7 February 2011

Mr John Bradley
Director General
Department of Environment and Resource Management
Level 13
400 George Street
BRISBANE QLD 4000

Dear John,

Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges

I refer to correspondence from The Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy, and Minister for Trade, dated 20 January 2011. I confirm that, as requested, Seqwater has undertaken further simulation modelling to assist DERM in its consideration of the appropriate Full Supply Level (***FSL***) for Wivenhoe Dam. The purpose of the modelling is to provide information to assist DERM in formulating a policy position by providing an indicative assessment of a range of FSLs and pre-release strategies to pre-emptively reduce the FSL of Wivenhoe Dam.

I enclose a memorandum *Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges*, which provides a summary of Seqwater's preliminary assessment into the impact of reducing the initial storage level of Wivenhoe Dam on the downstream discharges for major flood events. A number of scenarios are presented in the memorandum for consideration by DERM in determining, from a policy perspective, whether the FSLs for Wivenhoe Dam should be changed.

The scenarios presented in the memorandum provide an approximate analysis to help inform discussion and for further consideration by DERM. The review is intended only to provide an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose. More accurate estimates would require a detailed investigation and analysis of the entire river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models.

The analysis is based upon computer modelling of simulated gate opening sequences specified in the Flood Mitigation Manual during a "loss of communications" scenario. For the reasons noted in section 2 of the enclosed memorandum, while this scenario provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event. The model utilised adopts flood inflows that have been derived from an analysis of past historic events, in combination with design hydrographs developed previously for design and planning purposes by the Wivenhoe Alliance (2005).

The applicable assumptions for the modelled options, presented in section 2 of the memorandum, apply equally to the scenario set out in the correspondence from Seqwater's Chairman, Phil Hennessy, to Minister Robertson, dated 4 February 2011.

Yours sincerely,

Peter Borrows
Chief Executive Officer

Encl.

Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges

1 Introduction

This memo provides a summary of a preliminary assessment into the impact of reducing the initial storage level of Wivenhoe Dam on the downstream discharges for major flood events. Information is provided on the impacts of reducing the Wivenhoe Dam initial storage level to 95%, 90%, 85%, 75% and 50% of the normal full supply level (EL67.0M AHD).

2 Assumptions and Caveats

The analysis was undertaken using a computer model to simulate the gate opening sequence as provided in the Flood Manual during a "loss of communications" situation. During a loss of communications between the dam operators and the Flood Control Centre, operators would use predefined gate openings based solely on the Lake Level information available to them at the dams. It should be noted that in practice gate operations would normally seek to take advantage of additional information related to rainfall forecasts and tributary flows to ensure that flood peaks are reduced as far as possible without causing coincident flooding with downstream tributaries. Thus, while using the "loss of communications" flood operation rules provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event.

Flood inflows to the model were derived from an analysis of past historic events (1974, 1999, and 2011), in combination with "design hydrographs" developed previously for design and planning purposes (Wivenhoe Alliance, 2005[1]). These "design hydrographs" are obtained from models of both the rainfall and flood generation process, whereby floods of a given magnitude are assigned a specified probability of exceedance (eg a "1 in 200" event).

It should be stressed that the information presented here is based on approximate analyses to help inform discussion. More accurate estimates would require a detailed investigation and analysis of the whole river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models. This review should thus be seen as providing an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose.

[1] Wivenhoe Alliance, "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade, Q1091, September 2005

3 Options Considered

Five options are explored in this paper, as summarised in the following table:

There are five options considered going forward.

Option	Description	Comments
0 "Do nothing"	Continue with the current approved flood operation rules – that is, maintain the status quo and continue to utilise the dam as originally designed.	This option has utilised the existing strategies that have been implemented and refined over several flood events and the manual was developed by a comprehensive study.
1 "Early release"	Change the flood operating rules to ignore the early strategies designed to minimise disruption to the rural communities	Increase the release from the dam up to 1600 m³/s as soon as practicable after gate operations commence; it is assumed that no attempt would be made to maintain bridge access downstream of the dam other than Mt Crosby Weir Bridge and the Brisbane Valley Highway Bridge.
2 "Pre-release"	Implementing a significant release of water once the notification of a major rainfall event has been received.	The reliability of forecasts by the Bureau of Meteorology are such that they do not allow the reservoir to be drawn down in a timely manner without potentially causing appreciable "artificial" flooding downstream.
3 "75% FSL"	Lower the storage level in Wivenhoe Dam to 75% of the current full supply level, and operate the dam under the current operating rules.	To safely lower the storage it is proposed that this option would be implemented by "Sunny Day" releases at a rate low enough to minimise disruption to the rural areas. This would be difficult to implement during a wet year where the risk of major flooding is greater. Once the storage level reached EL67 gate operations would commence as per the current flood manual.
4 "85% FSL amended"	Lower the storage level in Wivenhoe Dam to 85% of the current full supply level and amend the current flood manual to commence releases once the storage level exceeds EL65.25	The amended flood operating rules would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.
5 "75% FSL amended"	Lower the storage level in Wivenhoe Dam to 75% of the current full supply level and amend the current flood manual to commence releases once the storage level exceeds EL64.00	Same comment as for Option 4.

4 Results

The results of this analysis is summarised in Table 1 and Table 2.

Flood Event			Option 0 - Existing Rules		Option 1			Option 4			Option 5		
Event description	Maximum Inflow (m^3/s)	Flood Volume (ML)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,613	71.27	6%	2,639	70.66	32%	1,971	70.24	49%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,915	72.09	4%	4,028	71.53	21%	3,446	71.17	33%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,854	72.68	3%	5,031	72.16	17%	4,504	71.83	26%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,994	74.66	1%	8,535	74.37	6%	8,217	74.17	10%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,101	74.1	1%	7,821	73.92	5%	7,609	73.79	7%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,426	73.67	2%	7,135	73.49	5%	6,916	73.35	8%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	6,986	73.39	4%	6,751	73.25	7%	6,635	73.17	9%
January 2011 historic	10,470	2,650,000	7,528	74.98	7,452	74.95	1%	5,746	74.62	24%	4,512	74.25	40%
1974 historic	5,953	1,410,000	3,275	73.31	3,159	73.26	4%	2,737	72.91	16%	2,493	72.71	24%
1999 historic	6,358	1,220,000	2,312	72.23	2,251	72.504	3%	1,814	71.89	22%	1,561	71.48	32%

Table 1 – Option Results

* Design events taken from the Wivenhoe Alliance (2005)

Flood Event			Option 0 - Existing Rules (Storage Level 100%)		Storage Level 95%		Storage Level 90%		Storage Level 85%		Storage Level 75% (Option 3)		Storage Level 50%	
Event description	Maximum Inflow	Flood Volume	Maximum Outflow	Maximum Lake Level	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction	Maximum Outflow	Flow Reduction
	(m^3/s)	(ML)	(m^3/s)	(m AHD)	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%	(m^3/s)	%
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,579	7%	3,237	16%	2,965	23%	2,356	39%	1,134	71%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,863	5%	4,531	12%	4,271	17%	3,693	28%	2,213	57%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,795	4%	5,478	9%	5,235	13%	4,705	22%	3,329	45%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,949	1%	8,779	3%	8,645	5%	8,339	8%	7,397	19%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,111	1%	7,995	3%	7,902	4%	7,689	6%	7,071	14%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,447	1%	7,325	3%	7,233	4%	7,017	7%	6,404	15%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	7,098	2%	6,911	5%	6,829	6%	6,702	8%	6,360	12%
January 2011 historic	10,470	2,650,000	7,528	74.98	7,453	1%	6,756	10%	5,876	22%	5,748	24%	4,209	44%
1974 historic	5,953	1,410,000	3,275	73.31	3,153	4%	2,974	9%	2,810	14%	2,618	20%	2,067	37%
1999 historic	6,358	1,220,000	2,312	72.23	2,132	8%	2,003	13%	1,920	17%	1,687	27%	1,007	56%

Table 2 – Routing Results for Storage Levels using the current Flood Manual Rules

5 Conclusions

Reductions in outflow flood can be achieved by the adoption of different storage levels and release strategies. However, due to the large volumes of water associated with major flood events, it is necessary to consider large changes to the full supply level to achieve appreciable reductions in flood magnitude. The impact of different initial storage levels reduces as the magnitude of the event increases.