IN THE MATTER OF
THE QUEENSLAND FLOODS COMMISSION OF INQUIRY

A COMMISSION OF INQUIRY UNDER THE COMMISSIONS OF INQUIRY ACT 1950

AND PURSUANT TO COMMISSIONS OF INQUIRY ORDER (No. 1) 2011

STATEMENT OF TERRENCE ALWYN MALONE

On the 25th day of March 2011, I, Terrence Alwyn Malone of 240 Margaret St, Brisbane say as follows:

Introduction

Current Role

1. I am employed by Queensland Bulk Water Supply Authority (***Seqwater***) in the position of Principal Hydrologist, Water Delivery. I have held this position since February 2009.

2. In this position, I am responsible for the following:

   (a) reviewing and updating design flood hydrology for Seqwater's dams;

   (b) developing, calibrating, setting up and operating real time flood models for Seqwater water storages;

   (c) overseeing the Bureau of Meteorology (***BoM***) Modernisation Program in Seqwater, which involves the expenditure of over $2 million on network expansion and upgrades, bathymetric survey and database development;

   (d) managing the implementation of the new operating platform (known as "FEWS") for Seqwater flood operations;

   (e) participating in and providing training to Seqwater dam operators;

   (f) overseeing the reporting of hydrometric data to meet internal and external reporting requirements; and

   (g) undertaking the Somerset – Wivenhoe Interaction Study, which was utilised as part of the most recent revision of the Manual of Operational Procedures for Wivenhoe Dam and Somerset Dam (Revision 7) (the ***Wivenhoe Flood Manual***).

3. In my current position, I also participate as Duty Engineer in managing flood operations for Somerset, Wivenhoe and North Pine Dams. I was approved by the Dam Safety Regulator to act as Duty Engineer in managing these flood operations at the end of January 2008 and I have held such approval since this date.

4. During the January 2011 Flood Events which impacted Somerset, Wivenhoe and North Pine Dams, I was one of four Flood Operations Engineers who managed the flood events on behalf of Seqwater from the Flood Operations Centre, which is located at premises in Turbot Street, Brisbane. When on duty in the Flood Operations Centre, the duty Flood Operations Engineer is commonly called the Duty Engineer.

5. During flood events, my role as Duty Engineer takes precedence over all of my other tasks.

Previous Roles

6. Prior to being employed by Seqwater in my current position, I held the positions outlined below.

7. Between September 2006 and February 2009, I was employed by SunWater Limited as Senior Engineer, Asset Solutions. In this role, I was responsible for:

   (a) reviewing and updating flood hydrology for proposed and existing dams;

   (b) carrying out an assessment of the Wivenhoe Dam Full Supply Level on Flood Impacts. I produced a report on this issue in August 2007;

   (c) assisting with the management of flood operations for Ross River, Scrivener, Somerset, Wivenhoe and North Pine Dams. Following my approval to act as Duty Engineer by the Dam Safety Regulator in January 2008, my tasks included acting as Duty Engineer in declared flood events affecting the dams I mention above.

8. Between January 1986 and September 2006, I was employed by BoM in the Flood Warning Centre in a number of different roles. From January 1992 to September 2006 I held the position of Senior Engineer Queensland. Before this, I was the Senior Engineer Tasmania from June 1988 to December 1991. Before this, I was the Engineer and then Senior Engineer New South Wales from January 1986 to June 1988. In these roles, I was responsible for the following:

   (a) operational flood forecasting for river basins in New South Wales, Tasmania and Queensland, including real time data collection and collation, hydrological analyses, preparation and dissemination of flood warnings and post flood analyses and reports;

   (b) design and installation of flood monitoring systems;

   (c) developing flood forecasting models for the river systems in Tasmania and Queensland;

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(d) liaising with other organisations such as emergency services, water resource agencies, local government, media and members of the community on matters relating to floods and flood warning;

(e) training of BoM staff in all States of Australia in the application and use of flood forecasting models; and

(f) annual state wide pre wet season workshops for emergency management personnel to ensure effective liaison during flood events.

9. Between January 1984 and December 1985, I was employed by Willing & Partners as Design Engineer. In this role, I was responsible for hydrological investigation, design and construction of drainage works and systems, primarily using the RAFTS runoff routing model.

10. During my employment as outlined above, I have also consulted to various overseas projects. In this regard:

(a) Between September 2001 and October 2004, I held the position of Flood Forecasting Advisor, AusAid Project for the Yangtze River Flood Control and Management Project. My work comprised 5 in-country missions over 21 weeks providing:

(i) technical advice in the development of a flood forecasting system (***FFS***) utilising both hydrologic and hydraulic models;

(ii) advice to the developers of the decision support system;

(iii) training to local staff in the use of the FFS; and

(iv) presentations to local project managers and administrative personnel.

(b) Between April 2006 and February 2009, I held the position of Senior Flood Forecasting Expert for the Mekong River Commission (***MRC***). My work comprised 9 in-country missions over 3 months providing:

(i) the review of the flood forecasting system used by the MRC's Regional Flood Management and Mitigation Centre (***RFMMC***);

(ii) identification of components required to update the flood forecasting system with new technology, models and systems;

(iii) development of a roadmap for the new flood forecasting system for the whole of the Mekong River;

(iv) presentations at local and regional forums to discuss implementation of the new flood forecasting system;

(v) training of local staff in model development and use of the new flood forecasting system;

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(vi) oversight of the implementation of the new system to ensure readiness for the 2008 wet season.

Professional Qualifications

11. I hold a Bachelor of Engineering (Second Class Honours) from the University of Technology, Sydney (1978-1982).

12. I also hold a Master of Engineering Science, University of New South Wales (1987-1990). The focus of this qualification was hydrology with my thesis being directed to "An Assessment of Non-Linear Network Models for Flood Forecasting".

13. I have been a Registered Professional Engineer Queensland since the end of 2007.

Publications

14. I have written a number of papers, including:

(a) "An Assessment of Non-Linear Network Models for Flood forecasting", T. Malone and I. Cordery, IAHS Third Scientific Assembly, USA 1989;

(b) "Forecasting Mary River Floods", T. Malone, International Hydrology & Water Resources Symposium, Adelaide 1994;

(c) "Real-Time Modelling of Floods in North Queensland Rivers", T. Malone, Flood Management Workshop, James Cook University, Cairns, 1996;

(d) "Flood Forecasting in North Queensland", T. Malone, International Workshop on Flood Forecasting for Tropical Regions, Kuala Lumpur, 1999;

(e) "Using URBS for Real Time Modelling", T. Malone, 25th Hydrology and Water Resources Symposium, Brisbane, 1999;

(f) "Streamflow Routing Techniques in Large Rivers in Queensland", T. Malone, WMO Project: Intercomparison of Forecast Models for Streamflow Routing in Large Rivers, April 2000;

(g) "HYMODEL – A Real Time Flood Forecasting System", T. Malone, A. Johnston, J. Perkins, Soori Sooriyakumaran, 28th International Hydrology and Water Resources Symposium, Wollongong, November 2003;

(h) "Integration of weather radar data into a raster GIS framework for improved flood estimation", B. Yu, A. Seed, L. Pu and T. Malone, Sixth International Symposium on Hydrological Applications of Weather Radar, February 2004;

(i) "Requirements for Data Inputs to the New Flood Medium Term Forecasting System – Improved Real Time Data Exchange", Bob Pengel, Katry Phung and Terry Malone. 5th Annual Mekong Flood Forum, Phnom Penh, Cambodia, 2007;

(j) "Development of Improved Hydrological Forecasting Models For the Lower Mekong Basin", Terry Malone, Marco Hartman, Sopharith Tes, Phung

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Katry, Sambo Pich and Bob Pengel. 5th Annual Mekong Flood Forum, Phnom Penh, Cambodia, 2007;

(k) "Towards A New Flood Forecasting System For The Lower Mekong River Basin", B. Pengel, T. Malone, Sopharith Tes, Phung Katry, Sambo Pich and M. Hartman 3rd South East Asia Water Forum. Kuala Lumpur, Malaysia, 2007;

(l) "The Mekong River Flood Forecasting System At The Regional Flood Management And Mitigation Centre", Bob Pengel, Janejira Tospornsampan, Terry Malone, Marco Hartman and Ms. Astrid Janssen. 6th Annual Mekong Flood Forum 6. Phnom Penh, Cambodia, 2008;

(m) "Towards A New Flood Forecasting System For The Lower Mekong River Basin", B.E. Pengel, T. Malone and M. Hartman. 4th International Symposium on Flood Defence, Toronto, Canada, 2008;

(n) "Comparative Design Flood Analysis", D. Carroll and T. Malone, 31st Hydrology and Water Resources Symposium, April 2008;

(o) "Hydrologic Techniques for Checking River Flow Ratings", C. Wright and T. Malone, 31st Hydrology and Water Resources Symposium, April 2008; and

(p) "Design Rainfall Issues in SE Queensland", T. Malone, ANCOLD Conference, November 2008.

Flood Operations Centre and Flood Event Log

15. The Flood Operations Centre had been demobilised on 2 January 2011 following the completion of flood events which impacted Somerset, Wivenhoe and North Pine Dams during the period 26 December 2010 to 2 January 2011.

16. I was the Duty Engineer on call during the week commencing 3 January 2011.

17. Following rainfall during Wednesday 5 January 2011 (which I was monitoring remotely) and in view of the forecast for further rainfall, I, in consultation with the Senior Flood Operations Engineer, decided to mobilise the Flood Operations Centre again in the morning of 6 January 2011. The Senior Flood Operations Engineer I consulted is referred to as "Engineer 1" in the "January 2011 Flood Event Report on the Operation of Somerset Dam and Wivenhoe Dam dated 2 March 2011" (***Somerset Wivenhoe Flood Report***). I am referred to in the Flood Report as "Engineer 2".

18. Following the mobilisation of the Flood Operations Centre, the usual steps were carried out. These steps are identified in section 3 of the Somerset Wivenhoe Flood Report. By way of summary, once a Flood Event commences:

(a) A Duty Engineer is present in the Flood Operations Centre 24 hours a day. This is achieved by the four Duty Engineers rotating through 12 hour shifts. The Duty Engineer is responsible for running the flood models (including assessing how much run-off is occurring and how high the water level in

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the dams might get) and assessing whether releases from the dams are required, and if so, ensuring that releases are made in accordance with the Wivenhoe Flood Manual.

(b) A Flood Officer is present in the Flood Operations Centre 24 hours a day. Again, Flood Officers rotate through 12 hour shifts. The Flood Officer is responsible for checking data, completing the Flood Event Log (which I explain below), general record keeping, faxing directives and assisting the Duty Engineer as requested.

19. One task which the Flood Officers carry out is maintaining the Flood Event Log. This is an Excel spreadsheet which is created upon mobilisation of the Flood Operations Centre. The purpose of the Flood Event Log is to record every significant event during the Flood Event. Significant events include phone calls to or from the Flood Operations Centre, model runs, situation reports and other communications to the Flood Operations Centre (such as emails or faxes). In relation to phone calls, often the Flood Officer inputs into the spreadsheet a short précis of the phone call between the Duty Engineer and the caller either as relayed by the Duty Engineer or as the Flood Officer overhears the conversation. During Flood Events, it is not always possible for the Duty Engineers to go back and check the entries the Flood Officer has made in the Flood Event Log. Generally, after conclusion of the Flood Event, the Duty Engineers check the entries in the Flood Event Log, but by then it is not always possible to recall the detail of the discussions or the events recorded in the Log.

20. Although the standard procedure is to have one Duty Engineer in the Flood Operations Centre 24 hours a day during Flood Events, this procedure was changed during the January 2011 Flood Event to have two Duty Engineers present in the Flood Operations Centre 24 hours a day from 1900 on Sunday 9 January 2011.

21. I was the Duty Engineer on shift during 0700 to 1900 on Sunday 9 January 2011. During that shift, I undertook an assessment of the potential for runoff volumes into the dams during the next three days. I did this by comparing rainfall and runoff since the commencement of the event up to that time and determining the fraction of rainfall which had been converted to runoff or "conversion rate". I applied this fraction to the lower and upper limits of the forecast rainfall for the following 3 days to determine the potential runoff volumes. After I completed my assessment I sent it to all of the Flood Operations Engineers. A copy of the assessment is shown in the Somerset Wivenhoe Flood Report at page 207 of Appendix K. Following this, Engineer 1 arranged a roundtable meeting of all Duty Engineers in the Flood Operations Centre at 1530. Engineer 4 attended by telephone, but Engineers 1 and 3 joined me in the Flood Operations Centre. We discussed the developing event, the current model predictions, the forecast rainfall and where we thought things might get to if significant rain continued to fall. My best recollection is that it was decided in that meeting that from the next shift (that is, the shift starting 1900

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that day) the Flood Operations Centre would be staffed by two Duty Engineers until the situation stabilised. Ultimately, this procedure remained in place until 1900 on 13 January 2011, after which the procedure reverted to one Duty Engineer being present 24 hours a day until the conclusion of the event.

22. During the January 2011 Flood Event I worked the following shifts in the Flood Operations Centre:

(a) 0700 – 1900 Thursday 6 January;

(b) 0700 – 1900 Friday 7 January;

(c) 0700 – 1900 Sunday 9 January. I also remained in the Flood Operations Centre following this shift to assist the other engineers until 2200;

(d) 0700 – 1900 Monday 10 January;

(e) 0700 – 1900 Tuesday 11 January. I also remained in the Flood Operations Centre following this shift to assist the other engineers until 2130 when I signed out of the Centre. I also slept in the Flood Operations Centre that night;

(f) 0700 – 1900 Wednesday 12 January. I slept in the Flood Operations Centre that night;

(g) 0700 – 1900 Thursday 13 January. I slept in the Flood Operations Centre that night;

(h) 0700 – 1900 Friday 14 January;

(i) 0700 – 1900 Saturday 15 January;

(j) 1900 Monday 17 January – 0700 Tuesday 18 January;

(k) 0700 – 1900 Wednesday 19 January.

Somerset Wivenhoe Flood Report

23. I refer to the Somerset Wivenhoe Flood Report.

24. I assisted in the preparation of parts of the Somerset Wivenhoe Flood Report.

25. I have read the majority of the Somerset Wivenhoe Flood Report and, to the best of my information and belief, consider it is a fair and reasonable reflection of the January 2011 Flood Event. I cannot say whether the Flood Event Log for my periods of duty in the Flood Operations Centre is accurate for the reasons outlined above.

26. I agree with the recommendations set out in section 20 of the Somerset Wivenhoe Flood Report but I would add the following two matters by way of clarification.

27. My opinion is that additional rain gauges should be installed at the bottom of the Upper Brisbane catchment (that is, around and in close proximity to Wivenhoe Dam). This is because this area of the catchment has the shortest response time (that is, the time it takes for the rain to run-off into the dam) and it is therefore

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important to decision making that rainfall in this area be recorded (accepting that no matter how many gauges are installed, the rain may still not fall in the gauges). The Somerset Wivenhoe Flood Report explains (see section 12.1) that during Tuesday 11 January intense rainfall on and near Wivenhoe Dam was not recorded in the rain gauge network. This rainfall resulted in rapid rises in the lake level which were not predicted by the modelling because one of the inputs to the model is actual rainfall recorded.

28. I have not been involved in the development of the Agency Communication Protocol used during the event. Based on my experience in BoM Flood Warning Centres, the more streamlined the communications process for the delivery of information to the public the better. In my view, it appeared that the technical information provided by the Flood Operations Centre was sometimes not communicated in a sufficiently timely manner to the public because of the requirement for public statements to be made only by designated persons or organisations. I also believe that Seqwater's website could be updated more regularly than it is, so that the most up to date information as issued by the Flood Operations Centre is available to the public.

29. I also agree that the matters raised in section 16 of the Somerset Wivenhoe Flood Report should be included as part of the standard review of the Wivenhoe Flood Manual. It is very important to note that any changes of substance to the Wivenhoe Flood Manual (in relation to the objectives or strategies), require detailed engineering and hydrological investigation. These investigations could take significant time (in excess of one year) and resources as the issues to be considered are extensive and the implications of changes need to be carefully considered so as to ensure that the changes do not create any unwanted outcomes.

30. In addition to the matters raised in section 16 of the Somerset Wivenhoe Flood Report, my opinion is that:

    (a) the Wivenhoe Flood Manual should be styled differently so that the technical operational data is separated from the objectives sections of the Manual. This layout would make it easier for the Duty Engineers during Flood Events to quickly access critical technical data in the Manual necessary for decision making;

    (b) the Wivenhoe Flood Manual should provide greater clarity in respect of the concepts and terms such as "predicted" lake levels or lake levels "likely" to exceed or "expected" to exceed certain levels.

31. My opinion is that the procedures in the Wivenhoe Flood Manual should be solely directed towards flood mitigation and not water supply security issues. By this I mean I do not think Duty Engineers should be asked during the Flood season to alter the Full Supply Level of the dams. The Full Supply Level should be a set parameter within the Wivenhoe Flood Manual (determined well in advance of

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Flood Events) and the Duty Engineers should manage the Flood Event within the confines of that pre-determined Full Supply Level.

Strategy W4

32. I have been made aware of a suggestion that Strategy W4 should have been triggered at some time in the evening of Sunday 9 January 2011. The basis of the suggestion appears to be that a model run performed early Monday morning (Period 9) predicted an estimated peak Wivenhoe Dam level of "72.9 (excluding forecast)" and "74.7 (including forecast)" (see page 18 of section 2 of the Somerset Wivenhoe Flood Report). I did not run that model. At the time of completion of my shift, the estimated Wivenhoe peak (including forecast rainfall) was 73.9.

33. The suggestion is incorrect because it assumes releases of flood waters are made from Wivenhoe Dam on the basis of model results which include forecast rainfall. Duty Engineers do not operate on this basis.

34. Prior to making such a critical decision to go to W4, I would require a high degree of certainty. At this stage of the event, this certainty did not exist. By way of explanation, I make the following comments.

35. Duty Engineers use a Real Time Flood Model (***RTFM***) to estimate likely dam inflows and predict lake levels based on those inflows less flows out of the dam that are being made or proposed to be made. Models are run regularly during flood events so that the Duty Engineers have up to date predictions of these matters.

36. The RTFM comprises a suite of hydrologic computer programs that process real time rainfall and water level data. The RTFM is described in more detail in sections 5 and 7 of the Somerset Wivenhoe Flood Report.

37. A key input into the RTFM (to enable it to predict likely dam inflows) is recorded rainfall data. Recorded rainfall data is the best estimate of rain that has fallen to a time. However, rain may fall intensely on certain gauges but not be widespread. Also, rain may fall in areas between gauges. The Wivenhoe catchment is over 7,000 km^2 and there are approximately 20 rain gauges across that area which provide data to the Flood Operations Centre. As a result, although the rain recorded in the gauges is an accurate measurement of the rain that has fallen at that point, there are limitations in using this point information to determine catchment wide rainfall.

38. Once the rainfall data is inputted to the RTFM, the RTFM does two things.

39. First, the RTFM runs a rainfall-runoff model to estimate how much of the gross or recorded rain is converted to excess rainfall or run-off. This depends upon a range of parameters such as how wet or dry the catchment is (initial loss) and an estimate of ongoing losses (continuing loss). At the start of the event, the initial loss is selected to match the start of rise of water level at the gauging station.

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During an event, the ongoing loss is regularly updated to ensure that the model is matching the recorded water level responses.

40. Secondly, the RTFM routes the excess rainfall generated by the rainfall-runoff model through the catchment to the outlet. By this I mean the RTFM predicts how long it will take for runoff that has generated in a particular area to travel downstream to the dam and in what shape (for example, as a steady flow or as flows with peaks) this response takes. The shape can be demonstrated in graphical form as a hydrograph.

41. In making these predictions, the RTFM, like all hydrologic models, is not perfect and is not precise. The model is modelling the behaviour of the catchment to rainfall and is attempting to provide an approximate result to the natural processes where rain is falling across a very wide catchment and is running off across a range of different terrains, vegetation and soil types (for example, uncleared land, cultivation and roads).

42. As indicated above, based on actual rainfall, the RTFM then predicts likely inflows and dam levels.

43. An example of one of the models I ran is Run 21 shown in Appendix A of the Somerset Wivenhoe Flood Report (pages 67-75). For convenience, I have attached these pages from the Somerset Wivenhoe Flood Report as **Annexure TM1**.

44. Looking at page 73 in **Annexure TM1**, everything to left of the black dotted line is known data (that is, the model has been calibrated to actual recorded lake levels). Everything to the right of the black dotted line is predicted. The red line is the prediction of dam levels based on rain that has already fallen. The blue line is the prediction of dam levels based on rain that has already fallen plus forecast rainfall. Duty Engineers make decisions to release flood waters based on the red line, not the blue line.

45. The forecast rainfall inputted into the model is taken from quantitative precipitation forecasts (***QPFs***) issued by BoM. Examples of the QPFs are shown in Appendix C of the Somerset Wivenhoe Flood Report.

46. I believe QPFs are prepared by BoM based upon the best available scientific knowledge.

47. However, there are always uncertainties associated with rainfall forecasts. In general the longer the forecast lead time, the higher degree of uncertainty of rainfall, flow and dam level predictions.

48. In my experience, QPFs are not sufficiently accurate so as to provide a basis for releasing flood waters from the dams. I have attached a paper (**Annexure TM2**) prepared by BoM in 2006 which supports this statement.

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49. In part, this is because the depth predicted is not accurate when compared with the recorded rainfall. The results from previous flood events and the January 2011 Flood Event confirm this. Further comments on this issue are set out in section 6.2 of the Somerset Wivenhoe Flood Report. I agree with those comments.

50. The other reason why QPFs are also not sufficiently accurate is because they forecast only a depth of rain averaged across the entire catchment. They do not predict the temporal distribution (that is, how the rain is distributed in time) or the spatial distribution (that is, how widespread the rain will be or where it will exactly fall). My understanding is that there is presently no scientific tool or model available to the BoM which would allow it to make such a forecast. The temporal and spatial distribution of rain is critical to the RTFM's prediction of rainfall run-off and routing (see my comments above on these topics). By way of simple example, 50 millimetres of light rain throughout the day over cultivation in the upper reaches of the catchment will run-off and route very differently to 50 millimetres of intense rainfall in 30 minutes in the hills in and about Wivenhoe Dam.

51. By including forecast rainfall in the RTFM the Duty Engineers are provided with an idea of where the event might be heading. This information is then used to forewarn agencies about the steps they should be taking in readiness to deal with the event, should the rain which is forecast actually be received.

52. As a result, Strategy W4 is only invoked when the RTFM predicts, based on actual rainfall and with some certainty, that the Wivenhoe Dam level will exceed EL74.0 (that is, when the red line on page 73 of **Annexure TM1** reaches EL74.0).

53. Even then, care needs to be exercised not to prematurely invoke Strategy W4.

54. Strategy W4 necessarily means moving to a release rate where urban areas below the Dam will be adversely affected.

55. Given the model is simply a predictive tool, and is not exact, my opinion is that there needs to be a high degree of confidence in the predictions being made by the model before Strategy W4 is invoked.

56. I would not move to invoke Strategy W4 based on one model run predicting a lake level slightly in excess of EL74.0. I would require a firm indication that the lake level will greatly exceed EL74.0 or additional consecutive runs which confirm the lake level would just exceed EL74.0 and generally consider things such as trends in the model results and any rapid deterioration in the weather in the catchment.

57. This scenario in fact occurred during the January 2011 Flood Event. Early on Tuesday morning, a model run performed by Engineers 1 & 3 indicated a predicted lake level of EL74.1 (see pages 112 – 120 of Appendix A of the Somerset Wivenhoe Flood Report). When I arrived for my shift at around 0645, very heavy rainfall was occurring in the catchment. Together with Engineer 4, I generated new model results at 0700. The output of that model run is shown as **Annexure**

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TM3. It predicted a Wivenhoe Dam level of EL74.35. We then consulted the BoM to see if their model results were predicting the same dam inflows and to discuss short term rainfall predictions for the following hours. As they were, and given the earlier model result plus the very heavy rainfall then falling in the catchment and with the expectation of continuing heavy rainfall, Strategy W4 was invoked at around 0800 on Tuesday 11 January.

4,000 m^3/s at Moggill

58. The intent of Strategy W3 is to limit the flow in the Brisbane River at Moggill to less than 4,000 m^3/s.

59. Moggill is a flood monitoring station downstream of Ipswich which monitors the combined flows of:

    (a) the Bremer River, which enters the Brisbane River at Ipswich;

    (b) the Lockyer Creek, which enters the Brisbane River below Wivenhoe Dam; and

    (c) releases from Wivenhoe Dam.

    (It should be noted that the station at Moggill is not an official DERM gauging station and therefore has no official rating i.e. a relationship between height and flow).

60. The Wivenhoe Flood Manual notes that a flow of 4,000 m^3/s at Moggill is the "upper limit of non-damaging floods downstream" (see page 28). This target flow has been contained in the Wivenhoe Flood Manual since the early versions of the manual and I believe the Brisbane City Council has a controlled copy of the Wivenhoe Flood Manual. My recollection is that the representatives from the Brisbane City Council also participated in the most recent review of the Wivenhoe Flood Manual.

61. At all times since I have been a Duty Engineer, I have proceeded on the basis that the 4,000 m^3/s target is the correct assessment of damaging flows.

62. During the January 2011 Flood Event, Strategy W3 was invoked at 0800 on Saturday 8 January 2011. This occurred during my shift. At the time, Strategy W2 was bypassed for the reasons explained on page 190 of the Somerset Wivenhoe Flood Report.

63. From this point until Strategy W4 was invoked at 0800 on Tuesday 11 January 2011, the strategy of the Duty Engineers was to seek to limit the flow at Moggill to less than 4,000 m^3/s so as to avoid damaging floods downstream.

64. In doing so, it is necessary to have regard to the flows from the Bremer River and the Lockyer Creek. Whilst the Bremer River model has proven to be reliable and reasonably accurate, , the model of the Lockyer Creek is not as good. This makes predicting the impact of the Lockyer Creek flow on overall flow at Moggill more difficult. This has implications for releases from Wivenhoe Dam because an objective of the Duty Engineers is to ensure that water released from Wivenhoe

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Dam does not arrive at Moggill at the same time as the peak flow from the Lockyer Creek. If this occurred, the peak at Moggill would be increased.

65. When I started my shift at 0700 on Monday 10 January 2011, I was informed by Engineers 1 and 3 that an officer from the Brisbane City Council had informed Engineer 3 during his shift that the limit of damaging flows in Brisbane was 3,500 m^3/s and not 4,000 m^3/s .

66. This was the first time I had heard this suggestion.

67. I participated in a telephone conference with officers of the Brisbane City Council at around 0938 on 10 January 2011. They again raised that the limit of damaging flows in Brisbane was 3,500 m^3/s and not 4,000 m^3/s .

68. Given:

(a) this new information;

(b) one of the objectives in the Wivenhoe Flood Manual is to provide optimum protection of urbanised areas from inundation; and

(c) the primary consideration under Strategy W3, which was then being deployed, is protecting urban areas from inundation,

Engineer 4 and I took seriously the information provided by the Brisbane City Council. We agreed that we would seek to accommodate the new information within the releases which were being made and planned to be made from Wivenhoe Dam. This issue is referred to in a Situation Report I issued at 1216 on 10 January 2011. A copy of that report is **Annexure TM4** (it is also shown at page 28 of Appendix E of the Somerset Wivenhoe Flood Report).

69. For about 6 hours on Monday 10 January 2011, releases were maintained at the same rate in an attempt to operate within the new information provided by Brisbane City Council. Ultimately, it was not possible to limit the flows in line with the new information from the Brisbane City Council and as a result a decision was taken at about 1430 to not limit the flows in line with the new information from the Brisbane City Council. I issued a new Situation Report at 1458 on 10 January 2011. A copy of that report is **Annexure TM5**.

70. I do not know whether the true figure for non-damaging flows in Brisbane is 3,500 m^3/s or 4,000 m^3/s. This issue needs to be resolved and this is one of the recommendations of the Somerset Wivenhoe Flood Report.

Allegation of delay in increasing releases from Wivenhoe Dam

71. I have been made aware of allegations to the effect that the Duty Engineers knew, by the evening of Sunday 9 January 2011, that releases of in the order of 3,000 – 3,500 m^3/s would be required by midnight that night, but releases were not increased to this rate until Tuesday morning.

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72. These allegations appear to be based on entries in the Flood Event Log, which I deal with below.

73. As I explain above in paragraph 22, I was on shift from 0700 to 1900 on Sunday 9 January 2011. I remained in the Flood Operations Centre until around 2200.

74. As I explain in paragraph 43, I also ran a model at 1900 on Sunday 9 January 2011. In summary, that model predicted the following:

(a) a peak outflow from Wivenhoe Dam of 2,880m^3/s on 11 January 2011. This peak flow had almost doubled from an earlier model run I performed at 1400 that day (run 17);

(b) a peak flow at Moggill of 3,300 m^3/s on 12 January 2011.

75. I issued Situation Reports as at 1700 and 2100 on Sunday 9 January 2011. These situation reports are **Annexures TM6 and TM7** (they are also shown on pages 19-22 of Appendix E of the Somerset Wivenhoe Flood Report).

76. The Situation Report issued at 2100 on Sunday 9 January 2011 picks up the new model results from my model run at 1900 and indicates that "*gate opening will start to be increased from noon Monday and the release is expected increase to at least 2,600m^3/s during Tuesday morning*". This Situation Report accurately reflected my understanding of the position at the time and my intention at the time with respect to future releases.

77. The Flood Event Log contains the following relevant entries for Sunday 9 January 2011 which appear to or may relate to me.

4:27 PM	BCC returned phone call. BCC was advised by Engineer 2 that the current strategy was to maintain a flow in the Brisbane River such that the Fernvale Bridge and the Mount Crosby Bridge could be kept open. However, future rainfall could well impact on those roads remaining open. Closure next Tuesday is a real possibility at this stage. Flow in the Lower Brisbane potentially might reach 3,000 cumecs by next Wednesday or Thursday.
5:25 PM	BCC returned call to Engineer 2. Engineer 2 advised potential for releasing up to 2,500 cumecs by Tuesday. With further heavy rainfall, as forecast, the flow in the Lower Brisbane could increase to 3,000 cumecs with potential for closure of Fernvale Bridge and Mount Crosby Bridge by Thursday (possibly Wednesday). Releases from Wivenhoe are dependant on flows from Lockyer Ck and inflow into Wivenhoe. FOC will continue to update BCC.
5:58 PM	Engineer 2 called BoM to discuss Wivenhoe Dam's release strategy i.e. Major bridge open strategy Vs increased inflow into Wivenhoe resulting from current heavy rainfall. Situation will become clearer in 24 hours time.
7:10 PM	FOC called SRC advising him that high releases from Wivenhoe (3000 cumecs) are expected to be necessary in view of heavy rain over the last 3 hours.
7:15 PM	FOC called Seqwater CEO advising him that high rainfall is expected overnight and releases from Wivenhoe causing damaging flooding are likely to be necessary.
7:15 PM	FOC called Director Dam Safety advising him that FOC is now looking at much larger flows and will have to ramp up releases to around 3000 cumecs as by as early as midnight which is likely to have flooding impacts on low-lying areas of Brisbane.
7:20 PM	Engineer 2 called BCC advising him of potential for high releases sooner than previously expected.

[redacted] [redacted]

78. I cannot now remember the detail of the discussions recorded in these entries. I also cannot now say whether the entries at 1910 and 1915 (which refer to "FOC called") were calls to which I was a party.

79. To the extent any of the entries suggest that there was need for releases to be increased to 3,000 m^3/s by midnight, the entries are incorrect. It was not my intention at that time that releases be increased to that level within that timeframe. My intention was set out in the Situation Report I issued at 2100 to increase releases throughout Monday and Tuesday to reach a peak outflow from Wivenhoe Dam of at least 2,600 m^3/s on Tuesday. My understanding is that this was agreed to by the other Duty Engineers working that shift.

Signed by Terrence Alwyn Malone in the presence of:

[redacted]

Witness Signature

[redacted]

Print Name

[redacted]

Signature

[redacted]

IN THE MATTER OF
THE QUEENSLAND FLOODS COMMISSION OF INQUIRY

A COMMISSION OF INQUIRY UNDER THE
COMMISSIONS OF INQUIRY ACT 1950

AND PURSUANT TO
COMMISSIONS OF INQUIRY ORDER (No. 1) 2011

STATEMENT OF TERRENCE ALWYN MALONE

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TM4	Situation Report	10/01/2011	22
TM5	Situation Report	10/01/2011	24
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Filed on behalf of: Queensland Bulk Water Supply Authority trading as Seqwater

Allens Arthur Robinson
Lawyers
Riverside Centre
123 Eagle Street
Brisbane QLD 4000

DX 210 Brisbane
Tel (07) 3334 3000 Fax (07) 3334 3444
Ref MGI:120128021

[redacted] [redacted]

"TM-1"

APPENDIX A – MODEL RESULTS (continued)

Run 21

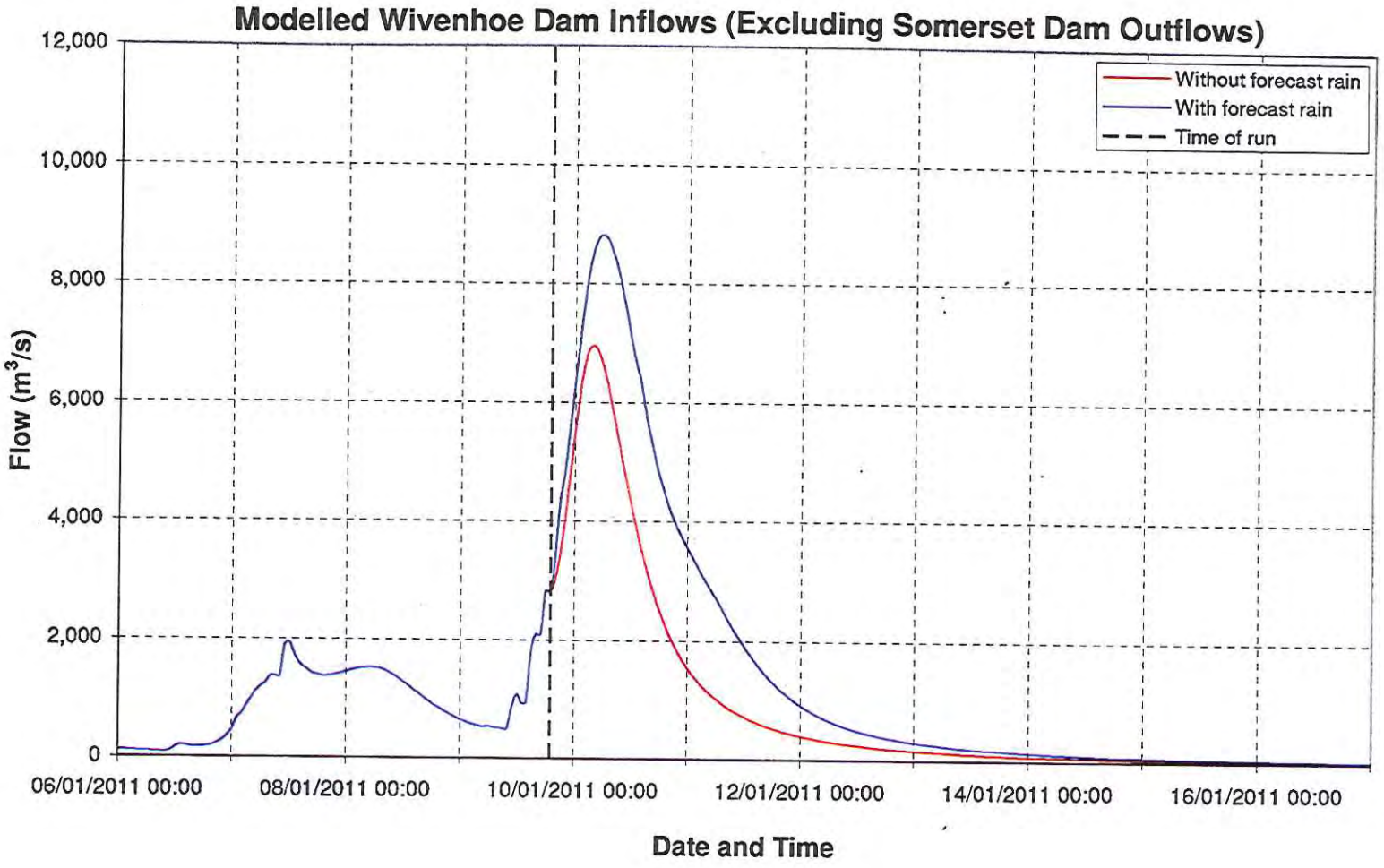
Date: Sunday 9 January 2011

Time: 19:00

[redacted]

[redacted]

1



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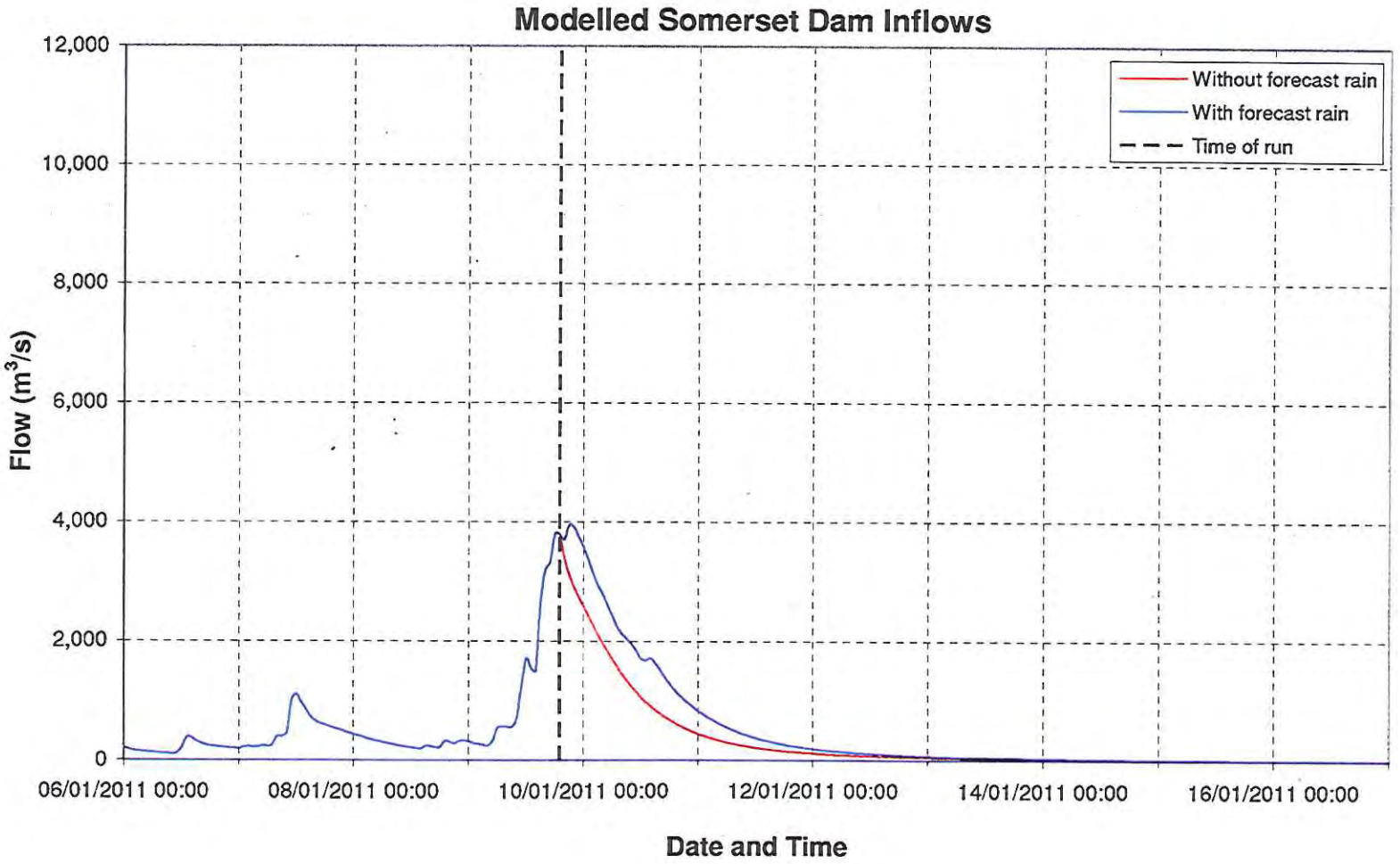

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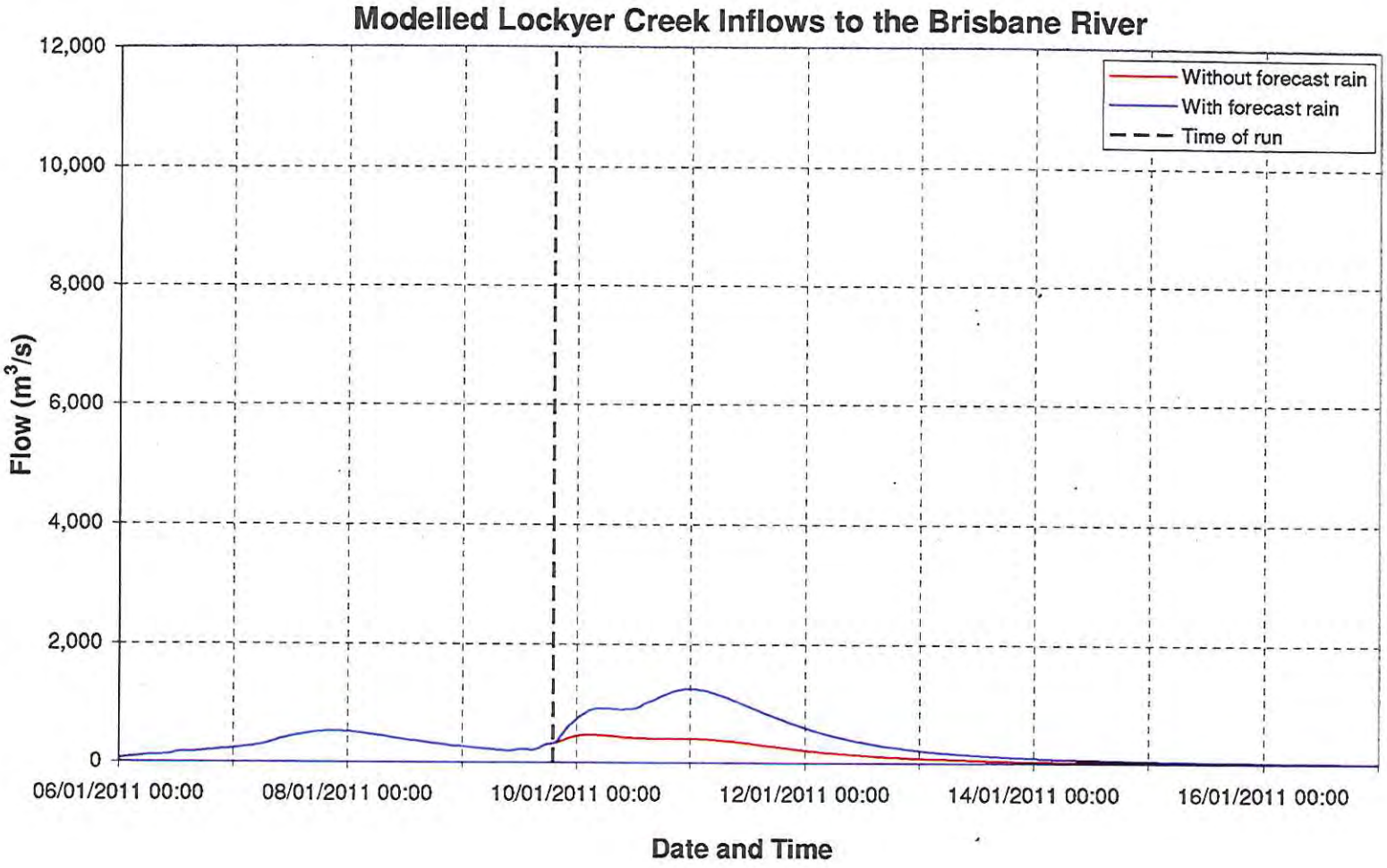

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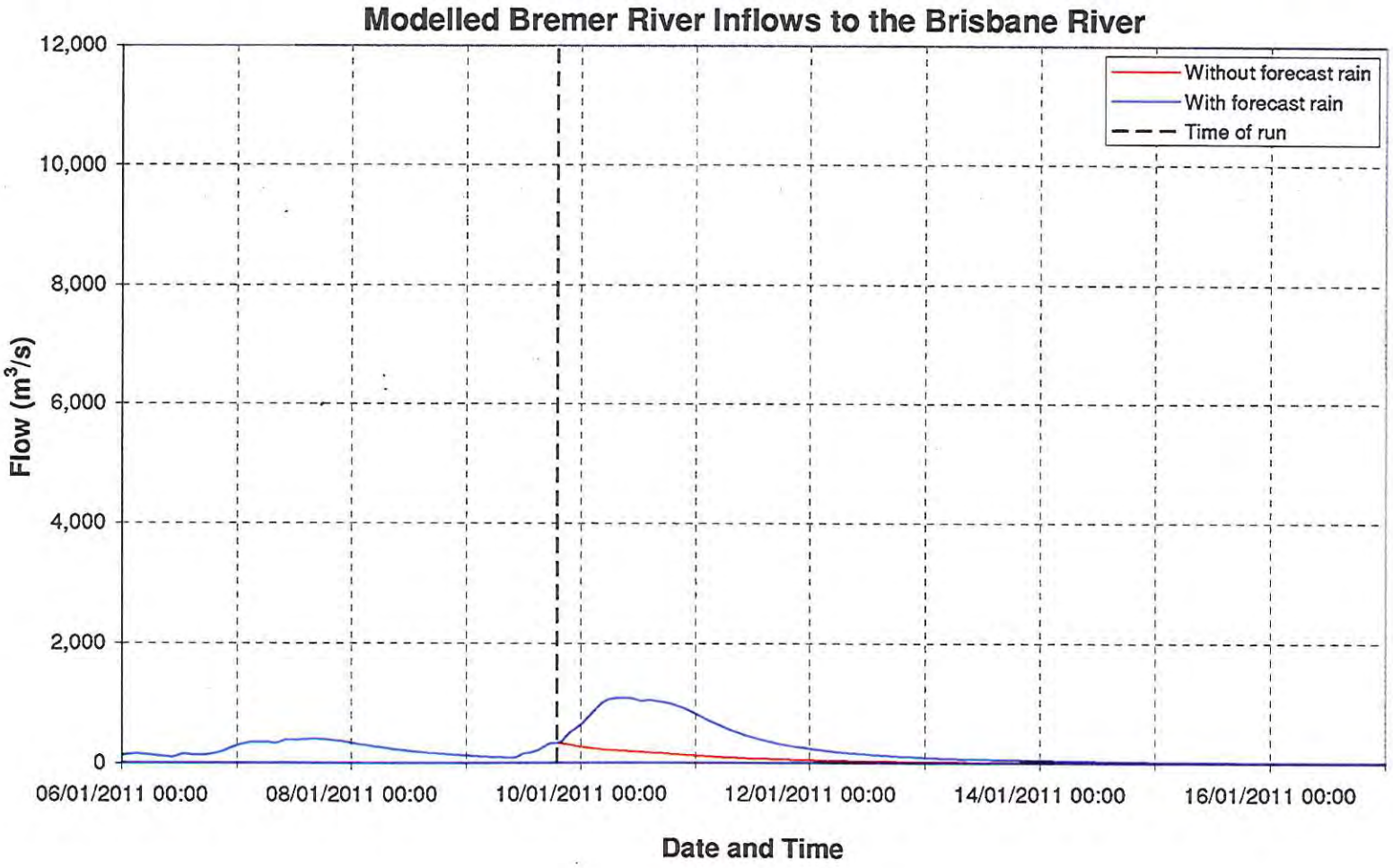

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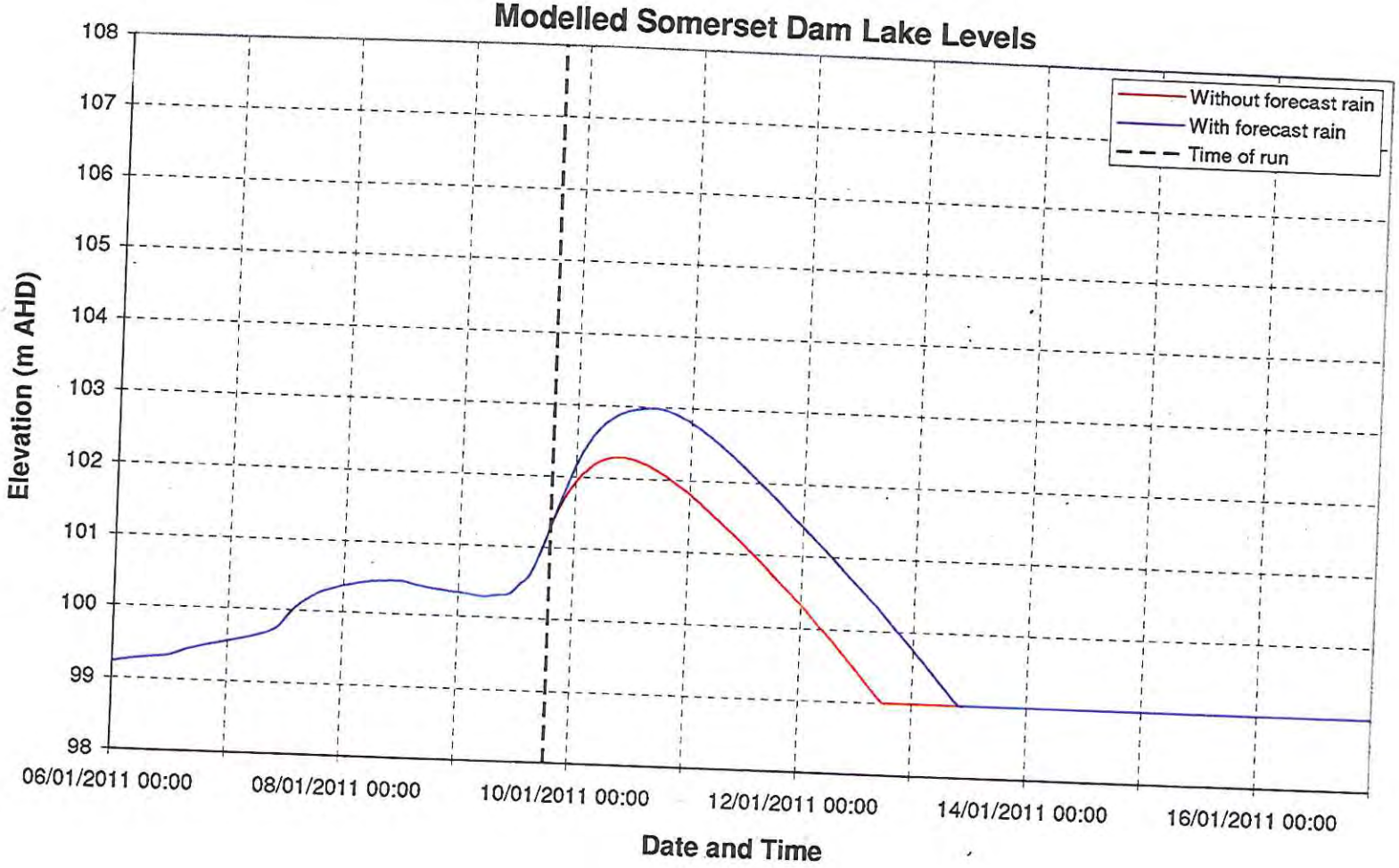
Modelled Somerset Dam Lake Levels
Without forecast rain
With forecast rain
Time of run
Elevation (m AHD)
108
107
106
105
104
103
102
101
100
99
98
06/01/2011 00:00
08/01/2011 00:00
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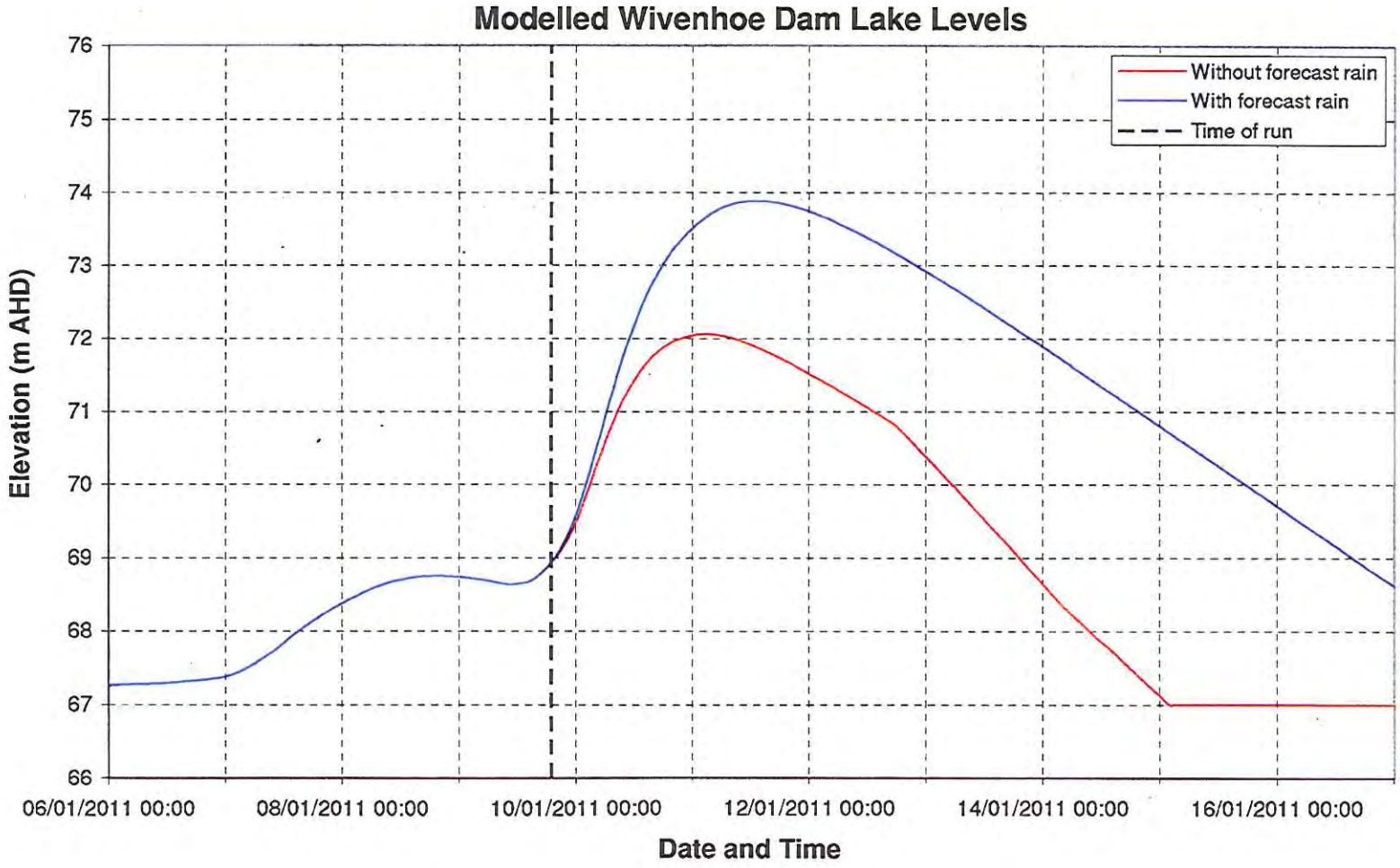
14/01/2011 00:00
16/01/2011 00:00
Date and Time



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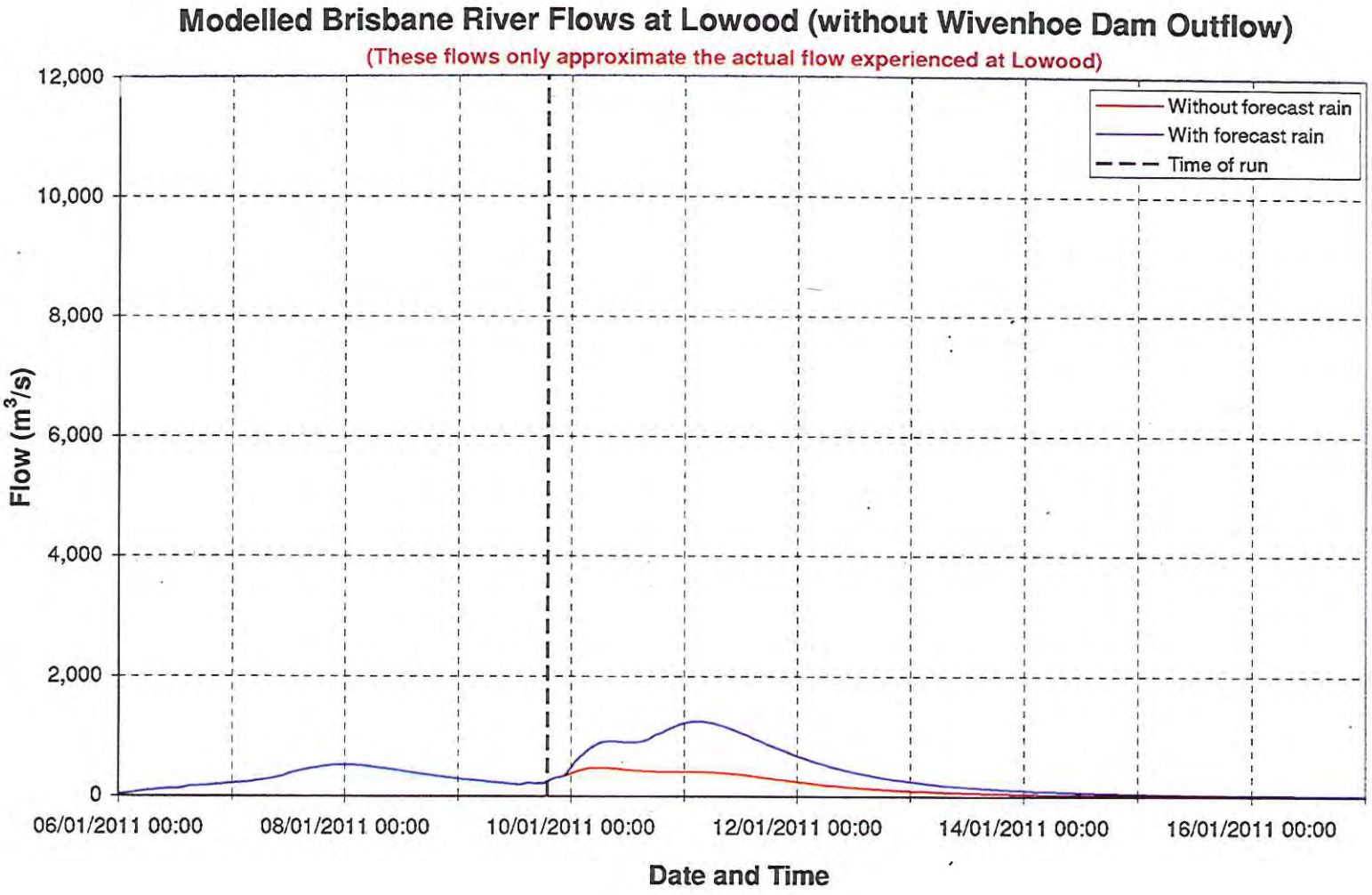

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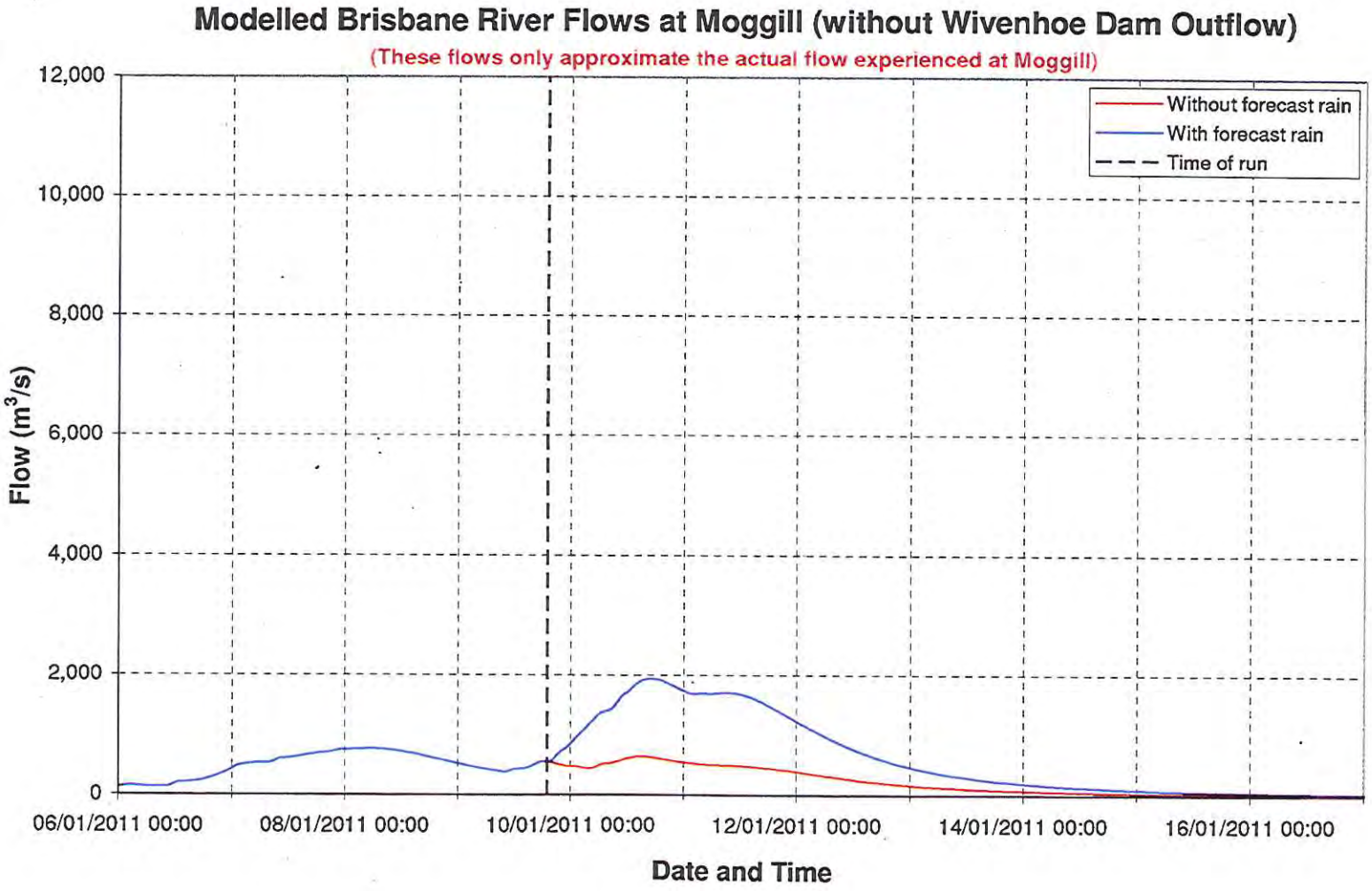


Run 21: Sunday 9 January 2011, 19:00

"TM-2"

Rainfall Forecasting for the Wivenhoe Dam Catchment

Background

1. On 6 July, Chris Russell, of Connell Wagner, met with Mike Bergin and Peter Baddiley seeking advice regarding the predictability of significant rain events over the Wivenhoe Dam catchment. Connell Wagner has been engaged by SEQWCo to provide advice on the feasibility of maintaining the water level in the Wivenhoe storage at one metre above Full Supply Level. As a part of the dam operations under that scenario, it would be required that the additional storage above FSL be released ahead of a major inflow into Wivenhoe Dam. This would require some 24 to 48 hour advance prediction of catchment average rainfalls in the order of 300mm in 24 hours; 375mm in 36 hours and/or 430mm in 48 hours.

2. Wivenhoe Dam catchment is located to the north-west of Brisbane and has an area of about 7,000 square kilometres. For meteorological forecasting, the catchment is broadly about 100 km in the north-south direction, and 70 kilometres wide (east-west); bounded in the west by the Dividing Range with its eastern boundary varying from about 40 to 80 kilometres inland from the coast. The distribution of rainfall over the catchment is significantly influenced by the topography in major events.

Discussion

3. As discussed at the meeting, the experience of Meteorologists and Hydrologists in the Brisbane office of the Bureau is that the short to medium term (0 to 48 hour) prediction of rainfall for the purpose of objective use in flood forecasting models is a difficult task. Quantitative Precipitation Forecasts (QPF) are available from the Australian and international Numerical Weather Prediction (NWP) models and have been used subjectively in the Brisbane office for many years. Whilst the NWP models have shown improvement in the accuracy of QPF over the past decade or so, there is still at times considerable error or uncertainty, in the prediction of the location, amount and timing of rainfall events at the catchment scale.

4. The improved skill of NWP models in recent years has particularly been in forecasting the development and movement of broad-scale synoptic features that would be likely to produce the threshold rainfall amounts in question. These large-scale features include decaying tropical cyclones, east coast low pressure systems and significant upper level troughs. However while these systems maybe well forecast on a time scale of 2 to 3 days the very heavy rainfall concentrations are dependent on finer scale (mesoscale) and convective features. Whilst there is often the ability to forecast the potential for a significant rain event to occur in the southeast Qld-northern NSW region, it is difficult (if not impossible) to predict the actual location of the heaviest rain, even with only a few hours notice.

5. Examples of high rainfall events that have occurred in the past 10 to 15 years in this region, some of which had little to no advance prediction of the "precise" location and/or magnitude of resulting rainfall, include Feb 1991, Dec 1991, Feb 1992, May 1996, Feb 1999, Mar 2001 and June 2005. Several of these events were not produced by large-scale features but by slow moving convergence zones which the current

[redacted] [redacted]

modelling capability cannot adequately predict. The two most recent events in 2001 and 2005 were relatively short-lived events and occurred at different times of the day – 2001 in the afternoon and 2005 overnight. While one could reasonably expect that most really significant rainfall events are most likely through the warmer months, winter extreme events are by no means rare.

6. Considerable effort is being applied to derive improved deterministic and probabilistic QPFs from NWP models. In the near future, the Bureau will be providing a publicly available rainfall forecasting service via a website. The rainfall predictions will be generated automatically by combining the outlooks from a suite of Australian and international. Forecast rainfall amounts for 24 hour periods will be given for 4 days ahead, together with the chance of exceeding various amounts from 1mm to 50mm. The latter is a "pseudo" measure of probability based on the consistency in the forecast rain amounts given by up to eight NWP models used in deriving the rainfall forecast. Whilst it is not considered that this will provide a sufficiently accurate method for objective decision making for pre-releases from Wivenhoe Dam, the probabilistic rain forecasts may provide a basis for a risk management approach. There may need to be further studies on risk quantification for prediction of high to extreme rainfall events to support this approach. Given that there are large levels of uncertainty in rainfall forecasts, the forecasting of hydrological response may require an ensemble of future rain scenarios to be considered for the Wivenhoe Dam application.

7. As for a potential service provided by the Bureau an alert type product would seem to be the best alternative where the potential for an extreme rainfall event in the following 2 to 3 days across southeast Queensland was given a rating on say a 3 level scale. If that rating was high then a second phase could be activated which could provide more detailed forecast of expected rainfall amounts and location. However I emphasise that this type of service can be expected to not provide the required 2 days advice of an event on some occasions and may fail to provide anything more than a few hours notice, such is the nature of the predictability of the mesoscale components of these events.

8. Currently the Bureau provides a QPF service for the dams in Southeast Queensland. This twice-daily service predicts the average rainfall across the catchments in the following 24-hour period. We have not undertaken any verification of the service. However it is likely that verification would show reasonable skill in identifying rainfall events but quite poor skill in predicting extreme events. This service is to be reviewed in the next few months and we may commence charging for the product as it is essentially not a basic service and should not be publicly funded. We have yet to commence discussions with the client so these comments should be kept confidential. This issue is raised because any future customized product provided in support of dam operations will certainly be on a fee for service basis. There is also the issue of whether the Bureau would have the capacity to provide such a service at all and that would have to be part of any future discussions.

Summary

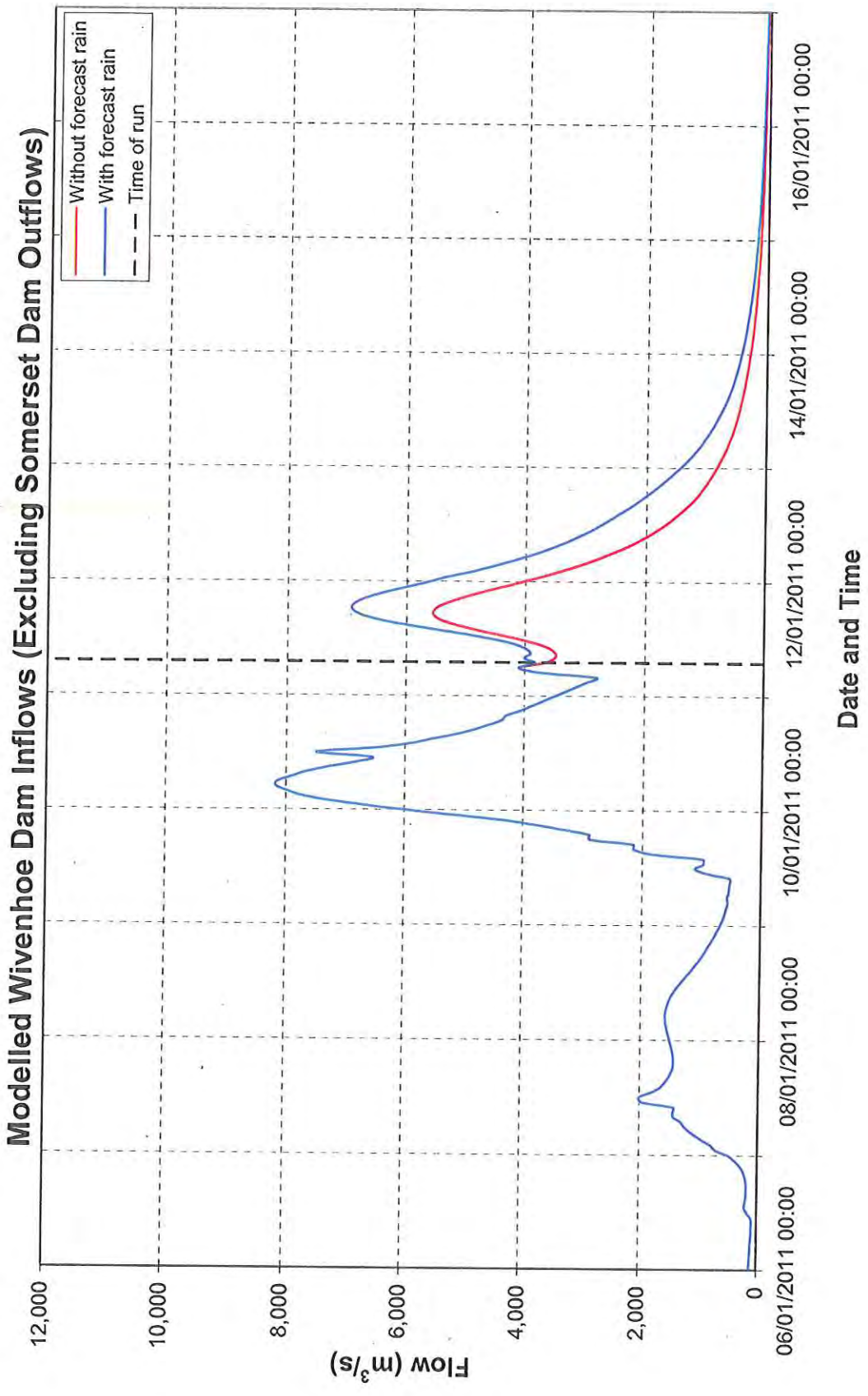
9. In light of the demand for water in southeast Queensland and the highly variable nature of rainfall in the area the project has many obvious attractions. However the capability of the science to provide sufficiently reliable 24 to 48 hour advance predictions of high catchment average rainfalls is limited. The Bureau would be willing to participate in future discussions on the subject and maybe able to assist with some service that would assist.

Mike Bergin
Manager Weather Services,
Bureau of Meteorology, Queensland.

Peter Baddiley
Supervising Engineer Hydrology
Bureau of Meteorology, Queensland

24 July 2006

"TM-3"



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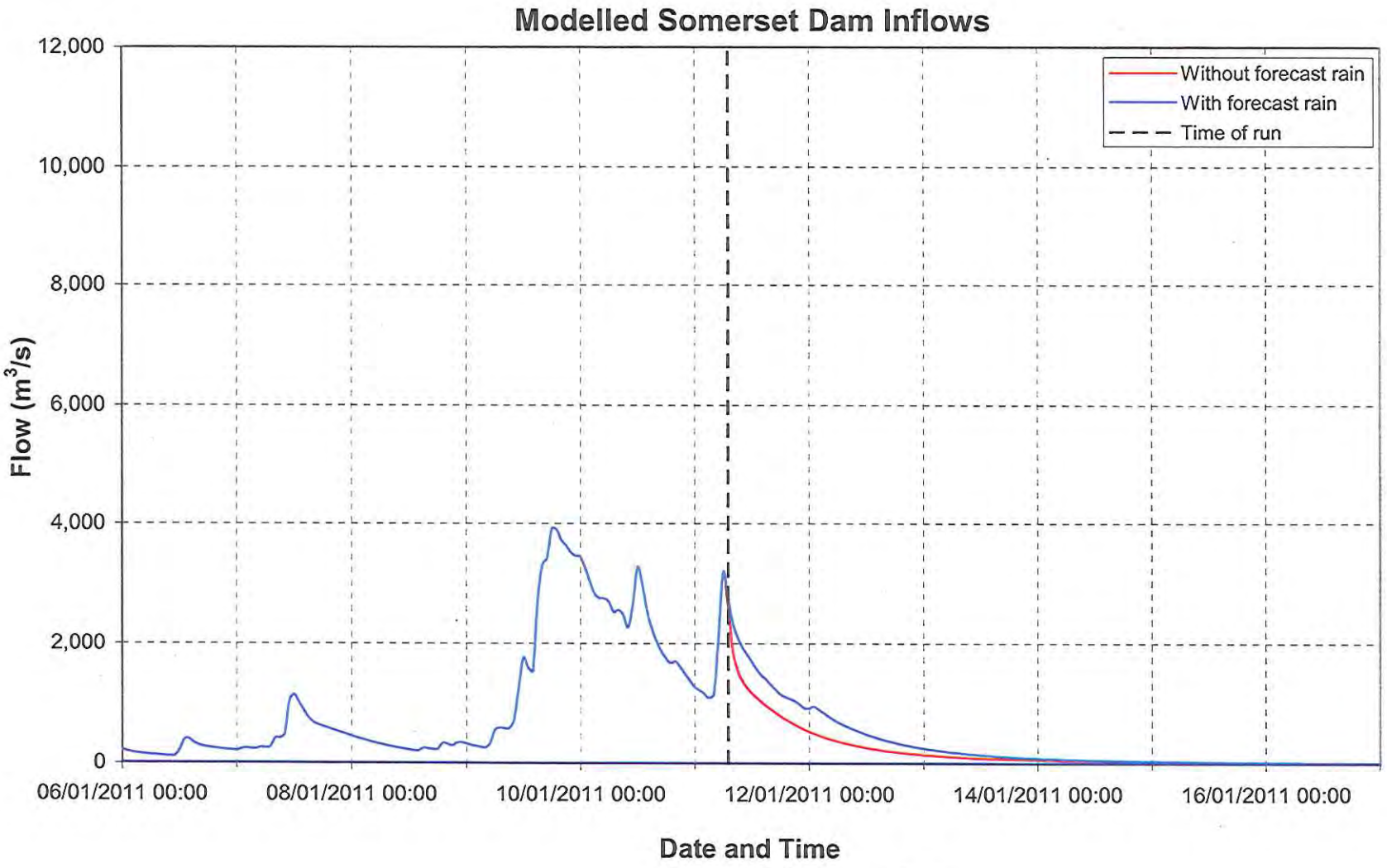
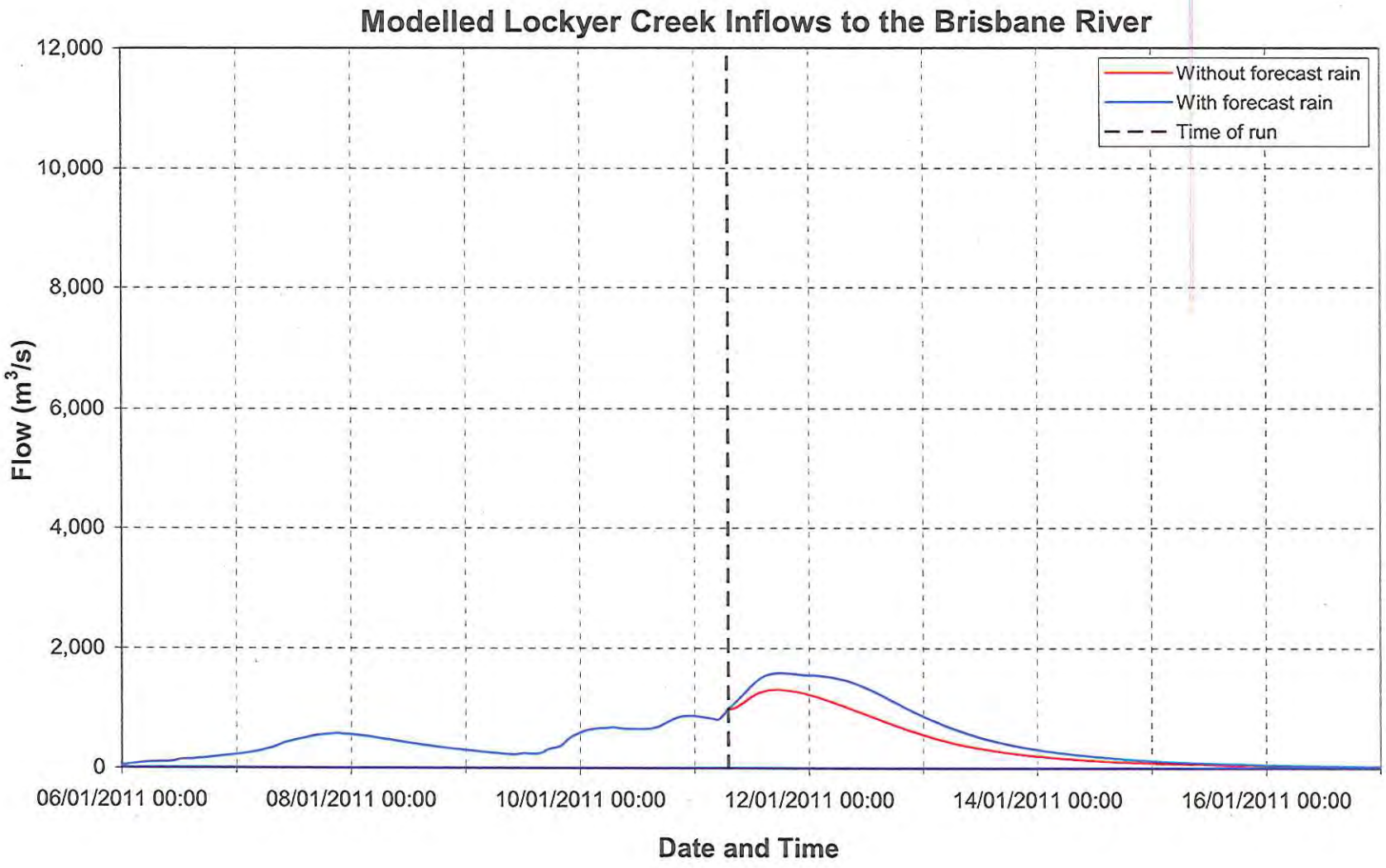
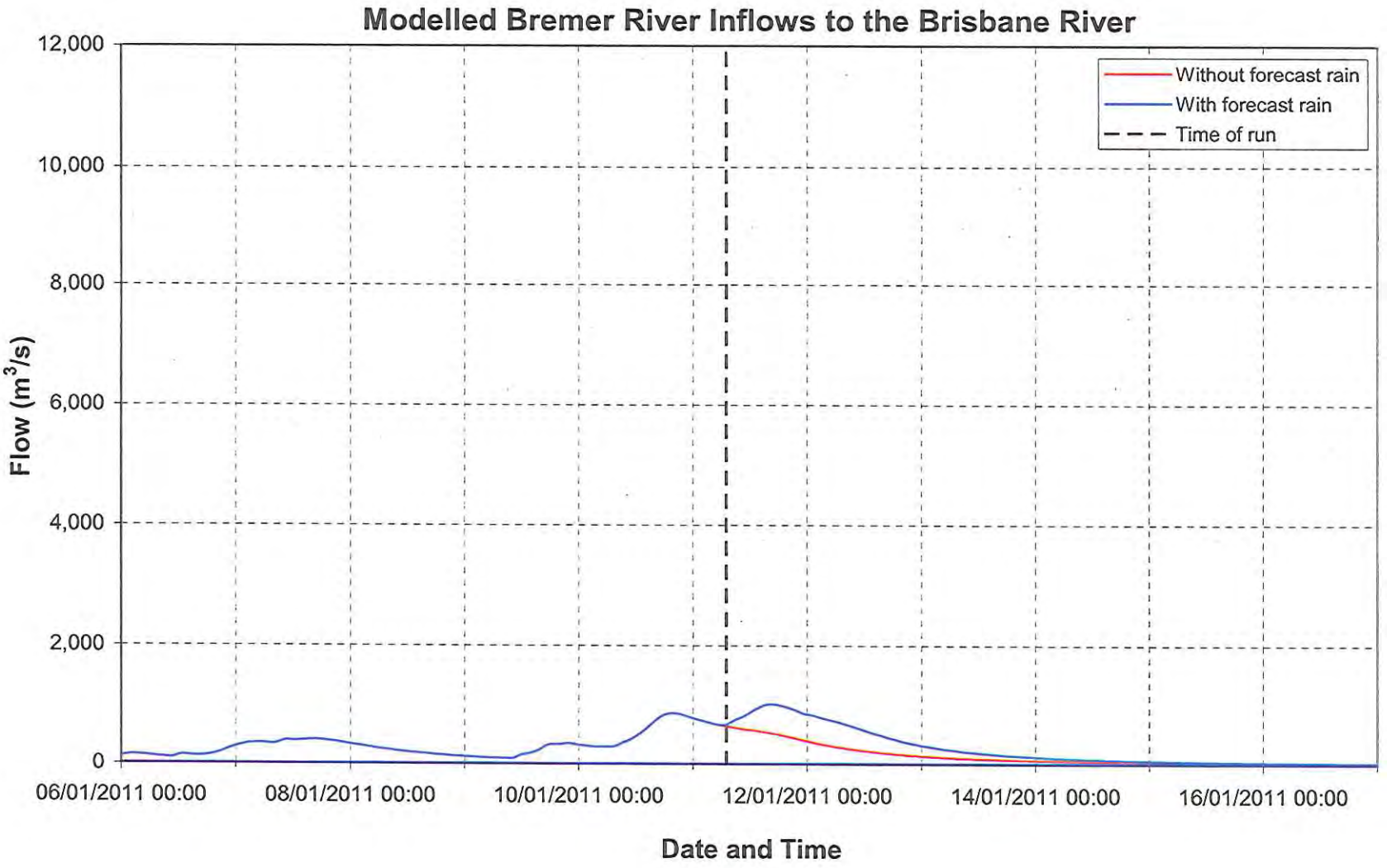
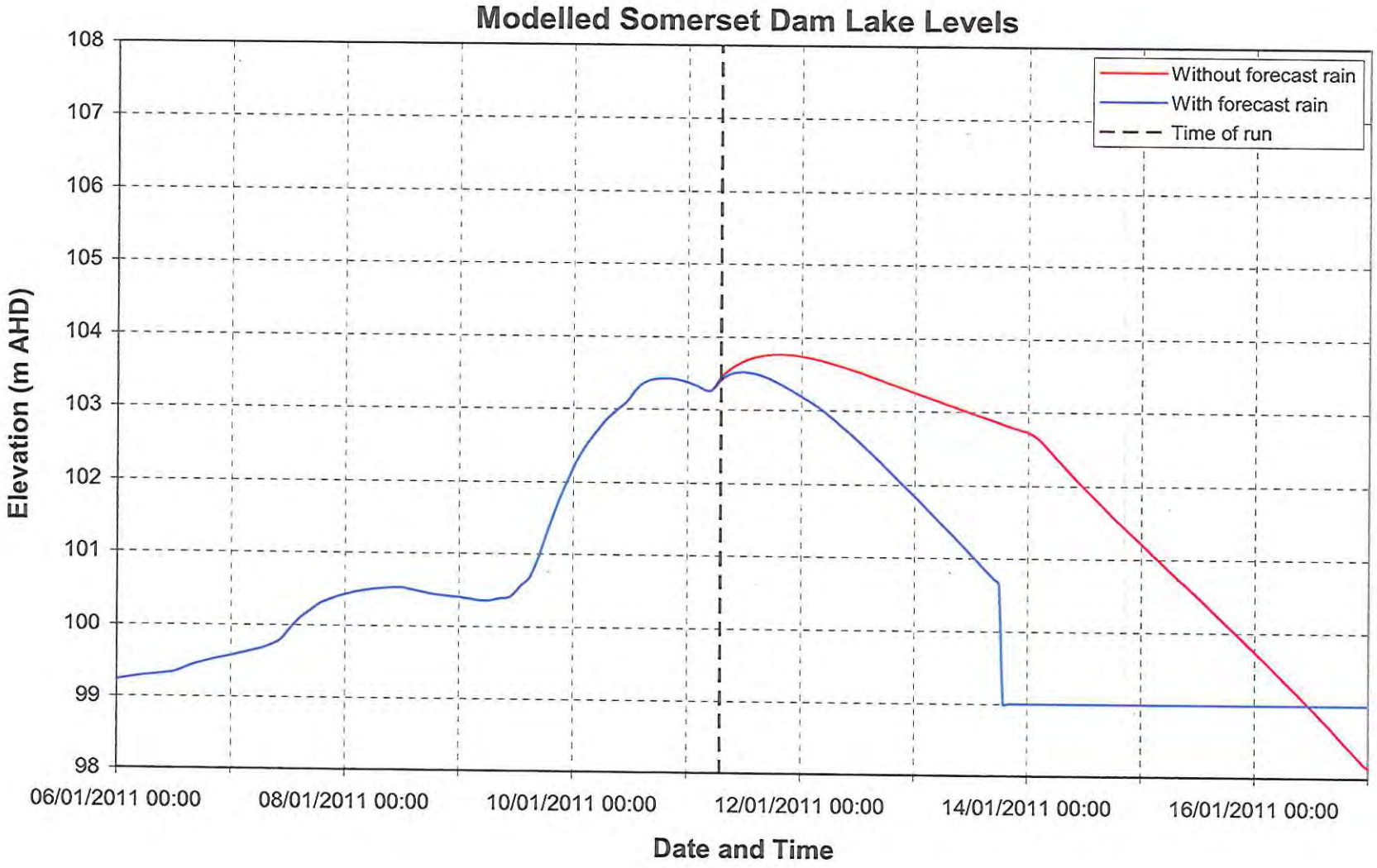
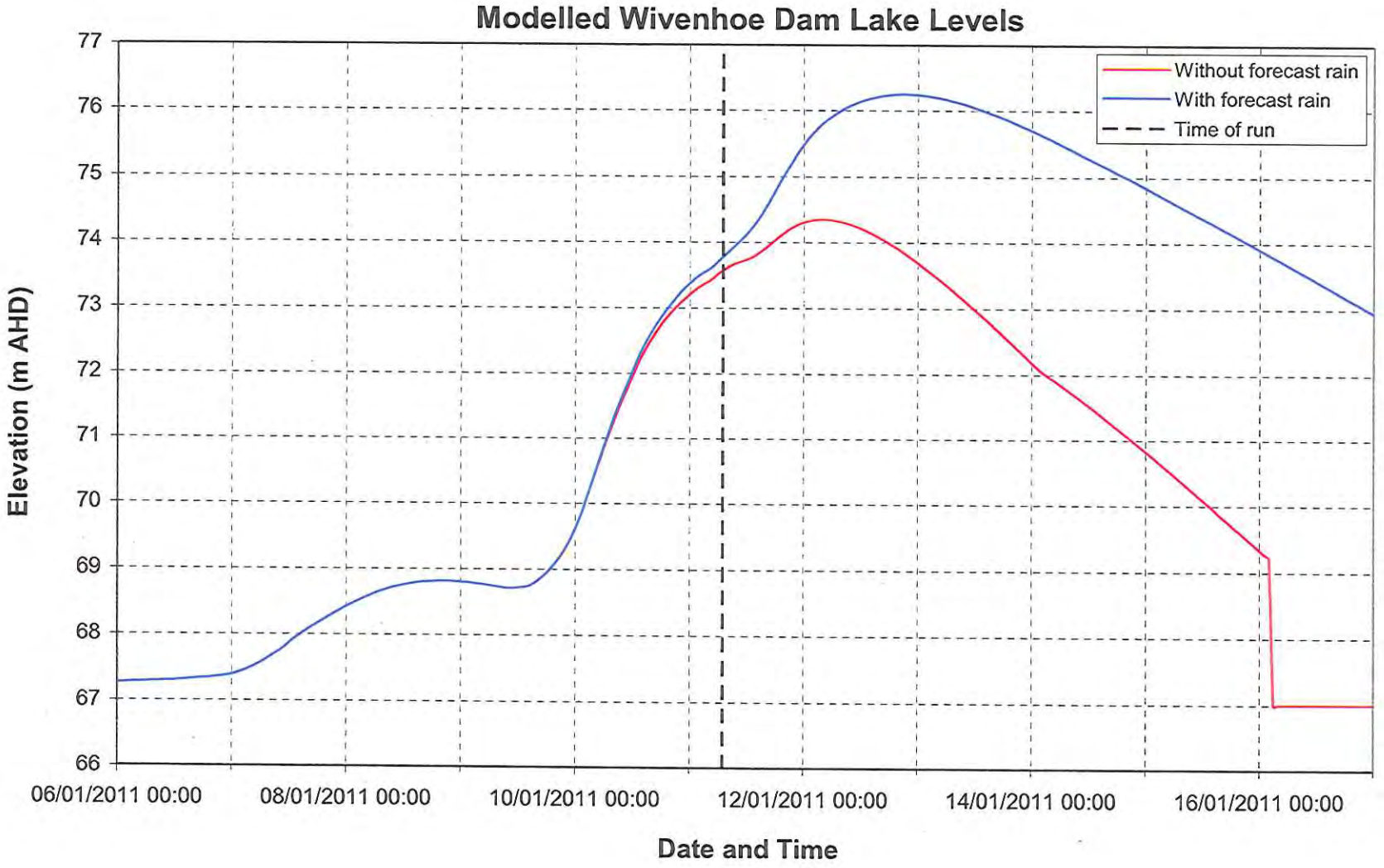

Modelled Somerset Dam Inflows
12,000
10,000
8,000
6,000
4,000
2,000
0
Flow (m3/s)
Without forecast rain
With forecast rain
Time of run
06/01/2011 00:00
08/01/2011 00:00
10/01/2011 00:00
12/01/2011 00:00
14/01/2011 00:00
16/01/2011 00:00
Date and Time

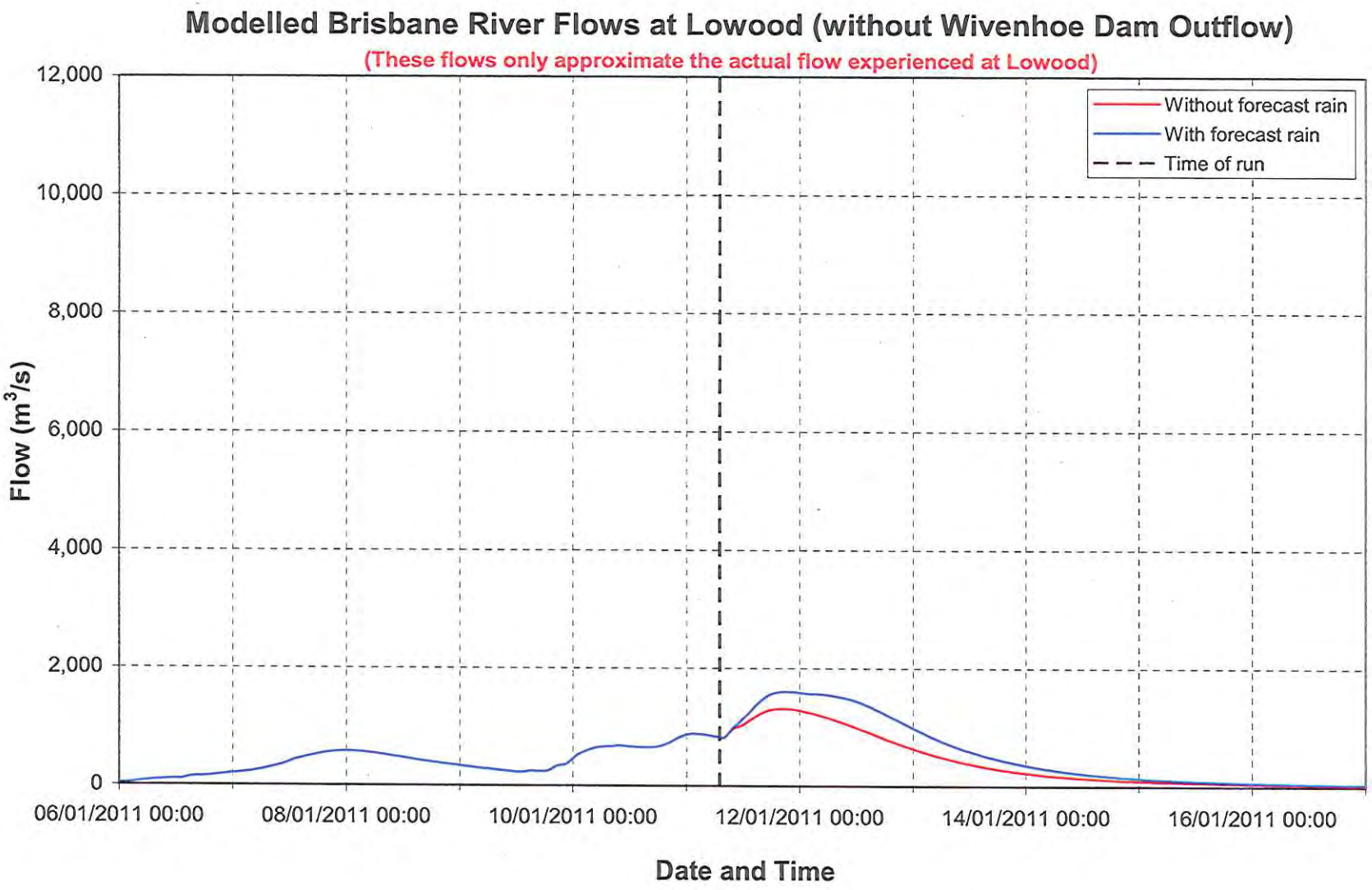
14

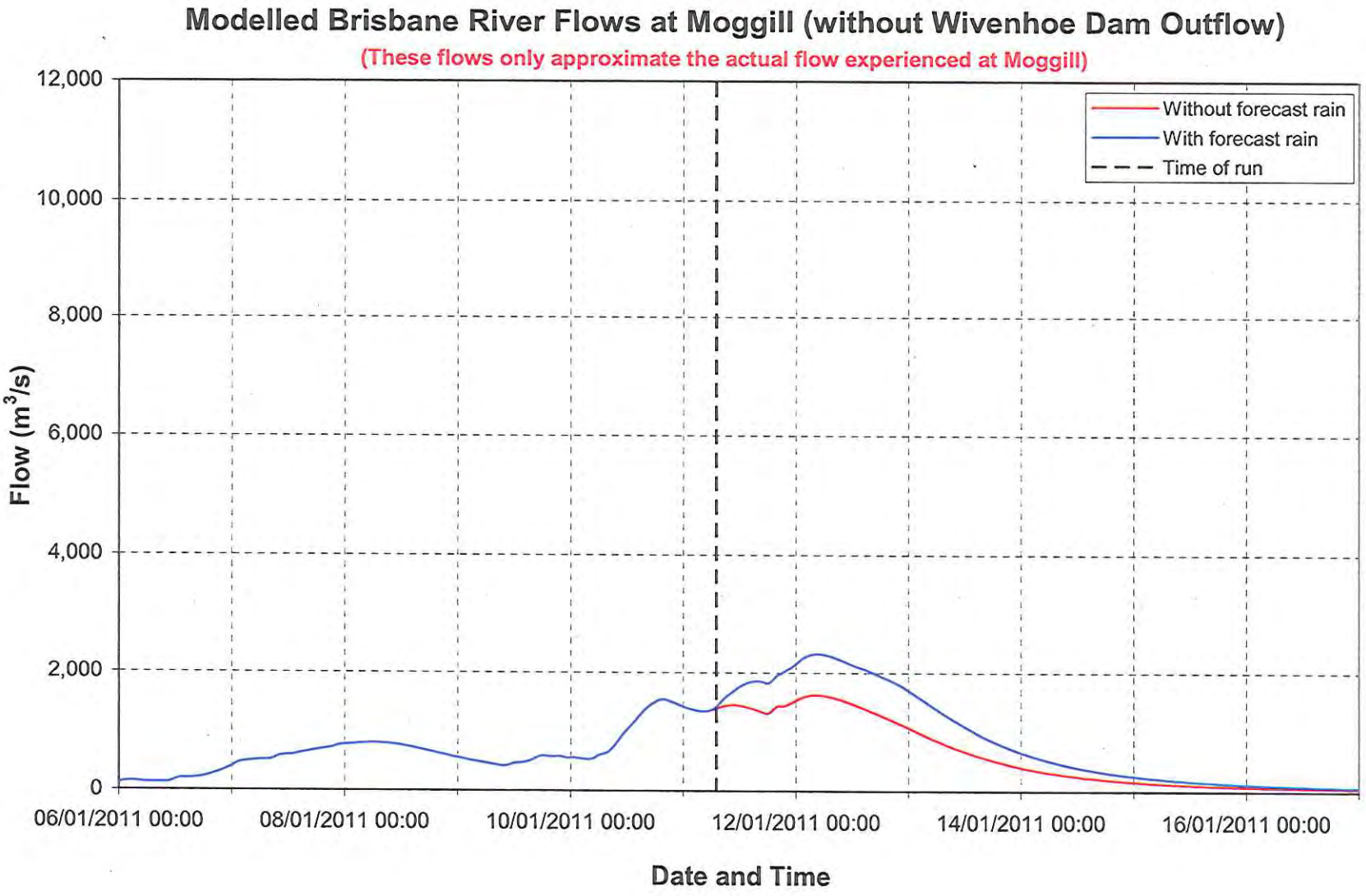

Modelled Lockyer Creek Inflows to the Brisbane River
12,000
10,000
8,000
6,000
4,000
2,000
0
Flow (m3/s)
Without forecast rain
With forecast rain
Time of run
06/01/2011 00:00
08/01/2011 00:00
10/01/2011 00:00
12/01/2011 00:00
14/01/2011 00:00
16/01/2011 00:00
Date and Time


Modelled Bremer River Inflows to the Brisbane River
12,000
10,000
8,000
6,000
4,000
2,000
0
Flow (m3/s)
06/01/2011 00:00
08/01/2011 00:00
10/01/2011 00:00
12/01/2011 00:00
14/01/2011 00:00
16/01/2011 00:00
Date and Time
Without forecast rain
With forecast rain
Time of run


Modelled Somerset Dam Lake Levels
Without forecast rain
With forecast rain
Time of run
Elevation (m AHD)
108
107
106
105
104
103
102
101
100
99
98
06/01/2011 00:00
08/01/2011 00:00
10/01/2011 00:00
12/01/2011 00:00
14/01/2011 00:00
16/01/2011 00:00
Date and Time


Modelled Wivenhoe Dam Lake Levels
Without forecast rain
With forecast rain
Time of run
Elevation (m AHD)
77
76
75
74
73
72
71
70
69
68
67
66
06/01/2011 00:00
08/01/2011 00:00
10/01/2011 00:00
12/01/2011 00:00
14/01/2011 00:00
16/01/2011 00:00
Date and Time


Modelled Brisbane River Flows at Lowood (without Wivenhoe Dam Outflow)
(These flows only approximate the actual flow experienced at Lowood)
Without forecast rain
With forecast rain
Time of run
12,000
10,000
8,000
6,000
4,000
2,000
0
Flow (m3/s)
06/01/2011 00:00
08/01/2011 00:00
10/01/2011 00:00
12/01/2011 00:00
14/01/2011 00:00
16/01/2011 00:00
Date and Time


Modelled Brisbane River Flows at Moggill (without Wivenhoe Dam Outflow)
(These flows only approximate the actual flow experienced at Moggill)
Without forecast rain
With forecast rain
Time of run
Flow (m3/s)
12,000
10,000
8,000
6,000
4,000
2,000
0
06/01/2011 00:00
08/01/2011 00:00
10/01/2011 00:00
12/01/2011 00:00
14/01/2011 00:00
16/01/2011 00:00
Date and Time

Run	36
Run Date	Tue 11/01/2011 07:00
Title1	Upper Brisbane R Modelled Flows
Title2	Stanley R Modelled Flows
Title3	Lockyer Ck Modelled Flows
Title4	Bremer R Modelled Flows
Title5	Somerset Dam
Title6	Wivenhoe Dam
Title7	Lowood
Title8	Moggill
Title9	Lowood (without WDO)
Title10	Moggill (without WDO)

	Min	Max
Run	11/01/2011 07:00	11/01/2011 07:00
Flow	0	100000
Somerset	98	108
Wivenhoe	66	77

"TM-4"

Situation Report 15

Date: Monday 10 January 2011

Time: 12:16

From: Duty Engineer
Sent: Monday, 10 January 2011 12:16 PM
To: Distribution List
Cc: Distribution List
Subject: FOC Situation Report at 12:00 on Monday 10 January 2011

Rainfall

Rainfall has continued in the dam catchments over the last 6 hours, with approximate catchment averages as follows: North Pine (30mm); Wivenhoe Dam (20mm); Somerset Dam (40mm). A severe weather warning remains current for heavy rainfall in the dam catchment areas. The QPF issued by BOM at 10:00 estimates rainfalls for the 24 hours to 10:00 Tuesday as North Pine Dam (75mm to 150mm); Wivenhoe/Somerset Dam Catchments (50mm – 100mm).

North Pine Dam (Full Supply Level 39.60 m AHD)

The dam level is 40.00m AHD and relatively steady (storing 9,000ML above FSL). Five gates are open and releasing 500 m3/s. The inflow into the dam since the commencement of the event is 63,000 ML. Estimated event volume is 77,000 ML assuming no further rainfall. Gate operations will continue until at least Wednesday 12 January 2011.

Somerset Dam (Full Supply Level 99.00 m AHD)

The dam level is 103.11m AHD and rising (storing 210,000 ML above FSL). Peak inflow to the dam is estimated to be about 4,200 m3/s. Five sluice gates are open releasing about 1,100m3/s (95,000ML/day) into Wivenhoe Dam. At this stage the dam lake level will reach about 103.5m AHD on Monday afternoon. Areas around Kilcoy will continue to be adversely affected.

Since the commencement of the event on 02/01/2011approximately 182,000ML has been released from the dam into Wivenhoe, with an event total of the order of 520,000ML expected. This is expected to increase due to the forecast rain in the next 24 to 48 hours. At this stage, releases will continue until at least Thursday 13 January 2011.

Wivenhoe Dam (Full Supply Level 67.00 m AHD)

The dam level is 71.95m AHD and rising quickly (storing 610,000 ML above FSL). Peak inflow to the dam is estimated to be about 8,800m3/s. Five radial gates are open releasing about 2000m3/s (170,000ML/day) into the Brisbane River. At this stage, the dam will reach about 73.5m AHD during Tuesday morning. Flows in the Brisbane River above the dam at Gregor's Creek peaked at 7,350m3/s and this peak is bigger than both the January 1974 and February 1999 flood events at this location.

The objective for dam operations is to minimise the impact of urban flooding in areas downstream of the dam and the current aim is to keep river flows in the lower Brisbane River below 3,500m3/s if possible. This is significantly less than the current estimated combined pre-dam peak inflow of 12,000m3/s.

Since the commencement of the event on 02/01/2011 approximately 325,000ML has been released from the dam, with an event total approaching 1,600,000ML without further rain and as much as 2,100,000ML with forecast rainfall of (both including Somerset outflow). At this stage, releases will continue until at least Sunday 16 January 2011.

The volume between the expected peak (73.5m AHD) and the level at which the safety of the dam becomes the primary objective in managing flood releases (74.0m AHD) is 75,000ML. The volume between the expected peak (73.5m AHD) and initiation of the first Fuse Plug is 330,000ML.

Impacts downstream of Wivenhoe Dam

The projected Wivenhoe Dam releases combined with Lockyer Creek flows and local runoff will mean that all crossings downstream of Wivenhoe (Twin Bridges, Fernvale, Savages Crossing, Burtons Bridge, Kholo Bridge, Mt Crosby Weir and Colleges Crossing) will be adversely impacted until at least Saturday 15 January in varying degrees.

Water levels in the lower Brisbane River will be impacted by the combined flows of Lockyer Creek, Bremer River, local runoff and releases from Wivenhoe Dam. If the predicted rainfall eventuates in the downstream tributary catchments the resultant combined flows in the lower Brisbane may exceed the threshold of damaging discharge in the urban areas within the next 24 to 48 hours. Currently the estimate peak flow in the lower Brisbane River will be the highest since Wivenhoe Dam was completed in 1984 but still well below flows the 1974 levels.

Somerset Regional, Ipswich City and Brisbane City Councils have been advised of the updated Wivenhoe operating strategy.

Outlook

Heavy rainfall continues throughout South East Queensland and the situation could deteriorate rapidly over the next 24 hours. The flood operation centre will continue to monitor the situation and provide every six hours until the situation stabilizes.

Engineer 2
Duty Engineer
Flood Operations Centre

"TM-5"

Hughes, James

From: Duty Engineer [redacted]

Sent: Monday, 10 January 2011 2:58 PM

To: 'Duty Engineer'; John Ruffini (Home); David Roberts; [redacted] Paul Bird; Peter Allen; [redacted] Rohan Thorogood; [redacted] Al Navaruk; Bill Stephens; David Pokarier; John West; Lou van Blerk; Mark Tan; Nev Ablitt; [redacted] Glenn Patterson; [redacted] Murray Dunstan; Rob Gorian; [redacted] Doug Grigg; [redacted] Graham Francis; Jayam Tennakoon; Matthew O'Reilly

Cc: Andy Bickerton; Deb Chandler; Mailbox; Tony Trace; Chris Lavin; Craig Logan; Don Carroll; Evan Caswell; James Charalambous; Ken Morris; Robert McGlinn; Santina Pennisi; [redacted]

Subject: RE: FOC Situation Report at 12:00 on Monday 10 January 2011

Rainfall

Significant rainfall has fallen in the Wivenhoe Dam catchment over the last 3 hours, with falls exceeding 100mm. This rainfall will significantly increase inflows into the dam. A severe weather warning remains current for heavy rainfall in the dam catchment areas. The QPF issued by BOM at 10:00 estimates rainfalls for the 24 hours to 10:00 Tuesday as North Pine Dam (75mm to 150mm); Wivenhoe/Somerset Dam Catchments (50mm – 100mm). Potentially significant rain moving towards the dam catchments is currently evident on the BOM radar.

Somerset Dam (Full Supply Level 99.00 m AHD)

The dam level is 103.41m AHD and rising. Peak inflow to the dam is estimated to be about 4,200 m3/s. Five sluice gates are open releasing about 1,100m3/s (95,000ML/day) into Wivenhoe Dam. At this stage the dam lake level will reach about 103.5m AHD on Monday afternoon. Areas around Kilcoy will continue to be adversely affected.

Wivenhoe Dam (Full Supply Level 67.00 m AHD)

The dam level is 72.41m AHD and rising quickly. The rainfall experienced over the last 2 to 3 hours will result in significant further inflows into the dam and releases from the dam will need to be increased in accordance with Flood Mitigation procedures and to ensure that a fuse plug is not initiated. The initiation of a fuse plug will result in a rapid uncontrolled outflow from the dam of 2,000m3/s being added to the gate release outflow. Outflows into the Brisbane River from both Lockyer Creek and the Bremer River are also increasing.

Five radial gates are currently open at the dam releasing about 2,000m3/s into the Brisbane River and this will need to be increased steadily to an outflow of 2,800m3/s over the next 9 hours (commencing at 1500). At this stage, the dam will reach about 73.8m AHD during Tuesday morning.

The objective for dam operations is currently to minimise the impact of urban flooding in areas downstream of the dam and to keep river flows in the lower Brisbane River below 4,000m3/s if possible. This is significantly less than the current estimated combined pre-dam peak inflow of 12,000m3/s. If further rainfall occurs, dam releases may need to be increased further and this may result in river flows in the lower Brisbane River approaching or exceeding 5,000m3/s.

Impacts downstream of Wivenhoe Dam

The projected Wivenhoe Dam releases combined with Lockyer Creek flows and local runoff will mean that all crossings downstream of Wivenhoe (Twin Bridges, Fernvale, Savages Crossing, Burtons Bridge, Kholo Bridge, Mt Crosby Weir and Colleges Crossing) will be adversely impacted until at least Sunday 16 January in varying degrees.

Water levels in the lower Brisbane River will be impacted by the combined flows of Lockyer Creek, Bremer River, local runoff and releases from Wivenhoe Dam.

Outlook

Heavy rainfall continues throughout South East Queensland and the situation could deteriorate rapidly over the next 24 hours. The flood operation centre will continue to monitor the situation and provide every six hours until the situation stabilizes.

Terry Malone
Duty Engineer
Flood Operations Centre

Situation Report 11

Date: Sunday 9 January 2011

Time: 17:51

From: Duty Engineer
Sent: Sunday, 9 January 2011 5:51 PM
To: Distribution List
Cc: Distribution List
Subject: Situation Report 1700 Sunday 9/1/2011

Rainfall

Catchment average rainfall for the past 12 hours is; North Pine Dam (60 mm); Somerset Dam (150 mm); Wivenhoe Dam (80 mm). The bulk of the rain that has fallen in the upper reaches of the Stanley and Brisbane Rivers.

The BOM rainfall forecast for the next few days is:-

Monday:	Very heavy rain periods with totals up to 300mm centred around North Pine.
Tuesday:	Rain periods with totals up to 150mm centred around North Pine.
Wednesday	A few showers less than 10mm
Thursday	A shower or two.
Friday	A shower or two.
Saturday	Mostly fine.

A severe whether warning remains current for heavy rainfall in the dam catchment areas. The dam catchments are relatively saturated and significant inflows will be generated if the forecast rainfall eventuates.

North Pine Dam (Full Supply Level 39.60 m AHD)

The dam level is currently 39.65 m AHD and rising at 1600. Following the rain in the 9 hours, the number of open gates has been increased from 2 to 5 which are expected to remain open for the next 12 hours. Youngs Crossing will remain closed while releases are in progress.

Somerset Dam (Full Supply Level 99.00 m AHD)

The dam level is 100.75 m AHD and rising quickly. Estimated peak inflow to the dam is about 3,000m3/s. Five sluice gates are open releasing about 1,100m3/s (95,000Ml/d) into Wivenhoe Dam. At this stage the dam will reach at least 101.5 during early Tuesday morning.

Since the commencement of the event on 02/01/2011approximately 80,000ML has been released from the dam, with an event total of at least 320,000ML based on the recorded rainfall to date. The event total is expected to increase significantly due to the forecast rain in the next 24 to 48 hours. At this stage, releases will continue until at least Wednesday.

Wivenhoe Dam (Full Supply Level 67.00 m AHD)

The dam level is currently rising again, with the current level being 68.70m AHD. Estimated peak inflow to the dam just from the Upper Brisbane R is about 5,000m3/s and, at this stage, the dam will reach at least 72.5 m AHD during Wednesday morning. River levels upstream of the dam are rising quickly with significant inflow being generated from the intense heavy rainfall. The current gate operation strategy will maintain flows of around 1,600m^3/s in the mid-Brisbane River for the next 24 hours. This may mean temporarily reducing releases from Wivenhoe Dam as Lockyer flows increase. However, releases may have to be increased significantly during Monday depending on the rain in the next 12 to 24 hours. The current release rate from Wivenhoe Dam is 1,400m3/s (120,000ML/day).

Since the commencement of the event on 02/01/2011 approximately 210,000ML has been released from the dam, with an event total approaching 1,000,000ML (including Somerset outflow) based on the recorded rainfall to date. The total release for the event is likely to increase over the next few days based on the current rainfall forecasts. At this stage, releases will continue until at least Saturday 15th January 2011.

Impacts downstream of Wivenhoe Dam

The current Wivenhoe Dam release combined with Lockyer flows and local runoff will mean that all low level crossings downstream of Wivenhoe (Twin Bridges, Savages Crossing, Burtons Bridge, Kholo Bridge and Colleges Crossing) will be adversely impacted until at least Saturday 15 January.

At this stage Fernvale and Mt Crosby Weir Bridge will not be affected for the next 24 hours but there is a strong possibility that, if the predicted rainfall totals eventuate in the next 12 to 24 hours, higher releases from Wivenhoe Dam will be necessary. This may adversely impact upon Fernvale and Mt Crosby Weir Bridges as early as Tuesday morning.

Water levels in the lower Brisbane R will be impacted by the combined flows of Lockyer Ck, Bremer River, local runoff and releases from Wivenhoe Dam.

Somerset Regional, Ipswich City and Brisbane City Councils have been advised of the Wivenhoe operating strategy.

Engineer 2
Duty Engineer
Flood Operations Centre

"TM-7"

Situation Report 12

Date: Sunday 9 January 2011

Time: 21:04

From: Duty Engineer
Sent: Sunday, 9 January 2011 9:04 PM
To: Distribution List
Cc: Distribution List
Subject: Situation Report 2100 9/01/2011
Importance: High

Rainfall

Very heavy rainfall has been recorded in the upper reaches of the Brisbane and Stanley in the last 6 hours with totals up 100 to 140mm. Totals for the last 24 hours range from 100 to 300mm.

Rainfall of similar magnitudes is expected in the 12 to 24 hours, especially around the Bremer/Warrill catchments as the system tracks south.

A severe weather warning remains current for heavy rainfall in the dam catchment areas.

Somerset Dam (Full Supply Level 99.00 m AHD)

The dam level is 101.68 m AHD (about 500,000ML currently in storage) and rising quickly. Peak inflow to the dam is estimated to be about 4,000 m3/s based on observed rainfall and could be as high as 5,000m3/s with additional forecast rainfall. Five sluice gates are open releasing about 1,100m3/s (95,000Ml/d) into Wivenhoe Dam. At this stage the dam will reach at least 103.5 early Tuesday morning which will adversely impact areas around Kilcoy.

Since the commencement of the event on 02/01/2011approximately 100,000ML has been released from the dam into Wivenhoe, with an event total of the order of 520,000ML expected. This may increase due to the forecast rain in the next 24 to 48 hours. At this stage, releases will continue until at least Thursday.

Wivenhoe Dam (Full Supply Level 67.00 m AHD)

River levels upstream of the dam are rising quickly with significant inflow being generated from the intense heavy rainfall. Flows in the Brisbane River at Gregor's Ck have already reached 6,700m3/s and the river is still rising.

The dam level is rising again, with the current level being 69.10m AHD (1,410,000ML with about 300,00 of flood storage). Estimated peak inflow to the dam just from the Upper Brisbane R alone may reach as high as 7,500m3/s and, at this stage, the dam will reach at least 73.0 m AHD during Tuesday morning. Given the rapid increase in inflow volumes, it will be necessary to increase the release from Wivenhoe Monday morning.

The objective for dam operations will be to minimise the impact of urban flooding in areas downstream of the dam and, at this stage, releases will be kept below 3,500m3/s and the combined flows is the lower Brisbane will be limited to 4,000m3/s. This is below the limit of urban damages in the City reaches.

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The current release rate from Wivenhoe Dam is 1,400m3/s (120,000ML/day). Gate opening will start to be increased from noon Monday and the release is expected increase to at least 2,600m3/s during Tuesday morning.

Since the commencement of the event on 02/01/2011 approximately 220,000ML has been released from the dam, with an event total approaching 1,000,000ML without further rain and as much as 1,500,000ML with forecast rainfall of (both including Somerset outflow). At this stage, releases will continue until at least Sunday 16th January 2011.

Impacts downstream of Wivenhoe Dam

The projected Wivenhoe Dam releases combined with Lockyer flows and local runoff will mean that all crossings downstream of Wivenhoe (Twin Bridges, Fernvale, Savages Crossing, Burtons Bridge, Kholo Bridge, Mt Crosby Weir and Colleges Crossing) will be adversely impacted until at least Saturday 15 January in varying degrees.

Water levels in the lower Brisbane R will be impacted by the combined flows of Lockyer Ck, Bremer River, local runoff and releases from Wivenhoe Dam.

Somerset Regional, Ipswich City and Brisbane City Councils have been advised of the updated Wivenhoe operating strategy.

Engineer 2
Duty Engineer
Flood Operations Centre