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TRANSCRIPT OF PROCEEDINGS

O/N H-910728

MR B. WALKER SC, Royal Commissioner

IN THE MATTER OF THE MURRAY-DARLING BASIN ROYAL COMMISSION

ADELAIDE

9.59 AM, THURSDAY, 28 JUNE 2018

Continued from 27.6.18

DAY 3

MR R. BEASLEY SC, Senior Counsel Assisting, appears with MR S. O'FLAHERTY, Junior Counsel Assisting

MR BEASLEY: We're ready whenever you are, Commissioner, so - - -

THE COMMISSIONER: Very well. Let's commence.

MR BEASLEY: All right. Since opening statements on 18 June, this morning I was given a copy of a submission from the South Australian Government, which is dated June 2018, which I understand came in after the first day's hearing. I should just put on the record it does address the issues in Issues Paper 1 and also the legal and construction arguments raised in Issues Paper 2.

A short summary of the South Australian Government's submission in relation to Issues Paper 2 is that the government contends that social and economic factors may not compromise environmental objectives of preventing the long-term decline of biological diversity. The Water Act doesn't permit a triple bottom line approach in which environmental factors are balanced against social and economic factors. And the contention is environmental objectives must be paramount.

The argument, however, is developed that there is textual support in the Water Act for achieving environmental objectives over a timeframe, given that the Basin Plan has some adaptive mechanisms and can be adjusted and amended. And there's an argument developed that where the Water Act – the text of the Water Act says that the long-term average sustainable diversion limit – Basin wide diversion limit must reflect an environmentally sustainable level of take, that that "does not demand immediate and direct equivalence" . And that argument is developed.

THE COMMISSIONER: That's an argument that seems to culminate in the notion of the possibility of a short period of transition.

MR BEASLEY: Yes. Yes. And I suppose that's an argument that is perhaps not reflective of the literal text but, as the argument is developed here, there are, that the plan can be amended and adjusted. And I think that's what that argument is based on. In relation to environmentally sustainable level of take, the government states that it has always been the South Australian Government's position that 2,750 gigalitres from a baseline for water recovery from the environment is not an environmentally sustainable level of take and that 3,200 gigalitres is required. And there's a reference to some expert reports which talk about whether environmental targets and environmental watering requirements are met; reports of the Goyder Institute and the like, some of which I referred to in opening.

There's support for the sustainable diversion limit adjustment; support for the Northern Basin Review', support for the supply measures, that is, the sustainable diversion limit adjustment. And then there are – I won't detail these now, but then there are some submissions on other issues raised in Issues Paper 2, such as whether water resource plans will be delivered on time by 30 June 2019. From the South Australian's Government's view, they say they're on track in relation to their water

resource planning. And then there's some submissions concerning the views of Indigenous people, illegal take and the health of the Basin and the like.

THE COMMISSIONER: Thank you.

MR BEASLEY: Yes. And had that been available to me in opening, I would have referred to it then, but anyway. I just want to clarify from yesterday, because people are very keen for me to do this, that Dr Colloff's witness statement, the CSIRO Multiple Benefits Report, the draft report referred to extensively in Dr Colloff's evidence, the Murray-Darling Basin Authority's report, 'Hydrologic Modelling to Inform the Proposed Basin Plan', dated February 2012, and Dr Colloff's handwritten notes concerning the meetings he had with the Basin Authority during his time as the team leader for that part of the Multiple Benefits Report that he was in charge, should all be considered tendered. And they will be given tender numbers. And so should Mr Cosier's statement be considered tendered.

Overnight, we have been provided with some of the documents that Mr Cosier mentioned in his evidence, but which weren't immediately available. Those matters are these, that the newspaper article from 2011 from The Weekly Times that was part of Mr Cosier's evidence, that there was a suggestion – and it is only a newspaper article – that Commonwealth officials were contacting Victorian Government officials to see whether a water recovery target of 2,200 to 2,400 gigalitres would be acceptable; whether they would "comfortable with these lower numbers". So that article will be tendered.

We've also been provided with Mr Cosier's letter of resignation from the Basin Testing Committee. That's a letter to Mr Craig Knowles, Chair of the Murray-Darling Basin Authority. The letter is dated 4 May 2011. It's on the Wentworth Group of Concerned Scientists letterhead, signed by Mr Cosier. And the reason given for the resignation is the refusal of the Basin Authority to accept the Wentworth group's suggestion that there should be an independent science accreditation panel for the Basin Plan. So I will tender that letter.

I will also tender what I just referred to. And that is a document headed 'Wentworth Group Suggestion for an Independent Science Accreditation Panel for the Murray-Darling Basin Plan'. It doesn't have a date on it, but it's clearly dated before May 2011, because it refers to a report to be – or released by May 2011. I won't read the document out, but, in a sense, it proposes that the board of the Basin Authority Commission appoint "an independent science accreditation panel", to:

> *…accredit the sustainable diversion limits in the draft Basin Plan as being consistent with the requirement of the Water Act to return over-allocated rivers to sustainable levels of extraction based on the best available science.*

So I will tender that. Mr Cosier in his evidence also made reference to a science leaders forum convened by the Basin Authority. I think the understanding from his evidence was that this two-day forum was convened on 3 or 4 May 2011 by the

Basin Authority as a substitute – or to try and accommodate the request by the Wentworth Group for there to be an independent science accreditation panel. What we have been supplied with is a document prepared by three of the scientists who were at that forum, Bill Young in dialogue with Don Blackmore and Gary Jones.

And the document – again, I won't read it out, but it indicates that the forum was not presented with a clear, robust overarching conceptual framework for the science guiding determination of an ESLT. Although the forum thought it was likely that the MDBA had assessed the best available science, it indicates that in discussion with MDBA people it's apparent that such a framework has not been developed by the MDBA. The note I've just been given which slightly interrupted my thought processes is that I must have said that this document was given to us by Mr Cosier. It was, in fact, found by one of the research officers. Thanks for that.

And makes other commentary that there is a lack of transparency and a lack of detail in relation to what the forum says they were advised by the MDBA people at that two-day forum. I will tender that. During Dr Colloff's evidence, when he was giving evidence concerning projections for climate change and about the absence of such projections being factored into the SDL for the Basin Plan, he made reference to a published research paper entitled 'Adaptation Services of Floodplains and Wetlands Under Transformation or Climate Change'. Dr Colloff is one of a number of authors of this publication which was published in Ecological Applications in 2016 at pages 1,003 to 1,017 by the Ecological Society of America. I have no doubt I will tender that, but I haven't read it and I'm not sure it's best practice to tender something you haven't read. So I will make sure I read that overnight.

THE COMMISSIONER: Thank you.

MR BEASLEY: And there is also – I'm not sure if you have been given it, Commissioner, but there's – I think it arrived after the South Australian Government's submission but there is a letter to you from the Minister for Environment and Water, the Honourable David Speirs MP. The letter is dated 18 June but it was received in the office on 26 June. You have seen one copy of that letter?

THE COMMISSIONER: No, I haven't.

MR BEASLEY: I won't tender it, then. I will just have it brought to your attention.

THE COMMISSIONER: Thank you.

MR BEASLEY: That completes the housekeeping matters I wanted to deal with.

THE COMMISSIONER: Just to be clear, when something is tendered after the appropriate logistics are accomplished, it will become publicly available through the Commission's website.

MR BEASLEY: Yes, it will. But many of them have already become publicly available.

THE COMMISSIONER: I understand. But - - -

MR BEASLEY: At least to the extent they have already been listed on the website as documents or research papers that – or reports that the Commission staff have considered.

THE COMMISSIONER: Thank you. People should understand that when you tender things, assuredly, they will become publicly available unless there is some order by me to the contrary.

MR BEASLEY: Yes. And the only time lag is getting it on the website.

THE COMMISSIONER: Thank you.

MR BEASLEY: But with the exception, I think, of the Multiple Benefits Report and, certainly, the multiple benefits draft, most of the reports I've referred to so far have been up on our website for a long time.

THE COMMISSIONER: Yes. Thanks.

MR BEASLEY: Professor John Williams is here to give evidence, Commissioner.

THE COMMISSIONER: Thank you.

<JOHN WILLIAMS, SWORN [10.13 am]

<EXAMINATION-IN-CHIEF BY MR BEASLEY

MR BEASLEY: Have a seat Professor Williams. Could you provide the Commission with your address please?

PROF WILLIAMS: Yes. I did with the form earlier. My address is 8 Harcourt Street, Weetangera, Canberra, 2614.

MR BEASLEY: And you are an Adjunct Professor at the Crawford School of Public Policy at the Australian National University.

PROF WILLIAMS: That's correct. They've changed the terminology, now, to an Honorary Professor, which is a little more paperwork. But it's the same function and I am very honoured to be able to use that title.

MR BEASLEY: And how long have been in that position?

PROF WILLIAMS: Around six years, I think. Pretty much since I retired from the Commission of Natural Resources in New South Wales.

MR BEASLEY: And I was going to come to, how long were you the Commissioner for Natural Resources in New South Wales?

PROF WILLIAMS: The best part of six years.

MR BEASLEY: And what did that role involve?

PROF WILLIAMS: That was a fascinating role. I was responsible to Premier and Cabinet. And the Commission had the primary objective of supervising the implementation or overviewing the implementation of the Vegetation Act New South Wales, the new one, and the Water Act and that meant establishment of the catchment management authorities and their actual accreditation and overview during that period. And when there was a great deal of action towards trying to set up a process at a catchment scale for strategic environmental planning in which, then, you could nest local government planning and subsequent coastal planning.

MR BEASLEY: And before I come to other matters concerning your work history, you are a – your tertiary qualifications are in hydrology?

PROF WILLIAMS: Yes. Soil science and hydrology. Soil physics hydrology was my PhD. Yes.

MR BEASLEY: And you are former Chief of the CSIRO's Land and Water Division. Is that what it's called?

PROF WILLIAMS: Yes. Exactly. I was Chief of CSIRO Land and Water for quite a period, three or four years. And then before that, Deputy Chief for three or four years.

MR BEASLEY: And approximately when was that?

PROF WILLIAMS: Well, I retired in April 2004.

MR BEASLEY: Thank you. You've provided the Commission with a joint submission with Professor Quentin Grafton, dated 19 April 2018.

PROF WILLIAMS: That's correct. Yes. It's a joint work.

MR BEASLEY: Yes. Do you have a copy of that submission?

PROF WILLIAMS: I do.

MR BEASLEY: And in the sense that it's a joint submission, should we assume that each paragraph or each section where you respond to various matters raised in the Commission's Issues Paper 1 or the Terms of Reference, reflects joint work with Professor Grafton? Or did you take responsibility for some parts of the submission and he took responsibility for others?

PROF WILLIAMS: We did it jointly but we had come together as an economist, a natural resource economist in Quentin, and myself as a hydrologist. So it's a very well nested collaboration. And so there will be some paragraphs where they sit clearly in his skills in the economics, although I have some background in that. So if you ask me a question that sits clearly in Quentin's territory, I will tell you that. If it's - - -

MR BEASLEY: All right. Well, he's giving evidence later so that will be helpful.

PROF WILLIAMS: Yes.

MR BEASLEY: Professor Grafton is also at ANU. Correct?

PROF WILLIAMS: That is true. He's a Professor.

MR BEASLEY: And without going through all of them, you and Professor Grafton have collaborated on a number of scientific papers?

PROF WILLIAMS: Yes. We've written – since I was made a Professor there, we have written, you know, maybe half a dozen joint authored papers in international literature and contributed to the public debate on natural resources and water.

MR BEASLEY: And at least some of those papers relate to the issue that I will call return flow?

PROF WILLIAMS: Yes. I – that is so. And the issue of return flows is something that is in paragraph 9 of our - - -

MR BEASLEY: Yes. I will come to that.

PROF WILLIAMS: Come to that.

MR BEASLEY: Don't jump right to paragraph 9 yet. We will get there, trust me. But - - -

PROF WILLIAMS: No, no. But I'm just – yes. But I'm saying that's where it's written down.

MR BEASLEY: Yes.

PROF WILLIAMS: Yes.

MR BEASLEY: But thanks for the reminder. There's no way I will forget now. I wanted to take you first, though, please, to that part of your submission where you and Professor Grafton discuss the process used to determine environmentally sustainable level of take.

PROF WILLIAMS: Yes.

MR BEASLEY: Based on the submission, we can assume that you are very familiar with the Basin Authority's publications being the Guide to the Basin Plan which came out in 2010 and its subsequent report that came out a year later concerning the determination of environmentally sustainable level of take?

PROF WILLIAMS: Yes. I'm familiar with both those documents.

MR BEASLEY: And whilst I'm going to ask you to develop your views, what comes clearly through your submission is that you and Professor Grafton are of the view that no scientifically credible justification has been provided by the Basin Authority for the changes of volume for water recovery from the environment between the Guide and then the lower figure of 2,750 in the ESLT report?

PROF WILLIAMS: Yes, yes. As a hydrologist, I see no scientific evidence that is publicly available – and, certainly, I have not been able to see it – which shows the line of logics and mathematics which takes us to the 2,750 from the credible report that was in the Guide. And the Guide was subject to international review by Gene Likens and others. And - - -

MR BEASLEY: Can I just stop you there, Gene is G-e-n-e?

PROF WILLIAMS: G-e-n-e.

MR BEASLEY: Yes.

PROF WILLIAMS: Gene Likens. Yes. He's a very eminent American Professor of Ecology. And he – there was a team with he and John Bisco, who's another irrigation – international irrigation scientist, no longer living, unfortunately. And another person ..... they conducted a good look at the Guide and they - - -

MR BEASLEY: At the request of the Basin Authority, I assume?

PROF WILLIAMS: At the request of the Basin Authority and when Michael Taylor was the head of that. And - - -

MR BEASLEY: He was the Chair.

PROF WILLIAMS: He was the Chair. Yes. And that was a very, I thought, thorough – although it's open-ended, in a sense, that it says it was a difficult task

they were given, but as far as they could see, the work had been done in the best scientific way possible.

MR BEASLEY: Can I ask you to pause there. From your evidence, I'm getting the impression that you have read this peer review, have you, or - - -

PROF WILLIAMS: I have. And I'm struggling to find a copy of it at the moment.

MR BEASLEY: So are we.

PROF WILLIAMS: And I haven't given up but I was hoping I could table one for you. But I have read it.

MR BEASLEY: We haven't given up either but there's a hearing later on in the year where we will find out whether we get it or not. But you don't have a copy, is the short answer?

PROF WILLIAMS: I don't have a copy that I can put to test. But I have been looking through my computer system to try and find it.

MR BEASLEY: What were the circumstances where you came to be able to read this – the peer review?

PROF WILLIAMS: It came available to me through the Commission, through the Authority. It wasn't a surreptitious or back room arrangement.

MR BEASLEY: Yes.

PROF WILLIAMS: It was a document that was available to those people who wanted to peruse it.

MR BEASLEY: Do I take, from that answer, that the method or means by which, or science by which the authority determined the ESLT at 2,750 is a matter that you've had discussions with people at the authority from time-to-time?

PROF WILLIAMS: Yes. I have voiced my concern to say, "Well, can you show me how you get to 2,750 when the figures in the Guide – where are the errors?"

MR BEASLEY: All right. I will come back to that.

PROF WILLIAMS: Yes, yes.

MR BEASLEY: I just wanted to flag that.

PROF WILLIAMS: Yes.

MR BEASLEY: And just before we get into the detail, I'm right, aren't I, that you've also had more than one discussion with people at the Basin Authority concerning your concerns and Professor Grafton's concerns about return flow?

PROF WILLIAMS: Yes. I've had meetings with the new CEO of the Authority. And we have had subsequent meetings, informal and formal, with other members discussing our concerns and the importance of - - -

MR BEASLEY: Well, I will ask you about those matters.

PROF WILLIAMS: The answer is yes.

MR BEASLEY: Yes. And so I don't forget to also raise this with you, that your concerns and Professor Grafton's concerns concerning return flow is also a matter you raised recently with the Productivity Commission in its five-yearly review of the Basin Plan.

PROF WILLIAMS: Yes, I did. I gave them a detailed account of the issue and documented it.

MR BEASLEY: Was that in a public hearing or a private meeting?

PROF WILLIAMS: Yes. That was in a private meeting. But the document was in a public submission which is available.

MR BEASLEY: Yes. All right. Thank you.

PROF WILLIAMS: Yes. Both. Yes. I followed up the public submission with an interview with the Commissioners to establish my concerns on that matter.

MR BEASLEY: All right. Did Professor Grafton go with you with that or was that - - -

PROF WILLIAMS: No. He was overseas at the time.

MR BEASLEY: Right. Okay. He had already gone to Bordeaux, had he?

PROF WILLIAMS: Yes. And that submission to the Productivity Commission was a joint piece of work between Matt Colloff, myself and Quentin Grafton. So - - -

MR BEASLEY: Right. All right.

PROF WILLIAMS: And I'm happy to table that, if you would like that or – it's publicly available.

MR BEASLEY: Yes. I think we already have a copy. Thanks, Professor.

PROF WILLIAMS: Okay. Well, there's one there if you want one.

MR BEASLEY: What I would like to do now to drill into some of the detail concerning what you've said about – the concerns you have raised about environmentally sustainable level of take determination, could the witness be given the guide to the proposed Basin Plan.

PROF WILLIAMS: Yes. I don't have that one with me.

MR BEASLEY: Both volumes 1 and 2, hopefully. In fact - - -

THE COMMISSIONER: Mr Beasley, can I ask a couple of questions - - -

MR BEASLEY: Yes. Go ahead.

THE COMMISSIONER: - - - about something the witness has already said. Professor - - -

PROF WILLIAMS: Thank you.

THE COMMISSIONER: - - - at page 204 of volume 1 of that Guide - - -

MR BEASLEY: No. Sorry. The Commissioner is taking that.

PROF WILLIAMS: Yes. Go ahead.

MR BEASLEY: It's all right. I was getting - - -

PROF WILLIAMS: So two hundred and - - -

THE COMMISSIONER: At page 204.

MR BEASLEY: Is this volume 1, Commissioner?

THE COMMISSIONER: Yes.

MR BEASLEY: Yes.

PROF WILLIAMS: Just a moment, I will be with you.

MR BEASLEY: That's all right.

THE COMMISSIONER: It's the acknowledgements.

MR BEASLEY: Yes.

PROF WILLIAMS: Yes, 204. Yes. Okay.

THE COMMISSIONER: Towards – about three-quarters of the way down you will see the reference to Professor Gene E. Likens - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - of the Cary Institute of Ecosystem Studies in the United States of America.

PROF WILLIAMS: Yes. That's the man I referred to.

THE COMMISSIONER: Thank you. And, as you understand the history of these things, that acknowledgement in appendix A of the Guide is with respect to what you call his peer review.

PROF WILLIAMS: Yes, that's correct.

THE COMMISSIONER: And you understand, because you've seen it in the past, that that peer review was reduced to writing.

PROF WILLIAMS: It was a document you could read, yes.

THE COMMISSIONER: Yes.

PROF WILLIAMS: Yes.

THE COMMISSIONER: And when you say you are finding it difficult to locate - - -

PROF WILLIAMS: It's just I'm not the most organised person sometimes.

THE COMMISSIONER: No. It's all right. I'm not saying... your study. I mean, so far as you're concerned, the MDBA must have - - -

PROF WILLIAMS: There must be a copy somewhere. Yes. Yes.

THE COMMISSIONER: Have you asked for the Authority for it?

PROF WILLIAMS: I haven't personally, but Matt Colloff, I think, may have. I haven't pursued it. I have asked to get one. We did contract Gene to see if he still had a copy and he said he didn't.

MR BEASLEY: Yes. I can tell you that one of the research officers has very recently found this document, this peer review, and it's about 400 pages, so - - -

THE COMMISSIONER: Thank you.

MR BEASLEY: - - - it will - - -

PROF WILLIAMS: Yes, a substantive piece of work. I mean - - -

MR BEASLEY: Unfortunately, it's probably – it might be something I would have wanted to ask this witness a question about.

THE COMMISSIONER: No doubt inquiries can be made in writing, as well as by correspondence with you, so – yes.

PROF WILLIAMS: Okay. Certainly. Absolutely. Yes. Yes. Absolutely.

THE COMMISSIONER: Now, just to complete my interest in this document, can you think of any reason why anyone would not want to reveal it? I'm not suggesting anyone is trying to hide it, but - - -

PROF WILLIAMS: No. I don't think I could see any reason for it. I mean, it gave a very honest, in my view, appraisal of where they had got to. It wasn't a tick in every corner, but it did indicate that the science they had done was robust, yes. And this is the sort of review that we should have had repeatedly at each stage. I mean, this is what I did raise with the Productivity Commission. And, seeing you raise it here, I think it's a major issue of having – the way the Commission conducted peer review is very different to the way the Authority has conducted peer review. And peer review – you know, I'm a member of the Academy and we do know there's some basic ways of doing that. And I did set out in my submission to the Productivity Commission detailed concerns that the Murray-Darling Authority does not conduct what we in the Academy would say is an independent peer review.

THE COMMISSIONER: When you say the Academy, you mean the Australian Academy of Sciences?

PROF WILLIAMS: The Australian Academy of Technological Sciences, yes.

THE COMMISSIONER: Right.

PROF WILLIAMS: AATS, yes, which I'm a member of.

THE COMMISSIONER: So capital A Academy as well as small A academy.

PROF WILLIAMS: Yes, that's right.

THE COMMISSIONER: Thank you.

PROF WILLIAMS: This is the applied one. Yes. Yes. So, you know, and we did try on a number of occasions, personally and elsewhere, I did negotiate with the Australian Academy, the capital A, to conduct a study on this paper back in 2011 earlier. They were willing to do it, but not the way the Authority was prepared to have it done.

THE COMMISSIONER: Could you just explain what you – I've read your material - - -

PROF WILLIAMS: Yes. Right. Well - - -

THE COMMISSIONER: - - - but can you explain what the differences are?

PROF WILLIAMS: - - - the differences are that a peer review must be done by people who have no links, financial or otherwise, to the body asking for the review, and that the review needs to have terms of reference that are sufficiently open that you can examine a full range of questions around the issues. So the terms of reference for review need to be done in such a way that the science can ask, "Are we asking the right questions?"

THE COMMISSIONER: So it's as if there was a set of specific questions, but at the end there has to be one and anything else you think appropriate?

PROF WILLIAMS: Yes, that's right. So have we really considered what matters most or have we just answered the questions that suited the particular review? So when a paper is reviewed, it has to be open to rigorous and thorough and open-ended scrutiny.

THE COMMISSIONER: Now, it's on pages 9 and following of your Productivity Commission submission with Dr Colloff and Professor Grafton that you develop this notion.

PROF WILLIAMS: Yes.

THE COMMISSIONER: Could you give me some idea, is this a controversial matter of scientific and professional method, academic method?

PROF WILLIAMS: No. No, not at all. I mean, it's done regularly.

THE COMMISSIONER: So there's not another school of thought that says what you have propounded is either radical or frowned on or - - -

PROF WILLIAMS: Unusual.

THE COMMISSIONER: Unusual.

PROF WILLIAMS: Not that I'm aware of.

THE COMMISSIONER: All right.

PROF WILLIAMS: It's mainstream science.

THE COMMISSIONER: Has the MDBA ever published anything that you have read suggesting that your views about peer review are maverick or wrong?

PROF WILLIAMS: No, I haven't seen that. It just seems to be that what is good culture in the scientific community has just been overlooked.

THE COMMISSIONER: Now, could that possibly be explained by budgetary constraints?

PROF WILLIAMS: No. No. No. No.

THE COMMISSIONER: So it might be more expensive to get a consultant to give - - -

PROF WILLIAMS: Well, there's a few - - -

THE COMMISSIONER: - - - an apparent peer review than to get academics

PROF WILLIAMS: - - - airfares, but I think it's well within the budget when you look at the public expenditure we're committing on the basis of the plan.

THE COMMISSIONER: Sorry. Continue.

MR BEASLEY: That peer review is on its way here and, given it's only 400 pages, I will get through it during morning tea and no doubt be able to ask some questions that are penetrating. I wanted to take you to volume 2 of the Guide to just lay the foundation for your concerns regarding the determination of the ESLT.

PROF WILLIAMS: Yes.

MR BEASLEY: If we go to page 70, first, of the Guide - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - you see there that the – this is for the proposed Basin Plan. Both service water and groundwater resource plan areas are identified on a map.

PROF WILLIAMS: That's true.

MR BEASLEY: On those maps.

PROF WILLIAMS: Yes, I can see that.

MR BEASLEY: And there is then a discussion at page 75 concerning the Basin Authority's approach to risks in relation to water resources.

PROF WILLIAMS: Yes.

MR BEASLEY: And, as it's a matter that you've raised in your submission, one of those risks identified in fact is the first one, is climate change.

PROF WILLIAMS: Yes.

MR BEASLEY: And then a rising number of farm dams, increased groundwater extraction. I assume increased groundwater extraction is a risk because it has an impact on base flows.

PROF WILLIAMS: That's right.

MR BEASLEY: Yes.

PROF WILLIAMS: Yes, exactly.

MR BEASLEY: Deforestation, bushfires and decreasing irrigation return flows - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - another issue.

PROF WILLIAMS: Yes. It's interesting that return flows are mentioned here.

MR BEASLEY: Yes, because the Basin Authority's view is to not consider them at all.

PROF WILLIAMS: That's true.

MR BEASLEY: Correct?

PROF WILLIAMS: That's my understanding.

MR BEASLEY: Yes. The risk management strategies are outlined on page 79. And then hydrological data and information start at page 81. And I particularly wanted to draw your attention to page 82, where there's a discussion of the hydrologic modelling for this Guide and discussion of the computer software tools that mathematically represent the complexity of water movement through a river system or an aquifer.

PROF WILLIAMS: Yes.

MR BEASLEY: You're familiar with those sorts of - - -

PROF WILLIAMS: Yes. Certainly.

MR BEASLEY: - - - software, etcetera. Then, at page 84, there's a discussion of social and economic assessments.

PROF WILLIAMS: Yes.

MR BEASLEY: And, as you're aware, the Basin Authority has factored social and economic outcomes into the determination of environmentally sustainable level of take.

PROF WILLIAMS: Yes.

MR BEASLEY: Is that a matter that you've had discussions with the Basin Authority about?

PROF WILLIAMS: Well, not at the same detail as return flows, but the point I had made – have made in my public submissions to the Senate inquiry at the time and to the Basin Authority was that I have no problem with us making a social economic judgment. But the scientific evidence of what the consequences of that is another issue. So the science should state the framework and the risk and likelihood of success. And the society is fine to choose where it operates. But it will have a scientific analysis of what that consequence of operating at that level means. So I've said that, you know, the science needs to say this is what the river needs. Society can choose to ignore it.

THE COMMISSIONER: Now, can we just distinguish at the moment between the ESLT, the environmentally sustainable level of take, and that which is produced under the Water Act from it, namely the sustainable diversion limit.

PROF WILLIAMS: Yes.

THE COMMISSIONER: I want to ask about the ESLT first.

PROF WILLIAMS: Yes.

THE COMMISSIONER: I don't understand, from anything I've read, how in any scientific or quantitative fashion - - -

MR BEASLEY: It's going to be hard to confiscate.

THE COMMISSIONER: I can order it to stop, can't I?

MR BEASLEY: You can try.

THE COMMISSIONER: I don't quite understand how, in any scientific or quantitative fashion, in estimating, as I think it must be, an ESLT there can be any account taken of what is called socio-economic impact or effect. Let me explain. If the ecosystems, taking a comprehensive expression - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - have been studied, as is required - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - the hydrology has been - - -

PROF WILLIAMS: Determined.

THE COMMISSIONER: - - - analysed and estimated as is required, then certain conclusions, some of them interim, can be expressed about levels of flow, perhaps different levels of flow, and their perhaps different impact on those ecosystems.

PROF WILLIAMS: That's correct.

THE COMMISSIONER: To use just one example - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - volumes and timing of river flow and their impact on breeding events - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - for certain water birds.

PROF WILLIAMS: Yes.

THE COMMISSIONER: I picked that not just at random; that happens - - -

PROF WILLIAMS: No.

THE COMMISSIONER: - - - to be important, obviously, for the international obligations.

PROF WILLIAMS: Absolutely. Yes.

THE COMMISSIONER: What I don't understand is how, having reached, as it were, a provisional view of the ESLT from the point of view of - - -

PROF WILLIAMS: The science, yes.

THE COMMISSIONER: - - - the breeding events necessary to prevent that population being endangered.

PROF WILLIAMS: Yes.

THE COMMISSIONER: I don't understand how the fact that, say, upstream there is a human settlement which has, over the last 20 years, been irrigating a crop, would, in order to achieve that ESLT, probably have to lose some of their irrigation allocation.

PROF WILLIAMS: Yes.

THE COMMISSIONER: I don't understand how that has any impact on the endangering of water birds in relation to their breeding events.

PROF WILLIAMS: Yes. I agree entirely with what you're saying.

THE COMMISSIONER: And I've not read anywhere how you would say, "Well, X is the number before I reach socio-economic factors. X is the number necessary to prevent these birds perhaps disappearing. But it will be X minus Y, because - - -"

PROF WILLIAMS: Because we have got people upstream will be an impact.

THE COMMISSIONER: "- - - if I use X, their almond trees won't produce as well or may even die, and their jobs may be reduced."

PROF WILLIAMS: Yes.

THE COMMISSIONER: Now, have you read anywhere, apart from those diagrams that Professor Hart gave you about decision-making - - -

PROF WILLIAMS: Yes. Yes.

THE COMMISSIONER: - - - which are only diagrams, have you read anywhere an explanation of how these numbers are meant to be factored in for socio-economic - - -

PROF WILLIAMS: No, I haven't. And that's one of my concerns. And a deep concern is that I haven't seen how you do that sum. I don't think it is possible. And I think its mixing apples and oranges.

THE COMMISSIONER: Well, it sounds to me it's even more alien than apples and oranges are to each other. And I mean that seriously.

PROF WILLIAMS: They just do not work together. You have an ecological, hydrological reality - - -

THE COMMISSIONER: Yes.

PROF WILLIAMS: - - - and that is the reality. Now, socially, you can determine to ignore it - - -

THE COMMISSIONER: Yes.

PROF WILLIAMS: - - - and reduce the number of birds and the breeding occurrences. That's a social choice.

THE COMMISSIONER: Well, that in effect is what we all have, done speaking collectively and historically. We have decided to, borrowing the language of the statute, to degrade - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - the environment in the Basin - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - in order to produce economic outcomes thought to be favourable.

PROF WILLIAMS: Yes. That's exactly what we have done. And this Act was to try and restore the damage that we had done. So, to me, the first thing is to establish what are the flow regimes you need to establish the healthy condition in those bird life or in the fish breeding.

THE COMMISSIONER: Yes.

PROF WILLIAMS: And that's what you need. Now, if you choose to do something else, that's a societal choice, but the science and the best we can do with that science can tell you what flow regimes you need to maintain that functionality.

THE COMMISSIONER: Yes. I have in mind in particular, as I know from your writings you do, in section 21 of the Act, subsection (2) requires, in particular, concerning the Basin Plan and its preparation, that it must be prepared having regard to what's called the fact – Parliament refers to it as the fact – that the use of the Basin water resources has had – that's the history – and is likely to have – that's the prospect, unless something is done – significant adverse impacts on the conservation and sustainable use of biodiversity.

PROF WILLIAMS: That's correct. Yes. That's what I hear.

THE COMMISSIONER: Biodiversity is an expression used in some of the treaties you're familiar with.

PROF WILLIAMS: Absolutely. Yes. Yes.

THE COMMISSIONER: And it can be used more or less as a synonym for what some people might call the ecosystem.

PROF WILLIAMS: That's right.

MR BEASLEY: I think it's defined, as well, in the Act.

THE COMMISSIONER: Yes. And then there is a requirement that the Plan must be prepared having regard to the fact – again, Parliament uses the word fact – that the Basin water resources require, as a result of that history and prospect, special measures to manage their use to conserve biodiversity.

PROF WILLIAMS: That's my understanding of it.

THE COMMISSIONER: Not to irrigate crops, but to conserve biodiversity.

PROF WILLIAMS: That's right.

THE COMMISSIONER: And then it goes on and says, in paragraph (b) of subsection (2) of section 21, that the Basin Plan must promote sustainable use of the Basin water resources. Pausing there, the word "sustainable" is a term of art in your science, is it not?

PROF WILLIAMS: Yes.

THE COMMISSIONER: And it also gets some definitional attention in the Act.

PROF WILLIAMS: Yes.

THE COMMISSIONER: But then it goes on, "its sustainable use" – and here is a phrase I want to emphasise:

…to protect and restore the ecosystems, natural habitats and species - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER:

…that are reliant on the Basin water resources and to conserve biodiversity.

PROF WILLIAMS: That's right.

THE COMMISSIONER: Now, I have struggled, I have to say, with how that compulsory requirement for regard to those matters in preparing the Basin Plan can be met by reaching, as it were, a provisional view on what, in my example, the water birds need and then reducing it below what they need in order to protect another wonderful species, human beings - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - from the economic effect and the social effects of reduced allocation of irrigation water.

PROF WILLIAMS: Yes. It makes no sense to me, because you are mixing the two situations. One, the science says if you want to retain and improve the quality of the ecosystems and the biodiversity, you need to have a certain level of flow regime. That is the fact.

THE COMMISSIONER: I talked about Professor Hart's pictures, diagrams that he gave you – just let me pick up where they are.

PROF WILLIAMS: They're triangles.

THE COMMISSIONER: Yes. They're in your - - -

PROF WILLIAMS: The paper there somewhere.

THE COMMISSIONER: The paper that you - - -

PROF WILLIAMS: Put in the - - -

THE COMMISSIONER: - - - published in the Royal Society proceedings. That's the Royal Society of New South Wales.

PROF WILLIAMS: Yes.

THE COMMISSIONER: It's tab 1 in the bundle I'm using.

PROF WILLIAMS: Yes. Okay. That's right. So that - - -

THE COMMISSIONER: And I think - - -

PROF WILLIAMS: His diagrams should occur - - -

THE COMMISSIONER: At page 80 of the journal - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - with a subscript that it's courtesy of Professor Barry Hart - - -

PROF WILLIAMS: Yes. Yes. Yes. Yes.

THE COMMISSIONER: - - - of the MDBA - - -

PROF WILLIAMS: Yes. Yes.

THE COMMISSIONER: - - - and with the title 'Balancing', there is a diagram of decision-making, I suppose it's meant to mean - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - where you see an intermediate collection point called the 'Ecological Water Requirements'.

PROF WILLIAMS: That's right. That's what we have just been talking about, yes.

THE COMMISSIONER: Thank you. And then with – I don't want to be facetious, but what looks like a diagram of what a washing machine does - - -

PROF WILLIAMS: Yes. Round and round.

THE COMMISSIONER: There's arrows in opposite directions.

PROF WILLIAMS: Yes.

THE COMMISSIONER: You've got 'Socio-economic Assessment' and what are called, I must say with my lawyer's disapproval – what's called 'System and Legal Constraints'.

PROF WILLIAMS: Yes.

THE COMMISSIONER: That's the law, is it?

PROF WILLIAMS: Well, that is the same - - -

THE COMMISSIONER: That's what the law requires?

PROF WILLIAMS: This is – let me – this is why I put it in the paper, because to me it illustrates where the fundamental problem sits.

THE COMMISSIONER: Well, you're jumping ahead. Just let me get this out step-by-step. So you've got this socio-economic assessment, the system and legal constraints, which I think means what the law requires, being turns in opposite - - -

MR BEASLEY: Systems constraints might be constraints in the river, who knows.

THE COMMISSIONER: It might be. But legal constraints are the law.

MR BEASLEY: No. Well, you would think so.

THE COMMISSIONER: Yes. Well, I hope so. And then that is meant to produce, by a simply black arrow - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - the red circle goal of SDL.

PROF WILLIAMS: Yes.

THE COMMISSIONER: Now, have you ever found anywhere some explanation of what goes on in that black circle with the washing machine arrows in opposite directions, the to and fro between socio-economic assessment and system and legal constraints, to move from ecological water requirements to sustainable diversion limit? Have you ever seen an explanation for that?

PROF WILLIAMS: No, I haven't. And what that means, that if you – if you need to – my understanding, how I would use it, that this is the ecological water requirements are established. How do you deliver them when you've got river plains with towns and bridges and camping grounds and private land, a whole host of things that - - -

THE COMMISSIONER: Which are sometimes called constraints.

PROF WILLIAMS: Constraints.

MR BEASLEY: Yes. Sorry. Yes.

PROF WILLIAMS: You have to deal with those constraints so you can have the flooding and you will have economic consequences and you have to deal with them so you can deliver the SDL which is, essentially, what you require to keep the fish and the bird life alive.

THE COMMISSIONER: So on that reading, they are things that society has to deal with - - -

PROF WILLIAMS: Do.

THE COMMISSIONER: - - - but they won't take the amount necessary for the environment.

PROF WILLIAMS: That is exactly my view. That is exactly my view. And that's why I've used that diagram.

THE COMMISSIONER: Please don't answer this if you don't think you can reliably. Is that the – the understanding you gave, is that what you understand Professor Hart's understanding was?

PROF WILLIAMS: I don't know that.

THE COMMISSIONER: Thank you.

MR BEASLEY: So legal constraints aren't anything to do with the constraints of the Water Act. It's to do with - - -

PROF WILLIAMS: It's – it's – it's, to me, the - - -

MR BEASLEY: That approach would be consistent with my theory that the Basin Authority people have never read the Water Act. But - - -

PROF WILLIAMS: The point about that diagram, it illustrates - - -

THE COMMISSIONER: It's not a very pleasant document, to be fair.

PROF WILLIAMS: A critical issue to me is that if you are going to deliver what the environment needs – and when you have had a system degraded over long periods, as we have, the amount of water you need and the reform to do that is not trivial.

THE COMMISSIONER: No.

PROF WILLIAMS: So you need to recognise that this is what the environment needs. How do we manage the social and economic and the land use issues and legal issues around that sensibly and with public investment to deliver what is needed for a healthy river? And that is why I think you cannot muck around with the science. The science might give you a certain probability of success. That's the best it can do. But once you've got that, you then need to move towards how do we adjust those socio-economic issues and those legal – and the way we've changed the floodplain, we have channelised it, we have done all sorts of things to it. But if we want to have that river healthy, we have to work back through that so we can deliver the SDL that will be the ecological water requirements for that system.

That's – and we've published that, or I published it with the Wentworth Group in 2010. When we did our simpler sums on the requirements of water in 2010 before any – before the issues hadn't hit the ground, what was clear to me, in the community as a whole, Commissioner, was that very few people were very – were cognisant of the large adjustment that is required to bring about an ecologically healthy system and project the biodiversity as the Water Act requires. When we did our preliminary sums, and they were, we said we needed 4,000 gigalitres of water. Now, that simply is based on what is well established in the literature of the two-thirds rule.

That is, you try and – once you reduce the flow regime of a long-term average, reduce it by more than two-thirds, you start to suffer serious degradation. So we have got to get up above that, which gives you something like 4,000 gigalitres. So when we did that, it was clear to us that the adjustment is significant. And, therefore, the need for public investment in helping communities make that adjustment and having investment in making the constraints operating, was where we should be putting most of the money and buy the water back directly on the market. So both of

those options, which we thought made sense because they allow you to separate the scientific requirement from the social adjustment and the land use adjustments that are required to bring about the level of reform that this Basin needs, that's why we did it. And, to me, that is still ahead of us.

THE COMMISSIONER: Thank you.

MR BEASLEY: Have you finished for the time being?

THE COMMISSIONER: I have. Thank you.

MR BEASLEY: Just going back - - -

PROF WILLIAMS: Sorry if I took you off topic.

MR BEASLEY: No, not at all.

THE COMMISSIONER: No. No apologies at all. It's not off topic, this is all - - -

MR BEASLEY: It's right on topic.

THE COMMISSIONER: - - - on topic.

MR BEASLEY: Going back to the Guide.

PROF WILLIAMS: Yes.

MR BEASLEY: At page 90, the topic is developed of what are the environmental water requirements. And, in particular, environmental requirements for key environmental assets, key ecosystem functions. The assets, they are described in table 4.1 - - -

PROF WILLIAMS: Yes. I've got that.

MR BEASLEY: - - - where the Basin Authority at page 93 has identified 2,442 assets as key.

PROF WILLIAMS: Yes.

MR BEASLEY: Then there's a description of the hydrological indicator sites, indicating where they are. There's 106 across the Basin.

PROF WILLIAMS: Yes.

MR BEASLEY: And some of them are identified at pages 96 and 97 of the Guide. And at 97, there's a discussion of what are the environmental water requirements of the key environmental assets - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - and a discussion of what flow events are needed for various responses.

PROF WILLIAMS: Yes.

MR BEASLEY: And that discussion of flow events continues over to page 98.

PROF WILLIAMS: Yes. And 99.

MR BEASLEY: Yes. 99 is where they've identified the environmental water requirements of the hydrological indicator sites for – this is an example from the Riverland-Chowilla Floodplain there.

PROF WILLIAMS: Yes. Which - - -

MR BEASLEY: They're seeking – the goal there, I think, is to maintain 80 per cent of the current extent of river red gum.

PROF WILLIAMS: Yes. And Black Box.

MR BEASLEY: And Black Box, etcetera.

PROF WILLIAMS: Yes. And that's something I had not to do with when I was Commissioner because I was responsible for providing a recommendation of government on the red gum forests.

MR BEASLEY: Sure. Then - - -

PROF WILLIAMS: So that's very familiar to me.

MR BEASLEY: Yes. Then there's a discussion commencing at page 100 of key ecosystem functions and identifying the hydrological indicator sites for those key ecosystem functions, of which 88 were identified. And that's, of course, discussing things like low flow, high flow, etcetera, overbank events, bankfull events, etcetera.

PROF WILLIAMS: Yes. And diagram figure 4.4 - - -

MR BEASLEY: Yes.

PROF WILLIAMS: - - - is a very important diagram.

MR BEASLEY: Yes. Explain why you say that.

PROF WILLIAMS: Yes. Because what it illustrates, that the river channel is only one part of the system.

MR BEASLEY: Sure.

PROF WILLIAMS: The ecosystem that we're trying to manage that has been so degraded requires the floods to go out across the overbank and into the wetlands, onto the floodplain. And when it goes into those circumstances, the vegetation, the nutrient and the carbon in that vegetation is, essentially, the engine room for those riverine ecosystems. So as the wetting happens, we start to see the food web generated in those forests. And as it gets to a certain size, it will have small – zooplanktons and other things will start coming. And then, in time, that slowly flows back into the river with a reconstructed ecosystem which drives the health of the river. And it's this interaction between the floodplain and the main plain across that cross section there and how it floods – and it is not a matter of just putting water on the floodplain and treating it like watering a lawn or petunias. It's about having the water flow into the floodplain, generate ecological function and flow back into the river systems. That's how the Murray-Darling works, largely.

MR BEASLEY: So environmental - - -

PROF WILLIAMS: And that diagram is trying to say that.

MR BEASLEY: Yes. Environmental watering requirements. - - -

PROF WILLIAMS: And the other ones over the page keep it going. Yes.

MR BEASLEY: In other words, environmental watering requirements aren't as simple as just a volume of water. They - - -

PROF WILLIAMS: No.

MR BEASLEY: The science dictates when flow is required for particular wetlands or floodplains, how much the flow will be from time-to-time and at what times of year.

PROF WILLIAMS: Yes, yes, yes.

MR BEASLEY: And how many times in a particular number of years.

PROF WILLIAMS: That's right. Exactly.

MR BEASLEY: And how long there should be – and how long is desirable for inundation.

PROF WILLIAMS: That's right.

MR BEASLEY: All driven by various factors in relation to an ecosystem.

PROF WILLIAMS: That's right. Exactly. So - - -

THE COMMISSIONER: Professor, could I just - - -

PROF WILLIAMS: Sorry.

THE COMMISSIONER: While we are talking about figures, I want to draw your attention to your figure 10 at page 77 of your Royal Society of New South Wales 2017 paper, Water Reform in the Murray-Darling Basin.

PROF WILLIAMS: Yes, yes. That's - - -

THE COMMISSIONER: May I suggest that that adds a little bit more, conceptually, to figure 4.4 in the Guide, doesn't it?

PROF WILLIAMS: I hope so.

THE COMMISSIONER: Because it has the difference between water shedding floodplain and water retaining floodplains, in particular.

PROF WILLIAMS: Yes. I think – to me, that diagram and its knowledge came from the Royal – from the Natural Resources Commission. And, subsequently to the Guide, we learnt more about it. And I was able to incorporate more of the literature into that conceptual framework.

THE COMMISSIONER: But, for my purposes, if I were to combine the learning from that figure 10 and the Guide's figure 4.4 - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - which has the laminations, if you like, of the channel.

PROF WILLIAMS: Yes.

THE COMMISSIONER: Then I would get - - -

PROF WILLIAMS: A much better picture.

THE COMMISSIONER: Thank you. Sorry. Thank you.

MR BEASLEY: That's all right. So what this all leads up to in the Guide is, in terms of conclusion-type material, is at, first of all, page 112 and table 4.4. Having done all this work in terms of identifying key environmental assets, key ecosystem functions, etcetera, etcetera – I think you might be looking at the wrong - - -

PROF WILLIAMS: Yes. I just wanted to say, as we go past 111 - - -

MR BEASLEY: Yes, yes.

PROF WILLIAMS: - - - that is, really, fundamental, good hydrology.

MR BEASLEY: Yes.

PROF WILLIAMS: You are looking at a time-duration curve - - -

MR BEASLEY: Yes.

PROF WILLIAMS: - - - and you're shifting that around. And that's, really, a critical piece of data that you need to have.

MR BEASLEY: Well, might – go ahead and explain further why you say that.

PROF WILLIAMS: Well, you can see it's giving you a sense of the flow through the Murray. This is the Murray Mouth.

MR BEASLEY: Yes.

PROF WILLIAMS: And so you've really got – rivers die from the mouth upward. And so you've really got to have that sort of criteria happening at the Murray Mouth if you want the rest of the system to also be successful.

MR BEASLEY: You've just reminded me. That was one of the questions I was going to ask because it sometimes has been suggested at various times to this Commission in – not in sworn evidence but in community consultations or we have read material that it may not – flow out of the Murray Mouth may not be particularly important. Would you like to spend some time now informing the Commissioner why flow out of the Murray Mouth and the extent of flow is important?

PROF WILLIAMS: Yes. That's fine. It's one of our myths in Australian culture that any water that gets to the sea is wasted.

MR BEASLEY: Yes. Irrigating the Southern Ocean is the phrase sometimes said.

PROF WILLIAMS: Yes. We're just wasting it. But it provides, first and foremost, a fundamental requirement of flow to remove the salt from the landscape. It has been happening for millennia and that's why the landscape has continued to function for so long so well. So you've got to have the flows out to the ocean. And, of course, to get those – those flows out to the ocean are taking with them carbon and nutrient and a whole lot of things for a whole lot of oceanographic function which we derive in the Southern Ocean through our fisheries. But - - -

MR BEASLEY: So there's an ecosystem beyond the Mouth.

PROF WILLIAMS: There's ecosystems out there and we depend on it.

MR BEASLEY: Yes.

PROF WILLIAMS: But, also, the flows at the Mouth give you good guides to what you can achieve right up the system. It's like – and it's a good measure of the rest of the system's health. And so that's critical. And so, therefore, because you've got some world heritage, important Coorong systems, it's vital that we have the Mouth doing what this diagram illustrates.

THE COMMISSIONER: Can I take you to table 4.4 in the Guide.

PROF WILLIAMS: 4.4.

THE COMMISSIONER: Page 112.

PROF WILLIAMS: Okey-doke. Yes. Yes. Okay.

THE COMMISSIONER: And the last entry is:

> *…described as Murray represents the whole of Murray-Darling Basin.*

Do you see that?

PROF WILLIAMS: Yes.

THE COMMISSIONER: And the gauge is the barrage flow.

PROF WILLIAMS: That's right.

THE COMMISSIONER: And without development the hydrological - - -

PROF WILLIAMS: Was 12,000.

THE COMMISSIONER: - - - estimate is 12 and a half thousand gigalitres under what are called current arrangements. Now, is that the current arrangements with the cap operating?

PROF WILLIAMS: I understand it is with the long-term cap involved, yes.

THE COMMISSIONER: Yes. Is - - -

MR BEASLEY: So that would be at 2009.

PROF WILLIAMS: Yes, somewhere around there.

THE COMMISSIONER: So it's 41 per cent of - - -

PROF WILLIAMS: That's right - - -

THE COMMISSIONER: - - - what I will call without development - - -

PROF WILLIAMS: That's right.

THE COMMISSIONER: - - - flow.

PROF WILLIAMS: Yes. And that's why that 67, two-thirds, rule is important, you see?

THE COMMISSIONER: That's right. You anticipated me. And 41 per cent is less than 66.6.

PROF WILLIAMS: That's my view.

THE COMMISSIONER: Thank you. It is - - -

PROF WILLIAMS: Yes. I reckon we got that right.

THE COMMISSIONER: Even I can say that.

PROF WILLIAMS: Yes.

THE COMMISSIONER: Now, the two columns that follow, high uncertainty and low uncertainty - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - the high uncertainty is a level at which achievement of predetermined ecological improvements - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: High uncertainty of that being achieved.

PROF WILLIAMS: That's right. So it's - - -

THE COMMISSIONER: And low uncertainty might be described as an acceptable degree of confidence - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - that they will be achieved. Is that correct?

PROF WILLIAMS: That's right. So when you go to low uncertainty, it says 80 per cent. There's an 80 per cent likelihood of success.

THE COMMISSIONER: well, is that what the percentage means there? I think – I'm just looking at - - -

PROF WILLIAMS: You mean of the flow. Well, I misunderstood that. That's right. But that's what low – it is the likelihood of success. Low uncertainty means that it's a high likelihood of success. It's the reciprocal of it.

THE COMMISSIONER: Yes, but the percentage figures in those columns - - -

PROF WILLIAMS: That's just the percentage of the flow.

THE COMMISSIONER: That's a percentage of without development flow.

PROF WILLIAMS: That's just the percentage of the flow. Yes. I .....

THE COMMISSIONER: No. That's all right. So I just want to - - -

PROF WILLIAMS: No. We need to get that clear. The 80 per cent is - - -

THE COMMISSIONER: So if I - - -

PROF WILLIAMS: - - - 10,046 over 12,503.

THE COMMISSIONER: So if I take – I want to go to the other end now, the Barwon-Darling, representing the whole of the Darling at Menindee. Do you see that?

PROF WILLIAMS: Yes. Yes.

THE COMMISSIONER: According to this table, the current, the then current arrangements saw only 53 per cent of the flow - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - for that end of system. And if you could improve that to 68 per cent of without development flow, you would still be in high uncertainty of achieving the environmental outcome.

PROF WILLIAMS: That's true.

THE COMMISSIONER: And you would need to get to 81 per cent of the without development flow in order to achieve low uncertainty of achieving the environmental outcome.

PROF WILLIAMS: The purpose. That's correct.

THE COMMISSIONER: And so that's an example of how one is meant to read this table.

PROF WILLIAMS: That's right.

THE COMMISSIONER: And what those figures, which you will notice all, I think, start with an eight in the right-hand column for low uncertainty, as in all in the 80 – the range of 80 to 89 per cent. What that suggests is that the two-thirds rule you've told us about is a point at which systems start to crash.

PROF WILLIAMS: That's the literature.

THE COMMISSIONER: So you need to be – if you were going to, to use the language of the statute, recover and protect, then you are going to have to be - - -

PROF WILLIAMS: Above it.

THE COMMISSIONER: - - - above the level at which you crash.

PROF WILLIAMS: That's right.

THE COMMISSIONER: Now, I know that sounds obvious as a matter of English, but I haven't seen any explanation in any published material by the MDBA or the department or the Minister - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - which suggests how you could reduce those figures in the range 80 to 89 per cent - - -

PROF WILLIAMS: Yes. I haven't seen - - -

THE COMMISSIONER: - - - and still comply with the Act.

PROF WILLIAMS: I haven't seen that. And that's what troubles me. And that's why we said what we said in our report.

MR BEASLEY: The Act also says commands not to compromise.

PROF WILLIAMS: Yes.

THE COMMISSIONER: Well, exactly.

PROF WILLIAMS: But it does just highlight that if you look at what happens at the bottom of the system, it's not a bad reflection of what happens right up the system.

THE COMMISSIONER: Now, is table 4.4, so far as you are aware from your study - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - is it superseded, refuted, in need of correction?

PROF WILLIAMS: Well, I haven't seen that. And that's the thing I would like to see: where did we go from table 4.4 to get to 2750?

THE COMMISSIONER: Now, I have - - -

PROF WILLIAMS: I don't know.

THE COMMISSIONER: I have read and been told a number of times in a number of different ways what I think I understand as follows. If you don't understand this, please let me know. That the Guide used modelling and reasoning based on end of system flows.

PROF WILLIAMS: Yes. Well, that's true.

THE COMMISSIONER: And that what some people have called more robust modelling since then, of a different kind – I think site-specific is one of these questions that has been used – produces a lower ESLT - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - than the method adopted in the Guide. Have I - - -

PROF WILLIAMS: Yes, that's my understanding.

THE COMMISSIONER: Right. Now, I just want to unpick that a bit, please. What's called end of system flows, I confess at one stage I thought they were just talking about the mouth of the Murray.

PROF WILLIAMS: No, the mouth of all the catchments.

THE COMMISSIONER: But they're not. These are – some of them are reaches, some of them are rather larger than reaches.

PROF WILLIAMS: Yes. Yes.

THE COMMISSIONER: And they are different ways, physically and conceptually, of dividing up the whole system. Is that right?

PROF WILLIAMS: Yes. And that's pretty credible to me.

THE COMMISSIONER: Well, now, table 4.4, when you see - - -

MR BEASLEY: Probably should be in conjunction with 4.5, I think - - -

THE COMMISSIONER: Yes.

MR BEASLEY: - - - too, with 114.

THE COMMISSIONER: The first and last entries seem to include the other entries. Is that correct?

PROF WILLIAMS: Say that again, sir.

THE COMMISSIONER: Well, the last entry is Murray; represents the whole of the Murray-Darling Basin.

PROF WILLIAMS: Yes, on page 4.4. Yes, I thought...

THE COMMISSIONER: So that, as it were, comprehends everything else in that table.

PROF WILLIAMS: Yes, that's right. It's the whole system. And it's looking the flow out of each catchment or large - - -

THE COMMISSIONER: Well, my point is that this is a table and an approach - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - which certainly does use end of flow for the whole system, but it also has end of system flows for integers of that aggregate.

PROF WILLIAMS: Absolutely. So it's looking at the component and it's the end of flow in the Condamine system - - -

MR BEASLEY: Yes.

PROF WILLIAMS: - - - the end of flow in all the different systems.

THE COMMISSIONER: So could you explain to me, because I don't understand it, what is the conceptual difference between that and a site-specific approach said to produce more robust modelling so as, apparently to conclude with - - -

PROF WILLIAMS: Well - - -

THE COMMISSIONER: - - - 2,750 gigalitres instead of 4,000?

PROF WILLIAMS: To be perfectly honest, I don't know, because - - -

THE COMMISSIONER: It is hydrological, this question, isn't it?

PROF WILLIAMS: It is a hydrological question, the end of flow question. But then you say – see, I haven't been able to see – and it might be my ignorance – but I haven't been able to see the site-specific analysis, which you would try and look at what flows at all these sites, will give the site some credible ecological performance and then you add it up.

THE COMMISSIONER: When you say you haven't been able to see - - -

PROF WILLIAMS: I haven't seen - - -

THE COMMISSIONER: - - - the MDBA has not published it, is that right?

PROF WILLIAMS: Not and it hasn't been – it's not published in a journal, it's not published in a peer review. I don't know where it is. I don't see how it gets there.

THE COMMISSIONER: Well, now am I simply being impatient when I say that doesn't sound like science?

PROF WILLIAMS: It doesn't sound like science and it isn't. And it's very interesting. When the CSIRO reviewed or have asked with a set of questions "Tell me what you get for 2,750 or 2,800", it said, "Are you only satisfied 60 per cent of the sites?" But also, CSIROs report, which surprised me that that's what they did, they said, "But we've analysed your work, but it isn't documented." Well, strike me lucky. I don't know how you analyse work when the workings are not documented.

THE COMMISSIONER: But if it's not documented - - -

PROF WILLIAMS: And then it was documented subsequently, but not robustly at all.

THE COMMISSIONER: So you have seen a subsequent documentation that is available to be criticised. Is that right?

PROF WILLIAMS: Well, in part, but there's not sufficient to really look at the engine room.

THE COMMISSIONER: The workings as it might be called are not available?

PROF WILLIAMS: I can't find them.

THE COMMISSIONER: Now, again - - -

PROF WILLIAMS: I may be just ignorant, but I haven't been able to find them.

THE COMMISSIONER: - - - please tell me if I am being Pollyanna here, but I had also understood in science a mark of its cogency - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - was the making available of the workings to be criticised?

PROF WILLIAMS: Absolutely. And that's why I was making the point earlier about failure to have peer review, because the first thing you would ask, "Show me the equations", then, "Let me look at your assumptions that you've built into each of those equations", then, "Can I have a look at the data." And if you can't do those three things, you cannot give a credible analysis of the science.

THE COMMISSIONER: Have you ever heard, privately or publicly, any explanation from the MDBA as to any reason, any reason at all, for a failure to make that material available publicly?

PROF WILLIAMS: I haven't heard a good reason why it isn't available.

THE COMMISSIONER: Have you heard any reason?

PROF WILLIAMS: I haven't heard any reason why we shouldn't – haven't got it.

THE COMMISSIONER: No one has said it's commercial in confidence, have they?

PROF WILLIAMS: Not to me.

THE COMMISSIONER: No. No one has said copyright?

PROF WILLIAMS: I don't think it would be copyright.

THE COMMISSIONER: No. Neither do I. I'm trying to think of a reason.

PROF WILLIAMS: I cannot see why the analysis has not been explicitly laid out and open to inquiry and critique.

THE COMMISSIONER: Well, let me suggest a possibility which I am, obviously, considering whether I should infer, that it has not been revealed for fear that if it were, weakness could be demonstrated.

PROF WILLIAMS: You get that impression.

THE COMMISSIONER: Well, I get that impression at least provisionally.

PROF WILLIAMS: But as a scientist, I find it just so disappointing, when we are a very able community scientifically as Australians, that we are investing all this money and we do not have the scientific analysis open and before us and available for scrutiny.

THE COMMISSIONER: Now, I think it's your understanding, from what I've read of your material, that a Senate committee has even suggested that there should be disclosure.

PROF WILLIAMS: Yes. And the Senate – if you look at the Senate inquiry that I think came in 2012, it asked for that explicitly, "Could you please tell us how you get the numbers."

THE COMMISSIONER: And have you seen any favourable response to that?

PROF WILLIAMS: Not to my knowledge. Not that satisfies me, anyhow, or anyone else of my hydrologists who are able to speak to the facts.

THE COMMISSIONER: It's just that... terms of reference involve expressions of opinion concerning the prospect of the plan succeeding. The Plan and the Act which regulates its making, adjustment and administration has the various requirements, some of which I've asked you about this morning. But they involve administration, active and continuing, by the authority, which has chosen not to cooperate with this Royal Commission.

PROF WILLIAMS: That's - - -

THE COMMISSIONER: Now, where the Authority has been asked by scientists on the one hand, for the sake of science, and by the Senate committee on the other hand, for the sake of responsible government, to supply the workings for its critical figure for the ESLT and has not, I am considering as a matter of inference that the Authority has an approach to its responsibilities which in and of itself threatens achievement of the Plan's goals.

PROF WILLIAMS: I would agree with that completely. I think the goals that are in the Act and supposed to be delivered by the Plan in the current form cannot succeed. Firstly, the amount of water is not scientifically defendable, which we have just been talking about. There's no adjustment for climate change - - -

THE COMMISSIONER: We will come to that, yes.

PROF WILLIAMS: And the water – and accounting hasn't been done properly, so we do not know what we have recovered and what we have taken from Peter to pay Paul. So there's a whole string of issues that I could list that, in my mind, place this plan in great jeopardy of failure.

THE COMMISSIONER: Well, when we talk about "the Plan", at the moment it is a plan – sorry, Mr Beasley. What's the figure? It's two - - -

MR BEASLEY: Now?

THE COMMISSIONER: Yes.

MR BEASLEY: Well, it's 2,750 less the 605 - - -

THE COMMISSIONER: But the 605 is not actually 605.

MR BEASLEY: The 605 has got to be 543, because of the five per cent rule. And we have got the northern Basin Review to come up and - - -

THE COMMISSIONER: So it's - - -

PROF WILLIAMS: Well, that's the point about not sufficient water.

MR BEASLEY: Let's call it a 2,100 gigalitre plan.

THE COMMISSIONER: It's much closer, isn't it, to 2,100 - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - than to 2,750?

PROF WILLIAMS: Absolutely. And I think we have got a figure here on page...

MR BEASLEY: I think Professor Williams and Professor Grafton have a view that even the figure of 2,100 may not be - - -

PROF WILLIAMS: No. 2,108 is, but that's what they are estimating at the moment, but we - - -

MR BEASLEY: But that includes 700 gigalitres for efficiency measures - - -

PROF WILLIAMS: ...

MR BEASLEY: - - - in relation to which you have some doubts.

PROF WILLIAMS: Absolutely.

MR BEASLEY: Yes.

PROF WILLIAMS: And we would say that the number you have got is somewhere between 649 gigalitres per year and 789 gigalitres per year, nothing like the 2,108 claimed.

THE COMMISSIONER: But if it was 2,108 - - -

MR BEASLEY: Sorry. Can I just – are you – I think something like 1,200 gigalitres in water entitlements have been purchased. Is your lower figure anything to do with the fact that some of those entitlements purchased weren't – that the irrigators weren't taking 100 per cent of their entitlement or - - -

PROF WILLIAMS: There's two things that take the number down from the number... those numbers. The world of a direct purchase still has a return flow problem.

MR BEASLEY: Right.

PROF WILLIAMS: Okay? But in addition to the return flow problem, it's the proportion of the entitlement actually used and it sits around .8, from the analysis that I have done. So when you've got a .8 times - - -

MR BEASLEY: I think Professor Wheeler may have done analysis, too. It's a - - -

PROF WILLIAMS: Yes. She did the analysis.

MR BEASLEY: - - - slightly lower figure of - - -

PROF WILLIAMS: She got even lower, but I was trying - - -

MR BEASLEY: Yes.

PROF WILLIAMS: - - - to be conservative.

THE COMMISSIONER: Is this the area where people talk about real water?

PROF WILLIAMS: Absolutely. It's not much like that. So the answer is that the entitlement is reduced by .8, if you use the figures I would stand with. And then you've got to take away the – that what was the return flow? If this particular entitlement was generating a large amount of return flow, then you've got a lot less, again. And we've taken that into account in the numbers we've provided.

THE COMMISSIONER: But, just so that I've understood this, is this how the reasoning is meant to work, that for what I'm going to call ecological reasons there is an estimate of how much more water than is presently available for the environment is needed to recover and protect?

PROF WILLIAMS: I think – I'm not sure I understand that, Commissioner. The figure of this 2,108 we think does not take into account either the amount of water that's actually used of an entitlement and it doesn't take into account how much it was affected by return flows.

THE COMMISSIONER: I think I understand.

PROF WILLIAMS: That's right.

THE COMMISSIONER: I just want to test whether I do.

PROF WILLIAMS: Yes. I want to help.

THE COMMISSIONER: Just going back to how this – this is a plan. This is an Act and a Plan under which, as we are told, there will be a reduction in the amount of consumptive use.

PROF WILLIAMS: Absolutely.

THE COMMISSIONER: Because of the legislated fact, I think also of the scientific and social fact, that we've been taking too much.

PROF WILLIAMS: Exactly.

THE COMMISSIONER: Too much meaning too much in order for the ecology to - - -

PROF WILLIAMS: Function.

THE COMMISSIONER: - - - continue in an acceptable fashion.

PROF WILLIAMS: That's right.

THE COMMISSIONER: Which can be summarised by the notion that the obligation is to have a plan which, to the extent possible, will recover and protect; that is, improve from the present unacceptable position and provide resilience for the future - - -

PROF WILLIAMS: That's very true.

THE COMMISSIONER: - - - against future degradation.

PROF WILLIAMS: Yes, I agree.

THE COMMISSIONER: That produces, by cooperative science and judgment of, among others hydrologists and environmentalists, no doubt mathematicians and biologists generally – it produces an understanding by way of estimate of the level of flow necessary to be achieved.

PROF WILLIAMS: Yes.

THE COMMISSIONER: And when you consider that against the history, long-term average of the river, you can reach, as it were, a figure – think of it as a proto SDL – which is the amount that we, humans, can take by way of consumptive use while leaving enough for the environment to be recovered, protected, etcetera.

PROF WILLIAMS: Exactly.

THE COMMISSIONER: Right. Now, if that is the system, what we happen to have, as social beings, is we have, supposedly, records of both allocation and usage for consumptive use, so that an irrigator has X megalitres per year.

PROF WILLIAMS: Yes.

THE COMMISSIONER: That is brought back so that a superficial understanding would say X that formerly was being consumed for irrigation is now - - -

PROF WILLIAMS: Available to the environment.

THE COMMISSIONER: Marvellous to relate, is now available for the environment.

PROF WILLIAMS: That's right.

THE COMMISSIONER: And then you say, "But, hang on a moment, even in a year when he or she took the whole of the X and put them on the paddocks, some got back into the river system."

PROF WILLIAMS: Yes.

THE COMMISSIONER: It was not, as it were, consumed by - - -

PROF WILLIAMS: The cropping.

THE COMMISSIONER: - - - the marvels of photosynthesis and transpiration.

PROF WILLIAMS: That's right.

THE COMMISSIONER: How much got back is a vexed and controversial and difficult to study matter, but some got back. So it's already X minus a mysterious Y that is in fact becoming available for the environment.

PROF WILLIAMS: That's correct.

THE COMMISSIONER: And then you say, "But, hang on a moment, it's a rare year that the lucky farmer gets 100 per cent allocation." And you add to that, "And not all farmers farm on the basis that come what may I'm going to use every drop of water I have, regardless whether the crop needs it."

PROF WILLIAMS: That's right.

THE COMMISSIONER: For example, it might surprise us all and rain. Well you don't need to irrigate.

PROF WILLIAMS: That's right.

THE COMMISSIONER: For all those reasons, it's pounds to peanuts, you say, that it will never be as much as X, except in a freak event, that is in fact made available to the environment when that farmer's allocation is purchased.

PROF WILLIAMS: That is exactly how I understand it.

THE COMMISSIONER: All right. Have you ever heard anyone suggest that the reasoning I've just expressed is wrong in any particular?

PROF WILLIAMS: No, I wish – I've sort of, you know, tried to rework this a number of times and check with my colleagues across the world, "Have I got this wrong?" And because I do the same sums, that's the sum that's in a paper that I - - -

THE COMMISSIONER: Yes.

PROF WILLIAMS: I would love to have it in there, but it's not quite ready yet. But we have one we think is in science and we have another one in another. I've never been told we're wrong.

THE COMMISSIONER: Well, now, doesn't that mean that for the MDBA to have approached a calculation which treats as 100 per cent available to the environment the nominal volume of a purchased allocation is, obviously, wrong?

PROF WILLIAMS: Yes, it is. And it's inconsistent with international trading. The American water system makes sure you take account of the return flow, particularly between interstate transfers, because someone in upper state says, "I let you have 30 per cent of what I'm being charged for. You've got it." So they make a very clear understanding of the return flow issues when you talk about the entitlement equivalent in the American language.

THE COMMISSIONER: It's not just return flows; it's also the fact that the purchased or the repurchased allocation - - -

PROF WILLIAMS: Is not what was used.

THE COMMISSIONER: - - - does not equate - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - to what is going to become available to the environment.

PROF WILLIAMS: Yes.

THE COMMISSIONER: Because, to put it another way, before the purchase, the farmer would take, say, 80 per cent of X, meaning 20 per cent of X was then and there already available to the environment.

PROF WILLIAMS: That's right. Yes. Exactly. That's how I understand it.

THE COMMISSIONER: Well, now, what - - -

PROF WILLIAMS: And I haven't heard anyone tell me that that is in error.

THE COMMISSIONER: Has anyone at the MDBA ever taken you to task for your repeated – and Professor Grafton's repeated – expositions of this point?

PROF WILLIAMS: Well, in public debate, no - - -

THE COMMISSIONER: All right. Privately?

PROF WILLIAMS: And in private – no, not in public debate. They've been courteous and said – and moved on. In private debate they say, "I think it doesn't matter."

THE COMMISSIONER: Why? Sorry. Did they explain why it doesn't matter?

PROF WILLIAMS: No. They could never explain to me why it is.... tell me when ..... and I was going to table another story which I didn't bring a copy of, the Pratt company funded a lot of work just when I was about to retire in 2003 – yes – 2002, 2003 – to look at the return flow situation in the Murrumbidgee. Now, that material is available and I will forward it to you, if that would be helpful to you.

THE COMMISSIONER: Yes, please.

PROF WILLIAMS: But it illustrates that in that system there's significant return flows. And in the analysis that CSIRO did, funded by Pratt, it shows clearly that water use efficiencies without taking into account return flows may not make much sense, because Pratt was of the view we could fix up the efficiencies and we would save a lot of water. And that was in part true. And when you do the return flow analysis and when you look at the Murrumbidgee system and then you look at the Coleambally system, the flows from one were feeding the other. And so when you did the sums, the merits were not apparent. And that paper is there.

So that information is locally available and it's well established in the international literature. And I just do not understand why – you're quite right to say the sums are not trivial to make, but they are part of hydrology that can be assessed in a number of ways. We have a lot of water balance on a size of this room or a couple of these size of the rooms where we know where the water goes. And that's the papers by – there's a stack of them by Roth and a whole lot of – who have collated the work. So we know the small scale water balance under irrigation, and so – but the measurement of larger scale is more difficult.

But, nevertheless, there has never been any reason that I've been able to get why the Murray-Darling Basin Authority has not dealt with the return flow issue. It was drawn to the attention of government repeatedly in papers that are in the documents that I've supplied and, as far as I can see, ignored.

THE COMMISSIONER: Thank you.

MR BEASLEY: Can I just ask you to just – sorry – I should put on the record that the Senate Committee report that I believe Professor Williams was talking about was the Rural and Regional Affairs and Transport References Committee. And they handed down a final report in January 2013. Recommendation 1 was that the committee recommends that the MDBA publicly release a succinct non-technical explanation of the assumptions used to develop the 2,750 gigalitre per year figure.

PROF WILLIAMS: Yes.

MR BEASLEY: The Australian Government's response to that recommendation is set out in two paragraphs - - -

THE COMMISSIONER: Yes.

MR BEASLEY: - - - which refers to previous publications of the authority, including the ECTL report, and four other brief matters, delivering a healthy working base in chapter 4, a hand-out called 'Frequently Asked Questions: How Do You Determine the Limits on Water Use?' A fact sheet regarding that. Two pages from a consultation report, and a chapter from an impact statement. Now, I'm a lawyer, but, as a lawyer trying to interpret a scientist, some of those documents I would frankly submit are not much more than press releases. They certainly don't contain - - -

THE COMMISSIONER: Well, I confess, I read - - -

MR BEASLEY: I can see the Professor nodding when I said press release. They certainly don't contain any more detail, in fact, probably a lot less, than the reports.

PROF WILLIAMS: That's right.

THE COMMISSIONER: I confess, I have read the Australian Government's response to the Australian Senate Committee's recommendation as meaning as following, "We're not going to give you anything that you haven't already got", a matter upon which I will, undoubtedly, comment in my report.

MR BEASLEY: All right. Well, that - - -

PROF WILLIAMS: Yes. Well, that's exactly what I understand. There was nothing that scientifically was helpful at all.

MR BEASLEY: I will tender that Australian Government response to the Senate Rural and Regional Affairs and Transport - - -

THE COMMISSIONER: Thank you.

MR BEASLEY: - - - References Committee, January 2013.

THE COMMISSIONER: Now, am I right in recalling that another of the recommendations refers to the release of the modelling?

MR BEASLEY: Sorry, Commissioner, I was distracted then and - - -

THE COMMISSIONER: That's all right. Am I right in recalling that another one of the recommendations of that committee concerned the release of modelling? I'm sorry if I've confused - - -

MR BEASLEY: No. One of the – well, one of the recommendations was that the committee recommends the Basin Authority consider modelling alternatives other than 2,750, etcetera, etcetera. And the response was, "Well we did three scenarios, 2,400, 28 and 3,200." I can check over – there's 20 recommendations. I will check over morning tea for anything else. Can I just finish with the Guide, though, before we break for morning tea because I've only got one more page reference? So page 114 and table 4.5, Professor, is the table concerning reductions in diversions required to achieve environmental water requirements. There's reductions in diversions provided for each of the various valleys at both the high uncertainty and the low uncertainty range that you've previously discussed.

PROF WILLIAMS: Yes. Yes.

MR BEASLEY: With the Basin total diversions there, we see the figures of 3,856 for high certainty - - -

PROF WILLIAMS: 6,983.

MR BEASLEY: - - - and 6,983 for low uncertainty.

PROF WILLIAMS: Yes.

MR BEASLEY: And that's where it rested upon publication of the Guide.

PROF WILLIAMS: That's correct. And that's – yes, that's what I understand. And that's an end of flow analysis, good hydrology. And that's where we should have started the sums from.

MR BEASLEY: When you say good hydrology for end of flow analysis, do you have – one, do you have a clear understanding of what the MDBA means by an indicator site model and, two, do you have a view about – if so, do you have a view about that sort of modelling compared to an end of flow analysis?

PROF WILLIAMS: Well, the problem with the – selecting sites and then trying to assess the impacts on them, it can become – and Gene Likens mentioned this a little. It can be that you're not – it's hard to do the science objectively because you actually are, in a way, saying, "Well, if I do this, what do I get?" You know, it's not quite the same rigour, in my view. And I, personally, think it is probably possible to do that

that way but I would like to be able to see it transparently, the assumptions and analysis fundamentals so you could make a judgment and be sure that you weren't playing games with yourself.

MR BEASLEY: Understood. And as you said - - -

PROF WILLIAMS: And that's not good science. A scientific analysis that doesn't – that keeps you out of that cycle where you can play around with things to fiddle and fiddle around, to me, good scientific analysis requires that the input parameters should be as independent as possible from the observations.

MR BEASLEY: Thank you. I'm going to ask some very brief questions about the ESLT report. So perhaps now would be a convenient time to – unless you have got anything further on that?

THE COMMISSIONER: No. I do on the Guide.

MR BEASLEY: You do on the Guide. Do you want to complete that now or have morning tea?

THE COMMISSIONER: I think we will have morning tea. Thanks.

MR BEASLEY: All right. So how long will we break - - -

THE COMMISSIONER: So we will adjourn for 15 minutes.

MR BEASLEY: 15 minutes. All right. Thanks.

ADJOURNED **[11.33 am]**

RESUMED **[11.47 am]**

THE COMMISSIONER: Professor, I just want to ask you a couple more questions about the Guide.

PROF WILLIAMS: Please.

THE COMMISSIONER: It's in volume 2, chapter 4, page 115.

PROF WILLIAMS: Yes.

THE COMMISSIONER: And we're still talking about - - -

MR BEASLEY: Sorry, what page are you on, Commissioner?

PROF WILLIAMS: 115.

THE COMMISSIONER: 115. So this is towards the end of the discussion of the end of system flows exercise with respect to surface water. And at the top of page 115 - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - there is an expression of confidence limits of plus or minus 20 per cent for the high uncertainty target, plus or minus 10 per cent for the low uncertainty target. Do you see that?

PROF WILLIAMS: Just let me look at that. The top of 115.

THE COMMISSIONER: 115.

PROF WILLIAMS: Yes.

THE COMMISSIONER: There's a reference to - - -

PROF WILLIAMS: Yes. Plus or minus 20 per cent. Yes.

THE COMMISSIONER: For the high uncertainty target. And plus or minus 10 per cent for the low uncertainty target. Do you see that?

PROF WILLIAMS: Yes.

THE COMMISSIONER: Now, I think I can do the arithmetic in both cases, the 3,000 gigalitres a year for a Basin wide reduction in diversions - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - is an approximation of 3,856 gigalitres that you see in table 4.5, reduced by 20 per cent.

PROF WILLIAMS: Yes, yes. 20 per cent. That's right.

THE COMMISSIONER: And, similarly, 7,600 gigalitres for the low uncertainty is, approximately, the 6,983 you see in table 4.5, increased by 10 per cent.

PROF WILLIAMS: That's right. That's my understanding.

THE COMMISSIONER: I can understand that but what I don't quite understand is, and perhaps you can help me here, why they went down to 3,000 for high uncertainty and up to 7,600 for low uncertainty.

PROF WILLIAMS: Yes. I - - -

THE COMMISSIONER: Is there something scientific that I'm missing?

PROF WILLIAMS: There's nothing scientific. It's a judgment. There's no - - -

THE COMMISSIONER: One attempt I've made to understand that is they are trying to express to the user of this Guide, the widest range that the science permits, 3,000 being the lowest in order to achieve high uncertainty and 7,600 being the highest in order to achieve low uncertainty

PROF WILLIAMS: Yes.

THE COMMISSIONER: But am I right that you could also compare, what, 4,700 or so to 7,600?

PROF WILLIAMS: Yes, you could have. Yes, you could have. And, I mean, maybe the work was to say, "Look, there's a big range for you to – a big range over which we have high confidence of success and a low, you know, a low confidence." And, other than that, I don't know why you would have written those two paragraphs the way they are.

THE COMMISSIONER: The only reason I can think – and I don't suggest anything sinister – is that it gives the reader the widest range that the science would understand.

PROF WILLIAMS: That's about the best of it, I think.

THE COMMISSIONER: And I don't know why it would be useful. But I can - - -

PROF WILLIAMS: That's what it does. It says there's a huge range from 3,000 to 7,600.

MR BEASLEY: What does the reader take from a sentence that is:

> *MDBA, therefore, believes the environmental water requirements for key environmental assets and key ecosystem functions can be achieved with a high level of uncertainty with diversions of 3,000.*

That's another way of saying we don't believe we can, isn't it?

THE COMMISSIONER: Mr Beasley, has anticipated me. I want to draw attention to words I've underlined in red from those he has just read to you:

> … *can be achieved with a high level of uncertainty.*

Do you see that? Second last line of that paragraph.

PROF WILLIAMS: Yes. It says low level of uncertainty.

THE COMMISSIONER: No, no, no. The first paragraph, second last line:

… *can be achieved with a high level of uncertainty.*

Do you see that?

PROF WILLIAMS: I see. Yes.

THE COMMISSIONER: Now, I'm just speaking as a native user of English and as a lawyer. But - - -

PROF WILLIAMS: That means you have got Buckley's.

THE COMMISSIONER: "Can be achieved with a high level of uncertainty" surely means probably won't be.

PROF WILLIAMS: That's what I would say, it has got Buckley's.

THE COMMISSIONER: Well, it may not be Buckley's but it may not be much better.

PROF WILLIAMS: That's right.

THE COMMISSIONER: A high level of uncertainty certainly means not probable.

PROF WILLIAMS: Not likely.

THE COMMISSIONER: Not more likely than not. Less likely.

PROF WILLIAMS: Yes. It means – well, a high level of uncertainty means that you have probably got very little chance of success.

THE COMMISSIONER: Well, now, what I want to ask you, then, is - - -

PROF WILLIAMS: And, therefore, why the heck would have 2,750?

THE COMMISSIONER: No. That's not what I was going to ask you.

MR BEASLEY: Why would you have 3,000?

THE COMMISSIONER: I was going to ask you this: that sounds to me, as a matter of English – and, to me, I should say, also as a matter of law – that were you to set the amount on the basis of something that "can be achieved for the high level of uncertainty", you would be compromising the outcome which constituted your target.

PROF WILLIAMS: Absolutely.

THE COMMISSIONER: And that, of course, is an expression, compromising, that comes from the definition of ESLT in the Water Act.

PROF WILLIAMS: Yes.

THE COMMISSIONER: It has to be a level above which there would be compromise.

PROF WILLIAMS: Yes. That's right.

THE COMMISSIONER: Now - - -

PROF WILLIAMS: That's exactly right.

THE COMMISSIONER: Now, the corresponding words attached to the estimate of 7,600 gigalitres a year in the next paragraph are, and I quote:

> … *can be achieved with a low level of uncertainty*.

PROF WILLIAMS: Yes.

THE COMMISSIONER: Now, that, again, means probably can be achieved.

PROF WILLIAMS: That's right. A high level of likelihood of success is how I would – I think they have reversed those languages around but a low level of uncertainty means a high likelihood of success.

THE COMMISSIONER: Is there an accepted approach in something I will call environmental hydrology to the levels of confidence, bearing in mind the inherent variability of river systems and terrestrial water - - -

PROF WILLIAMS: Yes. There is.

THE COMMISSIONER: Is there an approach in the science to a level of confidence with which one tries to address demands such as repair of environmental degradation?

PROF WILLIAMS: Yes. There is quite a literature on how you treat the probability of success. And I found that I used that often when I had to refer to a Minister, in the case of a Lachlan Groundwater System, for example, the probability of not damaging the system and the probability of damaging the system. And I could refer you to some of that requirement.

THE COMMISSIONER: Thank you, I was about to ask. Would you mind happily seeing whether you can supply something to the Commission staff to that effect?

PROF WILLIAMS: Yes, yes. No. Look, this is - - -

THE COMMISSIONER: I hope – I think you understand, I want something you regard as being - - -

PROF WILLIAMS: A good way forward.

THE COMMISSIONER: Not what you regard as good, but what you understand your peers, your colleagues, regard as a widely accepted approach.

PROF WILLIAMS: Okay. I will do that.

THE COMMISSIONER: I would be very much obliged. Thank you. Now, one other thing: climate change. Same volume of the Guide, picking it up at page 121. I won't take you in detail to it, but you see that it culminates in the notion on the next page of a three per cent allowance for what I will call the first 10 years. Is that correct?

PROF WILLIAMS: Yes. That's the adjustment that is recommended. Where the heck is that now?

THE COMMISSIONER: You see on page 122, second paragraph:

> *The Basin Plan will apply for successive 10 year periods. It must be reviewed by around 2021, if not beforehand. The Authority considers it unnecessary to incorporate the full effect of the 10 per cent predicted decline in average annual water availability.*

PROF WILLIAMS: Yes. That's what I see. Yes.

THE COMMISSIONER: So there they're talking about climate change which they have quantified at that 10 per cent figure of decline.

PROF WILLIAMS: But we know it – the CSIRO work, I think it was - - -

THE COMMISSIONER: The next paragraph - - -

PROF WILLIAMS: That three per cent is good enough.

THE COMMISSIONER: It says:

> *Three per cent is an appropriate allowance to account –*

and that is because, I gather, things can be re-examined in 10 years or so. That's the notion, I think.

PROF WILLIAMS: Yes. I think that's right. I just think it's a judgment call. The table 4.7, I think, sets, you know – just shows there's a huge range. And so that's

being pretty careful that you – you know, it doesn't make much provision for the fact that science is often conservative and it could be worse.

THE COMMISSIONER: But this three per cent, the notion is that you have provisionally reached an SDL but, then, considering climate change and for this first period you add – sorry, you reduce it by three per cent.

PROF WILLIAMS: Per cent.

THE COMMISSIONER: It is just that I haven't seen the workings that actually show that.

PROF WILLIAMS: Whether it's incorporated in the thing. I haven't seen whether that has actually been induced in the subsequent work to the Guide.

THE COMMISSIONER: Yes.

PROF WILLIAMS: No.

MR BEASLEY: It wasn't incorporated in the Plan.

PROF WILLIAMS: It wasn't incorporated in the subsequent work. What was believed to be sufficient was that in the 10 year review period, they may consider it. So no, that wasn't taken account. Climate change was not - - -

MR BEASLEY: Commissioner, are you asking whether it's in the 38 range to 69 range, the three per cent?

THE COMMISSIONER: That's one of the things I'm asking about. I can't see that it is.

MR BEASLEY: I can't – well, it sort of says it is but I can't see – there's no workings.

THE COMMISSIONER: Well, it doesn't seem to – if you go from table 4.4 to the plus or minus 20 per cent, plus or minus 10 per cent, there's no three per cent.

MR BEASLEY: Yes, I know.

PROF WILLIAMS: I don't believe the climate change.

THE COMMISSIONER: In any event, are you aware, because I am not, of what happened between the Guide and the Plan to remove, as an appropriate step in reaching an SDL, what here is called a three per cent allowance for climate change?

PROF WILLIAMS: As far as I know, climate change was not taken into account as - - -

THE COMMISSIONER: No. I know. But are you aware of any explanation for that change?

PROF WILLIAMS: No. Other than said we will do it with a review in 10 years' time. There's provision in the Act to adjust the SDLs under review and that might - - -

THE COMMISSIONER: You see, a suspicion, I think, is a reasonable one for me to entertain, and would much welcome the volunteered cooperation of the MDBA to allay, if it is wrong, is that it was something that could be jettisoned in order to minimise reductions in the SDL following the book burning.

PROF WILLIAMS: Well, I – only conjecture. But the point is that it was a dreadful oversight not to include the analysis of climate change in the subsequent report. And there's no evidence of why it was okay to do that.

THE COMMISSIONER: Well, we know that reductions in SDL were perceived as being unpopular with some people.

PROF WILLIAMS: Absolutely.

THE COMMISSIONER: So unpopular that they thought a response to science would be appropriately signified by book burning.

PROF WILLIAMS: That's what we saw.

THE COMMISSIONER: But you can't recall any scientific explanation for failing in the eventual plan to do what the Guide had proposed. Namely, some allowance immediately on account of climate change to be revisited within 10 years.

PROF WILLIAMS: No. I can't see any reason why they did what they did. It doesn't make any sense.

THE COMMISSIONER: But that allowance - - -

PROF WILLIAMS: There's no scientific – there's no scientific reason why they should drop the impact of climate change.

THE COMMISSIONER: But dropping – that is, minimising the reduction of consumptive use would tend to increase the SDL, wouldn't it?

PROF WILLIAMS: Absolutely.

THE COMMISSIONER: And so if you thought that people wanted the SDL maintained as high as possible, then - - -

PROF WILLIAMS: Ignore climate change.

THE COMMISSIONER: - - - a reduction on account of climate change would be a candidate to be dropped off.

PROF WILLIAMS: Absolutely. It is one we could get rid of easily. But it's not the right thing to do according to the science. And the CSIRO work in 2008 shows that, in fact, the level of uncertainty around what climate change may do suggests you need to be much more careful than even the three per cent, which the Guide, as you pointed out, set down. Why we moved from a three per cent adjustment to no adjustment at all, I see no foundation for that argument anywhere.

THE COMMISSIONER: Now, the Act requires, in section 20 - - -

MR BEASLEY: 21(4), best available science. Is that where you - - -

THE COMMISSIONER: No.

MR BEASLEY: No.

THE COMMISSIONER: It might be – it's – sorry. Yes. In paragraph 21(4)(a) it requires the authority in the Minister in exercising powers in performing functions under the division that includes making the Basin Plan, that they take into account the principles of ecologically sustainable development, which is defined in subsection (4)(2) in such a way as to include as a principle that, and I quote:

> *If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*

PROF WILLIAMS: Yes.

THE COMMISSIONER: Now, am I wrong in forming the view, as I have provisionally, that those are statutory words that describe to a tee, the position faced by the authority in light of climate change as it may affect the Murray-Darling?

PROF WILLIAMS: Exactly. Those words to me, climate change has to be a prime candidate that they were referring to.

THE COMMISSIONER: Now, a failure to restore and protect the ecosystems by enhancing the flows for the environment, would that in 2009, 2011, 2012 – would that have constituted a threat of serious or irreversible environmental damage?

PROF WILLIAMS: I think not to build into the future that climate change impacts was not defendable.

THE COMMISSIONER: And would – including flow in order to provide resilience to meet climate change, would that constitute a measure to prevent environmental degradation?

PROF WILLIAMS: Certainly.

THE COMMISSIONER: Thank you. Thanks, Mr Beasley.

MR BEASLEY: Commissioner, I've got a document here which is an MDBA document entitled 'Developing the Guide to the Proposed Basin Plan Peer Review Reports'. And I have review A1 which is the international review, which one of the authors is Professor Likens from the Cary Institute of Ecosystem Studies. I don't intend to read the entire review at all.

THE COMMISSIONER: No.

MR BEASLEY: But just as a highlight on page 32, there's an item 3, 'Creating the Science Driven Knowledge Base'. At the bottom of the page, the review committee states that:

> *As we understand the approach, the MDBA's approach –*

and this is clearly in relation to setting SDL and ESLT –

> *identifying key environmental assets, determining their water needs, determining the Environmental Watering Plan to deliver water to the asset and determining the residual –*

which they describe as a procedure, as a sensible method. Importantly, though, at page 34, and I think this is what Professor Williams was alluding to in part of his evidence, there's two options given which I will come back to, but the paragraph two-thirds of the way down:

> *It is a fundamental tenet of good governance that scientists produce facts and the government decides on values and makes choices. We are concerned that scientists in MDBA working to develop "the facts" may feel that they are expected to trim those so that the sustainable divergent limit will be one that is politically acceptable. We strongly believe this is not only inconsistent with the basic tenets of good governance but it's not consistent with the letter of the Water Act. We equally strongly believe that governments needs to make the necessary trade-offs and value judgments and needs to be explicit about these, assume responsibility and make the rationale behind these judgments transparent to the public.*

THE COMMISSIONER: Who is the author of those words?

MR BEASLEY: Well, I would assume, going back to page 31, it's a combination of Professor Briscoe, Professor Biswas – I hope that's the right way to - - -

PROF WILLIAMS: Biswas. Yes.

MR BEASLEY: Professor Likens and Mr Bertelson.

THE COMMISSIONER: ... so that these are gentlemen – I assume they are all gentlemen, who are reporting after they've had dealings with the MDBA or after they've simply read the material?

MR BEASLEY: If you have a look in the preamble, it says:

We spent a week - - -

THE COMMISSIONER: At a review workshop.

MR BEASLEY:

- - - reading the Guide and then we spent a week in Canberra interacting with management and staff of the MDBA and other key actors.

THE COMMISSIONER: And there was a review workshop.

MR BEASLEY: Yes. It looks like it.

PROF WILLIAMS: It was a proper review. Yes.

THE COMMISSIONER: Is there any response to that concern?

MR BEASLEY: Not in this document. This document just collates a series of 16 peer reviews. But, I mean, the inference is that they have – these authors of this peer review have spoken to scientists at the MDBA and formed a concern that they are reaching a sustainable diversion limit that isn't necessarily based on the best available science but is driven by notions of political acceptability.

THE COMMISSIONER: That's in relation to the Guide.

MR BEASLEY: That's in relation to the Guide.

THE COMMISSIONER: Which, perhaps, picks up on what I was asking earlier which is why you would get it down to 3,000?

PROF WILLIAMS: Yes. That's the point. And the point is that those people in that board – I know three of them quite well, in the sense of they're part of the international, you know, ecological hydrological group and, particularly, Professor Briscoe who is no longer living.

MR BEASLEY: Is Professor Likens still - - -

PROF WILLIAMS: Yes. He's alive still. He is 85.

MR BEASLEY: Right.

PROF WILLIAMS: But, you know, he's only 10 years older than me.

THE COMMISSIONER: He is in his prime.

PROF WILLIAMS: He's in his prime. Well, he is a brilliant mind. I mean, he really is. Anyhow, but those paragraphs you wrote are fundamentally important to the way science interacts with society. Science must be able to say what is the truth of the matter. It is for society to judge how it utilises it. But we need to be unfettered in stating what and how the science works. Once you start to fiddle with the science, you are just fooling yourself and you're not helpful to society.

THE COMMISSIONER: Again, I'm asking you a question on a familiar basis, but are you aware of any published response or private response of any kind by anyone at the MDBA to what might be called a gentle but clear reproof in the words Mr Beasley has read to you?

PROF WILLIAMS: No, I am not.

THE COMMISSIONER: Thank you.

MR BEASLEY: Can I take you very briefly, Professor, to the ESLT report which is RCE6 which came out a year after the Guide. Do you have a copy of that?

PROF WILLIAMS: Not in front of me.

MR BEASLEY: Sorry. One is coming.

PROF WILLIAMS: You're an amazing team. Yes. Okay. Yes, yes, yes.

MR BEASLEY: So I shouldn't laugh and I'm not. So you will see here if we go to page (v) to commence with - - -

PROF WILLIAMS: Yes.

MR BEASLEY: This commences – and it may actually be the extent of the explanation for the change of the volumes we see – we've seen in the Guide to the 2,750 in this report. You see under the heading 'Changes Since the Guide' on page (v):

> *The October 2010 Guide proposed a reduction in diversions between 3,000 and 4,000 gigalitres. This proposal was on a relatively simple end of system flow analysis to identify water requirements.*

Now do you agree that with the description "relatively simple"?

PROF WILLIAMS: No. I mean, it's solid flow duration hydrology which was broken up across the catchments of the Basin, which are real ecological and hydrological units. And so the end of flow in each of these was understood. And when that flow was understood and what the impacts were on the ecological biodiversity assets in that catchment, then, we added those right up through the system. I don't think it's a particularly simple and, therefore, inappropriate. I think it has a substantive rigour.

MR BEASLEY: And then in the paragraph below, the opinion is expressed that the – or the assertion is made, I should say that the indicator site method is a much more robust method to determine an ESLT.

PROF WILLIAMS: Well, I would like to see that documented.

MR BEASLEY: And that's what - - -

PROF WILLIAMS: And, as far as I know, it hasn't been documented.

MR BEASLEY: That's what is missing, is an understanding of how that particular method is produced 2,750.

PROF WILLIAMS: Yes.

MR BEASLEY: If you turn to page 2 and 3, you will see in the bottom paragraph of page 2:

> *The task for determining an ELST is, therefore, to determine the level of take that aligns with these objectives above ecological values and socio-economic benefits and is consistent with the legal definition of ESLT provided in the Water Act. To do this, MDBA has approached implementing the concept of compromise and the definition of ESLT, having regard to the objects of the Water Act, the purpose of the Basin Plan, the objective of a healthy working Basin and the wise use concept and the need to optimise economic, social and environmental outcomes, in this sense, taking into account a triple bottom line approach.*

That seems to be taking the word "compromise" in the definition of ESLT, which talks about not compromising environmental criteria as some sort of compromise between social, economic and environmental objectives.

PROF WILLIAMS: Absolutely. And it leads you to the situation that you're going to end up with a flow regime that is less than the critical levels required for healthy biodiversity and ecosystems. And, as I said before, the preferable way through that is to say this is what the environment needs now. If that's what the Act requires, how do we manage the social, economic issues and how do we manage the hydrological landscape issues to achieve that level of flow and the functionality of the ecosystem?

MR BEASLEY: All right.

PROF WILLIAMS: And this, to me, is a corruption of what the Act requires. But I understand that there was a legal debate to say that the Water Act could be interpreted in this way.

THE COMMISSIONER: There wasn't actually a debate at all. If you mean an argument in which people actually met and engaged with each other but I understand your point. Yes.

PROF WILLIAMS: Well let's put it this way then. What I understand happened was a determination that the Act could be interpreted this way and, to me, this is when a lot of this muddled thinking began and this led us to the situation we're in.

MR BEASLEY: Just as a matter of reference, Commissioner, I think page 3 of the ESLT report at the top of page 3, second line, that is the first reference I have found on the words triple bottom line.

THE COMMISSIONER: Yes.

MR BEASLEY: Which are now repeated in almost every report that the MDBA puts out. And I don't have to be as circumspect as others but in terms of statutory interpretation, it's just tripe. But I think the explanation given, Professor, at page 6 as to what has happened, I want your view on this, as to whether you've been given any explanation by the MDBA concerning what's raised at pages 16 and 17 of the ESLT report.

PROF WILLIAMS: 16 and 17 – just a moment.

MR BEASLEY: Yes. This is where the framework for determining an ESLT is described by the Basin Authority. And you will see on page 16 in item 1:

> *Establish a comprehensive set of local and environmental objectives –*

etcetera.

PROF WILLIAMS: Yes, yes.

MR BEASLEY: Then two:

> *Incorporates the assessment of the social and economic benefits and costs to changes in water use.*

Just dropping down further in the page to the third last bullet point, I will preface this with the words:

Some examples of way that method takes into account the need to optimise economic, social and environmental outcomes are –

third bullet point –

selecting ESLT options for testing that give consideration of economic, social and environmental outcomes.

PROF WILLIAMS: Yes.

MR BEASLEY: You will see in the diagram on page 17.

PROF WILLIAMS: Yes.

MR BEASLEY: There's an arrow after step 6:

Assess environmental outcomes of options.

And it goes into a box on the right-hand side:

Iterate, if required, to meet environmental and socio-economic objectives.

PROF WILLIAMS: Yes.

MR BEASLEY: Now, first of all, it seems, as a matter of obviousness, there might be times where, if you optimise an environmental outcome like wetting a floodplain and creating perhaps something that tourists want to go, you might simultaneously optimise economic environmental and social outcomes. But if you're, for example, optimising economic outcomes by giving water to irrigators, it's very difficult to see, in those circumstances, how you simultaneously optimise environmental outcomes.

PROF WILLIAMS: Yes.

MR BEASLEY: But has the MDBA ever given you an explanation in any of the discussions you have had with them what role – what precise role optimising socio-economic objectives played in the determination of ESLT and, in particular, what impact did it have on the volume that they determined is the ESLT of 2,750?

PROF WILLIAMS: No. I haven't. And Quentin Grafton, who is an economic and social scientist, has tried to find this out and we have had no success. So, to me, muddling the hydrological, ecological requirements that our river systems need and their functioning, muddling that up with the socio-economic is a very unsatisfactory, it's unscientific. There's no basis, I understand, in science for coming to those conclusions at all. What we know in ecological science is we need to say what the science says and then work through the management of the socio-economic issues that have to be dealt.

Now, society may make the call that the socio-economic difficulties are too difficult to achieve. So we shall accept a degraded environmental outcome. But the two things are separate. And whenever you mix them up, there's a good theoretical framework in science not to mix them up. And here we see it mixing them up. Compared to the claim that the end of flow is simple, they're implying that it's less quality of science is a nonsense, compared with this muddle that's on page 17. It's an absolute scientific muddle and not defendable, in my view on any sort of socio-economic science or hydrological and ecological science.

MR BEASLEY: And one of the reasons - - -

PROF WILLIAMS: It's a muddle.

MR BEASLEY: One of the reasons you would say that is that from the material I've taken you to, including that diagram, there's no possibility that you or any other scientist of any particular discipline that's relevant can actually work out how the figure 2,750 has been reached.

PROF WILLIAMS: That's exactly so. And the muddle we see on page 17 is exactly the trap that Gene Likens was trying to tell the Commission – I'm too old. I keep remembering the Commission. The agent - - -

MR BEASLEY: Whenever you say the Commission, you're talking about the Murray-Darling Basin Commission - - -

PROF WILLIAMS: Yes.

MR BEASLEY: Yes. Not the Productivity Commission.

PROF WILLIAMS: No. No.

MR BEASLEY: Yes.

PROF WILLIAMS: So let me go over that again. Every time we look at figure 2.1 on page 17 of this document, it's a great illustration that the warnings and advice that Gene Likens gave in the material you read out - - -

MR BEASLEY: Yes.

PROF WILLIAMS: - - - have been completely ignored.

MR BEASLEY: I want to ask you some questions about efficiency measures and return flows now. You were kind enough to supply the Commission with a diagram which – it might be behind your submission, I'm not sure.

PROF WILLIAMS: No, I've got a copy here.

MR BEASLEY: Does the Commissioner have a copy?

THE COMMISSIONER: Yes.

MR BEASLEY: Right.

PROF WILLIAMS: Right.

MR BEASLEY: So can I run through my understanding of the diagram and then you can tell me where I've gone wrong.

PROF WILLIAMS: No. I will be fine.

MR BEASLEY: The one I'm looking at is the one with – not the off-farm, on-farm one, but the one before 60 and 10 at the top.

PROF WILLIAMS: Yes. Yes. Yes. Yes.

MR BEASLEY: The example given is an irrigator with licence, say, for 100 litres of water.

PROF WILLIAMS: That's correct, yes.

MR BEASLEY: 60 applied to the crop for the crop to grow.

PROF WILLIAMS: Yes.

MR BEASLEY: 10 evaporate.

PROF WILLIAMS: Yes.

MR BEASLEY: 10 enter the streams and groundwater.

PROF WILLIAMS: Yes.

MR BEASLEY: And 20 run off into the - - -

PROF WILLIAMS: Streams.

MR BEASLEY: - - - streams and tributaries as return flow.

PROF WILLIAMS: You've got that exactly correct.

MR BEASLEY: In the after scenario, the irrigator has sold 12 litres of his licence back to the government.

PROF WILLIAMS: That's right.

MR BEASLEY: And received some funds for advanced efficiency - - -

PROF WILLIAMS: Technologies.

MR BEASLEY: Yes. So perhaps for irrigation - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - perhaps tenting or whatever. In those circumstances, he is left with an 88 litre licence, of which, because he is now more efficient – or she is more efficient, 78 litres can go on the crop. 10 still evaporates and there's nothing going as return flows.

PROF WILLIAMS: Yes.

MR BEASLEY: Meaning that there were 30 as return flows in the before scenario.

PROF WILLIAMS: Yes.

MR BEASLEY: In the after, 12 has gone back to the government, meaning there's a reduction for the environment as return flows of 18 litres.

PROF WILLIAMS: That's correct. And so the only flow that he has got in this after case is the 12 litres that the government received - - -

MR BEASLEY: Yes.

PROF WILLIAMS: - - - and which are then being, presumably, entered into the streams and groundwater.

MR BEASLEY: And that concern – sorry – the analysis there represented in the diagram is a concern you have in relation to both the estimation that the Basin Authority – I'm not even sure they say it's an estimation. They say they have as of October 17 recovered 703 gigalitres through efficiency projects.

PROF WILLIAMS: Yes.

MR BEASLEY: You have a concern as a result of the analysis we've been just been in as to the accuracy of that claim?

PROF WILLIAMS: That's correct.

MR BEASLEY: And also a concern in relation to any future efficiency projects, for example, for what's called the 400 gigalitres of up-water?

PROF WILLIAMS: Absolutely. Yes.

MR BEASLEY: And you have had several discussions, have you not, concerning, with Professor Grafton, with people at the MDBA - - -

PROF WILLIAMS: Yes, that's correct.

MR BEASLEY: - - - discussing this issue of return flow.

PROF WILLIAMS: Yes.

MR BEASLEY: Pausing there, there's plenty of literature raising this problem, not just in Australia, but also by scientists outside of Australia.

PROF WILLIAMS: Correct.

MR BEASLEY: In other words, this isn't an issue that has invented by you.

PROF WILLIAMS: No.

MR BEASLEY: It's a phenomenon that has been discussed in international scientific literature - - -

PROF WILLIAMS: Absolutely.

MR BEASLEY: - - - as a concern. And you've also mentioned how it's taken into account in the United States.

PROF WILLIAMS: Yes.

MR BEASLEY: Now, in your discussions with the MDBA, how many discussions can you recall having with the MDBA about return flow?

PROF WILLIAMS: Well... we had – the primary one was with the current director and his senior officials, three or four of them.

MR BEASLEY: Just stop there. Current director meaning of?

PROF WILLIAMS: Phil Glyde.

MR BEASLEY: Right. Sorry. CEO.

PROF WILLIAMS: CEO.

MR BEASLEY: Sorry. Yes.

PROF WILLIAMS: CEO Phil Glyde and his senior people, Colin Mues and - - -

MR BEASLEY: So he was appointed in 2016. So these are - - -

PROF WILLIAMS: Yes. So - - -

MR BEASLEY: relatively recent discussions.

PROF WILLIAMS: - - - relatively recently. Well, we had had earlier ones, but the recent one, it seemed that Phil was someone I felt was important to alert him to what I think was something that had been a substantive oversight. And subsequent to that meeting, I remember– at that meeting I, basically, drew a diagram like this on the whiteboard to explain the issue. And it was clear that very few in that room, the senior officials, really understood what I was saying. So, subsequently, we had a meeting – informal meeting in a coffee house at ANU where we went through it again with Colin. I think there was a recognition we ought to do something. But I don't feel they really saw it as significant. Then I went to a seminar - - -

MR BEASLEY: Just – sorry. Pausing there. When you say you don't feel they thought it was significant, was that based on something they said to you or a lack of reaction or - - -

PROF WILLIAMS: No. They, basically, said, "We have other priorities".

MR BEASLEY: Other priorities?

PROF WILLIAMS: Yes. "We have other priorities." And when I was at the seminar at University of Canberra, following the meeting with Phil Glyde, because the issue had become public in the interviews I did in ABC with Quentin, to which Phil Glide replied very courteously saying, "Well, we hear what John Williams is saying" and he moved on, which – he didn't deny it was an issue. But at the seminar when they were presenting this issue of efficiency gains and how well - - -

MR BEASLEY: Sorry. What seminar is this?

PROF WILLIAMS: This was a seminar in the University of Canberra where they were giving – the group was talking about the efficiency gain.

MR BEASLEY: When you say – sorry to interrupt again.

PROF WILLIAMS: Sorry. Sorry.

MR BEASLEY: When you say "they", this is - - -

PROF WILLIAMS: I need to sit down and give you the details of exactly who was - - -

MR BEASLEY: Is this a range of scientists?

PROF WILLIAMS: A range of scientists - - -

MR BEASLEY: Yes. Right. All right.

PROF WILLIAMS: - - - were meeting together. And when I raised the issue I said, "Can somebody please tell me have I got myself so out of whack that the return flows isn't important?" Most of them said privately, "John, it is important but we can't – we don't think it's a priority at the moment."

MR BEASLEY: Sorry. This is MDBA people saying this?

PROF WILLIAMS: Yes. And I was just surprising how it seemed to be the debate on the matter was stifled. I couldn't sense, well, surely you would be interested in such a matter. And I will give you the details of those attending, but I need to consult my notes.

MR BEASLEY: That's all right.

PROF WILLIAMS: To me, the issue has been ignored, yet there's plenty of evidence that it was drawn to people's attention in literature going right back to 2002, 2003.

MR BEASLEY: Yes. I was going to ask. There's papers – whilst these discussions with Mr Glyde postdate 2016, there are, for example, papers – I'm not sure if you're a joint author, but I've seen articles, for example, by Professor Grafton on this issue that are certainly, I think, 2013. But you're saying the issue dates back even further?

PROF WILLIAMS: Even earlier than that. When the whole issue of water reform in the Basin was being formulated in peoples' heads, there's a paper that I quote in a paper that I will give you, if you want it, of Mike Young's back in 2002. And then there's – bringing that issue up. And it was a fairly broad treatment, but it was showing how this issue needed to be – and then there was a consulting report by ASLTasman, who are a very credible consulting group, who reviewed the material around. And it says – their title of their 2003 article is 'Scope for Water Use Efficiency Savings As a Source of Water to Meet Increased Environmental Flows', independent review. This is available on the site. And in that report they're very - - -

MR BEASLEY: What's the date of that report?

PROF WILLIAMS: That's 2003.

MR BEASLEY: Right.

PROF WILLIAMS: So they were drawing, as people were thinking about the policy framing in response to the issue, these reports and along with the one of Mike Young's, which I think was - - -

MR BEASLEY: Please read the title of that.

PROF WILLIAMS: The title of the Mike Young one – Mike Young and other group of South Australian scientists, 2002, it was 'A Preliminary Assessment of the Economic and Social Implications of the Environmental Flow Scenarios for the Murray River System'. That was reported for the Commission. It wasn't a body today. So in that report, both of those reports – and I think the Mike Young one was broad and assessed the issue, but the ASLTasman one was – looked at a whole lot more work, again.

But it illustrated that if you are going to use water use efficiency as a means to recover water, you must done the return flow analysis. That is, the water accounting needs to follow international guidelines. That is, you need to know where the water is going. And you don't want to end up with robbing Peter to pay Paul, which you will if you don't do this properly. And so why Australia has not adopted water accounting which allowed us to accurately determine water that is recovered and available for enhancing the environmental flow, when that is such a critical part of the whole reform process, to me is mind boggling. I do not understand.

MR BEASLEY: And one of the reasons you don't understand is that, if return flows are an issue of any significance that needs to be accounted for in terms of gaining an accurate and best science based estimate of water that's recovered through the efficiency programs, is that the danger is that a large amount of Commonwealth money has been spent updating irrigators' water delivery technology for less water - - -

PROF WILLIAMS: Absolutely.

MR BEASLEY: - - - in the environment or no more.

PROF WILLIAMS: Or no great gain. Yes. So not only, as Quentin would demonstrate many times – he has published that – that the cost of buying water through water us efficiency is much, much higher than direct purchase through willing sellers – that's established. But it's even worse than that, if in fact you don't gain any water at all. It's infinitely expensive.

MR BEASLEY: Yes.

PROF WILLIAMS: So, to me, that is of critical importance to establish when you're using water use efficiency and when you are buying purchase – direct purchase – both of them, the return flow issue needs to be done through proper and reliable water accounting and specified by international criteria.

MR BEASLEY: Thank you. Can I just ask you to explain one term you've used in your submission. And it's in paragraph 4 (i) which I think will be page 3.

PROF WILLIAMS: Four (i). Yes .....

MR BEASLEY: Yes. The paragraph commencing:

The fundamental point we are making –

PROF WILLIAMS: Let me just check. Yes. Right. Four (i). We got carried away, didn't we. By contrast, is that – no, that's the (j). The (i). Yes.

MR BEASLEY:

The fundamental point we are making –

Now, this is you discussing - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - discussing – you and Professor Grafton really complaining about a lack of scientific justification for 2,750.

PROF WILLIAMS: Yes. That's right.

MR BEASLEY: But you use the term in "black-box".

PROF WILLIAMS: Yes.

MR BEASLEY: Do I take that to mean that what you're referring to there is that somewhere in a hypothetical box the MDBA has locked away how they've reached 2,750?

PROF WILLIAMS: I think figure – this figure is the black-box.

MR BEASLEY: But is my interpretation of the term black-box accurate, in that you're talking about, "They haven't told us how they have got to 2,750; it must be locked in this - - -"

PROF WILLIAMS: Black-box. And black-box in science language means you don't know what went on.

MR BEASLEY: Right.

PROF WILLIAMS: It's black. You can't see it.

MR BEASLEY: I haven't come across that expression. That's a commonly used scientific expression, is it, if people haven't - - -

PROF WILLIAMS: Well, in modelling jargon, we say, "Well that's a black-box solution. We don't know what you did behind the scenes."

MR BEASLEY: Right. And that's how you described the 2,750?

PROF WILLIAMS: Yes. Every modelling you ever do in water, you need to know the data - - -

MR BEASLEY: Yes.

PROF WILLIAMS: - - - the structure of the equations and the assumptions and the variables that drive those equations. If you don't separate those out, you do not know what you are doing.

MR BEASLEY: Just excuse me for one second while I make sure I've covered everything I wanted to. Four (e), Professor.

PROF WILLIAMS: Yes.

MR BEASLEY: So that same page as I was just taking you to.

PROF WILLIAMS: Yes. Yes, on the top. Yes.

MR BEASLEY: yes. You have expressed some concerns you have about – we have, of course, been spending the whole time discussing surface water - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - SDLs. In that paragraph, you raise the baseline version for ground water.

PROF WILLIAMS: Yes.

MR BEASLEY: And you express some concerns there - - -

PROF WILLIAMS: Substantive concerns.

MR BEASLEY: Yes. And that's in relation to connectivity and base flow and the impacts of increasing the extractions for groundwater; correct?

PROF WILLIAMS: Yes, that's correct. And so the principle of our concern is that groundwater and surface water are connected in those instances and you need to manage them in a collective sense.

MR BEASLEY: And is the problem, in a nutshell, that there's no indication in relation to the 2,750 for surface water that what's provided for in relation to groundwater extractions has been applied to that or considered in that?

PROF WILLIAMS: Yes. That's right. The interplay between the consequence of the 2,750 and the Basin up to 3,334 gigalitres is not taken into account. That's bad enough. But what is really unsettling to me is that in the Guide at 2010 and then the CSIRO report in 2008, which was a thorough piece of work – I wasn't there at the

time so I think that holds a specific yield project that CSIRO published around 2008 – was gold hydrology. In that it said we should be reducing ground water extraction, and in the Guide similar sort of numbers of – represents a huge increase in groundwater.

MR BEASLEY: So just so I - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - understand this. What was proposed is actually an increase in extractions - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - for groundwater.

PROF WILLIAMS: That's right.

MR BEASLEY: And your point being, as a hydrologist in relation to connectivity and impacts on base flows of rivers - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - that that should – the fact that groundwater extractions are going up - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - needs to be considered. Either it shouldn't happen - - -

PROF WILLIAMS: Yes.

MR BEASLEY: - - - or it needs to be then considered in how much water is required for the environment in terms of surface water.

PROF WILLIAMS: Absolutely. And the point was that when a substantive piece of work, like the CSIRO work in 2008, said that we should be probably reducing extractions, then to find that in the Plan we are going to increase it substantially. And if you can find the evidence of why that is and the case for it, I cannot.

MR BEASLEY: And, just as with the issue of return flows and having discussions with people at the MDBA, this concern regarding groundwater and the lack of connecting it up or taking it in into consideration in relation to surface water is a matter you have raised with the MDBA?

PROF WILLIAMS: Yes. Yes. And particularly the concern, I think you will find, in the Senate inquiry, the concern we expressed – I think I appeared as a Wentworth

Group person in those days. I've since retired from that. But, yes, we expressed bewilderment of why we had this big increase. And when I did ask the question, I said, "Well, how did you come across to that? What's the analysis?" And they said, "We had a two-day workshop."

MR BEASLEY: Just pausing there, I will come back to the workshop but, approximately, when were you having these discussions with the MDBA and who with?

PROF WILLIAMS: Well, we had them in – up to that 2012, the final report you quoted was 2013. But I think a lot of the early work in that Senate inquiry went through 2012.

MR BEASLEY: Yes. You are quite right, there was some interim recommendations in that year too.

PROF WILLIAMS: So in that 2012 period.

MR BEASLEY: So it was during - - -

PROF WILLIAMS: Prior to – and as soon as we saw these numbers, I approached different individuals and I would have to look at my notes know which ones particularly - - -

MR BEASLEY: These were scientists.

PROF WILLIAMS: Yes. Scientists. I was saying, "Guys, what's going on? How do you get to that?" A person who may be able to give you some really good background information on this is Jason Alexandra, who was in the MDBA and is now able to be – to speak his mind. But, to me, hydrologically, there is no document that develops the case and the analysis for that increase in groundwater.

MR BEASLEY: Just so that everyone here understands, you've raised this concern about groundwater.

PROF WILLIAMS: Yes.

MR BEASLEY: And its impact in relation to surface water with the MDBA and expressed - - -

PROF WILLIAMS: Concern.

MR BEASLEY: - - - bewilderment, I think, was closer to your state of mind.

PROF WILLIAMS: Yes.

MR BEASLEY: The response, you said, was, "We've had a two day workshop." Was anything else said as an explanation?

PROF WILLIAMS: Well, I – no. It was – we brought the state agencies together and we had a two day workshop and this is it. And I said, "Well, that's" - - -

MR BEASLEY: This is it in terms of - - -

PROF WILLIAMS: This is how we came to this number.

MR BEASLEY: For groundwater .....

PROF WILLIAMS: I mean, it's a big number.

MR BEASLEY: And nothing more was explained.

PROF WILLIAMS: No. I could not get any more documents. I mean, not that people won't help me, they like to talk to me.

MR BEASLEY: Yes.

PROF WILLIAMS: But I could not get any data or analysis that made the case for that level of increase.

MR BEASLEY: All right. Thank you. I don't have any further questions for Professor Williams in relation to the submission.

THE COMMISSIONER: Would you just excuse me?

MR BEASLEY: Yes. Sure. Can I help, Commissioner? Are you looking for - - -

THE COMMISSIONER: No. It is all right. I think we're under control. I just wanted to find out, have you studied the – any of the work by the CSIRO in relation to - - -

PROF WILLIAMS: Specific yields projects, 2008?

THE COMMISSIONER: No. First of all, have you seen the 28 March 2012 final report?

PROF WILLIAMS: Yes.

THE COMMISSIONER: To the authority from the CSIRO, 'Multiple Benefits of the Basin Plan Project'?

PROF WILLIAMS: Yes, I have. That is authored by Bill Young, is it?

THE COMMISSIONER: It's probably not. There's another one I'm going to ask you about.

PROF WILLIAMS: Okay. No. Go ahead and let's see how we go.

MR BEASLEY: Dr Colloff is one of the authors.

THE COMMISSIONER: Yes. Dr Colloff was the - - -

PROF WILLIAMS: Yes.

THE COMMISSIONER: - - - task leader for the 'Environmental Benefits of Flow' section of that.

PROF WILLIAMS: Yes.

MR BEASLEY: The project director was Ian Prosser.

PROF WILLIAMS: Okay. Wow you're right. Yes.

THE COMMISSIONER: Have you seen that work?

PROF WILLIAMS: I have seen it. I haven't studied it as well as I have the other documents that you've given me.

THE COMMISSIONER: That's all right. Now, you've referred to something that – is it Dr Young?

PROF WILLIAMS: Yes. Bill Young. Yes. And his team.

THE COMMISSIONER: That's November 2011, the scientific review by the CSIRO of the estimation of an ESLT for the Murray-Darling.

PROF WILLIAMS: That's right.

THE COMMISSIONER: You are familiar with that work?

PROF WILLIAMS: Yes. I am familiar with that one.

THE COMMISSIONER: Now, do you understand that that is work that was directed to the kind of modelling which was used - - -

PROF WILLIAMS: This was looking at the work – this type of modelling.

THE COMMISSIONER: You mean in the Guide?

PROF WILLIAMS: In the ..... yes. This was the recent – this is the numbers, the 2,750, they were asked to look at the 2,800 and so on.

THE COMMISSIONER: They were looking at the process which culminated in the setting of 2,750.

PROF WILLIAMS: That's my understanding.

THE COMMISSIONER: So I should gather, then, that they were looking at MDBA processes?

PROF WILLIAMS: Yes.

THE COMMISSIONER: Which had moved on in the way variously described from the Guide?

PROF WILLIAMS: That's correct.

THE COMMISSIONER: And it includes, for example, at page 30 – is this – it is publicly available, is it?

PROF WILLIAMS: Yes.

MR BEASLEY: It is. It's already on the website. It has got a red dot. It looks like it is an exhibit.

THE COMMISSIONER: It's all part of RCE9. Yes. Thank you.

MR BEASLEY: I'm told I tendered it this morning. So there you go, it's fresh.

THE COMMISSIONER: It says at page 30, this is the CSIRO team speaking:

> *In summary, the modelling indicates that the proposed SDLs –*

now, it's they which produce 2750 –

> *would be highly unlikely to meet the specified ecological targets, even in the absence of future for climate change. Operational constraints are a key reason for this but a large number of achievable targets are also not met in the modelling.*

PROF WILLIAMS: 66 per cent, I think I remember.

THE COMMISSIONER: Now, I don't quite understand why, in the face of that being published by the CSIRO, one could regard the modelling of which it spoke as producing a figure that did not compromise the key environmental - - -

PROF WILLIAMS: It's a nonsense, I mean that report says.

THE COMMISSIONER: So I'm not misreading it.

PROF WILLIAMS: No. You are not misreading it. That's exactly true. The CSIRO, with all the issues around the table at the time, basically said the modelling shows that, in fact, the 2,750 will not deliver.

THE COMMISSIONER: Now, was there - - -

PROF WILLIAMS: I think it's 66 per cent of the sites would not be met. I might – but the really important thing that report does, which is an embarrassment as an ex-CSIRO chief, that that study was done without the process and the science model properly documented. Now, I think one of their recommendations is that the modelling be documented.

THE COMMISSIONER: Yes.

PROF WILLIAMS: So you could see how difficult it was for them to do a review when they didn't really have a documented set of analyses and model formulas to work with. It just so happened that Bill was in a position, because he knew what was going on in the Murray-Darling Basin, could actually do it, I imagine. But, to me, one of his recommendations was they need to get the thing documented.

THE COMMISSIONER: Well, on the same page, Dr Young and his colleagues for the CSIRO said this:

> *An interpretation of what ecologically can be realistically achieved with the Basin Plan are the proposed SDLs.*

And I interpolate those are the ones that – based on 2,750 recovery:

> *… has not yet been clearly articulated either at a site level or at a basin level.*

PROF WILLIAMS: Yes.

THE COMMISSIONER: Now, has that happened since, to your knowledge?

PROF WILLIAMS: I don't think so.

MR BEASLEY: Can you just tell us what page you are on, Commissioner?

THE COMMISSIONER: Page 30.

MR BEASLEY: 30?

THE COMMISSIONER: Three-zero.

PROF WILLIAMS: Could I have a copy because there are a couple of things I could draw to your attention. I just didn't – is there another copy around?

THE COMMISSIONER: I'm sure there is.

PROF WILLIAMS: No. Look, don't hold up. My memory is not too bad.

MR BEASLEY: There is one on the screen.

PROF WILLIAMS: No. Don't worry. Keep going.

THE COMMISSIONER: No. It's all right. You may take it for granted because it is true that we have read it carefully and we will - - -

PROF WILLIAMS: I know you have. No. I just wanted to refer to something in there but I couldn't find where it is. But go ahead, please. Sorry.

THE COMMISSIONER: No. I think that completes what I wanted to ask about that.

PROF WILLIAMS: I mean, Commissioner, the point I would like to say, with a review like that to go ahead to the level of expenditure that we have done, to me, I cannot understand.

THE COMMISSIONER: Thank you.

MR BEASLEY: Thank you, Professor. That completes your evidence. Thank you for coming.

THE COMMISSIONER: I'm much obliged. Thank you.

PROF WILLIAMS: Thank you very much.

MR BEASLEY: We may as well adjourn for lunch and have Professor Kingsford after lunch.

THE COMMISSIONER: Yes, please. If that is convenient for him. I'm happy to start now.

MR BEASLEY: I think I might prefer just to look at the – a couple of things. So if we can have until two clock, I would be grateful.

THE COMMISSIONER: Thank you.

PROF WILLIAMS: Commissioner, if it was helpful to you, I could table a draft of the analysis of the return flow issues, which is still tidying up before we put it into a journal.

THE COMMISSIONER: Depending on your timing, I'm happy to receive that when you are happy with it being tidied up.

PROF WILLIAMS: Okay. Right.

THE COMMISSIONER: We will take it into account and if we need to make any inquiries, we will correspond.

PROF WILLIAMS: Please. And I will provide that information on the judgments in terms of probability that are common in hydrology.

THE COMMISSIONER: I'm very grateful for that. Thank you.

PROF WILLIAMS: Thank you.

MR BEASLEY: Right. So we adjourn to 2?

THE COMMISSIONER: Very well. We will adjourn until 2 pm.

MR BEASLEY: Thank you.

<THE WITNESS WITHDREW [12.50 pm]

ADJOURNED [12.50 pm]

RESUMED [2.04 pm]

MR BEASLEY: We have Professor Richard Kingsford here to give evidence. So he will need to be sworn.

<RICHARD KINGSFORD, AFFIRMED [2.04 pm]

<EXAMINATION-IN-CHIEF BY MR BEASLEY

MR BEASLEY: If you could give your work address is fine, Mr Kingsford.

PROF KINGSFORD: I'm the Director of the Centre for Ecosystems Science at the University of New South Wales.

MR BEASLEY: And that was established in 2009.

PROF KINGSFORD: Correct.

MR BEASLEY: Yes.

PROF WILLIAMS: I was employed there from 2005.

MR BEASLEY: And you have a Bachelor of Science and a PhD from the University of Sydney.

PROF KINGSFORD: Correct.

MR BEASLEY: And your PhD is in relation to what field?

PROF KINGSFORD: Water bird ecology.

MR BEASLEY: Commission, there's in – and you've provided the Commission with a written submission that is dated perhaps at the end - - -

PROF KINGSFORD: Sorry, I can't remember when that was. Sometime in May, I think.

MR BEASLEY: It may not actually have a date on it.

PROF KINGSFORD: It may not.

MR BEASLEY: But sometime in May, anyway, you've provided a copy of a written submission to the Commission. And you have a copy of that there.

PROF KINGSFORD: I do.

MR BEASLEY: Thank you. Commissioner, at pages - - -

PROF KINGSFORD: I think you might have trouble with the pages, sorry .....

MR BEASLEY: Right. Okay. Yes. They're - - -

THE COMMISSIONER: I've got quite a few pages 1.

PROF KINGSFORD: Yes. Sorry.

THE COMMISSIONER: That's all right.

MR BEASLEY: Yes. Well, there is a section, then, of this - - -

PROF KINGSFORD: Yes. The sections I can deal with.

MR BEASLEY: - - - submission entitled Expertise and Qualifications.

PROF KINGSFORD: Yes.

MR BEASLEY: I don't intend to take the witness through all that.

THE COMMISSIONER: No. No. No.

MR BEASLEY: Can we take it as read.

THE COMMISSIONER: Yes.

MR BEASLEY: What you can't take as read, Professor, is your 141 peer review publications. I haven't got to them all.

PROF KINGSFORD: I hope not.

MR BEASLEY: If we can take your qualifications as read. Can I ask you some questions of clarification in relation to your submission, but – and this question does arise out of a part of your submission, but I noticed you were sitting in the hearing room while Professor Williams was giving his evidence.

PROF KINGSFORD: Yes.

MR BEASLEY: And you would have heard both myself and the Commissioner directing questions to Professor Williams regarding, I think both his frustration and lack of understanding as to the volume changes for the water said to be required for the environment from the Guide in 2010 to the ESLT report in 2011.

PROF KINGSFORD: Yes.

MR BEASLEY: And that's a matter that you're familiar with. And I think you raise those volumes in your submission.

PROF KINGSFORD: Yes, that's correct. I've got some concern about those.

MR BEASLEY: Do you have a different view to Professor Williams, who indicated that he has not ever seen any scientifically justifiable explanation for the figure 2,750 in the ESLT determination report?

PROF KINGSFORD: I have not seen anything justifiable on scientific grounds for that figure and changes to that figure.

MR BEASLEY: When you say changes to that figure, do you mean the recent adjustment, the 605 gigalitres or the Northern Basin Review proposal or something else?

PROF KINGSFORD: I guess, justification from the three to 4,000 gigs - - -

MR BEASLEY: I see.

PROF KINGSFORD: - - - to the 2,750, and - - -

MR BEASLEY: So the three to 4,000 gigs was two of the modelling scenarios in the Guide - - -

PROF KINGSFORD: Yes. Yes.

MR BEASLEY: - - - that was 3,000, 3,500, 4,000 modelled - - -

PROF KINGSFORD: Yes.

MR BEASLEY: - - - although the Guide expresses – the Guide provides an explanation that those scenarios were chosen as the lowest end, because - - -

PROF KINGSFORD: Yes.

MR BEASLEY: - - - we have taken into account social and economic. Whether it's impacts or optimisation, I'm not quite sure. It's probably both.

PROF KINGSFORD: Yes. Yes.

MR BEASLEY: Even though the figures in the Guide for low uncertainty of achieving environmental water targets were in round terms 3,900 and – sorry – high uncertainty of achieving, 3,900, and low uncertainty of achieving at 6,900 in round terms.

PROF KINGSFORD: Yes.

MR BEASLEY: All right.

PROF KINGSFORD: That's correct.

MR BEASLEY: So you were expressing the view you haven't seen any scientific justification for going from the three modelled scenarios of 3,000, 3,500 and 4,000 down to 2,750?

PROF KINGSFORD: That's correct. And, I guess by extension, I was concerned about the Northern Basin Review.

MR BEASLEY: Yes. I'm going to come to that.

PROF KINGSFORD: Yes.

MR BEASLEY: Yes. In fact, we might come to that now. The Northern Basin Review is a review proposing the seventy gigalitre reduction for recovery of water for the environment in the northern Basin from 390 gigalitres down to 320 gigalitres.

PROF KINGSFORD: Correct.

MR BEASLEY: And you've made some references to that. I think it's the environmental outcomes of the Northern Basin Review Murray-Darling Basin Authority report of October 2016.

PROF KINGSFORD: Yes.

MR BEASLEY: I'm going to tender that report, Commissioner. It's not tendered yet. One of the points you make concerning the results in this document is the fact that in terms of environmental watering targets for the northern Basin, even at a 415 gigalitre recovery for the environment, only 24 out of 43 indicators are met. I draw your attention to page 27. You might have been given the wrong document, I'm sorry. So in your submission, you – I think you're referring to page 27 and the table there.

PROF KINGSFORD: Yes.

MR BEASLEY: Which has water recovery scenarios - - -

PROF KINGSFORD: Yes.

MR BEASLEY: - - - from 278 to 415.

PROF KINGSFORD: Yes.

MR BEASLEY: And, down the bottom, the number of flow indicators that are met - - -

PROF KINGSFORD: Yes.

MR BEASLEY: - - - for the northern Basin catchment in various modelled scenarios. I want to ask you this. You refer in your submission to the modelling. And we can see there that there's what are described as three different models, 320A, 320B and 320C - - -

PROF KINGSFORD: Correct.

MR BEASLEY: - - - all in relation to 320 gigalitres. It could be me. I've read the explanation as to the differences between model A, B and C. And I don't understand what the differences are said to be, other than what a brief matter of text tells me. Do you have a firm understanding of what the differences are between models A, B and C for the 320 gigalitres?

PROF KINGSFORD: No, I don't and I understood there were actual further models, which aren't explained in here, and perhaps even a final model that was used, and wasn't assessed against the environmental targets - - -

MR BEASLEY: Right.

PROF KINGSFORD: - - - isn't in this report. That was my understanding. Look, I don't know - - -

MR BEASLEY: I think if I help you by going to page 22. There's discussion of the different modelling or scenario descriptions, start. We've got the 320A, water recovery less than Basin Plan. Scenario description:

> *Represents water recovery at December 2015, 278, supplement with the 442 gigs recovered from Condamine-Balonne, Border Rivers and Namoi catchments.*

320 B is described as:

> *Represents a 320 gigalitre recovery volume that is based primarily on achieving an equitable recovery strategy.*

Do you have any understanding of that that means in terms of the parameters of the models, the inputs of the models?

PROF KINGSFORD: Look, I don't. I guess, you know, one would think there were some weasel words in there in terms of transparency. It's not clear at all what is happening there. I guess my - - -

MR BEASLEY: I'm just, really, asking you whether I have missed something – you think I've missed something.

PROF KINGSFORD: No, not that I can see.

MR BEASLEY: And 320C is described as another variation of the 320 gigalitre scenario:

> *This option was designed based on the results from previous scenarios. There is an adjustment to the pattern of catchment water recovery to achieve outcomes in an efficient way.*

Do you – are you able to help us understand that?

PROF KINGSFORD: I guess my concern here is that the modelling is a bit like, as Professor Williams was describing, a black-box, in the sense of there not being a lot of clarity about a number of input variables. And I did spend quite a bit of time in the New South Wales Government working with the models that are used in this

space, the integrated quality and quantity model. And quite regularly we would get output from that model and the hydrologists from the water agency would say that doesn't make sense or perhaps we can change that. And then one of the input variables would be changed and we would get a different number. And so my understanding about that model is it has a number of different assumptions and input variables that can be changed in a number of different ways and you will get a different output. So what I would have liked to have been seen - - -

MR BEASLEY: Yes.

PROF KINGSFORD: - - - was the clarity around each one of these and what input variables were actually changed to get to the various levels of delivering – or getting some understanding of what environmental flow targets might be met. I also have a serious concern that those models are primarily for running the main stem of the river. They don't actually tell you anything very much about what's happening on the floodplain, because all the gauges are in the middle of the river and, essentially, it's just a binary guess at what happens once the water gets out on to the floodplain.

MR BEASLEY: What's the inadequacies in relation to that?

PROF KINGSFORD: Well, the inadequacy is that – I mean, we know, for example, that the Darling River catchments have these massive river floodplains which are very complex, and usually quite shallow channels, apart from the Darling, which is deep. And as soon as the water gets out on to that floodplain, it can go any number of different ways. And it's that flooding and the frequency and the regime and the duration that are critical in terms of the biology, the ecology of those systems and all of the – most of the river biota, plants, animals, microorganisms, occur on those floodplains. They are the engine room, as Professor Williams described, of the river systems.

And so that deep understanding of the relationship between what gets out of the river banks and onto that floodplain and how long it stays there is very poorly known and I would argue wasn't really dealt with at all in the modelling. And so there's a fundamental lack of transparency, but also a fundamental lack of understanding. And I would contend that the insensitivity we see in some of these modelling runs is because, in fact, they're not able to adequately model those floodplain flows. And we have actually written a paper comparing the model, or an earlier version and a statistical model, and found that it underestimates the impact of diversions on the systems.

MR BEASLEY: Can you tell me what the title of that - - -

PROF KINGSFORD: It's a peer reviewed paper, Ren and Kingsford, 2011, I think. I think I - - -

MR BEASLEY: Hang on. Let me just see if we've got that.

PROF KINGSFORD: I can provide it if you don't have it.

MR BEASLEY: I was just seeing if I've got – I've got a – I was going to take you to a couple of your – did you say Ren and Kingsford?

PROF KINGSFORD: Yes, Ren and Kingsford.

THE COMMISSIONER: Does that have this snappy title: Statistically Integrated Flow and Flood Modelling - - -

PROF KINGSFORD: That's the one.

THE COMMISSIONER: - - - Compared to Hydrologically-Integrated Quantity and Quality Model for Annual Flows in the Regulated Macquarie River in Arid Australia?

PROF KINGSFORD: That's correct.

THE COMMISSIONER: Thank you.

MR BEASLEY: Thank you.

THE COMMISSIONER: I hope you didn't spend too long devising that title.

MR BEASLEY: Sorry. Had you completed your answer in relation to that, because I will come back to floodplain.

PROF KINGSFORD: Just to say that we use real data in the sense of - - -

MR BEASLEY: Yes.

PROF KINGSFORD: - - - hydrological flow data, realising some of the limitations in terms of floodplains, but found, in fact, that the hydrological model used to run the northern Basin – sorry – for making decisions on those rivers and ultimately the decisions behind the Basin Plan were really underestimating the impact of development, in other words, diversions and regulation on floodplain wetlands. They're not very good at dealing with the large flows on those floodplains and they overestimate the small flows.

MR BEASLEY: Your concerns in this area, reflected in some of your papers, are (1), in a general sense, it hasn't been investigated properly.

PROF KINGSFORD: Correct.

MR BEASLEY: (2) concerns about subsequent approvals of things like levies and what not that will divert floodplain water for storage, rather than going back into the

river system that would be illegal now, but have been given the tick – or I think your word is grandfathered.

PROF KINGSFORD: That's correct. So I guess, from a public policy point of view, from an ecological point of view, one realises that, obviously, there has been development in these rivers. The Murray-Darling Basin cap of 1995 was specifically articulated at holding water resource developments at '93, '94 levels of development.

MR BEASLEY: Yes.

PROF KINGSFORD: Now, it was perhaps never explicit, but implicit in that was this also referred to floodplain development. Since that period, we have seen, because of lack of policy, the legislation hasn't really been implemented or compliance issues, we have seen development occur. And, more recently, the New South Wales Government has moved to, essentially - - -

MR BEASLEY: Regulate.

PROF KINGSFORD: - - - regulate and, what I said, grandfather - - -

MR BEASLEY: Yes.

PROF KINGSFORD: - - - and recognise those structures. But they are still diverting water – environmental water, potentially.

MR BEASLEY: And it's not that the amount of water being diverted is not accurately known.

PROF KINGSFORD: Correct.

MR BEASLEY: And am I right that really one of the very big problems with this is if you don't know how much water is being diverted for consumptive use from the floodplain, rather than getting back to the river system, you actually don't have an accurate gauge of what the baseline diversions are.

PROF KINGSFORD: Yes, that's correct. And I guess my concern is that, even though there's a perception, as there was under the Murray-Darling Basin cap, that the policy parameters had been drawn and there was no further development, we still have opportunities, I believe, whereby, even under the Basin Plan, environmental water continues to be developed for irrigated - - -

MR BEASLEY: Yes.

PROF KINGSFORD: - - - areas.

MR BEASLEY: Can I take you to another couple of aspects of the northern Basin Review to see whether you are able to assist or have a better understanding than I do,

at least, of these matters. If you have a look at page 9 of this environmental outcomes report.

PROF KINGSFORD: Yes.

MR BEASLEY: You will see a heading "About This Report".

PROF KINGSFORD: Yes.

MR BEASLEY: And in the first paragraph, last line, it says:

> *The report also describes what additional measures (referred to as toolkit measures) may be useful in securing and strengthening these environmental outcomes.*

And the toolkit measures are then described, commencing at the bottom of page 11.

PROF KINGSFORD: Sorry. This is on page 9, paragraph - - -

MR BEASLEY: Page 9.

PROF KINGSFORD: Paragraph?

MR BEASLEY: First paragraph. You've got a heading, "About this Report"?

PROF KINGSFORD: Yes, I have.

MR BEASLEY: Yes.

PROF KINGSFORD: Yes. Sorry. I'm .....

MR BEASLEY: So bottom of the paragraph you see:

> *The report also describes* - - -

PROF KINGSFORD: Yes, yes.

MR BEASLEY: Yes. So there's a mention of these toolkit measures.

PROF KINGSFORD: Yes.

MR BEASLEY: And then on page 11, they are described in more detail as being protection of environmental flows, targeted recovery of water entitlements, market-based mechanisms such as one-off temporary trade by event, improved coordination of environmental water, constraints management, infrastructure investment and mitigation of cold water pollution. Do you see those matters - - -

PROF KINGSFORD: I do.

MR BEASLEY: - - - as the toolkit? Do you have any understanding as to what extent of the recommended 70 gigalitre reduction is related to the toolkit measures?

PROF KINGSFORD: No. I don't. And I don't know – there's no transparency in those that convinces me that, in fact, those will work. I guess, they're also dependent, primarily, on the State of New South Wales in terms of - - -

MR BEASLEY: They require government cooperation, in other words.

PROF KINGSFORD: They do, in terms of delivery. And, I guess, we haven't seen, until relatively recently, much appetite for implementing some of these.

MR BEASLEY: There has been some recent changes to the Water Management Act.

PROF KINGSFORD: That's correct.

MR BEASLEY: Which might change when water can be pumped at certain flows.

PROF KINGSFORD: That's correct.

MR BEASLEY: But in terms of an answer to my question, you're not aware of how this is converted – the toolkit measures are said to be in any way converted into a volume of water.

PROF KINGSFORD: No, I'm not.

MR BEASLEY: Can I take you back to page 9 where we were before.

PROF KINGSFORD: I guess, just to make one point - - -

MR BEASLEY: Yes. Go ahead.

PROF KINGSFORD: I see mitigation of cold water pollution.

MR BEASLEY: Yes.

PROF KINGSFORD: This is an issue, clearly, in rivers with large dams. The water comes out and doesn't get to natural levels for sometimes 200 kilometres downstream. That's a completely different issue to the amount of water in the river. It's a different threat. And I guess it's odd that it's in there as almost a substitute for the amount of water. And there's no ecological reason for why that should actually sit there at all. It, to me, is just an option, if you like, for arguing and you couldn't scientifically support that argument that there would be less flows required.

MR BEASLEY: Yes. Thank you.

THE COMMISSIONER: We don't know whether the mitigation of cold water pollution is said to justify a reduction in environmental recovery, though, do we?

PROF KINGSFORD: No. We don't. I guess - - -

MR BEASLEY: We don't know that for any of them. But - - -

PROF KINGSFORD: - - - the argument would be that environmental recovery is going to occur because – is more likely to occur because this issue of cold water pollution is going to be addressed in the toolkit measure. But, I agree, it doesn't actually - - -

MR BEASLEY: There's another report just called the Northern Basin Review report where the Authority in that report says, and I'm paraphrasing slightly but words to this effect: this 70 gigalitre reduction is under pinned by these toolkit measures.

THE COMMISSIONER: But you can't explain to us, Professor, how the mitigation of cold water pollution by measures such as the thermal curtain at Burrendong affects the amount of water needed to be recovered for the environment in the northern Basin?

PROF KINGSFORD: No. I mean, you know, the thermal pollution issue is quite a different threat. It's about water quality and temperature. It's not about the amount of water that's in the river. And how much water would go out on to the floodplain. So it's a fish and invertebrate challenge, primarily.

THE COMMISSIONER: It kills them, does it?

PROF KINGSFORD: It won't kill them but a lot of fish rely on temperature cues to breed. So it means that they don't breed. Eventually, you know, populations go down as a result of not as much food being in the river.

THE COMMISSIONER: It doesn't kill the individual.

PROF KINGSFORD: No.

THE COMMISSIONER: But it may discourage them from reproducing.

PROF KINGSFORD: That's correct. And the other aspect of it is it may also slow down the productivity of invertebrates that form the food web for fish.

THE COMMISSIONER: Thank you.

MR BEASLEY: Just going back to page 9, and this was something explored between the Commissioner and Professor Williams, but you will see also in the bold blue, or bold print in the heading "The Report Should Be Read in Conjunction", etcetera, in the last sentence it says:

> *The decision on whether or not to amend the current legislated sustainable diversion limit for the northern Basin is based on finding a balance between social, cultural and economic impacts using a triple bottom line assessment.*

Are you aware, or are able to assist, in relation to how specifically an attempt to balance social, cultural and economic impacts has, to any extent, resulted in the recommendation of a 70 gigalitre reduction for the northern Basin recovery of environmental water?

PROF KINGSFORD: I can only assume that that is the main reason why we have gone from 390 to 320 because I can't see any reason in terms of environmental argument that it should be there. And I guess the other thing that concerns me about that statement is – and I've read the socioeconomic reports and it doesn't do very much more than pay lip service to me to many other social and economic benefits of the river with environmental flow. So it primarily - - -

MR BEASLEY: In other words, it benefits from having a healthy river.

PROF KINGSFORD: Correct.

MR BEASLEY: Yes.

PROF KINGSFORD: So it, primarily, looks at the irrigation impacts. It doesn't look at the importance of floodplain grazing. Many of the people who derive their income from livestock – and most of the floodplains are privately owned in the Murray-Darling Basin, most of them have relied on water coming on to their floodplains and have seen the transfer of wealth up the river system, essentially. They talk about that. And they, in the past, also paid more money for floodplain land than dry land because they were expecting a bigger income with more frequent flooding. So there's that aspect. There's also the tourism aspect. And from a cultural flows point of view, we're understanding much more how important these healthy rivers are for Aboriginal communities. And that, to me, did not have much weight in the social and economic dimensions.

MR BEASLEY: So just to sum up what you said then. A failure to consider positive economic benefits in relation to the ability of people to grow crops from the floodplain, tourism because healthier wetlands, healthy icon sites, etcetera, healthier Ramsar sites will attract people that are interested in walking around and having a look. And, three, the significance of the entire river system from a cultural and spiritual perspective to Aboriginal Australians.

PROF KINGSFORD: Yes. I'll just correct on one thing. Many of these graziers aren't actually growing crops.

MR BEASLEY: Right.

THE COMMISSIONER: The crop is pasture.

MR BEASLEY: The crop is pasture. I'm sorry.

PROF KINGSFORD: Their crop is pasture and their pasture is not exotic pasture.

MR BEASLEY: But it's food.

PROF KINGSFORD: These are natural wetland plants.

MR BEASLEY: And so - - -

PROF KINGSFORD: It's food.

MR BEASLEY: Yes.

PROF KINGSFORD: But they also have the same – many of the same functions as they would in a natural wetland. The plants might be a bit shorter but, you know, for example, in the Macquarie Marshes, which is – only about 10 per cent is part of a nature reserve, many of the major breeding sites for water birds are on private land. There are issues with grazing but it's nothing like the issue about lack of water in terms of that system.

MR BEASLEY: All right. Can I summarise what you have said this way and, please, don't let me put words in your mouth and tell me if this is an accurate summary. But as I understand the criticism you are making there, is that whatever perhaps undisclosed balance the Basin Authority has engaged in between social, cultural and economic impacts in the use of what they call their triple bottom line, your criticism is there hasn't been a balance between what might be economic impacts in relation to more water for the environment as against economic benefits as a result of more water for the environment.

PROF KINGSFORD: Yes. That's correct. And I guess we are learning more and more about this tourism aspect. And the environment can generate wealth. We've actually just published a paper about an exotic – what's called a vagrant bird in the US which over a month, I think, people travel to see and paid out in terms of travelling time and restaurants and accommodation, $250,000. So I guess we're foreclosing those economic options in the future because I've got little doubt that if we were well organised, from a government point of view, in terms of a place like Macquarie Marshes, it has significant tourism potential.

MR BEASLEY: All right. Would it be fair to say, then, in terms of whatever merits there are legally and otherwise, or not, in relation to a triple bottom line approach, a proper triple bottom line approach in terms of balancing environment, social and economic outcomes, needs to take into account economic benefits of a healthy river, healthy river system.

PROF KINGSFORD: Absolutely. And I think one of my criticisms is we tend to look at economics in a fairly narrow temporal window, two or three years. You know, it would be nice to have this economic analysis over, say, 50 years. These are, you know, there forever. And so being able to think about some of these – what might be regarded as not obvious economic benefits, there are certainly some - - -

MR BEASLEY: In terms of projections in the future.

PROF KINGSFORD: In terms of projections. There are certainly some ecological economists who are beginning to try and get a handle on the so-called natural capital. So, I mean, one of the changes that we have in the economic world is that we don't value that natural capital until it gets turned into something by humans. And we don't actually look at the long-term cost. We just tend to call those externalities. So they aren't properly incorporated in the economic equation. We published a paper, which I'm not sure if you have, about looking at the Coorong in the Lower Lakes where we looked at the cost of just dealing with the symptoms of lack of water in those Lower Lakes in the Coorong.

MR BEASLEY: I don't think we do. Can you give us the title of that?

PROF KINGSFORD: Yes. It's – I can't remember. It's not quite as bad as this title but it's something like the Lower Lakes and the Coorong and Ramsar Wetland in Crisis.

MR BEASLEY: You can provide it to us later?

PROF KINGSFORD: Yes. But it has some data in there about what it actually costs in terms of dealing with acid sulphate soils, putting in levy banks and - - -

MR BEASLEY: Keeping the barges – the barges for the mouth dredging.

PROF KINGSFORD: Yes. That as well.

MR BEASLEY: Yes.

PROF KINGSFORD: And desalination plant for Adelaide which was required as a result of not enough water coming down the Murray. So there is a very narrow perspective in terms of long-term sustainability and just on cost to government about this problem in relation to the decisions that have been made around the Basin Plan.

MR BEASLEY: All right. And can I ask you this: where the Basin Authority says that a decision on whether or not to amend the sustainable diversion limit for the northern Basin is based on a balance between social, cultural and economic impacts, that, clearly – whatever has been done, that doesn't sound entirely based on science. Would you agree with that?

PROF KINGSFORD: No, I certainly haven't seen – first of all, from the ecological point of view, I'm not convinced that we've adequately looked at the difference between 390 and 320 gigs. And then how that connects to that economic decision that was made, I'm not clear in any way how that has been done.

MR BEASLEY: Is it a concern to you that in relation to this report that even a recovery of 415 gigalitres misses a number of the targets?

PROF KINGSFORD: Yes, that certainly does.

MR BEASLEY: Can I be - - -

PROF KINGSFORD: Yes. Sorry.

MR BEASLEY: - - - more specific about that. A number of these – I will just get to the relevant parts. For example, at page 44 there's a discussion – not a discussion, but it's mentioned that the Narran Lakes is Ramsar listed.

PROF KINGSFORD: Correct.

MR BEASLEY: Is there anything you have seen in this report on the Northern Basin Review that implementing Australia's obligations under the Ramsar Convention or any other relevant convention was taken into account in the decision – recommendation to reduce the water recovery by 70 gigalitres?

PROF KINGSFORD: I think there was consideration in the early parts of it. So there was a review of the science in the northern Basin done by Sheldon et al. And I guess I had some concerns about how much of that actually made its way into the decision-making process. Certainly – and you would have thought the New South Wales Government would have certainly alerted the MDBA that it's a Ramsar site and they would have known. And the obligations around Ramsar site management in terms of sustainability are well known.

It was also well known, even as far back as when the Queensland Government first did their water resource planning for the Condamine-Balonne that something in the region of 75 per cent reduction in median flows to Narran Lakes. And there was – I can't remember the dates exactly, but the Queensland Government asked Peter Cullin and two other scientists to put together a review around the science of Condamine-Balonne. And I can provide you with that, if you need it. But all of those pointed to the real problem ecologically that was in this system as a result of the very rapid water resource development that occurred pretty much after 1990.

Most of the development occurred in the Condamine-Balonne. So – and when I was with the New South Wales Government we would regularly talk to the Queensland Government about our concerns. But, in terms of the Northern Basin Review, I was underwhelmed by the lack of attention to what's a key international obligation.

MR BEASLEY: And bearing that in mind, also, that a 415 gigalitre recovery scenario, only two of the four flow indicators are met for the Narran Lakes. And I think that's page 51.

PROF KINGSFORD: Yes. And, even subsequent to this, we have been looking at this issue in terms of one of the key criteria for ecological sustainability for Narran Lakes. And, in fact, one of the main ones that it was nominated as a wetland of international – and gazetted was the breeding of colonial water birds. And there are some serious long-term issues around the sustainability of that metric, and obligation in terms of it being a wetland of international importance.

THE COMMISSIONER: Can I just ask, while we're on those pages, I'm not sure I understand the graphics. Take, say, page 48, figures 19 and 20. This is intended to record the modelled analysis by reference to different levels of environmental recovery. Is that correct? And different scenarios.

PROF KINGSFORD: Correct. And I guess it's looking at these indicators, river channel, connectivity and floodplain and wetland connectivity.

THE COMMISSIONER: Yes. But just taking that one – the actual content doesn't matter so much as, am I reading the graphic properly? The figure 19 announces, in effect, that it's recording the results of an investigation as to whether, with respect to river channel connectivity, those various volumes and scenarios achieve the pre-set target of 75 per cent; is that right?

PROF KINGSFORD: Yes. So only a 20 per cent chance for 278 gigs, yes.

THE COMMISSIONER: Yes. So a 20 per cent chance of it – that is, of achieving the 75 per cent. Is that right?

PROF KINGSFORD: That's my reading of it.

THE COMMISSIONER: Yes. So the blue oblong is of no significance at all; it just marks 75 per cent, does it?

PROF KINGSFORD: Yes.

THE COMMISSIONER: And these circles on the bottom ..... presume significant. What does that refer to?

PROF KINGSFORD: I guess that's meaning – just looking at the graphics, that means how much water is actually getting towards that. I'm assuming that these

targets are saying if we wanted to improve floodplain connectivity by, say, 75 per cent - - -

THE COMMISSIONER: Yes. You're not going to do it with any of the scenarios.

PROF KINGSFORD: You're not going to do it with any of those. And it does show a little bit more sensitivity in that indicator, as opposed to the river channel connectivity indicator. And that - - -

THE COMMISSIONER: By which you mean volumes and scenarios don't seem to make much difference to the very poor prospect of meeting the river channel connectivity target.

PROF KINGSFORD: Correct. And - - -

THE COMMISSIONER: As you say, a bit more sensitivity: say, 415 gigalitres has a 56 per cent chance, compared to zero per cent for the baseline.

PROF KINGSFORD: Correct.

THE COMMISSIONER: Now, over the page, with Narran Lakes, figure 22 - - -

PROF KINGSFORD: Yes.

THE COMMISSIONER: - - - that shows a relative insensitivity, doesn't it?

PROF KINGSFORD: Yes, of those different - - -

THE COMMISSIONER: For the floodplain and wetland connectivity.

PROF KINGSFORD: That's correct. And I'm not quite clear why.

THE COMMISSIONER: Is that floodplain and wetland connectivity – is that one of the flow indicators?

PROF KINGSFORD: Yes.

THE COMMISSIONER: So if I go back to page 11, where not for the first or only time there's a reference in the third paragraph to the modelling results to show that between 19 and 27 flow indicators cannot be achieved.

PROF KINGSFORD: Yes.

THE COMMISSIONER: Then it says:

Regardless of water recovery scenario.

That must mean for any of the scenarios modelled.

PROF KINGSFORD: For any of the scenarios modelled. And I would imagine they have a few nodes on the lower Balonne, one of which is Narran.

THE COMMISSIONER: Right. And why doesn't that mean that you might need to investigate other scenarios, such as more water?

PROF KINGSFORD: Well, I guess – I guess the question there would be – I'm assuming that they went under the parameters of not – of having the 2,750 and saying, within that, that's all they would look at.

THE COMMISSIONER: But why?

PROF KINGSFORD: Well, that's a good question, because, I mean, one of the issues was, in fact, it wasn't necessarily a question of, you know, that system – being enough information to know that that system was over-allocated or there was too much environmental water going back.

THE COMMISSIONER: Doesn't this mean there's not enough environmental water?

PROF KINGSFORD: Absolutely. So – yes. So

THE COMMISSIONER: The Water Act and the Basin Plan - - -

MR BEASLEY: It purports to set 415 as full recovery, but you could have 416.

THE COMMISSIONER: But what I'm saying is the scenarios include a volume of 415.

PROF KINGSFORD: Yes.

THE COMMISSIONER: Which might be intuitively regarded as more likely than a materially smaller volume to achieve an environmental target. But intuition is not enough. You need to test it.

PROF KINGSFORD: Correct.

THE COMMISSIONER: Having tested it, the MDBA is here reporting that of targets set for that testing there are between 19 and 27, which is a very large proportion that cannot be achieved even at that based intuitively likely level.

PROF KINGSFORD: Correct.

THE COMMISSIONER: Why isn't the obvious response to that to say, "Well, that higher scenario turns out not to be high enough, because the Act says we have to

recover and protect. And that means we have to find – at the very least, we have to find a level at which further degradation won't occur."

PROF KINGSFORD: Yes.

THE COMMISSIONER: Isn't that what the target is?

PROF KINGSFORD: Absolutely. And from a scientific point of view, you would like to know exactly where on the level of degradation and restoration you are going to sit. And currently we've only got a subset of that.

THE COMMISSIONER: I appreciate that. And I appreciate it depends on how fine-grained you do things.

PROF KINGSFORD: Yes.

THE COMMISSIONER: But it's the MDBA who set these targets.

PROF KINGSFORD: Correct.

THE COMMISSIONER: And they're set on what I will call an ecological basis.

PROF KINGSFORD: Yes.

THE COMMISSIONER: You need to achieve certain outcomes, which are variously expressed - - -

PROF KINGSFORD: Yes.

THE COMMISSIONER: - - - in order, so it is thought, or hoped, to recover and protect the relevant ecosystem.

PROF KINGSFORD: Yes.

THE COMMISSIONER: I've got that correct?

PROF KINGSFORD: Correct.

THE COMMISSIONER: And, of course, being scientific rather than political, you set your target first and see whether your proposed means will meet it - - -

PROF KINGSFORD: Correct.

THE COMMISSIONER: - - - rather than adjust your target to the means you have decided you will not exceed.

PROF KINGSFORD: Correct.

THE COMMISSIONER: You will gather that I am beginning to form an uncomfortable suspicion that it is in fact the latter that has been going on here.

PROF KINGSFORD: Well, I think they clearly set these targets in the Basin Plan and the Guide to the Plan and then - - -

MR BEASLEY: Just pausing there.

THE COMMISSIONER: But when they don't meet them - - -

PROF KINGSFORD: That's right.

THE COMMISSIONER: - - - rather than say, "Then let's find an expedient in terms of environmental watering, which may mean more recovery and less irrigation, that will meet the target, we will simply note that the target is not met." And I don't know how to describe what then happens in this document. I much regret to say, it sounds like a corporate shrug.

PROF KINGSFORD: Look, I have to say – and I express this in my submission to the Murray Darling Authority about the Northern Basin review, is that I felt there was a total lack of transparency, it wasn't clear what the modelling was doing and from an environment point of view really hadn't grasped the nettle in terms of working out how much water this system needed. So, to come to your original question, absolutely there should be everything from natural through to, you know, where we are today in terms of options of water recovery.

THE COMMISSIONER: Well, at page 11, again, in that same passage I've drawn to your attention, the Authority says:

> *Therefore, a level of environmental risk will remain in the northern Basin.*

Now, that is a bland way of saying - - -

PROF KINGSFORD: It's in trouble.

THE COMMISSIONER: - - - that the environmental outcomes are compromised, isn't it?

PROF KINGSFORD: Seriously.

THE COMMISSIONER: Well, I mean, this is very serious. This seems to be a report saying that, "Notwithstanding that our own modelling" – that is, "our, the Authority's, own modelling and testing shows that the targets we ourselves set on ecological grounds will not be met by the most generous of the scenarios we tested. Our response is not to say, 'Well, we're going to have to devise more generous scenarios to reach the targets', rather as to say, 'well, that means there will be serious compromise to the key environmental outcomes'."

PROF KINGSFORD: I think you've got it in one. And, I guess - - -

THE COMMISSIONER: And for me as a lawyer as to whether I regard that as unlawful, it's not - - -

PROF KINGSFORD: Yes.

THE COMMISSIONER: It shouldn't be a surprise to anyone from Issues Paper Number 2 to suggest it sounds unlawful to me.

PROF KINGSFORD: Yes.

THE COMMISSIONER: And if the Authority or the Commonwealth or anyone else wishes to persuade me to the contrary, they are most welcome to do so by correspondence, or attendance, or any other means they think appropriate.

PROF KINGSFORD: Look, I - - -

MR BEASLEY: Press release.

PROF KINGSFORD: Look, I have to just express frustration with this process, because I think, at the beginning, we all went into this with good faith. But various decisions have been made along the way that clearly, in my mind, show that there was an end point in mind and – in terms of water recovery, and a lack of transparency.

THE COMMISSIONER: Well, you could do that. You could say, "We are not going to recover and protect the environment."

PROF KINGSFORD: Absolutely.

THE COMMISSIONER: "We are going to compromise it and we are going to deprive it of the resilience that climate change might indicate as appropriate."

PROF KINGSFORD: Absolutely.

THE COMMISSIONER: Because we are going to permit consumptive use over the amounts we know – over the levels we know are necessary to prevent that.

PROF KINGSFORD: Correct. And I would have loved to have seen a Northern Basin Review that put all of that on the table. That said, essentially, this is what we're going to lose if we have this much and this is what we would gain if we had this much water in. So that we could actually have a full and frank debate with the politicians making the decisions about where that line should be drawn. In reality, we have only got half of the story here, in my mind anyway. And even that half isn't particularly transparent in terms of the real environmental impact. And I believe that

the decisions around the Northern Basin Plan lock us in to a very long-term degradation in that system.

Because much of the development in the northern Basin is relatively recent, we are talking particularly about floodplain Eucalypts that will die over a long period of time. There are even some black box trees in the Murrumbidgee, where I've worked, which even after 100 years are still alive. There are a few green leaves on the end. But they haven't had the floods. And so the same thing will happen in the Condamine-Balonne. It has got one of the biggest floodplains – it has the biggest floodplain in the Murray-Darling. But, essentially, it will be – it is dying. And over the next 100 years it will continue to die. There is nothing in the northern Basin Review that in any way identifies that. I couldn't even find where they determined that the dependent floodplains in these systems, even though they have the data, were actually spelt out.

THE COMMISSIONER: So when you go to page 26, the first thing is trivial. I take it there's a typographical error in that figure 9, northern Basin minimum recovery scenarios, it should read 278, should it? It's 278, isn't it?

MR BEASLEY: Yes, yes. I think you are right, Commissioner. Yes.

THE COMMISSIONER: I wanted to make sure I hadn't missed something out. On that page – you have already had drawn to you by Mr Beasley of this but, as I say, there's a repeated statement about targets not being achieved.

PROF KINGSFORD: Correct. And, I guess, you know, again, back to my original point, it would have been nice to know what volumes of water were required to meet those targets – and modelled.

THE COMMISSIONER: Well, don't you need to – unless the targets have been set wrongly, then, one would assume, as a reader in good faith of this document, that the targets were regarded as appropriate, for example, to permit Australia to make appropriate efforts to meet its international obligations.

PROF KINGSFORD: That's correct. And so – but there are only some targets for some wetlands that occur. So in the northern Basin it's the Gwydir, the Narran and the Macquarie Marshes with Ramsar sites. The other aspects of international obligations around migratory shorebirds, which are a lot easier to sort of work into this discussion - - -

THE COMMISSIONER: But for the Ramsar sites in the northern Basin, the Authority to have set a target, which I'm going to assume in its favour was in good faith intended to be a performance of the obligations of Australia.

PROF KINGSFORD: Yes.

THE COMMISSIONER: And then to find out that the so-called scenarios don't allow those targets to be met - - -

PROF KINGSFORD: Yes.

THE COMMISSIONER: - - - it seems to me to add up to finding out that what you're proposing to do won't comply with your international obligations.

PROF KINGSFORD: Yes, well - - -

MR BEASLEY: Four out of five indicators not met for Gwydir.

PROF KINGSFORD: Yes.

MR BEASLEY: Which - - -

THE COMMISSIONER: Doesn't that mean that you've set a target to meet your obligations, you find out the targets won't be met. Doesn't it follow that that means that what you have undertaken to do under the treaty is not something you think will happen?

PROF KINGSFORD: So I'm not a lawyer but, as a scientist, I would have thought that would have been what you would be doing. You would be saying - - -

THE COMMISSIONER: That's why you have said to me so you would want to find out what is the amount of water necessary to reach the target.

PROF KINGSFORD: Correct.

THE COMMISSIONER: I think scientists and lawyers are not very different in that regard.

PROF KINGSFORD: No.

THE COMMISSIONER: So that – have you read anywhere, spoken with anybody, publicly or privately, to give me any understanding of why they would not have gone on to find out the levels or scenarios which would permit, even if barely, the targets to be met with an appropriate degree of confidence?

PROF KINGSFORD: So I guess my – and this is just a reflection of watching the process underway from development of the guide through to the Basin Plan through to the Northern Basin Review, there was a lot of cultural change within the Murray-Darling Basin Authority. I think when the targets were set, they were set involving the scientific community, involving each of the states and the scientists in the states. And so there was - - -

MR BEASLEY: This is leading up to the Guide.

PROF KINGSFORD: Leading up to the Guide. So there was a fair bit of confidence that they were good targets. It was at least going to put you in the place of making the difficult decisions and knowing what you would lose and what you would not lose. Since that time, I guess, you know, I've been concerned both about the big decisions around water that have been made, the latest being the Northern Basin Review, and the lack of political will in State agencies to implement the plan. And the third and most worrying aspect of it is the loopholes that will actually undermine the objectives of the plan in terms of, you know, things like floodplains, return flows, all of those things that are also in that mix.

THE COMMISSIONER: Well, I'm not aware that there has been a debunking of the targets.

PROF KINGSFORD: No.

THE COMMISSIONER: And I'm not aware that there has been a criticism by the Authority of the modelling which produced this failure to achieve any targets.

PROF KINGSFORD: No. And, you know, I – from my scientific point of view because of the issues I've mentioned earlier about the problems with the current modelling in relation to the modelling being in the main stem of the river, I actually believe that there are more targets that aren't met.

THE COMMISSIONER: Yes. I understand.

PROF KINGSFORD: Yes.

THE COMMISSIONER: I just want to ask something.

MR BEASLEY: I don't know that you need my permission.

THE COMMISSIONER: I'm sorry to distract you.

MR BEASLEY: In case you do, I grant it.

THE COMMISSIONER: I've read in a lot of places – we are all very familiar with this idea to which the word "constraint" has been attached. And sometimes the expression third party is used, sometimes private property is used, sometimes riparian owner is used, sometimes we talk about infrastructure, etcetera, etcetera. But the homely example is somebody has bought the kind of what used to be formerly desirable grazing, sometimes cropping, land called a floodplain and they put in a road and gates and fences and bridges perhaps, all of which are useful if you're engaging in animal husbandry or cultivation. Presumably, you build them. That is, you spend the money, in the hope that it won't be swept away annually. Because in some places, and I think the English call them water meadows, you actually manage the land on the basis that it will be inundated – in England, likely enough, probably more than once a year.

And so the improvements you have are usually nothing more than the quick growing crop or pasture which the inundation fosters. Given that this country is – that kind of country is called a floodplain, and even with the infrequency and lack of regularity of the occurrence of our floods in this country, I'm really struggling with what I call the social policy, whereby you would regard as a constraint that somebody has a fence, a gate, a culvert or even a crop that he, she or it would really rather than not be washed away. Now, I understand socially the idea that we, by which I mean the taxpayers, who are heavily concentrated out of the Basin in the cities, I understand the argument whereby we should, as a matter of policy, bear that cost because we wish this kind of country to be exploited.

It's for all of our benefits. And I understand the thinking that says where something is being done for public benefit, a private individual or entity should not be left to bear, arbitrarily, the whole of the cost. I understand that. But, after all, we also tend in this country, or used to tend in this country, to restrict the kind of development that could be carried on, on the floodplain, precisely because of the risk of damage. Now against all of that background, I would be very grateful if you could give me your thoughts on what is wrong with the idea that we should never consider any of those things constraints, not least because breaking the banks is a critical core ecological feature of these rivers?

PROF KINGSFORD: Yes. I mean, part of it, a sort of cultural thing that flooding has a bad press because it does cause - - -

THE COMMISSIONER: Why is that?

PROF KINGSFORD: Because it causes some damage.

THE COMMISSIONER: But only if we built something in the way of it.

PROF KINGSFORD: Not necessarily. If you think about – well, that's correct. I mean, if you think about those Toowoomba floods, for example - - -

THE COMMISSIONER: That is because Toowoomba was there.

PROF KINGSFORD: Correct. That's absolutely correct.

THE COMMISSIONER: I don't mean that harshly. I'm just saying - - -

PROF KINGSFORD: No. That's absolutely correct. And - - -

THE COMMISSIONER: - - - people who build houses on sand dunes facing the ocean, I mean, I'm sorry.

PROF KINGSFORD: Yes.

THE COMMISSIONER: If it falls down, it falls down because that's where you built it.

PROF KINGSFORD: And if you look at the settlers that went on to these floodplain rivers, most of them built on sand dunes where they knew they wouldn't be flooded because they knew this is flood country. And if you look at the unregulated rivers of the Lake Eyre Basin, for example, where I do a lot of my work, they are absolutely all about the boom and bust of those, recognising that you will get a ferocious flood every now and again and that it will wash things away. But the benefits far exceed those costs. So I think what we have seen in the Murray-Darling is that we have seen a shift from those sorts of people who were making a livelihood out of these floodplains getting less and less water.

So, for example, there was a property in the Macquarie Marshes called Never Dry and they had to build a bridge because they couldn't get across one of the little distributaries and now it hardly ever gets water. So that's a change that has occurred. And, as a result of that, we've seen the shift into a lot of these people starting to use dry land crops on the floodplains. Same happens on the Gwydir. And, as a result of that, they've then said, "Well, we are no longer on a floodplain, we are not getting flooded." Or, "Even if we are on a floodplain, we have diversified into another industry and it's the government's fault that we are getting our floodplains wet."

So we see this argument around the Environmental Water Holder and its management of water in terms of not being able to release water when it's good for the environment, because, in some places, as you rightly say, these are called constraints, but that's a social artefact of reinterpreting the ecology of that floodplain, because it has, essentially, now become the place for an industry or an agricultural crop that doesn't do well if you've got a flood.

THE COMMISSIONER: So that the pattern of consumptive use since development has reduced the frequency and heightened duration of floods - - -

PROF KINGSFORD: Correct.

THE COMMISSIONER: encouraging people to diversify their exploitation of the land into non-floodplain uses - - -

PROF KINGSFORD: Correct.

THE COMMISSIONER: - - - whereby when floods are – or flooding, either actual or simulated, is proposed to be carried out for environmental reasons, there is, as it were, the double disappoint: the first disappoint of losing a floodplain and the second disappoint of becoming a floodplain again.

PROF KINGSFORD: That's right. And - - -

THE COMMISSIONER: That's a good example, isn't it, why all of us, not those land owners, should be bearing the cost?

PROF KINGSFORD: Absolutely. And it's not all land owners. So there are many still gaining from environmental flows in terms of that grazing country that gets inundated. So they are not complaining, but we don't really hear very much from them. So they're a sort of silent majority, I would believe, out there. But we hear vocal people talking about the damage to their livelihoods as a result of government policies.

THE COMMISSIONER: I think it's very easy to sympathise with that.

PROF KINGSFORD: Yes. Absolutely.

THE COMMISSIONER: And all of us should be making good their loss.

PROF KINGSFORD: Absolutely.

THE COMMISSIONER: Because their loss is for a public benefit.

PROF KINGSFORD: Absolutely. And I think some of the mechanisms that I've seen in the United States and Canada, for example, where there are set aside easements, which, essentially, are where the public pay some of that cost in terms of, you know, these are the places you can expect to flood.

THE COMMISSIONER: We're using similar language for similar concepts here, I think.

PROF KINGSFORD: Yes. Yes. But I don't see that we have made a lot of progress here, because of – you know, there's a lot of tension in this space.

THE COMMISSIONER: Yes. Thank you.

MR BEASLEY: Can I, with permission, go back - - -

THE COMMISSIONER: Yes, please.

MR BEASLEY: - - - to 415 gigalitres.

THE COMMISSIONER: You can.

MR BEASLEY: I will give what I think is the answer as to why it is the ceiling, but then can I draw everyone's attention to something that will no doubt confuse things further. But page 12 of this report, in the third-last paragraph, the only answer that I can see as to why 415 is at the top and 320 is what's settled on is that the Murray-Darling Basin Authority will use a triple bottom line framework to recommend a final water recovery scenario that best balances social, economic and environmental

outcomes. That, as far as I can see, is the answer given as to why it's 415 at the top and 320 settled on. I notice also it goes on to say the triple bottom line - - -

THE COMMISSIONER: I was about to say that very next sentence rather suggests that this is not a paragraph that could be regarded as dedicated to plain speech.

MR BEASLEY: The next sentence is – if I can say so, manages to be perhaps the most extraordinarily optimistic and thoroughly inaccurate sentence in this report.

THE COMMISSIONER: In a word, it's disingenuous.

MR BEASLEY: However, can I confuse things further. There's no need for these old reports to be dug out, but the witness referred to the fact that the Guide – sorry – Professor Kingsford, you referred to the fact that the Guide, despite the ranks of 3,900 to 6,900 for high and low uncertainty model 3,000, three-five and 4,000, the environmentally sustainable level of take determination report a year later – and I will just give the references – at page 68, discusses the 3,000 range from the Guide and says that that was split 2,350, southern Basin; 650 gigalitre for the northern Basin.

PROF KINGSFORD: Yes.

MR BEASLEY: And 45 for the disconnected rivers. So somehow 650 became 390, became 320, when in the ESLT report 3,000 as the bottom range in the Guide became 2,800, which eventually becomes 2,750. But in relation to 2,800 at page 69, it says that split, 2,280 gigalitres, southern Basin; 70 gigalitres, disconnected rivers; and 450 gigalitres for the northern Basin. So even under the 2,800 gigalitre scenario, 450 became 390, became 320.

THE COMMISSIONER: But, again, it has got the cart before the horse. First you find out what the environment needs according to the Water Act - - -

MR BEASLEY: Of course.

THE COMMISSIONER: - - - and then you add up to what that produces as a requisite.

MR BEASLEY: I'm only drawing that to your attention to show that there's figures before this report where something well beyond 415 was said to be required for the northern Basin, ie, up to 650.

PROF KINGSFORD: Maybe I can just add one of the things that I remember recalling when I was spending quite a bit of time in the Authority and talking to scientists was there was, I guess, a concern that the Darling didn't contribute much water to the Murray and, therefore, was not contributing much to the Lower Lakes and Coorong. And one potential argument for those shifting numbers was that there was a potential belief that they didn't need to rely as much on the Darling - - -

MR BEASLEY: Yes.

PROF KINGSFORD: - - - to deliver on that. I guess one of my - - -

MR BEASLEY: It's about a 20 per cent contribution, is it - - -

PROF KINGSFORD: Yes.

MR BEASLEY: - - - the Darling to the Murray or 19?

PROF KINGSFORD: I thought it was five or 10, but - - -

MR BEASLEY: Okay.

PROF KINGSFORD: - - - it has varied considerably.

MR BEASLEY: Yes.

PROF KINGSFORD: So this is one of the other things that - - -

MR BEASLEY: It might depend on whether it rains up there might be one.

PROF KINGSFORD: That too. And also some of the modelling tends to change

MR BEASLEY: And that percentage could only have ever been an average, in any event, I suppose.

PROF KINGSFORD: Correct. But I guess, you know, one of the things that has been sort of lost a bit in the whole Basin Plan is that every one of those river systems in the northern Basin has its own major environmental asset.

MR BEASLEY: Yes.

PROF KINGSFORD: And so I think to some extent, in my view, they've been discounted in some of the decision-making, which has – quite rightly there's concern about the lower lakes and the Coorong, but also there should be just as much concern over particularly the international ones, the Ramsar sites.

MR BEASLEY: Yes.

PROF KINGSFORD: And I was very critical, for example, in terms of the Northern Basin Review, which I think argued that there should be 12 gigs – that there was too much environmental water in the Macquarie. I think it was 12 gigs. I could be corrected on that.

MR BEASLEY: Over-recovery.

PROF KINGSFORD: Over-recovery.

MR BEASLEY: Yes.

PROF KINGSFORD: And yet all of the science is saying this is a Ramsar site, it's in terrible shape, whichever indicator. And I have worked on red gums, I have worked on frogs, I've worked on fish, I've worked on water birds. These are all of the major indicators for that system, as well as how much area is flooded. And yet – and not only that. The Commonwealth Government has formally notified the Ramsar secretariat that under article 3.2 - - -

MR BEASLEY: 3.2, yes.

PROF KINGSFORD: - - - there's a likely change in ecological character. And that was – seems to be ignored.

THE COMMISSIONER: By the way of degradation.

PROF KINGSFORD: By the way of degradation. Likely change in ecological character as a result of human impacts, essentially. And yet we still, despite all of that - - -

MR BEASLEY: So that's:

> *Each contracting party shall arrange to be informed at the earliest possible time of the ecological character of any wetland and its territory included in the list has changed, is changing or is likely to change as a result of technology developments, pollution, human interference.*

PROF KINGSFORD: Correct. And I guess one of my major criticisms is we keep being told that the Basin Authority has been making decisions on the best available science, and yet I did not see any one of my peer reviewed papers on the Macquarie turn up in the Northern Basin Review.

THE COMMISSIONER: Now, that's not just personal vanity; you're talking about what the record plainly shows in terms of the available sites.

PROF KINGSFORD: That's correct. And you know other people have worked on the Gwydir or the Darling. There was a process whereby the Basin Authority commissioned a piece of work which was to come up with the state of play of the science. But none of that really migrated into the decision-making space of the Northern Basin Review, which, essentially, came down to one thing, and that was, "Let's see what these hydrological models deliver." Well, I didn't really see anything more about the state of those ecosystems or other multiple lines of evidence that said, "You need this much water."

It was, essentially, came down to, "We have the best available models, sure, across the whole Basin." But in my mind they should have been taking into account a whole dialogue, particularly in the communication, about what's our understanding. So what was put forward is this is the state of play in each of these river Basins. There was no narrative based on peer reviewed science that said, "Well, hang on. This is what the peer reviewed science is telling us about this system, and this is why we have to make these decisions." And I think to me that was an oversight, both in terms of the difficult decisions that needed to be made, but also in terms of communicating to the public about, you know, where we're up to in terms of degradation and the tension between water recovery and environmental degradation.

MR BEASLEY: Yes. All right. One of the topics that you raise in your submission to the Commission is the supply measure – well, the supply measure for the Menindee Lakes and you raise various concerns regarding ecological environmental concerns. Can I ask you have you seen the MDBA's analysis of that supply measure that was supplied through the Senate?

PROF KINGSFORD: I did see it briefly at one point. I did see it, yes.

MR BEASLEY: Which raises several concerns in relation to environmental risks and potential environmental impacts, including on Golden Perch habitat, but also as a result water birds' food resources going down, etcetera. One of the things you've, I think, pointed out to us is that environmental concerns in terms of a reconfiguration of the Menindee Lakes is not new knowledge. And you provided us with a paper, I think, that dates back to 1994, Water Resource Investigations at Menindee Lakes, New South Wales by Bewsher, Hugh, Milner and David Harriss, H-a-r-r-i-s-s, two of them from the New South Wales Government and Bewsher from Bewsher Consulting, where a possible reconfiguration of Menindee Lakes involving Lake Cawndilla is discussed - - -

PROF KINGSFORD: Yes.

MR BEASLEY: - - - and a range of environmental issues are raised, including the need to get an EIS, and potential impacts in relation to changes in fish habitat, lake bed ecology, foreshore erosion, regional groundwater, impact on flora and fauna, including water birds in Lake Cawndilla and impact on recreational activities in Lakes Menindee and Cawndilla. And I think the purpose of giving that – as I would understand it, the purpose of referring us to that paper is to make it clear that environmental impacts of reconfiguring the Menindee Lakes is something that had been a concern for – that would be nearly 25 years.

PROF KINGSFORD: That's correct.

MR BEASLEY: And it might pre-date that. I don't know. But that paper is 24 years.

PROF KINGSFORD: Look, and when I was in the New South Wales Government we were also asked to look at, you know, the water birds, changes in that system. They were regularly discussed. There was at various times pressure put on the water agency, when the water was drying back, to pump out or to dig a channel into Lake Cawndilla to get it out there for ..... so there has always been quite a lot of that long-term discussion.

I guess, you know, from an environmental interagency point of view in New South Wales, I think we calculated 28 per cent of the Menindee Lakes is in Kinchega National Park. So we have a reconfiguration in the middle of a national park which doesn't seem to go through what you would regard as the usual environmental assessment processes. And there also seems to be a discussion that there is no environmental value in that system in itself, therefore, making it more efficient, throwing out the lakes, as proposed for Lake Cawndilla, would make for a better environmental flow downstream and, essentially, meet some of the targets, whereas it's quite clear to me that the case hasn't been put that this wouldn't have a net environmental cost, because Menindee Lakes is actually a very important environmental asset.

MR BEASLEY: One has to achieve environmental equivalency - - -

PROF KINGSFORD: Correct.

MR BEASLEY: - - - for it to be a supply measure.

PROF KINGSFORD: Correct. I am in no way convinced that what I have seen and read comes even close to that.

MR BEASLEY: Well - - -

PROF KINGSFORD: And there is certainly no transparency or analysis that has been done to that effect.

MR BEASLEY: Well, the document that I referred to in terms of the MDBA's analysis and your comment about transparency, that document only became available to be read by the public because it was compelled to be produced to the Senate. And a reading of that document raises what would seem, on the face, fairly alarming risks to the environment. Would you agree with that?

PROF KINGSFORD: Look, absolutely. And to come back to your point, it's not that governments didn't know those existed. And there has been this discussion since 1994. Within – I was within government when there were discussions. There was all of these issues raised then. But that seems to have been one of these big infrastructure projects that the Water Agency in New South Wales has put forward without really – look, I don't know how much consultation there was with the Environment Agency. If there was, my question would be: why weren't all these red flags raised? They certainly were in the past. They weren't this time. And I'm

not sure where that has got up to in terms of internal New South Wales Government processes. But, then, in terms of MDBA and equivalency, as I said, I'm very much yet to be convinced that there's good enough evidence to give it a tick on that basis.

MR BEASLEY: You also have a topic in your submission to us titled "Ecosystem Resilience to Climate Change". Again, I assume you heard Professor Williams' views and his evidence regarding his view that climate change projections should have been taken into account in relation to the sustainable diversion limit. Do you have a different view?

PROF KINGSFORD: No. And, again, I think the whole idea of this Plan was it's supposed to be planning for the future. And, yet, it's missing a big component of that future. You know, many of us would say it's not just the future, it's happening now. And the evidence seems to indicate that climate signature, particularly with rising temperatures, and you know, some of the CSIRO modelling is showing that there's less run-off in the major catchment areas.

MR BEASLEY: And you've referred us to one of your recent papers in relation to climate change projections in relation to a basin plan that's 2,800 gigalitres in relation to water bird numbers which, without climate change projections, 18 per cent over pre-plan levels. But with climate change projections, it's a one per cent increase.

PROF KINGSFORD: Yes. So, I mean, just the background - - -

MR BEASLEY: Sorry, decrease.

PROF KINGSFORD: Decrease. Yes. So the background there is we showed that there's a good relationship between water bird numbers over three decades and, you know, the amount of water in the river. And, therefore, that allowed us to model the potential effect of the Basin Plan on those and we estimated it to be 18 per cent. But when we put in 20/30 median estimates on climate change, we lost a lot of that benefit. I guess the other thing, just to mention which is a concern, is around what happens in terms of climate change impacts on the shares of water in the river. Essentially – and there is CSIRO report which goes to the heart of this, that says under future – well, projected climate change, essentially, impacts much more on the planned environmental water as opposed to the held environmental water and the licences. So, as a result of that, the environment is also going to be affected more than current users in these river systems.

MR BEASLEY: Because they're entitlement would stay but the environment's entitlement would drop.

PROF KINGSFORD: That's right.

MR BEASLEY: They were the questions I had by way of clarification by way of Professor Kingsford's submissions. I don't know if you had any further - - -

THE COMMISSIONER: I just wanted to pick your brain about Menindee Lakes supply measure.

PROF KINGSFORD: Yes.

THE COMMISSIONER: Over almost two decades, I think, starting late 40s, ending in the 60s, on and off, that system was engineered.

PROF KINGSFORD: I think Menindee Lakes went in the 50s and finished in the 60s. Yes.

THE COMMISSIONER: And the effect of the - - -

PROF KINGSFORD: Sorry. The Dam went in the – yes.

THE COMMISSIONER: And the effect of the engineering was that system held more water for longer periods than would otherwise have been the case.

PROF KINGSFORD: That's correct.

THE COMMISSIONER: So that, for example, levels were held sufficiently higher than they had been for a very, very long time. A new kind of erosion exposed archaeological remnants of Indigenous habitation.

PROF KINGSFORD: Yes.

THE COMMISSIONER: The supply measure so-called has as its main rationale the reduction of evaporation.

PROF KINGSFORD: Yes.

THE COMMISSIONER: By, as it were, referencing deeper storage so as to reduce the ratio of surface area.

PROF KINGSFORD: Yes.

THE COMMISSIONER: And I think, also, by means of depleting or exhausting the storage more rapidly.

PROF KINGSFORD: Yes. Correct.

THE COMMISSIONER: Both of them, however, are ultimately aimed in terms of a so-called saving - - -

PROF KINGSFORD: Yes.

THE COMMISSIONER: - - - at the evaporative loss which is natural.

PROF KINGSFORD: Yes.

THE COMMISSIONER: Because water evaporates – I don't mean in a consistent fashion, it depends upon local and temporal changes.

PROF KINGSFORD: Sure.

THE COMMISSIONER: But water evaporates from a cotton growers storage as it does from Lake Menindee, except Lake Menindee is probably deeper.

PROF KINGSFORD: Yes.

THE COMMISSIONER: Or Cawndilla. Cawndilla - - -

PROF KINGSFORD: I'm not sure about that. Some of the water storages these days are quite deep.

THE COMMISSIONER: Well, you would have to be about 7 metres to be deeper than Cawndilla, wouldn't you?

PROF KINGSFORD: Yes. I think – anyway, I think there's some storages that are now getting up to that sort of level.

THE COMMISSIONER: About the same as Cawndilla, you mean.

PROF KINGSFORD: Yes.

THE COMMISSIONER: Well, Cawndilla is sometimes called very shallow.

PROF KINGSFORD: Yes.

THE COMMISSIONER: But it translates to about seven metres, I think.

PROF KINGSFORD: Yes.

THE COMMISSIONER: Well, now, is it correct that, in hydrological terms, pre that engineering, Cawndilla was at a level where it would dry last? Is that correct? Menindee would dry before Cawndilla?

PROF KINGSFORD: Yes. I'm not sure about that but I think it might have been - - -

THE COMMISSIONER: I'm sorry. Is it the other way around?

MR BEASLEY: No. I think it fills last. It does dry last.

PROF KINGSFORD: It fills – fills – it fills last.

THE COMMISSIONER: It fills last and dries last.

PROF KINGSFORD: That's right. Yes.

THE COMMISSIONER: Because it is connected via Lake Menindee.

PROF KINGSFORD: That's right. Yes. That's right.

THE COMMISSIONER: And the environmental studies seem to show that, what, it's both Cawndilla and Menindee or just one of them that turns out to be so important for Golden Perch.

PROF KINGSFORD: I am not sure about that. I think they're both important.

MR BEASLEY: They are. The MDBA analysis in relation to potential impacts of this supply measure suggested it might lead to the loss of 8000 hectares of Golden Perch nursery in Lake Cawndilla for over 65 per cent of the time and over 15,000 of Golden Perch nursery habitat in Lake Menindee for over 20 per cent of the time.

THE COMMISSIONER: Now, that nursery function, fish nursery function of those water bodies, is that an artefact of the work of the 50s and 60s or is that millennial?

PROF KINGSFORD: No. Look, can I just perhaps explain what that system was before river regulation?

THE COMMISSIONER: Please.

PROF KINGSFORD: So, there is a wonderful narrative in the 1901 Royal Commission into water, where one of the landholders who had been living there for 30 years, essentially, described the inundation regime of those lakes. And in those 30 years there was more than water than there was not. But, obviously, that dried in different ways across that system. Essentially – well, and we know, for example, I have a photograph of Lake Menindee when it was full of black box and red gum. So all of those trees died when they got submerged more often than they used to. And we actually have a paper, which I don't know if you are interested in, which shows what happens with the ecology of these lakes that are permanently flooded compared to natural lakes.

But, essentially, you lose the natural cycle of drying, which is when lots of crustaceans lay down their eggs for – and you lose that productivity and the plants grow. So they actually become depauperate in terms of their ecology when they are held artificially high. Having said that, you know, these native fish species are geared to this boom and bust. So, you know, that system has gone through the last few years what I would regard as more of a natural cycle because there hasn't been as much water coming down the Darling. And so I don't know but I would surmise that what we are seeing in the Golden Perch is actually more of a sort of natural response to a flooding and drying pattern.

One of my frustrations, in terms of the Menindee Lakes, is I believe there was an opportunity there to get an environmental gain as well as free up, in inverted commas, some water. So reinstate the natural flooding patterns in those lakes as best we possibly could. And that doesn't include trying to get the water out as quickly as possible which is currently what is being looked at or wasting water in Lake Cawndilla. We know that the systems become highly productive both in terms of water birds, as in that phase of drying. And, in fact, Menindee Lakes is one of the most important places in the Basin for migratory shorebirds. Which, again, has never turned up in the discussions about Menindee Lakes, even though it's critical for the Basin Plan.

When it's drying back there are big numbers of these migratory shorebirds because they're able to access a large wetland area with lots of food responses in there. So an environmental approach to that system would have said, "We don't know how much we could save in terms of water if we reinstated the familial flow pattern but it might be this much. Let's put that back into the river but maintain as much as possible and reinstate the natural flooding patterns in that system." That is still contingent on water coming down the river, which is another issue.

THE COMMISSIONER: I was going to say all of that involves, first of all, understanding, if I can use the word, connectivity so as to ensure that - - -

PROF KINGSFORD: Yes.

THE COMMISSIONER: - - - there will be the freshes and other events which will maintain the variable but present water levels.

PROF KINGSFORD: And the volume. We've seen a significant decline in the volume of water coming down the Darling as a result of development in the tributaries. So there's not as much water coming down. And if you didn't do anything to the Menindee Lakes, the question might be, "Well, would they actually fill as often as they used to anyway?" Because we have seen this significant development over the 90s and 2000s in terms of that water coming down the system.

THE COMMISSIONER: Now, a very basic question, I think, but I don't really know the answer. These lakes are said to be very important for the Golden Perch nursery for the whole of the Murray-Darling system. Which requires a modicum of connectivity.

PROF KINGSFORD: Yes.

THE COMMISSIONER: Because it is true, isn't it, that the fish need the water in the Darling through to the Murray.

PROF KINGSFORD: They do. Yes. So they breed and recruit in the Menindee Lakes. And the latest research is saying they connect into the Murray and the

Murray seems to have lost its Golden Perch. I heard a talk from a fisheries biologist - - -

THE COMMISSIONER: Lost the fish or lost the nursery?

PROF KINGSFORD: No. The fish are coming down the Darling. So the fish are there but they're not breeding the way they used to.

THE COMMISSIONER: So the Golden Perch in the Murray are thought to be from the Darling.

PROF KINGSFORD: That's the latest.

THE COMMISSIONER: Do you have any idea or where would one look if you're interested in the question how long can the system go without connection of the Darling to the Murray before having an impact on the fish?

PROF KINGSFORD: Look, I don't know. I think to some extent, you know, those fish will also survive in some of the Darling because they will move up the Darling as well. And so there will be some - - -

THE COMMISSIONER: They will only move up the Darling so far as there is water.

PROF KINGSFORD: Of course. Of course. So if you're arguing, "Well what happens if the Menindee Lakes is dry and we get another dry spell and it's not connected?" Then, you're in trouble unless there are Golden Perch up the Darling - - -

THE COMMISSIONER: Not as much trouble as the fish are.

PROF KINGSFORD: No. That's right. That's right. Yes. That's what I mean. The fish are in serious trouble. And, you know, one of the big challenges, which we – the science is, really, very poor is understanding how we get through the bust periods in terms of all of our organisms because, you know, when these lakes dry out, when the water holes dry up, there's no coming back. Essentially, these animals are going to die unless there are water birds that can go to another system. But that's assuming other systems have water. And, I guess, the big decline we have seen in water birds in the Murray-Darling over the last 30 years, I would argue, is because we're progressively drying off these systems and every now and again in the past they would have had one of their refuges with water so they would have been able to go to the Menindee Lakes when the Gwydir or the Macquarie was dry or there was water in - - -

THE COMMISSIONER: You mean too try.

PROF KINGSFORD: Too dry.

THE COMMISSIONER: They need some drying off to make the nutritious flat available.

PROF KINGSFORD: That's right and then the frequent floods would come through. But, if you like, in the past, these systems used to turn on and off asynchronously, sometimes synchronously. But when water goes into a system like the Menindee Lakes, for example, it would hang around for two or three years while the floodplain dries out.

THE COMMISSIONER: Yes.

PROF KINGSFORD: And so the connectivity between the river and these big wetland systems is also critical in terms of providing a refuge. For a lot of these organisms to be there when another flood comes up and they can breed up their numbers and recolonise some of those places they haven't been.

THE COMMISSIONER: And an EIS, an environmental impact statement or similarly scientific work in relation to the supply measure for the Menindee Lakes would have to consider the kind of factors that you've been talking about.

PROF KINGSFORD: You would hope so. And you would have to think, also, that it would be looking at, you know, what would be the impact to the national park there, given that nearly a third of it is a wetland system. Interestingly, that is not – even though it's a national park, they're not allowed to engage in the water management until that lake is dry. So because that's part of the water regime, the Water Agency essentially does all of the work of the water management until Menindee is dry.

THE COMMISSIONER: Thank you.

MR BEASLEY: Can I just be comprehensive in relation to some of the matters you and Professor Kingsford have just discussed. In the MDBA analysis document of the Menindee Lakes water saving supply measure, the MDBA analysis contains this sentence:

> *An environmental impact statement is required.*

It then says:

> *Potential adverse impacts for which the MDBA seeks further assessment as part of the EIS include potential implications for water dependent by on biota and ecological functions of the altered rates of rise and fall in Lake Cawndilla, consideration of the ecological benefits and potential adverse impacts of all proposed changes, including on the aquatic community more broadly in this EEC* –

that would be endangered ecological community, I assume –

an assessment of the impacts of the proposal on the wider range native fish and aquatic species within the entire Lowland Darling River aquatic endangered ecological community, as listed under the New South Wales Fisheries Management Act 1994.

I mentioned the concerns in relation to Golden Perch nursery habitat of Lake Cawndilla and also Lake Menindee. I didn't mention there's also a concern in relation to the potentially functional nursery habitat in other lakes in the Menindee system "not able to be determined yet from this proposal" which, as we know, has been endorsed.

Pending adequate assessment of potential impacts on Golden Perch the water birds components may also need reassessment as this could significantly impact on their food resources.

That's probably enough.

THE COMMISSIONER: Could I just – in that same document, Professor, it says – and this is seven of 11. There's two sentences in the third paragraph I want to draw to your attention. This is all under the heading – the topic is "Assessment of Risks and Impacts of the Operation of the Measure". It says:

The mitigation strategy proposed for identified environmental risks is the EIS process.

Now, I interpolate that you don't deal with risks by finding out about them, although finding out about them is no doubt a first step. Then it goes on:

Given scheduled timing for EIS completion is late 2020, it's not possible to assess whether mitigation strategies from the EIS process are acceptable.

Now, looking behind the bureaucratese, until they know of the risks and of the expedience proposed to render them acceptable, this writer, at least, is saying it's not known whether this proposal will be environmentally acceptable. Isn't that how I should read that?

PROF KINGSFORD: That's correct. I think it's, you know, a weakness more generally in the EIS processes that sometimes EISs can become like a rubber stamp.

THE COMMISSIONER: But they're meant to come at the beginning of a process, surely.

PROF KINGSFORD: They are meant to come at the beginning of the process. Correct.

THE COMMISSIONER: I confess, I'm at a bit of a loss to understand the purpose of writing two sentences like that. It's saying, "We don't know what will happen.

When we do know what will happen, we will then have a further decision about whether we are prepared for it to be so."

PROF KINGSFORD: I would say maybe we're not worried about what will happen.

THE COMMISSIONER: You may be right.

PROF KINGSFORD: I mean, you know, in my experience of Menindee Lakes, it has been like a juggernaut and it doesn't matter that there are various environmental aspects that have been raised through, since I've been involved, since 1994. They've tended to just fall on deaf ears.

THE COMMISSIONER: Is it possible that, because of the extensive engineering in the 50s - - -

PROF KINGSFORD: Yes.

THE COMMISSIONER: - - - is it possible that there is a kind of suppressed premise here that, "It doesn't matter if we're not doing much different from reverting to what happened before the engineering"?

PROF KINGSFORD: Perhaps.

THE COMMISSIONER: Although - - -

PROF KINGSFORD: Look – but they are doing a lot different. They're, essentially – if you think about what that system was before the engineering - - -

THE COMMISSIONER: Well, for a start, more watering was going to be coming downstream.

PROF KINGSFORD: And it was also connected. They're cutting off connections. They're, essentially, saying we want to get the water out of there more quickly - - -

THE COMMISSIONER: Yes.

PROF KINGSFORD: - - - which also cuts into life history processes for breeding and all those sorts of things.

THE COMMISSIONER: And there's still less water coming down.

PROF KINGSFORD: Yes. And I guess, you know, the last thing to say it's not that there's no data available. You know, there is data on water birds, there is data on fish. And so it's – yes – it's just a lack of wanting to do it.

MR BEASLEY: Can I just refer you, Commissioner, and Professor Kingsford to page 4 of the same document, where in the middle of the page it states:

> *An EIS is a statutory requirement. However, the required EIS tests to determine whether a project can proceed are unlikely to fully take into account of the need for environmental equivalence as per the ESDL adjustment mechanism.*

Then it goes on to suggest some additions to the normal EIS procedure, no doubt to cover information to deal with the environment equivalence test. Given what the other parts of this document we have referred to in relation to the lack of knowledge about potential impacts, it's worth reminding ourselves that section 7.17(2)(a) of the Basin Plan says these things are not meant to be determined at a certain gigalitre supply contribution unless the Authority is satisfied of environmental equivalency.

PROF KINGSFORD: No. Quite.

MR BEASLEY: It's very difficult to see how that possibly could have been done in relation to this project.

THE COMMISSIONER: Mr Beasley, the EIS there is a New South Wales EIS?

MR BEASLEY: I assume it would be, yes.

THE COMMISSIONER: It just doesn't seem to be entirely kosher, that paraphrase of the legal nature of an EIS that you see on pages 4 and 5.

MR BEASLEY: No. I wouldn't have thought you just worry about threatened species in an EIS.

THE COMMISSIONER: No.

MR BEASLEY: I've always thought that you had to be more comprehensive than that.

THE COMMISSIONER: Yes.

MR BEASLEY: I mean, usually you're given – the Director General would give you your range of requirements that have got to be in the EIS. But I've never seen one that says the only thing you need to worry about is a threatened species.

THE COMMISSIONER: Yes. "Kill as many wombats as you like - - -"

MR BEASLEY: Yes.

THE COMMISSIONER: "- - - but not - - -"

MR BEASLEY: Yes.

PROF KINGSFORD: But, also, they're ignoring the EEC that's there, which would have been the next obvious thing to put in there.

MR BEASLEY: Yes. I'm not sure that the drafter of that fully - - -

THE COMMISSIONER: Grasps the law.

MR BEASLEY: Yes.

THE COMMISSIONER: Yes. Thanks.

MR BEASLEY: Well, that's one way of putting it. There's one important question I've forgotten to ask the witness. I just wanted to clarify a couple of things. In terms of the depths of Lake – Lake Cawndilla is seven metres, according to the paper that Professor Kingsford has given to us. Lake Menindee is four to five metres. The lakes themselves are 25,000 years old, but the construction was from '49 to – '68 I think it was finished. The important matter I wanted to – and last question I wanted to put to you, Professor, is – and please feel free to answer this as fully as you like, but one of the questions I asked Professor Kingsford was the importance of flow out of the Murray Mouth.

PROF KINGSFORD: Professor Williams.

MR BEASLEY: Sorry, Professor Williams.

PROF KINGSFORD: Yes.

MR BEASLEY: Was because – that's the only slip I've made today. I reckon that's pretty impressive, if I do say so myself.

PROF KINGSFORD: Easy one to make.

MR BEASLEY: Yes. Now I've completely forgotten the question, and it was so important. I put to Professor Williams the importance of flow out of the Murray Mouth because of the suggestion that has been said, not just by people in consultations, but I've heard this said by politicians in Federal Parliament, that you're irrigating the Southern Ocean and also, "Why not just let the Lower Lakes become extremely salty and see what happens?" The question for you is, can you explain to us the importance of the Lower Lakes as a habitat for migratory birds and other bird species and also the importance – and, in answering that question, could you also inform us as to the importance of the Lower Lakes to the Basin as a whole.

PROF KINGSFORD: Yes. So, there is a paper that we put together on a project that was funded by the National Water Commission. And I'm not sure if you have that. But we surveyed every major wetland in Australia, more than 4,000 wetlands.

And, as far as I can remember, the Lower Lakes and the Coorong were in the top five. But I can check on that. So at a national level, they're critically important. In terms of shorebirds, migratory shorebirds, they're, you know, by far the most important place in the whole of the Murray-Darling Basin. But, also, even for all water birds, they tend to be orders more magnitude more water birds there than anywhere else. And this is really primarily because there's such a large, wide expanse with lots of different habitats. They're highly productive, both in having fresh water areas and salt areas.

The water going through the Murray Mouth is critical, as Professor Williams explained, both in terms of getting rid of salt. We know probably in the last 10, 20 years we've understood a lot more about the role of rivers in terms of providing water to marine ecosystems. It's now well known that a lot of marine fisheries in Australia, particularly up in the gulf, depend on the rivers disgorging, if you like, their nutrients and providing nursery habitats for a whole range of different organisms.

But places – the flip side of that; places like, say, the Nile and Yangtze more recently have had collapses in their fisheries at their mouths after the dams have been built. The Three Gorges Dam and the Aswan Dam on the Nile and the Yangtze. So we understand much more how important those flows are, but, of course, there are also a lot of fish that actually need to come into fresh water in the Murray-Darling. So they come out from the sea and go up into the fresh water to breed. And that's – the only - - -

MR BEASLEY: Their lifecycle is both salty and fresh water. Yes.

PROF KINGSFORD: Their lifecycle – and that's the only mechanism they can do that. If we in fact close the Murray Mouth, it would become hypersaline, like lower areas of the Coorong. And we know from other salt lakes in Australia when that happens there is only a limited number of plants and animals that can tolerate that. So diversity drops down and once they become hypersaline nothing, really, will survive there. And, in fact, if you go – and we do aerial surveys regularly, right down the Coorong and you see this gradation between the hypersaline, where there are, really, no water birds, nothing to eat up, up into the upper parts of the Coorong where there's fresh water, water not that salty. And so the ..... can grow the vegetation on the bottom and the invertebrates can thrive.

And that is where you get these tremendous numbers of migratory shorebirds occurring because there's lots of food to eat. In terms of – you know, I've heard a lot of people argue that all we need to do is return this system to what it was naturally. In other words, take out the barrages and let the sea come in. There was a reason the barrages were put in there originally and that was that, essentially, the water that used to come down that river system no longer came down. And so – and there are arguments about, you know, sharks being up the river and seals and, yes, they're true. But you could guarantee that, at various times, there would be a huge big

freshwater flood come down and clean out the system. So we have a highly managed system.

If you took the barriers away, I think you would have a – well, it would be even saltier than seawater, and not much would live there. You would, essentially, say goodbye to the tourism industry and a lot of the ecological values there, you would certainly be destroying a Ramsar site and one of the most important sites we have got in the Murray-Darling Basin and, also, one of the most important sites we have in Australia for a whole lot of ecological values. And, obviously, there are fisher people down there and traditional owners that also have a stake in the future of that place. So it's not a simple solution. We're in a place where we've had to deal, in essence, with a compromised river system and – but there are costs. And I think it comes back to one of my other concerns about the Basin Plan, is that we never really adequately – if we were going down a socioeconomic path, we never really adequately addressed, or transparently, the the costs.

So the Basin Plan is very costly both in terms of the amount of money that has been put into it but also the amount of time and energy of government departments. And, also, there are big capital costs when we build large dams and there are big operating costs for managing rivers. These are all primarily for one industry that we have. And so it should be. But if we had a really transparent way of looking at this and looked at the public purse and how much we spend on rivers, and then said, "Well, you know, is this what we should be doing? Or can we do this differently?" That's the sort of discussion that would have been welcomed in terms of the discussions and, you know, the costs and benefits both in terms of the economy and also the environment.

MR BEASLEY: Thank you for that.

THE COMMISSIONER: Wouldn't it be true that you might have to consider removing the barrage as an artificial feature, it would only make sense if you were willing to remove the dams upstream that regulate it.

PROF KINGSFORD: The dams and also - - -

MR BEASLEY: And stop irrigation.

THE COMMISSIONER: I actually mean all of that, from Dartmouth down.

PROF KINGSFORD: Yes. So, I mean - - -

THE COMMISSIONER: And I'm not suggesting anyone would consider that seriously.

PROF KINGSFORD: No, no, no, no.

THE COMMISSIONER: I'm certainly not going to. But I don't understand, at the moment, why at the moment you would stigmatise the barrage as an artificial change and not Dartmouth and the Hume.

PROF KINGSFORD: That's correct. And, you know, there are all of the big dams in the Darling as well. I guess the other interesting, from a historical point of view, that's happened in the Basin is that the large dams were built sort of sequentially from the bottom up on the River Murray and then into the Darling catchments. And then, essentially, the cost benefits started to fall away. But what you had was private river regulation, in the sense that large off-river storages were doing the same ecological impact by pumping that flow out.

THE COMMISSIONER: Yes. So, in other words, the weight, admittedly, variable from year-to-year and time-to-time, the weight of water down the river, I will call it fresh even though it's carrying out a lot of important salt, is obviously hugely reduced by what we will call development.

PROF KINGSFORD: Yes.

THE COMMISSIONER: And the barrage is some kind of compensation for that.

PROF KINGSFORD: That's correct.

THE COMMISSIONER: By preventing the ocean and its influences from penetrating further up the north than it was ever able to do in the past.

PROF KINGSFORD: That's correct.

THE COMMISSIONER: Thank you.

MR BEASLEY: Thank you for coming. That's all the question we have. Thank you.

THE COMMISSIONER: I'm much obliged for your assistance.

PROF KINGSFORD: Thank you for the invitation.

MR BEASLEY: Commissioner, you have to leave so we had better adjourn.

THE COMMISSIONER: Yes. We will adjourn or, at least, I will leave.

MR BEASLEY: We will adjourn until Tuesday.

THE COMMISSIONER: Tuesday, 3 July at 10 o'clock here.

<THE WITNESS WITHDREW [3.55 pm]

MATTER ADJOURNED at 3.55 pm UNTIL TUESDAY, 3 JULY 2018

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