QWC-6

Queensland water Commission

Securing our water, together.

Our ref: ME/11/0017

14 February 2011

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

Peter

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.

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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

Document Control

Date	Author/Reviewer	Description	Version
3/2/2011	Wai-Tong Wong	Draft	1
3/2/2011	Julie Allan, Mark Askins Richard Scott, Wendy Auton Justin Claridge, Gayle Leaver	Reviewed Draft - with edits	1, 2, 2A
8/2/2011	Wai-Tong Wong Mark Askins Wendy Auton	Draft edited with additional sections on modelling review by DERM, demand reduction and Waspp simulations. Incorporated comments by Karen Waldman	3
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11/2/2011	Wai-Tong Wong Julie Allan Mark Askins Justin Claridge	Incorporated minor edits and improved formatting	6

Approval

Date	Name	Description	Version
3/2/2011	Tad Bagdon Gayle Leaver	Reviewed	2
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11/2/2011	Tad Bagdon Gayle Leaver Karen Waldman	Reviewed	5
11/2/2011	Tad Bagdon Karen Waldman	Reviewed	6

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Executive Summary

The purpose of this report is to provide information on the potential impact on the security of supply in South East Queensland (SEQ) if a significant volume of water is released from the water supply capacity of Wivenhoe Dam as a potential flood mitigation measure.

In the main the scenarios considered would be potentially a temporary measure over the 2011 wet season, based on the impacts to the SEQ Water Grid as a whole. The underlying assumptions used include the demand and supply capacity contained in the SEQ Water Strategy, with demand forecasts updated to align with the recent bulk water price review in November 2010.

For completeness two scenarios involving permanent reduction in the full supply volume of Wivenhoe Dam have also been considered, but further investigation is required to understand the full impacts. This assessment is based on sensitivity analysis of the total grid capacity and no detailed assessment has been undertaken.

The following observations can be drawn from these assessments:

- 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 (five year) Risk Criteria of the SEQ System Operating Plan (SOP) would still be met.
- Despite the SOP Risk Criteria being met, if inflows for the next 6 years were as low as the 2001-2006 drought, full desalination production 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 in the full supply volume of 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 5 years to 2021, based on current demand assumptions. Other options to mitigate the yield reduction such as demand management measures may also be possible.

These analyses are an exercise in assessing risk management rather than a forecast for the future. Therefore an understanding of the consequences involved for a particular risk profile is important.

This report does not recommend a particular scenario for adoption as other factors such as social, economic and environmental may also need to be considered. It provides some risk information on the security of supply based on the short term (SOP Risk Criteria) and the long term water demand/supply balance in the SEQ Water Strategy.

Operational and regulatory impacts such as increased pumping costs and the Water Resource Plan have not been assessed. Advice from the responsible agency or entity would need to also be considered.

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.

The Commission also makes and administers the South East Queensland System Operating Plan (SOP) under the *Water Act 2000* which sets out the rules for operating the SEQ Water Grid to help achieve the LOS objectives.

While the LOS objectives specify the basis for operating the Grid over the long term, the risk criteria of the SOP provide the basis for balancing water security and operating costs over the short term (up to 5 years).

The SOP risk criteria are given below:

Volume of water stored by all key water grid storages	**Probability of reaching 40% and 30% volume of water stored**		
	within 1 year	**Within 3 years**	**Within 5 years**
40%	Less than 0.2%	Not Specified	Less than 5%
30%	Not Specified	Less than 0.5%	Less than 1%

3.2 Report to Seqwater

To support Seqwater's review of the operations of Wivenhoe and Somerset Dams, the Commission has conducted a series of modelling exercises to determine the potential impacts of certain operating arrangements on the security of supply for the region.

Consideration has been given to the ability of the SEQ Water Grid to continue to achieve the desired Level of Service objectives in the short term (up to 5 years) for various scenarios of lowering the deemed full water supply level particularly at Wivenhoe Dam, and also for Hinze and Baroon Pocket Dams.

For completeness two scenarios involving permanent reduction in the full supply volume of Wivenhoe Dam have also been considered, but further investigation is required to understand the full impacts. This assessment is based on sensitivity analysis of the total grid capacity and no detailed assessment has been undertaken.

These analyses are an exercise in assessing water security risk rather than a forecast for the future. Therefore an understanding of the consequences involved for a particular risk profile is important.

Operational and regulatory impacts such as increased pumping costs and the Water Resource Plan have not been assessed. Advice from the responsible agency or entity would need to also be considered.

This report provides an input, amongst other considerations, for Seqwater or other agencies to assist in developing advice to Government on the operating level of Wivenhoe Dam over this 2011 forecast wet season.

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 Model[1] 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.

Table 1: Modelled scenarios

Scenario	%reduction Wivenhoe Dam (from Full Supply)	%reduction from other dams (from Full Supply)	Volume of Water Released (ML)#	%reduction of key Grid 12 Storages (from Full Supply)
1	13*	none	150,000	7.2
2	25	none	291,250	14.0
3	30	none	349,500	16.9
4	50	none	582,500	28.1
5	50	50 (Baroon Pocket) 50 (Hinze Dam)	693,500	33.5

* Scenario 1 was selected as a starting point for the assessment of 150,000 ML (about 12.9%, but rounded up to 13% in the Table).

This is only the total volume and the strategy for release has not been considered. Operational constraints are also not considered for the purpose of this assessment.

The corresponding risk criteria results as compared to the SOP requirements are shown in Table 2.

Table 2: Results of risk criteria

Period	SOP Criteria	Scenarios (Wivenhoe/Baroon Pocket/Hinze capacities)				
		1 (87/100/100)	2 (75/100/100)	3 (70/100/100)	4 (50/100/100)	5 (50/50/50)
Probability of reaching 40% Grid 12 Storage Volume						
1 year	<0.2%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
5 year	<5%	0.09%	0.15%	0.20%	0.31%	0.49%
Probability of reaching 30% Grid 12 Storage Volume						
3 year	<0.5%	<0.01%	<0.01%	<0.01%	<0.01%	0.01%
5 year	<1%	<0.01%	<0.01%	<0.01%	<0.01%	0.03%

From the above analysis, all scenarios 1 to 5 in Table 2 pass the SOP risk criteria. While this means that the risk associated with the short term security of supply is acceptable, the consequences of each scenario with respect to other factors would need to be examined – see Section 6.

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.

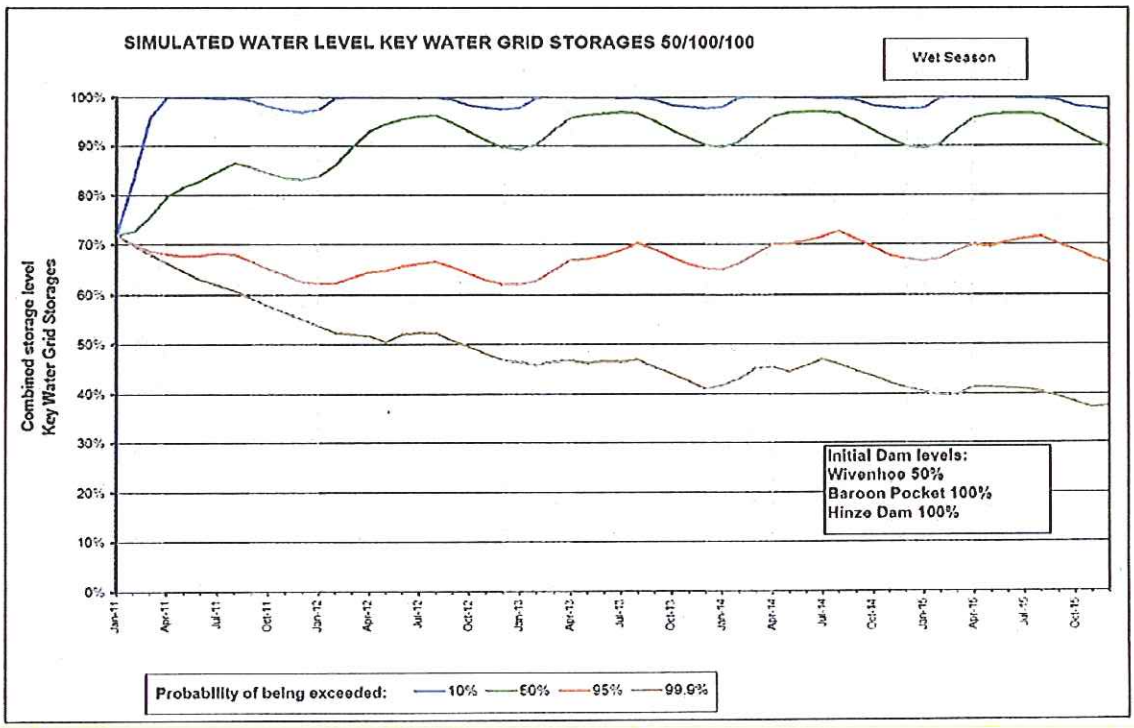
Stochastically generated data provides longer time sequences of hydrologic data that have similar statistical characteristics of that of the historical record. This data provides better information about climate variability and the potential for droughts worse than have occurred on record.

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

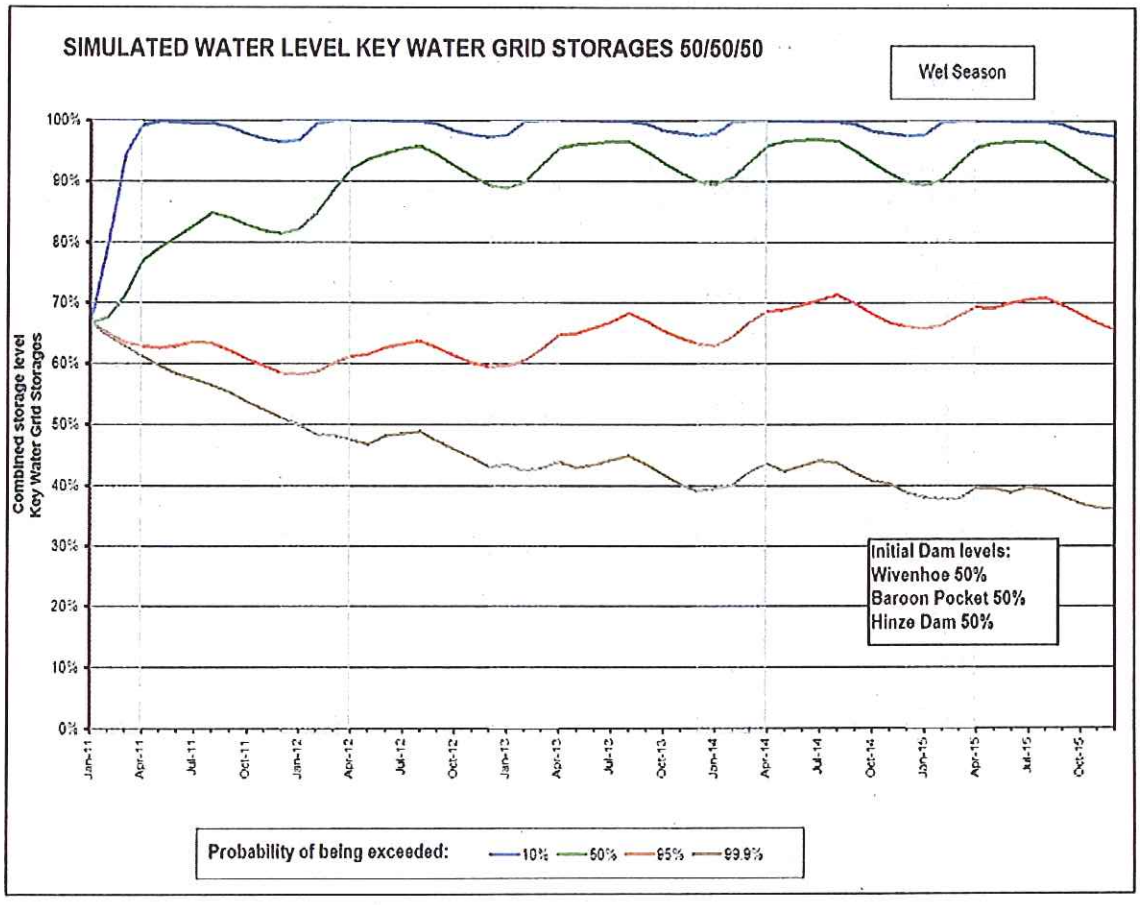


Scenario 5 (as described in Section 4.1) tests the sensitivity of the model findings by starting with Wivenhoe, Baroon Pocket and Hinze Dams all drawn down to 50% and the rest of the Grid 12 storages at 100% at the start of the simulation. This scenario represents the highest risk situation of all the modelled scenarios. The results are still within the bounds of the risk criteria set in the SOP.

In this scenario (Figure 2):

- There is almost a 95% probability that the combined Grid 12 storage level will stay above 60% for the next 5 years.
- There is at least a 95% probability (could be approaching 99.9%) that the combined Grid 12 storage level will stay above 40% for the next 5 years.
- There is a 50% probability that the combined Grid 12 storage level will climb back up to 90% and remain about this level for the next 5 years.

Figure 2: Scenario 5 with Wivenhoe, Baroon Pocket and Hinze Dams all 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

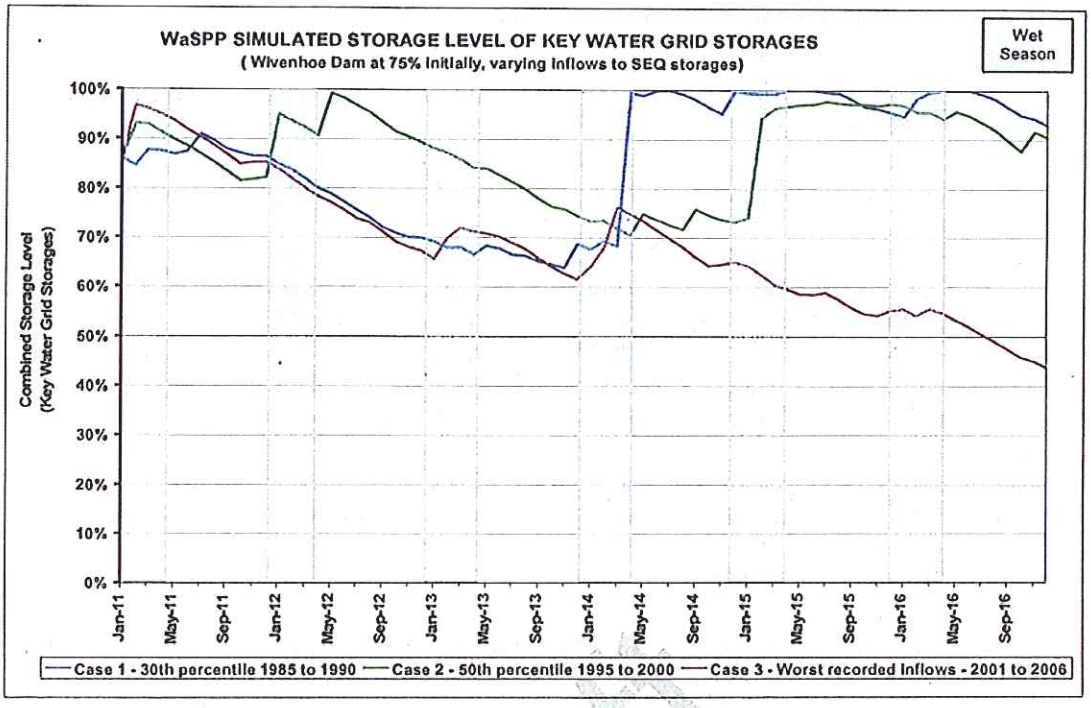
Scenario	Exceedance Probability of Inflows	Continuous Sequence (6 years)	Total Inflow Volume Grid 12 (ML)
1	30%	Jan 1985 – Dec 1990	10,193,300
2	50%	Jan 1995 – Dec 2000	7,243,300
• 3	• 100%	• Jan 2001 – Dec 2006	• 2,752,000

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.

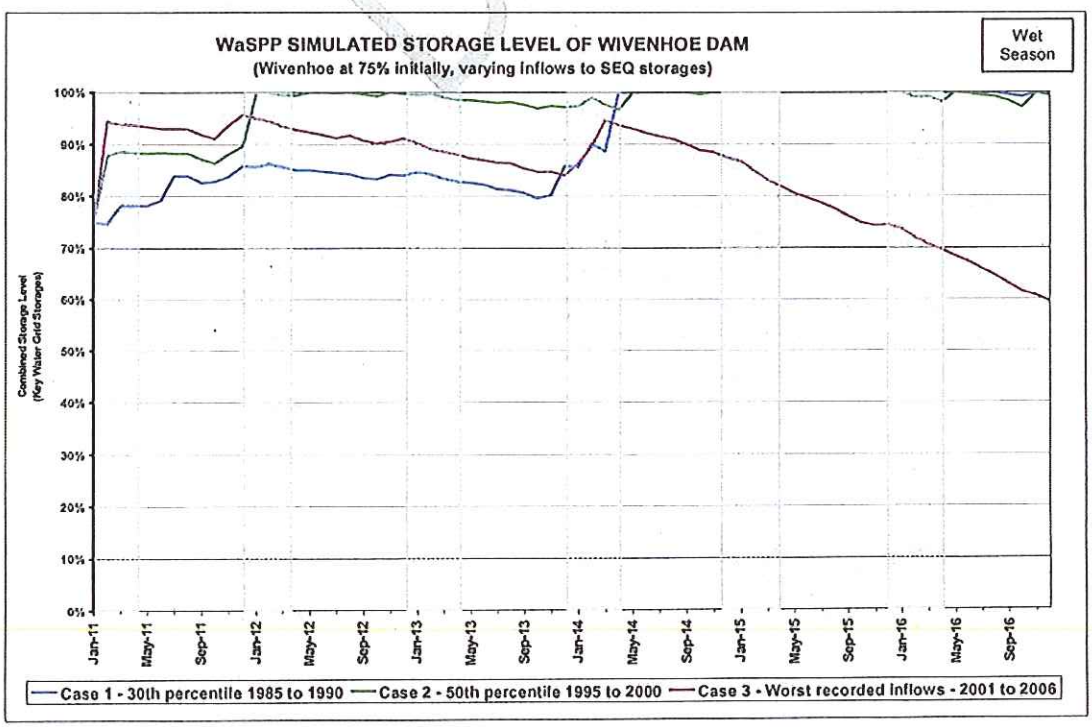
The results of the simulations for the 3 scenarios are shown in Figure 3. The worst case scenario from the historical records shows the lowest combined storage levels after June 2014, but staying above the 40% capacity to the end of 2016. Under this scenario of inflows, Purified Recycled Water is not 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.

Figure 3: Simulated Grid 12 storage levels for 3 inflow scenarios



The simulated storage level behaviour of Wivenhoe Dam for the three inflow scenarios is indicated in Figure 4. As expected, the simulated level for Wivenhoe Dam reduces significantly due to the worst inflow sequence. With scenarios 1 and 2, Wivenhoe Dam recovers within about 3 years.

Figure 4: Simulated Wivenhoe Dam storage levels for 3 inflow scenarios



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.

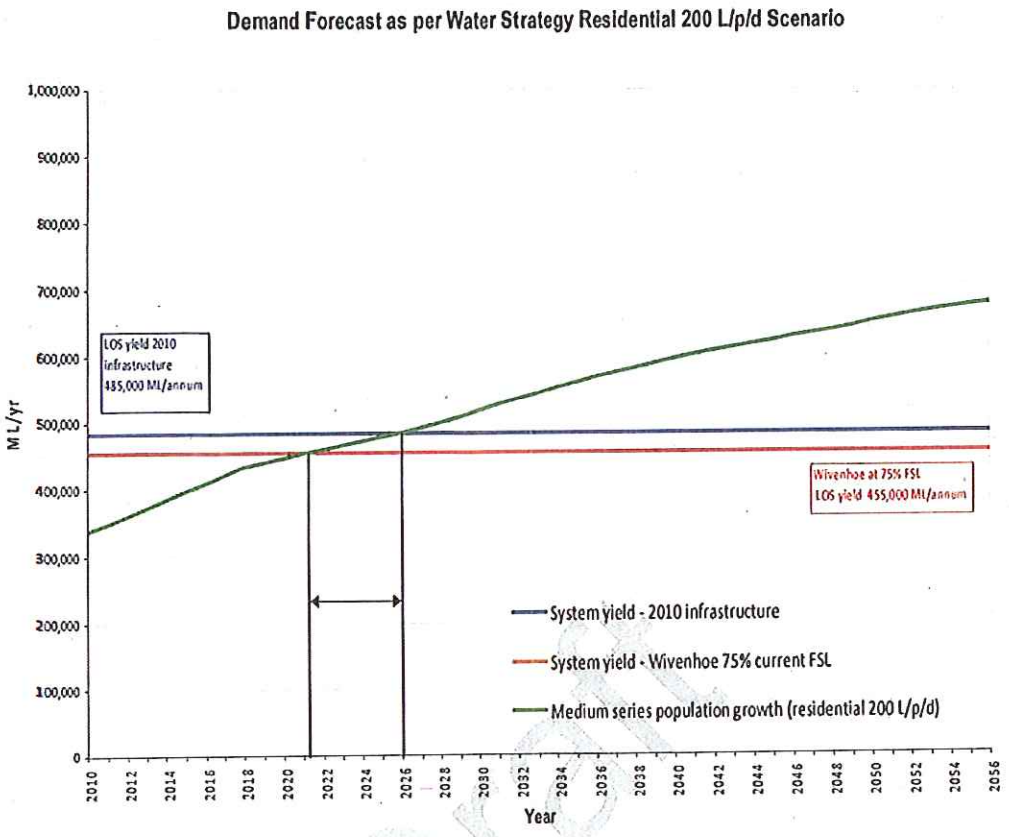
Preliminary modelling work suggests that the impact of a permanent 10% reduction in the full supply volume at Wivenhoe Dam is minimal on the LOS yield as this is within the tolerance of the model. This needs further investigation.

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.

Figure 5: LOS Yield comparison



5.3 Potential for demand reduction

One of the input factors that impacts on the water supply balance is the level of extractions from the supply storages. The level of extraction depends on the level of demand in South East Queensland (SEQ).

The supply balance and risk assessment modelling conducted for this information paper includes the level of expected demand based on residential water consumption of 200 litres/person/day (l/p/d). This demand scenario is the same as the demand forecast as agreed by Government in late 2010 (residential consumption increasing from current levels to 200 l/p/d by 2018).

The 200 l/p/d demand scenario is the equivalent of total water demand of 870 ML per day for SEQ or 317,550 ML per annum.

The level of total water demand in SEQ for the last three months has been approximately 670 ML/d, which when annualised gives 244,550 ML per annum. On a per person basis this is the equivalent of 150 l/p/d. However, this level of consumption is unlikely to remain at this level.

The late 2010 demand scenario includes a residential demand at approximately 185 l/p/d for 2011, being the equivalent of 800 ML per day for SEQ or 292,000 ML per annum. If demand was to be maintained at this level, this represents a demand saving of 25,550 ML per annum.

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.

Table 3: Preliminary Framework for Consideration of Impacts on SEQ Water Strategy for Various Operating Levels of Wivenhoe Dam

Description	Base Case (status quo)	Short Term Scenario (Temporary Wivenhoe Dam drawdown)			Intermediate Option	Long Term Scenario (Permanent Wivenhoe Dam drawdown)	
		13%	25%	50%	Review	[2]10%	25%
Security of supply							
• Sufficiency	✓	✓	✓	✓	Review	✓	×
• LOS Yield	✓	✓	✓	✓		✓	×
• Demand/ Supply Balance	✓	✓	✓	✓		✓	×
• Desalination	✓	✓	If 2001-2006 inflows - may potentially trigger full desalination	If 2001-2006 inflows - may potentially trigger full desalination		✓	×
Levers							
• Levels of Service					Review		
• Policies							
• Assumptions							
Input							
• Allocation[1]/Yield	✓	✓	Allocation - determined by DERM	Allocation - determined by DERM	Review	× (impacted)	×
• Demand	✓	✓	✓	✓		✓	×
• Supply	✓	✓	✓	✓		× (impacted)	×
Pricing							
• Impact on pricing	✓	✓	✓	✓	Review	✓	× new price path is potentially required

Note: ✓ Minimal Impact × Impacted

[1] A permanent change in the full supply level of Wivenhoe Dam would require a review of available entitlements from Wivenhoe Dam under the Water Resource Plan.

[2] Needs further assessment.

QWC-6

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."

Appendix A – Level of Service Objectives (SEQ Water Strategy)

• During normal operating mode, sufficient water will be available from the SEQ Water Grid to meet an average regional urban demand of 375 litres per person per day (including residential, non-residential and system losses).

• Sufficient investment in the water supply system will occur so that:

-Medium Level Restrictions will not occur more than once every 25 years, on average

-Medium Level Restrictions will only reduce consumption by 15 per cent below the total consumption volume in normal operating mode

-drought response infrastructure will be not be required to be built more than once every 100 years, on average

-combined regional storage reserves do not decline to 10 per cent of capacity more than once every 1000 years, on average

-regional water storages do not reach 5 per cent of combined storage capacity

-Wivenhoe, Hinze and Baroon Pocket dams do not reach minimum operating levels.

• It is expected that Medium Level Restrictions will last longer than six months, no more than once every 50 years on average.

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**

Appendix C – Wivenhoe Dam Storage Capacity Data

EL (M)	AREA (HA)	VOLUME (ML) TOTAL	CUM
82.00	22161	3665000	
81.75	21916	3499906	
81.50	21668	3445429	
81.25	21415	3391560	
81.00	21166	3338361	
80.75	20918	3285762	
80.50	20677	3233774	
80.25	20431	3182392	
80.00	20192	3131619	
79.75	19952	3081433	
79.50	19735	3031816	
79.25	19509	2982768	
79.00	19285	2934279	
78.75	19051	2886356	
78.50	18831	2839009	
78.25	18613	2792205	
78.00	18390	2745957	
77.75	18173	2700265	
77.50	17956	2655069	
77.25	17746	2610476	
77.00	17535	2566379	
76.75	17322	2522810	
76.50	17118	2479767	
76.25	16930	2437223	
76.00	16724	2395172	
75.75	16531	2353607	
75.50	16337	2312525	
75.25	16147	2271925	
75.00	15954	2231791	
74.75	15763	2192119	
74.50	15572	2152874	
74.25	15443	2114055	
74.00	15269	2075676	
73.75	15105	2037713	
73.50	14943	2000156	
73.25	14782	1963000	
73.00	14620	1926252	
72.75	14454	1889912	
72.50	14286	1853992	
72.25	14121	1818486	
72.00	13955	1783389	
71.75	13800	1748690	
71.50	13642	1714393	
71.25	13484	1680498	
71.00	13323	1646983	
70.75	13167	1613871	
70.50	13009	1581156	
70.25	12851	1548833	
70.00	12693	1516906	
69.75	12529	1485379	

EL (M)	AREA (HA)	VOLUME (ML) TOTAL	CUM
69.50	12355	1454267	
69.25	12205	1423557	
69.00	12046	1393246	
68.75	11889	1363332	
68.50	11723	1333815	
68.25	11561	1304714	
68.00	11401	1276013	
67.75	11240	1247714	
67.50	11080	1219815	
67.25	10916	1193301	
67.00	10751	1166238	
66.75	10572	1139550	
66.50	10389	1113278	
66.25	10197	1088644	
66.00	9990	1061414	
65.75	9797	1036697	
65.50	9558	1012440	
65.25	9412	988681	
65.00	9234	965378	
64.75	9058	942515	
64.50	8884	920080	
64.25	8712	898049	
64.00	8541	876532	
63.75	8371	855381	
63.50	8184	834681	
63.25	8027	814418	
63.00	7864	794567	
62.75	7710	775097	
62.50	7558	756014	
62.25	7402	737320	
62.00	7247	719011	
61.75	7115	701062	
61.50	6987	683435	
61.25	6855	666123	
61.00	6745	649112	
60.75	6629	632398	
60.50	6512	615960	
60.25	6403	599809	
60.00	6299	583927	
59.75	6190	568318	
59.50	6085	552976	
59.25	5975	537895	
59.00	5875	523069	
58.75	5775	508516	
58.50	5674	494209	
58.25	5573	480151	
58.00	5467	466340	
57.75	5371	452812	
57.50	5273	439507	
57.25	5175	426447	

EL (M)	AREA (HA)	VOLUME (ML) TOTAL	CUM
57.00	5078	413632	
56.75	4985	401055	
56.50	4897	388706	
56.25	4810	376573	
56.00	4721	364652	
55.75	4627	352973	
55.50	4537	341519	
55.25	4445	330291	
55.00	4348	319302	
54.75	4255	308551	
54.50	4144	298084	
54.25	4048	287851	
54.00	3942	277871	
53.75	3837	268147	
53.50	3735	258683	
53.25	3633	249474	
53.00	3524	240539	
52.75	3425	231845	
52.50	3329	223403	
52.25	3212	215230	
52.00	3121	207334	
51.75	3029	199691	
51.50	2932	192303	
51.25	2837	185158	
51.00	2744	178215	
50.75	2654	171475	
50.50	2578	164938	
50.25	2501	158592	
50.00	2427	152431	
49.75	2350	146439	
49.50	2284	140604	
49.25	2179	134909	
49.00	2100	129354	
48.75	2029	124434	
48.50	1957	119652	
48.25	1889	114944	
48.00	1820	110306	
47.75	1754	105742	
47.50	1693	101235	
47.25	1639	97073	
47.00	1590	93138	
46.75	1542	89323	
46.50	1488	85335	
46.25	1444	81670	
46.00	1393	78116	
45.75	1355	74673	
45.50	1312	71343	
45.25	1255	68139	
45.00	1214	65053	
44.75	1174	62069	

EL (M)	AREA (HA)	VOLUME (ML) TOTAL	CUM
44.50	1134	59185	
44.25	1095	56389	
44.00	1043	53727	
43.75	1005	51167	
43.50	977	48696	
43.25	944	46295	
43.00	911	43956	
42.75	879	41728	
42.50	825	39593	
42.25	801	37557	
42.00	774	35589	
41.75	744	33682	
41.50	715	31838	
41.25	686	30116	
41.00	659	28439	
40.75	625	26829	
40.50	593	25259	
40.25	575	23734	
40.00	554	22424	
39.75	533	21066	
39.50	512	19761	
39.25	494	18504	
39.00	475	17292	
38.75	456	16128	
38.50	433	15014	
38.00	398	12937	
37.50	338	11096	
37.00	305	9480	
36.50	279	8066	
36.00	232	6825	
35.50	184	5765	
35.00	168	4866	
34.50	153	4103	
34.00	132	3479	
33.50	104	2937	
33.00	96	2511	
32.50	84	1964	
32.00	60	1507	
31.50	55	1220	
31.00	51	955	
30.50	44	718	
30.00	39	510	
29.50	34	327	
29.00	30	167	
28.50	19	47	
28.00	3	12	
27.50	2	1	
27.00	0	0	
26.50	0	0	
26.00	0	0	

Level Datum AHD - PM 34781 EL 74.784 m
Computed using photogrammetric DTM produced in 1996 from 1991 photography
Survey records : 95787 FD
Full Supply Level: EL 67.000 m AHD [1,165,200 ML ; 100.750 m]
River outlet : EL 39.200 m AHD [2,510 ML ; 39.70 m]
Catchment Area : 1020 SQ KM
Latitude 27 23 39 Longitude 152 36 05

DEPARTMENT OF PRIMARY INDUSTRIES

BRISBANE RIVER - BASIN 143
WIVENHOE DAM 150.2 KM

STORAGE DATA

A3-110405

19/09/95