

Our ref: ME/11/0017

14 February 2011

Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002



Dear Mr Borrows

On 20 January 2011, the Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy and Minister for Trade, wrote to the Queensland Water Commission (Commission) requesting the Commission provide all necessary assistance to Seqwater to ensure the Minister's requests to Mr Phil Hennessy, Chair, Seqwater, as raised in his letter of 20 January 2011, are able to be responded to as a matter of priority and with urgency.

On 25 January 2011, the Commission advised the Minister that it was liaising with Seqwater and undertaking preliminary work to support the matters raised.

Since that time the Commission has progressed its work in order to be in a position to provide advice to Seqwater and/or the Minister as and when required.

On 4 February 2011, you provided us with a copy of a letter from Seqwater's Chair to Minister Robertson regarding Seqwater's consideration of the appropriate Full Supply Levels (FSL) for Wivenhoe and Somerset Dams. This letter advised that "DERM may be satisfied, based on advice from QWC and the WGM from a water supply security perspective, that Wivenhoe Dam's FSL could be reduced in the short term to, say, 75% of its current FSL".

I note that the South East Queensland (SEQ) Water Grid Manager has provided you with a letter on 9 February 2011, confirming that "from a water security perspective, the SEQ Water Grid Manager has no objection to Wivenhoe Dam being drawn down to 75% of its FSL".

As you are aware, the Commission has now finalised a draft report as input information material for Seqwater, as requested by the Minister (attached), titled *Impacts on SEQ Water Strategy of Various Operating Scenarios for Wivenhoe Dam, 14 February 2011, Version 6*. The purpose of this report is to provide information on the potential impact on the security of supply in SEQ if a significant volume of water is released from the water supply capacity of Wivenhoe Dam as a potential flood mitigation measure. The information in this report has been shared with Seqwater officers during the course of its preparation, and a full version provided to you on 12 February 2011.

In preparing this report, the Commission has based its assumptions on the SEQ Water Strategy of July 2010, including the addition of purified recycled water into Wivenhoe at the 40% trigger level. Demand forecasts have been updated to align with the recent bulk water price review in November 2010.

The report has considered scenarios as temporary options for the 2011 wet season, and commenced consideration of scenarios contemplating any permanent reductions to FSL from a Level of Service (LOS) yield perspective.

In summary, the report concludes that:

- If releases were made as a temporary measure to reduce the water level in Wivenhoe Dam by 25% from its FSL (a release of about 291,250 ML), the Risk Criteria of the *South East Queensland System Operating Plan* would still be met.
- Despite the above being met, if inflows for the next six years were as low as the 2001-2006 drought, full desalination may be triggered, as Grid 12 storage levels could drop to 60% in this time.
- As the volume released increases, more factors become impacted such as the increased likelihood of triggering desalination and the use of purified recycled water and restrictions, and potentially increased operating costs of the grid.
- Permanent reduction of the FSL by 25% will lower the LOS yield by about 30,000 ML/annum. This reduction in LOS yield may require the construction of new infrastructure to be brought forward by about five years to 2021, based on current demand assumptions. Other options to mitigate the yield reduction such as demand management measures may also be possible.
- Given the current demand is less than that in the recent bulk water price review assumptions used in this assessment, there is more confidence in the margin of supply security available in the demand/supply balance.
- Any permanent reduction would have to be more critically investigated, with this report commencing the analysis for purposes of assisting to inform the annual update of the SEQ Water Strategy and investigations related to the Brisbane River system.

Given the announcement on 13 February 2011 to lower the FSL to 75% for the 2011 wet season, the Commission looks forward to working with you closely in relation to any consideration of a permanent reduction of Wivenhoe's FSL.

The Commission would appreciate your feedback on this draft report, prior to formally progressing it as a final report to Seqwater and the Minister. I will be in touch shortly in order to discuss timing for your feedback with the aim of finalising the report within the next week or so.

If you require any further information, please contact me on [REDACTED] or on email at [REDACTED]

Yours sincerely

[REDACTED]
Karen Waldman
Chief Executive Officer

Enc (1)

cc John Bradley, Director General, Department of Environment and Resource Management

Barry Dennien, Chief Executive Officer, SEQ Water Grid Manager

INFORMATION MATERIAL ONLY



**Impacts on SEQ Water Strategy of
Various Operating Scenarios for
Wivenhoe Dam**

14 February 2011

Version 6

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1 Purpose

The purpose of this report is to outline the results of the assessment, from a water supply security perspective for South East Queensland (SEQ) over the short and long term, of possible scenarios for lowering of Wivenhoe Dam below the current deemed full operating supply level (i.e. 100 percent dam level for water supply purposes). The effects of temporarily lowering the full supply level of Baroon Pocket and Hinze Dams were also assessed.

For the purpose of this report, short term is defined as the period over the next 5 years (as per risk criteria of SEQ System Operating Plan) where the supply security in SEQ may be impacted by any proposed temporary lowering of the Wivenhoe Dam operating level over the 2011 wet season.

Long term is defined as a period of up to 50 years in relation to the demand and supply (LOS Yield) balance in the SEQ Water Strategy.

This assessment does not consider the environmental, social and economic impacts of the dam operating levels in relation to flood mitigation for downstream properties and infrastructure.

2 Background

Major flooding occurred in the Brisbane River catchment on 13 January 2011.

This resulted in the Brisbane River peaking at 4.46m at the Port Office in Brisbane City and causing extensive damage to properties and businesses throughout the catchment. The 2011 flood was about 1m lower than the 1974 Flood event of 5.45m at the Port Office, Brisbane City. However, indications are that the social and economic impacts are much more significant given the building and business developments in the catchment over the last 37 years. Flood rebuilding is currently estimated to cost about \$5B.

The Minister for Natural Resources, Mines and Energy and the Minister for Trade has written to the Commissioner on 20 January 2011, requesting the Queensland Water Commission provide all necessary assistance to Seqwater in their review of the operation of Wivenhoe and Somerset Dams.

3 Role of Queensland Water Commission

3.1 Background/Context

The Queensland Water Commission (the Commission) is responsible for providing advice to the Minister on matters relating to water supply and demand management for water for SEQ. A key function of the Commission is to provide advice on the desired Levels of Service (LOS) for water supplied in SEQ.

The SEQ Water Strategy defines the LOS objectives to include the expected frequency, duration and severity of restrictions during future droughts based on a total demand of 375 litres/person/day (including residential, non-residential and system losses) of which 230 litres/person/day is attributed to residential demand. The LOS objectives are provided in Appendix A.

4 Short Term Impacts

The potential short term impacts are assessed using hydrological modelling. These are described in sections 4.1 to 4.3.

4.1 Use the SEQ Regional Water Balance Model (Wathnet Model) to assess the SOP risk criteria

The modelling conducted for this report was carried out using the Wathnet Model¹ which assesses the likelihood of reaching particular water storage volumes. Under the current operating arrangements and policies, the volumes of interest are:

- 60% of the Grid 12 volume, when full desalination production is triggered; and
- 40% of the Grid 12 volume, when full production of purified recycled water from the Western Corridor Recycled Water Project is triggered, to augment water supplies in Wivenhoe Dam and medium level restrictions would be introduced.

The Grid 12 storages and their corresponding capacities are provided in Appendix B.

Table 1 presents the five scenarios modelled. Scenarios 1 to 4 involved a reduction in water level at Wivenhoe Dam to 87%, 75%, 70% and 50% supply capacity with all other storages set at 100% full supply initially. The fifth scenario also includes a reduction of 50% capacity at Hinze and Baroon Pocket Dams with all other storages set at 100% full supply initially. This allows an assessment of the sensitivity to the security of supply should there be a need to also reduce the full operating levels in the Sunshine Coast (Baroon Pocket Dam) and Gold Coast (Hinze Dam).

For example, a 25% reduction of volume of 291,250 megalitres (ML) from Wivenhoe Dam would correspond to about 3 m drawdown from the full supply level based on the storage capacity data provided in Appendix C.

The key assumptions adopted for these runs were:

- Simulations start at the end of January 2011 with initial dam level (inflows from February 2011)
- Northern Pipeline Interconnector Stage 2 excluded
- Demand forecast as agreed by Government in late 2010 (residential consumption increasing from current levels to 200 litres/person/day by 2018)
- Medium series population growth consistent with SEQ population forecasts
- No desalination above 60% Grid 12 Storages
- Full desalination below 60% Grid 12 Storages

The scenarios do not consider day-to-day operational matters.

¹ Wathnet Model refers to the Generalised Water Supply Headworks Simulation using Network Linear Programming Model.

4.2 Forecast the probability of Grid 12 storage levels over the next 5 years

To forecast the probability of the Grid 12 storages reaching a certain level, the Wathnet Model was used, based on stochastic data generation for 117 years of historical information.

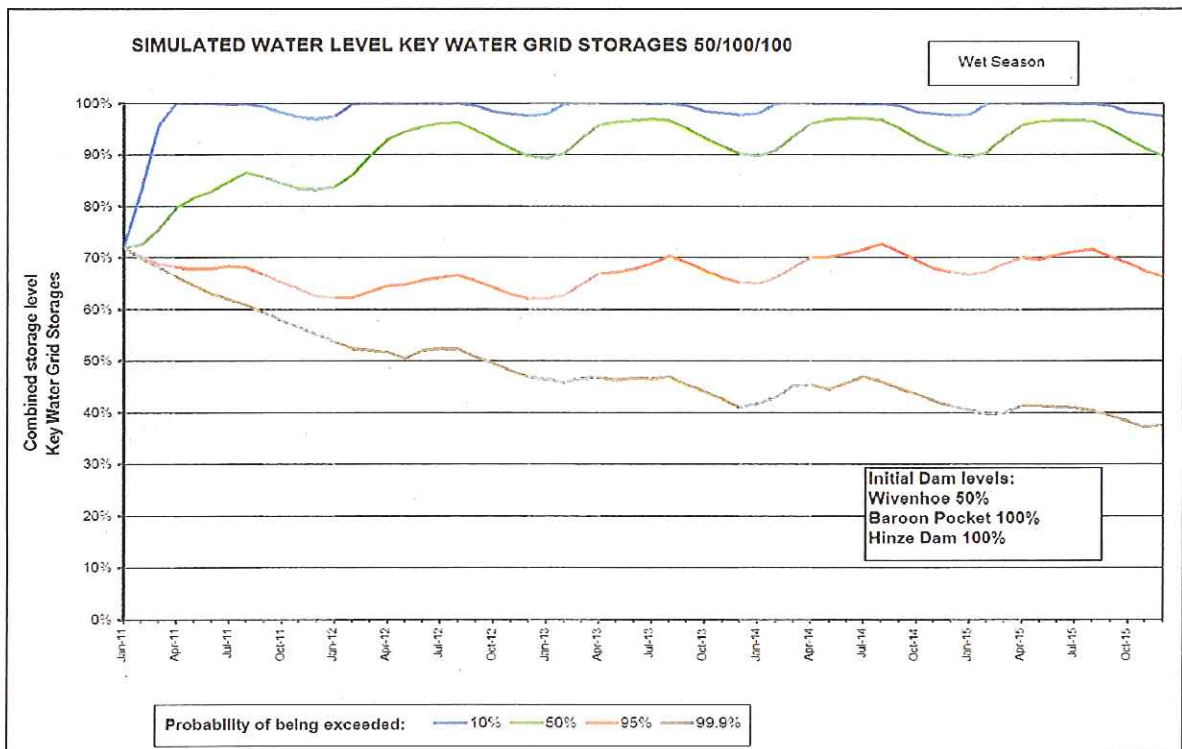
Stochastically generated data provides longer time sequences of hydrologic data that have similar statistical characteristics of that of the historical record. This data provides better information about climate variability and the potential for droughts worse than have occurred on record.

Figure 1 shows the forecast storage level for the Grid 12 storages for Scenario 4 (as described in Section 4.1) with Wivenhoe drawn down to 50% and the rest of the storages at 100% at the start of the simulation in end January 2011. (Note: The plots for Scenarios 1 – 3 would show higher storage levels than those shown in Figure 1).

In this scenario:

- there is a 95% probability that the combined Grid 12 storage level remain above 60% for the next 5 years;
- there is a 99.9% probability that the combined Grid 12 storage level remains above 40% for the next 4 years; and
- there is a 50% probability that the combined Grid 12 storage level will climb back to 90% and remain at this level for the remainder of the 5 year period.

Figure 1: Scenario 4 with Wivenhoe Dam drawn down to 50% - forecast combined Grid 12 storage level showing probabilities of exceedance



4.3 Simulated storage behaviour of Grid 12 storages over the next 6 years for three inflow scenarios (using Waspp Model)

The purpose of these simulations was to assess the potential behaviour of the Grid 12 storages over the next 6 years using three inflow scenarios based on probability of combined inflows into the storages.

For all inflow scenarios, Wivenhoe Dam was assumed to be initially at 75% capacity.

There are various methodologies that could be used for the selection of inflow sequences. For the purpose of this work, it is considered necessary to test scenarios covering a period of relative wet, of average inflow and of the driest years. The annual inflows for the Grid 12 storages from 1890 to 2007 were used in the analysis. Table 5 provides the scenarios corresponding to the 30% (wet), 50% (average) and 100% (dry) exceedance probabilities based on 6 years of cumulative inflow sequence.

The worst 6 years of inflows (100% exceedance probability) was found to correspond to the most recent drought on record from 2001 to 2006 as shown in Scenario 3 (Table 5).

Table 5: Inflow scenarios assessed

Scenario	Exceedance Probability of Inflows	Continuous Sequence (6 years)	Total Inflow Volume Grid 12 (ML)
1	30%	Jan 1985 – Dec 1990	10,193,300
2	50%	Jan 1995 – Dec 2000	7,243,300
• 3	• 100%	• Jan 2001 – Dec 2006	• 2,752,000

The assumptions adopted in the modelling were:

- 75% initial storage volume at Wivenhoe Dam (all other storages at 100% full) - or Grid 12 storages at 86% capacity
- Demands forecast as agreed by Government in late 2010 (residential consumption increasing from current levels to 200 litres/person/day by 2018)
- Full desalination production when Grid 12 storages drop below 60% capacity, and no desalination above 60%
- Northern Pipeline Interconnector Stage 2, Hinze Dam raising and Wyaralong Dam not included
- Purified Recycled Water introduced into Wivenhoe Dam when Grid 12 storages drop below 40% capacity.

The results of the simulations for the 3 scenarios are shown in Figure 3. The worst case scenario from the historical records shows the lowest combined storage levels after June 2014, but staying above the 40% capacity to the end of 2016. Under this scenario of inflows, Purified Recycled Water is not expected to be introduced into Wivenhoe Dam within the next 5 years. For scenarios 1 and 2, the storage levels generally decreased for the first 3 years before increasing thereafter.

5 Long Term Impacts - assessment of the potential impact on the LOS Yield (using Wathnet Model)

To assess the long term impacts on the LOS yield if Wivenhoe Dam was permanently operated at a reduced water supply capacity, two scenarios involving a 10% and 25% reduction from full supply level were investigated.

This assessment is carried out for completeness only and does not suggest that the dams be operated permanently with a reduced full supply level. Further investigation is necessary to understand the full impacts.

The Regional Water Security Program for SEQ establishes the desired LOS objectives which form a basis for the SEQ Water Strategy and are implemented through the SOP. These objectives provide long term security of water supply and are defined as the:

- desirable maximum frequency, duration and severity of water restrictions, and
- the average amount of water per person that must be supplied in normal times.

These objectives are used to determine the Level of Service (LOS) Yield. The LOS Yield is used, along with the projected demands, to ensure that adequate initiatives are in place to meet demand in the future.

The LOS Yield for the 2010 Infrastructure (capacity to deliver) is assessed to be 485,000 ML/a. This assumes that the desalination plant is providing 125 ML/day and Purified Recycled Water (PRW) 142 ML/day.

To assess the impact on the long term LOS Yield, the Wathnet Model was used.

This assessment was based on the following assumptions:

- 2010 infrastructure, prior to the full operation of Wyaralong Dam and Hinze Dam Stage 3
- PRW production at 52,000 ML/a (142 ML/day) and supplies 34,950 ML/a (96 ML/day) to industry
- Desalination production at 46,000 ML/a (125 ML/day)

5.1 Results – 10% reduction on Full Supply Volume for Wivenhoe Dam

The LOS Yield for the 2010 Infrastructure (capacity to deliver) is assessed to be 485,000 ML/a.

Preliminary modelling work suggests that the impact of a permanent 10% reduction in the full supply volume at Wivenhoe Dam is minimal on the LOS yield as this is within the tolerance of the model. This needs further investigation.

5.2 Results – 25% reduction on Full Supply Volume for Wivenhoe Dam

There is a significant reduction in the LOS yield of 30,000 ML/annum with a scenario where Wivenhoe Dam was permanently operated at 25% lower than the full supply level. The LOS yield has reduced from 485,000 ML/annum to 455,000 ML/annum.

Figure 5 shows that new infrastructure would need to be brought forward by about 5 years to about 2021 from 2026 under medium series population growth.

A saving of 25,550 ML per annum (difference between 317,550 and 292,000 ML per annum) would significantly offset the LOS yield reduction of 30,000 ML/annum if Wivenhoe Dam was operated at 25% lower than Full Supply Level (FSL) over a long period (Refer to section 5.2).

6 Implications of each scenario

Table 3 provides a general framework for the assessment of the consequences of each scenario based on the following criteria for the short, intermediate and long term periods:

- Security of supply - involves examining the sufficiency, LOS Yield, desalination, and demand and supply balance
- Levers – these are some of the factors that could be reviewed to optimise the security of supply such as Levels of Service, policies and assumptions
- Inputs – these are some of the input factors which could be impacted e.g. allocation/yield, demand and supply
- Pricing – some of the scenarios may impact upon a future review of the Price Path such as through increases in operating costs.

The following observations are made and reflected in Table 3:

Short Term Reduction in Full Supply Capacity

- If releases were made as a temporary measure to reduce the water level in Wivenhoe Dam by 25% of full supply capacity (a release of about 291,250 ML), the Risk Criteria of the SEQ SOP (System Operating Plan) would still be met.
- As the volume released increases, more factors become impacted such as, the increased likelihood of triggering desalination, use of purified recycled water or introduction of restrictions and potentially increased operating costs of the grid.
- The SOP Risk Criteria are satisfied for scenarios with up to 50% of water released from Wivenhoe Dam. However other factors become impacted. This assessment deals only with the volume capacity and does not consider actual availability due to operational constraints.
- Operational costs may be impacted when the storage is drawn down to 50% as the grid operating costs will increase with the need for desalination being triggered more frequently.

Long Term (Permanent) Reduction in Full Supply Capacity at Wivenhoe Dam

- A reduction of 25% in the full supply level would have an impact on the security of supply.
- New infrastructure would need to be brought forward about 5 years to meet the LOS objectives for a 25% drawdown scenario.
- There could be an impact on the future bulk water through an increase in operational costs for a 25% drawdown scenario.

There could potentially be some optimal operating arrangement, indicated as Intermediate Option in Table 3. This could involve a review of the levers such as redefining the LOS objectives based on further investigations, to ensure that the short term operating options do not compromise the long term security of supply.

7 Peer review of modelling by Department of Environment and Resource Management

The results of this modelling work were reviewed by the Queensland Hydrology Group of the Department of Environment and Resource Management.

The review of the input and results for the Wathnet Model was carried out by Dr John Vitkovsky, Senior Hydrologist, who stated that: "modifications were made to the WathNet SEQ Grid model for the purposes of a sensitivity analysis of the SEQ LOS statistics from lowering the full storage volume of key large storages. There (are) a number of changes to the model that can only be done by someone with intimate knowledge of the lower-level files in the model—and cannot be made using the spreadsheet. However, as long as it is only the SEQ volume LOS statistics that are being reported on and given the modifications made to the spreadsheet the results should be reasonable." Further:

- The model setups for all runs seem correct
- The results seem entirely reasonable and satisfy the SOP Risk Criteria
- The output statistics for both the long-term and forecast model runs seem reasonable (without re-running those scenarios) and are compliant with the LOS and SOP criteria."

For the review of the Waspp Model, Mr Craig Johansen (Principal Hydrologist) has stated that "the results of the scenarios presented for review appeared logical and appropriate based on the rules of the SEQ Water Grid and the understanding (of) the model."

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Appendix B - Grid 12 Storages in South East Queensland

As at 27 October 2010

	FULL SUPPLY VOLUME (Megalitres)
Southern	
Little Nerang	6,705
Hinze	161,073
Total Southern	167,778
Central	
North Pine	214,302
Somerset	379,849
Wivenhoe	1,165,238
Lake Kurwongbah	14,370
Leslie Harrison	24,868
Total Central	7,798,627
Northern	
Baroon Pocket	61,000
Cooloolabin	13,800
Ewan Maddock	16,587
Lake MacDonald	8,018
Wappa	4,694
Total Northern	104,099
TOTAL SEQ	2,070,504

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Director General
Department of Environment and Resource Management
GPO Box 2454
Brisbane Qld 4001

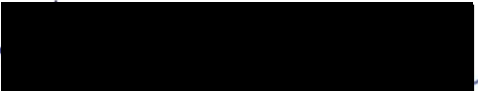

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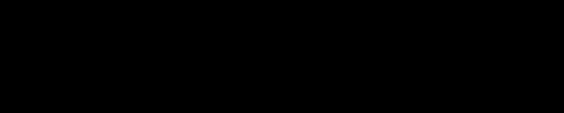

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Yours sincerely

[REDACTED]
Karen Waldman
Chief Executive Officer

Enc (1)

cc John Bradley, Director General, Department of Environment and Resource Management

Barry Dennien, Chief Executive Officer, SEQ Water Grid Manager