Gladstone Area Water Board

Submission to the Queensland Competition Authority

Fitzroy River Contingency Infrastructure

Part (b) – Augmentation Triggers

21 December 2007

Contents

Executive Summary

GAWB proposes two augmentation triggers. One trigger is applied for augmentations due to drought and another for augmentations due to unexpected demand.

1. Drought

GAWB is obliged by the *Water Act* 2000 (Qld) ('**Water Act**') to comply with the terms of its Drought Management Plan ('DMP') once that document has been registered by the Regulator.

GAWB's objectives in drought led augmentation are:

- to avoid the introduction of emergency stage restrictions under its DMP and on that basis to ensure continuity of supply to its customers;
- to ensure in doing so that at least two years supply buffer will remain at the target completion date, so that options to mitigate continuing supply risks (such as construction delay and lower inflows) remain open to it during and immediately following augmentation.

GAWB will defer the augmentation process (following preparatory works) until a point in time no earlier than the date at which storage levels, within GAWB's existing system, reach a trigger level based on inflow and storage assumptions set out in GAWB's DMP(currently 48 months from failure).

Shortly prior to that point, GAWB will:

- confirm its assessment of the appropriate sizing and timing of the augmentation;
- notify customers of the likely need for, and possible alternatives to, augmentation;
- conduct a formal evaluation of proposals by customers to reach commercial arrangements facilitating the implementation of demand side management alternatives in the context of the likely price impacts of augmentation including:
    - relinquishment of reservations or assignment of capacity which would otherwise be relinquished under contract;
    - load curtailment; and
    - investment in contracted demand reduction such as the installation of air cooling at power stations.

Where appropriate, GAWB will consider entering into commercial arrangements to implement these demand management measures.

In summary, GAWB proposes that a process that may result in drought-led augmentation be triggered so that defined outcomes are achieved within a defined timeframe. The outcomes, timeframe and inflow assumptions used to calculate the trigger date are set out in the DMP.

In this specific case, a Low Supply Alert has been advised and the matters described above are presently underway. The advent of Supply Restrictions is proposed as the trigger to commence the construction phase. In general, assuming no change to the DMP, the Low Supply Alert is proposed as a trigger to make a final review of alternatives and the appropriate augmentation, and Supply Restrictions as the trigger for the construction phase.

GAWB submits that the course adopted must prolong forecast demand failure beyond 60 months.

2. Unexpected additional demand

GAWB defines 'unexpected additional demand' as:

> *"Demand that is beyond the available capacity of existing sources (taking into account distribution losses and contingency) that have been approved by the QCA for inclusion in GAWB's regulated asset base for pricing purposes".*

GAWB's objectives in augmentation due to unexpected demand are:

- to ensure that water will be available to current and prospective customers when required; and
- to ensure that appropriate financial arrangements are in place to underwrite new capacity.

GAWB will use a process based on that set out in paragraph 1 above for augmentation. For clarity augmentation due to additional demand will be underwritten by firm contracts, for that additional demand.

GAWB proposes that a process that may result in demand-led augmentation be triggered when the aggregate of water reserved by supply contracts exceeds 64.4GL (based on GAWB's current notional allocation of approximately 70GL). This trigger level may change, in accordance with the formula set out in section 7.2.5 below, as GAWB's

capacity to supply water changes.

3. Ex ante approval of expenditure

Because of the size of capital expenditure involved, GAWB foreshadows seeking ex-ante approval of capital expenditure on any augmentation (subject to the issuing of appropriate Terms of Reference).

4. Ongoing planning cycle

GAWB proposes to undertake regular updates and reviews of its water supply planning ('**WSP**'). At a minimum, this would align with pricing reviews (5 yearly) but may be revised more frequently (eg, annually), or involve updates as new information emerges.

The WSP will provide customers with ongoing information on the timing and cost of augmentations considered in response to drought and demand, and the consequent pricing impacts. The planning process will include consultation with customers and the opportunity for customers to offer commercial arrangements to implement demand management measures.

5. The current drought scenario

The current DMP suggests that, if drought conditions continue (including inflows of 23GL or less over the next 12 months):

- 10% Supply Restrictions will need to be applied from July 2008; and
- construction of the contingent water source will need to commence shortly thereafter (based on the current program, on-ground works occur in October 2008).

As indicated in the QCA's Part (a) Draft Report, the current program provides a limited window to assess various options before making a commitment to the 30GL/annum Gladstone-Fitzroy Pipeline. In summary, by July 2008, GAWB must be satisfied that it has a 'bankable' alternative in order to dismiss the 30GL pipeline option. Given the unfeasibility of a desalination solution within this timeframe, the current alternatives to the 30GL pipeline option are limited to the demand side measures recommended by the QCA. For example the July 2008 trigger point may be deferred if (in addition to material inflows into Awoonga Dam):

- greater reductions to demand occur; or
- if customers present viable and acceptable alternative proposals that enable

deferral of augmentation, such as the conversion of power stations to partial air cooling.

The following table summarises the proposed actions and timeframes for responding to the current drought circumstances, on the basis of inflows and demands occurring in accordance with the projections described in GAWB's drought model.

Step	Item	Action	Timeframe
1	PLANNING	UNDERTAKE PREPARATORY PLANNING WITH INVOLVEMENT OF CUSTOMERS TO DEVELOP PREFERRED AUGMENTATION SOLUTIONS.	REFER TO THE STRATEGIC WATER PLAN
2	NOTICE TO CUSTOMERS	PROVIDE NOTICE TO CUSTOMERS OF A LOW SUPPLY ALERT, AND LIKELY AUGMENTATION TIMING AND FORM	CUSTOMERS ADVISED BY LETTER IN SEPTEMBER 2007
		PROVIDE INDICATIVE PRICING INFORMATION	GAWB TO ADVISE BY 31 JANUARY 2008
3	CUSTOMER RESPONSES	SEEK AND OBTAIN FORMAL AND BINDING PROPOSALS FROM CUSTOMERS FOR ALTERNATIVE PROPOSALS (EG FOR AIR COOLING AND SEA WATER COOLING).	COMMERCIAL PROPOSALS LODGED BY 30 MARCH 2008
4	FINAL EVALUATION	GAWB TO EVALUATE ALTERNATIVE PROPOSALS RECEIVED AND REVIEW NEED FOR AND TIMING OF GLADSTONE-FITZROY PIPELINE (SEE ANNEXURE A).	RECOMMENDED OPTION – 31 MAY 2008
5	EX ANTE APPROVAL	IF REQUIRED, GAWB MAY SEEK EX ANTE APPROVAL FOR SCOPE AND/OR STANDARD AND COST (SUBJECT TO REFERRALS FROM QCA MINISTERS). THIS INCLUDES FUNDING TOWARDS ANY ALTERNATIVE PROPOSALS THAT MEET THE EVALUATION CRITERIA (ANNEXURE 1).	PROCESS COMPLETED – 31 JULY 2008[1]
6	CONSTRUCTION TRIGGER	GAWB DECIDES ON ITS FINANCIAL COMMITMENT TO THE APPROPRIATE AUGMENTATION	AUGUST 2008[2]
		CONSTRUCTION – PROVIDED AWOONGA DAM IS LESS THAN 4 YEARS FROM PROJECTED FAILURE[3]	PROJECTED FOR OCTOBER 2008

GAWB submits that the QCA consider this timeframe and process and either:

- endorse it for the purpose of responding to a continuation of the current drought; or
- recommend an alternative timeframe and process that GAWB can implement having regard to the present circumstances.

1 Subject to GAWB seeking such approval.
2 This will be subject to the process to determine the appropriate augmentation.
3 Based on the inflow assumptions, demands and restrictions in the DMP.

1 Introduction

On 17 February 2007 the QCA received a referral notice and Terms of Reference from the QCA Ministers to undertake an investigation of the pricing practices of the Gladstone Area Water Board's (**GAWB**) with respect to its contingent source strategy.

GAWB made its submission to the QCA on 26 March 2007 ('**Original Submission**'), in which it proposed arrangements for the recovery of preparatory expenditure associated with the Gladstone-Fitzroy Pipeline. On 5 October 2007 the QCA published its Draft Report in response to GAWB's Original Submission (the **Part (a) Draft Report**).[4]

1.1 Purpose of this submission

This submission responds to Part (b) of the Terms of Reference, setting out GAWB's proposed criteria for triggering construction of the appropriate augmentation in the event of drought or unexpected additional demand.

This submission proposes:

- a trigger point for augmentation in response to drought (Section A);
- a trigger point for augmentation in response to unexpected demand (Section B); and
- a process to determine the appropriate augmentation (Section C).

GAWB will address its proposed application of its pricing practices relating to declared activities to enable the recovery of its efficient costs of the system in its submission on Part (c) of the Terms of Reference.

1.2 Outcomes sought

GAWB has a statutory duty to carry out its functions, including the storage and supply of water, in an efficient and effective way. Within that framework, GAWB is required to

[4] Queensland Competition Authority, *Draft Report. Gladstone Area Water Board: 2007 Investigation of Contingent Water Supply Strategy Pricing Practices. Stage A* (October 2007).

operate under a commercial framework.[5] GAWB is required to forecast likely future demand and manage its resources and infrastructure to meet the water needs of current and future customers.

In this submission, GAWB's objective is to establish criteria and a process that will enable it to undertake timely and efficient source augmentations into the future, with prudent commercial certainty. It is important that this process can apply over the long term, and can be adapted as circumstances and information change over time.

As a result, GAWB has proposed a generic process and criteria, but has also submitted details on how these would be applied in the current drought.

1.3 Interpretation of the Terms of Reference

There are three key terms in the Part (b) Terms of Reference:

- event of drought;
- unexpected additional demand; and
- appropriate augmentation.

The interpretation of these terms is an important element of this submission and the outcome of the Part (b) review. Accordingly, GAWB's interpretation of these terms is set out below.

1.3.1 Event of drought

GAWB has obligations under the Water Act to register and comply with its DMP.

The DMP sets the timing of drought responses. Accordingly, it is the relevant mechanism for considering supply augmentation in response to drought. GAWB has, therefore, interpreted an event of drought to mean:

> *A defined circumstance contemplated in GAWB's registered Drought Management Plan (such as a storage level or period to supply failure) triggering*

[5] section 640 of the *Water Act*

mitigating actions.

In the context of the current drought, this would mean circumstances warrant the commencement of a Low Supply Alert under the existing DMP, which would see customers forewarned of the risk of shortage and require them to consider their immediate water needs and scope for voluntary reductions.

In this regard, GAWB notes that this Low Supply Alert has been activated, and customers are encouraged to consider the scope for voluntary reductions based on their immediate water needs.

1.3.2 Unexpected additional demand

GAWB's functions include forecasting future demand and managing to meet that demand. In one sense, unexpected demand could be taken to mean demand that was not anticipated in those forecasts. However, such an approach is not in GAWB's view appropriate in the context of a decision to commence augmentation. In that context, unexpected additional demand is more properly characterised as new demand which cannot be met through access to existing sources.

Accordingly, for the purposes of the Part (b) Terms of Reference, GAWB has interpreted *unexpected additional demand* to mean*:*

> *" Demand that is beyond the available capacity of existing sources (taking into account, distribution losses and contingency) that have been approved by the QCA for inclusion in GAWB's regulated asset base for pricing purposes."*

1.3.3 Appropriate augmentation

GAWB has interpreted *appropriate augmentation* as meaning:

> *" The augmentation determined as appropriate, using cost benefit analysis, in response to specific circumstances and information at the time of the investment decision."*

Given the range of options before GAWB to manage the supply-demand balance, it is important to define *augmentation*. GAWB submits that demand side responses, including supply-substitutions such as air cooling of power stations, are *not* augmentations. Rather, these demand side responses are important measures that may

defer or avoid an increase to source capacity. They should be pursued when they represent the most efficient outcome. These measures are examined later in this submission.

Accordingly, GAWB has defined *augmentation* to mean:

> *"An investment in additional source capacity that increases the total annual volumes that GAWB can supply."*

In the context of the current drought, the appropriate augmentation is taken to mean the Gladstone-Fitzroy Pipeline. However, the appropriate augmentation may be a different solution in future years, for example, a desalination plant. Furthermore, demand side measures may in any case be implemented to defer or avoid the need for this augmentation.

Section A – Event of Drought

Awoonga Dam is presently storing 32.86% of its capacity (**or 255,294 ML**), and currently supplies around 55,000ML of water to its customers each year.

GAWB's Original Submission set out the need and rationale to conduct preparatory expenditure to enable the Gladstone-Fitzroy Pipeline to be commissioned within a target two year timeframe. This timeframe is necessary to enable a timely and efficient response to drought or unexpected lumpy demand growth.[6]

This section sets out the key considerations relating to drought triggers, and proposes the trigger points for supply augmentation in response to drought conditions, by examining:

- the target outcomes from drought augmentation;
- the timing issues for the trigger; and
- the criteria for triggering construction.

[6] Refer particularly to Part (b) of GAWB's Original Submission.

2 Effect of Drought Management Plan

GAWB's response to drought is regulated by its DMP.

The DMP must:

- be prepared in accordance with guidelines issued by the regulator (DNRW);
- have been developed in consultation with customers;
- be registered if it satisfies certain criteria;[7]
- be reviewed by GAWB and updated periodically; and
- be subject to regulatory review and amendment.

The guidelines for the DMP require GAWB to consider a broad range of available water supplies, including those to be sourced as emergency measures, and set trigger points to maintain supply as long as possible whilst minimising social and economic impact on the area.[8]

The relevant regulator may only register a DMP if he or she '*… is satisfied a drought management plan complies with the registration criteria …*'.[9] It is noted however that registration does not constitute formal approval of the contents of the DMP.[10]

Under Section 429J of the Water Act, GAWB, as a water service provider

> '*… must comply with the drought management plan when supplying water services to the service provider's customers ...*'

That is, the drought management plan is legally binding. The registered plan may only be amended with the approval of the relevant regulator.[11]

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7 Refer to the *Water Act*, particularly sections 429A to 429K.
8 Queensland Department of Natural Resources and Water. *Guidelines for the Preparation of a Drought Management Plan*. 2007
9 *Water Act*, S429H
10 Water Act, S429H(3)
11 *Water Act*: S429I(2)

3 Target outcomes

The outcomes sought from augmentation are an important guide in the development of trigger points. These outcomes can be described in terms of volume and time. That is, the volume of water that will continue to be supplied, and the period of time over which that water can continue to be supplied.

GAWB submits that the target outcomes to guide the criteria for triggering construction are as follows:

- ***Volume of supply:***

  The need for the *emergency* restrictions under the DMP should be avoided;[12]

- ***Period of supply:***

  As a base case, absent cheap short term alternatives, the period of supply (detailed in GAWB's DMP) should be extended by at least two years beyond the projected dam failure date in GAWB's DMP absent augmentation so that options to mitigate continuing supply risks (such as construction delay and lower inflows) remain open to it during and immediately following augmentation.

These target outcomes may be amended from time to time via reviews to GAWB's DMP and water supply plan – this will enable GAWB to adapt to changing circumstances and to use new options as they become available.

On the basis of these desired outcomes, we now turn to the factors impacting on the *timing* of the augmentation trigger.

4 Timing issues

When faced with drought, deferring augmentation to increase supply has both risks and benefits. For example, delay may increase the risk of supply failure which can only be addressed through increasing restrictions or the capacity of the new supply source – both of these come at a cost. Augmentation in response to drought can also lead to

[12] These are 50% restrictions for municipal customers, and a total water use ban for all other customers (including industry).

sub-optimal (thus inefficient) sequencing of development.

However, deferral also defers expensive capital expenditure and creates time for drought-breaking inflows that may neutralise the circumstances requiring augmentation.

Assumptions about inflow may also affect timing decisions. For example, higher inflow assumptions will defer action, but at greater risk that lesser inflows will occur in reality.

This section examines the principal timing issues for augmentation, namely:

- demand side options for deferral;
- supply side options for deferral;
- the value of deferral;
- the variance of inflows and the risk of supply failure; and
- staging of commitment to expenditures.

4.1 Demand side options for deferral

When faced with water shortages, reducing demand will extend the time for replenishing inflows to occur until storage inflows can occur and/or extend the time for source augmentation. GAWB has a number of present options which it proposes to deploy before augmentation. In addition, there are a number of supply side options.

4.1.1 Customer's existing discretion to reduce demands

GAWB's standard Water Reservation and Storage Contract (**WRS Contract**) enables a customer to reduce its demand by:

- requesting a reduction of its Water Reservation throughout the course of the water year, or on review of the water consumption by GAWB; and
- trading with other customers.

Customers have the right to trade their Water Reservation to other users. GAWB recognises that from time to time, customers may require more or less water in a financial year than they have contracted to purchase, and trading between customers

may allow a more efficient use of resources. Accordingly, a customer is entitled to trade where:

- any additional costs to GAWB are appropriately met and secured;
- the customer has made all necessary arrangements to enable the assignee to take delivery of the water the subject of the trade; and
- the trade is permitted by the Water Act.

These are voluntary measures that customers may take where they develop preferences for alternative sources. In addition, these reductions can be permanent to cater for a customer's long-term bypass of GAWB's supply system (for example for process improvements to reduce water consumption).

Possible increases in prices as a consequence of drought augmentation are expected to be highly relevant to considerations of trading by customers.[13] Accordingly, GAWB submits that decisions concerning trading are improved where potential traders understand the pricing impacts from drought augmentation.

4.1.2 Establishing a water level

The first step in this process is the establishment of trigger points based on dam levels, under the DMP.

Trigger levels will be used to determine the respective levels in Lake Awoonga at which GAWB calculates that it will be able to provide Contracted supply to all Customers on the basis of an assumed level of inflow.

Following the end of the wet season, (being 30 April for the purposes of the DMP, but no later than 30 June in fact each year), GAWB is required to review and update the data inputs to recalculate trigger levels. Upon recalculating the trigger levels, an assessment is made as to the likely period to projected storage failure.

[13] This is considered in Section C.

In summary, the DMP provides for:

- Low Supply Alert to be issued at five years to projected storage failure. Customers will be issued with a notice requesting them to consider voluntary adoption of additional demand management strategies and techniques to reduce demand. GAWB will, at this point, provide customers with a comprehensive assessment of its plans to access supplementary water, including associated costs and estimated time for completion of these works;

- Upon the issue of a Low Supply Alert, GAWB will communicate with its customers to identify means by which augmentation can be deferred. These will include consideration of voluntary surrender, trading, and mandated solutions. However, GAWB expects that the pricing signals established by the preliminary work it is currently undertaking on augmentation options will establish a basis to determine the economic viability of voluntary and contracted reduction and trading measures.

- Supply Restrictions to be imposed under s389 of the Water Act at 48 months to projected storage failure. (At this point, GAWB's DMP also triggers the commencement of construction works to access additional water from the Fitzroy River, with the objective of completion within 2 years.)

- Emergency Restrictions to be imposed under s389 of the Water Act at six months to projected storage failure. This measure is two fold. First, all non-Municipal customers will be informed that their water supply will cease. Secondly, all Municipal customers will be restricted to 50% of their water reservation.

GAWB submits that its primary focus to mitigate the effect of drought should be upon economic supply augmentation and market based alternatives to augmentation, not demand restrictions.

In undertaking demand-side measures, there is a trade-off between the benefits of reducing demands, and the costs of that reduction. The main benefit from reducing demand amidst a drought is the deferral (or avoidance) of source augmentations that would otherwise occur (see 4.3 below).

Reductions to demand may enable augmentation to be deferred, subject to the quantum

of these reductions, however such reductions lead to impacts and financial and economic costs. Moreover, blanket restrictions, do not sufficiently discriminate between users who have varying capacities to accommodate severe restrictions, and bear the burden of costs associated with abatement. Further, the benefits of deferral should not exceed the costs of abatement.

In addition, we note that a number of GAWB customers have stated that they have limited ability to reduce demand.

For example, in Queensland Alumina Limited's ('**QAL**') submission to the QCA in response to GAWB's Original Submission, it notes that:

> *"…Water is fundamental to QAL's production process- 5% reduction in supply results in 5% reduction in alumina output…the suggestion that the deficiency can be addressed and the customer able to manage the risk by customers being contractually entitled to trade either their capacity or their water reservation is unlikely to be borne out in practice … "*[14]

It is clear that it would be difficult for QAL to manage substantial reductions, as to do so would have a direct impact on its business and the quantity of product it can produce.

4.1.3 Negotiated reductions (curtailment)

GAWB proposes to enter into discussions with customers on the merits of establishing commercial arrangements for reducing demand (curtailment), which could defer augmentation. If this proposal proceeds, GAWB submits that the costs of curtailment should be recovered from all customers (in the same way as the costs of the deferred augmentation would have been recovered from all customers) so long as this cost does not exceed the benefits generated from deferring augmentation. The curtailment could be either temporary or permanent depending on its underlying nature.

GAWB considers that the proposals from power stations to reduce demand through investing in air cooling, should be considered within this framework, as this is essentially a commercial proposal to reduce demand and thereby generate broader customer benefits by deferring augmentation.

A process for generating these proposals is set out in Section C, and an evaluation

[14] QAL submission to the QCA dated 8 June 2007 regarding GAWB's 2007 Investigation of pricing practices contingent supply strategy

framework is proposed in Annexure A.

4.2 Supply side options for deferral

If drought conditions continue, supply side responses will ultimately be required to avoid the threat of supply failure. The key elements to a supply side response are:

- the timing for the trigger for construction; and
- the capacity of the appropriate augmentation.

These factors are interrelated. For example, assuming similar construction timeframes, larger capacity augmentation could be deployed at a later time, albeit at greater cost.

We now turn to how the benefits of deferral which can be valued.

4.3 Valuation of deferral

The previous sections highlighted the ways augmentation could be deferred through reducing demand or increasing the capacity of the contingent source. This deferral generates benefits by:

- delaying capital expenditure (and hence the present value cost of the contingent augmentation); and
- 'buying time' for inflows to occur that will further defer the augmentation, or avoid it all together.

These benefits can be quantified using measures such as net present value ('**NPV**') analysis to capture the time value of money, and real options analysis to estimate the value of 'buying time' for inflows to occur.

The precise tools which are used to value deferral will be determined in the light of circumstances at the time of a decision. However GAWB sees the objectives of the process as being constant. It submits they are as follows:

- a method that compares the value of augmentation to the value of demand side measures;

- a method that assesses the long-run impact on their present and prospective customers;
- a method that places appropriate value on security of supply; and
- a method that assesses the relativity between timing and capacity of the augmentation.

4.4 Inflows – variance and risk

The selection of a trigger point for augmentation in response to drought is, by its nature, an exercise in risk management. Given the uncertainty of future inflows, it will be impossible to guarantee the triggering of augmentation that proves perfect with the benefit of hindsight.

GAWB submits that the appropriate regulatory instrument for determining drought management measures, including restrictions and inflow assumptions, is the DMP which has statutory effect under the *Water Act*. These matters should continue to be determined in accordance with the processes required under the *Water Act*, including periodic review and consultation with GAWB's customers.

GAWB recently reviewed the inflow assumptions under the DMP, and these changes were approved and registered by the regulator (DNRW).[15]

In undertaking this review, two important factors were considered:

- the variance of flows from the assumed average; and
- enabling responses to extreme scenarios (risk management).

This review considered a range of inflow options before concluding that the average of the worst 3 years on record (currently 23GL/annum) assumption was appropriate. These options are summarised below. They are discussed further (and the basis for revival assumptions are analysed) in Attachment 1, which is the discussion paper provided to customers and the QCA.

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[15] In accordance with the *Water Act*, S429H

Table 3 below sets out the inflow assumptions before arriving at the 23GL assumption.

TABLE 3. INFLOW OPTIONS CONSIDERED IN REVIEWING THE DMP

Option	Inflow Period	Flow Sequence	Years	Average Annual Inflows (ML)	EL Trigger (Low Supply Alert)
1	LOWEST 10 YEARS	CONTINUOUS SEQUENCE	1993 - 2002	69,243	23.6M
2	LOWEST 3 YEARS	CONTINUOUS SEQUENCE	2004 –2007	23,633	30.4M
3		LOWEST FLOW YEARS	1987/88 1995/96 2005/06	18,068	31M
4	LOWEST 4 YEARS	CONTINUOUS SEQUENCE	1998 - 2002	46,432	26.6M
5		LOWEST FLOW YEARS	1987/88 1995/96 2005/06 2006/07	18,506	31M
6	NO INFLOWS	-	-	0	34.2M

A more detailed discussion of inflow variance and risk is contained in Annexure 1.

4.4.1 Risk management

While GAWB has extensive, historic inflow data, it cannot reliably predict actual inflows over any given extended future period.

Accordingly, another approach is to enable adaptive responses to be employed should unlikely, but not unforeseeable, circumstances arise.[16] This would ensure that regardless of inflows, a minimum amount of stored water is maintained once storage levels fall below that minimum bank. This can be achieved by ensuring that at the point of the Low Supply Alert, Awoonga Dam was storing at least three years forward supply, regardless of inflows. This would enable GAWB to respond to an extreme event that arose in the first year (eg a near zero inflow event), and then adapt its response to those circumstances, by potentially bringing forward augmentation and securing future supplies.

Based on current demands, this storage level would be EL 28.2m or 225,060ML. This was a significant factor in GAWB selecting the inflow assumption in the current DMP.

[16] GAWB would also revisit its inflow assumptions upon new information being available – including the emergence of a worse series of inflows should extreme drought conditions continue.

4.4.2 Inflow assumptions used elsewhere

The inflow assumptions used for drought management planning vary across urban centres in Australia. GAWB has provided a summary below in Table 4 of the inflow assumptions recently adopted for Southeast Queensland, Perth and Melbourne for water supply planning purposes.

TABLE 4. SCENARIOS – COMPARISON OF INFLOW ASSUMPTIONS

	INFLOW ASSUMPTION	PURPOSE	COMMENTARY
SOUTH EAST QUEENSLAND	REPEAT OF SINGLE LOWEST YEAR ON RECORD (2006)	TO SET RESTRICTIONS AND DEVELOP NEW WATER SOURCES	THIS ASSUMPTION HAS BEEN EMPLOYED AS A RISK MANAGEMENT TOOL IN THE CURRENT DROUGHT
PERTH	AVERAGE OF THE LOWEST 6 YEAR INFLOWS	SET AS THE BASIS FOR DETERMINING LEVELS OF SERVICE AND LONG-TERM PLANNING	THIS ASSUMPTION WAS ADOPTED TO GUIDE SOURCE AUGMENTATION TO OVERCOME FUTURE DROUGHTS (NOT RESPOND TO THEM)
MELBOURNE	AVERAGE OF THE LOWEST 3 YEARS	APPLIED TO RESPOND TO THE CURRENT DROUGHT TO SET RESTRICTIONS AND TRIGGER SOURCE AUGMENTATIONS	THE VICTORIAN GOVERNMENT RECENTLY ADOPTED THIS ASSUMPTION TO BE MORE CONSERVATIVE – 10 YEAR INFLOWS WERE PREVIOUSLY ASSUMED.

The QCA is familiar with these decisions and GAWB does not propose to summarise them here. However it is appropriate to make the following 3 points:

- the Queensland Water Commission makes conservative inflow assumptions, based on the worst singular inflow year, because of the serious consequences of over estimations;
- the Western Australian Water Corporation's proposals for the South West are set to avoid the chance of restrictions being employed to less than 0.5%;
- the Victorian Government in relation to Melbourne Water Supply has, similarly to GAWB, adopted an average of the lowest 3 year inflows, in response to declining inflows.

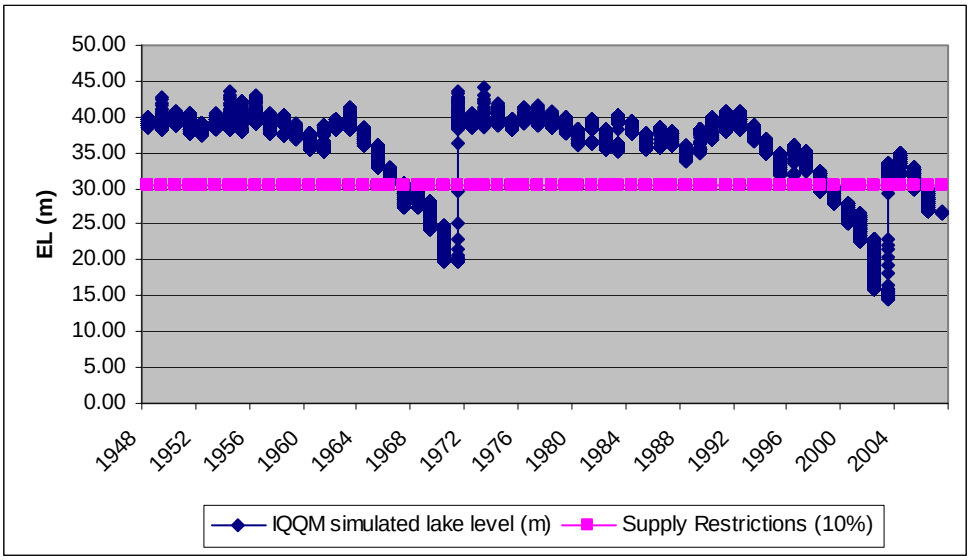
4.4.3 Impact on frequency of restrictions.

An overly conservative inflow assumption can lead to unnecessarily frequent triggering of restrictions.

To assess this impact, simulation modelling has been performed using the DNRW's

IQQM model, assuming historic inflows and 100% utilisation of GAWB's water allocation, to plot a theoretical historic storage level. This is then compared against the current storage trigger for the 10% supply restrictions – EL 30.5m.[17] The outputs of this modelling indicate that over the 110 years simulated, the restrictions under GAWB's DMP would only have been applied three times (1966, 1998 and 2005). Figure 5 below displays the storage simulation since 1948. It will be noted that there were no incidences of the storage reaching below EL 30.5m in the preceding period.

FIGURE 5. SIMULATED STORAGE LEVELS (1948 – 2006)



Note that these are simulated conditions based on full demand and other assumptions – in reality GAWB has only employed restrictions once in 2002.

4.4.4 Conclusion

GAWB submits that the inflow assumption to the DMP is appropriate to its circumstances for the purposes of determining augmentation criteria and assessing the risk of supply failure. The rationale for GAWB's approach was provided to customers and the regulator, as set out in Attachment 1, and is supported by:

- *industry practice* – for example supply augmentations are currently underway for Melbourne and South East Queensland, based on drought inflows that are equivalent (or more conservative) to that adopted by GAWB. For example, in

[17] It is acknowledged that this is not a perfect comparison, as the 30.5m trigger level will increase slightly as demand approaches GAWB's full allocation. However, based on the data review, this is not likely to materially alter the trigger level to the extent it would generate any meaningful increase to the frequency of restrictions.

SEQ the repeat of the single worst year is assumed; and

- *prudent risk management* – the approach adopted by GAWB enables it to adapt its response should more severe events emerge than those envisaged (ie extremely low inflows).

4.5 Staging of commitment

The development process for any project can be tailored to limit major financial commitments in the event that certain milestones are (or are not) met. This is particularly important for drought-related projects where the underlying need can change in a matter of days, for example rainfall from a cyclone event.

GAWB submits that a prudent trigger process for drought-related infrastructure should be able to respond to changes in circumstances (eg drought-breaking inflows) and limit the potential exposure to unnecessary (with the benefit of hindsight) financial commitment and expenditure. This can be achieved by adopting an incremental approach to commitment; to the extent this is feasible given constraints of the construction and supplier market.

The proposed trigger(s) are discussed in the following section.

5 Augmentation Trigger

It is important that the criteria that trigger construction are clearly specified, and able to be applied in response to a range of circumstances, including those currently faced by GAWB and its customers. The criteria have therefore been considered at two levels:

- the instrument used to set and amend the trigger over time; and
- the criteria to be applied.

5.1 Instrument – Drought Management Plan

GAWB submits that the DMP is the most appropriate instrument to determine the trigger point for construction, as well as the inflow assumptions. The legally binding nature of

the DMP is discussed in Part 3 of this submission.

GAWB submits that its DMP is designed to provide for the timely least cost augmentation of supply to mitigate the effects of drought, and thus substantially reduce the likelihood of circumstances arising that would require the imposition of restrictions. The DMP is sufficiently regulated by DNRW, as part of its broader responsibility for the regulation of water service providers pursuant to the terms of the *Water Act (2000).*

5.2 Criteria to trigger augmentation (trigger point)

The criteria can be described in terms of a trigger point, being time at which GAWB must commit to construction (including procurement of long lead time items or a construction contractor) in order for the appropriate augmentation to be commissioned and operational by a specified date (the **Operations Date**).

This Operations Date is set to achieve the target outcome that applied at the time, as a minimum requirement. This target outcome may be revised from time to time to respond to circumstances and the outcomes of future water supply planning.

The following assumptions would be applied to calculate trigger dates:

- inflow and storage performance data as set out in GAWB's DMP;
- demand secured by contract that incorporated negotiated or mandated curtailment arrangements; and
- a project delivery timeframe that incorporates project delivery risks.

5.3 Summary

GAWB proposes that a process that may result in drought-led augmentation be triggered so that defined outcomes are achieved within a defined timeframe. The outcomes, timeframe and inflow assumptions used to calculate the trigger date are set out in the DMP.

As discussed in section 11.1 below, the current DMP suggests that, if drought conditions continue (including inflows of 23GL or less over the next 12 months):

- Supply Restrictions may need to be applied from July 2008; and
- assuming no efficient demand management alternatives are proposed by customers, construction of the contingent water source may need to commence as soon as possible after then (currently projected for October 2008).

As discussed in section 11.2 below, to ensure that efficient demand management alternatives are thoroughly investigated before an augmentation is triggered, GAWB proposes to call for formal and binding proposals from customers for demand management projects (e.g. for air cooling of power stations and sea water cooling of coastal industrial processes).

Section B - Unexpected Additional Demand

This section of the submission examines the conditions to trigger augmentation in response to unexpected additional demand, and is structured as follows:

- Target outcomes for augmentation;
- Prudent timing of augmentation; and
- Criteria to trigger augmentation in response to unexpected additional demand.

6 Target outcomes

GAWB's submission in response to the Part (a) Terms of Reference highlighted its unique demand environment, due to its industrial customer base and the lumpy nature of new demands. This demand environment presents GAWB with challenges for water supply planning and investment, resulting from its central role in forecasting and meeting the water demands of the region.

The target outcome that GAWB seeks from the trigger criteria is relatively straight forward. GAWB must be able to respond to demand growth and provide its customers and potential investors in the region with confidence that their future water requirements will be met. This could be achieved through infrastructure measures, such as source augmentation, or non-infrastructure measures such as trading or demand management.

In any case, it is in the public interest for GAWB to be able to contract with prospective (and existing) customers for new demands to provide certainty for both parties:

- *for prospective customers:* that, when required, water will be available; and
- *for GAWB:* that if required, it can invest in source augmentation to meet these demands and recover its costs.

These are the target outcomes for setting trigger criteria.

7 Setting Trigger Date

The key issue for the criteria to trigger the appropriate augmentation is the timing of its deployment, which is influenced by:

- the extent to which existing customers are able and willing to reduce their demands or trade with new entrants, thereby deferring augmentation;
- the capacity of existing sources, including allowances for contingency reserve; and
- the nature of GAWB's commitments to provide that capacity, for example the use of forecasts as opposed to binding contracts.

These factors are discussed below.

7.1 Demand side responses for deferral

GAWB's standard WRS Contract has been prepared following the QCA's previous investigations. This WRS Contract contains a number of provisions that enable customers to adjust their reserved demands in response to changing conditions. (although reductions in reserved demand in excess of 10% may require the payment of compensation to GAWB).

The provisions of the WRS Contract require:

- GAWB to use its best efforts to inform customers when its predicted demand exceeds available supply, and the options available to GAWB for augmentation;
- customers to participate with GAWB and other customers in discussions relating to options for timing of augmentation; and
- customers to contemporaneously review their present and future need for water against the background of discussions, and communicate this updated information to GAWB to assist it to make its augmentation decisions.

This is important in the context of GAWB's augmentation decision process, as it allows

customers to bypass GAWB's supply system in favour of an alternative supply, as well as allowing for market responses via trading. These issues are examined below.

7.1.1 Demand Reduction

Customers have the ability to reduce demand in response to major price increases that might otherwise occur following augmentation. A demand reduction can be effected under the WRS Contract as discussed in section 4.1 of this Submission.

Of course, a customer's reduction of its water reservation can bring benefits to the remaining customer base, if that reduction leads to a deferral of augmentation. In this case, there may be a case for GAWB to negotiate the terms of this reduction so that it secures this deferral (if it would not otherwise occur), and achieves the most efficient outcome for customers generally. This is examined further in section 11.2 and Annexure A, which sets out GAWB's proposals for evaluating demand management proposals from customers.

7.1.2 Trading

Those customers with the ability to reduce their reservation may seek to trade surplus to a new user.

As discussed in section 4.1.1 of this submission, customers have the right to trade their Water Reservation to other users. GAWB recognises that trading between customers can, in appropriate circumstances, promote efficiency of water use. Accordingly, a customer is entitled to trade where:

- any additional costs to GAWB are appropriately met and secured;
- the customer has made all necessary arrangements to enable the assignee to take delivery of the water the subject of the trade; and
- the trade is permitted by the Water Act.

The operation of secondary markets is important to the prudent timing of augmentation. As a water supplier, GAWB can assist market processes, particularly through the provision of information, for example:

- publishing any new demands that emerge (within the bounds of commercial in

confidence obligations), particularly where these demands may trigger the need for an augmentation; and

- being a central information point for buy and sell offers, for example from publishing the names and contact details of interested parties on its website.

GAWB intends to pursue these initiatives as a longer term measure. The costs of these initiatives are not expected to be significant, and would be recovered as overhead costs in water prices.

7.1.3 Planning and information

GAWB proposes to undertake a formal planning process in a regular cycle. This planning will examine:

- new demands;
- infrastructure responses, including the timing, capacity and scope of augmentation;
- trading opportunities for customers; and
- demand side responses to defer augmentation.

This will require customer involvement in the planning process, similar to that which previously occurred in the development of the Strategic Water Plan.

GAWB proposes to publish the outcomes of this regular planning, including cost benefit analysis of the various options and the pricing impacts arising from augmentation.

7.2 Capacity and customer commitment

The timing of augmentation requires a trigger level of customer commitment to be clearly specified, as well as the nature of that commitment.

To do so, it is necessary to define the available capacity, and determine the point at which augmentation would be triggered, based on current circumstances.

7.2.1 Defining commitment

Augmentation might occur unnecessarily early if it was based on expectation for demand growth that did not materialise. This is clearly a challenge for GAWB given its uncertain growth environment.

In its 2005 report, the QCA acknowledged the difficulties associated with forecasting GAWB's demands, and the importance of contracts to provide certainty over those demands:

> *"…In recognition of the lumpiness of demand, uncertainty involved, and past propensity for overestimation, the Authority has noted the importance of contractual arrangements. Basing demand on estimates of likely demand independently of customers' proposed contractual amounts is not sound and errors could impose high costs on users and the community…"*[18]

The QCA went on to state that, under its suggested approach for the optimisation of GAWB's asset base:

> *"…The treatment of investments undertaken by GAWB in response to uncontracted potential future demand is a key concern. Investments of such a nature would, at least in the light of recent experience, not be considered to be prudent in the future (even though they may have been in the past) given associated significant costs and high uncertainty associated with the likelihood of additional demand materialising – unless supported by contracts…"*[19]

The criteria to trigger augmentation should therefore be set to address the QCA's concerns about augmenting supply based on uncontracted or uncertain demands. As a result, GAWB proposes that appropriate contractual arrangements should precede major works on augmentation. However, the implications of this approach are that preparatory expenditure is required to have a readily deployable water source available to meet the 2-3 year period between contracts becoming binding, and the customer's requirement for water.[20]

7.2.2 Current Supply Capacity

GAWB's current supply capacity is derived solely from its annual allocation of approximately 70GL based upon the notional Historic No Failure Yield (**'HNFY'**) of

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[18] Queensland Competition Authority. *Gladstone Area Water Board: Investigation of Pricing Practices. Final Report.* (March 2005). pp 83-84.

[19] Ibid. p95.

[20] Refer specifically to Section 8.6 of GAWB's Part A submission. Reference is also had to *Awoonga Dam, Calliope River and Baffle Creek - Update and Review of Yield Assessments*; SunWater July 2004; Ref: G-80600-07-06, Table 4.1 at p13.

Awoonga Dam.[21] This allocation increases to 78GL when the dam first fills to 40m.

If the HNFY of Awoonga Dam is revised downward, GAWB's allocation is likely to be commensurately reduced upon the revision of the *Water Resources (Boyne River Basin) Plan 2000*.[22]

GAWB's current allocation of approximately 70GL represents the absolute limit on GAWB's diversions from the ponded area of the dam. This is distinguished from an ability to supply an aggregate of 70GL as measured at customers' meters. The maximum amount that GAWB can supply to customers must also be adjusted for distribution losses and contingency.

7.2.3 Distribution losses

GAWB's water allocation is defined and measured at Awoonga Dam. However, an allowance is required for losses within GAWB's distribution network. These 'distribution losses' arise from the physical loss of water in the system and pipe leakage. GAWB has previously estimated these losses to total 2,668ML/annum in its System Leakage Management Plan (**'SLMP'**) submitted to DNRW.[23] This represents a 90% distribution efficiency of delivery of water within GAWB's reticulation network.[24]

GAWB in its SLMP has proposed a range of operational improvements and capital works to reduce these losses to 840ML/annum (or 97% distribution efficiency) over a five year period. This target will be monitored and assessed by both GAWB and DNRW to ensure it is achieved.

In order to establish the uncommitted portion of GAWB's allocation, it is proposed to include an allowance for 5% distribution losses (contrasted to the present rate of 10% noted above) for deliveries to customers within GAWB's distribution network. This is consistent with loss factors applied for other bulk industrial pipeline systems owned by SunWater which were also set at 5%.[25]

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[21] Refer Section 2.5.2 of GAWB's Part A Submission.
[22] To be undertaken by DNRW and expected to be commenced in 2010.
[23] Gladstone Area Water Board. *System Leakage Management Plan* (September 2007).
[24] This excludes deliveries to power stations taking water directly from Awoonga Dam, as these power stations bear the losses after diversion.
[25] Loss allowances provided for SunWater's pipelines were set at 5% of delivery volume when formalising water entitlements from Queensland water supply schemes in 2000. For example, refer to the loss allowance in the Collinsville Pipeline in SunWater's interim Resource Operations License for the Bowen Broken Water Supply Scheme

Assuming that:

- growth in demand continues in GAWB's distribution network rather than direct from the dam (GAWB currently supplies 22GL directly from Awoonga Dam); and
- an average distribution efficiency of 95%,

then an allowance for future distribution losses of some 2,100ML/annum is required.[26]

This loss allowance will be revised over time as GAWB implements further measures to reduce leakage and losses after taking account of the costs and benefits derived. This revision will be part of future water supply planning.

7.2.4 Contingency

GAWB does not believe it would be prudent to contract to the precise amount of water allocation it holds for a number of reasons, including:

- it has statutory obligations under the Water Act to divert water within the limits of its water allocation. It is common practice for water allocation holders to retain a small surplus above their expected requirements to avoid exceeding their allocation, particularly where day-to-day demands can vary as the end of the water accounting period approaches;
- it provides scope for customers to use more than their water reservation in a particular year, given this volume is set effectively based on +/- 10% of reserved consumption;[27]
- the uncertain nature of GAWB's industrial demands warrants the retention of a reasonable volume of water to be available in unforeseen circumstances that could not be met through augmentation.[28] This is effectively 'headroom' for GAWB to meet a sudden spike in demand, particularly from existing customers

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(Schedule 2). These are different to distribution losses in irrigation channel networks, which are far greater. This license can be found at http://www.nrw.qld.gov.au/water/management/pdf/bowen_broken.pdf.

[26] This assumes that at augmentation there has been no growth that in demand serviced directly from Awoonga Dam, with growth being exclusively serviced from its distribution network. Any decision to augment however will based upon actual demand supplied by GAWB through its distribution network.

[27] Under QCA's 2005 pricing recommendations, for industrial customers, no overrun charges will be payable until volumes exceed 110% of contracted quantity. For municipal customers, no overrun charges will be payable until volumes exceed 125% of contracted quantity.

[28] GAWB's submission to Part (a) set this out in some detail.

who may have a short-term need to increase their water use; and

- as previously demonstrated in the Water Resources (Boyne River Basin) Plan 2000, the volumetric entitlement to GAWB from Awoonga Dam can be revised downwards, to maintain a prescribed security objective.

It is therefore proposed that a contingency allowance be made, based on 5% of GAWB's total potential water allocation for these events.[29]

7.2.5 Trigger level of commitment

In summary, GAWB proposes that its trigger level of commitment be defined as follows.

Trigger Level = Maximum Supply Quantity – Distribution Losses – Contingency

Maximum Supply Quantity being the lesser of GAWB's water allocations or the assessed Historic No Failure Yield from those water sources

Distribution Losses being assessed at 5% of water supplied via GAWB's distribution network[30]

Contingency being 5% of Maximum Supply Quantity

On the basis of its present 70GL allocation from Awoonga Dam:

- Water allocation: 70GL; less
- Distribution losses: 2.1GL; less (5% of 42GL[31])
- Contingency: 3.5GL; equals (5% of 70GL)
- **Trigger level: 64.4GL.**

Where GAWB held a 78GL water entitlement, the trigger level would be 71.4GL/annum.[32]

This trigger level would be reviewed as part of GAWB's regular planning cycle, and take account of changes over time to its allocation, estimated requirements for distribution losses and contingency.

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[29] That is, 5% of 78GL.
[30] or actual assessed losses whichever is the lower.
[31] The assumed delivered water figure of 42GL assumes growth in demand occurs exclusively in Gladstone Region.
[32] As above, this assumes growth in demand occurs exclusively in Gladstone Region.

The materiality of the breach would be considered, before an augmentation is actually triggered. A minor breach would not be expected to cause augmentation. In any event the amount of the breach would be a key consideration to the appropriateness of any augmentation proposed – this is considered further in Section C.

7.3 Valuation of deferral

The valuation of deferring augmentation is calculated on the basis of the time value associated with deferring capital and operating expenditures.

This valuation is particularly relevant in circumstances where customers are considering reducing their demands through bypass or efficiency measures. Part of those savings could be used as an incentive to permanently reduce their water reservation if this was supported by cost benefit analysis.

Moreover, calculating the deferral value is non trivial. GAWB appreciates that if, for example, the successful implementation of demand management defers augmentation for some period of time and subsequent high inflows and Awoonga storage levels allow GAWB's water allocation to be revised to 78GL, then the demand management has effectively deferred the augmentation even when the demand reduction has been absorbed by other customers' growth. That is, all other things being equal, demand reduction before Awoonga Dam first fills to 40m will be more valuable than demand reduction following this initial filling.

8 Augmentation Trigger

It is proposed that the following criteria be satisfied in order to trigger construction:

> *GAWB has entered into binding contracts with customers that exceed the trigger level of commitment of water sources.*[33]

As set out above, this trigger level is currently 64.4GL.

The nature of these binding contracts will be a commercial matter for GAWB and its

[33] Due to the requirements of the current ROP, such contractual obligations would be conditional upon GAWB securing the further necessary allocation of water (eg upon the construction of additional water storage facilities on the Fitzroy River as contemplated by the Central Queensland Regional Water Supply Strategy) .

customers, and the criteria should not be so prescriptive as to preclude flexible and tailored arrangements to emerge bi-laterally.

In general terms, GAWB would expect a binding commitment to provide it with a sufficiently certain revenue stream from a defined point in time. Customers would also expect GAWB to provide commitments about the volume and timing for water availability subject to negotiated conditions.

In applying this trigger point, GAWB would adopt a practical approach, particularly if it emerged that the trigger point was breached by only a very small volume, and there was no or little prospect of additional short-term demands. In this case it may be more prudent to supply the new (small) demands from the contingency volume (or from a relatively more expensive but flexible, small volume source) rather than triggering augmentation.

In addition, GAWB has proposed that the capacity of the augmentation is explicitly considered for the appropriate augmentation, thereby taking account of the demand circumstances at the time. This is considered further in Section C.

8.1 Summary

GAWB proposes that a process that may result in demand-led augmentation be triggered when the aggregate of binding supply contracts exceeds 64.4GL. This trigger level may change, in accordance with the formula set out in section 7.2.5 above, as GAWB's capacity to supply water changes.

As discussed in section 10.1 and Annexure A below, to ensure that efficient demand management alternatives are thoroughly investigated, GAWB proposes to call for formal and binding proposals from customers for demand management projects before an augmentation is triggered.

Section C. Determining the appropriate augmentation

In its Part (a) Draft Report, the QCA recommended that GAWB undertake further work to assess augmentation options. Whilst GAWB has acknowledged the need for further analysis over time, it also requires certainty over the treatment of major expenditures on augmentation into the future, including the Gladstone-Fitzroy Pipeline if required in 2008.

The Terms of Reference for this Part (b) refer to a generic concept of an 'appropriate augmentation', which GAWB has interpreted to mean:

> *the augmentation determined as appropriate, using cost benefit analysis, in response to specific circumstances and information at the time of the investment decision.*

This Section C highlights the need for regulatory certainty, and then proposes a process to determine the appropriate augmentation in light of specific circumstances, which provides for ex ante regulatory approval should this be sought.

9 Certainty and ex ante approval

The scale of investment faced by GAWB for the next source augmentation is significant: an additional $345M (in $2006) investment against its current recommended regulated asset base of $355M (in $2005).[34] As such, GAWB submits that an ex ante approval process should be developed and made available to enable it to expedite its investment decisions.

9.1 Precedent and need

Regulatory pricing practice typically sets an asset value, for pricing purposes, following an assessment of the depreciated optimised replacement cost ('**DORC'**) of the asset.[35] However, a DORC valuation is a forward looking assessment, which does not necessarily take into account the conditions at the time of the investment decision.[36] The QCA considered this issue in its Draft Report on extraordinary circumstances:

> *"…The Authority accepts that, to ensure efficient service delivery, service providers need to generate sufficient revenue to meet efficient operational and capital costs.*
>
> *However, as noted by Ergas (2003, quoting James Buchanan), past choice is irrelevant to current valuation 'excepting insofar as the experience may modify those alternatives in the future'. That is, while regulators may have regard to service providers' legitimate interest in recovery any investment they have made, such regard need not extend to indulging all past choices. The efficient value of an asset and the return appropriate to it should remain a forward-looking concept. …*
>
> *Service providers can legitimately expect to receive a return on past investments only where these represent the least-cost means of service provision into the future…"*[37]

The DORC methodology is usually applied to re-value assets based on current-day technology, construction methods and costs. Whilst this approach achieves the objective of setting an efficient (or market-reflective) price for services from the asset, it introduces significant optimisation risk to the asset owner when faced with an investment decision

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[34] Queensland Competition Authority. Gladstone Area Water Board – Investigation of Pricing Practices. (March 2005). P109.

[35] For example, refer to the Authority's final report investigating GAWB's pricing practices (March 2005) and the Authority's *Statement of Regulatory Pricing Principles for the Water Sector* (December 2000).

[36] There are some exceptions to this approach. For example, the Independent Pricing and Regulatory Tribunal (IPART) has previously adopted a two stage regulatory test process. An efficiency test is applied for forward looking capital expenditure, whilst a prudence test is applied for prior capital expenditure. Refer to IPART's 2005 review of water prices for Sydney Water and other providers.

[37] Queensland Competition Authority. General Pricing Principles for Infrastructure Investments made in Response to Extraordinary Circumstances – Draft for Comment. (March 2004). P51.

at a point in time.

In any event the Water Act makes specific provision relating to the valuation and ex-post optimisation of assets built in response to emergency drought events. These provisions, which preclude such ex-post optimisation, were highlighted by the Queensland Water Commission in their report on pricing and institutional arrangements for Southeast Queensland:

> *"…The asset values of the essential new SEQ water infrastructure, as described in section 82 of the Water Regulation 2002 ('Water Regulation') should not be subject to optimisation in the future by the QCA, either during or subsequent to the transition period. This is consistent with the requirements in the sections of the Water Act under which the Water Amendment Regulation (No. 6) (Water Amendment Regulation) 2006 was made…"* [38]

In Sydney, the NSW Minister for Water Utilities has directed the Independent Pricing and Regulatory Tribunal ('**IPART**') to include in its current price determination the efficient costs of a desalination plant to be constructed by Sydney Water. IPART noted that this would limit the Tribunal's review of Sydney Water's charges (with respect of the desalination plant) to assessing whether the project was being undertaken in the most cost-effective way possible.[39]

GAWB's concern over ongoing exposure to ex post optimisation of its regulatory asset base is founded on the potential for a regulator to reduce the value of its water source assets, including for any ex post assessment in years to come that concluded, for example, that:

- the augmentation was not necessary (in hindsight) due to later inflows occurring;
- the capacity of the augmentation proved to be beyond that reasonably required (with perfect hindsight);
- changes to technologies or costs following GAWB's investment produce lower cost modern day solutions;
- Awoonga Dam should be subsequently optimised and its valuation reduced as a result of the construction of the Gladstone-Fitzroy pipeline; or
- despite the state of the market conditions at the time of construction, the

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[38] Queensland Water Commission. *Our Water – urban water supply arrangements in South East Queensland. Final Report*. (May, 2007). p72.

[39] Independent Pricing and Regulatory Tribunal. *Review of prices for Sydney Water Corporation's water, sewerage and recycled water from 1 July 2008. Water – Issues Paper* (August 2007). p3.

construction costs of the project were considered excessive compared with modern day costs (at the time of a future assessment).

9.2 Framework for ex ante approval

Given the range of options available to GAWB at any point in time for augmentation, and the complexities surrounding the timing and capacity of augmentation, it is clearly prudent to obtain ex ante approval for the appropriate augmentation.

The QCA currently administers ex ante approval processes for QR and the Dalrymple Bay Coal Terminal ('**DBCT'**). These processes are aimed at achieving prudence in scope, standard and cost for capital expenditure. An important element of these arrangements is a framework for ongoing network planning and user involvement.

GAWB foreshadows a process that involves:

- approval of timing and sizing of the augmentation;
- procurement processes that allow for control of costs and assessment of value for money; and
- an agreed consultation process with tight time frames and clock stoppers.

GAWB proposes to formalise its WSP activities and conduct updates to these plans on a regular basis. In addition, this planning process would continue the practice to date of involving customers and eliciting and evaluating a range of alternatives using cost benefit analysis. If required, GAWB would then use this planning as the basis for seeking ex ante approval for scope of investment when the need for the investment arises.

A similar approach is proposed by GAWB for ex ante approval of the appropriate augmentation. GAWB proposes that ex ante approval can be sought for either or both of the scope, or standard and cost of augmentation. Standard and cost are combined given their interrelationship.[40] This approval process would be initiated after a request by GAWB (or its customers in the event that a pricing dispute arises). Of course, this

[40] For example, a number of difficulties would emerge in separating the design standards from outturn cost and procurement and project delivery, and in the context of the proposed regulatory framework, these could be considered together.

would be subject to the processes set under the *Queensland Competition Authority Act* (**'QCA Act'**) for such reviews, including referrals from the QCA Ministers.

10 Planning and option assessment process

The appropriate augmentation will be determined through a process of consultation with customers, and analysis of options using cost benefit analysis. This process has generic characteristics, namely:

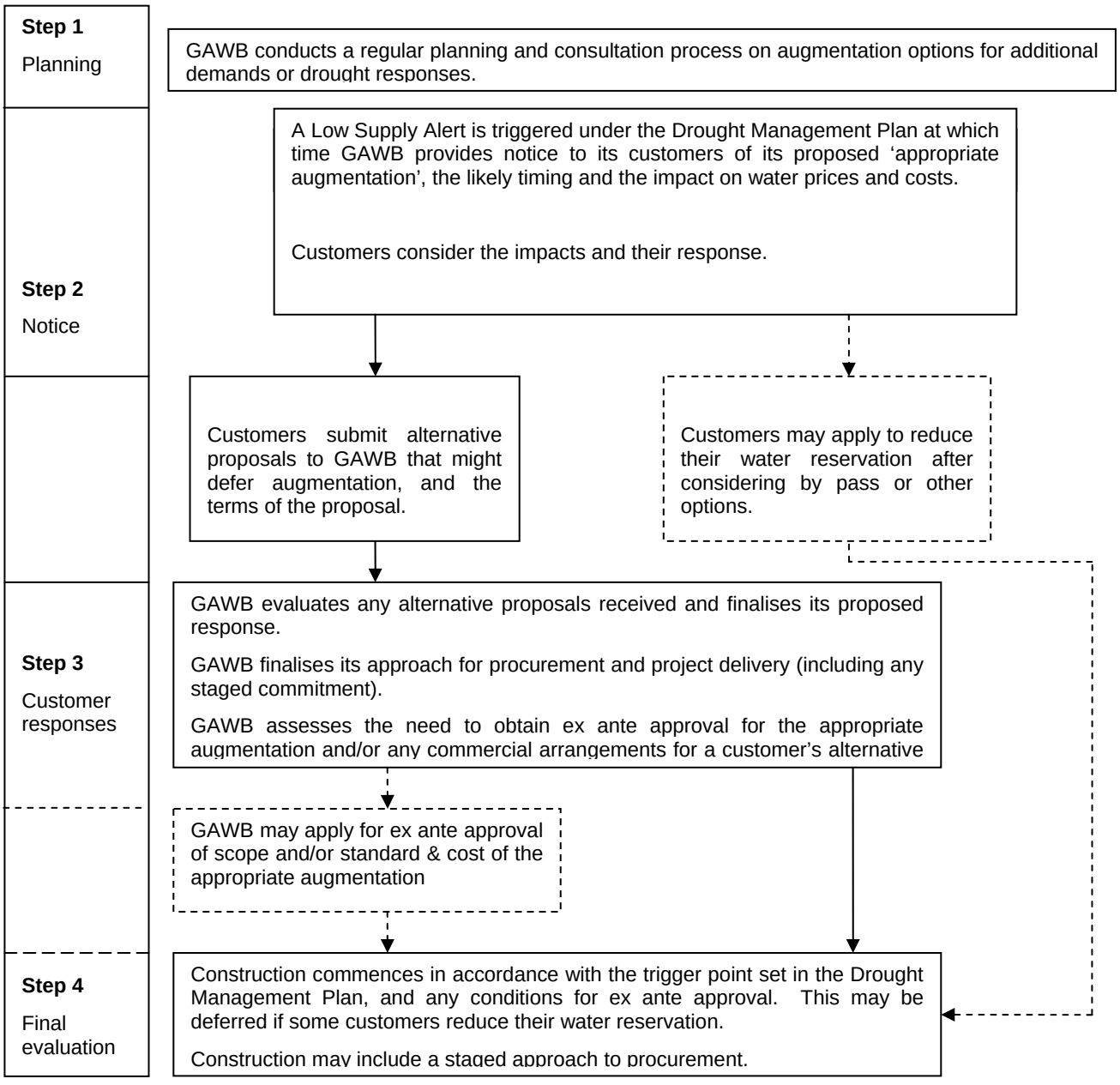
- planning;
- notice to customers of an imminent augmentation event;
- customer responses;
- evaluation;
- ex ante approval (if sought); and
- triggering construction.

The details of this process vary between an augmentation in response to unexpected demand, and an augmentation for drought.

10.1 Process overview

Figures 6 and 7 below provide an overview of the process for the two augmentation events (eg drought and unexpected demand).

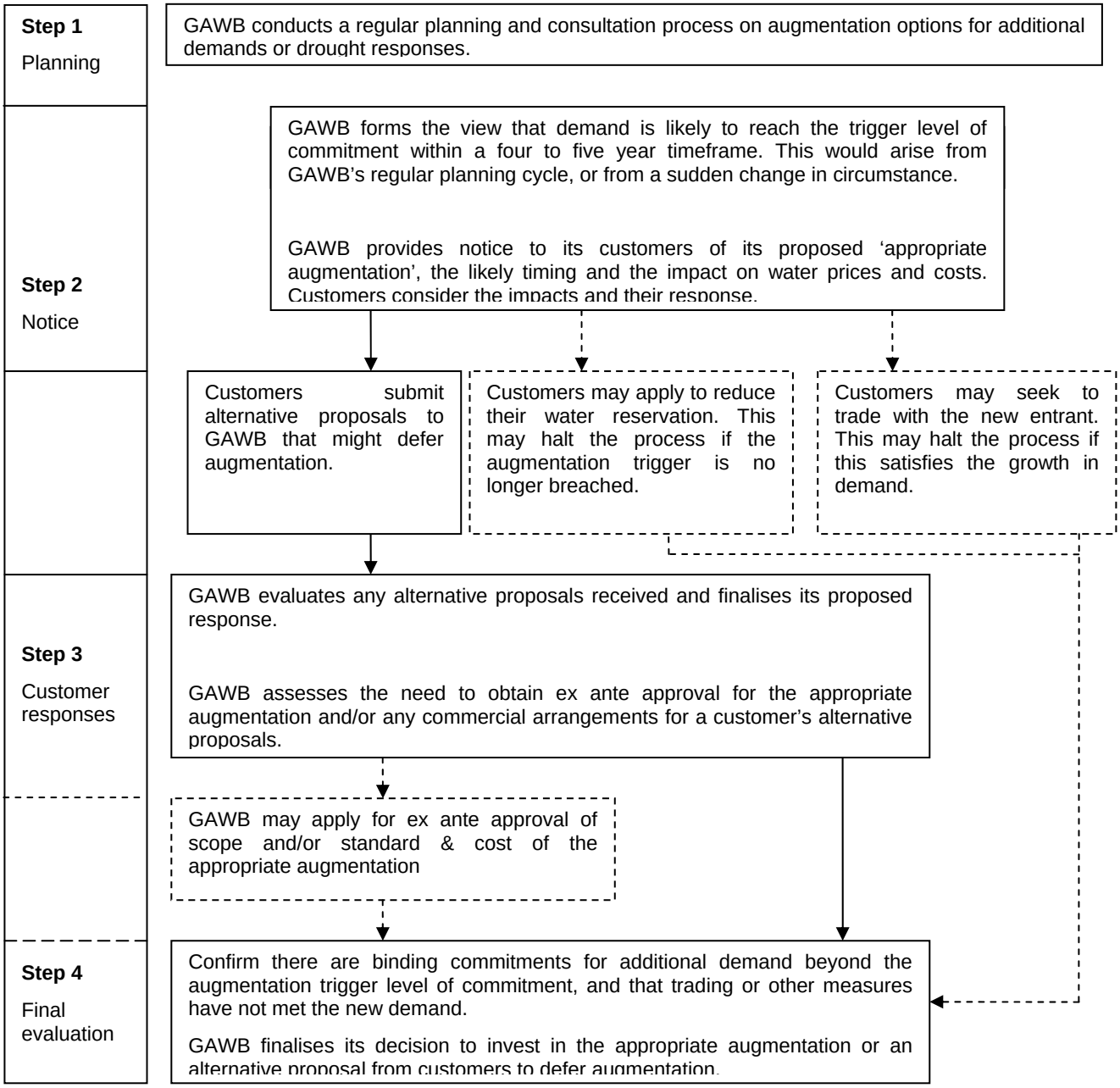
FIGURE 6. SUMMARY OF THE PROCESS FOR AUGMENTATION – DROUGHT



A similar process applies for an augmentation in response to unexpected demand, although trading may play a role in re-allocating available water supplies and deferring

augmentation.

FIGURE 7. SUMMARY OF THE PROCESS FOR AUGMENTATION – UNEXPECTED DEMAND



This submission now turns to the key features and timings for this process.

10.2 Summary of steps

10.2.1 Step 1. Planning

GAWB proposes to undertake water supply planning in a regular cycle. At a minimum, this would align with pricing reviews (5 yearly) but may be revised more frequently (eg annually) or involve updates as new information emerges.

This process will provide customers with ongoing information on the timing and cost of augmentations which may be made in response to drought and demand, and the pricing impacts. The planning process would also include consultation with customers and the calling for non-infrastructure proposals.

This planning would include cost benefit analysis (in accordance with a predetermined methodology and criteria) to determine the appropriate augmentation at any given time. This would also form the basis for any augmentations included in the 20 year planning horizon used for setting prices, and may also be subject to regulatory scrutiny from time to time in accordance with the QCA Act.

10.2.2 Step 2. Notice

Where this planning reveals that an augmentation may be imminent, GAWB will commence a formal process of notifying customers of this event, its proposed augmentation response, and the estimated pricing implications.[41]

GAWB would also invite customers to submit firm proposals for alternatives, for example to invest in process improvements that reduce water consumption, or by pass GAWB's supply system.

Where augmentation was driven by unexpected demands, GAWB would actively facilitate trading between existing customers and new entrants to the extent this was possible, within any commercial in confidence constraints.

[41] The impact on prices will of course depend upon the timing difference of source augmentation between that assumed in GAWB's prices, and the forecast date from above.

Timing

Where a drought event has occurred, GAWB would provide this notice in accordance with its DMP, currently 5 years from projected storage failure. Otherwise, GAWB would provide information to customers where demand projections indicated an augmentation was likely to be required within a 5 year planning horizon (aligned with pricing reviews).

10.2.3 Step 3. Customer responses

Customers may respond to the information regarding a potential augmentation as follows:

- make no change to their water demands, but prepare for the pricing impacts;
- examine bypass or efficiency investments to reduce their water reservation and apply to GAWB for a reduction;
- trade part or all of their water reservation; or
- submit proposals to GAWB for the funding of investments that reduce the customers' water reservation and therefore defer the need for augmentation (see also Annexure A).

In drought circumstances, curtailment arrangements would apply in accordance with the DMP and customer contracts.

Timing

Customer proposals to GAWB will need to be considered alongside infrastructure options to ensure that a decision is made on 'viable' options that GAWB can employ with certainty. These proposals would be required within a 30 to 60 day period, as customers will have already had the opportunity to submit these proposals to the broader planning process, and will have already developed information on the technical and commercial issues.

Where customers are considering trading or otherwise reducing water reservations, this will take time for commercial arrangements to be developed with the relevant parties

(including GAWB). However, these should remain 'live' options until the time that construction is triggered, and should not be ruled out early in the process.[42]

10.2.4 Step 4 – Evaluation and option selection

GAWB would evaluate the proposals against a predetermined set of criteria and methodology (using cost benefit analysis). A specific set of evaluation criteria would apply to customer proposals as demand side measures (these evaluation criteria are proposed in Annexure A).

The outcome from this process would be an updated proposal from GAWB to either:

- enter into a negotiated arrangement with a customer(s) to reduce their water reservation and thereby defer augmentation or reducing the capacity (and cost) of that augmentation; or
- construct the appropriate source augmentation (following cost benefit analysis).

Where a source augmentation was required, GAWB would also propose the prudent capacity of that augmentation, particularly the provision of excess capacity.

Timing

This evaluation process should be an update to previous planning work (including preparatory expenditure) and hence could be carried out relatively quickly. GAWB would conclude this evaluation within 30 days, and may need to exclude some options (including customer proposals) that do not meet a threshold requirement for certainty of cost, timeframe and deliverability.

10.2.5 Step 5– Ex ante approval (if sought)

As discussed above, GAWB may, subject to Terms of Reference being issued, seek ex ante regulatory approval for one or more of the following:

- the scope of response (for example the 'appropriate augmentation' and trigger); and/or

[42] Trading is only relevant for augmentations in response to unexpected demand.

- the efficient standard and cost of the asset.

Timing

Approval of the scope and efficient standard in cost would need to be provided within a 30 – 60 day timeframe, having regard to the construction trigger date set in the DMP.

There are opportunities to develop, in advance, a process for GAWB to seek ex ante approval for standard and cost, which could then be employed if and when required. GAWB therefore requests the QCA to develop guidelines, in advance of a trigger, to be employed under an ex ante approval process.

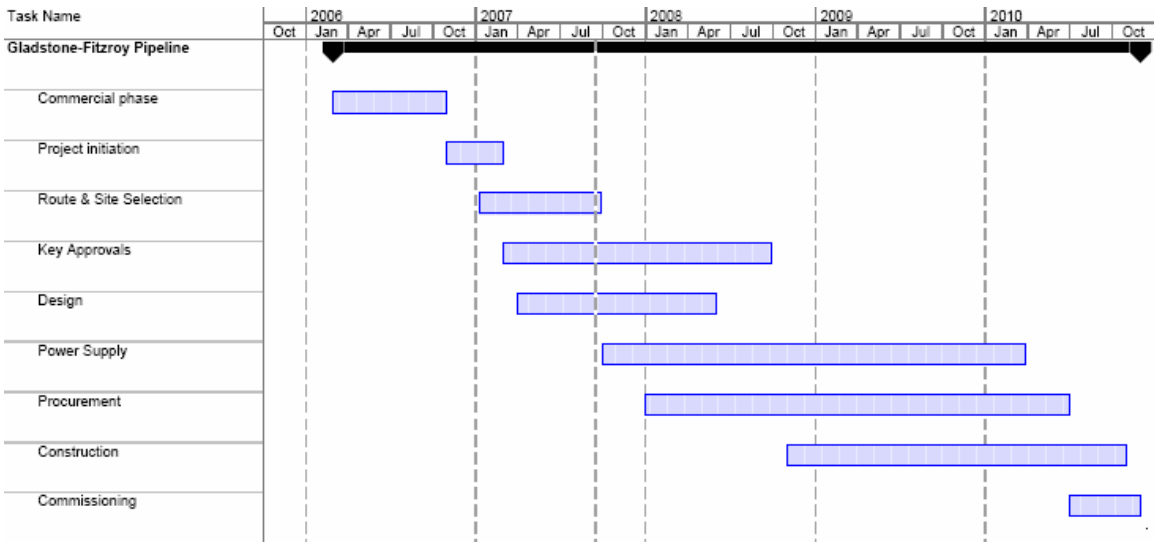
10.2.6 Step 6 – Construction trigger

GAWB would commence the construction phase at the relevant trigger point, subject to its board and other approvals. GAWB will be responsible for demonstrating that it has complied with the trigger points that are to be set as a result of this Part (b) process.

11 Appropriate augmentation – current drought

GAWB has proposed a high-level construction timeframe in response to the current drought, including a two-year window for construction. This is set out in Figure 8 below, which is set against the current drought management timeframes given the status of Awoonga Dam at the time of making this submission.

FIGURE 8. CURRENT PROJECT TIMELINE



11.1 Trigger point

The current DMP suggests that, if drought conditions continue (including inflows of 23GL or less over the next 12 months):

- Supply Restrictions may need to be applied from **July 2008.** A Low Supply Alert has been issued and GAWB is currently seeking voluntary reductions in water usage by its customers; and
- construction of the contingent water source will commence shortly thereafter. Based on current program (above), this is likely to occur in **October 2008**.

11.2 Appropriate augmentation

The trigger point for augmentation is limited by two factors:

- storage levels within Awoonga Dam falling below the appropriate thresholds; and
- deferral options, principally reductions in demand, are exhausted.

Trigger point may be deferred if:

- greater reductions to demand occur, via additional, voluntary reductions, any negotiated or mandatory curtailment arrangements for short-term reductions to demand; or
- if customers present acceptable alternative proposals that enable deferral of augmentation, for example reduction in demand facilitated by retrofitting power stations to facilitate partial air cooling.

The following table summarises the proposed actions and timeframes for responding to the current drought circumstances, assuming that annual inflows and demands occur as per GAWB's drought model (including annual inflows of 23GL or less).

TABLE 5. ACTIONS AND TIMEFRAMES TO RESPOND TO CONTINUATION OF CURRENT DROUGHT

Step	Item	Action	Timeframe
1	PLANNING	UNDERTAKE PREPARATORY PLANNING WITH INVOLVEMENT OF CUSTOMERS TO DEVELOP PREFERRED AUGMENTATION SOLUTIONS.	REFER TO THE STRATEGIC WATER PLAN
2	NOTICE TO CUSTOMERS	PROVIDE NOTICE TO CUSTOMERS OF A LOW SUPPLY ALERT, AND LIKELY AUGMENTATION TIMING AND FORM	CUSTOMERS ADVISED BY LETTER IN SEPTEMBER 2007
		PROVIDE INDICATIVE PRICING	GAWB TO ADVISE BY 31 JANUARY 2008
3	CUSTOMER RESPONSES	SEEK AND OBTAIN FORMAL AND BINDING PROPOSALS FROM CUSTOMERS FOR ALTERNATIVE PROPOSALS (EG FOR AIR COOLING AND SEA WATER COOLING).	COMMERCIAL PROPOSALS LODGED BY 30 MARCH 2008
4	FINAL EVALUATION	GAWB TO EVALUATE ALTERNATIVE PROPOSALS RECEIVED AND REVIEW NEED FOR AND TIMING OF GLADSTONE-FITZROY PIPELINE (SEE ANNEXURE A).	RECOMMENDED OPTION – 31 MAY 2008

Step	Item	Action	Timeframe
5	EX ANTE APPROVAL	IF REQUIRED, GAWB MAY SEEK EX ANTE APPROVAL FOR SCOPE AND/OR STANDARD AND COST (SUBJECT TO REFERRALS FROM QCA MINISTERS). THIS INCLUDES FUNDING TOWARDS ANY ALTERNATIVE PROPOSALS THAT MEET THE EVALUATION CRITERIA (ANNEXURE A).	PROCESS COMPLETED – 31 JULY 2008[43]
6	CONSTRUCTION TRIGGER	GAWB DECIDES ON ITS FINANCIAL COMMITMENT TO THE APPROPRIATE AUGMENTATION	AUGUST 2008[44]
		CONSTRUCTION – PROVIDED AWOONGA DAM IS LESS THAN 4 YEARS FROM PROJECTED FAILURE[45]	PROJECTED FOR OCTOBER 2008

GAWB submits that the QCA consider this timeframe and process and either:

- endorses it for the purposes of responding to a continuation of the current drought; or
- recommends an alternative timeframe and process that GAWB can implement with its customers having regard to the present circumstances.

11.3 Adequacy of the 30GL augmentation option

The following table sets out the modelled time to supply failure (in months) for various augmentation capacities. The analysis assumes that reductions to demand are achieved in accordance with the outcomes sought in the current DMP, and augmentation (with capacity as noted).

	ADDITIONAL MONTHS TO FAILURE (INFLOW ASSUMPTION WORST 3 YEAR AVERAGE 23GL/ ANNUM)
WITH AUGMENTATION – 15GL (TRIGGERED 48 MONTHS FROM FAILURE)	11
WITH AUGMENTATION – 30GL (TRIGGERD 48 MONTHS FROM FAILURE)	36
WITH AUGMENTATION – 46GL (TRIGGERED 48 MONTHS FROM FAILURE)	106

Note:

[1] This is based on conditions at October 2007.

This highlights that, (on the basis of the 23GL/annum inflow assumption prescribed by the DMP) the 30GL/annum augmentation is required to meet the target outcome of

[43] Subject to GAWB seeking such approval.
[44] This will be subject to the process to determine the appropriate augmentation.
[45] Based on the inflow assumptions, demands and restrictions in the DMP.

postponing (supplies) for at least an additional two years.

In any event, GAWB is limited to a 30GL reservation from the Central Queensland Regional Water Supply Strategy, and has assessed that short-term supplies from the Lower Fitzroy are unlikely to be available in excess to this quantity should water be required before new storages (and allocations) are activated.

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Annexure A. Evaluation criteria for alternative proposals

GAWB's Strategic Water Plan included an assessment of a range of options, including demand side measures (or source substitution) such as air cooling of power stations. The QCA's Part (a) Draft Report recommends that these options be further evaluated using a cost benefit analysis framework.

Under the current drought conditions, it may emerge that alternative proposals, including air cooling of power stations or sea water cooling, may prove feasible and would defer the need for augmentation as demand is removed from Awoonga Dam.

In expectation that it will receive proposals from customers , GAWB submits that specific evaluation criteria be established as part of this Part (b) to guide the development of these proposals, and assist GAWB in making an assessment.

This Annexure A sets out these proposed criteria for review by the QCA.

Precedent arrangements

Alternative proposals such as air and sea water cooling are demand side measures to defer or avoid augmentation. These are analogous to demand side measures to reduce peak load demands from electricity networks thereby deferring network capacity augmentation. For example the NSW code of practice for demand management for electricity distributors states that:

> *"…It is recognised that demand reduction can provide long term network benefits, not only when the system constraint occurs. This is because such demand reduction can reduce the need for future network augmentation under a wide range of plausible future scenarios. The essence of cost-effective network demand reduction is the postponement of a known capital expenditure and funding the demand reduction option from the avoided distribution costs…"* [46]

Similarly, in South Australia, ESCOSA has recently approved a number of demand management measures to reduce peak demands, including curtailable load control, under a curtailment contract, between the network owner and commercial customers.

[46] Department of Energy, Utilities and Sustainability. 'Demand Management for Electricity Distributors. NSW Code of Practice.' 2004 Page 21.

These contracts are aimed at large businesses, and require them to shed specific loads in times of peak demand, in exchange for a financial incentive.

The costs and benefits of alternative proposals

The costs of reducing demand through an alternative proposal include the capital cost (eg retrofitting of a power station for air cooling) as well as ongoing costs, such as increases to the cost of producing electricity (for example taking account of reduced efficiencies within the plant). This results in reduced generation (and thus, reduced income) if, as a result of air cooling, a power station's standing on the merit order of dispatch was reduced.

If an alternative proposal results in a long-term reduction to demand, then prices will rise for those customers who remain, as the fixed costs of Awoonga Dam are spread across a smaller customer base.

There needs to be clarity as to the extent of costs and benefits that will be assessed. For example, cost benefit analysis for non-infrastructure proposals relating to electricity transmission and distribution typically specify that cost benefit analysis be limited to examining the impacts on market participants.[47]

The NSW code of practice requires the payment level for 'curtailment' to be no greater than the benefits received, and gives guidance on what can be considered:

> *"… the level of standard payment should generally not exceed what is considered to be the benefits derived from implementing the initiative. For the purposes of this Code, distributors are only expected to offer payments up to the value of the distribution network benefits. (While other costs and benefits may accrue in terms of distribution customer, transmission, generation and other environmental and societal impacts, these are not necessarily the responsibility of the distributor to coordinate or identify)…"* [48]

The benefits of an alternative proposal can be calculated as the deferred or avoided cost of augmentation. In drought circumstances, this value can take account of the probabilities of further deferral or avoidance of augmentation due to inflows.

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[47] For example, the regulatory test under the National Electricity Rules.

[48] Department of Energy, Utilities and Sustainability. *Demand Management for Electricity Distributors. NSW Code of Practice*. (September 2004). P.22.

Inclusion of curtailment payments in user prices

GAWB interprets QCA's Part (a) Draft Report to confirm that where the costs to customers of implementing a demand management proposal are to be met, partially or wholly, by GAWB, those costs should be recovered from all customers through increased prices (in the same way that the costs of the deferred augmentation would have been recovered from all customers). Accordingly, if GAWB was to invest $50M to reduce contracted demand achieved by whatever method (but for example retrofitting a power station to allow partial air cooling) this $50M would need to be added to GAWB's Regulated Asset Base (RAB) and recovered over time.

Evaluation of alternative proposals

Alternative proposals are essentially controlled and implemented by the proponent. Accordingly, it will be necessary for customers to submit proposals to GAWB, following a process of engagement and appropriate assistance, to enable GAWB to evaluate a proposal that is acceptable to and deliverable by the customer.

The key test of any alternative proposal is whether it can deliver net benefits over and above the augmentation. The following are proposed as the evaluation criteria:

- the proposal must generate reductions to water demand that GAWB is contractually obligated to meet;
- the costs of the alternative proposal must be less than the benefits of deferral to customers, expressed as the NPV of their water costs. That is, the alternative proposal should result in lower water costs for GAWB's customers than would have occurred if the planned augmentation proceeded; and
- where competing (and mutually exclusive) alternative proposals were received that generated similar quantum of benefit, a further evaluation would be undertaken for the broader economic costs and benefits (including externalities and qualitative assessments of social impacts).

In determining the costs and benefits, and comparing these with proceeding with the augmentation as planned, the analysis should take account of:

- the time value of deferral (calculated by reference to the expected price effect for customers, which essentially sets the time value of money in the analysis at

GAWB's weighted average cost of capital);

- a comparable period for cash flows (say 20 years or such longer period as is necessary taking into account the lives of the options under consideration) including a value for the enduring costs and benefits (if any) from an alternative proposal and supply augmentation that may extend beyond this timeframe (residual value); and
- the existing 20-year demand and augmentation profile used to calculate water prices.

In order to be considered, alternative proposals must contain the following as a minimum requirement:

- a specified proponent, being the customer entity whom GAWB is contracted with;
- the commitments the proponent is willing to enter into, and in particular set out:
    - the costs to GAWB;
    - the commencement date for the reduction to demand and the term of that reduction;
    - the amount of reduction; and
    - the allocation of risks between the proponent and GAWB (for example cost, timing and volume); and
- the arrangements for the payment of ongoing water charges (if any).

Glossary

Term	Meaning
AHD	Australian height datum – survey reference to a level of height to a standard base level
Board	GAWB
Dead Storage	means the volume of water remaining in Lake Awoonga below the level of the lowest off-take and which cannot be used without the use of pumps or other means to extract it from the Lake.
DMP	Drought Management Plan
DNRW	Department of Natural Resources and Water
DORC	Depreciated optimised replacement cost
Fitzroy ROP	Fitzroy Resource Operations Plan
GAWB	Gladstone Area Water Board
Minister	Minister for Natural Resources and Water
Original Submission	GAWB Submission to the QCA dated 26 March 2007
QAL	Queensland Alumina Limited
QCA	Queensland Competition Authority
QCA Ministers	The Ministers responsible for the *QCA Act* – being the Premier and Treasurer of Queensland.
RAB	Regulated Asset Base
RTA	Rio Tinto Aluminium
Water Act	Water Act 2000

Attachment 1. Review of inflow assumptions

For clarity, the *Review of inflow assumptions* paper was issued to customers in July 2007 prior to the revision of the DMP. Following this revision, the inflow assumption was changed from 5 years to 3 years.

Gladstone Area Water Board

Review of inflow assumptions

Drought Management Plan

May 2007

(updated to December 2007)

Synergies Economic Consulting Pty Ltd

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Synergies Economic Consulting (Synergies) has prepared this advice exclusively for the use of the party or parties specified in the report (the client) and for the purposes specified in the report. The report is supplied in good faith and reflects the knowledge, expertise and experience of the consultants involved. Synergies accepts no responsibility whatsoever for any loss suffered by any person taking action or refraining from taking action as a result of reliance on the report, other than the client.

In conducting the analysis in the report Synergies has used information available at the date of publication, noting that the intention of this work is to provide material relevant to the development of policy rather than definitive guidance as to the appropriate level of pricing to be specified for particular circumstance.

1 Background

GAWB released its current Drought Management Plan (**DMP**) on the 30th of September, 2006. This plan required GAWB to review the inflow assumption following the 2007 wet season having regard to the 2006/07 inflows.

Inflows for this latest water year (May to April) continued at the very low levels recently experienced. The table below summarises the inflows from the most recent three years:

Table 1 Recent inflows to Awoonga Dam

Water year	Inflow (ML)
2004/05	**31,796**
2005/06	**19,338**
2026/07	**19,765**

This compares with the current inflow assumption in the DMP of 69,243ML per annum used to trigger Low Supply Alerts and Supply Restrictions.

The review of this assumption has now commenced.

This paper addresses options and makes recommendations for the review of this inflo assumption and related matters. In summary, it is recommended that GAWB:

- adopt an revised annual inflow assumption of 23,633ML for the DMP (Option 2), compared with the current assumption of 69,243ML;
- make further reviews of this assumption following the 2007/08 year to re-assess recent inflows and the storage situation current at the time; and
- make consequential amendments to the DMP as described below.

This paper also contains additional material to that originally provided in May 2007, to recognise more recent approaches for inflow assumptions in other cities (Attachment 1), and to discuss in more detail the risks associated with more optimistic inflow assumptions. Additional information has been provided on the impact on the frequency of restrictions from moving to the recommended inflow assumption (Attachment 2).

2 Scope of the review

As indicated in the DMP, this review is limited in scope to the inflow assumption used to determine trigger points for the Low Supply Alert, Supply Restrictions and Emergency Restrictions. It does not extend to broader matters such as the review of the nature or extent of these restrictions themselves.

Nontheless it is important to note that related work is underway with respect to drought management – particularly the current review by the Queensland Competition Authority (QCA) of GAWB's proposed contingent supply strategy – namely to be in a position to deploy the Gladstone-Fitzroy pipeline in a two-year timeframe to respond to drought or demand situations.

The outcomes of this review may have a fundamental impact on the nature of the DMP, as GAWB is proposing to move from a demand response (via restrictions) to a supply-response model.

The trigger points and underlying assumptions for the construction of this pipeline are to be discussed and reviewed through this QCA review process. Once complete, this would then inform subsequent updates to the DMP to incorporate, among other things, triggers for expenditures to augment supply..

3 Basis for revising inflow assumptions

The current inflow assumption is the average the 10 worst consecutive years of inflow on record – 69,243ML/annum based on the period 1993 to 2002.[49] This assumption was based on advice from Hydro Tasmania Consulting that a 10-year period was necessary to provide an appropriate sample size over the history of inflow record.

The current DMP sets out context for the review of this assumption:

> *The decision to use assumed inflows based upon the average of the worst 10 year inflow was made with due acknowledgement of the unquantifiable effect that climate variability will have upon the use of historic inflow data. Statistical tests that GAWB commissioned indicate that a strong downward trend for inflows to Awoonga Dam …*
>
> *GAWB will review the appropriateness of the use of average of the worst 10 year actual inflows as the assumed inflow … Any persistence of the relatively low inflows recorded to the End of the Wet Season for the past 2 wet seasons (approximately 24,000MLpa and 31,000MLpa respectively) would be an important factor in GAWB's considerations.*

Inflows from May 2006 to April 2007 were 19,765ML – a continued decline from those experienced prior to the DMP being published in late 2006 and culminating in an average annual flow over these three years of 23,633ML.[50]

Secondly, the current inflow assumption would see Awoonga Dam continued to be drawn down until it reached EL23.6, or approximately 106,000ML. This represents around 18 months supply held in reserve (ie with zero inflows).

The current inflow assumption relies upon one or more years of substantial inflows within a five-year window to achieve the assumed annual average. There is clearly a scope for inflow sequences to occur within a three-five year period well below this volume given the recent history of the previous three years.

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[49] This was based upon an October to September water year. The drought modelling has now adopted a May – April water year to better account for the seasonality of inflows. The equivalent flows for 10-year period, for a May-April water year, is 71,738ML. Given the difference is not material between the two years, the current 10-year assumption (69,243ML) based on the October – September year has been adopted throughout this document to avoid confusion and maintain a baseline position for comparison.

[50] The current water year adopted for the purposes of drought management is May – April . The 2006 DMP utilised annual data based on an October – September year. Hence the 19,765ML referred to above for 2006/07 (May – April) should be compared to 19,338ML for 2005/06 and 31,796ML for 2004/05. The continued decline in flows remains clear regardless of the water year adopted.

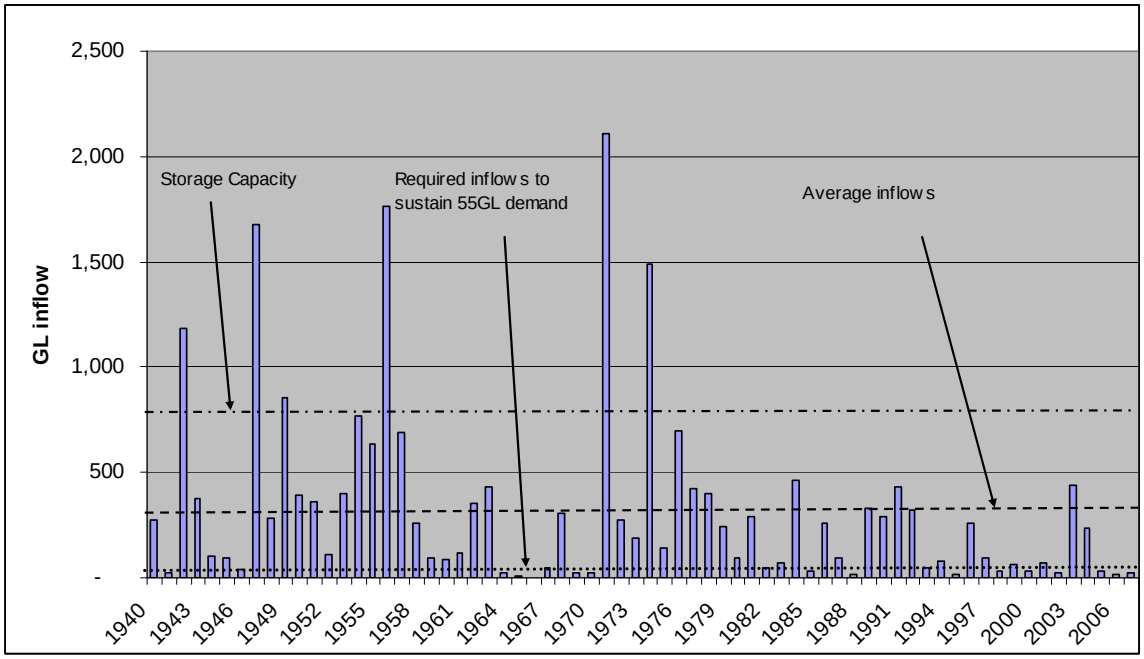
This would suggest that the review of inflow assumptions should focus on more conservative options given the continued declining pattern of inflows.

3.1 Risk-based approach to inflow assumptions

One measure of risk is the variance of outcomes – the greater the variance from the mean or average, the higher its risk. The inflow data clearly demonstrates that major flood inflows are required periodically to sustain the storage's yield.[51] This makes the task of forecasting inflows, especially when faced with low storage levels, extremely difficult and it is necessary to take an explicit view of the acceptable level of risk – for example the extent to which a major inflow event should be assumed into the forecast.

The risk associated with inflows is highlighted by the variance in streamflows since 1939/40. Figure 2 sets out these historic inflows.

FIGURE 1. HISTORIC FLOWS.



Source: inflow data used for GAWB's Drought Management Plan, as reviewed by Hydro-Tasmania.

This historic data highlights the variance in flows between years, and the clustering of flow events – for example series of high inflow years and the series of low inflow years.

[51] In fact, the average annual flow to Awoonga Dam is 323GL, yet the standard deviation of these flows is 433GL.

It is important to note the reliance on one-off events to sustain water supplies – the most recent example of this was Cyclone Beni, which resulted in some 388GL flowing into the Dam in February, 2003.

Secondly, the comparative impacts from restrictions and storage failure should be considered. In the absence of a contingent supply source, the DMP should prudently apply restrictions to avoid major water shortages for customers that substantially impact upon their operations and the region's economy.

Hence a balance is required between:

- the risk of not applying restrictions early enough in a drought cycle – for example by assuming inflow assumptions higher than that actually experienced; and
- the risk of imprudently requiring restrictions causing unnecessary disruption to customers – through setting overly conservative inflow assumptions far lower than that produced by future droughts, resulting in frequent, yet unnecessary, supply alerts and restrictions.

The implications from unforeseen water shortages clearly outweigh the implications of frequent yet unnecessary supply alerts and restrictions (as presently provided for in the DMP). Hence, it is recommended that greater weight be given to the risk of shortfall in assessing options. The inflow assumption should also specifically take account of the risk of inflows occurring that were less than anticipated or assumed, and enable GAWB to respond to this scenario.

Finally, the assessment of inflow assumption should canvass a wide range of options and scenarios.

3.2 Matters to consider in determining the preferred inflow assumption

The selection of an inflow assumption is, by its nature, imprecise. It is clearly impossible to accurately predict future rainfall and inflows into the storage, particularly given the reliance of the storage on large, periodic inflow events that are often years apart.

The task is further complicated by the implications of climate change and the prospect that the limited historic information available to GAWB may:

- not be a representative sample of catchment conditions in the long term, due to the relatively short period of data;
- be fundamentally changed due to the impacts of climate change; and
- may be subject to collection or calculation error.

The recent report to GAWB from the Department of Natural Resources and Water highlights this issue. This report described a step change in rainfall (and therefore inflows) in the region since the 1970s. Whilst a number of explanations were offered for this change (including climate change or random occurrence), the report concluded that historic flows should not be relied upon to inform the future. That is, the worst droughts over this period could be repeated, or in fact more severe droughts could be experienced.

By way of comparison, the Water Corporation has recently changed the basis for its flow forecasting and planning to the flow regime since 1997, when drier climate and streamflow conditions commenced, affecting water supplies to Perth and south-west Western Australia.

Hence the DMP and the inflow assumption must take account of what is possible – including events that are worse than historic record (such as zero inflows), and what history has indicated can occur and could therefore be expected to occur again – such as the recent inflow sequence over the past three years.

3.2.1 Determining an inflow assumption that is sufficiently conservative

Historic data may not be a good indicator of the future, however there are no practical forecasting tools available to GAWB. For example, weather outlooks are available using Southern Oscillation Index (or SOI) and sea-surface temperature.[52] These forecasting tools are extremely limited in their forward outlook period (usually eight

[52] The current outlook is for a higher than normal chance of La Nina climate pattern returning and possible a return to more normal rainfall patterns (though not necessarily drought-breaking). Refer to the Long Paddock website at http://www.longpaddock.qld.gov.au/SeasonalClimateOutlook/OutlookMessage/index.html.

months) and there is not a precise or certain correlation between rainfall probabilities at a regional level, and rainfall in the Awoonga Dam catchment.

These tools are useful as a broad-brush indication of the upcoming wet-season, but are unsuitable as a basis to set multiple year projections.

Hence GAWB's options are largely limited to drawing upon:

- historic data, including previous drought sequences; and
- stochastic modelling to identify a range of possible scenarios to provide a measure of the probability of certain events occurring.

As a result, options have been gathered based upon:

- recorded historic sequences;
- a collection of the lowest inflow years (assuming that disparate years occur in sequence); and
- no inflows occurring.

An assessment of the likelihood of the various inflow assumptions has also been made using stochastic modelling. Whilst this is not a definitive measure, it allows options to be screened that present an unacceptable risk. Hence the outcomes from this modelling should be considered in a measured fashion, given the data set and the complexities in measuring a relationship between flows in sequential years – for example the extent to which these may be random or not.

3.2.2 Avoiding overly-conservative assumptions

A balance is required to avoid setting inflow assumptions that frequently trigger unnecessary restrictions.

It is worthy to note that GAWB's environmental releases from Awoonga Dam cease when the storage reaches EL 30m, or 282,000ML in storage. This cessation of environmental base flow releases relieves the storage of up to 11,806ML/annum.

Any reduction in water use from a Low Supply Alert is likely to be minor in comparison to these environmental releases from the storage.

When comparing options, it is therefore recommended that the likely elevation of the storage for triggering Low Supply Alerts be considered, with preference given to those options that avoid triggering a Low Supply Alert whilst the storage is substantially above EL 30 (or 282,000ML).

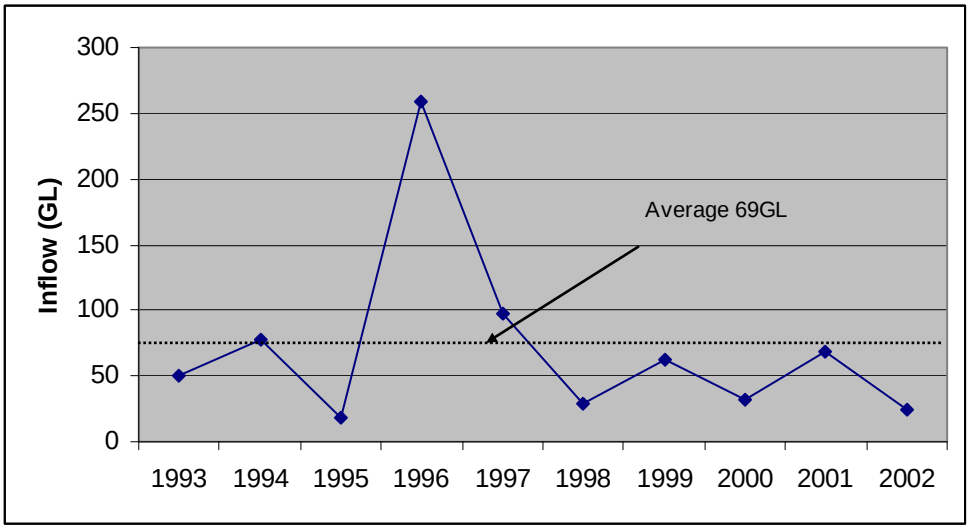
Secondly, studies of storage evaporation at Awoonga Dam performed by Connell Wagner for GAWB demonstrate the impact of evaporation at high storage levels. For example, evaporation at EL32 depletes the storage to a greater level than releases for current demand.

3.2.3 Managing the risk of over-estimation

Any inflow assumption has an inherent risk of over-estimation – that is there is a risk of inflows occurring below that assumed.

A further risk is failing to take account of the pattern of inflows within a time period. Given the variance in inflows as discussed above, there is a substantial scope for forecasting error by relying on long-term averages when making inflow assumptions. The figure below illustrates the variance even across the lowest 10 year sequence: (option 1):

FIGURE 2. INFLOW PROFILE – LOWEST 10 YEAR SEQUENCE

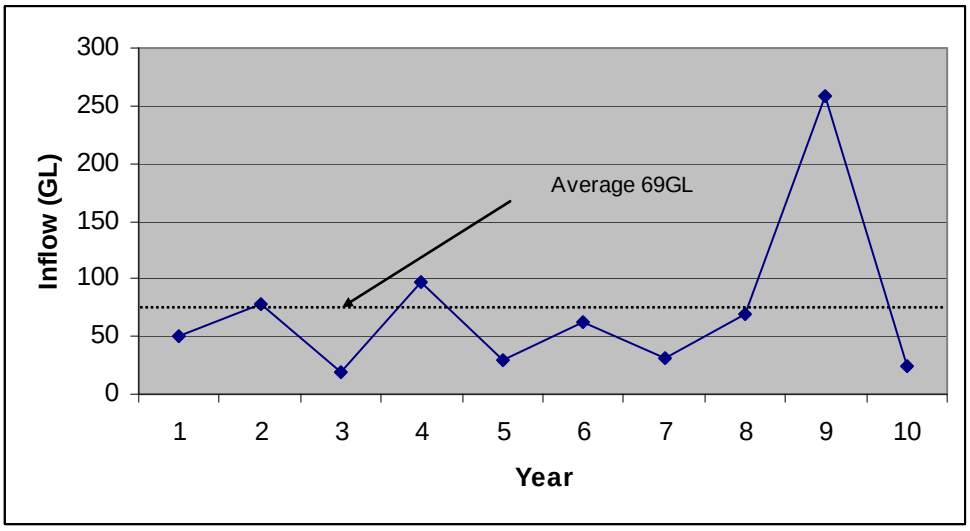


In this case, the average inflow of 69GL is heavily skewed by a one-off major inflow in 1996 of some 258GL. More importantly, under drought circumstances this average will

become meaningless if this inflow does not occur within the drought management period – that is 5 years from projected failure. Hence, adopting a long-term average – which includes a major inflow event – poses an increased risk of supply failure as very low inflow may continue in the first five years, yet the inflow assumption will hold true (in hindsight) if a major inflow occurs in latter years when it is too late.

The graph below provides an alternative example, using the same inflows but re-ordered, to demonstrate this point.

FIGURE 3. INFLOW PROFILE – ALTERNATIVE INFLOW SEQUENCE



Under this scenario, the actual inflows leading up to supply failure into Awoonga Dam would be well below the 69GL average assumed for drought management planning, yet the assumption may still prove 'true' from a major inflow in later years – which may occur after the storage has reached critical levels.

One way to avoid such an event is to assume zero inflows during the period, which would require commencing DMP actions with relatively high storage levels and thereby increasing the likelihood of unnecessary restrictions.

Another approach is to ensure a Low Supply Alert is triggered with sufficient water in storage that would enable a supply response to an extreme series of years (eg zero inflow). This can be achieved by ensuring that, at the point of the Low Supply Alert, Awoonga Dam was storing at least three years forward supply, regardless of inflows. This would enable GAWB to respond to an extreme event that arose in the first year,

and take measures to augment supply within a two year target timeframe with allowance for delay risk.

Based on current demands, this storage level would be EL 28.2m or 225,060ML.

In summary, the following guidelines can be applied when generating and considering the various options:

- flow assumptions should draw from historic events, but be conservative (for example having a very low probability of lower flows occurring);
- all other things being equal, it would be desirable (but not essential) for the inflow assumption to avoid triggering Low Supply Alerts and restrictions at above EL 30 when environmental releases are being made which may reduce the effectiveness of reductions in demand; and
- at the trigger point for a Low Supply Alert, it is desirable to have at least three years forward supply as reserve in storage (accounting for losses).

4 Determining inflow options

A number of alternative inflow assumptions have been considered, including approaches previously raised by customers in their comments to the initial DMP.

The key issues that have framed the set of options are briefly described below.

4.1 Data set

NRW has assembled streamflow extending back to 1891.

In their recent review of the drought model, Hydro Tasmania Consulting made a number of alterations to this data to correct apparent errors in distribution in flows. This resulted in a more conservative flow data set which was considered more robust for the purposes of drought modelling.

This updated data has been adopted for the purpose of the drought model.

4.2 Data quality

Any historic data set is only as good as the records kept at the time, and the form of measurement. For example, streamflow monitoring was not consistent over the period of record – in fact no streamflow monitoring occurred prior to 1939. Moreover, historic data over a long period may contain errors or anomalies.

Given this background, the review of inflow assumptions has included a re-assessment of the previous lowest inflow years on record in the mid-1960s, where current data (using the Hydro Tas data set) indicates the lowest inflow year occurring in 1965/66 - 278ML[53], and the second-lowest year in 1964/65 of 8,464ML.

However, rainfall data in the catchment during those years is not consistent with the flow data available. That is, given rainfall record in those years it is difficult to conclude that the flow data is credible. This has been endorsed by Connell Wagner in their

[53] The IQQM data, which is the basis for the current DMP, recorded 1,211ML.

review of the drought model and assumptions.[54]

As a result, these years have been excluded when determining inflow sequences for various options.

Accordingly, the minimum historic inflow year is now 1987/88 where some 16,000ML of inflow was recorded, and the second-lowest inflow year was 1994/95 where some 18,000ML inflow occurred. The lowest three-year sequence is the three years leading up to 2007 – that is May 2004 to April 2007 (23,633ML annual average).

4.3 Data sequencing

Two approaches have been adopted in selecting historic data as the basis for the inflow assumption:

- historic sequences; and
- collection of lowest flow years.

Historic sequences may be considered useful in highlighting the inter-year pattern of inflows – for example Awoonga Dam relies on irregular, large inflow events interspersed with relatively smaller inflows.

However, assembling the individual lowest flow years across the period of record is a more conservative assumption and would support the notion that major inflows are relatively random events that should not be relied upon for drought management purposes.

4.4 Period of years

The current DMP takes the average annual inflows over a 10 year sequence. There is a strong argument to reduce the sequence or number of years within the periods contemplated in the DMP, given:

[54] The annual rainfall over the Boyne Catchment was calculated to be 809mm (May 1964- Apr 1965) and 525 mm (May 1965 – Apr 1966). The 1965/1966 inflow of 278 ML would have required a much lesser annual rainfall than 525mm.

- it provides an unrealistic “smoothing” of inflows across years which does not reflect the volatile nature of inflows to Awoonga Dam;
- it assumes a period longer than that managed through the DMP – that is this assumption may prove prudent over a 10-year timeframe, but actual inflows during a 5 year period could be well below this longer-term average.

This issue is highlighted by the fact that the 10-year period includes two high-inflow years of 258,000ML (1995/96) and 435,000ML in 2002/03. This compares with the average of 69,243ML.

A more prudent measure is to limit the ‘window’ for inflows to, at most, the five year forecast period used for the DMP, particularly when examining historic sequences as the basis of inflow assumptions. Moreover, the options developed have been limited to three and four year periods to provide for conservatism of the inflow assumption. For example, adopting the worst 3 years on record effectively assumes that those flows would in fact extend for a five-year period to trigger the Low Supply Alert, and four years from Supply Restrictions.

This recognises that historic flows are not a reliable forecast of the future, and the need to plan for scenarios where historic drought years are not only replicated, but could be worse than previously experienced.

4.5 Stochastic modelling

Stochastic modelling has been applied to assess the likelihood of each assumed inflow sequence being exceeded. This information is complementary to the overall analysis and provides an indication of the probability of actual inflows being less than that assumed in the DMP. Whilst this is not definitive it provides a confidence measure as to the riskiness of the assumed inflow.

Stochastic modelling indicates the following flows would have a 99% chance of being exceeded (or less than 1% chance that lower flows would occur):

- over a continuous three year period – 57,000ML or 19,000ML/annum; and

- over a continuous five year period – 240,000ML or 48,000ML/annum.55

4.6 Inflow assumptions – other water supply schemes

A comparison can be drawn between the inflow assumptions adopted in water sharing rules for high priority water allocations in other Queensland water supply schemes. The Resource Operations Plans (ROP) for these schemes typically set aside two years demand in storage for high priority water allocations, before making any water available to other entitlement holders (eg irrigators with a medium priority allocation).

The ROP usually requires a zero inflow assumption to be made in determining this reserve volume for high priority allocations and an assumption that customers will use their full water allocation, each year.[56]

The framework for these water sharing rules is clearly different to that faced by GAWB. For example, a 'no risk' assumption is required to avoid making water available to irrigators erroneously, as this would diminish the formal rights of high priority users to water under their entitlement. Moreover, high priority water allocation holders do not face restrictions until such time as storage cannot meet allocations for a water year.

Nonetheless, this highlights the degree of conservatism that is employed when making inflow assumptions for high-value industrial users.

4.7 Options

Table 1 below summarises the options considered and their relevant inflows and storage trigger levels. It is worthy to note that Option 2 reflects the previous three years of inflow. This option is hence more timely and significant given it is reflective of recent drought conditions, and assumes these would continue over the coming five years. This option is discussed in further detail later in this paper.

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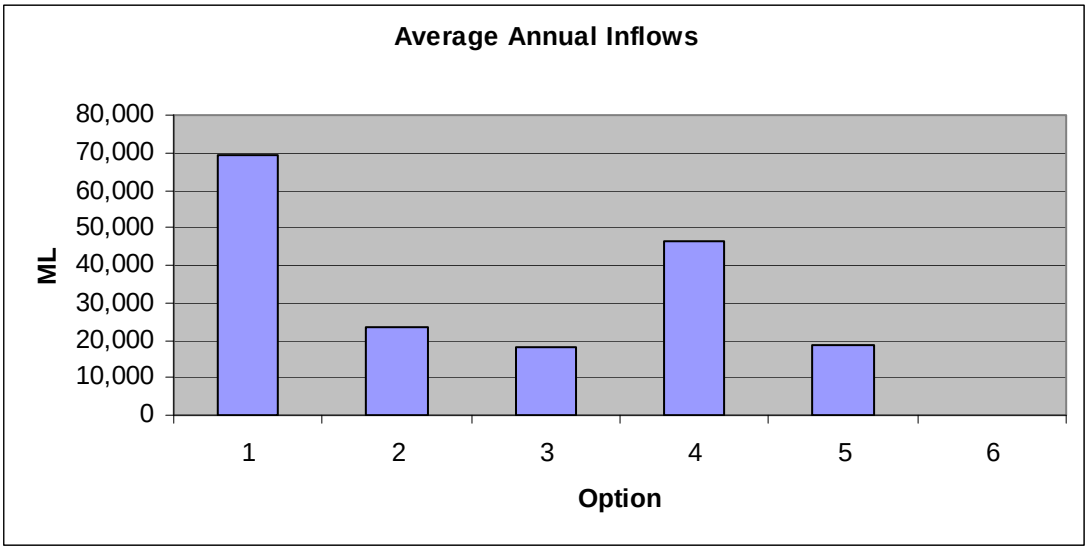
55 This reflects the increased likelihood of major inflows occurring over longer timeframes.
56 Refer to the water sharing rules for the Nogoa Mackenzie Water Supply Scheme as an example.

Table 1 Summary of options

Option	Inflow period / years	Flow sequence	Years[57]	Average annual inflows (ML)	EL Trigger (Low Supply Alert)
1	LOWEST 10 YEAR (CURRENT ASSUMPTION)	CONTINUOUS SEQUENCE	1993 - 2002	69,243	23.6m
2	Lowest 3 years	Continuous sequence	2004 –2007	23,633	30.4m
3		Lowest flow years	1987/88 1995/96 2005/06	18,068	31m
4	Lowest 4 years	Continuous sequence	1998 - 2002	46,432	26.6m
5		Lowest Flow Years	1987/88 1995/96 2005/06 2006/07	18,506	31m
6	No inflows	-	-	0	34.2m

The annual inflow assumptions can be compared in Figure 1.

FIGURE 4. COMPARISON IF INFLOWS UNDER VARIOUS ASSUMPTIONS



[57] All years are from 1 May to 30 April, with the exception of Option 1 which reflects the current DMP (October – September)

4.8 Consideration of options

The inflow assumption generated under each option can be compared in a number of ways:

- the storage level at the Low Supply Alert trigger;
- the probability (using stochastic modelling) of a lesser flow sequence occurring; and
- the future scenarios for Low Supply Alerts and restrictions based on current storage position.

4.8.1 Probability of actual inflows being less than assumed

Based on the stochastic modelling, there is less than a 1% probability that lower inflows would occur for options 2 to 5 (ie they all assume less than 48,000ML/annum over a five year period). This compares to the average annual inflow over the past three years of 23,633ML.

A three-year time sequence is a more conservative measure – and probably more relevant given the inflow assumption will remain through the point of Supply Restrictions (4 years from failure). Stochastic modelling indicates that an average annual flow less than 19,000ML has less than a 1% chance of occurring over a three-year sequence. Options 3 and 5 are below this 19,000ML (1%) benchmark, while Option 2 (23,633ML) is slightly above this level.

4.8.2 Forward storage at Low Supply Alert

Options 1 and 4 trigger a Low Supply Alert when the storage is beyond the point of withstanding an extreme (eg zero) inflow event over three years – EL28.2m

Options 2, 3 and 5 are more robust and can provide at least 36 months forward supply (based on current demand) in storage. Option 6 also satisfies this criterion as it assumes zero inflows over a 5-year period.

4.8.3 Relationship with environmental releases

Options 1 and 4 would be triggered well after cessation of environmental releases. Conversely, options 3 and 5 would trigger a Low Supply Alert with environmental releases continuing for some time after this trigger.

Option 2 would also be triggered during environmental releases, although with closer proximity to the cessation of such releases.

Whilst this relationship with the environmental release should only be considered as a guide (and not a threshold for decision making), it indicates that Options 3 and 5 might be less effective given the relative benefits of customer reductions in demand at a Low Supply Alert against the draw down of the storage from environmental releases.

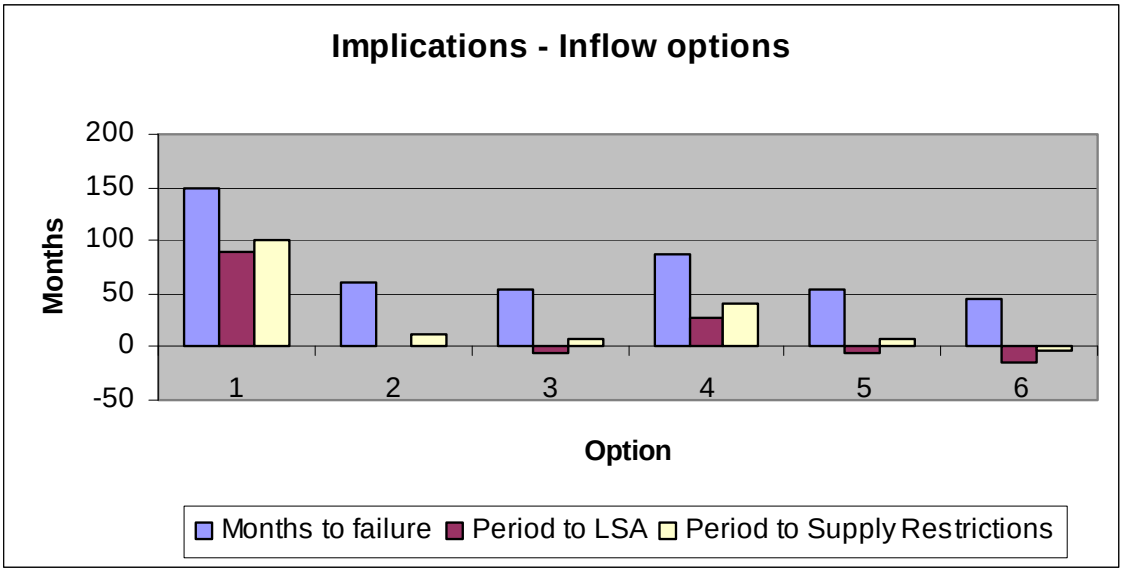
4.8.4 Current implications of inflow assumptions for DMP trigger points

Options have been examined using the drought model and current storage levels to determine:

- the period to the next Low Supply Alert (LSA) and subsequent Supply Restrictions; and
- the forecast months to failure assuming this annual inflow were to occur from May 2007, given the current storage elevation.

The results of this modelling are summarised in the graph below.

FIGURE 5. COMPARISON OF INFLOWS UNDER VARIOUS ASSUMPTIONS



This indicates that the more conservative options (3 and 5) should have already triggered a Low Supply Alert, and Supply Restrictions would be required in only three months time (assuming monthly inflows occur as per that assumed for each option).

Option two inflows would require a Low Supply Alert being issued now, with Supply Restrictions required in 12 months (assuming a continuation of the current average inflows – as reflected in Option 2.

Finally, Figure 2 highlights the vast difference in timeframes to failure under the different inflow assumptions (refer to the blue bar). For example, the current inflow assumption (Option 1) assumes that failure would not occur for more than 12 years. This compares with the less optimistic options (eg 2, 3 and 5) which would result in storage failure in 4.5 to 5 years.

5 Recommended option

Based on the analysis above, Option 2 (23,633ML/annum) is recommended on the basis that:

- it is relevant in terms of the current drought sequence, given the potential for a step-change in inflows over recent years;
- is prudently conservative, as:
  - it is the worst three-year sequence on record and hence assumes this sequence continued for a period of 5 years; and
  - stochastic modelling supports a very low probability of lower inflows occurring; and
- it triggers a Low Supply Alert at or around EL 30.4m (296,000 ML), and therefore DMP actions, with sufficient storage to support current demands for more than 36 months if the worst-case (nil) inflows occurs, and therefore providing a window for GAWB to trigger supply augmentation to avoid storage failure in such an extreme event.

This is not meant to suggest that a three-year trigger point for supply augmentation is required, although this matter is currently being considered by GAWB in its submission to the QCA. Rather, in the context of this review, a three-year storage reserve at the commencement of drought responses is seen as a prudent contingency to provide time to respond to inflows being far lower than that anticipated.

Moreover, Option 2 should be considered within the current drought sequence being experienced at Awoonga Dam. Hence, this three-year sequence would be rolled forward should the 2007/08 year prove to continue the period of severely low inflows and result in inflows lower than that in the previous three years. This can be reviewed in April 2008 and incorporated into the inflow assumptions going forward.

In this sense, Option 3 is a ‘rolling’ average until such time as major inflows occur.

It should be noted that this is not the most conservative option considered – these more conservative options are based on a collection of worse flow years, rather than

sequential years. The zero inflow option has been discounted given there is no precedent for such an event, although the risk of this occurring has been incorporated into the decision criteria.

Attachment 1 provides an overview of the approaches taken to inflow assumptions in other major metropolitan centres in late 2007, and supports these recommendations.

Attachment 2 describes the impact of the recommended option on the frequency of restrictions, and demonstrates that this does not lead to a material impact.

6 Other amendments to the DMP

A number of amendments to the DMP are recommended to align with more recent demand projections, and to reflect the current status of the Lower Fitzroy as a contingent supply strategy.

6.1 Projected water demand

The base case demand scenario has been updated with current information and used to derive the updated forecast trigger points for the Low Supply Alert and Supply Restrictions. A summary of the previous and updated demands is set out in the table below.

Table 3 Updated Demand Scenario

Year	Previous (ML)	New forecast (ML)	Difference (ML)
2006/07	55,938	52,750	-3,188
2007/08	56,607	53,056	-3,551
2008/09	60,733	53,229	-7,504
2009/10	70,000	56,970	-13,030
2010/11	70,000	61,955	-8,045
2011/12	70,000	64,559	-5,441
2012/13	70,000	66,402	-3,598
2013/14	70,000	68,308	-1,692
2014/15	70,000	70,000	-
2015/16	70,000	70,000	-
2016/17	70,000	70,000	-
2017/18	70,000	70,000	-
2018/19	70,000	70,000	-
2019/20	70,000	70,000	-
2020/21	70,000	70,000	-
2021/22	70,000	70,000	-
2022/23	70,000	70,000	-
2023/24	70,000	70,000	-

As indicated in this table, the current forecast demands are less than that previously assumed in the current drought model. This is the result of updated forecasts for these demands. The cap on demand at GAWB's current water allocation – 70,000ML - has

been maintained.

This has the effect of reducing the likely impact of drought and extending the period to supply failure. The risk is for actual demand to exceed this forecast during an extended drought, thereby bringing forward restrictions and failure earlier than otherwise anticipated. However, these updated forecasts are considered to reflect current conditions.

6.2 Forward water sales

The current DMP requires the forward water demand projection to be reviewed based on customer commitment to reservation contracts within a defined (30 days) period of triggering a Low Supply Alert. Hence one possible implication of adopting Option 2 inflows, which will trigger a Low Supply Alert, is a requirement for customers who have a projected demand being required to commit to a reservation or allow their identified water demand to lapse.

Secondly, GAWB has committed in the DMP to not increase the volume of water it is obligated to supply upon the declaration of a Low Supply Alert.

This arrangement warrants reconsideration given the new inflow assumption is more conservative as a Low Supply Alert will be issued at a higher storage level (296,000ML) than the at the current inflow assumption (106,000ML).

It is therefore recommended that customer views be sought on a proposal for the Supply Restriction (4 years from failure) to be used as the threshold point for the cut-off for new contracts, rather than the Low Supply Alert.

6.3 References to augmentation triggers

The current DMP sets out GAWB's (and customers) preferences to develop contingency sources rather than adopt restrictions. Whilst the DMP is not definitive on this point, events have since moved forward with GAWB now preparing its submission to the QCA for drought triggers to construct the Gladstone-Fitzroy pipeline.

It is therefore suggested that the DMP be updated to reflect the current status of this

work and to make clear that drought triggers for augmentation will be determined following the QCA review.

7 External reviews and sign-offs

The data in this paper has been provided by GAWB, from its drought management model. This model, and the data set, has been separately reviewed by Connell Wagner whom we understand have validated the appropriateness of the model for the purpose and the underlying assumptions.

Attachment 1. Recent approaches to inflow assumptions

The inflow assumptions used for drought management planning vary across urban centres in Australia. A summary is provided below of the inflow assumptions recently adopted for Southeast Queensland, Perth and Melbourne for water supply planning purposes. The following table summarises these assumptions, followed by a more detailed description.

SCENARIOS – COMPARISON OF INFLOW ASSUMPTIONS

	INFLOW ASSUMPTION	PURPOSE	COMMENTARY
SOUTH EAST QUEENSLAND	REPEAT OF SINGLE LOWEST YEAR ON RECORD (2006)	TO SET RESTRICTIONS AND DEVELOP NEW WATER SOURCES	THIS ASSUMPTION HAS BEEN EMPLOYED AS A RISK MANAGEMENT TOOL IN THE CURRENT DROUGHT
PERTH	AVERAGE OF THE LOWEST 6 YEAR INFLOWS	SET AS THE BASIS FOR DETERMIING LEVELS OF SERVICE AND LONG-TERM PLANNING	THIS ASSUMPTION WAS ADOPTED TO GUIDE SOURCE AUGMENTATION TO OVERCOME FUTURE DROUGHTS (NOT RESPOND TO THEM)
MELBOURNE	AVERAGE OF THE LOWEST 3 YEARS	APPLIED TO RESPOND TO THE CURRENT DROUGHT TO SET RESTRICTIONS AND TRIGGER SOURCE AUGMENTATIONS	THE VICTORIAN GOVERNMENT RECENTLY CHANGED THIS ASSUMPTION TO BE MORE CONSERVATIVE – 10 YEAR INFLOWS WERE PREVIOUSLY ASSUMED.

South East Queensland

The Queensland Water Commission has assumed a continuation of the worst single inflow year on record in its drought management planning for the region, including the timing of restrictions and supply side contingency measures. It is also understood that the Commission has assumed a buffer in the 'failure' point for major storages of 4% storage capacity – that is, the assumed failure point is 5% storage capacity, rather than the lower levels (1%) at which storage owners believe water can still be made available.

One observation that can be drawn from this inflow assumption is the relationship between the consequences of over-estimation, and the conservatism of the

assumption. That is, given current storage levels in South East Queensland contain little reserve, it is clearly prudent to take a very conservative inflow assumption to manage for drought.

Perth

In Perth, the Economic Regulatory Authority (**ERA**) recently addressed a proposal by Water Corporation to increase tariffs to account for a number of factors, including planned investment in a pipeline from the South West Yarragadee and associated treatment and integration works.[58] The Corporation submitted that this pipeline was required to be operational by 2009/10 in order to maintain the target levels of service to customers, namely sprinkler bans occurring in no less than 1 in 200 years.[59]

A key matter for the ERA was the conservatism of the Corporation's assumptions, namely:

- the target level of service; and
- the inflow assumptions used to calculate the probability of restrictions being required – namely the last six years of inflow data, rather than the previous assumption of the last 10 years.60

There are clearly a number of contrasts between this situation and that faced by GAWB. Most notably, Water Corporation's proposals were set to avoid the chance of restrictions – sprinkler bans - being employed to less than a 0.5% probability. Hence the inflow assumption is set to guide investment in new infrastructure to meet this target. This could occur at any time in the hydrological cycle as new information emerged about the long-term supply available from various sources.

By contrast, GAWB's drought management plan is a responsive measure to a drought event, if and when it occurs. The inflow assumption is only applied when faced with drought conditions, and is then used as a trigger for action – by applying the 10%

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58 Economic Regulatory Authority. *Final Report. Inquiry on Water Corporation's Tariffs. 7 May, 2007*.
59 The ERA noted its previous advice to government that this service level was inefficiently high, and recommended a 1 in 50 year target.
60 *Ibid*. at pp8-9.

restrictions and subsequently augmenting supply.

Finally, the consequences of inflows occurring below that assumed are vastly different. For example, the consequences of lower inflows occurring for the Water Corporation's storages will be to trigger sprinkler bans more frequently than the 1 in 200 target level.

By contrast, the consequences of GAWB receiving less than its assumed inflows *when a drought event arises* have far greater implications, and could lead to the need for extreme measures such as the bringing forward of emergency rationing.

Melbourne

The Victorian Government recently released its updated proposals for managing the water supply-demand balance for Melbourne.[61] The evolution of the inflow assumptions used to guide this plan changed from using long-term and 10-year average inflows, to a more conservative inflow assumption as severe drought conditions continued in Victoria into 2007:

> *In the past, long-term rainfall throughout parts of Victoria has been fairly reliable. Now, with the rainfall uncertainty due to climate change, many more outcomes are possible, and different rainfall patterns may emerge in different parts of the State.*
>
> *We have now developed a number of rainfall and inflow scenarios to guide us in water supply planning for Melbourne. These are plausible scenarios, designed to cover the range of possible futures for rainfall and run-off…*
>
> *Put simply, if we use the past 100 years' average inflows as the basis for planning Melbourne's water supplies, we don't need to add to our water supply at all …*
>
> *If the past 10 years' average inflows are used, we will need to add (additional sources)…*
>
> *These two scenarios were included in the Central Region Sustainable Water Strategy in 2006. The third new scenario takes into account what we now know is possible, by incorporating the extreme low inflows of 2006 in a scenario based on the past three years' experience…*
>
> *Our water planning must enable us to deal with very low inflows. When it comes to water, being risk averse and prudent makes good sense. The inflows of the past three years will therefore be added to planning Melbourne's future water supply*

[61] Department of Sustainability and Environment. *"Our Water, Our Future – The Next Stage of the Governments Water Plan"*. (June, 2007).

> *system.*
>
> *Despite the impact of climate change, we see this as a relatively unlikely scenario. Based on the average of the last 20 years, with conservation and planned new supply, it is more likely that we will see an early recovery in storages. But to manage the risk of very low inflows, new water supply projects will be brought forward immediately.* [62]

There are clearly comparisons between the inflow assumptions recommended for the DMP, and GAWB's approach to risk management, and that adopted for Melbourne. In particular, both approaches adapt to incorporate new information, and adopt an increasingly conservative position based on declining inflows experienced over recent years.

This is not to suggest that adopting a three-year inflow sequence is 'correct' or should be broadly applied – this is clearly a matter that should be determined based on individual circumstances. However, comparison's can be drawn between the approach used for Melbourne and in planning for possible scenarios, particularly when faced with imminent supply shortfall due to extended drought conditions. Moreover, the Victorian Government has committed to investing in source augmentations as a result of taking this more conservative view of inflows, thereby reducing the risk of supply failure.

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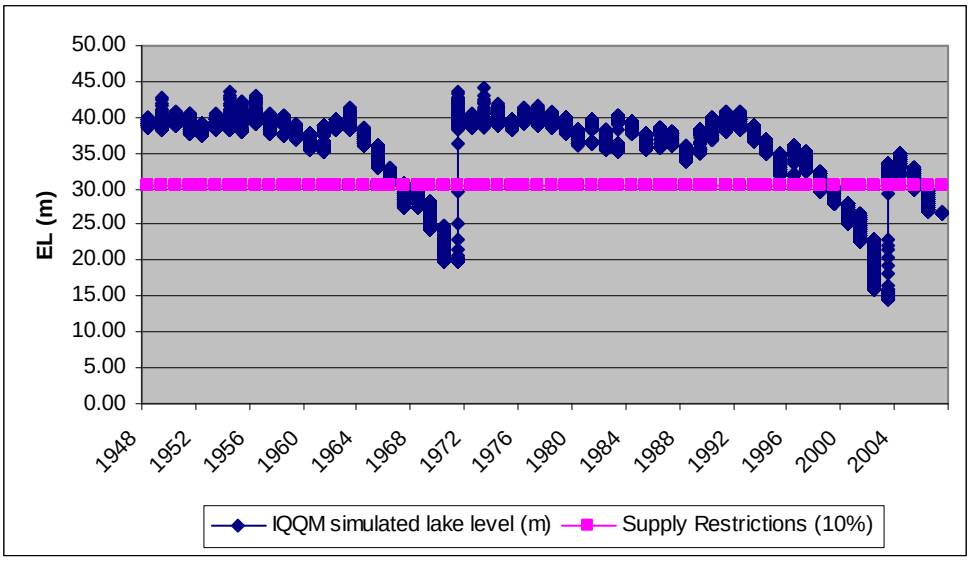
[62] *Ibid*. At p22.

Attachment 2 Impact on frequency of restrictions.

An overly conservative inflow assumption can lead to unnecessarily frequent triggering of restrictions.

To assess this impact from adopting the recommended inflows, simulation modelling has been performed using the Department of Natural Resources and Water's IQQM model has been performed, assuming historic inflows *and 100% utilisation of GAWB's water allocation*, to plot a historic storage level. This is then compared against the current storage trigger for the 10% supply restrictions – EL 30.5m.[63] The outputs of this modelling are set out indicate that over the 110 years simulated, restrictions under GAWB's Drought Management Plan would only have been applied three times (1966, 1998 and 2005). Figure 5 below displays the storage simulation since 1948 – there were no incidences of the storage reach below EL 30.5m in the preceding period.

SIMULATED STORAGE LEVELS (1948 – 2006)



Note that these are simulated conditions based on full demand and other assumptions – in reality GAWB has only employed restrictions once in 2002.

[63] It is acknowledged that this is not a perfect comparison, as the 30.5m trigger level will increase slightly as demand approaches GAWB's full allocation. However, based on the data review, this is not likely to materially alter the trigger level to the extent it would generate any meaningful increase to the frequency of restrictions.

This compares with the previous DMP inflow assumption of 69GL/annum, based on the lowest 10 year inflow sequence, which would require a trigger for restrictions at EL23.6m. Based on the above data, this would have occurred on two occasions, albeit later in these drought events. In theory, this would have meant a lesser duration of restrictions, but would have required a far greater severity or otherwise would have involved substantial risk of supply failure if the assumed inflows (69GL/annum) did not occur within one to two years.