



## **QCA review of irrigation prices**

### **Supplementary information**

## **Headworks Utilisation Factors, Critical Periods and Bulk Water Supply Capital Cost Allocation**

**April 2011**

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## Summary

The approach for allocating capital costs should reflect the proportion of storage capacity dedicated to high priority and medium priority water entitlements.

The practice of water management requires that a portion of stored water is first set aside for high priority entitlements, with any residual available for medium priority entitlements. For example, water sharing rules prescribed by the resource regulator specify that a certain volume of stored water is required for high priority entitlements before water can be made available to other users. This often means that one to two years of water is effectively set aside in storage for high priority entitlements (including an allowance for evaporation and losses).

SunWater has proposed headworks utilisation factors (HUFs) to allocate capital costs. These HUFs have been calculated to determine the storage capacity required for high priority water entitlements, having regard to the worse-case inflow scenario (based on historic inflows over the worse 15 year period). This approach establishes the storage capacity required for those high priority entitlements as a percentage of current storage capacity. In essence, the balance of capacity is assigned to medium priority users.<sup>1</sup> This is consistent with the actual practice of water sharing as set out above.

SunWater's approach contrasts with the usual approach taken for hydrologic modelling, which typically draws from the widest available data set (e.g. full record of storage inflows) to generate output statistics. However, the purpose of this modelling is usually to determine the historic, long-term performance of high and medium priority water entitlements, rather than to determine the allocation of capital costs.

The QCA commissioned consultants Gilbert and Sullivan (G&S) to undertake a technical review the HUF and SunWater's modelling. In performing this review, G&S recommended that the 'standard' hydrological modelling approach be adopted, that is, using the full streamflow period to determine the HUF.

SunWater strongly disagrees with this approach, as it will simply result in cost allocations based on average storage utilisation over the period of streamflow record. This will not properly reflect the proportion of storage capacity dedicated to high priority water entitlements given the required capacity is driven by worse-case inflow scenarios, not long-term averages.

Accordingly, SunWater submits that the QCA does not accept G&S's recommendations in this regard. Rather, SunWater submits that its HUFs (as calculated), appropriately reflect the share of storage, and capital costs, dedicated to high priority and medium priority water entitlements.

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<sup>1</sup> A detailed explanation of SunWater's approach has been previously provided to the QCA and is published on QCA's website. This includes a more precise description of how HUFs are calculated and how storage capacity is assigned to high priority water allocations.

# 1. Introduction

The Queensland Competition Authority (QCA) is currently investigating irrigation prices to apply in 22 bulk water schemes and 8 distribution systems owned by SunWater. A key issue for this investigation is how costs should be assigned between different priority water entitlements, and in particular the capital costs of bulk water supply schemes, namely water storages.

The QCA released an issues paper prepared by PricewaterhouseCoopers (PWC) titled “Allocating Capital Costs of Bulk Water Supply Assets” (the PWC issues paper)<sup>2</sup>, which included a review of entitlements and SunWater’s approach based on headworks utilisation factors (HUFs)

In assessing the HUF approach, the PWC issues paper discussed the following matters in accordance with its Terms of Reference:

- SunWater’s rationale underlying the proposed HUF;
- issues relevant to applying HUF for the purpose of allocating capital costs, including reference to:
  - whether the approach is consistent with generally accepted means of allocating capital costs of bulk water supply assets (including between different classes of entitlement) adopted by regulators;
  - valuation of irrigation supply in the establishment of a regulatory asset base; and
  - the conversion factors used to transform water entitlements into high and medium reliability entitlements.

The QCA subsequently commissioned Gilbert and Sutherland (G&S) to undertake a “Quality Assurance of SunWater’s Review of its Headworks Utilisation Factors Methodology” (the G&S review)<sup>3</sup>.

The G&S review noted that SunWater had prepared a report entitled “Headworks Utilisation Factors – Technical Paper”<sup>4</sup> (SunWater’s Technical Paper) to support and explain its approach, and that the approach together with the underlying data, assumptions and calculations, as summarised in the technical report, has been subjected to an independent peer review by Dr Sharmil Markar of WRM Water and Environment.

The G&S review was commissioned by the Authority to undertake “an independent quality assurance of the expert review undertaken by Dr Markar.” The Terms of Reference particularly required G&S to “attest to the veracity of the approach taken by Dr Markar in certifying that SunWater’s HUF approach is rigorous and robust, is based on reasonable assumptions, is founded on appropriate models and data sources, and results in appropriate calculations for HUF factors.”

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<sup>2</sup> QCA. *Issues Paper. Allocating Capital Costs of Bulk Water Supply Assets – An Issues Paper prepared for the Queensland Competition Authority by PricewaterhouseCoopers. September 2010*

<sup>3</sup> QCA. *Quality Assurance Assessment of a Review of SunWater’s Headworks Utilisation Factors Methodology – Prepared for the Queensland Competition Authority by Gilbert and Sutherland. March 2011*

<sup>4</sup> SunWater. *Submission. Headworks Utilisation Factors - Technical Paper. September 2010*

The G&S review did not question or make any adverse findings with respect to the veracity of the expert review undertaken by Dr Sharmil Markar. This is reassuring and supports the finding in the PWC issues paper which observed that although the proposed HUF methodology was complicated, it:

*“largely meets the characteristics of internal consistency, replication and transparency and reasonableness”.*

The G&S review also made comment about matters relating to the data set used for the HUF, which goes directly to how storage capacity is assigned to different priority entitlements (and in turn, cost allocation), rather than a hydrologic review of the HUF calculation. The G&S review recommended that:

*“HUFs be calculated from assessment across full period of available data rather than 15-year period returning lowest HUFmp” and that “Assessment data set be extended/infilled with recorded data (where available) to provide assessment against all available data”.*

SunWater contends that this recommendation ignores the purpose of the HUF itself, which is to allocate capital costs. Rather, the G&S recommendation to adopt the full period of streamflow record is more aligned with the ‘standard’ hydrological approach where models are used to determine long-run expected water availability. Accordingly, SunWater submits that the G&S recommendations should not be given any weight by the Authority. This is discussed in more detail in the following section.

Further, the G&S review also suggested that:

*“HUFs be calculated on the basis of existing levels of entitlement only (i.e. no assumption of full MP to HP conversion), with updates to HUFs as required able to be undertaken with conversions as they occur”.*

This suggestion fails to recognise or understand the important market influences that are driving water entitlement conversions at the present time, and will not result in HUFs that will endure in the long-term as medium priority entitlements are converted to high priority (within the constraints of the ROP), which is SunWater’s expectation. Indeed, in schemes such as the Burdekin-Haughton, conversions have already occurred to the full extent allowed under the ROP.

Subsequent discussions between the QCA and SunWater in relation to the proposed HUF approach has revealed that there is a need to clearly explain why the G&S findings on the above matters should not be considered.

The purpose of this supplementary submission is therefore to provide further information in relation to the HUF approach, in particular, the importance of differentiating between a hydrologic assessment of long-term entitlement performance (and consequently storage utilisation), against an assessment of share of storage capacity used for allocating capital costs.

In making this supplementary submission, SunWater aims to build on its previous submissions relating to the subject by drawing on its operational experience in administering and reforming water sharing arrangements in water supply schemes.

## 2. HUFs and protecting high priority entitlements

HUFs are proposed by SunWater as the basis to allocate capital costs (i.e. asset value and renewal costs) associated with SunWater’s bulk water assets.

The PWC issues paper, which reviewed the HUF approach, explored a number of regulatory principles for cost allocation including the peak responsibility pricing approach. In its outline of the principles of the peak pricing approach, the PWC issues paper referenced Kahn<sup>5</sup>:

*“if the same type of capacity serves all users, capacity costs as such should be levied only on utilisation at the peak. Every purchase at that time makes its proportionate contribution in the long-run to the incurrence of those capacity costs and should therefore have that responsibility reflected in its price. No part of those costs as such should be levied on offpeak users”.*

The PWC issues paper examined a number of examples of where peak responsibility approach is reasonably commonly applied and noted that:

*“... where capacity was created to meet the demand requirements of certain users, it may be appropriate to impose a form of peak responsibility pricing to ensure priority requirements were reflected in the allocation of required capacity”.*

While peak pricing is not perfectly analogous, there are some similarities to SunWater’s HUF approach. SunWater’s approach is based on the premise that the water sharing rules set out in Resource Operations Plans (ROPs) require that sufficient water must be held in storage before any water is available to lower priority entitlements. These high priority water entitlements are conceptually similar to a ‘peak’ access right in so far as they command priority access to water in times when demand exceeds supply.

More importantly, the water sharing rules operate so that a certain amount of storage (headworks) capacity is firstly dedicated to high priority water entitlements. For example, water sharing rules usually mean that one to two years of water is effectively set aside in storage for high priority entitlements (including an allowance for evaporation and losses).

The setting aside of a significant part of the storage for high priority to cater for periods of very low inflows, has been demonstrated and affirmed in a variety of real-world situations time and time again. Specific examples include:

- 1) Unequivocal priority of access to stored water supplies is, without exception, expected by and given to higher priority water entitlements during periods of prolonged or recurring critical water supply shortages such as those experienced in many schemes in recent years.

Such preferential access is guaranteed to higher priority entitlement holders by specific ‘cut-off’ rules and other operational requirements set out in statutory Resource Operations Plans or Critical Water Supply Arrangements.

In addition, higher priority entitlement holders are further assured of

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<sup>5</sup> Kahn, A.E. *The Economics of Regulation: Principles and Institutions*. The MIT Press. Cambridge. 1988

preferential access to stored water supplies through the inclusion of specific powers within the Water Act<sup>6</sup> that provide powers and mechanisms for the resource regulator to step in and ensure priority of access by such users.

There is no doubt that higher priority water entitlement holders clearly understand, depend on and in fact demand such preferential and priority of access given by the combination of these arrangements. Investment decisions by holders of such entitlements (such as industrial, mining and power generation enterprises for example) are founded on the resultant level of service that they can expect from such arrangements in the future particularly if faced with a series of dry climatic years.

- 2) Processes involving the initialisation of Continuous Share sizes within a water supply scheme have seen the expectations and demands of higher priority water entitlement holders acceded to with respect to reserving them a sufficiently large enough proportion of a system storage capacity to ensure that their access during a future possible critical period is no worse than what they might expect under the prevailing water sharing arrangements.

In the case of the initialisation of share volumes MacIntyre Brook Water Supply Scheme, for example, the continuous share volume for the high priority water entitlement holders was sized in order that such users could expect no decrease in their level of service compared with what they could expect under current sharing arrangements under critically dry conditions.

Should other schemes consider moving to a system of continuous sharing in the future (such as the Burdekin where the Resource Operations Plan includes provisions for such change within the ten year life of the plan), it is clear that the storage capacity share volumes would be set based on the principle of higher priority entitlement holders' level of service being no worse off than under current water sharing arrangements in a critically dry period.

Discussions with irrigation industry representatives indicate that they are in no doubt that the desire by irrigators to move to Continuous Sharing is unlikely to be satisfied unless high priority water entitlement holders can first be assured of being apportioned sufficient storage capacity to survive the next critically dry period.

SunWater considers that, taking into account SunWater's and stakeholders' practical experiences in operationalising continuous sharing over the last 15 years (rather than a strictly theoretical hydrologic modelling view taken in the G&S Report), it would be a serious mistake to suggest calculating HUFs based purely on the assessment of long-term data without taking proper account of the critical period – a flawed suggestion that would have not only result in the under-sizing of the high priority share of the storage but also represent a serious undermining of the future water supply security for high priority water entitlement holders.

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<sup>6</sup> See Section 25A Water Act (Queensland) 2007 which describes Ministerial powers that may be applied to 'water supply emergencies' in order to protect "essential water supply needs".

- 3) Recent regional water supply planning processes in Queensland have seen the adoption of ‘level of service’ criteria for urban end-water users.

In this context where local governments rather than end-users typically hold the water entitlements, level of service objectives are typically couched in terms of the minimum frequency, duration and severity of restrictions to normal urban supplies that are considered to be acceptable to the community. The development of such objectives are based on testing and analysis of the adequacy of existing water sources in supplying end users during critically dry periods.

SunWater’s HUF approach is based on identifying that portion of storage capacity that is dedicated to, or required for, high priority entitlements to meet the expected performance requirements, addressing the realities set out above. As such, the HUF for high priority in a scheme will approximate the stand-alone storage capacity required to supply high priority water entitlements.

For example, consider a bulk water scheme that was designed to only supply a given amount of high priority water entitlements at a given reliability (e.g. 100% monthly reliability). The storage capacity required for these entitlements will be driven by the assumed worst-case historical inflow period (or critical period). Streamflows outside this assumed worst-case period are of no relevance.

Consider then if this storage was to be expanded to also supply medium priority entitlements. Once these medium priority entitlements are introduced, then streamflows outside the critical period become relevant as they inform the performance of those entitlements for a given storage capacity and nominal volume (yield).

In essence, SunWater’s HUF approach first determines the minimum storage capacity required by high priority entitlements, before assigning the residual capacity<sup>7</sup>. As set out above, the minimum capacity required for high priority is determined by the assumed, worse-case inflows to the dam.

Adopting inflows over the entire period of record, as suggested by G&S, will result in HUFs that reflect long-term average storage utilisation of each priority group. This approach would fail to properly recognise the minimum storage required to provide security of access to high priority entitlements and would utilise flow sequences that are irrelevant to this calculation.

SunWater’s approach recognises that, as high priority water entitlements clearly require first priority over a proportion of headworks capacity on an ongoing basis, it follows that these entitlement holders should be apportioned a higher share of the headworks capital costs.

The PWC issues paper acknowledges this premise and concludes that:

*“setting charges in a way that allocates costs on the basis of levels of service, or capacity utilisation is consistent with economic principles and charging approaches used in other jurisdictions and other utilities”.*

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<sup>7</sup> Details of the approach as applied to each water supply scheme is outlined in SunWater’s *Submission. Headworks Utilisation Factors - Technical Paper, September 2010*

In closing, it is critical that capital cost allocation takes account of the storage capacity set aside for high priority entitlements, and the residual capacity available to medium priority. In order to do this, a ‘worse case’ scenario needs to be determined which, by definition, will be a period less than the full streamflow record. The next section examines why SunWater has proposed a 15-year period for this purpose.

### 3. Choosing an inflow period

The HUF approach requires an assumption about the worst case inflow scenario in order to determine the storage requirement for high priority entitlements.

Consistent with the preceding discussion, the HUF approach adopts the historically driest fifteen year period as a key input to taking account of the level of service that is associated with the performance of storage infrastructure.

Importantly, the HUF approach is based on an assessment of storage performance using a worse-case assumption over a longer period rather than, say, just the driest year or even day. This is because choosing too short a timeframe would effectively represent an assessment of the performance of just a small part of the storage (i.e. the bottom, wettest component which is usually 100% utilised by the higher priority entitlements) rather than the whole storage.

Choosing a period of fifteen years is considered a reasonable period over which all parts of the storage will be utilised at least once.

In support of the choice of a fifteen year critical period, SunWater’s Technical Paper stated that

*“A fifteen year period was considered an appropriate duration for the purposes of this analysis and is consistent with short and medium term planning periods used in contemporary climate scenario modelling in Australia<sup>8</sup>”.*

SunWater’s Technical Paper further made the point that:

*“a fifteen year period is also representative of the typical horizon over which irrigation enterprises plan for and base their business investment decisions”.*

The sensitivity of HUF values to the choice of shorter (10 year) or longer (20 year) periods was also presented in SunWater’s Technical Paper and reviewed by Dr Sharmil Markar. HUF values were found to be relatively stable across this range for most water supply schemes.

The HUF adoption of the use of a fifteen year period is not dissimilar to the assumptions embedded within the approach used by IPART in its 2010 price determination for State Water. In NSW, IPART ruled that high security water licence holders receive a higher level of service compared to general security water licence holders, and therefore a differentiated price, including a high security premium was deemed to be appropriate. IPART’s methodology used a twenty year period (1989/90 to 2008/09) in its calculation of a high security premium.

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<sup>8</sup> See Chiew FHS, Cai Wand Smith IN, 2009. Advice on defining climate scenarios for use in Murray-Darling Basin Authority Basin Plan modelling, CSIRO report for the Murray-Darling Basin Authority.

In comparing the HUF methodology to the NSW approach, the PWC issues paper concluded that

*“While similar methodologies in other jurisdictions, such as NSW may provide a simpler approach, the proposed HUF methodology captures a number of additional variables which impact on the utilisation of dam headworks, such as water sharing and critical water supply arrangements, and which arguably provide a more accurate representation of headworks utilisation by different priority water entitlement holders”.*

## 4. Conclusion

In conclusion, SunWater submits that the QCA should not give weight to the G&S recommendations about the period of inflows used to determine the HUF percentages, as G&S has not properly considered this from a cost allocation and pricing perspective. Instead, SunWater submits that the QCA should acknowledge the PWC analysis as being more relevant in examining whether the HUF is appropriate for assigning capital costs, and consider the G&S report in relation to the calculation of the HUF itself.

SunWater’s HUFs have been calculated to determine the storage capacity required for high priority water entitlements, having regard to the worse-case inflow scenario (based on historic inflows over the worse 15 year period). This approach establishes the storage capacity required for those high priority entitlements as a percentage of current storage capacity. In essence, the balance of the capacity is assigned to medium priority entitlements.<sup>9</sup>

G&S’s recommended approach of adopting the full period of record would result in cost allocations that reflect average storage utilisation over long timeframes. This will not properly reflect the proportion of storage capacity actually dedicated to high priority water entitlements given this capacity is driven by worse-case inflow scenarios, not long-term averages.

Accordingly, SunWater submits that the QCA does not accept G&S’s recommendations in this regard. Rather, SunWater submits that its HUFs (as calculated), appropriately reflect the share of storage, and capital costs, dedicated to high priority entitlements and the remaining share that is available to medium priority water entitlements.

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<sup>9</sup> A detailed explanation of SunWater’s approach has been previously provided to the QCA and is published on QCA’s website. This includes a more precise description of how HUFs are calculated and how storage capacity is assigned to high priority water allocations.