

# **Brisbane River 2011 Flood Event - Investigation into Causes of Property Inundation**

REVIEW OF FOUR INSURANCE MATTERS -  
DECEMBER 2011

- Version A
- 14 December 2011



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## 1. Introduction

1. This report has been prepared in response to a Brief from the Queensland Floods Commission of Enquiry (the "Commission"). The Commission requested that Sinclair Knight Merz "*review the information used by insurers in four different cases to determine claims..... The purpose of the review is to give your opinion on whether in each case the information used was adequate to conclude the cause of inundation. If in any case your view is that the information was inadequate to conclude the cause of inundation, could you please specify in what ways the information was inadequate.*"
2. The claims relate to the matters of:
  - Judith Dobrowa;
  - Robert Clements;
  - Gary Lobleby; and
  - Julian Chambers.
3. Background information provided by the Commission is attached as Appendix A.
4. In the matter of Judith Dobrowa, the Commission requested responses to additional questions as follows:
  - *Whether the opinion/report of the loss assessor (who is not a hydrologist) alone provided a sound/reliable basis for the insurer to conclude that flood had caused the damage to the property?*
  - *What weight can be given to the assessor's report in reaching a conclusion as to the cause of inundation? Again, you can assume that neither the assessor nor the person relying on the report was a hydrologist.*
  - *Whether the set of questions contained in Annexure 7 to Mr Merchant's statutory declaration would provide a sound/reliable means of ascertaining whether damage at a particular property had been caused by flood or stormwater?*
  - *"The review of the report for 12/13 Bridge Street, Redbank, Ipswich (paragraph 26(c)) (Queensland Floods Commission of Enquiry, "Brisbane River 2011 Flood Event – Investigations onto Causes of property Inundation – Review of Insurance reports", Version A, 5 November 2011, by Sinclair Knight Merz) comments on the flood extent mapping in the ICA Ipswich LGA report..... The question relates to the "Matter of Judith Dobrowa"..... The insurer in that case relied on flood mapping provided by the ICA - could you advise if the mapping used in that case is that contained in the ICA report (it will be the report for*



*Brisbane) and, if so, whether the concerns you expressed about those maps apply in Mrs Dobrowa's case."*

5. A summary of the qualifications and experience of the authors of this report are provided in Appendix B.



## 2. Review of Matters

### 2.1. Overview

6. As indicated in SKM's Review of Insurance Reports (Queensland Floods Commission of Enquiry, "Brisbane River 2011 Flood Event – Investigations onto Causes of property Inundation – Overview of Insurance reports", Version A, 5 November 2011, by Sinclair Knight Merz), flooding can be assigned as the causes of inundation to a specific property provided there is evidence that (paragraph 11):
  - a) *the property was within an area of inundation, based on either aerial photography or a flood extent derived from peak water levels and appropriately accurate terrain data, or that peak water levels in the waterway adjacent to the property were above property levels;*
  - b) *local rainfall was unlikely to have been sufficient to significantly surcharge the local drainage system; and*
  - c) *in instances where the insurer provides coverage against "flash flooding", the property was inundated at least 24 hours after the commencement of the catchment rainfall that caused the inundation."*
7. We have been advised that none of the insurers provided coverage for "flash flooding" in any of the four cases under consideration in this current report.
8. The issues to consider in determining whether or not the information used was adequate to conclude the cause of inundation in each of the four cases are the strength of the evidence indicating that:
  - a) *the property was within an area of inundation, based on either aerial photography or a flood extent derived from peak water levels and appropriately accurate terrain data, or that peak water levels in the waterway adjacent to the property were above property levels;*
  - b) *local rainfall was unlikely to have been sufficient to significantly surcharge the local drainage system*
9. The area hydrology reports for the Brisbane and Ipswich LGAs commissioned by the Insurance Council of Australia ("the ICA report, Volume 2", and "the ICA report, Volume 3"), both dated 20<sup>th</sup> February 2011, note that "*the piped drainage system across the Brisbane City/Ipswich City LGA is expected to have the capacity to handle storm events of at least 2-*



*Year ARI in most areas.*” These same reports tabulate the ARI<sup>1</sup> of storm events at a number of locations in the Brisbane and Ipswich City LGAs around the time of the January 2011 flood event. In cases where these storm events had an intensity of less than the 2-Year ARI, it is considered most unlikely that they would have been sufficient to surcharge the local drainage system.

## 2.2. Matter of Judith Dobrowa

10. The address of this property is 12 Carnegie Street, Westlake.
11. As indicated in Appendix A, the information the insurer relied on comprised:
  - the insured’s responses to questions from the insurer;
  - Worley Parsons’ South East Queensland Weather Report dated 18<sup>th</sup> February 2011;
  - a loss adjustor’s report, based on discussions with the insured and inspection of the property;
  - flood mapping provided by the Insurance Council of Australia;
  - aerial photography available from [www.nearmap.com](http://www.nearmap.com); and,
  - Google Maps (satellite imagery).
12. Although not relied on by the insurer, relevant information from the following sources was also reviewed during preparation of this current report:
  - area hydrology report for the Brisbane LGA commissioned by the Insurance Council of Australia (“the ICA report, Volume 2”) dated 20 February 2011; and
  - Queensland Reconstruction Authority interactive flood map.
13. The loss adjustor’s report indicates that “*the high water mark in the house was at approximately 45 cm*”. These reviewers were unable to obtain a copy of the aerial flood photography from the [www.nearmap.com](http://www.nearmap.com) site, relied on by the insurers, during the preparation of this report. It has been possible, however, to view a NearMap aerial flood photograph of another site in Brisbane, and this clearly shows the extent of flood inundation to individual property scale. If the quality of imagery relied on in the Dobrowa case was similar to this, then it is considered likely that this will have clearly shown the extent of inundation in the vicinity of the Dobrowa property. The Queensland Reconstruction Authority interactive flood map was not relied on by the insurers. It should nevertheless be noted that whilst this property is on the edges of the “2010-11 Interim Flood Lines” shown on

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<sup>1</sup> The “ARI” of an event is another way of expressing the probability that the rainfall of a given depth is exceeded in any one year, where, for example, a “2 year ARI” represents an annual probability of exceedance of “1 in 2” (ie a 50% chance of exceedance).





this mapping, the vast majority of this property is clearly within these flood lines. The ICA report Volume 2 was also not relied on by the insurers. The resolution of the maps in the ICA report is not adequate to determine whether or not the property was within the maximum flood inundation extent.

14. The Worley Parsons' report indicates that peak rainfall intensity in the Brisbane region around the time of the January 2011 event was between 1 and 2 years ARI. Whilst not relied on by the insurers, this assessment is reasonably consistent with the ICA report Volume 2, which indicates that the intensities associated with local rainfall in the vicinity of the property were of the order of 1-Year ARI. As noted in paragraph 9 above, peak rainfall intensity of 1 to 2 year ARI is considered unlikely to have been sufficient to surcharge the local drainage system.
15. In our opinion the information relied on was adequate to support the conclusion that the inundation was caused by flooding. Based on the assumptions noted in paragraph 13 above it is likely that the evidence relied on showed that the property was within an area of inundation, the local rainfall was unlikely to have been sufficient to surcharge the local drainage system, and the reported depth of inundation was unlikely to have been caused by local stormwater runoff resulting from this relatively low intensity rainfall event.

**Responses to specific questions on this matter:**

*Whether the opinion/report of the loss assessor (who is not a hydrologist) alone provided a sound/reliable basis for the insurer to conclude that flood had caused the damage to the property?*

16. The loss assessor's report makes no reference to any local rainfall intensity or associated analyses, or to any flood inundation extent mapping or photography. As indicated previously, it notes that "*the high water mark in the house was at approximately 45 cm*". The report includes responses to a number of questions put to the insured:
  - The insured did not know the date of the heaviest rainfall and when it stopped;
  - The insured noted that the property was inundated on 13 January 2011, but did not know at what time the inundation peaked;
  - Inundation was preceded by "toilets and tubs" spilling sewage into the home, commencing at 2am on 13 January 2011;
  - The insured indicated that water came "From the toilets and drains, and then, later, from the Brisbane River behind the houses across the street and from Mount Ommaney Creek, which overflowed, a couple of blocks behind their home."



17. In our opinion, the information contained in the loss assessor's report is only just barely sufficient to support a conclusion of inundation by flooding. The most significant evidence in support of the conclusion is the insured's response to the question around the direction from which the water came onto the property (ie from the Brisbane River and Mount Ommaney Creek), and the inference in this response that the property is very close to both those waterways. Given this, and the depth of inundation (45 cm) it would be difficult to conclude that the inundation was caused by a process other than flooding. Nevertheless, the conclusion would have been greatly strengthened by one or more of the following:
- comparison of peak flood levels in the Brisbane River adjacent to the property with reported inundation levels in the property;
  - analysis of local rainfall intensity;
  - analysis of relative timing of rainfall and inundation; and
  - inspection of aerial flood photography.

*What weight can be given to the assessor's report in reaching a conclusion as to the cause of inundation? Again, you can assume that neither the assessor nor the person relying on the report was a hydrologist.*

18. In our opinion, as noted in paragraph 17 above, the information contained in the loss assessor's report is only just barely sufficient to support a conclusion of inundation by flooding. The most significant evidence is the insured's observation that the water came from the Brisbane River and Mount Ommaney Creek. Whilst we are not aware of this particular insurance company's definition of flood, most other insurance companies' definitions (refer Queensland Floods Commission of Enquiry, "Brisbane River 2011 Flood Event – Investigations onto Causes of property Inundation – Review of Insurance reports", Version A, 6 November 2011, by Sinclair Knight Merz) relate this to overtopping or overflow from a waterway. In our opinion, no hydrological expertise would therefore be required to conclude that the insured's observations would constitute flooding as defined by most insurance companies.

*Whether the set of questions contained in Annexure 7 to Mr Merchant's statutory declaration would provide a sound/reliable means of ascertaining whether damage at a particular property had been caused by flood or stormwater?*

19. It is understood that these question do not relate specifically to Dobrowa property, but rather were formulated for the assessment of any specific property. The 'set of questions' referred to is as follows:
- a) What type of house is on the property – low set, highest, double storey, split level, etc?



- b) Is the house on stumps or slab on-ground?
- c) Approximately how high is the habitable floor level above surrounding ground level?
- d) Is the ground level at the house higher than the street level?
- e) What date and time was the rain heaviest?
- f) What time did the heavy rain stop?
- g) When did the property get inundated (date)?
- h) What time did the inundation of the property (yard) commence?
- i) What time did water come into the house, garage, shed, etc?
- j) What date and time did the water level in the property peak?
- k) At its peak, how deep was the water inside the house, garage, shed, etc?
- l) At its peak, how deep was the water in the yard?
- m) Which direction did the water come into the property?
- n) Was the water inundating the property 'clean' or 'dirty'?
- o) Was there any and if so what damage caused by rainwater through the roof or by overflowing gutters?

20. From our understanding of usual insurance company definitions (refer Queensland Floods Commission of Enquiry, "Brisbane River 2011 Flood Event – Investigations onto Causes of property Inundation – Review of Insurance reports", Version A, 6 November 2011, by Sinclair Knight Merz), flooding is characterised by overtopping of a waterway or similar, where stormwater is characterised, amongst other things, by surcharge of a drainage system. It appears that the questions listed in Paragraph 19 are intended to draw out some of the more common expected differences between flooding and drainage system surcharge, namely:

- (a) Inundation resulting from surcharge of a drainage system would usually be expected to occur at the same time as, or shortly after, intense local rainfall. Questions e) to j) in paragraph 19 relate to this. Whilst less usual, there could however be circumstances where the drainage system became surcharged either (1) several hours after intense local rainfall, or (2) where there was little if any intense rainfall at the site in question.
- (b) Inundation resulting from surcharge of a drainage system would normally be expected to be relatively shallow, whereas inundation resulting from flooding could be either shallow or deep. Questions a) to d), and k) and l) in paragraph 19 relate to inundation depth. Although less common, it would not however be unfeasible for relatively deep inundation to result from drainage system surcharge. This could occur, for example, as a result of very intense local rainfall in a steep sided valley.



- (c) Inundation resulting from surcharge of a drainage system would normally be expected to come from uphill, whereas inundation from flooding would normally be expected to rise more gradually from downhill. Question m) in paragraph 19 relates to this.
  - (d) The relevance of question n) in paragraph 19 is uncertain, as water resulting from both flooding and stormwater surcharge would generally be expected to be relatively dirty.
21. In summary, whilst the questions listed in paragraph 19 could be useful in providing some preliminary indication of the likely source of inundation of a particular property, they should not, in our opinion, be relied on solely to ascertain whether damage at a particular property had been caused by flood or stormwater.

*"The review of the report for 12/13 Bridge Street, Redbank, Ipswich (paragraph 26(c)) (Queensland Floods Commission of Enquiry, "Brisbane River 2011 Flood Event – Investigations onto Causes of property Inundation – Review of Insurance reports", Version A, 5 November 2011, by Sinclair Knight Merz) comments on the flood extent mapping in the ICA Ipswich LGA report..... The question relates to the "Matter of Judith Dobrowa"..... The insurer in that case relied on flood mapping provided by the ICA - could you advise if the mapping used in that case is that contained in the ICA report (it will be the report for Brisbane) and, if so, whether the concerns you expressed about those maps apply in Mrs Dobrowa's case."*

22. As noted in Paragraph 13 above, the resolution of the maps in Volume 2 of the ICA report is not adequate to determine whether or not the property was within the maximum flood inundation extent.

### **2.3. Matter of Robert Clements**

23. The address of this property is 312 Long Street East, Graceville.
24. As indicated in Appendix A, the information the insurer relied on comprised:
- information provided by the insured;
  - a loss adjustor's report, based on discussions with the insured and inspection of the property; and
  - an area hydrology report for the Brisbane LGA commissioned by the Insurance Council of Australia ("the ICA report, Volume 2") dated 20 February 2011.
25. The loss adjustor's report notes: *"Water to a depth of approximately 2600mm was noted within the internal ground floor area of the premises. Water levels external to the premises reached an estimated depth of approximately 5200mm."*



26. The information provided by the Commission does not indicate that any reliance was placed on aerial flood photographs of the property. It is not clear whether this would have been readily available to the insurer on the date the claim was denied; the letter was dated 18 March 2011. It should nevertheless be noted that whilst this property is near to edge of the “2010-11 Interim Flood Lines” shown on the [www.qldreconstruction.org.au](http://www.qldreconstruction.org.au) website, it is nevertheless clearly within these flood lines. It should be noted that the adjacent property to the east is only particularly within the flood lines.
27. The ICA report indicates that the intensities associated with local rainfall in vicinity of the property were of the order of 1-Year ARI. As noted in paragraph 9 above, this is most unlikely to have been sufficient to surcharge the local drainage system.
28. In our opinion the information relied on was clearly adequate to support the conclusion that the inundation was caused by flooding. Local rainfall was unlikely to have been sufficient to surcharge the local drainage system, and the depth of inundation was so great that it is virtually inconceivable that it could have been caused by local stormwater runoff resulting from this relatively low intensity rainfall event.

#### **2.4. Matter of Gary Lobley**

29. The address of this property is 14 Inskip Street Rocklea.
30. As indicated in Appendix A, the information the insurer relied on comprised:
  - a loss adjustor’s report, based on discussions with the insured and inspection of the property;
  - area hydrology report for the Brisbane LGA commissioned by the Insurance Council of Australia (“the ICA report, Volume 2”) dated 20 February 2011; and
  - Queensland Reconstruction Authority interactive flood map.
31. The Queensland Reconstruction Authority’s interactive flood map shows that this property was clearly within the extent of inundation shown on aerial photography of the January 2011 flood event. The loss adjustor’s report indicates that the property was inundated to a depth of approximately one metre in the living areas, and three metres in the street. This was based on a site inspection and interview with the insured.
32. The ICA report indicates that the intensities associated with local rainfall in vicinity of the property were of the order of 1-Year ARI. As noted in paragraph 9 above, this is most unlikely to have been sufficient to surcharge the local drainage system.
33. In our opinion the information relied on was clearly adequate to support the conclusion that the inundation was caused by flooding. The property was clearly within an area of inundation, the local rainfall was unlikely to have been sufficient to surcharge the local



drainage system, and the depth of inundation was so great that it is virtually inconceivable that it could have been caused by local stormwater runoff resulting from this relatively low intensity rainfall event.

## 2.5. Matter of Julian Chambers

34. The address of this property is 86 South Queensborough Parade, Karalee.
35. As indicated in Appendix A, the information the insurer relied on comprised:
  - a loss adjustor's report, based on discussions with the insured and inspection of the property;
  - area hydrology reports for the Brisbane Valley (Overview) ("the ICA Report, Volume 1") and Ipswich LGA commissioned by the Insurance Council of Australia ("the ICA report, Volume 3") dated 20 February 2011; and
  - Queensland Reconstruction Authority interactive flood map.
36. The Queensland Reconstruction Authority's interactive flood map shows that this property was clearly within the extent of inundation shown on aerial photography of the January 2011 flood event. The loss adjustor's report notes that "*all walls, ceilings, fixtures and fitting have been damaged or destroyed by the ingress of water to a depth of at least 3 metres (e.g. to the roof of the insured building).*" The adjustor's report was based on a site inspection and interview with the insured.
37. The ICA report indicates that the intensities associated with local rainfall in vicinity of the property were of the order of 1-Year ARI. As noted in paragraph 9 above, this is most unlikely to have been sufficient to surcharge the local drainage system.
38. In our opinion the information relied on was clearly adequate to support the conclusion that the inundation was caused by flooding. The property was clearly within an area of inundation, the local rainfall was unlikely to have been sufficient to surcharge the local drainage system, and the depth of inundation was so great that it is inconceivable that it could have been caused by local stormwater runoff resulting from this relatively low intensity rainfall event.



### **3. Summary and Conclusions**

#### **3.1. Matter of Judith Dobrowa**

39. In our opinion the information relied on by the insurers was adequate to support the conclusion that the inundation was caused by flooding.
40. In our opinion, the information contained in the loss assessor's report is only just barely sufficient to support a conclusion of inundation by flooding, based predominantly on the observations by the insured that the water came from the Brisbane River and Mount Ommaney Creek. This conclusion would have been greatly strengthened by one or more of:
  - comparison of peak flood levels in the Brisbane River adjacent to the property with reported inundation levels in the property;
  - analysis of local rainfall intensity;
  - analysis of relative timing of rainfall and inundation; and,
  - Inspection of aerial flood photography.
41. In relation to the loss assessor's report, in our opinion no hydrological expertise would be required to conclude that the insured's observations would constitute flooding as defined by most insurance companies.
42. Whilst the questions listed in paragraph 19 could be useful in providing some preliminary indication of the likely source of inundation of a particular property, they should not, in our opinion, be relied on solely to ascertain whether damage at a particular property had been caused by flood or stormwater.
43. The resolution of the maps in the ICA report is not adequate to determine whether or not the property was within the maximum flood inundation extent.

#### **3.2. Matters of Robert Clements, Gary Lobleby and Julian Chambers**

44. In our opinion, in all three cases the information relied on was clearly adequate to support the conclusion that the inundation was caused by flooding.



## Appendix A Summary of Information Provided by the Commission

### Matter of Judith Dobrowa

The following information has been provided:

1. Pages 1-3 of statutory declaration of James Bruce Merchant (CGU Insurance Limited): the relevant paragraphs are 6 and 7
2. Annexure 5: letter dated 4 March 2011 notifying customer that her claim had been denied
3. Annexure 7 to Mr Merchant's statutory declaration: set of questions asked to customers to ascertain whether damage had been caused by flood or stormwater
4. Excerpt of Annexure 2 to Mr Merchant's statutory declaration which records the customer's responses to some of the questions
5. Annexure 9 to Mr Merchant's statutory declaration: Crawford loss assessor's report, dated 21 February 2011
6. Annexure 10 to Mr Merchant's statutory declaration: flood mapping provided by the Insurance Council of Australia

The information on which the insurer (CGU Insurance Limited) relied is listed in paragraph 7 of Mr Merchant's statutory declaration. Copies of the information listed at sub-paragraphs 7.1, 7.3 and 7.4 have been provided with this document. The hydrology report to which sub-paragraph 7.2 refers has been provided to you previously: it is report number 10 in the "Review of Insurance Reports". Please advise if you require us to provide another copy of the hydrology report. The information listed at sub-paragraphs 7.5 (aerial photography from [www.nearmap.com](http://www.nearmap.com)) and 7.6 (Google maps) has not been provided to the Commission. Please advise if this causes any problems.

Paragraph 6 gives a chronology of the claim (paragraphs 8 to 16 are not relevant for the purposes of the review). You will see that, while the insurer based its decision on the information listed in paragraph 7, the assessor's report was determinative: the claim was denied on the basis of the report. The insurer instructed the assessor to 'assess and report on cause of damage as [the] insured has stated that there have been issues over recent years with the council in regards to sewerage. Need to ascertain if flood/storm damage or sewerage issues.'

The Commission has some specific questions about this particular matter:

1. Whether the opinion/report of the loss assessor (who is not a hydrologist) alone provided a sound/reliable basis for the insurer to conclude that flood had caused the damage to the property?





2. Whether the opinion/report of the loss assessor in conjunction with the other information listed in paragraph 7 of Mr Merchant's statutory declaration provided a sound/reliable basis for the insurer to conclude that flood had caused the damage to the property? (The following question was later substituted for this question: What weight can be given to the assessor's report in reaching a conclusion as to the cause of inundation. Again, you can assume that neither the assessor nor the person relying on the report was a hydrologist.)
3. Whether the set of questions contained in Annexure 7 to Mr Merchant's statutory declaration would provide a sound/reliable means of ascertaining whether damage at a particular property had been caused by flood or stormwater?

Please advise if you require any further information about this matter in order to answer the questions posed.

#### **Matter of Robert Clements**

The following information has been provided:

1. Pages 7 and 8 of the statement on behalf of the insurer (Allianz Australia Insurance Limited) about the claim: the relevant paragraphs are 3.6, 3.8 and 3.9
2. Letter dated 18 March 2011 notifying customer that claim had been denied
3. Instructions to loss adjusters, dated 13 January 2011
4. Cunningham & Lindsey assessor's report, dated 22 February 2011

Paragraphs 3.6, 3.8 and 3.9 refer to the information on which the insurer relied to determine the claim: information provided by the customer (recorded in the instructions to the loss adjusters), the loss adjuster's report and the area hydrology report for the Brisbane LGA commissioned by the Insurance Council of Australia. This report has been provided to you previously: it is report number 1 in the "Review of Insurance Reports". Please advise if you require us to provide another copy of the hydrology report.

Paragraph 3.6 states: "In circumstances where Allianz considered flood may be the proximate cause of damage, Allianz reviewed the area hydrology reports commissioned by the Insurance Council of Australia before making a decision to accept or deny a particular claim".

By way of background, Allianz relied on the area hydrology reports for the majority of claims. Site specific reports were sought where there was any doubt. Otherwise, site assessments were carried out by loss adjusters on each claim. Loss adjusters were instructed to determine the likely cause of inundation. Where the cause of loss was thought to be flood, Allianz did not make a final determination until the area hydrology reports were available.

Please advise if you require any further information about this matter.



### **Matter of Gary Lobley**

The following information has been provided:

1. Pages 8 and 9 of the statement on behalf of the insurer (AAMI) about the claim: the relevant paragraphs are 41 and 42
2. AAMI's home assessment instruction sheet to loss adjustors, Cunningham & Lindsey, dated 20 January 2011 (provided for completeness)
3. Cunningham & Lindsey assessor's report (undated) with attached flood questionnaire, map showing location of property and schedule of photographs (however, the map and photographs are not useful because of their poor quality; they were provided to the Commission in that form – if necessary the Commission request better quality maps and photographs from the insurer)
4. Letter dated 31 March 2011 notifying customer that claim had been denied

Paragraph 42 refers to the information on which the insurer relied to determine the claim: the loss adjuster's report, area hydrology report for the Brisbane LGA commissioned by the Insurance Council of Australia dated 20 February 2011 and Queensland Reconstruction Authority interactive flood map. The area hydrology report has been provided to you previously: it is report number 1 in the "Review of Insurance Reports". Please advise if you require us to provide another copy of the hydrology report. The insurer has not provided the QRA flood map to the Commission. Please advise if this causes any problems.

By way of background, AAMI generally relied on the Insurance Council's area hydrology reports, but site specific hydrology inspections and reports were commissioned if information from the area hydrology report and assessor's report was not sufficient to determine the cause of damage to a particular site. Loss adjusters carried out site inspections for every claim. They were instructed to provide a preliminary report on the cause of inundation; in particular, they were instructed to provide a preliminary opinion as to whether or not they believed the inundation may have been caused by flood as defined in the policy.

Please advise if you require any further information about this matter.

### **Matter of Julian Chambers**

The following information has been provided:

1. Pages 8 and 9 of the statement on behalf of the insurer (AAMI) about the claim: the relevant paragraphs are 28 to 32
2. Letter dated 12 May 2011 notifying customer that claim had been denied.



3. Instructions to loss adjusters, Cunningham & Lindsey, dated 17 January 2011 (provided for completeness)
4. Cunningham & Lindsey assessor's report (undated) with attached flood questionnaire, an aerial photograph obtained from Nearmap of the area and photographs

Paragraph 28 refers to the information on which the insurer relied to determine the claim: the loss adjuster's report, area hydrology reports for the Brisbane River Catchment (Vol 1) and Ipswich City LGA (Vol 3) commissioned by the Insurance Council of Australia dated 20, and Queensland Reconstruction Authority interactive flood map. The area hydrology reports has been provided to you previously: they are reports 1 and 2, respectively, in the "Review of Insurance Reports".

Please advise if you require us to provide another copy of the hydrology reports. The insurer has not provided the QRA flood map to the Commission. Please advise if this causes any problems.

By way of background, AAMI generally relied on the Insurance Council's area hydrology reports, but site specific hydrology inspections and reports were commissioned if information from the area hydrology report and assessor's report was not sufficient to determine the cause of damage to a particular site. Loss adjusters carried out site inspections for every claim. They were instructed to provide a preliminary report on the cause of inundation; in particular, they were instructed to provide a preliminary opinion as to whether or not they believed the inundation may have been caused by flood as defined in the policy.

Please advise if you require any further information about this matter



## Appendix B Curriculum Vitae of Reviewers



## Dr Rory Nathan

Practice Leader Hydrology

### Qualifications

B.E.(Agr), University of Melbourne, 1980

M.Sc., D.I.C., University of London (Groundwater Modelling), 1984

Ph.D., University of Melbourne (Hydrological Regionalisation), 1990

### Affiliations

Fellow, Institution of Engineers, Australia

Honorary Fellow, Dept. Civil Engineering, Monash University

Past Honorary Fellow, Dept. Civil and Environmental Engin., University of Melbourne

Floods Committee, International Committee on Large Dams (ICOLD Aust. Rep.)

Hydrology Sub-committee, NSW Dams Safety Council

### Awards & Recognition

- Engineers Australia Ambassador for the Year of Engineering Leadership, 2010
- Named on list of “Top 100 Most Influential Engineers” by Engineers Australia
- National Civil Engineer of the Year, awarded by the Institution of Engineers, 2000
- W.H. Warren Medal (1992, 1998, and 2005) for best paper in Civil Engineering, Eng Aus
- G.N. Alexander Medal (1998) for best paper in Hydrology and Water Resources, Eng Aus
- ASCE Journal of Irrigation and Drainage Engineering Best Research Paper Award (1997)
- Victorian Engineering Excellence Award for “Environmental Sustainability” (2003).
- ACEA Award of Excellence for flood risk evaluation of Snowy Mountain Scheme (1998).
- Best presentation of a technical paper at the Hydrology & Water Resources Conf. (1993)

### Fields of Special Competence

Dr Rory Nathan has around 30 years experience in environmental and engineering hydrology in both the academic and consulting fields. He has been actively involved in a number of research projects with Cooperative Research Centres, and has adapted many research concepts to the solution of practical problems. For example he developed the technical basis that underpinned the introduction of farm dams legislation in Victoria, and led the conceptual development of the framework used to govern the sustainable diversion limits of surface water in two mainland States; he also developed the basis adopted by several State and Territory agencies for characterising the threat to river health due to flow stress. While he has generally worked in areas of hydrological processes, regionalisation, and catchment hydrology, Dr Nathan has developed specific skills in the following areas:

- Hydrologic estimation in ungauged catchments
- Regionalisation of hydrologic information and its relevance to policy formulation
- Surface-water groundwater interaction



- Assessment of system yields using stochastic techniques
- Characterisation of flow regimes for environmental flows
- Modelling and simulation of hydrologic processes
- Hydrologic model development and application
- Estimation of extreme hydrologic events (floods and low flows)

### Relevant experience

- Development of a strategic plan for development of a national hydrological modelling system (Bureau of Meteorology)
- Development of “sustainable limits of diversion” over the winterfill season for all of Victorian rivers (Dept Sustainability and Environment)
- Provision of a “hydrology atlas” for the Lake Eyre basin
- Provision of advice to ACTEW/AGL on how to best account for climatic variability in the development of options for their future water supply options (ongoing)
- Assessment of the vulnerability to climate change and variability for the water resources of the Fitzroy River
- Provision of advice to Hunter Water on how to best characterise system performance to allow for climate variability in development of water supply agreement.
- Contracted by the U.S. Bureau of Reclamation to provide input to the development of guidelines on the characterisation of hydrologic inputs for risk analysis
- Contracted by the U.S. Army Corps of Engineers to help formulate research directions to be undertaken in the area of hydrologic risk using federal agency funding
- Development of procedure to characterise degree of ecological stress in rivers using hydrological indices (for both MDBC and DSE)
- Assessment of the impact of farm dams on streamflow indices
- Characterisation of flow regimes in gauged and ungauged catchments for the specification of environmental water requirements in numerous catchments in south-east Australia
- Development of a procedure to South Australia Water Corporation - Development of daily, monthly, and long-term forecasts of reservoir inflows and demands to numerous sites within the South Australian headworks
- Kiewa System Forecasting - development of a computer model for the forecasting of snow-melt streamflows to a cascade of hydro-electric storages.
- Western Water - development of a streamflow forecast model for operational purposes
- Senior author of national flood guidelines on extreme flood estimation (Book VI, Australian Rainfall and Runoff)
- Expert Reviewer on a number of dam risk assessment projects (SE Queensland Water Board, Southern Rural Water, Hydro-Electric Corporation of Tasmania)
- Co-supervisor of PhD student at Monash University for research into estimating the exceedance probabilities of Probable Maximum Events
- Snowy Mountains HydroElectric Scheme - undertaking of risk calculations and assessment of hydrologic loads for input to dam risk assessment study (in association with RAC Engineers & Economists and SMEC).
- South Australia Water Corporation - undertaking of risk calculations, assessment of dam failure consequences, and assessment of hydrologic loads for input to dam risk assessment study (in association with RAC Engineers & Economists).
- Assessment of spillway adequacy and storage configuration under extreme flood events for numerous reservoirs ranging in size from small storages impounding 500 ML to large



reservoirs of 4 GL capacity. Storages analysed include the Snowy Mountains HydroElectric Scheme, Lake Eildon, Lake Dartmouth, and Rocklands Reservoir.

- Sydney Water - analysis of environmental streamflow characteristics for the Hawkesbury-Nepean catchment.
- Development of a lumped conceptual model of regional water quantity and quality processes in surface and runoff and surface/subsurface interactions in the Tragowel Plains, an irrigation district located in Northern Victoria.
- Investigation of hydrologic influences causing degradation of the Yellingbo wetland area, Melbourne.
- Assessment of the impact of land use changes on water quality indices in the Goulburn River catchment.
- Derivation of a methodology for the determination of low flow environmental flows in the Thomson and Macalister catchments.
- The application of the complex physically based SHE model to investigate water quantity and quality processes at the plot scale.
- Estimation of hydrologic inputs for numerous bulk-entitlement applications and water system simulations using catchment modelling, data transposition and extrapolation techniques, and multi-site stochastic data generation.
- Synthesis of hydrologic inputs and modelling of Lake Corangamite and associated wetlands to maximise management of both environmental and water conservation objectives.
- Computer modelling of the water quality along the Goulburn River between Lake Eildon and the Waranga basin, particularly in relation to developing dryland salinity problems.
- Compilation of a Low Flow Atlas and also an Evaporation Atlas for Victoria.
- Development of a generalised technique for the derivation of PMP temporal patterns for the Bureau of Meteorology.

### **Publications**

Rory has published around 60 papers in refereed journals and books, and a further 100 papers in refereed conference proceedings, on a wide range of engineering and environmental hydrology subjects.



## David B Sheehan

Global Services Leader – Natural Resource Management

### Qualifications:

Bachelor of Engineering (Civil) (First Class Hons.), University of Melbourne, 1976

Master of Engineering Science, University of Melbourne, 1981

### Affiliations:

Member, Institution of Engineers, Australia (Membership No. 15755)

Past Chairman, Institution of Engineers, Australia, Victorian Water Engineering Branch

### Fields of Special Competence:

Flood hydrology and hydraulics; urban and rural drainage and flood mitigation; flood plain management; water quality management; water resources management; project management.

### Relevant Experience:

**Sinclair Knight Merz, Australia**

**2001 to date:**

Global Services Leader – Natural Resource Management (July 2011 to date).

- Responsible for the development and deployment of the firm's global capabilities in Natural Resource Management, which comprises the following five Practice Sectors - Catchment Management, Ecology and Water Quality, Groundwater, Hydrology and Water Resources, and Marine and Coastal Sciences.

Operation Centre Manager, Water and Environment - South East Australia (2008 to June 2011).

- Responsible for financial, client service delivery and people management of this 350 person Operations Centre, in 10 offices across Victoria, South Australia, Tasmania and the Australian Capital Territory, with an annual budget of around \$70 million.

Manager Catchment Planning (2007 to 2008).

- Department of Sustainability and Environment: Project Director for Northern Victorian Foodbowl Irrigation Modernisation Environmental Approvals Project.
- Department of Sustainability and Environment: Project Director for feasibility study of Goulburn-Murray Interconnector Channel.
- Goulburn Broken Catchment Management Authority: Project Manager for the Goulburn Loddon Campaspe Environmental Flow Constraints Study. This project investigated current





constraints to the delivery of environmental flows in these three major northern Victorian river basins, and developed and evaluated options to overcome these constraints.

- Goulburn-Murray Water: Project Manager for the Broken River and Broken Creek Loss reduction Concept Study. This project investigated transmission and operational losses in the Broken system, and the relative effectiveness of various packages of offset measures required to restore system reliability following the decommissioning of Lake Mokoan.
- Department of Sustainability and Environment: Project Manager for preparation of a report integrating earlier studies on the decommissioning of Lake Mokoan, and the feasibility of a mid-Murray storage in the Kerang Lakes.
- Melbourne Water: Project Director for Redevelopment Service Scheme Projects - 2005/06 and 2006/07. Involved development of drainage scheme works in 10 catchments, required to cater for projected future development.
- West Gippsland Catchment Management Authority: Project Manager for investigation of the potential impacts of a second entrance to the Gippsland Lakes.
- City of Bunbury: Development of Bunbury Floodplain Management Strategy.
- Department of Sustainability and Environment: Project Manager for investigation of future irrigation demands along the lower Murray under a range of potential trade and environmental flow scenarios. The project also investigated a wide range of options to mitigate any future demand shortfalls.
- Murray Darling Basin Commission: Team Leader for the first stage of the New South Wales regional water recovery study undertaken as part of the Living Murray initiative. Objectives of this study included assessment of the feasibility and credibility of proposed water recovery options, and of the acceptability of proposed water recovery mechanisms to regional stakeholders.
- Department of Sustainability and Environment: Project Manager for investigation of the potential to use Lake Boga and other surrounding water bodies as mid-Murray storages. These would be used to harvest water savings from Lake Mokoan, thus enabling these savings to be transferred to the Snowy River. The project included consideration of infrastructure requirements, water resource system modelling to assess the effectiveness of a range of options and downstream salinity impacts, and assessment of environmental and social implications.
- Murray Darling Basin Commission: Project Manager for Stage 2 of the Irrigation Management Information and Reporting System (IMIRS) Project. This project aims to provide easier access to relevant and up to date information about irrigation in the Murray-Darling Basin.
- Mallee Catchment Management Authority: Project Manager for development of a water management plan for the Hattah Lakes. This included consideration of range of possible options to provide a watering regime to maintain or enhance the ecological values of lakes in the Hattah Lakes National Park.
- Department of Land and Water Conservation: Project Manager for investigation of options for improved management of rainfall rejection of irrigation orders upstream of the Barmah-Millewa choke. Options considered included storages to temporarily retain excess flows and provide short term on-line irrigation supply, improved irrigation ordering procedures, increased channel outfall capacities, operational changes to maximise use of existing storages, and enhanced diversion capacities.



- Mildura Rural City Council: Project Manager for preparation of the Sunraysia Drainage Strategy, and Mildura Urban Stormwater Quality Management Plan. This comprised development of physical, institutional and funding strategies for management of irrigation and urban drainage in the Sunraysia region to 2050, and included an extensive stakeholder consultation program.

Appointed Associate of SKM in 2006.

Appointed Senior Associate of SKM in 2007.

Appointed Principal of SKM in 2010.

***Egis Consulting Australia (formerly CMPS&F Pty Limited), Melbourne  
1995 to 2001:***

Manager, Water Resources Section.

As Manager of the Water Resources Section, responsible for directing, co-ordinating and providing technical input to projects as follows:

- North Central Catchment Management Authority, Victoria: Review and update of the 1985 Lower Loddon Hydrologic Study. This involved updating a highly complex RORB hydrological model to account for flood events subsequent to the original study.
- NRE, Victoria: GIS-based mapping of existing and interpreted flood data for the North Central, East and West Gippsland and Glenelg-Hopkins Regions of Victoria, as part of NRE's Flood Data Transfer Project (project fees \$1.5 million).
- Melbourne Water: Preparation of digital flood inundation maps and property flood information databases as part of the Melbourne Water Drainage Survey Project covering several hundred kilometres of drains across 26 municipalities in metropolitan Melbourne (project fees \$2 million).
- Baulderstone Hornibrook, Melbourne: Hydraulic investigations of the impacts of the Melbourne City Link works on flood levels along Moonee Ponds Creek. Studies undertaken included mathematical modelling, and physical modelling of a complex reach that included bridges, roadway support pylons, a lake and architectural features.
- Government of Sarawak, Malaysia: Development of an urban drainage master plan for state capital city of Kuching (population approx. 400,000), as part of the Sg Sarawak Environmental Control and River Management Study.
- Nangiloc Colignan Committee of Management: Detailed design of a pumped drainage scheme serving a major irrigated horticultural area south of Mildura, as part of an overall salinity management plan. The scheme incorporated more than 50 km of pipelines and 100 drainage sumps.
- Hunter Water Corporation: Assessment of the effects of various management and disposal strategies for three wastewater treatment plants discharging to the Hunter River and its tributaries, using the AQUALM water quality model.
- VicRoads: Hydrologic and hydraulic investigations to determine Calder Freeway bridging requirements of the complex Campaspe River flood plain immediately to the south of



Kyneton. Hydraulic investigations were undertaken using a transient two-dimensional flow model.

- Goulburn Murray Water: Quantification of nutrient loads emanating from urban runoff from more than 30 towns in a catchment covering more than 2 million hectares in northern Victoria. Water quality modelling was used to assess the effectiveness of various management practices including artificial wetlands and gross pollutant traps.
- Hunter Water Corporation: Salinity and water quality study of the Black Creek catchment, a significant tributary of the Hunter River. AQUALM was used to simulate both existing conditions, and the effects of management strategies including modifications to discharge from the Maitland Wastewater Treatment Plant.

**CMPS&F Environmental (Formerly Camp Scott Furphy Pty Ltd), Melbourne**

**1992 to 1995:**

Senior Water Resources Engineer

Technical control and/or project management of water resources, drainage, flood plain management, hydrology and water quality projects including the following:

- Department of Defence, Army: Investigation and detailed design of drainage works, including works to protect the downstream face of an existing retarding basin in the event of overtopping. (Project value approx. \$0.9m)
- Ovens Catchment Management Board: Assessment of the effectiveness of various management practices including artificial wetlands, gross pollutant traps and grassed swales on the quality of urban stormwater runoff. The study included development of a procedure to enable the Board to assess Best Management Practices for individual drainage catchments.
- Melbourne Water: Independent technical review of Salt Creek and Roseland Grove Major Drainage Scheme designs.
- Coliban Water: Waterway management study of the Campaspe Catchment (area approx. 4,000 sq km), including developing of physical strategies for waterway rehabilitation, and future management options.
- Shire of Euroa: Flood study of Euroa township (population 3,000), which straddles the flood plains of both Sevens and Castle Creeks. Mitigation options investigated included levee bank construction, and adoption of appropriate planning controls.
- City of Doncaster and Templestowe: Investigation and detailed design of a backlog drainage scheme in an area of intensive residential development. (Project value approx. \$0.5m).
- Shire of Mildura: Conceptual design of an artificial wetland and gross pollutant trap for the removal of litter, sediment and nutrients from urban stormwater runoff.
- Thiess Contractors: Specialist review of a complex freeway drainage system designed to cater for a peak flow of 40 cumecs.
- Koondrook Murrabit Community Surface Drainage Group: Feasibility study for proposed drainage scheme to service 140 sq km irrigated area to the north of Kerang. Aspects of particular relevance included an extensive program of community consultation, and hydrologic studies aimed at quantifying the future benefits of drainage.
- Macedon Region Water Authority: Future Water Resources Study, which included mathematical simulation of existing and future supply systems using "REALM".



- Shire of Cobram: Town levees upgrade including investigation and design of 12 km of levees up to 2.5 m high.
- Government of Malaysia: Detail design of major and secondary urban and rural drainage and flood mitigation work for the Federal Territory of Labuan (total project value approx. M\$40 million). Aspects of particular relevance included flooding from combined tide and storm events and use of storage basins and tidal gates to mitigate flooding.

Appointed Associate of CMPS&F Pty Limited in 1994.

***Kinhill Engineers Pty Ltd, Melbourne***

***1991 to 1992:***

Senior Project Engineer. Projects included:

- Shire of Melton: Project Manager for the Melton South Drainage Strategy Study which included use of artificial wetlands for removal of nutrients and sediment from urban stormwater.
- MPA Williams and Associates: Design of diversion weir, spillway and stilling basin for the Benambra Mining development tailings dam.
- Town of St. Arnaud: Design of civil works for an extension to the town's wastewater treatment plant to enable use of effluent for irrigation.

***Binnie & Partners Pty Ltd, Melbourne (Acquired by Kinhill Engineers in October 1991)***

***1986 to 1991:***

Senior Project Engineer. Projects included:

- Department of Conservation and Environment: Project Manager for hydrological study of flood events within Wyperfeld National Park.
- Tambo River Improvement Trust: Project Manager for a study investigating the feasibility of managing the Tambo and Nicholson River basins on a whole of catchment basis. Considerations included erosion, siltation, flood plain management, drainage, development of works programs and optional future institutional and financial management arrangements.
- Shire of Kaniva: Project Manager for Shire of Kaniva Rural Drainage Study.
- City of Morwell: Project Manager for a flood mitigation and flood plain management study for Waterhole Creek.
- City of Waverley: Project Manager for development of a drainage strategy for a large urban municipality in the eastern suburbs of Melbourne.
- Shire of Swan Hill: Project Manager for the Swan Hill and Tyntynder Flats Flood Plain Management Study. Considerations included geotechnical stability of existing levee banks, flood damage assessment for irrigated agricultural area, and development of structural and non-structural flood mitigation options.
- Geelong and District Water Board: Project Manager for a study of physical, infrastructural and financial requirements for river management in the Barwon, Moorabool and Otway Coast Basins. Issues considered included flood plain management, regional drainage, salinity, conservation, environmentally acceptable stream management works and legislative frameworks.



- Shire of Corio: Project Engineer for evaluation of the present and planned future operations of the Shire's solid waste disposal facility and effects on adjacent properties.
- Rural Water Commission: Seconded to the Commission's flood plain management section to prepare maps showing extent of land liable to flooding in the Shires of Wangaratta, Oxley and Beechworth.
- Birmingham (Frankley) Water Treatment Plant Augmentation: Seconded to Binnie & Partners (UK) to assist team preparing contract documents for re-development of Frankley WTP including one of the largest potable DAF plants in the world (ultimate capacity 450 ML/d). Tasks included plant hydraulics, and detailed design of filter backwash tanks, pipework, and raising of filter walls.
- Geelong and District Water Board, Victoria: Design and contract documentation of 2.1 m HDPE reservoir outlet pipeline and associated screens.
- Freehill, Hollingdale & Page (Solicitors): Expert witness on flooding issues to Administrative Appeals Tribunal Hearing concerned with expansion of an existing piggery.
- Alor Setar Town Drainage Scheme, Malaysia: Conceptual and detailed design of M\$15m urban drainage scheme, including 18 cumec capacity pumping station, sluice gate, bund, floodway, and trunk and secondary drains.
- State Electricity Commission of Victoria: Technical co-ordination of non- steady state computer modelling study to determine the extent of flooding caused by hypothetical dam failures.
- Department of Works and Supply, Papua New Guinea: Liaison engineer in an American/Australian team producing a manual for Roads and Bridges Division staff to improve the effectiveness of river training works in sensitive stream channel systems.
- Public Works Department, Brunei: Responsible for hydraulic engineering aspects of a drainage standards manual for the State of Brunei.

***Binnie & Partners Pty Ltd, Melbourne***

***1980 to 1985:***

Engineer. Project involvement included:

- Commonwealth Department of Housing and Construction: Investigated various options for upgrading pollution control facilities at the discharge point of the Eastern Valley Way stormwater system into Lake Ginninderra.
- Commonwealth Department of Housing and Construction: Carried out computer-based pipe network analysis of the Footscray Small Arms and Ammunition Factory and assessed options for improvement of water pressures for fire fighting.
- Geelong & District Water Board: Hydraulic analysis for detailed design of ocean outfall and diffuser, including review and analysis of tide, wave and wind data.
- Government of the Cook Islands: Computer pipe network analysis resulting in upgrading of water supply mains on the island of Rarotonga.
- Public Works Department, Brunei: Visited Brunei to investigate stream diversion requirements around the International Airport and to estimate runoff from adjacent urban development schemes.
- Black Dog Creek Improvement Trust: Investigated alternative schemes for draining farmland subject to water-logging damage in north-east Victoria.



- State Rivers and Water Supply Commission of Victoria: Responsible for development and operation of an hydraulic cell model of 120 sq km of the Ovens and King River flood plains upstream of Wangaratta.
- State Electricity Commission of Queensland: Member of a study team which formed part of a group of consultants investigating the feasibility of proposed power station sites on the Queensland coast. Included studies of cooling water dispersion, storm surge and wave analysis, and sea defences.
- Commonwealth Department of Housing and Construction: Responsible for design and analysis of new tidal channel drainage system as part of redevelopment of Brisbane International Airport. Primary considerations included estuary hydraulics and channel stability.
- Ok Tedi Mining Limited: Hydrologic and sediment modelling studies as part of environmental impact study of Ok Tedi gold and copper mine, PNG.
- Mordialloc City Council: Advised Council staff on the Environment Protection Authority's draft policy on the Dandenong Creek catchment.
- State Electricity Commission of Victoria: Member of study team reviewing alternative proposals for diverting the Morwell River to allow additional development of open cut brown coal mining for power station fuelling.
- Victorian Ministry of Water Resources and Water Supply: Member of study team examining various proposals for financing of water and sewerage authorities throughout Victoria.
- Northern Territory Department of Transport and Works: Member of study team examining all aspects of the management and financing of the Northern Territory Water Division.
- State Rivers and Water Supply Commission of Victoria: Hydrological investigations as part of a comprehensive study of flooding at Wangaratta.

***University of Melbourne***

***1977 to 1979:***

Postgraduate research: Masters thesis on sediment transport in open channel flow.

***Environment Protection Authority, Melbourne***

***1977:***

Graduate Engineer, Water Quality Section

- Member of a team examining water quality in the Yarra catchment and Lake Burrumbeet.

**Registrations:**

Chartered Professional Engineer, Australia

**Appointments:**

Chairman, Organising Committee, 2002 Hydrology and Water Resources Symposium.

**Awards:**

- A T Danks Exhibition for Civil Engineering, University of Melbourne, 1975.
- Dixon Scholarship for Engineering Mathematics, University of Melbourne, 1975.



- McFarland Scholarship, Ormond College, University of Melbourne, 1976.
- Commonwealth Postgraduate Research Award, 1977.

**Papers and Presentations:**

- Sheehan D B, Charteris A B and Barry C R, 2006, 'Impacts to the Hydraulic Regime of Gippsland Lakes due to a Second Entrance', 15<sup>th</sup> New South Wales Coastal Conference, Coffs Harbour.
- Sheehan D B, Middelmann M, Jordan P, Zoppou C and Druery C, 2005, 'National Catalogue of Flood Studies', NSW Floodplain Management Authorities Conference, Narooma.
- Sheehan, D B and Alexander, D, 2003, 'Irrigation Management Information and Reporting System (IMIRS) Project', ANCID 50<sup>th</sup> National Irrigation Conference, Shepparton.
- Sheehan, D B and Graze, T H, 1998, 'Digitised Technology for Urban Flood Mapping', Hydrastorm Conference on Urban Stormwater Management, Adelaide.
- Sheehan, D B and O'Dell, M, 1990, 'Alor Setar Town Drainage, Malaysia', Conference on Hydraulics in Civil Engineering, Sydney.
- Sheehan, D B and Rippin, K G, 1986, 'Ovens River Floodplain Management' Hydrology and Water Resources Symposium, Brisbane.
- Sheehan, D B, 1982, 'Energy Loss Parameters for Flow Profile Computation: Ovens - King Floodplain at Wangaratta', ACADS Workshop/Forum on Energy Loss Parameters for Flow Profile Computation Programs, Melbourne.
- Sheehan, D B, 1981, 'Sediment Transport in an In-stream Settling Basin', M.Eng.Sc. Thesis.