IN THE MATTER OF
THE QUEENSLAND FLOODS COMMISSION OF INQUIRY 2011

A COMMISSION OF INQUIRY UNDER THE COMMISSIONS OF INQUIRY ACT 1950

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

STATEMENT OF BARTON JEFFERAY MAHER

On the 1st day of April, 2011, I, **Barton Jefferay Maher** of [redacted] say as follows:

Introduction

Current Role

1. I am currently employed by Queensland Bulk Water Supply Authority (***Seqwater***) as Principal Engineer, Dams and Weirs Planning.

2. I have held this position since June 2010.

3. My primary role is to manage and oversee Seqwater's future planning for the capital upgrade programme of the dams and weirs.

Previous Roles

4. Between February 2006 and November 2007, I held the position of Operations Engineer. I held this position with South East Queensland Water Corporation and was responsible for the day to day operations of the three dams owned by the Corporation (Wivenhoe, Somerset and North Pine Dams). My position was changed to Project Director, Dams and Weirs upon transfer of my employment to Seqwater after it was established in November 2007. In this position I was responsible for the planning and delivery of the dams and weirs capital works projects and the 10 year capital works program for Seqwater.

5. Between 1995 and 2006, I was employed by the NSW Department of Commerce (**NSW Commerce**). I started as a graduate engineer and was eventually promoted to a Senior Project Engineer by the time I left.

6. I have experience in all aspects of dam design and operations, remedial works, risk assessment and other relevant matters.

Qualifications

7. I hold a Bachelor of Civil Engineering (Honours) from University of Technology Sydney (1989 – 1995).

8. I have been a Registered Professional Engineer in Queensland since December 2004.

Nature of this statement

9. This statement is provided to the Queensland Floods Commission of Inquiry pursuant to a "Requirement to Provide Statement" issued by the Commission dated 25 March 2011 (the ***Requirement***). The statements I make below are my best recollections of the significant matters referred to in the Requirement which I have been able to prepare in the short time since I received the Requirement.

2005 Upgrade to Wivenhoe Dam including the Installation of the Fuse Plugs

10. In March 2003, SEQ Water Corporation awarded the Wivenhoe Dam upgrade contract to the Wivenhoe Alliance, a consortium made up of NSW Commerce, Coffey Geosciences, MWH (an engineering firm) and Leighton Contractors. My employer at the time, NSW Commerce, assigned me to the project as a Senior Project Engineer. I fulfilled the role of Design Manager during the upgrade project.

11. In September 2005, I was involved in approval and review of a report on behalf of the Wivenhoe Alliance on the proposed upgrade. This report was called *Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade Q1091* and is attached as **Annexure BM1**. Among other things, the report:

    (a) outlined the reasons for upgrading Wivenhoe Dam;

    (b) provided the design specifications of the upgrade to Wivenhoe Dam; and

    (c) modelled the impacts of the upgrade to Wivenhoe Dam.

12. As part of my work on the 2005 upgrade I had regard to the *Wivenhoe Dam Design Report – Department of Primary Industries – 1994,* a copy of which is attached to this statement as **Annexure BM2.**

Details of the 2005 Upgrade

13. From **BM1** it can be seen that the 2005 upgrade would be undertaken in two stages.

14. The Stage 1 works would include:

    (i) construction of a new spillway on the right abutment that would enable the dam to pass an inflow flood with an AEP of 1 in 100,000 at a maximum flood level of EL 80. The spillway would be controlled by three fuse plug embankments;

    (ii) upgrading the embankment crest to retain a maximum flood level of EL 80 with nil freeboard; and

    (iii) upgrading associated structures as appropriate, including protection of the main spillway gates and bridge, and strengthening of the spillway gravity structure by post tensioning.

15. The proposed Stage 2 works included reconstruction of Saddle Dam 2 as a fourth fuse plug spillway. At the time of the report at **BM1** it was anticipated that the requirement for the Stage 2 works would be reviewed in around 2015 during the 20 year design review.

Fuse Plugs

16. A fuse plug is an embankment that impounds water until the water rises to a predetermined level at which point the embankment erodes in a controlled manner. A cross-section of a typical fuse plug embankment and further explanation of fuse plugs is detailed at pages 14 to 15 of **BM1**.

17. In my experience fuse plugs are designed so that the level at which the embankments erode is sufficiently below the dam crest level to ensure operation of the auxiliary spillway when it is required. This is so that the operation of the fuse plugs is initiated in time to avoid failure of the dam through over-overtopping of the crest of the wall. In turn, this increases the flood passing capacity of the dam. Fuse plugs are primarily constructed at an AHD level to prevent the operation of an auxiliary spillway until it is necessary for the spillway to operate to prevent dam failure.

18. In the case of Wivenhoe, the 'spillway crest level' of the fuse plugs is EL 67, which is the Full Supply Level. This means after a fuse plug is triggered, the fuse plug embankment erodes leaving the spillway sill at a level of EL 67. Consequently, following an initiation event and until the embankment is reconstructed, the auxiliary spillway will operate every time the water in the dam exceeds FSL.

19. Once the fuse plugs have been triggered it takes four to six months to rebuild the fuse plug embankment.

20. The practical effect of the inclusion of the fuse plug spillway is to allow the dam to release a greater volume of water during extreme flood events while also preventing operation of auxiliary spillways until they are required to prevent the dam overtopping. Without the fuse plugs the only method of releasing water from the dam is by raising the radial gates. The 2005 upgrade recognised that there may be rare rain events of such intensity that the lake level would continue to rise notwithstanding all radial gates being opened. When initiated the fuse plugs operate to release more water such that the risk of the dam overtopping (and therefore failing) is reduced even further. At levels above the initiation point of the fuse plugs, the dam is still providing flood mitigation by storing water all the way to the dam crest (if necessary). Prior to the upgrade, the dam could only cope with up to a 1 in 22,000 AEP flood event. After the 2005 upgrade the dam now has the capacity to withstand up to a 1 in 100,000 AEP flood event, which is a near 5 fold decrease in failure risk.

Design Requirements of Fuse Plugs

21. I refer to Seqwater's opening submission filed with the Commission on 11 March 2011. To the best of my knowledge, annexure 5 of the submission is a correct statement of a number of applicable dam safety guidelines in Queensland.

22. The DERM AFC Guidelines, attached at **Annexure BM3** specify that fuse plugs should be appropriately designed, constructed and maintained in order to fulfill their required function in accordance with the following:

    (a) initial triggering of the fuse element is not to occur for floods having greater probability than 0.2 per cent AEP;

    (b) failure of successive fuse plugs or fuse gates is to be progressive, predictable and designed to minimise the impact on downstream Population at Risk (***PAR***); and

    (c) the potential downstream impacts of fuse plug or fuse gate triggering at representative locations of PAR are to be identified and documented as part of the Acceptable Flood Capacity Report (see page 5 of the DERM AFC Guidelines **at BM3**).

23. The DERM AFC Guidelines, at **BM3** additionally state that, unless varied by the above, the design of fuse plugs is to comply with the provisions of US Department of the Interior (USBR 1987), *Guidelines for Using Fuse-plug Embankments in Auxiliary Spillways.*

The Wivenhoe Fuse Plugs Satisfy the Design Requirements

24. In my opinion, each of the above DERM AFC Guideline requirements is satisfied by the Wivenhoe Dam fuse plug spillway as:

(a) the threshold of a 0.2% AEP trigger level equates to an AEP of approximately 1 in 500. In contrast, the initiation of the first fuse plug at Wivenhoe Dam occurs at an AEP of about 1 in 6,000. This is an exceptionally rare initiation level in comparison to auxiliary spillway retrofits of other large dams in Australia. For instance, the initiation of the first fuse plug at Warragamba Dam in Sydney is at an AEP of 1 in 750;

(b) the downstream incremental impacts of the initiation of the fuse plugs are small compared to the flood heights occurring immediately prior to initiation: peak water levels are increased by only 0.7m to 1.1m at Savages Crossing, and by 0.3m to 0.5m at Moggill Gauge; and

(c) downstream impacts are identified and documented at pages 35 to 52 of **BM1**; and

(d) the Wivenhoe fuse plugs comply with the US Department of the Interior (USBR 1987), *Guidelines for Using Fuse-plug Embankments in Auxiliary Spillways*.

Studies and reports completed after the 2005 upgrade to Wivenhoe Dam and their findings

25. Schedule 1 to this statement contains a list of studies and reports completed after the 2005 upgrade of which I am aware. Copies of these documents are attached to this statement as **Annexure BM4**.

The advantages and disadvantages to Wivenhoe Dam's water storage and Flood Mitigation capacities following the 2005 Upgrade

26. In my opinion, the advantages of the 2005 upgrade in respect of Wivenhoe Dam's water storage and flood mitigation capacities are:

(a) as I explain in paragraph 20, above, the dam now has an increased flood passing capacity;

(b) the dam now has an increased flood storage capacity to pass floods due to strengthening the crest of the dam and raising it up to EL 80;

(c) the operation of the secondary spillway is not initiated until the occurrence of rare rain events: the first fuse plug initiates at an AEP of about 1 in 6,000;

(d) the upgrade did not reduce the flood storage capacity of Wivenhoe Dam. The plugs simply introduced an additional means of releasing water from the dam as explained in paragraph 20;

(e) the flood mitigation strategies in the flood operations manual were able to be maintained for Wivenhoe Dam; and

(f) in the event of one or more of the gated spillway's gates failing or otherwise becoming inoperable, Wivenhoe Dam still has additional spillway capacity to manage extreme flood events and reduce the risk of failure.

27. In my opinion, the disadvantages of the 2005 upgrade in respect of Wivenhoe Dam's water storage and flood mitigation capacities are:

(a) once the fuse plugs have initiated the auxiliary spillway will operate every time the water level in the dam exceeds FSL until the embankment is reconstructed. This may be problematic if there are two closely spaced very large flood events. However, some capacity remains to control flood releases through the gated spillway;

(b) the operation of the auxiliary spillway after the initiation of each fuse plug is likely to cause erosion in the area immediately downstream. The fuse plug spillway does not have any mechanism (energy dissipater) to reduce the velocity of a water release in the same manner as the gated spillway does.

28. I am aware of suggestions to the effect that Wivenhoe Dam 'lost' flood mitigation capacity as a result of the introduction of the fuse plugs. This is incorrect for the reasons I outline above in paragraphs 20 and 26.

Future Upgrades Planned for Wivenhoe and Somerset Dams

29. I refer to Seqwater's opening submission filed with the Commission on 11 March 2011. To the best of my knowledge, the matters referred to in pages 76, 77 and 78 of Seqwater's opening submission are a correct statement of the DERM AFC Guidelines and their application to Wivenhoe and Somerset Dams. On page 78, table 17 outlines the program of upgrades for Seqwater's assets, including Wivenhoe and Somerset Dams.

My role in determining or altering the Full Supply Levels at Wivenhoe Dam and Somerset Dam outside of flood events

30. Shortly after commencing my role with SEQ Water in 2006, I prepared a report, in conjunction with the Queensland Department of Natural Resources and Water, to investigate raising the FSL as part of the South East Queensland Regional Water Supply Strategy. The report *SEQWater, Provision of Contingency Storage in Wivenhoe & Somerset Dams*, (March 2007) (***Contingency Report***) is annexed to my statement as **Annexure BM5.**

31. The Contingency Report was a very high level report that was intended only to be a preliminary feasibility investigation for options to raise the FSL of Wivenhoe or Somerset Dams.

32. I understand that, following the completion of the Contingency Report, the Dam Safety Regulator required further information by way of:

(a) a review of the flood impacts of raising FSL; and

(b) a structural review of Wivenhoe Dam to assess the impacts of raising FSL.

33. I understand that SunWater was engaged to review the flood impacts of raising FSL. This Report was completed in December 2007 and is annexed as **Annexure BM6.**

34. I understand that GHD was engaged to conduct the structural review of Wivenhoe Dam. This Report was completed in December 2009 and is annexed as **Annexure BM7**.

Modelling done in relation to potential changes to the FSL at Wivenhoe and Somerset Dams from 1 September 2010 to 31 December 2010

35. I was not involved in any modelling done in relation to potential changes to the FSL at Wivenhoe and Somerset Dam from 1 September 2010 to 31 December 2010.

Discussions, correspondence, meetings or briefings from 1 September 2010 to 30 March 2011 regarding possible changes to FSL

36. Following the January 2011 Flood Event, on or about 24 January 2011 I was requested by Seqwater's CEO, Peter Borrows, and the Executive General Manager of Water Delivery, Jim Pruss, to conduct a high-level assessment of the flood mitigation impacts of a reduction to FSL.

37. As the Flood Operations Engineers were occupied with preparing the Flood Event Report for the January 2011 flood event, I conducted the assessment. I met with Terry Malone, Seqwater Hydrologist on the 27th of January and was provided with flood data to be used for the assessment.

38. Annexed to this Statement in **Annexure BM8** is a bundle of documents including reports, correspondence, meetings and briefings in relation to my high level assessment of the flood mitigation impacts of a reduction to FSL which I have been able to collate in the short time available since receiving the requirement. As shown in **Annexure BM8** I arranged for Dr Rory Nathan and Peter Hill of Sinclair Knight Mertz to peer review my high level assessment.

39. All the facts and circumstances above deposed to are within my own knowledge save such as are deposed to from information only and my means of knowledge and sources of information appear on the face of this my affidavit.

SWORN by **BARTON JEFFERAY MAHER** on 1 April 2011 at Brisbane in the presence of:

[redacted]

Deponent

[redacted]

Solicitor

Schedule 1 - studies and reports completed after the 2005 upgrade to Wivenhoe Dam:

Seqwater, *Somerset-Wivenhoe Interaction Study*, (October 2009)

Seqwater, *Flood Procedure Manual – Wivenhoe Dam, Somerset Dam, North Pine Dam, Leslie Harrison Dam, Uncontrolled Spillway Dams*, (January 2010)

Seqwater, *Wivenhoe Dam Emergency Action Plan*, (September 2010)

Seqwater, *Wivenhoe Dam Emergency Action Plan*, (August 2009)

Seqwater, *Wivenhoe Dam Emergency Action Plan*, (September 2008)

SEQWater, *Emergency Action Plan – Wivenhoe and Somerset Dam* (June 2007)

SEQWater, *Emergency Action Plan – Wivenhoe and Somerset Dam*, (December 2005)

Seqwater, *Wivenhoe Dam – Five Year Comprehensive Dam Safety Inspection Report*, (September 2010)

Seqwater, *Wivenhoe Dam Annual Dam Safety Inspection 2009*, (22 October 2009)

Seqwater, *Wivenhoe Dam Annual Dam Safety Inspection 2008*, (11 November 2008)

Queensland Government Department of Natural Resources and Water, *SEQWater Water Services Dam Safety Audit*, (June 2007)

New South Wales Government Public Works – Water Solutions, *SEQWater Dams – Wivenhoe Dam Comprehensive Inspection July 2006 – Surveillance Report – Final Report*, (December 2010)

Seqwater, *Dam Safety Management Program*, (May 2010)

SEQWater, *The Dam Safety Management Program for Wivenhoe, Somerset and North Pine Dams*, (April 2007)

SunWater, *Seqwater – Training and Flood Preparedness for Seqwater Dams for the Year Beginning 30 September 2009* (October 2009)

SunWater, *Training and Flood Preparedness for Seqwater Dams for the Year Beginning 30 September 2008* (October 2008)

SunWater, *Training and Flood Preparedness for Seqwater Dams for the Year Beginning 30 September 2007* (October 2007)

Seqwater, *Standing Operation Procedures*, (March 2009)

Seqwater, *Flood Operations Preparedness Report Wivenhoe, Somerset and North Pine Dam*, (October 2010)

Glenn Hobbs and Associates, *Wivenhoe Dam Radial Gate Trunnion Bearings Peer Review*, (May 2006)

Letter from Garth Powell of Coffey Geotechnics to Barton Maher of SEQWater dated 15 May 2008 enclosing site assessment report

Letter from Phillip Styles of Coffey Geotechnics to Barton Maher of SEQWater dated 7 January 2008 enclosing site inspection report

R Drury, *Briefing Note on Rasing Wivenhoe Full Supply Level*

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INDEX OF ANNEXURES

Annexure No.	**Document**	**Date**
BM1	Wivenhoe Alliance, *Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade Q1091*	September 2005
BM2	Department of Primary Industries, *Wivenhoe Dam Design Report*	September 1995
BM3	Department of Environment and Resource Management, *Guidelines on Acceptable Flood Capacity for Dams*	February 2007
BM4	Studies and reports completed after the 2005 upgrade to Wivenhoe Dam referred to in Schedule 1	Various
BM5	Seqwater, *Provision of Contingency Storage in Wivenhoe & Somerset Dam*	March 2007
BM6	SunWater, *Wivenhoe Dam – Assessment of Wivenhoe Dam Full Supply Level on Flood Impacts*	December 2007
BM7	GHD, *South East Queensland Water Corporation Limited – Report for Wivenhoe Dam Full Supply Level Review – Technical Assessment of Raising Potential*	December 2009

Annexure No.	Document	Date
BM8	Bundle of correspondence and documents regarding FSL Review	January 2011 – March 2011