

QUEENSLAND FLOOD COMMISSION OF INQUIRY

SUPPLEMENTARY WITNESS STATEMENT OF ROBERT ARNOLD AYRE

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I, **ROBERT ARNOLD AYRE**, of c/- SunWater Limited (**SunWater**), Level 10, 179 Turbot Street, Brisbane in the State of Queensland state as follows:

INTRODUCTION

- 1 This statement is supplementary to the statement I provided to the Commission of Inquiry on 23 March 2011 (**my first statement**).
- 2 This statement addresses the events with which I was involved during the January 2011 Flood Event and responds to media reports in relation to the operation of Wivenhoe, Somerset and North Pine Dams during the January 2011 Flood Event.
- 3 This statement has been provided without any knowledge of the contents of other evidence that will or may be adduced, or the submissions that have or will be made to the Commission of Inquiry. I will supplement this statement with addendum statements if it is necessary.
- 4 The opinions that are contained in this statement are my own. I do not provide this statement on behalf of Seqwater.
- 5 I will provide any further information or explanation required by the Commission of Inquiry.
- 6 Documents referenced in this statement can be provided on request.
- 7 The definitions used in this supplementary statement are the same as the defined terms in my first statement.

EVENTS DURING THE JANUARY 2011 FLOOD EVENT

The Event Log

- 8 As referred to in my first statement to the Commission of Inquiry (at paragraphs 134 & 135), an Event Log was kept in accordance with the Seqwater Flood Operations Procedures Manual (**the Procedures Manual**).
- 9 Most of the entries in the Event Log are made by the technical assistants who are on shift in the Flood Operations Centre (**FOC**) during the January 2011 Flood Event. For example, telephone conversations are relayed to the technical assistant who then makes the Event Log entry. Some other information in the Event Log, for example, the situation reports, were added to the Event Log after the January 2011

Flood Event. Accordingly, the Event Log is not a verbatim record of the January 2011 Flood Event.

- 10 I have set out below my comments in respect to the entries in the Event Log with which I had direct involvement.

Thursday 6 January 2011

- 11 At about 7am on 6 January 2011, I was not at work, but Terry Malone (who was the rostered Duty Operations Flood Engineer for the FOC) telephoned me on my mobile and said that he had mobilised the FOC and Wivenhoe, Somerset and North Pine Dams in response to the rainfall overnight and the water flowing into each of the Dams. I agreed with Terry that it was necessary to mobilise the FOC because all three Dams were above Full Supply Level (**FSL**) and the outlook was for more rain. Terry indicated that the outlook was for more rain in the next two days. As the current Duty Operations Flood Engineer, Terry was responsible for arranging the roster for staffing the FOC, so I advised him that I was available any time.
- 12 I began my shift as a Duty Flood Operations Engineer on Thursday 6 January 2011 at about 7pm after arriving at the FOC at about 6:30pm.
- 13 I remained on shift as a Duty Flood Operations Engineer until 7am on Friday 7 January 2011.
- 14 At approximately 7pm on Thursday 6 January 2011 I conducted the normal shift handover meeting with Terry Malone. During that meeting we discussed the information contained in the situation report that had been issued at approximately 5.33pm, including the following relevant matters:
- (a) The status of North Pine Dam. North Pine Directive 1 had been issued at 5:30pm. And required gate operations commencing at 7pm that night (provided that Moreton Bay Regional Council (**MBRC**) had confirmed that Youngs Crossing had been closed). At the time of the handover, North Pine Dam was at 39.7m AHD;
 - (b) The status of Somerset and Wivenhoe Dams. In respect to Wivenhoe Dam, no gates were open although the regulator valve and the hydro were still releasing at approximately 50m³/s. The focus was on what was

happening in the Lockyer Creek and Terry said that he thought the peak of Lockyer Creek would be on about Friday afternoon and would be around $600\text{m}^3/\text{s}$, which would be sufficient to take out Burtons Bridge; and

- (c) The strategy for Somerset and Wivenhoe Dams was to release on the back of the Lockyer Creek peak.

15 I note from the 5:30pm situation report and the Schedule to my first statement that, at the time I came on shift at 7pm:

- (a) Strategy W1A had been invoked (at the start of the flood event), but there was no need for any gate openings at that stage because water was being released through the regulator valves and the hydro at $50\text{m}^3/\text{s}$ and we were waiting for the natural flows from the Lockyer Creek to take out Burtons Bridge before operating Wivenhoe Dam gates. This is to allow the longest time possible for Somerset Regional Council (**SRC**) to close Burtons Bridge; and
- (b) Gate operations at North Pine Dam were about to commence under North Pine Directive 1 issued at 5:30pm (gate operations were to commence at 7pm) following the gate opening trigger level (39.65m AHD) being reached at about 2pm. Where possible, releases from North Pine Dam are timed so that the downstream bridge closures do not occur during peak hour traffic.

16 At about 6:57pm on Thursday 6 January 2011, Brett Schultz from North Pine Dam called the FOC. I took that call from Brett. I recall that Brett told me that he had done a visual inspection of Youngs Crossing and he had spoken to MBRC workmen who advised Brett that they were waiting until 7pm to close Youngs Crossing, in order to let the peak hour traffic pass. Releases from North Pine Dam cannot occur until there has been confirmation that the downstream bridges have been closed to the public. I said to Brett that we would still proceed with the gate opening sequence in North Pine Dam Directive 1 except that there would be a 15 minute delay added to all of the gate opening times to allow Youngs Crossing to be closed. As the gates at Youngs Crossing were not being closed until 7pm, the gate openings at North Pine Dam were then delayed by approximately 15 minutes. I asked Brett if he wanted me to reissue the Directive, but he said we did not need to.

- 17 At about 7:45pm on Thursday 6 January 2011 I received a telephone call from Graham Francis, a dam operator from Somerset Dam. I recall that Graham called the FOC to find out about the current release strategy for Somerset Dam. I recall that I informed Graham that we were monitoring the impacts of the Lockyer Creek flow and once we had a good handle on that we would be able to confirm future gate operations. Graham also asked if he could provide the FOC with lake levels by email and I said that was fine. Dam operators generally provide hourly lake levels by email and fax.
- 18 At about 8:15pm on Thursday 6 January 2011, North Pine Dam Directive 2 was issued at my direction by email and fax. The standard procedure when I issue directives is for me to type out the directive and then ask the technical assistant to review the pertinent details, for example, the correct sequencing of the gates and directive number. Once the directive is printed out I sign it and it is then sent by email and fax. Directive 2 took all of the gates to setting 2 with gate sequences commencing at 8.30pm. That directive was sent in order to release further water from North Pine Dam in order to reduce the lake level from about 39.7m AHD to 39.4m AHD, which would allow Youngs Crossing to be opened in time for the morning peak hour traffic.
- 19 Between 9pm through to 2am Friday, I continued to monitor the rainfall and the inflows for each of the Dams.

Friday 7 January 2011

- 20 At about 2am, I ran models for Wivenhoe, Somerset and North Pine Dams. In respect to Wivenhoe Dam I noted that the model showed a predicted lake level (on a 'no further rainfall' basis) of 68.2m AHD. The model was suggesting that this predicted lake level would not occur until 11pm the following day, namely 8 January 2011. Therefore, Wivenhoe Dam was still operating within strategy W1.
- 21 Between 2am and 6am, I continued to monitor the rainfall and the inflows for each of the Dams.
- 22 At about 6am, and in preparation for the handover at 7am, I reviewed the ACCESS forecast (which had come in at about 12am) and the Water and the Land Forecast Rainfall (**WATL**) and noticed that the four and five-day forecasts showed estimates of rainfall between 100 to 200mm. This was the first indication of an escalation of forecast rainfall, which had not been apparent in earlier forecasts. As I said in my

first statement, forecast rainfall is useful in allowing the Duty Flood Operations Engineers to gain an understanding of how a flood event might progress, and also assists in emergency management by allowing other relevant agencies to plan for things such as possible bridge closures and dam releases. That is why the forecast rainfall is included in the situation reports.

- 23 At about 6:07am, I sent a situation report, which I drafted with the assistance of the technical assistant on shift, Neville Ablitt. Situation reports are sent to the relevant agencies listed in the W&S and NP Manuals, namely, Seqwater, Department of Environment and Resource Management (**DERM**), Bureau of Meteorology (**BoM**) Flood Warning Centre, Brisbane City Council (**BCC**), Ipswich City Council (**ICC**) and SRC. This situation report stated:

'Rainfall

There have been general totals around 30 to 50mm with isolated heaving falls up to 75mm in the Somerset and Wivenhoe catchments since the event commenced on Wednesday 5 January 2011. There have been some significant rainfalls in the Lockyer Ck catchment in the last 72 hours with widespread falls of 50mm and isolated falls up to 100mm.

Totals in the North Pine catchment have generally been about 35mm.

Falls between 20 and 30mm were recorded in the Leslie Harrison catchment.

The forecast for the next five days is for totals between 100 and 200mm in SE Qld. Given the saturated condition of the catchments further runoff will most likely be generated from this rainfall.

North Pine Dam

At 0600 Friday, North Pine Dam was at 39.48m, 0.12m below FSL. Gate operations at 1915 on Thursday 6 January and are expected to continue until at least mid-day Friday 7 January when North Pine Dam is expected to be at 39.40m. These releases have impacted on Youngs Crossing. Moreton Bay Regional Council was advised and they closed Youngs Crossing prior to gate operations commencing. Based on the forecast rainfall, gate operations may continue into Saturday, but at this stage it is anticipated that gate operations will cease at around mid-day on Friday 7 January 2011.

Somerset Dam

At 0600 Friday, Somerset Dam was 99.59m, 0.59m above FSL, and rising slowly. The rain in the Stanley River catchment has produced a small amount of runoff in the Upper Stanley but there have been significant rises in Kilcoy Creek, contributing to the Somerset inflows. Somerset Dam is currently releasing at a rate of 35 cumecs and further regulator/slice operations will be required in the next 24 to 72 hours.

The estimated even inflow volume into Somerset Dam is around 50,000ML.

Wivenhoe Dam

At 0600 Friday, Wivenhoe Dam was at 67.64m and rising slowly. This is 0.64m above FSL and above the gate trigger level of 67.25m. Upstream of the dam river levels have peaked at the Linville and Gregors Ck gauges. The estimated event inflow volume into Wivenhoe Dam is 230,000ML including Somerset Dam outflow.

A peak of about 470 cumecs is expected from Lockyer Creek by mid-afternoon on Friday 7 January. At this stage there is some uncertainty associated with this estimate but it may be of sufficient magnitude to inundate Burtons Bridge.

Wivenhoe gate releases will occur after the impact of Lockyer flows on Burtons Bridge has been ascertained and flood levels in the lower Lockyer subside. It is proposed that Wivenhoe releases will commence late Friday/early Saturday and may be as high as 1,200 cumecs, (similar but slightly smaller to recent events), and the releases are expected to continue over the weekend though to Monday or Tuesday.

Impacts of Downstream of Wivenhoe

Somerset Regional Council, Ipswich City Council and Brisbane City Council have been advised of the potential for gate operations during the next 24 hours.

The relatively high Lockyer flows will adversely impact upon Twin Bridges, Savages Crossing and Colleges Crossing for several days and may impact upon Burtons Bridge from Friday mid-day and Kholo Bridge late on Friday evening. At this stage, there are not expected to be any adverse impacts upon Fernvale Bridge or Mt Crosby Weir Bridge.

Leslie Harrison Dam

Following the heavy rainfall Wednesday night, gate operations commenced at Leslie Harrison Dam late Wednesday night and are continuing. Given the forecast rainfall, gate operations are expected to continue for the next 24 to 48 hours.

The next situation report will be issued at 1800 Friday 7 January 2011.'

- 24 The key points to note about the situation are that:
- (a) There had been rainfall of around 30-50mm with isolated heavier falls up to 75mm in the Somerset and Wivenhoe catchments since the event commenced;
 - (b) There had been significant falls in the Lockyer Creek catchment in the last 24 hours with isolated falls up to 100mm;
 - (c) North Pine Dam was at 39.48m AHD (0.12m below FSL) and releases were being made and expected to continue;
 - (d) Somerset Dam was 99.59m AHD (0.59m above FSL) and rising slowly and releasing 35m³/s; and
 - (e) Wivenhoe Dam was 67.64m AHD (0.64m above FSL) and rising slowly. Gate releases would occur after the impact of the Lockyer Creek flows on Burtons Bridge had been ascertained. Releases from Wivenhoe Dam were proposed to commence late Friday or early Saturday and may be as high as 1,200m³/s.
- 25 Leslie Harrison catchment, which is a gated structure that Seqwater operates, has been mentioned in this situation report. Technically, this catchment is not the responsibility of the FOC, but I left it in the situation report because Terry Malone had mentioned it in previous reports.
- 26 The situation report notes that North Pine Dam will continue to release water even though the level is lower than FSL. At 6am, North Pine Dam was 39.48m AHD, which is below FSL for North Pine Dam (39.6m AHD). However, with rainfall continuing to fall in the catchment and the forecast for further rainfall, I determined that releases should continue to be made from North Pine Dam. If releases had ceased at that time, the dam level was likely to rise again above the FSL and this

would result in further gate operations. Therefore, the strategy remained to continue to release water from North Pine Dam pursuant to Directive 2, because I wanted to avoid a situation where the gates at North Pine Dam were continually opening and closing. This strategy of continuing releases from North Pine Dam was aimed at minimising the impacts on Youngs Crossing, which is consistent with the objectives of the NP Manual.

27 In operating North Pine Dam, one of the objectives is to ensure that North Pine Dam is at FSL at the end of a flood event. The NP Manual contemplates the lake level falling below FSL to ensure FSL level is reached at the end of a flood event (section 8.5 of the NP Manual).

28 I finished my shift in the FOC at 7am. During the handover to Terry Malone, Terry and I reviewed the most recent situation report (which had been sent at 6:07am) and I recall discussing:

- (a) That there was a prospect of increased gate operations and that the rosters would need to be updated to make sure that staff were available and that the dam operators and supplies were fully provisioned;
- (b) The current situation at North Pine Dam and in particular that the gates would remain open to allow further releases so as not to impact on Youngs Crossing. We also discussed that the releases may be halted if there was no further rainfall in the next few hours;
- (c) The model results of the flows from Lockyer Creek. In the situation report those flows were noted as $470\text{m}^3/\text{s}$, which were expected to arrive from the Lockyer Creek into the Brisbane River by mid-afternoon on Friday 7 January 2011;
- (d) That $470\text{m}^3/\text{s}$ would put Burtons Bridge in jeopardy of being inundated and on that basis, Terry would proceed with Wivenhoe Dam gate openings after that peak had passed from Lockyer Creek; and
- (e) That the forecast for the next five days was for totals between 100mm and 200mm in South East Queensland.

29 I also note from the Schedule to my first statement that, at that time:

- (a) The lake level at Wivenhoe Dam was at 67.52m AHD (just over the W1B level) and the modelling suggested that the Dam would not reach 68.2m AHD until 11pm on the following evening (which is still within strategy W1). The releases from Wivenhoe Dam at 7am were from the regulator valve and hydro, with 50m³/s having been released each previous hour. Savages Crossing Bridge had already closed the previous morning and Colleges Crossing had closed the previous evening;
- (b) The lake level at Somerset Dam had reached 99.60m AHD and Somerset Dam was releasing 35m³/s through one regulator. The model that had been run at 2am suggested that Somerset Dam would peak at 99.7m AHD; and
- (c) North Pine was at 39.45m AHD and was releasing 197m³/s.

30 I was off shift from 7am Friday 7 January 2011 until 7am Saturday 8 January 2011. I cannot recall having conversations with anyone at the FOC during that period but I did monitor the situation reports and the dam directives that I received on my blackberry.

Saturday 8 January 2011

- 31 I commenced another shift in the FOC at 7am and the handover was from John Ruffini to me.
- 32 During that handover we discussed the situation report that had been issued at 6:32am. John and I discussed:
- (a) That there had been no significant rainfall in the last 12 hours;
 - (b) That the strategy for North Pine Dam was to keep current gate openings because significant rainfall was forecast over the next four days;
 - (c) That Somerset Dam was releasing into Wivenhoe Dam through one sluice and that this was expected to be maintained until the Upper Brisbane inflows into Wivenhoe Dam had peaked; and
 - (d) That Wivenhoe Dam was releasing 890m³/s and the model run that John had run at 7am predicted Wivenhoe Dam lake levels of 68.5m AHD by 2pm

that afternoon, which would mean the releases would need to be increased incrementally to 1,250m³/s by 2pm.

- 33 The Event Log records that at 7:55am, I received a telephone call from Agg (Anthony) Dagan a dam operator from Somerset Dam. I recall that Agg telephoned the FOC and asked me about the strategy for Somerset Dam. I advised Agg that the forecast was for further rain and that this meant that there was a possibility of further gate openings later in the day based upon current modelling and that a further sluice opening may occur.
- 34 By about 8am, Wivenhoe Dam had reached 68.52m AHD. Because this level was above the predicted lake level of 68.5m AHD relevant to strategy W1, I was conscious of the fact that we were transitioning the strategies from W1 to W2 or W3. As a consequence of the 7am model run I was planning to increase releases from Wivenhoe Dam to 1,250m³/s by about 2pm. I knew that Burtons Bridge had been inundated on Friday evening, as had Kholo Bridge, so I was now concentrating on ensuring that Mt Crosby Weir Bridge was not inundated by making sure the releases plus the combined flows from Lockyer Creek were less than 1,900m³/s.
- 35 I note from the Schedule to my first statement that by 8am on Saturday Wivenhoe Dam was within the parameters of strategy W3 because the level of the lake was slightly above 68.5m AHD and Wivenhoe Dam was releasing above the naturally occurring peak flow at Lowood. However, at this stage of operations it was still important to focus on minimising the downstream impacts of releases, in particular to reduce further downstream bridge closures. That strategy is in keeping with the objectives of the W&S Manual.
- 36 At about 8:15am, I issued Wivenhoe Dam Directive 4 to the dam operators at Wivenhoe Dam in keeping with the strategy discussed at handover with John Ruffini to increase the releases gradually up to 1,250m³/s. Directive 4 required six gate openings commencing at 9am and finishing at 2pm. The directive notes that at the completion of these gate operations the Dam will be releasing 1,247m³/s. I note from the Schedule to my first statement that by 3pm, the total releases from the Dam had reached at least 1,240m³/s.
- 37 At about the same time as I issued Wivenhoe Directive 4, I called Matthew O'Reilly a dam operator at Wivenhoe Dam. The purpose of making this call was to let

Matthew know that I was now on shift and to discuss with him the overall strategy of increasing releases up to about 1,250m³/s by mid-afternoon.

38 At about 8:20am, I telephoned Brett Schultz, the dam operator at the North Pine Dam, and discussed the current strategy. I informed Brett that I was on shift and that the strategy was to keep making releases from the Dam even though the Dam level was below FSL as I did not want to have releases stop, and then simply have to recommence releases if further rainfall occurred as was forecast. This strategy is in keeping with the NP Manual.

39 At about 9am, I received a telephone call from Agg Dagan, a dam operator from Somerset Dam, and he advised me that he was going into Kilcoy to see the treatment plant and will be off-site for a couple of hours. I confirmed with Agg that no gate movements were scheduled for the next few hours so he would be able to visit the treatment plant. I also confirmed that a standby operator was still on site (I can no longer recall who that was).

40 At about 10.30am, I issued North Pine Dam Directive 5 by email and fax. By 10am, North Pine Dam was still below the FSL at 39.47m AHD and had been at that level since 4am. Between 4am and 7am, the catchment average rainfall for North Pine Dam was not recording any rainfall. Therefore, Directive 5 required Gate 'A' to be closed to 0 increment at 11am.

41 At about 10:50am, I received a telephone call from Rob Drury, the Dam Operations Manager at Seqwater. During that conversation, I recall that Rob and I discussed the current status and strategy at each of the Dams. I recall that we discussed that:

- (a) The current gate openings would be maintained at North Pine Dam;
- (b) Somerset Dam had one sluice open and that I was waiting for the peak in the Upper Brisbane to arrive before making further gate movements; and
- (c) That Wivenhoe releases would increase to 1,250m³/s by 2pm.

42 At about 11:30am, I issued Somerset Directive 3 by email and fax directing sluice M to be opened to 100%. Directive 3 notes that Somerset Dam is expected to peak at around midday at about 100.48m AHD (which is above fixed crest level of 100.45m AHD). The directive states that the strategy is aimed at maximising the benefits of the mitigation storage in both Somerset and Wivenhoe Dams by following the

Operating Target Line. I note that the reference in Directive 3 to 'we will need to implement strategy S2' is an error because, in fact, we were already implementing strategy S2 and the directive was based upon strategy S2.

43 At about 11:30am, I was aware that Al Navruk, one of the technical assistants, answered a call from Ken Morris, the Principal Engineer Water and Environment at BCC. While Al was on the phone, he asked me what the combined flows were in the Brisbane River, that is, the combined flows of Wivenhoe Dam, Warrill Creek and the Bremer River. I told Al that the combined flows were not expected to exceed 1,500m³/s. Al then relayed that to Ken Morris over the phone.

44 At about 2pm, a further model was run. That model indicated the following:

- (a) That Wivenhoe Dam would peak at 68.7m AHD at 1am on 10 January 2011 (Wivenhoe Dam was at the time at 68.61m AHD); and
- (b) That Somerset Dam would peak at 100.5m AHD (Somerset Dam was at the time at 100.44m AHD).

45 Once the gate movements at Wivenhoe Dam had been completed, I issued a further situation report at 2:22pm. The report stated:

'Rainfall

No significant rain has fallen over the dam catchments in the past 18 hours.

Advice from BoM indicates that SE Qld can expect further high rainfall totals over the next 4 days.

Saturday: Rain light at times 5-50mm with higher falls along the coast

Sunday: Widespread rain with totals between 50-100mm

Monday: Widespread rain again with totals between 50-100mm

Tuesday: Rain easing with totals between 25-50mm

Given the saturated conditions of the catchments, significant inflows to Seqwater dams will be generated, especially following the forecast rainfall on Sunday/Monday.

North Pine (Full Supply Level 39.60 m AHD)

At 1200 Saturday, North Pine Lake Level was 39.46 m AHD and is steady. Currently 2 gates are open to release runoff generated from rainfall over the last three days. Given the very high likelihood of significant runoff during the next 4 days, gates will be kept open to match inflows over the next few days, rather than opening and closing at various times with short notice. Lake Kurwongbah spillway flows are also contributing to the adverse impacts experienced at Youngs Crossing.

Youngs Crossing will remain adversely impacted for the duration of the gates being open.

Moreton Bay Regional Council has been advised and concurs with this strategy.

Somerset (Full Supply Level 99.00 m AHD)

At 1000 Saturday, Somerset Dam level peaked at 100.47m AHD and is now slowly falling. At 1200 it is now 100.45m. Somerset Dam is releasing into Wivenhoe through two open sluice gates and over the fixed crest at a rate of about 415 m³/s.

Since the commencement of the event on 02/01/2011, approximately 91,000ML has flowed into Somerset Dam with a further 20,000ML expected based on the recorded rainfall to date. Approximately 29,000ML has been released into Wivenhoe.

Wivenhoe (Full Supply Level 67.00 m AHD)

At 1200 Saturday, Wivenhoe Dam was 68.60 m AHD and rising steadily with all five gates open and releasing about 1,150 m³/s. River levels upstream of Wivenhoe Dam have peaked and are now receding. However the further inflows into the dam has led to elevated levels. It is intended to increase the release from Wivenhoe to 1,250 m³/s by 14:00 on Saturday 08/01/2001. This will maintain flows of up to 1,600 m³/s in the mid-Brisbane River throughout the afternoon.

Further assessments will be undertaken to determine increases above this level given the high likelihood of significant inflows in the next few days. The interaction with runoff from the Bremer River and Warrill Creek catchment will also be assessed to determine an appropriate releases strategy. Projections based upon the forecast rainfalls suggest flows of up to 1,200 m³/s will emanate from the Bremer River catchment.

Since the commencement of the event on 02/01/2001, approximately 202,000ML has flowed into Wivenhoe Dam (including Somerset releases) with a further

210,000ML expected based on the recorded rainfall to date. Approximately 66,000ML has been released from Wivenhoe via the radial gates, hydro and regulator.

Impacts downstream of Wivenhoe

The projected Wivenhoe release of 1,250m³/s and 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 for several days. At this stage Fernvale and Mt Crosby Weir Bridge are not expected to be affected, but they could potentially be affected if the predicted rainfall totals eventuate and higher releases from Wivenhoe Dam are considered necessary.

The current available assessments indicated that the combined flow in the lower Brisbane River would only add 50mm to an upper limit of 100mm to the recorded water levels in the City Reach of the Brisbane River. However, it is noted that tides in the lower Brisbane R will be 0.4 to 0.5 metres higher than predicted tides. The tide level at the Port Office Gauge at 1200 Saturday was 1.56 m and rising.

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

- 46 The key points to note in this situation report are that:
- (a) At 12pm. North Pine Dam was at 39.46m AHD with 2 gates releasing water;
 - (b) That Somerset Dam had peaked at 100.47m AHD and had fallen to 100.45m AHD; and
 - (c) That Wivenhoe Dam was 68.60m AHD. The Dam was releasing about 1,200m³/s, and the intention was to increase releases from Wivenhoe Dam to 1,250m³/s by 2pm so that flows of 1,600m³/s could be maintained in the middle Brisbane River throughout the afternoon.
- 47 A release of 1,200m³/s from Wivenhoe Dam is a significant release. It will result in the closure of several downstream bridges. The release rates during the October and December 2010 flood events were about 1,600m³/s and the combined flow had lead to minor flood damage in Brisbane. I was conscious, therefore, of trying to

minimise the release rates from Wivenhoe Dam in order to minimise the risk of urban damage occurring, which is in keeping with the objectives of the W&S Manual. I was aware of further predicted rainfall but there was still a significant amount of flood storage capacity available, so I was still of the view that we could accommodate that predicted rainfall if it arrived and still stay within the parameters of strategy W3. I included information about 'Impacts downstream of Wivenhoe' in the situation report in order to notify the relevant agencies of the potential for downstream urban inundation.

- 48 At about 3pm, I sent an email to staff members at the BoM Flood Warning Centre and the BCC Flood Information Centre containing the data of the actual and projected releases (based upon the model runs at that time) from Wivenhoe Dam.
- 49 At about 5:53pm, I issued a further situation report. That situation report stated:

'Rainfall

Some rain has fallen over the dam catchments in the past 12 hours. Catchment average rainfall for this period for North Pine Dam is 6 mm; Stanley River has received 12 mm; and the Upper Brisbane River 4 mm. This has resulted in minor increases in runoff into Somerset Dam.

Advice from BoM indicates that SE Qld can expect further high rainfall totals over the next 4 days.

The forecast for the Somerset-Wivenhoe catchment for the next 24 hours is 30 to 50 mm, whilst North Pine is expected to receive 40 to 60 mm in the next 24 hours

The outlook for the following days are:-

Sunday: Widespread rain with totals between 50-100mm

Monday: Widespread rain again with totals between 50-150mm

Tuesday: Rain easing with totals between 25-50mm

Given the standard conditions of the catchments, significant inflows to Seqwater dams will be generated, especially following the forecast rainfall on Sunday/Monday.

North Pine (Full Supply Level 39.60 m AHD)

At 1700 Saturday, North Pine Lake was 39.47 m AHD and steady. Currently two gates are open to release runoff from rainfall over the last three days. Given the very high likelihood of significant runoff during the next 4 days, gates will be kept open to match inflows over the next few days, rather than opening and closing at various times with short notice. Lake Kurwongbah spillway flows are also contributing to the adverse impacts experienced at Youngs Crossing.

Youngs Crossing will remain adversely impacted for the duration of the gates being open.

Moreton Bay Regional Council has been advised and concurs with this strategy.

Somerset (Full Supply Level 99.00 m AHD)

Somerset Dam level peaked at 100.47m AHD at 10:00 today and is now slowly falling. At 1700 it is now 100.41m. Somerset Dam is releasing into Wivenhoe through two open sluice gates and over the fixed crest at a rate of about 415 m³/s.

Since the commencement of the event on 02/01/2011, approximately 95,000ML has flowed into Somerset Dam with a further 20,000ML expected based on the recorded rainfall to date. Approximately 38,000ML has been released into Wivenhoe.

Wivenhoe (Full Supply Level 67.00 m AHD)

At 1800 Saturday, Wivenhoe Dam was 68.65 m AHD and rising slowly with all five gates open and releasing about 1,250 m³/s. River levels upstream of Wivenhoe Dam have peaked and are now receding. However the further inflows may result from any additional rainfall. The current gate operation strategy will maintain flows of up to 1,600 m³/s in the mid-Brisbane River throughout the evening.

Since the commencement of the event on 02/01/2011, approximately 227,000ML has flowed into Wivenhoe Dam (including Somerset releases) with a further 200,000ML expected based on the recorded rainfall to date. Approximately 93,000ML has been released from Wivenhoe via the radial gates, hydro and regulator.

Impacts downstream of Wivenhoe

The current Wivenhoe release of 1,250 m³/s 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 for several days (until Wednesday 12 January). At this stage Fernvale and Mt Crosby Weir Bridge are not expected to be affected, but they could potentially be affected if the predicted rainfall totals eventuate and higher releases from Wivenhoe Dam are considered necessary.

The current available assessments indicate that the combined flow in the lower Brisbane River would only add 50mm to an upper limit of 100mm to the recorded water levels in the City Reach of the Brisbane River. However, it is noted that tides in the lower Brisbane R will be 0.4 to 0.5 metres higher than predicted tides. The tide level at the Port Office Gauge at 1700 Saturday was 0.06 m and falling.

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

Forecast Scenario – Based upon mid-range rainfall forecasts.

Assessments have been undertaken to determine possible increases to possible increases to releases given the high likelihood of significant inflows in the next few days. The interaction with runoff from the Bremer River and Warrill Creek catchment is an important consideration as the event magnitude will require the application of Wivenhoe Dam flood operation strategy W2 (Transition strategy between minimizing downstream impacts and maximizing protection to urban areas).

Projections based upon the forecast rainfalls suggest flows of up to 1,200 m³/s will emanate from the Bremer River catchment. If similar rainfall magnitudes occur in the Upper Brisbane and Stanley Rivers then increased releases may be required from both Somerset Dam and Wivenhoe Dam. Preliminary projections suggest that such a forecast will extend the release duration until next Saturday 15 January, but mid-Brisbane River flows will be kept to a maximum of 1,800 m³/s. However, if falls are greater than those forecast releases from Wivenhoe Dam may need to adversely impact Mt Crosby Weir Bridge (1,900 m³/s) and possibly Fernvale Bridge (2,100 m³/s) but will be maintained below 3,500 m³/s.

The assessments will be updated as the event progresses.'

50 The key points to note about this situation report are that:

- (a) No significant rainfall had fallen over the catchments in the last 12 hours;

- (b) North Pine Dam was 39.47m AHD and steady. Two gates were open and releasing 32m³/s and gates would be kept open over the next few days to match inflows;
- (c) Somerset Dam was 100.41m AHD and slowly falling. The Dam was releasing through two sluice gates a rate of 415m³/s;
- (d) Wivenhoe Dam was 68.65m AHD and rising slowly, releasing 1,250m³/s through all five gates;
- (e) The river levels upstream of Wivenhoe Dam had peaked and were now receding; and
- (f) All lower level bridges were closed. Fernvale Bridge and Mt Crosby Weir Bridge remained open but could potentially also be closed if further rainfall eventuated.

51 One important point to note from this situation report is the information under the heading 'Forecast Scenario - Based on mid-range forecasts'. The models that I used in preparing the projections I refer to were based on 72 hour rainfall forecasts (I note that the 72 hour forecast models were included in Appendix K of the Wivenhoe and Somerset Dams Flood Report 2011). The information contained in this section was included to make the regional councils aware that:

- (a) If the forecast rainfall eventuated the flows could be limited to 1,800m³/s and Fernvale Bridge and Mt Crosby Weir Bridge could remain open;
- (b) If more than the forecast rainfall eventuated then Fernvale Bridge and Mt Crosby Weir Bridge would be closed; and
- (c) The model projections were that downstream flow would still be maintained below 3,500m³/s (which is the W&S Manual reference to 3,500m³/s at Lowood).

52 At about 7pm, I finished my shift in the FOC. At this time

- (a) Wivenhoe Dam was at 68.65m AHD and was releasing 1,242m³/s;
- (b) Somerset Dam was at 100.37m AHD and was releasing 413m³/s; and

(c) North Pine Dam was at 39.48m AHD (still below FSL) and was releasing 32m³/s.

53 At the end of my shift, I handed over to John Tibaldi. We discussed the situation report that had been issued at 5:53pm. John had been away on annual leave and this was his first shift back. Accordingly, we discussed matters, such as:

(a) A description of the rainfall that had fallen to date;

(b) The current outlook in terms of forecast rainfall; and

(c) The current dam levels and releases from each of the Dams.

54 My next shift in the FOC was not scheduled to commence until Monday 10 January 2011.

55 I am aware that some commentators have suggested that after the January 2011 Flood Event more water should have been released from Wivenhoe Dam over the course of Saturday 8 January 2011. I reject this suggestion. Over the course of the Saturday, the lake level at Wivenhoe Dam rose from 68.32m AHD to 68.65m AHD. There was still a significant amount of flood storage would have been available in the Dam if rainfall increased significantly. The lake level was predicted to peak at 68.7m AHD at about 1am on Tuesday 11 January 2011 (more than 48 hours away), by which time the releases from the Dam would need to have been increased gradually to 1,480m³/s. By the end of Saturday, releases from Wivenhoe Dam had already been increased to 1,242m³/s, which meant that the estimated maximum required release rate of 1,480m³/s, which was required to be reached at 1am on Tuesday, was easily obtainable. By 5am Sunday morning, the release rate had already been increased to 1,336m³/s.

56 I also note that rainfall was not significant over the course of the Saturday and that inflow rates into Wivenhoe Dam on the Saturday decreased from the peak rate of 2,144m³/s at 7am down to 899m³/s by 11pm. Further rainfall had been forecast but as set out in my first statement, and as I had identified in the 5:53pm situation report, it was only if and when further rainfall eventuated that increased releases from Wivenhoe Dam would be necessary and justified.

57 For these reasons, it was appropriate that releases from Wivenhoe Dam maximised protection to urban areas while still minimising the impact to rural life downstream.

Sunday 9 January 2011

- 58 During the day on Sunday 9 January 2011, I received the situation report that had been sent at 6:15am on the Sunday morning. I also received the QPF that had been sent at 10am. This QPF provided a catchment average rainfall forecast for the 24 hour period to 9am Monday of 40-60mm for the Wivenhoe and Somerset Dam catchments, and an identical forecast in relation to the North Pine Dam catchment. At about 11am, I logged on to the FLOOD PC from remote access at home and I could see the heavy rainfall that had already been recorded in the Stanley River catchment over the morning.
- 59 As a result of having received that information, at 12pm I telephoned the FOC and spoke to Terry Malone. I called Terry to confirm the information that I had obtained from home about the heavy rain in the Stanley River catchment and indicated to him that I was going to organise a meeting of all four Duty Flood Operations Engineers to discuss what was likely to happen over the next 24 hours in light of those heavy falls and the forecast for further rain. I then emailed Terry Malone, John Ruffini and John Tibaldi and asked them to attend a meeting (by telephone if they could not attend by person) at the FOC.
- 60 By about 3pm, Wivenhoe Dam had reached 68.61m AHD. A model had been run at 2pm which suggested that Wivenhoe Dam would peak at 70.0m AHD at 10pm on 10 January 2011 (and at 71.3m AHD at 9am on 11 January 2011 if forecast rainfall was included).
- 61 At about 3:30pm that afternoon, I attended at the FOC for the meeting with the three other Duty Flood Operations Engineers, namely John Ruffini, Terry Malone and John Tibaldi. John Ruffini, Terry Malone and I attended in person and John Tibaldi attended by telephone.
- 62 During this meeting we discussed that an additional 500,000ML was expected to flow into the Dams from rainfall already on the ground, but that BoM ACCESS model forecasts and general synoptic weather forecast indicated that there was a rainfall producing system that was currently in the north east part of the catchment and expected to travel south over the next 24 to 36 hours.
- 63 At this time, Fernvale Bridge and Mt Crosby Weir Bridge had not been inundated. Fernvale Bridge in particular is an important bridge, as it allows access through the Brisbane Valley, including to Wivenhoe Dam. The Fernvale Bridge is located on the

Brisbane Valley Highway, and, therefore, inundation of the Fernvale Bridge will effectively cut the Brisbane Valley Highway. The Mt Crosby Weir Bridge is inundated once the combined flows from the Lockyer Creek and Wivenhoe Dam exceed $1,900\text{m}^3/\text{s}$. Fernvale Bridge is inundated once the combined flows from the Lockyer Creek and Wivenhoe Dam exceed $2,000\text{m}^3/\text{s}$. At 3pm, the RTFM System showed the flow at Lowood was $1,415\text{m}^3/\text{s}$, however, the flow from the Lockyer Creek was expected to continue rising. I note that those expected increases in the Lockyer Creek flow did in fact take place as expected and by 12am on Monday 10 January 2011, the flow rate at Lowood was $1,840\text{m}^3/\text{s}$ and Mt Crosby Weir Bridge had closed.

- 64 During the 3:30pm meeting (on Sunday), the Duty Flood Operations Engineers discussed that the forecast rainfall system had the potential to significantly increase flows in the Lockyer Creek and the Bremer River, which could potentially close Fernvale Bridge and Mt Crosby Weir Bridge and increase the risk of flooding in the lower Brisbane River. For this reason, we discussed maintaining releases from Wivenhoe Dam at $1,400\text{m}^3/\text{s}$ so as to try and keep Fernvale Bridge and Mt Crosby Weir Bridge open bearing in mind the flow rate was likely to increase because of increases in the Lockyer Creek and the Bremer River. Even though the strategy for Wivenhoe Dam was above W1, it is still necessary to consider the lower level objectives of minimising bridge closures and disruption to rural communities. We also discussed that if required (that is, if the Lockyer Creek and the Bremer River flows increased significantly) the releases from Wivenhoe Dam could be reduced so as to contain the flow in the mid-Brisbane River to $1,600\text{m}^3/\text{s}$ and the flow in the lower Brisbane River to $3,000\text{m}^3/\text{s}$ so that Mt Crosby Weir Bridge and Fernvale Bridge could remain open and we could still meet the lower level objectives of the W&S Manual.
- 65 Based on a recent model run by Terry Malone, we discussed that we anticipated that we could achieve levels below about 101.50m AHD at Somerset Dam (I believe that the reference in the Event Log to '102.50m AHD' may be an error) and 72.15m AHD at Wivenhoe Dam (I believe that the reference in the Event Log to '72.5m AHD' may be an error), which was still 1.85m below 74.0m AHD.
- 66 During the meeting we discussed that Terry Malone, who was on shift, would make phone calls to the regional council contacts, BoM and Rob Drury (the Dam Operations Manager) to notify them of the increase in flows, particularly in lower Brisbane River, and the potential for both the Fernvale Bridge and Mt Crosby Weir

Bridge being inundated, so that they could make necessary preparations for the bridge closures.

- 67 The 3:30pm meeting was finished and at about 4.30pm I left the FOC.
- 68 At 6:45pm, I received a telephone call from John Ruffini, who was coming on shift. John told me that there had been heavy rainfall in the Stanley River and Upper Brisbane catchment over the last few hours and, in his view, because the event was getting larger it would be better for operational reasons if two Duty Flood Operations Engineers were on shift. I said that I agreed with him and I agreed to commence a shift with John at 7pm even though I had not been rostered to work.
- 69 I arrived back at the FOC at about 7:30pm. Terry Malone and John Ruffini were at the FOC. We then had a handover meeting to discuss the current situation.
- 70 During the handover, we looked at the RTFM System to identify where the rain was coming from. During the handover we discussed:
- (a) That catchment average rainfall for the past 12 hours for North Pine Dam was 60mm, for Somerset Dam 150mm and for Wivenhoe Dam 80mm;
 - (b) The QPF that had been received at about 4pm, which forecast 50-80mm in the next 24 hours in the Wivenhoe/Somerset catchments;
 - (c) The BoM online weather radar and noted that the rainfall system was still entrenched in the upper Brisbane River;
 - (d) The BoM rainfall forecasts referred to in the situation report;
 - (e) That North Pine Dam level was 39.81m AHD and the increases in gate operations that had occurred over the course of Sunday and the expectation that gates would remain open for the next 12 hours and that Youngs Crossing would remain closed while releases continued;
 - (f) That Somerset Dam level was at 100.75m AHD and rising quickly and that the estimated peak inflow to the dam was about 3,000m³/s. We also discussed that five sluice gates were open releasing into Wivenhoe Dam and that releases were expected to continue until at least Wednesday;
 - (g) That Wivenhoe Dam had started to rise again and would reach 72.15m AHD during Wednesday morning with river levels upstream of the Dam

rising quickly with the significant inflow being generated from the intense rainfall. We also discussed that the current gate operational strategy will be to maintain flows of around 1,600m³/s in the mid-Brisbane River for the next 24 hours, but that releases may have to be increased significantly during Monday depending on the rain in the next 12-24 hours and that Fernvale and Mt Crosby Weir bridge would be inundated if the forecast rainfall eventuated;

- (h) That John Ruffini had called Peter Allen, the Dam Safety Regulator from DERM shortly before I arrived in the FOC. John mentioned that he had advised Peter Allen that much larger flows are expected and we would have to increase releases to around 3,000m³/s based upon the latest model run. John mentioned that he had told Peter Allen that this was likely to have flooding impacts on low-lying Brisbane; and
- (i) That Terry Malone had also recently called Peter Borrows, the CEO of Seqwater, and had given him a similar message.

71 At about 7:30pm, when I came into the FOC, North Pine Directive 8 was issued by John Ruffini directing gate openings.

72 Following the handover and the discussions in relation to the need to increase release to about 3,000m³/s, I ran a new model at about 8pm. That model confirmed that the predicted Wivenhoe Dam lake level (on a 'no further rainfall' basis) was 73.05m AHD, which would be reached on Tuesday 11 January 2011 and that the release rate would have to be increased incrementally to get to 2,600m³/s by that time. The rainfall that had fallen since the 3:30pm meeting and the model that I had run at 8pm meant that I was no longer considering reducing release rates from the Dam to accommodate the expected peak of the Lockyer Creek. The plan was now to incrementally increase releases to at least 2,600m³/s on Tuesday.

73 At about 8:05pm, I called Shane Watson, a dam operator at North Pine Dam, to confirm that the last directive had been completed. Shane told me that all gates were at increment 2 as per the directive.

74 At about 8:50pm, I called Ken Morris from BCC to request a copy of the flood damages curve from the 2007 study (referred to at paragraph 257 in my first statement). I recalled the flood damages curve from the 2007 study showed the properties affected and the amount of damage expected in the Brisbane City area

for a number of river flow rates. I wanted to review that damage curve so that I was fully aware of the consequences of making releases at varying rates.

75 At about 9pm, John Ruffini issued North Pine Directive 9. At 9pm, North Pine Dam was at 39.91m AHD and had been steadily increasing over the course of Sunday afternoon and evening despite increases in the gate increments. North Pine Directive 9 required gate operations occur at 10 minute intervals, rather than 15 minute intervals as per North Pine Directive 8.

76 At 9:04pm, Terry Malone (who was still at the FOC), John Ruffini and I prepared a situation report. The report stated:

'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 02/01/2011 approximately 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 38 hours. At this stage, releases will continue until at least Thursday.

Wivenhoe Dam (Fully 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 Gregors 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 300,000 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 in the lower Brisbane will be limited to 4,000m³/s. This is below the limit of urban damages in the City reaches.

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.'

- 77 The key points to note from this situation report are that:
- (a) Very heavy rainfall had been recorded in the upper Brisbane and Stanley Rivers with totals over the last 24 hours ranging from 100 to 300mm;
 - (b) Somerset Dam was 101.68m AHD and rising quickly, releasing 1,100m³/s through the five opened sluice gates;
 - (c) Wivenhoe Dam was 69.1m AHD and rising, releasing 1,400m³/s, which would be increased on Monday 10 January 2011 to at least 2,600m³/s by Tuesday 11 January 2011; and
 - (d) Releases were being kept below 3,500m³/s and the combined flows limited to 4,000m³/s at Moggill to maximise the protection to urban areas.
- 78 A release of 2,600m³/s would affect some low-lying areas and we were no longer able to prevent closure of downstream bridges. This release rate meant that Fernvale Bridge and Mt Crosby Weir Bridge needed to be closed before the increased releases could start to occur. Once this situation report had been issued, I started trying to co-ordinate the relevant bridge closures through the SRC and ICC.
- 79 At about 9:10pm, Rob Drury, the Dam Operations Manager at Seqwater, phoned the FOC. I spoke with Rob and he said he wanted to check the situation report with me. I confirmed with Rob that releases would need to be increased from 1,400m³/s to 2,600m³/s (I believe the reference to 2,500m³/s in the Event Log is an error). I also told Rob that that rate of release was expected to cause flooding in low lying areas of Brisbane. I also said that this would result in Mt Crosby Weir Bridge and Fernvale Bridge being inundated. I told Rob that, prior to the releases being made, we needed to ensure that SRC and ICC had closed those particular bridges prior to increasing releases out of Wivenhoe Dam. I told Rob that Terry Malone had told me that he had spoken with Tony Jacobs at SRC and that Tony had said that the Department of Main Roads was responsible for closing Fernvale Bridge (being part of the Brisbane Valley Highway) and that Tony did not have the after hours contact number, but would contact them on Monday morning. I was concerned, therefore, that Fernvale Bridge may not be closed in time so I asked Rob Drury to locate an after hours contact number if possible.

- 80 Rob and I also discussed that John Ruffini had told me that he had had a telephone call a short time earlier with Ken Morris of the BCC and that the BCC's Flood Information Centre had still not been mobilised. I also informed Rob that the magnitude of the event in the Upper Brisbane was approaching the levels of the January 1974 flood. Finally, I told Rob that the situation report from 9:04pm had been emailed to the named agencies.
- 81 At about 9:20pm, I telephoned the ICC and spoke to Tony Trace. I was aware that the ICC liaised with the Department of Main Roads regarding the Mt Crosby Weir Bridge, and so I telephoned to ask for the Department of Main Roads after hour contact number if they had one. Tony informed me that he would email the after hours contact number to me. During this conversation, Tony informed me that the kiosk caretaker at Colleges Crossing had been evacuated. Tony later emailed to me the after hours contacts for the Department of Main Roads.
- 82 At about 10:20pm, I received a call from Rob Drury, the Dam Operations Manager at Seqwater. Rob informed me that a teleconference between Seqwater, the Water Grid Manager and DERM had just been completed. Rob and I discussed that, since the 9pm situation report had been issued, it was becoming evident that our primary concern had to now be minimising damage in the urban areas. I said to Rob that I expected there to be damage to urban areas based on the predicted required release rates. Rob told me that the Water Grid Manager would be distributing media releases in the morning regarding the closure of Fernvale Bridge and Mt Crosby Weir Bridge.
- 83 At about 10:30pm, I received a telephone call from Brett Myatt, the manager for the Mt Crosby Weir water treatment plant. Brett said that he was concerned that the guardrails needed to be taken off Mt Crosby Weir Bridge before it became inundated. I recommended that the guardrails be removed immediately in preparation for the closure of the bridge. I told Brett that the flows in the river were increasing due to runoff from downstream tributaries and that we will also be ramping up releases from Wivenhoe Dam. I said to Brett the expected releases from Wivenhoe Dam will be at least 2,000m³/s by the morning (Mt Crosby Weir Bridge would be inundated at 1,900m³/s).
- 84 At 10:45pm, Rob Drury again telephoned me. Rob told me that he would be contacting the Water Grid Manager to advise that Fernvale Bridge and Mt Crosby Weir Bridge would be closed. Rob asked me if Mt Crosby Weir Bridge had been

closed already as he was aware that Police were on site. I told Rob that I had just spoken with Brett Myatt about the guardrails being removed and that I expected the bridge would be closed once the guardrails had been removed.

85 At about 11:25pm, I telephoned Doug Grigg, one of the dam operators at Wivenhoe Dam, regarding the status of Fernvale Bridge. Doug told me that the flood water was up to the centreline of the approaches on the northern side of the bridge at Shines Gully (located on the south of the junction with England Creek Road). Shines Gully gets inundated before Fernvale Bridge. Doug told me that Esk Police were on site at Fernvale Bridge and were considering closing the road in Fernvale. Doug informed me that two standby dam operators were staying in Fernvale and that they would be mobilised to the Dam prior to the Fernvale Bridge being closed.

86 At 11:35pm, I telephoned the after hours contact number I had been provided with for the Department of Main Roads, however, I was unable to reach anyone on this number. I left a message regarding the impending closure of Fernvale Bridge, however, I was not concerned about the situation in light of the conversation I had just had with Doug Grigg at 11:25pm that police were on site at Fernvale Bridge.

87 I note here that there were no further Wivenhoe or Somerset directives issued after the 3:30pm meeting, but that was because we had decided to maintain the releases from Wivenhoe Dam at about 1,400m³/s in order to allow the peak from the flow from Lockyer Creek and Bremer River to pass and because Wivenhoe Dam lake level was still at about 68.0 – 69.0m AHD, which was well within strategy W3 and we were waiting for bridges to be closed before increasing releases.

Monday 10 January 2011

88 At about 12:45am, John Ruffini told me that he had just spoken with Ken Morris of the BCC. John said that Ken had told him that the reference to 4,000m³/s as the upper limit of non-damaging floods for Brisbane stated in the situation reports had caused some confusion amongst BCC staff because internally, the BCC recognises that lower flow rates would cause urban damage in low-lying areas of Brisbane. John said that Ken had asked, therefore, that the situation reports not specify a flow rate for urban damage in Brisbane. John told me that he had told Ken that we would not refer to a particular flow rate in the situation reports but that we would be operating at the value specified in the W&S Manual. Therefore, situation reports from this point in time did not include a reference to the upper limit of non-damaging

floods being 4,000m³/s (but did specify that flow rates would be limited to 4,000m³/s at Moggill if possible).

89 I note that the Event Log refers to a telephone call at 12:55am between John Ruffini and Rob Drury, the Dam Operations Manager at Seqwater. I was not involved in that telephone call and I cannot recall discussing it with John. However, looking at the entry in the Event Log, I do not consider that the part of the sentence, which says "... if flows were kept below 3500 the fuse plug would be triggered" is correct. That is because, assuming the reference to 3,500 means 3,500m³/s released from the Dam, at that stage model run 23 (which was run at about 1am that morning) showed a predicted lake level (on a 'no further rainfall' basis) of 72.1m AHD and that releases were required to be increased to 2,880m³/s by 8am on Tuesday 11 January 2011. The lake level trigger point for the first fuse plug is 75.5m AHD. Accordingly, it was not the case that releases below 3,500m³/s would cause a trigger of the fuse plug at that stage of the event.

90 In his email at 12:07am, Tony Trace of ICC referred to unsubstantiated media reports of cracks the monoliths at Somerset Dam. At about 1am, I phoned Ray Ballinger, a dam operator at Somerset Dam, and asked him to confirm if there were any issues relating to the structural stability of the Dam. Ray said that he had just done a routine inspection of the galleries and there were no issues.

91 At about 1:14am, a situation report was sent that was prepared by John Ruffini and I. The report stated:

'Rainfall

Very heavy rainfall has been recorded in the Upper Brisbane and Stanley Rivers in the last 12 hours with totals up 100 to 240mm. Totals for the last 24 hours range from 100 to 300mm.

Rainfall of similar magnitudes is expected in the 12 to 24 hours around the downstream catchments as the system tracks south.

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

North Pine Dam (Fully Supply Level 39.60 m AHD)

The dam level was 39.95 m and steady. Five gates are open releasing 445 m³/s. The inflow into the dam since the commencement of the event is 42,000 ML. Estimated event volume is 57,000 ML assuming no further rainfall. Gate operations will continue until at least Tuesday 11 January 2011.

Somerset Dam (Full Supply Level 99.00 m AHD)

The dam level is 102.22 m AHD and rising quickly (storing 157,000 ML above FSL). Peak inflow to the dam is estimated to be about 4,200 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 (95,000 ML) into Wivenhoe Dam. At this stage the dam will reach at least 103.5 on Monday afternoon which will adversely impact areas around Kilcoy.

Since the commencement of the event on 02/01/2011 approximately 115,000ML 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.

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 7,350m³/s and the river has just peaked at 23:00 on Sunday 9 January.

The dam level is rising quickly, with the current level being 69.60m AHD (storing 301,000 ML). Estimated peak inflow to the dam just from the Upper Brisbane R alone may reach as high as 8,800m³/s and, at this stage, the dam will reach at least 73.3 m AHD during Tuesday morning. Given the rapid increase in inflow volumes, it will be necessary to increase the release from Wivenhoe during 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 in the lower Brisbane will be limited to 4,000m³/s if possible.

Fernvale Bridge approaches and Mt Crosby Weir Bridge have been inundated and both bridges are now closed or are in the process of being closed.

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

Since the commencement of the event on 02/01/2011 approximately 240,000ML has been released from the dam, with an event total approaching 1,500,000ML 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 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 Bridge 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. 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.

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

92 Two key points to note about this situation report are that:

- (a) Very heavy rainfall had been recorded in the upper Brisbane and Stanley Rivers in the last 12 hours with totals up to 100 to 240mm; and
- (b) That rainfall of similar magnitudes was expected in the 12 to 24 hours around the downstream catchments as the system tracks south. The radar imaging accessed through the BoM website had indicated that the rainfall system was moving south.

93 I also note that this situation report states in the paragraphs under the heading 'Wivenhoe Dam' that the combined flows in the lower Brisbane will be limited to 4,000m³/s if possible. As had previously been discussed, John and I did not include

a reference to the 'limit of urban damages in city reaches' as had been set out in the 9:04pm situation report to accommodate Ken Morris' request (during the 12:45am telephone call with John Ruffini) so as not to create confusion amongst BCC staff as to the levels, which would cause urban damage. However, we maintained the reference to 4,000m³/s in that paragraph because that is the upper limit referred to in the W&S Manual and, therefore, the limit under which we were operating. Further on in the situation report under the heading 'Impacts downstream of Wivenhoe Dam', we referred to the 'threshold of damaging discharge in urban areas', but did not refer to a flow rate so as to avoid the confusion that Ken Morris had been concerned about amongst BCC staff.

94 At about 2am, John Ruffini issued Wivenhoe Directive 8. At that time Wivenhoe Dam was at 70.17m AHD, which meant that it had risen since the last directive. Directive 8 was issued at this time because the bridges were now closed, (or were about to be closed), and the peak of the main inflow had passed Gregors Creek, which meant that we were aware that the largest amount of inflow to Wivenhoe Dam had either arrived or was about to arrive (the inflow rates into Wivenhoe Dam had increased over Sunday afternoon, but the rate of increase had been much smaller over the last few hours). We increased the release rates to off-set those inflows and thereby arrest the rate of rise in the lake level. Directive 8 required the gates to be opened incrementally between 2am and 6am for this purpose. We continued to operate in accordance with strategy W3. This particular directive was aimed at increasing the releases towards the 2,600m³/s required release rate that had been indicated by the model that I had run at 8pm the previous evening (Monday). In summary, the process of increasing the releases from Wivenhoe Dam to the estimated peak release rate of 2,600m³/s commenced as soon it was safe to do so whilst minimising the impacts on rural communities by not prematurely inundating those areas. These increased releases could not have safely been made whilst downstream bridges remained open to the public.

95 At about 5am, I received a call from Graham Francis, a dam operator from Somerset Dam. Graham said that he was about to go off shift and handover to Agg Dagan. Graham asked whether we were expecting any gate movements so he could advise Agg. I told Graham that there were no planned gate movements at least for the next 12 hours.

96 At about 5:20am, I phoned the Flood Warning Centre at BoM regarding the next forecast. I cannot now recall who I spoke with. The reason for my call was to find

out when the next flood warning was planned to be released so that we could provide an updated projected and actual release date for inclusion in that flood warning. The person I spoke with said that they were hoping to issue the next flood warning for the lower Brisbane, which I was told was due at 9am (I note that that information was provided by the FOC at about 9am).

- 97 At about 6:30am, a situation report was sent, which was prepared by John Ruffini and me. The report stated:

'Rainfall

Moderate to heavy rainfall has been recorded in the Upper Brisbane and Stanley Rivers in the last 12 hours with totals up to 90 mm. Totals for the last 24 hours range from 100 to 325mm.

Mt Glorious recorded 100 mm in the last 12 hours.

Rainfall of similar magnitudes is expected in the 12 to 24 hours around the downstream catchments as the system tracks south.

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

North Pine Dam (Full Supply Level 39.60 m AHD)

The dam level was 39.97 m and steady. Five gates are open releasing 475 m³/s. The inflow into the dam since the commencement of the event is 52,000 ML. Estimated event volume is 72,000 ML assuming no further rainfall. Gate operations will continue until at least Tuesday 11 January 2011.

Somerset Dam (Full Supply Level 99.0 m AHD)

The dam level at 05:00 was 102.84 m AHD and rising (storing 193,000 ML above FSL). Peak inflow to the dam is estimated to be about 4,200 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 (95,000 ML/d) into Wivenhoe Dam. At this stage the dam lake level will reach about 103.5 m AHD on Monday afternoon. Areas around Kilcoy will continue to be adversely affected.

Since the commencement of the event on 02/01/2011 approximately 142,00ML 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.

Wivenhoe Dam (Full Supply Level 67.00 m AHD)

River levels upstream of the dam have peaked and are falling slowly with significant inflow being generated from the intense heavy rainfall. Flows in the Brisbane River at Gregor's Ck have peaked at 7,350m³/s at 23:00 on Sunday 9 January. This peak is bigger than January 1974 and February 1999 at this location.

The dam level is rising quickly, with the current level being 70.77m AHD (storing 450,000 ML). Estimated peak inflow to the dam just from the Upper Brisbane R is around 8,800m³/s and, at this stage, the dam will reach at least 73.3 m AHD during Tuesday morning. Given the rapid increase in inflow volumes, it was necessary to start to increase the release from Wivenhoe during 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 in the lower Brisbane will be limited to 4,000m³/s if possible. This is significantly less than the current estimated combined pre-dam peak inflow of 12,000m³/s.

Fernvale Bridge approaches and Mt Crosby Weir Bridge have been inundated and both bridges are now closed.

The current release rate from Wivenhoe Dam is 1,753m³/s (150,000ML/day). Gate opening will continue to be increased during Monday and the release is expected to increase to at least 2,600m³/s in the next 12 to 24 hours.

Since the commencement of the event on 02/01/2001 approximately 270,000ML 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 16th January 2011.

Impacts on downstream of Wivenhoe Dam

The projected Wivenhoe Dam release 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 Bridge 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. 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.'

98 The key points to note in this situation report are that:

- (a) There had been moderate to heavy rainfall in the Upper Brisbane and Stanley Rivers in the last 12 hours and there had been very heavy rainfalls in the last 24 hours between 100 to 325mm;
- (b) North Pine Dam was 39.97m AHD and steady and releasing 475m³/s through five gates;
- (c) Somerset Dam was 102.84m AHD and rising and releasing about 1,100m³/s;
- (d) River levels upstream of Wivenhoe Dam had peaked and had started falling slowly;
- (e) Wivenhoe Dam was 70.77m AHD and rising quickly and releasing 1,753m³/s. Gate releases would continue to be increased to at least 2,600m³/s over the next 12 to 24 hours; and
- (f) Releases from the Dam will be kept below 3,500m³/s and the combined flows at Moggill would be limited to 4,000m³/s if possible.

- 99 At this stage we were aware of the possibility of further significant rainfall and that the situation could deteriorate rapidly over the next 24 hours if the heavy rainfall continued. I had run a model at 1am (on a 'no further rainfall' basis), which predicted a lake level of 73.3m AHD and the 'with further rainfall' model had predicted the lake level above 74.0m AHD. As explained in my first statement, Wivenhoe Dam releases are ordinarily based on predicted levels on a 'no further rainfall' basis, therefore, we were able to continue to operate within strategy W3. In this situation report, I included the results from my 'with further rainfall' model, which indicated that if the forecast rainfall eventuated, combined flows in the lower Brisbane may exceed the threshold of damaging discharge in the urban areas within 24 to 48 hours to make the relevant agencies aware of this possibility.
- 100 The best forecast information (from the BoM's ACCESS models and the WATL website) that was available at that stage indicated that the rainfall producing system was moving south and contracting towards the coast so our expectation at that stage was the metropolitan Brisbane and the Bremer River would bear the brunt of the rainfall on Monday and Tuesday and that was another reason why we did not want to greatly increase the rate of releases considering that downstream Brisbane may well have significant flows from rainfall in the local catchments.
- 101 This was a critical issue because if we did release more water on top of the heavy rain in the downstream areas it would have caused more damage than necessary.
- 102 At about 6:30am, John Ruffini issued Wivenhoe Directive 9. This directive was part of the series of directives aimed at increasing the release rate from Wivenhoe Dam to 2,600m³/s. At 6am, the Wivenhoe Dam level had been 70.96m AHD, which meant it had risen since the last directive. Directive 9 required gates to be opened incrementally between 7am until to 11am. Directive 9 noted that at the end of these operations the Dam would be releasing around 2,180m³/s.
- 103 John Ruffini and my shift in the FOC ended at approximately 7am. Terry Malone and John Tibaldi took over the shift.
- 104 The handover involved all four Duty Flood Operations Engineers so we could discuss strategy and the developing situation.
- 105 During the handover John Ruffini and I spoke with Terry Malone and John Tibaldi about the current strategy to increase releases to 2,600m³/s in the next 12 to 24 hours, as per the situation reports, but also the possibility that the situation would

deteriorate if the further rainfall did eventuate. (I observe that the process of incrementally increasing releases to 2,600m³/s continued while I was off shift under Wivenhoe Directives 10 and 11 which were issued once my shift had finished).

- 106 During the handover, John Ruffini also relayed to Terry and John Tibaldi the discussion he had had with Ken Morris of the BCC about the reference in the situation reports to the level of damaging flows in Brisbane. John said to Terry and John Tibaldi that he had told Ken Morris that we would take this into consideration when preparing the situation reports but that we would continue to operate under the W&S Manual strategy flow level of 4,000m³/s. John Ruffini and I pointed out to Terry and John Tibaldi that we had drafted the situation reports (sent at 1:15am and 6:30am) so as not to refer to the upper limit of non-damaging floods as 4,000m³/s and, thereby, avoid confusion.
- 107 I left the FOC at about 7am and went home. I started my next shift at about 7pm. During the period I was away, I received and noted the situation reports that had been sent by Terry Malone and John Tibaldi.
- 108 When I arrived back at the FOC at about 6:45pm. John Ruffini was also due back on shift at that time and the four Duty Flood Operations Engineers had another handover meeting. I recall that we discussed the 6:43pm situation report that had been sent by Terry Malone and John Tibaldi and in particular, that there was potentially significant rainfall moving towards the Dams' catchments. We also discussed the recent QPF and the current status of each of dam.
- 109 We also discussed the reference in the situation report to 'flash flooding being experienced in the upper areas of Lockyer Creek'. Terry explained that he had received an email from the Flood Warning Centre and BoM at about 5:30pm, which noted flash flooding but did not quantify the amount of expected inflow into Lockyer Creek. I mentioned that I had seen the news footage before I had left home, which showed significant flash flooding in the Upper Lockyer Valley regions, such as Grantham. John Ruffini and I noted we would monitor the Lockyer Creek and its potential impact on downstream Brisbane River flows.
- 110 We discussed the reference in the situation report that Wivenhoe Dam was predicted to reach about 73.8m AHD during Tuesday morning and we discussed that we were getting close to the upper range of strategy W3 and may move into strategy W4 if rainfall continued.

- 111 I queried the reference in the situation report to 'increasing releases to ensure that a fuse plug was not initiated' because we had not reached a level at which strategy W4 was invoked and, therefore, the purpose for increasing releases was not to prevent fuse plug trigger but to minimise urban damage. Terry Malone said that he agreed that we were still operating within strategy W3 under the W&S Manual, but the reference to the fuse plug in the situation report was to make relevant authorities aware that the situation could deteriorate and there was a risk that the fuse plugs may be initiated.
- 112 At about 7:20pm, John Tibaldi issued North Pine Directive 12, which directed gate closures. By 7pm, North Pine Dam had continued to fall to 39.82m AHD.
- 113 At about 7:30pm, I received a telephone call from Agg Dagan, one of the dam operators at Somerset Dam. Agg told me that the mini-hydro at Somerset Dam was inundated. We discussed that the mini-hydro at Somerset Dam had been de-commissioned for some time, but that the water would still need to be drained from the mini-hydro at the end of the flood event. Agg informed me that he had found the source of the leak and had tightened the seals to prevent further leakage, so now the mini-hydro had been secured, but that he wanted me to be aware of the situation. Agg also said that the water was oily, and I recall saying that we would need to wait until the end of the event before we de-watered the chamber and we would need to be careful not to contaminate the tailwaters downstream of the Dam with the oily water.
- 114 At 8pm, I took part in a conference call between me and John Ruffini from the FOC, and Peter Baddiley and Jimmy Stewart from the BoM. In this conference call we discussed the magnitude of the flash flooding in the Upper Lockyer Creek that had occurred that afternoon. Peter described the event as similar to the Cooyar Creek flash flood of 1983 (which I am familiar with). We discussed the rate of rise experienced at Helidon and Gatton's stream gauging stations and the fact that both sites had now stopped reporting. Peter said that the heavy rainfall responsible for such rises was not captured in any rainfall gauges and, therefore, modelling the flood response was problematic. He said that the BoM Flood Warning Centre estimated that up to 600mm of rainfall must have fallen in the Lockyer Creek catchment because that was the estimated amount required to produce the recorded rate of rise in the river height gauges.

- 115 Peter Baddiley said that the BoM Flood Warning Centre was now relying on the Glenore Grove stream gauge to monitor progress of the flood hydrograph and to confirm the magnitude of the event. Peter indicated that the BoM's preliminary view was that the rainfall was the biggest event on record for the Lockyer.
- 116 This conversation provided information that had not previously been available. The 600mm of rainfall, which had now been estimated to have fallen on the Toowoomba escarpment was much more significant than the data had previously suggested, and this meant that the flows coming into the Brisbane River below the dams from the Lockyer would be very significant, even without releases from Wivenhoe Dam.
- 117 After this conversation with Peter, I recall looking at the BoM website (the registered user service) to examine the latest model runs conducted by the BoM for the Brisbane River Basin and I was particularly interested in the Lockyer Creek flows. I recall seeing that the predicted flow rate for the Lockyer Creek provided on the BoM website was much more significant than the initial data observations referred to in the situation report sent at about 6:43pm. The BoM modelling was suggesting that, even without releases from Wivenhoe Dam, the flow from the Lockyer Creek would be about 1,400m³/s (whereas the FOC modelling was only suggesting 780m³/s). If these flows eventuated, the upper limit of non-damaging floods of 4,000m³/s at Moggill would be exceeded if the current rate of releases from Wivenhoe Dam was maintained (releases were being made at about 2,700m³/s at this stage).
- 118 As a result of my conversation with Peter Baddiley, and the modelling results I had looked at, John Ruffini and I decided to contact Peter Allen, the Dam Safety Regulator. At 9pm, John and I participated in a telephone conference call with Peter Allen, the Dam Safety Regulator, regarding the possibility of reducing of releases from Wivenhoe Dam to accommodate the peak from the Lockyer to flow through the middle Brisbane River. Reducing releases from the Dam might mean that the dam level rose above 74.0m AHD.
- 119 As this was a potential departure from the W&S Manual, section 2.8 required me to consult with the Chief Executive (John Bradley, the director general of DERM), who would authorise any departure from the W&S Manual; however, Peter Allen, as dam safety regulator, is a nominated delegate of the Chief Executive and so the proposal could be authorised by Peter.

- 120 During this telephone call, I told Peter that the BoM models were suggesting that up to 600mm of rain had fallen in the Upper Lockyer, and that we were expecting significantly increased flows emanating from Lockyer Creek, but that there was uncertainty in the flows being contemplated because of the unavailability of the stream gauge data in the upper reaches of Lockyer Creek as those gauges had failed.
- 121 I informed Peter that releases were being made from Wivenhoe Dam at about 2,700m³/s and that these releases, combined with the expected flow from Lockyer Creek would be sufficient to exceed the upper limit of non-damaging flows at Moggill, which is 4,000m³/s.
- 122 We informed Peter that we were therefore contemplating reducing the releases from Wivenhoe Dam to enable the peak of the Lockyer Creek to pass into the middle Brisbane River to try to maximise the protection of urban areas and keep the Lower Brisbane as close as possible to 4,000m³/s.
- 123 John Ruffini and I asked Peter Allen if he would agree to the use of the discretionary powers under section 2.8 of the W&S Manual, to not invoke strategy W4 even if the dam level exceeded 74.0m AHD so as to allow the peak of the Lockyer to pass. Peter agreed that this could be possible if we could demonstrate that the lake level would not exceed 74.0m AHD by a significant amount (Peter suggested 100 to 200mm), and would only stay above that level for a short period of time (Peter suggested less than 12 hours).
- 124 John Ruffini and I said to Peter Allen that we would conduct further modelling to assess the viability of the proposal and would call him again for further discussion once we were in a position to demonstrate whether the conditions could be satisfied.
- 125 At 9:30pm, North Pine Directive 13 was issued by John Ruffini directing further gate closures. By 9pm, North Pine Dam had continued to fall to 39.80m AHD.
- 126 At about 10.00pm, North Pine Directive 14 was issued by John Ruffini directing gate closures when the level of the Dam falls to 39.775m AHD and then again when the Dam level falls to 39.60m AHD.
- 127 During this period, of time, I was conducting modelling in response to the earlier discussions that I had with Peter Allen and Peter Baddiley about the significant

increase in flows expected from the Lockyer Creek as a result of the flash flooding earlier in the day, and the viability of reducing the releases from the dams so as to allow the peak from the Lockyer Creek to pass.

128 After I had finished analysing the model results, at about 11:20pm, John Ruffini and I telephoned Rob Drury, the Dam Operations Manager at Seqwater, to give him an update on the situation. During this conference call, we informed Rob that we were investigating the possibility of reducing releases from Wivenhoe Dam so as to accommodate the peak from the Lockyer flash flooding. I informed Rob that we had spoken with Peter Allen, the Dam Safety Regulator, to inform Peter that we were considering the viability of reducing releases from Wivenhoe Dam to allow the peak from the Lockyer Creek flash flooding to pass, and that this could result in the dam level exceeding 74.0m AHD. I also indicated that we would be issuing a situation report at midnight.

129 At 11:56pm on Monday 10 January 2011, I issued a situation report. The situation report stated:

'Rainfall

Rainfall continues in the North Pine Dam, Somerset Dam and Wivenhoe Dam catchments with falls of generally less than 20mm since 18:00 today. However, some isolated falls in the Upper Brisbane River of up to 110 mm have been recorded at Monsildale in this time. This rainfall will increase flows into the dam.

A severe weather warning remains current for heavy rainfall in the dam catchment areas. The QPF issued by BOM at 16:00 estimates rainfalls for the next 24 hours to 10:00 Tuesday as North Pine Dam (25mm to 50mm, with isolated falls to 100mm); Wivenhoe/Somerset Dam Catchments (25mm to 50mm, with isolated falls to 100mm).

North Pine Dam (Full Supply Level 39.60 m AHD)

The dam level is 39.80m AHD and falling slowly (storing 4,400ML above FSL). Five gates are open, releasing 153 m³/s. The inflow into the dam since the commencement of the event is 74,000 ML. Estimated event volume is 84,000 ML assuming no further rainfall. Releases from the dam will continue until at least Wednesday 12 January 2011.

Somerset Dam (Full Supply Level 99.00 m AHD)

The dam level is 103.40 m AHD and falling slowly. Peak inflow to the dam is estimated to be about 4,200 m³/s. Total discharge into Wivenhoe Dam is currently 1700m³/s and this discharge will decrease slowly in the next 24 hours to be around 1200m³/s late Tuesday. The dam level peaked at 103.25m AHD at 19:00 on Monday 10 January 2011, unless further significant rainfall is experienced. Areas around Kilcoy will continue to be adversely affected.

Wivenhoe Dam (Full Supply Level 67.00 m AHD)

The dam level is 73.22m AHD and rising at about 50mm/hour. Releases from the dam have been held at a rate of 2,750 m³/s since 19:30 hours. Outflows into the Brisbane River from both Lockyer Creek and the Bremer River are also increasing.

The BoM provided further advice about the flash flooding experienced in the upper areas of Lockyer Creek. The rainfall responsible for this event was not observed at any rainfall stations but it is considered to be very significant. Flood levels in the Lockyer Creek catchment will exceed maximum recorded levels in some stations in the upper catchment. This flow may result in increases in Brisbane River levels below the junction of Lockyer Creek.

Five radial gates are currently open at the dam releasing about 2,750m³/s into the Brisbane River. At this stage, the dam will reach about 73.8m AHD during Tuesday afternoon.

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.

The BoM will provide further information regarding the magnitude of the flash flood event occurring in the Lockyer Creek early Tuesday morning. Consideration will be given to modifying the releases from Wivenhoe Dam to try to moderate the peak flows emanating from Lockyer Creek.

Outlook

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

- 130 The key points to note from this situation report are that:
- (a) The lake level at Wivenhoe Dam was below 74.0m AHD, namely 73.22m AHD, and was not expected to peak until Tuesday afternoon at 73.8m AHD (which is still within strategy W3);
 - (b) The lake level at North Pine Dam was falling;
 - (c) The lake level at Somerset Dam was falling;
 - (d) The rainfall in the Upper Lockyer was not observed at any stations but it was considered to be very significant;
 - (e) Flood levels in the Lockyer Creek were expected to exceed maximum recorded levels at some stations, and that this flow may result in increases in Brisbane River levels below the Lockyer Creek junction;
 - (f) Consideration was being given to modifying the releases from Wivenhoe Dam to try to moderate the peak flows emanating from Lockyer Creek; and
 - (g) The situation could deteriorate over the next 24 hours if heavy rains continued.
- 131 By the time of this situation report, inflows rates into Wivenhoe Dam had eased (reduced from 10,095m³/s at 8am to 4,574m³/s at 11pm) and the rainfall being recorded in the catchment areas over the Monday had eased. The releases being

made from Wivenhoe Dam were matching the projected maximum release rates that had been modelled. For these reasons, the objective for dam operation was 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. However, I was aware that if further heavy rainfall occurred, 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. That is why I referred in the situation report to the possibility of increased releases in the event that further rainfall occurred.

Tuesday 11 January 2011

- 132 Tuesday 11 January 2011 saw some of the highest rainfall ever record in the Brisbane River and Pine Rivers Basin. In the early hours of this morning, and before the heavy rains had commenced, I was considering whether releases from Wivenhoe Dam could be reduced to allow the peak of the Lockyer Creek to pass before release rates were increased.
- 133 Between midnight and 2am, I continued to conduct modelling to assess the viability of reducing releases from Wivenhoe Dam as had been discussed with Peter Allen the previous evening. The 2am modelling indicated that if releases from Wivenhoe Dam were reduced to 1,900m³/s, the lake level would rise to at least 74.24m AHD and would exceed 74.0m AHD for at least 22 hours. This was outside the parameters that had earlier been discussed with Peter Allen, and so I determined that releases for Wivenhoe Dam could not be reduced to accommodate the peak of the flow from the flash flooding in the Lockyer Creek, and that the current rate of release would have to be maintained. At 2am, releases from Wivenhoe Dam were being made at the rate of 2,721m³/s, and the predicted maximum required release from the Dam of 2,760m³/s was not required until 6am on the Wednesday, which would have been after the peak of the Lockyer had passed.
- 134 Localised, intense rainfall around the Wivenhoe lake area commenced from about 4am on Tuesday 11 January 2011 and continued into the afternoon.
- 135 The following table sets out some of the highest rainfall intensities that occurred during the January 2011 Flood Event. I point out that the highest rainfall intensities during the January 2011 Flood Event occurred on the Tuesday, with 70.5 mm/hour of rainfall occurring for three hours and rainfall exceeding 40mm/hour occurring for six hours. Rainfall with an AEP of 1 in 2000 occurred over Tuesday:

January 2011 Flood Event – Highest rainfall intensities					
Duration	ALERT ID	Station	Recorded intensity	End time	AEP
			mm/hr		1 in Y
3 H	6559	Savages Crossing	70.5	11/01/2011 09:34	500 - 1000
6 H	6559	Savages Crossing	47.8	11/01/2011 12:49	> 2000
	6649	Lowood	40.0	11/01/2011 14:04	
12 H	6559	Savages Crossing	30.7	11/01/2011 14:34	> 2000
	6643	Wivenhoe Dam	29.4	11/01/2011 16:29	
	6649	Lowood	29.0	11/01/2011 14:49	
18 H	6649	Lowood	19.6	11/01/2011 19:34	> 2000
24 H	6649	Lowood	14.8	11/01/2011 19:19	> 2000
48 H	6649	Lowood	9.0	11/01/2011 14:49	> 2000
72 H	6649	Lowood	6.4	12/01/2011 01:19	1000 - 2000
96 H	6649	Lowood	4.9	12/01/2011 01:19	500 - 1000
120 H	6649	Lowood	4.0	12/01/2011 01:04	500 - 1000

- 136 Rainfall totals in the 12 hours to 3pm ranged from 410mm at Mount Glorious on the eastern side of the lake, to only 32mm at Rosentretters on the Western side of Lake Wivenhoe. The following table sets out the hourly rainfall totals recorded between 3am and 3pm on Tuesday 11 January 2011:

Hourly rainfall stations around Wivenhoe Dam reservoir											
Hour ending	Lowood	Savages Crossing	Wivenhoe Dam	Mt Glorious	Kluvers Lookout	Mt Mee	Somerset Dam	Caboonbah	Toogoolawah	Rosentretters	Cressbrook Dam
	6646	6559	6636	6680	6610	6690	6590	6574	6604	6553	6523
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
05:00 11 Jan	3	1	3	14	12	14	37	32	23	19	13
06:00 11 Jan	16	16	20	27	26	24	40	24	3	4	18
07:00 11 Jan	43	31	32	28	46	29	4	6	2	1	0
08:00 11 Jan	53	86	35	57	7	9	3	10	0	0	0
09:00 11 Jan	56	93	38	71	40	15	0	4	0	0	0
10:00 11 Jan	19	18	32	51	36	16	0	0	0	2	0
11:00 11 Jan	51	36	31	50	50	24	8	2	3	0	1
12:00 11 Jan	34	18	36	39	33	33	3	4	5	5	3
13:00 11 Jan	39	33	52	28	33	59	24	11	2	0	1
14:00 11 Jan	56	33	39	28	20	9	19	24	3	0	2

- 137 At 2:15am, I received a telephone call from James Charalambous from the BCC. James said that he had just received the flood forecast from the BoM Flood

Warning Centre, which had indicated a flow of $4,600\text{m}^3/\text{s}$ at Moggill and on that basis, the forecast peak height of 3.1m at the Brisbane city gauge would coincide for the high tide on Wednesday night.

138 James Charalambous said he had based this predicted peak height of 3.1m at the Brisbane City gauge on the flow of $4,600\text{m}^3/\text{s}$ at Moggill as modelled by the BoM. I confirmed that the number $4,600\text{m}^3/\text{s}$ provided by the BoM was consistent with the modelling that I had conducted, but that potentially higher releases from Wivenhoe Dam, combined with flows from the Lockyer Creek flash flooding, might result in estimated flows at Moggill of about $5,000\text{m}^3/\text{s}$.

139 At 4am, a further model was run in the FOC. I note that the lake level was predicted to rise to 74.1m AHD by that model; however, at that stage, releases from Wivenhoe Dam were approximately $2,750\text{m}^3/\text{s}$ and we did not increase the rate of release until Wivenhoe Directive 12 was issued at 8am for a number of reasons:

- (a) The expected peak of 74.1m AHD was only slightly above 74.0m AHD and was within the bounds of the modelling uncertainty (that is, the level of accuracy in modelling the Wivenhoe Dam lake level is plus or minus 250mm);
- (b) The actual dam level at that stage was still below 74.0m AHD (at 73.4m AHD), and the predicted peak of 74.1m AHD was not expected to occur until the following afternoon at 4pm, and so there was some time available to allow the peak of the Lockyer Creek to pass before 74.0m AHD would be exceeded;
- (c) The predicted maximum release rate of $2,970\text{m}^3/\text{s}$ (which was not required to be reached until 2pm on the Wednesday afternoon), was very close to what was already being released at $2,750\text{m}^3/\text{s}$. Such a small increase in release rates could be made up in a single directive in a very short space of time. At this stage, the peak flow from the heavy rainfall occurring in the Lockyer had not yet passed into the Brisbane River;
- (d) The inflows into the dam had reduced over the previous day. At 8am on the Monday 10 January 2011 the inflow into Wivenhoe Dam was $10,005\text{m}^3/\text{s}$, however this rate had reduced to $4,974\text{m}^3/\text{s}$ by 4am on Tuesday 11 January 2011;

- (e) I took into account that the best forecast information that was available at that stage indicated that the rainfall producing system was moving south, and was contracting towards the coast;
- (f) I also took into account that the next BoM forecast updates would be available shortly as BoM weather forecasting tools are progressively updated from about 4am;
- (g) The duty point in the Operating Target Line had moved above the target line, which meant that releases from Somerset Dam flowing into Wivenhoe Dam could be reduced, which would slow the rate of rise at Wivenhoe Dam; and
- (h) All of those matters meant that it was unnecessary to immediately increase release rates significantly as there was no immediate threat to dam safety (which is primary consideration in strategy W4).

140 At 4:30am, I issued Somerset Directive 6 directing the closure of three of the sluices. By 4am, Somerset Dam had reached 103.23m AHD. Between 4pm on Monday 10 January and 4am Tuesday 11 January, Somerset Dam had fallen from 103.45m AHD to 103.23m AHD. Because the dam levels in Somerset Dam were falling, whilst they continued to rise in Wivenhoe Dam (at 4am Wivenhoe Dam had reached 73.4m AHD), this directive reduced flows from Somerset Dam into Wivenhoe Dam. The directive states that significant rainfall has fallen in the Upper Brisbane River in the last 12 hours and which resulted in further inflows into Wivenhoe Dam. The directive provides that 'to prevent Wivenhoe Dam exceeding the trigger level for implementation of strategy W4' (74.0m AHD) releases from Somerset Dam would be reduced so as to equalise the relative volumes in flood storage. The directive requires sluice J to be closed at 5am, sluice N to be closed at 6am and sluice K to be closed at 7am. The benefit of this directive was that the releases from Somerset Dam to Wivenhoe Dam were reduced, which would slow the rate of rise in Wivenhoe Dam.

141 At 6am, North Pine Directive 16 was issued by John Ruffini directing 5 successive gate openings when the dam reached certain levels. North Pine Dam had been dropping over the course of the previous day, and had remained at a constant level over the previous evening at 39.8m AHD, however, the Dam had risen once again

by 6am to 39.84m AHD as a result of the heavy rainfall that had fallen over the last two hours in the catchment.

- 142 At 6:12am, a situation report was sent by John Ruffini. I assisted in the preparation of that situation report. The situation report stated:

'Rainfall

Rainfall continues in the North Pine Dam, Somerset Dam and Wivenhoe Dam catchments. Isolated falls in the Upper Brisbane River of up to 125 mm have been recorded with widespread falls of 40 to 70 mm in the Somerset Dam catchment. This rainfall will increase inflows into the dam.

There has also been 20 to 60 mm in the Lockyer Creek catchment in the last 12 hours with falls of up to 30 mm in the Bremer River.

A severe weather warning remains current for heavy rainfall in the dam catchment areas. The QPF issued by BOM at 16:00 estimates rainfall for the 24 hours to 10:00 Tuesday as North Pine Dam (25mm to 50mm, with isolated falls to 100mm); Wivenhoe/Somerset Dam Catchments (25mm to 50mm, with isolated falls to 100mm).

North Pine Dam (Full Supply Level 39.60 m AHD)

The dam level is 39.80m AHD and has commenced rising again (storing 4,400ML above FSL). Five gates are open releasing 177 m³/s. The inflow into the dam since the commencement of the event is 77,000 ML. Estimated event volume is 88,000 ML assuming no further rainfall. Releases from the dam will continue until at least Wednesday 12 January 2011.

Somerset Dam (Full Supply Level 99.00 m AHD)

The dam level is 103.27m AHD and falling slowly. Peak inflow to the dam is estimated to be about 4,200 m³/s. Total discharge into Wivenhoe Dam is currently 1400 m³/s and this discharge will be decreased in the next few hours to be around 500 m³/s later on Tuesday. This is to ensure that the combined flood mitigation capacity in Somerset and Wivenhoe Dam is maximized.

The dam level peaked at 103.52m AHD at 19:00 on Monday 10 January 2011, (unless further significant rainfall is experienced). Areas around Kilcoy will continue to be adversely affected.

Wivenhoe Dam (Full Supply Level 67.00 m AHD)

The dam level is 73.51m AHD and rising at about 25 mm/hour. Releases from the dam have been held at a rate of 2,750 m³/s since 19:30 hours on Monday 10 January 2011. Outflows into the Brisbane River from both Lockyer Creek and the Bremer River are also increasing.

The BoM has provided further advice about the flash flooding experienced in the upper areas of Lockyer Creek. The rainfall responsible for this event was not observed at any rainfall stations but it is considered to be extreme. Flood levels in the Lockyer Creek catchment will exceed maximum recorded levels in some stations in the upper catchment. This flow will result in increases in Brisbane River levels below the junction of Lockyer Creek.

Five radial gates are currently open at the dam releasing about 2,750m³/s into the Brisbane River. At this stage, the dam will reach just over 74.0m AHD during Tuesday evening.

Above EL 74.0m AHD the objective for dam operations is to maintain the security of the dam and minimise downstream flood flows if possible.

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 release from Wivenhoe Dam.

The BoM will provide further information regarding the magnitude of the flash flood event occurring in Lockyer Creek early Tuesday morning. Consideration was given to modifying the releases from Wivenhoe Dam to try to moderate the peak flows emanating from Lockyer Creek but the rainfall in the past 12 hours in the catchment above the dam makes this option not possible. Therefore instead of decreasing releases to accommodate the Lockyer Creek flows, the strategy will endeavour to maintain the current releases until Lockyer Creek peaks.

Outlook

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

- 143 Some of the key points to note from this situation report are that:
- (a) The dam level was still below 74.0m AHD at 73.51m AHD;
 - (b) Releases had been held at a rate of 2,750m³/s over the course of the evening to allow the peak of the Lockyer to pass;
 - (c) Releases from Somerset Dam had now been reduced;
 - (d) There had been isolated heavy falls in the upper Brisbane River and widespread falls in the Somerset Dam catchment;
 - (e) There had been 20 to 60mm of rainfall in the Lockyer in the last 12 hours;
 - (f) Consideration had been given to reducing releases from Wivenhoe Dam to moderate the peak flows emanating from the Lockyer Creek, but that the rainfall in the past 12 hours in the catchment above the Dam made this impossible;
 - (g) The strategy at present was to endeavour to maintain the current releases (currently releasing 2,750m³/s) until the Lockyer Creek peak had passed before increasing releases; and
 - (h) If further rainfall occurs, dam releases would need to be increased further and that this may result in river flows in the lower Brisbane River approaching or exceeding 5,000m³/s.

144 I ended my shift at approximately 7am on Tuesday 11 January 2011. The handover that occurred at the end of shift involved all four duty engineers. During the shift handover, we discussed the situation report that had been issued at 6:12am, and specifically:

- (a) The rainfall that had occurred in the Upper Brisbane, and we noted the heavy rainfall that had occurred in the previous 12 hours;
- (b) That North Pine Dam was at 39.8m AHD and had commenced rising again, which had resulted in further gate operations;
- (c) That Somerset Dam was 103.27m AHD and falling slowly. I informed Terry Malone and John Tibaldi, who were starting their shift, that I had just issued Directive 6 for Somerset Dam and that the discharge from it into Wivenhoe Dam would be decreased in the next few hours to be around 500m³/s later that day as Somerset Dam had moved above the Operating Target Line allowing us to reduce the releases from the sluices at Somerset Dam. I informed Terry Malone and John Tibaldi that they would need to issue a further directive for sluice closures once Directive 6 had been completed. We noted that the lake level had peaked at 103.25m AHD at 7pm on Monday (unless further rainfall was received), but would start rising again following the sluice closures;
- (d) That Wivenhoe dam was at 73.51m AHD and rising at about 25mm/hour, and that releases from the dam have been held at 2,750m³/s since 7:30pm the previous evening in order to allow the peak of the Lockyer Creek to pass and thereby minimise urban flooding;
- (e) The expected Lockyer Creek flows from the flash flooding and John Ruffin I and I appraised John Tibaldi and Terry Malone about the BoM's predicted Lockyer Creek flows from the BoM's user website; and
- (f) I informed Terry Malone and John Tibaldi that the objective for dam operations at that stage was still to minimise downstream urban damage, but that Wivenhoe Dam releases may need to be increased if further rainfall was received.

145 Terry Malone and John Tibaldi took over from John Ruffini and me at 7am.

- 146 Although I was not on shift at time, I note that strategy W4 was implemented at 8am on that day after model run 37 was completed. Between about 4am and 8am on Tuesday very significant rainfall had fallen around Lake Wivenhoe. Whilst the dam level was still below 74.0m AHD, strategy W4 was adopted as the rain that occurred in the last few hours meant that higher releases could not be avoided. (I observe that this rainfall was the onset of the second and highest peak of inflow to Wivenhoe Dam). Therefore, gate operations immediately commenced. Wivenhoe Directive 12 was issued at 8am, and was followed by Directives 13 at 9am, 14 at 12pm, 15 and 16 at 1pm, 17 at 2pm, 18 at 2:15pm, 19 at 3:15pm, 20 at 3:30pm, 21 at 4:15pm, 22 at 4:45pm, 23 at 5:15pm, 24 at 6pm, 25 at 9pm, and 26 at 9:30pm. Directives can require movements at five separate gates, and for that reason, are sent in short sequences during flood events so that a dam operator is not issued with an excessively long list of gate operations at the one point in time. This allows the dam operator to concentrate on the particular gate operations relevant to that directive, and serves to ensure that a gate sequence is not inadvertently overlooked in a long sequence of gate operations. This process also allows the response of the dam to be assessed and gate operations to be refined accordingly.
- 147 At about 10:14am, I received the QPF on my blackberry whilst I was at home resting after the night shift. I reviewed the QPF as soon as I received it and noticed that the QPF was predicting rainfall in excess of 100mm in the Somerset and Wivenhoe catchment areas.
- 148 I was concerned by the recent QPF because the predicted rainfall was higher than previously forecast. For example, the QPF issued at 4pm on Monday 10 January 2011 was for 25 to 50mm falls with isolated falls up to 100mm, whereas the 10:14am QPF issued on Tuesday predicted catchment average rainfall in excess of 100mm.
- 149 At about 10:30am, I telephoned the FOC and spoke with Terry Malone. Terry Malone told me that there had been intense rainfall in the North Pine catchment and in the immediate surrounds of Wivenhoe Dam. Terry said that the levels in Wivenhoe Dam were almost at 74.0m AHD and gate operations had already commenced. I advised Terry Malone that I would come back to the FOC.
- 150 I knew it was likely that I would be in the FOC for an extended period of time so I packed up some clothes and food for the next few days.

- 151 At about 11:51am, while waiting for a train to get back to the FOC I telephoned the FOC. I cannot recall who I spoke with, I note that the Event Log notes that I spoke with someone with the initials 'SS', however, I do not recall speaking to anyone with those initials. During my call to the FOC, I was advised that releases at Wivenhoe Dam would be increased to 4,000m³/s and that it was likely that FOC staff would have to stay in the offices overnight because of the anticipated flooding in the CBD.
- 152 I arrived at the FOC at about 12:30pm to assist Terry Malone and John Tibaldi, who continued to act as the rostered Duty Flood Operations Engineers on shift. From the time I arrived until the start of my next shift, I assisted with the operations by doing the rate of rise calculations and reviewing rainfall and river height data.
- 153 A situation report had been issued at 12:11pm and I discussed this situation report with John Tibaldi and Terry Malone as soon as I arrived at the FOC. We discussed that the current strategy was to prevent the initiation of the first fuse plug (by 12pm the Dam was at 74.27m AHD).
- 154 I discussed with Terry Malone and John Tibaldi the suggestion in the situation report that fuse plug initiation might in fact result in a lower outflow than increasing the gate outflow to protect it. My view, which I expressed, was that it would be appropriate to follow the W&S Manual and use the gates for water release rather than allow a fuse plug to be initiated. Terry and John Tibaldi said they agreed.
- 155 At about 1pm, Wivenhoe Directive 15 and Wivenhoe Directive 16 were issued by Terry Malone. Directive 15 required gate openings at 1:15pm, which were to be followed by the further gate openings required by Directive 16. Wivenhoe Dam had risen to 74.39m AHD since the last directive at 12pm.
- 156 I note that Wivenhoe Directives 15 and 16 require successive gate openings from 1:15pm and 2pm consecutively. These directives, although sent at the same time, are part of an overall operating strategy. As previously explained, over the course of this Tuesday successive directives were issued requiring continued gate operations at staggered times because it minimised the risk of a gate operation being overlooked by a dam operator and it allowed sufficient time for each gate to be opened. A stepped approach to increasing gate operations is the best means of minimising the downstream impacts of those releases from the Dam.

- 157 At this stage, we became aware that the models were not accurately predicting the rapid rate of rise at the Wivenhoe Dam because there is no rainfall gauge on the lake and, therefore, the rainfall falling directly on the lake was not being recorded. Therefore, we started basing releases from Wivenhoe Dam on reverse-routing calculations, which use actual lake levels and current gate settings to determine the rate of inflow. That process worked effectively during the remainder of the flood event.
- 158 The rain continued to fall heavily across the dams during this period and there were significant inflows to the Dams. The dam levels continued to rise and, therefore, further increases in releases were required at Wivenhoe Dam (while Somerset Dam sluices were closed).
- 159 At about 2pm, Wivenhoe Directive 17 was issued by Terry Malone. Directive 17 directed further gate openings on all gates at 2:15pm. By 2pm, Wivenhoe Dam had risen to 74.5m AHD and had risen since the last directive at 1pm.
- 160 At about 2:15pm, Wivenhoe Directive 18 was issued by Terry Malone. Directive 18 directed further gate openings on all gates at 3pm.
- 161 At about 2:46pm, John Tibaldi told me that Brett Schulz from North Pine Dam had called to report the lake level of 41.11m AHD and that this level had been steady for the last 30 minutes.
- 162 By 3pm, Wivenhoe Dam had risen to 74.71m AHD and was still rising due to the significant inflow.
- 163 At about 3:15pm, Wivenhoe Directive 19 was issued by Terry Malone. Directive 19 directed further gate openings on all gates.
- 164 Wivenhoe Directive 19 was followed shortly after by Wivenhoe Directive 20 at 3:30pm as part of the continued stepped approach to gate openings.
- 165 At about 3:49pm, a teleconference was held between Peter Baddiley and Jimmy Stewart from the BoM and all four Duty Flood Operations Engineers. The purpose of the teleconference was for the FOC to provide information on dam release rates to BoM so that the BoM could update their upcoming flood warning. During this teleconference I recall that we discussed the following:

- (a) Gates at Wivenhoe Dam would be opened to 9.5m by 4pm and that Wivenhoe Dam would be discharging 5,800m³/s at that time;
- (b) The Wivenhoe Dam lake level was, at that time, 74.81m AHD and rising at 100mm per hour;
- (c) The BoM thought the rainfall was easing; and
- (d) The possible maximum release scenario of 10,000m³/s, which I understood had been discussed earlier that day between Terry Malone, John Tibaldi and Peter Borrows, CEO of Seqwater. We discussed that a release of 10,000m³/s from Wivenhoe Dam (if that was required) would be similar in magnitude to the February 1893 flood event in that there would be a similar result at the Port Office gauge in Brisbane, which Peter and Jimmy indicated would be a level of 8.36m.

166 At about 3:58pm, I called Brett Schultz, the dam operator at North Pine Dam, to check everything was going ok. Brett told me that the lake levels were slowly reducing.

167 At about 4:15pm, Wivenhoe Directive 21 was issued by Terry Malone. Directive 21 directed further gate openings at 4.30pm on all gates to 10m. By 4pm, Wivenhoe Dam had reached 74.81m AHD and was still rising.

168 At about 4:41pm, all four Duty Flood Operations Engineers had a conference call with Peter Allen, the Dam Safety Regulator from DERM. Peter had called the FOC to request that more technical information be included in the future situation reports. We said that we would include more technical information but that our primary concern was stabilising the situation. Peter acknowledged that our primary concern at this stage had to be the management of the Dam and said that he would send through an example of the type of technical information that could be included in the situation reports. Peter later emailed to the FOC an example of the type of technical information to be included in the situation reports.

169 As the lake level at Wivenhoe Dam continued to rise, further gate openings were required so as to match the outflows with the inflows.

170 At about 4:45pm, Wivenhoe Directive 22 was issued by Terry Malone. Directive 22 directed that all gates be opened to 10.5m at 5pm. This directive was issued to allow sufficient time for the previous directive to be implemented.

- 171 At about 5:15pm, Wivenhoe Directive 23 was issued by Terry Malone. Directive 23 directed gate that all gates be opened to 11m at 5:30pm. This gate opening at 5:30pm increased the release rate to 6,774m³/s by 6pm. At 5pm Wivenhoe Dam had risen to 74.95m AHD.
- 172 At about 5:48pm, I called Rob Drury, Dam Operations Manager from Seqwater, to ask if Rob could contact Tarong Energy (the operators of the Splityard hydro-generation plant at Wivenhoe Dam) to tell them to postpone any operation Tarong Energy had planned for Tuesday night. Rob said that he would contact Tarong Energy. Because Wivenhoe Dam is the lower pumping pool of the hydro-electric scheme at Splityard, we did not want any water from Splityard going into Wivenhoe Dam if there was a hydro operation. An operation at Splityard can add up to 300mm to Wivenhoe Dam.
- 173 At about 6pm, Wivenhoe Directive 24 was issued by Terry Malone. Directive 24 directed all gates be opened to 12m at 6:15pm. Although previous directives had been for half metre openings, as gates were now exceeding 11m, one metre increments were used because that is the recommended sequencing in the W&S Manual. At 6pm, Wivenhoe dam was at 74.95m AHD.
- 174 Also at about 6pm, a situation report was sent, which was prepared by Terry Malone. The report stated:

'In the last twelve hours totals of up to 370mm have fallen in the area around Wivenhoe Dam. In the last hour, rainfalls between 15 and 30mm have been recorded in the same area. At 1600, the BoM advised that falls between 50 to 100mm are still forecast for the 24hrs to 1600 Wednesday 12 January 2011 for the North Pine and Somerset/Wivenhoe catchments.

At 1730 Wivenhoe Dam was 74.92m AHD and rising slowly and releasing about 6,700m³/s.

The current expectation is that the dam will reach a steady state (outflow equals inflow) within the next 3 hours without further significant rainfall. At this time, release from the dam will be about 8,000 m³/s.

If there is no further rainfall, it may be possible to then slowly reduce this release overnight.

The dam is expected to peak below 75.5m AHD which is 100mm below the first fuse plug initiation level.

Note that the automatic reader as indicated on the BoM website is affected by drawdown and is not reflecting the actual lake level and tendency.

The Flood Operations Centre is continuing to monitor rainfalls and water levels through the Brisbane and Pine catchments and reviewing operating strategy every 30 minutes. The FOC is also maintaining close contact with warning agencies and local councils.

The next report will be issued at 2100 12 January 2011.'

175 The key points to note from this situation report are that:

- (a) Wivenhoe Dam lake level was at 74.92m AHD and was rising slowly;
- (b) In the last 12 hours, totals of up to 370mm had fallen in the area around Wivenhoe Dam;
- (c) Wivenhoe Dam was expected to stabilise with outflows equalling inflows within the next three hours, without further significant releases. I note that this stabilisation occurred between about 6pm and 7pm that night;
- (d) Wivenhoe Dam was expected to peak below 75.5m AHD, which is 100mm below the first fuse plug initiation; and
- (e) The data from the automatic headwater gauge on Wivenhoe Dam, which is published on the BoM website, was affected by drawdown or blockage in the float well and was not properly reading the actual lake level. Drawdown is the effect on a storage caused by significant discharges through the release infrastructure. The gauge is located near the throat of the Dam's spillway and the water was essentially being sucked down and through the spillway, which produced an inaccurate lake level record. The inaccurate reading had the effect of suggesting that the lake level was in fact lower than it really was. Manual readings were relied upon instead and those gave accurate readings as to the true lake level. The automatic headwater gauge has since been serviced and recalibrated and brought back into use. (I observe here that some media reports and commentators

have wrongly relied on this headwater gauge to assert that Wivenhoe Dam lake levels were much less than they actually were at the time).

176 At about 6:07pm, the four Duty Flood Operations Engineers met in the FOC to discuss the current release strategy and shift handover. I recall that we discussed the following:

- (a) Wivenhoe Dam was, at that stage, at 74.95m AHD and all gates were being opened to 12m;
- (b) We thought that we were probably close to the peak lake level and we were close to achieving inflows equalling outflows Wivenhoe Dam (I note that the Dam level peaked at 74.97m AHD at 7:30pm and at that time inflows had once again reduced to below the level of outflows); and
- (c) We would not open gates to 13m unless the lake level at Wivenhoe Dam increased to 75.0m AHD.

177 At about 7pm, John Ruffini and I started our shift as the Duty Flood Operations Engineers in the FOC, although we had both been assisting in the operations since about 12:30pm that day. Terry Malone and John Tibaldi had now finished their shift, however, they too stayed in the FOC to assist us in the same way we had assisted them earlier that day.

178 At about 7:30pm, North Pine Directive 19 was issued by John Ruffini. Directive 19 directed gates to be closed to setting 11. This directive was issued because the lake level was falling. At 7pm, North Pine Dam lake level was 40.44m AHD.

179 Also at about 7:30pm, John Ruffini told me that Doug Grigg from Wivenhoe Dam had spoken with John and said that the level of the dam was 74.97m AHD and holding at that level. This was a significant piece of information because it indicated the peak in the lake level at Wivenhoe Dam had been reached.

180 At about 8:25pm, I called Chris Hughes, from Collier Building Services (the building manager) to discuss power to the FOC's building. I had been told by John Tibaldi that he had been told (by Joe Meisner, the technical maintenance engineer at Seqwater) that Energex were considering cutting off power to parts of the CBD and I wanted to see whether or not we would lose mains power (and therefore have to rely on back-up supply). I left a message for him to return my call.

- 181 At about 8:30pm, Chris Hughes returned my call. I asked about the power supply to the building and Chris told me he was checking with Energex and then asked me to email him through a list of the FOC's power requirements.
- 182 Also at about 8:30pm, I phoned John Thornton, who works for SunWater in corporate services and who looks after any issues with the building, to advise him that the power will be shutting down in the CBD from tomorrow morning, I asked if there was anything John could do to assist. He said he would follow up with any contacts he had and would advise me accordingly.
- 183 At 8:35pm, Peter Borrows, the CEO of Seqwater, telephoned to speak with all of the Duty Flood Operations Engineers about the current situation and strategy:
- (a) We advised Peter that we believed that Wivenhoe Dam has peaked and that the lake level was showing signs of falling; and
 - (b) Peter also asked ask what was proposed in terms of the drain down strategy. We informed Peter that the drain sequence (that is, reductions in releases from Wivenhoe Dam) would commence as quickly as possible, but we wanted to make sure that the dam level had peaked first.
- 184 At about 8:40pm, I was informed by Al Navruk that Mark Tan, one of the technical assistants, had telephoned the FOC to ensure that we were aware that Energex would be cutting power to the CBD.
- 185 At 8:45pm, I received a telephone call from Warren Shallcross, a systems engineer at SunWater. I advised Warren that Energex would be cutting power to the CBD in the morning. Warren has a very good understanding of the FOC's back-up systems as he helped design those systems. I wanted to ensure that Warren was aware of the possible loss of power, and to seek Warren's advice on how a possible loss of power was best approached. Warren informed me that the back-up systems activated automatically, and that there was no particular action required by me to ensure a seamless transition to back-up power should a loss of mains power occur. Warren informed me that he would call Mike Minter (the IT manager at SunWater) to make sure that he was aware of the potential loss of mains supply power, and that he would also call the security staff at Mineral House (the back-up FOC).
- 186 At 9pm, I emailed Chris Hughes from Collier Building Services with our power requirements as he requested. The email was to inform Chris that access to the

floor that the FOC was located on needed to be maintained, and access to the roof would also need to be maintained (where the base stations are located). I also wanted to make sure that Colliers were making sure that the back up generator was operational and ready to be used.

- 187 Also at 9pm, North Pine Directive 20 was issued by John Ruffini directing gate closures to increment 6. I was aware that North Pine Dam was falling and that directives were directing the closing of gates. By 9pm, North Pine Dam had fallen to 40.06m AHD.
- 188 Also at 9pm, John Tibaldi sent out Wivenhoe Directive 25 directing gate closures to 11m. This was a reduction to 11m from the previous 12m opening that had been achieved at the peak of the flood.
- 189 At 9:30pm, I issued Wivenhoe Directive 26. Directive 26 was issued at 9pm and amended Directive 25, because it required the gates be set at 11.5m, rather than the 11m applicable under Directive 25. By 9pm, Wivenhoe Dam had reduced slightly from its peak of 74.97 to 74.95m AHD. The reason I amended Wivenhoe Directive 25 was that I was concerned that Wivenhoe Directive 25 required a rate of closure that was too swift and might actually cause the lake level to rise again. If the lake level started to rise again, gates would simply have to be opened.
- 190 Given the context of the situation we were in, I wanted to be certain that the lake level would continue to fall. I believed that the cautious approach was to close the gates by half a metre in the first instance, and then increase the increments with further gate operations if the lake level continued to fall.
- 191 At 9:10pm, John Thornton (building services manager at SunWater) telephoned me and said that he had just spoken to Chris Hughes of Colliers Building Services and that John would try to obtain a contact at Energex so that we could inform Energex of the power supply requirements of the FOC.
- 192 At 9:20pm, I received another call from Warren Shallcross. Warren said that the FOC might not have air-conditioning if mains supply power was lost.
- 193 At 9:25pm, I telephoned John Thornton (the building services manager at SunWater) to say that Chris Hughes had arranged an electrician to attend the building on Wednesday morning to be available in the case of any electrical problems.

- 194 At 9:35pm, John Tibaldi telephoned me to discuss Wivenhoe Directive 26. John said he thought the gates could be closed by a metre at this stage, rather than the 0.5 metre increment required by Directive 26. I explained to John that I wanted to be certain that the dam level would not again commence rising with gate closures, and that the increments would be increased with subsequent directives if the dam level kept falling.
- 195 At 10pm, I received a telephone call from John Thornton. John provided me with a telephone number for a contact person at Energex about the power supply for the FOC and asked for my mobile number to pass on the contact.
- 196 At 10:15pm, North Pine Directive 21a was issued by John Ruffini directing gate closures. By 10pm, North Pine Dam had fallen down to 39.95m AHD.
- 197 At 10:30pm, John Thornton of SunWater telephoned me to say that Geoff White (the acting SunWater CEO) had contacted the CEO of Energex to explain the situation about power to the FOC and, as a result of the call, it was likely that the building will not lose power.
- 198 At 11pm, I issued Wivenhoe Directive 27 directing all gates to be closed down to 10m. By 11pm, I was satisfied that the peak of the flood had passed as dam levels had continued falling even with the earlier gate closure. The Dam level was at 74.92m AHD at 11pm.
- 199 The event log notes that Wivenhoe Directive 28 was a duplicate of directive 27 and so was not sent to the dam operators.
- 200 At 11:10pm, Rob Drury, the Dam Operations Manager for Seqwater, telephoned me. He said that he had received the last directive, and he wanted to know what the release rate from Wivenhoe Dam would be when the gates are lowered to 10m. I informed Rob that the flow would be 6,100m³/s.

Wednesday 12 January 2011

- 201 At 12am, North Pine Directive 22 was issued by John Ruffini directing gate closures down to increment 1 for gates A and E when the lake level reached 39.775m AHD and 39.76m AHD respectively. By midnight, North Pine Dam had fallen to 39.86m AHD.

- 202 At 1am, I received a telephone call from John Thornton. John provided the mobile telephone number of a contact person at Energex named Steve. John told me that Steve, the Energex contact, had indicated that he did not believe the building would be disconnected from the power grid.
- 203 At 1:15am, I telephoned Doug Grigg, a dam operator at Wivenhoe Dam, I advised him that I was sending through a further directive for Wivenhoe Dam that would result in all gates being closed to 9m. I told Doug that we wanted to get the releases from Wivenhoe Dam down as quickly as possible whilst at the same time lowering the lake level. In this telephone call, I also told Doug that there was a chance that the CBD might lose power and if there was a loss of communications with the FOC we would have to resort to the loss of communications procedure in the W&S Manual (section 10 of the W&S Manual deals with emergency procedures including gate operations at the Dam during a loss of communications).
- 204 Immediately after the telephone call with Doug, I issued Wivenhoe Directive 29 directing all gates be closed to 9m. By 1am, Wivenhoe Dam had continued falling to 74.87m AHD.
- 205 At 2am, North Pine Directive 23 was issued by John Ruffini directing gate closures to increment 2. This directive meant that all gates at North Pine Dam would be closed to increment 2 by 3am. By 2am, North Pine Dam had fallen to 39.81m AHD.
- 206 The Event Log records that James Charalambous from the BCC telephoned called at about 2:10am to enquire about our release strategy. I cannot recall if I took this call; however, at about 3am, I sent the actual and projected releases for Wivenhoe Dam to the BCC Flood Information Centre and the BoM Flood Warning Centre.
- 207 At 3:15am, I issued a further directive for Wivenhoe Dam. Wivenhoe directive 30 required all gates to be closed down to 8m. By 3am, Wivenhoe Dam had fallen to 74.81m AHD.
- 208 At 3:30am, I spoke with Brett Myatt, from the Mt Crosby water treatment plant, who called enquiring about the levels at Mt Crosby Weir would get to so he could determine what to expect at Mt Crosby. I can recall providing the estimated water levels, which I recall was somewhere about 26m. I recall discussing the expected travel time and I told Brett it takes about 12 hours for the water to travel from Wivenhoe Dam to Mt Crosby.

- 209 At 3:50am, I called Chris Lahey from the BoM Flood Warning Centre. I told Chris that, because the inflows into Wivenhoe Dam were not as high as previously anticipated, the releases from Wivenhoe Dam would be less than previously suggested, so releases were not going to get up to the possible 10,000m³/s that I had discussed with Peter Baddiley and Jimmy Stewart from the BoM at 3:49pm on Tuesday. The inflows peaked at 1pm on Tuesday 11 January 2011 at about 11,561m³/s and the releases had peaked about 7:30pm on Tuesday 11 January 2011 at 7,464m³/s, so the releases were being reduced at the time of this call.
- 210 At 4:15am, North Pine Directive 24 was issued by John Ruffini directing gate closures to down to increment 1. North Pine Dam had fallen to 39.79m AHD by 4am, and was discharging 201m³/s. This directive meant that releases from North Pine Dam would fall to just over 100m³/s once the gate operations had been completed.
- 211 At 4:30am, I issued Wivenhoe Directive 31 directing gate closures to 7m. By 4am, Wivenhoe Dam had continued falling to 74.80m AHD.
- 212 At about 4:40am, Al Navruk, a technical assistant on shift, told me that Brett Myatt, from the Mt Crosby water treatment plant, had telephoned to check that his emails with the Mt Crosby levels were being received by the FOC. I confirmed that they were and Al relayed that to Brett.
- 213 At about 5:30am, Rob Drury, the Dam Operations Manager from Seqwater, phoned again to ask about the estimated time that North Pine Dam would be closed. I advised Rob that it would possibly be today, but that I had not yet decided. I also advised Rob that at that stage, the inflows into North Pine Dam were equivalent to a 1:10,000 AEP event based on the lake levels specified in the design flood hydrology report for North Pine Dam prepared in 2007.
- 214 At about 5:30am, I issued Wivenhoe Directive 32 and Wivenhoe Directive 33 directing gate closures to 6m at 5:45am, and 5m at 6:45am as the dam levels had continued to fall. By 5am, Wivenhoe Dam had fallen to 74.77m AHD. These directives resulted in the releases from Wivenhoe Dam falling to below 4,000m³/s. By 7am, the releases from the Dam were down to 3,143m³/s.
- 215 At about 5:49am, I issued a situation report. The situation report stated:

'No significant rain has fallen over the catchments in the past twelve hours. Less than 10 to 15 millimeters of rainfall is expected over the next 24-48 hours.

Wivenhoe Dam peaked on the 11th January, Tuesday night at 19:00 at 74.97 mAHD with a corresponding discharge of 7.450 m³/s. The releases have now been scaled back to 4,300m³/s at 05:00 am. Wivenhoe Dam is currently 74.77 m AHD and falling slowly.

The releases from Wivenhoe Dam will be temporarily reduced to 2,500 m³/s to allow the peak of Lockyer Creek to enter the Brisbane River, after which they will be increased to maximum of 3,500 m³/s. This release will then be maintained to drain the flood storage component within the required 7 days.

Somerset Dam is at 105.10 mAHD and slowly rising. The dam is discharging 1,230 m³/s over the spillway. The dam is expected to peak this morning near its current level. Sluice gates will be utilised to assist the draining of the flood storage compartment commencing on Thursday. The combined flood event volume in Somerset and Wivenhoe Dams is estimated to be in excess of 2 million megalitres.

North Pine Dam is currently releasing 105 m³/s through five gates. At 17:00 the lake was 39.78 mAHD. The event has a volume of around 200,000 ML. The peak discharge from the dam was 2,800 m³/s. This is categorised as an extreme event in the order of 1 in 10,000.

The Flood Operations Centre is continuing to monitor rainfalls and water levels through the Brisbane and Pine catchments and reviewing operating strategy every 30 minutes. The FOC is also maintaining close contact with warning agencies and local councils.

The next report will be issued at 08:00 12 January 2011.'

216 The key points to note about this situation report are:

- (a) That no significant rainfall had fallen over the catchments in the last 12 hours;
- (b) That Wivenhoe Dam had peaked at 74.97m AHD at 7pm Tuesday 11 January 2011, with a corresponding discharge of 7,450m³/s;

- (c) That releases from Wivenhoe Dam were to be temporarily reduced to $2,500\text{m}^3/\text{s}$ to allow the peak of Lockyer Creek to enter the Brisbane River, after which they were to be increased back up to a maximum of $3,500\text{m}^3/\text{s}$ (in order to achieve the seven day drain down requirement in the W&S Manual);
- (d) That Somerset Dam was 105.10m AHD and slowly rising but expected to peak within the next couple of hours; and
- (e) That North Pine Dam was currently releasing $105\text{m}^3/\text{s}$ through five gates and that the event is categorised as an extreme event in the order of 1 in 10,000 AEP.

217 When this situation report was sent, the magnitude and impact of the Lockyer Creek flows was still uncertain. The river gauge located on Lockyer Creek (at Lyons Bridge) was reading about $1,200\text{m}^3/\text{s}$, whereas the FOC and BoM models were estimating flows of about $3,000\text{m}^3/\text{s}$ so there was still a lot of uncertainty about the extent of the Lockyer Creek flows. The reason for the difference in readings (which we were aware of at the time) is that the Lyons Bridge river gauge does not capture all flows through Lockyer Creek during a flood event because there is a breakout upstream from the gauge, which means that part of the flow travels over land and bypasses the gauge before rejoining the Lockyer Creek below the gauge.

218 At about 6am, John Tibaldi and Terry Malone both came back into the FOC.

219 My shift in the FOC finished at about 6:15am. Terry Malone and John Tibaldi took over from John Ruffini and me. All four Duty Flood Operations Engineers participated in the handover meeting and discussed the 5:49am situation report. In particular I recall discussing:

- (a) That no significant rainfall had fallen over the catchments in the last 12 hours;
- (b) That releases from Wivenhoe Dam would be temporarily reduced to $2,500\text{m}^3/\text{s}$ to allow the peak of Lockyer Creek to enter the Brisbane River, after which they will be increased to a maximum of $3,500\text{m}^3/\text{s}$;
- (c) That Somerset Dam was expected to peak very soon;

- (d) The latest model results in relation to the flow of the Lockyer Creek but also that the figures were not certain; and
 - (e) That North Pine Dam was currently releasing $105\text{m}^3/\text{s}$ through five gates.
- 220 I finished my shift at the FOC around 7am and John Ruffini and I left the FOC but stayed in and around the city. I did not go home as I did not want to be isolated from the FOC. I had a sleep at John Ruffini's house before returning to the FOC with John Ruffini at about 2pm to check on the situation and to assist Terry Malone and John Tibaldi, who were the Duty Flood Operations Engineers on shift.
- 221 At about 2:05pm, I took a telephone call from Brett Schultz, a dam operator from North Pine Dam. Brett told me that the lake level was at 39.74m AHD and based on this level he recommended at least one gate closure. I passed this information on to John Tibaldi.
- 222 At about 2:10pm, I received a telephone call from Graham Keegan, one of the dam operators at Wivenhoe Dam. Graham said that the SES and the irrigators at Fernvale had concerns that a flood peak might be coming down the Lockyer Creek within the next couple of hours. I told Graham that the flood heights had been reduced by up to three metres because of the significant reduction in dam releases and any increase from the Lockyer Creek flows would be less than one metre.
- 223 At this time, and in accordance with the strategy, we now had releases from Wivenhoe Dam down to about $2,500\text{m}^3/\text{s}$ ($2,549\text{m}^3/\text{s}$ at 2pm) to allow the peak of the Lockyer Creek to pass, before increasing releases to $3,500\text{m}^3/\text{s}$ so that Wivenhoe Dam was returned to FSL within the required time frame for drain down under the W&S Manual.
- 224 At about 2:15pm, I left the FOC and went into the CBD to get some food. I returned to the FOC later than afternoon but was not involved in the operations before my shift started at 7pm.
- 225 At about 7pm John Ruffini and I started our shift as the Duty Flood Operations Engineers. There was a handover discussion between all four Duty Flood Operations Engineers and we discussed the situation report that had been issued at 5:57pm. In particular, I recall discussing:
- (a) The lake level at Wivenhoe Dam was steady at 74.82m AHD and we discussed that it would be another day or so before releases from

Wivenhoe Dam could be increased for the drain down, so as to allow the Lockyer Creek peak to pass;

- (b) Somerset Dam had peaked, so we were considering the drain down sequence that we would implement;
- (c) That there had been no further significant rainfall in the last 12 hours and the outlook was for no further significant rainfall in the next four days; and
- (d) That North Pine Dam was 39.74m AHD and steady with all gates open to 1 increment and that we expected that gates would be closed on Thursday or Friday.

226 At about 7:45pm, John Ruffini and I took part in a telephone conference with Chris Lahey from the BoM. We informed Chris that the FOC would be sending updated projected and actual releases for Wivenhoe Dam, which had been prepared with the aim of limiting flows at Moggill to 3,500m³/s once the peak of the Lockyer Creek had passed.

227 At about 8pm, John Ruffini and I had a telephone conference call with David from the BCC Flood Information Centre (I cannot remember David's last name). We informed David that the FOC would be sending updated projected and actual releases from Wivenhoe Dam, which has been prepared with the aim of limiting flows at Moggill to 3,500m³/s once the peak of the Lockyer Creek had passed.

228 At about 8:06pm, the projected and actual releases were sent to the BoM Flood Warning Centre and the BCC's Flood Information Centre.

229 At about 8:55pm, I received a telephone call from Doug Grigg, a dam operator at Wivenhoe Dam, who called to report the lake level at 74.82m AHD. Doug said he would now report the level every two hours as the lake level had stabilised. I told him that this was acceptable.

230 At about 9:50pm, I received a telephone call from Brett Myatt from the Mt Crosby water treatment plant. Brett gave me an update on the situation at Kholo Bridge and Mt Crosby water treatment plant. Brett said that the level at Kholo Bridge was 20m and the level at Mt Crosby was 23.5m. I also provided Brett with the current release strategy for Wivenhoe Dam. I told Brett that releases from the Dam had been reduced to about 2,500m³/s to allow the peak of the Lockyer from the flash

flooding to pass, and that releases from Wivenhoe Dam would then be increased to a maximum of 3,500m³/s to return the Dam to FSL.

Thursday 13 January 2011

- 231 At about 1:05am, I called the BoM hotline to check that communications were still working (which they were) because the peak of the flood in Brisbane was expected at 4am and I wanted to make sure we were still able to contact the BoM, whose office is located in the CBD, as and when required.
- 232 Between midnight and 5am I continued to monitor the dam levels and release data in order to provide that information to the BoM as and when it was requested. The Brisbane River in the CBD was expected to peak at this time.
- 233 At about 5:43am, I issued a further situation report. The report stated:

'Rainfall

Rainfall in the last 12 hours is generally below 5mm with isolated falls of up to 15mm in the Stanley, Lockyer and Pine River catchments. There is no significant rain expected fin [sic] the next 4 days.

Somerset/Wivenhoe

Somerset Dam peaked at 105.11 mAHD at 06:00 on Wednesday 12 January 2011. The current level is 104.34 mAHD. One sluice was opened at 10:30 on 12 January 2011 and the dam is currently discharging 1,130 m³/s. Sluice gates will be utilised to drain of the flood storage compartment during the next 5 days.

Wivenhoe Dam peaked at 74.97 mAHD at 19:00 on Tuesday 11 January 2011 with a corresponding discharge of 7,450 m³/s. Wivenhoe Dam was 74.72 m AHD at 06:00 and commence [sic] to fall slowly.

The releases from Wivenhoe Dam have been temporarily reduced to 2,500 m³/s at 07:30 on Wednesday 12 January 2011 to allow the peak of Lockyer Creek to enter the Brisbane River. The Brisbane River has peaked at the Port Office Gauge early Thursday morning. Releases from Wivenhoe Dam will be managed to achieve a targe flow of around 3,500 m³/s at Moggill. The release will be maintained to drain the flood storage component within the required 7 days.

The combined flood event volume in Somerset and Wivenhoe Dams is estimated to be in excess of 2.6 million megalitres.

North Pine

At 06:00 North Pine Dam was 39.70 mAHD falling with all gates open 1 increment, releasing about 80 m³/s. North Pine peaked at 41.11 mAHD at 14:00 on Tuesday 11 January 2011 with peak release of 2,800 m³/s. The event has a volume of around 200,000 ML. It is expected that all gates will be closed on Friday.

Strategy

The Flood Operations Centre is continuing to monitor rainfalls and water levels throughout the Brisbane and Pine River catchments and reviewing operating strategy. The FOC will continue to maintain close contact with warning agencies and local councils.

The next report will be issued at 18:00 on Thursday 13 January 2011.'

- 234 The key points to note about this situation report are that:
- (a) There had not been any further significant rainfall in the previous 12 hours and that there was no significant rainfall expected in the next four days;
 - (b) That Wivenhoe Dam was at 74.72m AHD and falling;
 - (c) That Somerset Dam was at 104.34m AHD and falling;
 - (d) That the Brisbane River had peaked at the Port Office gauge early Thursday morning; and
 - (e) That North Pine dam was 39.7m AHD and falling and that all gates were expected to be closed on Friday.
- 235 At about 7am, Terry Malone and John Tibaldi took over as the Duty Flood Operations Engineers and all four Duty Flood Operations Engineers participated in the handover discussions and we discussed the 5:43am situation report. In particular, I recall discussing:
- (a) That the Brisbane River had peaked at the Port Office gauge earlier that morning and the peak had not been as high as previously estimated;

- (b) We also noted that the BoM had recalibrated the Port Office gauge by approximately 300mm, so the BoM's peak reading of 4.46m was higher than the peak shown in the FOC's RTFM system of 4.16m. The recalibration did not have any impact on the FOC's operations;
- (c) There had not been any further significant rainfall in the previous 12 hours and the outlook was for no significant rainfall in the next four days;
- (d) That Wivenhoe Dam was at 74.72m AHD and Somerset Dam was at 104.34m AHD and both were falling. We discussed that we were now in the drain down phase for both Dams so we would be increasing gate settings to increase releases; and
- (e) That North Pine Dam was 39.7m AHD and falling and that all gates were expected to be closed on Friday.

236 At about 7:30am, I took a call from Agg Dagan, a dam operator at Somerset Dam. Agg said that he had been advising the Kilcoy police of the strategy to lower the levels at Somerset Dam during the next 24 hours by opening a sluice later today. The Kilcoy police needed that information because of road closures at the D'Aguilar highway.

237 After that phone call, John Ruffini and I left the FOC and went to look at the Port Office gauge. John dropped me back into the FOC at about 8:30am.

238 At about 9am, I took a call from Rob Drury, the Dam Operations Manager from Seqwater. Rob asked me to keep him informed of when gate settings are changed on all Dams. I advised Rob that we would do so and also that we had now decided to close the gates at North Pine Dam on Friday.

239 After this phone call I went into one of the meeting rooms outside of the FOC to sleep. I told the staff in the FOC to come and wake me if I was required.

240 I returned to the FOC at about 2:15pm to check on the situation and to assist Terry Malone and John Tibaldi, who were the Duty Flood Operations Engineers on shift.

241 When I returned to the FOC to check on the situation, releases from Wivenhoe Dam had again started to be increased up to the 3,500m³/s mark as the peak from the Lockyer Creek had passed the junction of the Brisbane River by this time. Wivenhoe Directive 35 had been issued at 12pm as the first directive after the peak

of the Lockyer Creek had passed and Wivenhoe Directive 36 followed this at 2:30pm.

242 Once I had checked on the situation, I went into the CBD to get something to eat. When I returned I was not involved in the operations up until the start of my next shift at about 7pm.

243 At about 7pm, I commenced my next shift in the FOC. As we had now entered the drain down phase of the flood event, only one Duty Flood Operations Engineer was in the FOC from this point in time, so John Ruffini did not start on shift with me.

244 During the shift handover, Terry Malone, John Tibaldi and I discussed the situation report that had been issued at 6:43pm. In particular I recall discussing:

- (a) That there had been no significant rainfall in the last 12 hours and none was expected for the next five days;
- (b) That Somerset Dam was at 103.60m AHD and falling. We discussed trying to get the level at Somerset Dam below levels, which were impacting Mary Smokes Bridge as quickly as possible;
- (c) That Wivenhoe Dam was at 74.5m AHD and we were increasing the releases to reach a maximum of 3,500m³/s to return the Dam to FSL at the conclusion of the flood event; and
- (d) Terry Malone and John Tibaldi told me that they had a discussion with MBRC and told MBRC that we were ceasing gate operations at North Pine Dam at 5am on Friday morning to allow MBRC to consider re-opening Youngs Crossing in time for the morning peak hour.

245 At about 7:37pm, I received a call from John Thornton of SunWater, who called to confirm that building services, such as power and telephones, were working and all was in order.

246 At about 7:51pm, I called Mal Lane at North Pine Dam to discuss the current drainage strategy. I informed Mal that the plan was to close all gates by 5am tomorrow. I said that I needed the water level at North Pine Dam to be frequently monitored against the predictive model results and I would direct gate openings to be adjusted if required.

- 247 At about 8:15pm, I issued Wivenhoe Directive 38 directing gate openings. This directive required gates to be opened successively between 9pm and 3am the following morning. This directive meant that releases from the Dam would be at about 3,500m³/s by 3am to allow the Dam to be returned to FSL within seven days of the end of the flood event (as required by the W&S Manual).
- 248 At about 8:45pm, I issued Somerset Directive 11 directing that sluice N be fully opened at 9pm. Somerset Dam had fallen to 103.46m AHD by 8pm.
- 249 Once I had sent that directive, I called Graham Francis, a dam operator at Somerset Dam, to tell him that the directive had been issued and to confirm it had been received.
- 250 At about that time, I also called Rob Drury, the Dam Operations Manager at Seqwater, to inform him of the current release rate from Wivenhoe, Somerset and North Pine Dams. I told Rob that by 3am Wivenhoe Dam would be releasing about 3,500m³/s.
- 251 Between 9pm and midnight I continued to monitor the situation at the Dams.

Friday 14 January 2011

- 252 At about 12:46am, I received a telephone call from David Preston from Ipswich District (Fernvale) Police. David was calling to enquire about the integrity of Somerset Dam, based on information provided by the police. I told David that surveillance procedures are in place to monitor the integrity of the Dam and that I would confirm with the operators that there were no structural issues with Somerset Dam.
- 253 At about 12:47am, I called Ray Ballinger, a dam operator at Somerset Dam, to ask about the integrity of the Dam. Ray indicated that he had just done a walk through of the galleries, which are inside the structure and that all was good and that no anomalies had been detected.
- 254 At about 12:49am, I called David Preston back to confirm that Somerset Dam was recently inspected and verified that there were no structural issues with Somerset Dam.

- 255 At about 2am, I issued North Pine Directive 30. This directive required all gates to be fully closed by 5am, with gate operations occur each 15 minutes between 3:15am and 5am to achieve this.
- 256 At about 2:10am, I called Shane Watson, a dam operator at North Pine Dam, to confirm Directive 30 and to ensure that gate operations commenced at 3:15am so that the gates were all fully closed by 5am.
- 257 At about 5:13am, a fax was received from North Pine Dam confirming that all gates had been closed.
- 258 At about 5:15am, I called MBRC call centre and told them we had completed gate operations at North Pine Dam at 5am. I also said that MBRC would be in a position to inspect Youngs Crossing and possibly open it in time for morning peak hour traffic as releases from the Dam take about an hour to pass Youngs Crossing.
- 259 At about 5:16am, I received a call from Mal Lane, a dam operator from North Pine Dam, who called to confirm that the gates were closed and that Youngs Crossing should be passable within two hours. Mal said that the level at Lake Kurwongbah was 20.43m AHD. The level of 20.43m AHD at Lake Kurwongbah is important because if the level reaches 20.51m AHD the discharge is sufficient to inundate Youngs Crossing on its own. As the level was less than 20.51m AHD and North Pine Dam was now closed, Youngs Crossing could be opened.
- 260 At about 5:28am, I received a call from Rob Drury, the Dam Operations Manager from Seqwater, who called to obtain a situation report. I informed Rob that I was about to send a situation report and I gave him a verbal summary of what was in the situation report.
- 261 At about 5:35am, I issued a situation report. The report stated:

'Rainfall

There has been no significant rainfall in the last 12 hours and falls of only 5mm is expected in the next twenty-four hours. Mostly fine conditions are expected over the weekend, but showers will return early next week.

Somerset/Wivenhoe

Somerset Dam peaked at 105.11 mAHD at 18:00 on Wednesday 12 January 2011. The current level is 102.87 mAHD and falling. Four sluices are open and the dam is currently discharging about 1,300 m³/s.

Wivenhoe Dam peaked at 74.97 mAHD at 19:00 on Tuesday 11 January 2011 with a corresponding discharge of 7,450 m³/s. At 05:00 Wivenhoe Dam was 74.74.08 [sic] mAHD and continuing to fall.

The releases from Wivenhoe Dam are currently about 3,500 m³/s and are being managed to achieve a target flow of around 3,500 m³/s at Moggill. This release will then be maintained to drain the flood storage component by Wednesday.

The combined flood event volume in Somerset and Wivenhoe Dams is estimated to be in excess of 2.6 million megalitres.

North Pine

At 05:00 North Pine Dam was 39.40 mAHD and gate operations have ceased. The current level is expected to increase to just over 39.5 mAHD in the next few days due to base-flow. This could be higher if further rainfall occurs.

Fish recovery has commenced and MBRC have been advised that the gates have been closed. MCRC will inspect Youngs Crossing to determine if the crossing can be re-opened.

North Pine peaked at 41.11 mAHD at 14:00 on Tuesday 11 January 2011 with a peak release of 2,800 m³/s. The flood event volume is estimated to be around 200,000 ML.

Strategy

The Flood Operations Centre is continuing to monitor rainfalls and water levels throughout the Brisbane and Pine River catchments. The FOC will continue to maintain close contact with warning agencies and local councils.

The next report will be issued at 18:00 on Friday 14 January 2011.'

262 The key points to note from this situation report are that:

- (a) There had been no significant rain over the last 12 hours and that mostly clear conditions were forecast for the weekend, however, showers were forecast to return next week;
- (b) That the drain down from the Wivenhoe and Somerset Dams was continuing so that the Dams could be returned to FSL within seven days of the end of the flood event; and
- (c) That gate operations at North Pine Dam had ceased at 5am. Whilst the Dam was now below FSL, the current level of 39.4m AHD was expected to increase to just over 39.5m AHD in the next few days due to base flow and that this could be higher if further rainfall occurred.

263 Around 7am, I finished my shift at the FOC and went home. I handed over to Terry Malone and during handover we discussed the situation report that was sent at 5:35am. We discussed the key points from the situation report as set out above.

264 My next shift in the FOC was not due to commence until 7am on Sunday morning.

Saturday 15 January 2011

265 At about 12:12pm on Saturday, I received a telephone call from Rob Drury, the Dam Operations Manager from Seqwater, who asked me to attend the FOC at 2pm to participate in a telephone conference with the Minister and Peter Borrows, the CEO of Seqwater.

266 This telephone call was followed by another telephone call from Peter Borrows who called to inform me of the teleconference at 2pm. Terry Malone also phoned me at about 12:55pm to make sure that I was aware of the 2pm conference.

267 I returned to the FOC around 1:30pm.

268 At 2pm, myself, Terry Malone, John Tibaldi, Rob Drury, Peter Borrows, John Bradley (the Director General of DERM), Peter Allen (Director of Dam Safety of DERM), Bob Reilly (General Manager of the Water Supply Regulator DERM) and Barry Dennien (the CEO SEQ Water Grid Manager) all took part in a conference call. During this conference call, we were informed by John Bradley that a report outlining the operations during the flood event was required to be prepared for the Minister by the close of business on Sunday. Once this telephone call finished, I

assisted in preparing the requested report before leaving the FOC around 7pm. My next shift began at 7am on Sunday.

Sunday 16 January 2011

269 I commenced my next shift at 7am on Sunday morning. The handover was from John Ruffini and I recall discussing the situation report that had been issued at 6:09am. In particular I recall discussing:

- (a) That we were expecting showers early next week;
- (b) Somerset Dam was now at 100.01m AHD and we were expecting final closure at Somerset Dam on Monday 17 January 2011; and
- (c) Wivenhoe Dam was at 71.3m AHD and still falling and we expected the level to continue falling until Wednesday 19 January 2011.

270 At about 7:10am, I received an email from Agg Dagan, a dam operator from Somerset Dam, indicating that he believed the FOC phones were out. I asked Bill Stephens, a technical assistant, to try calling Somerset Dam. I was not involved in the telephone contact that was referred to in the Event Log, however, I did receive the email from Agg Dagan to confirm that he could make local calls but not STD calls.

271 At about 8:30am, I issued Wivenhoe Directive 45 directing gate openings. By 8am, Wivenhoe Dam had fallen to 71.18m AHD and release rates from the Dam were diminishing as the Dam level was falling. As the Dam level falls, the gates need to be opened further to maintain the same release rate (due to a drop in pressure from reduced water levels). This directive was aimed at returning the Dam to FSL within seven days of the end of the flood event.

272 After I issued the directive, I telephoned Matthew O'Reilly, a dam operator at Wivenhoe Dam, to confirm that Directive 45 had been received. Matthew said he had not been received it by fax, but confirmed it was received by email.

273 At about 9:05am, I issued Somerset Directive 12 directing that Sluice N be fully closed at 10am. This was part of the final shutdown sequence for Somerset Dam. By 9am, Somerset Dam had fallen to 99.84m AHD.

- 274 At about 10:20am, I received an email from Agg Dagan from Somerset Dam confirming that Somerset Directive 12 had been implemented.
- 275 At about 11:30am, I received a call from Robbie Goodger from the Queensland Police. Robbie said that he was aware the Wivenhoe Dam viewing area had been damaged and he wanted us to confirm that the viewing area had been closed. Once I had received this information, I immediately commenced making phone calls to verify the information and to make sure that appropriate steps were being taken.
- 276 I first attempted to contact Matthew O'Reilly, a dam operator at Wivenhoe Dam, by telephone but I was unable to get through and so I left a message for him relaying the information I had been told and asking him to return my call.
- 277 I then tried to call Doug Grigg, another dam operator at Wivenhoe Dam. I was able to get through to Doug and he confirmed that the viewing area at Wivenhoe Dam had been damaged. Doug said that the viewing platform had been closed and there were two security guards on site.
- 278 I then telephoned Robbie Goodger back and confirmed the viewing platform had been closed and that security guards were on site. Robbie told me that there was also damage to the safety rails around the viewing area and the water supply to the toilets.
- 279 At this point, Matthew O'Reilly returned my call and I confirmed the details about the viewing area with him. I also told Matthew that I would be issuing a Wivenhoe Directive shortly.
- 280 At about 12:15pm, I issued Wivenhoe Directive 46 directing gate openings so that the release rate could be maintained. At 12pm, Wivenhoe Dam had fallen to 70.87m AHD.
- 281 At about 12:30pm, I received a phone call from Matthew O'Reilly at Wivenhoe Dam. Matthew said that he had not received the directive I had said that I would send. I gave Matthew a verbal directive and I resent the directive by email.
- 282 At about 12:40pm, I received a telephone call from Ian Holland, a contract programmer from Seqwater. Ian told me that the duplicate Linux box 'Namah' at the back-up FOC at Mineral House was showing file corruption errors and this meant that the FOC was effectively without a back-up system. I told Ian that I

would contact Warren Shallcross so Warren could investigate the duplicate Linux box remotely and I would get Warren to contact Ian directly.

283 I also took the opportunity to tell Ian that the hydraulic modelling in RTFM System was not working (which is unrelated to the Linux box issue) and asked him to investigate that. The hydraulic models are not used for flood operations, but I wanted to be able to use the hydraulic modelling to model downstream flows, in addition to using the hydrologic models. Ian said it was not working because two fortran programs had not been ported into the Linux box following a conversion from an HP Unix system in 2007.

284 At about 12:55pm, I telephoned Warren Shallcross, the SunWater systems engineer, and told him about the problems with the Linux box at Mineral House. Warren said he would visit the back-up FOC at Mineral House as soon as possible.

285 At about 2:40pm, Terry Malone called me and said that the Water Grid Manager wanted a summary of the flood volumes and peak discharges for the preparation of the Ministerial briefing. At this stage, Terry Malone, John Tibaldi and Rob Drury were all at Seqwater's offices at Margaret Street finalising the report. I later emailed that information to Terry.

286 At about 3pm, I again spoke with Warren Shallcross. Warren told me that the computer system at Mineral House has been rebooted and was now functional.

287 At about 3:10pm, I spoke with Rob Drury, the Dam Operations Manager for Seqwater, who telephoned to confirm the current release rates from the Dams. I told Rob that approximately 600m³/s was being discharged from Somerset Dam and 3,500m³/s was being discharged from Wivenhoe Dam.

288 At about 3:15pm, I issued Wivenhoe Directive 47 directing gate openings to maintain the current release. At 3pm, Wivenhoe Dam had fallen to 70.68m AHD.

289 At about 6:45pm, I issued Wivenhoe directive 48 directing gate openings to maintain the current rate of release for a short period, before the release rates would quickly start to fall. This directive represents the start of the shutdown phase for the gates. At 6pm, Wivenhoe Dam had fallen to 70.45m AHD.

290 At about 6:52pm, I called Doug Grigg at Wivenhoe Dam about the latest directive. Doug confirmed that he had received the directive.

291 At about 7pm, I finished my FOC shift and handed over to John Tibaldi. During the shift handover, John and I discussed that the release rate from Wivenhoe Dam would now drop as the shutdown sequence had commenced and no further gate openings were required. We also discussed that we expected Somerset Dam would reach FSL on Monday 17 January 2011.

Monday 17 January 2011

292 I was not on shift on Monday 17 January 2011 and I did not attend the FOC.

Tuesday 18 January 2011

293 I returned to the FOC at 6:45am on Tuesday 18 January 2011 and took over from Terry Malone. During the handover Terry and I discussed the situation report that had been issued at 6:17am. In particular I recall discussing:

- (a) No rainfall had occurred that day and nothing much was expected in terms of rainfall in the next 24 hours;
- (b) Somerset Dam sluice operations had ceased on Monday 17 January 2011 but that there was a regulator open to manage the base flow into the Dam;
- (c) That Wivenhoe Dam was 67.82m AHD and continuing to fall slowly. The releases were held at about 2,050m³/s overnight to assist the water supply pumping at Lowood. We discussed that gate closures should resume at 9am on Tuesday before final closure on Thursday morning; and
- (d) That North Pine Dam was at 39.5m AHD and that all gates were closed, with no further gate operations expected.

294 At about 7:35am, I received a telephone call from Ken Morris from the BCC, who asked for a preliminary assessment of the magnitude of the flood event. Ken said that he thought that all of the agencies involved in the flood event (namely, Seqwater, the BoM and the BCC) should get together to assess the magnitude of the event so there is a consistent understanding of the flood event. I said that I agreed with that approach. Ken also asked me if the FOC had performed an assessment of the effects of the Dam on the peak flow. I indicated that our preliminary figure was that there would have been a peak flow of 13,000m³/s at the city gauge without the Dams.

- 295 At 8:45am, I issued Wivenhoe Directive 55 directing gate closures. By 8am, Wivenhoe Dam had fallen to 67.7m AHD and the releases had decreased to about 2,000m³/s and were continuing to fall.
- 296 At about 10.10 am, I was informed by Ken Price, a technical assistant that Rob Townsley, from the Mt Crosby water treatment plant, had called to request some forwarded projections for flows at Mt Crosby Weir for the next 48 hours as they were looking into sludge dilution. At about 10:15am, I called Rob to provide the information on the projected flows at Mt Crosby Weir. I told Rob that:
- (a) On 18 January 2011 at 10am, the flow would be approximately 2,300m³/s;
 - (b) On 19 January 2011 at 10am, the flow would be approximately 1,130m³/s; and
 - (c) On 20 January 2011 at 10am, the flow would be approximately 360m³/s.
- 297 At about 10:19am, I received a call from Mark Gibson from the BCC's Flood Information Centre. Mark told me that Lord Mayor Campbell Newman had requested an indication of what the flood would have been without the Dams. Mark asked me if the figure of 13,000m³/s that I had provided to the BCC earlier could be released to the public. I said that I would make inquiries and get back to him.
- 298 At about 10:24am, I spoke to Rob Drury, the Dam Operations Manager from Seqwater, to ask for Seqwater's policy regarding the release of information, as requested by the BCC. Rob said that he would confirm the policy with the communications people at Seqwater.
- 299 At about 10:30am, Paul Bird, the Seqwater communications officer, called me to advise that the Minister's office had recommended, because of the Commission of Inquiry, information regarding releases from Wivenhoe Dam should not be released to the public. Paul said that he would now communicate this response to the BCC's Flood Information Centre.
- 300 At about 10:38am, I received a call from Tony Jacobs at the SRC who asked when Burtons Bridge was expected to be free from inundation. I told Tony that under the current shutdown sequence at Wivenhoe Dam, I expected Burtons Bridge to be free from inundation around midnight on Wednesday. Tony said that the bridge on New England Creek would become flood free at around the same time and he said that at 8am today, the approaches to the Fernvale Bridge were clear of water but the

powerlines and silt still needed to be removed. Tony said that he expected Fernvale Bridge to be open at some stage in the afternoon on Tuesday 18 January 2011.

- 301 At about 10:55am, I received a call from Barton Maher, the Principal Engineer for Dams and Weirs Planning at Seqwater, who called to ask if we had received the hydraulic model from the consultancy firm Water and Resource Management. These models had been requested from Seqwater earlier so that I could conduct hydraulic modelling of river flows. I told Barton that we had received the hydraulic model access codes by email.
- 302 At about 12:05pm, I received a call from Peter Borrows, the CEO of Seqwater, who called to advise the he and DERM representatives were coming to visit the FOC at 2:30pm that afternoon.
- 303 At about 12:15pm, I issued Wivenhoe Directive 56 directing gate closures. By 12pm, Wivenhoe Dam had fallen to 67.52m AHD and release rates were down to 1,688m³/s.
- 304 At about 12:26pm, I received a phone call from Rob Drury. Rob asked me about the planned final shutdown sequence for the gates at Wivenhoe Dam. I told Rob that the final gate closure was planned for 9am Thursday 20 January 2010. Rob said he would organise people to be available for fish recovery at the completion of gate operations.
- 305 At about 1:22pm, I called Matthew O'Reilly, a dam operator at Wivenhoe Dam, to confirm that the gate closure sequence was in accordance with Directive 56 because there was an inconsistency in the gate sequence in the email sent from Matthew at 1pm. In the email, Matthew indicated he had closed the gates in a different order to what was required by Directive 56. When I called Matthew, he told me he had closed the gates in accordance with the directive and the email contained an error.
- 306 At about 2pm, I received a call from John Tibaldi for an update on the closedown sequence. I cannot now recall why John called for an update at that time. I gave that information to John over the phone.

- 307 At about 2:15pm, I tried to call to Greg Roads of WRM because I could not access the hydraulic model of the Brisbane River on the WRM website as the login and password were not working. I was told that Greg was not available at that time.
- 308 At about 2:30pm, Peter Borrows, the CEO of Seqwater, and Bob Reilly from DERM visited the FOC to check on the current situation and to pass on thanks for the job performed so far. I was told by Peter and Bob that some repairs were needed at the Lowood pump station and I was asked to hold further gate operations until the repairs at the Lowood pump station were finalised.
- 309 At about 2:55pm, I telephoned Matthew O'Reilly, a dam operator at Wivenhoe Dam, to ask him to put a hold on completion of the directions in the last Wivenhoe Directive issued at 12:15pm. I said that I would confirm that by email in a new directive.
- 310 At about 3:15pm, I issued Wivenhoe Directive 57 directing operations to be ceased under Directive 56 and for the current gate settings to be maintained for the next 12 hours. This directive was issued to accommodate the repairs at the Lowood pump station.
- 311 At about 4:05pm, I called Mal Lane, a dam operator at the North Pine Dam, to alert him to the possibility of operating North Pine Dam due to incoming storms. The BoM had been issuing severe thunderstorm warnings since 12:48pm on Tuesday 18 January 2011.
- 312 At about 4:30pm, Rob Drury, the Dam Operations Manager from Seqwater, called me to discuss the current storms and asked that I call MBRC to advise them of the possibility of operating North Pine Dam.
- 313 At about 4:34pm, I received an email from Peter Borrows, the CEO of Seqwater, to confirm the approval from Bob Reilly at DERM to vary the flood release regime to enable a constant flow for the Lowood water treatment plan off-take.
- 314 At about 4:45pm, I telephoned Tony Martini from the MBRC to inform him of the possibility of operating North Pine Dam in the next day or so if the predicted falls of 50mm occurred.
- 315 At about 5:40pm, I issued a situation report. The situation report stated:

'Rainfall

Severe thunderstorms are passing over Wivenhoe, Somerset and North Pine Dams this afternoon. To 17:00 falls of 20 to 30 mm where [sic] recorded at isolated locations including Mt Peachy and Kluvers Lookout.

A severe thunderstorm warning remains in place for the Stanley River Valley near Kilcoy.

Somerset/Wivenhoe

At 16:00 Tuesday Somerset Dam was 98.95 mAHD and steady. The last sluice gate was closed at 07:00 17/01/2011 and one regulator remains open managing the base-flow into the Dam. Somerset Dam peaked at 105.11 mAHD at 18:00 on Wednesday 12 January 2011.

At 16:00 Tuesday Wivenhoe Dam was 67.31 mAHD and continuing to fall slowly. Releases were held constant since 15:00 at about 1,450 m³/s to assist water supply pumping at Lowood. The shutdown sequence is scheduled to re-commence at 03:00 on Wednesday 19 January 2011 morning before final closure on Thursday morning. The Dam will be lowered to 66.5 mAHD (95% capacity) and releases will be made through the regulator to account for ongoing base-flow.

Wivenhoe Dam peaked at 74.97 mAHD a 19:00 on Tuesday 11 January 2011 with a corresponding discharge of 7,450 m³/s.

The combined flood event volume in Somerset and Wivenhoe Dams is estimated to be in excess of 2.6 million megalitres.

It should be noted that Seqwater water level gauge currently being reported on the BoM website is currently slightly under ready by about 50mm.

North Pine

At 09:00 North Pine Dam was 39.56 mAHD and rising slowly. All gates are closed. No further gate operations are expected unless additional rainfall falls. This situation will be closely monitored whilst storms remain in the vicinity.

North Pine peaked at 41.11 mAHD at 14:00 on Tuesday 11 January 2011 with a peak release of 2,800 m³/s. The flood event volume is estimated to be around 200,000 ML.

Strategy

The Flood Operations Centre is continuing to monitor rainfalls and water levels throughout the Brisbane and Pine River catchments and is maintaining close contact with warning agencies and local councils. Councils have been informed of the current release strategy.

The remaining bridges below Wivenhoe Dam will progressively come out of water over the next few days.'

- 316 The key points to note from this situation report are:
- (a) That severe thunderstorms were passing over Wivenhoe, Somerset and North Pine Dams that afternoon;
 - (b) That Somerset Dam was at 98.5m AHD and steady. All sluices were closed, but one regulator valve remained open;
 - (c) That Wivenhoe Dam was 67.31m AHD and continuing to fall slowly, however, releases had been maintained at about 1,500m³/s to allow the issues at the Lowood pump station to be resolved before the shutdown sequence recommences; and
 - (d) That all gates were closed at North Pine Dam and further gate operations were not expected unless additional rainfall occurred.
- 317 At 6:25pm, I received a call from Rob Drury, the Dam Operations Manager from Seqwater, who called to discuss the situation report for North Pine Dam. Rob wanted to know whether I thought the gates at North Pine Dam would have to operate because of the severe thunderstorms that were passing over the catchment. I said it was touch and go and that I would discuss it with John Tibaldi when he arrived in the FOC for his shift.
- 318 I finished my shift in the FOC at about 6:40pm and I handed over to John Tibaldi. During the shift handover, John and I discussed the situation report that I had issued at 5:40pm. We also discussed the following:
- (a) Whether we needed to undertake gate operations at North Pine Dam that evening. We determined that gate operations would be needed; and
 - (b) The Wivenhoe Dam shutdown sequence and that we were holding the releases from the Dam at current levels to accommodate the Lowood

pump station. We discussed that the releases were scheduled to recommence at 3am. John said that he knew who was on site at the Lowood pump station and that he would contact the person directly.

Wednesday 19 January 2011

- 319 I was not on shift on Wednesday 19 January and I did not attend the FOC.
- 320 After the gate operations at Wivenhoe Dam had finished at about midday, I received a call from Terry Malone who told me that there had been significant erosion of the spillway channel and that John Tibaldi was organising to visit the site on Thursday morning.

Thursday 20 January 2011

- 321 I commenced my shift at the FOC at 7am and took over from John Ruffini. During the handover John and I discussed that North Pine Dam was operated in light of the rainfall that had occurred overnight and that operations were going to continue during the day. We also discussed the erosion of the Wivenhoe Dam spillway channel and that John Tibaldi was going to site to inspect the damage.
- 322 I reviewed the RTFM and noted that the flows in the Lockyer Creek had risen as a consequence of the rainfall that had occurred overnight. That was significant because of the potential impact it might have had on bridge closures, in particular, Savages Crossing, Burtons Bridge and Colleges Crossing.
- 323 At about 7:20am, I called Tony Jacobs at the SRC and informed Tony that the rainfall overnight had resulted in a renewed rise in Lockyer Creek. Tony said that the SRC was concerned about Burtons Bridge because any further isolation of the community would be a great inconvenience. I indicated that we would endeavour to keep combined flows below 400m³/s, which would mean that Burtons Bridge could remain open.
- 324 At about 7:25am, I called Tony Trace at the ICC and told Tony that there were increased flows in the Lockyer Creek and Middle Brisbane River and that Savages Crossing and Colleges Crossing will continue to be inundated. I told Tony that it would be another 30 to 36 hours before that flow would recede and Colleges Crossing would no longer be inundated.

- 325 At about 7:40am, I called Chris Lavin at the BCC and told Chris that there had been increased renewed flows in the Lockyer Creek and Middle Brisbane River. I told Chris that Savages Crossing and Colleges Crossing would remain inundated. I told Chris that it would be another 30 to 36 hours before that flow would recede and Colleges Crossing would no longer be inundated.
- 326 At about 7:55am, I telephoned Doug Hunt, the standby dam operator at North Pine Dam, to inform him of the proposed strategy, which was to drain from the Dam until around 2pm with current gate settings. I also requested hourly readings of the lake level so as to monitor model performance.
- 327 At about 8am, Mal Lane, a dam operator at North Pine Dam, called me to ask about the planned operations. I indicated that releases from the Dam would continue as they were until 10am that day when the next QPF was received and then we will decide the closure strategy from there.
- 328 At about 8:40am, I received a call from Rob Drury, the Dam Operations Manager from Seqwater. Rob said he had received feedback from MBRC about dam operations at North Pine Dam. MBRC said that they had not been notified that the dam had closed on Wednesday morning. I said to Rob that I was not on shift at that time. Rob said to make sure that when the gates were to be closed that day, to make sure that I informed MBRC.
- 329 At about 8:45am, I received a call from John West, a technical officer, who called to ask for information as to the time for the peak height and flow rate at Lowood pump station. I told John it would be in about nine hours time and the height would be about 3.7m corresponding to 300m³/s.
- 330 At about 8:50am, I received a further call from John West, this time enquiring about the current height and flow rate at Lowood pump station. I told John that we estimated the current flow rate was about 150m³/s (being 50m³/s from Lockyer Creek and 100m³/s from Wivenhoe Dam) corresponding to 2.4m in height at Lowood.
- 331 At about 9:45am, I received a call from Rob Drury, the Dam Operations Manager from Seqwater. Rob advised that Wivenhoe Dam would not be drained to 66.5m AHD but will be maintained at or just below FSL to allow for a visual inspection of the plunge pool in the spillway channel.

- 332 At about 10:21am, I received a QPF, which forecast 15mm to 25mm of rainfall with isolated heavier falls of about 50mm in the Brisbane and North Pine catchments.
- 333 At about 10:30am, I received a telephone call from Rob Drury, the Dam Operations Manager from Seqwater. Rob asked whether closing all gates at Wivenhoe Dam would cause the lake level to exceed the gate trigger level in the next three days in light of the forecast rain. I advised Rob that with no rain on the ground, I expected that the Dam would not exceed the trigger level. I said that the forecast was for 15mm to 25mm with isolated falls of about 50mm, so the decision about gate operations at Wivenhoe Dam may have to be reviewed the following day.
- 334 At about 11:12am, I received a call from Tony Martini from the MBRC. Tony asked when gate operations were likely to cease at North Pine Dam. I told Tony that all gates at North Pine Dam would be closed at 2pm that day.
- 335 At about 11:14am, I called Murray Dunstan, the Operations Co-ordinator (North) for Seqwater. Murray was a standby dam operator for North Pine Dam for that day. We discussed the planned closure of the gates at North Pine Dam by 2pm so as to allow MBRC to open Youngs Crossing for the afternoon traffic peak.
- 336 At about 11:15am, Kim Hang said to me that John West, a technical assistant, had called to ask for the height and discharge information at Lowood, but also asked that we email to him the Lowood rating curve. I subsequently sent that rating curve to John by email.
- 337 At about 11:33am, I called Mal Lane, a dam operator at North Pine Dam, regarding North Pine Directive 36 to make sure that it had been received.
- 338 At about 11:36am, I called Terry Malone to inform him that the gates at North Pine Dam were to be closed at 2pm. Terry said he would monitor the situation overnight as he was on call.
- 339 At about 1:07pm, Rob Drury, the Dam Operations Manager from Seqwater, called to confirm that North Pine Dam gates would be closing at 2pm. I said that they would be.
- 340 At about 1:35pm, I received a call from Peter Parnell from Seqwater. Peter called about the Lowood pump motor, which he said was sitting on the platform. Peter asked me what flow would come down Lockyer Creek. I said that the peak flow was about 300m³/s at Lowood.

- 341 At about 2:10pm, I advised an officer at the MBRC that North Pine Dam gate operations had ceased at 2pm and that Youngs Crossing should be clear of water within the next 1 to 1 ½ hours.
- 342 At about 2:15pm, I called Mal Lane, a dam operator at North Pine Dam. I told Mal that Terry Malone would be the Duty Flood Operations Engineer on call tonight and that he would be monitoring the situation. Mal advised me that a tree branch had snagged on Gate C of the Dam and had swung around and was now resting on the pier, so it was not going to get in the way of the gates. Mal also said that a 75mm diameter branch was caught in the ropes of Gate B and may need to be removed before another operation. Mal also told me that Murray Dunstan, the Operations Co-ordinator (North) from Seqwater, had organised for the Rangers to come out tomorrow to examine and remove the branches if necessary.
- 343 At about 2:40pm, I received a telephone call from Agg Dagan, a dam operator at Somerset Dam, who called to ask about the proposed operational release strategy for Somerset Dam. I advised that no releases were planned for now until the Wivenhoe Dam spillway issues were resolved.
- 344 At about 3:20pm, I called the MBRC call centre to inform the MBRC of the possibility of gate operations that evening. I indicated that with the forecast 25mm of rain over the catchment, we would commence gate operations at 9pm. I said that the FOC would contact the MBRC again if this rainfall eventuates.
- 345 I finished my shift in the FOC at about 4pm. I had already done a handover to Terry Malone by telephone at 11:36am and from 4pm Terry was the on call Duty Flood Operations Engineer.
- 346 The FOC was demobilised at the end of my shift at 4pm. I sent an email to the relevant agencies notifying them that the FOC had demobilised.

RIVER FLOW TIMES

Annexure 1 – Approximate Flood Peak Travel Times

- 347 Annexure 1 to this supplementary statement is a diagram, which shows the approximate flood peak travel times through the Brisbane River Basin.
- 348 I have provided this document to assist the Commission of Inquiry in understanding the approximate travel times between various points leading in the Brisbane River

Basin. However, I wish to stress that this document is a guide only and provides nothing more than an approximate estimate of travel times and that actual travel times for flows vary from these estimates depending on a wide range of factors.

RESPONSE TO MEDIA REPORTS

349 This section addresses some of the criticisms raised in the media concerning the operations of Wivenhoe Dam during the January 2011 Flood Event.

350 The list below is not intended to be exhaustive nor should the fact that I have not addressed some of the comments be taken as an admission that I consider those comments to be true.

Pre-release

351 In an article published in The Australian on 15 February 2011 titled '*Release is proof that Wivenhoe dam bosses messed up in flood crisis say victims*' it is asserted that there should have been a reduction in Wivenhoe Dam to 75% of FSL in anticipation of the La Nina weather system. Reference is also made to La Nina systems in an article in the Weekend Australian dated 12 March 2011 titled '*Stakes are high in the Brisbane Flood Blame Game.*'

352 I have pointed out the reasons why releases are not made in advance of the wet season at paragraphs 210 to 221 of my first statement (paragraph 305 is also relevant). In summary, those reasons are:

- (a) The W&S Manual does not authorise pre-release in advance of a wet season by the Duty Flood Operations Engineers;
- (b) The W&S and NP Manuals specify the point at which the spillway gates can be opened;
- (c) The W&S and NP Manual do not allow the Senior Flood Operations Engineer to alter the setting of FSL in the Dams;
- (d) FSL of the dams is set by DERM as part of the Water Resource Planning process in respect of water security;

- (e) Forecasts in the Brisbane River and the North Pine River catchment areas involve an element of uncertainty, and are not sufficiently accurate to use for operational strategies;
- (f) The Dams are the primary urban water supply for South East Queensland; and
- (g) Pre-releases might result in the needless inundation of bridges, impacts on riparian flora and fauna, the inundation of rural communities, the inundation of urban areas and the compromise of the urban water supply.

Forecasts to blame?

- 353 In an article printed in The Australian on 8 March 2011 titled *Forecasts to blame, 'not Wivenhoe Dam operator'*, the author states that the operator of Brisbane's major dam has cleared itself of responsibility for significantly contributing to the January 2011 floods, instead blaming inaccurate weather forecasts for underestimating rainfall volumes.
- 354 During the January 2011 Flood Event, there were significant variations between forecasts rainfall and actual rainfall. This is demonstrated by comparing the forecast rainfall with the actual rainfall received during the January 2011 Flood Event.
- 355 However, it is not correct to state that inaccurate weather forecasts were 'to blame' for how the dams were operated. As set out in my first statement at paragraphs 199 to 209, there is a degree of uncertainty associated with the reliability of rainfall forecasts.
- 356 I have set out a comparison of the catchment average 24 hour forecast rainfall with the actual total catchment average rainfall in the table produced at paragraph 206 of my first statement. A similar comparison is made on the three and five day ACCESS model forecasts at paragraph 207 of my first statement.
- 357 I have set out the comparison for North Pine Dam at paragraph 208 of my first statement.
- 358 Rainfall forecasts provide the Duty Flood Engineers with an awareness of potential flood event conditions and assist in flood event planning (for example, by allowing local councils to make plans for the possible closure of bridges); however, the

forecasts themselves do not provide a sufficiently reliable basis upon which to make operational decisions. I have explained the reasons why predicted lake levels are based on models run on a 'no further rainfall' basis at paragraph 305 of my first statement.

Higher releases over Thursday 6 January 2011 and Friday 7 January 2011

359 An article published in *The Australian* on 19 March 2011 titled "*Council linked to dam mistake*" contains a bar graph which suggests that releases could have been made in the earlier stages of the January 2011 Flood Event which would have avoided major flooding.

360 That bar graph appears to suggest that releases from Wivenhoe Dam of 250m³/s on Thursday 6 January 2011 would have been required to avoid major flooding.

361 Releases at that rate on Thursday 6 January would have breached the W&S Manual. As shown in Schedule 1A to my first statement, on Thursday 6 January, strategy W1A was applied because the dam level was greater than 67.25m AHD, but less than 67.5m AHD, and the predicted lake level was less than 68.50m AHD. Higher releases could not have been made on Thursday without breaching the W&S Manual.

362 That bar graph also appears to suggest that releases of 2,151m³/s were required on Friday 7 January 2011 to avoid major flooding. As shown in Schedule 1A to my first statement, strategy W1B to W1E was required to be applied over the course of the Friday because the predicted lake level did not exceed 68.50m AHD. The maximum release allowed under these strategies is 1,900m³/s. The suggested release rate of 2,151m³/s for the Friday would have breached the W&S Manual.

Higher releases on Saturday 8 January 2011

363 I am aware that some commentators have suggested more water should have been released from Wivenhoe Dam over the course of Saturday 8 January 2011. For instance, an article published in the *Weekend Spectator* on 8 March 2011 titled '*Wivenhoe Dam avoids flood blame: report*' states that the dam's operator has come under harsh criticism for keeping significant volumes of water in the dam over the weekend of January 8-9. I reject any such criticisms and I point out that:

- (a) Over the course of the Saturday, the lake level at Wivenhoe Dam rose from 68.32m AHD to 68.65m AHD. There was a still a significant amount of flood storage available in the Dam if rainfall increased significantly;
- (b) As can be seen from Schedule 1A to my first statement, at 2pm on Saturday (model run 10) the lake level at Wivenhoe Dam was predicted to peak at 68.7m AHD at about 1am on Tuesday 11 January 2011 (more than 48 hours away), by which time the releases from Wivenhoe Dam would need to be increased gradually to 1,480m³/s. By the end of Saturday, releases from Wivenhoe Dam had already been increased to 1,242m³/s, which meant that the estimated maximum required release rate of 1,480m³/s required at 1am on Tuesday was easily obtainable. By 5am Sunday morning, the release rate had already been increased to 1,336m³/s;
- (c) Rainfall was not significant over the course of the Saturday. Inflow rates into Wivenhoe Dam on the Saturday decreased from the peak rate of 2,144m³/s at 7am down to 899m³/s by 11pm on Saturday 8 January 2011;
- (d) Higher releases would have resulted in the premature inundation of Fernvale Bridge and Mount Crosby Weir Bridge;
- (e) It was important that releases from Wivenhoe Dam maximised protection to urban areas while still minimising the impact to rural life downstream. By setting releases at rates that would not inundate Mount Crosby Weir and Fernvale Bridge, consideration was being given to the lower level objectives as expressly required by the W&S Manual. In my view, releases over the course of the Saturday in excess of those made would have resulted in the inundation of Fernvale Bridge and Mount Crosby Weir Bridge, and in my view, this would not have been consistent with the requirement of the W&S Manual that lower level objectives be considered even when operating within higher-level strategies; and
- (f) Releases which approached 1,600m³/s would likely have resulted in minor flood damage in low lying areas in Brisbane, based on previous experience (see paragraph 47 of this statement).

364 I have provided a more detailed explanation of the strategy concerning releases over Saturday 8 January 2011 at paragraphs 31 to 57 of this statement.

Higher releases on Sunday 9 January 2011

- 365 Similar criticisms are made in media reports suggesting that more water should have been released on Sunday 9 January 2011. As can be seen from Schedule 1A to my first statement, on this day, Wivenhoe Dam rose from 68.64m AHD to 69.60m AHD and was releasing a maximum of 1,450m³/s by the end of the day.
- 366 Heavy rainfall had occurred in the Stanley River catchment on Sunday morning and further rainfall was forecast (see paragraph 58 of this statement). As a result of that rainfall, I arranged a meeting of the Duty Flood Operations Engineers for 3:30pm that afternoon.
- 367 During that meeting, the Duty Flood Operations Engineers discussed maintaining releases at the current release rate of 1,400m³/s in order to allow the peak of the flow in Lockyer Creek to pass through the Brisbane River without having to close Fernvale Bridge and Mount Crosby Weir Bridge. We also discussed the possibility that releases from Wivenhoe Dam might be temporarily reduced if the Lockyer Creek and Bremer River flows increased significantly to contain the downstream flow rates at levels that would allow bridges to remain open before release rates were increased on the back of the peak of Lockyer Creek. I provide further explanation of this meeting at paragraphs 64 to 67 of this statement. This strategy was consistent with the requirement of the W&S Manual that the lower level objectives be considered.
- 368 Maintaining release rates to allow the peak of the Lockyer Creek to pass before increasing releases (and thereby allowing Fernvale Bridge and Mount Crosby Weir Bridge to remain open) is consistent with the requirement of the W&S Manual that minimising disruption to downstream rural life be considered in making decisions about releases.
- 369 However, following that meeting at 3:30pm on Sunday, further heavy rainfall fell. This rainfall, and the modelling that I conducted after I started my shift at about 7:30pm on Sunday, meant that releases would now need to be increased to at least 2,600m³/s by the morning of Tuesday 11 January 2011. I provide further information on how I determined this at paragraph 72 of this statement.
- 370 Releases at the rate of 2,600m³/s would inundate Fernvale Bridge and Mt Crosby Weir Bridge. At this stage, Fernvale Bridge and Mount Crosby Weir Bridge had not yet closed to the public, and of course it is important that bridge closures occur well

before the bridges are inundated by flood waters. At 9:04pm on Sunday 9 January 2011 I assisted in preparing and issuing a situation report alerting the relevant agencies that Fernvale Bridge and Mt Crosby Weir Bridge would be adversely impacted (see paragraph 76 of this statement) and I commenced making telephone calls to ensure those bridges were closed. I provide further information on these telephone calls at paragraphs 79 to 86 of this statement. The higher releases were immediately put in place through Wivenhoe directives once it was safe to do so (see paragraphs 94 onwards of this statement).

371 Accordingly, I reject the suggestion that there was undue delay in increasing releases from the Dam over the course of the Sunday. Releases were increased once the downstream bridges were closed and it was safe to do so.

The alleged delay in increasing releases after Sunday evening

372 In an article published in the Australian on 9 March 2011 titled *The 48 hour delay that sealed Brisbane's fate*, it is asserted that the Duty Flood Operations Engineers "knew by 7.10pm on Sunday January 9 that high releases of water from Wivenhoe Dam (about 3000 m³/s) would be needed 'in view of heavy rain over the last 3 hours'", but there was a delay in the increase of releases for 48 hours, which meant that much larger releases were required on Tuesday 11 January 2011. The article asserts that that delay was the cause of the flooding in Brisbane.

373 I believe that the reference to '7:10pm' in that article is a reference to entries in the event log of telephone calls of Terry Malone and John Ruffini on Sunday 9 January 2011 shortly before the hand-over to John Ruffini and me. As set out in this statement at paragraph 70, Terry and John told me at our handover meeting at about 7:30pm that they had had conversations with Peter Borrows, CEO of Seqwater and Peter Allen, the Dam Safety Regulator from DERM; however, I was not a party to those telephone calls, so I cannot comment on the telephone calls.

374 In my view, however, the assertions in the article are wrong.

375 As explained at paragraph 72 of this statement, when I arrived on shift on Sunday 9 January 2011, I conducted a model at about 8pm which confirmed that releases would be required to be increased gradually to reach 2,600m³/s by 8am on Tuesday 11 January 2011. Contrary to the assertion in the media article, the models did not show that releases were required to be increased dramatically by Sunday evening. Subsequent models that were conducted showed similar requirements.

- 376 Further, there was no delay in the increase of releases as has been suggested in the article. The Wivenhoe directives that were sent after Sunday 8pm, for example WD8, WD9, WD10 and WD11 (which were sent during Monday 10 January 2011) directed the incremental opening of the gates at Wivenhoe Dam so that releases were gradually increased up to the required 2,600m³/s by Monday evening in accordance with the modelling. Those increases could not start to commence until Fernvale Bridge and Mt Crosby Weir Bridge had been closed to the public. Once I had determined that releases would need to increase to at least 2,600m³/s, I immediately started to inform the relevant agencies that the bridges would be inundated and would therefore need to be closed to the public. A situation report was issued with this information, and telephone calls were made as outlined in paragraphs 76 and 79 to 86 of this statement. Releases reached 2,600m³/s the following evening, and were maintained at above 2,700m³/s until 8am on Tuesday morning, when further increases in releases commenced.
- 377 As set out in this statement at paragraphs 134 to 136, by Tuesday morning there had been further significant rainfall in the catchment to the Dam which meant that by 8am on Tuesday 11 January 2011, strategy W4 was triggered and further significant releases were required. The operations of the Dams from Sunday evening to Monday did not cause further significant releases to be required on Tuesday 11 January as has been suggested. The heavy rainfall between 4am and 8am meant that releases had to be increased to protect the structural safety of the dam.
- 378 I also refer to an article published in the Courier Mail on 9 March 2011 titled '*Dam chiefs say actions spared city greater pain*'. In this article, the journalist points out that when the dam level reached 70mAHD on Monday 10 January (at 2am), releases were "*between 1500 and 1800 megalitres per second while inflows were between five and seven times greater.*" As has previously been explained, significant rainfall occurred on Sunday afternoon after the 3.30pm meeting.
- 379 At the time of the 3:30pm meeting on 9 January, releases from the dam were being made at the rate of about 1,390m³/s, and the predicted maximum release rate required to be reached by 9am on Tuesday 11 January was predicted to be 1,490m³/s. At 8pm on Sunday 9 January, I had determined to increase releases to at least 2,600m³/s by Tuesday 11 January, which was as a result of the predicted maximum release rate model results.

380 These increases started to commence with Wivenhoe Directive 8 once bridge closures could safely be achieved. By 8pm Monday 10 January, these release rates had been increased to 2,695m³/s. At that stage, the predicted maximum release of 2,760m³/s (model run 31) had already almost been obtained even though that predicted maximum release was not required to be reached until 6am on Wednesday 12 January 2011. In summary, the gate operations after heavy rainfall on Sunday were increased appropriately to counteract the peak in inflow rates caused by that rainfall.

Panicked releases on Tuesday 11 January 2011

381 In an article in the Australian dated 19 March 2011 titled “*Engineer bores a hole in dam untruths*”, there is a suggestion that the duty flood engineers “panicked” in releasing water on Tuesday 11 January. I do not agree with this suggestion.

382 Strategy W4 was implemented at 8am once significant rainfall had fallen between 4am and 8am. I have provided further information on the intensity of this rainfall at paragraphs 134 to 136 of this statement. Strategy W4 was not required to be implemented prior to that point for the reasons explained in paragraph 139 of this statement. Once that rainfall had started to accumulate, strategy W4 was implemented, and the primary consideration became protecting the structural safety of the dam. Successive Directives were sent over the course of the day on Tuesday 11 January 2011 in short sequences. I have explained the reason for these short sequences in paragraph 146 of this statement. These directives preserved the structural safety of the dam and prevented the initiation of a fuse plug. The dam had peaked at 74.97m AHD at about 7:30pm.

383 The successive directions sent in short sequences over the course of the Tuesday 11 January 2011 does not mean that the Duty Flood Operations Engineers “panicked” in releasing water from the dam over the course of the Tuesday. Each directive required five separate gate movements, and shorter, more frequent directives have the advantage that a gate operation is not as likely to be inadvertently overlooked by the dam operators, compared to using a long sequence of gate operations. This approach also allows the response of the dam to be assessed and gate operations to be refined in response to any changes in the lake levels.

That releases on Tuesday 11 January 2011 'breached' the W&S Manual

- 384 In an article published in the Australian on 24 January 2011 titled *Dam outflows may have breached guide – Flood Disaster* it is suggested that because “*peak outflows generally should not exceed peak inflows*” the dam operators “*came close*” to breaching the W&S Manual.
- 385 By Tuesday 11 January 2011, Wivenhoe Dam was being operated in accordance with strategy W4. The primary consideration is protecting the structural safety of the dam. This primary consideration was achieved. The peak inflow into the dam over the course of the January 2011 Flood Event was 10,376m³/s, which occurred at about 10am on Tuesday 11 January. The peak release of 7,464m³/s was reached at 8pm on Tuesday 11 January and was less than the peak outflow. Release rates did not exceed inflow rates until the peak of the dam had passed and the water had started to recede. In my view, the purpose of such a guide in the W&S Manual is to ensure that the Dam provides a flood mitigation benefit, in ensuring that the releases from the dam are lower than the inflow into the dam at the height of the flood (which is what happened in the January 2011 Flood Event). This strategy results in a lower downstream flood level than would otherwise occur had the dam not been there to mitigate the flood. Once the peak of the flood passes, releases will need to exceed inflows as otherwise the lake level could never be reduced.

Improper influence by the Brisbane City Council

- 386 An article printed in the Australian Newspaper on 9 March 2011 titled ‘*the 48-hour delay that sealed Brisbane's fate*’ suggest that officers from the BCC improperly influenced the Duty Flood Operations Engineers in their decisions concerning releases from the Dam. The article states that evidence in the Event Log points to the BCC’s input influencing the release strategy on Sunday January 9 2011.
- 387 As previously stated, I had made a telephone call to Ken Morris at the BCC to request a copy of the flood damages curve from the BCC’s 2007 study at 8:50pm on the Sunday evening. I have provided further details on this phone call at paragraph 74 of this statement. I wanted to review that damage curve so that I was fully aware of the consequences of making releases at varying rates. I was already aware of this BCC 2007 study for the reasons stated in paragraph 257 of my first statement.

388 The W&S Manual specifies that $4,000\text{m}^3/\text{s}$ is the upper limit of non-damaging floods in urban areas. I understand from speaking with John Ruffini (see paragraph 88 of this statement) that the purpose of the telephone call from Ken Morris of BCC noted in the Event Log at 12:45am on Sunday was not to influence release rates, but rather, it was to minimise confusion amongst BCC staff caused by a reference in earlier situation reports to $4,000\text{m}^3/\text{s}$ as being the upper limit of non-damaging floods in urban areas. As explained in paragraph 88 of this statement, I was told that this was because internally, the BCC recognises that lower flow rates (i.e. $3,500\text{m}^3/\text{s}$) would cause urban damage in low-lying areas of Brisbane. As is pointed out in paragraph 93 of this statement, subsequent situations reports did not specify the flow rate for the limit of non-damaging floods, however, the situation reports that I sent continued to refer to combined flow rates of $4,000\text{m}^3/\text{s}$ at Moggill due to the fact that this is the rate set out in the W&S Manual.

389 I point out that the situation report issued at 9:04pm on Sunday, specified that releases from Wivenhoe Dam would be increased from noon Monday to $2,600\text{m}^3/\text{s}$ by Tuesday. As I have previously mentioned, these increases started once the bridges were closed, and the release rate of $2,600\text{m}^3/\text{s}$ had been exceeded by 8pm (which was in fact earlier than had been indicated in the situation report). Therefore I reject any assertion that this contact from the BCC had any influence on the operational decisions made in the FOC during the January 2011 Flood Event.

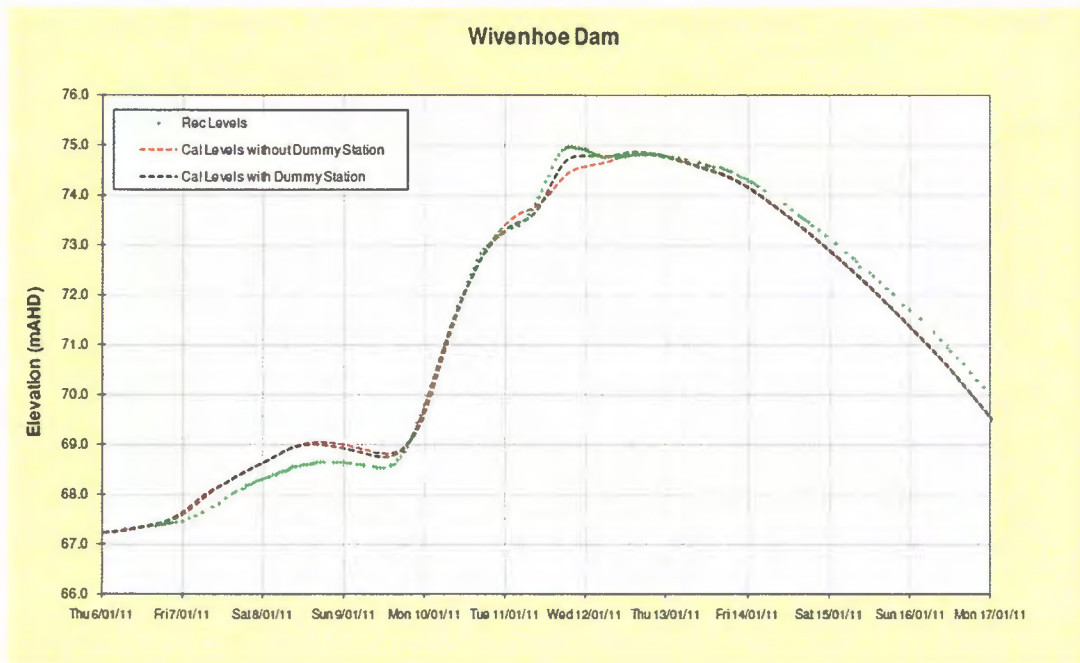
Water releases from Wivenhoe Dam were reduced from $7,500\text{m}^3/\text{s}$ to $2,500\text{m}^3/\text{s}$ at the height of the flood event on Tuesday 11 January 2011

390 An assertion has been made in one media article by a commentator that on Tuesday 11 January 2011, water releases from Wivenhoe Dam were reduced from $7,500\text{m}^3/\text{s}$ to $2,500\text{m}^3/\text{s}$, which then had the effect that the lake levels unnecessarily rose again. This assertion is wrong because it is based upon a malfunctioned headwater gauge level reading, which because of drawdown effect or blockage at the gauge incorrectly recorded the reduction in releases. I provide further information on the 'drawdown' effect at paragraph 175(e) of this statement.

That rain data was 'invented'

391 I refer to an article published in The Australian on 26 March 2011 titled 'Operator of dam 'invented' rain data'.

- 392 In this article, it is suggested that rain data on Tuesday 11 January 2011 had been
"invented" to "justify the near loss of control of the dam". I reject that assertion for
the reasons set out below.
- 393 As I have previously stated, extremely high levels of rainfall fell across the Brisbane
River catchment area on Tuesday 11 January 2011. I provide a summary of the
rainfall that was actually captured in rainfall gauges at paragraphs 134 to 136 of this
statement.
- 394 Further I refer to paragraphs 195 and 196 of my first statement. Rainfall gauges
can only capture rainfall that falls within the range of that particular gauge. There
were rapid rises in the lake level on Tuesday 11 January 2011. The real time
modelling undertaken with the actual data does not reproduce or account for the
rapid rise in lake level recorded that afternoon. The likely answer for this is that
there are no catchment gauges directly on Lake Wivenhoe. However, very high
rainfall was recorded in the rain gauges to the east and south of Lake Wivenhoe.
Accordingly, there is a large, unmonitored area where there are no rainfall gauges
which covers a large component of Lake Wivenhoe.
- 395 In the 12 hours to 3pm on 11 January 2011, 410mm of rain was recorded at Mt
Glorious just to the east of Lake Wivenhoe. Modelling has since been undertaken,
in which the rapid rises in lake level were modelled by way of a "dummy" rainfall
gauge transposed onto the lake. In order to reproduce the rapid rises in lake levels
on Tuesday, rainfall at 68mm/h (with an AEP of 1 in 2,000) had to be input into the
dummy gauge transposed on the lake in order to account for the rapid lake level
rise. I note that rainfall with an AEP greater than 1 in 2,000 was actually recorded
at other gauges (see paragraph 135 of this statement). Rainfall with an intensity of
70.5mm/hr was recorded over three hours at Savages Crossing on 11 January, and
rainfall with an intensity of 86mm/hour was recorded at Savages Crossing in the
hour ending at 8am and 93mm/ hour fell in the hour ending at 9am. At Mt Glorious,
the highest hourly rainfall intensity was 71mm/hr in the hour ending at 9am.
- 396 The results of this modelling more accurately reproduced the recorded water levels
than the originally modelled inflows.



397 This modelling is more completely described in section 8.9 of the Wivenhoe and Somerset Dams Flood Report.

398 This modelling has been performed post event, in order to assist in providing an understanding of the magnitude of the flood event. It was not relied upon as the basis of operational decisions during the January 2011 Flood Event. It is wrong to suggest, therefore, that rainfall was “invented” by the dam operators.

Signed.

Robert Arnold Ayre

Dated.....

29 / 3 / 2011

ANNEXURE 1

