Transcript of Proceedings

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THE HONOURABLE JUSTICE C HOLMES, Commissioner

MR JAMES O'SULLIVAN AC, Deputy Commissioner
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IN THE MATTER OF THE COMMISSIONS OF INQUIRY ACT 1950

COMMISSIONS OF INQUIRY ORDER (No. 1) 2011

QUEENSLAND FLOODS COMMISSION OF INQUIRY

BRISBANE

..DATE 13/04/2011

..DAY 4

THE COMMISSION RESUMED 10.01 A.M.

ROBERT ARNOLD AYRES, CONTINUING:

MR CALLAGHAN: I'm sorry, Madam Commissioner, may I just as a preliminary matter tender a document, namely a letter on behalf of the Crown Solicitor to the Executive Director of the Floods Commission of Inquiry? It concerns the issue of Mr Robertson's claim of Parliamentary privilege and there were already two items of correspondance on that topic tendered. This completes the set.

COMMISSIONER: All right. That will be Exhibit 35, thank you.

ADMITTED AND MARKED "EXHIBIT 35"

COMMISSIONER: Mr Rangiah?

MR RANGIAH: Mr Ayre, yesterday afternoon we were dealing with events that occurred on the 11th of January, which is the Tuesday?-- Yes.

Could I take you back to your supplementary statement, paragraph 146? Do you have that?-- Yes, I have that.

You have noted there that Strategy W4 was implemented at 8 a.m. on the Tuesday?-- Yes.

And at that stage dam safety became a priority over urban flooding, didn't it?-- It did, yes.

And that resulted in a series of rapidly escalating release rates?-- I describe it as incremental increasing release rates, yes.

So, the release rates that were implemented are contained in Schedule 1A to your statement?-- Yes, that's correct.

If we could turn to that? On the second page of the Schedule 1A, the entries start with the 11th of January, don't they?-- I'm not sure I am necessarily on the same page, but, yes, I have a copy.

Is yours large enough to decipher?-- It's fairly small, but I do have larger set here, but there's not enough room to actually lay those out, so I will struggle on with the fine print.

All right. So, the third column contains the date and then the time?-- Yes.

All right. And then further over there's column that says, "Total Release."?-- Yes, that's correct.

And that's measured in cubic metres per second?-- Yes, that's right.

And what this shows is that at 8 o'clock the release rate was 2,753?-- Yes.

And by 10 o'clock, it had increased to 3,347?-- Yes.

By 12 o'clock to 3,367?-- 3,667, I think, yes.

And then there's a rapid increase after that, so that at 3 p.m. or by 3 p.m. the release rate had reached 5,167?-- Yes.

By 5 p.m. it was 6,432?-- Yes.

By 7 p.m., 7,464 cubic metres of water was being released per second?-- That's correct, yes.

And that was the peak release rate?-- That, indeed, was the maximum rate that we achieved, yes.

And the same rate was released at 8 p.m.?-- Yes.

And the release rate remained at over 7,000 until just after 11 p.m.?-- Yes, that's correct.

And then there was a rapid decline of release rates until it reached 3,000 by 9 a.m. on Wednesday the 12th?-- We reduced it down to 2,547 CUMECS, yes, by 8 p.m., yes.

Now, if you could go back to paragraph 174 then? You set out in that paragraph a situation report prepared at about 6 p.m. on Tuesday the 11th of January?-- Sorry, I'm almost there. Yes.

That was prepared by Terry Malone?-- Yes.

And Mr Malone noted that at 7.30 Wivenhoe Dam was 74.92 metres and rising slowly and releasing about 6,700?-- Yes.

And then he said that, "The current expectations that the dam will reach a steady state, that is outflow equals inflow, within the next three hours without further significant rain rainfall. At this time release from the dam will be about 8,000 cubic metres per second."?-- Yes.

And then over the page, as to my note of it, "The dam was expected to peak below 75.5 metres."?-- That's correct, yes.

Which is below the first fuse plug initiation level. Now, that expectation that it would peak below 75.5 metres was because of the very high rates of release that had already occurred and were going to continue to occur?-- As required

under the strategy W4, yes.

And up to 8 a.m. on that Tuesday, the highest rate of release had been 2,753?-- Yes.

Now, according to the manual, releases above 4,000 - I'm sorry, releases up to 4,000 cubic meters per second would produce minor flooding in Brisbane?-- Yes.

And releases of over 7,000 cubic meters per second would certainly produce flooding in Brisbane, wouldn't it?-- Yes, it would.

And would it produce major flooding - would releases at those rates produce major flooding of its own, of itself?-- Yes, I believe it would.

So, do you accept that the rapid increase in releases on Tuesday the 11th and Wednesday the 12th did make a contribution to the major flooding that occurred in Brisbane?-- Yes.

And to the major flooding that occurred in Fernvale?-- Yes.

And you accept that those high release rates contributed to the scarring and erosion of riverbeds?-- Indeed. It's the accelerated gate openings that we were utilising. I would expect that bank slumping and erosion would occur. However, we noted that based on observations of television coverage, particularly of the Lockyer Creek, that this particular flood event appeared to be a very high energy naturally occurring flood anyway, and so both factors would have contributed.

And the rapid drawdown of release rates would have also contributed to bank slumping?-- It's quite likely it did. However, our objective in undertaking those reductions was to actually try and mimic the natural recession on the inflow hydrograph, which I think we did reasonably well. So, we would suggest that we were effectively just replicating nature in terms of that recession.

Do you accept that if there had been higher levels of water released but at levels below 4,000 cubic meters per second from Saturday the 8th of January then lower releases would have been required to avoid triggering of the fuse plugs?-- I don't believe, based on the information we had at hand on the Saturday, that necessarily higher releases were justified.

But do you accept that if there had been higher releases starting from the Saturday, lower releases would have been required on the Tuesday and the Wednesday?-- Yes, I accept that would be the case.

At paragraph 363 you refer to suggestions made that more water should have been released from the Saturday and you reject those suggestions. Do you have that paragraph?-- Sorry, that was paragraph 363, is it?

Yes. And you give a number of reasons for rejecting that criticism. Among them, in paragraphs D and E, you refer again to issues of premature inundation of the Fernvale bridge and the Mt Crosby Weir Bridge?-- Yes, I do.

And that's a recurring theme throughout your evidence, isn't it?-- As I have indicated previously, we are very cognisant of both issues of closing bridges and inundating property and we don't take those decisions lightly.

And you have accepted, I think, that by about 8 p.m. on Saturday the 9th of January, you'd recognised the need to increase releases to about 3,000?-- Yes, that was the release strategy at that time.

And releases didn't, in fact, reach 3,000 until about 10 a.m. on the 11th of January?-- That was because of the uncertainty associated with the events unfolding in the Lockyer on the Monday afternoon and Monday evening.

There was a delay of something like 38 hours before that rate of release was reached?-- The rate of release that was required on the Sunday evening we are talking about now? If I can refer back to my Schedule 1A? So, the required rates of release was indeed 3,000 cubic meters per second but not required until 1 p.m. on the 11th.

Now, I want to suggest squarely to you that you gave keeping open the Fernvale Bridge and Mt Crosby Weir priority from the Saturday at the expense of the primary consideration under the W3 strategy of protecting urban areas from inundation?-- The information we had at hand on the Saturday I don't believe suggested that we were necessarily required to make releases up to the maximum release rate under Strategy W3.

And I suggest that you gave - that you got those priorities wrong because you were confused about when the strategy changed from W1 to W2 or W3?-- No, I believe we were fully aware of the period of transition and were, in fact, progressing through that transition accordingly.

COMMISSIONER: How long do you expect a period of transition to take?-- The gate operation strategies are incrementally changed, so they're not necessarily, as I said yesterday, a step/jump type process, so it really depends on how the situation is involving as to just how long we would transition through those strategies.

So, it could be an hour or it could be 36 hours?-- It could longer, yes, and it really relates to, again, confirmation of the fact that bridges have been closed, communities have been evacuated as necessary, or, indeed, people who - certainly provisions have been made for the isolated communities.

Thank you.

MR RANGIAH: Well, if you get back to those strategies, strategy W1 is engaged as the first strategy when the releases

are required?-- It's the entry point, yes.

So, at that point, you definitely are in strategy W1 and there's no issue of any transition there?-- Only between the substrategies in W1, yes.

All right. And then you then get to Strategy W2 and Strategy W2 is itself a transition strategy, isn't it?-- That's what it's described as, yes.

So, that's a period of time in which you're in transition from W1 to W3, in effect?-- Yes.

But once you get to W3, I suggest that there's no question of transition any more, you're in W3?-- We are. However, it depends on the actual lake levels in the dam and downstream tributary flows as to whether a maximum release rate is necessary, also keeping in mind requirements to return full supply back to - return the level back to full supply within the seven day drainage phase.

So, what you mean by "transition" when you are talking about transitioning from W1 to W3, is that a reference to the strategy under W2?-- No, not necessarily, it's really we - in the past, I guess, we have not necessarily captured the strategies as they're numbered in our situation reports, which is effectively where we describe to others what we're - our current operating philosophy is, and the reason being is that most of the other agencies, whilst they have a copy of the manual, don't necessarily recognise what W1 may mean, and so when we talk about our strategies we identify the actual objectives that we're trying to achieve at any particular time and recognising that there are a sliding scale, if you like, of those objectives.

But there is a definite point, isn't there, at which you are no longer in Strategy W2 and you're now in Strategy W3?-- Well, the point at which that occurs is where the releases exceed the naturally occurring flows from the downstream tributaries.

Well, the point here at which W3 was engaged was 8 a.m. on the Saturday?-- Yes, and, indeed, that's when the releases exceeded our estimates of naturally occurring flows.

And I suggest to you that the particular relevance of the point in time at which you move from one strategy to the next is that the primary consideration changes?-- Primary consideration does shift in focus, yes.

And while you might still release water at the same rates as under the previous strategy, what is important is that your primary focus is now different?-- Yes, that's true.

So, I suggest to you that there is no question of a period of transition from one strategy into the next?-- Well, I disagree. I think if you have got a water level in Wivenhoe which has only just exceeded EL68.5, that's a very different

scenario to if you have lake level which is just below EL74 yet they're both within the zone of Strategy W3.

Yes, but once Strategy W3 is engaged, it's engaged?-- Yes.

And there's no question of transition into Strategy W3?-- But it's a progression through that strategy.

Yes. So, in other words the rates of release might change?-- Exactly, yes.

And it's only a transition to that extent that you might increase rates of release?-- Yes.

Or you might leave them the same?-- Yes.

But what is important is that the priority changes?-- That's correct, yes.

And there's no question of transition then of - there's no question of a period of transition in relation to the priority changing?-- It's a progression through that particular strategy, if you like.

All right. Now, can I take you to the manual to page 26? Just at the bottom of page 26 under, "Strategy W1E.", in bold is the statement, "If the level reaches EL68.5 AHD in Wivenhoe Dam switch to Strategy W2 or W3 as appropriate."?-- Yes.

And I'm not intending this as a criticism, but I just want to ask you, is that inconsistent with the flowchart on page 23?-- There is a discrepancy in the flowchart that needs to be amended, yes.

So, is it more correct to say that the statement on page 26 should be amended rather than the flowchart?-- No, I believe the flowchart is actually - does actually reflect how we operate, and I have made suggestions to that change in my statement.

All right. The change I suggest in terms of - so, do you say the statement under paragraph 26 is correct then and it should remain the same?-- I believe so, yes.

All right. And then page 29, the second paragraph under the box, "Conditions."-----?-- Mmm-hmm.

-----talks about Strategy W4 and says, "This strategy normally comes into effect when the water level in Wivenhoe Dam reaches 74 metres AHD." Is that inconsistent with the first of the conditions that Wivenhoe storage level is predicted to exceed 74?-- No, I think that statement actually reinforces that, and I take that to mean actual lake levels, and I think it reinforces the point I made yesterday, that you have to be confident that you are actually going to exceed EL74 before you implement Strategy W4.

But Strategy W4, is that engaged when the water level reaches 74 metres, or when it's predicted to exceed 74 metres?-- I believe the manual gives you the flexibility to use either interpretation as is appropriate to the situation at hand.

At page 15 of the manual there is a reference to communications. Just under the heading 6.2, "Dissemination of Information.", it's indicated in summary that there are agencies other than Seqwater that have responsibility for advice to the public associated with flood events?-- Yes.

And it requires Seqwater to provide adequate and timely information to the responsible agencies?-- Yes.

And the relevant agencies are shown in the table below, and one of the agencies is Somerset Regional Council and it has responsibility, according to this, for flooding level information upstream of Somerset Dam and upstream and downstream of Wivenhoe Dam?-- It doesn't have responsibility for it, they require that information.

All right. But in 6.2 it's indicated that agencies other than Seqwater have responsibilities for advice to the public?-- Yes, that's correct.

And in that context, that's what the table refers to?-- It does, yes.

And just above the table, it's indicated that, "Seqwater must liaise and consult with these agencies with a view to ensuring all information relative to the flood event is consistent and used in accordance with the agreed responsibilities."?-- Yes.

And do you take that to mean that there's an agreement in place between the councils and Seqwater about who assumed responsibility for the dissemination of information to the public?-- I believe that's the case. There is an emergency action plan where members of the Southern Regional Council are nominated and they're the contact persons to which the Flood Operations Centre direct information.

So, when you prepare a situation report, that appears to be e-mailed to a distribution list?-- Yes.

And the people on the distribution list are the nominated contact from each of the agencies-----?-- They are indeed.

-----that are referred to in the table?-- Yes.

And the agencies that are listed don't include the Department of Main Roads?-- No, they're not.

And certainly there's a contact or - I'm sorry, I will start that again. Certainly the situation reports are e-mailed to the contact from the Somerset Regional Council?-- Yes, usually accompanied by a phone call.

I see. Now, can I just refer to the report on the operation of Somerset Dam and Wivenhoe Dam? Now, that was a report prepared principally by you and the other three Flood Operations duty engineers?-- Yes.

Do you accept there may have an been unconscious bias towards justifying your actions in the operation of events?-- The purpose of the report was for us to describe what actions we undertook.

You certainly accept it wasn't an independent report?-- It's never been intended to be an independent record, it's a report required under the manual to the Dam Safety Regulator.

And you and the other flood duty engineers reached a consolidated view that you hadn't breached the manual?-- Yes, that's correct.

Was that consistent with your e-mail of the 14th of January saying that you should all reach a consolidated view?-- That e-mail was not in relation to the report, because the report hadn't been produced, we were still operational at that stage. It was simply in response to the misinformation, in my view, that was occurring in the media and I just wanted to make sure that information leaving the Flood Operations Centre was consistent and didn't add to the misinformation that was being promulgated.

You were asked some questions yesterday about the second statement of Terry Malone?-- Yes.

Mr Malone conducted modelling based on a theoretical release strategy of 3,000 CUMECS from just after midnight on Monday, the 10th of January?-- Yes, he did.

He used a hydrological model, didn't he?-- He did.

And is that a model using a software program URBS or URBS?-- Yes, it is.

You didn't use a hydrodynamic model?-- No, he didn't.

And there is software for a hydrodynamic model available, isn't there, called Mike-11?-- There is a Mike-11 model, amongst others, available for Brisbane River, yes.

And was the Mike-11 software used to test the effectiveness of the auxiliary spillway when it was constructed?-- It was developed as part of the Wivenhoe Alliance Design Project, yes.

And is it the case that the Mike-11 software would - I'm sorry, I will start that again. Is it the case that the URBS software is cruder than the Mike-11 software?-- I wouldn't necessarily say cruder, it's a different model in terms of it's a hydrologically based model, so it's uses conceptual storage routing as opposed to a hydrodynamic model which uses - I think a combination of momentum and mass as the primary

equation, so it's more physically based.

And one of the factors that the Mike-11 model takes into the account that the URBS doesn't is water height?-- Well, in URBS you can actually incorporate a rating curve for areas of specific interest, but URBS is predominately a model which converts rainfall into a flow and then by the rating curves you can get height information out of it, whereas the hydrodynamic model, it uses flows as its major input and determines velocities and flows along the river system.

Would you agree that the Mike-11 model is likely to produce a more accurate result than the URBS system?-- If it was properly calibrated, yes.

Now, is it the case that no modelling has been done about the effect of potential earlier releases on the overall flooding in the Fernvale area?-- For a hydrodynamic model are we talking about?

Well, for any model?-- Well, the URBS model does take that into account, yes.

So Mr Malone should have those results?-- Yes.

Now, Mr Malone did conclude that earlier releases - earlier larger releases would have provided some reduction in the peak river level in Brisbane?-- That's correct, yes.

So it would have made some difference to the extent of the flood damage?-- Yes.

In other words, some houses might not have flooded at all?-- It is possible that would be the case, yes.

And others might have had less damage?-- Indeed, yes. Well, not necessarily because the duration of the flooding changed. So there was a longer duration above 4,000 CUMECS, so, indeed, there may have been worse damage using that operational strategy.

Now, you were the senior flood duty operations engineer during this flooding event?-- I was, yes.

And when you were on duty, the decisions that were made as to release strategy were ultimately yours?-- I had the overall responsibility for directing the strategies, yes.

But when you were on duty, the decisions that were made were your decisions in the end, weren't they?-- When I was - not necessarily. It depends who was nominated as the actual duty engineer. When we were doing dual shifts, John Ruffini and I alternated as to who was actually signing the directives. So we shared those responsibilities. John is also a senior flood operations engineer.

Was he at the time?-- Yes, he is, yeah. John is actually the longest serving duty engineer on the team.

Thank you. I have nothing further.

COMMISSIONER: I think Mr Dunning is next on the list.

MR DUNNING: I am, thank you, Commissioner.

MR DUNNING: Mr Ayre, I would like to start with the topic of compliance with the manual, but before I do - Commissioner, may Mr Ayre please have his four statements which are exhibits 17 through to 20, and the manual for Wivenhoe and Somerset was Exhibit 21. It might be convenient if he just has all of them with him.

COMMISSIONER: Do you have them already?-- I have them.

MR DUNNING: All right, thank you.

Can we start, please, Mr Ayre with the manual which is Exhibit 21? Now, you have already been asked a lot of questions about what appears on page 22 of that manual. Can I ask you to go to that for me? And I will endeavour to do this without revisiting at unnecessary length those topics already covered, and with a view to doing this as expediently as possible, I am going to suggest a series of things to you, and if you just agree with them, I want you to tell me you agree with them, or if you don't agree or if you think they need qualification, I want you to add your qualification, all right?-- Yes.

Okay. Now, can I suggest to you that when we get to these flood operation strategies that are set out at 8.4 on page 21 and are further expanded upon in the strategies that commence on the pages following, it might be observed that 8.4, in effect, summarises matters more fully set out in the passages that precede it. Would you agree with that?-- I agree, yes.

In particular, can I take you please to the - sorry, can I just make one other thing clear at the outset: I don't, at least for my part, want answers as to what you think the document means. Ultimately, that's for others to determine. My questions are focussed at when you were discharging your functions in accordance with the manual, is this how you used the manual for your purposes. Do you understand?-- Yes, I understand.

Okay, thank you. Can I take you, please, to the first paragraph under 8.4 where it refers to, "There are four flood strategies used when operating Wivenhoe during a flood event. These strategies are based on the flood objectives of this manual." Can I ask you, please, then to turn to page 9 of Exhibit 21, which is part 3? And can I suggest to you that part 3 sets out in considerably more detail what those objectives are?-- Yes, I agree.

Thank you. And, in particular, if we go to 3.2, that it makes structural safety of the dam the first consideration in its operation?-- I agree, yes.

Right. And whilst we're dealing with that, in all but extreme circumstances, the safety of the dam won't be an issue presently of concern?-- There is a very small risk. That's the case, yes.

Thank you. And there is a procedure for dealing with it when that occasion arises?-- That's correct, yes.

Thank you. Then if we go to 3.3 on page 10, it records there that "The prime purpose of incorporating flood mitigation into Wivenhoe is to reduce flooding in urban areas, the floodplains below." Agree?-- I agree, yes.

And that when we go to those operational strategies that we're talking about on page 22, you took it to be and you acted under the manual as if that was informed by the fact that that was the primary purpose of those objectives?-- Yes.

Thank you. Then can I take you, please, to the second full paragraph on page 22, and you will see there that it talks about within those strategies, "Consideration is always given to these objectives in this order when making the decision on dam releases." Now, can I suggest to you the way that you and your colleagues in the FOC operated was that if a particular - if we go to those dot points that appear in the first paragraph, if the highest in the hierarchy was not a matter of present concern, you focussed on the next most senior?-- Yes, I agree.

So that the practical consequences is - is other than those exceptional circumstances where dam safety becomes an issue, and thus takes primacy. Otherwise, your primary concerns remain with the optimum protection of urbanised areas from inundation?-- Yes.

And you operated the manual understanding the relevant distinction between optimum protection on the one hand and the avoiding of all inundation on the other?-- Yes, that's correct.

Because the former might necessarily involve some of the latter?-- Yes.

Thank you. Can I take you, please, to the third paragraph on page 22 where it speaks of, "The strategy chosen at any point will depend on the actual levels in the dams and of the following predictions which are to be made using the best forecast rainfall and stream flow." Now, our learned friend Mr Devlin took you to page 13 of part 5 and I understood from your answers to be that just as part 3, as you explained to me, or agreed with me sets out in detail what appears in the first paragraph, part 5 sets out in detail what appears in that third paragraph?-- I agree, yes.

All right, thank you. And that in particular the topic that has occupied some interest at best rainfall forecast and stream flow information is informed in a material way by what's set out in 5?-- Yes, that's correct.

Thank you. While I am on that point you were asked some questions about this might seem odd to the ordinary person reading this document. It is the case, isn't it, this is a controlled document?-- It is indeed, yes.

The only persons permitted to make changes to it are within

Seqwater?-- Yes, that's correct.

Indeed, because of its sensitive nature, not even all of the parties have an unedited copy of it, correct?-- That's correct, yes.

And apart from the fact that it is only to be amended by Seqwater, it is also the case that it is only circulated to a very limited number of people?-- I believe so, yes.

Yes. And those are persons who have some involvement in the professional response to a flood event, agreed?-- Yes, that's correct.

Thank you. So it is the case, isn't it, that the average person will never really be troubled to be called upon to tell us what it means?-- That's true, yes.

Can I then, please, move to the next paragraph, paragraph 4, "Strategies are likely to change during a flood event as forecasts change and rain is received in the catchment", and then over a sentence, "Strategies are changed in response to changing rainfall forecasts and stream flow considerations to maximise the flood mitigation benefits to the dam." Insomuch as that paragraph refers to forecasts and predictions, did you operate the manual on the basis that such forecasts and predictions were as informed by what we see in part 5?-- Yes, the predictions come out of the Real Time Flood Operations Model.

All right, thank you. And you have on a number of occasions talked about there being no stepped procedure for changing between strategies?-- That's correct. We progressively or incrementally change the release rates to accommodate the change in objectives.

And, in effect, there is no bright line between when you have ceased to be in one strategy and you are in the next?-- Indeed. Yes, I agree with that.

And there are a series of reasons for that - and without suggesting this is an exhaustive list, some of the more important are you are always keeping the strategy you are in and the strategy you might move to under constant view?-- That's correct, yes.

And that's informed by changes in the weather?-- It is based on observations collected through the real time data, yes.

And expectations as to how that might move in the future?-- Yes.

And what's being presently experienced?-- Yes, that's correct.

In terms of run-off and the like?-- Mmm.

Thank you. Now, can I then take you to just a couple of other

features of Exhibit 21 before we leave that? Can I ask you, please, to go to page 1 of it, the first two paragraphs of 1.1. Just read them to yourself for the moment. You have read that?-- Yes, I have.

Now, it is the case, isn't it, that not only is this document a document that is acted upon within a very small group of professional persons and provided for information to another small group of interested professional persons, it is, in fact, the product of iterative learning dating back about 40 years?-- It is, yes. It does draw on previous experiences.

And if I can then take you, please, to page 3 and part 1.3, and can I direct your attention, please, to that second paragraph and just ask you to read that to yourself for a moment?-- Yes.

So can I suggest to you that insofar as you sought to discharge your functions pursuant to the manual, you did so as it compelled you by recognising that whatever decisions you made had to recognise the limitations of, in particular, obtaining accurate forecasts for rainfall?-- Yes, that's correct.

And similarly accurate forecasts for run-off?-- Yes.

All right, thank you. If we go to that third dot point where it talks of "identify all potential flood hazards and their likelihood", that - and related to that is the fourth, "the removal or reduction of community vulnerability to flood hazards", that insomuch as you have been asked quite a number of questions about concerns regarding inundation of bridges and the like, that in operating under this manual you were cognisant of your obligation there to achieve the flood mitigation while being mindful of risks, not only to property but persons, which included the risks attendant with discharges, by, for example, closing bridges, isolating communities?-- Yes, that's true. Public safety is certainly paramount in our thoughts.

Thank you. Now, may I then ask you, please, to return to 8.4 on page 22? Now, can I suggest to you that the more fulsome account of what is required of those strategies described in 8.4 in the parts that precede it is also informed by the parts that follow it and the particular summaries of the different strategies?-- Yes, I agree.

And you operated the manual at least to suggest on the basis that those strategies, as they are recorded on the following pages, are also informed by that more detailed account that appears earlier in the manual?-- Yes, I believe so.

Thank you. Can I take you, please, to page 23? Now, I don't need to take you to it unless you want me to but in your first statement, which is Exhibit 17, at page 301, you talk of a need to make a change to the box that appears in the middle of that flowchart where you say the word "and" should be the word "or"?-- That's correct, yes.

You don't need me to take you to that passage?-- No, no, I recall that.

Thank you. But it is the case, isn't it, that the movement from strategy 1 - or W1 through to strategy W2 or W3, in particular is an area where there is no clear demarcation?-- Well, it depends on what criteria you are using. If you're using actual levels, then W1 does have a series of defined levels.

But once it becomes apparent you are going to leave W1, as to whether you are going to W2 or W3 will really depend on the particular rain event you are dealing with, won't it?-- It does, yeah. It will relate to the estimates of what the naturally occurring flows are-----

Yes?-- -----emanating from the downstream catchments.

Because once you get to the sort of level of rainfall that you are talking of in W2 or W3, it might be you're dealing with an event that would move you straight to W3?-- Yes, that's correct.

Now, can I then ask you, please, to - sorry, can I suggest to you that in the operation of the manual that's not only your understanding but how it was reflected at the foot of page 26?-- Yes.

Thank you. Then can I suggest to you that in terms of how you operated under the manual during this event, the distinction between whether you were in W2 or W3 was not of itself of great moment?-- I don't believe it was materially important as such, no.

And one of the reasons, can I suggest to you, for that is that unlike the tenor, perhaps, of some of the questions that have already been asked, the aim is not to get as close to the below which figure in strategy 2 or 3, but rather to keep your discharge rates as low as possible?-- That's right, to achieve full mitigation, you want as low a release as possible.

Thank you. And in your professional opinion is the relevant point of inquiry not how high you can get them to achieve it, but rather how low you could get them to achieve flood mitigation?-- Yes, it certainly is an indication of efficiency.

All right. Now, can I then take you to another matter in relation to W2 and W3? It has been suggested to you many times that the maximum release rates were 3,500 and 4,000, and I am not suggesting much turns on it but, as you operated it and as it literally says there, the maximums are under those figures?-- That's correct, yes.

Now, there is the topic of what appears in W3 but we will return to deal with that in a moment - a little later in these

questions. Could I then take you, please, to page 29 and to W4? And you have been asked a number of questions about the prediction - effectively the first dot point of conditions, the prediction that Wivenhoe will exceed 74 AHD. Can I suggest to you these things, and you tell me whether you agree or disagree: as you operated the manual, you have operated it by reference to what appears in the first of the paragraphs after the highlighted paragraph starting "the intent", and in particular this sentence: "The strategy normally comes into effect when the water level in Wivenhoe Dam reaches 74 AHD"?-- That's my understanding, yes.

That's how you operated under the manual?-- Yes, that's how we operated, yeah.

Thank you. And you operate in that way because the decision to go to W4 is a major one?-- It is the decision that has the highest consequence, yes.

Because you ceased being able to determine your flow rate primarily on the basis of the minimisation of downstream urban damage and your primary focus becomes the integrity of the dam?-- Indeed. It is basically aimed at minimising the increases in lake level.

Thank you. Now, you have been asked some questions to the effect, oh, well, you can go to W4 but you are not obliged to have a higher rate of release; you have got complete discretion. But can I suggest to you that's not right because once you have put yourself in the W4 situation, you are bound to have such releases as you might need to achieve its requirements of dam security?-- That's correct. In my interpretation in a flood, the threat to the structural security of the dam is, indeed, the rising lake level and, as indicated in the paragraph there, that under strategy W4 the release rate is increased as the safety of the dam becomes the priority. Opening of the gates to occur generally in accordance with the requirements of the gate opening sequences in section 8.6 until the storage level of Wivenhoe Dam begins to fall. So I don't think there is any option except to keep increasing gate openings until you achieve that.

And as you have operated under these procedures and their predecessors, you have operated on the basis that that discretion given to you at around 74 AHD is so as to allow you to avoid having to make maximum releases if at all possible?-- Yes, that's correct.

And insomuch as there have been questions about the precautionary principle or precautionary higher releases, the practical consequences in the event - in this event and, indeed, in most where you are talking of rainfall of the volume that was falling in the lead-up to the events of Monday the 10th and Tuesday the 11th, a precautionary release is really code for some precautionary flooding of the people downstream, isn't it?-- Yes.

Thank you. Now, can I then, please, move to another topic,

and that is the topic of rainfall forecasts, and you might remember yesterday afternoon Commissioner Holmes asked you one or two questions on this topic, and it is really to that particular issue that I want to return, and, again, what I want you to do to the extent you disagree with this I want you to tell me. Can I suggest to you that a summary of how you go about this process is as follows: the decision to move between strategies and, more particularly, the decision as how to execute a particular strategy is one ultimately of judgments upon which there will typically be a number of reasonable alternatives, and that operators have to choose one?-- I would agree, and it is an incremental change, as such.

All right. And, indeed, there would be, amongst those options, options upon which reasonable minds might differ as to which will be the best?-- Yes.

And because of their incremental nature and the dynamic nature of what's unfolding, there is not only room but with a view to the best response you may actually look to tweak or alter at the fringes a particular strategy that you had originally considered?-- We certainly endeavour to keep a degree of flexibility available, yes.

All right. Now, when you go about - and that judgment that is exercised is in a great part science but to some part it is art, isn't it?-- I would put it down to experience, as such, or in terms of interpretation of the information available.

All right. Well, let's call it some part science and some part experience. But there is a non-quantifiable but rather - there is an element of judgment and feeling that comes in there?-- There is certainly an element of judgment, yes.

So the process is one that's both quantitative and qualitative?-- Yes.

Now, in particular, it is quantitative in the sense that you have at your disposal a series of bespoke models that are designed to give you predicted lake levels?-- Yes, that's correct.

And you govern the inputs that you can put into those models?-- We take account of the accuracy of that information, yes.

Certainly. And what you do is you, it seems, run the model with a no further rainfall scenario, and an alternative with some predicted rainfall?-- Yes, that's correct.

And then - so it is quantitative in that sense and it is qualitative in the sense that once you have those figures at your disposal, you make a judgment as to which is the most useful figure to inform your strategy at that moment in time?-- Indeed. The model results are not necessarily truth. A comparison of the performance of the models was supplied in appendix B, I think, of the Flood Event Report. It does

demonstrate the validity of the performance of the models, as such.

If we can get particularly to the question that the Commissioner - that topic the Commissioner raised with you yesterday, on a quantitative level you run these models and, typically, at least, you use the no rainfall result as the predicted dam level that you are going to base your strategy on?-- Yes, that's correct.

But you haven't actually ignored the predicted rainfall because you've typically modelled it as well?-- We do, and I guess that information is used to inform us as to what the difference is between the two results to give us an idea of what sort of change we may need to undertake on the basis of if that forecast rainfall does arrive in the location it is predicted to arrive and in the time-frame it is predicted to arrive.

I want to explore that quickly with you, Mr Ayre. So you - once you've got that the quantitative information, you really make a qualitative judgment that I am going to use the no rainfall to give me my predicted flood level, correct?-- Yes.

But you don't leave it at that and you don't ignore the other result that you've got, that is with the predicted rainfall. What you then do is say, "Well, I am going to take that as my predicted lake level because experience tells me that that's the - and history tells me that that's the most reliable, but I am also going to take into account that either no further rainfall is predicted or some rainfall predicted, or in this case a lot of rainfall is predicted and I am going to use that to inform how I execute the strategy that I am in"?-- Yes, I agree with that.

And to foreshadow the prospect that I may need to move to another strategy if that predicted rainfall comes to pass?-- Yes, indeed. That's the case. And when we are in periods where there is an escalation of activity, we will actually increase the frequency at which we do the modelling to take account of those changes.

All right. That's to allow you to make both those qualitative assessments - those quantitative assessments and qualitative judgments that are necessary to inform your overall decision?-- Yes, that's correct.

COMMISSIONER: Can I just clarify, so I am sure that I have understood? You look at the with rainfall model to foreshadow what changes you may need to make if the rainfall actually happens?-- Well, we base our operational strategy on the no rainfall model, so we devise the directives on the basis of that particular model, but we're informed by the forecast rainfall model as to incrementally what we could expect if rainfall does occur.

All right. But that's a case of really seeing if it does happen, then you will do something about it; is that right?-- As the rain falls and, indeed, the forecast is proved true or otherwise, we can adjust the strategy accordingly.

All right. That's one leg of what you said, but you also agreed with Mr Dunning that it would inform how you executed your strategies, and that's the bit I wanted clarification on?-- In terms of informing how we - how that informs the strategies, it really is just a - seeing how closely bound those two estimates are. If they're consistent and - then we recognise that we are fairly comfortable within the particular operational strategy, but if they're fairly diverse, then that gives us an idea that potentially we will have to be revising the strategy as we progress.

So, it does not much more for you than tell you something may be coming up, you don't act on it, but you recognise things may be going to change effectively?-- We don't necessarily act on it, but we do incorporate the information we take from the forecast models into our situation reports, and that information is really used as a heads-up, if you like, to the response agencies in terms of informing them of potential bridge closures or, indeed, areas of inundation.

Thank you. Thanks, Mr Dunning.

MR DUNNING: Is it effectively a forewarned is forearmed approach?-- We attempt to provide as much lead time to the response agencies as is possible based on those forecasts.

All right. Thank you. And there's another issue that sits in amongst this in relation to the topic of forecasts and this qualitative and quantitative analysis that you engage in in not only deciding what strategy you are in but how to execute it, and that is there's a time lag factor as well, isn't there?-- Yes, there's certainly a time factor to be built in, yes.

Yes, so that when you release water from Wivenhoe, your ultimate inquiry, if downstream inundation is your concern, is not what is the situation at the moment I decide to release or increase my release, but what will be the situation when that water arrives in those downstream locations?-- Indeed. There is an approximate travel time between Wivenhoe Dam and Moggill of some 16 hours. That can be shorter in the larger floods, but - and it's 26 hours from Wivenhoe to Brisbane City, for instance, so that time factor has to be accounted for.

And not only does it have to be accounted for, but it is outside that range which by history and experience you found the Bureau of Meteorology to be most reliable on?-- It's certainly on the upper limit of those forecast horizons, yes.

COMMISSIONER: Can I just ask something there too so I have got it clear? With your Real Time Flood Model, are you factoring in Bureau of Meteorology information or-----?-- We - when we do our hydrologic analysis, we do incorporate the

rainfall forecast information. So, the with forecast rainfall does include the information from the Bureau, yes.

Bureau of Meteorology, and do you use their forecasts independently of that? If they say to you, "You have got four days of rain coming.", do you look at that, apart from looking at what's come out of your Real Time Flood Model?-- Well, we can do longer sequence runs, so we have - in this particular event we used the three day forecast estimates to try and get a longer planning horizon, if you like, as to what the floods were going to be.

I am just trying to understand whether you always feed their information into your modelling or whether you use it independently of the modelling at all?-- Well, we do use it, both quantitatively and qualitatively, yes.

Thanks, Mr Dunning.

MR DUNNING: Well, just dealing, though, with the Commissioner's question, do you actually use it independently of it, that is, when you say qualitatively, do you mean by that that apart from putting it into the model, you are cognisant of the forecast that you have received and how you might exercise your judgment when you receive the product of that model analysis?-- Yes. Certainly with respect to movement of the storm throughout the catchment and certainly on occasions during Tuesday the 11th we were aware the forecast was suggesting that the rainfall was actually contracting to the coast and moving south, so effectively moving over the Bremer River catchments and metropolitan Brisbane.

All right. Now, you have been asked a number of questions, not only by me but by some of my learned friends, and as a consequence, you have had the chance to renew your acquaintance with really all aspects of the manual now. It's been suggested to you by others that your conduct and those of your colleagues over this time was noncompliant with the manual. With the benefit of all of those questions I asked you and thinking about it fairly but also those topics I have now raised with you, I take it you maintain your earlier answers to my learned friends that you did operate in accordance with the manual?-- It's my belief that we did, yes.

Now, happily, Mr Ayre, we might move to another topic, and the first topic that I now want to address with you is the differing roles in a flood event between the members of the FOC, such as yourselves, and relevant in particular to me the Brisbane City Council for whom I appear. Now, I think you will agree with me, won't you, that it's the case and it's recognised in how you acquit your duties that there are different roles and interests of the Brisbane City Council and Seqwater and, in particular, the Brisbane City Council's interests, amongst other things, is to be effective in its response to a flood event in Brisbane; do you agree?-- I agree, yes.

Whereas the Seqwater's interest and role is the operation of the dam, which has a central function of minimising downstream effects, but obviously not only in Brisbane?-- Yes, that is correct.

Can I ask you, please, to go to your first statement, which is Exhibit 17, and paragraph 302 of that statement, which you will find starting on page 63. Now, you have set out there a summary of the four strategies which I have taken you to in a little more detail, but nothing in the discussion you and I have just had over the last little while affects what you say in the paragraph 302?-- No, I don't believe so, no.

And it follows from that that your aim in setting those strategies is to achieve the lowest level of discharge, not the highest?-- Yes, that's correct.

Thank you. Now, it's right, isn't it, that once you get to the situation of W2 and W3, you are dealing with a significant rain event?-- Yes, there is certainly a significant volume of inflow to reach those trigger points, yes.

And there will already have been damage and inconvenience as a result?-- Obviously depending on where the rain falls, but, yes, generally speaking it would be a fairly broad event to reach those trigger points.

Yes, certainly. And as to whether you move to W2 or W3 and as to whether you remain within them and as to your decisions about transitioning, that will not be governed by the sort of lengthy considered approach that we're going to here, but it will largely be governed by the amount of rain that's presently falling, won't it?-- Yes, that's right.

Thank you. Now, you will be aware, Mr Ayre, that an issue has been raised as to the reference in the Wivenhoe and Somerset Manual in W3 noting 4,000 CUMECS at Moggill as the upper limit of nondamaging downstream flooding?-- Yes, I am aware.

And that's a topic that you touch upon at paragraph 409 of your first statement. Now, we've already agreed and it is, in fact, reported at page 147 of the statement, that the manual, and in particular the part that's concerned with W3, could only be changed by Seqwater?-- Yes, that's correct.

Thank you. And to the extent the Brisbane City Council provided a copy and had some involvement in the consultation with it, that's all it did, it had no control over how it was described in the manual?-- No, that is correct.

Nor did it purport to be a reflection of its operating procedures?-- No.

Thank you. And you have been asked some questions about the review of it in - the review of revision 7 and you have told us that you were aware of the Brisbane City Council 2007 flood

damage report?-- Yes, that's correct.

All right. And, in fact, it was the topic, it seems of some discussion by yourself and your colleagues who were responsible for revision 7 at the time?-- Yes, that's correct.

Thank you. So, the decision to leave the flow rate at less than 4,000 in the model was an informed one, made knowing of the 2007-----?-- It was a panel interpretation based on the information contained in that report, yes.

Thank you. Now, that panel was the one that I think you described to us in evidence yesterday at page 104 of the transcript. I won't trouble you to be shown it, but, as I understand it, that it was the four duty engineers and Peter Allen, Director of Dam Safety, and possibly Ron Guppy?-- Yes, that's correct.

And that's the panel to which you refer?-- It is, yes.

And that's the panel that considered, amongst other things, the 2007 flood damage report in finalising revision 7 of the manual?-- It did, yes.

Now, I am going to come back to this expression of 4,000 that is also a topic that occupies a fair bit of interest, but before I do, I have got a couple of other questions. Remember I asked you a little before about these distinctions between roles between the council and Seqwater. I want to suggest to you that they - those distinctions and roles inform why 3,500 is a figure of significance to the Brisbane City Council, but 4,000 CUMECS is the settled figure in W3?-- Yes, I agree with that.

You'd agree with that?-- Yes.

I take it you'd agree that - or you have no difficulty understanding why Brisbane City Council see 3,500 as a significant figure for them, because their researches show that that will be where damaging - property damage in floods will start to occur?-- Yes.

But the position for Seqwater is a little different. I should have made that clear, that that's damage to habitable areas?-- Mmm-hmm.

The position for Seqwater is somewhat different, because what it's looking to do at that 4,000 figure is set the less than figure for the W4 strategy - W3 strategy?-- W3, yes.

Which is itself related to its W2 strategy, which sets it a little higher, at less than 3,500?-- Yes, that's correct.

And it's an important figure for Seqwater because what it's aiming to do is arrive at a figure or a less than figure that will, in effect, allow it to stay within W3?-- That's correct, yes, it maximises the benefit of the flood mitigation

factor.

Yes, because as soon as you fail to be able to stay within W3 and move to W4, the interests of flood mitigation get subrogated to the protection of the dam?-- That's correct, yes.

And you're then, as you have explained to us earlier, in a position where you become bound to releases at whatever rates are necessary to return the dam to a particular level?-- Yes, that's correct.

Now, it's with that in mind, can I suggest to you, that knowing of the Brisbane City Council three and a half thousand CUMECS beginning of habitable damage, that you set your level a little higher than that?-- I guess - well, I think the 4,000 value was an historic value, it was originally derived out of the 1985 investigations.

But it remained, didn't it, a useful level to keep at because you would tolerate some minor level of nonetheless significant downstream flooding if it avoided you having to go into a situation where you had to subrogate that concern for protection of the dam?-- Yes, that would be preferable.

Thank you. Now, once one sees it in that context, there's nothing particularly wrong with the 4,000 figure?-- No, I don't believe so.

Or surprising in its inclusion?-- No.

And I can take you to W3. Why don't we go back to W3, which appears on page 28, and whilst there's been a good deal of interest in how felicitously expressed it is, the only real criticism of what appears there is not the reference to 4,000, but rather that it carries those added words, "Is the upper limit of nondamaging floods downstream", rather than perhaps "is the lower limit of damaging floods downstream"?-- Yes, yes.

That's all there is to this point?-- Yes.

Thank you. And on a practical level, whether you are at 3,500 or 4,000 is never going to be a matter of choice, in a practical sense it will be what's falling from the sky and gathering at Wivenhoe that ultimately determines that?-- That's correct, yes.

Thank you. Mr Ayre, can we move to another topic, please, and you will be aware that an issue has arisen in relation to the removal of a reference to that 3,500 being the limit of nondamaging flows in the situation report issued by the FOC?-- I am. I wasn't involved directly in the phone call, but John Ruffini did inform me of that, yes.

Certainly. Now, you have discussed this matter in paragraphs 88 and 388 of your second statement, which is Exhibit 18. Now, can I suggest to you that the fact that an

officer of Brisbane City Council raised this with your colleagues in the FOC and the fact that they acted upon it in the way they did reflects the protocol arrangements that were in place regarding communications?-- Yeah, I believed it was entirely appropriate, yes.

And it produced the desirable outcome of that protocol that there be consistent and robust information provided?-- Yes.

All right. Thank you. And you would agree with me that an assessment of whether rates of flow will produce damage in Brisbane is probably a matter for the judgment of the Brisbane City Council?-- Yes.

All right. Thank you. And, finally, the discussion that was had in the decision to remove that reference is also consistent with what you say at paragraph 229 of your first statement, in Exhibit 17, in that it has the advantage of keeping the FOC limited in focus in the provision of information role that it does have in its charge?-- Yes, that's correct.

Can I move to, then, please, to the final topic, and that is this issue of the decision to release for a period of time at 2000 CUMECS rather than 2,600 CUMECS. You are familiar with that issue?-- I am, yes.

Thank you. Now, I won't take you to it, but for the record, it's dealt with in Mr Ayres' statement number 2 as Exhibit 18 at paragraphs 386 to 389, and in statement 3, which is Exhibit 19, at paragraphs 9 and 12. Now, again, I want you to tell me do you agree with these propositions or if you disagree with them I want you to tell me how you disagree with them. Can I suggest to you that the discussions that you have referred to between the council officers and your colleagues in the FOC about the flow rates were the sort of interagency communications that are part of achieving the best overall result from an event like this?-- I believe it is, yes.

Right. Thank you. Those sorts of discussions are the discussions that the FOC routinely has with not only the Brisbane City Council, but with other interested agencies?-- Yes, that's correct.

Right. And in terms of achieving those responsibilities with which it is charged under the manual, which I have taken you to in a little detail earlier, you need to have those discussions so that you can achieve the optimum flood mitigation result on the basis of the information you presently have to hand?-- It certainly helps to inform them of those decisions, yes.

Indeed, it's part of that information and intelligence gathering exercise?-- Yes, that's correct.

Thank you. And, in particular, can I suggest to you that in terms of the decision that your colleagues in FOC made with the benefit of that information being provided by the Brisbane

City Council, that was a decision that was not only open to them but calculated to best give effect to Strategy 3 on the then information available?-- Yes, I agree.

All right. Thank you. And it follows that it was a proper interagency communications?-- I believed it's to be so, yes.

All right. Thank you. And when it became clear that that particular consideration could no longer be accommodated along with other more important considerations as events had unfolded, the FOC acted accordingly?-- Yes, I believe John and Terry, who were the duty engineers at the time, acted on the basis of the developing situation and recorded the entries.

Just as their decision to accommodate it for as long as they could was a proper one, you agree with me their decision to cease accommodating it was also a proper one?-- Yes.

Now, can I suggest to you that in light of all of the answers you have just given me, you would in terms reject that the discussions with the Brisbane City Council in any way amounted to any improper influence on the operations of the FOC?-- Yes, that's correct. I reject that assertion.

Yes. And, indeed, you would accept, wouldn't you, that not only was there nothing improper in it, but they were very proper discussions and acted upon properly to achieve the best overall outcome in the difficult circumstances that then pertained?-- Yeah, I believe so, yes.

All right. Thank you. Mr Ayre, thank you for your attention to my questions. Commissioners, that's the cross-examination.

COMMISSIONER: Thank you. Can I just ask you a broader question, which I think you have pretty much avoided in your statements on the basis that it it's really a political issue, but you might be able to help me with some Police practical implications. Is there, in your view, any practicable benefit from the point of view of the job you have to do in having a temporary lowering of the FSL when there is contemplated an extraordinary wet season so that you get, say, a 75 per cent level for a particular season which would give you, on my calculations, about 300,000 megalitres extra buffer?-- The 300,000 number is indeed correct. I believe the temporary reduction that occurred after the January flood was indeed appropriate in terms of the context in helping the recovery process. I have a little bit of difficulty assessing or accepting the fact that you would necessarily do it on a seasonal basis, only on - the problem about actually how do you assess or what sort of criteria would you use? I think the seasonal outlooks that are provided by the Bureau of Meteorology are very good in terms of providing awareness or the likelihood of events, but they don't necessarily actually quantify or, indeed, identify when those events are likely to occur. I think having a predefined set of rules under which to operate the dam is important and the full supply level is one of those factors in those rules.

So, you really don't like the idea about a season by season approach?-- I don't necessarily think it would assist. In an event like we just had, the magnitude of this particular flood and the preceding events, I think, would have really not made the lowering particularly effective.

Well, that may be true for this particular flood, it remains to be seen about Mr Malone's modelling, but we have to think also about other events which mightn't be of quite this magnitude?-- Yes.

There's a range of possibilities?-- It certainly would have an improvement on managing the smaller events. I guess the other side of the coin is then what impact does that have on the water security aspect, but I don't have anything to do with it.

I am asking you as a flood engineer and what you think about the prospect. You think it's all a bit too uncertain to be worth it effectively; is that it?-- Yes, yes.

All right. Thank you for that. We will resume at quarter to.

THE COMMISSION ADJOURNED AT 11.27 A.M.

THE COMMISSION RESUMED AT 11.45 A.M.

ROBERT ARNOLD AYRE, CONTINUING:

COMMISSIONER: Mr Flanagan?

MR FLANAGAN: Mr Ayre, can I take you to paragraph 142 of your supplementary statement, exhibit 18?-- Yes, I have it.

This refers to a situation report sent by Mr Ruffini at 6.12 a.m. on 11 January 2011. This is a report that you assisted in?-- That's correct, yes.

Thank you. May I take you to the section that deals at page 51 with the impacts downstream of the Wivenhoe Dam?-- Yes, I have it.

And you will see the paragraph that reads - or the sentence that reads: "Water levels in the lower Brisbane River will be impacted by the combined flows of the Lockyer Creek, Bremer River, local run-off and release from Wivenhoe Dam"?-- Yes.

You agree that the assessment of these impacts in this particular situation report were based, at least in part, on release rates from the dam of 2,750 CUMECS?-- It would have been in accordance with the last model run done, yes.

And you will see that modelling is contained under the heading "Wivenhoe Dam full supply level"?-- Yes.

You will see there the reference to 2,750?-- I do, yes.

Now, the impacts which you and Mr Ruffini identified in this situation report appear to be in relation to water levels in the lower Brisbane River, is that correct?-- Yes.

It does not contain any detail as to the potential impact of releases on the Bremer River itself or the general Ipswich area, does it?-- No, it doesn't.

Is there a reason for this?-- The hydrologic models that we use don't satisfactorily account for backwatering effects, so in that context we were not able to readily assess those impacts.

Right. At paragraph 139 of your supplementary statement, which is in the same document, you state that at 4 a.m. on the 11th of January 2011 you did some further modelling in the Flood Operations Centre?-- Yes.

What was the purpose of this particular modelling?-- At that point in time we were trying to accommodate the flows that

were emanating out of Lockyer Creek, and adjust the release rates accordingly from Wivenhoe Dam.

Is your modelling or this type of modelling that you did on this occasion provided to the Bureau of Meteorology?-- Yes. We provide actual and projected releases on a regular basis to both the Flood Warning Centre at the bureau and, indeed, Brisbane City Council Flood Information Centre.

Again, Mr Ayre, is there any part of this modelling which you carried out which sought to predict the possible impact of dam releases on the Bremer River and the Ipswich area?-- No, it was focussed on the Brisbane River.

May I take you then to paragraph 174 of your supplementary statement? This is a situation report for 6 p.m. on the 11th of January 2011. This is in circumstances where W4 stage had been reached by 8 a.m. on that same day, is that correct?-- That's correct, yes.

It notes in this situation report an increase of the release from Wivenhoe of 2,750 CUMECS to 6,700 CUMECS and subsequently to 8,000 CUMECS. Do you see that?-- Yes.

Was any modelling done prior to these increases on the 11th January 2011 with a view to determining the potential impact of these releases on the Bremer River and the Ipswich area?-- No, there wasn't.

COMMISSIONER: Is there anything to be done about that, the fact that you don't have the capacity to model for that flow into the Bremer?-- It would be useful, certainly in these circumstances, to have the hydrodynamic model available to undertake those assessments.

Any steps underway to make sure that you do for the future?-- Yes, we now have the alliance model which is being currently recalibrated to this particular event.

MR FLANAGAN: And, Mr Ayre, I take it that prior to January 2011 no modelling had in fact been undertaken by Seqwater in relation to possible impacts of differing releases from the Wivenhoe Dam in relation to the Bremer River and its tributaries?-- Not that I am aware of, no.

Whilst it is not stated at paragraph 174, the situation report issued at 6 p.m. also dealt with the impacts downstream of the Wivenhoe Dam, but rather than take you to the document, can you accept from me that it dealt with the impacts in exactly the same way as the previous reports had?-- I would believe that, yes.

So the impact that was identified was that water levels in the lower Brisbane River will be impacted by the combine flows of the Lockyer Creek, the Bremer River, local run-off and releases from Wivenhoe Dam?-- Yes.

Now, whilst there is a reference here to the Bremer River,

would you agree with me that it is in respect to the Bremer River's flow into the Brisbane River?-- Yes, that's correct.

Indeed, no part of that warning or that situation report would inform the Ipswich local disaster coordinator of any potential impacts from W4 releases from the Wivenhoe Dam on the Bremer River itself or its tributaries?-- That's correct, yes.

Now, what's the purpose then of issuing these types of situation reports with this little - or this information or this type of information to the Ipswich City Council?-- It is included in the protocol we have, to keep the local disaster members informed, but I agree there is scant information from which they can utilise.

Would you agree with me that the situation reports issued by Seqwater for the purposes of this event gave very little information to the Ipswich City Council for the purposes of planning?-- Yes, I agree.

Now, did you discuss with the three other engineers the possible impact - this is among yourselves - the possible impact that the increased W4 releases may have on the Bremer River itself?-- We did have discussions and were, indeed, referring to reports we had in association with the January 1974 flood, where it was evident there was backwatering effects in the Bremer.

Was it at all contemplated by yourself and the three other engineers that the size of the W4 releases on Tuesday the 11th and Wednesday the 12th of January could result in a back-up effect from the Brisbane River in the lower Bremer area?-- We were aware that that impact was likely to occur but we didn't feel we had appropriate means to assess or quantify that impact.

Do you recall that either yourself or the other engineers made a request to the bureau to examine scenarios of 9,000 and 10,000 CUMECS peak outflows from the Wivenhoe Dam?-- I believe John Ruffini and Terry Malone did request that of the bureau, yes.

And do you recall that you were also asked to request of the bureau some modelling as to how this or these proposed releases - at this stage theoretical releases, but we will come back to that - would affect predicted flood levels at Brisbane?-- Yes, we did have access to the bureau's registered user web page which provides copies of their model results.

Was this request also made in respect to Ipswich?-- The basin actually includes the Bremer River, so the Bremer River information is included in that access.

Rather than guess, can I show you - for the purpose of giving your evidence, have you familiarised yourself with the bureau's report to the Commission of Inquiry?-- No, I haven't, in fact, at this stage.

In any event, may I refer the Commission at this stage to paragraph 242 of the bureau's report to the Commission of Inquiry dated 4 March 2011? And if it is convenient, Commissioner, may I have that on the screen? This is in fact annexure JD1 to Mr Davidson's statement. Could you just read that passage commencing with the words "The bureau used the Seqwater advice of actual and projected releases in its Brisbane River flood forecasting model during the process of developing and updating predicted flood levels for Brisbane and Ipswich Cities." Do you see that?-- Yes.

Was it the case that you and the other engineers fed to the bureau information about actual releases from the Wivenhoe Dam?-- Yes, we did.

And predicted releases from the Wivenhoe Dam?-- We call them projected releases in that context, but yes.

Thank you. For the purposes of assisting the bureau in modelling the likely flood peaks for both the Brisbane River and the Bremer River?-- Yes, that's correct.

If you read on from there you will see that, "The bureau was also requested to examine scenarios of 9,000 and 10,000 CUMECS peak outflows from Wivenhoe Dam and how this would affect predicted flood levels for Brisbane and Ipswich." Do you see that?-- Yes.

To your own knowledge when was that request made?-- That would have been during the morning or mid-afternoon of Tuesday the 11th of January.

May I take you to the flood event log then, Mr Ayre, which is Exhibit 21? May I take you to the entry of 11 January at 1.26 p.m.? It reads: "Seqwater CEO called and requested the FOC request to the BOM to consider if Wivenhoe is releasing 9,000 CUMECS." Do you see that entry?-- Yes, I do.

Just so we can translate it into English, the Seqwater CEO is Mr Borrows, is it not?-- That's correct, yes.

So he called and requested yourself and the other four engineers to request the bureau to consider if Wivenhoe is releasing 9,000 CUMECS?-- I did not take that call personally, but, yes, I was aware of it.

Who took it?-- I can't recall whether it was John Tibaldi or Terry Malone at that stage.

Did they discuss the request with you?-- No, not at that stage.

When did you come to know that the CEO of Seqwater was requesting modelling to be done from the bureau in relation to this size of releases?-- It was probably around about 2 o'clock when we were doing the modelling.

If you look beside that log you will see flood officer 4 is recorded as the person who took the telephone call?-- Yes.

And that's Mr Tibaldi, is it not?-- Flood officer 4 is David Beccaria.

Thank you. Do you recall that the impacts sought from Mr Borrows was the impacts on both Brisbane and Ipswich?-- I can't recall, no. I can't recall that detail.

Now, if we put this into perspective, that's an entry for 1.26 p.m., is it not?-- Yes.

As at 1.26 p.m. on 11 January 2011, directives 15 and 16 had been issued, hadn't they?-- They had, yes.

According to paragraph 146 of your supplementary statement, you identify those directives but you don't tell us what the actual outflow from the Wivenhoe Dam was, but if we have reference to schedule 1A of your-----?-- Statement, yes.

-----statement, I think we can agree that the actual outflow from the Wivenhoe Dam at the time that Mr Borrows makes this request is approximately 4,250 CUMECS, is that correct?-- Cubic metres per second, yes.

Thank you?-- Yes.

Now, from your own knowledge and, indeed, your knowledge gained from speaking to the other three engineers, the modelling that was sought by Mr Borrows through you of the bureau in relation to Wivenhoe Dam releasing 9,000 CUMECS, did this reflect a view that the actual release rate as at 1.26 p.m. on 11 January was insufficient for the purposes of ensuring dam safety?-- Yes, we had not arrested the rate of rise in Lake Wivenhoe so we recognised that greater releases were needed.

May I take you then to the next relevant flood event log entry, which is 3.14 p.m. on the same day? This one states "Seqwater CEO called to discuss the proposed release of 10,000 CUMECS." Do you see that?-- Yes.

"Engineer 4 and engineer 2 explained the release strategy is constantly being revised." Who is engineer 4?-- That's John Tibaldi.

And engineer 2 you have told us?-- Terry Malone, yes.

Thank you. This is again a call from Mr Borrows, the CEO of Seqwater, is that correct?-- That's correct, yes.

Now, at this stage the request is not for 9,000, it is actually for 10,000, is it not?-- It is, yes.

Again, does this reflect the view that the release rate as at 3.14 p.m. was insufficient for the purposes of ensuring dam safety?-- Yes, that's correct.

Now, was that discussed between yourself and the other engineers?-- The call from Peter Borrows?

Yes?-- Yes, I was made aware that Peter had put that request in.

Now, by this stage did you then become aware yourself that what was being considered was releases in the order of 9 to 10,000 CUMECS?-- We were still trying to ascertain that number but it was certainly escalating quite rapidly at that stage.

Is the only reason we didn't get to this point of 9 or 10,000 CUMECS that by act of God it stopped raining on 12 January?-- No, I believe our increased - well, our strategy of reassessing every half an hour and making appropriate increases in the gate releases finally equalised the inflow and the release.

Only because it stopped raining?-- Not necessarily. The flows were still coming in from the rain that had already occurred.

Did you participate in these discussions with Mr Borrows directly?-- No.

Now, if we put this into perspective, at 3.14 p.m. you agree that directive 17 and 18 had been made. That's referred to in paragraph 159 and 160 of your supplementary statement?-- Yes.

Rather than you guess, can you accept from me that the release rate at this time according to schedule 1A to your statement was approximately 7,464 CUMECS?-- Yes.

You will see that immediately after the conversation with Mr Borrows at 3.14 p.m. that you report in paragraph 163 that at 3.15 p.m., almost as soon, it seems, as the phone is hung up, Wivenhoe Directive 19 was issued by Mr Malone?-- Yes.

Which was followed at 3.30 p.m. by Directive 20?-- Yes, that's correct.

Now, can you tell us as at - well, you have already told us or agreed that the release rate at this time with Directives 19 or 20 was 7,464, is that correct?-- I will just confirm - that release rate wasn't achieved until 7 p.m., so I think the release rate was slightly less. So at 3 p.m. the release rate was 5,167 CUMECS.

Thank you. And the maximum release rate of 7,464 CUMECS was not reached till 7.30 p.m. on the night of the 11th of January 2011; is that correct?-- That's correct, yes.

Now, I take you to the third entry on the Flood Event Log which is for 3.49 p.m., which states that, "The BOM" - sorry, do you have that, Mr Ayre?-- Yes.

States that, "BOM", the Bureau, "had a conference with Engineers 1, 2, 3 and 4." Does that include yourself?-- Yes, it does, yes.

Thank you, "About current release strategy and a possible maximum release scenario of 10,000 CUMECS." Do you see that?-- Yes.

It's the case, is it not, that the four engineers, including yourself, were seriously contemplating the release rate up to 10,000 CUMECS?-- We were certainly considering that it could actually achieve that magnitude, yes.

And prior to that contemplation, it is the case, is it not, that no modelling had been done by Seqwater or, indeed yourself or other persons, to your knowledge, that could have estimated the potential impact on both the Brisbane River and the Bremer River of such a release?-- That's correct.

Now, the Bureau did, however, in this telephone conversation give you some idea of what sort of impact that would have had, didn't they?-- They did. They made reference to the February 1893 flood peak at the Brisbane Port Office gauge.

And that's the 1893 event?-- 1893 event.

Can I ask you if you're asking the Bureau to model the scenes of 9,000 and 10,000 CUMECS, you are doing so in the context that both yourselves and the Bureau are in a crisis situation, aren't you?-- We were in - well, we were heading to strategy W4, so the situation was ensuring the security of the dam.

My point is this: the request for the Bureau to model possible releases of 9,000 and 10,000 were not theoretical, were they?-- No, they were in places potential contingency plans to allow as much advance planning as possible.

And by the engineers seeking modelling from the Bureau in relation to such releases, it was implicitly recognised that such releases would have impacts on the Bremer River, its tributaries, and the Ipswich City Council area?-- Yes.

From your own experience with this event, what was the event that caused the engineers to be able to avoid such massive releases from the Wivenhoe Dam?-- The event was our continual reviewing of the rate of rise of the storage and our reverse routing calculations determinate - to determine an appropriate release rate.

Intuitively, did the weather have anything to do with it?-- The fact that the intense rainfall did desist in the upstream areas and, in particular, on the immediate environs of the lake, certainly it was useful, yes.

Now, in your discussion with the Bureau of Meteorology in which you participated with the other engineers, you accept that the consequences of such releases on the Ipswich area, the Bremer River and the Brisbane River were discussed and contemplated?-- Yes.

And would you accept that the advice you were receiving from the Bureau is that such releases would have had a catastrophic effect both on Ipswich and Brisbane?-- Certainly we were aware of the magnitude and severity of those releases, yes.

Now, I need to ask you this: the advice from the Bureau, was that simply based on a scenario given the size of the releases, or was it modelling based on other issues such as the peak flow from the Lockyer Creek, the peak flow from the Bremer River, and local run-off?-- I believe it incorporated all of those factors, yes.

Now, do you accept that the reason that Ipswich was being considered in these discussions with the Bureau was because it was recognised by yourself, by you and the other engineers, that these releases do impact and have traditionally or historically impacted on the Bremer River and its tributaries?-- Yes.

Now, when you went to W4, did you and the other engineers have any idea from any information or any modelling how these releases were going to impact on the Bremer River at Ipswich?-- We had reference to previous hydraulic modelling studies that John Ruffini and I had both participated in, so we were aware of the potential for backwatering impacts into Ipswich, yes.

What were the age of these studies?-- They were conducted in the early 1990s, from around 1992 through to 1994.

And were these the studies that were actually commissioned by the Ipswich City Council itself?-- No, these were studies commissioned or - by the then Brisbane Area Water Board.

Thank you. May I move, then, to your statement of the 11th of April 2010, which is Exhibit 20? I wish to start with paragraph 52, Mr Ayre. May I refer you to the sentence - are you right?-- Sorry, this is the supplementary statement?

It's your statement of the 11th of April 2010, which is your response to Mr O'Brien. Paragraph 52, may I direct you to the sentence where you say, "It is correct to say that the high flow rates in the Brisbane River will result in a backwater effects in Lockyer Creek and the Bremer River and any other tributary for that matter." That's simply stating what's historically true, isn't it?-- That's correct, yes.

At paragraph 52, you state this, "It is not possible to conclude that releases from the Wivenhoe Dam increase flooding in Lockyer Creek and Bremer River without further hydraulic analysis."?-- Yes.

And this hydraulic analysis, we take it, has yet to be carried out?-- That's correct, yes.

If such an analysis had not been carried out, why is it, Mr Ayre, that you proceed in paragraphs 53 to 58 to seek to identify the impact of the releases from the Wivenhoe Dam on the Bremer River so as to conclude at paragraph 58, "Accordingly, the Wivenhoe Dam releases were timed so as to avoid the peak in Lockyer Creek and Bremer River and hence any possible backwater effects were limited."?-- Well, the peak out of the Bremer River occurred some, I think, 13 hours in advance of those releases - sorry, 13 hours after those releases.

I think my question is quite different?-- Sorry.

Having identified that one needs a hydraulic analysis to properly assess the releases from the Wivenhoe Dam and their effect on the Bremer River and Ipswich area, having identified that correctly, I might say, why do you go on to try to establish that "the effects from the releases were limited"?-- Yes, I guess probably the word "limited" is a bad choice, yes. They're unquantifiable at this point in time, from my perspective.

Understandably you may have stung by the criticism from Mr O'Brien. Were you simply seeking to answer that particular criticism?-- Yes, I was, yes.

All right. If we go to the conclusion, though, "hence any possible backwater effects were limited", can we understand that conclusion as simply saying this, is that even though you were in a W4 situation on the 11th of January, you were tempted to time the releases from the Wivenhoe Dam so that they did not coincide with the Lockyer Creek peak and the Bremer River peak?-- Well, we don't necessarily take into account the downstream tributaries when we are at strategy W4, so the timing thereof is circumstantial to some extent in that context.

I would have thought so. Isn't the timing of the W4 releases entirely predicated on dam safety?-- Yes.

Because if the dam was to fail, the 1893 flood would not appear as catastrophic as such an event as the dam failing?-- That's correct, yes.

So, was any attempt made to time the releases from the dam so as not to coincide with the Bremer River peak and the Lockyer Creek peak?-- I agree that that statement's is misleading. What I should have said properly was that the timing of those releases didn't necessarily coincide with the naturally occurring peak coming out - or emanating from the

Bremer River.

And may I suggest a more accurate statement was that you simply don't know until modelling is done as to what effect these releases had on the Bremer River?-- Yes, I'd agree with that.

To that extent do you draw the conclusion in paragraph 58?-- Yes, I would.

Thank you. In the last sentence of paragraph 55, you state that the estimated peak flows from the Bremer River was 2,793 CUMECS at about 9 p.m. on the Tuesday, the 11th of January 2011?-- Yes.

Which was before the peak releases from Wivenhoe Dam, and we know that the peak release from Wivenhoe Dam was 7.30 p.m.-----?-- Yes, that's correct.

-----on the 11th; is that correct?-- Yes.

And what you seem to be saying is that because of the 16 hour difference between the releases from the dam, they could not have had much of an impact on the Bremer River and the City of Ipswich; is that correct?-- I was indicating the concurrence of the peaks weren't necessarily coinciding.

When you refer to the peak flow in the Bremer River, so that we may understand it, are you referring to the peak flood level of the Bremer River?-- No, it's the flow rate, yes.

So, when you identify the peak flow for the Bremer River at 9 p.m. on Tuesday, the 11th of January, you will accept that the peak flood as advised by Bureau was, in fact, 16 metres?-- Yes.

And that the Bremer River itself did not peak until 1 p.m. to 5 p.m. on the 12th of January 2011 at 19.4 metres?-- Yes, I would agree with that.

Now, when it peaked at 19.4 metres, that is well and truly 16 hours after the releases under the W4 arrangements from the Wivenhoe Dam, aren't they?-- Yes.

So, one can't say or infer from what you have said here that the peak of the Bremer River, in terms of its flood peak, did not directly coincide with the releases from the dam?-- In terms of flood peak, in height, yes.

Having identified that, why did you use the term "peak flow" rather than "flood peak"?-- Because peak flow is the hydrologic modelling estimates I had.

In any event, you really can't assist this Inquiry as to the conclusions you have drawn until hydrological-----?-- Hydrologic - sorry, hydraulic modelling is done.

Indeed, a hydrodynamic modelling?-- One and the same thing,

yes.

May I turn to a slightly different topic, then, which is the modelling of Mr Malone which I understand from the evidence you gave to my learned friend, Mr Devlin, that you've adopted; is that correct?-- That's modelling that I'm aware of, yes.

I'm sorry, I thought your evidence was different, I thought you had adopted it? I might be mistaken on that, but I thought you agreed with it?-- I do agree with it, yes.

May I take you, then, to Mr Malone's statement, which is Exhibit 33? Have you got that in front of you?-- No, I do not have you a copy.

May I present you with a copy or it will be on the screen, in any event. While that's coming, would you agree that Mr Malone, Mr Ayre, has undertaken a modelling analysis to investigate and to refute two propositions: the first proposition which he seeks to refute by his modelling is that if the Wivenhoe releases were increased to 3,000 CUMECS at midnight on Sunday the 9th of January 2011, the peak of the flood in the lower Brisbane River, Moggill, would have been significantly lower. That's the first thing he models?-- Yes.

And the second suggestion is that if the level in the Wivenhoe Dam was at 75 per cent FSL, that is Full Supply Level, at the commencement of the January 2011 flood event, then the peak of the flood in the lower Brisbane River Moggill would have been significantly lower. You agree that they're the two criticisms made by Mr O'Brien that Mr Malone's modelling was seeking to refute?-- Yes.

Can we start with the first theory then? If you look at paragraph 3 of Mr Malone's statement, in relation to the analysis in paragraph 3, do you agree with this proposition, that analysis is based on the Wivenhoe Dam being at 100 per cent FSL?-- Yes.

Just to make it clear, we're not talking about releases commencing on the 9th of January where the dam is at 75 per cent FSL, it's where the dam is at 100 per cent FSL?-- Sorry, whereabouts in paragraph 3 are we looking?

What I'm suggesting is that the whole of paragraph 3 is based on that assumption?-- The whole of paragraph 3 is, indeed, based on the assumption that was in accordance with how the January 2000 event played out, so the starting level was, indeed - should have been 67.09 metres AHD.

Is that 100 per cent?-- It's slightly over.

It's slightly over 100 per cent. But it's still, for the purposes of our understanding Mr Malone's modelling, it's 100 per cent or over 100 per cent of FSL?-- Yes.

And would you also agree that the modelling is only based on

increasing releases from the 9th of January 2011 and no earlier?-- That's correct.

Whereas in effect or, in fact, as you well know you had commenced releases from the Wivenhoe Dam prior to the 9th of January 2011?-- And I will retract that actually. By looking at the plots in figure 1, the modified release rates actually track the adopted release rates up to that point in time.

I see. Thank you. But, in any event, it's releases from the 9th of January 2011 that the model is based on?-- The model incorporates the entire hydrograph and - but includes that modification to that time.

That was all very good, but I don't quite understand the answer. Is it the case that the modelling is based on releases only from the 9th of January-----?-- No, I don't believe so, it incorporates the entire event.

The entire event?-- Yes.

In relation to paragraph 5, the modelling of Mr Malone, if we look at that's 5(b) - if you read that first then I will ask you this question. It says, "Modelling of inflows to the dam shows that this deficit would have been filled and gate trigger level reached on early Sunday morning without any releases up to that time."?-- There were two separate models conducted here.

Yes?-- One was the adjusted release rates which are - was highlighted in figure 1, and then the second set of modelling was - is highlighted in figure 4, and figure 4 does, indeed, show it was storage deficit incorporated in accordance with the 75 per cent starting level.

Yes. But may I suggest this, that the modelling of Mr Malone is based on this fact, that you start at 75 per cent, you wait till that deficit of 25 per cent is filled so that one reaches 100 per cent FSL, then you start to release?-- Yes, that's correct.

Now, that modelling is, in fact, quite different to what was adopted by the government in relation to the operation of the Wivenhoe Dam from February 2011 to the 31st of March 2011, wasn't it?-- I am unaware of the modelling actually. I have not seen it.

May I just show you this document, and I need to go to Mr Borrow's statement for this purpose, and may we have up on the screen PB28? I might have been a bit loose in my language, Mr Ayre. I probably shouldn't have said modelling that led to the Government's position in relation to the February and March operation of the Wivenhoe Dam, certainly some study that was done in relation to what should be done?-- As I said, I'm unaware of the contents of that statement.

You weren't involved in that process?-- I was not, no.

You weren't invited to be involved in that process?-- No.

Is that surprising to you?-- Not necessarily.

Have you got that on your screen?-- Yes.

I am just using you now as a flood engineer, nothing more, so as a flood engineer, if you read that letter, you will see that under the heading, "The Revised Interim Program.", so there was a revised interim program done for the purposes of advising the government as to how the operation - how the dam should operate on an interim basis for February and March 2011; correct?-- Yes.

Were you involved in that process?-- No, I was not.

"If approved, it would authorise releases to affect the initial reduction in the water storage level of Wivenhoe Dam to an interim security supply level, being 75 per cent of its FSL from the 20th of February 2011." Can I just understand that first dot point? Is that saying that you initially release sufficient water from the dam, no doubt in a measured way, to achieve 75 per cent FSL?-- The arrangements that were put in place were the lake was drained over a period of nine days-----

Yes?-- -----as a release rate of approximately 400 cubic meters per second.

What was achieved was 75 per cent FSL at the end of that process?-- Pretty close, yes, not quite.

And Mr Ayre, if you read there - if you read on then, it says, "Thereafter on the 31st of March 2011", so we can take it that the dam is no longer being operated this way, at least up to the 31st of March 2011, "To bring Wivenhoe Dam back to the interim security supply level where inflows occur after the initial reduction", again, if we can put that into English, if you can agree with me, what that means is that you, by measured releases from Wivenhoe Dam, ensure that the dam remains at 75 per cent FSL; is that correct?-- They were operational releases undertaken by Seqwater, yes.

For the purpose of maintaining the dam at 75 per cent FSL?-- Yes, that's correct.

Now, that's the major difference, is it not, between this interim program and Mr Malone's modelling. Mr Malone's modelling waits for the dam to fill to 100 per cent FSL before any releases are made?

MR O'DONNELL: Commissioner, I object to the question. In my submission the question is on a wrong premise. My learned friend, if he looks at Borrows exhibit 27, he will see the legislative instrument under which the drawdown of the dam level was made. If he reads it carefully he will see it performs exactly to Mr Borrows' model. It is exhibit 27.

COMMISSIONER: We will have to look at that but I rather thought that Mr Ayre had accepted that there were being releases made to keep it at 75 per cent during this later period. So it doesn't matter very much what the legislative requirement is if, in fact, it was done in this way, does it? It doesn't mean that-----

MR O'DONNELL: No, no, the legislative instrument contemplates what happens if a flood event occurs while the level is drawn down. It says the manual applies. In other words, you don't start releasing in a flood event until the water rises back up to 67.

COMMISSIONER: But I had understood Mr Ayre to say - and I may be wrong about this - that when the 75 per cent level was achieved, it was maintained; that releases were made to maintain the 75 per cent level. Is that right, Mr Ayre, or not?-- Yes, I believe that's the case. That operational releases were made to maintain the 75 per cent during that particular time-frame.

COMMISSIONER: So that the premise of Mr Flanagan's question seems right.

MR O'DONNELL: No, the exercise Malone does is say what happens if a flood event occurs while the dam is drawn down to 64. And under the interim program if a flood event occurs, the water rises back up to 67 and it is only then that you start releasing.

COMMISSIONER: Well, that's fine, but I can't see the problem with Mr Flanagan's question. He is saying that what happened in practice here is different from what Mr Malone has modelled. What's wrong with that?

MR O'DONNELL: The talk of what happened in practice is maintaining it at 64 in the absence of a flood event. What Malone models is what happens if there is a flood event when it has been drawn down to 64.

COMMISSIONER: Sorry, Mr O'Donnell, you just haven't succeeded in clarifying to me what the problem is. I think the

question-----

MR O'DONNELL: I think it is my fault. I am obviously not communicating it correctly to you.

COMMISSIONER: I propose to let Mr Flanagan continue. It may become clearer. Mr Flanagan, I am not sure, do you appreciate the difference?

MR FLANAGAN: Not presently, but I had great difficulty hearing my learned friend. So, with respect to him, there may well be a difference but he can correct that, if necessary, in his examination of this witness.

COMMISSIONER: Thank you. You can continue.

MR FLANAGAN: Because he goes after me.

COMMISSIONER: Yes.

MR FLANAGAN: It is the case, is it not, Mr Ayre, that in relation to the operation of the Wivenhoe Dam, it had never before, until 8 a.m. on the 11th of January 2011, reached a W4 stage?-- That's correct. That's the first time we have operated in that strategy.

And you agree that once W4 is reached, the dam's flood mitigation function is greatly reduced?-- Well, the objective is dam security, and so flood mitigation is certainly a secondary consideration.

And, as I understood your evidence before, even in trying to time releases from the dam so as not to coincide with peak flows from other waterways, such as the Lockyer Creek or the Bremer River, that's just a matter of coincidence rather than good planning because you are at W4?-- That's correct, yes.

It was the case, Mr Ayre, wasn't it, that having reached W4, yourself, the other engineers and Mr Borrows were seriously contemplating releases from the Wivenhoe Dam that would have equated with other flow events as modelled by the bureau to an 1893 flood event?-- It would have been a very significant magnitude flood, yes.

Do you agree that for future purposes one primary object - or one primary objective has to be that the Wivenhoe Dam operates in such a way that the dam engineers are not faced with going into the W4 phase?-- I don't believe so. I think the design of the dam is such that it only has a finite capacity to handle extreme flood events even. So it would be inevitable that at some future time that you would actually have to invoke strategy W4. It is effectively only a matter of time.

As a matter of practice, though, isn't it better that steps are taken so as to take all precautionary steps to avoid such a situation arising again?-- I don't believe - I don't see how that can happen at this point in time.

I won't go any further because your Honour has already asked the crunch question.

COMMISSIONER: I am so sorry.

MR FLANAGAN: It is all right.

COMMISSIONER: You might want to explore it a little more, Mr Flanagan. Feel free.

MR FLANAGAN: No, your Honour. It was covered by, with respect, your Honour's question. That's the cross-examination of Mr Ayre. Thank you, Mr Ayre.

COMMISSIONER: Thank you. Mr MacSporran?

MR MacSPORRAN: Thank you, your Honour. Mr Ayre, you agreed with Mr Dunning earlier, I think, that when you and your fellow engineers make decisions as to which strategy to employ, and, indeed, how you will transition between the strategies, you make a number of quantitative assessments and qualitative judgments?-- Yes, that's correct.

What I would like to do briefly, if I could, is take you to what I hope you will agree are a couple of clear examples of where you have employed that strategy. Can I take you firstly to your first supplementary statement, exhibit 18? And take you to paragraph 97. And this deals with, does it not, the situation report at 6.30 in the morning of Monday the 10th of January?-- Yes, that's correct.

We can see what is set out in the situation report about the dam levels, the weather, impacts downstream of the Wivenhoe Dam. Then at paragraph 98 you set out a number of subparagraphs dealing with the key points you take from the situation report?-- Yes.

Then you say in paragraph 99, do you not: "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." And then critically in paragraph 100, you talk about "The best forecast information...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."?-- Yes, that's correct.

So is what you are saying there this: you do your modelling without reference to the rainfall that may or may not fall in the future, firstly?-- No, we - well, we do the two scenarios as discussed, and are aware of the synoptic situations that

surround the forecasts.

Sorry, what I meant to say, I suppose, is one of the models you do is without rainfall. We have seen that in your material?-- Yes.

And that's the hard figure, if you like, that you look at to initially success quantitatively what sort of releases are justified at that point in time from the dam?-- Yes.

But in doing so, you also factor in the forecasts and the likely effect - you make a qualitative judgment of the likely effect of those releases taking into account those other factors?-- The with forecast rainfall models do provide some information in terms of the interpretation of forecast. So that is taken into account, yes.

And is this paragraph 100 a good example of that process-----?-- Yes.

-----where you don't increase the releases that you determined were appropriate quantitatively based on the without rainfall figures because of the predicted rainfall downstream of the dam?-- Yes, it would be.

Because if you increased the releases that might have been permissible on the quantitative analysis, you could potentially have caused a serious inundation that wasn't justified downstream in Brisbane, Ipswich?-- We're certainly aware of the issues I have identified yesterday that we wish to avoid unnecessarily flooding or exacerbating flood conditions in catchments downstream of the dam.

So in the process you adopt, you do take into account the forecasts in that way?-- Yes.

Is another example - can I take you briefly to it - paragraph 139, I think it is, in the same statement? This deals with the following day. It is Tuesday the 11th. It refers to another model run at 4 a.m. And we see in subparagraph (c) the reference to the predicted maximum release rate which wasn't required until 2 o'clock the following afternoon, and was very close to what was then being released, and the figures are given there, 2,970 CUMECS as opposed to the then current release rate of 2,750?-- Yes, that's correct.

And you had it in your mind that the difference in those two rates could easily be made up in a single directive in a short space of time if needed?-- Yes.

You go on to say at subparagraphs (e) and (f) that you took into account the best forecast information that was available at that stage?-- Yes.

And that that indicated that the rainfall producing system was moving south and was contracting towards the coast. Now, that's the same system that you have taken into account the previous day in paragraph 100, isn't it?-- It is part of that

system, yes.

Which is an indication that you need to take that into account because it will impact upon the total quantity of water coming to Ipswich and Brisbane?-- Yes, that's correct.

From releases from Wivenhoe?-- Yes.

So in both of those examples, you have applied the quantitative assessments as well as the qualitative judgments that you make taking into account, as much as you can, the forecasts?-- Yes.

Now, the forecasts themselves, for reasons you have articulated earlier, have to be treated with some caution because of their demonstrated unreliability?-- Yes.

And the figures that you have referred to in your various statements of predicted and actual rainfall clearly demonstrate that reasoning, don't they?-- That quantifies the variation in the depths, yes.

And provides a very sound reason why you couldn't rely upon the forecasts alone to quantify actual release rates from Wivenhoe?-- Yes.

The bureau itself recognises the unreliability of that sort of forecasting, doesn't it?-- They have acknowledged that, yes.

Could the witness see, your Honour - it is a slide presentation that is attached to Mr Davidson's statement, I think.

COMMISSIONER: Did you say something about unreliability of forecasting?

MR MacSPORRAN: Yeah.

COMMISSIONER: Isn't that really a matter for submission, Mr MacSporran, rather than getting this witness to look at something that exists as an exhibit and say, "Yes, it is there."

MR MacSPORRAN: Your Honour, ordinarily it would be. I only seek to draw attention to it because this is a public Inquiry. There has been a lot of media reporting, which in our submission has been informed about the science.

COMMISSIONER: All right. You would like to have a look at this now?

MR MacSPORRAN: Just very quickly. It is one slide, in effect, or two slides. I don't think they are paginated. But if the witness could have a hard copy, and perhaps if it is available electronically - it is section 6 of the slide presentation of 8 April 2011, and it is section 6 in that, and by my calculations the sixth and seventh slides in that section. It is a slide headed "Quantitative Precipitation

Forecasts". Now, it is the third of those three statements that I want to draw your attention to, Mr Ayre. It clearly recognises the difficulty in relying upon such forecasts, doesn't it?-- It does, yes.

And is that the basis upon which you have not relied upon them, because of that unreliability factor?-- It is indeed, yes.

Can we just go quickly to the next slide, please, number 7? We see the last two highlighted paragraphs essentially make the same statement, do they not?-- They do indeed, yes.

One of the real difficulties you have is that the forecast of where the rain is going to fall, in particular, and, secondly, the intensity when it does fall in that area, can be very unreliable?-- That's correct, yes.

Now, can I take you quickly - you told Mr Devlin, I think, that the flood mitigation capacity of Wivenhoe was demonstrated to be alive and well during the January event?-- Yes, I believe it to be so.

And you have set out in your statement some figures that demonstrate that fact clearly, haven't you?-- Yes.

Could I take you then to your statement, exhibit 17, to paragraph 356? You talk there about the flood event in January this year actually consisted of two separate flood peaks arriving within close proximity of each other in the dam, is that so?-- That's correct, yes.

And that, in effect, caused the real difficulty with managing this event?-- Indeed. The second peak was effectively responsible for sending us into strategy W4.

W4, yes. The first peak was contained, the second peak couldn't be contained and you had to transition into W4?-- Yes.

You go on to say, as we've heard in the evidence already, on page 77, the bottom part of paragraph 356, "The peak water level in the dam was 74.97 metres"?-- Yes.

And that was reached at 7 p.m. on the Tuesday evening?-- I actually think it was 7.30 p.m., but yes.

Approximately that?-- Yes.

Then you mention key points in paragraph 357 after the diagram refers to those two peaks. You say - and you have mentioned this figure earlier, I think, that the mitigation capacity meant that the dam was 40 per cent lower than the peak - the outflow from the dam was 40 per cent lower than the inflow?-- Yes.

And that equates to the figures of the outflow at the peak was 7,464 CUMECS?-- Yes.

Whereas the peak inflow was 11,600 CUMECS?-- Yes, that's correct.

That's the flood mitigation capacity of the dam working as it should?-- Indeed. Even in strategy W4, yes.

You go on to refer to some modelling you did, and it has been done, at paragraph 371 of that same statement, and you give some indication of the - of some case studies that refer to various scenarios. We see (a) is the actual downstream estimated flow during the January event?-- Yes.

The second case is Wivenhoe could have retained all of the water which flowed into the lake-----?-- Yes.

-----as opposed to any releases being factored in. Case 3 is releases from the dam only, excluding flows downstream from Lockyer Creek, Bremer River, and rainfall in the Brisbane catchment, and case 4 and 5 for that fact referring to cases where neither Wivenhoe nor Somerset Dam actually existed?-- Yes, typically this was an extract of our Flood Event Report, and typically in Flood Event Reports we try to demonstrate the performance of the dam during flood events. So, indeed, we include those hypothetical cases where the dams are removed from the catchment.

And, as you say in paragraph 373, had the dams not existed - that's cases 4 and 5 in your modelling - the damaging flood would have lasted for about 12 hours longer in the Brisbane area?-- Yes.

And caused significant more damage for that reason alone?-- And including the peaks, yes.

And that equates, as you say in 377, as I interpret it, that the level at the Port Office gauge would have been about seven metres?-- Yes, that's our estimate, yes.

As opposed to - what was it in the event? 4-----?-- 4.46 metres.

4.46. So the 74 flood was 5.5, or thereabouts?-- 5.45 metres, yes.

And the 1893 event was just over 8?-- 8.36.

At 7 we get an idea of how damaging the flood level would have been absent those two dams?-- It would have been very substantial, yes.

But you go on to say at 377(b) that if there had been no releases from Wivenhoe - that's case 2 in your modelling scenario - there would still have been a moderate flood at the Brisbane gauge?-- Yes.

Is there any work that equates that moderate flood, as you refer to it, to an actual height at the gauge?-- It is - it

is reference to the Bureau of Meteorology's standard flood classification. So that's 2.6 metres at the Brisbane gauge.

Finally, can I ask you this: in terms of Mr Malone's modelling relating to the dam level being 75 per cent FSL?-- Yes.

As you understand it, is it the case that in that modelling he has taken the dam as being 75 per cent full but on the basis that if a flood event occurred, the dam, in accordance with the manual, would require the filling of the dam to 67 point whatever it is, the usual FSL-----?-- Yes.

-----before any releases commenced from the dam?-- It is my understanding that the interim arrangements were as such, that the normal Flood Operation Manuals would apply but only after the lake level had actually achieved the required gate trigger of 67.25.

So if you are lowering the dam to 75 per cent or 64 metres or so, all you are doing is providing a greater flood mitigation capacity by that flood storage area?-- It is the storage deficit, yes.

Of three point something metres, whatever it is, before the other operation comes into effect?-- Yes.

It would be a different scenario to model starting at an FSL of 75 per cent of the usual value and starting your releases as soon as the rain started, in effect, in a flood event?-- Yes, that would be a-----

A different outcome?-- -----different set of rules, basically, yes, so the gate trigger levels would all have to be adjusted accordingly.

And the modelling for that, as far as you know, hasn't at this stage been done?-- I am not aware of it at this stage, no.

All right. That's all I have, thank you.

COMMISSIONER: Thanks, Mr MacSporran. Ms McLeod, I think you are next.

MS McLEOD: Thank you, your Honour. Mr Ayre, I appear for the Commonwealth, in this case the Bureau of Meteorology. Could I ask you some more general questions about the reliability of forecasts and predictions, and you address these issues in your first statement in paragraph 199. I take it from the evidence you've given this morning, and leading into this afternoon, that as a general statement you agree that bureau forecasts, warnings and communications provide useful guidance to dam operators but they are not determinative of decisions about release or retention of water in the dams?-- Yes, they are extremely useful in forming, in general terms, the conditions that apply.

Now, if you look at paragraph 202 of your statement you are not saying, you make clear, that "The bureau or its staff failed in the performance of their jobs in any manner or that they lack any expertise; it is simply a function of the unpredictable nature of weather systems and the technology that's available to predict and quantify expected rainfall." If your evidence or the Seqwater report has been interpreted as being critical of the bureau, that would be wrong, would it not?-- That's correct, yes.

It is, as you point out in paragraph 203, the issues of uncertainty that surround the measurement of weather data, the interpretation of that data, and generally the science of forecasting?-- Yes.

Can I put it simply: forecasts point to a potential; they do not guarantee a result?-- Yes, I agree with that.

Do I understand you as saying that the differences in forecasts and actual rainfall is simply a function of - you point out unpredictable - that unpredictable nature of weather systems - let's look at that first. We will hear from Mr Davidson next but do I take it you are talking in this context about the strength of the La Nina?-- Yes.

You are talking about the fact that sea surface temperatures were very high-----?-- Yes.

-----from last year. The enhancement of the monsoon?-- Yes.

And extreme rainfall in south east Queensland?-- Yes.

Which obviously impacted on the saturation of the catchments?-- Yes, it contributed to the run-off generated, yes.

Now, you said it would be helpful to have some more information about unusual meteorological events?-- Yes.

Are you aware that the bureau forecasters are available directly to queries from Seqwater about meteorology?-- I am, yes.

Do you agree that the lines of communication between the Flood Operations Centre and the bureau are very good?-- Yes, I believe they are excellent and serve their purpose well.

You also in paragraph 202 point out to issues with technology and that could include, for example, malfunctioning measuring devices-----?-- Yes.

-----that fail to transmit data for one reason or another?-- Yes, that's true.

Or that might send inaccurate data?-- Corruption of the data is always an issue, yes.

In fact, in your statement you mention one of the gauges that was inundated?-- Yes.

They can include faults in relaying the information from the measuring device or station back to the base?-- Yes.

They can include the known limitations or margin of errors with each of those diagnostic tools and models that you list in paragraph 204?-- Yes.

And each has their own peculiar limitations, don't they?-- They do, yes.

And you are aware that the bureau is constantly working to improve the technology and reduce those margins of error?-- Yes.

However, the limitations remain?-- They do, yeah.

And those limitations are well known to Seqwater?-- Yes, they are.

The best way to assess as a general proposition what will happen with floods and the impact of floods is to review the actual rainfall data instead of the projections of rainfall, is that correct?-- Yes.

There are still then issues, once you have the actual data about rainfalls with extrapolating, or perhaps it is interpolating the data from a specific site or the gauge to a broader area?-- Yes, the interpolation is certainly one of the factors that can jump you to the uncertainty.

As you said yesterday, there are issues of uneven falls across a particular area?-- Yes.

Not just in the temporal distribution but in terms of the uneven intensity of falls?-- Yes.

There could be more falling between the gauges or there could be less?-- Yes, not all of the intense rainfall was necessarily captured.

And I think we all have that experience of seeing heavy rain in one suburb and less in the next suburb. That's just an effect of rainfall?-- Yes.

All of that impacts upon the flow of water in streams and rivers and into dams?-- Yes.

The data is then interpreted using various models and, again, there are a number of variables or uncertainties in the model parameters that are built into forecasts, assuming, for example, that historical conditions will be replicated?-- Yes, that's true. The model calibrations parameters are, indeed, based on historical events and not necessarily of the same magnitude as the ones experienced.

So in paragraph 204 you list the various tools that are available to you or available on the bureau website. You also receive the bureau warning products?-- Yes, we do.

The manual does not prescribe one diagnostic tool or model over another?-- No, it doesn't.

And the bureau doesn't - it might express cautions or limitations with each model but it doesn't tell you to prefer one model over another?-- No, it doesn't.

The quantitative precipitation forecasts are preferred by Seqwater for a number of reasons you mention. As you noted yesterday, they are issued twice daily for a shorter lead time of 24 hours?-- Yes.

And that compares with a three or four day outlook, or a seasonal outlook, or the general warnings?-- Yes.

You also noted they are specific to the catchments?-- Yes, that's the big advantage.

And they have another big advantage, I suggest, because they have the input of senior meteorologists?-- They do, yes.

And because they are quantitative as opposed to qualitative, they give you a measure or a range of expected rainfall?-- Yes, they do.

You will often see them expressed in terms of a range; for example, next 24 hours expect 50 to 100 mm of rainfall?-- Yes, that's correct.

And as I understand your evidence in the last hour or so, what you do is run two simultaneous inputs once you have those QPFs, one is based on rainfall as measured on the ground, which gives you a base level from which to make predictions about run-off based on what is known?-- Yes.

And simultaneously you will run the second based on a number within the estimated range of rainfall?-- Yes.

The QPFs, are you aware, are produced by the meteorologists who reconcile approximately five different models of rainfall?-- I understand they are based on an ensemble of orders, yes.

And the excess model that you refer to is also one of those models that is fed in?-- Yes.

Okay. Just to make the point, if you had a four day forecast for, say, the 9th or 10th of January of 400 to 600 mm of rain, that would tell you that there is an enormous volume of rain coming but it wouldn't tell you when?-- That's correct, yes.

If you had a QPF for the same day or the next day, say, of 100 to 150 mm in the catchment, that gives you precise information about what you should do in the next 24 hours?-- Yes.

You don't factor it in, as I understand, to your operations, but you do, as I understood your answer to her Honour, take it into account when you are moving towards a new strategy?-- Yes. And, indeed, the 24 hour forecast period is really the time-frame in terms of how far we look ahead in setting our operational - or the actual releases, as such.

Okay. You also have the various qualitative products that the bureau publishes and the various tools that you can read for yourselves?-- Yes, we do.

Like the radar results and the satellite results, things like that?-- Yes.

The QPFs give you an indication not of volume of falls within a particular timeframe, but just the rainfall over that 24 hours?-- It's a catchment average rainfall, yes.

And as we've already covered, it doesn't give you an indication of where within the catchment the rain is likely to fall?-- No, that's correct, yes.

Each of which is relevant, of course, to working out from your point of view what's going to flow into dams and what's going to flood into rivers below dams?-- Yes.

The various tools that the BOM provide are published as we know. Are you familiar with water and land forecasts known as WATL?-- Yes, I am.

Sometimes depending on what information Seqwater is after, those tools, like ACCESS and the WATL products are preferred by you?-- Yes.

Depending on what you're looking for?-- Yes.

So, for example, when you are looking at where a system is likely to impact, you might look to those tools rather than the QPFs?-- Yes, that's correct.

Or, for example, where one tool might take into account more recent Bureau data, so, for example, if you have a QPF issued at 4 p.m. and you're looking for flood predictions based at 5 a.m. in the morning, you might look at more recent publications?-- Yes, that's correct.

COMMISSIONER: Ms McLeod, can I just ask you, how much longer do you think you will be? I don't want to bind you to anything, I just want to know whether we should take the lunch break?

MS McLEOD: I think we should take a break actually, your honour, because there are some matters raised by Mr Flanagan I do need to get some instructions about, communications with the BOM offices and so on.

COMMISSIONER: We will adjourn then until 2.30.

THE COMMISSION ADJOURNED AT 1.02 P.M. TILL 2.30 P.M.

THE COMMISSION RESUMED AT 2.32 P.M.

ROBERT ARNOLD AYRE, CONTINUING:

COMMISSIONER: Ms McLeod?

MS McLEOD: Thank you, your Honour. Mr Ayre, I was asking you about various Bureau products that are available to Seqwater and the Flood Operations Centre. These published tools and warnings are also supplemented during floods by a frequent and direct e-mail and telephone communications with Bureau Flood Warning Centre, are they not?-- They are indeed, yes.

Now, I have mentioned the Bureau cautions in terms of reliance on forecasts and your own awareness of the limitations of forecasts on small catchment areas. You were taken yesterday by Mr Devlin to an e-mail from Mr Baddiley to Mr Drury sent in December last year?-- Yes.

Please tell me if you want to see it again, but it appears in various places, if the Commission pleases, including Mr Tibaldi's statement, JT1, an e-mail of the 1st of December last year. Now, that e-mail was sent, as you understand it, was it not, in the context of discussions with the Bureau about the availability of short term forecasts of large rainfall events?-- Yes.

And Mr Baddiley produced the response that he and Mr Bergin had prepared on the 24th of July 2006, and Mr Devlin took you to that as well?-- Yes.

In summary - the letter speaks for itself, of course, but in summary, back in 2006 the Bureau was emphasising this cautionary approach to both a quantitative precipitation forecast, the use of them, and the numerical weather prediction models?-- Yes, they do.

The Bureau noted back in 2006 that they showed considerable error or uncertainty in the prediction of location, amount and timing of rainfall events at the catchment scale, despite improvements at the larger scale?-- I can recall that, yes.

Did you participate in the technical meetings in October /November last year between Seqwater and the Bureau?-- No, I did not.

Okay. Do you understand the purpose of those technical meetings was to discuss and refine technical capabilities and arrangements in flood prediction and warning for the Brisbane River?-- Yes.

I should say the Brisbane City Council participated in those as well. The Bureau noted their concerns then by reproducing

this letter of 2006 about the state of accuracy or inaccuracy of the QPFs-----?-- Yes.

COMMISSIONER: Ms McLeod, is there much point asking Mr Ayre if he wasn't there?

MS McLEOD: I will move on, your Honour. In summary, it's the aim of both organisations to continue to improve these capabilities and the arrangements on an ongoing basis; would you agree with that?-- Yes.

In your second statement, at paragraph 109, you mention an e-mail - if you have that paragraph now, you refer to an e-mail from the Bureau Flood Warning Centre which noted flash flooding in the Lockyer Creek?-- Yes.

And you mentioned the discussion between the Flood Operations Centre and the Flood Warning Centre at paragraph 114 onwards?-- Yes.

Those discussions concerned the magnitude and the timing of the arrival of the peak of the flood in the Lockyer Creek, did they not?-- They did, yes.

The Flood Operations Centre needed to take those flows into account for an assessment of the impact of releases on the Brisbane River levels overnight on the 10th and 11th of January?-- That's correct, yes.

And that was about 8 p.m., was it?-- Around about 8 p.m. that evening, yes.

Were you aware at that time there had been issued on the 10th of January a flood warning at 4.16 p.m. which specifically mentioned Brisbane City?-- Yes, I was aware.

Okay. Incidentally, are you aware that the flash flood warning posted by the Bureau on 10th of January is not a usual Bureau product?-- Yes, I am.

You would, therefore, know that the Bureau does not issue flash flood warnings?-- Yes, I'm aware of that.

Do you understand why?-- Yes.

Could you tell the Commission why they don't do that?-- It's just such short response and on such localised scales that reporting that sort of information is very difficult.

In terms of the short scale, a flash flood is considered to be one that develops within six hours of rainfall?-- Yes.

In terms of the local knowledge, that can include topography, the creek systems, infrastructure and things that the Bureau is simply not aware of at a local scale?-- That's correct, yes.

Okay. The Bureau predictions are for catchments across

Queensland, not for individual creek systems, are they?-- That's correct.

COMMISSIONER: Ms McLeod, wouldn't all this be better put to your witness when he turns up, not that he's your witness actually, but Mr Davidson? I understand you want to get this across to the public, but I don't really see the point of doing it through Mr Ayre, who is a flood engineer, not someone employed by the Bureau.

MS McLEOD: I think I have finished that line of questions, anyway, your Honour. The last thing I need to ask you about is at paragraph 165. You refer to a teleconference with the Bureau on the 11th of January at 3.49 p.m.?-- Yes.

Now, there had been at approximately 1.30 p.m. on the 11th of January a communication to the Bureau of a significant change to the release strategy that was signalled. You are aware of that?-- I am aware of that.

And the difference was essentially an increase from - an expected peak of between 3 and 4,000 CUMECS to around six and a half thousand CUMECS?-- Yes.

You'd also asked the BOM to consider the impact of around 9,000 CUMECS at around that 1.30 p.m. time?-- Not me personally, but the Flood Operations Centre.

Yes, I'm sorry, I should have specified that. The Bureau proceeded to model the outcomes of that new six and a half thousand CUMECS maximum peak and produced - discussed that with the Flood Operations officers at 3.49?-- Yes.

Prior to the issuing - just before that teleconference, they had issued a flood warning at 3.24 p.m.. Were you aware of that?-- I can't recall that one, no.

I should ask: you did you participate in that teleconference at 3.49 p.m.?-- Yes, I believe I was there.

The 3.24 flood warning issued by the Bureau for the Lockyer, Bremer, Warrill and Brisbane River below Wivenhoe, including Brisbane City, made mention at that time of the 1974 flood peak expected at Brisbane City gauge and, for Ipswich, reaches of at least 22 metres during Wednesday and further rises. So, do you recall whether those matters were discussed in the teleconference with the Bureau?-- I do have a recollection of those numbers, yes.

And those were predicated upon the releases of six and a half thousand CUMECS?-- I believe that to be so, yes.

You indicated, I think, in your evidence that it wasn't - you didn't need to proceed with a 9,000, 10,000 CUMECS releases

because of the rerouting calculations you'd undertaken?-- Yes, that's correct.

Yes. The effect of the Bureau warning at 3.24 p.m. was, I suggest, that Ipswich had at least 24 hours lead time of a flood of at least 22 metres and Brisbane City had a lead time of approximately 36 hours for floods exceeding the 1974 peak; do you agree with that?-- Yes.

This is, in fact, I suggest, an example of an efficient exchange of information between the Bureau and the Flood Operations Centre?-- I'd agree with that, yes.

And the net result was that Ipswich, Moggill and Brisbane - well, Ipswich and Moggill had a warning about flood levels with about a 24 hour lead time, as I said, and Brisbane had about a 36 hour lead time?-- Yes.

Thank you, Mr Ayre.

COMMISSIONER: Mr Telford?

MR TELFORD: Thank you, your Honour. Mr Ayre, good afternoon. My interests involve the operation of the Splityard Creek Dam?-- Yes.

I have only two matters that I'd like to clarify concerning your evidence. Can I ask you to take Exhibit 18, which is your statement made 29 March, and turn to page 58, please, and also you have in front of you paragraph 8.1 of the Wivenhoe and Somerset Flood Manual. Do you have those?-- Yes, I have those.

Mr Ayre, at the commencement of paragraph 172, you describe a communication made to Tarong Energy?-- Yes.

It's the case, isn't it, that Tarong Energy complied with that request?-- They did indeed, yes.

Thank you. And cooperated with Seqwater?-- They did, yes.

Yes. Can I take you to the last sentence in paragraph 172?-- Yes.

The 300 millimetres that you referred to there you take from paragraph 8.1 of the manual?-- I believe I do so, yes.

That's not a calculation that you have arrived at yourself?-- No, not in that context.

Can I suggest to you that if you look at paragraph 8.1 of the manual, the figure of 300 millimetres involves two variables? The first is an input effectively of the entire volume of Splityard Creek Dam, 28,000-odd megalitres?-- Yes, it would.

And the second input is that discharge occurring at or about FSL?-- Yes, that's correct.

Neither of those things happened on this occasion, did they?-- No, that's right.

And, in fact, when you refer to the figure of 300 millimetres at paragraph 172, you are talking about initially an interaction or a conversation that occurs shortly prior to 6 p.m. on the 11th of January?-- Yes.

So, the reference there to 300 millimetres being added to the height of Wivenhoe Dam is not something that happened on the 11th of January?-- No, that wouldn't have been contemplated at that time.

Yes, thank you. Those are my questions, Commissioner.

COMMISSIONER: Thanks, Mr Telford. Mr O'Donnell?

MR O'DONNELL: Can I show you this, please? Did you recall - it's the attached report I'm interested in, Rainfall Forecast for the Wivenhoe Dam Catchment."?-- Yes.

You have seen that before?-- I have, yes.

Around the time it issued?-- Yes, I believe it was some time in December.

And this was giving advice to the flood engineers specific to what reliance they can place upon the Bureau's rainfall forecasting in making decisions about the management of Wivenhoe Dam?-- Yes, it was.

Can I direct your attention to the second page, paragraph 6? Would you mind counting down with me to about halfway through the paragraph, there's a sentence, "Whilst it is not considered", do you see that?-- Yes.

"Whilst it is not considered that this will provide a sufficiently accurate method for objective decision-making for prereleases from Wivenhoe Dam, the probabilistic rainfall forecast may provide a basis for a risk management approach." Has that sentence, read in the context of the rest of the advice here, influenced the extent to which you as the flood engineer place reliance upon forecasts of rainfall and making decisions whether to release water from the dam?-- It is a consideration we take into account, yes.

In what respect or in what way?-- It's, I suppose, a judgment in terms of how reliable or how much uncertainty is associated with those forecasts.

In other words, the weight you put upon-----?-- Yes.

-----forecasts or modelling?-- Yes.

In particular, if someone was considering whether to move to a W4 strategy or not, given what you have told us here of the consequences of that strategy, what weight, in your opinion, ought to be placed upon modelling done with forecasts?-- I would - I certainly wouldn't be relying on that approach solely, I would have to be very sure, and in consideration of page 29, the second paragraph in the manual, in fact, I would be putting - placing more weight on the actual lake levels in - before I invoked Strategy W4.

In other words, whether the level was at 74?-- Or close to, with a high degree of confidence that it would exceed EL74.

Thank you. Has any advice been issued from the Bureau, so far as you know, saying that reliance to be placed upon its forecasts has improved significantly since this advice was given?-- No, I don't believe so.

Thank you. I will tender that document, your Honour.

COMMISSIONER: Exhibit 36.

ADMITTED AND MARKED "EXHIBIT 36"

MR O'DONNELL: Now, can I take you to something else? You can close that up, Mr Ayre. I would like you to have before you the model runs, which are now Exhibit 22-----?-- Yes.

-----the manual, the Flood Report and your second witness statement, which is Exhibit -----?-- I don't have the Flood Report with me.

If you go first to the model runs, Exhibit 22, and turn to model run 22, this is the model run on Sunday, the 9th at 8 p.m.?-- Yes.

And Counsel Assisting the Commission took you to page 120, which is the model Wivenhoe Dam level lakes?-- That's right. That's on the screen, yes.

And he showed you that the blue line exceeded the 74 level?-- Yes.

And one of the questions he put to you was along the lines of, "Well, there you are, the model shows above 74, so that's an appropriate justification for moving to W4 strategy on the night of Sunday, the 9th."?-- In light of the discussion we have just had, I would suggest that we would be relying more

heavily on the actual lake levels approaching the EL74 before we would actually invoke Strategy W4.

That's the area I want to explore with you. What I would like to do is imagine we are back in the Flood Operations Centre on Sunday the 9th and can we look at what was actually happening on the dam and what information was available to you as overall flies on the wall. Can we do that?-- Yes.

Now, firstly, can we look at the physical situation at the dam? I think you will find some information about that in the Flood Report. I will go to page 157. Now, at page 157 is part of a section called, "Dam Inflow and Flood Release Details." ?-- Yes.

And if we can look down the left-hand column of page 157, for the 9th of January we see an entry at 8 p.m.?-- Yes, I do.

Which is the same time as the model-----?-- Model run, yes.

-----Counsel Assisting took you to, and if we look across to the right-hand examine columns, we see under the second column, "Lake Level.", the level of the lake at that time?-- 69.1 metres AHD.

Right. So, it's got nearly five metres to rise before the lake level actually crosses the 74 threshold?-- Yes.

Can we look across to the right-hand side of that page? See the columns, "Total Outflow.", and, "Total Inflow."?-- Yes.

Can we see from those what was the outflow of the lake at the time?-- The release was 1,419 cubic meters per second.

And the inflow?-- 7,338 cubic meters per second.

And can we also some of the other considerations applying at the time that are described in your second witness statement, if you wouldn't mind looking at pages 26 and 27? Page 26 at paragraph 76 commences with the situation report at about 9 p.m. on the 9th, so about an hour later than the time we're looking at?-- Yes.

Can you highlight for us what are the key features in that that bear upon this question of should you go to W4 at this time?-- The fact that there was heavy rainfall that had been recorded particularly in the upper reaches of the Brisbane and surrounding catchments which then flowed into Lake Wivenhoe and Lake Somerset.

All right?-- The other important features of it are the actual recorded - the lake levels at that particular time.

The 69.1?-- Yes.

All right. You also discuss at paragraph 78 and 87 a need to

close bridges before the releases are dramatically increased?-- Yes.

And that had yet to happen?-- No, Mt Crosby Weir Bridge and Fernvale Bridge, the Brisbane Valley Highway was still open at that stage.

So, they would have to be closed before you could ramp up that-----?-- Yes.

Let's say that Counsel Assisting the Commission though is there, he's standing in the room with you, and he's pointing

to that blue line and saying, "Time to move to W4." Let's just assume that for the moment. You're the senior engineer, it's your call?-- Yes, I would resist the suggestion, because I wouldn't think it was appropriate at that stage, given that the lake level was still at 69.10 metres.

Would you take into account the consequences if you then moved to the W4 strategy?-- The consequences would be very significant, yes.

Let's think about those for a moment. If we look at the manual as to what it tells us is to happen under a W4 strategy - I am looking at page 29 - about halfway down the page, under the paragraph commencing, "Under Strategy W4.", "The release rate is increased as the safety of the dam becomes a priority.", and then the next statement rather suggests the opening of the gates is to occur until the storage level at the Wivenhoe Dam begins to fall?-- Yes.

Now, as you would apply that in practice, does that mean you increase the gates until the outflows exceed inflows?-- Yes.

Now, if we look at the inflows to Wivenhoe Dam on this Sunday evening, if we go back to the Flood Report page 157? Can you tell us what the inflow was at the time?-- The inflow at 9 o'clock?

8 o'clock, I think it was?-- Oh, 8 o'clock when the model run was down was 7,338 cubic meters per second.

So, you would have to increase the releases until you had reached that figure or at least until that figure diminished below the release level?-- Yes, that's correct.

If you had began opening the gates up to release that sort of rate on the Sunday evening, given the flows from Bremer and Lockyer into the Brisbane River, can you give us some idea of what might have been the consequences in Brisbane?-- I believe very significant flooding would have occurred in the lower reaches of the Brisbane River due to the combination of the releases and the downstream tributaries.

So, does that mean water over people's floors?-- I believe it would be certainly a major flood in Brisbane.

The maximum release date from Wivenhoe in the January '11 period was about seven and a half thousand CUMECS, wasn't it?-- Yes.

So, you would be looking for release rates close to that?-- We're - just looking at the inflows, they don't peak until 8 a.m. on the Monday morning, so I would expect actually the release rates to be somewhere between 7,000 and, indeed, 10,000 cubic meters per second.

What would you say to residents of Brisbane who came to you and said, "Well, you flooded my house, but you didn't need to. Wivenhoe was still five metres below the 74 level. You

flooded my house on a forecast that the rain might not fall, it might not fall as much as the Bureau has said, might fall else where."?

COMMISSIONER: That's a rhetorical question, is it, Mr O'Donnell?

MR O'DONNELL: I am inviting a response from Mr Ayre.

COMMISSIONER: Well, what would you say?-- Well, I'd have to agree, there's no guarantee that rainfall in a forecast would necessarily occur in terms of the depth or the location that's been specified.

MR O'DONNELL: Would you say that this highlights the dangers of moving to a strategy like W4 based upon a forecast?-- Yes, I do believe that's the case.

And it highlights the W4 is more something of last resort rather than something you go to unless you're forced to?-- It's certainly a decision that we - or don't take lightly and, indeed, is only taken when there is little other alternative in which to deal with the flood.

Can I move from there? Counsel Assisting put to you that following that model run 22 there's a series of model run all showing the blue line over 74. So, I want to take you to a number of time periods between that Sunday evening and the Tuesday morning and get your assessment of the situation and where it was appropriate to move to W4 at other times as well. Can we look - you're on that nightshift, that Sunday night?-- I was, yes.

You finished the nightshift about 7 a.m. on Monday morning?-- Yes.

Can we look around the end of that shift on Monday morning? I think you will find the appropriate model run is number 25. Page 138 I am looking at?-- Yes.

Again, it shows the blue line above the 74, about 74 and a half?-- Yes.

The red line was well below, it was below 73?-- Yes.

Can we look at what's the physical situation of the dam at this time? Do we see that in the Flood Report, page 157, the 10th of January? I am looking at the entry for 6 o'clock, towards the end of your shift. We see that the level of the lake is now 70.96?-- It's just been scrolled off, sorry. Yes.

So that's about 71?-- Yeah, very close to 71 metres.

So it still has three metres to rise-----?-- Yes.

-----before you cross the 74 line. The outflows are 1,806 and the inflows are 9,312?-- Yes.

And you describe the situation in your second affidavit at page 35. There is a condition report you quote from just at the end of this shift. Could you tell us what would be the material considerations you think would favour or be opposed to moving to W4 strategy at this time?-- The situation I believe in the Upper Brisbane, the levels had actually peaked and were now starting to fall, so indicating that at least in the Upper Brisbane catchment the inflows were diminishing. It is certainly a large event by any standards, rivalling that of the February 1999 flood, but an event I would expect, given the current lake level, could be contained within the strategy of W3.

Would you see it as a situation where the safety of the dam was under threat?-- Not at that stage.

Or a situation where it was necessary to cause releases which would produce urban flooding at Brisbane?-- No. At that stage I believe we could limit the releases to maximum of 4,000 cubic metres per second as required in strategy W3.

Was there a further consideration described in paragraph 100 and 101 of your statement? Was that a material consideration?-- It was a material consideration, that we were aware that the forecast was suggesting the rainfall moving further downstream from Wivenhoe Dam and, indeed, starting to impact on the lower downstream tributaries of the Bremer River and, indeed, Metropolitan Brisbane.

Can I take you to one other document on this topic? It is in flood report page 19? That's the Flood Event Summary-----?-- Yes.

-----which concludes on Monday the 10th at 9 a.m., so just shortly after your shift comes to an end?-- Yes.

It is on the right-hand column, the last dot point. Could you explain that? That was part of your thinking at the time?-- Yes, it was, although at 9 a.m. I wasn't necessarily on shift but the duty engineers, John Tibaldi and Terry Malone, they would have contributed to this. Effectively, we believed we could actually contain this flood using strategy W3 and limit the releases at that stage to less than 4,000 cubic metres per second.

So your strategy was to avoid urban flooding in Brisbane?-- Yes.

And the statement says "until it was certain it could not be avoided"?-- That's correct.

Had you reached that stage, given the level of the lake?-- No, we did not believe so.

All right, thank you. Then can I move to another time, please, when you start your next shift, which is on the evening of Monday the 10th. The closest model looks to be 31. Could we have a look at that, please? I am looking at page 109. Again, Counsel Assisting would point out the blue line is over 74 and here the red line is somewhere between 73 and 74?-- Yes.

So it is approaching 74?-- It was, yes.

What were the conditions - or how would you assess the conditions, whether they favoured or did not favour moving to a W4 strategy at that stage?-- At that stage we were still of the opinion that the lake level would be contained below an elevation of 74 and thus not necessarily require the strategy W4 to be invoked.

And the lake level at that time?-- Did you say it was 22:00 hours? 20:00 hours. The lake level was 73.06 metres.

We see that on page 158. Finally, then, the area Counsel Assisting took you to, the following morning, Tuesday the 11th. He took you to model runs at 3 o'clock and 4 o'clock?-- Yes.

If I take you back to those? Your model run of 34 and 35. 34 shows the red line just touching 74?-- Yes.

35 shows the red line just nudging over 74?-- Yes.

In terms of the manual, do we have a situation where the water has yet reached 74?-- No, these were still predicted levels, so they were predicted to occur at 14:00 hours on the 12th, so the following day.

And do we see from the flood report page 158 the level of the lake at that time was about 73.4?-- Yes.

So it has still got 600 millimetres to rise?-- Yes.

What were the factors which were in favour or opposed to moving to W4 at this time on the Tuesday morning?-- Well, we certainly were running out of freeboard between the actual lake level and the threshold of invoking W4. At that stage our model predictions were suggesting that if, indeed, we did exceed EL 74 it would not necessarily be by a large margin. So on the basis of trying to maximise protection to downstream areas, we were having to maintain the strategy W3 for as long as possible.

Have you discussed this in your second witness statement at paragraph 139?-- Yes, I do.

And does that reflect you actually gave consideration to

moving to W4 at that stage?-- I believe it - we did contemplate whether we needed to but at this point we determined there was no immediate threat to Wivenhoe Dam in terms of security of the dam, so we continued to implement strategy W3.

And did you also speak to the Director of Dam Safety, Mr Allen, about whether it might be permissible to exceed 74 without invoking W4?-- Yes. About 9 p.m., I think it was, the previous evening we did have a discussion with Peter along those lines. Peter agreed in principle that he could consider the senior flood operations engineer using discretion provided the lake level didn't exceed EL 74 by more than a small amount, normally 100 to 200 millimetres, and for a relatively short duration, so less than 12 hours.

All right. That was using your discretion under 2.8 of the manual?-- To be able to do so we would have to apply to Peter to seek use of that discretionary power, yes.

Right. And are those conversations referred to in your witness statement at paragraph 117 and 118?-- Yes, they are.

And also 123?

COMMISSIONER: Mr Ayre, did you find the conversations with Mr Allen in those paragraphs?-- Sorry, yes, I did.

Thank you.

MR O'DONNELL: You can close that up, thank you. Can I ask you something else? If you go to the flood report, please, to page 140.

MR DEVLIN: Commissioner, I am having difficulty hearing counsel's questions. I am sure the rest of the room is as well. I am right behind him. I am just wondering if he will speak up?

MR O'DONNELL: I will try. I want to ask you a question on a different topic. Counsel Assisting asked you about a number of operational decisions that might or might not be made when managing the flood crisis?-- Yes.

But he didn't ask you the so-what question; in other words what difference would any of those have made. I would like to get you to stand back a bit from the flood event and look at the overall picture of the size and the consequences of the inflow of the water. I ask you to do it with hindsight. If we look at page 140 of the flood report, can we see there a comparison of this flood event with other flood events?-- Yes.

If I could just focus on the '74, the '99 and the 2011 flood events. If we look in the second column to the right under the heading "Wivenhoe", against the 2011 flood event we see the total inflow 2.65 million megalitres?-- Yes.

Compared to the '74 flood which is 1.41?-- Yes.

And that must be a calculated inflow, assuming Wivenhoe had stood at that time?-- It is a volume flowing past the location Wivenhoe would have been, yes.

Against February 1999, 1.22 million litres indicating that the 2011 event was roughly twice the size of either '74 or '99?-- In volumetric terms, yes, it was certainly more than 200 per cent compared to the others.

Can we also look at the rate of the inflow into Wivenhoe? If you go back to (iv) in that report, please? Does the Commission have a copy of the flood report?

COMMISSIONER: It is being put up in front of me.

MR O'DONNELL: I am interested in the figure 9.1.2 in the flood report. The dark blue line which starts in the bottom left-hand corner indicating the inflows to the dam. You see the distinguishing feature of the two large spikes in the middle of the page in the dark blue line?-- Yes.

Being the two major inflows to the dam?-- They were, yes.

All of which takes place between about Sunday the 9th and the end of Tuesday the 11th?-- Yes.

So roughly three days?-- Yes, a very short duration event in the context of the flood volume.

And could I ask you to assume the calculation, if you take from the 2.65 million megalitres, the inflows before and after the 9th to the 12th - in other words, you are just looking at what was the inflow on the three days, the 9th, the 10th and the 11th?-- Yes.

We get a calculation of about 1.55 million megalitres?-- I believe that would be close to the mark, yes.

So you have got about 1.55 million megalitres flowing into Wivenhoe over three days?-- Yes.

Your flood capacity between level 68 and 74, if we look at what that capacity is compared to an inflow of 1.55?-- Notionally we have 1.42 million megalitres of flood storage available.

I am interested in the levels between 68 and 74. If you look in the manual, please, if you go to page 52. That's appendix C to the manual?-- Yes.

Now, down the left-hand column we have the levels and in the next adjoining columns we have the storage capacity and the flood capacity?-- Yes.

I am interested in the flood capacity which you see starts at zero at level 67?-- Yes.

If we look up to level 74, the flood capacity is 910,000 megalitres?-- Yes.

So if my figures are right, the inflow on the three days is about 1.55 million megalitres, it is well in excess of the storage capacity between level 67 and 74?-- Yes.

Did that have some - looking at it with hindsight - some inevitable consequences for the management-----?-- Certainly the characteristics of the event being a double peaked and effectively a back-ended loaded storm, meant that the size of the event during those periods was in excess of what is physically available in the flood mitigation compartments of Wivenhoe Dam.

Does it have any consequence in terms of the inevitability of going to a W4 strategy and therefore releasing high rates of water?-- Well, the effect of it means you have got no other option, yes.

So whether you enter a W4 strategy on the Sunday night, or the Monday morning, or the Tuesday morning, with hindsight was it inevitable, given the rate of inflow that you would have to go to a W4?-- I believe it would have been, yes.

And therefore it would have been in combination with flows from the Bremer and Lockyer flooding into Brisbane?-- Yes.

Thank you. You can close that up. Just a few last topics before I sit down. My learned friend Mr Rangiah who was sitting here asked you some questions this morning about whether there should have been higher releases on Saturday the 8th?-- Yes, I recall that.

Would you mind looking at the flood report at page 156? I am interested in the entries on the 8th of January. We can see in the - if you look on the right-hand side of the page under the headings "total outflow" and "total inflow", a comparison between the inflow to the dam on Saturday the 8th, hour by hour, as against the outflows from the dam?-- Yes.

Can you - by reference to those can you make any comment on his suggestion that circumstances on Saturday the 8th warranted higher outflows?-- Certainly the releases being made at that time were at or near the actual inflows, so if we were making greater releases then we wouldn't be acting as a flood mitigation storage.

He also suggested that if there had been higher releases on the Saturday the 8th, that would have led to lower releases being necessary on the following Tuesday and Wednesday. I think you agreed with that. Can you comment on what effect that would or would not have had on flooding on urban Brisbane?-- I believe it would not necessarily have had a material effect necessarily. It would be less than 300 millimetres.

Can you look in the flood log, please? If you go to the 10th of January - I am looking at page 85 - the 12.55 a.m. entry. "Reference: Engineer confirmed that if flows were kept below 3,500 the fuse plug would be triggered"?-- Yes.

Can we test that against the model run being done close to that time?-- Yes, we can.

Can we look, please, at - I think it is model 23 is the closest in time. What I might do is take you to the summary of model runs in volume 1 of the flood report?-- I have actually got the numbers here, yes.

You have got it? All right. I am looking at appendix A?-- I am just looking at my schedule 1A.

That's fine. Can you tell us, please, what's the predicted rate of flow at Moggill - the 1 a.m. model run taking into account the predicted releases from Wivenhoe?-- The rate for model run 23?

Yes?-- Is this with or without Wivenhoe releases?

With Wivenhoe releases?-- The rate of release at Wivenhoe with - sorry, rate of release at Moggill with Wivenhoe releases for model run 23 is 3,240.

So it is below the figure of 3,500 CUMECS?-- Yes.

What rate of release is then contemplated at Wivenhoe?-- Sorry, I didn't hear that?

What was the maximum rate of release being contemplated for Wivenhoe?-- Under strategy W3 maximum rate from Wivenhoe is 4,000 CUMECS.

No, but at the time of that model run?-- At the time of that model run what was Wivenhoe releasing?

What was the predicted peak hour flow from Wivenhoe?-- 2,700 CUMECS.

So both the Wivenhoe predicted peak release and the predicted peak at Moggill were below 3,500?-- Yes.

What was the predicted lake level at the peak at Wivenhoe?-- The predicted lake level for run 23 with no further rain included is 72.9 metres.

Can you see on that model run an objective basis for fear that if the flow from Wivenhoe is kept under 3,500 CUMECS, or the flow at Moggill has to be kept under 3,500 CUMECS that the fuse plug could be triggered?-- No.

Thank you. You can close that up. One last topic I wanted to raise with you, something Counsel Assisting the Commission raised, whether the introduction of the fuse plugs in 2005 reduced the flood mitigation capacity of the dam?-- Okay.

Can I come at it this way: is it right that both before and after the fuse plugs were introduced, the manual for Wivenhoe prescribed 74 metres as the height at which strategy W4 should be introduced?-- Yes. That trigger levels remained constant.

So in other words, both before and after the fuse plugs, once the water level got to 74, the instruction was release water from the dam to the extent - to the point where outflows exceed inflows?-- Yes.

So it wasn't a case that before the 2005 fuse plugs, damage engineers could retain the water in the dam above 74 up to the crest of the dam but after the fuse plugs they couldn't because the fuse plugs would be triggered?-- No, no, that's not the case.

And is it right also that after the fuse plugs were introduced, in an extreme situation where the inflows to the dam - where the water level was above 74, radial gates were opened, the fuse plugs are triggered. If the inflow to the dam continues to be higher than the outflow, the dam would still retain water up to the crest of the walls which had been increased to 80 metres?-- Yes.

So in that sense its flood mitigation capacity had been enhanced?-- Yes, that's correct.

Thank you.

COMMISSIONER: Yes, Mr O'Donnell. Mr Schmidt?

MR SCHMIDT: Good afternoon, Mr Ayres. There have been references to the 1893 flood. Would you agree that the 1893 flood was a natural event without the impact of water impoundments?-- Yes, it occurred before any major dams were constructed in the Brisbane catchment.

Isn't it the case that in 2011 the flood water velocity was influenced by a peak release in excess of 7,000 CUMECS?-- Certainly downstream of the dam the velocities would have been affected by the releases, yes.

Thank you. Can I refer you to the Seqwater report on the operations of Somerset Dam and Wivenhoe Dam - I am sure we are fairly familiar with this by now - Exhibit 22? This is the model lake levels.

COMMISSIONER: Would you like a particular page put up, Mr Schmidt?

MR SCHMIDT: Page 82, sorry. It's model number 23. Had you been using the with forecast rainfall - that's the blue line - modelling at this time, then is it true that you would have had the opportunity to increase the releases within W3 or move to W4?-- Well, that's not we've interpreted the manual, so we wouldn't have used that consideration.

Would it be at all possible for you to have done that?-- I-----

Using those best forecast rainfall figures?-- It's not keeping with the way we interpret the manual.

Okay. I then refer you to the graph in figure 1 on page 2 of the second statement from Terrence Malone. You have been referring to this over the period of today and yesterday. Do you have a copy of that?-- No, I don't have a copy of that.

COMMISSIONER: We will get it put up, Mr Schmidt. That won't be a problem. You are looking at that now, Mr Ayre?-- Yes, I am.

MR SCHMIDT: Thank you. I refer to the graph on the second page, and I am just looking at the peak release from Wivenhoe. Sorry, Madam Commissioner, I am just trying to imagine what that peak would have been like in Fernvale if it was a 10,000 cubic metre peak. That was a peak of over 7,000 cubic metres?-- Yes.

And had the dam been releasing water earlier at the 3,000 cubic metre mark, as the model says, even though it goes against the manual, the peak would have been substantially reduced to just over 4,000 CUMECS; is that correct?-- In accordance with modelling that Terry's presented there, yes.

As you stated, as Mr Malone, this would have little effect on the peak flow at Moggill?-- Yes, I believe that's the case.

It would be slightly lower, though it would have little effect?-- Yes.

Okay. Would a substantial drop in the release rate like this, in your opinion, have had an effect on the peak flows at, say, the Savages Crossing gauge at Fernvale?-- It would have had some effect, yes.

Could you say as a hydrologist approximately how many metres lower it would have been with 3,000 CUMECS?-- Oh, no, not off the top of my head, in terms of - I am not that familiar with the rating curves.

Sorry, I thought you would have been, being an experienced hydrologist in the area, sorry. It may be a couple of metres difference?-- I wouldn't expect it to be necessarily more than two metres, no.

Are you aware that the township of Fernvale was inundated during the peak release for approximately eight hours on the night of Tuesday and early Wednesday morning and the levels were actually in excess of 1974?-- Yes, I was aware of that.

So, bearing that in mind, are you aware that the township of Fernvale is within the SEQ regional plan and part of the urban footprint, so is, therefore, classed as urban area?-- No, I wasn't actually aware it was-----

Okay. Well, it is, it is, I can vouch for that. So, then maybe perhaps by using that earlier release strategy, you could have dropped the level in Fernvale by one or two metres, which was about all that inundated the houses, and saved that urban area from inundation?-- Unfortunately the justifications earlier in the event I don't believe were there in terms of interpretation of the manual.

That's all, thank you.

COMMISSIONER: Thank you, Mr Schmidt. Now, I think we're back to you, Mr Devlin.

MR DEVLIN: Yes, I have only got a couple of matters.

COMMISSIONER: Actually before you do, I will just ask my fellow Commissioners if they have any questions.

MR CUMMINS: Just one question, Mr Ayre. What are the adverse consequences of triggering the first fuse plug, given that you can compensate for the outflow by a relatively minor adjustment of the gates?-- The - well, the adverse or disbenefit of the fuse plug going is for subsequent follow up floods in terms of - it then becomes essentially a fixed crest spillway which requires the modification of the gate strategies, but that can be accommodated. It's the reconstruction of that particular fuse plug is, I suppose, a disbenefit in that sense.

Can you quantify that?-- No, I'm not sure exactly how much material is required.

Fair enough.

COMMISSIONER: Mr Devlin?

MR DEVLIN: Yes, thank you. Mr Ayre, just a couple of matters. We have heard some discussion about the cooperation between the Flood Operations Centre and Tarong Power at Splityard Creek, but does the Flood Operations Centre have any power to direct hydro operations at that location to cease?-- I don't believe it's in the manual, no.

It can ask the operator to cease?-- We can certainly request it, yes.

To make that or to give the Flood Operations Centre that power, does that add anything to the way the dam then ultimately can be managed?-- I don't believe so, provided there's - the cooperation was continuing between the two entities.

Okay. So, do you think it would make any difference if there was a power to direct?-- Not necessarily, certainly not in this case.

At least so long as the cooperation continued, I suppose?-- Yes, that's correct.

All right. Finally, in answer to Mr Dunning, one of Mr Dunning's questions, you said words to this effect, "If the models are consistent, we are comfortable. If they are diverse, we are on notice of a possible change and we notify the authorities of possible bridge closures, for example, and perform more frequent modelling."?-- Yes.

Do you remembering giving an answer like that? If we go to your Schedule 1A - sorry, first of all, did you mean if the numbers for the predicted lake level start to diverge between no rainfall - no predicted - no forecast rainfall and the other figure-----?-- Further rainfall, yes, that's the case.

If they start to grow apart, you're saying to yourself, we have got a developing future situation?-- Yes.

We will, therefore, have to model more frequently?-- Yeah, we certainly need to keep a close eye on the situation as it develops.

Which causes more frequent modelling?-- Yes.

As those figures, the two figures of the two models, diverge?-- Yes.

Now, do we see evidence of more frequent modelling in your Schedule 1A over to the right there where you have got the various models, model runs noted?-- I believe so, and they correspond to - well, the first and second peaks, as I see it.

Yes. So, at the top of that Schedule 1A - I don't need to take you to it - we see the model runs more scattered, albeit regular, but then we see them very close together, hour by

hour?-- Yes, we start off normally every six hours as we get into the event, and, as you say, as we got into the rapidly developing situation, we were running models effectively hourly.

As those figures diverged?-- Yes.

And those two figures are partly built on rainfall outlooks?-- Yes.

COMMISSIONER: Was it because the figures were diverging or because the lake was going up that you were doing more?-- It's a combination of both, but the - taking into account that, indeed, if the lake levels are going up, it must mean the forecast rainfall is actually on the ground and so we can put a bit more weight into those particular forecast runs.

MR DEVLIN: Thank you, Mr Ayre.

COMMISSIONER: Mr Callaghan?

MR CALLAGHAN: Well, that last answer probably picks up on the one thing that I really wanted to clarify, and that is what weight is attached to the forecast rain predictions in determining the prediction of the lake level, not the prediction as to the strategy or releases or anything else, just the lake level? What weight, if any, is attached to the forecast rain when making a prediction as to the lake level?-- No, we rely more heavily on the models, we have no - no rain predictions.

So, the answer to my question is none? When you say "more heavily"-----?-- They're not considered strongly, no.

Or at all?-- Oh.

Just for that prediction?-- For that prediction, yeah. In most cases it wouldn't be included, no.

And certainly not in this case anyway?-- Yes.

And can we just clarify one thing which probably covers all of your evidence? Were you actually there in the Flood Operations Centre when W4 was formally adopted?-- Not when it was formally adopted, no.

That was after run 37?-- Yes. I'd left the flood room around about 7 a.m. and only returned at about 12.30 p.m. on the Tuesday.

All right. Thank you. And it follows from that, I suppose, that when we have been talking about transition to W4, you had been speaking about what the practice is or ought to be as you have understood it?-- Yes, that's correct.

Yes. And in that regard, in terms of the transition between

the strategies, at one stage, I think during Mr Rangiah's cross-examination of you, you said, "It's not a step/jump process between strategies, it's a gradual transition."?-- Yes.

But at least let's just confine ourselves to considering W4. The fact is you're either there or you're not, isn't it? The strategy is either in play or it's not?-- When you have decided that it's inevitable that the lake level will exceed EL 74 then, yes, you are committed to that strategy.

So perhaps the thought processes about the strategy are an evolving process?-- Yes.

It's a gradual movement in your state of mind towards the declaration of W4?-- Yes.

But once you reach that point, it is, indeed, a step/jump to W4?-- It is, yes, that's fairly distinctive, yes.

And there's only one consideration?-- Yes.

One primary consideration?-- One primary consideration, yes.

Given that - it may not matter so much - but I do want to clarify just one part of the transcript, I anticipate the transcript from this morning will read. You will recall that you were being asked by Madam Commissioner about how long you might be in transition for, and Madam Commissioner asked you is it an hour, is it 36 hours, and you said yes. That all happened very quickly. I wasn't sure whether the "yes" was adopting the hour before the 36 hour question came or not. Do you recall that exchange?-- I do, and it was an agreement that the transition can actually take a variable amount of time for certainly the lower level objectives.

Yes. What about the - but I think, as I said, you probably clarified the actual transition only takes as long as it takes to say?-- Yes, "we are now committed to that strategy."

Obviously, you are thinking about it for a long time before that?-- Yes.

Okay. That's all I have, thank you, Madam Commissioner.

COMMISSIONER: Can Mr Ayre now be excused?

MR CALLAGHAN: Yes, after all that.

COMMISSIONER: You will be relieved to hear that, I imagine.

WITNESS EXCUSED

COMMISSIONER: Who is your next witness?

MR CALLAGHAN: Mr Davidson. Can I say about Mr Davidson, from the Bureau of Meteorology, that his evidence is relevant to more than one Term of Reference, more than one topic. He will be called next week in Toowoomba and we anticipate that he will be called again later in these sittings in relation to issues such as early warning systems generally. So, I will be submitting to the Commission that the questioning for Mr Davidson at this stage be confined, so much as it can be, towards questions relevant to the Wivenhoe issue. Obviously there will be overlap. We are not seeking to confine cross-examination unnecessarily, I suppose, just putting everybody on notice, as I think they were already, there will be other opportunities to explore other issues with Mr Davidson at a later stage.

COMMISSIONER: All right. That seems entirely rational. Does anyone know what that volume still remaining in the witness box is?

JAMES THOMAS DAVIDSON, SWORN AND EXAMINED:

MR CALLAGHAN: Could you tell the Court your full name and occupation?-- James Thomas Davidson, regional director, Bureau of Meteorology, Queensland.

Mr Davidson, there are a number of documents which have been prepared for the assistance of the Commission by you. There is, firstly, a statement dated the 4th of April 2011?-- That's correct.

Yes. I tender that.

COMMISSIONER: Exhibit 37.

ADMITTED AND MARKED "EXHIBIT 37"

MR CALLAGHAN: That statement also includes the report provided in response to a request for information from the Queensland Flood Commission; is that correct, Mr Davidson?-- Yes, that's correct.

All right. You have also prepared a revision of preliminary meteorological and hydrological information background briefing; is that correct?-- Yes, that's right.

I tender that.

COMMISSIONER: Exhibit 38.

ADMITTED AND MARKED "EXHIBIT 38"

MR CALLAGHAN: And, finally, for the assistance of all present, you have actually prepared a presentation referable to the weather events of late last year and early this year; is that correct?-- Yes, that's correct.

Just tell us the form of that presentation, that is to say is it on a disc, or-----?-- It's on a USB stick, although I believe the Commission does have a copy.

Yes. I will tender the presentation.

COMMISSIONER: Exhibit 39.

ADMITTED AND MARKED "EXHIBIT 39"

MR CALLAGHAN: And I think at this stage with leave, Madam Commissioner, it might be appropriate if Mr Davidson simply gave the presentation.

COMMISSIONER: Is this going to involve a laser pointer?

MR CALLAGHAN: I hope so. We have got one especially.

COMMISSIONER: Do you think you will be pointing to things, Mr Davidson?-- I will just see - no, I don't think it will - I don't think it will work, Commissioner. I can't see the - no.

Do you need to point to things?-- I will get around it, Commissioner, thanks.

Thank you?-- Okay. Now, good afternoon, everyone. Through the Commissioner, I can go as quickly or as slowly through this presentation as you wish. So, I am in your hands as to how fast I need to go.

All right. What do we want first up, next page, next slide?-- Sorry, next page, yes. Okay. I have got one corporate slide at the beginning, and all this does is say the Bureau of Meteorology is a Commonwealth agency, and in the context of this Inquiry, the legal basis for our activities in disaster mitigation is the Meteorology Act of 1955, the Commonwealth Act, and the Bureau does contribute to all aspects of disaster management, including planning, preparation, response and recovery, and later on I will say a few more words about that. Effective partnerships are the key to success in disaster management, so the Bureau works very

closely with State disaster managers and State and local governments in order to routinely provide the best possible meteorological and hydrological advice and warning service. This presentation is in nine parts. As you heard at the outset, this particular session of the Inquiry will not look too closely at the events that unfolded, the tragic events that unfolded in Toowoomba and the Lockyer Valley. There are probably about half-a-dozen slides that relate to those events, so I will quickly skip through those when the time comes. So, the first action is our Bureau offices networks and the main purpose of this slide is to say that the heart of our operations here in Queensland is the Queensland regional office, which is just around the corner, and in the Queensland regional office you find the Brisbane Regional Forecast Centre and colocated with the Forecast Centre is the Queensland Flood Warning Centre, and the Queensland Tropical Cyclone Warning Centre. There's about 150 staff in Queensland. During the recent floods and Cyclone Yasi we did supplement our staffing with valuable support and assistance from our colleagues from around Australia. So, our numbers were bolstered during that period at times by 10 or more. Okay. Our Weather Watch Radar network - we now have 14 Weather Watch Radars in Queensland with one more to go in into Mt Isa in the next 12 months or so. The flagship of our radar network is the Doppler radar at Mt Staplylton near Brisbane. That has the capacity in Doppler mode to see out to about 150 kilometres, which extends to about 25 kilometres west of Toowoomba. The other radar, which has Doppler capability, is the Gympie radar, although the Mt Staplylton radar is definitely the more high performing one. There's redundancy in the network as far as South East Queensland here is concerned. We can see the greater Brisbane area from at least three radars, the Mt Stapylton, the Marburg and the Gympie radar.

Would you mind explaining the Doppler capability, Mr Davidson?-- Okay. In very simple terms, Commissioner, it relates to the - to the ability to estimate the speed and direction of the low level wind. It sees not only precipitation but also wind flows. Okay. Here we have a map of the Queensland weather observing stations. We have over 100 AWSs, the Automatic Weather Stations. At least eight or 10 of those are on inshore or offshore reefs as a frontline defence against tropical cyclones, we are able to monitor tropical cyclones when they're still a fair way off the coast. The other 90 or more are over the mainland. Besides our weather station network, we have field observers in the offices, which you may have seen on the previous slide, which provide manual observations several times a day or more. Now, once again, in the context of this Inquiry, these are maps of our flood warning rainfall and River Height Stations in Queensland and for those who are able to read the words down the bottom, the Flood Warning Centre and the other warning centres and the Regional Forecast Centre has access to about 2,200 stations owned by the Bureau and various partner agencies providing rainfall and/or water level information, and about 60 per cent of those stations transmit their data feeds directly into the Regional Forecast Centre and the warning centre. You can gain an appreciation there of the red

dots, they're our high level ALERT station networks. They're heavily clustered around the main population centres. I guess there's very good reason for that, that's where the people are most vulnerable, we have more people in those areas. There was a comment made, I think it was yesterday, about the adequacy of the networks. Even though those red dots may seem as if there's lots of them, we can always do with more. There are various ways we have of collecting the flood warning data, ranging from the manual observations, which we receive by remote observer terminal and telephone, through to the more sophisticated networks which involve the ALERT system, VHF radio communication, and these ALERT systems, and there's quite a number in Queensland, have a base station and ground stations, and they're ideal in a sense for - they're an ideal network for establishing a flash flood warning system. The ownership of the 2,200 stations used for flood warning in Queensland, the Bureau itself owns about 40 per cent. We share ownership with another 20 per cent or so and other agencies, such as Seqwater, Sunwater and local governments and the like own the other 40 per cent. Once again, if anyone does want - through the Commissioner, if someone does want to ask a question, please do. This is just a flow diagram of meteorological and hydrological information and how - what sort of information we gather, which feeds into our database, not only from other agencies, as I have already referred to, but satellite and radar. The amount of satellite data is growing exponentially. Almost every few years, a lot more radar data is getting into our database. There on the right, for those who can see it, we have pluviographs, that's the rainfall registrations, and along that part of the diagram too we talk about storm spotters, and we won't be talking much about those today but in Toowoomba next week we will be referring to them, and all that data feeds into our computer models, and the next slide will show the access model in a minute, but before we do that, if you can just go back a sec, I'm sorry. I just want to make a point here of the two orange boxes at the base there, one is labelled, "Forecast and Warnings.", and the other is, "Briefings." We see our complete forecast and morning package as including extensively liaison and briefings with our many stakeholders. So, in that, "Briefing.", box is all the media crosses and the like that we do, and the many, many briefings we do to local government, to emergency services and the like, and Seqwater during events, and, as I said, all our data feeds into, in the Bureau's case the ACCESS model. That's our numerical model which is based on the UK Met Office Unified Model. It's run at various resolutions. The global model in that suite is run twice a day and the output from that model goes out to eight days. The higher resolution model surrounding the cities, the main capital cities, the model output from those runs goes out to 36 hours. Thank you. Okay. I was asked to do a 101 on La Nina and the associated climate phenomena, so I will do that now, and the first slide - I have tried to capture in - on one slide what a La Nina is. Just excuse me a moment while I just get a bit more organised. Okay. When you talk about La Nina and its partner El Nino, it's really a major shift in weather patterns across the Pacific, usually in one to three year cycles. So, what we have is a large scale

oscillation across the Pacific between La Nina and El Nino and some people refer to that as a see-saw effect. This particular slide highlights La Nina, which, of course, we have had over the past six months or more now, and I know I can't point - I can here. Okay. And when we do have a La Nina situation over northern Australia, we see relatively low pressures, warm oceans, increased cloudiness, and together they induce a higher likelihood of rain and tropical cyclones which once again we saw this particular summer.

When we have those conditions around northern Australia out in the central and further out in the Pacific we have the opposite; high pressures, cool oceans, decreased cloudiness, and a lower likelihood of rain and tropical cyclones. Now, perhaps the principal way we have of measuring how strong a La Nina is or how strong an El Nino is is what we call the Southern Oscillation Index - or SOI is the acronym - is the normalised pressure difference between Darwin and Tahiti. So when pressures are high in Tahiti, as they are at the moment, and low in Darwin, you end up with a positive SOI. So that's pretty well it in a very few short words. The other strong influence we have at this time of year is the monsoon. The Queensland wet season officially extends from October to April, although in the last season it did start a bit earlier than that. We had our wettest September on record, but officially normally from October to April. And during that wet season we would normally see three or four bursts of the monsoon, and that's been pretty much the case this year, although some - one or two of those bursts of the monsoon this year have stayed around a bit, they haven't kept going, and that's - that was one of the reasons we had the rain continue for more than just the normal week or so. In a couple of cases the rain persisted for a few weeks. But in a typical wet season we normally find that the dryer half of the cycles between the bursts of the monsoon is actually longer than the period the rain is with us. But not so this year. The rain periods actually lasted overall longer than the dryer periods. Okay. Just having a look at what we normally did expect in terms of rainfall in La Nina years, this particular map is 12 strong La Nina years, summer rainfall, and there will be quite a few - well, a number of maps in this presentation which are decile maps - and at the outset I should briefly explain that with these decile maps, the darker the blue colour - there is a fair bit of blue on that one and green - the more above average the rain is. And the darker the red colour colours - there is no red on there, or very little - the darker the red the more below average. So what we find on average during strong La Nina years is above average rain over pretty well all of Queensland, and in some cases very much above average rain. The opposite - no, keep going, sorry. The opposite El Nino years is quite interesting. This is 12 moderate to strong classic El Ninos in our database, and the bias is nowhere near as strong as it is during La Nina years. You will see far northern Queensland, there is definitely a reduction in rain on average in El Nino years but not so much over southern Brisbane, including the greater Brisbane area. If we're forecasting an El Nino, it doesn't necessarily mean conditions will be relatively dry, and I will have another slide in a minute, but last year, for example - last reason, for example, the Southern Oscillation Index was negative, which one would expect would be a relatively dry year, a relatively dry season, but it wasn't. For two reasons: (1) there is no clear bias and we will also see in a minute that the other reason was the ocean temperature surrounding Australia were quite warm even during our El Nino years, which is not what we normally see. The distribution of cyclones between El Nino and La Nina years is quite marked. During El

Nino years, the spread across the specific is quite - it goes as far east as Tahiti, or even a bit further, whereas in La Nina years, the cyclones are more clustered in the Coral Sea and close to the Queensland coast with very few out further east. So it does have a bearing on the distribution of cyclones as to whether we're heading into a La Nina or El Nino. And you will see that reflected in our seasonal outlooks as you would have last year. Okay, I will be very quick on this one. We have had four tropical cyclones this year. Tasha was the first and, of course, that was the beginning of a big wet between Christmas and New Year. I'll talk a little bit more about that in a minute. Zelia had little impact on Queensland. Cyclone Anthony was a category 2 at landfall and that was the forerunner to Cyclone Yasi. The media at the time were billing that as little and big brother and we had Yasi come ashore just days after Cyclone Anthony. Just for the record we call Tropical Cyclone Yasi a marginal category 5 at landfall. The post analysis we have done so far more or less confirms that. The information we do have to hand suggests that it was a borderline category 5 at landfall but you will hear more about that in coming months.

I don't know that we will, Mr Davidson?-- The Commission won't but the media probably.

Right?-- Okay. That's a good point, Commissioner. Southern Oscillation Index, as I said this is perhaps, along with sea surface temperature, is one of the indicators that we use to distinguish El Nino and La Nina. You will see this is a plot from 2006 through to the present and those - I haven't got a pointer - but the four marked periods you see there, two La Ninas followed by an El Nino and then the recent La Nina, we have had four very wet seasons in a row in Queensland after a fairly prolonged period of drought. And, as I said, it came as, I guess, a bit of a surprise to quite a few people that last year was so wet, but quite a plausible explanation for that being the very warm ocean temperatures around Australia. As you will see at the bottom of the slide, this particular La Nina was the second strongest on record after 1917/18, and for interest, the SOI is still plus 26. The ocean temperatures are quickly returning to normal now. We did expect the La Nina to break down in Autumn. It is certainly doing that but the southern oscillation index is lagging behind what we're seeing in the oceans.

What's the significance of that? What does that mean?-- I wish I had an answer for that, Commissioner, but I guess the science is such at the moment that we probably can't provide a good explanation. I think.

What about the consequences? Will it have any consequences in terms of the amount of rain we get over the balance of the year or-----?-- Okay, no - yes, that's a very good question, Commissioner. If I could just say, first of all, I think the main reason why it is still so positive is the monsoon trough has been hanging around northern Australia now for the last week or two, not particularly strong but it has been there, which has kept the pressures low. There is no cyclone

activity around Tahiti so that's what's keeping up the SOI. The second part of the question, Commissioner, was to do with what does this possibly mean for the rest of the season. You will find that our current three-month outlook is showing the likelihood - a moderate likelihood of above average rain over southern Queensland for the next few months. You will probably find that trend continue on our outlooks until we see a significant reduction in the SOI.

Thanks?-- This particular snapshot just highlights the sea conditions that we were experiencing just before the summer rain set in in intensity. So that bright orange colour is the highest on record in terms of sea surface temperatures between September and December. So most of the northern tropical waters were very, very warm. Okay. This particular - slightly different colour shades but it, too, is showing in this case sea surface temperature anomalies, that is how much warmer or colder the sea surface was for the week 9th to the 16th of January, the week that we have discussed at some length here in the inquiry, and you can see the relatively cool tongue, a broad large relatively cool tongue of water stretching from South America right through to Papua New Guinea and warm water - relatively warm water surrounding much of Australia and the oceans to the south of the cooler water. That type of pattern, that sea surface temperature and anomaly pattern is what you would expect with a La Nina. Before we switch to the next slide, the next slide is a moving loop. You will probably be able to see it. It runs from the 2009 - middle of 2009 to the current time and you will see in the middle of 2009 where that blue tongue of water is - band of water, it was red. So, as I said, the season before last we were in El Nino. That particular part of the Pacific Ocean was red but the difference with this El Nino and most El Ninos is the water surrounding Australia was relatively warm, as I said earlier. Normally with an El Nino, that would be relatively cool, and that's why the main reason we think that the rains were above average. So if we can just run that loop, and we can run it twice if we have to. You can see that - as I said, that's July 2009. Can you just click on it to see whether it will run, thanks? No, just go back again. It looks like the loop won't run. But at least you can see the first - the first snapshot in that loop. It is a contrast to what we saw with the previous picture in terms of that tongue stretching from South America. Okay, we will move on. Okay, this is perhaps the most complex slide I will be showing today. There is good reason for showing this because as our knowledge has increased of what does - what the factors are that lead to increased rainfall and the like, we've come to monitor this Madden Julian Oscillation much more closely. Basically the Madden Julian Oscillation is an eastward moving pulse of cloud and rainfall which moves from the Indian Ocean across to the Pacific Ocean. Doesn't always move at the same speed, isn't always at the same strength but it generally occurs about every 30 to 50 days during the year but, of course, we're only - we only see the impacts, really, during the warmer months. Now, the plot on the left is what the southern - is what the MJO, Madden Julian Oscillation was doing up until New Year's - up until New Year and the plot on

the right is this year. Now, this is a particular plot diagram which is now freely available on our website. I would encourage you to look at it if you get an opportunity. But what it is showing is which sector of the Pacific, the Madden Julian Oscillation is at any time and the sectors of most interest to us are sectors 5 and 6 which is up to the north-east. So when the plot is going through those two particular sectors, it means that the MJO is enhancing the monsoon over Queensland. And you will see that - and the further it is from the centre of the plot, the stronger it is. That red area on the left is what the MJO was doing during October. So when we issued the media release the preseason outlook on the 18th of October - no, it was the 4th of October, sorry - that particular strengthening of the monsoon was already taking place, and that was the strongest the MJO has been since the early 1980s. So we saw that as being quite significant at the time and had an impact of what we wrote in our seasonal outlook, and the same thing happened at another - very strong bursts of the MJO happened about the time of the Brisbane floods. The early part of that red trace on the right is early - first half of January. So we tend now to monitor this MJO very closely. Okay, that's the end of section 2. Section 3, Queensland rainfall to January 2011. Once again we're using decile maps so the blue means above average and this is the year's map, 2010, and it was our wettest year on record in Queensland. That's one single message in that picture. We had three other records. It was our wettest spring on record and that's the springtime map. And down the bottom of that you will see Queensland also experienced its wettest September and December on record. So we were going into this season, as it has been said many times already this inquiry, with very wet catchments. Here we have the decile maps lined up from August. This is the top row for those - August, September, October is on the top line, November, December January on the bottom line. You can see most of the months - for most of the months most of Queensland had above average rain but when it comes to January, it is quite interesting. This, of course is the month for the Brisbane floods. The focus for that month was very much on south east Queensland. The rainfall over south west Queensland was a little bit above normal, but it was south east Queensland, which did see the heaviest rain and we can certainly attribute those heavy falls in great part to a strong upper level low, which I will show in a minute, and to just one map of rainfall totals to January 2010. As that previous decile map showed, the focus over south east Queensland, and those very bright colours just around to the north-west of Brisbane are the maximum rainfall for the month. There was in excess of 800 millimetres. So that's very, very heavy rain. Okay, just quickly running through now our main media releases and briefings. I won't dwell too much on this first slide because it has been mentioned a number of times already. On the 4th of October we did alert Queensland to the fact that we could be in for a very active summer and the message was reinforced by the bureau at various briefings to government and disaster management authorities, including an invited briefing to Premier and Cabinet on the 18th of October. I should say, though, that in framing the

seasonal outlook, I did enjoy the support and assistance of my professional colleagues around Australia. This was very much a team effort, and this particular slide appears in some of the inquiry submissions. It was a slide I used at some of the high level presentations, and the first line "This is not a run-of-the-mill La Nina", and the final dot point spoke about those wet catchments. I won't dwell on that in the interests of time. Our preseason public awareness campaign just before the season started is something we have been doing now for 25 years or more, where we go to cyclone and flood prone areas of the State. We talk to disaster manages, we conduct seminars, and the idea of the campaign is to prepare disaster management officials and the wider community for the wet season ahead. We started in Charleville on the 7th of September, finished in Kowanyama on the 27th of October. The second last entry there you will see a flood exercise ORKO, which is a three-day exercise in the Toowoomba and Lockyer Valley. The most suitable, I guess, Commission session for talking about that will be in Toowoomba. So I won't dwell on that at the moment. Now, there were two, I guess, main periods of rain once we got towards Christmas. There was the big rains we saw between Christmas and New Year following Cyclone Tasha, and then, of course, the Brisbane flood episode. Just before the Christmas to New Year rains were experienced we did - the Bureau of Meteorology issued a media release alerting Queenslanders - warning Queenslanders to prepare for heavy rain and flooding during the holiday period, and the message was reinforced as earlier ones were by the bureau at Extraordinary - at an Extraordinary State Disaster Management Group meeting the following day. And then the day after that Cyclone Tasha came ashore and the rains commenced. Now, the other main period, of course, is the Brisbane floods. Just before the Brisbane floods on the 4th of January, Peter Baddiley, my chief hydrology expert, and I briefed an Extraordinary meeting of the State Disaster Management Group and the next day, 5th of January, gave a similar briefing by invitation to Premier and Cabinet. At both these briefings reference was made to the large and intense upper level low developing over south east Queensland and the impact that was likely to have on rainfall and flooding during the following week. I thought it worthwhile just to show the very high level briefings that the bureau participated in. You will see there quite a few Extraordinary State Disaster Management Group meetings. That's where we get the opportunity to brief the state Director-Generals of the departments, and we value that highly. It is something the bureau truly appreciates. And right down the bottom it talks about the bureau participation in twice daily teleconferences hosted by the State Disaster Coordination Centre, and those occurred between day between Christmas eve and the 20th of January. I think this has been a real success story for disaster management in Queensland. It is my recollection that these teleconferences commenced probably after Cyclone Larry and for all the major events since, Emergency Management Queensland has hosted these teleconferences, which enables all the stakeholders to share information at the one time in the one session. And from the Bureau of Meteorology perspective, it gives both the weather side and the flood side an opportunity at the front end of

these teleconferences to present their story. And so, as I said, that's been a real success story in disaster management in Queensland, along with our briefings to the State Disaster Management Group. Communication channels - we're up to section 5, halfway through. Communication between the bureau and disaster management authorities, and this particular schematic is intended to show the total warning system, the end-to-end warning system, the importance of developing partnerships earlier on, getting the stakeholders involved, the public awareness exercises and that that I spoke about before, and during the impact, the media interviews, the briefings to disaster management, and following the impact, the continuing provision of briefings at those teleconferences, the provision of forecasts and warnings for the impact area and then reporting on that at the end. So this is the second time I have mentioned this: we believe we do have a role in all phases of the disaster management cycle and right through - from prevention right through to recovery. Bureau communication channels, we had a little difficulty how best to show this. We didn't want it to seem as if the bureau was the centre of the universe. That's not what we intend. What this is showing is the number of agencies and the like that we do engage with, not just during events but preseason and post events, ranging from the very high level Premier and Cabinet, State Disaster Management Groups, through to the all-important Disaster District Management Groups and Local Disaster Management Groups. That's where the people on the ground need the best intelligence they can to make the very important decisions that they have to make. There is another layer of briefings which isn't on this and that's the many, many phone calls we take in the Flood Warning Centre and the regional forecast centre at these times. On the main days this year we had over 300 calls into the forecast centre and the co-located warning centre another 300. So we can get over 600 telephone calls in a day and we cope with those as best we can. We hope we're responding to at least the important ones. Down the bottom is how we get to the general public, media. Of course we do a lot of media, radio courses, TV grabs, and through the internet, on line media and the like, and our website - the next slide will be about the website - recorded phone messages. So we have many - quite a number of channels of ways of getting our message out to the public. We believe that redundancy should be very much part of our service provision. Right down the bottom I had - it doesn't really matter - there is a dedicated telephone hot line between the bureau and the State Disaster Coordination Centre which enables direct, secure and rapid transfer of key information, and we also have a special email on the flood side which enables stakeholders to email the flood group in the Flood Warning Centre, which goes straight to the key people. Just a plot of our website hits since July 2005 to February 2011 and you will see three peaks there which is December, January, February. Each of those months we had over 4 billion hits. So we were in record territory from the moment the rain started. Our web servers coped with that, which was very good. So a lot of people, including disaster management authorities and the media getting their information from our website, which is great. Okay, forecast rainfall from October

2010. These are our three-month outlooks. It is currently based on a statistical model. We hope to introduce a numerical model in the not too distant future but at the moment we're running a statistical model. The top two maps are October-December, which was released in late September. The next one is November-January, which was released in late October, and so on. The bottom on the left was released in late November, and then late December for the next one. And it does show that all four of the three-month outlooks show, generally speaking, the chance of exceeding median rainfall in Queensland was greater than 50 per cent. If you see, say, a 75 per cent probability on one of these maps, it is based on our historical records. So if you see 75 per cent it means that in three or four occasions in the past where we've seen a similar set of circumstances, the rainfall has been above normal. Important also to note, though, on one occasion out of four it has been below normal. So it is all about probabilities. So it doesn't mean, as has also been said several times during this inquiry, that it will rain or it will be above normal, it is just a probability estimate from our statistical model. And I guess it is no secret that from the November-January outlook through to January-March, there was a bit of an emphasis on the south-east corner of Queensland. It was showing the higher probability of exceeding median rainfall. What's also been referred to in this inquiry is our Water and the Land website, which is growing in popularity. On this particular website is the model output. There is no forecaster input to the products on this website. The WATL - Water and the Land is called WATL - the WATL rain and forecast maps are generated automatically by weather forecast, numerical weather prediction models. So up to eight models are combined, which includes the bureau's ACCESS Model. And the four day - no, sorry, the four day WATL rainfall forecasts about that period of the Brisbane floods, the top line is the four days from the 7th to the 10th of January. So that was issued on - catching up - that was issued on the Thursday. The next one, the 8th to the 11th of January was issued on the Friday, and then the bottom two issued on the Saturday and Sunday. And I guess - you might notice the consistency from one run to the next, and what a forecaster would be looking for is exactly that. The more we see consistency in successive model runs, the more likely we'll believe what the models are telling us. So I guess when we saw that we had a higher level of confidence, that what the models were showing was more likely to be correct than not. So it is just a little tool we have. And the other thing we look for is how strong the dynamics are, how strong are the weather systems that are generating the particular heavy rain. In this case, as I have already referred to, the upper lows. So we knew we had strong dynamics, we had consistency from one model run to the next. So from a forecaster viewpoint, we were more likely than not to believe what the models are telling us. And on that particular website is a daily forecast as well, and probabilities. I haven't got a probability map in this particular presentation but they are available. And this was the rainfall forecast on Monday the 10th of January issued on the Sunday. And there is a - I guess a maximum over this extreme south-east corner of

Queensland between 150 and 200 millimetres but we have all heard so far that this is really just a heads-up. It is saying, "Look, somewhere over the south-east corner of Queensland it is quite - it is possible that you will see very heavy rainfalls." What you can't conclude from this particular map is that that - is very heaviest rainfalls will be in exactly that location. Thank you.

Okay. We have gone to some efforts to verify how accurate these Brisbane and Toowoomba - these WATL rain forecasts are, and I must say that the - these verifications are very much in the early stage. What we see here is a verification for Brisbane and Toowoomba for the two months, December and January, and it's showing a very good match, but I think to be totally honest, we should also point out that on the occasions when the heavier rainfall was experienced, it could easily be out by a factor of two, you can overestimate or under estimate by a factor of two. But one of the important things, I feel, is it is really showing promise, this particular method of generating rainfall forecasts by looking at what all the models are telling us, the average of the models. Quantitative Precipitation Forecast, now, I may not - I might be able to just about skip over this. What the first - the - Peter Baddiley, my colleague, the hydrology head in the Queensland Bureau, if I can just draw the Commission's attention to his witness statement, paragraphs 20 to 25? To me, that is a very comprehensive story - my screen's gone dead - a very comprehensive story on what the Bureau's position is with respect to Quantitative Precipitation Forecasts. So, if you want to read the full story, I refer you to his witness statement. The summary points, though, are on this slide and the next. I haven't got a picture. It doesn't matter. Keep talking?

It will come back?-- Come back. Okay. These two slides were referred to by an earlier counsel. The first dot point talks about the longer - longer range forecast for this wet season. They did provide - well, we believe they did provide a good quality guidance for disaster managers and dam owners and operators regarding the expected very heavy rainfalls, and the second point's also important, as I have just said, the Bureau also believes that the WATL rainfall products are useful in providing advance notice of a possible heavy rainfall situation, especially when the rainfall forecast pattern is reasonably consistent from one model run to the next, and, plus, as I said also, the dynamics which are generating that rain are strong, as they were in this case. And the second slide-----

I think we may not - sorry, was there another slide in that section that-----?-- Just one more slide in the section. Once again, I can quickly - just reiterate, it may well have been brought up earlier, but the improved skill of NWP models in recent years has been largely in forecasting the development and movement of broad scale synoptic features, that's larger scale features, that would likely produce high rainfalls. These large scale features include decaying topical cyclones, east coast lows, and significant upper level troughs and lows as we saw in this case. However, while these systems may be well forecast on a time scale of two to three days, the very heavy rainfall concentrations are dependent on finer scale convective features, such as thunderstorm complexes. So, while is often the ability to forecast the potential for a significant rain event to occur, it is difficult, if not impossible, to predict the actual location of the heaviest rain, even with only a few hours notice. And

the last dot point has been added by my hydrologist. He thought it important that this Inquiry note that for larger catchments it is more likely that the area averaged - Numerical Model Rainfall Forecast will be more reliable, so the larger the catchment, the more reliable they are, although in Queensland, and this includes the Brisbane River Catchment, runoff generation may still be dominated by embedded heavy rain over parts of the catchment. So, we learnt earlier how important the distribution - spacial distribution was over a catchment and the temporal distribution as well. Thank you, Commissioner.

I think we will stop there for the afternoon, Mr Davidson, and go on with it. There's another three sections, I think?-- I think so.

We will go on with that at 10 a.m. tomorrow morning. Could you adjourn, please?

THE COMMISSION ADJOURNED AT 4.35 P.M. TILL 10.00 A.M. THE FOLLOWING DAY