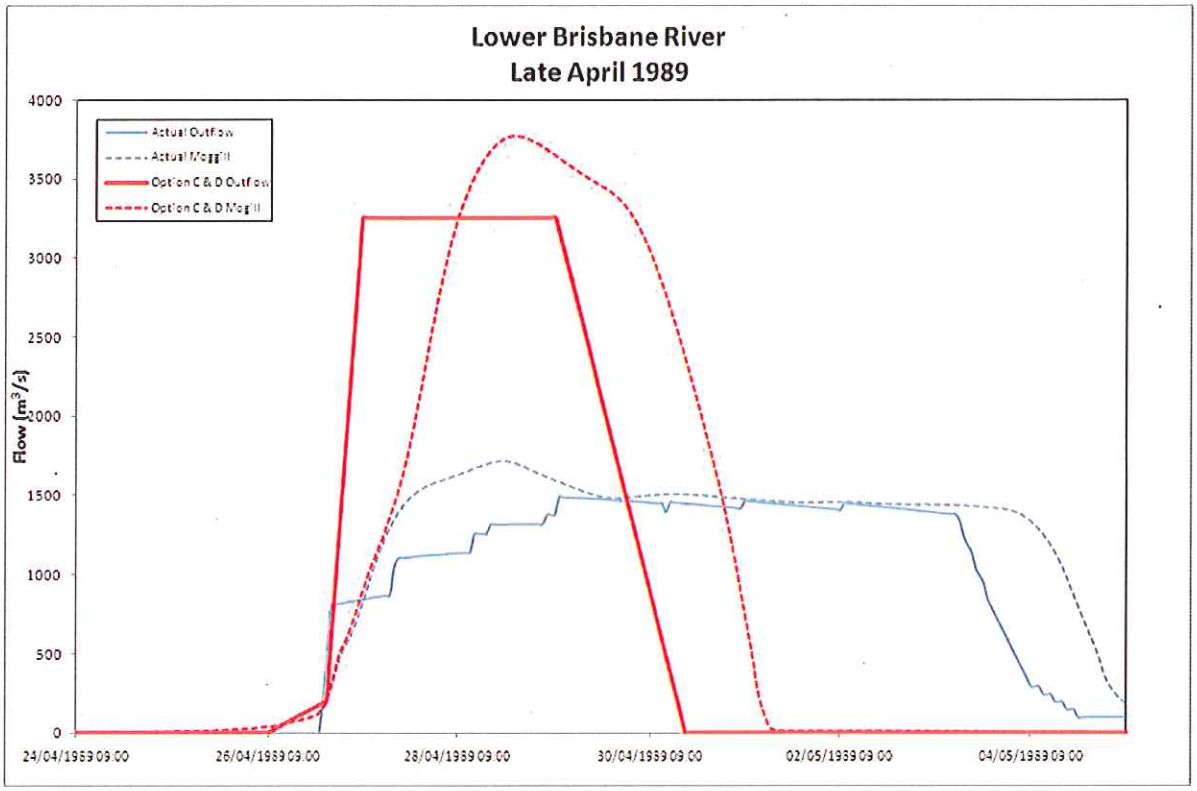
The costs shown in the table do not include the following additional impacts:

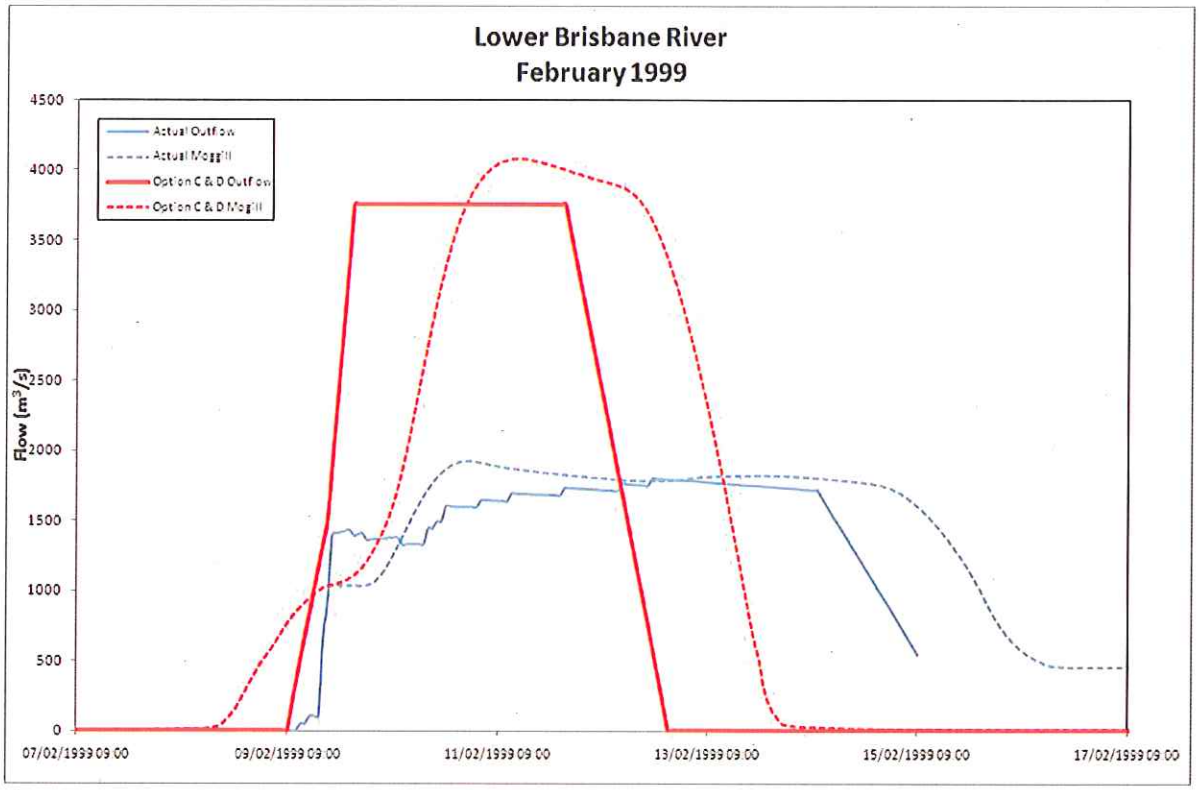
- The impact of the closure of the Brisbane Valley Highway (National Highway 17).
- The impact of isolating residential communities due to the closure of Fernvale Bridge and the Mt Crosby Weir Bridge.
- Direct and indirect flood impact costs affecting the Somerset Regional Council area.
- Direct and indirect flood impact costs affecting the Ipswich City Council area.
- Indirect flood impact costs affecting the Brisbane City Council area.

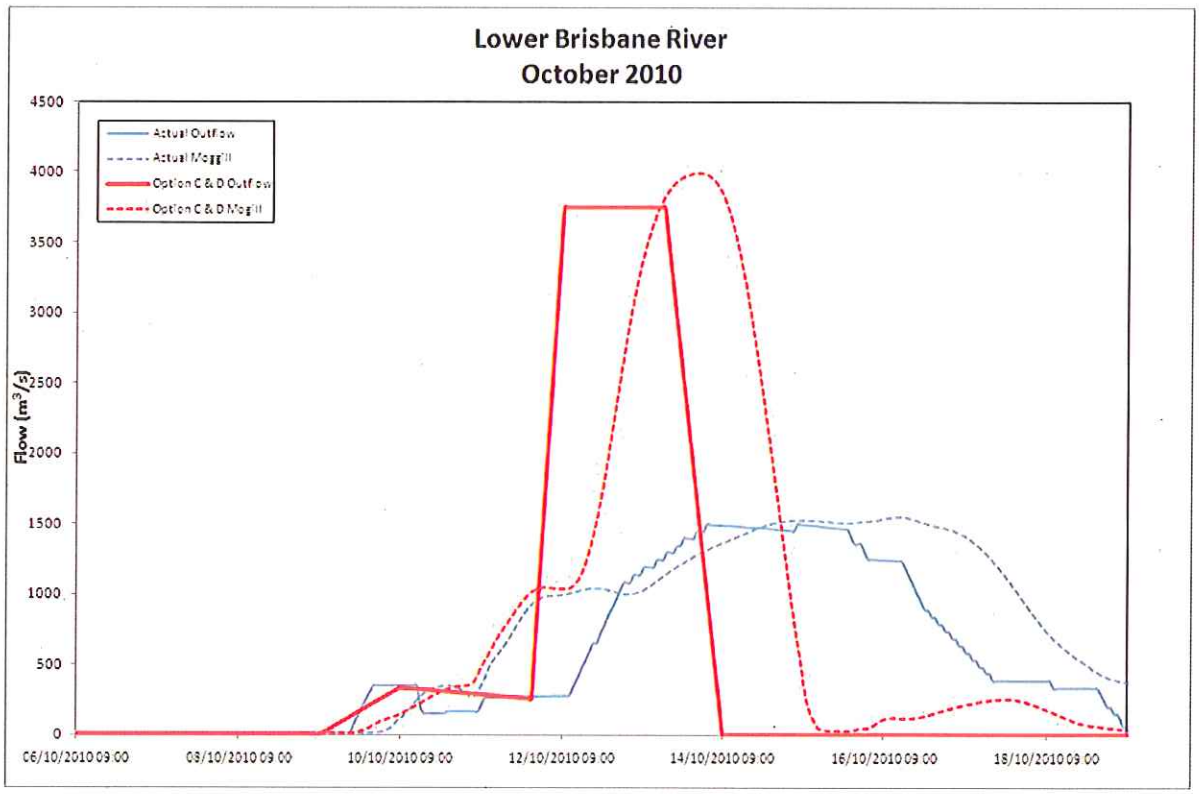
Flow at Moggill (m^3/s)	2000	3000	4000
Residential Properties Impacted	1756	2600	5325
Estimated Commercial/Industrial Damage	$1,081,663	$ 2,941,054	$ 29,421,876
Estimated Residential Damage	$ 726,527	$ 2,683,657	$ 17,801,777
Estimated Total Damage	$1,808,190	$ 5,624,711	$ 47,223,653

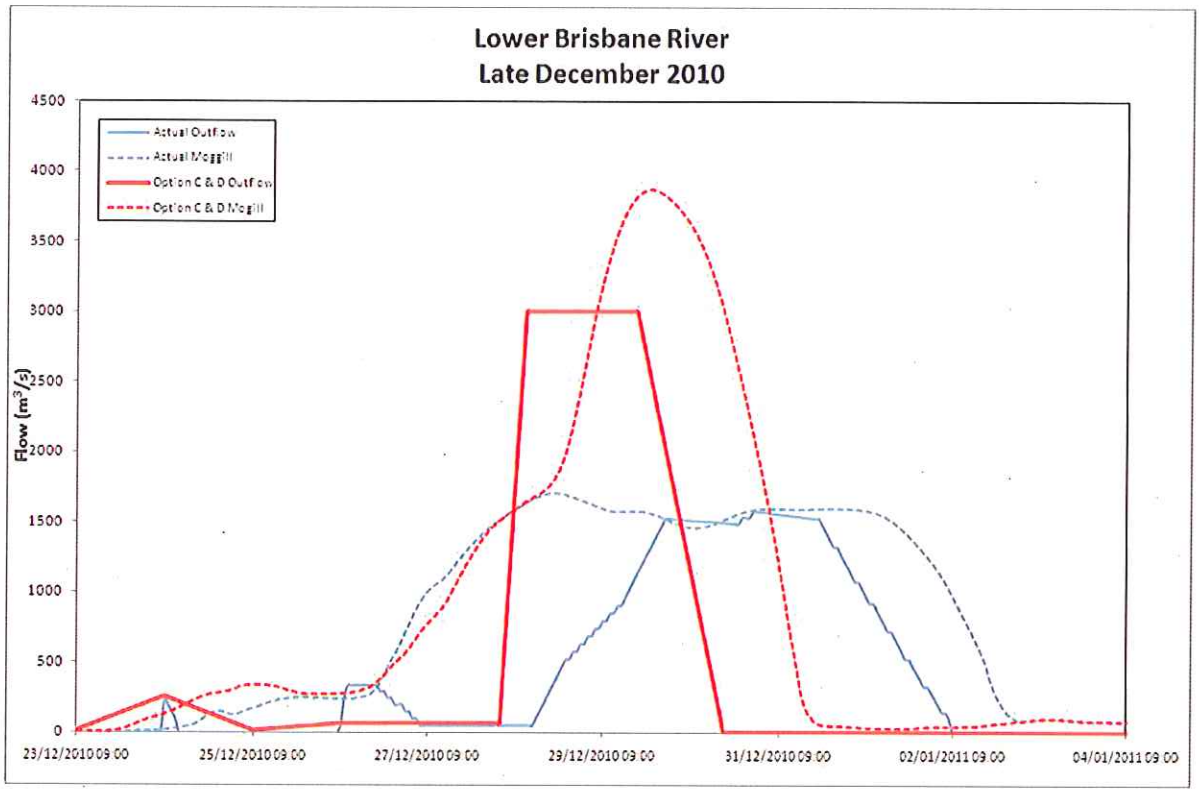
The following graphs show the actual Wivenhoe outflows and flows at Moggill for five flood events that occurred in 1989, 1999 and 2010, plotted against Wivenhoe outflows and flows at Moggill assuming an early release strategy consistent with Option C and Option D as contained in Mr Babister's report.


Lower Brisbane River
Early April 1989
Actual Outflow
Actual Mogill
Option C & D Outflow
Option C & D Mogill
Flow (m³/s)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
31/03/1989 09:00
02/04/1989 09:00
04/04/1989 09:00
06/04/1989 09:00
08/04/1989 09:00


Lower Brisbane River
Late April 1989
Actual Outflow
Actual Mogill
Option C & D Outflow
Option C & D Mogill
Flow (m³/s)
4000
3500
3000
2500
2000
1500
1000
500
0
24/04/1989 09:00
26/04/1989 09:00
28/04/1989 09:00
30/04/1989 09:00
02/05/1989 09:00
04/05/1989 09:00


Lower Brisbane River
February 1999
Actual Outflow
Actual Moggill
Option C & D Outflow
Option C & D Moggill
Flow (m3/s)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
07/02/1999 09:00
09/02/1999 09:00
11/02/1999 09:00
13/02/1999 09:00
15/02/1999 09:00
17/02/1999 09:00


Lower Brisbane River
October 2010
Actual Outflow
Actual Moggill
Option C & D Outflow
Option C & D Moggill
Flow (m3/s)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
06/10/2010 09:00
08/10/2010 09:00
10/10/2010 09:00
12/10/2010 09:00
14/10/2010 09:00
16/10/2010 09:00
18/10/2010 09:00


Lower Brisbane River
Late December 2010
Actual Outflow
Actual Moggill
Option C & D Outflow
Option C & D Moggill
Flow (m³/s)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
23/12/2010 09:00
25/12/2010 09:00
27/12/2010 09:00
29/12/2010 09:00
31/12/2010 09:00
02/01/2011 09:00
04/01/2011 09:00